ENGINEERING SERVICE CENTER
Port Hueneme, California 93043-4370

TECHNICAL MANUAL

FIELD TEST HANDLING EQUIPMENT OPERATIONS & MAINTENANCE

VOLUME I
REVISION ~

DRAFT June 8, 2011

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RECORD OF CHANGES

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LIST OF ACRONYMS

ACRONYM	DEFINITION
A	Ampere
A/D	Analog to Digital
ABS	American Bureau of Shipping
AC	Alternating Current
AC	Accelerometer
ACC	Accumulator
AF	A-Frame
AGP	Accelerated Graphics Port
AI	Analog Input
AMP	Ampere
ANSI	American National Standards Institute
AO	Analog Output
Approx	Approximately
AR	As Required
AS	Audible Alarm
Assy	Assembly
AVR	Automatic Voltage Regulation
AWG	American Wire Group
AWS	American Welding Society
BK	Brake Assembly
BV	Ball Valve
C	Centigrade
CB	Circuit Breaker
CBV	Counterbalance Valve
CC	Cleanout Cover
cc	Cubic Centimeter
CCA	Circuit Card Assembly
CCW	Counter-Clockwise
CD	Compact Disk
CD	Current Level Detector
CD-RW	Compact Disk - Rewritable
CH	Control Handle
CI	Computer Interface
COMP	Compressor
COMP	Compensator
COND.	Conductor
CONOPS	Conduct Of Operations
Cont.	Contactor
CORBA	Common Object Request Broker Architecture

ACRONYM	DEFINITION
CP	Coupling
CPRV	Cross Port Relief Valve
CPU	Central Processing Unit
CT	Contactor
cu. in.	Cubic Inch
CV	Check Valve
CVP	Control Van Panel
CW	Clockwise
CYL	Cylinder
D	Diode
D/A	Digital to Analog
DAQ	Data Acquisition
db	Decibel
DC	Direct Current
DCV	Directional Control Valve
DD	Dynacon Drawing
DDR	Dial-on Demand Routing
DH	Docking Head
DIO	Digital Input/Output
DOI	Date of Issue
DSP	Display
DVI	Digital Visual Interface
DWG	Drawing
DWT	Deep Water Training
EDC	Electronic Displacement Control
EHPU	Electro-Hydraulic Power Unit
EM	Electric Motor
ENC	Enclosure
EOT	End-of-Travel
EPROM	Erasable Programmable Read-Only Memory
ESAC	Enhanced Stand Alone Consoles
ESD	Electrostatic Discharge
F	Fuse
FAT	Factory Acceptance Test
FB	Filter Breather
FC	Filler Cap
FCV	Flow Control Valve
FL	Filter
FOR	Fixed Orifice
fpm	Feet Per Minute
fps	Feet Per Second

ACRONYM	DEFINITION
FSB	Front Side Bus
ft	Feet
FTHE	Field Test Handling Equipment
Fwd.	Forward
GA	Gage
GB	Gas Bottle
GB	Gearbox
GB	Gigabyte
GHz	GigaHertz
GI	Gas Intensifier
GND	Ground
gpm	Gallon per minute
GUI	Graphical User Interface
H	Height
H. C.	Heave Compensator
HC	Heave Compensator
HDD	Hard Drive Disk
HDR	Header
HM	Elapsed Time Meter
HM	Hydraulic Motor
HP	Hydraulic Pump
HP	Horse Power
HPU	Hydraulic Power Unit
HTR	Heater
HX	Heat Exchanger
Hz	Hertz
I/O	Input/Output
IAW	In Accordance With
IBM	International Business Machines
IDE	Integrated Drive Electronics
IEC	International Electrotechnical Commission
in	Inch
in.	Inch
IS	Isolator Switch
ISA	Industry Standard Architecture
J	Jack
JB	Junction Box
J-Box	Junction-Box
JIC	Joint Industry Council
K	Relay
kgs.	Kilograms

ACRONYM	DEFINITION
kW	Kilowatt
L	Length
LAN	Local Area Network
LARS	Launch and Recovery System
LBS	Pounds
lbs	Pounds
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LFV	Loop Flushing Valve
Lg	Long
LG	Level Gauge
LRU	Line Replaceable Unit
LS	Level Switch
LT	Indicator Lamp
LW	Levelwind
M. S.	Military Specification
m/s	Meters Per Second
mA	MilliAmperes
Mbps	Megabits Per Second
MHz	Megahertz
MIO	Multifunction I/O
mm	Millimeters
MOV	Metal Oxide Varistor
MS	Motor Starter
MSDS	Material Safety Data Sheet
N/A	Not Applicable
NAAP	Not Available at Publication
NBVC	Naval Base Ventura County
NC	No Connection
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFESC	Navy Facility Engineering Service Center
NI	National Instruments
No.	Number
NUM	Number
NV	Needle Valve
O. D.	Outside Diameter
O/E	Optical/Electrical
OTDR	Optical Time Domain Reflectometer
OSD	On-Screen Display
P	Plug

ACRONYM	DEFINITION
P. O.	Purchase Order
PA	Pump Adapter
PB	Push Button
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect
PED	Pedestal
PFD	Personal Flotation Device
PG	Pressure Gauge
Pkg.	Package
PM	Phase Monitor
PN	Part Number
POV	Pilot Operated Valve
PPE	Personal Protective Equipment
PR	Pressure Regulator
PRRV	Pressure Reducing/Relieving Valve
PRV	Pressure Reducing Valve
PS	Power Supply
PSH	Pressure Switch
psi	Pounds per Square Inch
psig	Pounds per Square Inch Gauge
PWB	Printed Wiring Board
PX	Pressure Transducer
Q	Transistor
QD	Quick Disconnect
R	Resistor
RB	Relay Board
Req.	Required
ROM	Read-Only Memory
ROV	Remotely Operated Vehicle
RV	Relief Valve
SBC	Single Board Computer
SC	Signal Conditioner
SCIF	Sensitive Compartmented Information Facility
SCSI	Small Computer System Interface
SDRAM	Synchronous Dynamic Random Access Memory
SG	Level Gauge
SHV	Shuttle Valve
SI	Signal Interface
SOV	Solenoid Operated Valve
SQV	Sequence Valve
SS	Soft Start Controller

ACRONYM	DEFINITION
SS	Stainless Steel
STB	Signal Terminal Board
Stbd.	Starboard
STR	Strainer
SUV	Start-Up Valve
SVV	Servo Control Valve
SW	Switch
SWL	Safe Working Load
T	Transformer
TB	Terminal Board
TD	Transducer
TEMP	Temperature
TIO	Timing Input/Output
TMS	Tether Management System
TP	Test Point
TPS	Telemetry/Power Segment
TSH	Temperature Switch
TTL	Transistor-Transistor Logic
Typ.	Typical
U	Amplifier
UNC	United National Course
UPS	Uninterruptible Power Supply
U.S.	United States
UW	Umbilical Winch
V	Volts
VA	Volt-Amperes
VAC	Volts Alternating Current
VDC	Volts Direct Current
VESA	Video Electronics Standards Association
VGA	Video Graphics Array
VME	Versa Module Europa
Vs	Versus
W	Watt
W	Weight
W	Width
WROV	Workover Remotely Operated Vehicle
WTMS	Workover Tether Management Segment
w/	With
X	Coil
XS	Proximity Sensor

FOREWORD

The technical manual's maintenance contractor for this manual is GPA Technologies, Inc.

This technical manual has been developed in a large part based upon the original equipment manufacturer (DYNACON - Job No. 707) technical manual, assembly drawings, and electrical and hydraulic schematics. Additional information was developed through initial operating experience by General Dynamics - Advanced Information Systems (GDAIS), where a follow-on Operation & Maintenance Manual A128297-1 was developed and submitted to NFESC with delivery of the FTHE system. In many instances, whole sections of text have been lifted from their documents and included in this work.

This FOREWORD is to provide proper credit due to previous efforts on the O&M development.

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SAFETY SUMMARY

Introduction

This manual describes procedures and operations that may cause injury or death to personnel or damage to equipment if not properly followed. This safety summary includes general INLS safety precautions and instructions that must be understood and applied during operation and maintenance to ensure personnel safety and the protection of equipment. Additional safety precautions specific to FTHE may be found in Section 1.2, SAFETY PRECAUTIONS, and relevant cautions and warnings will be included in each chapter throughout the manual where applicable. Prior to performing a task, the warnings, cautions, and notes included in that task shall be reviewed and understood.

Warnings, Cautions and Notes

Warnings and cautions are used in this manual to highlight operating or maintenance procedures, practices, conditions or statements that are considered essential to the protection of personnel (WARNING) or equipment (CAUTION). Warnings and cautions immediately precede the step or procedure to which they apply. Warnings and cautions consist of four parts: the heading (WARNING, CAUTION), a statement of the hazard, minimum precautions, and the possible result if disregarded. Notes are used in this manual to highlight operating or maintenance procedures, practices, conditions or statements that are not essential to the protection of personnel or equipment. Notes may precede or follow the step or procedure, depending upon the information to be highlighted. The headings used and their definitions are as follows.

WARNING

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in injury to or death of personnel or to long-term health hazards.

CAUTION

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in damage to or destruction of equipment or to the loss of mission effectiveness.

NOTE

Highlights an essential operating or maintenance procedure, condition, or statement.

General Precautions

The appropriate authority shall issue orders as deemed necessary for any situation not covered in the general and specific safety precautions. Operation, maintenance, adjustment, and calibration of the equipment should never be taken lightly. Personnel performing such tasks should fully understand the consequences of their actions because failure to do so could result in serious injury or loss of life.

The following general precautions are to be observed at all times.

1. Install and ground all electrical components associated with this system/equipment in accordance with applicable Navy regulations and approved shipboard practices.
2. Ensure that all maintenance operations comply with the latest issue of NFESC Occupational Safety and Health Program Manual, NFESCINST 5100.11.
3. Follow guidance from 5100.11 Chapter 9 on Mishap Investigation, Reporting, and Record Keeping.
4. Ensure that the protective guards and Shut-Down devices are properly installed and maintained around the rotating parts of machinery and high-voltage sources.
5. Do not wear loose clothing while working around the rotating parts of machinery.
6. Ensure that special precautionary measures are employed to prevent applying power to the system/equipment at any time that maintenance work is in progress.
7. Do not make any unauthorized alterations to equipment or components.
8. Before working on electrical system/equipment, check, using a voltmeter, to ensure that the system is not energized.
9. Consider all circuits not known to be "dead" as "live" and dangerous at all times.
10. When working near electricity, do not use metal rulers, flashlights, metallic pencils, or any other objects having exposed conducting material.
11. De-energize all equipment before connecting or disconnecting meters or test leads.
12. When connecting a meter to terminals for measurement, use a range higher than the expected voltage.
13. When operating equipment or performing any tests or measurements, ensure that the frames of all motors and starter panels are securely grounded.
14. Ensure that the area is well ventilated when using cleaning compounds or solvents. Avoid prolonged breathing of fumes and contact with skin or eyes.
15. Ensure that the hydraulic pressure is bled from the tank and system before "breaking" hydraulic fittings.

Live Circuits: Operating personnel must at all times observe all safety precautions cited in 5100.11 Chapter 26 Control of Hazardous Energy. The AC voltage generated by this equipment can cause severe injury or death. Do not replace components or make adjustments inside the equipment with the high-voltage supply turned on. Only authorized personnel are allowed to open the electrical control panel for troubleshooting. Ensure that the power is disconnected and tagged before working on any part of the electrical system. Measure voltage with a voltmeter to ensure that circuits are de-energized before touching any part of the electrical system.

Working Alone: Under no circumstances should any person attempt to service or adjust the equipment except in the presence of someone who is capable of rendering first aid.

Test Equipment: Make certain that test equipment is in good working condition. If a metal-cased test meter must be held, ground the meter case before starting the measurement. Do not

touch live equipment, or personnel working on live equipment, while holding a test meter. Some types of measuring devices should not be held when taking measurements.

First Aid: An injury, however slight, should never go unattended. Always obtain first aid or medical attention immediately.

Resuscitation: Personnel working with or near high voltage shall be familiar with approved resuscitation methods. Such information may be obtained from the Bureau of Medicine and Surgery. If someone is injured and stops breathing, initiate resuscitation immediately; a delay could result in loss of life.

Energized Equipment: Before working on energized equipment, ensure against grounding. Remove watches, rings, or other items that will conduct electricity. If possible, make repairs/adjustments with one hand, leaving the other hand clear of the equipment.

Hazardous Material/Hazardous Waste

Special precautions for the handling, use, storage, and disposal of hazardous materials are summarized below. Each individual is personally responsible for the proper handling of hazardous material/hazardous waste (HM/HW). Significant hazards include fire, poisoning by breathing toxic substances in unventilated areas, dermatitis, asphyxiation, and burns to the skin and eyes. Some materials normally thought to be safe may become hazardous under certain usage or storage conditions.

General Handling and Use Requirements

1. Supervisors shall ensure that, prior to using any HM, personnel under their supervision have read and are trained on the Material Safety Data Sheet (MSDS) for that material and that they are provided with the necessary protective clothing and equipment (e.g., eye protection, respiratory devices, and gloves).
2. Supervisors shall ensure that supply and exhaust ventilation systems are installed in all areas where HM is used. These systems must be in good operating condition and must have been tested and determined to be adequate for the job. The ventilation systems should be regularly tested and maintained in accordance with regulations and the original equipment manufacturer's recommendations.
3. Never exceed a 1-week of HM outside of Hazard Minimization Center (HAZMINCEN); return surplus material to its appropriate storage area at the end of each work day.
4. Avoid breathing vapors or dust when using HM.
5. Avoid contact with the eyes or prolonged contact with the skin when using HM.
6. Prohibit smoking, drinking, or eating in areas where HM is used.
7. Ensure that personal protective equipment (eye/clothing protection, respiratory devices, clothing, gloves, etc.) is readily available to all personnel working with HM.
8. Ensure that eye protection equipment (to protect against irritating vapors or corrosive liquids), such as chemical goggles and full face shields, is cleaned/disinfected before use.
9. Use a respirator with an appropriate filter when exposed to particulate matter, hazardous gases, or vapors.

Flammable Material Handling and Usage Requirements: Handling and use of flammable materials shall be in accordance with precautions listed in OPNAVINST 5100.19C.

1. Never use flammable material near a heat source or a spark-producing device. Do not smoke in an area where flammable material is used. Post NO SMOKING signs in these areas.
2. Keep cleaning rags soaked with flammable material in a Department of Transportation (DOT) approved, covered, metal container. Do not leave rags in a soaked condition, even in a covered metal container, for longer than one work shift. Treat such materials as if they are HW and containerize them to prevent leakage; then properly label the containers and store them.
3. Keep suitable fire extinguishing equipment and materials ready at all times, in accordance with fire code regulations.

General Storage Requirements: The following general precautions must be observed to minimize hazards inherent in the handling and storage of HM. Storage should be in accordance with 29 CFR 1910.106, 29 CFR 1910.176, DoD 4145.19-R, and DoD 4145.19-R-1.

1. Mark storage areas to identify the type of HM/HW stored, and keep the area clean and dry at all times.
2. Provide both supply and exhaust ventilation in storage areas. Ensure that ventilation systems are in good operating condition.
3. Allow only authorized personnel in storage areas.
4. When transferring material from one container to another, ensure that existing precautionary labeling is retained. Ensure that subsequent containers are marked with appropriate precautionary labels. Ensure that transfers are done in an area with secondary containment.
5. Prohibit smoking, eating, or drinking in storage areas.
6. Ensure that open flames or spark-producing items are not permitted in storage areas.
7. If the safety of a storage area is questionable, a safety engineer will conduct monitoring for oxygen depletion, explosive atmosphere, toxic vapors, and carbon dioxide prior to personnel entering the area.
8. Seal and protect all containers against physical damage and appropriately secure them for heavy sea conditions.
9. Inspect containers for leaks, corrosion, and weakened areas before placing HM/HW in them. Inspections must also be accomplished at regular intervals to prevent spills.
10. All storage areas should have secondary containment in case of a leak or spill.
11. Do not store non-compatible materials in the same area. Ensure that they cannot mix in case of leak or spill.

<u>Separation of Chemicals for Storage (Basic List)</u>:

1. Flammables
2. Oxidizers
3. Corrosives (acids/bases)

4. Highly reactive material
5. Extremely toxic/regulated material
6. Low-hazard material

Flammable Material Storage Requirements: Store flammable materials following the precautions listed in OPNAVINST 5100.19C. A list of authorized storage locations for flammable materials may be obtained by calling (805) 982-3677 NBVC HAZMAT.

1. Ensure that combustible materials (e.g., rags, paper, and wood) are not stored in flammable storage areas. Oily rags are stored in these areas only after placement in suitable DOT-approved containers.
2. Prohibit open flames or spark-producing items in flammable storage areas.
3. Ensure that containers are secured with metal banding or other approved tie downs.
4. When transferring flammable liquids from one container to another, ensure that the container is grounded and that a connection exists between the containers.

Hazardous Material Disposal Instructions: Comply with individual ship/station procedures for handling/disposal of hazardous materials (HM) and hazardous waste (HW). Pick up and storage of HM/HW may be arranged by calling (805) 982-3677 NBVC HAZMAT.

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1.0 CHAPTER 1 - INTRODUCTION

1.1 INTRODUCTION

1.1.1 Purpose

This manual was designed for technicians/operators with prior experience in the use of umbilical handling systems and with a basic understanding of hydraulic and electrical systems. It provides information required for mobilizing, operating, troubleshooting, maintaining, and demobilizing the Field Test Handling Equipment (FTHE) tailored for Deep Water Training (DWT) program.

1.1.2 Scope

The FTHE Installation, Operation and Maintenance technical manual provides mobilization, de-mobilization, operation and maintenance information within two volumes including ten chapters and appendixes as follows:

- **Volume I**
  - Chapter 1 – Introduction and Safety Precautions
  - Chapter 2 – System Description
  - Chapter 3 – Conduct of Operations (ConOps)
  - Chapter 4 – Theory of Operation
  - Chapter 5 – Scheduled Maintenance
  - Chapter 6 – Troubleshooting
  - Chapter 7 – Corrective Maintenance
- **Volume II**
  - Chapter 8 – Parts List
  - Chapter 9 – Mobilization
  - Chapter 10 – Demobilization
  - Appendixes

1.1.3 Associated References

Other documents containing supporting information for the FTHE are as follows:

1.1.3.1 Government Documents

1.1.3.1.1 Specifications and Standards

Design	American Bureau of Shipping (ABS)
Electrical	National Electric Code (NEC)
Welding	American Welding Society (AWS)
DOD-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment (Excluding Electrically Initiated Explosive Devices)

1.1.3.1.2 Program Documents

NFESC Drawing No. MAR-2005-1	Blue Gear Installation A-Frame Deck Insert Plate Details
T9493-AY-INM-	Telemetry/Power Segment (TPS) Cable Retermination Technical Manual

010/TPS RETERM

Dynacon System (Project) 707	Installation, Operation and Maintenance Manual: A-Frame, Docking Head, Cursor, and Active-Over Passive Heave Compensator
Dynacon Job 1088	Installation, Operation and Maintenance Manual: Direct Drive Umbilical Winch System with Overhead Right Angle Levelwind and Turning Sheaves, and Electro-Hydraulic Power Unit (for use with Job 707 Heave Compensator and A-Frame)

1.1.4 Operational Environment

The majority of the FTHE is shipboard mounted on the after deck and is therefore susceptible to all conditions of sun, wind, rain, and humidity with the exception of the Control Van that is a typically air-conditioned space. The operating and long-term storage temperatures are listed in Table 1-1.

Table 1-1 Environmental Parameters

ITEM	PARAMETER
Operating Temperature	14 °F to 104 °F
Storage Temperature	-4 °F to 122 °F
Control Van	Capable of continuous operation in a typical air-conditioned office environment with a temperature of approximately 70 °F and a relative humidity between 40% and 60%.

1.1.5 Applicability

The FTHE system is comprised of hardware and software that provides the capability to launch, deploy, operate at depth, and retrieve a Workover Tether Management Segment (WTMS) [including a Workover Remotely Operated Vehicle (WROV)] with and without modules/mission packages in the water column.

1.2 SAFETY PRECAUTIONS

1.2.1 Safety Awareness

Personal safety and the safe operation of the FTHE are important when working around and operating the FTHE system. This manual prompts for safety awareness when deemed necessary due to a particular application or situation. Refer to the Safety Summary front mater for general safety information and definitions of safety note prompts - WARNING, CAUTION, and NOTE.

1.2.2 General Safety Precautions

General safety precautions necessary for the protection of personnel and equipment are provided in the following paragraphs. General safety precautions are related to all procedures and therefore do not appear elsewhere in this manual. Personnel must understand and apply these precautions at all times during the operation and maintenance of the equipment documented in this manual. The general safety precautions must be observed during all phases of operation, service, repair, and testing of the documented equipment. Failure to comply with these precautions or with specific warnings contained in this manual violates safety standards of the design, manufacture, and intended use of the instruments or devices.

Some safety precautions that are appropriate to be aware of when working around the FTHE operations are identified below. All personnel in the operations area shall be aware of them.

- Watch for and avoid trip hazards or slip hazards from spilled oil
- Stand clear of all lines and wires (under tension or slack)
- Use proper lifting techniques for heavy objects
- Use proper lifting equipment for each lift
- Watch for and avoid swinging loads
- Stand clear of forklift operations and crane operations
- Be cautious around high pressure hydraulic systems
- Be extraordinarily alert when working near a platform edge
- Be aware of other personnel to prevent injury to them

Personal Protective Equipment (PPE): All personnel will be required to wear safety approved PPE such as a safety hard hat, steel-toed safety shoes, and safety glasses any time they visit the after deck since the work and working conditions can sometimes be hazardous to personal safety. It is also suggested that leather workman's gloves be worn when handling heavy or awkward components to protect the fingers, hands, and wrists from pinch points.

Safety Harness: A properly approved and maintained safety harness (as opposed to a "safety belt") should be worn when working aloft, outside of physical restraints (such as hand rails), and a fall of 6 feet or greater is possible. A "stand-by" person ready to render aid should be in attendance on deck as well. Do not store the harness where it can be affected by heat, light, excessive moisture, oil, chemicals, or other degrading elements.

Deck Work: All personnel on the ship's aft deck or any other areas unprotected with bulwarks are required to wear U.S. Coast Guard approved buoyant safety work vests while at-sea.

1.2.3 Operational Considerations

Inadvertent Movement of Project Hardware on Deck: All hardware will be securely tied/welded down prior to the start of operations.

A-Frame/Winch/HC Operations: A-Frame/Winch/HC operations will only be conducted by properly trained and qualified personnel.

Tensioned Lines: Project personnel shall not stand near any lines or cables under tension.

Line Bights: Project personnel shall not stand in the bight of any line that is being used.

A-Frame Operations: The A-frame will be fully functional at start of operations. It is possible that a failure with the A-frame could occur, so all personnel will be directed to ***not*** go beneath the A-frame or load that the A-frame is moving. No unnecessary personnel will be present near the A-frame when operations are in progress.

Crane Operations (*M/V INDEPENDENCE*): The vessel's crane will be fully functional at the start of operations. It is possible that a failure with the crane could occur, so all project personnel will be directed to ***not*** go beneath the crane or load during crane operations. Also, no unnecessary personnel will be present on the back deck of the vessel when crane operations are in progress. All crane operations will be directed by *M/V INDEPENDENCE* personnel. All personnel required on the deck, at the direction of the *M/V INDEPENDENCE*, will wear hard-hats, safety shoes, and buoyant safety vests. The designated Safety Observer and Deck Leader will observe the crane and surrounding area during lifts. Finally, the loads that the crane will be moving for this project's operations shall be below the safe working lift capability of the crane.

Physical Limits: Some of the FTHE procedures require two persons or more to lift, move, or service the equipment due to its weight or size. Failure to observe this warning could result in personal injury or equipment damage.

Heavy Lift Machinery: Only qualified personnel will operate heavy lift machinery. Operations with heavy lift equipment are inherently hazardous. Qualified personnel operate under these conditions on a regular basis and have developed procedures to minimize risk.

Hazardous Voltages: Are generated and distributed within FTHE enclosures and assemblies. Extreme caution must be exercised when working with this equipment. While practicable safety precautions have been incorporated in design, strict adherence to all advisories is emphasized.

Avoid Physical Contact With Hazardous Voltages**:** All maintenance and operating personnel must observe applicable safety procedures to avoid creating any hazardous situation involving personnel. Do not attempt any adjustments, repairs, or component exchanges in this equipment while in any operational mode where hazardous voltages may be present. Capacitors in this equipment will retain charges hazardous to personnel after all external power sources have been disconnected. It is, therefore, a requirement that all internal high voltage circuits be properly discharged where indicated to earth ground prior to any physical contact.

Do Not Service Or Adjust Circuits Alone: Under no circumstances should personnel open and reach into energized enclosures or the Electronics Cabinet for the purpose of servicing or adjusting the equipment for any purpose except in the presence of someone who is qualified and capable of rendering aid.

Do Not Defeat Or Bypass Interlocks Or Safety Switches: Interlocks and safety switches are incorporated in the equipment design for the primary purpose of minimizing hazards to personnel. Do not attempt to defeat, bypass, or override any such personnel safety device in the normal course of equipment operation. If it is determined that defeating, bypassing, or overriding safety devices is required during equipment troubleshooting procedures, it should only be done by fully qualified personnel after appropriate authorization has been granted.

Electrostatic Discharge (ESD) Protection: Circuit Card Assemblies (CCAs) and Printed Wiring Boards (PWBs) used in the various FTHE enclosures and in the Electronics Cabinet contain electrostatic discharge sensitive integrated circuit devices. Personnel, equipment, and tools should have proper grounding when working with static sensitive devices. Work surfaces should be conductive and properly grounded. Static control tabletop mats and wrist straps should be used for these conditions. When a CCA or PWB has been removed from its assembly, it must be stored or shipped in a static shielding bag.

Use Only One Hand where possible when it becomes necessary to work with powered circuits.

Abnormal Potentials May Exist in the event of component failure at what are normally low-voltage points.

Grounding Test Instruments: For test instruments using 115 VAC, the instrument or chassis must be connected to an electrical ground to prevent shock hazard. Therefore, the instruments are provided with three wire power cords. Never alter the power connections on any instrument. Avoid simultaneous physical contact with test equipment, units under test, and other personnel while power is applied.

2.0 CHAPTER 2 - SYSTEM DESCRIPTION

2.1 INTRODUCTION

This chapter identifies the major components of the FTHE system, describes their overall functional and physical descriptions, and provides various performance and reference data.

2.2 MAJOR SYSTEMS

The functional operations of the FTHE combine various individual units as major systems or assemblies as listed below. The FTHE deck layout is provided in Figure 2-1 and their functional descriptions are provided in section 2.3.

- **Umbilical Winch (UW) System**
  - Umbilical Winch Assembly
  - Levelwind (LW) Assembly
- **Hydraulic Power Unit (HPU) Assembly**
- **Heave Compensator (HC) Assembly**
- **A-Frame Assembly**
  - Docking Head (DH) General Assembly
  - Cursor Assembly
- **Operator Control Stations**
  - Manual DCV Station
  - Pedestal (Local Control 2)
  - Control Van (Remote Control 1)

The FTHE deck layout for M/V INDEPENDENCE is shown in Figure 2-1.

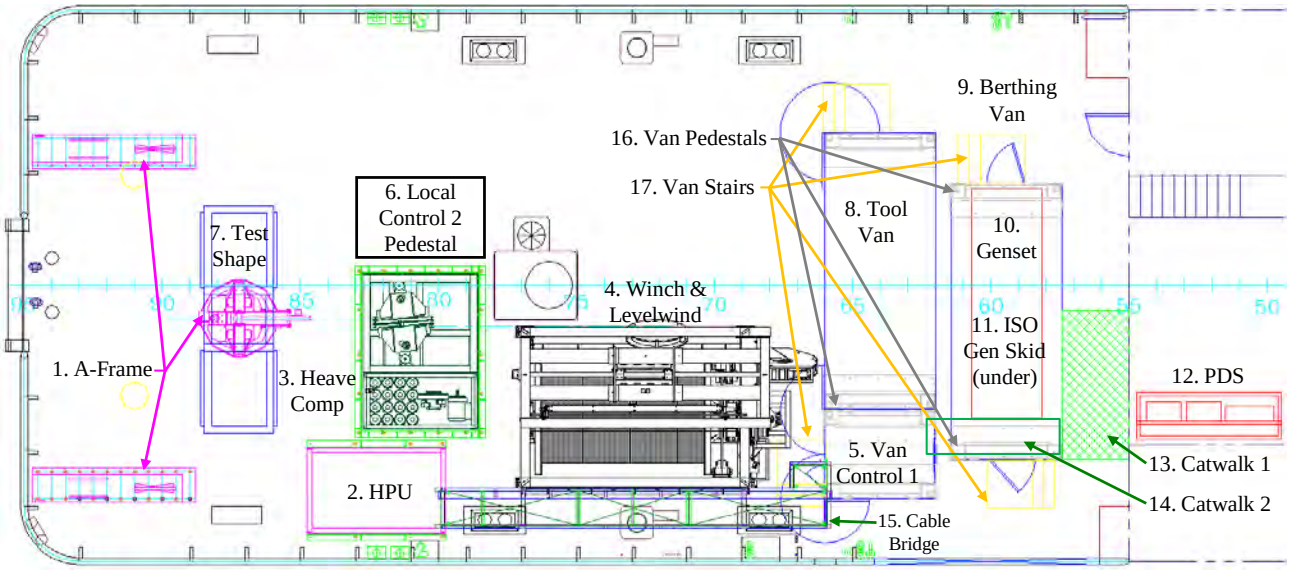

Figure 2-1 FTHE Deck Layout on *M/V INDEPENDENCE*

2.2.1 Engineering and Manufacturing Documentation

2.2.1.1 Dynacon Engineering Drawings

Dynacon drawings (DD) are referred to throughout this manual, where Appendix A provides a drawing index and hard copy prints on 11” x 17” paper are packaged in a separate binder.

2.2.1.2 Manufacturer Component Support Literature

Manufacturer component support literature is provided under separate cover for the FTHE system components to include manufacturers’ bulletins, catalogs, ordering/maintenance procedures, parts lists, and service instructions.

2.3 FTHE FUNCTIONAL DESCRIPTION

This section provides a functional description (“what it does”) of the FTHE major systems. Specific equipment descriptions can be found in section 2.4, Equipment Description.

NOTE

Some of the pictures used to display components may have been taken prior to last refurbishment. While there may be details in the pictures that differ from the present configuration, the differences should not be significant enough to impede understanding. Updates to this manual will be done as often as possible and as program funding becomes available.

2.3.1 Umbilical Winch System

The Umbilical Winch System is a cable handling system designed to deploy, tend, recover, and store up to 12,800 feet (3,902 meters) of 1.4 inch (35.56 mm) diameter umbilical on 6 layers.

Principal sub-assemblies include a umbilical winch, overhead right angle electro-active/diamond screw levelwind, 2X125 HP electro-hydraulic power unit, lower and upper turning sheaves, and local controls. The system is designed for operation with 707 A-frame and heave compensator.

The drum is direct driven on one end by a winch drive assembly consisting of a Haaglunds CB-840 3220 cu. in. hydraulic motor. The winch drum is supported within a base frame on each end by a pillow block bearing assembly constructed to accommodate a drum shaft extending through the entire length of the drum. Internal support and ambient air cooling is provided to the drum core and drum shaft with two internal baffles. Additional internal support to the drum core is also provided by the winch drum drive plate and an end plate. Customer provided air cooling inside the drum is provided for. The drum shaft features an inside diameter equal to 5.75 inch.

The brake holds loads in excess of 1.25 times the Safe Working Load (SWL) but will slip before the load exceeds 1.4 times the SWL. A hydraulically applied, spring release caliper brake, acting on a common brake disc mounted to the winch drum drive plate, provides for fail-safe braking of the winch drum. The spring applied, hydraulically released caliper brake is a Dellner SKP 220 SA, and the hydraulic applied, spring release caliper brake is Dellner SKD 4X125. The spring applied brake is set when the system is off and the hydraulic applied brake is used for braking during operations.

Four-point lifting of the umbilical winch is provided by a lifting eye attached to each corner of the winch base frame.

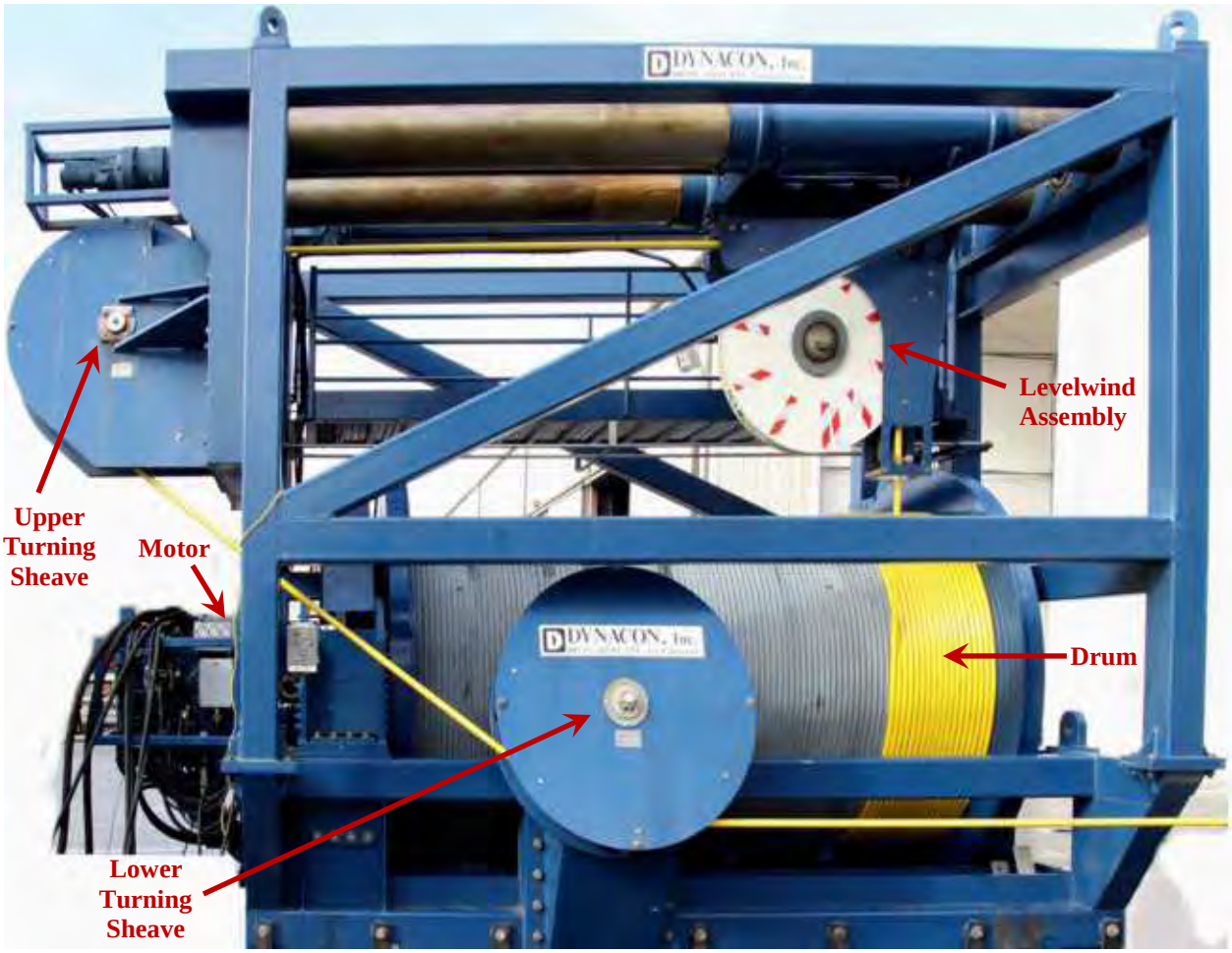

Figure 2-2 Umbilical Winch System

2.3.1.1 Umbilical Winch Assembly

The Umbilical Winch Assembly provides a means to store and deliver the thousands of feet of umbilical cable required to deploy and retrieve the vehicle and packages. The umbilical winch is the principal umbilical pulling component, bearing the entire payload and cable weight under high line tension throughout the operational cycle.

2.3.1.2 Levelwind Assembly

The Levelwind (LW) Assembly provides a means to keep an orderly wrap and prevent excessive slack when hauling in or paying out the umbilical cable. The umbilical cable pays off the winch drum, passes through the LW sheave assembly, and on to the HC Assembly.

The levelwind assembly features an overhead right-angle levelwind design. The assembly has both an electro-active levelwind system and a diamond-screw driven system. The sheave is instrumented for Line Count / Line Speed and has targets for sensors which provide count/speed output data for display at the LCI-90 monitor units located in the Control Van and the Pedestal.

2.3.1.3 Umbilical Winch Hydraulic System Circuits

The Umbilical Winch Hydraulic System consists of two hydraulic circuits: the Umbilical Winch Closed-Loop Circuit and the Levelwind/Auxiliary A-Frame Assembly Open-Loop Circuit.

2.3.2 HPU Assembly

The Hydraulic Power Unit (HPU) (Figure 2-3) has two electric motor/pump strings which can be configured to operate independently (redundant) or together, for increased line speed. Hydraulic manifolds are used to combine the individual or dual power unit flow to the winch circuits.

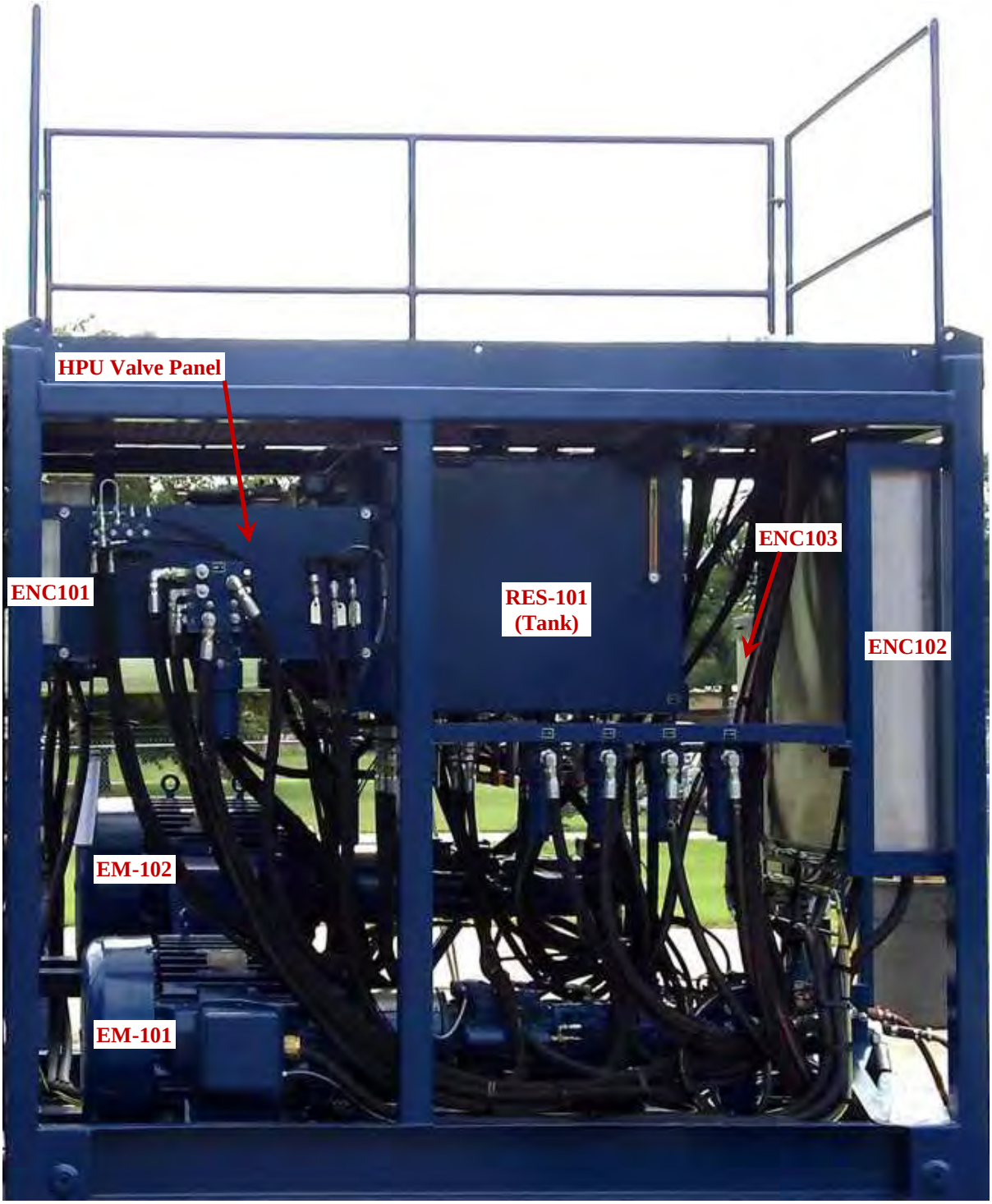

Figure 2-3 HPU Assembly

Maximum system performance is achieved when both HPU motors are operating simultaneously. Should a problem develop with an individual HPU motor, it can be secured and the remaining HPU motor can satisfactorily drive the Umbilical Winch System at a reduced speed.

2.3.2.1 HPU #1 and HPU #2

The HPU #1 and HPU #2 each have two hydraulic pumps mounted in tandem on an electric motor. Each string has a 125 HP electric motor driving a pump string consisting of three pumps. The first pump in the string is a closed loop hydrostatic transmission (HP-101A, HP-102A) that powers the umbilical winch hydraulic motor. The second pump in the string is a pressure compensated open loop pump (HP-101B, HP-102B) that provides power to the electro-active levelwind motor/gearbox (HM-102, GB-102). The third pump is a gear pump (HP-101C, HP-102C) which provides power to the diamond screw levelwind drive motor.

2.3.2.2 Umbilical Winch Drive

A series of ball valves are used to select which pump is active depending upon FTHE operations. Ball valve selection determines which power unit or combination of power units will start based on whether the valves are open or closed.

2.3.2.3 Levelwind/Auxiliary Drives

The Electro Active Levelwind Control System operates with a single coil hydraulic displacement control and appropriate sensor to control a hydraulic motor driven levelwind. The Levelwind Assembly is a mechanical device that is sensor controlled to place the umbilical cable on the winch drum in an orderly fashion.

2.3.3 Heave Compensator Assembly

The HC Assembly (Figure 2-4 and Figure 2-5) is an active over passive heave compensator and is comprised of a Traveling Sheave Compensator, an HC HPU, and the Compressor/Intensifier System which includes a Nitrogen Bottle Rack. Nitrogen is used to balance against the hydraulic accumulators to dampen the in and out motion of the umbilical cable caused by wave action.

NOTE

To say that the Heave Compensator (HC) Assembly is an “active over passive heave compensator” indicates that the basic operating mode is the Passive mode. From the Passive mode, the HC System transitions into the Active mode and eventually transitions back to the Passive mode when securing from FTHE operations. The result is that during normal operations, the HC System always has at least the Passive compensation mode working.

2.3.3.1 Traveling Sheave Compensator

The Traveling Sheave Compensator pays out or hauls in umbilical cable to control tension and vehicle position for varying sea states. To accomplish this, the Lower Head Assembly, comprised of the Lower Sheave Assembly (three fixed sheaves) is mounted in the HC Assembly base. The Flying Head Assembly, comprised of the Upper Sheave Assembly (two moveable sheaves), travels in an up and down direction by the Cylinder/Valve/Accumulator/Manifold Assembly. The Traveling Sheave Compensator, a part of the HC Assembly, is mounted between the Umbilical Winch System and the A-Frame Assembly and thus ensures the umbilical cable wraps stay even and tight on the umbilical winch drum.

Figure 2-4 HC Assembly (Aft View - Reeving)

Figure 2-5 HC Assembly (Forward View)

2.3.3.2 HC Assembly HPU Motor

The HC Assembly HPU has two hydraulic pumps mounted in tandem on an electric motor (EM3). The first pump (HP-3) provides open-loop hydraulic power to the active assist portion of the HC Assembly. The second pump (HP-4) is used to provide system oil cooling.

NOTE

With the HC System in the Passive mode, the system is simply reacting to the changing tension due to sea swells: the tension, in essence, pulls down or lets up the Flying Head Assembly. In the Active mode, the Flying Head Assembly is pushed down using hydraulic power and let up by pulling off the hydraulic pressure and letting the nitrogen pressure push the Flying Head Assembly up. The change in tension (or other control variable) is used to create the signal that adjusts the hydraulics.

2.3.3.3 Compressor/Intensifier System

An electric motor driven compressor/intensifier nitrogen gas system (Figure 2-6) is used to adjust the HC Assembly accumulator gas pressure to provide the proper umbilical cable tension according to the weight of the load and operating mode. This system is also referred to as the gas reclamation system and is a completely closed system.

Figure 2-6 HC Assembly (Gas Intensifier)

2.3.3.4 Bottle Rack

A separate bottle rack with high pressure nitrogen bottles is mounted on top of and within the HC Assembly. The bottle rack contains two types of gas storage bottles: nine replaceable bottles rated at 2300 psig that serve as the supply to the system; five permanent bottles rated at 3000 psig., painted blue, plumbed together, and serve as a reservoir for the HC Assembly accumulators. Depending on the mode of operation, the compressor/intensifier pumps nitrogen between the two groups of bottles in either direction, as required.

2.3.4 A-Frame Assembly

The A-Frame Assembly (Figure 2-7) consists primarily of two A-Frame legs, a Docking Head General Assembly/Swing Frame which includes a Cursor Assembly. The A-Frame Assembly is articulated through its range of travel (22° forward of center and 45° aft of center) by two hydraulic cylinders. Load holding valves are installed on all cylinders to prevent the frame from falling in the event of hydraulic line failure or unauthorized operation of directional control when the HPU Assembly is disabled.

In general terms, the Docking Head General Assembly/Swing Frame, working in tandem with the A-Frame Assembly, provides the means to launch and retrieve the vehicle and packages. The Swing Frame is free to rotate fore and aft according to the movement s of the ship, or positioned or locked in place through the use of hydraulics.

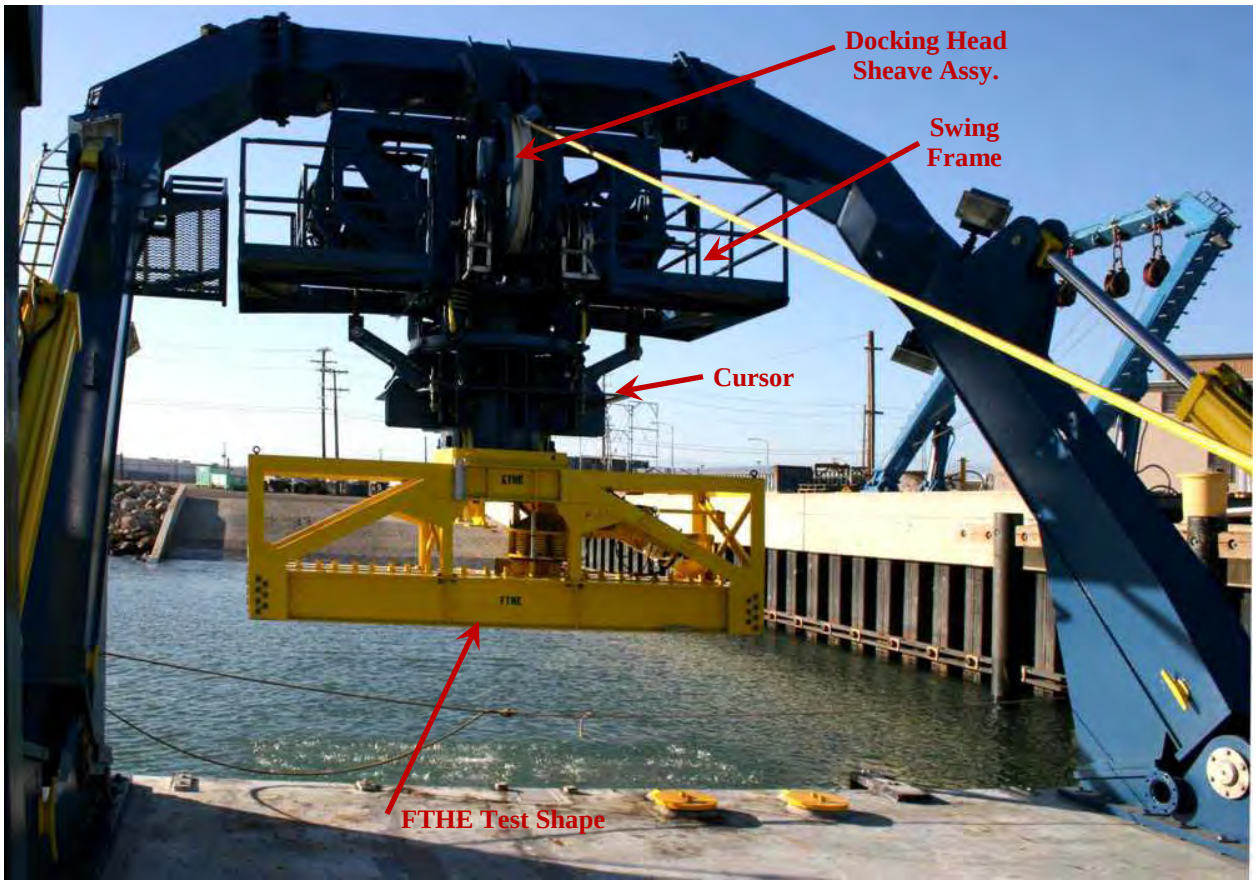

Figure 2-7 A-Frame Assembly

The A-Frame legs provide the support for the Docking Head General Assembly/Swing Frame which includes the Cursor Assembly.

2.3.4.1 Docking Head General Assembly

The Docking Head General Assembly (Figure 2-8) includes the docking head cross member weldment (from which the auxiliary winch is hook-mounted) and all the assemblies and equipment that are supported below it by the docking head pivot pins. Everything supported by the pivot pins is collectively known/referred to as the "Swing Frame," and that is how its controls are identified on the Pedestal. These assemblies and equipment include: Docking Head Sheave Assembly, Cursor Lift Winch Assembly, Catch and Latch Assembly, Docking Head Cushion Assembly, Cursor Assembly, cursor hose reel, and docking head platform weldment.

The Swing Frame accommodates a 10° forward and a 30° aft-of-vertical tow angle.

The 3-ton electrically operated auxiliary winch is used to raise the WROV from the WTMS when access is necessary to perform maintenance to either vehicle.

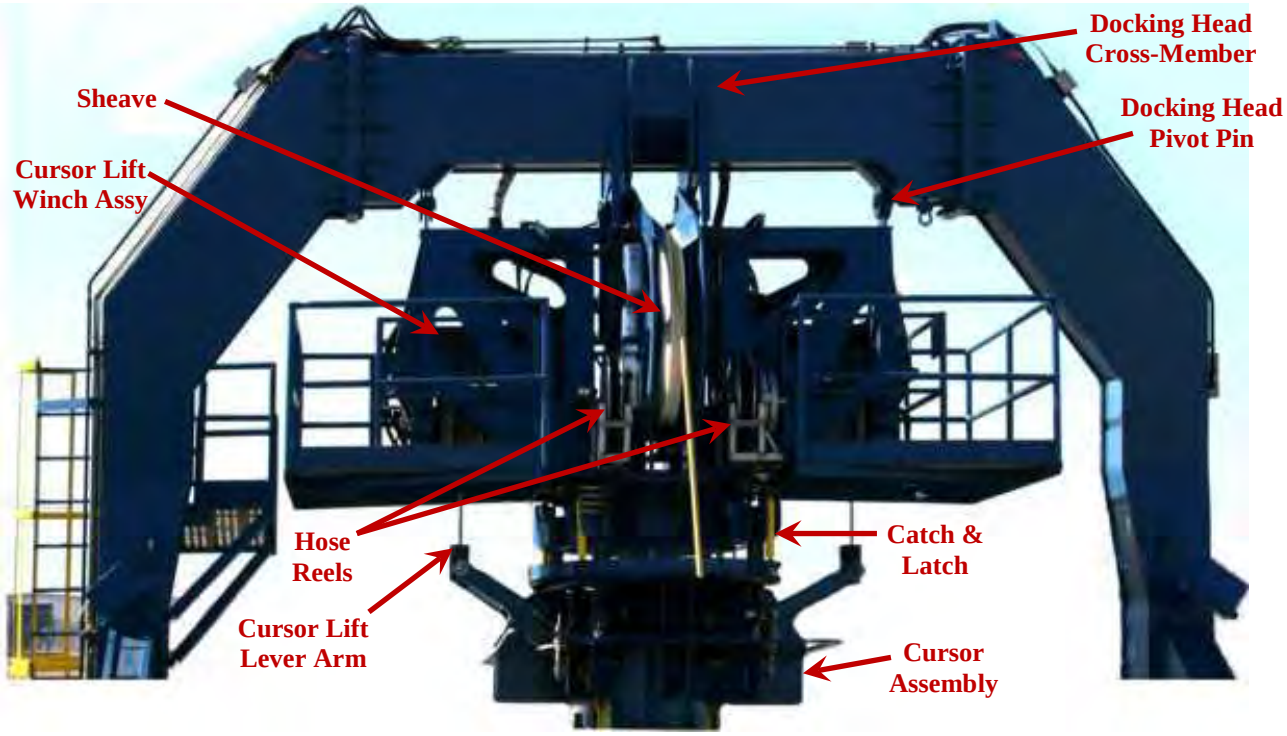

Figure 2-8 Docking Head General Assembly

2.3.4.1.1 Docking Head Sheave Assembly

The Docking Head Sheave Assembly is suspended from the docking head cross member weldment and consists of the sheave and the left and right Cursor Lift Winch Assemblies. The sheave acts as a fairlead to safely guide the umbilical cable from the HC Assembly to the vehicle without being cut or chafed.

Other assemblies/equipment attached to the Docking Head Sheave Assembly, but not considered a part of this assembly include the Catch and Latch Assembly, Docking Head Cushion Assembly, Cursor Assembly, docking head platform weldment, and cursor hose reels.

2.3.4.1.1.1 Cursor Lift Winch Assemblies

The Cursor Lift Winch Assemblies are mounted within the Docking Head Sheave Assembly and use wire ropes working in tandem to raise and lower the Cursor Assembly and ultimately the vehicle/package.

A proximity sensor prevents the cursor lift winch assembly from paying out more than approximately 40 feet of its 90 foot total length. When the limit is reached, the sensor is activated and operation of the cursor lift winch assembly from the Pedestal is halted. The cursor lift winch assembly can still be operated from the Manual Directional Control Valve [DCV] Station because it ignores the sensor circuit.

2.3.4.1.2 Catch and Latch Assembly

The Catch and Latch Assembly is mounted to the Docking Head Sheave Assembly and provides a dock/latch assembly to lock the Cursor Assembly into the Docking Head Sheave Assembly when it is raised to that position.

2.3.4.1.3 Docking Head Cushion Assembly

The Docking Head Cushion Assembly is mounted between the Catch and Latch Assembly and the Cursor Assembly. As its name implies, it provides a cushioning effect through the use of four shock absorbers when the Cursor Assembly locks in place.

2.3.4.1.4 Cursor Assembly

The Cursor Assembly is attached to the Docking Head Sheave Assembly by wire ropes operated by the two cursor lift winch assemblies. The Cursor Assembly latch jaws attach to the vehicle locking ring and provide the physical attachment for deployment and retrieval of the vehicle/package.

2.3.4.1.5 Cursor Hose Reels

Hydraulic power is provided to the cursor latch cylinders by two hydraulic hoses that run from the Cursor Latch Control Station (physically mounted to the Manual DCV Station) to the cursor hose reels, mounted on the Docking Head Sheave Assembly framework, and then to the cursor latch cylinders. As the Cursor Assembly is raised or lowered, the cursor hose reels haul in or pay out the hydraulic hoses as required.

2.3.4.1.6 Docking Head Platform Weldment

The docking head platform weldment is physically attached to the Docking Head Sheave Assembly and provides a safe platform with side rails to stand on when inspecting or working aloft is necessary.

2.3.5 Operator Control Stations

There are three operator winch control stations and they have different functions and capabilities. The Manual DCV Station is situated directly adjacent to the starboard A-Frame leg. The Pedestal (local control) is, in fact, mounted on a pedestal attached to the deck on the port side of the HC Assembly. The Control Van Panel (remote control) is located in the Control Van and is rack mounted within the Electronics Cabinet.

2.3.5.1 Manual DCV Station

NOTE

Using the Manual DCV Station overrides all control functions at the Pedestal.

The FTHE Operator at the Manual DCV Station (Figure 2-9) can operate the A-Frame (luff in/out), Cursor Winch (haul in/pay out), Swing Frame (inboard/outboard), and the Umbilical Winch (haul in/pay out) using the appropriate joysticks; all the same operations that can be accomplished at the Pedestal. However, operating the Cursor Latch (latch/unlatch) can only be done at the Manual DCV Station.

The left and right Cursor Winch Lift Assemblies each have 90 feet of wire rope wound on their grooved drums. One end of each wire rope has a crimped lug which slides into a slot located on the drum flange and is held in place while both wire ropes are wound simultaneously onto their respective drums. The other end of each wire rope is attached to the left and right Cursor Lift Lever Arm Assemblies using an open spelter socket. As long as the wire ropes remain taut on their drums, the crimped lugs stay in their slots keeping wire ropes secured to the winch drum.

CAUTION

Using the Manual DCV Station defeats the Cursor Winch depth limit. When paying out umbilical cable, leave a minimum of 5 wraps of cable on the Cursor Winch.

When operating the Cursor Winch from the Manual DCV Station, the Cursor Winch depth limit switch is defeated. Therefore, it is incumbent upon the FTHE Operator to leave a minimum of five wraps (approximately 35 feet) of wire rope on the Cursor Winch. This ensures the crimped lug stays in its slot at the drum flange and therefore, the wire rope remains firmly attached.

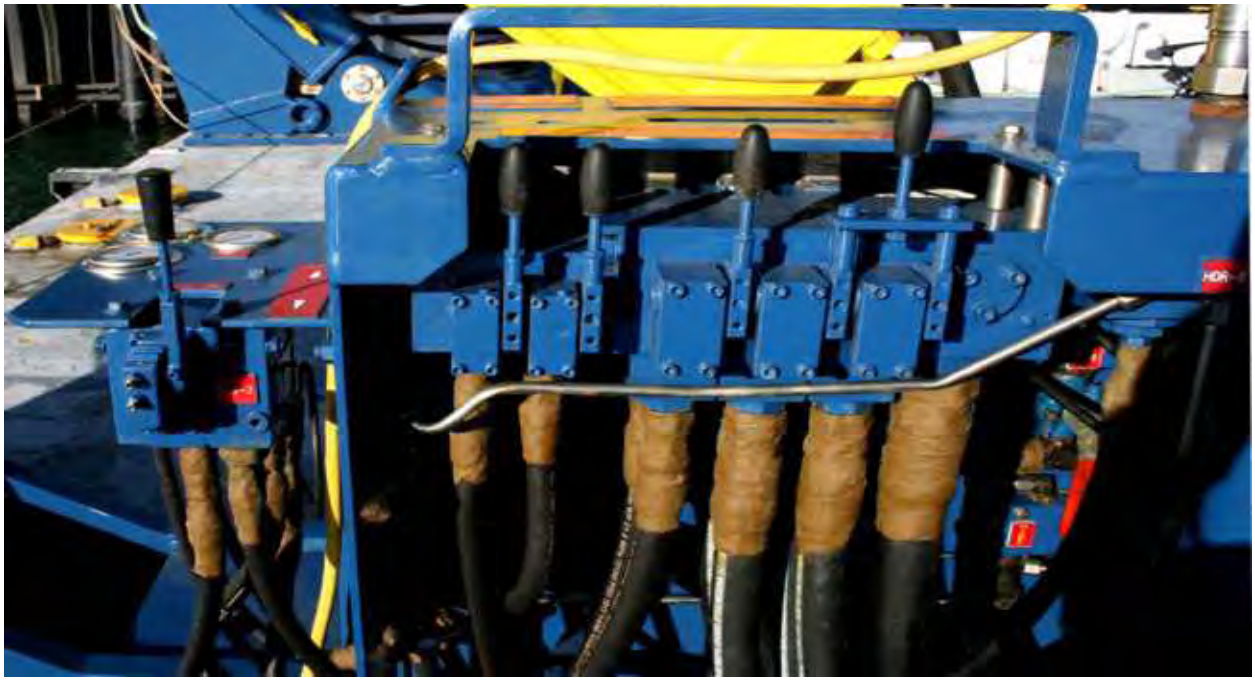

Figure 2-9 Manual DCV Station

2.3.5.2 Pedestal (Local Control)

The operator at the Pedestal control station (Figure 2-10) can operate the A-Frame Assembly (luff in/out), Cursor Winch Assembly (haul in/pay out), Swing Frame Assembly (inboard/outboard), and the Umbilical Winch Assembly (haul in/pay out) using the appropriate joysticks and toggle switches. This is the work position for the FTHE Operator (designated as "**Control 2**") during deployment and retrieval operations.

Figure 2-10 Pedestal (Local Control)

Two options for the winch tension/speed operation can be selected: high tension/low speed (120 fpm) or low tension/high speed (240 fpm). However, a creep speed of as little as 0.1 fps may be possible when the winch joystick is moved off neutral just enough to make the winch operate. The winch constant tension mode can be enabled or disabled and the Levelwind corrector can be shifted to the left or right as required to manually control the Levelwind action. The HC Flying Head Assembly can be secured at the bottom of its travel by selecting the "Heave Comp" toggle switch lock or unlock position.

CAUTION

Selection of low tension/high speed is not recommended for normal FTHE operations when lowering the vehicle/package. The umbilical cable could pay out quicker than the vehicle/package descends allowing the umbilical cable to slacken causing control of the descent to diminish.

The umbilical cable line count, speed, and tension can be monitored using the remote display.

When the Pedestal "Remote Enable" toggle switch is moved to "Enable," control of the umbilical winch is passed from the Pedestal Operator on the after deck to one of the vehicle operators sitting at a control station within the Control Van. Control of the umbilical winch is returned to the Pedestal when the Pedestal "Remote Enable" toggle switch is moved to the "Disable" position or the joystick on the Pedestal is moved off of neutral.

When the Emergency Stop System push button is activated, all HPU motors shut down on both the HPU and HC Assemblies. When the Winch/A-Frame HPU Stop push button is activated, both HPU motors shut down on the HPU Assembly.

2.3.5.3 Control Van (Remote Control)

The ESAC Control Van is a typical lab environment-type Sensitive Compartmented Information Facility (SCIF) which houses various consoles used for control of the overall DWT operations. During Calibration Cruise, the NFESC Control Van is utilized for testing FTHE prior to DWT. This is the work position for the DWT Operator (designated as "**Control 1**") during operations.

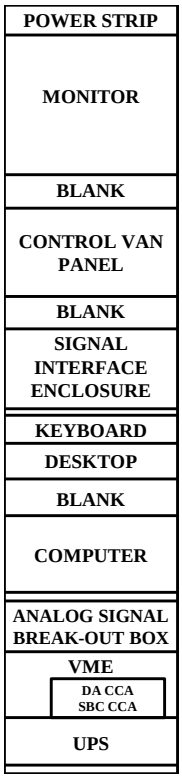

Figure 2-11 Control Van Electronics Cabinet

NFESC FTHE team has responsibility for the Electronics Cabinet (Figure 2-11) in a 19-inch equipment rack within this space. (Refer to ESAC manual for details of other electronics.)

2.3.5.3.1 Monitor

The monitor is the computer interface and by way of a graphical user interface (GUI), provides visual indication of the communications between the computer software programs and the FTHE conditions. By placing the cursor over a selectable item, the FTHE Operator can select/deselect various user controlled options (Figure 2-12).

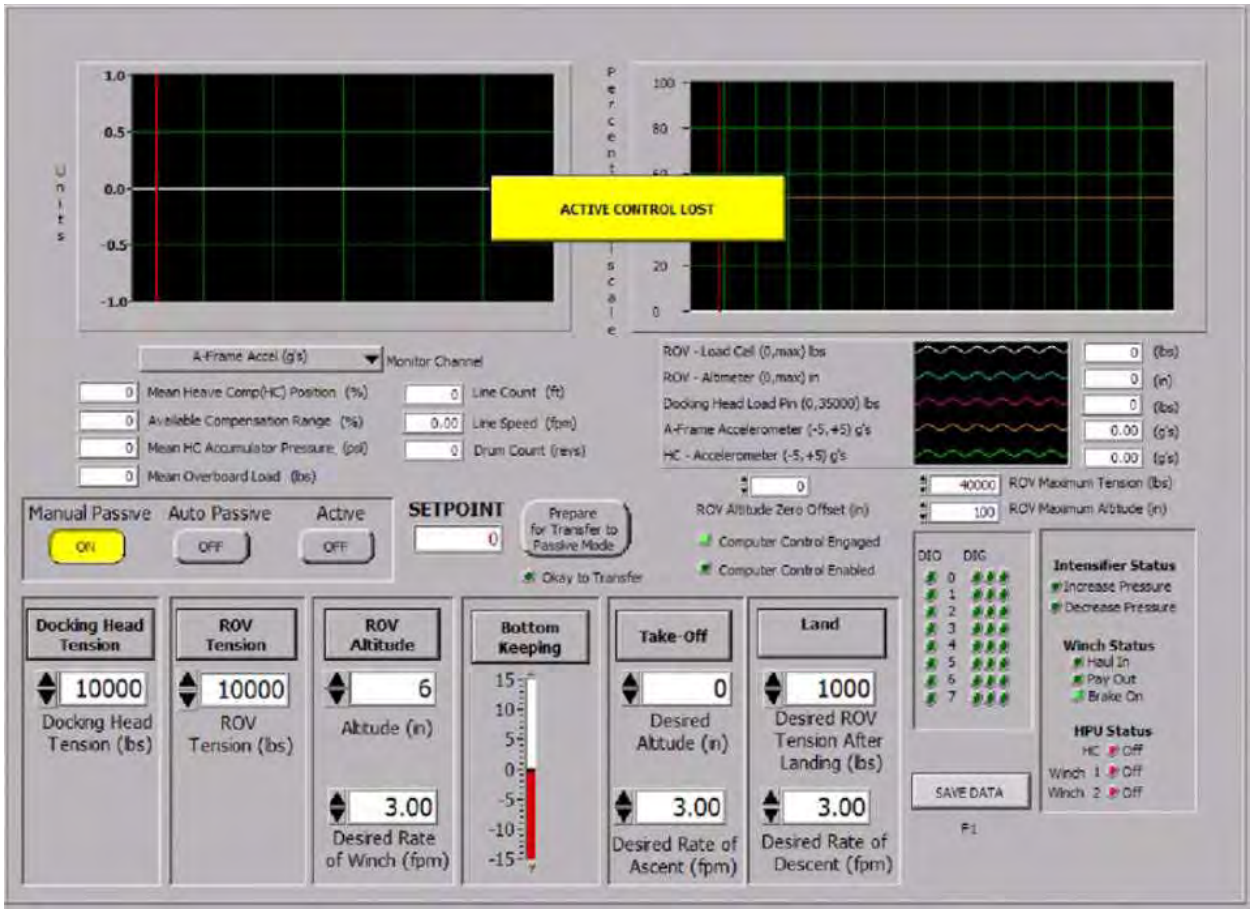

Figure 2-12 Monitor – GUI Presentation

2.3.5.4 Control Van Panel (Remote Control)

The Control Van Panel (Figure 2-13) allows personnel in the Control Van to monitor various operating functions relating to the HPU and HC Assemblies via indicating lamps. The umbilical cable line count, speed, and tension can be monitored using the master display.

When the Pedestal "Remote Enable" toggle switch is moved to "Enable," control of the umbilical winch is passed from Pedestal Operator (**Control 2**) in Control Booth to the DWT Operator (**Control 1**) sitting at the FTHE control station in the Control Van. Computer control of the umbilical winch is disabled when the Pedestal "Remote Enable" toggle switch is moved to the "Disable" position or the Pedestal joystick is moved off of neutral. When the Control Van Panel "Computer Control" toggle switch is moved to "Enable," a signal from the motion compensation software prepares the HC System for automatic control.

Figure 2-13 Control Van Panel (Remote Control Station)

Should an emergency condition present itself, either the HPU Assembly or the HC Assembly HPU motors can be quickly shut down using Emergency Stop Switches prominently located at the top of the Control Van Panel.

2.3.5.4.1 Computer

The FTHE control computer is a standard Peripheral Component Interconnect (PCI) computer in an industrial rack mount format. The computer contains three National Instruments (NI) CCAs, a CyberResearch® CCA, a 3-1/2 inch floppy disk drive for transferring data in/out of the computer, and a CD writer for creating data CDs.

2.3.5.4.1.1 Real-Time Data Acquisition (DAQ) CCA

The Real-Time DAQ CCA (NI PCI-7041) (includes PCI-7041/6040E) board delivers real-time, deterministic, and reliable Input/Output (I/O) for measurement and automation. The board has an independent processor running a real-time operating system. An NI-6040E Multifunction I/O (MIO) daughter-board installed on the PCI-7041 provides 16 single-ended/8 double-ended analog input channels, 2 analog voltage output channels, and eight 5V/Transistor-Transistor Logic (TTL) digital I/O channels.

2.3.5.4.1.2 Digital I/O (DIO) CCA

The DIO CCA (NI PCI-6527) is a board with devices that are 48-bit, parallel, isolated digital I/O interfaces for PCI bus computers. The devices offer 48 channels of isolated digital data acquisition: 24 optically isolated inputs, and 24 isolated solid-state relay outputs.

2.3.5.4.1.3 Multifunction DAQ CCA

The Multifunction DAQ CCA (NI PCI-6034E) is a high performance multifunction analog, digital, and timing I/O device for PCI and PCMCIA computers. Supported functions include Analog Input (AI), Analog Output (AO), DIO, and Timing I/O (TIO). It provides 16 single-

ended/8 double-ended analog input channels and 8 digital I/O channels. It receives analog signals from the VME Enclosure D/A CCA (originally digital signals provided from the WROV) for processing.

2.3.5.4.1.4 Processor CCA

The CyberResearch® Processor Card (CPPC P4-24-X) with Ethernet and AGP Video functions is based on the Intel® 865G chipset and is fully designed for a harsh industrial environment. The CPPC series has an 800 MHz Front Side Bus (FSB) with chipset (GMCH) on die-enhanced Intel® Extreme Graphics 2, and one 10/100/1000 Megabits per second (Mbps) Gigabit Ethernet controller computer running Windows XP Professional as its operating system and is configured to automatically launch the special purpose FTHE application upon start-up.

2.3.5.4.2 Keyboard Tray

The keyboard tray contains the standard “qwerty” keyboard and roller-ball mouse which provides the means of operator input to the computer.

2.3.5.4.3 Signal Interface Enclosure

The Signal Interface Enclosure provides the I/O interface between the Computer, Control Van Panel, and the deck mounted HPU Assembly, Umbilical Winch System, A-Frame Assembly, and HC Assembly. The enclosure contains signal conditioning circuits (SC-3, SC-4, and discrete components), in addition to 11 (10 plus 1 spare) I/O optocouplers that use 5 VDC logic signals provided by the computer to control 24 VAC signals of the deck mounted system components, and a CCA to map the various signals to the correct computer ports as well as provide for termination of some signals.

SC-3 receives the voltage signals generated by the computer and converts them to current signals for use by the HC Assembly Servo Valve (SVV-2). SC-4 receives the voltage signals generated by the computer and converts them to current signals for use by the Umbilical Winch Assembly.

2.3.5.4.4 VME Enclosure with I/O Adapter

The FTHE VME Enclosure contains two CCAs: a Single Board Computer (SBC) CCA and a Digital-to-Analog (D/A) CCA. Custom software loaded onto the SBC receives Common Object Request Broker Architecture (CORBA) messages over the Ethernet network coming from the vehicle electronics (tension, altitude, and HC position). The custom SBC software appropriately scales the digital data and commands the D/A CCA to output on assigned channels scaled analog voltages corresponding to the digital tension, altitude data, and heave compensator position. These 2 analog voltages are wired to a multifunction DAQ CCA in the FTHE control computer.

A fourth, compounded signal, that provides ordered altitude mode, is generated from the vehicle console and is converted by the D/A CCA. There are actually two signals: one announces an altitude change request, while the other signal provides direction (up or down).

2.3.5.4.5 Uninterruptible Power Supply (UPS)

The UPS stores incoming energy in its internal battery. The internal battery allows the UPS to smooth out voltage variations and, during complete power failure, support power to the Electronics Cabinet long enough for an orderly Shut-Down. The UPS suppresses input transient/surges and sends regulated 115 VAC output power to the equipment assemblies via appropriate cabling and connectors.

2.4 EQUIPMENT DESCRIPTION

2.4.1 Umbilical Winch System

Each of the following subsections provides a physical description ("what it is") of the FTHE major systems. Functional descriptions were described in section 2.3, Functional Description.

2.4.1.1 Umbilical Winch Assembly

FTHE dimensions are defined as Length (port-to-starboard), Width (forward-to-aft), and Height, (L x W x H). The overall Umbilical Winch Assembly is 146-3/16 x 258-5/8 x 173-1/2 inches. The Winch weighs 48,250 pounds (with umbilical) and Levelwind weighs 25,400 pounds.

The major Umbilical Winch Assembly components include the winch drum, hydraulic motor, overhead levelwind assembly, upper turning sheave, lower turning sheave, and local controls. The drum core is grooved to accommodate the cable's initial and successive orderly wraps.

Principal dimensions of the umbilical winch drum are as follows: 74-inch diameter drum core, 98-inch drum flange, and 141-inch spacing between flanges. The winch drum is supported within a base frame on each end by a pillow block bearing assembly constructed to accommodate a drum shaft extending through the entire length of the drum. Internal support and ambient air cooling is provided to the drum core and drum shaft with two internal baffles. Additional internal support to the drum core is also provided by the winch drum drive plate and an end plate. The drum shaft features an inside diameter equal to 5.75-inch. The drum is direct driven on one end by a winch drive assembly consisting of a Haaglunds CB-840 3220 cu. in. hydraulic motor. The umbilical winch is equipped with one Dellner SKP 220 SA spring applied, hydraulically released caliper brake and one Dellner SKD 4X125 hydraulic applied, spring release caliper brake acting on a common brake disc mounted to the winch drum drive plate. The spring applied brake is set when the system is off and the hydraulic applied brake is used for braking during operations.

Four point lifting of the umbilical winch is provided by a lifting eye attached to each corner of the winch base frame.

2.4.1.2 Levelwind Assembly

The major LW Assembly components include the traveling overhead right-angle Sheave Assembly, Electro-Active Levelwind system and Diamond-Screw driven system. The LW Drive Assembly has two externally greased guide bars and an ACME drive screw, which causes the LW Carriage Assembly to traverse along the guide bars.

2.4.1.2.1 Overhead Right-Angle Sheave Assembly

The overhead right angle sheave assembly has a 40 inch tread diameter and is grooved to accommodate the umbilical cable. It fairleads the umbilical cable from the umbilical winch to the upper turning sheave and from there to the lower turning sheave.

2.4.1.2.2 Electro-Active Levelwind System

The electro-active levelwind ACME screw is driven by a Charlynn 19 cu-in hydraulic motor interfaced with a Brevini 6.1 ratio EM1065 gearbox. Control of the levelwind is provided by the levelwind sensor in conjunction with the electro-active levelwind PCB board.

2.4.1.2.3 Diamond Screw Levelwind System

The diamond screw is directly driven by a White 24.9 cu-in RS 200 series hydraulic motor. Control of the levelwind is provided by a levelwind sensor in conjunction with the diamond screw levelwind PCB board.

The diamond screw is designed to be mechanically tied to the electro-active levelwind during setup procedures. The diamond screw is tied to the electro-active levelwind system by a pawl peg when the system is operating in the diamond screw mode and is inactive when the system is operating in the electro-active mode (not mechanically tied to the diamond screw pawl peg.

2.4.1.3 Upper Turning Sheave Assembly

The upper turning sheave is located parallel to and on the outside of the levelwind sheave. It is tilted along a parallel line to the lower turning sheave assembly. The sheave has a 40-inch tread diameter and is grooved for the umbilical being used. The umbilical cable is reeved from the top of the levelwind sheave to the top of the upper turning sheave and downward to the lower turning sheave assembly.

2.4.1.4 Lower Turning Sheave Assembly

The lower turning sheave assembly is bolted to the front of the inch frame and the sheave is tilted to accept the cable from the upper turning sheave and route the cable to the heave compensator. The sheave has a 44-inch tread diameter and is grooved for the umbilical being used. The umbilical cable is reeved from the top of the upper turning sheave to the bottom of the lower turning sheave and is routed to the Heave Compensator and on to A-frame overboarding sheave.

2.4.2 HPU Assembly

The overall HPU Assembly is 121 x 87 x 142-1/4 inches and weighs 13,350 pounds with oil. (Refer to Chapter 9 Mobilization for HPU figures.)

The power unit has two (2) electric motor/pump strings which can be configured to operate independently or together, for increased line speed.

Each string has a 125 HP electric motor driving a pump string consisting of three (3) pumps. The first pump in the string is a Sauer-Danfoss 90R-130 cc closed loop hydrostatic transmission (HP-101A, HP-102A) which powers the umbilical winch hydraulic motor (HM-101). The second pump in the string is a Rexroth A1V140 140 cc pressure compensated open loop pump (HP-101B, HP-102B) which provides power to the electro-active levelwind motor/gearbox (HM-102, GB-102). The third pump is a Rexroth AZ 11 cc gear pump (HP-101C, HP-102C) which provides power to the diamond screw levelwind drive motor (HM-103). Hydraulic manifolds are used to combine the individual or dual power unit flow to the winch circuits. The manifolds are discussed later in the manual.

An Indeeco thermostatically controlled oil heater (HTR101) is installed in the reservoir. The thermostat is set to be on at startup until the oil reaches a temperature of 60 degrees Fahrenheit, after which it shuts off automatically.

Oil cooling is provided by a Thermal water-over-oil heat exchanger (HX-101). The heat exchanger accepts customer supplied cooling water and is to be on during operations to supply required oil cooling. The heat exchanger should be drained during cold weather when not in use to prevent freezing and cracking components and zinc anodes should be checked on a quarterly

basis and replaced when one-half or greater deterioration occurs. A second water-over-oil heat exchanger is provided for cooling the HP-101C/HP-102C hydraulic circuit.

Both pump strings share a common 210 gallon reservoir and heat exchanger. The power unit framework is constructed of structural steel tubing. The unit has lifting eyes located at the top corners of the framework.

The 2 X 125 HP electric motor/ hydraulic pump strings are bolted to mounting plates welded to the power unit floor plate. The hydraulic reservoir is mounted above and adjacent to the pump motor assembly. Suction strainers are installed inside the reservoir to provide initial filtering for the suction lines.

Primary electrical power is supplied to a power isolation enclosure (ENC-101). All motor controls are installed in a NEMA-4X high voltage enclosure (ENC-1022) installed on the power unit framework. The enclosure contains the 2 X 125 HP electric motor soft starts, Magnetic Motor Starters and bypass contactors, 115 VAC and 24 VAC transformers, current sensor, power monitor, and associated high voltage components. A low voltage enclosure (ENC-3) contains the low voltage control circuitry and consists of 12 VDC operated control circuitry and modules.

Pressure gauges are mounted in a gauge panel mounted on the power unit. These gauges allow technicians to check pump pressures at the power unit. Hydraulic interconnect hoses with fluid disconnects join the power unit pumps to the umbilical winch, and levelwind drive motors to form one integrated assembly during operations.

2.4.3 Hydraulic System

The hydraulic system of the Winch & A-Frame consists of one closed loop circuit and two open loop circuits. The closed loop system drives the umbilical winch and the two open loop systems drive the A-Frame, levelwind motor/gearbox and the diamond screw motor.

The prime mover of the winch system is dual 125 HP @ 1760 RPM, 460 VAC, 3 phase, 60 Hz electric motors which are coupled inline to a Sundstrand 90R-130 Series closed loop variable displacement pump via a pump/motor coupling. Output developed by the closed loop pumps are controlled by an electric displacement controller (EDC) mounted on the pump. A signal generated by the operator is transformed into linear motion of the internal swash-plate of the pump supplying flow to the winch drive motor. As the swash-plate moves, pressure, rate, and direction of the pump discharge flow are proportionally controlled.

A charge pump is an integral part of the variable pump. The purpose of this pump is to: 1) provide a flow of oil through the pump motor circuit for cooling purposes, 2) supply oil under pressure to maintain a positive pressure on the low side of the pump/motor circuits, 3) supply sufficient oil under pressure for control purposes , and 4) provide makeup oil for internal leakage. Hydraulic oil supplied to the pump from the reservoir is filtered through a 1 micron suction strainer mounted in the reservoir. The pressure developed by this charge pump is called charge pressure and can be monitored to detect symptoms of pump problems. Pressure gauges (0-600 psi) monitor charge pressure.

Working pressure and flow from the umbilical winch variable displacement pump is plumbed via hydraulic hoses to the winch drive hydraulic motor. Oil is circulated from one side of the closed loop pump into one side of the motors and is returned to the opposite side of the pump forming a closed loop system. Tilting the swash-plate in the pump the opposite direction reverses the flow

of oil, therefore reversing the rotation of the winch drive motor. The pressure required to rotate the hydraulic motor is called System Pressure.

The open loop pumps (HP-101B/HP-102B) are in line to the closed loop pumps in the pump string and consist of a Rexroth A10V140 140 cc open loop pump which provides power to the auxiliary circuit and to the electro-active levelwind drive motor (HM-102) and diamond screw drive motor (HM-103).

Open loop pumps (HP-101C/HP-102C) are also inline to closed loop pumps in pump string and consist of a Rexroth 11 cc gear pump which provides power to flush the winch drive motor case.

The winch has two toggle switch selectable modes of operation: Normal and Constant Tension. Constant Tension Mode is employed during launch and recovery procedures and has a tension load range between 5,000 – 8,000 lbs.

2.4.3.1 Hydraulic Manifolds

Hydraulic manifolds are used combine the flow of the two power units and to simplify the hydraulic circuitry of the system.

Hydraulic Manifold	**General Description**
HPU MANF-101	Open Loop
HPU MANF-102	Closed Loop Flushing
HPU MANF-104	Winch Pump Isolation Manifold
HPU MANF-105, MANF-106	Sea Water for Oil Coolers
WINCH MANF-101	Counterbalance Valve Block
WINCH MANF-102	Winch Control Block
WINCH MANF-103	Electro-Active Servo Valve
WINCH MANF-104	Diamond Screw Servo Valve

2.4.3.2 Ball Valves

Ball valve selection determines which power unit or combination of power units will start based on whether the valves are open or closed.

SUCTION BALL VALVES (X = OPEN, C = CLOSED)

Pump String #1			Pump String #2				
Closed Loop BV-102	Open Loop BV-106	Open Loop BV-108	Closed Loop BV-103	Open Loop BV-107	Open Loop BV-109	START #1	START #2
X	X	X	X	X	X	Y	Y
C	X	X	X	X	X	N	Y
X	C	X	X	X	X	N	Y
X	X	C	X	X	X	N	Y
X	X	X	C	X	X	Y	N
X	X	X	X	C	X	Y	N
X	X	X	X	X	C	Y	N

Suction Interlock Sensors XS-101 through XS-106 sense the open/close status of the suction valves.

2.4.4 HC Assembly

The HC Assembly is comprised of a Traveling Sheave Compensator, an HC Assembly HPU motor, and the Compressor/Intensifier System which includes a Nitrogen Bottle Rack. It also includes a hydraulic supply tank, and associated valves, filters, sea water/oil heat exchanger, and circuit lamp indicators.

The supply tank is a 180 gallon hydraulic reservoir with a level gauge. The overall HC Assembly footprint is 137 x 101 x 162 inches with the Flying Head Assembly below the upper Heave Compensator Skid Weldment. The maximum height is 190.625 inches when the Flying Head Assembly is fully raised.

The HC Assembly weighs 34,340 pounds.

2.4.4.1 Traveling Sheave Compensator

The Traveling Sheave Compensator is comprised of the Flying Head Assembly and the Cylinder/Valve/Accumulator/Manifold Assembly and is physically mounted in the port side of the HC Assembly. The Flying Head Assembly (including top compression weldment) is 49 x 48 x 65 inches. The Cylinder/Valve/Accumulator/Manifold Assembly (excluding the Temposonic Transducer) is 113 inches high.

The Lower Head Assembly (the opposing end of the Flying Head Assembly) has three fixed sheaves and is mounted in the HC Assembly base. The full-travel of the Flying Head Assembly is 48 inches and with four wraps of umbilical cable, the Traveling Sheave Compensator can haul in or pay out a total of 16 feet (48” x 4 wraps) of umbilical cable.

The Flying Head Assembly (with two traveling sheaves) is supported at the rod end of two hydraulic cylinders. The hydraulic cylinders are constructed with low friction seals and over-sized ports. The sheaves are constructed of polyamide to reduce mass.

Protective screen guards (with access doors where necessary) are installed around the moving assemblies, both lower and upper levels, for personnel safety and to prevent equipment damage.

2.4.4.2 HC Assembly HPU Motor

Only one HPU motor is used in the HC Assembly and it is mounted on the starboard, lower side of the unit. It is powered by one 150 HP, 460 VAC + 10%, 3-phase, 60 Hz electric motor and drives two pumps in tandem. The first pump is a Rexroth 355 cc variable displacement, axial piston pump that provides open-loop hydraulic power to the active assist portion of the heave compensator. The second pump is a fixed displacement gear pump used to provide system oil cooling.

2.4.4.3 Compressor/Intensifier System

The compressor/intensifier system is mounted in the upper half of the HC Assembly on the starboard side. The Gas Intensifier Panel is mounted internally, on the aft end of the HC Assembly. Located on this panel are the Gas Intensifier Enclosure (ENC7) as well as all the valves and pressure switches associated with this system. An audible alarm (AS-1) is also mounted on the panel and it sounds when the computer has lost control of the heave compensation system in the automatic mode. The electric motor starter (MS4), low voltage

control transformer, bridge rectifiers, terminal blocks, air filters, and low voltage controls are located within ENC7.

The compressor/intensifier electric motor (EM4) and compressor (COMP-1) are mounted directly in front of the Gas Intensifier Panel. Using a belt and pulley linkage, the 11 kW (15 HP) motor drives the air-cooled compressor which functions as the compressor/intensifier.

2.4.4.4 Bottle Rack

The Bottle Rack is mounted in the upper half of the HC Assembly, starboard side, forward. It is divided into 16 equally sized areas which house the 9 low pressure (2300 psig) nitrogen storage bottles and 5 high pressure (3000 psig) nitrogen receiver bottles. On top of the Bottle Rack is a panel that provides mounting for the low pressure and high pressure manifolds, valves and pressure gauges associated with the Bottle Rack circuitry.

The overall Bottle Rack Assembly footprint is 48 x 54 x 65-1/4 inches and weighs 3,410 pounds. A full bottle of nitrogen weighs approximately 130 pounds.

2.4.5 A-Frame Assembly

The A-Frame Assembly is constructed of structural steel suitable for the 14 °F minimum operating temperature. The A-Frame Assembly breaks down into four sections for shipping and/or storage. (Refer to Chapter 11, Demobilization.) The assembled A-Frame/Docking Head/Cursor footprint (assembled – single footprint) is 30 x 142 x 370 inches (maximum height, nominal) while the outside width (base-to-base) is 320 inches, including the ladder is 332 inches, and the inside width (between base-to-base) is 260 inches. (Refer to Table 2-3 for weights.)

The left and right A-Frame legs are joined together by the docking head cross-member weldment which directly supports the Docking Head Sheave Assembly. Attached outboard of the starboard leg is a ladder which allows entrance to the access platform, docking head platform weldment, auxiliary winch, and the cursor winch hose reels. One end of a hydraulic luffing cylinder is attached to each leg and the other end is attached to the A-Frame base weldment. Two lights, one facing inboard the other facing outboard, are provided on the port A-Frame leg with a control panel on the starboard A-Frame leg to support night-time operations.

2.4.5.1 Docking Head General Assembly

The Docking Head General Assembly is bolted at the docking head cross-member weldment to both the left and right A-Frame legs. All the assemblies and equipment that hang from the two docking head pivot pins make up the Swing Frame, and as its name implies, swings freely when not enabled. There are four hydraulic cylinders, two to each side of the Docking Head Sheave Assembly. The upper ends are attached to the docking head cross-member weldment and the lower ends are attached to the Docking Head Sheave Assembly framework. When the Swing Frame is enabled, hydraulic power is applied to these cylinders and the Swing Frame can be positioned fore or aft or held in place.

The 3-ton Auxiliary Winch is a hook-mounted, single-speed chain hoist with a 1-HP 115 VAC motor that is electrically operated by a 24 VAC push button controller. It is physically attached to the docking head cross-member weldment. It has a 6,000 pound (3-tons) SWL lifting capacity at a lift speed of 5 feet per minute (fpm) and a maximum lift of 30 feet.

A 30 A single-feed power cable goes to a control box mounted at the base of the starboard A-Frame leg and supplies power required for the winch through a 25 A circuit breaker. The cable

runs up the starboard A-Frame leg, over the Docking Head Cross Member Weldment, and down the port A-Frame leg to a junction box with receptacles.

2.4.5.1.1 Docking Head Sheave Assembly

The Docking Head Sheave Assembly is the actual assembly that is directly attached to the

A-Frame Assembly by the two docking head pivot pins. The 48-inch tread diameter docking head sheave acts as a fairlead to safely guide the umbilical cable from the HC Assembly to the vehicle without being cut or chafed. The sheave has fairings and cable keepers to prevent the cable from fouling between the side plates and the sheave itself.

2.4.5.1.2 Cursor Lift Winch Assemblies

Two cursor winch lift assemblies have approximately 90 feet of wire rope wound on each drum. A proximity sensor and mechanical arm (target) are mounted on the starboard cursor winch lift assembly. When the cursor lift winches are operated from the Pedestal, the proximity sensor should disable the cursor lift winches, with at least five wraps (35 feet) or more of wire rope remaining on the winch drums

2.4.5.1.3 Catch and Latch Assembly

The Catch and Latch Assembly is a center-opened frame weldment that contains the latch weldments that lock the Cursor Assembly into place. It includes a bell mouth that provides a smooth radius to prevent damage to the umbilical cable as it guides the vehicle termination into the latching assembly. The four green-tipped latch indications (the ends of cable assemblies) are mounted on this unit.

2.4.5.1.4 Docking Head Cushion Assembly

The Docking Head Cushion Assembly is comprised of a ¾" thick neoprene sheet attached to the cushion mount ring and four spring/shock absorber assemblies.

2.4.5.1.5 Cursor Assembly

The Cursor Assembly is a frame weldment that is open in the bottom center but has a cursor cable guide mounted in the top which allows clear passage of the umbilical cable. The cursor latches are mounted within the bottom portion and movement is provided by a cursor latch cam assembly controlled by four hydraulic cylinders. Spring assemblies mounted on the end of the latch cylinder rods allow passage of the termination through the latch assembly even if the latch is closed to provide fail-safe latching. A bell mouth provides a smooth radius for the umbilical cable and guides the vehicle termination into the latching assembly.

2.4.5.1.6 Cursor Hose Reels

The 2 hydraulic hoses that supply power to cursor latch cylinders are wound around the cursor hose reels which are physically mounted on the Docking Head Sheave Assembly framework. As the Cursor Assembly is lowered, the hydraulic hoses are paid out and as the Cursor Assembly is raised, the hoses are hauled in due to the pre-loaded spring tension within the cursor hose reels.

2.4.5.1.7 Docking Head Platform Weldment

The docking head platform weldment uses 1-1/2” pipe and 3” flat bar of various lengths for the framework and aluminum-serrated grip strut for the walking surface which provides for safe, sure footing even in inclement weather and yet prevents rain or sea spray from pooling. Strategic

sections of the rails are secured using mounting hardware. These sections must be removed prior to assembling or disassembling structure from the Docking Head Sheave Assembly framework.

2.4.6 Operator Control Stations

There are three operator winch control stations: 1) Manual DCV Station located adjacent to the starboard A-Frame leg, 2) a Pedestal (Local Control, adjacent to the HC Assembly), and 3) Control Van Panel (Remote Control) in an Electronics Cabinet within the Control Van.

2.4.6.1 Manual DCV Station

The Manual DCV Station is comprised of five individual proportional control valves. Each control valve is operated by its own joystick except two valves (Cursor – Payout/Haul In) are controlled by only one joystick. The Cursor Latch (Control Station) is mounted on the aft end of the DCV Control Station and includes only the Cursor Latch control valve/joystick and a pressure gauge. Hydraulic power is provided to the Cursor Latch through two quick-disconnect hoses mounted underneath this station.

2.4.6.2 Pedestal (Local Control)

The local, externally mounted control panel is mounted on a Pedestal and its base is welded to the ship's aft deck. The panel is installed in a National Electrical Manufacturers Association (NEMA) 4X stainless steel enclosure with passivated panel faces to reduce discoloration and corrosion. The Local Control Station weighs approximately 50 pounds.

2.4.6.3 Control Van (Remote Control)

The Control Van is a typical lab environment-type SCIF with two controlled entrances. It is an air-conditioned space located on the forward portion of the after deck and is approximately 30 feet long by 8 feet wide. The FTHE Electronics Cabinet is located at the starboard end of the SCIF and is used to house the monitor, control van panel, computer, keyboard tray, signal interface enclosure, VME enclosure, and the UPS.

2.4.6.3.1 Monitor

The CRBR 19C Series Industrial Video Monitor is a 19" LCD flat panel, color monitor offering simultaneous dual analog (Video Graphics Array [VGA]) and digital (Digital Visual Interface [DVI]) source inputs. The 19" diagonal, viewable screen size offers a 500:1 contrast ratio, 1280 x 1024 resolution, a 0.29 mm pixel pitch, with a 170° viewing angle.

The display can be adjusted by function buttons located on the rear of the unit although On-Screen Display (OSD) software is included. When installed, it provides users with an intuitive interface menu allowing for display adjustment functions directly on the screen. Multisync capability is provided and compatible with all of the IBM and Video Electronics Standards Association (VESA) standards as well as the Apple Macintosh II family of computers.

The monitor is manufactured as a standard, 9U, 19" rack-mounted unit meeting NEMA 4X standards for water tightness. The glass front panel is of high light transmission tempered glass featuring an anti-reflecting, antiglare, hard-coat glass screen. The monitor is self-contained with an internal power supply which also powers three cooling fans. The three removable, washable filters are located on the rear of the unit.

2.4.6.3.2 Control Van Panel (Remote Control)

The Control Van Panel is a 6U, 19" rack-mounted unit that weighs approximately 50 pounds. It is supplied with a 150-foot cable with inline connectors on both ends for electrical connectivity. It has push button switches, a toggle switch, several indicating lamps, and a jack for connecting a winch controlling joystick. It provides a digital readout for the speed, tension, and length of umbilical cable paid out, as displayed on the Line Control Instrument module.

2.4.6.3.3 Computer

The CPPC Series computer is a standard 4U, 19" rack-mounted unit made from heavy duty steel employing a front-mounted cooling fan with removable filter. It provides a 14-slot chassis (4 PCI, 8 Industry Standard Architecture [ISA], and 2 Control Processing Unit [CPU] slots) with a 300 W power supply. It has a lockable front floppy disk drive door for security, dust, and waterproof protection. The computer has the standard complement of controls and indicators for ease of use.

The computer has an 80 GB Internal Integrated Drive Electronics (IDE) hard disk drive (HDD) hard drive, 512 MB PC3200 Dial-on Demand Routing (DDR)-(Synchronous Dynamic Random Access Memory (SDRAM), a 3.5" 1.44 MB Floppy Disk drive, and an internal IDE Compact Disk-Read/Write (CD-RW) drive. The CPPC P4-24-X single board computer is a 2.4 GHz Intel® Pentium®4 CPU card. Windows XP Professional operating system is installed as is a 400 watt Advanced Technology form factor (ATX) power supply upgrade.

Installed in the card rack are four CCAs:

1. NI Real-Time DAQ CCA (PCI-7041) (includes PCI-7041/6040E)
2. NI DIO CCA (NI PCI-6527)
3. NI Multifunction DAQ CCA (NI PCI-6034E)
4. CyberResearch® Processor Card with Ethernet and AGP Video (CPPC P4-24-X)

2.4.6.3.4 Keyboard Tray

The keyboard is a standard 1U, 19" rack-mounted keyboard with a two-button trackball pointing device and built-in wrist rest. It has the standard “qwerty” keyboard of 104 full-travel keys (standard touch-typing) which lends itself well to typing, not just occasional data entry.

2.4.6.3.5 Signal Interface Enclosure

The signal interface enclosure is a standard 4U, 19" rack-mounted chassis and contains signal conditioning circuits (SC-3, SC-4, and discrete components), in addition to 11 I/O optocouplers.

2.4.6.3.6 VME Enclosure with I/O Adapter

The FTHE VME Enclosure with I/O Adapter is a 3U, 5 CCA slot, 19" rack-mounted chassis containing two 6U CCAs: a SBC (Thales model VMPC6a-450-128-F1102) CCA and a D/A (CM Computer model CM-DA-40) CCA. It weighs less than 25 pounds when fully populated. Two dual DC intake fans pull the cooling air in through a front screen, exhaust it over the CCAs, and then out through the rear exit screen. A rear-mounted power supply has its own fan which exhausts air through the rear of the unit.

2.4.6.3.7 UPS

The UPS is a standard 2U, 19" rack-mounted unit operating on 120 VAC, 60 Hz, 3,000 VAC 2,250 W output power capacity. The UPS provides line interactive Automatic Voltage Regulation (AVR) which corrects inputs from 79-147 VAC back to usable 120 VAC levels

without consuming battery power. The UPS includes 9 output receptacles arranged in 3 load banks (4 NEMA 5-15R, 4 NEMA 5-15/20R, and 1 NEMA L5-30R). Controls and indicators include 3-stage metered LEDs offering current monitoring and battery charge level, main power and voltage regulation LEDs offer at-a-glance power status information, and front panel switches support self-test and alarm cancel functions.

2.5 PERFORMANCE AND REFERENCE DATA

This section lists general system features as well as specific performance and reference data for FTHE system.

2.5.1 Design Codes and Standards

The design codes and standards for the FTHE are listed in Table 2-1.

Table 2-1 Design Codes and Standards for Acceptance Criteria

CRITERIA	ORGANIZATION
Design	American Bureau of Shipping (ABS)
Electrical	National Electric Code (NEC)
Welding	American Welding Society (AWS)

2.5.2 FTHE Dimensions

The normal dimensions for the FTHE are defined as Length (port-to-starboard), Width (forward-to-aft), and Height, (L x W x H). Dimensions that deviate from this are clearly identified. All dimensions are measured in inches and are listed in Table 2-2.

Table 2-2 FTHE Dimensions

UNIT	DIMENSION (L x W x H Inches)
UMBILICAL WINCH SYSTEM	
Overall Winch Assembly	146-3/16 x 258-5/8 x 173-1/2
Winch Drum Core Diameter Core Width Flange Diameter	 74 141 98
HPU ASSEMBLY	
Overall HPU Assembly	121 x 87 x 142-1/4
HC ASSEMBLY	
Overall HC Assembly	137 x101 x 162
HC Assembly (Flying Head Assembly Raised)	190.625
A-FRAME ASSEMBLY	
A-Frame/Docking Head/Cursor (Assembled-Single Footprint)	30 x 142 x 370 (Maximum height, nominal)
Outside Width (Base-to-Base)	320
Outside Width (Including Access Ladder)	332
Inside Width (Between Base-to-Base)	260

2.5.3 FTHE Nominal Weights

The FTHE system assemblies'/units' nominal weights are listed in Table 2-3.

Table 2-3 FTHE Nominal Weights

EQUIPMENT	WEIGHT (POUNDS)
Umbilical Winch (with Umbilical)	48,250
Levelwind Assembly	25,400
Slip Ring	1,000
HPU	13,350
A-Frame Assembly (Total)	68,030
Docking Head (with Cross Member Weldment)	22,700
A-Frame (Right Leg)	20,600
A-Frame (Left Leg)	20,600
A-Frame (Weld Down Pad, 1,000 lbs x 2)	2,000
A-Frame (Leg Platform)	230
A-Frame (Ladder)	500
A-Frame (Hardware)	100
Docking Head Platform weldment	1,300
Cursor (Only)	5,030
WROV Interface Plate	500
Vehicle	34,000
HC	34,000
HC (Computer System)	250
Bottle Rack (with 9 Storage and 5 Receiver Bottles)	3,045
Bottle Rack (Empty)	1,200
Storage Bottle (Full: 9 x 130 lbs)	1,170
Receiver Bottle (Full: 5 x 135 lbs) (110 lbs empty, each)	675
Control Station – Local (Pedestal Panel)	50
Control Station – Remote (Control Van Panel)	50
Cursor Interconnect Hoses	25

2.5.4 FTHE Individual Unit Ratings

FTHE individual unit ratings are provided for the Umbilical Winch Assembly, HPU Assembly, HC Assembly, and the A-Frame Assembly and are listed in Table 2-4.

Table 2-4 FTHE System Ratings

UMBILICAL WINCH ASSEMBLY	
Safe Working Load (SWL)	34,000 lbs
Line Pull (Maximum Full Drum)	43,600 lbs
Line Speed (at mid-drum)	175 fpm / 2.92 fps
Braking	42,500 lbs (Maximum brake hold) 47,600 lbs (Slip Rating [1.4 x SWL])
Drum Capacity	12,800 feet (1.40 " diameter umbilical cable on 6 layers max)
HPU ASSEMBLY	
Primary AC Power	460 ± 10% VAC, 3-phase, 60 Hz
Electric Motor	2 x 125 HP with wash-down protected motors. Soft Start motor controller with inline and bypass magnetic contactors.
HC ASSEMBLY	
Compensated Load (Passive)	6,000 lbs (Nominal)
Compensated Load (Maximum)	24,500 lbs
Static Load (Maximum)	68,000 lbs (2 x SWL of Winch or A-Frame)
Compensated Load Range (Active)	1,000 to 10,000 lbs ± 15% or 500 lbs whichever is greater.
Cable Take-Up	18 ft (Maximum)
Compensator Sheave Diameter	48 in (Tread diameter minimum)
Primary AC Power (HC)	460 ± 10% VAC, 3-phase, 60 Hz
Electric Motor (HC)	1 x 150 HP with wash-down protected motors. Soft Start motor controller with inline and bypass magnetic contactors.
Electric Motor (Gas Intensifier)	1 x 15 HP Compressor/Intensifier Driver
A-FRAME ASSEMBLY	
SWL (Luffing)	34,000 lbs
SWL (Static)	42,500 lbs (1.25 x SWL)
Luffing Load (Maximum)	42,500 lbs (1.25 x SWL)
SWL (Fully extended on hard stops)	34,000 lbs (Static)
Docking Head Sheave	48 in (Tread diameter [minimum])
Overboarding Reach	160.5 in (Minimum to centerline of umbilical cable as measured from aft end of mounting plate)
Inboard Reach	167 in (Minimum to centerline of umbilical cable as measured from aft end of mounting plate)

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3.0 CHAPTER 3 - CONDUCT OF OPERATIONS (CONOPS)

3.1 INTRODUCTION

The FTHE operates in support of the DWT program, providing launching and retrieving, landing, and altitude control functions as well as vertical stabilization while in the water column.

3.1.1 Overview

This chapter provides FTHE operating procedures including prestart inspection, start-up, normal operation, normal Shut-Down, emergency Shut-Down, and various vehicle/package launch and recovery modes. In order to successfully execute CONOPS, the FTHE Operator must have a thorough understanding of these operating procedures for the major FTHE System Assemblies. Additionally, the operator must also be intimately familiar with the capabilities and operations of the individual unit subassemblies as provided in Chapter 4, Theory of Operations, [Controls, Indicators, and Alarms (section 4.2)].

3.1.2 Manned Stations

There are two stations manned when operating the FTHE: one is on the Aft Deck and the second is in the Control Van. The FTHE Deck Leader is responsible for overseeing both locations.

- **Aft Deck** – responsible for operation of all FTHE on deck
- **Control Van** – responsible for operation of all FTHE computer scenarios

3.1.3 Precautions

Precautions are required concerning sea state and personnel safety during FTHE operations.

- **Sea State** – The FTHE is designed to operate in a Sea State 3 or less. Operations above that level are hazardous and require evaluation and approval by the Cruise Leader.
- **Personnel Safety** – All personnel will wear safety approved PPE such as a safety hard hat, steel-toed safety shoes, and safety glasses any time they visit the after deck since the work and working conditions can sometimes be hazardous to personal safety. It is also suggested that leather workman's gloves be worn when handling heavy or awkward components to protect the fingers, hands, and wrists from pinch points.

Some specific warning and caution statements are listed here to remind the FTHE Operator that ignoring attention to the job/function at hand can create unnecessary hazardous situations.

WARNING

DANGER TO PERSONNEL! Prior to startup of the Umbilical Winch System, ensure all personnel remain clear of Umbilical Winch Assembly and umbilical cable path.

WARNING

DANGER TO PERSONNEL! Prior to placing the Control Van Panel (remote control station) in the enabled mode, ensure the Winch PAY OUT/HAUL IN joysticks at both the Pedestal (local control station) and the Control Van Panel are in the neutral position.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Prior to operation of the Umbilical Winch System, all installation procedures, hydraulic connections, and electrical connections must be completed for the entire system.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! After FTHE initial startup, verify that minimum acceptable hydraulic system pressure levels are reached.

NOTE

The Umbilical Winch System and operational functions may be stopped at any time by depressing HPU STOP push button located on Pedestal (local control), Control Van Panel (remote control), or HPU Assembly High Voltage Enclosure.

3.2 OPERATING PROCEDURES

This paragraph describes the detailed operating procedures used to monitor and control the FTHE during all phases of operations (Figure 3-1) which include:

- Prestart Inspection
- Start-Up
- Normal Operation
- HC Assembly Start-Up/Shut-Down During Vehicle Deployment
- Normal Shut-Down
- Emergency Shut-Down
- Vehicle/Package Launch Procedure
- HC Assembly Activation Procedures During Vehicle Deployment
- Vehicle/Package Recovery Procedure

As an aid to the FTHE Operator, some of these procedures have been reduced to a single page of instructions and can be found in the Appendixes: FTHE System Start-Up Procedure (A-4), FTHE System Shut-Down Procedure (A-5), FTHE Inspection Sheet (A-6), and HC Assembly Start-Up/Shut-Down Procedure (During Vehicle Deployment) (A-7).

The FTHE Operator receives FTHE operating instructions over a headset directly from the Control Van Operator or the Deck Leader and each deployment scenario may have varying instructions due to operating conditions or other factors. Typical scenarios for deploying/recovering the vehicle can be found in the Appendixes: Checks for Deploying Vehicle (A-2) and Checks for Recovering Vehicle (A-3). The Deck Leader has the responsibility for all operations and therefore, directs all FTHE operations.

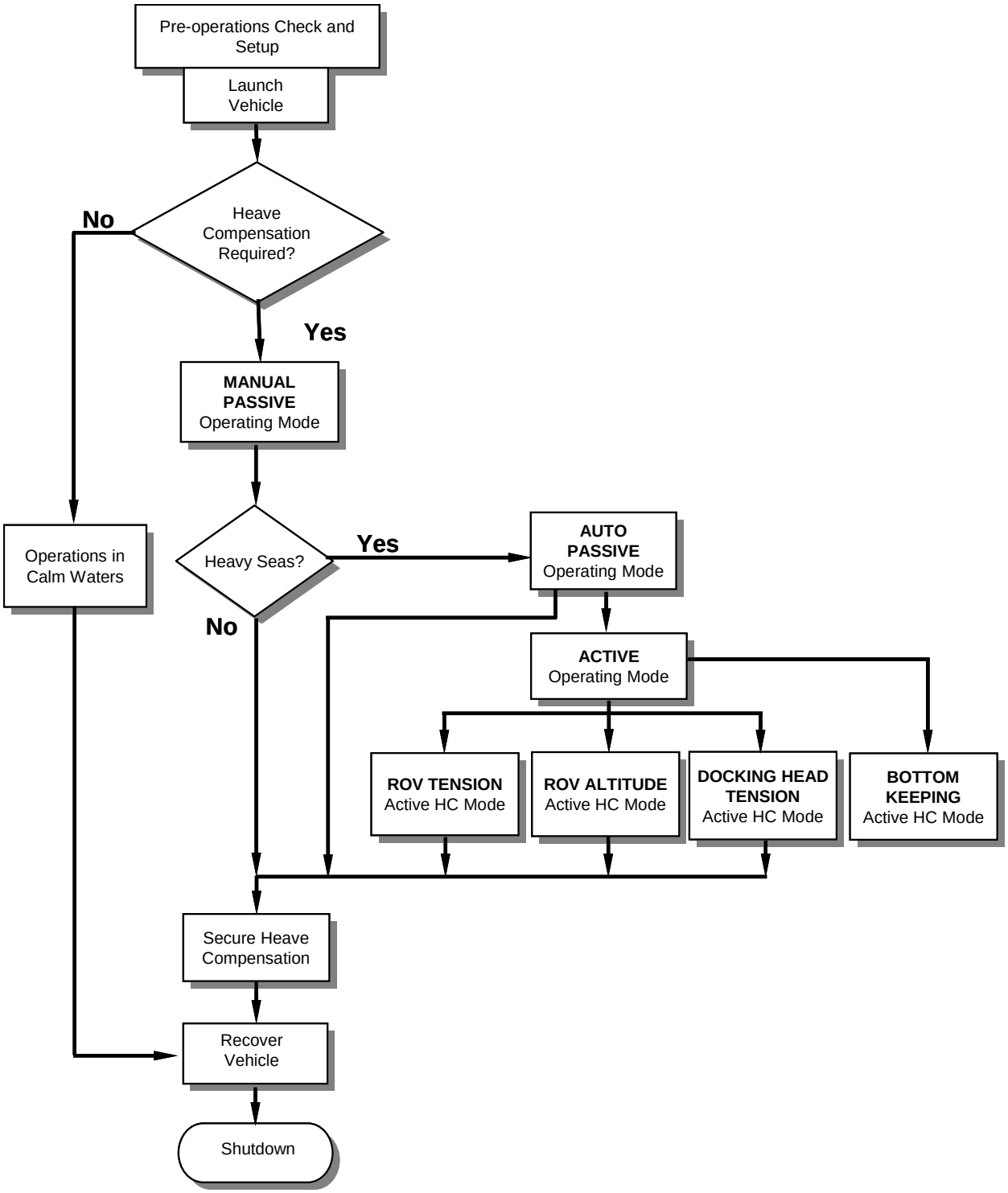

Figure 3-1 Variations in FTHE Operations

3.2.1 Prestart Inspection

A daily prestart inspection is required to ensure the FTHE is ready to conduct safe operations. Every time the FTHE system is to be operated, there are procedures and critical inspections that shall be conducted to confirm system readiness, to prevent equipment damage, and to ensure safe operations.

See Appendix A, Section A-4.0, of FTHE O&M Manual Volume II for procedure and check list.

3.2.1.1 Pedestal

Verify the Heave Comp Lock/Unlock toggle switch (SW108) is in the LOCKED position.

3.2.1.2 A-Frame Assembly

Inspect or perform the actions indicated:

From the Deck

- Verify the two A-Frame Main Cylinder ball valves (BV-6 and BV-7) are OPEN.
- Verify ball valve (BV-8) at the Manual DCV Station is OPEN.
- Inspect A-Frame Manual DCV Station for loose hydraulic leaks or unusual conditions.
- Move levers on Manual DCV Station to ensure range of motion.
- Inspect A-Frame Base Weldments to ensure no foreign material has been inadvertently placed or left on the A-Frame pads and would be crushed when the A-Frame Assembly is luffed outboard.
- Verify connector cables are tight at A-Frame Junction Box on Manual DCV Station.

From the Swing Frame Platform

- Inspect the Swing Frame for loose hoses/hydraulic leaks or unusual conditions.
- Verify the Load Pin cable connector is tight on ECL11.
- Inspect the quality of the Cursor Lift Winch Assembly cable (both left and right sides) and verify the Cursor Winch Payout Limit Switch (XS11) target arm is free to move.

3.2.1.3 HPU Assembly

Inspect or perform the actions indicated:

- Inspect and clean strainers behind HPU manifold (also check HC strainer prior to turning on the cooling water).
- Inspect the HPU cooling water discharge hose and turn on to verify discharge overboard. (Notify ship's personnel that cooling water is required if no discharge is evident.)
- Verify hydraulic oil is visible in the HPU Assembly Supply Tank sight glass; preferably that it indicates the tank is 4/5 full.
- Verify all cable connectors are tight under the Low Voltage Enclosure (ENC102)
- Verify the Power Switch is in the OFF position (ENC103).
- Verify the ground wire connections are tight and clean.
- Inspect HPU Assembly for loose hoses/leaks or unusual conditions.

3.2.1.4 Umbilical Winch System

3.2.1.4.1 Umbilical Winch Assembly

Inspect or perform the actions indicated:

- Verify the Umbilical Winch Assembly slip ring cable connectors are tight.
- Verify UW Drum Count cable connector tightness on JB-106.
- Verify the ground wire connections are tight and clean.
- Verify UW Mtr Dist. Hose connector is tight (forward-starboard).
- Verify the umbilical is tightly and orderly wrapped on the drum and free to travel.
- Inspect Umbilical Winch Assembly for loose hoses/leaks or unusual conditions.

3.2.1.4.2 Levelwind Assembly

Inspect or perform the actions indicated:

- Verify the Levelwind Sheave Assembly is free to rotate and the grove is free of any debris that may damage the umbilical jacket.
- Verify the LW is free to travel by holding umbilical at bottom of LW Sheave and moving back and forth to move guide pins. Adjust PRRV-101 if umbilical is not centered vertically after power up.
- Verify Guide Bars and ACME Drive Screw and Diamond Screw are sufficiently greased.
- Verify cable connector tightness at ENC108 (top, forward-starboard).

3.2.1.5 HC Assembly

3.2.1.5.1 Lower Level

Inspect or perform the actions indicated:

- Verify the Power Switch is in the OFF position on High Voltage Panel (ENC8).
- Inspect and clean the strainer (should be performed with HPU strainers prior to turning on cooling water and checking discharge overboard).
- Verify the umbilical cable, routing through the Flying Head Assembly and the Lower Head Assembly sheaves, and the sheave are free to travel and have nothing on their surfaces to damage the umbilical jacket.
- Verify hydraulic oil is visible in sight tube (COMP-1), in midrange level (orange color).
- Verify intensifier oil is visible in the HC Assembly Supply Tank sight glass (LG-2), preferably that it is in midrange indicating the tank is half-full.
- Verify the two accumulator ball valves (BV-9 for ACC-1, and BV-11 for ACC-2) are CLOSED (handles in low position).
- Verify cross-connect ball valve BV-10, on top-aft HC hydraulic panel, is OPEN (**blue** handle, horizontal).
- Verify ball valves BV-30 & BV-31, on HC hydraulic panel, are CLOSED.
- Verify ball valve BV-32, on bottom-aft of HC hydraulic panel, is CLOSED (**black** handle, horizontal). It is the Flying Head back-up lock valve and will be opened just prior to operations.

- Verify ball valves BV-22 & BV-23, on top-fwd of HC hydraulic panel, are OPENED (**green** handles, horizontal). These valves isolate the Intensifier.
- Verify ball valve BV-29, on bottom-aft of HC hydraulic panel, is CLOSED (**red** handle, horizontal). This valve isolates the Storage Bottles.
- Verify four high pressure nitrogen ball valves (BV-12, BV-13, BV-15, & BV-16), top-fwd on HC hydraulic panel, are OPEN (**green** handles, horizontal). These valves isolate ACC-1 & ACC-2 at HDR-11.
- Verify high pressure nitrogen ball valves (BV-24, BV-25, BV-26, BV-27, & BV-28), top-fwd on HC hydraulic panel, are OPEN (**yellow** handles, horizontal). These valves isolate the high pressure N2 receiver bottles.
- Verify ball valve BV-20, on bottom-fwd of HC hydraulic panel, is CLOSED (**red** handle, horizontal). This valve isolates the gas makeup bottles GMB-1, GMB-2 and GMB-3.
- Verify ball valve BV-TF, on bottom-fwd of HC hydraulic panel, is CLOSED (**red** handle, horizontal). This valve is used for initial N2 charge of the Storage Tank, ACC-3, GB-1& GB-2.
- Verify nitrogen ball valves BV-14, BV-GB1, & BV-GB2, mounted on bottom-fwd of HC hydraulic panel, are OPEN (**green** handles, horizontal). HDR-16: Used for initial N2 charge of ACC-3, GB-1& GB-2.
- Verify nitrogen ball valve (BV-17 & BV-18), mounted on bottom-middle of HC hydraulic panel, are CLOSED (**red** handle, horizontal). Located below HDR 16, used with BV-TF to charge Storage Tank
- OPEN both ball valves BV-38 & BV-39, top of GB-1 & GB-2 at HC aft-center.
- Check HC Assembly, Lower Level for loose hoses, hydraulic and nitrogen leaks, or unusual conditions.
- Verify the ground wire connection is tight and clean.

3.2.1.5.2 Upper Level

Inspect or perform the actions indicated:

- OPEN the valves on eleven nitrogen gas storage bottle (GB-8 through GB-18) located in the Gas Bottle Rack. Open all the valves fully and then rotate the handle back ¼ turn. These ball valves are used to isolate the N2 Storage Bottles.
- OPEN the valves on five blue N2 Receiver Bottles (BV-33, BV-34, BV-35, BV-36, & BV-37) located in the Gas Bottle Rack. Open valves fully, handles in vertical position. These ball valves are used to isolate the N2 Receiver Bottles.
- Verify the high pressure nitrogen ball valve (BV-21) is OPEN, mounted on the nitrogen Gas Intensifier Panel by red alarm horn. This ball valve is used (in series with BV-22) to isolate high pressure N2 between the receiver gas bottles and the Intensifier.
- Verify the Flying Head has freedom to travel.
- Perform a general pneumatic inspection, checking all connection fittings and valves for leaks (listen for hiss). Use soapy water to spray on connection points to visually see leaks form bubbles.

Heave Compensator Valve Color Key: Green – OPEN during operations, Red – CLOSED during operations, and Yellow – Changes during operations

3.2.2 Start-Up

The FTHE System Start-Up Procedures should be performed whenever the FTHE system is started in preparation for operation. Ensure that all personnel in the operation area are aware that system is about to be powered up and will move to appropriate safe zones if not wearing PPE (hard hats, steel toe boots, etc). All pressure gauge and filter indicator checks (Normal Operation, section 3.2.3) should be completed immediately after start-up (or as soon as practical depending upon DWT operations) and periodically thereafter, to ensure that all conditions are normal.

3.2.2.1 Control Van Electronics Cabinet

NOTE

If the UPS was unplugged from the Control Van wall receptacle to be completely turned OFF, and therefore supplying no power to its LOAD 1 and LOAD 2 circuits, the UPS must be plugged into the live Control Van wall receptacle. After the UPS is plugged into a live AC receptacle, the UPS (in “Standby” mode) will automatically charge its batteries but will not supply power to its LOAD circuits until it is turned ON.

NOTE

The UPS power light blinks when the AC voltage is OFF.

Verify and perform the actions indicated:

- Depress and hold the UPS ON/OFF/STAND-BY button until the power LED is illuminated and an audible “beep” occurs (approximately one second).
- Depress the VME Enclosure DC “Power Supply Enable” switch to ON and observe the six system LEDs are illuminated. It takes approximately 1-1/2 minutes to complete its boot-up cycle.
- Power up the computer monitor by depressing the red button in the lower left corner and ensure Video 1 is selected by depressing “vid-1” button.
- Open computer panel door, depress POWER button to “1” (ON), observe the POWER LED illuminates, and the monitor powers-up. Visually observe that the computer automatically launched the host.exe application which provides the GUI display.

3.2.2.2 Ship’s Services

Ship’s Services (electricity and cooling water) are required for FTHE operations.

3.2.2.2.1 Cooling Water

The FTHE requires a continuous flow of cooling (sea) water of 35 ±5 gpm to both the HPU heat exchanger (HX-101 & HX-103) and the HC heat exchanger (HX-2) from the ship’s service source. Both units require 1" pipe connections for the inlet as well as the discharge sides.

3.2.2.2.2 Electricity

The FTHE requires 440 VAC, 60 Hz, 300 A, 3-phase power to the HPU Power Isolation Enclosure (ENC101) and 250A, 3-phase power to the HC Assembly, High Voltage Enclosure (ENC8) and is provided from two portable service generators via the Power Distribution System (PDS) panel/circuit breakers.

Verify/perform/record the actions indicated:

- Open the PDS Main Power Transfer Switch Panel and ensure that the TWO circuit breakers for the HPU are in the OFF position, and the HC, and Spare are in the OFF position.
- Ensure the Transfer Switch (TS-2) toggle is in the NORMAL POWER position.
- Perform portable Generator start-up procedure by following the instructions from the manufacturer's operation manual.
- Once the Generator has been started, check the panel meters to ensure correct voltage of 480VAC and frequency of 60Hz, adjust as needed..
- Check that the PDS Transfer Switch (TS2) panel's NORMAL POWER green indicator lamp is on. Also check the Shark 100 panel meter to ensure correct readings for voltage of 480VAC and frequency of 60Hz.
- Open the PDS Main Power Transfer Switch Panel and turn ON both the HPU (225 & 250 Amp) circuit breakers. Turn ON the HC (225 Amp) circuit breaker. CHECK ALL GROUND CONNECTIONS.
- Check all circuit breakers and grounds on both Gen Sets.

3.2.2.3 <u>HPU Assembly</u>

- Turn High Voltage disconnect switch at Power Isolation Encl (ENC101) to ON.
- Verify power "OK" lamp at High Voltage Enclosure (ENC102) is illuminated green.
- Verify Low Oil Level and High Oil Temperature alarm lamps are not lighted.
- Hydraulic oil "Heating" lamp may be illuminated if oil temperature is low.
- Depress HPU #1 START button (High Voltage Panel) (ENC102).
- Verify HPU #1 "Running" lamp is illuminated (ENC102).
- Verify #1 Charge Pressure is about 390 psi, *otherwise* hit STOP & check.
- Depress HPU #2 START button (High Voltage Panel) (ENC102).
- Verify HPU #2 "Running" lamp is illuminated (ENC102).
- Verify #2 Charge Pressure is about 380 psi, *otherwise* hit STOP & check.
- Verify #1 Auxiliary Pressure is approximately 3,000 psig (#1 Open Loop Gage)
- Verify #2 Auxiliary Pressure is approximately 3,000 psig (#2 Open Loop Gage)
- Verify Return Header Pressure is approximately 25 psig (max).
- Visually observe HPU Assembly for hydraulic oil leaks.
- Visually observe Winch and A-Frame Assemblies for hydraulic oil leaks.

3.2.2.4 <u>HC Assembly</u>

Verify/perform/record the actions indicated:

- Move HC Power Breaker to ON (High Voltage Panel) (ENC8).
- Verify AC Power "OK" lamp is illuminated.
- Verify Low Oil Level and High Oil Temperature alarm lamps are not lighted.
- Verify Boost Accumulator Gas Pressure is between 1,850 to 2,500 psig, depending on load. If not in range, then correct prior to starting system.
- Verify Intensifier is operational by toggling Compensator – Raise & Lower

- Depress the HC START button (High Voltage Panel) (ENC8).
- Verify HC Assembly "Running" lamp is illuminated (ENC8).
- Verify Open Loop System Pressure is between 1,850 to 2,500 psig load dependant.
  Note: Boost Accum. Gas Press. will increase to same pressure.
  Note: Main Cylinders Rod End Pressure at 0 psig until HC mode active
  Note: Cooling gage NOT USED.
- Verify Tank Air Pressure (nitrogen) is approximately 5 psi (maximum).
- Verify Storage Bottles Gas Pressure is between 1,000 to 2,300 psig.
- Visually observe HC Assembly for hydraulic oil leaks and listen for N2 leaks.
- ***AFTER LAUNCH,*** Open BV-32 THEN CLOSE BV-10 just prior to activation of HC.

3.2.3 Normal Operation

This paragraph describes the normal operating procedures of the FTHE once it has been started. Verification should be made immediately after startup, and periodically afterwards, to ensure that all conditions are normal.

3.2.3.1 Pressure Gauge Checks

Check the pressure gauges for normal indications.

3.2.3.1.1 HPU Assembly

The charge, open loop, levelwind, and return pressures should read as indicated during HPU Assembly operation. The HPU Assembly port pressures display a pressure only when the Winch Assembly is actually being operated.

- PG-106: HPU #1 A-PORT PRESSURE should be between 0 and 3,000 psig
- PG-107: HPU #1 B-PORT PRESSURE should be between 0 and 3,000 psig
- PG-104: HPU #1 CHARGE PRESSURE should be a nominal 390 psig
- PG-114: HPU #1 AUXILLIARY PRESSURE should be a nominal 3,000 psig
- PG-108: HPU #2 A-PORT PRESSURE should be between 0 and 3,000 psig
- PG-109: HPU #2 B-PORT PRESSURE should be between 0 and 3,000 psig
- PG-105: HPU #2 CHARGE PRESSURE should be a nominal 380 psig
- PG-115: HPU #2 AUXILLIARY PRESSURE should be a nominal 3,000 psig
- PG-118: CONSTANT TENSION PRESSURE SETTING
- PG-117: CT A-PORT PRESSURE should be 700-800 psig while rendering
- PG-119: CT B-PORT PRESSURE
- PG-116: RETURN HEAD PRESSURE should be 25 psig maximum

3.2.3.1.2 HC Assembly

The open loop, cooling pump, and tank nitrogen pressures should read as indicated during HC Assembly operation while the accumulator, boost accumulator, and main cylinder rod end pressures change depending upon HC Assembly application during FTHE operations.

- PG-11: Accumulator Gas Pressure should be a minimum of 500 psig.
- PG-12: Storage Gas Bottles Pressure can vary between 1,000 and 2,300 psig.

- PG-13: Open-Loop System Pressure should be at approximately 2,000 psig.
- PG-14: Cooling Pump Pressure NOT USED.
- PG-20: Boost Accumulator Gas Pressure should be a nominal 1,850 psig when the pre-charge on ACC-3 is configured for a load range of 5,000 to 24,000 pounds. The pressure should be 2,500 psig when the pre-charge on ACC-3 is configured for a load range of 24,000 to 34,000 pounds.
- PG-21: Tank Pressure should be 5 psig maximum.
- PG-23: Main Cylinders Rod End Pressure should be a nominal 1,000 psig.

3.2.3.2 Filter Indicator Checks

Once the FTHE is operating, the filter elements should be checked to ensure they have not gone into the "red" zone indicating the filter element is dirty and needs to be replaced.

3.2.3.2.1 HPU Assembly

Check that filter indicators are in the "green" zone on the following HPU Assembly filters (when the HPU Assembly is running):

- FL-101 (Magnom Filter Element)
- FL-103 (Hydac Filter Element)
- FL-104 (Zinga Filter Element)
- FL-105 to FL-108 (Hydac Filter Elements)
- FL-112 & FL-113 (Donaldson Filter Elements)

3.2.3.2.2 Umbilical Winch System

3.2.3.2.2.1 Umbilical Winch Assembly

Check that filter indicators are in the "green" zone on the following Umbilical Winch Assembly filters (when the Umbilical Winch Assembly is running):

- FL-109 (System A-Port) (Hydac Filter Element)
- FL-110 (System B-Port) (Hydac Filter Element)

3.2.3.2.2.2 Levelwind Assembly

Check that filter indicator is in the "green" zone on the following Levelwind Assembly filter (when the Levelwind Assembly is moving):

- FL-111 (Donaldson Filter Element)

3.2.3.2.3 Manual DCV Station

Check that filter indicator is in the "green" zone on the following Manual DCV Station filter (when luffing):

- FL-11 on the Manual DCV Station hydraulic panel

3.2.3.2.4 HC Assembly

Check that filter indicator is in the "green" zone on the following HC Assembly filter (when in Active mode):

- FL-13 on the HC Assembly hydraulic panel

3.2.4 HC Start-Up / Shut-Down During Vehicle Deployment

Although the Start-Up procedures for the HC Assembly may be accomplished each time the FTHE is made ready for operations, its use is not always required or the HC Assembly may be started and secured several times during the day due to the type of operations being performed. Since the HC Assembly is not completely secured for this type of intermittent service, use the following procedures to start-up/shut-down during daily operations.

3.2.4.1 HC Assembly Start-Up

Verify and perform the actions indicated:

- Perform the HC Assembly Start-Up Procedure (section 3.2.2.4).

3.2.4.2 Operate HC Assembly as Directed

Standby to receive and execute operations as directed by the Control Van Operator. This may include raising and lowering the accumulator pressure using the Intensifier.

3.2.4.3 HC Assembly Shut-Down

Verify and perform the actions indicated:

- Depress the HC Assembly STOP button.
- Verify the HC Assembly “Running” lamp is extinguished.
- Move the AC POWER circuit breaker to OFF.

3.2.5 Normal Shut-Down

This paragraph describes the normal Shut-Down procedures once the determination to secure FTHE operations has been made.

NOTE

Secure HC prior to recovering Test Shape / Vehicle onboard with A-Frame.

3.2.5.1 HC Assembly

Verify or perform the actions indicated:

- Verify that all FTHE activities are complete and the Flying Head Assembly is bottomed.
- On Control Pedestal, flip "Heave Comp" toggle switch to LOCK position.
- Close valve BV-32, handle horizontal (HC Hydraulic Panel – Lower Level).
- Depress the HC STOP button (High Voltage Panel).
- Move AC POWER circuit breaker to OFF.
- Move HC Power Breaker to OFF (High Voltage Panel)

NOTE

Procedures after recovering Test Shape / Vehicle and secured to deck.

- Close valves BV-38 & BV-39 on top of GB-1 & GB-2 (lower level, aft).
- Close valve BV-23 (HC Hydraulic Panel – Lower Level)
- Open valve BV-10 to equalize hydraulic pressure between HDR-12 & HDR-13
- Close valves BV-22, BV-24, BV-25, BV-26, BV-27 & BV-28 (High Pressure)
- Close valves on all N2 cylinders in the Gas Bottle Rack (HC upper level)
- Visually observe HC for hydraulic oil leaks and listen for N2 leaks.

3.2.5.2 HPU Assembly

Verify or perform the actions indicated:

- Verify that all FTHE activities are complete.
- Depress HPU #1 STOP button (ENC102).
- Depress HPU #2 STOP button (ENC102).
- Turn High Voltage circuit breaker at Power Isolation Enclosure (ENC101) to OFF.
- Visually observe HPU for hydraulic oil leaks.
- Visually observe Winch, Levelwind, and A-Frame for hydraulic oil leaks.
- Verify ship's service cooling water has been secured (section 3.2.5.5).

3.2.5.3 A-Frame

Verify or perform the actions indicated:

- Close BV-8 (to secure Swing Frame).
- Close BV-6 & BV-7 (to secure Luff).

3.2.5.4 Control Van Electronics Cabinet

Verify or perform the actions indicated:

- Depress "CTRL-ALT-DEL" keys simultaneously on the Remote Control keyboard and select "Shut-Down" with the cursor.
- Depress the Test Shape Enclosure power switch to OFF.
- Open the computer panel door when prompted on the monitor, depress the POWER button to "0" (OFF), and observe the POWER LED and the monitor extinguish.
- Depress and hold the UPS ON/OFF/STAND-BY button until the power LED extinguishes and an audible "beep" occurs.

3.2.5.5 Utilities

Verify or perform the actions indicated:

- Inform ship's crew that cooling water may be secured to the HPU and the HC.
- Verify that ship's cooling water is secured and the discharge overboard has stopped.
- Shut off breakers in PDS Main Breaker Panel and Genset Power Switch.

3.2.6 Emergency Shut-Down

Once it has been determined that an emergency exists, the FTHE can be Shut-Down at one of three locations; however, there are some differences.

3.2.6.1 Pedestal (ENC104)

- PB106: WINCH / A-FRAME - HPU STOP shuts down the HPU Assembly HPU #1 and HPU #2 motors (EM-101 & EM-102) simultaneously.
- PB107: EMERGENCY STOP SYSTEM shuts down HPU Assembly HPU #1 and HPU #2 motors (EM-101 & EM-102) and the HC Assembly HPU motor (EM-3) simultaneously.

3.2.6.2 HPU Assembly

3.2.6.2.1 High Voltage Enclosure (ENC102)

- PB105: EMERGENCY STOP shuts down the HPU Assembly HPU #1 and HPU #2 motors (EM-101 & EM-102) simultaneously.

3.2.6.3 Control Van Panel (ENC5)

- PB8: WINCH / A-FRAME - HPU STOP shuts down the HPU Assembly HPU #1 and HPU #2 motors (EM-101 & EM-102) simultaneously.
- PB9: HEAVE COMPENSATOR - HPU STOP shuts down HC’s HPU #1 and HPU #2 motors (EM-101 & EM-102) and the HC Assembly HPU motor (EM-3) simultaneously.

3.2.7 Vehicle (or Test Shape) Launch Procedure

The Control Van Operator may have a formal check sheet to follow when launching the Vehicle (or Test Shape); however, many variables could come into play during this evolution. A normal launch evolution consists of activities performed not only by the FTHE Operator, but by Control Van personnel, Deck Leader, and aft deck line handlers. The following procedures list the specific FTHE Operator actions required to launch the vehicle/package. (Refer to Appendix 2, Checks for Deploying Vehicle, to view a typical, check sheet scenario.)

3.2.7.1 Pre-Launch Activity

Normally, the FTHE Operator completes the Prestart Inspection and powers-up the Electronics Cabinet equipment in the Control Van well before FTHE/DWT operations are ready to commence. If however, the inspection has not been accomplished and the Electronics Cabinet equipment has not been powered-up prior to this time, it must be done now.

a. Complete a Prestart Inspection (section 3.2.1).
b. In the Control Van, power-up the VME Enclosure, and PC located in Electronics Cabinet.

WARNING

POSSIBLE DEATH, INJURY, OR EQUIPMENT DAMAGE may result when operating FTHE (lifting and moving vehicle/package loads) on the aft deck if not done in a safe manner. The FTHE Operator must not take any action without a direct order from either the Deck Leader.

3.2.7.2 Raise Vehicle (or Test Shape) to the Docking Head Assembly

To raise the vehicle to the Docking Head Assembly, the FTHE Operator must perform the following steps:

a. Initiate the Start-Up sequence for the HPU Assembly (section 3.2.2.2). (Although the HC Assembly could be powered-up at this time, it is usually delayed until after the vehicle has entered the water column.)
b. Take position by standing at the Pedestal (Local Control) station.
c. Establish communications with the Deck Leader and the Control Van Operator by using the headsets.
d. Enable the Swing Frame with the Swing Frame Enable/Disable toggle switch (Figure 4-18, Item 15) and using the Swing Frame joystick (Figure 4-18, Item 13), line up the Swing Frame with the vehicle as the Deck Leader instructs.

CAUTION

POSSIBLE UNSAFE CONDITION! Any tension in excess of 6,000 lbs will prematurely lift the vehicle off the sawhorses. Do not exceed 3,000 lbs when removing slack from the umbilical cable.

e. Once the four taglines are connected to the vehicle, use the Winch joystick (Figure 4-18, Item 17) to slowly haul in on the umbilical cable until there is approximately 2,000 to 3,000 lbs tension on the vehicle as indicated by the LCI-90 Line.

f. Control Instrument display (Figure 4-18, Item 26).

g. Unlatch the Cursor Assembly from the Docking Head Sheave Assembly.

   1. Use the Cursor Winch joystick (Figure 4-18, Item 11) to haul in the Cursor Assembly to take the weight off of the four cursor latches.
   2. In parallel with hauling in the Cursor Assembly, open the cursor latches using the Latch Open/Close toggle switch (Figure 4-18, Item 16).
   3. Verify the cursor latches are opened by viewing the green-tipped cable latch indicators (Figure 4-17, Item 4) as being extended approximately 2 inches.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Rough handling to the vehicle can damage internal electronics. Care should be exercised to lower the Cursor Assembly quickly, carefully, and lightly to the vehicle's lift ring.

h. Lower the Cursor Assembly to the vehicle's lift ring and gently allow it to lock into place.

i. Verify the Cursor Assembly is securely latched in the lift ring by viewing the cursor latches (Figure 4-17, Item 5) and receiving confirmation from the Control Van Operator.

NOTE

Enabling constant tension provides a computer controlled moderate back-tension (approximately 4,000 lbs) on the umbilical cable when the vehicle/package is eventually luffed outboard and lowered to release depth.

j. Enable constant tension using the Constant Tension Mode Disable/Enable toggle switch (Figure 4-18, Item 24) and observe the Constant Tension Enabled lamp (Figure 4-18, Item 23) illuminates.

k. If the Winch Brake Released lamp (Figure 4-18, Item 18) fails to illuminate, re-toggle the Constant Tension Mode Disable/Enable toggle switch several times. (If the lamp remains extinguished, begin troubleshooting the brake system controls. If this becomes required each time constant tension is initiated, it is time to bleed the brakes.)

NOTE

If the four green-tipped cable latch indicators do not snap into place indicating that the Cursor Assembly is firmly locked into the Docking Head Assembly, move the Pedestal Latch toggle switch (Figure 4-18, Item 16) to the "Close" position until the four green-tipped latch indicators are totally seated.

l. After the tie-down straps are removed from the vehicle, disable the swing frame using the swing frame Enable/Disable toggle switch.

m. Using the Cursor Winch joystick, raise the Cursor Assembly/vehicle to the Docking Head Assembly until the four green-tipped cable latch indicators come out approximately 2

inches and then “snap” back into place indicating the four Catch and Latch Assembly latch weldments (Appendix 10, DD 0707-6006-02, Sheet 2, Item 10) have locked into position.

3.2.7.3 Attach Package to Vehicle

At times, the DWT operations require a package being attached to the vehicle. (If a package is not required for DWT Operations, this paragraph is skipped.) It is assumed the Cursor Assembly has already been attached to the vehicle and the Cursor Assembly and/or vehicle are currently locked into the Docking Head Assembly. To attach a package to the vehicle, perform the following steps:

n. Enable the Swing Frame (if not already enabled) using the Swing Frame Enable/Disable toggle switch as before. (This locks the Swing Frame in place preventing it from swinging on its docking head pivot pins due to movement of the seas while the package is being positioned below.)

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Rough handling to the vehicle can damage internal electronics. Care should be exercised to lower the Cursor Assembly/Vehicle quickly, carefully, and lightly to the package.

NOTE

The tag-line personnel and other ship’s company must remove the sawhorses and accurately position the package directly under the suspended vehicle before proceeding.

o. When the Deck Leader issues the command to lower the staubs on the vehicle, the FTHE Operator immediately begins to lower the vehicle to the package using the Cursor Winch joystick and the Latch Open/Close toggle switch as before.

p. After the Deck Leader has determined the vehicle is firmly attached to the package, disable the Swing Frame using the Swing Frame Enable/Disable toggle switch as before and ascertain that it is free to rotate on its pivot pins.

NOTE

If the four green-tipped cable latch indicators do not snap into place indicating that the Cursor Assembly is firmly locked into the Docking Head Assembly, move the Pedestal Latch toggle switch (Figure 4-18, Item 16) to the “Close” position until the four green-tipped latch indicators are totally seated.

q. When ordered to do so by the Control Van Operator, raise the Cursor Assembly/vehicle/package to the Docking Head Assembly until the four green-tipped cable latch indicators come out approximately two inches and then “snap” back into place indicating the four Catch and Latch Assembly latch weldments (refer to Appendix 10, DD 0707-6006-02, Sheet 2, Item 10) have locked into position.

3.2.7.4 Luff A-Frame Assembly Outboard

This paragraph assumes the Cursor Assembly has already been attached to the vehicle and the Cursor Assembly and/or vehicle are currently locked in the Docking Head Assembly. If a

package is being used for the DWT operations, it has already been attached to the underside of the vehicle and it too is suspended in air. To luff the vehicle/package outboard, perform the following step:

CAUTION

POSSIBLE EQUIPMENT DAMAGE! It is not recommended that any vehicle/package combination be suspended for long periods of time with the A-Frame luffed out, especially in rough weather. Tremendous loads are placed on the Docking Head General Assembly and damage to equipment could result.

NOTE

The four tag-lines and ground strap must be removed (in that order) prior to luffing the vehicle/package outboard.

a. Luff the A-Frame Assembly outboard using the A-Frame joystick (Figure 4-18, Item 9) and verify the A-Frame Outboard lamp (Figure 4-18, Item 8) illuminates indicating the A-Frame Assembly is positioned hard into its base weldment boom stops.

3.2.7.5 Lower Cursor Assembly/Vehicle/Package to Depth and Release

Once the A-Frame Assembly with the Cursor Assembly/vehicle/package have been luffed outboard, it is ready to be lowered into the water column. To lower the Cursor Assembly/vehicle/package into the water column, perform the following steps:

NOTE

Normally the FTHE Operator waits until commanded to lower the Cursor Assembly/vehicle/(and package) into the water column due to various Control Van events unrelated to the FTHE Operator; however, if the sea state and wind are sufficient to anticipate the assembly swinging wildly, the FTHE Operator may be pre-directed to lower the Cursor Assembly/vehicle/package into the water column as soon as the A-Frame Assembly has been luffed outboard.

a. Unlatch the Cursor Assembly from the Docking Head Sheave Assembly:
    1. Use the Cursor Winch joystick to first raise the Cursor Assembly to take the weight off the four cursor latches.
    2. In parallel with raising the Cursor Assembly, open the cursor latches using the Latch Open/Close toggle switch.
    3. Verify the cursor latches are opened by viewing the green-tipped cable latch indicators as being extended approximately 2 inches.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Using the Manual DCV Station defeats the cursor lift winch depth limit. When paying out cable, leave 5 wraps of cable on the cursor lift winch.

NOTE

Each cursor winch is equipped with 90 feet of cable on its drum. However, the interlock on the starboard drum is set for approximately 45 feet of cable paid out to prevent unspooling of the cable.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! The vehicle and/or package are in its most vulnerable position while lower into the water column. Do not linger when lowering. Lower quickly to an operational depth.

b. Quickly lower the Cursor Assembly/vehicle/package into the water column to a depth of 35-40 feet (as ordered by the Control Van Operator) and indicated on the LCI-90 Line Control Instrument.

c. Disable constant tension of the umbilical cable using the Constant Tension Mode Disable/Enable toggle switch and observe the Constant Tension Enabled lamp extinguishes.

d. Pay out enough umbilical cable using the Cursor Winch joystick to slack the cables which allows the entire vehicle/package weight to be supported by the umbilical cable.

NOTE

The Cursor Assembly can only be unlatched from the vehicle by using the Latch Open/Close control handle mounted on the Manual DCV Station located at the base of the starboard A-Frame leg.

e. Move to the Manual DCV Station and operate and hold the Latch Open/Close control handle (Figure 4-17, sheet 4, Item 11) to unlatch the four Cursor Assembly latches from the vehicle lift ring.

f. When the Control Van Operator verifies the Cursor Assembly latches are unlatched, raise the Cursor Assembly towards the Docking Head Assembly using the Manual DCV Station Cursor Payout/Haul In control handle (Figure 4-17, Sheet 4, Item 14). After the Cursor Assembly has raised a couple of feet, the Latch Open/Close control handle may be released.

NOTE

If the Deck Leader directs operation of the Latch Open/Close control handle at the Manual DCV Station, then the FTHE Operator can remain at the Pedestal and raise the Cursor Assembly to the Docking Head Assembly using the Cursor Winch joystick as done previously.

g. Continue raising the Cursor Assembly until it is securely locked into the Docking Head Assembly as verified by the four green-tipped cable latch indicators.

h. Verify the Tension/Speed Select toggle switch (Figure 4-18, Item 12) is in the Low Tension/High Speed position and observe the Enabled lamp (Figure 4-18, Item 14) is illuminated.

NOTE

The Remote Enabled function passes control of the winch assembly from the FTHE Operator on the aft deck to the Control Van Operator located in the Control Van. At this point, the vehicle/package are controlled from inside the Control Van. Once Remote Control is enabled, if the Winch joystick on the Pedestal or on the Control Van Panel in the Control Van is moved from the neutral position, Remote Control Enabled will be disabled and control will return to the FTHE Operator at the Pedestal.

i. Enable remote control of the winch assembly using the Remote Enable Disable/Enable toggle switch (Figure 4-18, Item 22) and observe the Remote Enabled lamp (Figure 4-18, Item 21) illuminates.

3.2.8 HC Activation Procedures During Vehicle Deployment

The HC Assembly, depending upon DWT operations, sea state, and other factors, can be used in various modes ranging from not used at all (such as when conducting DWT operations in extremely calm waters or alongside the pier) to full, active control (when the wind is extreme and seas are rough). The various modes include (refer to Figure 3-2):

- **Manual Passive**
- **Auto Passive**
- **Active**
  - ROV Tension
  - ROV Altitude
  - Docking Head Tension
  - Bottom Keeping

3.2.8.1 Manual Passive Mode

The HC Assembly (and therefore the computer) do not have to be powered-up in order to perform FTHE operations. As such, the FTHE System is already operating in the Manual Passive mode. However, if the HC Assembly is powered-up, the Flying Head Assembly is manually set at midpoint of the HC Assembly Cylinders and therefore free to move up and down due to sea surface fluctuations. The computer, if powered-up, is only monitoring the HC System and has no control over any of the system components.

3.2.8.1.1 Start-Up and Operating in Manual Passive Mode

When the HC Assembly is first powered-up, it is ready to operate in the Manual Passive mode. To start-up the HC Assembly and operate the HC system in the Manual Passive mode, perform the following steps:

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Damage and loss of control to the vehicle while on the aft deck is possible if the HC system is activated prior to the vehicle/package entering the water. Do not activate the HC system until the vehicle is in the water column.

a. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5) if not accomplished earlier.

b. Verify the Computer Control Disable/Enable toggle switch (Figure 3-3, Item 8) on the Control Van Panel is in the "Disable" position and the Computer Control Enabled lamp (Figure 3-3, Item 9) is extinguished (refer to Table 3-1 for parts identification).

c. Start-Up the HC Assembly using the HC Assembly Start-Up/Shut-Down During Vehicle Deployment procedure (section 3.2.4.1).

NOTE

The HDR-10 BV-32 must be opened prior to powering-up the HC Assembly since you cannot gain access to it once the HC Assembly is running.

d. Unlock the HC cylinders by opening NV-5 (Figure 4-12, Item 14), moving the Pedestal Heave Comp Lock/Unlock toggle switch (Figure 4-18, Item 19) to "Unlock", and by observing that the HC actuating cylinder (CYL-15 and CYL-16 respectively) ball valves (BV-9 and BV-11) open. (If they fail to open the first time, try cycling them two or three times. If they still fail to open, begin troubleshooting procedures.)

NOTE

A piece of yellow tape has been affixed to the port (left) HC accumulator (ACC-1) just below the end cap indicating the mid-stroke (half-way) of the HC cylinder (CYL-13). When the upper part of the cylinder rod (Figure 2-5) is positioned at this mark, it's up and down movement is equidistant in either direction.

NOTE

Increasing the nitrogen pressure in the HC accumulators (ACC-1 and ACC-2) raises the Flying Head Assembly while decreasing the pressure lowers it. The pressure required to find mid-stroke depends on the weight of the vehicle/package. A general rule of thumb is that the pressure per square inch is approximately one-tenth the weight of the load when its in the water column, e.g., for a 10,000 pound load, a pressure of 1000 psig would be appropriate.

e. Raise the Flying Head Assembly to mid-stroke by moving the Intensifier Compensator Raise/Lower toggle switch (Figure 4-15, Item 4) to the "Raise" position and hold it there until the Flying Head Assembly has reached mid-stroke. Release the switch.

f. Monitor the HC Assembly approximately every half hour to ensure the Flying Head Assembly remains centered around the mid-stroke. All HC Assembly pressure gauges and filter indicator checks (Normal Operation, section 3.2.3) should be made at the same interval as well.

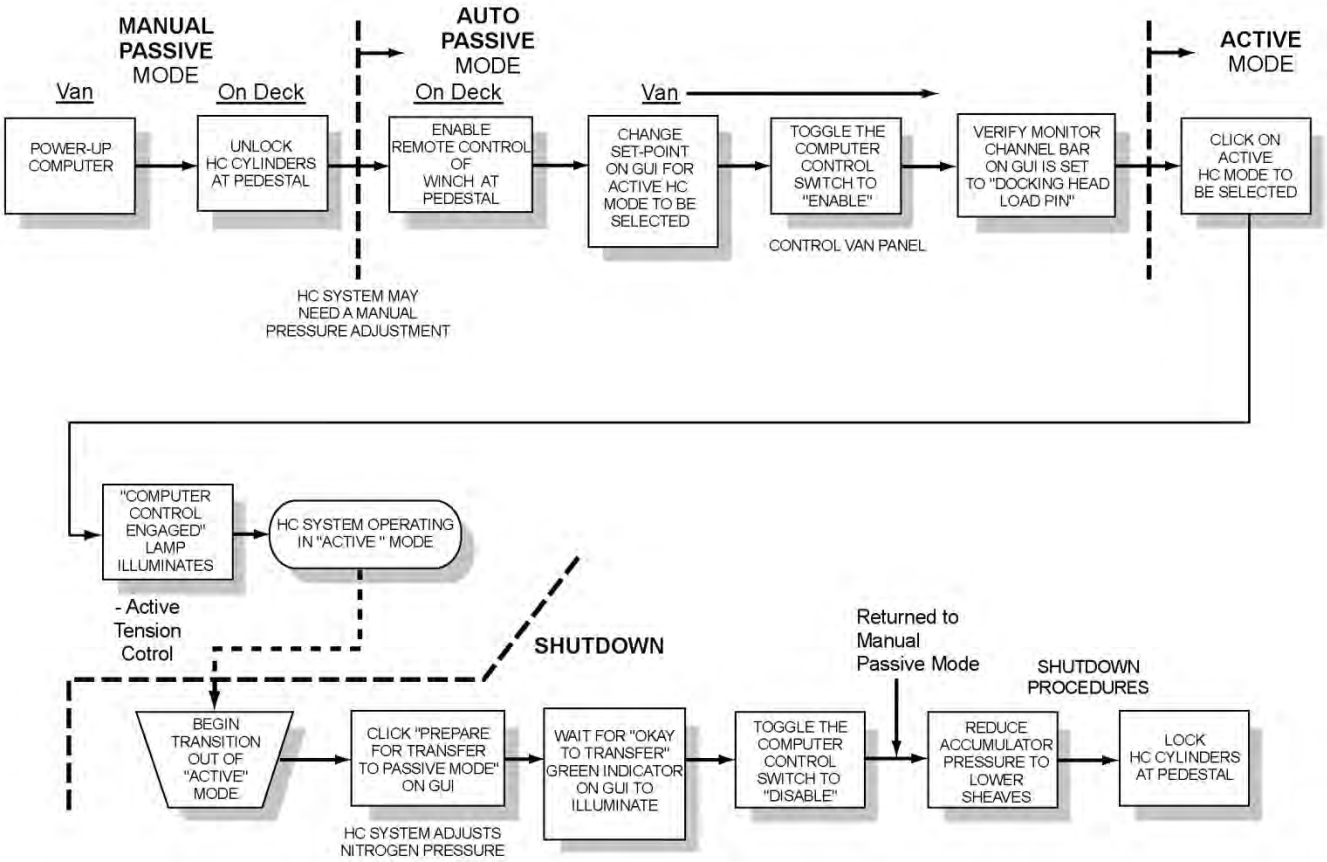

Figure 3-2 HC System Modes Flow Chart

Figure 3-3 Control Van Panel, Components

Table 3-1 Control Van Panel, Parts Identification

ITEM	DESCRIPTION
1	Heave Compensator HPU Stop Push Button
2	Heave Compensator Low Oil Level Lamp
3	Heave Compensator HPU Running Lamp
4	Heave Compensator High Oil Temperature Lamp
5	Remote Enabled Lamp
6	Winch Cable to Control Handle
7	Winch Brake Released Lamp
8	Computer Control Disable/Enable Toggle Switch
9	Computer Control Enabled Lamp
10	Computer Control Engaged Lamp
11	Winch/A-Frame Low Oil Level Lamp
12	Winch/A-Frame High Oil Temperature Lamp
13	Winch/A-Frame HPU #2 Charge Pressure Lamp
14	Winch/A-Frame HPU #1 Charge Pressure Lamp
15	Winch/A-Frame HPU #2 Running Lamp
16	Winch/A-Frame HPU #1 Running Lamp
17	Winch/A-Frame HPU Stop Push Button
18	LCI-90 Line Control Instrument Display

3.2.8.1.2 Secure Operating and Shut-Down from Manual Passive Mode

To secure operating the HC system and shut-down the HC Assembly from the Manual Passive mode, perform the following steps:

NOTE

After the Flying Head Assembly has bottomed, it is recommended that the nitrogen pressure in the HC accumulators be reduced to approximately 600 psig.

a. Lower the Flying Head Assembly by moving the Intensifier Compensator Raise/Lower toggle switch (Figure 4-15, Item 4) to the "Lower" position. Hold it there until the Flying Head Assembly has bottomed and the Accumulator Gas Pressure gauge (Figure 4-11, Item 5) indicates 600 psig. Release the switch.
b. Lock the HC cylinders by moving the Pedestal Heave Comp Lock/Unlock toggle switch (Figure 4-18, Item 19) to "Lock" and observing the HC actuating cylinder (CYL-15 and CYL-16 respectively) ball valves (BV-9 and BV-11) close. Shut NV-5.
c. Power-Down the HC Assembly using the HC Assembly Start-Up/Shut-Down During Vehicle Deployment procedure (section 3.2.4.3).

3.2.8.2 Auto Passive Mode

The Auto Passive mode is not a truly operational state but rather a transitional state. In the Auto Passive mode, the computer controls the intensifier to center the HC System (accumulator and Flying Head Assembly) around mid-stroke. Coincidentally, the computer also causes various solenoid operating valves to open or close thereby varying the hydraulic oil volume in the accumulators for this same purpose.

3.2.8.2.1 Transitioning into Auto Passive Mode

The HC System must be stabilized in the Auto Passive mode prior to operating in the Active mode. To transition the HC system into the Auto Passive mode, perform the following steps:

a. Ensure the HC system is operating in the Manual Passive mode (section 3.2.8.1.1).
b. Relocate your position from the Pedestal on the aft deck to the Electronics Cabinet in the Control Van. (The Deck Leader normally assumes responsibility for the safe operation of the FTHE while the Operator is in the Control Van.)
c. Verify that all the equipment in the Electronics Cabinet is energized and observe the monitor/GUI (Figure 3-4) for the status of the A-Frame Assembly, HPU Assembly, and the HC Assembly accumulator and cylinder levels. (For detailed information of the equipment location and description of features, refer to Chapter 4, Theory of Operations.)
d. Verify vehicle load cell readings are correct. If a value is invalid, not changing, check the power status of the VME Enclosure. If powered, check WROV to FTHE communications.
e. Request the Deck Leader operate the intensifier by moving the Compensator toggle switch (Figure 4-15, Item 4) to raise or lower the accumulator pressure and thus position the Flying Head Assembly at approximately 40% of the cylinders full travel height.
f. On the GUI screen, preselect where the computer receives its signal when it goes into the "Active Mode" by clicking on either: ROV Tension, ROV Altitude, or Docking Head

Tension from the Active Heave Compensation Mode Selector (Figure 3-4, Item 4). The pointer moves to your choice.

g. Observe the Set-point display (Figure 3-4, Item 5) to view the current value of the selected compensation mode from which the computer is receiving the signal, e.g., ROV Tension, ROV Altitude, and Docking Head Tension.

NOTE

You cannot use the GUI Operating Mode Selector (Figure 3-4, Item 3) to move from the Manual Passive mode to the Auto Passive mode.

h. At the Control Van Panel, move the Computer Control toggle switch (Figure 3-3, Item 8) to the “Enable” position and observe that the Computer Control Enabled lamp (Figure 3-3, Item 9) illuminates. At the same time, the Operating Mode Selector pointer (Figure 3-4, Item 3) moves to the “Auto Passive” position indicating the computer has automatically transitioned to the Auto Passive mode.

NOTE

The FTHE Operator should monitor the HC and Accumulator positions and ensure that they are centering around the 50% position prior to going into the Active mode.

i. Leave the computer in this state for at least 1 to 3 minutes to ensure the computer has had ample time to adjust the accumulator and cylinder positions to bring the Flying Head Assembly to approximately 50 ±5% of full height. The HC System is now ready to be placed into the Active mode (section 3.2.8.3).

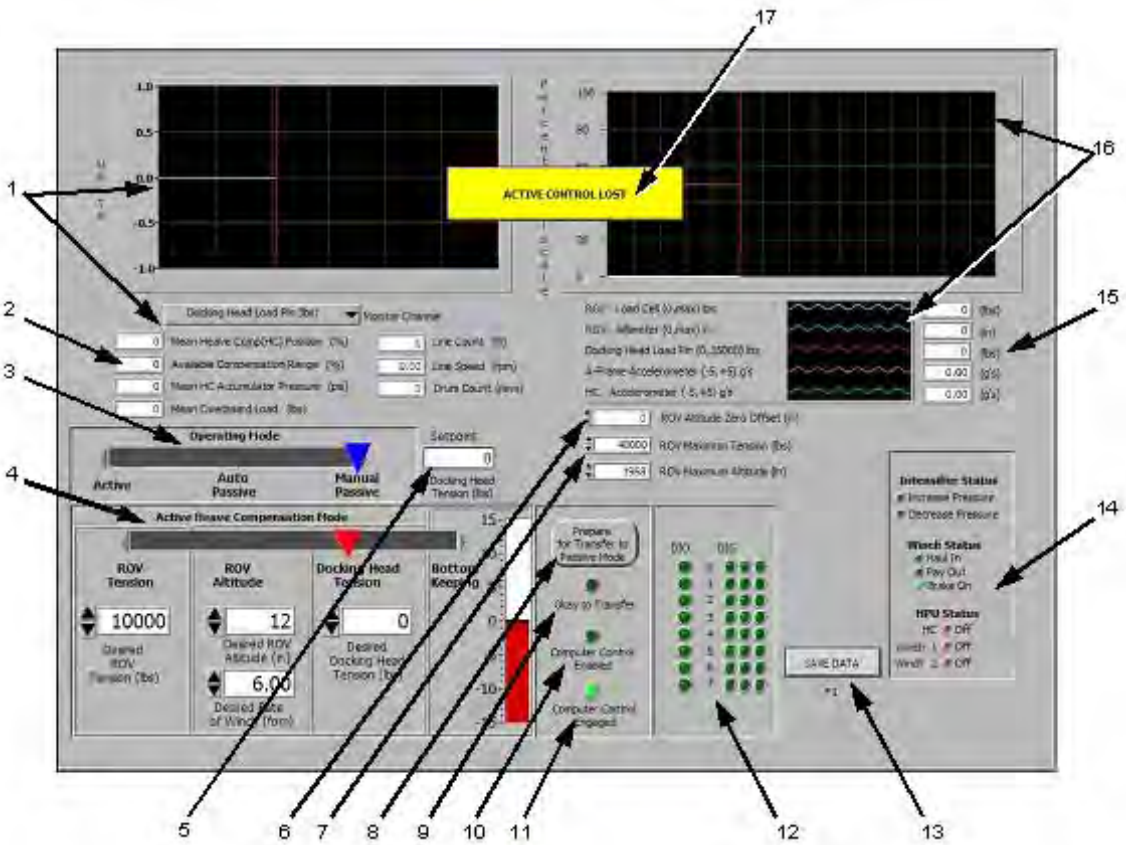

Figure 3-4 Monitor – GUI Presentation, Components

Table 3-2 Monitor - GUI Presentation, Parts Identification

ITEM	DESCRIPTION
1	Graph 1, GUI Selector Bar, and Digital Outputs
2	Average Values
3	Operating Mode Selector
4	Active Heave Compensation Mode Selector
5	Set-point Value
6	ROV Altitude Zero Offset Value
7	Full Scale Values
8	Prepare for Transfer to Passive Mode Button
9	Okay to Transfer Indicator
10	Computer Control Enabled Indicator
11	Computer Control Engaged Indicator
12	DIO and DIG Signal Indicators
13	Save Data Button
14	System Status Indicators
15	Current Values
16	Graph 2 and Legend
17	Active Control Lost Indicator

3.2.8.2.2 Transitioning Out of Auto Passive Mode

Once the HC System has been changed from the Active mode to the Auto Passive mode, it is ready to transition to the Manual Passive mode. To move the HC System out of the Auto Passive mode and back to the Manual Passive mode, perform the following steps:

a. At the Control Van Panel, move the Computer Control toggle switch (Figure 3-3, Item 8) to the "Disable" position and observe that the Computer Control Enabled lamp (Figure 3-3, Item 9) extinguishes. At the same time, the Operating Mode Selector pointer (Figure 3-4, Item 3) moves to the "Manual Passive" position indicating the computer has transitioned to the Manual Passive mode.
b. At this time, the HC System can be operated normally in the Manual Passive mode or the HC System can be secured (section 3.2.8.1.2).

3.2.8.3 Active Mode

The Active mode is used when computer controlled heave compensation of the vehicle/package is desired by preselecting one of the ROV Tension, ROV Altitude, Docking Head Tension, or Bottom Keeping modes.

3.2.8.3.1 Operating in the Active Mode

The current value of which ever mode is selected (refer to Active Heave Compensation Modes, section 3.2.8.4) is used as the initial set-point value although this value can be changed using the keyboard/mouse after going into the Active mode. To enter the Active mode, perform the following steps:

NOTE

The computer may delay the shift into Active mode until the Flying Head Assembly is within 5% of mid-stroke. Additionally, the HC system pressure may be too low, or too high, and the active control may not work at its optimum level until the intensifier has had time to adjust the system pressure. In extreme cases, the HC stroke may "top out" or "bottom out" until the system pressure is properly adjusted.

a. Click on "Active" on the Operating Mode selector (Figure 3-4, Item 3) and observe the pointer moves to the "Active" position.
b. Observe the Control Van Panel and verify the Computer Control Engaged lamp (Figure 3-3, Item 10) illuminates. The HC system is now operating in the Active mode.

3.2.8.3.2 Securing from the Active Mode

Securing the HC System from the Active mode requires a transition through the Auto Passive mode and back to the Manual Passive mode. To secure from the Active mode, perform the following steps:

NOTE

The GUI Operating Mode Selector (Figure 3-4, Item 3) can be used to go to the Manual Passive mode at any time. If the Computer Control Enabled signal is lost from remote due to switching it off or due to a system fault, the computer will automatically go to the Manual Passive mode. Additionally, the computer will not be able to switch out of the Manual Passive mode until and unless the Computer Control Disable/Enable toggle switch (Figure 3-3, Item 8) is activated once again.

NOTE

If the joystick is moved when the HC System is in the Active mode, the Active Heave Compensation Mode selector (ROV Tension, ROV Altitude, Bottom Keeping) reverts control to the Manual Passive mode.

a. Click on "Prepare for Transfer to Passive Mode" button (Figure 3-4, Item 8) on the GUI.

NOTE

When the "Prepare for Transfer to Passive Mode" button on the GUI is depressed, the intensifier is activated to adjust the accumulator gas pressures and the cylinder hydraulic oil volumes to the same values they were at when going into the Auto Passive mode.

b. Observe the "Okay to Transfer" lamp (Figure 3-4, Item 9) illuminates. The HC System is now in the transitional Auto Passive mode.
c. To move the HC System out of the Auto Passive mode and back to the Manual Passive mode, refer to Transitioning out of Auto Passive Mode (section 3.2.8.2.2).

3.2.8.4 Active Heave Compensation Modes

There are four Active Heave Compensation modes of which three (Bottom Keeping is the exception) must be selected prior to going into the Active mode. Once the HC System is in the Active mode, the FTHE Operator can select a different mode if desired/required.

3.2.8.4.1 ROV Tension

Once in the ROV Tension mode, the tension on the umbilical cable is determined by a signal from the vehicle. The current value in the "Set-point" window (Figure 3-4, Item 5) is the initial set-point target. To change the desired ROV Tension set-point, perform the following steps:

a. Click on the up or down arrow indicator on the GUI to change the Desired ROV Tension set-point (Figure 3-4, Item 4).
b. Observe the desired set-point value increases or decreases as appropriate in the ROV Tension window.
c. Observe the actual set-point value (Figure 3-4, Item 5) change, up or down, as appropriate as the desired set-point value is approached.

3.2.8.4.2 ROV Altitude

NOTE

ROV Altitude should not be used above 600 inches (50 feet).

Once in the ROV Altitude mode, the altitude of the vehicle is determined by a signal from the vehicle. The current value in the “Set-point” window (Figure 3-4, Item 5) is the initial set-point target. To change the desired ROV Altitude set-point and/or the desired rate of winch set-point, perform the following steps:

- **Desired ROV Altitude:**

  a. Click on the up or down arrow indicator on the GUI to change the Desired ROV Altitude set-point (Figure 3-4, Item 4).
  b. Observe the desired set-point value increases or decreases as appropriate in the ROV Altitude window.
  c. Observe the actual Set-point value (Figure 3-4, Item 5) change, up or down, as appropriate as the desired set-point value is approached.

- **Desired Rate of Winch:**

  d. Click on the up or down arrow indicator on the GUI to change the Desired Rate of Winch set-point (Figure 3-4, Item 4).
  e. Observe the desired set-point value increases or decreases as appropriate in the Desired Rate of Winch window.

3.2.8.4.2.1 Ordered Altitude

The Ordered Altitude function can only be used after the FTHE HC System has entered the Active, ROV Altitude mode. There is nothing for the FTHE Operator to do at this point. An operator at the ROV consolette turns the Ordered Altitude dial: for each “click” of the dial, the vehicle altitude is either increased or decreased by four inches.

3.2.8.4.3 Docking Head Tension

Once in the Docking Head Tension mode, the tension on the umbilical cable is determined by a signal from the Docking Head Load Pin from the Docking Head Sheave Assembly axle. The current value in the “Set-point” window (Figure 3-4, Item 5) is the initial set-point target. To change the desired Docking Head Tension set-point, perform the following steps:

a. Click on the up or down arrow indicator on the GUI to change the Desired Docking Head Tension set-point (Figure 3-4, Item 4).
b. Observe the desired set-point value increases or decreases as appropriate in the Docking Head Tension window.
c. Observe the actual Set-point value (Figure 3-4, Item 5) change, up or down, as appropriate as the desired set-point value is approached.

3.2.8.4.4 Bottom Keeping

The Bottom Keeping function can only be selected after the FTHE HC System has entered the Active mode and from one of the Active Heave Compensation Modes (usually ROV Altitude) and the vehicle is actually sitting on the bottom of the ocean. Once in the Bottom Keeping mode, the FTHE Operator can only monitor the vehicle heave compensation function as viewed from the Bottom Keeping GUI indicator (Figure 3-4, Item 4). To enter the Bottom Keeping mode, perform the following steps:

CAUTION

The FTHE immediately attempts to "center" the vehicle heave compensator. DO NOT go into Bottom Keeping mode unless the vehicle is within 11 inches of the sea floor.

a. Click on "Bottom Keeping" on the Active Heave Compensation Mode selector (Figure 3-4, Item 4) and observe the indicator moves to that position.

NOTE

If the vehicle heave compensator exceeds ± 11 inches as indicated on the Bottom Keeping GUI indicator, and the FTHE HC Flying Head Assembly exceeds ± 24 inches, then the FTHE HC System, under control of the computer, operates the Umbilical Winch to either pay out or haul in the umbilical cable attempting to maintain the Bottom Keeping GUI indicator at the midpoint.

b. Observe the Bottom Keeping GUI indicator to ascertain the vehicle heave compensation remains between ± 11 inches.

3.2.8.5 Landing and Take-Off of Vehicle/Package

Landing and take-off of the vehicle/package from the ocean floor can be done in the Manual Passive mode or the Active (ROV Altitude – Ordered Altitude) mode. The Manual Passive mode is the preferred method.

3.2.8.5.1 Manual Passive Mode

The Manual Passive mode can be used for vehicle/package landing and take-off as long as the sea state is relatively calm.

3.2.8.5.1.1 Landing

To land the vehicle/package on the ocean floor using the Manual Passive mode, perform the following steps:

a. Bring the HC System to the Manual Passive mode (section 3.2.8.1.1).
b. Lower the HC accumulator gas pressure to 500 psig by moving the Compensator toggle switch (Figure 4-15, Item 4) to the "Lower" position and observing the Accumulator Gas Pressure gauge (Figure 4-11, Item 5).
c. Visually verify that the Flying Head Assembly (Figure 2-5) has bottomed in the HC Assembly cylinders and notify the Control Van Operator of the same.
d. When the Control Van Operator announces that the vehicle is about to land, prepare to observe the Flying Head Assembly movement.
e. When the Flying Head Assembly begins to rise, IMMEDIATELY announce, "Heave Comp moving. Keep Coming." This communicates to the Control Van Operator that the vehicle/package is resting on the ocean floor, the weight of the vehicle/package is no longer supported by the umbilical cable, and only a little more umbilical cable needs to be paid out.
f. The Flying Head Assembly continues to raise taking up the cable slack. When the upper part of the HC cylinder rod reaches the yellow tape affixed just below the end cap of the

port (left) HC accumulator, announce, “Mid-Stroke.” This communicates to the Control Van Operator that the Flying Head Assembly is at the midpoint (50% mark) and to stop paying out umbilical cable.

g. The FTHE Operator observes the Flying Head Assembly is free to move within its ± 24 inches of travel in time with the up and down motion of the ship, indicating the vehicle/package is remaining on the ocean floor.

h. The FTHE Operator resumes his normal watch-standing functions on the after deck.

3.2.8.5.1.2 Take-Off

For vehicle/package take-off from the ocean floor using the Manual Passive mode, perform the following steps:

NOTE

It is assumed that the vehicle/package is sitting on the ocean floor, the Accumulator Gas Pressure is at 500 psig, and the HC System is in the Manual Passive mode.

a. The Control Van Operator announces, “Prepare to Lift-Off.” This communicates to the FTHE Operator to observe, in parallel, for a taut umbilical cable and Flying Head Assembly movement in a general down-ward direction. (Naturally, heaving up and down with the ship’s movement causes some hesitation in movement.)

b. At the point that the Flying Head Assembly has bottomed, the FTHE Operator announces “Lift-Off” to the Control Van Operator. This communicates that the vehicle/package is no longer on the ocean floor.

c. The Control Van Operator brings the vehicle/package to an altitude of approximately 10 feet to ensure that it will not strike the ocean bottom due to the ship riding the ocean swells.

d. The HC System and the vehicle/package are now ready to be further used as the Control Van Operator dictates.

3.2.8.5.2 Active Mode (ROV Altitude – Ordered Altitude)

The Active (ROV Altitude – Ordered Altitude) mode is the preferred method for vehicle/package landing in rough seas.

3.2.8.5.2.1 Landing

To land the vehicle/package on the ocean floor using the Active (ROV Altitude – Ordered Altitude) mode, perform the following steps:

NOTE

ROV Altitude should not be used above 600 inches (50 feet).

a. Operate the HC System in the Active mode (section 3.2.8.3) using ROV Altitude (section 3.2.8.4.2) and Ordered Altitude (section 3.2.8.4.2.1) modes.

b. An operator at the ROV consolette adjusts the Ordered Altitude dial in successive “clicks” until the vehicle/package nears the ocean floor.

c. Once on the bottom, the FTHE Operator changes the Active Heave Compensation Mode to “Bottom Keeping” (section 3.2.8.4.4) and maintains watch on the Bottom Keeping GUI indicator to ensure the vehicle/package remains on the ocean floor.

3.2.8.6 Saving Data

Monitoring data can be recorded on the computer hard drive at any time by depressing the SAVE DATA bar on the GUI using either the mouse or by depressing F1 on the keyboard. Data will continue to be saved until the bar (or F1) is depressed again. Normally used for troubleshooting purposes, it is selected prior to leaving the Manual Passive mode. The data recorded is the various valve, accumulator, and cylinder positions critical to the operation of the FTHE.

The data collected should be copied to a CD and removed using local standard data removal protocols. Once the data is copied to a CD, it serves no purpose on the hard drive and should be deleted from the computer along with any other outdated or unused files to ensure the hard drive does not reach full capacity.

3.2.9 Vehicle (or Test Shape) Recovery Procedure

The Control Van Operator may have a formal check sheet to follow when recovering the Vehicle (or Test Shape); however, many variables could come into play during this evolution. A normal recovery evolution consists of activities performed not only by the FTHE Operator, but by Control Van personnel, Deck Leader, and aft deck line handlers. The following procedures list only the specific FTHE Operator actions required to recover the vehicle/package. (Refer to Appendix 3, Checks for Recovering Vehicle, to view a typical, check sheet scenario.)

WARNING

POSSIBLE DEATH, INJURY, OR EQUPEMENT DAMAGE may result when operating the FTHE (lifting and moving vehicle/package loads) on the aft deck if not done in a safe manner. The FTHE Operator must not take any action without a direct order from the Deck Leader.

3.2.9.1 Lower Cursor Assembly and Attach to Vehicle (or Test Shape)

To lower the Cursor Assembly and attach it to the vehicle/package, the FTHE Operator must perform the following steps:

NOTE

The HC Assembly must be secured and the cylinders locked prior to recovering the vehicle/package. The Control Van Operator must return the vehicle to a depth of 35-40 feet in preparation for recovery of the vehicle/package.

a. Ensure the swing frame is disabled using the Enable/Disable toggle switch (Figure 4-18, Item 15) making the swing frame free to move about its pivot pins.
b. Ensure the A-Frame Assembly is luffed outboard using the A-Frame joystick (Figure 4-18, Item 9) and verify the A-Frame Outboard lamp (Figure 4-18, Item 8) illuminates indicating the A-Frame Assembly is positioned hard into its base weldment boom stops.

NOTE

When Remote Enable is disabled, control of the winch assembly is passed back to the FTHE Operator at the Pedestal on the aft deck.

c. When directed by the Control Van Operator, disable remote control of the winch assembly by using the Remote Enable Disable/ Enable toggle switch (Figure 4-18, Item 22) and observe the Remote Enabled lamp (Figure 4-18, Item 21) extinguishes.

d. Unlatch the Cursor Assembly from the Docking Head Sheave Assembly:

1. Use the Cursor Winch joystick (Figure 4-18, Item 11) to first raise the Cursor Assembly to take the weight off of the four cursor latches.
2. In parallel with raising the Cursor Assembly, open the cursor latches using the Latch Open/Close toggle switch (Figure 4-18, Item 16).
3. Verify the cursor latches are opened by viewing the green-tipped cable latch indicators (Figure 4-17, Item 4) as being extended approximately 2 inches.

e. Lower the Cursor Assembly into the water column and as you quickly approach a depth of approximately 25-30 feet as indicated on the LCI-90 Line Control Instrument display, slow the descent and take commands from the Control Van Operator to gently lower the Cursor Assembly onto the vehicle lift ring, locking it in place.

f. Once the Control Van Operator verifies the Cursor Assembly is locked onto the vehicle, enable constant tension using the Constant Tension Mode Disable/Enable toggle switch (Figure 4-18, Item 24) and observe the Constant Tension Enabled lamp (Figure 4-18, Item 23) illuminates.

g. If the Winch Brake Released lamp (Figure 4-18, Item 18) fails to illuminate, re-toggle the Constant Tension Mode Disable/Enable toggle switch several times. If the lamp remains extinguished, begin troubleshooting the brake system controls.

NOTE

If the four green-tipped cable latch indicators do not snap into place indicating that the Cursor Assembly is firmly locked into the Docking Head Assembly, move the Pedestal Latch toggle switch (Figure 4-18, Item 16) to the “Close” position until the four green-tipped latch indicators are totally seated.

h. Using the Cursor Winch joystick, raise the Cursor Assembly/vehicle/package to the Docking Head Assembly until the four green-tipped cable latch indicators come out approximately two inches and then “snap” back into place indicating the four Catch and Latch Assembly latch weldments (refer to Appendix 10, DD 0707-6006-02, Sheet 2, Item 10) have locked into position.

i. Once again, verify the swing frame is disabled using the Swing Frame Enable/Disable toggle switch making the swing frame free to move about its pivot pins.

3.2.9.2 Luff A-Frame Assembly Inboard

This paragraph assumes the Cursor Assembly has already been attached to the vehicle/(and they are currently locked in the Docking Head Assembly). To luff the vehicle/package inboard, perform the following steps:

a. Luff the A-Frame Assembly inboard using the A-Frame joystick (Figure 4-18, Item 9) and verify the A-Frame Outboard lamp (Figure 4-18, Item 8) extinguishes.

NOTE

The Swing Frame is enabled to prevent it from swinging while the ground strap and tag-lines (in that order) are attached.

b. Enable the Swing Frame using the Swing Frame Enable/Disable toggle switch (Figure 4-18, Item 15) and thus preventing the Swing Frame from swinging on the docking head pivot pins.

3.2.9.3 Remove Package from Vehicle

There are times when the DWT operations require a package to be detached from the vehicle. (If a package was not required for DWT Operations and is not currently attached to the vehicle, this paragraph is skipped.) It is assumed the Cursor Assembly is attached to the vehicle and the Cursor Assembly/vehicle/package are currently locked into the Docking Head Assembly. To remove a package from the vehicle, perform the following steps:

NOTE

The tag-line personnel and other ship's company must remove the sawhorses and accurately position the package storage device directly underneath the vehicle/ package.

a. Unlatch the Cursor Assembly from the Docking Head Sheave Assembly.

1. Use the Cursor Winch joystick (Figure 4-18, Item 11) to first raise the Cursor Assembly/vehicle/package to take the weight off of the four cursor latches.
2. In parallel with raising the Cursor Assembly/vehicle/package, open the cursor latches using the Latch Open/Close toggle switch (Figure 4-18, Item 16).
3. Verify the cursor latches are opened by viewing the green-tipped cable latch indicators (Figure 4-17, Item 4) as being extended approximately 2 inches.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Rough handling to the vehicle can damage internal electronics. Care should be exercised to lower the Cursor Assembly/vehicle/package quickly, carefully, and lightly to the deck.

b. Lower the Cursor Assembly/vehicle/package quickly but carefully so that the package is guided appropriately onto the package storage device and there is no weight on the umbilical cable.

c. Disable the Swing Frame using the Swing Frame Enable/Disable toggle switch as before and ascertain that it is free to rotate on its pivot pins.

NOTE

If the four green-tipped cable latch indicators do not snap into place indicating that the Cursor Assembly is firmly locked into the Docking Head Assembly, move the Pedestal Latch Open/Close toggle switch (Figure 4-18, Item 16) to the "Close" position until the four green-tipped latch indicators are totally seated.

d. When it is confirmed that the vehicle locking device has been released from the package, gently raise the Cursor Assembly/vehicle from the package to the Docking Head Sheave Assembly until the four green-tipped cable latch indicators come out approximately two inches and then "snap" back into place indicating the four Catch and Latch Assembly latch

weldments (refer to Appendix 10, DD 0707-6006-02, Sheet 2, Item 10) have locked into position.

NOTE

The tag-line personnel and other ship's company must move the vehicle/package storage device to its appropriate storage place on the aft deck and then reposition the sawhorses under the vehicle in preparation for its support.

3.2.9.4 Lower Vehicle onto Sawhorses

This paragraph assumes the Cursor Assembly/vehicle is locked in the Docking Head Assembly. To lower the Cursor Assembly/vehicle to the sawhorses, perform the following steps:

NOTE

The Deck Leader must ensure the ground strap and tag-lines are appropriately attached to vehicle and sawhorses are positioned correctly to receive the vehicle.

a. Enable the Swing Frame using the Swing Frame Enable/Disable toggle switch preventing the Docking Head Sheave Assembly from pivoting on its pivot pins.
b. Unlatch the Cursor Assembly from the Docking Head Sheave Assembly.
   1. Use the Cursor Winch joystick to first raise the Cursor Assembly/vehicle to take the weight off of the four cursor latches.
   2. In parallel with raising the Cursor Assembly/vehicle, open the cursor latches using the Latch Open/Close toggle switch.
   3. Verify the cursor latches are opened by viewing the green-tipped cable latch indicators as being extended approximately 2 inches.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Rough handling to the vehicle can damage internal electronics. Care should be exercised to lower the Cursor Assembly/vehicle quickly, carefully, and lightly to the sawhorses.

c. Lower the Cursor Assembly/vehicle quickly but gently to the sawhorses and continue to payout just enough umbilical cable until they go slack.
d. The tag-line personnel can now securely strap the vehicle to the deck.
e. Disable constant tension of the umbilical cable using the Constant Tension Mode Disable/Enable toggle switch (Figure 4-18, Item 24) and observe the Constant Tension Enabled lamp (Figure 4-18, Item 23) extinguishes.
f. Move to the Manual DCV Station and operate and hold the Latch Open/Close control handle (Figure 4-17, Sheet 4, Item 11) to unlatch the four Cursor Assembly latches from the vehicle lift ring.
g. When the Deck Leader verifies the Cursor Assembly latches are unlatched, raise the Cursor Assembly towards the Docking Head Assembly using the Manual DCV Station Cursor Payout/Haul In control handle (Figure 4-17, Sheet 4, Item 14). After the Cursor Assembly has raised a couple of feet, the Latch Open/Close control handle may be released.

NOTE

If the Deck Leader directs operation of the Latch Open/Close control handle at the Manual DCV Station, the FTHE Operator can remain at the Pedestal and raise the Cursor Assembly to the Docking Head Assembly using the Cursor Winch joystick as done previously.

NOTE

If the four green-tipped cable latch indicators do not snap into place indicating that the Cursor Assembly is firmly locked into the Docking Head Assembly, move the Pedestal Latch Open/Close toggle switch (Figure 4-18, Item 16) to the "Close" position until the four green-tipped latch indicators are totally seated.

h. Continue raising the Cursor Assembly until it is securely locked into the Docking Head Assembly as verified by the four green-tipped cable latch indicators.

i. Using the Winch joystick, reduce tension on the umbilical cable to approximately 500-750 pounds as indicated on the LCI-90 Line Control Instrument display (Figure 4-18, Item 26).

j. Secure the FTHE system by following the Normal Shut-Down procedures (section 3.2.5).

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4.0 CHAPTER 4 - THEORY OF OPERATION

4.1 INTRODUCTION

This chapter describes the associated controls, indicators, and alarms used to monitor and control the FTHE individual units as well as the theory of operation for the software, hydraulic, and electrical FTHE systems.

4.2 CONTROLS, INDICATORS AND ALARMS

The various controls, indicators, and alarms required to operate and maintain the FTHE are grouped according to the unit they are physically associated with: Umbilical Winch Assembly, Levelwind Assembly, HPU Assembly, HC Assembly, A-Frame, Pedestal, and Control Van.

4.2.1 Umbilical Winch System

The Umbilical Winch System is composed of the Umbilical Winch and Levelwind Assemblies.

4.2.1.1 Umbilical Winch Assembly

The location of features for the Umbilical Winch Assembly is provided in Figure 4-1 and a description of those features is provided in Table 4-1.

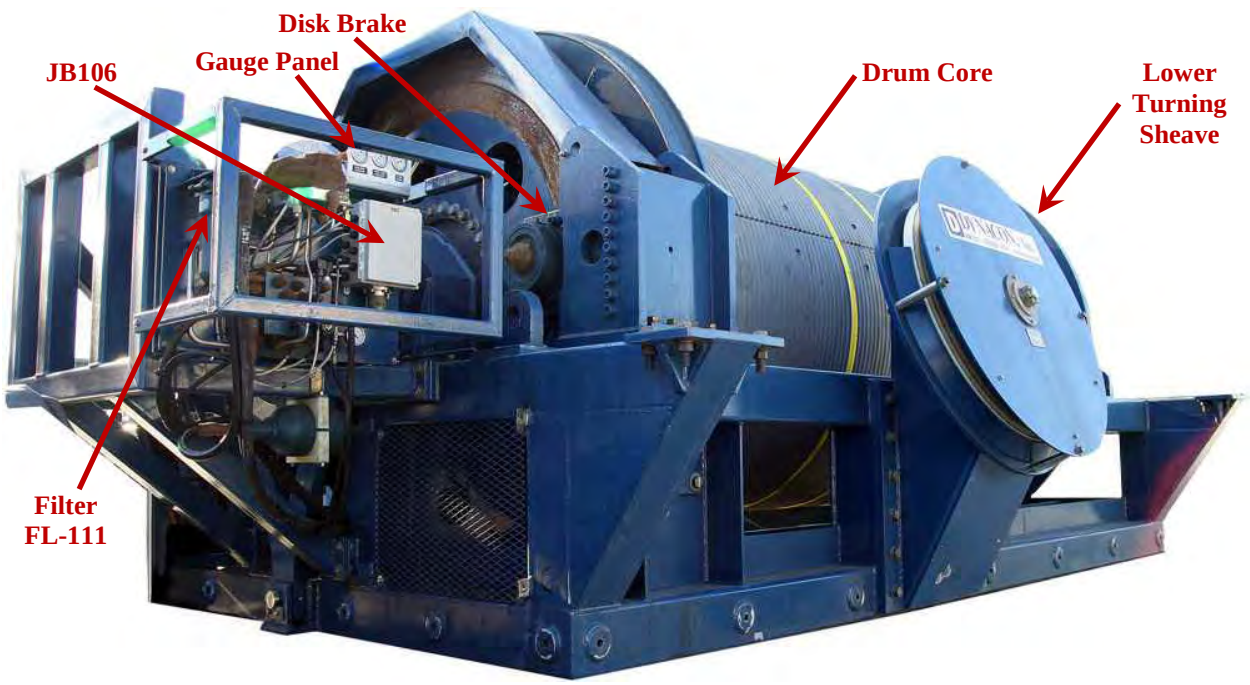


Figure 4-1 Umbilical Winch Assembly, Location of Features

Table 4-1 Umbilical Winch Assembly, Description of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
N/A	Lower Turning Sheave	This sheave routes umbilical from Upper Turning Sheave to the Heave Compensator.
N/A	Drum Core	Outer drum has Lebus shell grooved specifically for the 1.40” umbilical. The drum is supported for rotation on each end by pillow block bearing assemblies.

Table 4-1 Umbilical Winch Assembly, Description of Features *(continued)*

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
FL-111	Filter Head/Bowl type with indicator	Filter with indicator for Levelwind Assembly. As filter element becomes dirty, difference in pressure causes indicator to move from the green area to the red area, indicating filter element replacement is required.
PG-101, PG-102, and PG-103	Pressure Gauge Panel	Provides a means to determine oil pressure. PG-101: Levelwind Pressure PG-102: Open Loop Pressure PG-103: Case Drain
N/A	Disk Brake Assembly	When the brake circuit is de-energized, spring pressure applies the brake pads to the drum brake disk much like the brake calipers on an automobile and prevents the drum from turning. When the brake circuit is energized, oil pressure releases brake pad from the drum brake disk and allows winch drum to turn.

4.2.1.2 Levelwind Assembly

The location of features for the Levelwind Assembly is provided in Figure 4-2 and a description of those features is provided in Table 4-2.

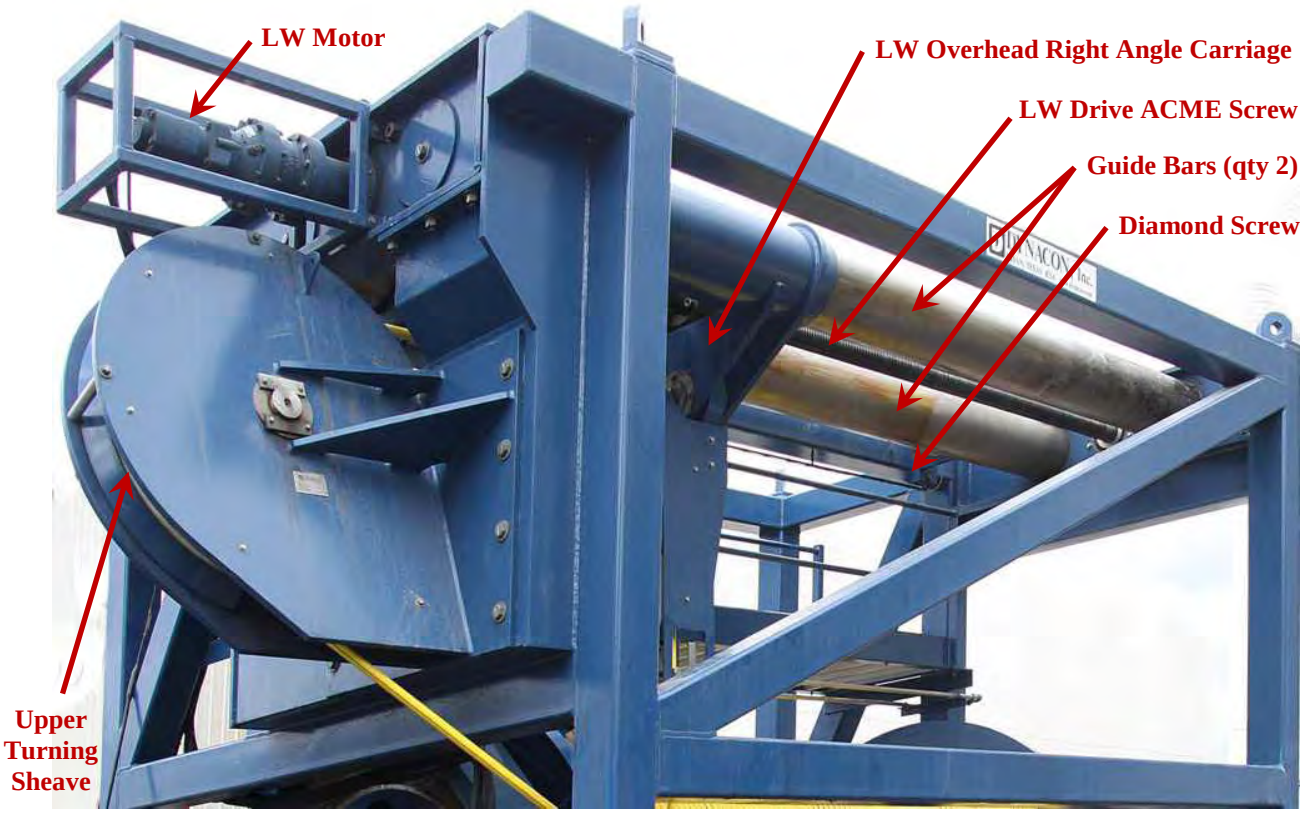


Figure 4-2 Levelwind Assembly, Location of Features

Table 4-2 Levelwind Assembly, Location of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
HM-102 & GB-102	Motor & Gearbox	Turns the ACME Screw for precision moment of the LW Carriage in order to place umbilical tightly on winch drum.
N/A	LW Carriage	Holds LW traveling sheave, moves on the guide bars, driven by the ACME Screw.
N/A	LW Drive ACME Screw	Used to precisely move the LW Carriage.
N/A	Guide Bars	Greased alloy steel bars to guide the LW Carriage over the winch drum.
N/A	Diamond Screw	Designed to be mechanically tied to the Electro-Active LW during setup procedures
N/A	Upper Turning Sheave	A 40-inch tread diameter sheave and is grooved for 1.40-inch diam. umbilical.

The levelwind assembly features an overhead right-angle levelwind design. The assembly has both an Electro-Active Levelwind system and a Diamond-Screw driven system. The sheave is instrumented for Line Count / Line Speed and has targets for sensors which provide count/speed output. The sheave has a 40-inch tread diameter and is grooved for a 1.40-inch diam. umbilical.

The overhead right angle levelwind fairleads the umbilical from the umbilical winch to the upper turning sheave and from there to the lower turning sheave. The cable exits the lower turning sheave and is routed to the Heave Compensator and on to the A-Frame overboarding sheave.

4.2.1.2.1 Electro-Active Levelwind

The electro-active levelwind ACME screw is driven by a Charlynn 19 cu. in hydraulic motor (HM-102) interfaced with a Brevini 6.1 ratio EM1065 gearbox (GB-102). Control of the levelwind is provided by the levelwind sensor in conjunction with the electro-active levelwind PCB board.

4.2.1.2.2 Diamond Screw Levelwind

The diamond screw is directly driven by a White 24.9 cu in RS 200 series hydraulic motor. Control of the levelwind is provided by a levelwind sensor in conjunction with the diamond screw levelwind PCB board.

The diamond screw is designed to be mechanically tied to the electro-active levelwind during setup procedures. The diamond screw is tied to the electro-active levelwind system by a pawl peg when the system is operating in the diamond screw mode and is inactive when the system is operating in the electro-active mode (not mechanically tied to the diamond screw pawl peg.

4.2.1.2.3 Levelwind Control Panel (ENC107)

Electrical Diagram Drawing: 1088-9001-07, Drawing: 1088-9002-07

The Levelwind Control Panel (ENC107) is shown in Figure 4-3 and followed by description of control functions in Table 4-3.

Figure 4-3 Levelwind Control Panel

Table 4-3 Levelwind Control Panel Features

Control Label	Control Function
Levelwind Disable / Enable Switch	When the Levelwind Disable toggle switch is moved to the DISABLE position that both the Diamond and Electro-Active are disabled. Move local and remote control winch control handle out of neutral and the alarm sounds at the local control.
Levelwind Disabled Lamp	The lamp is lit when the Levelwind Disable toggle switch is moved to the DISABLE position.
Levelwind Control Electro-Active / Diamond Switch	When the Levelwind Control toggle switch is moved to the ELECTRO-ACTIVE position that the carriage is controlled by the electro-active levelwind sensor. When the Levelwind Control toggle switch is moved to the DIAMOND position that the carriage is controlled by the diamond levelwind sensor.
Diamond Levelwind Auto-Align	The diamond screw pawl automatically moves to the null point of the diamond levelwind sensor.
Diamond Screw Levelwind Corrector Switch	The diamond screw turns clockwise, with respect to the back of the diamond screw hydraulic motor, when toggle switch is moved to CW position. The diamond screw turns counter-clockwise, with respect to the back of the diamond screw hydraulic motor, when toggle switch is moved to CCW position.
Electro-Active Levelwind Corrector Switch	Levelwind moves LEFT or RIGHT in response to direction the switch is toggled as indicated by the arrows.

4.2.1.2.4 Levelwind Enclosure (ENC105)

Electrical Diagram Drawing: 1088-9001-07, Drawing: 1088-9001-05

The Levelwind Enclosure (ENC105) is provided in Figure 4-4 and a description of those features is provided in Table 4-4.

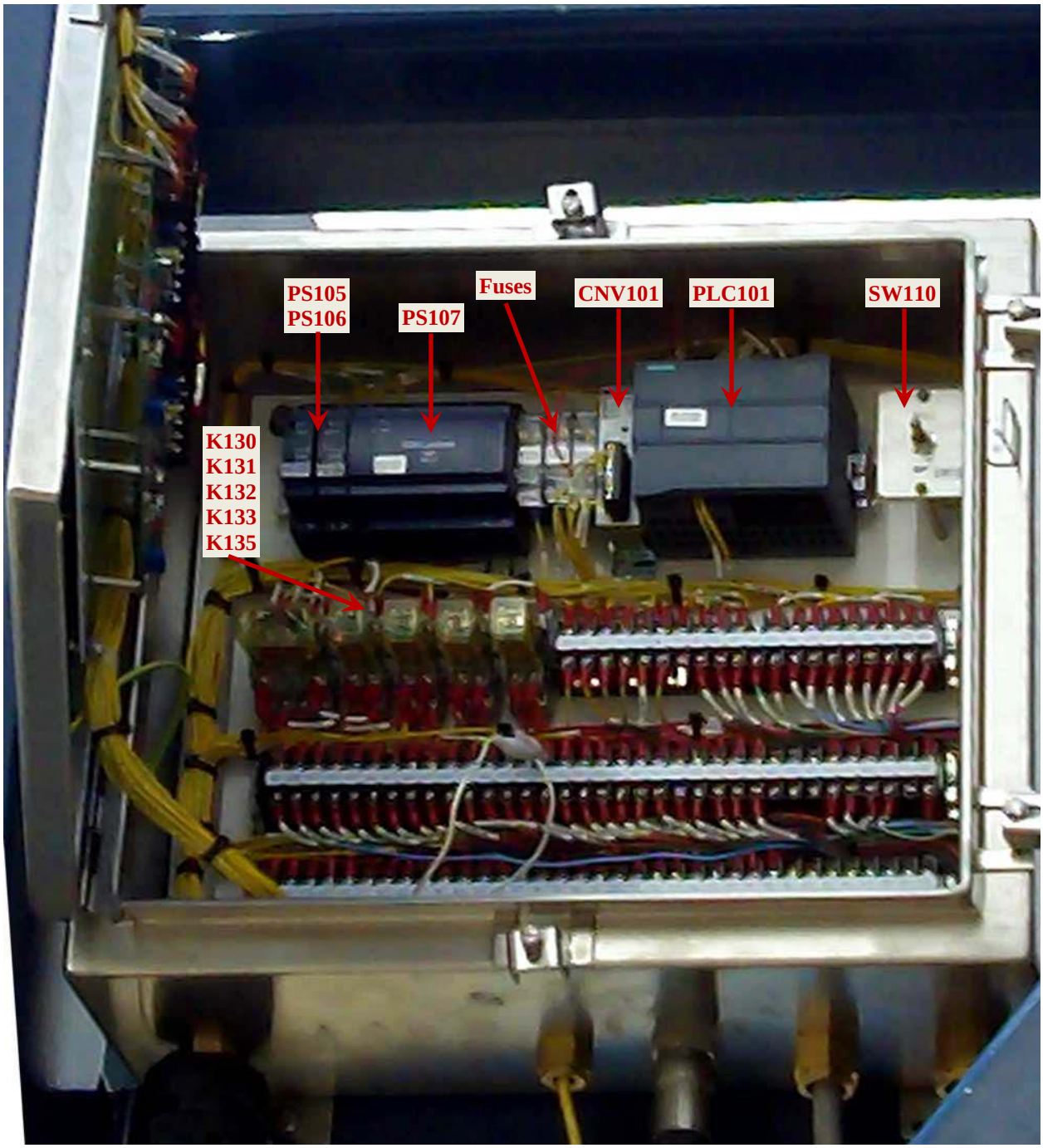


Figure 4-4 Levelwind Enclosure, Location of Features

Table 4-4 Levelwind Enclosure, Description of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
SW110	Toggle Switch	Toggle Switch – Single Pole, Momentary
PLC101	PLC	Programmable Logic Controller
CNV101	Converter	Voltage to Current Converter, transforms ±10V signals into current signals for driving hydraulic servo valves.
PS105 & PS106	Power Supply	Power Supply, 0.83A at 12V (10W)
PS107	Power Supply	Power Supply, 4.2A at 24V (100.8W)
F115	Fuse, 1A	Protects PS105 from excessive current and shorts
F116	Fuse, 1A	Protects PS106 from excessive current and shorts
F117	Fuse, 3A	Protects PS107 from excessive current and shorts
K130	Relay	Diamond Follower Selected (24VAC) A. Diamond Follow Failure Interlock B. Levelwind Enable Steer C. Levelwind Servo Steer D. Levelwind Servo Steer
K131	Relay	Diamond Follower Selected (24VAC) A. PLC Signal B. Not Used
K132	Relay	Levelwind Disabled (24VAC) A. Levelwind Enable Break B. Alarm Signal
K133	Relay	Brake Interlock (24VAC) A. Latch B. Spring Applied Brake Release Enable
K135	Relay	Hyd. Applied Brake Pressure Present (24VAC) A. K133 Signal B. Not Used

4.2.2 HPU Assembly

The main controlling features for the HPU Assembly can be found on the High Voltage Enclosure, Low Voltage Enclosure, Load Break Center Enclosure, and Port Access Area.

4.2.2.1 HPU Port Access Area

The location of features for the HPU Assembly Port Access Area is provided in Figure 4-5 and a description of those features is provided in Table 4-5.

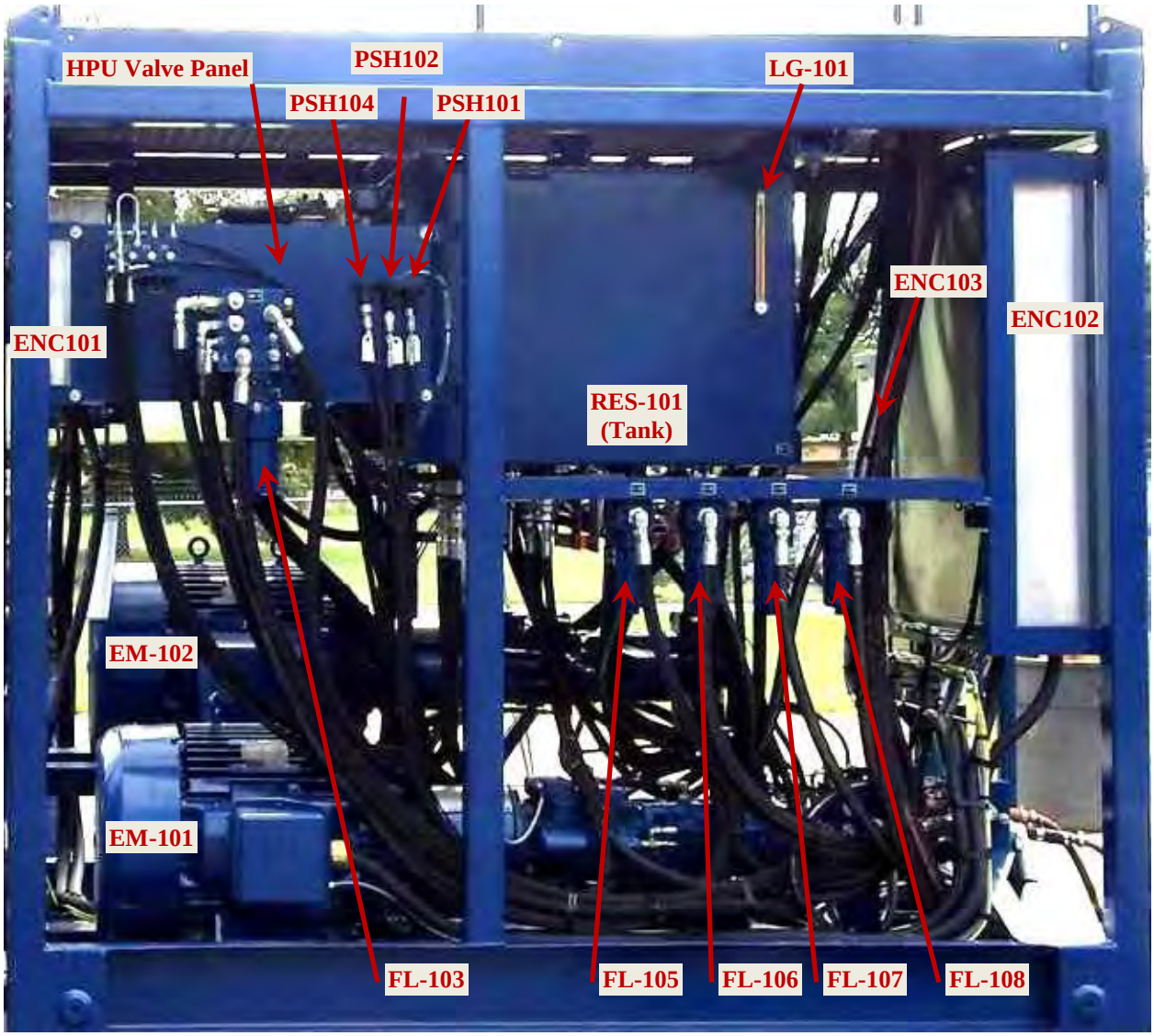


Figure 4-5 HPU Port Access Area, Location of Features

Table 4-5 HPU Port Access Area, Description of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
EM-101	Electric Motor	Powers HPU #1
EM-102	Electric Motor	Powers HPU #2
N/A	HPU Valve Panel	Located on port side for ease of access, see section 4.2.2.3 for details.
RES-101	Oil Reservoir	Stores system oil for HPU
LG-101	Level Gauge	Indicates oil level in reservoir RES-101 tank
PSH-101	Pressure Switch	Sensor detects pressure at HP-101A (HPU #1)
PSH-102	Pressure Switch	Sensor detects pressure at HP-102A (HPU #2)
PSH-104	Pressure Switch	Sensor detects pressure in Closed Loop B-Port
FL-103	Filter, Manifold Mount type	Filters oil for Open Loop System (Auxiliary)
FL-105	Filter, Head/Bowl type	Filters oil for HP-101A System A-Port
FL-106	Filter, Head/Bowl type	Filters oil for HP-101A System B-Port
FL-107	Filter, Head/Bowl type	Filters oil for HP-102A System A-Port
FL-108	Filter, Head/Bowl type	Filters oil for HP-102A System B-Port

4.2.2.2 HPU Gauge Panel

The location of features for the HPU Gauge Panel is provided in Figure 4-6 and a description of those features is provided in Table 4-6.

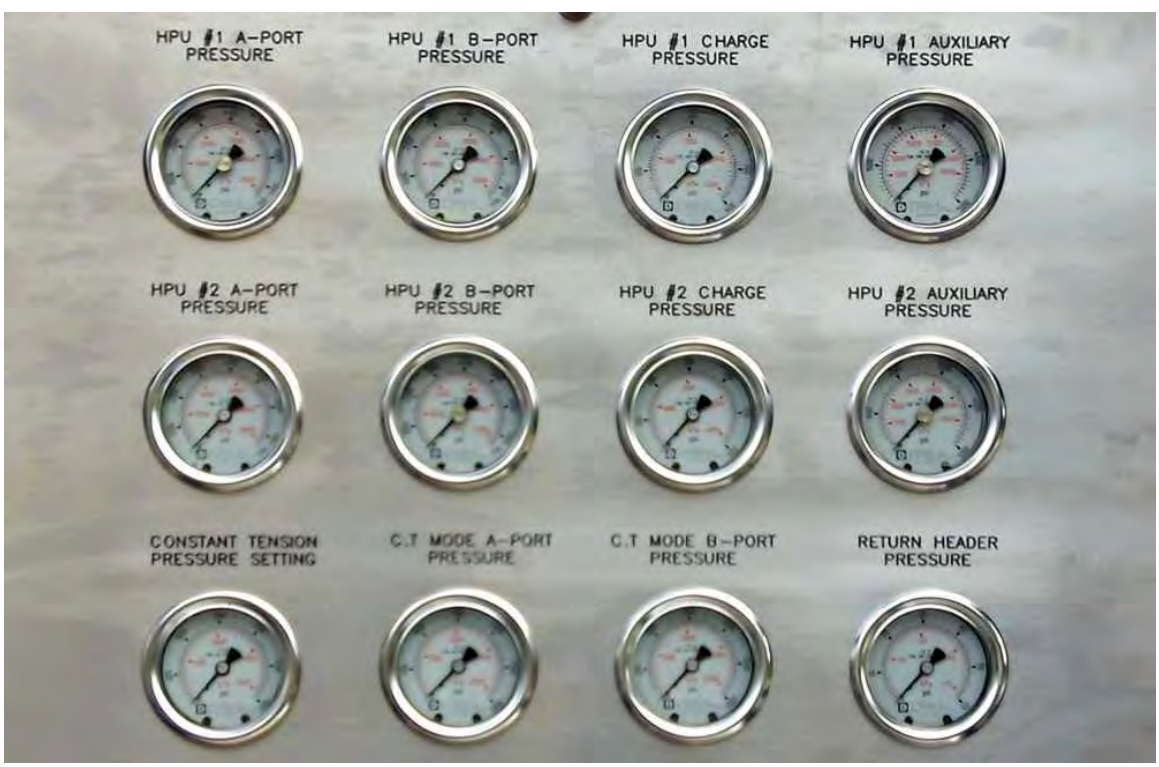


Figure 4-6 HPU Gauge Panel, Location of Features

Table 4-6 HPU Gauge Panel, Description of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
HPU #1 A-PORT PRESSURE	Pressure Gauge (0-7,500 psig)	**PG-106:** Indicates winch-1 A-port charge hydraulic pressure. Normal pressure reading is between 0 - 3,000 psig depending upon winch use and direction of movement.
HPU #1 B-PORT PRESSURE	Pressure Gauge (0-7,500 psig)	**PG-107:** Indicates winch-1 B-port charge hydraulic pressure. Normal pressure reading is between 0 - 3,000 psig depending upon winch use and direction of movement.
HPU #1 CHARGE PRESSURE	Pressure Gauge (0-600 psig)	**PG-104:** Indicates winch-1 charge hydraulic pressure at HP-1A. Nominal 390 psig.
HPU #1 AUXILIARY PRESSURE	Pressure Gauge (0-5,000 psig)	**PG-114**: Indicates auxiliary hydraulic pressure. Nominal 3,000 psig.
HPU #2 A-PORT PRESSURE	Pressure Gauge (0-7,500 psig)	**PG-108:** Indicates winch-2 A-port charge hydraulic pressure. Normal pressure reading is between 0 - 3,000 psig depending upon winch use and direction of movement.
HPU #2 B-PORT PRESSURE	Pressure Gauge (0-7,500 psig)	**PG-109:** Indicates winch-2 B-port charge hydraulic pressure. Normal pressure reading is between 0 - 3,000 psig depending upon winch use and direction of movement.
HPU #2 CHARGE PRESSURE	Pressure Gauge (0-600 psig)	**PG-105:** Indicates winch-2 charge hydraulic pressure at HP-2A. Nominal 380 psig.
HPU #2 AUXILIARY PRESSURE	Pressure Gauge (0-5,000 psig)	**PG-115**: Indicates auxiliary hydraulic pressure. Nominal 3,000 psig.
CONSTANT TENSION PRESSURE SETTING	Pressure Gauge (0-3,000 psig)	**PG-118**: Indicates CT hydraulic pressure. Nominal 3,000 psig.
CT MODE A-PORT PRESSURE	Pressure Gauge (0-3,000 psig)	**PG-117**: Indicates CT A-Port pressure.
CT MODE B-PORT PRESSURE	Pressure Gauge (0-3,000 psig)	**PG-119**: Indicates CT B-Port pressure.
RETURN HEADER PRESSURE	Pressure Gauge (0-60 psig)	**PG-116**: Indicates open loop return hydraulic pressure. 25 psig Maximum

4.2.2.3 HPU Valve Panel

The location of features for the HPU Valve Panel is provided in Figure 4-7 and a description of those features is provided in Table 4-7. (Refer to Chapter 7 for a complete listing of all components found on this hydraulic panel).

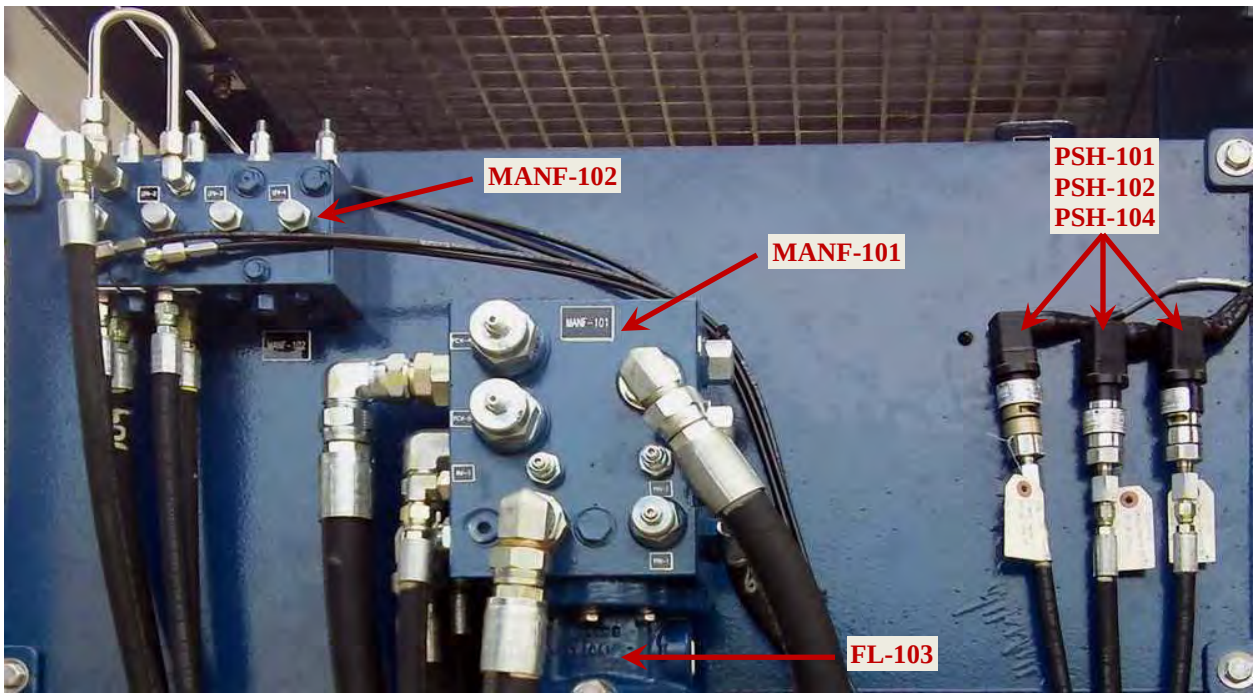


Figure 4-7 HPU Valve Panel, Location of Features

Table 4-7 HPU Valve Panel, Description of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
PSH-101	Pressure Switch	Pressure switch for HPU #1 Winch Pump (HP-101A) charge pressure.
PSH-102	Pressure Switch	Pressure switch for HPU #2 Winch Pump (HP-102A) charge pressure.
PSH-104	Pressure Switch	Pressure switch for Closed Loop B-Port.
FL-103	Filter, Manifold Mount type	Filter with 3000psi design pressure, 10µ
MANF-101 Counterbalance Valve Block		
CV-1, -2, -3, & -4	Check Valves	To only allow flow one way in line
FCV-4 & FCV-5	Flow Control Valves	To control hydraulic oil flow rate
PRV-1 & PRV-2	Pressure Reducing Valves	To reduce pressure downstream in line
RV-1	Relief Valve	To relieve pressure at set value (max.)
MANF-102 Winch Control Block		
LFV-1, -2, -3, & -4	Loop Flushing Valves	Operates so that charge pressure in the low pressure side of the loop is maintained by the relief valve incorporated in the flushing valve.
RV-2, -3, -4, & -5	Relief Valves	To relieve pressure at set value (max.)
SHV-3 & SHV-4	Shuttle Valves	Allows two different sources to provide pressure without the threat of backflow from one source to the other.

4.2.2.4 HPU Low Voltage Enclosure (ENC103)

The location of features for the HPU Low Voltage Enclosure is provided in Figure 4-8 and a description of those features is provided in Table 4-8.

Figure 4-8 HPU Low Voltage Enclosure, Location of Features

Table 4-8 HPU Low Voltage Enclosure, Description of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
LC101	Load Controller	12VDC Supply, Reverse Acting
F110, F11, & F112	Fuse, Class 3AG, 5Amp	Protects from overloads or short circuits
PS101	Power Supply	Lambda DSP Series, 7A @ 5V
PS102	Power Supply	Lambda DSP Series, 4.5A @ 12V
PS103	Power Supply	Lambda DSP Series, 0.83A @ 12V
PS104	Power Supply	Lambda DSP Series, 4.2A @ 24V

4.2.2.5 HPU High Voltage Enclosure (ENC102)

The location of features for the HPU High Voltage Enclosure is provided in Figure 4-9 (2 Sheets) and a description of those features is provided in Table 4-9.

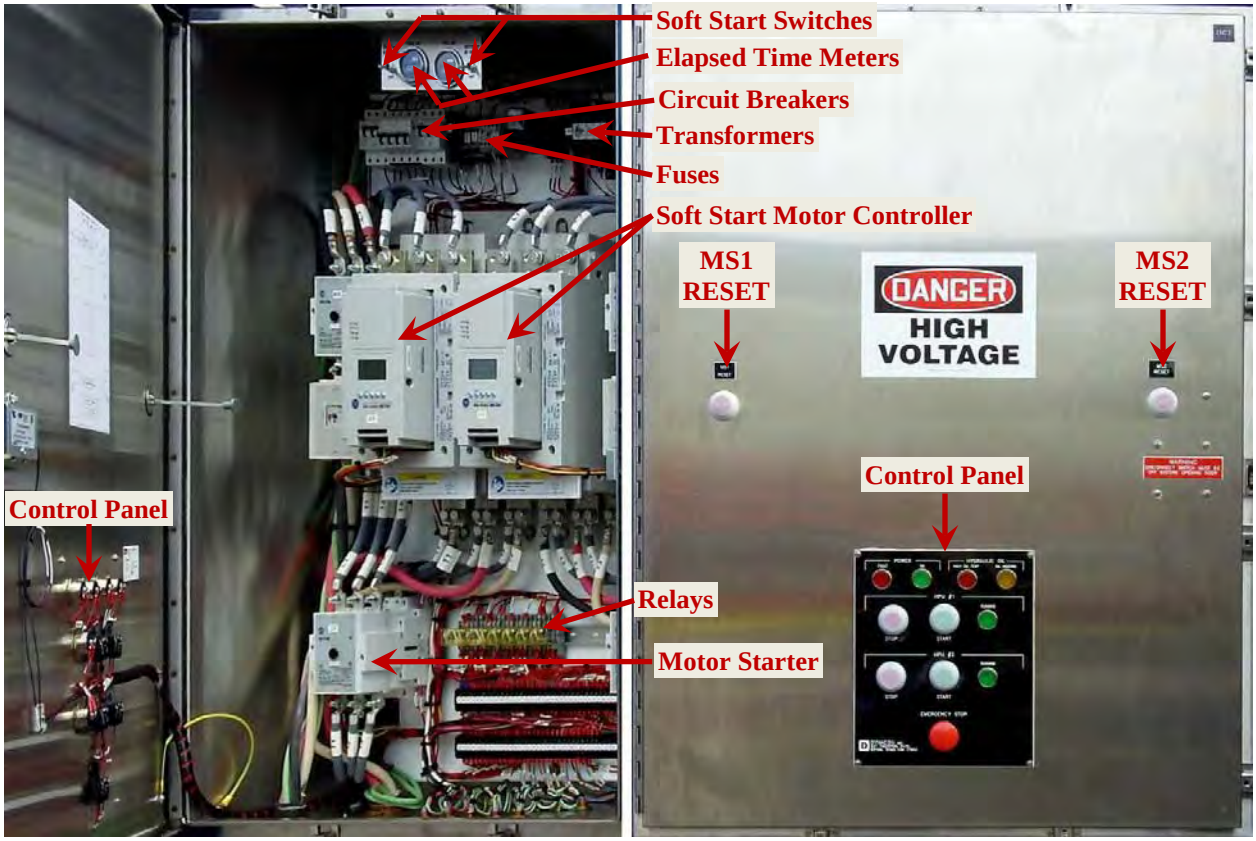


Figure 4-9 HPU High Voltage Enclosure, Location of Features

Table 4-9 HPU High Voltage Enclosure, Description of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
MS1 RESET	Push Button, Mechanical	The RESET push button is a mechanical extension which allows the operator to manually reset the HPU #1 motor starter (MS101) overload relay without opening the HPU Enclosure door.
MS2 RESET	Push Button, Mechanical	The RESET push button is a mechanical extension which allows the operator to manually reset the HPU #2 motor starter (MS102) overload relay without opening the HPU Enclosure door.

Table 4-9 HPU High Voltage Enclosure, Description of Features - *continued*

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
CONTROL PANEL (outside door)		
POWER FAULT	Lamp (Red)	**LT101** is momentarily illuminated when power is first applied but immediately extinguishes. The lamp remains illuminated when a power fault (such as, but not limited to, a phase reversal) is present. If a fault persists, the HPU motor shuts down automatically.
POWER OK	Lamp (Green)	**LT102** is illuminated when power status is complete and power is OK.
HYDRAULIC OIL HIGH OIL TEMP (alarm light)	Lamp (Red)	**LT106** is controlled by a thermostat and is illuminated to indicate a high hydraulic oil temperature alarm condition when hydraulic oil in the HPU supply tank is more than 150 °F.
HYDRAULIC OIL OIL HEATING (alarm light)	Lamp (Yellow)	**LT105** is controlled by a thermostat and is illuminated when the oil immersion heaters are energized. The lamp is extinguished when the HPU Assembly is powered up.
HPU #1 STOP	Push Button Switch, Normally closed contacts	**PB101**: HPU #1 motor stops running when the switch is depressed.
HPU #1 START	Push Button Switch, Normally open contacts	**PB102**: HPU #1 motor starts when the switch is depressed. HPU #1 motor does not start if joysticks are out of the neutral position.
HPU #1 RUNNING	Lamp (Green)	**LT103** is illuminated when HPU #1 motor is running.
HPU #2 STOP	Push Button Switch, Normally closed contacts	**PB103**: HPU #2 motor stops running when the switch is depressed.
HPU #2 START	Push Button Switch, Normally open contacts	**PB104**: HPU #2 motor starts when the switch is depressed. HPU #2 motor does not start if joysticks are out of the neutral position.
HPU #2 RUNNING	Lamp (Green)	**LT104** is illuminated when HPU #2 motor is running.
EMERGENCY STOP	Push Button Switch, 2-Position Maintained	**PB105**: Both HPU motors stop running when switch is depressed.

Table 4-9 HPU High Voltage Enclosure, Description of Features - *continued*

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
BYPASS ON OFF	Toggle Switches (SW101 & SW102)	These switches bypass the Soft Start for HPUs and allow direct across the line starting. The HPU RUNNING lamps will always be illuminated. This feature should be used only for emergency starts.
HM101 & HM102	Elapsed Time Meters	Elapsed time meters for HPU #1 & HPU #2
CB101	Circuit Breaker, 3-pole	Provides input control and circuit protection for the HPU line power phase monitor (PM101).
CB102	Circuit Breaker, 2-pole	Provides input control and circuit protection for Transformer (T101).
CB103	Circuit Breaker, 2-pole	Provides input control and circuit protection for Transformer (T102).
CB104	Circuit Breaker, 3-pole	Provides input control and circuit protection of the HPU Supply Tank heater (HTR-101).
T101 & T102	Transformers	Steps down voltage
F101 & F102	Fuses	Protects the Transformers from overloads or short circuits.
MS101	Magnetic Motor Starter with overload relay	MS101 is an inline contactor with an overload relay. If rated current is exceeded, the overload contacts open causing MS101 to drop out and EM101 motor will stop. Depressing the RESET push button allows the overload to reset.
MS102	Magnetic Motor Starter with overload relay	MS102 is an inline contactor with an overload relay. If rated current is exceeded, the overload contacts open causing MS102 to drop out and EM102 motor will stop. Depressing the RESET push button allows the overload to reset.

4.2.2.6 HPU Power Isolation Enclosure (ENC101)

The location of features for the HPU Power Isolation Enclosure (ENC101) is provided in Figure 4-10 and a description of those features is provided in Table 4-10.

Figure 4-10 HPU Power Isolation Enclosure, Location of Features

Table 4-10 HPU Power Isolation Enclosure, Description of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
IS101	Power Switch	Ship's Main 460 VAC, 3-phase, 60 Hz power is provided to the HPU when the switch is moved to the ON position for operation of either or both HPU #1, HPU #2, and all other HPU functions. Ship's Main Power is removed from the HPU when the switch is moved to the OFF position.

4.2.3 HC Assembly

The main controlling features for the HC Assembly can be found on the Gauge Panel, Hydraulic Panel, Gas Intensifier Panel, Gas Intensifier Enclosure, Low Voltage Enclosure, and the High Voltage Enclosure.

4.2.3.1 HC Assembly Gauge Panel

The location of features for the HC Assembly Gauge Panel is provided in Figure 4-11 and a description of those features is provided in Table 4-11.

Figure 4-11 HC Gauge Panel, Location of Features

Table 4-11 HC Gauge Panel, Description of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
BOOST ACCUMULATOR GAS PRESSURE	Pressure Gauge (0-5,000 psig)	**PG-20**: Indicates boost accumulator nitrogen gas pressure at HDR-16. Nominal 1,850/2,500 psig.
COOLING PUMP PRESSURE	Pressure Gauge (0-600 psig)	**PG-14**: Indicates cooling water pressure at HX-2. Nominal 20 psig.
TANK AIR PRESSURE	Pressure Gauge (0-60 psig)	**PG-21**: Indicates nitrogen gas pressure at HC hydraulic oil supply tank. 5 psig max.
STORAGE BOTTLES GAS PRESSURE	Pressure Gauge (0-5,000 psig)	**PG-12**: Indicates nitrogen storage bottle pressure at BV-29. Nominal pressure is between 1,000 and 2,300 psig
ACCUMULATOR GAS PRESSURE	Pressure Gauge (0-5,000 psig)	**PG-11**: Indicates accumulator 1 and accumulator-2 nitrogen gas pressure at HDR-11. 500 psig minimum.
MAIN CYLINDERS ROD END PRESSURE	Pressure Gauge (0-5,000 psig)	**PG-23**: Indicates main cylinder rod end hydraulic oil pressure at CYL-13. Nominal 1,000 psig.
OPEN LOOP SYSTEM PRESSURE	Pressure Gauge (0-5,000 psig)	**PG-13**: Open-loop hydraulic oil pressure at HDR-10. Nominal 2,000 psig.

4.2.3.2 HC Hydraulic Panel

The location of features for the HPU Hydraulic Panel is provided in Figure 4-12 and a description of those features is provided in Table 4-12. (Refer to Chapter 7 for a complete listing of all components found on this hydraulic panel.)

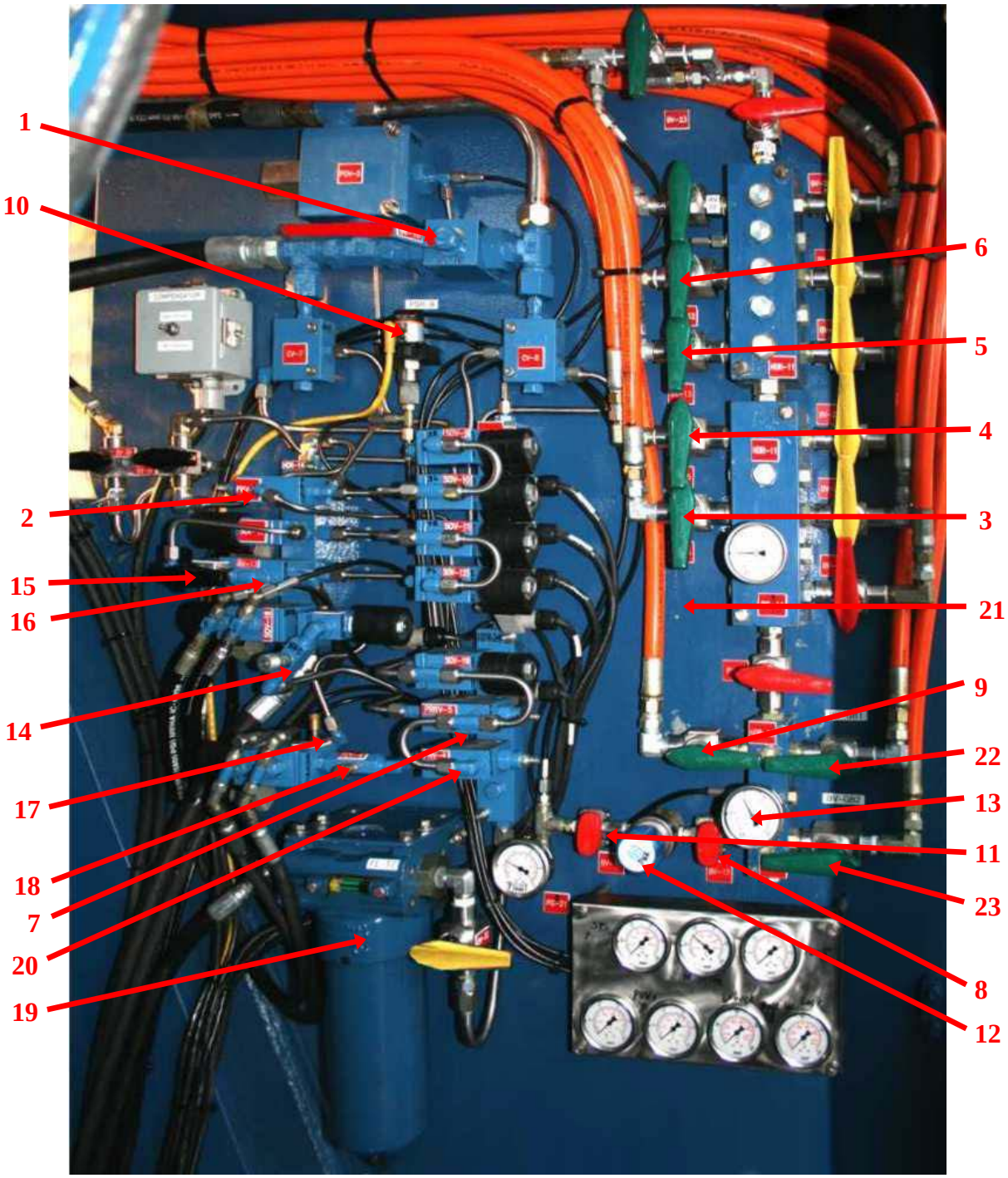


Figure 4-12 HC Hydraulic Panel, Location of Features

Table 4-12 HC Hydraulic Panel, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	BV-10	Ball Valve, Hydraulic	Normally closed. Manually cross-connects HDR-12 & HDR-13
2	PRV-5	Pressure Reducing Valve, Hydraulic	Protects POV-5 by reducing pressure to a safe level.
3	BV-16	Ball Valve, Nitrogen	Used to isolate high pressure nitrogen between receiver bottles and ACC-2.
4	BV-15	Ball Valve, Nitrogen	Used to isolate high pressure nitrogen between receiver bottles and ACC-2.
5	BV-13	Ball Valve, Nitrogen	Used to isolate high pressure nitrogen between receiver bottles and ACC-1.
6	BV-12	Ball Valve, Nitrogen	Used to isolate high pressure nitrogen between receiver bottles and ACC-1.
7	PRRV-5	Pressure Reducing/ Relieving Valve, Hydraulic	Reduces pressure to SOV-20 through NV-5 and relieves pressure back to the supply tank if NV-5 is closed.
8	BV-17	Ball Valve, Nitrogen	Normally closed. Isolates nitrogen to Reservoir & BV-17
9	BV-14	Ball Valve, Nitrogen	Normally closed. Isolates nitrogen to Boost Accumulator (ACC-3). Used in conjunction with BV-TF to allow pressurization of ACC-3.
10	PSH-9	Pressure Switch with 3 LEDs (Red)	Pressure switch for the hydraulic cylinder actuated BV-9 and BV-11 circuit. The sensor detects system pressure, displays it as 1% to 105%, and generates 2 output signals according to the set output configuration. A programmable electronic pressure monitor that features 2 switching outputs with a 7-segment LED display and 2 programming buttons.
11	BV-18	Ball Valve, Nitrogen	Normally closed. Isolates nitrogen to Reservoir & BV-17
12	PR-1	Pressure Regulator	Operating this valve allows the operator to regulate the Reservoir air (nitrogen) pressure to 5 psig maximum.

Table 4-12 HC Hydraulic Panel, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
13	PG-21	Pressure Gauge	Reads the nitrogen pressure on the supply tank.
14	NV-5	Needle Valve	Controls the amount of hydraulic oil going to SOV-20.
15	BV-19	Ball Valve, Hydraulic	Used to isolate hydraulic oil discharge from HP-3 to SOV-17.
16	RV-13	Relief Valve	Allows HP-3 oil discharge back to supply tank if BV-19 is closed during pump operation.
17	FCV-5	Flow Control Valve	Controls the flow of hydraulic oil through SOV-7.
18	FCV-6	Flow Control Valve	Controls the flow of hydraulic oil through SOV-7.
19	FL-17	Filter, Head/Bowl and indicator	Constantly filters a percentage of the HC Assembly hydraulic oil to 5 micron particles, absolute. As the filter element becomes dirty, the difference in pressure causes the indicator to move from the green area to the red area, indicating filter element replacement is required.
20	PRV-4	Pressure Reducing Valve, Hydraulic	Protects SOV-7 by reducing pressure to a safe level.
21	BV-20	Ball Valve, Nitrogen	Used to add nitrogen to system from 3 spare GB, HC port deck level
22	BV-GB1	Ball Valve, Nitrogen	Isolates nitrogen from GB1
23	BV-GB2	Ball Valve, Nitrogen	Isolates nitrogen from GB2

4.2.3.3 HC Assembly Gas Intensifier Panel

The location of features for the HC Assembly Gas Intensifier Panel is provided in Figure 4-13 and a description of those features is provided in Table 4-13. (Refer to Chapter 7 for a complete listing of all components found on this nitrogen panel.)

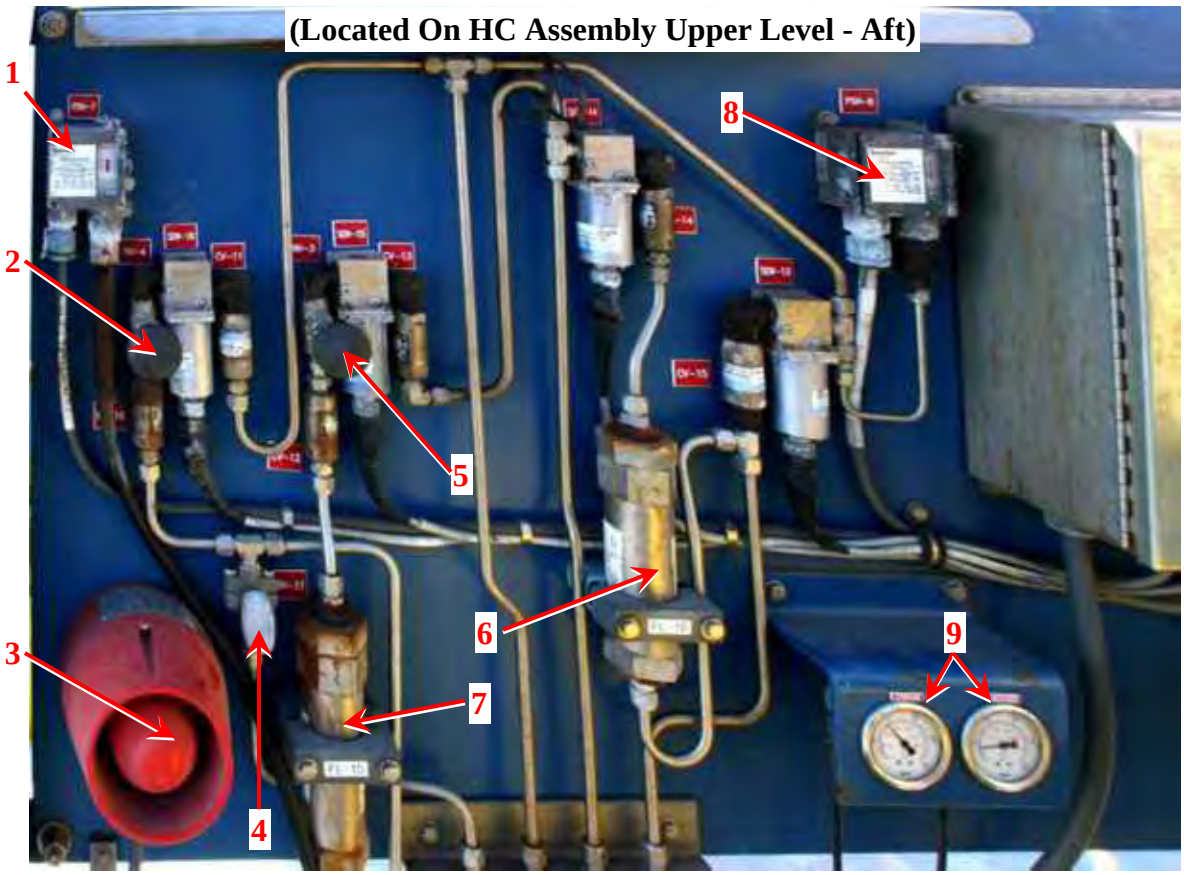


Figure 4-13 HC Gas Intensifier Panel, Location of Features

Table 4-13 HC Gas Intensifier Panel, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	PSH-7	Pressure Switch	Prevents compressor/intensifier from running when the nitrogen pressure drops too low.
2	NV-4	Needle Valve	Adjusts volume of nitrogen going to SOV-16.
3	N/A	Audible Alarm 107 ± 3 db	Alarm sounds when there is a Computer Control System fault.
4	BV-21	Ball Valve	Normally open. Used to isolate high pressure nitrogen from HDR-21 to Gas Intensifier Panel.
5	NV-3	Needle Valve	Adjusts volume of nitrogen going to SOV-15.
6	FL-16	Filter Cartridge	Prevents foreign debris from entering the intensifier.
7	FL-15	Filter Cartridge	Prevents foreign debris from entering intensifier.
8	PSH-8	Pressure Switch	Prevents compressor/intensifier from running when the nitrogen pressure rises too high.
9	PG-15 & PG-16	Pressure Gauges	Indicates nitrogen gas pressures

4.2.3.4 HC Assembly Gas Intensifier Enclosure (ENC7)

The HC Assembly Gas Intensifier Enclosure 7 is identified in Figure 2-6. The location of features for the Enclosure 7 is provided in Figure 4-14 and a description of those features is provided in Table 4-14.

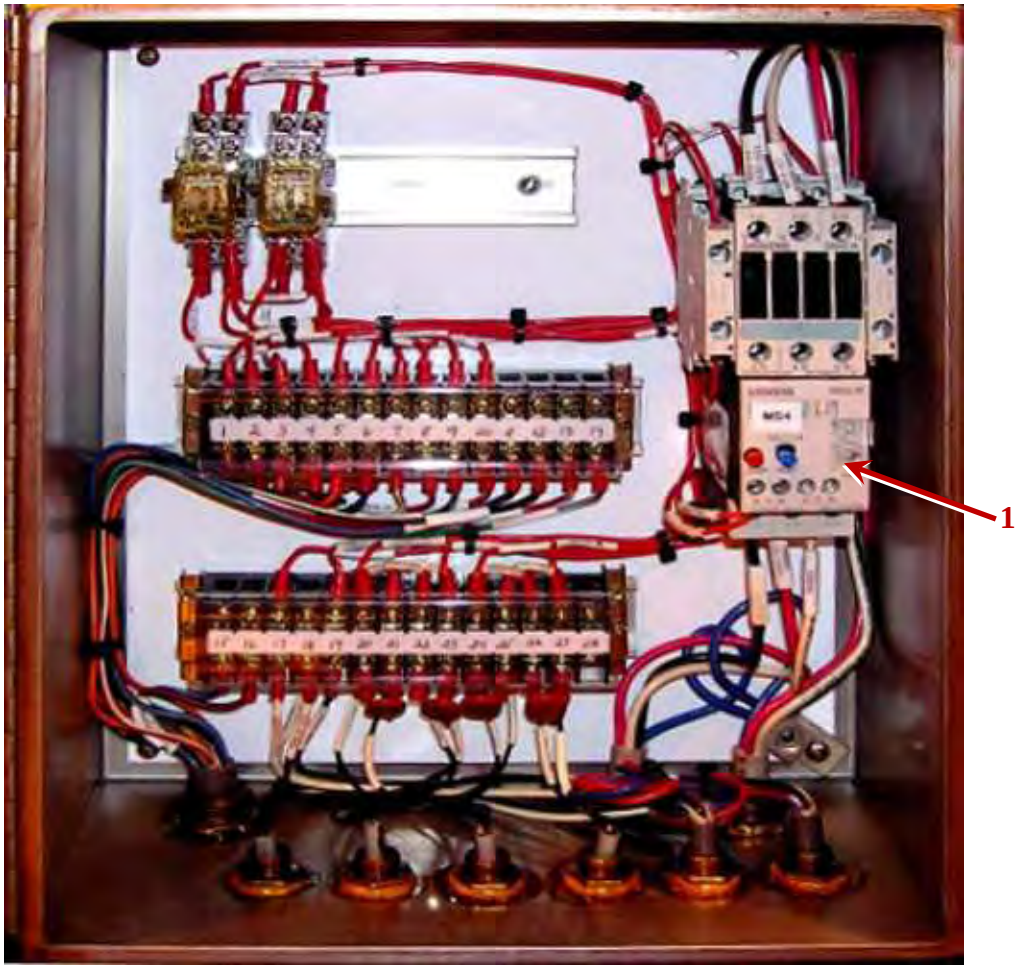


Figure 4-14 HC Gas Intensifier Enclosure, Location of Features

Table 4-14 HC Gas Intensifier Enclosure, Location of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	MS4	Magnetic Motor Starter with overload relay	**MS4** is an inline contactor with an overload relay. If rated current is exceeded, the overload contacts open causing MS4 to drop out and the HC compressor/intensifier motor (EM4) will stop. Depressing the RESET push button (Item 1) allows the overload to reset.

4.2.3.5 HC High Voltage Enclosure (ENC8)

The location of features for the HC High Voltage Enclosure (ENC8) is provided in Figure 4-15 (2 Sheets) and a description of those features is provided in Table 4-15.

Figure 4-15 HC High Voltage Enclosure, Location of Features (Sheet 1 of 2)

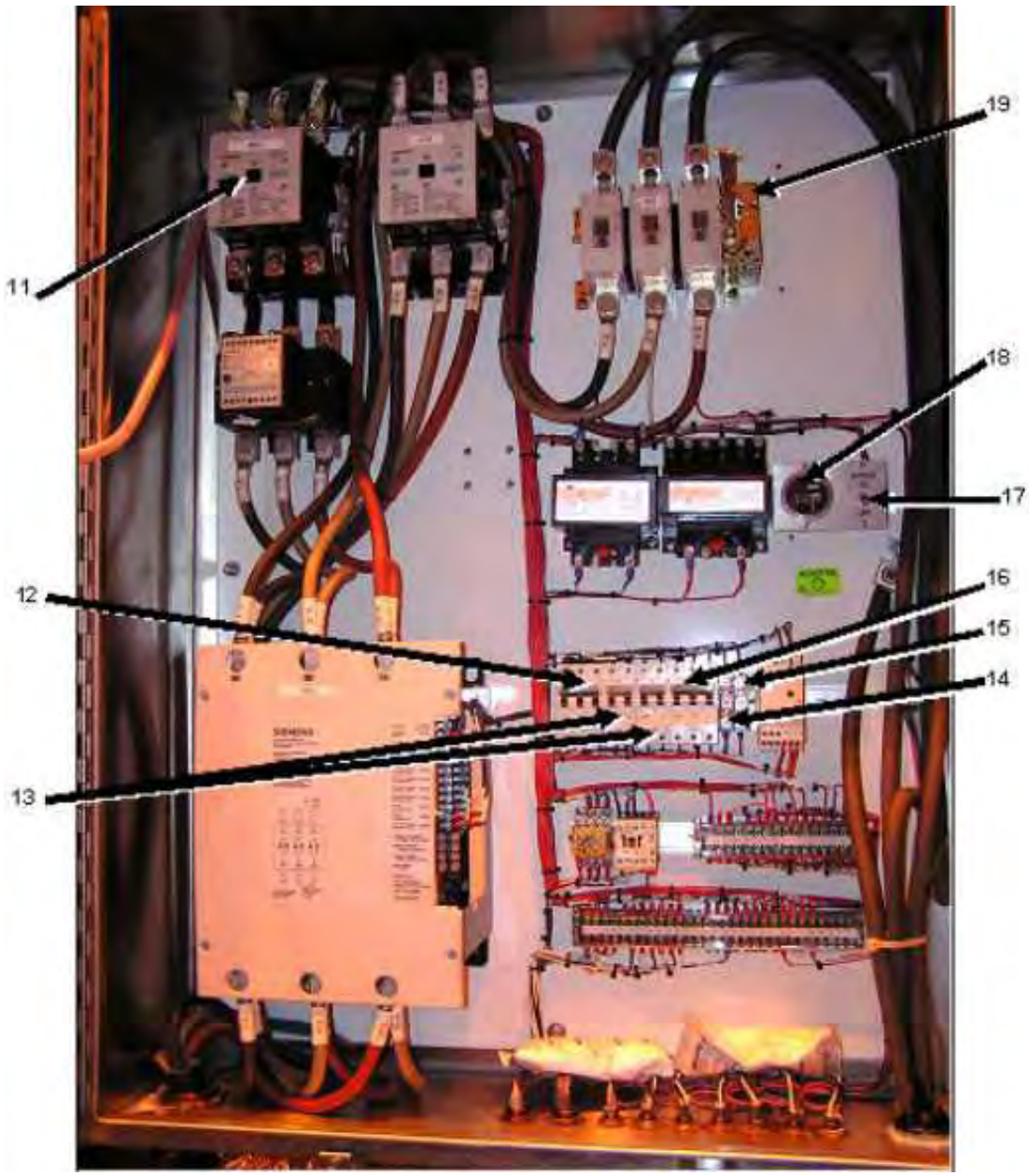


Figure 4-15 HC High Voltage Enclosure, Location of Features (Sheet 2 of 2)

Table 4-15 HC High Voltage Enclosure, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	RESET	Push Button, Mechanical	The RESET push button is a mechanical extension which allows the operator to manually reset the HC HPU motor starter (MS3) overload relay without opening the HC High Voltage Enclosure (ENC8) door.
2	HPU STOP	Push Button Switch, Normally open contacts	**PB10**: HC HPU motor stops running when the switch is depressed.

Table 4-15 HC High Voltage Enclosure, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
3	HPU START	Push Button Switch, Normally closed contacts	**PB11**: HC HPU motor starts running when the switch is depressed.
4	COMPENSATOR RAISE LOWER	Toggle Switch	**SW10**: The gas compressor/intensifier operates to raise the HC flying head by increasing the nitrogen pressure in the HC accumulators (ACC-1 and ACC-2) when the toggle switch is moved/held in the RAISE position. The gas compressor/intensifier stops running when the toggle switch is released. The gas compressor/intensifier operates to lower the HC flying head by decreasing the nitrogen pressure in the HC accumulators (ACC-1 and ACC-2) when the toggle switch is moved/held in the LOWER position. The gas compressor/intensifier stops running when the toggle switch is released.
5	HPU RUNNING	Lamp (Green)	**LT33** is illuminated when HC motor is running.
6	ON OFF	Isolator Switch with Handle	**IS2**: Ship's Main 460 VAC, 3-phase, 60 Hz power is provided to the HC Assembly (including Compressor/Intensifier motor) for operation when the HC Assembly ON/OFF switch is moved to the ON position. Ship's Main Power is removed from HC Assembly (including Compressor/Intensifier motor) when the HC Assembly ON/OFF switch is moved to the OFF position.
7	ALARMS HIGH OIL TEMPERATURE	Lamp (Red)	**LT32** is controlled by a thermostat and is illuminated to indicate a high hydraulic oil temperature alarm condition when hydraulic oil in the HC supply tank is more than 150 °F.
8	ALARMS LOW OIL LEVEL	Lamp (Red)	**LT31** is illuminated to indicate a low hydraulic oil level alarm condition when the hydraulic oil in the HC supply tank is below minimum level. The HC HPU motor will not start when this lamp is illuminated.
9	POWER OK	Lamp (Green)	**LT30** is illuminated when power status is complete and power is OK.

Table 4-15 HC High Voltage Enclosure, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
10	POWER FAULT	Lamp (Red)	**LT29** is momentarily illuminated when power is first applied but immediately extinguishes. The lamp remains illuminated when a power fault (such as, but not limited to, a phase reversal) is present. If a fault persists, the HC HPU motor shuts down automatically.
11	MS3	Magnetic Motor Starter with overload relay	**MS3** is an inline contactor with an overload relay. If rated current is exceeded, the overload contacts open causing MS3 to drop out and HC HPU motor (EM3) will stop. Depressing the RESET push button (Item 1) allows the overload to reset.
12	CB6	Circuit Breaker, 3-pole	**CB6**: Provides input control and circuit protection for the HC line power phase monitor (PM2).
13	CB7	Circuit Breaker, 2-pole	**CB7**: Provides input control and circuit protection for Transformer (T4).
	CB8	Circuit Breaker, 2-pole	**CB8**: Provides input control and circuit protection for Transformer (T3).
14	F6	Fuse, Cartridge, Glass Body	Protects Transformer (T3) from excessive current and short circuits.
15	F7	Fuse, Cartridge, Glass Body	Protects Transformer (T4) from excessive current and short circuits.
16	CB9	Circuit Breaker, 3-pole	**CB9**: Provides input control and circuit protection of the HC Supply Tank heater (HTR-3).
17	BYPASS ON OFF	Toggle Switch	**SW11**: This switch will bypass the Soft Start for HC and allow direct across the line starting. The HC RUNNING lamp will always be illuminated. This feature should be used only for emergency starts.
18	N/A	Elapsed Time Meter	**HM3** is an elapsed time meter that indicates HC operating hours up to 9999.9 hours.
19	OFF ON	Isolator Switch with Handle	**IS2**: Ship's Main 460 VAC, 3-phase, 60 Hz power is provided to the HC Assembly when the switch is moved to the ON position for operation of the HC HPU motor and all other HC Assembly auxiliary functions. Ship's Main Power is removed from the HC Assembly when the switch is moved to the OFF position.

4.2.3.6 HC Low Voltage Enclosure (ENC9)

The location of features for the HC Low Voltage Enclosure (ENC9) is provided in Figure 4-16 and a description of those features is provided in Table 4-16.

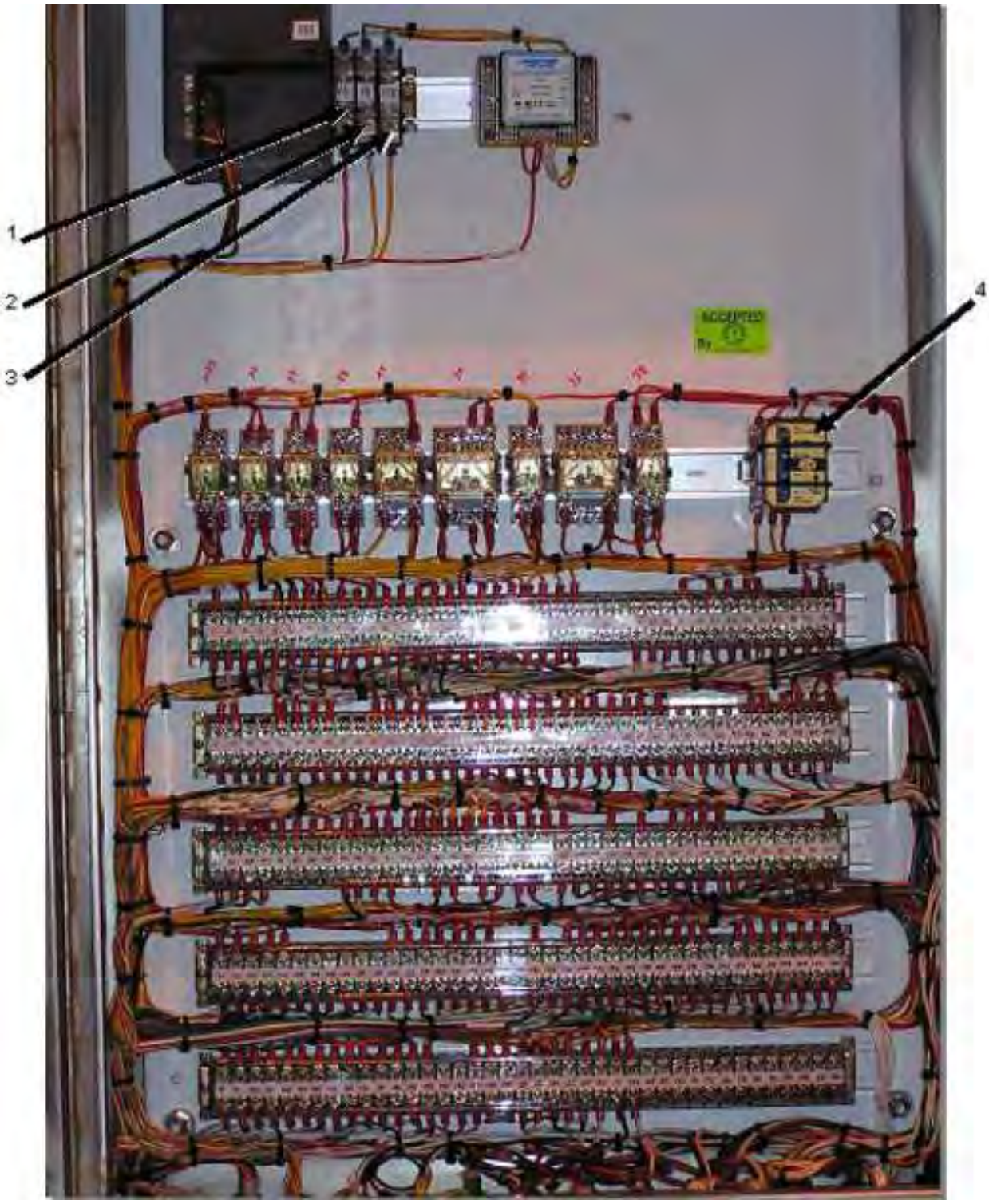


Figure 4-16 HC Low Voltage Enclosure, Location of Features

Table 4-16 HC Low Voltage Enclosure, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	F5	Fuse, Cartridge, Glass Body	Protects PS4 +24 VDC power supply from excessive current and short circuits.
2	F9	Fuse, Cartridge, Glass Body	Protects PS4 +15 VDC power supply from excessive current and short circuits.
3	F10	Fuse, Cartridge, Glass Body	Protects PS4 -15 VDC power supply from excessive current and short circuits.
4	SC2	Signal Conditioner, Field Selectable	**SC2** is a field selectable DC-to-DC isolator transmitter with an output that is linearly related to the input. It provides ground loop elimination, common signal rejection, and noise pickup reduction between the HC Accelerometer (AC1) and the A/D CCA mounted in the Signal Interface Enclosure (ENC10).
	Input Loop Tracker	LED (Green – with variable brightness)	This LED illuminates to provide a visual indication that a signal is being sensed and varies in intensity to indicate the input signal strength.
	Test Switch	Push Button Switch	When depressed/held, in conjunction with the Test Range pot, it allows any output value between the preset minimum and maximum values to be selected for system diagnostic aid during initial start-up or during troubleshooting procedures. When the push button is released, the output will return to normal.
	Test Range	Potentiometer, Multiturn	Used in conjunction with the Test Range push button to select any value between the preset minimum and maximum output values.
	Span	Potentiometer, Multiturn	The Span control is used during calibration to adjust SC2 for the exact maximum range required.
	Zero	Potentiometer, Multiturn	The Zero control is used during calibration to adjust SC2 for the exact minimum range required.
	Output Loop Tracker	LED (Red – with variable brightness)	This LED illuminates to provide a visual indication that the output signal is functioning and varies in intensity to indicate the signal strength.
	Input Select I ← → V	Slide Switch	Allows current or voltage to be selected depending on input type. For FTHE application, move the slide switch to “V” (voltage).

Table 4-16 HC Low Voltage Enclosure, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
	Output Select I ← → V	Slide Switch	Allows current or voltage to be selected depending on output type. For FTHE application, move the slide switch to "I" (current).
	A	Rotary Switch	The three switches are set according to the values for SC2 listed on DD 0707-9001-07 (A=6, B=5, and C=1).
	B	Rotary Switch	
	C	Rotary Switch	

4.2.4 A-Frame Assembly

The A-Frame legs and docking head cross-member weldment support the Docking Head Sheave Assembly, Lift Winch Assemblies, Catch and Latch Assembly, Docking Head Cushion Assembly, and the Cursor Assembly. The DCV Station is mounted outboard on the starboard A-Frame base weldment. The compilation of these units comprises the A-Frame Assembly. The location and description of their features are provided in Figure 4-17 (5 Sheets) and Table 4-17.

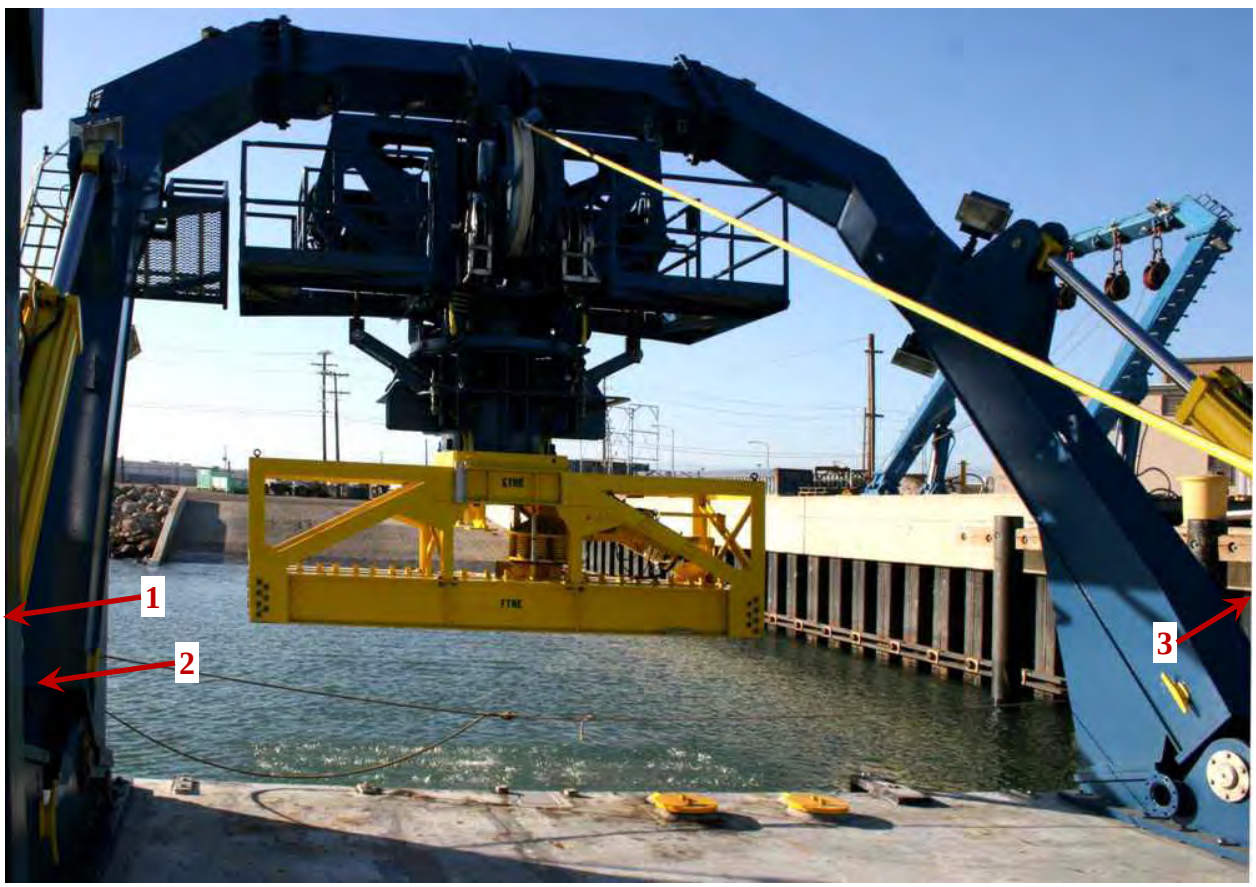


Figure 4-17 A-Frame, Location of Features (Sheet 1 of 5)

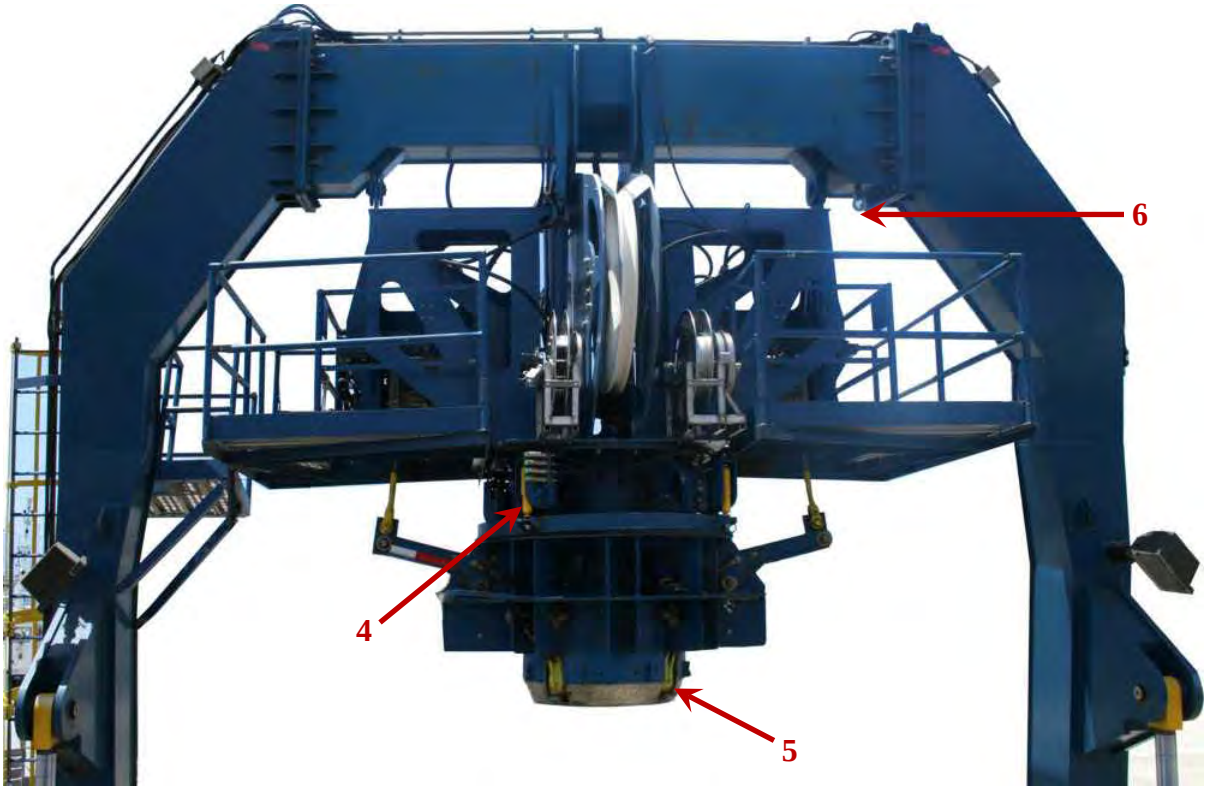


Figure 4-17 A-Frame, Location of Features (Sheet 2 of 5)

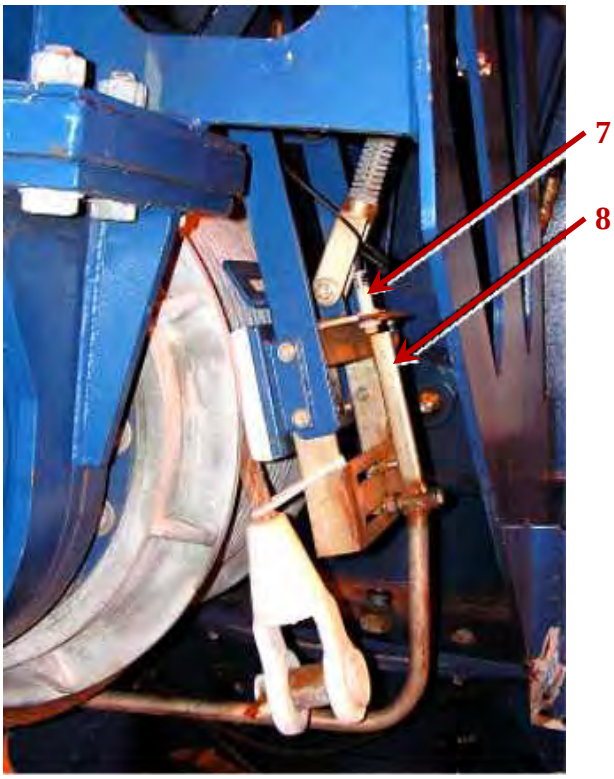


Figure 4-17 A-Frame, Location of Features (Sheet 3 of 5)

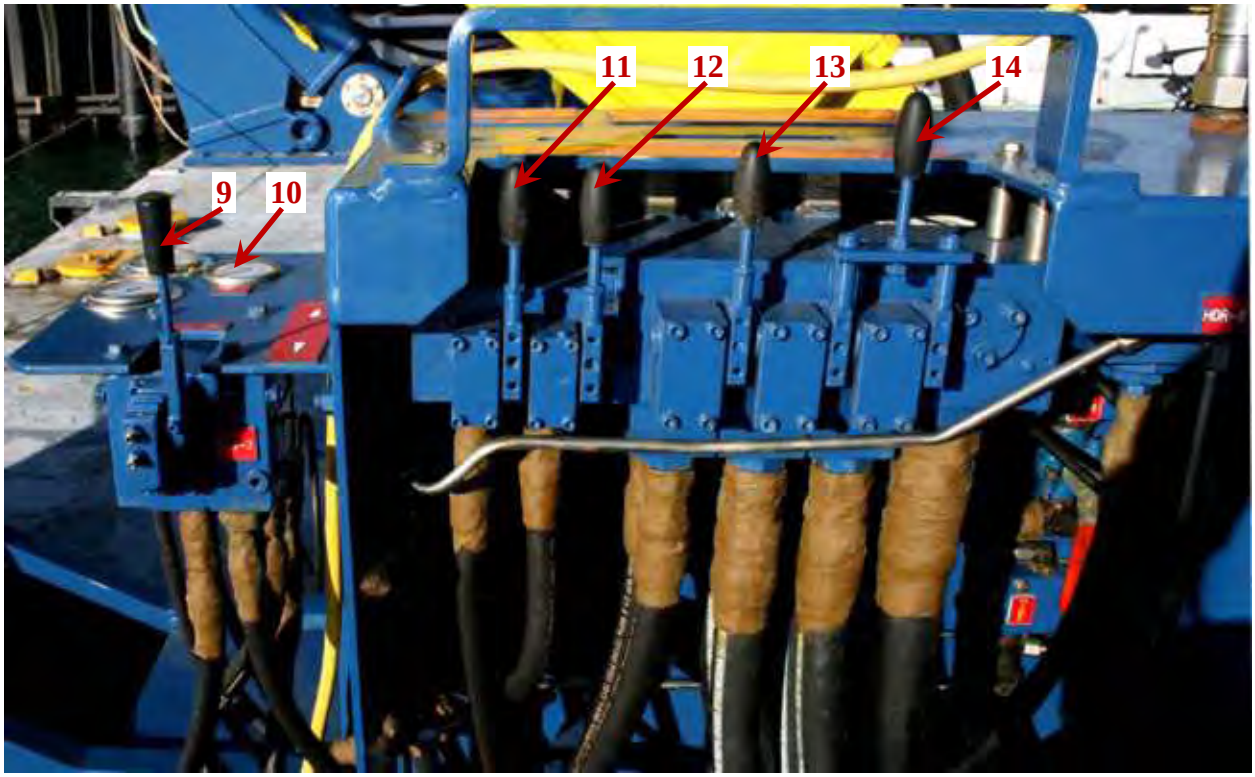


Figure 4-17 A-Frame, Location of Features (Sheet 4 of 5)

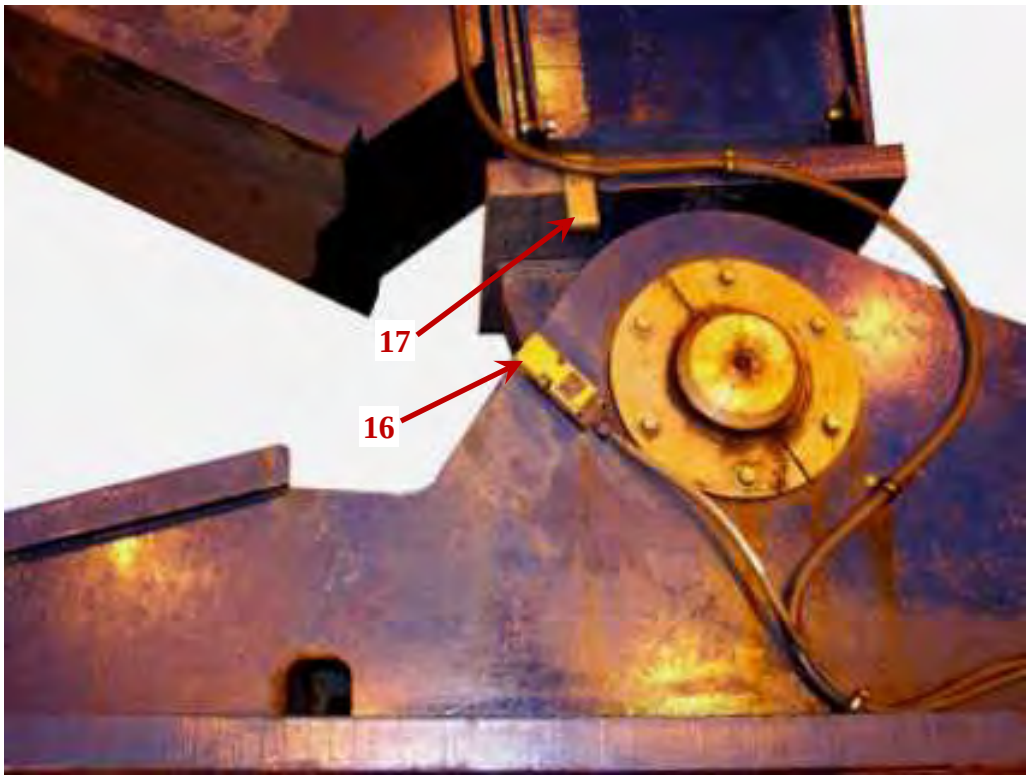


Figure 4-17 A-Frame, Location of Features (Sheet 5 of 5)

Table 4-17 A-Frame, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	BV-6	Ball Valve (not shown)	Ball valve used to isolate hydraulic oil between A-Frame cylinder and hydraulic header.
2	N/A	Hydraulic Control Panel/Station	Manual DCV Station **CAUTION** POSSIBLE EQUIPMENT DAMAGE Using this Manual DCV Station defeats the cursor lift winch depth limit. When paying out cable, leave 5 wraps of cable on the cursor lift winch. **NOTE** All A-Frame Assembly operations can be performed from this manual station; the Cursor Latch operation can ONLY be done from this manual station. Operating the Manual DCV Station takes precedence over Pedestal or Control Van Panel operations.
3	BV-7	Ball Valve (not shown)	Ball valve used to isolate hydraulic oil between A-Frame cylinder and hydraulic header.
4	N/A	Latch Indicator, Cable	**Docking Head Catch and Latch Assembly Latch Weldment Indicators**: The four cable ends (approximately 1 inch colored green) when protruding from their housings signifies the four latch weldments are open. When the four cable ends are flush with their housings, it signifies the latch weldments are locked in place.
5	N/A	Mechanical Latch, Spring Loaded, Hydraulically Operated	**Cursor Latches**: The four cursor latches are spring loaded and automatically lock into place when the cursor head is lowered onto the vehicle lifting ring. The four cursor latches are hydraulically operated open to allow the cursor head to detach from the vehicle.
6	N/A	Chain Hoist, Electrically Operated	**Auxiliary Winch**: The winch is used to raise/lower the ROV when maintenance is required.
7	N/A	Proximity Sensor	**Cursor Winch Payout Limit Sensor (XS11)**: This sensor causes the cursor winch to stop when a predetermined length of cable has been paid out thus preventing a chance for the cable to become detached and causing the loss of the vehicle/package.

Table 4-17 A-Frame, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
8	N/A	Target, Metal	**Target**: When the metal rod comes within target range, it triggers the sensor circuit and causes the cursor winch motors to stop preventing the cable from running off the drum.
9	CURSOR LATCH CONTROL STATION UNLATCH LATCH	Directional Control Valve, Proportional	**DCV-2**: Controls operation of the spring loaded cursor latches (via CYL-17, CYL-18, CYL-19, and CYL-20). Moving the control handle to the UNLATCH position unlocks the four latches. Moving the control handle to the LATCH position locks the four latches (if the latches have not snapped into position on their own.)
10	PG-22	Pressure Gauge	Indicates cursor latch pressure.
11	LATCH OPEN CLOSE	Directional Control Valve, Proportional, 5-Section Combination	**DCV-1 (Section 5)**: Controls operation of the docking head Catch and Latch Assembly (via CYL-7, CYL-8, CYL-9, and CYL-10). Moving the control handle to the OPEN position unlocks the four latch weldments that retain the cursor assembly in the Docking Head Sheave Assembly. Moving the control handle to the CLOSE position shifts the four weldments to lock the cursor assembly in the Docking Head Sheave Assembly.
12	SWING OUTBOARD INBOARD		**DCV-1 (Section 4)**: Controls operation of the Docking Head Sheave Assembly (swing frame) (via CYL-3, CYL-4, CYL-5, and CYL-6). Moving the control handle to the OUTBOARD position moves the Docking Head Sheave Assembly outward. Moving the control handle to the INBOARD position moves the Docking Head Sheave Assembly inward.
13	LUFF LUFF OUT LUFF IN		**DCV-1 (Section 3)**: Controls operation of the A-Frame Assembly (via CYL-11 and CYL-12). Moving the control handle to the LUFF OUT position moves the A-Frame Assembly outward. Moving the control handle to the LUFF IN position moves the A-Frame Assembly inward.
14	CURSOR PAY OUT HAUL IN		**DCV-1 (Sections 1 and 2)**: Controls operation of the cursor winch motors (HM-4 and HM-5). Moving the control handle to the PAYOUT position causes the cursor winch motors to lower the cursor assembly. Moving the control handle to the HAUL IN position causes the cursor winch motors to raise the cursor assembly.

Table 4-17 A-Frame, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
15	FL-11	Filter, Head/Bowl with indicator	Filter with indicator for all the A-Frame Assembly hydraulic oil system components. As the filter element becomes dirty, the difference in pressure causes the indicator to move from the green area to the red area, indicating filter element replacement is required.
16	N/A	Proximity Sensor	**A-Frame Outboard Sensor (XS6)**: This sensor causes the Pedestal A-Frame Outboard lamp to illuminate when the A-Frame is luffed outboard and is stationary on the A-Frame base weldment hard stops.
17	N/A	Target, Metal	**Target**: When the metal rod comes within target range, it triggers the A-Frame Outboard Sensor.

4.2.5 Pedestal Control Panel Enclosure

The location of features for the Pedestal Control Panel Enclosure (ENC104) is provided in Figure 4-18 and a description of those features is provided in Table 4-18.

There are two precautionary statements engraved on the face of the Pedestal Control Panel Enclosure (ENC104) that are particularly important to the FTHE Operator.

CAUTION

Under no circumstances shall the spring center function of a control/joystick be defeated or mechanically held, tied, or restrained in the off-center position.

CAUTION

Prior to engaging active mode, place winch in high tension.

The first is to caution the FTHE Operator that it is essential to maintain absolute control of the FTHE system at all times and the second ensures that computer control of the Umbilical Winch Assembly is be better maintained when high tension/low speed is selected.

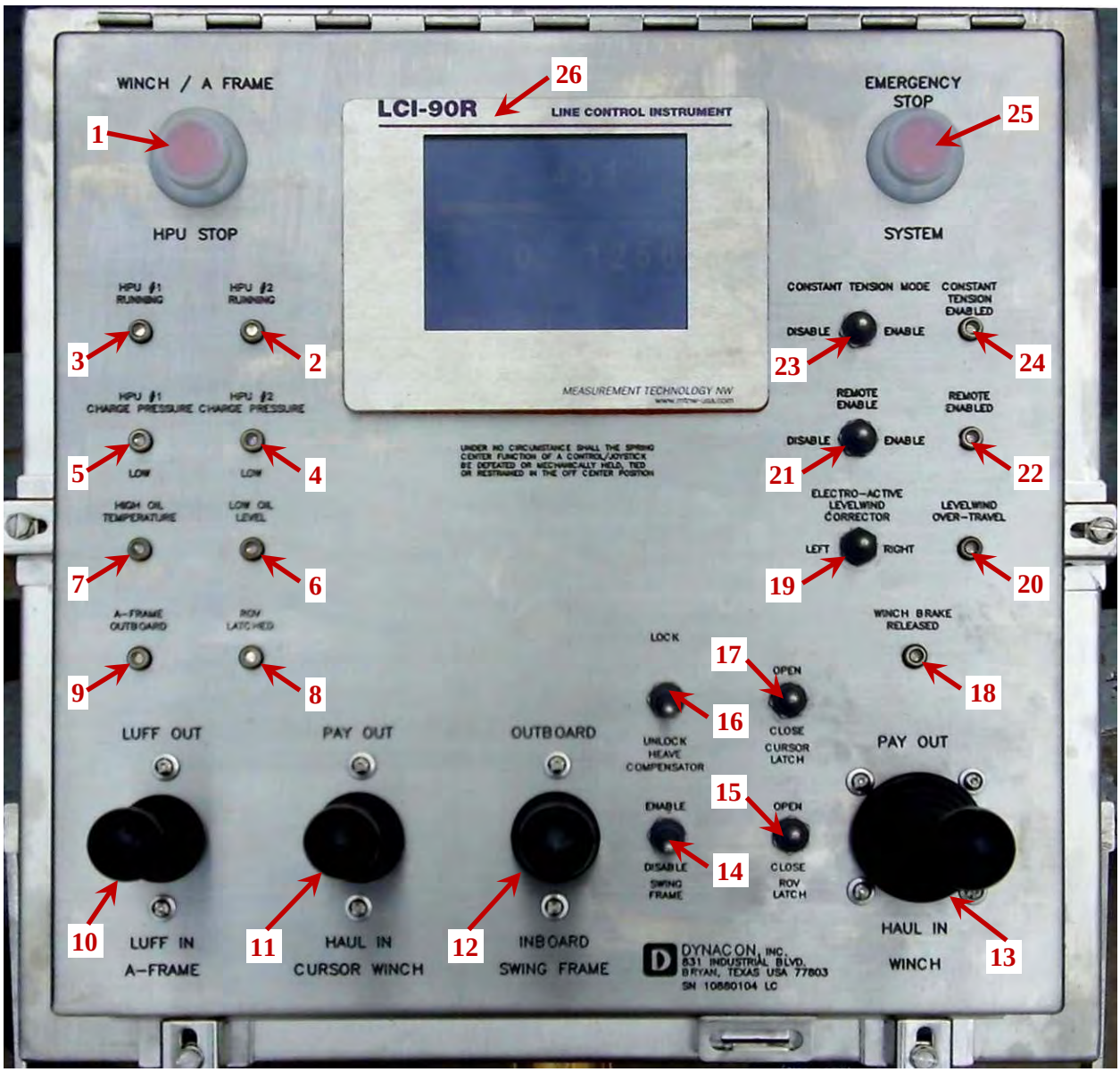


Figure 4-18 Pedestal Enclosure, Location of Features

Table 4-18 Pedestal Enclosure, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	WINCH / A-FRAME HPU STOP	Push Button Switch, Normally closed contacts	**PB106**: Both HPU motors shut down when push button is depressed.
2	HPU #2 RUNNING	Lamp (Green)	**LT108** is illuminated to indicate HPU #2 is operating.
3	HPU #1 RUNNING	Lamp (Green)	**LT107** is illuminated to indicate HPU #1 is operating.

Table 4-18 Pedestal Enclosure, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
4	HPU #2 CHARGE PRESSURE LOW	Lamp (Red)	**LT114** is illuminated to indicate a low pressure alarm condition when the HPU #2 Charge Pressure is less than 310 psi.
5	HPU #1 CHARGE PRESSURE LOW	Lamp (Red)	**LT113** is illuminated to indicate a low pressure alarm condition when the HPU #1 Charge Pressure is less than 310 psi.
6	LOW OIL LEVEL	Lamp (Red)	**LT115** is illuminated to indicate a low hydraulic oil level alarm condition when the hydraulic oil in the HPU supply tank is below minimum level. The HPU #1 and HPU #2 motors will not start when this lamp is illuminated.
7	HIGH OIL TEMPERATURE	Lamp (Red)	**LT112** is illuminated to indicate a high hydraulic oil temperature alarm condition when hydraulic oil in the HPU supply tank is more than 150 °F.
8	ROV LATCHED	Lamp (Green)	**LT117** is illuminated to indicate the ROV Latches are fully engaged.
9	A-FRAME OUTBOARD	Lamp (Amber)	**LT116** is illuminated to indicate A-Frame is luffed outboard and is stationary on the hard stops.
10	A-FRAME LUFF OUT LUFF IN	Proportional Control Handle	**CH102**: The A-Frame luffs in when the joystick is stroked to the LUFF IN position and luffs out when stroked to the LUFF OUT position.
11	CURSOR WINCH PAY OUT HAUL IN	Proportional Control Handle	**CH103**: The cursor winch pays out cable when the joystick is moved to the PAY OUT position and hauls in cable when moved to the HAUL IN position.
12	SWING FRAME OUTBOARD INBOARD	Proportional Control Handle	**CH104**: Swing frame moves outboard when joystick is moved to OUTBOARD position and moves inboard when moved to the INBOARD position.
13	WINCH PAY OUT HAUL IN	Proportional Control Handle	**CH101**: The winch pays out cable when the joystick is moved to the PAY OUT position and hauls in cable when moved to the HAUL IN position.
14	SWING FRAME ENABLE DISABLE	Toggle Switch	**SW107**: When the toggle switch is moved to the ENABLE position, the operator has control of the movement of the swing frame using the SWING FRAME joystick. When toggle switch is moved to the DISABLE position, the swing frame is free to move.

Table 4-18 Pedestal Enclosure, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
15	ROV LATCH OPEN CLOSE	Toggle Switch	**SW109**: The ROV latches are opened when the toggle switch is moved to the OPEN position and closed when moved to the CLOSE position.
16	HEAVE COMP LOCK UNLOCK	Toggle Switch	**SW108**: When the toggle switch is moved to the UNLOCK position, HC cylinders (CYL-15 and CYL-16) open ball valves (BV-9 and BV-11) between the primary HC cylinders (CYL-13 and CYL-14) and the primary HC accumulators (ACC-1 and ACC-2) allowing the HC flying head to move (unlocking). When the toggle switch is moved to the LOCK position, HC cylinders (CYL-15 and CYL-16) close ball valves (BV-9 and BV-11) between the primary HC cylinders (CYL-13 and CYL-14) and the primary HC accumulators (ACC-1 and ACC-2) preventing the HC flying head from moving (locking).
17	CURSOR LATCH OPEN CLOSE	Toggle Switch	**SW103**: The docking head CURSOR latches are opened when toggle switch is moved to the OPEN position and closed when moved to the CLOSE position.
18	WINCH BRAKE RELEASED	Lamp (Amber)	**LT109** is illuminated to indicate the winch brake is released when the winch pay out/haul in joystick is moved from the center position or the Umbilical Winch Assembly is in Constant Tension.
19	ELECTRO-ACTIVE LEVELWIND CORRECTOR LEFT RIGHT	Toggle Switch	**SW105**: The Levelwind Carriage Assembly moves to the left when LEFT is depressed/held and stops when LEFT is released or to the right when RIGHT is depressed/held and stops when RIGHT is released.
20	LEVELWIND OVERTRAVEL	Lamp (Red)	**LT118** is illuminated to indicate the Levelwind has over-traveled boundary.

Table 4-18 Pedestal Enclosure, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
21	REMOTE ENABLE DISABLE ENABLE	Toggle Switch	**SW106**: Control of the winch is at the Pedestal (using the WINCH joystick [Item 13]) when the toggle switch is moved to the DISABLE position. Control of the winch is passed to the Control Van remote joystick when the toggle switch is moved to the ENABLE position. If the Pedestal WINCH joystick is moved out of the center position, control reverts to the Pedestal. If the Pedestal WINCH joystick is out of the center position to begin with, REMOTE ENABLE is impossible.
22	REMOTE ENABLED	Lamp (Amber)	**LT110** is illuminated to indicate the Control Van computer has control (enabled) of the winch.
23	CONSTANT TENSION MODE DISABLE ENABLE	Toggle Switch	**SW104**: The Umbilical Winch System is in manual mode and movement of the umbilical cable is controlled by the Pedestal WINCH joystick when the toggle switch is moved to the DISABLE position. The Umbilical Winch System is in the automatic mode and movement of the umbilical cable is controlled by the HC Assembly when the toggle switch is moved to the ENABLE position.
24	CONSTANT TENSION ENABLED	Lamp (Amber)	**LT111** is illuminated to indicate the umbilical winch constant tension mode is enabled.
25	EMERGENCY STOP SYSTEM	Push Button Switch 2-Position	**PB107**: All HPU motors (2 HPU and 1 HC) shut down when push button is depressed.
26	LCI-90 LINE CONTROL INSTRUMENT	Line Data Display (LCI-90R: Slave)	**DSP101**: The Pedestal display receives its input from the Control Van Panel display (master) and indicates umbilical line count, speed, and tension. Line Count: The line count increases in value as the umbilical cable is paid out and decreases in value as the cable is hauled in. Line Speed: The line speed numbers are positive when the umbilical cable is paid out and negative when the umbilical cable is hauled in. Line Tension: The tension of the umbilical cable at the docking head sheave assembly is measured and provided by a load pin at the axle of the docking head sheave.

4.2.6 Control Van

The Control Van is a typical lab environment-type SCIF which houses the various consoles used for control of the overall DWT operations. FTHE has responsibility for one Electronics Cabinet within this space.

4.2.6.1 Electronics Cabinet

The Electronics Cabinet (Figure 4-19) houses the monitor, Control Van Panel, Computer, Keyboard Tray, Signal Interface Enclosure, VME Enclosure with I/O adapter, and an Uninterruptible Power Supply (UPS). The location and description of their features are provided in the following figures and associated tables.

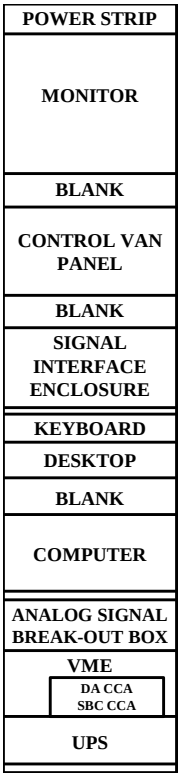


Figure 4-19 Control Van Electronics Cabinet

4.2.6.2 Monitor and GUI Interface

The monitor provides the FTHE Operator a means to have communications with the computer through the use of the GUI interface.

4.2.6.2.1 Monitor

The location of features for the Monitor is provided in Figure 4-20 and a description of those features is provided in Table 4-19.

Figure 4-20 Monitor, Location of Features

Table 4-19 Monitor, Description of Features

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
MENU	Push Button Switch	OSD Off: Launches OSD menu & highlights function displayed.
		OSD On: Selects menu items.
⏻	Push Button Switch	Powers the monitor and works in conjunction with the status indicator. LED illuminates steady green to indicate monitor is ON, or illuminates a blinking green to indicate the monitor has power but no signal. LED is extinguished indicating the monitor has no power.
AUTO	Push Button Switch	OSD Off: Automatically adjust image quality to optimum level.
		OSD On: Automatically adjust image quality to optimum level.
↵	Push Button Switch	OSD Off: Toggles the display between VGA and DVI input.
		OSD On: Backs out of currently selected menu item.
◐/▼	Push Button Switch	OSD Off: Adjusts the brightness settings.
▲/☼		OSD On: Selects tabs on the OSD menu; adjusts settings on the OSD menu.

4.2.6.2.2 GUI Interface

The location of features for the GUI interface is provided in Figure 4-21 and a description of those features is provided in Table 4-20.

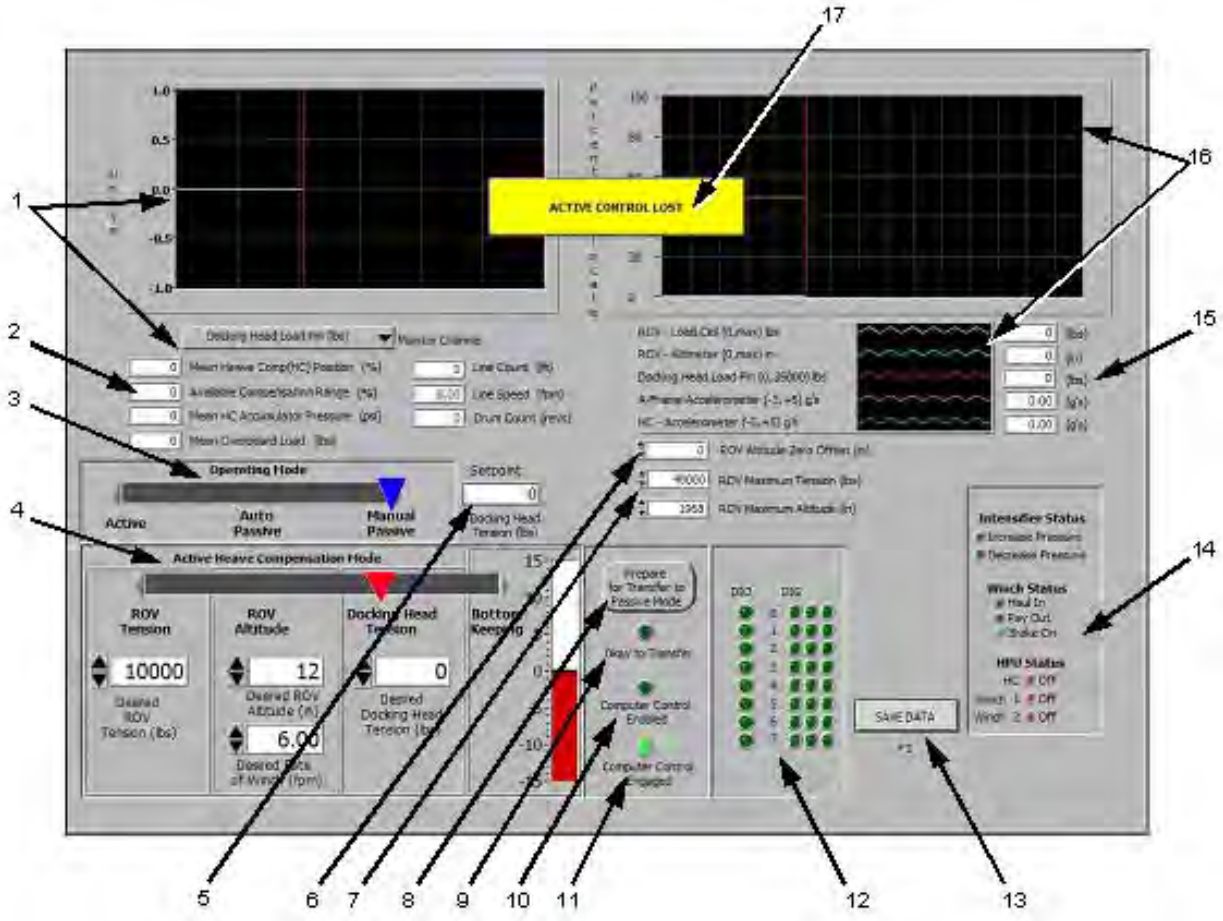


Figure 4-21 GUI Interface, Location of Features

Table 4-20 GUI Interface, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	**Units** **A-Frame Accel (g's)** Mean Heave Comp (HC) Position (%) Available Compensation Range (%) Mean HC Accumulator Pressure (psi) Mean Overboard Load (lbs) **Monitor Channel** Line Count (ft) Line Speed (fpm) Drum Count (revs)	Graph 1, GUI Selector Bar, and Digital Outputs	Graph 1, GUI Selector Bar, and Digital Outputs. (Refer to the paragraphs following this table for the functional description of the monitor/GUI features. The titles in this column are the paragraph heading titles.)
2	<Seven Digital Numbers>	Digital Output	Average Values.
3	**Operating Mode** Manual Passive Auto Passive Active	GUI Select Switches	Operating Mode Selector.
4	**Active Heave Compensation Mode** Docking Head Tension ROV Tension ROV Altitude Bottom Keeping	GUI Select Switches GUI Indicator	Active Heave Compensation Mode Selector.
5	SET-POINT ROV Tension ROV Altitude Docking Head Tension	Digital Output (of current function selected)	Mode Specific Information.
6	ROV Altitude Zero Offset (in)	GUI Selected Input	ROV Altitude Zero Offset Value.
7	ROV Maximum Tension (lbs) ROV Maximum Altitude (in)	GUI Selected Input	Full Scale Values.
8	Prepare for Transfer to Passive Mode	GUI Select Switch	Prepare for Transfer to Passive Mode.
9	Okay to Transfer	LED (Green)	Okay to Transfer Indicator.
10	Computer Control Enabled	LED (Green)	Computer Status.
11	Computer Control Engaged	LED (Green)	Computer Status.
12	DIO DIG 0 1 2 3 4 5 6 7	32 LEDs (Green) DIO has 1 bank of 8 LEDs (Channels) DIG has 3 banks of 8 LEDs (Channels)	Digital Signal Indicators.

Table 4-20 GUI Interface, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
13	SAVE DATA F1	GUI Select ON/OFF Switch/Keystroke	Save Data.
14	**Intensifier Status** Increase Pressure Decrease Pressure **Winch Status** Haul In Pay Out Brake On **HPU Status** HC Off Winch 1 Off Winch 2 Off	 LED (Green) LED (Green) LED (Green) LED (Green) LED (Green) LED (Red) LED (Red) LED (Red)	System Status.
15	<Five Digital Numbers>	Digital Output	Current Values.
16	**Percent Full-scale** ROV – Load Cell (0, max) lbs ROV – Altimeter (0, max) in Docking Head Load Pin (0, 25000) lbs A-Frame Accelerometer (.5, +5) g's HC – Accelerometer (.5, +5) g's	Graph 2 and Legend Displayed in White Displayed in Blue Displayed in Red Displayed in Orange Displayed in Green	Graph 2 and Legend.
17	**ACTIVE CONTROL LOST**	Display Window	Active Control Lost.

NOTE

The following paragraphs describe the GUI controls as shown in Figure 4-21 and listed in Table 4-20, Items 1 through 17.

4.2.6.2.2.1 Graph 1 Monitor Channel Bar, and Digital Outputs (Sheet 1, Item 1)

Clicking on the Monitor Channel bar will access a drop-down menu of the analog signals that can be graphed. The graph will auto scale the selected signal in the units specified on the selector as the graph transitions from the right-most boundary to the left-most boundary. Both graphs can be switched from auto scale to fixed y-scale by right clicking on the y-axis and changing the format in the pull down menu. After the auto scale has been disabled, the y-values can be selected and new values typed in. The graph can be reset by right-clicking on the graph area and selecting "Clear Chart."

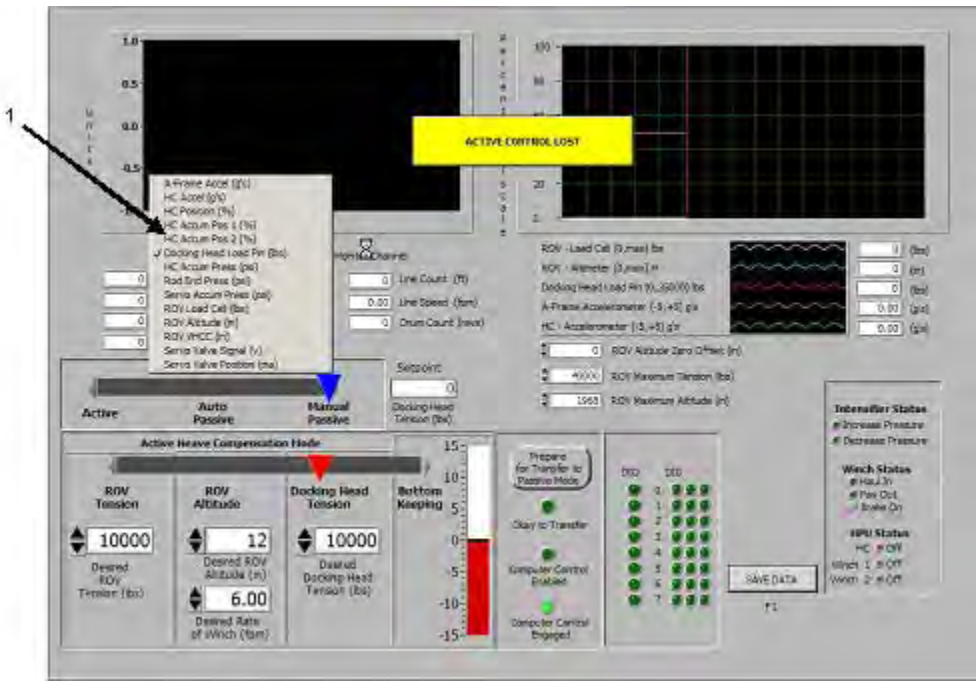


Figure 4-22 GUI Interface, Location of Features

4.2.6.2.2.1.1 Drop-Down Menu

Clicking on the Monitor Channel bar produces a drop-down menu (Figure 4-22) with the following choices:

- A-Frame Accel (g's) – indicates the umbilical cable rate of change as a measure of the universal gravitational constant when measured at the A-Frame Accelerometer (ENC11, AC-1).
- HC Accel (g's) – indicates the Flying Head Assembly rate of change as a measure of the universal gravitational constant when measured at HC Accelerometer (ENC12, AC-2).
- HC Position (%) – indicates the Flying Head Assembly position as a percent of full scale when measured at the HC cylinder (CYL-13, TD-1).
- HC Accum Pos 1 (%) – indicates the HC Accumulator position as a percent of full scale when measured at the HC Accumulator (ACC-1, TD-2).
- HC Accum Pos 2 (%) – indicates the HC Accumulator position as a percent of full scale when measured at the HC Accumulator (ACC-2, TD-3).
- Docking Head Load Pin (lbs) – indicates the umbilical cable tension at the Docking Head Sheave Assembly as a measure of pounds when measured at the Docking Head Sheave Assembly axle (LP-1).
- HC Accum Press (psi) – indicates the HC Accumulator pressure as a measure of pounds per square inch when measured at the HC Header (HDR-11, PX-2).
- Rod End Press (psi) – indicates the HC Accumulator Rod End pressure as a measure of pounds per square inch when measured at topside of HC Accumulator (ACC-1, PX-1).
- Servo Accum Press (psi) – indicates the Servo Accumulator (SVV-2) pressure as a measure of pounds per square inch when measured at HC Header (HDR-10).

- ROV Load Cell (lbs) – indicates the vehicle weight as a measure of pounds as a signal received from the vehicle.
- ROV Altitude (in) – indicates the vehicle position off the bottom of the ocean as a measure of inches as a signal received from the vehicle.
- ROV VHCC (in) – indicates the vehicle HC position as a measure of inches as a signal received from the vehicle.
- Servo Valve Signal (v) – indicates the servo valve (SVV-2) signal voltage as a measure of volts when the signal is physically measured at SVV-2.
- Servo Valve Position (ma) – indicates the servo valve (SVV-2) position as a measure of milliamperes when the signal is physically measured at (SVV-2).

4.2.6.2.2.2 Average Values (Item 2)

Several important variables are averaged to aide the Operator in determining system status. When the program is first started, the average values take approximately 30 seconds to stabilize. Do not switch into the computer controlled modes until this occurs.

4.2.6.2.2.3 Operating Mode Selector (Item 3)

The Operating Mode selector allows the FTHE Operator to use the keyboard/mouse to select one of the three operating modes for the FTHE HC system:

- Manual Passive – used in calm seas or alongside the pier when the ship's heave is minimal and to lower the vehicle/package to operating depth. The HC Assembly does not have to be powered-up to operate in the Manual Passive mode. However, if the HC Assembly is powered-up, the Flying Head Assembly is manually set at midpoint of the HC Assembly Cylinders and therefore free to move up and down due to sea surface fluctuations. The computer, if powered-up, is only monitoring the HC System and has no control over any of the system components.
- Auto Passive – is not a truly operational state but rather a transitional state. It is used to allow computer control of the intensifier to align the energized HC system (accumulators and Flying Head Assembly) to approximately 50% height. Coincidentally, the computer also causes various solenoid operating valves to open or close thereby varying the hydraulic oil volume in the HC accumulators for this same purpose. The HC system must be stabilized prior to transitioning to the Active mode.
- Active – used when computer controlled heave compensation of the vehicle /package is desired by preselecting one of the ROV Tension, ROV Altitude, Docking Head Tension, or Bottom Keeping modes. The current value of whichever mode is selected is used as the initial set-point value although this value can be changed using the keyboard/mouse after going into the Active mode.

The computer is in the Manual Passive mode when the system is initially powered-up. Changing from the Manual Passive mode to the Auto Passive mode is accomplished by the Computer Controlled Enable Switch on the Control Van Panel. The keyboard/mouse on the GUI cannot activate the system and transfer to the Auto Passive mode. Changing to the Active mode is accomplished by clicking on "Active" on the GUI. The GUI selector can be used to go to the Manual Passive mode at any time, but the system should first be transferred to the Auto Passive mode, allowing the system to restabilize once again, and then switched to the Manual Passive mode by disabling the computer Enable/Disable switch.

If the Computer Control Enabled signal is lost from remote due to switching it off due to a system fault, the computer will automatically go to the Manual Passive mode. Additionally, the computer will not be able to switch out of Manual Passive control until and unless the Computer Control Enabled switch is activated once again.

If either the Pedestal or Control Van Panel joystick is moved during Active mode, the Active Heave Compensation mode (ROV Tension, ROV Altitude, Docking Head tension, and Bottom Keeping) reverts to the Manual Passive mode.

4.2.6.2.2.4 Active Heave Compensation Mode Selector (Item 4)

The Active Heave Compensation Mode selector allows the FTHE Operator to use the keyboard/mouse to choose one of four methods by which the FTHE HC system controls the position of the vehicle/package once the Active mode has launched:

NOTE

Adjusting the set-points on the GUI for either the ROV Tension or the Docking Head Tension can have adverse affects on system operation since the Flying Head Assembly is driven either up (for higher tension settings) or down (for lower tension settings).

- ROV-Tension – the tension on the umbilical cable as determined by the vehicle is used as the set-point criteria. The desired set-point can be adjusted using the keyboard/mouse.
- Docking Head Tension – the tension on the umbilical cable as determined by the FTHE Docking Head Load Pin is used as the set-point criteria. The desired set-point can be adjusted using the keyboard/mouse.

NOTE

ROV Altitude should not be used above 600 inches (50 feet).

- **ROV-Altitude** – The altitude of the vehicle as determined by the vehicle is used as the set-point criteria. The set-point for both the Desired ROV Altitude and the Desired Rate of Winch speed can be adjusted using the keyboard/mouse.
  - Ordered Altitude – The ordered altitude function is provided by the FTHE through the VME Enclosure I/O adapter network interface. Once the FTHE is in the Active mode, a consolette operator can change the ordered altitude of the vehicle by turning the Ordered Altitude dial on the ROV consolette, but this will have no effect unless the system is in the Active, ROV Altitude mode.

    The VME Enclosure I/O Adapter uses two signal lines that toggle between 0 and 10 volts, depending on the sense of the signal coming from the consolette. Signal lines for both signals are configured in a Non-Referenced Single Ended configuration. Each time a new ordered altitude is received, the “command” line of the interface signals the FTHE that an ordered altitude command has been received by toggling the line between 0 and 10 volts or 10 and 0 volts depending on its original state.

    The “direction” signal line is in one of two different states: 0 volts which indicates an *increase* of altitude by 4 inches or 10 volts which indicates a *decrease* of altitude by 4 inches. All proportional and differential altitude controls are active in this state and the Umbilical Winch Assembly should only move when the FTHE HC Floating Head Assembly gets outside of its performance band (<22% or >78%).

- Bottom Keeping – the position of the vehicle for bottoming purposes is controlled by a proportional interface between the FTHE HC system and signals sent from the vehicle HC system attempting to maintain the vehicle HC system at the midpoint position. A CORBA signal from the vehicle enters the FTHE through the VME Enclosure I/O adapter where it is converted to a differential signal (one volt of signal equals three inches of position displacement) for processing by the computer.

  The vehicle HC system uses a cylinder having an allowed travel of ± 11 inches from its center position as represented by the ± 15-inch GUI depiction. As the vehicle HC system rises, as indicated by a movement in the positive direction (white), the FTHE HC system pays out umbilical cable to maintain the desired vehicle heave comp position. Conversely, as the vehicle HC system lowers, as indicated by a movement in the negative direction (red), the FTHE HC system hauls in umbilical cable to maintain the desired vehicle heave comp position.

Changing to the Active mode causes the pointer to move to the Docking Head Tension, therefore, the desired Active Heave Compensation mode should be selected *after* the computer operating mode is switched to Active compensation. Clicking on "ROV Tension," "ROV Altitude," "Docking Head Tension," or "Bottom Keeping" (the pointer will move to the appropriate indication) selects the function while clicking on the appropriate up/down arrow allows the operator to increase or decrease the desired tension/altitude/desired rate of winch. Selecting Bottom Keeping allows the GUI to indicate vehicle heave ±15 inches.

The mode specific information will be overwritten with the current values when the switch occurs and can be adjusted after the mode change is complete. The compensation mode can be changed whenever desired; however, the change will not take affect while the system is in either of the Passive modes.

4.2.6.2.2.5 Mode Specific Information (Item 5)

When the system transitions from Auto Passive to Active, the current value of the ROV Tension, ROV Altitude, or Docking Head Tension is used as the set point, depending upon the selected compensation mode. The "Set-point" value read in this window is the current value of the particular compensation mode selected:

- ROV-Tension – the tension on the umbilical cable as determined by the vehicle.
- ROV-Altitude – the altitude of the vehicle as determined by the vehicle.
- Docking Head Tension – the tension on the umbilical cable as determined by the FTHE Docking Head Load Pin.

4.2.6.2.2.6 ROV Altitude Zero Offset (Item 6)

The ROV Altitude Zero Offset is normally zero; however, there may be times when it is advantageous to adjust the signal being provided to the computer. The offset entered here is added to the calculated ROV Altitude signal from the Multifunction DAQ NI 6034E CCA and provided for processing.

4.2.6.2.2.7 Full Scale Values (Item 7)

Full scale values for the five ROV signals shown simultaneously in Graph 2 (Item 16) can be entered here using the keyboard/mouse.

4.2.6.2.2.8 Prepare for Transfer to Passive Mode (Item 8)

Depressing this button resets the accumulator nitrogen pressure to its original preactive mode setting and allows the HC to return to Manual Passive mode.

4.2.6.2.2.9 Okay to Transfer Indicator (Item 9)

Indicator illuminates after the Prepare for Transfer to Passive Mode switch has been selected and the accumulator pressure has reset to its original preactive mode setting.

4.2.6.2.2.10 Computer Status

4.2.6.2.2.11 Computer Control Enabled Indicator (Item 10)

The Computer Control Enabled indicator illuminates to indicate the status of the Computer Control Enabled toggle switch.

4.2.6.2.2.11.1 Computer Control Engaged Indicator (Item 11)

The Computer Control Engaged indicator illuminates after the motion control software causes the HC accumulators and cylinders to come to mid-stroke and the computer has taken control of the HC in Active mode.

4.2.6.2.2.12 Digital Signal Indicators (Item 12)

The status of the digital signals used in the control system is shown on the monitor GUI (Table 4-21). The left column shows the status of the digital signals on the NI Real-Time card. These eight signals are comprised of 5 inputs (0 - 4) and 3 outputs (5 - 7). The last three columns show the status of the digital signals on the NI 6527 digital card. The second and third column are digital inputs and the final column is outputs. The first three columns use positive logic, i.e. light on indicates the input/output is true/on. The last column uses negative logic, i.e., light off indicates the output is true/on. Some of the information here (Digital Signal Indicators) is duplicated from the indicators in System Status (Table 4-20, Item 14).

Table 4-21 Digital Signal Indicators Identification

DIO – RT CARD		DIG – DIGITAL CARD		
Intensifier - Decrease Pressure	0	A-Frame Luff Proximity Switch	HPU #1 Running	Computer Control Engaged
Control System Fault	1	Not Used	HPU #2 Running	Not Used
Mode Switching Valve	2	Not Used	Not Used	Not Used
Brake Release	3	Not Used	Not Used	Accumulator Oil Left Raise
Intensifier – Increase Pressure	4	Not Used	Not Used	Accumulator Oil Left Lower
HC HPU Running	5	Winch General Fault	Not Used	Accumulator Oil Right Raise
Drum Count	6	HC General Fault	Not Used	Accumulator Oil Right Lower
Drum Count	7	Active Mode Enable	Not Used	Not Used

4.2.6.2.2.13Save Data (Item 13)

System data can be saved at any time from any operating mode. The data will be saved in: E:\data\datetime.txt (filenames are created using the current date and time so that they are always unique). Pressing the ‘F1’ key or pressing the ‘Save Data’ button on the screen will begin data capture. Pressing either of these again will stop data capture. Data is taken at 8 Hz and each reading requires approximately 300 bytes of disk space.

4.2.6.2.2.14System Status (Item 14)

The intensifier, winch, and HPU status are self-evident and are displayed for quick reference.

4.2.6.2.2.15Current Values (Item 15)

The instantaneous values of the five signals shown in Graph 2 are displayed adjacent to the legend.

4.2.6.2.2.16Graph 2 and Legend (Item 16)

Graph 2 will show the five signals indicated simultaneously. These signals are graphed as a percent of full scale. The procedure for formatting the graph is the same as for Graph 1.

4.2.6.2.2.17Active Control Lost (Item 17)

When in the Active mode, the “Active Control Lost” pop-up box displays when the computer has actually lost control of the FTHE HC System.

4.2.6.2.3 Control Screen

CAUTION

Changing values on the Control Screen can severely impact system operations and should only be performed by the FTHE calibration specialists.

To access the control screen, press ‘F111’ and type in the password (the password is case sensitive). The gains for each of the operating modes can be adjusted along with the calibration factors for the various analog signals used by the control system. Press the Exit button to save the values and return to the main screen. To restore factory defaults, press ‘F112’ and all user specified values will be lost (Figure 4-23.)

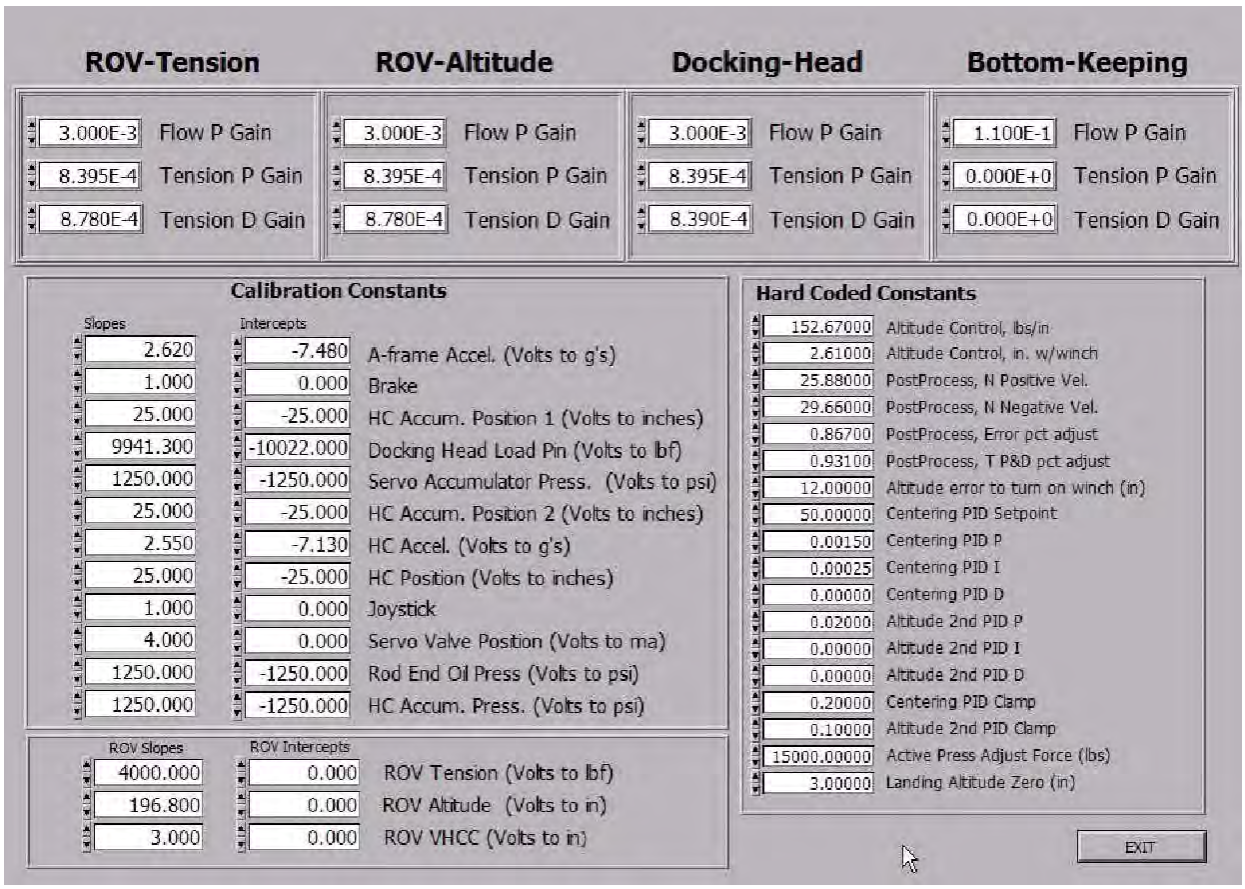


Figure 4-23 Control Screen

4.2.6.3 Control Van Panel (ENC5)

The location of features for the Control Van Panel is provided in Figure 4-24 and a description of those features is provided in Table 4-22.

4.2.6.3.1 LCI-90 Line Control Instrument

The LCI-90 front panel (Figure 4-24, Item 18) provides a high visibility display panel and a five-button keypad located at the bottom of the display. For operation and programming, the five buttons offer different functions depending upon the current operating mode. Hotkey labels: MENU, DIAG, ALRM, CALB, and RSET (Item 19) just above each button, identify their current function.

In normal operation, the RUN screen, pictured, is displayed. The screen is actually divided into three separate displays that are partitioned as the Top, Left, and Right and can be user programmed as desired. For FTHE purposes, they are Payout, Speed, and Tension respectively. The Top display includes a bar graph with operator selectable limits and a visual indication of alarm set-points. Alarm message displays are located below the parameter displays. A maximum of six alarm conditions can be shown in this area.

This paragraph and the applicable items in Table 4-22 only provide a basic awareness of the normal RUN screen. For a thorough understanding of how to operate this unit, refer to the LCI-90 Line Control Instrument Installation Manual, located in the FTHE Component Literature Manual, Section: “Electrical_Component_Literature_All_Assemblies.

Figure 4-24 Control Van Panel, Location of Features

Table 4-22 Control Van Panel, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	HEAVE COMPENSATOR HPU STOP	Push Button Switch, Normally closed contacts	**PB9**: The HC HPU motor shuts down when push button is depressed.
2	LOW OIL LEVEL	Lamp (Red)	**LT36:** Lamp is illuminated to indicate a low hydraulic oil level alarm condition when the hydraulic oil in the HPU supply tank is below minimum level.
3	HPU RUNNING	Lamp (Green)	**LT34** is illuminated to indicate the HC HPU is operating.
4	HIGH OIL TEMPERATURE	Lamp (Red)	**LT35** is illuminated to indicate a high hydraulic oil temperature alarm condition when hydraulic oil in the HC supply tank is more than 150 °F.
5	REMOTE ENABLED	Lamp (Amber)	**LT16** is illuminated to indicate the Control Van computer has control (enabled) of the winch.

Table 4-22 Control Van Panel, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
6	WINCH	Proportional Control Handle	**CH5**: The remote winch joystick is connected here and has control when provided by the Pedestal. The winch pays out cable when the joystick is moved to the PAY OUT position and hauls in cable when moved to the HAUL IN position.
7	WINCH BRAKE RELEASED	Lamp (Amber)	**LT15** is illuminated to indicate the winch brake is released when the winch pay out/haul in joystick is moved from the center position.
8	COMPUTER CONTROL DISABLE ENABLE	Toggle Switch	**SW9**: When the toggle switch is moved to the ENABLE position, the COMPUTER CONTROL ENABLE lamp is illuminated and a signal is sent to the motion compensation software to prepare the HC for automatic control. When the toggle switch is moved to the DISABLE position, the ENABLE lamp is extinguished and automatic control of the HC is ceased.
9	COMPUTER CONTROL ENABLED	Lamp (Amber)	**LT21** is illuminated when the COMPUTER CONTROL toggle switch is moved to ENABLE which indicates a signal has been sent to the motion compensation software to prepare the HC for automatic control.
10	COMPUTER CONTROL ENGAGED	Lamp (Amber)	**LT22** is illuminated to indicate the motion compensation software is controlling the action of the HC.
11	LOW OIL LEVEL	Lamp (Red)	**LT20** is illuminated to indicate a low hydraulic oil level alarm condition when the hydraulic oil in the HPU supply tank is below minimum level.
12	HIGH OIL TEMPERATURE	Lamp (Red)	**LT19** is illuminated to indicate a high hydraulic oil temperature alarm condition when hydraulic oil in the HPU supply tank is more than 150 °F.
13	HPU #2 CHARGE PRESSURE LOW	Lamp (Red)	**LT18** is illuminated to indicate a low pressure alarm condition when the HPU #2 Charge Pressure is less than 310 psi.

Table 4-22 Control Van Panel, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
14	HPU #1 CHARGE PRESSURE LOW	Lamp (Red)	**LT17** is illuminated to indicate a low pressure alarm condition when the HPU #1 Charge Pressure is less than 310 psi.
15	HPU #2 RUNNING	Lamp (Green)	**LT14** is illuminated to indicate HPU #2 is operating.
16	HPU #1 RUNNING	Lamp (Green)	**LT13** is illuminated to indicate HPU #1 is operating.
17	WINCH / A-FRAME HPU STOP	Push Button Switch, Normally closed contacts	**PB8**: Both HPU motors shut down when the push button is depressed.
18	LCI-90 LINE CONTROL INSTRUMENT	Line Data Display (Master)	**DSP1**: The Control Van Panel display receives its input from the Signal Interface Enclosure and indicates umbilical line count (feet), speed (fpm), and tension (lbs). **PAYOUT** (Line Count): The line count increases in value as the umbilical cable is paid out and decreases in value as the cable is hauled in. **SPEED** (Line Speed): The line speed numbers are positive when the umbilical cable is paid out and negative when the umbilical cable is hauled in. **TENSION** (Line Tension): The tension of the umbilical cable at the Docking Head Sheave Assembly is measured and provided by a load pin at the axle of the Docking Head Sheave Assembly.

Table 4-22 Control Van Panel, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
19	(See Functional Description)	Five-Button Keypad	When in the normal RUN mode, the five keys support the following functions: **MENU**: Displays the menu for programming and/or calibration of the unit. **DIAG**: Switches to the diagnostics screen which shows raw sensor inputs and scaled Tension and Payout. Once in DIAG mode, the same button, now labeled "MAIN," returns display to the RUN screen. **ALRM**: If an alarm condition is present, this button resets all alarm output modules. Double pressing this button within a two-second interval brings up the "1.0 SET ALARMS" menu. **CALB**: Acts as a shortcut to the "2.0 CALIBRATION" menu. **REST**: Resets Payout to zero. Double pressing this button within a two-second interval zeroes the Payout display.

4.2.6.4 Computer

The location of features for the Computer is provided in Figure 4-25 and a description of those features is provided in Table 4-23.

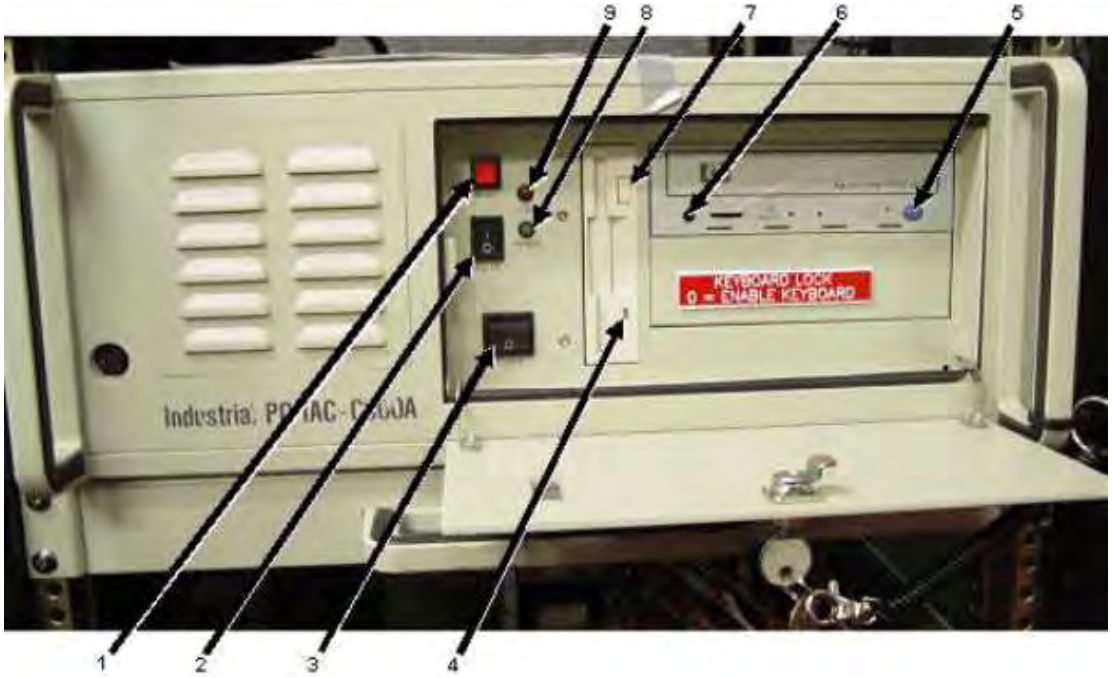


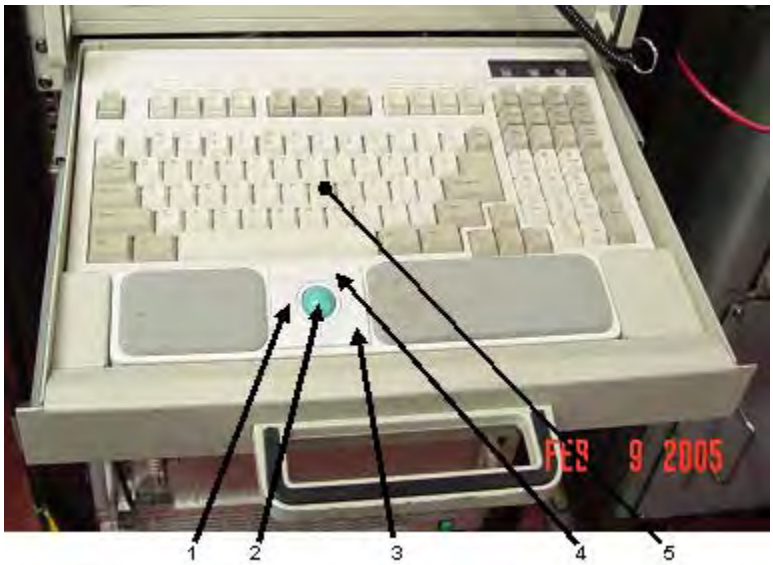
Figure 4-25 Computer, Location of Features

Table 4-23 Computer, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	RESET	Push Button Switch	Depressing the RESET push button will restore the CPU to system defaults.
2	KB/LK	Rocker Switch	Depressing the “1” locks the keyboard to prevent inadvertent key strokes while depressing “0” unlocks the keyboard for use.
3	POWER 0 1	Rocker Switch	Depressing “1” (ON) powers up the computer while depressing “0” (OFF) turns the computer off.
4	N/A	LED (Amber)	LED illuminates to indicate the floppy disk drive is being accessed.
5	N/A	Momentary Push Button Switch	Depressing this switch opens the CD writer door for access to the CD. Depressing this switch again closes the door.
6	N/A	LED (Amber)	LED is illuminated to indicate the CD writer is being accessed.
7	N/A	Momentary Push Button Switch	Depressing this switch causes the floppy disk to be ejected from drive.
8	POWER	LED (Green)	LED is illuminated to indicate the computer has power.
9	H.D.D.	LED (Red)	LED illuminates to indicate the hard disk drive is being accessed.

4.2.6.5 Keyboard Tray

The location of features for the keyboard tray is provided in Figure 4-26 and a description of those features is provided in Table 4-24.



(TRAY PULLED OUT FOR VIEWING)

Figure 4-26 Keyboard Tray, Location of Features

Table 4-24 Keyboard Tray, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	N/A	Push Button Switch	Left mouse button.
2	N/A	Roller Ball	The track ball moves the cursor around the screen as desired.
3	N/A	Push Button Switch	Right mouse button.
4	N/A	Push Button Switch	Middle mouse button.
5	N/A	Push Button Switch	Typical “QWERTY” keyboard.

4.2.6.6 Signal Interface Enclosure (ENC10)

The location of features for the Signal Interface Enclosure (ENC10) is provided in Figure 4-27 and a description of those features is provided in Table 4-25.

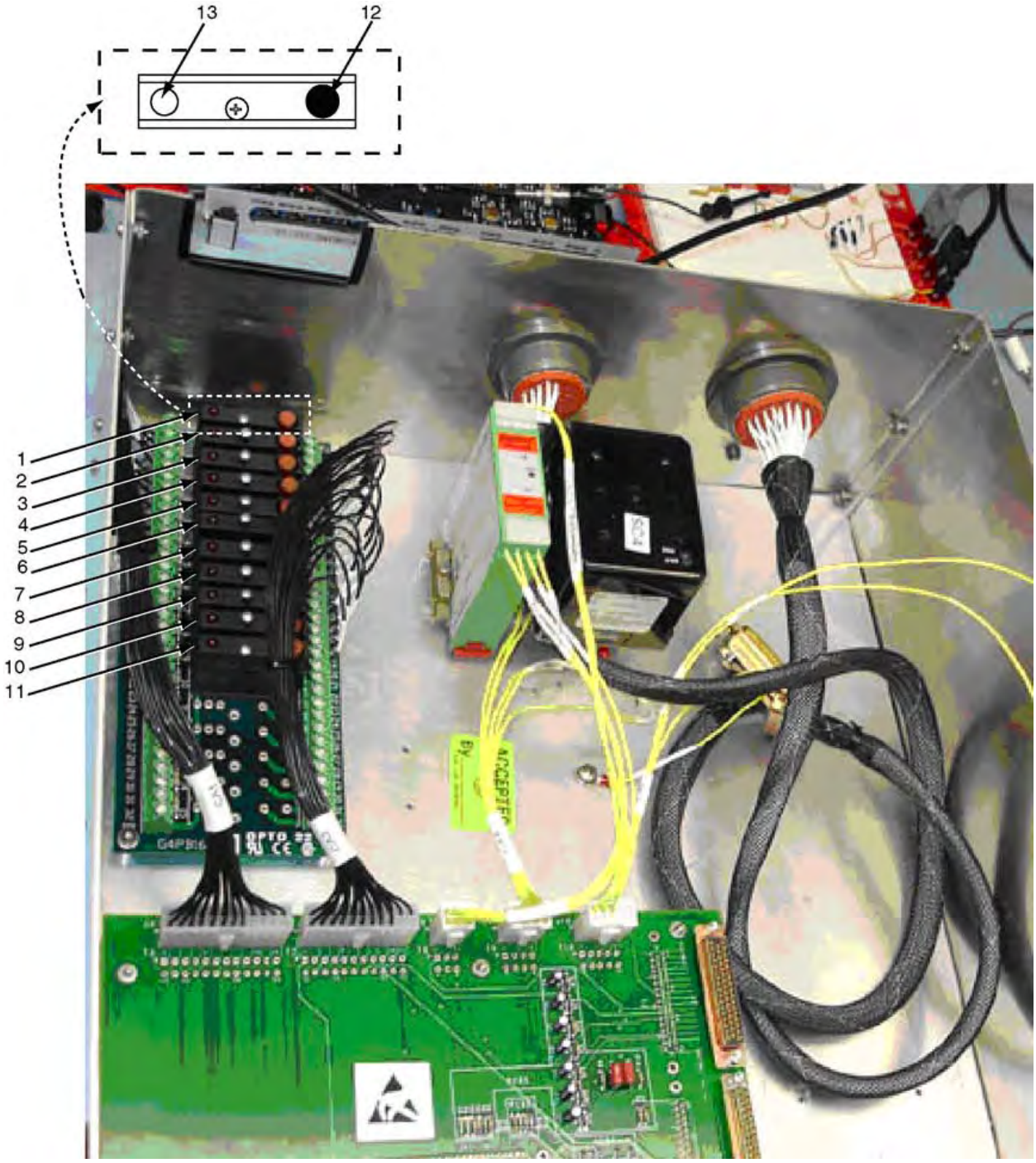


Figure 4-27 Signal Interface Enclosure, Location of Features

Table 4-25 Signal Interface Enclosure, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	M0	Optical I/O Module with LED (Red) and Fuse	**Computer Control Engaged**: This optorelay is energized by the computer's +5 VDC logic circuit when in the Active mode to illuminate the Computer Control Engaged lamp (LT22).
2	M1	Optical I/O Module with LED (Red) and Fuse	**Mode Switching Solenoid**: This optorelay is energized by the computer's +5 VDC logic circuit when in the Active mode to operate K38, the Active Mode Enable circuit, and energize the fail-safe valve of SVV-2.
3	M2	Optical I/O Module with LED (Red) and Fuse	**Lower Oil Right Solenoid**: This optorelay is energized by the computer's +5 VDC logic circuit when in the Manual and Auto Passive mode to operate SOV-12 which allows the removal of oil from CYL-14 to lower the starboard (right) accumulator (ACC-2).
4	M3	Optical I/O Module with LED (Red) and Fuse	**Raise Oil Right Solenoid**: This optorelay is energized by the computer's +5 VDC logic circuit when in the Manual and Auto Passive mode to operate SOV-11 which allows oil to be introduced into CYL-14 to raise the starboard (right) accumulator (ACC-2).
5	M4	Optical I/O Module with LED (Red) and Fuse	**Lower Oil Left Solenoid**: This optorelay is energized by the computer's +5 VDC logic circuit when in the Manual and Auto Passive mode to operate SOV-10 which allows the removal of oil from CYL-13 to lower the port (left) accumulator (ACC-1).
6	M5	Optical I/O Module with LED (Red) and Fuse	**Raise Oil Left Solenoid**: This optorelay is energized by the computer's +5 VDC logic circuit when in the manual and Auto Passive mode to operate SOV-9 which allows oil to be introduced into CYL-13 to raise the port (left) accumulator (ACC-1).
7	M6	Optical I/O Module with LED (Red) and Fuse	**Intensifier Raise Pressure**: This optorelay is energized by the computer's +5 VDC logic circuit when in the Auto Passive mode to operate SOV-14 and SOV-16 which allows the pressure to be raised by the Compressor/Intensifier System.

Table 4-25 Signal Interface Enclosure, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
8	M7	Optical I/O Module with LED (Red) and Fuse	**Intensifier Decrease Pressure**: This optorelay is energized by the computer's +5 VDC logic circuit when in the Auto Passive mode to operate SOV-13 and SOV-15 which allows the pressure to be lowered by the Compressor/Intensifier System.
9	M8	Optical I/O Module with LED (Red) and Fuse	**Control System Fault**: This optorelay is energized by the computer's +5 VDC logic circuit when in the Auto Passive mode to operate K35, the Control System Fault circuit which sounds the audible alarm (AS-1).
10	M9	Optical I/O Module with LED (Red) and Fuse	**Brake Release**: This optorelay is energized by the computer's +5 VDC logic circuit when in the Active mode to operate K124, the Brake Release circuit.
11	M10	Optical I/O Module with LED (Red) and Fuse	Spare.
12	N/A	Fuse	Protects the device from excessive current and short circuits.
13	N/A	LED (Red)	LED illuminates to indicate +5 VDC control voltage circuit is energized.

4.2.6.7 VME Enclosure

The location of features for the VME Enclosure which includes a Single Board Computer (SBC) CCA and a Digital to Analog (D/A) CCA is provided in Figure 4-28 (3 sheets) and a description of those features is provided in Table 4-26.

Figure 4-28 VME Enclosure, Location of Features (1 of 3)

Figure 4-28 VME Enclosure, Location of Features (2 of 3)

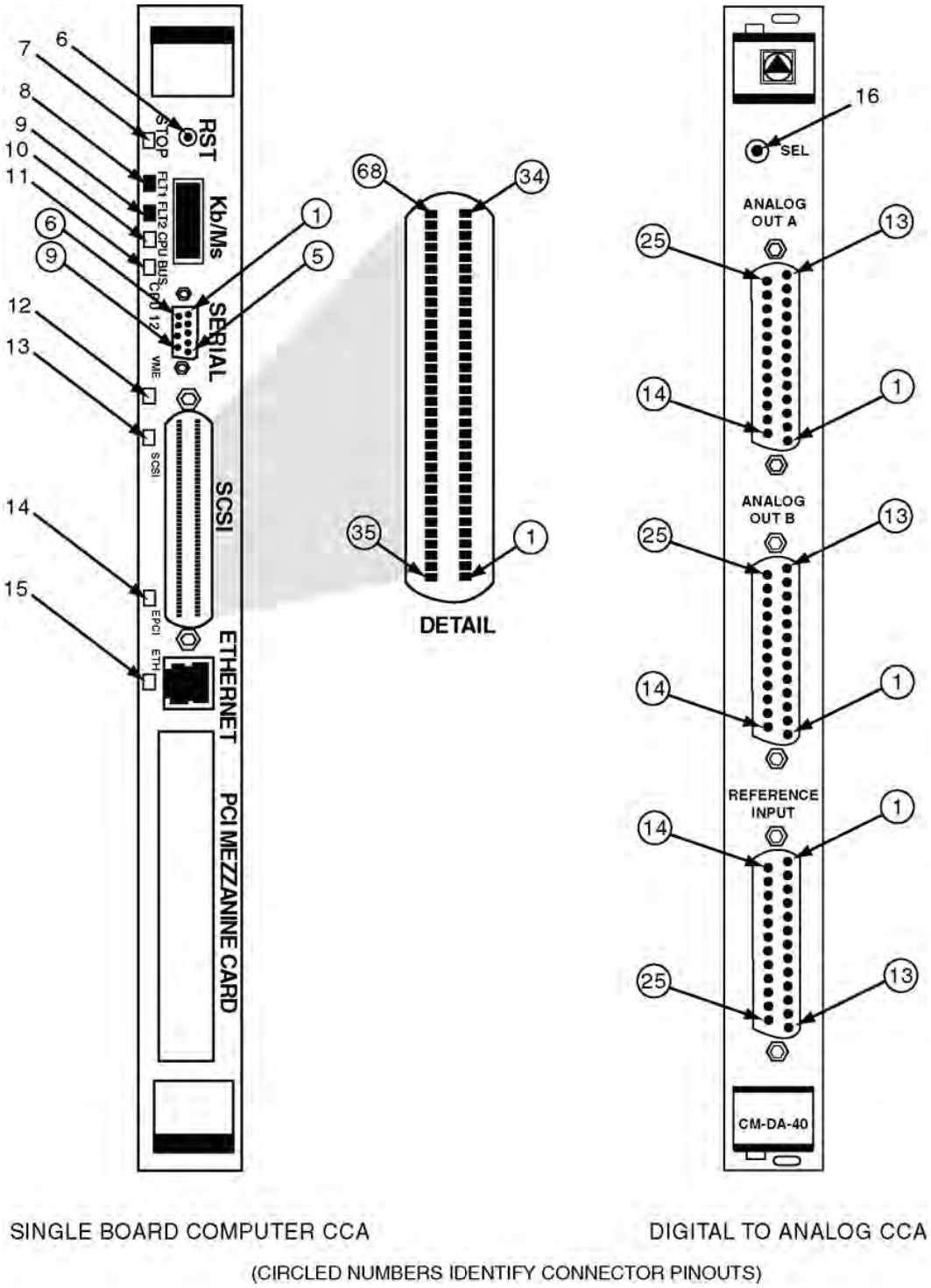


Figure 4-28 VME Enclosure, Location of Features (3 of 3)

Table 4-26 VME Enclosure, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1	+3.3V +5V +12V -12V TEMP FANS	LEDs (Red or Green)	The six LEDs monitor the various functions of the VME chassis. All LEDs initially illuminate red when the chassis is energized but quickly change to a steady green indicating all functions are performing normally. LEDs illuminate red to indicate a power supply failure, high temperature, or a fan has failed. LEDs are normally illuminated green.
2	N/A	SBC CCA	The SBC CCA, located in backplane slot A1, translates LAN provided digital vehicle tension and altitude information and passes it to the D/A CCA for further use.
3	N/A	D/A CCA	The D/A CCA, located in backplane slot A2, is used to develop the analog signals fed to the A/D CCA in the computer.
4	1/0	Push Button Rocker Switch	The DC power supply enable switch controls application of 115 VAC power to the DC power supplies and ultimately the DC fans. Depress 1/0 for ON/OFF functions.
5	1/0	Push Button Rocker Switch	The AC Power switch controls application of 115 VAC, 60 Hz, single-phase input power to the chassis assembly. (It does not power up the power supplies or fans.) Depress 1/0 for ON/OFF functions.
SINGLE BOARD COMPUTER CCA			
6	RST	Push Button Switch	In NORMAL position, the Single Board Computer CCA is operational. Momentarily depressing push button switch generates a hard reset.
7	STOP	LED (Yellow)	LED is illuminated indicating CCA is in RESET phase or that one of the power supplies (Central Processing Unit [CPU] core, +3.3 V, or +5 V) is out of range. Normally extinguished.
8	FLT1	LED (Red)	LED is illuminated indicating a checkstop condition for CPU0. Normally extinguished.
9	FLT2	LED (Red)	LED is illuminated indicating a checkstop condition for CPU1. Normally extinguished.

Table 4-26 VME Enclosure, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
10	CPUBUS	LED (Green)	LED is illuminated indicating activity on either CPU0 or CPU1 bus.
11	CPU 1/2	LED (Red or Green)	Green LED is illuminated indicating activity on CPU0 bus when CPU0 bus has gained address bus mastership. Red LED is illuminated indicating activity on CPU1 bus when CPU1 bus has gained address bus mastership.
12	VME	LED (Yellow)	LED is illuminated indicating the CCA is the VME-bus master.
13	SCSI	LED (Yellow)	LED is illuminated indicating activity on SCSI bus.
14	EPCI	LED (Yellow)	LED is illuminated indicating activity on PCI bus.
15	ETH	LED (Green) LED (Red)	Green LED is illuminated indicating Ethernet interface is working. Red LED is illuminated indicating operation in 100Base-T mode or extinguished indicating operation in 10Base-T mode.
			For further operating procedures and technical information relating to the Single Board Computer CCA, refer to *VMPC6x or VMPC6x-Dual Cetia Single or Dual Processor VME64 Board User's Guide*, Document CA.DT.129-2e.
DIGITAL TO ANALOG CCA			
16	SEL	LED (Green)	LED is illuminated indicating VME-bus master accesses the CCA (SELected).
			For further operating procedures and technical information relating to the Digital to Analog CCA, refer to *CM-DA-40, 24 Channel Optoisolated D/A Module User's Manual*, Document CM-DA-40 MAP/I, Version: 5.2, Board PCB: 1.0, January 1999.

4.2.6.8 UPS

The location of features for the UPS is provided in Figure 4-29 (2 Sheets) and a description of those features is provided in Table 4-27.

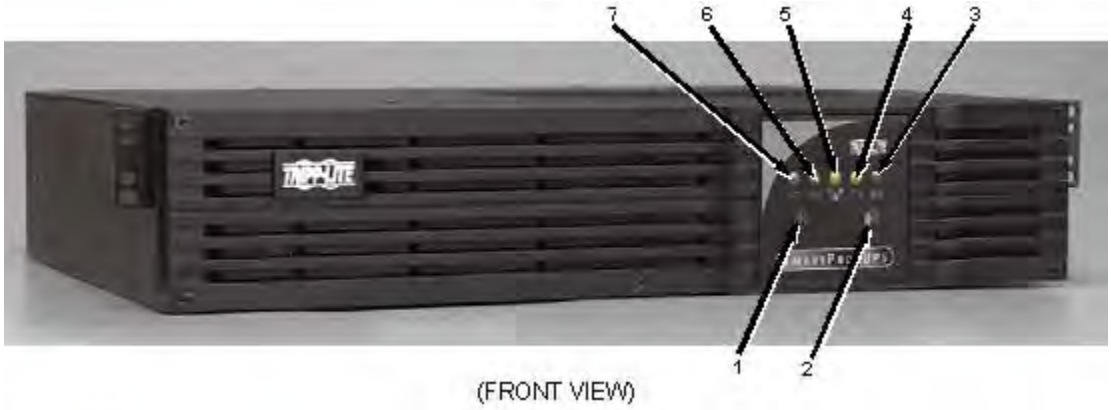


Figure 4-29 UPS, Location of Features (1 of 2)

Figure 4-29 UPS, Location of Features (2 of 2)

Table 4-27 UPS, Description of Features

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
1		Push Button Switch	**ON/OFF/STANDBY**: To turn the UPS ON, depress and hold the ON/OFF/STANDBY button for 1 second and then release the button. To turn the UPS OFF, depress and hold the ON/OFF/STANDBY button for 1 second, release the button, and remove the 115 VAC UPS input power to have the UPS completely OFF. (With the power cord plugged in and 115 VAC input power available, the UPS is in the STANDBY mode and the battery is charging.)

Table 4-27 UPS, Description of Features - *continued*

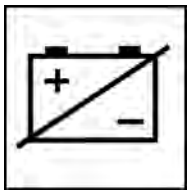
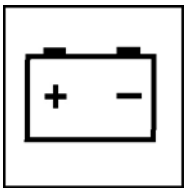
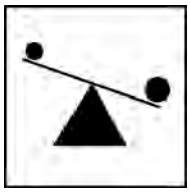
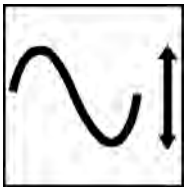
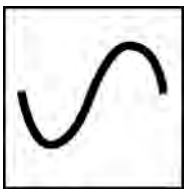
ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
2		Push Button Switch	Mute/Test POSSIBLE EQUIPMENT DAMAGE. Do not unplug the UPS to test its batteries as this will remove safe electrical grounding and may introduce a damaging power surge into the network connections. **To Mute UPS Alarms**: Briefly depressing the MUTE/TEST button will silence the UPS alarms. **To Run a Self-Test**: With the UPS plugged in and turned ON, depress and hold the MUTE/TEST button for 2 seconds at which time the alarm will beep once briefly. Continue depressing the button until the alarm beeps several times and the UPS begins the self-test.
3		LED (Red)	**Battery Warning**: LED illuminates and the alarm sound intermittently after initiating a self-test to indicate UPS batteries need to be recharged or replaced.
4		LED (Green or Amber or Red)	**Battery Charge**: When UPS is operating from utility power, the multicolored LED illuminates to indicate the approximate charge state of the internal batteries. Green indicates fully charged, amber indicates midway through charge, and red indicates batteries are beginning to charge.
5		LED (Green or Amber or Red)	**Output Load Level**: This multicolored LED illuminates to indicate the approximate electrical load of equipment connected to the UPS AC outlets. Green indicates a light load, amber indicates a medium load, and red (either continuously or flashing) indicates an overload.

Table 4-27 UPS, Description of Features - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
6		LED (Green)	**Voltage Correction**: LED illuminates continuously whenever the UPS is automatically correcting high or low AC voltage on the utility line without the assistance of battery power. The UPS will also emit a slight “clicking” noise which is normal, automatic operations of the UPS, and no action is required by the operator.
7		LED (Green)	**Power**: LED is continuously illuminated when the UPS is energized and supplying UPS connected equipment with AC power from a utility source. The LED flashes and an alarm sounds (4 short “beeps” followed by a pause) to indicate the UPS is operating from its internal batteries during a blackout or severe brownout.
8	OUTPUT BREAKER	Push Button Switch	Protects Load 1 circuits from output overload. If the output breaker trips, remove some of the Output Breaker load and depress the Output Breaker button to reset the breaker.
9	OUTPUT BREAKER	Push Button Switch	Protects Load 2 circuits from output overload. If the output breaker trips, remove some of the Output Breaker load and depress the Output Breaker button to reset the breaker.
10	AC INPUT BREAKER	Push Button Switch	Protects electrical circuit from over current. If the breaker trips, remove some of the load from either or both of the Output Breakers and depress the AC Input Breaker button to reset the breaker.

4.3 THEORY OF OPERATION

This section describes theory of operations for software, hydraulic, and electrical FTHE systems.

4.3.1 Theory of Operation - Software

This paragraph provides definitions of the Normal Operating modes used for FTHE in addition to the Control Loop modes used for each of the Operational modes. A brief narrative describes the relationships between the Operating modes and the Control Loop modes from the perspective of the normal operations scenarios involved in the use of the equipment.

4.3.1.1 Operational Modes

The FTHE is normally operated in one of three basic Operational modes. These modes typically involve operation in predefined "phases" that essentially reconfigure the underlying Control Loops depending on the immediate operation being performed.

a. Operation In The Water Column:
   1. Hovering: the ability to maintain some approximate depth regardless of sea floor depth.
   2. Station Keeping: the ability to maintain a somewhat fixed altitude above the sea floor.
b. Landing: the act of descending to the sea floor and then physically allowing the vehicle to rest on the floor.
c. Take-Off: the act of preparing the vehicle for leaving the sea floor and then ascending towards the surface.

4.3.1.2 Control Loop Modes

While performing the defined Operational modes, the FTHE is normally operated in one or more Control Loop modes depending on either the phase of the Operational mode or the current sea state. Contingencies are provided to allow safe and reliable recovery if a fault occurs that precludes the use of the normal loop(s). There are two "Passive" and three "Active" Control Loop modes.

a. Passive:
   1. Manual Passive: There is no feedback. The HC is operated at about mid-stroke and simply provides basic heave compensation. The FTHE Operator may manually readjust the average HC cylinder position by increasing or decreasing the accumulator gas charge system using the HC compressor/intensifier
   (Figure 4-15, Item 4).
   2. Auto Passive: Feedback is from the HC cylinder and HC accumulator position sensors. Accumulator pressures are used to ensure operation within limits allowed for the accumulators. This is a transitional mode used to "align" the HC components (HC cylinders and accumulators) each to about mid-stroke in anticipation of entering "Active Compensation."
b. Active:
   1. Docking Head Tension: Feedback is from the Docking Head load pin (LP-1) and the control loop is set to maintain a tension set-point at the Docking Head.
   2. ROV Tension: Feedback is from a signal developed from the vehicle load cell and transmitted to the FTHE via the fiber-optic signal path in the umbilical cable. The control loop is set to provide a tension set-point at the vehicle.

3. ROV Altitude: Feedback is from an altitude signal developed in the vehicle and transmitted to the FTHE via the fiber-optic signal path in the umbilical cable. The control loop is set to maintain the vehicle at the set-point altitude above the sea floor. The altitude set-point can be adjusted ¼ ft/click by using a control knob on the ROV consolette.
4. Bottom Keeping Feedback is from a vehicle sensor transmitted to the FTHE via the fiber-optic path in the umbilical cable. The control loop is set to maintain the vehicle on the bottom with the Heave Compensator on the vehicle centered.

4.3.1.3 Descriptions of the Operational Scenarios Using Operation and Control Loop Modes

The following paragraphs describe the relationships between the Operational modes and the Control Loop Modes as the FTHE is operated in typical operational scenarios. An attempt is made to include the descriptions of the algorithms (gains, topologies, decision, criteria, set-points) exercised as the operation is conducted.

a. Operation in the Water Column:

1. Hovering: In this mode, the vehicle has been deployed and is simply holding a relatively stationary depth in the water without regard of the actual altitude above the sea floor. It assumes the vehicle is well above the sea floor so that any untenanted heave motions or vehicle motions are not large enough to cause “grounding” of the vehicle. During this mode, and in relatively calm seas, the system is normally configured in the Manual Passive control loop mode and the HC provides basic Heave Compensation with no feedback. As the seas become rougher, the Operator can command the system to enter the Docking Head Tension active heave compensation mode. To do so, the Operator first commands the system to “Transition” through the Auto Passive mode. This properly aligns both average accumulator positions and corresponding Heave Cylinder positions to about mid-stroke, to avoid problematic offsets and/or imbalances in the initial conditions before entering the Docking Head Tension Control Loop.

Hover_Mode{

Enter Manual Passive Mode:

Manual_Pass_Mode{

- If the seas are “calm” then no servo valve signal required.
- If the HC is at mid-stroke there is no need to increase/decrease the pressure.
- If the HC is below mid-stroke then the pressure needs to increase to bring it up to mid-stroke.
- If the HC is above mid-stroke the pressure needs to decrease to bring it down to mid-stroke.
- If the seas are “rough” then you may want to enter the Auto_Passive_Mode.
- The FTHE Operator decides to exit the Manual Passive Mode.

}End_Manual_Pass_Mode

Enter Auto Passive Mode:

Auto_Pass_Mode (90 Hz){

- If the [(HC position – HC accumulator position) is < the Mid – DeadBand] and the [accumulator pressure is < 3,000 psi] then the Intensifier is ON and the pressure is increasing causing the Flying Head Assembly to rise.
- If the [(HC position – HC accumulator position) is > the Mid + DeadBand] and the [accumulator pressure is < 600 psi] then the Intensifier is ON and the pressure is decreasing causing the Flying Head Assembly to lower.
- The FTHE Operator decides to exit the Manual Passive mode.

}End_auto_pass_mode

Enter Docking Head Load Pin Tension Mode:

The Docking Head Load Pin mode is controlled by the physical dimensions of the system, the flow rate of the hydraulic system, the tension given by the docking head load pin, and the measured hydraulic pressure in the accumulators.

As tension increases at the docking head load pin, the FTHE system must pay out a sufficient amount of umbilical cable to maintain the vehicle at its current position within the water column. With the umbilical winch inactive, the HC flying head sheave assembly must move down towards the lower (fixed) sheave assembly. The system software calculates an error function that determines how much fluid must be removed from the accumulators (via SVV-2) and thus allows the flying head assembly to drop to the appropriate level.

If the velocity of the change in tension is increasing, then the software calculates the valve opening position in accordance with the following:

DHT_Mode (90 Hz){
Valve Signal = (Flow + Error + DeltaError) ($P_{Accum} – T_{DHLP}$)
P_{Accum} = Accumulator Pressure
T_{DHLP} = Docking Head Load Pin Tension
Flow = a function of the cylinder's physical dimensions
Error = (Set-point tension - T_{DHLP})
DeltaError = Last tension read – current tension

If the velocity of the change in tension is decreasing, then the software calculates the valve opening position in accordance with system pressure minus valve signal above.

If the "Joystick is Inactive" then there is no movement from the winch

If the "Joystick is Active" then there is movement from the winch

}End DHT_Mode

}End_Hover_Mode

2. Station Keeping: In this Operational mode, the vehicle is operated at a somewhat fixed altitude above the sea floor. This mode is similar to the Hovering Mode, except that vehicle excursions due to sea-current forces impinging on the package mass and stimulating the "springy" umbilical cable need to be attenuated to maintain the desired altitude. Therefore, the feedback must come from the vehicle. For this mode, then, the system is, by virtue of having feedback, configured in the active Heave Compensation, ROV Tension control loop mode. Winch control is then used to maintain mid-stroke position of the HC.

Station_Keeping_Mode{
Enter ROV Tension Mode:
ROV_T_Mode (90 Hz){
Total Servo Signal = PostProcess Valve Signal + Centering
PostProcess Valve Signal = Sum (Flow, Tension1, Tension2)

- Valve Signal is averaged over the previous 5 loops
- Valve Signal Amplitude is limited to ±5 VDC
- Delta Valve Signal is limited to ±1.05 VDC per sampling loop
- Error = some Set-point
- Vel = Velocity of the flying head: UP = +, Down = –
  Velocity is calculated using the average of current plus previous 4 HC positions minus the average of the 10 previous HC positions divided by 0.0550 seconds ($5*T_s$). The value is converted to inches/second. HC total travel is 48 inches. Subtract 24 inches to make 0 at the center of the stroke. Multiply times 37.7 (rod end area) to get flow ($inch^3$/second). The output labeled VEL is actually Flow.

If the "Joystick is Inactive" then there is no movement from the winch

If the "Joystick is Active" then it goes into the DHT_Mode
}End ROV_T_Mode
}End_Station_Keeping_Mode

b. Bottom Keeping: The Bottom Keeping function provided by the FTHE provides a proportional interface between the FTHE Heave Comp and the ROV Heave Comp for landing purposes. The ROV heave comp is a cylinder that has an allowed travel of 22 inches (±11 inches from the center position). The FTHE, once placed in the Bottom Keeping mode, will pay out cable through movement of its HC if the ROV heave compensator is raised above the center position and will reel in cable if the ROV heave compensator is below center. The only feedback used in the position maintaining mode is the position of the ROV heave compensator and the FHTE adjusts its heave compensator to compensate for sea conditions while maintaining a center on the ROV heave compensator. There is no indication on the FTHE of movement out of band similar to that used on the tactical equipment (i.e., the tactical equipment changes colors of its display to indicate safety bands, finally turning red when the ROV heave comp is at its maximum safe travel band.) The Bottom Keeping display has dual color bands that are used to mark the position

of the center pointer. On the FTHE display, the color is white above the position pointer and red below.

c. Ordered Altitude: The ordered altitude function is provided by the FTHE through the I/O adapter network interface. The operator at the ROV consolette can change the ordered altitude of the vehicle (once the FTHE is in Active, ROV Altitude mode) by turning the dial on the ROV consolette. The I/O adapter uses two signal lines that toggle between 0 and 10 volts, depending on the sense of the signal coming from the consolette.

4.3.2 Theory of Operation - Hydraulics

4.3.3 Umbilical Winch System

The Umbilical Winch System is comprised of the following hydraulic system circuits:

- Umbilical Winch Closed-Loop Circuit
- Levelwind/Auxiliary Open-Loop Circuit

There are two identical and redundant power units (HPU #1 and HPU #2) installed on the same hydraulic power unit (HPU). Each power unit consists of a 125 HP electric motor (EM-101 and EM-102) driving a closed-loop hydrostatic transmission for umbilical winch (HP-1A & HP-2A) and an open-loop pressure compensated pump (HP-1B & HP-2B) for the levelwind and auxiliary equipment including the A-Frame, Docking Head, and Cursor Assemblies.

4.3.3.1 Umbilical Winch Drive

The winch drum is direct driven on one end by a drive assembly consisting of a Haaglunds hydraulic motor (HM-101). The HPU has 2 electric motor/pump strings (HP-101A, HP-102A) with Sauer-Danfoss closed loop hydrostatic transmission which powers the umbilical winch hydraulic motor. They can be configured to operate independently or together, for increased line speed. Although the FTHE can be successfully operated with only one winch pump unit, maximum system performance is achieved when both power units are online.

4.3.3.2 Levelwind/Auxiliary Drives

The 2nd pump string is a Rexroth pressure compensated open-loop pump (HP-101B, HP-102B) that provides power to Electro-Active Levelwind motor/gearbox (HM-102, GB-102).

4.3.3.3 Umbilical Winch Hydraulic System Circuits

The Umbilical Winch Hydraulic System consists of two hydraulic circuits:

- Umbilical Winch Closed-Loop Circuit
- Levelwind/Auxiliary A-Frame Open-Loop Circuit

4.3.3.3.1 Umbilical Winch Closed-Loop Circuit

4.3.3.3.1.1 Umbilical Winch – Manual Mode

Oil is drawn from the HPU Reservoir through a suction strainer (ST-101 or ST-102) and into the selected closed-loop pump (HP-101A or HP-102A). Hydraulic oil enters a charge pump integral to the closed-loop pump. The charge pump supplies hydraulic oil for the entire umbilical winch circuit at a nominal 340 psi. Charge pressure for the umbilical winch closed-loop pump may be read from a system pressure gauge (PG-106 and PG-107 or PG-114 and PG-109).

The winch has two toggle switch selectable modes of operation: Normal and Constant Tension. Constant Tension mode is employed during launch and recovery procedures for providing constant umbilical tension load range between 5,000 – 8,000 lbs (to prevent slack cable).

Open-Loop pumps (HP-101C & HP-102C) are also inline to closed loop pumps in pump string and consist of a Rexroth gear pump that provides power to flush the winch drive motor case. Case Flush to the Umbilical Winch Motor (HM-101) is passed from the Supply Tank through a supply filter (FL-101) heated by Heat Exchanger (HX-103).

4.3.3.3.1.1.1 Umbilical Winch Haul-In Circuit (A-Port)

When the umbilical winch joystick is placed in the Haul-In position, the swash-plate angles to provide flow and pressure to the "A" side of the pump to the Haul-In side of the umbilical winch motor (HM-101). Return flow from the motor is fed back to the "B" side of the pump. Return flow is directed to a return header (HDR-102) and proceeds to a heat exchanger (HX-101) through a return filter (FL-104) and back to the Supply Tank.

4.3.3.3.1.1.2 Umbilical Winch Pay-Out Circuit (B-Port)

By placing the Umbilical Winch joystick to the Pay-Out position, the swash-plate angles to provide flow and pressure from B-Port to Pay-Out side of Umbilical Winch Motor (HM-101).

When the umbilical winch joystick is moved to the Haul-In or Pay-Out position, a solenoid valve (S31-2, **SOV-102** for BK-102) (S31-3, **SOV-103** for BK-101) is energized, receiving reduced hydraulic oil pressure from pressure reducing valve (PBDB-2 for BK-102) (PBDB-3 for BK-101). Hydraulic oil continues through a Fixed Orifice (FOR-108 for BK-102) and releases the umbilical winch brakes (BK-101 and BK-102). Winch brakes require 2465 psig to fully release.

4.3.3.3.2 Levelwind/Auxiliary A-Frame Assembly Open-Loop Circuit

4.3.3.3.2.1 Levelwind Open-Loop Circuit

Hydraulic pressure and flow are directed from pump (HP-101B or HP-102B) through a start-up valve (SUV-101 or SUV-102) to Electro-Active Levelwind Motor (HM-102) that will turn in either CW or CCW direction depending on signal received by LW servo valve (SVV-101). Check valves CV-1 and CV-2 isolate flow from the selected pump string HP-101B or HP-102B from each other.

Return flow from SVV-101 proceeds to the Open Loop Return Header (HDR-102), heat exchanger (HX-101), return filter (FL-104), and then to the Supply Tank. The levelwind pump case returns flow to Open Loop Zero Pressure Return Header (HDR-101) and then to tank. Zero Pressure Return flow is directed to Zero Return Header (HDR-101) and back to the Supply Tank.

4.3.3.3.2.2 Auxiliary A-Frame/Docking Head/Cursor Assemblies Circuits

Hydraulic pressure from the auxiliary pump (HP-101B or HP-102B) is directed to the manifold (MAN-101) and from there to the A-Frame Assembly circuit. Check valves CV-3 and CV-4 isolate flow from the selected pump string HP-101B or HP-102B from each other.

Return flow is directed to the Return Header (HDR-102) and from there is directed through the heat exchanger (HX-101) and return filter (FL-104) before returning to the supply tank. Zero Pressure Return flow is directed to Zero Return Header (HDR-101) and back to the Supply Tank.

Primary hydraulic pressure and flow is directed to the directional control valve bank (DCV-1) which has separate sections controlling A-Frame luffing, cursor winches Pay-Out/Haul-In, docking head latch, and docking head swing functions.

4.3.3.3.2.2.1 Luffing

Luffing of the A-Frame Assembly is provided by actuating hydraulic cylinders (CYL-11 and CYL-12). Counterbalance valves (CBV-3 and CBV-4) maintain hydraulic back pressure for the open-loop circuit in the A-Frame cylinders to prevent inadvertent movement when hydraulic power is lost or the DCV joystick is returned to neutral.

4.3.3.3.2.2.2 Latching

Latching of the Docking Head Assembly is provided by extending or retracting the hydraulic cylinders (CYL-7, CYL-8, CYL9, and CYL-10) by moving the Manual DCV Station joystick to the Latch or Unlatch position as required.

WARNING

POSSIBLE PERSONAL INJURY OR EQUIPMENT DAMAGE! Needle valve (NV-2) is open during shipping but must be closed and locked during FTHE operations to ensure that swing frame is free to swing fore and aft. Ensure needle valve (NV-2) is closed and locked during FTHE operations.

4.3.3.3.2.2.3 Swing

Swing frame function of the Docking Head Assembly is actuated by hydraulic cylinders (CYL-3, CYL-4, CYL-5, and CYL-6). A needle valve (NV-2) regulates hydraulic oil flow to control the rate of fore and aft movement dampening of the Docking Head Swing Frame Assembly. Turn the valve CCW to open and increase the rate of speed of fore and aft movement. Turn the valve CW to close and decrease the rate of speed of fore and aft movement. NV-2 is open for shipping but must be closed and locked for FTHE operations. The dual counterbalance valve (CBV-2) prevents inadvertent movement when hydraulic power is lost or the Manual DCV Station joystick is returned to neutral.

4.3.3.3.2.2.4 Cursor Winch

Cursor winch Pay Out and Haul In is actuated by the movement of the directional control valve handle in the appropriate direction.

4.3.4 Heave Compensator

The piston ends of the compensating hydraulic cylinders (CYL-13 and CYL-14) (actuated by opening ball valves [BV-9 and BV-11]) are plumbed to two piston-type nitrogen charged accumulators (ACC-1 and ACC-2). Gas line connections from the Bottle Rack are made at the hydraulic header (HDR-11). Opening the ball valves (BV-12, BV-13, BV-15, and BV-16) allows the gas from the nitrogen bottles to flow to the accumulators to form a hydraulic spring.

The nitrogen accumulators are precharged and, along with the hydraulic oil, provide a closed-loop internal system during umbilical cable tensioning operations. The accumulators are supplied with 48" long integral transducers (TD-2 and TD-3) that can determine the position of the hydraulic pistons using a moving magnet. A pressure transducer (PX-2) is installed at HDR-11 to indicate the hydraulic oil pressure at that point. These pressure signals are then sent to the

Control Van for use by the computer when it has control of system operations. Pressure in the accumulators is monitored on deck by pressure gauge (PG-11).

4.3.4.1 Compressor/Intensifier System

An electric motor (EM4) driven air-cooled compressor (COMP-1) which functions as the compressor/intensifier unit for the nitrogen gas system (Figure 2-6) is provided to transfer the nitrogen between the supply bottles and the receiver bottles. The circuit takes gas from the supply bottles (GB-8 thru GB-16) through the low pressure header (HDR-20), pumps the gas to the high pressure receiver bottles and the heave compensator accumulators.

This gas is reclaimed by reversing the flow direction from the high pressure bottles (GB-3 thru GB-7) back to the supply bottles. Mode dependent, pressure is manually or automatically raised or lowered by solenoid valves (SOVs): SOV-14 and SOV-16 raise pressure, while SOV-13 and SOV-15 lower pressure. Pressure is sensed by a low pressure switch (PSH-7) and a high pressure switch (PSH-8) and is limited by the pressure switch settings.

The storage bottle circuit is connected to the accumulator system hydraulic reservoir charging system. The tank is charged by opening ball valve BV-18 and BV-TF. Pressure in this circuit is limited to 5 psi at pressure reducing valve (PR-1).

4.3.4.1.1 Bottle Rack

A separate Bottle Rack with both high pressure and low pressure nitrogen bottles is mounted on top of and within the HC. The storage bottles provide a means of nitrogen supply to the compressor/intensifier when increased pressure is required in the receiver bottles to accommodate the accumulator requirements. When the increased pressure is no longer needed, the high pressure nitrogen in the receiver bottles is recovered by reversing the nitrogen flow through high pressure header (HDR-21), the compressor, and returning the nitrogen back to the supply bottles through low pressure header (HDR-20). Direction of flow is controlled by a pair of electrically controlled valves.

4.3.5 Theory of Operation – Electrical

4.3.5.1 Levelwind Circuit Theory

The Levelwind circuitry consists of:

- Electro-Active Levelwind Control PC Board (PCB102) (DD DYN-9600-01)
- Electro-Active Levelwind Sensor XS107 (DD 1088-2003-01, Item 14)
- Two Levelwind EOT Sensors (Right = XS109, Left = XS110)
- Levelwind Servo Valve (SVV-101) (DD 1088-8211-01 and Figure 7-1)

Amplifier (U) 1A level-shifts the input signal to zero VDC at test point (TP) A. With the levelwind sensor magnet removed and no flux signal present, the Zero potentiometer, resistor R4 is adjusted to indicate 0 VDC at TP-A.

When an error signal is present at TP-A, the output of U1B will swing to +12 VDC. This signal is clamped to 4.0 VDC and a part of this signal is added to the error signal at U1C to reduce the deadband in the hydraulic servo control. The amount of deadband reduction is controlled by R30. Turning R30 CW increases the amount of deadband. In general, the closer the levelwind carriage assembly is to the winch drum, the less deadband can be tolerated. The amount of time the levelwind has to react to a fleet angle is reduced with distance and the system must respond faster by reducing deadband effects.

Overall gain is controlled by a fixed resistor R14 and potentiometer R13. Turning R13 CCW will increase the gain of amplifier U1C. The final adjustment of R13 will depend on the characteristics of the overall system. Transistors (Q1 and Q2) are current boost transistors for the output amplifier. Diodes (D3 through D8) and resistors (R16 and R17) form a current limiting circuit and are preset according to the servo valve coil requirements. PCB102 is preset to a current limit of 100 mA.

Relay K110 is energized by an external signal to enable the drive signal to the servo valve. This feature prevents the levelwind drive assembly from "hunting" when the winch drum is not in motion.

The Left and Right toggle switch located on the LW Control Panel (Figure 4-3) energize relays K113 (left) and K112 (right) respectively, to inject a signal to the servo valve for manual positioning. The relays override the PCB102 signal. Potentiometer R19 and R21 determine the rate of manual movement of the levelwind carriage assembly. These can be set by the operator.

The left and right EOT sensors energize relays K114 (right) and K115 (left). These sensors are located so they are energized when the levelwind carriage assembly reaches its maximum travel. The levelwind carriage assembly should stop when the umbilical cable is one cable diameter's width from the winch drum flange. This allows the umbilical cable to wrap all the way to the flange but keeps the cable from stacking up.

Resistors R22 and R24 provide an opposite polarity signal when the levelwind carriage assembly is driven to its maximum travel. R22 and R24 provide minimal movement away from the flange when either of the EOT sensors is encountered.

The EOT sensors are proximity sensor devices that respond to the presence of ferrous metal within the target sensor range (approximately 0.5 inches). If the cable is not wrapping close enough to the flange, the round rods (targets) (DD 1088-2005-01, Item 8) that pass in front of the levelwind EOT sensors can be moved out to allow the levelwind carriage assembly to move closer to the winch drum flange. Conversely, they can be moved in to allow the levelwind carriage assembly to stop sooner. The EOT sensors also prevent the levelwind carriage assembly from manually being moved beyond the normal travel range.

The levelwind sensor (XS107) (DD 1088-2003-01, Item 14) is a solid-state sensor that measures the fleet angle of the umbilical cable between the LW Assembly and the Umbilical Winch Assembly. When the umbilical cable is paid out (or hauled in), as the angle of the umbilical cable increases and comes in contact with the levelwind guide finger, the levelwind sensor sends an error signal to PCB102 for processing.

The levelwind servo valve receives the error signal from PCB102 and sends it to the levelwind motor HM-102 (DD 1088-2005-01, Item 23) which operates the levelwind drive ACME screw (Item 11). The levelwind carriage assembly is then driven appropriately to provide the proper angle and ensure the umbilical cable has good, tight wraps on the winch drum.

4.3.5.2 Electric Motor Control

NOTE

Refer to DD 1088-9001-02, HPU High Voltage Enclosure Electrical Diagram and Figure 7-5.

The Siemens Power Monitor (PM101) is installed to prevent startup if incoming voltage is low, phase reversed, or phase imbalanced due to loss of a leg.

The Siemens reduced voltage inline magnetic Motor Starters (MS101 and MS102) are used in conjunction with two magnetic contactors. One contactor is equipped with an overload relay and provides motor protection.

The second magnetic contactors (CT101 and CT102) are not equipped with an overload relay. Their primary purpose is to bypass the soft start Silicon Controlled Rectifiers (SCRs) after the electric motor is running. This feature reduces heat generated by the soft start. All logic and timing functions for this are provided by the soft start.

The bypass contactors and the inline contactors are International Electrotechnical Commission (IEC) rated for full system horsepower. The inline contactors could be used to start the electric motor should the soft start fail. In order to do this, pull in bypass contactors by using the emergency #1 Bypass and #2 Bypass switches, located inside the HPU High Voltage Enclosure.

4.3.5.3 Computer Control Engaged Indicator Lamp (LT22)

The Computer Control Engaged indicator lamp (Figure 4-23, Item 10) is illuminated when motion compensation software is controlling the action of the HC Assembly.

The sequence required for this lamp to illuminate follows:

a. Move the Computer Control toggle switch (Figure 4-23, Item 8) to the Enabled position.
b. The Computer Control Enabled indicator lamp (Figure 4-23, Item 9) will illuminate sending a signal to the motion control software. The software will begin to position the primary HC accumulators and cylinders for mid-stroke. Additionally, the Preparing Active Control LED illuminates. This LED is located in the bottom left-hand corner of the CPU user screen.
c. Once positioning is completed, the computer takes over and the Computer Control Engaged indicator lamp on the Control Van Panel illuminates. Also, observe that the Computer Control Engaged LED in the bottom left-hand corner of the CPU user screen illuminates.
d. Note that neither lamp on the Control Van Panel (and neither LED on the CPU user screen) is illuminated when the Control Van Panel Computer Control toggle switch is moved to the Disable position.

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5.0 CHAPTER 5 - SCHEDULED MAINTENANCE

5.1 INTRODUCTION

This chapter describes the general and scheduled maintenance procedures required to ensure optimum performance of the FTHE. It also provides the recommended lubricants and the surface and painting preparations.

5.1.1 Scheduled Maintenance Instructions and Schedules

Scheduled maintenance is a routine maintenance performed on various equipment according to best engineering practices and past experience to provide a long life for the equipment as well as to help prevent breakdowns during operational schedules. A list of the scheduled maintenance activities, their frequency, and where to find the appropriate procedure is provided in Table 5-1.

It should be noted that unless otherwise indicated, all scheduled maintenance is performed after the equipment has been secured.

WARNING

POSSIBLE DEATH, INJURY, OR EQUPEMENT DAMAGE may result if performing scheduled maintenance on energized, pressurized, or moving machinery. Ensure the FTHE is de-energized and secured prior to performing any scheduled maintenance.

Table 5-1 Scheduled Maintenance List

EQUIPMENT/ITEM	ACTIVITY	FREQUENCY	PROCEDURE
UMBILICAL WINCH ASSEMBLY			
General Hydraulic Leaks	Inspect	Daily	5.1.2.1
Inspect Deck Bolts for Tightness and Base Frame Weldment	Inspect	Weekly	5.1.2.2
Grease Bearings, Turning Sheaves, Brakes, Bearing Housings	Inspect and Lubricate	Monthly	5.1.2.3
Check Accumulator Pressure	Inspect	Monthly	5.1.3.1
Hydraulic Oil Filter Element (Head/Bowl Model)	Replace	At Mobilization	5.1.3.3.1
Check Brake Disk Pads	Inspect	Monthly	5.1.4.1.1

Table 5-1 Scheduled Maintenance List - *continued*

EQUIPMENT/ITEM	ACTIVITY	FREQUENCY	PROCEDURE
LEVELWIND ASSEMBLY			
General Hydraulic Leaks	Inspect	Daily	5.1.2.1
Gear Box Oil Level	Inspect	Daily	5.1.3.1
Guide Bars	Inspect and Lubricate	Weekly	5.1.4.2.1
ACME Screw	Inspect and Lubricate	Weekly	5.1.4.2.2
ACME Nut	Inspect for Wear	Monthly	5.1.4.2.3
Sheave Bearings	Lubricate	Weekly	5.1.2.3
Sheave Pivot Pin	Lubricate	Weekly	5.1.2.3
ACME Screw Support Bearing	Lubricate	Monthly	5.1.2.3
Guide Fingers	Inspect for Wear	Monthly	5.1.4.2.4
Frame Weldment and Bolts	Inspect for Tightness	Monthly	5.1.2.2
Hydraulic Oil Filter Element (Head/Bowl Model)	Replace	At Mobilization	5.1.3.3.1
HPU ASSEMBLY			
General Hydraulic Leaks	Inspect	Daily	5.1.2.1
Hydraulic Oil Supply Tank	Inspect Level	Daily	5.1.3.2
Heat Exchanger Strainer	Inspect and Clean	Daily	5.1.4.3.1.1
Hydraulic Oil	Test Quality	At Mobilization, At Demobilization	5.1.3.3.3
Hydraulic Oil	Filter	As Required	5.1.4.3.2
Hydraulic Oil Filter Element (Head/Bowl Model)	Replace	At Mobilization	5.1.3.3.1
Hydraulic Oil Filter Element (Spin-On Model)	Replace	At Mobilization	5.1.3.3.2
Base Frame Weldment and Deck Plate Bolts	Inspect for Tightness	Monthly	5.1.2.2
HC ASSEMBLY			
General Hydraulic Leaks	Inspect	Daily	5.1.2.1
Hydraulic Oil Supply Tank	Inspect Level	Daily	5.1.3.2
Heat Exchanger Strainer	Inspect and Clean	Daily	5.1.4.4.1.1
Hydraulic Oil	Test Quality	At Mobilization, At Demobilization	5.1.3.3.3
Hydraulic Oil	Filter	As Required	5.1.4.4.5
Hydraulic Oil Filter Element (Head/Bowl Model)	Replace	At Mobilization	5.1.3.3.1
Hydraulic Oil Filter Element (Spin-On Model)	Replace	At Mobilization	5.1.3.3.2
Base Frame Weldment and Deck Plate Bolts	Inspect for Tightness	Monthly	5.1.2.2
SHEAVE ASSEMBLIES			
Sheave Axles	Lubricate	Weekly	5.1.2.3

Table 5-1 Scheduled Maintenance List - *continued*

EQUIPMENT/ITEM	ACTIVITY	FREQUENCY	PROCEDURE
CYLINDERS			
Exposed Cylinder Rods	Lubricate	Weekly	5.1.4.4.2
Upper and Lower Support Bolts	Inspect for Tightness	Monthly	5.1.4.4.3
ACCUMULATORS AND NITROGEN CYLINDERS			
Gas Fittings and Flow lines	Inspect for leaks	Daily	5.1.3.3.4
COMPRESSOR/INTENSIFIER			
Lube Oil	Inspect Level and Add As Required	Daily	5.1.4.4.4.1
Lube Oil	Change	At mobilization or annually	5.1.4.4.4.2
Oil Pump Drive V-Belt	Inspect	1000 Hrs.	5.1.4.4.4.3
Cylinder Head Valves	Inspect Operation	½ Hour After Startup	5.1.4.4.4.4
Cylinder Head Valves	Dismantle, Clean, Check, and Replace As Required	750 – 800 Hrs.	5.1.4.4.4.5
Cylinder Head Valves	Replace	2000 Hrs.	5.1.4.4.4.6
Mounting Bolts	Inspect for Tightness	Monthly	5.1.4.4.4.7
A-FRAME AND DOCKING HEAD GENERAL ASSEMBLIES			
A-FRAME AND SHEAVE ASSEMBLIES			
General Hydraulic Leaks	Inspect	Daily	5.1.2.1
Sheave Axles	Lubricate	Weekly	5.1.2.3
A-Frame Leg Pivot Pins	Lubricate	Weekly	5.1.2.3
Base Frame Weldment and Deck Plate Bolts	Inspect for Tightness	Monthly	5.1.2.2
Hydraulic Oil Filter Element (Head/Bowl Model)	Replace	At Mobilization	5.1.3.3.1
OPERATOR CONTROL STATION - LOCAL			
PEDESTAL	**PEDESTAL**	**PEDESTAL**	**PEDESTAL**
LCI-90R Display	Clean	AR	5.1.4.5.1.1
OPERATOR CONTROL STATION – REMOTE			
ELECTRONICS CABINET			
MONITOR			
Screen	Clean	As Required	5.1.4.6.1.1.1
Filter	Clean	Monthly	5.1.4.6.1.1.2
CONTROL VAN PANEL			
LCI-90 Display	Clean	As Required	5.1.4.6.1.2.1
COMPUTER			
Filter	Clean	At Mobilization	5.1.4.6.1.3.1

Table 5-1 Scheduled Maintenance List - *continued*

EQUIPMENT/ITEM	ACTIVITY	FREQUENCY	PROCEDURE
KEYBOARD TRAY			
Keyboard	Clean	At Mobilization	5.1.4.6.1.4.1
VME ENCLOSURE			
Air Louvers	Clean	At Mobilization	5.1.4.6.1.5.1
UPS			
Batteries	Replace	As Required	5.1.4.6.1.6.1
Batteries	Charge	Quarterly	10.5.2.4.1.1.1

5.1.2 General Maintenance Procedures

General maintenance procedures for the FTHE system are described in the following paragraphs. Unless otherwise stated, all scheduled maintenance is done when the FTHE system is secured.

5.1.2.1 Inspect For General Hydraulic Leaks

To inspect for general hydraulic leaks, perform the following steps:

a. Inspect the base of all assemblies for the collection of hydraulic oil.
b. Inspect all hydraulic connections paying particular attention to hose fittings looking for obvious leaks. Tighten appropriately.
c. Inspect along the length of the flow lines for any bulges that would indicate a layer has become weakened and is about to rupture or for any worn areas on hoses.
d. Investigate any areas that look wet which may indicate a leak has begun. Most fittings are wrapped with denzel tape. Look for moist or dirty tape.
e. Make appropriate repairs as required.
f. Wipe up all oil spills and dispose of oil or grease contaminated rags in accordance with local procedures.

5.1.2.2 Inspect Base Frame Weldment and Deck Plate Bolts

The base frame weldments could crack and the deck plate bolts could become loose over time due to normal ship vibrations. To inspect the base frame weldment and the deck plate bolts for correct torque requirements, perform the following steps:

a. Visually inspect the base frame weldments for cracks and notify the Deck Leader if any are discovered.
b. To check the deck plate bolts for tightness, obtain the proper tools including a calibrated torque wrench
c. Ensure the deck plate bolts for each major FTHE assembly are properly tightened by torqueing to values listed in Table 9-3.

5.1.2.3 Grease Fittings

Grease fittings (Zerk) are installed for those bearings which require periodic lubrication. Periodic greasing removes dirt, dust, splash water, condensation, and other contaminants. Grease packing seals the bearing, reduces friction, and protects against corrosion. A complete list of all FTHE

grease fittings requiring lubrication is provided in Table 5-2 and a list of recommended lubricants is provided in Table 5-3. To apply grease to a grease fitting using a grease gun, perform the following steps:

a. Obtain the grease gun and ensure it is loaded with a cartridge of appropriate grease (Table 5-3, Item 1).
b. Locate the grease fitting to be lubricated.
c. Remove the grease fitting cap and with a clean rag, wipe off any dirt or other foreign accumulations.
d. Attach the grease gun nozzle to the grease fitting and pump the grease gun until grease is observed extruding from the axle or joint being greased.
e. Remove grease gun nozzle and wipe grease fitting with a clean rag to remove any new grease that may have squeezed out of the nozzle/fitting union.
f. Inspect grease fitting cap for damage and replace if worn or missing.
g. Wipe up any dirt/grease that gets pushed out from the subject axle or joint using a clean rag as required.
h. Return the grease gun to its storage space and dispose of grease contaminated rag in accordance with local procedures.

Table 5-2 FTHE Lubrication Chart

EQUIPMENT	SUBASSEMBLY	LOCATION	FITTINGS (NUMBER OF)
A-Frame	Leg (Starboard)	Pivot Pin (Stbd. Face)	1
	Leg (Port)	Pivot Pin (Port Face)	1
	Cylinder (Starboard)	Pin Face (Upper and Lower)	2
	Cylinder (Port)	Pin Face (Upper and Lower)	2
Docking Head	Latch Pins	Latch Pivot Pin (Side)	4
	Swing Pins (Starboard)	Swing Pin (Side)	1
	Swing Pins (Port)	Latch Pivot Pin (Side)	1
	Load Pin	Connector Side	1
	Cylinder 3	Outside edge on pivot point (Top and bottom)	2

Table 5-2 FTHE Lubrication Chart - *continued*

EQUIPMENT	SUBASSEMBLY	LOCATION	FITTINGS (NUMBER OF)
Docking Head (Continued)	Cylinder 4	Outside edge on pivot point (Top and bottom)	2
	Cylinder 5	Outside edge on pivot point (Top and bottom)	2
	Cylinder 6	Outside edge on pivot point (Top and bottom)	2
	Swing Pin (Center)	Face of Pin (Port and Stbd.)	2
	Cushion Ring	Pins (Side of each can)	4
Cursor	Attachment Arms	At end of arms	2
HC	Electric Motor	Motor Bearing (Fwd. and Aft)	2
	Sheave Bearings (Lower)	Support Structure (Behind Sheaves)	5
	Compressor Motor	Motor Bearing (Port and Stbd.)	2
Levelwind	ACME Screw	Bearing Housing (Drive End)	2
		Bearing Housing and Bearing Cap Cover (Bearing End)	2
	ACME Screw	External Surface	NA
	Guide Bars	External Surface	NA
	Sheave Bearings	LW Carriage	1
Winch	Axle Bearings (Drum)	Axle Bearings (Fwd. and Aft)	2
HPU	Electric Motor #1	Motor Bearing (Fwd. and Aft)	2
	Electric Motor #2	Motor Bearing (Fwd. and Aft)	2

5.1.3 Recommended Lubricants

The recommended lubricants for the FTHE are listed in Table 5-3.

Table 5-3 FTHE System Recommended Lubricants

ITEM	LUBRICANT	TYPE	USE
1	Grease	Mystik JT-6 or Equivalent (MIL-G-81322D)	Grease Fittings/Guide Bars
2	Hydraulic Fluid	Chevron Rando, ISO VG-68	Hydraulic Fluid
3	Gear Oil	Royal Purple, Max Gear High Performance Gear Oil, 80W90 (PN 05302) or Equivalent	Gearbox
			Compressor/Intensifier
4	Silicone Grease	Dow Corning MS4	O-Rings, Sealing Rings Olive of Pipe Connectors
5	Lithium Grease	Alvania R3	Metallic Components
6	Anti-Seize Lubricant	Nev-Sz NMBT-16	Pipe Connector Threads
7	Lube Oil	Mobil Delvac 1230, 30W or Equivalent	Compressor
8	Lithium Grease	Chevron Delo Grease EP	Filter Head Threads
9	Lubricating Oil	Nuvair 751	Compressor Valves
10	Molykote P 37 Paste	Antiseize Paste	FTHE Assy Mounting Bolts

5.1.3.1 Check Accumulators Pressure

For proper winch operations, the accumulators need to be precharged:

ACC-102 to 600 psi and ACC-103 to 700 psi

To check accumulator pressure, perform the following steps:

CAUTION

Check that there is no pressure on the oil side prior to checking nitrogen charge pressure.

a. Turn the valve control knob counterclockwise until it is fully disengaged and install it on the accumulator.
b. Close the nitrogen discharge valve and turn the “AR” valve knob clockwise until the pressure gauge signals that there is no internal pressure left of the knob is fully turned clockwise in the event that the accumulator is fully discharge.
c. Once the nitrogen pressure has been checked, slowly unscrew the discharge valve until the pressure starts decreasing. Once the desired nitrogen pressure is reached, fully unscrew the control valve knob, and open the nitrogen discharge valve to eliminate any residual pressure and then unscrew the “AR” valve from the accumulator.
d. Re-install the nitrogen valve protective cap on accumulator and ensure it is tightly secured.

5.1.3.2 Inspect Hydraulic Oil Supply Tank Level

To inspect the hydraulic oil supply tank level, perform the following steps:

a. Visually inspect the level gauge on the hydraulic oil supply tank.
b. If the level indicates the tank is approximately 2/3 full (or the same level as initial mobilization) then the level is satisfactory.
c. If the level indicates a decrease from that of the previous day, suspect a leak in the system and begin an investigation. Repair as required.

5.1.3.3 Filters

This paragraph provides the general instructions for replacing hydraulic oil filters. A complete list of all FTHE filter elements requiring replacement is given in Table 5-4.

Table 5-4 FTHE Filter Elements

EQUIPMENT	FILTER	PART NUM	TYPE	QUANTITY
HPU	FL-103	0330D010BH4HC	MANF Mnt	1
	FL-104	LE-10	Spin-On	2
	FL-105, FL-106, FL-107, FL-108	0240D010BH4HC	Head/Bowl	4
Winch	FL-109 & FL-110	066010BH4HC	Head/Bowl	2
Levelwind	FL-111	P167186	Head/Bowl	1
A-Frame	FL-11	P167174	Head/Bowl	1
HC	FL-12	LE-10	Spin-On	1
	FL-13	P165041	Head/Bowl	1
HC (Full-Filter Flow)	FL-14	DFBHHC660F5D1.1 HD08-DFBHHC660F	NAAP	1
Compressor/Intensifier (Nitrogen System)	FL-15, FL-16	715-10WE (Element) 910N O-Ring/Element 920N O-Ring/Case Plug	Straight, In-Line	2 2 2

5.1.3.3.1 Filter Replacement – Head/Bowl

The head/bowl filter (Table 5-4) is comprised of a filter element contained within the bowl (canister). To replace a head/bowl filter element, perform the following steps:

NOTE

It is strongly suggested that oil filters be replaced at least several hours after the equipment has been secured and the oil has had a chance to cool.

NOTE

It may be advantageous for two people to work in tandem when replacing filter elements due to their accessibility/mounting locations.

a. Obtain absorbent rags, new filter element, and tools prior to replacing oil filter.

b. If possible, place a 5-gallon bucket under the filter.
c. Loosen and remove the bowl drain plug and allow the oil to drain into the bucket.
d. When the oil is finished draining, replace the drain plug and tighten.
e. Remove the filter bowl using a strap wrench and a wrench on that part of the bowl just above the drain plug.
f. Remove the filter element from the filter head.
g. Inspect the filter head O-Ring and replace as required.
h. Apply slight pressure and install the replacement filter element onto the filter head.
i. Slide the bowl over the filter element and screw onto filter head tightening with a strap wrench.
j. Wipe up any oil spills with a rag.
k. Dispose of used filter element, contaminated rag, and excess oil in accordance with local procedures.

5.1.3.3.2 Filter Replacement – Spin-On

The spin-on filter (Table 5-4) is a canister and filter element combined. To replace a spin-on filter, perform the following steps:

NOTE

It is strongly suggested that oil filters be replaced at least several hours after the equipment has been secured and the oil has had a chance to cool.

NOTE

It may be advantageous for two people to work in tandem when replacing filter elements due to their accessibility/mounting locations.

a. Have a helper hold a 5-gallon bucket under the filter to be changed.
b. Loosen the filter with a strap wrench and remove filter.
c. Apply a light coating of oil on the new filter element gasket and place on filter.
d. Screw filter element to filter head until just snug, and then turn filter element ½-turn more.
e. Wipe up any oil spills with a rag.
f. Dispose of used filter element, contaminated rag, and excess oil in accordance with local procedures.

5.1.3.3.3 Filter Cleaning/Replacement – Straight In-Line

The 303 SS case/case plug straight in-line filter (Table 5-4) uses a 304 SS element of precision-pleated, re-cleanable, woven wire filtering at the 10 micron level. The filter element life is based upon cleaning cycles and pressure drop. The estimated life of the element is 10 to 14 cleaning cycles. If the element has exceeded this level, discard and replace. To clean the filter element, perform the following steps:

WARNING

DANGER TO PERSONNEL AND POSSIBLE EQUIPMENT DAMAGE! Nitrogen filters can be under tremendous pressure. Servicing a filter assembly before relieving all pressure could be injurious to the individual and possibly cause equipment damage. Relieve all pressure in the nitrogen line before servicing filter assembly. Follow all company and OSHA safety rules, such as wearing protective goggles and gloves when working around high pressure system.

a. Disconnect the filter assembly from the system.
b. Unscrew the plug from the case.
c. Discard the plug seal.
d. Unscrew the filter element from the plug.
e. Discard the element seal.

NOTE

Normally maintenance consists of cleaning the filter element and replacing the two O-Rings. If the system pressure has dropped or the filter element has been cleaned between 10 and fourteen cycles, discard the filter element along with the two O-Rings and replace all three items.

NOTE

The manufacturer recommends acetone or mineral spirits to be used as the cleaning agent and then using isopropyl alcohol to remove the last remnants of the cleaning agent.

f. When cleaning the stainless steel elements, remove external dirt in a separate container with cleaning fluid and a light brush.
g. Submerge the filter for 30 minutes in cleaning fluid.

WARNING

DANGER TO PERSONNEL AND POSSIBLE EQUIPMENT DAMAGE! Wear safety goggles for personal protection and do not exceed 120 psig when cleaning the filter element. Debris could be inadvertently blown into the eye and/or the filter element damaged due to the high pressure.

h. After the soaking, purge the filter element from inside to outside with clean compressed air or similar clean rags. Remove any remaining cleaning solution by dipping the filter in isopropyl alcohol or drying appropriately.

NOTE

The manufacturer recommends halo-carbon grease and Krytox be used as lubricating agents although other acceptable lubricants include petroleum jelly or silicone. Caution should be used when using dry lubricants due to the fact that our threads are single point, precision threads and dry lubricants can disrupt clearances.

i. Lubricate a new case plug O-Ring and install it on the case plug.
j. Lubricate a new filter element O-Ring and install it on the filter element.
k. Lubricate the filter element and corresponding case plug threads.
l. Thread the filter element into the case plug and torque to 5 ft-lbs.
m. Lubricate the threads of the case and plug.
n. Thread the plug into the case and torque to 12 ft-lbs.
o. Reinstall the filter in the nitrogen system and lubricate the inlet and outlet threads.
p. Check for leaks using a bottle of leak detector at the filter connections while the nitrogen system is being re-pressurized and again several times until the pressure reaches normal operating pressure.

5.1.3.3.4 Test Hydraulic Oil Quality

The quality of hydraulic oil is important for trouble-free operation and longevity of the FTHE and therefore must be sampled prior to mobilization. To take an oil sample, perform the following steps:

a. Ensure the HPU Assembly and the HC Assembly have been running long enough to reach normal operating temperature.
b. Obtain two oil sample kits, one for each assembly, and follow the oil sampling kit instructions completely.
c. Clean the discharge valve at the bottom of the HPU Assembly supply tank so no dirt drops into the sample jar.
d. Discharge approximately 1 quart of oil into a 1 gallon bucket. This helps to avoid collecting localized sediment in the actual oil sample to be taken.

WARNING

POSSIBLE BURNS! The oil is hot and can cause burns if allowed to come in contact with bare skin. Use caution when taking an oil sample not to get hot oil on your skin or clothing.

e. Remove the oil sample jar cover and carefully set it aside so it does not become contaminated.
f. Place the jar under the discharge valve and crack the valve long enough to fill the jar.
g. Immediately return the cover to the jar and tighten securely.
h. Wipe up any spilled oil and dispose of contaminated rags in accordance with local procedures.

i. Follow the instructions that come with the oil sample kit for labeling the jar and completing the form with the appropriate information.
j. Mail the oil sample as soon as practicable.
k. Repeat the procedures to obtain an oil sample from the HC Assembly.

5.1.3.3.4.1 Fluid Analysis Service Report

It is highly recommended that an oil sample be taken from the HPU Assembly and the HC Assembly upon initial service from the manufacturer as well as each time the FTHE is mobilized and demobilized. The fluid analysis service reports that result should be reviewed not only for the immediate equipment performance but for long-term equipment trends as well. These reports should be retained for historical reference for the life of the FTHE.

A sample Fluid Analysis Service Report can be found in Appendix 14 and was the result of using the Eaton Corporation Fluid Analysis Kit (PN: 894276). The kit includes a sample collecting jar and the paperwork describing how to take a sample and then how to mail it to the Eaton Corporation for testing. The box the kit is packaged in is the box used to mail it for testing. The current mailing address for sending the sample is:

Laboratory Manager
Vickers Fluid Analysis Service
26201 Northwestern Highway
Southfield, MI 48076-3926
Phone: (248) 354-2919

The report consists of a cover page, two pages of current sampling results, and the last page provides information to “Understanding Your Fluid Analysis Report”. In general terms, the report provides a “quick overview” picture representation of fluid results, identifies the dominant size of contaminants observed (whether metallic or nonmetallic), a photo analysis (magnified 100 X), particle size trends (current and previous two samples), a chart showing actual/target cleanliness code, and some general maintenance recommendations.

5.1.3.3.4.2 Filtering Hydraulic Oil with the Filter Cart

Whether or not to incorporate the use of a filter cart will come as a recommendation from the results of the oil sample/fluid analysis service report.

CAUTION

The quality of hydraulic oil is important for trouble-free operation and longevity of the FTHE. Do not add or change hydraulic oil to the HPU Assembly or HC Assembly unless it is passed through the oil filter cart with a new, 5-micron filter element installed.

To use the filter cart on the HPU Assembly, refer to section 5.1.4.3.2 and for the HC Assembly, refer to section 5.1.4.4.5. Refer to the Parker Filtration Portable Filter Carts literature, located in FTHE Component Literature Manual, Section: “Other”, for instructions to operate the filter cart.

5.1.3.3.5 Inspect Gas Fittings and Flow lines

Gas fittings can become loose over time due to vibration while gas flow lines can become worn due to fraying, abrasion, and fatigue. To inspect gas fittings and flow lines, perform the following steps:

a. Apply a leak detector fluid to the gas fittings and flow lines and check for leaks.
b. Visually inspect along the length of the flow lines for any bulges that would indicate a layer has become weakened and is about to rupture.
c. Tighten fittings and or replace flow lines as required.

5.1.4 Assembly Specific Maintenance Procedures

5.1.4.1 Umbilical Winch Assembly

The maintenance procedures found in this paragraph are specific to the Umbilical Winch Assembly only. For general maintenance procedures that apply to the Umbilical Winch Assembly see section 5.1.2.

5.1.4.1.1 Inspect Brake Disk Pads

The stainless steel brake disk is mounted directly to the forward end of the winch drum. Fail safe braking is accomplished when the spring-applied, hydraulically released brakes are applied to the disk. The brake is designed to be used only as a parking and emergency stopping brake. To inspect the brake, perform the following steps:

a. Inspect the steel disk to ensure it is relatively smooth with no gouges in its surface.
b. Ensure no foreign debris has become lodged in or around the brake which could affect the efficiency of its braking action.

WARNING

BEWARE OF PERSONAL INJURY, WEAR GLOVES AND SAFETY GOGGLES.

The brake pads will lose friction if they are contaminated with oil or grease. The brake pads should be replaced if the pad material has absorbed oil or grease.

c. Inspect the brake disk pads to ensure they have not been contaminated with oil or become too thin. The brake pads need to be replaced when 2 mm of pad thickness is left (e.g.: pads wore 7mm).
d. The brakes require retesting after replacement of the disk pads.

5.1.4.2 Levelwind Assembly

The maintenance procedures found in this paragraph are specific to the Levelwind Assembly only. For general maintenance procedures that apply to the Levelwind Assembly see section 5.1.2.

5.1.4.2.1 Inspect and Lubricate Guide Bars

The two guide bars (Figure 7-6 and Table 7-3) support the Levelwind Carriage Assembly and guides it as it traverses its full travel, forward and aft. To inspect and lubricate the guide bars, perform the following steps:

a. Inspect the guide bars to ensure no debris has become lodged under the guide tube bushings nor any foreign items are preventing free movement of the Levelwind Carriage Assembly.
b. Wipe away any large amounts of old, hard, dirty grease that may have accumulated during its operation.
c. Grease the Zerk fittings in the middle of the Levelwind Carriage Assembly on guide tubes by following the procedures in section 5.1.2.3.
d. Apply a thin coat of grease along the entire length of the guide bars.
e. Wipe up any grease that may have fallen to the base of the Levelwind Assembly.
f. Dispose of contaminated rags in accordance with local procedures.

5.1.4.2.2 Inspect and Lubricate ACME Screw

The ACME screw (Figure 7-6 and Table 7-3) transmits torque into linear motion through direct sliding friction. It is therefore imperative to ensure this unit is properly lubricated. To inspect and lubricate the ACME screw, perform the following steps:

a. Inspect the ACME screw to ensure no debris has become lodged onto the unit nor any foreign items are preventing its free movement.
b. Wipe away any large amounts of old, hard, dirty grease that may have accumulated during its operation.
c. Apply a thin coat of grease (Table 5-3, Item 1) to the outside diameter of the screw along its entire length.
d. Wipe up any grease that may have fallen to the base of the Levelwind Assembly.
e. Dispose of contaminated rags in accordance with local procedures.

5.1.4.2.3 Inspect ACME Nut for Wear

The Levelwind System has two ACME nuts (DD 1088-2005-01, Item 20) a primary and a secondary. The primary ACME nut drives the Carriage Assembly and the secondary ACME Nut bears no load. The primary ACME nut is bolted to the Carriage Assembly on the overboarding side and the secondary nut is located on the opposite side of the carriage.

During the assembly stage, the primary ACME nut assembly is attached to the carriage. Slack is removed by pushing or pulling the carriage to the primary nut. The secondary nut is moved to the carriage, backed off until the first bolt hole position lines up, and then secured. The space on the sides of the secondary nut allows it to ride free during operation.

In order to monitor wear on the primary ACME nut, measure the distance between the secondary ACME nut and carriage assembly before any wear occurs on the primary ACME nut. Record the measured value. Thread wear on the primary nut causes this distance to increase. When the measured gap reaches the initial measured value plus 1/16 inch, the primary nut should be replaced.

If no initial measurement between the secondary ACME nut and the carriage assembly was made or recorded, use the following alternate approach.

Alternate method: Loosen the bolts holding the primary nut to the Carriage Assembly and push the nut away from the Carriage Assembly. Measure the gap when it reaches its maximum distance. Then push the nut back toward the Carriage Assembly and measure the gap again. Normal tolerance between the nut and the screw is approximately one to two thousandths of an inch. When the *difference* between the two measurements exceeds 1/16 inch, excessive wear has occurred and the nut should be replaced.

When replacement of the primary ACME nut is required or the nut has no significant wear, the gap between the secondary nut and the carriage should be measured and recorded.

5.1.4.2.4 Inspect LW Sensor Guide Fingers for Wear

The Levelwind Sensor Guide Fingers (Figure 7-6, Table 7-3) are adjusted so that the gap between them is "just slightly wider" than the diameter of the umbilical cable passing between them. Since the umbilical cable has an exterior hytrel jacket, wear on the faces of the guide fingers could abrade the umbilical cable jacket. To inspect the guide fingers for wear, perform the following steps:

a. Visually inspect the guide fingers for any trapped foreign debris that could interfere with the smooth operation of the umbilical cable passing through them.
b. Gently run your fingers over the surface of the levelwind guide fingers feeling for gouges or any signs of a rough surface that could abrade the hytrel jacket of the umbilical cable.
c. If any roughness is indicated, the guide fingers should be filed smooth or be replaced.

5.1.4.3 <u>HPU Assembly</u>

The maintenance procedures found in this paragraph are specific to the HPU Assembly only. For general maintenance procedures that apply to the HPU Assembly see section 5.1.2.

5.1.4.3.1 Heat Exchanger Strainer

5.1.4.3.1.1 Cleaning the Heat Exchanger Strainer

The HPU Heat Exchanger Strainer (STR-8) (Figure 5-1) must be checked and cleaned of any foreign material prior to HPU operation as part of the normal daily FTHE inspection procedure. To clean the strainer, perform the following procedures:

Figure 5-1 HPU & HC Strainer for Water/Oil Heat Exchangers

a. Verify the HPU Isolator Switch (IS-101) is OPEN on the Power Isolation (ENC101).
b. Inform ship's personnel to secure cooling water to the FTHE and verify that no cooling water is being discharged from the HPU Assembly cooling water discharge hose.
c. Open cover on strainer, remove basket, and remove/clean debris from basket.
d. Return basket to strainer bowl, replace cover, and tighten cover screw finger tight.
e. Maintenance to the HPU Assembly Heat Exchanger Strainer is complete.

5.1.4.3.2 Filtering HPU Assembly Hydraulic Oil Using the Filter Cart

To filter the HPU Assembly hydraulic oil using a filter cart, perform the following steps:

a. Ensure all equipment has been run for a minimum of 4 hours to ensure all the oil has become sufficiently warmed and then secure the FTHE.
b. Obtain the filter cart and install a new 5 micron filter element.
c. Clean the supply tank fill cover and surrounding area with a clean rag.
d. Clean the supply tank discharge valve and surrounding area with a clean rag.
e. Connect the filter cart to the discharge valve on the supply tank.
f. Remove the fill cover on the supply tank and then remove the strainer basket directly inside.
g. Ensure the discharge hose is clean and insert into the supply tank fill port and secure in place with suitable line.
h. Energize the filter cart with 110 VAC and monitor the filtering maintenance task.

i. When filtering is completed, secure power to the filter cart and remove hoses from the supply tank.
j. Return strainer basket to supply tank fill tube and replace the supply tank cover.
k. Wipe up any spilled oil with a rag and dispose of contaminated rags in accordance with local procedures.

5.1.4.4 HC Assembly

The maintenance procedures found in this paragraph are specific to the HC Assembly only. For general maintenance procedures that apply to the HC Assembly see section 5.1.2.

5.1.4.4.1 Heat Exchanger Strainer

The HC Assembly Heat Exchanger Strainer (STR-7) must be checked and cleaned of any foreign material prior to HC Assembly operation as part of the normal daily FTHE inspection procedure. Refer to HPU & HC Strainer for Water/Oil Heat Exchangers [Figure 5-1]. To clean the strainer, perform the following steps:

a. Verify the HC Isolator Switch (IS-2) is OPEN on the High Voltage Enclosure (ENC8).
b. Inform ship's personnel to secure cooling water to the FTHE and verify that no cooling water is being discharged from the HC Assembly cooling water discharge hose.
c. Open cover on strainer, remove basket, and remove/clean debris from basket.
d. Return basket to strainer bowl, replace cover, and tighten cover screw finger tight.
e. Maintenance to the HC Assembly Heat Exchanger Strainer is complete.

5.1.4.4.2 Lubricate Exposed Cylinder Rods

It is important that BV-9 and BV-11 actuating cylinder rods (CYL-15 and CYL-16) remain clean and lubricated to prevent early failure of the cylinder seals. To lubricate the cylinder rods, perform the following steps:

a. Use a rag to wipe down the cylinder rods removing any dust, salt, and any other foreign debris.
b. Apply a light, uniform coat of grease to the cylinder rods with a clean, dry rag.
c. Wipe up any excess grease and dispose of grease contaminated rags in accordance with local procedures.

5.1.4.4.3 Inspect Upper and Lower Support Bolts

The upper and lower cylinder/valve accumulator/manifold assembly support bolts (DD 0707-7001-05, Item 16) can loosen over time due to vibrations from operation of the HC Assembly as well as the vibrations caused by the ship's operations. Inspect the bolts for tightness by torqueing to 465 ft-lbs.

5.1.4.4.4 Compressor/Intensifier

The compressor/intensifier (Figure 5-2 and Table 5-5) is used to recompress air and gas up to 5,000 psig maximum, employing a one-stage (four cylinders), air-cooled reciprocating piston compressor. The cylinders are lubricated by means of the forced-feed lubrication system. The compressor block lube oil capacity is approximately 4.0 liters. The ambient temperature is from

41 °F to 113 °F. The design life of this compressor is 30,000 operating hours and all valves have free access meaning there is no need for the dismantling of pipes during maintenance.

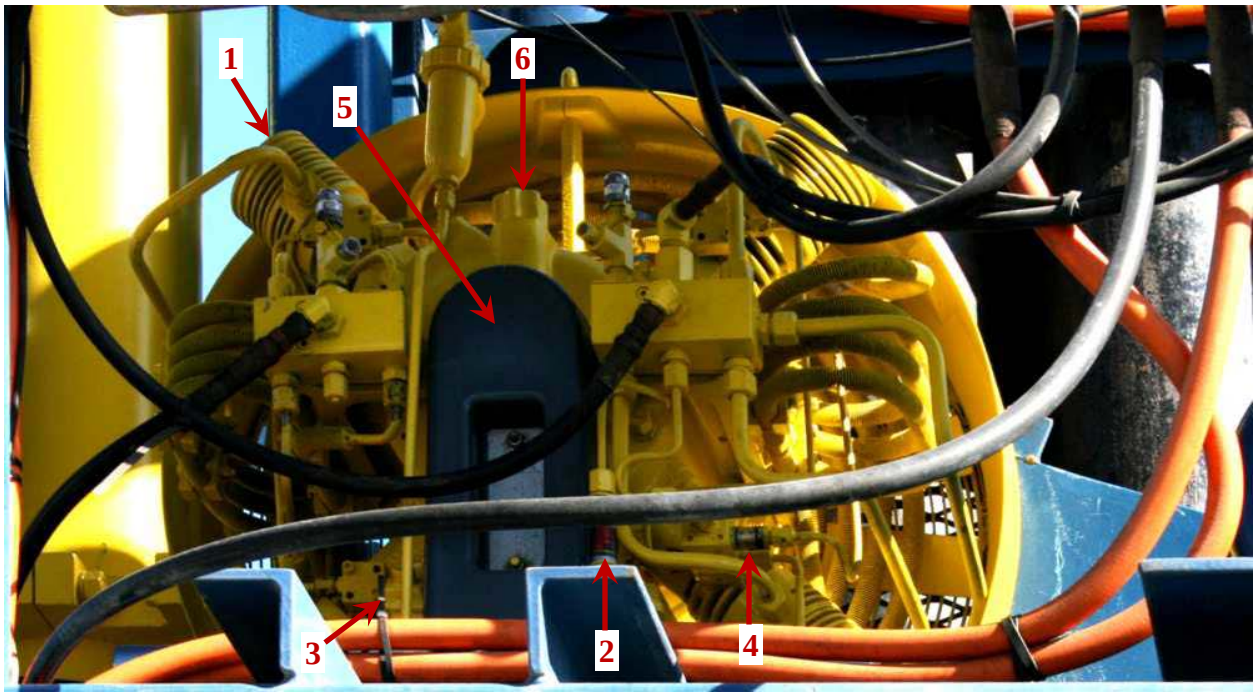


Figure 5-2 Compressor/Intensifier Assembly, Components

Table 5-5 Compressor/Intensifier Assembly, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	N/A	Cylinder Head (Valve Internal)
2	N/A	Oil Sight Glass
3	N/A	Oil Drain Plug
4	N/A	Oil Pressure Regulating Valve/Sight Glass
5	N/A	Oil Pump Drive V-Belt Cover
6	N/A	Oil Filler Cap

5.1.4.4.4.1 Inspect Lube Oil Level and Add Oil as Required

To inspect the lube oil level and add oil as required, perform the following steps:

a. Visually inspect the oil sight glass (Table 5-5, Item 2) to ensure the oil level is between the lower and upper level marks scribed on the oil sight glass.
b. If the level is adequate, no further maintenance is required.
c. If the level is below the low level mark, additional oil must be added.
d. Inspect the compressor for oil leaks and repair as required.

CAUTION

Oil level must not exceed the maximum fill line as this will cause excessive lubrication of the compressor and result in the valves sooting excessively.

e. To add oil, remove oil filler cap (Table 5-5, Item 6) and slowly pour enough oil into the compressor until the level is sufficient as visually indicated through the oil sight glass.
f. Replace the oil filler cap and clean up any oil that may have been spilled.
g. Dispose of any oil soaked rags in accordance with local procedures.

5.1.4.4.4.2 Change Lube Oil

To change the lube oil, perform the following steps:

a. Run the compressor until warm so lube oil will run freely.
b. Secure the compressor
c. Remove oil drain plug (Table 5-5, Item 3) and drain oil into a 5-gallon bucket or other suitable container.
d. Replace oil drain plug.

CAUTION

Oil level must not exceed the maximum fill line as this will cause excessive lubrication of the compressor and result in the valves sooting excessively.

e. Remove oil filler cap (Table 5-5, Item 6) and slowly pour approximately 4.0 liters of oil into the compressor until the level is between the lower and upper level marks on the oil sight glass (Table 5-5, Item 2).
f. Replace the oil filler cap and clean up any oil that may have been spilled.
g. Wait an additional 5 minutes after having added the lube oil and then put compressor into operation.
h. Check for proper operation of the oil pump by observing <u>no</u> air bubbles in the oil sight glass.
i. If air bubbles are visible, the oil pump must be vented while the compressor is in operation.
j. Loosen the vent screw at the top of the oil pressure regulating valve one or two turns until oil emerges free of air bubbles. Tighten vent screw.
k. Loosen oil pressure regulating valve coupling and bleed until oil emerges free of air bubbles. Tighten coupling.
l. Recheck oil sight glass to ensure the oil level has remained between the lower and upper level marks. If not, add more oil per the instructions in this paragraph.
m. Visually inspect compressor for oil leaks; clean and repair as required.
n. Dispose of lube oil and oil soaked rags in accordance with local procedures.

5.1.4.4.4.3 Inspect Oil Pump Drive V-Belt

The two compressor oil pump drive V-belts can fail over time due to aging and wear. To inspect the oil pump drive tooth belt for aging and wear, perform the following steps:

a. Loosen the retaining screw and remove the oil pump V-belt cover (Figure 5-2 and Table 5-5, Item 5).
b. Visually inspect the oil pump V-belts for signs of aging and wear such as cracking, stretching, and tearing – replace as required.
c. Inspect the oil pump housing to ensure it is free of sludge or any foreign materials.
d. Reinstall the oil pump drive V-belt cover and tighten the retaining screw.

5.1.4.4.4.4 Inspect Cylinder Head Valves for Operation

The valve heads form the top part of the cylinders. The intake and pressure valves are fitted inside the valve heads. The valves are operated by the nitrogen gas. To inspect operation of the cylinder head valves, perform the following steps:

a. Run the compressor for at least ½ hour.

WARNING

POSSIBLE BURNS! Do not allow your hand to come into physical contact with the compressor valve heads. They could be hot and burns to the skin are possible.

b. Carefully put your hand close to the valve head (Table 5-5 and Figure 5-2, Item 1) inlet pipe but do not touch it. It should feel warm.
c. Carefully put your hand close to the valve head discharge pipe but do not touch it. It should feel noticeably hotter than the valve head inlet pipe.
d. If the two previous steps are true then the valves are working properly.
e. If either of the two previous steps is not true, Shut-Down the compressor and investigate.

5.1.4.4.4.5 Cylinder Head Valves: Dismantle, Clean, Check, and Replace as Required

To dismantle, clean, check, and replace as required the cylinder head valves is a maintenance item beyond the scope of this document. Refer to the Bauer Compressors Instruction Manual, Section 9, located in the FTHE Component Literature Manual, Section: “Gas Reclamation System” for maintenance information relating to the valve heads and valves.

5.1.4.4.4.6 Replace Cylinder Head Valves

To dismantle, clean, check, and replace as required the cylinder head valves is a maintenance item beyond the scope of this document. Refer to the Bauer Compressors Instruction Manual, Section 9, located in the FTHE Component Literature Manual, Section: “Gas Reclamation System” for maintenance information relating to the valve heads and valves.

5.1.4.4.4.7 Inspect Mounting Bolts

The mounting bolts that retain the compressor/intensifier to the HC Assembly can loosen over time due to vibrations from its operation as well as the vibrations caused by the ship’s

operations. To inspect the mounting bolts for correct torque requirements, perform the following steps:

a. Obtain the proper tools including a calibrated torque wrench.
b. Refer to the Bauer Compressors Instruction Manual, Section 20, located in the FTHE Component Literature Manual, Section: “Gas Reclamation System” for the proper torque value based on the bolt size.

5.1.4.4.5 Filter HC Assembly Hydraulic Oil Using the Filter Cart

To filter the HC Assembly hydraulic oil using a filter cart, perform the following steps:

a. Ensure all equipment has been run for a minimum of 4 hours to ensure all the oil has become sufficiently warmed and then secure the FTHE.
b. Obtain the filter cart and install a new 5 micron filter element.
c. Ensure nitrogen to supply tank BV-18 is closed.
d. Open NV-28 on supply tank to bleed tank pressure to zero.
e. Clean the supply tank fill plate and surrounding area with a clean rag.
f. Clean the supply tank discharge valve and surrounding area with a clean rag.
g. Connect the filter cart to the discharge valve on the supply tank.
h. Loosen and remove the fill plate and gasket on the supply tank.
i. Ensure the discharge hose is clean and insert into the supply tank fill port and secure in place with suitable line.
j. Energize the filter cart with 110 VAC and monitor the filtering maintenance task.
k. When filtering is completed, secure power to the filter cart and remove hoses from the supply tank.
l. Install supply tank fill plate gasket and cover and tighten securely.
m. Close NV-28 and open BV-TF and BV-18 to place a 5 psi maximum charge on the supply tank as viewed on PG-21.
n. Wipe up any spilled oil with a rag and dispose of contaminated rags in accordance with local procedures.

5.1.4.5 <u>Operator Control Station – Local</u>

5.1.4.5.1 Pedestal

The only maintenance required on the Pedestal is to clean the enclosure panel including the LCI-90R display as required.

5.1.4.5.1.1 Clean the LCI-90R Display

To clean the Pedestal/LCI-90R display, perform the following steps:

a. Ensure the enclosure cover mounting bolts are securely fastened.
b. Ensure display is not hot to the touch from sitting in the sun for an extended period of time.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Damage to the display can result from using chemicals, paper products, or dry cleaning cloths to clean the screen. Use only household glass cleaner or just plain water and a dampened, lint-free, soft cloth when cleaning the display.

c. Lightly spray fresh water on the enclosure and display to wash off sea salt and other contaminants.
d. Use a lint-free, soft cloth dampened with household glass cleaner or plain water and carefully wipe the display until clean. The rest of the enclosure can air dry.
e. If the Pedestal is not being used, place the cover over it to protect it from the elements.

5.1.4.6 Operator Control Station – Remote

5.1.4.6.1 Electronics Cabinet

5.1.4.6.1.1 Monitor

The monitor is primarily a maintenance free unit but does require occasional cleaning to keep the display clean and fan filters free of dirt.

5.1.4.6.1.1.1 Clean the Screen

To clean the display, perform the following step:

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Damage to the monitor screen can result from using chemicals when cleaning it. Use only fresh water to clean the monitor screen.

a. Use a lint-free cloth dampened with water and wipe the display until clean.

5.1.4.6.1.1.2 Clean the Fan Filter Screens

To clean the fan filter screens (Figure 5-3, Table 5-6), perform the following steps:

a. Ensure the Electronics Cabinet equipment is shut-down IAW the Electronics Cabinet (UPS, VME, and PC) procedure (section 3.2.5.3).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the Electronics Cabinet. Verify the Electronics Cabinet is de-energized prior to performing any corrective maintenance.

b. Gain access to the rear of the Electronics Cabinet and verify electrical components are de-energized. (If the monitor status indicator LED is blinking green, depress the ON/OFF

power button to secure power to the monitor and extinguish the LED [Figure 5-3, Item 2].)

c. Remove the power cord from the power connector (Figure 5-3, Item 1) and set aside.

d. Carefully run a vacuum hose with crevice attachment over the protective fan filter screens (Figure 5-3, Item 3) to remove dust and debris.

e. When clean, reinstall power cord. (If the ON/OFF power button was depressed previously to power-down the unit, depress the ON/OFF power button now to power-up the monitor. Verify monitor status indicator LED is illuminated a steady green color [Figure 5-3, Item 2].)

f. Start-Up the Electronics Cabinet equipment IAW the Control Van Electronics Cabinet procedure (section 3.2.2.4).ensuring the monitor status indicator LED (Figure 7-22, Item 1) illuminates a steady green color.

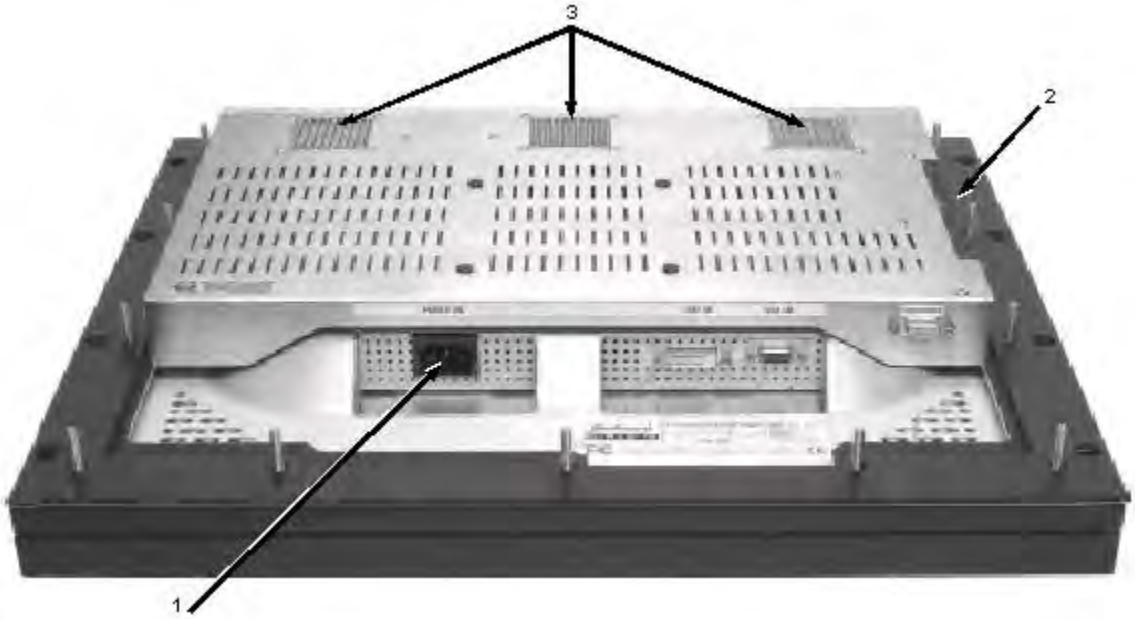


Figure 5-3 Monitor, Components

Table 5-6 Monitor, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	N/A	Power Connector
2	N/A	Display Function Buttons and Status Indicator LED
3	N/A	Fan Filter Screens

5.1.4.6.1.2 Control Van Panel

The only maintenance required on the Control Van Panel is to clean the LCI-90 display as required.

5.1.4.6.1.2.1 Cleaning the Display

To clean the Control Van Panel LCI-90 display, perform the following step:

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Damage to the display can result from using chemicals, paper products, or dry cleaning cloths to clean the screen. Use only household glass cleaner or just plain water and a dampened, lint-free, soft cloth when cleaning the display.

a. Use a lint-free, soft cloth dampened with household glass cleaner or plain water and carefully wipe the display until clean.

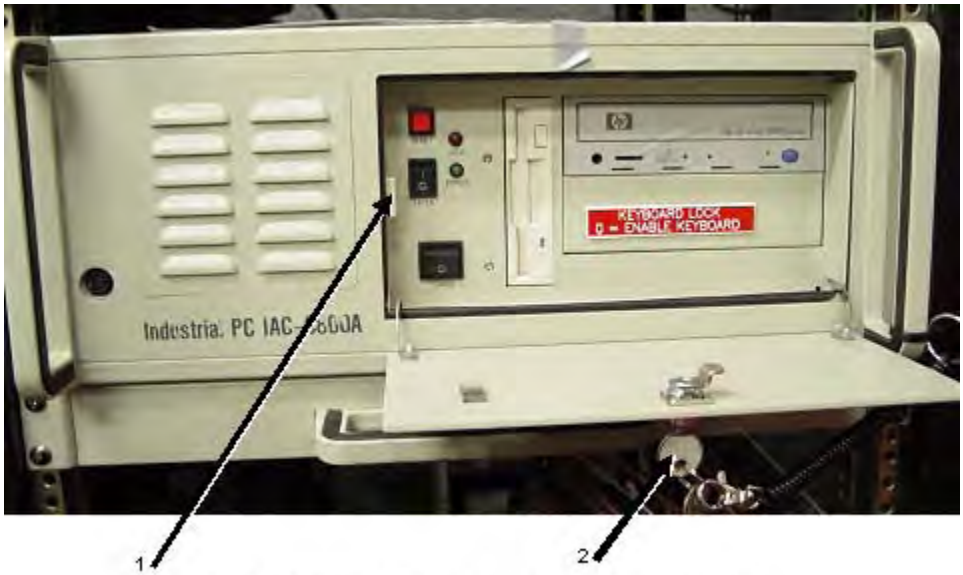
5.1.4.6.1.3 Computer

The only maintenance required on the computer is to clean the filter at mobilization.

5.1.4.6.1.3.1 Cleaning the Filter

To clean the computer filter (Figure 5-4, Table 5-7), perform the following steps:

a. Unlock and open the door.
b. Ensure the computer is powered OFF.
c. Pull on the filter handle to remove the filter screen from the computer.
d. Vacuum the filter screen and louvers free of dust.
e. Install filter screen into computer.
f. Close door and lock.



(DOOR OPENED FOR VIEWIING INTERNAL DETAIL)

Figure 5-4 Computer, Components

Table 5-7 Computer, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	N/A	Filter Element Handle
2	N/A	Door/Key Lock

5.1.4.6.1.4 Keyboard Tray

The only maintenance required on the keyboard tray is to clean the keyboard at mobilization.

5.1.4.6.1.4.1 Cleaning the Keyboard

To clean the keyboard, perform the following steps:

a. Ensure the computer is OFF.
b. Pull the keyboard tray out from the equipment cabinet.
c. Use a vacuum brush attachment and carefully vacuum the keys free of dust and dirt.
d. Use a lint-free cloth dampened with water and wipe the keys, as required, until clean.
e. Push the keyboard tray back into the equipment cabinet.

5.1.4.6.1.5 VME Enclosure

The only maintenance required on the VME Enclosure is to vacuum the front and rear air screen at mobilization.

5.1.4.6.1.5.1 Cleaning the Air Screens

To clean the VME Enclosure air screens, perform the following steps:

a. Ensure the VME Enclosure is OFF.
b. Use a vacuum brush attachment and vacuum the front and rear air screens free of dust and dirt.

5.1.4.6.1.6 UPS

Maintenance to the UPS is limited to charging batteries quarterly when the UPS is stored for long periods of time and replacing the batteries when required.

5.1.4.6.1.6.1 Replacing the Batteries

Under normal conditions, the batteries in the UPS will last for many years. The batteries are designed for “hot-swap” although the UPS will not provide backup power in the event of a blackout or other power interruptions. The UPS should never be operated without batteries. Refer to the Tripp Lite Power Protection Owner’s Manual, located in the FTHE Component Literature Manual, Section: “Other” for more detailed information regarding the UPS battery.

NOTE

The batteries are recyclable, sealed lead-acid batteries and should be recycled. Refer to local codes for disposal requirements or in the USA call 1-800-SAV-LEAD (1-800-728-5323) or online at Rechargeable Battery Recyclable Corporation (www.rbrc.com) for recycling information.

WARNING

POSSIBLE ELECTRICAL SHOCK OR BURNS! Batteries can present a risk of electrical shock and burn from high short-circuit current. Do not short or bridge the battery terminals with any object. Observe proper cautions when handling batteries.

To replace the UPS batteries, perform the following steps:

a. Remove 4 screws and UPS front panel.
b. Disconnect wire connectors from battery terminals: black-to-black, and red-to-red.
c. Remove the batteries and dispose or recycle in accordance with local procedures.
d. Install new batteries and reattach wire connectors to battery terminals: black-to-black, and red-to-red.
e. Replace the UPS front panel and 4 screws.

6.0 CHAPTER 6 - TROUBLESHOOTING

6.1 INTRODUCTION

This chapter provides a list of the relays, lamps/Light Emitting Diodes (LEDs), and protective devices used to monitor/protect the FTHE. It provides detailed troubleshooting information to assist in detection and isolation of malfunctions for the FTHE Line Replaceable Units (LRUs).

6.2 TOOLS AND TEST/SUPPORT EQUIPMENT

Refer to Chapter 7, Tools and Test/Support Equipment table which contains a list of tools and test/support equipment required to troubleshoot, maintain, mobilize, and demobilize the FTHE.

6.3 ELECTRICAL ENCLOSURES

The FTHE uses NEMA 4X stainless steel enclosures to house the various electrical components (i.e., electromagnetic and optical relays, lamps, fuses, circuit breakers, and) used in the control and operation of the FTHE system. Two junction boxes and a single winch joystick (at the Control 1 Van Console) are also critical items in the control of the FTHE.
The FTHE enclosures and junction boxes are listed in Table 6-1.

Table 6-1 Electrical Enclosures Labels and Locations

ENC / J-BOX	ENCLOSURE DESCRIPTION	TB	DRAWING	LOCATION
ENC101	HPU Power Isolation	N/A	1088-9001-02	HPU, Forward-Starboard
ENC102	HPU High Voltage	TB102	1088-9001-02	HPU, Aft-Port
ENC103	HPU Low Voltage	TB103	1088-9001-03	HPU, Aft-Starboard
ENC104	Pedestal (Local Control)	TB104	1088-9001-04	Pedestal, in Control 2 Booth
ENC105	Levelwind Enclosure	TB105	1088-9001-05	Levelwind 2nd Level, Fwd-Stbd
JB106	Winch J-Box	TB106	1088-9001-06	Winch 1st Level, Fwd-Port
ENC107	Levelwind Control Panel	TB107	1088-9001-07	Winch 1st Level, Port-Fwd
ENC5	Control Van Panel (Remote Control)	TB4	0707-9001-04	Control Van Electronics Cabinet
ENC7	Gas Intensifier	TB10	0707-9001-09	HC 2nd Level, Gas Intensifier Panel
ENC8	HC High Voltage	TB11	0707-9001-08	HC, Starboard Side
ENC9	HC Low Voltage	TB9	0707-9001-07	HC, Aft
ENC10	Signal Interface	TB12	0707-9001-10	Control Van, Cabinet
ENC11	A-Frame Accelerometer	TB13	0707-9001-06	Docking Head Sheave, Aft
ENC12	HC Accelerometer	TB14	0707-9001-07	Flying Head, Topside, Forward
ENC13	A-Frame Load Pin J-Box	N/A	0707-9001-06	DCV Station, forward
JB3	A-Frame J-Box	TB6	0707-9001-06	DCV Station, forward
ENC14	PDS Main Circuit Breaker	N/A		PDS forward end
ENC15	PDS Transfer Switch 2	N/A		PDS middle enclosure
ENC16	PDS Transfer Switch 1	N/A		PDS aft end
ENC17	Test Shape Electronics			Control Van electronics cabinet
ENC18	NFESC Control Van Enclosure (break-out box)	N/A		Control Van aft, port side
ENC19	NFESC Control Van J-Box	N/A		Control Van aft, port side

6.4 RELAYS

The FTHE uses two types of relays to provide operating control to various electronic components: electromagnetic relays and optical relays.

6.4.1 Electromagnetic Relays

The electromagnetic relays are located onboard deck in the HPU, HC, and Gas Intensifier NEMA enclosures. They are used to control the +12 and +24 VDC circuits, 24 and 120 VAC circuits, and are listed in Table 6-2.

Table 6-2 FTHE Electromagnetic Relays

RELAY	POWERED BY	FUNCTION	CONTACT	PURPOSE
K101	PB102 (Start #1)	HPU #1 Start (24VAC)	A	Inline Contactor
			B	Enable Soft Start
			C	HPU #2 Simultaneous Start Disable
			D	Not Used
K102	PB104 (Start #2)	HPU #2 Start (24VAC)	A	Inline Contactor
			B	Enable Soft Start
			C	HPU #1 Simultaneous Start Disable
			D	Not Used
K103	TSH-101 (Heater Thermostat)	HPU Oil Tank Heater (24VAC)	A	460 VAC
			B	460 VAC
			C	460 VAC
				Oil Heating Light (LT105)
K104	XS105 Suction Interlock Sensor	HPU #1 Suction Ball Valve Interlock (24VAC)	A	HPU #1 A/B Start Disable
			B	Not Used
K105	XS106 Suction Interlock Sensor	HPU #2 Suction Ball Valve Interlock (24VAC)	A	HPU #2 A/B Start Disable
			B	Not Used
K108	SS101 Soft Start Controller	HPU #1 Soft Start Ramp Complete (24VAC)	A	Simultaneous Start Disable
			B	HPU #1 Running
K109	SS102 Soft Start Controller	HPU #2 Soft Start Ramp Complete (24VAC)	A	Simultaneous Start Disable
			B	HPU #2 Running
K110	CH101 & CH5 Winch Control Handle	Any Control Handle Out of Neutral (12VDC)	A	Not Used
			B	K129 Counter-Balance Reset
			C	Constant Tension Disable
K111	CH101 & CH5 Winch Control Handle	Any Control Handle Out of Neutral (12VDC)	A	Computer Signal
			B	Computer Override
			C	Levelwind Disabled Alarm Pilot

Table 6-2 FTHE Electromagnetic Relays – *continued*

K112	CH101 Winch Control Handle	Local Control Handle Out of Neutral (12VDC)	A	Brake Release Pilot
			B	Levelwind Enable
			C	Remote Disable
K113	CH 5 Winch Control Handle	Remote Control Handle Out of Neutral (12VDC)	A	Brake Release Pilot
			B	Levelwind Enable
			C	Remote Enable Interlock
K114	K108B	HPU #1 Running (24VAC)	A	Charge Pressure Alarm Enable
			B	HP #1 Running Computer Signal
			C	EDC Steering
			D	Dual EDC Mode Pilot
K115	K109B	HPU #2 Running (24VAC)	A	Charge Pressure Alarm Enable
			B	HP #2 Running Computer Signal
			C	EDC Steering
			D	Dual EDC Mode Pilot
K116	SW106 (Remote Enable)	Remote Enable (24VAC)	A	Brake Pilot Interlock
			B	Latch
			C	EDC Steering
			D	EDC Steering
K117	K112C	Remote Enable (24VAC)	A	Control Handle Power Steering
			B	Levelwind Enable Interlock
K118	K114D & K115D	Dual EDC Select (24VAC)	A	HP #1 EDC Steering
			B	HP #2 EDC Steering
K119	SW105	Computer Control Enable	A	Latch
			B	Computer Signal
			C	Not Used
			D	Not Used
K120	K119A	Computer Control Enable (24VAC)	A	Brake Pilot Enabled
			B	Levelwind Enable
			C	EDC Steering
			D	EDC Steering
K121	K122A	Constant Tension (24VAC)	A	X2 Latch
			B	Digital Valve Controller Enable
			C	Levelwind Enable
			D	Brake Release Pilot
K122	K136A	Constant Tension (24VAC)	A	Latch
			B	EDC Steering (A)
			C	Constant Tension Solenoid Pilot
			D	EDC Steering (B)
K123	PSH-103 (Winch Brake Pressure Switch)	Winch Brake Pressure Switch (24VAC)	A	Brake Light Pilot
			B	Computer Signal

Table 6-2 FTHE Electromagnetic Relays – *continued*

RELAY	POWERED BY	FUNCTION	CONTACT	PURPOSE
K124	Computer Interface RB1-M9 (Computer Brake Release)	Brake Release From Computer (24VDC)	A	Brake Pilot
			B	Not Used
K125	SW108 HC Cylinder Lock	Heave Compensator Cylinder Lock (24VAC)	A	Compensator Lock Enable Interlock
			B	Computer Control Disable
K126	LS-2 (Low Oil Level Switch)	Low Oil Level (24VAC)	A	CPU and Remote Signal
			B	Not Used
K127	TSH102 (High Oil Temp. Switch)	High Oil Temp. (24VAC)	A	CPU and Remote Signal
			B	Not Used
K128	PSH-102 (HPU #2 Charge Pressure)	Counter-Balance (12VDC)	A	Counter-Balance SOV Pilot
			B	Latch
			C	Not Used
K129	PSH-101 (HPU #1 Charge Pressure)	Cursor Winch Payout Limit (12VDC)	A	Payout Pilot Interlocked
			B	Not Used
			C	Not Used
K130	SW113-3	Diamond Follower Selected (24VAC)	A	Diamond Follow Failure Interlock
			B	Levelwind Enable Steer
			C	Levelwind Servo Steer
			D	Levelwind Servo Steer
K131	SW113-3	Diamond Follower Selected (24VAC)	A	PLC Signal
			B	Not Used
K132	SW112-3	Levelwind Disabled (24VAC)	A	Levelwind Enable Break
			B	Alarm Signal
K133	X1	Brake Interlock (24VAC)	A	Latch
			B	Spring Applied Brake Release Enable
K134	K110	Any Control Handle Out of Neutral (12VDC)	A	Start Disable
			B	Start Disable
			C	Not Used
K135	PSH103	Hyd. Applied Brake Pressure Present (24VAC)	A	K133 Signal
			B	Not Used
K136	K136A	Constant Tension Pressure (24VAC)	A	K136 Latch X1
			B	Constant Tension Latch Interlock
			C	Reduced Speed Bypass
			D	Constant Tension Latched Light

Table 6-2 FTHE Electromagnetic Relays – *continued*

K23	PB10 (HPU Start)	HPU Start Heave Compensator (24 VAC)	A	Inline Contactor
			B	Enable Soft Start
			C	X1 120 VAC Switched
			D	Not Used
K24	TSH-5 (Oil Heater Temperature Switch)	Oil Reservoir Heater (24 VAC)	A	460 VAC
			B	460 VAC
			C	460 VAC
			D	Not Used
K25	CT3 (Bypass Contactor)	Heave Compensator HPU Running (24 VAC)	A	Active Servo Enable
			B	Computer Signal
K26	SW10 (Raise/Lower)	Gas Intensifier Interlock (24 VAC)	A	Raise Pressure Interlock
			B	Lower Pressure Interlock
K27	LS-2 (Low Oil Level Switch)	Low Oil Level (24 VAC)	A	HPU Stop Pilot
			B	Computer Signal
K28	K31A	Active Mode Enable (24 VAC)	A	Loop Solenoid Pilot
			B	Lock Solenoid Pilot
K29	PSH-9 (Flying Head Unlock Pressure Switch)	Compensator Ball Valve Open (+12 VDC)	A	Loop Valve Close Pilot
			B	Not Used
			C	Not Used
K30	K28A	Loop Valve Latch (24 VAC)	A	Latch
			B	Loop Valve Open Solenoid Pilot
			C	Not Used
			D	Not Used
K31	SW12 (Heave Comp Cylinder Lock)	Heave Compensator Cylinder Lock (24 VAC)	A	Not Used
			B	Computer Control Disable
			C	Not Used
			D	Not Used
K32	SW10 (Raise)	Raise Pressure (24 VAC)	A	Intensifier Run Pilot
			B	Solenoid Pilot
K33	SW10 (Lower)	Lower Pressure (24 VAC)	A	Intensifier Run Pilot
			B	Solenoid Pilot
K34	TSH-6 (High Oil Temp. Switch)	High Oil Temp (24 VAC)	A	Computer Signal
			B	Not Used
K35	Computer Interface RB1-M8 Control Sys. Fault	Control System Fault (24 VAC)	A	Audible Alarm Pilot
			B	Not Used
K36	XS-11 (Cursor Winch Payout Limit Switch	Cursor Winch Payout Limit (+24 VAC)	A	Payout Pilot
			B	Not Used
			C	Not Used
K38	Computer Interface RB1-M1 Active Mode Enable	Active Mode Enable (24 VAC)	A	Servo Enable Pilot
			B	Active Mode Solenoid Pilot

6.4.2 Optical Relays

The optical relays are located inside the Control Van within the Signal Interface Enclosure. They are operated by the +5 VDC computer interface logic and are used to control HC operation via the computer while “Auto Passive” or “Active” operating mode has been selected. The optical relays are listed in Table 6-3.

Table 6-3 FTHE Opto 22 Relays

DESIGNATION	FUNCTION
M0	Computer Control Engaged
M1	Mode Switching Solenoid
M2	Lower Oil Right Solenoid
M3	Raise Oil Right Solenoid
M4	Lower Oil Left Solenoid
M5	Raise Oil Left Solenoid
M6	Intensifier Raise Pressure
M7	Intensifier Decrease Pressure
M8	Control System Fault
M9	Brake Release
M10	Spare

6.5 LAMPS

Lamps are used to provide visual indications of the status or condition of the various FTHE units and are listed in Table 6-4.

Table 6-4 FTHE Lamps and LEDs

DESIGNATION	COLOR	PURPOSE
HPU LOCAL CONTROL (PEDESTAL) ENCLOSURE (ENC104)		
LT107	Green	Lamp is illuminated to indicate HPU #1 is operating.
LT108	Green	Lamp is illuminated to indicate HPU #2 is operating.
LT109	Amber	Lamp is illuminated to indicate Winch brake is released.
LT110	Amber	Lamp is illuminated to indicate the Control Van computer has control (enabled) of the Winch.
LT111	Amber	Lamp is illuminated to indicate Winch Constant Tension mode is enabled.
LT112	Red	Lamp is illuminated to indicate a high hydraulic oil temperature alarm condition when hydraulic oil in the HPU Supply Tank is more than 150 °F.
LT113	Red	Lamp is illuminated to indicate a low pressure alarm condition when HPU #1 Charge Pressure is less than 310psi
LT114	Red	Lamp is illuminated to indicate a low pressure alarm condition when HPU #2 Charge Pressure is less than 310 si

Table 6-4 FTHE Lamps and LEDs – *continued*

DESIGNATION	COLOR	PURPOSE
LT115	Red	Lamp is illuminated to indicate a low hydraulic oil level alarm condition when the hydraulic oil in the HPU Supply Tank is below minimum level.
LT117	Red	Lamp is illuminated to indicate the ROV / Test Shape is latched and secured on the Cursor.
HPU HIGH VOLTAGE ENCLOSURE (ENC3)		
LT101	Red	Lamp is illuminated to indicate a power fault is present. The lamp illuminates momentarily at start-up but quickly extinguishes.
LT102	Green	Lamp is illuminated to indicate 460 VAC, 3-phase power is correct and available.
LT103	Green	Lamp is illuminated to indicate HPU #1 is operating.
LT104	Green	Lamp is illuminated to indicate HPU #2 is operating.
LT105	Yellow	Lamp is illuminated to indicate the HPU hydraulic oil immersion heaters are energized.
LT106	Red	Lamp is illuminated to indicate a high oil temperature exists.
CONTROL VAN PANEL (ENC5)		
LT13	Green	Lamp is illuminated to indicate HPU #1 is operating.
LT14	Green	Lamp is illuminated to indicate HPU #2 is operating.
LT15	Amber	Lamp is illuminated to indicate Winch brake is released.
LT16	Amber	Lamp is illuminated to indicate the Control Van (Remote Enabled) has control of the Winch.
LT17	Red	Lamp is illuminated to indicate a low pressure alarm condition when HPU #1 Charge Pressure is less than 310psi
LT18	Red	Lamp is illuminated to indicate a low pressure alarm condition when HPU #2 Charge Pressure is less than 310psi
LT19	Red	Lamp is illuminated to indicate a high hydraulic oil temperature alarm condition when hydraulic oil in the HPU Supply Tank is more than 150 °F.
LT20	Red	Lamp is illuminated to indicate a low hydraulic oil level alarm condition when the hydraulic oil in the HPU Supply Tank is below minimum level.
LT21	Amber	Lamp is illuminated to indicate the Control Van computer has control (enabled) of the Winch.
LT22	Amber	Lamp is illuminated to indicate the Control Van computer motion compensation software has control (engaged) of the HC system.

Table 6-4 FTHE Lamps and LEDs - *continued*

DESIGNATION	COLOR	PURPOSE
LT34	Green	Lamp is illuminated to indicate the HC HPU is operating.
LT35	Red	Lamp is illuminated to indicate a high hydraulic oil temperature alarm condition when hydraulic oil in the HC Supply Tank is more than 150 °F.
LT36	Red	Lamp is illuminated to indicate a low hydraulic oil level alarm condition when the hydraulic oil in the HC Supply Tank is below minimum level.
HC HIGH VOLTAGE ENCLOSURE (ENC8)		
LT29	Red	Lamp is illuminated to indicate a power fault is present. The lamp illuminates momentarily at start-up but quickly extinguishes.
LT30	Green	Lamp is illuminated to indicate 460 VAC, 3-phase power is correct and available.
LT31	Red	Lamp is illuminated to indicate a low hydraulic oil level alarm condition when the hydraulic oil in the HC Supply Tank is below minimum level.
LT32	Red	Lamp is illuminated to indicate a high hydraulic oil temperature alarm condition when hydraulic oil in the HPU Supply Tank is more than 150 °F.
LT33	Green	Lamp is illuminated to indicate HC HPU is operating.

6.6 PROTECTIVE DEVICES

Two types of protective devices, fuses and circuit breakers, are incorporated into the FTHE design and used to protect various equipment from electrical faults such as shorts or other over-current conditions. Both components are rated for certain values based upon the circuit they are designed to protect. When that value is exceeded, the device is triggered and either opens the circuit or limits the current being provided by the circuit.

6.6.1 Fuses

Fuses operate as a “one-time shot” meaning when an over-current condition exists, the fuse triggers, burns itself open thereby opening the circuit and preventing damage to the circuit. However, by protecting the circuit, it damages itself and therefore must be replaced. Fuses used in the FTHE system are listed in Table 6-5.

Table 6-5 FTHE Fuses

DESIGNATION	RATING	PURPOSE
HPU LOW VOLTAGE ENCLOSURE (ENC1)		
F110	5A, 250 V	Protects PS101 +5VDC power supply from excessive current and short circuits.
F111	5A, 250 V	Protects PS104 +24VDC power supply from excessive current and short circuits.

Table 6-5 FTHE Fuses - *continued*

DESIGNATION	RATING	PURPOSE
F112	5A, 250 V	Protects 12VDCPower Supply (PS102) from excessive current and short circuits.
PEDESTAL ENCLOSURE (ENC104)		
F0	0.5A, 250 V	Protects DPS2 from excessive current and short circuits.
HPU HIGH VOLTAGE ENCLOSURE (ENC102)		
F101	3A, 250 V	Protects Transformer (T101) from excessive current and short circuits.
F102	20A, 32 V	Protects Transformer (T102) from excessive current and short circuits.
F103	2A, 250 V	Protects Enclosure ENC102 Door Interlock (IL101) from excessive current and short circuits.
F104	2A, 250 V	Protects Motor Starter (MS101) from excessive current and short circuits.
F105	1A, 250 V	Protects Motor Starter (MS102) from excessive current and short circuits.
LEVELWIND ENCLOSURE (ENC105)		
F115	1A, 250 V	Protects the 12VDC Power Supply (PS105) from excessive current and short circuits.
F116	1A, 250 V	Protects the 12VDC Power Supply (PS106) from excessive current and short circuits.
F117	3A, 250 V	Protects the 24VDC Power Supply (PS107) from excessive current and short circuits.
CONTROL VAN PANEL (ENC5)		
F0	0.5A, 250 V	Protects DPS1 from excessive current and short circuits.
HC LOW VOLTAGE ENCLOSURE (ENC9)		
F5	2A, 250 V	Protects PS4 +24 VDC power supply from excessive current and short circuits.
F9	0.5A, 250 V	Protects PS4 +15 VDC power supply from excessive current and short circuits.
F10	0.5A, 250 V	Protects PS4 -15 VDC power supply from excessive current and short circuits.
HC HIGH VOLTAGE ENCLOSURE (ENC8)		
F6	3A, 250 V	Protects Transformer (T3) from excessive current and short circuits.
F7	15A, 32 V	Protects Transformer (T4) from excessive current and short circuits.

6.6.2 Circuit Breakers

Circuit breakers work in much the same way as fuses; however, when the circuit breaker triggers, the action opens contacts de-energizing the circuit without injury to itself. When the faulty condition is cleared, resetting the circuit breaker allows it to be used over again. Circuit breakers used in the FTHE system are listed in Table 6-6.

Table 6-6 FTHE Circuit Breakers

DESIGNATION	RATING	PURPOSE
HPU HIGH VOLTAGE ENCLOSURE (ENC102)		
CB101	0.5A	Provides input control and circuit protection for the HPU line power phase monitor (PM101).
CB102	2A	Provides input control and circuit protection for Transformer (T101).
CB103	2A	Provides input control and circuit protection for Transformer (T102).
CB104	6A	Provides input control and circuit protection of the HPU Supply Tank heater (HTR-101).
HC HIGH VOLTAGE ENCLOSURE (ENC8)		
CB6	0.5A	Provides input control and circuit protection for the HC line power phase monitor (PM2).
CB7	2A	Provides input control and circuit protection for Transformer (T4).
CB8	2A	Provides input control and circuit protection for Transformer (T3).
CB9	6A	Provides input control and circuit protection of the HC Supply Tank heater (HTR-3).

6.7 PROXIMITY AND LOAD PIN SENSORS

Proximity sensors are devices that respond to the presence of strategically placed metal targets within the target sensor range. When the sensor is activated, it causes a lamp to illuminate (identifying a system status change), a digital display to vary (identifying a unit of measurement change), or an action to cease (preventing a unit from reaching its end-of-travel [EOT]).

A load pin sensor is a device used to provide data to the load pin circuit to measure (calculate) the cable tension between the Docking Head Sheave Assembly and the Winch Drum. Proximity sensors used in the FTHE system are listed in Table 6-7.

Table 6-7 FTHE Proximity Sensors

DESIGNATION	SENSOR	PURPOSE
XS107	Levelwind	This sensor is mounted in the center of the LW Carriage Assembly It measures the fleet angle of the umbilical cable between the LW and the Umbilical Winch drum and sends an error signal to LW Control Board (PCB102) for processing.
XS109	Right EOT	This sensor is mounted inside the Carriage LW frame, right side. It stops the LW carriage when the cable is approximately one cable diameter's width from the right-side end of the drum flange.
XS110	Left EOT	This sensor is mounted inside the Carriage LW frame, left side. It stops the LW carriage when the cable is approximately one cable diameter's width from the left-side end of the drum flange.
XS111, XS112	Line Count	These sensors are mounted adjacent to each other on the LW Sheave. They work in conjunction with each other to provide umbilical cable line count and line speed data for display at the Pedestal and Control Van Panel.
XS108	Diamond Screw LW Sensor	
XS13	Diamond Follower Sensor	
XS6	A-Frame Outboard	This sensor causes the Pedestal A-Frame Outboard lamp to illuminate when the A-Frame is luffed outboard and is stationary on the A-Frame base weldment hard stops.
RE102	**Drum Speed Encoder**	**???**
XS9	HC Top	Indicates when the Flying Head has topped out.
XS10	HC Bottom	Indicates when the Flying Head has bottomed out.
XS11	Cursor Winch Payout Limit	This sensor causes the Cursor Winch to stop when a predetermined length of cable has been paid out thus preventing a chance for the cable to become detached and causing the loss of the vehicle/package.
LP-1	Load Pin	This sensor is mounted at the Docking Head Sheave Assembly. It provides data to the load pin circuit to measure (calculate) the umbilical cable tension between the Docking Head Sheave Assembly and the Winch Drum. The data is displayed at both Pedestal and Control Van Panel.

6.8 TROUBLESHOOTING PROCEDURES INDEX – FTHE GENERAL

This section contains information necessary to locate a malfunction in the FTHE system using Table 6-8, FTHE Fault Isolation Table, Table 6-9, FTHE System Troubleshooting Procedures Index, and Table 6-10, FTHE System Troubleshooting Procedures. When a fault occurs, identify the symptom in Table 6-8 and the suspected ID Tag # or component as appropriate. In Table 6-9 under the appropriate FTHE assembly, locate the ID Tag # of the suspected faulty component and the referenced Table-10, Item Number. Refer to Table-10 to locate the Item Number and the troubleshooting procedures associated with the suspected faulty ID Tag #/component.

This manual was designed for technicians/operators with prior experience in the use of umbilical handling systems and with a basic understanding of hydraulic and electrical systems. Because of this assumed level of understanding, no attempt has been made to provide obvious troubleshooting solutions such as what to do if an electrical cable is disconnected, the Umbilical Winch Assembly chain breaks, or a lamp is burned out.

Affected component parts are identified by "ID TAG #" where appropriate and are listed in Table 8-2, Shipboard Maintenance Parts List or Table 8-3, Depot Maintenance Parts List. Shipboard Maintenance Parts are those parts that are stowed onboard ship and can be replaced with appropriate tools and test equipment also found onboard ship. Depot Maintenance Parts are those parts not carried onboard ship and due to size, weight, tools/test equipment required, and/or complexity of repair, are not intended to be replaced onboard ship.

Following any corrective action listed in Table 6-10 or other actions deemed necessary by maintenance personnel, appropriate testing shall be performed on the unit which has been repaired to ascertain that the repair has been accomplished satisfactorily.

Table 6-8 FTHE Fault Isolation Table

SYMPTOM	ID TAG #/COMPONENT
Intensifier fails to start	• High pressure nitrogen ball valve (BV-22) closed • Lower pressure nitrogen ball valve (BV-23) closed • Low pressure switch (PSH-7) failed • High pressure switch (PSH-8) failed • Low nitrogen pressure (less than 500 psig.)
Nitrogen system leaking	• Loose hose connection • Damaged hose/tubing • SOV-15 leaking
LCI-90 Line data display fails	• DSP101 Fuse (F0) • DSP2 Fuse (F0) • Power cable disconnected
No tension reading on LCI-90 Line Data display	• Docking Head Load Pin (LP-1) failed • Computer I/O CCA failed • DSP2/DSP101 failed • VME Enclosure SBC CCA failed • VME Enclosure D/A CCA failed

Table 6-8 FTHE Fault Isolation Table – *continued*

SYMPTOM	ID TAG #/COMPONENT
No altitude reading on LCI-90 Line Data display	• Vehicle altimeter failed • Computer I/O CCA failed • DSP2/DSP101 failed • VME Enclosure SBC CCA failed • VME Enclosure D/A CCA failed • Loose signal sensor at rear of computer • Network problem
No ship's system cooling water	• Ship's supply pump failed • Strainer (STR-7) clogged • Strainer (STR-8) clogged
No AC power	• Power generator(s) failed • HPU HV Enclosure Fuse (F101) failed • HPU HV Enclosure Fuse (F102) failed • UPS failed • HPU LBC Enclosure 3-phase power connected incorrectly
HC Assembly Flying Head collapsed	• Nitrogen pressure low • SVV-2 pilot valve failed • CV-7 failed • CV-8 failed • SOV-9 through SOV-12 failed
Oil temperature alarm	• No cooling water • Sensor
Levelwind Carriage Assembly drives into stop	• EOT Right (XS109) sensor failed • EOT Left (XS110) sensor failed
LW Assembly becomes sluggish or stops completely	• Replace filter (FL-111) element
Umbilical Winch Assembly Brakes fail to release	• Joystick faulty • Relay failure • Low oil pressure • Air in line • PSH-103 failure

The FTHE Troubleshooting Procedures Index (Table 6-9) is sorted by the LRU ID TAG within the major FTHE System Assemblies listed in the following order:

- Umbilical Winch Assembly
- Levelwind Assembly
- HPU Assembly
- HC Assembly
- A-Frame Assembly
- Control Station – Local
- Control Station – Remote

Table 6-9 FTHE System Troubleshooting Procedures Index

ID TAG	DESCRIPTION	REFER TO TABLE 6-10 ITEM NO.
---	**UMBILICAL WINCH ASSEMBLY**	---
BK-101, BK-102	Winch Brakes	1
---	**LEVELWIND ASSEMBLY**	---
GB-102	Gearbox	4
SVV-101 & SVV-102	Servo Valves	5
PSH-103	Pressure Switch for Brake BK-102	6
PCB102	Levelwind Controller	7
XS107	Electro-Active Levelwind Sensor	8
XS109	EOT Right Proximity Sensor	9
XS110	EOT Left Proximity Sensor	10
XS111, XS112	Line Count Proximity Sensor	11
XS108	Diamond Screw LW Proximity Sensor	11
XS113	Diamond Follower Proximity Sensor	12
---	**HPU ASSEMBLY**	---
CB101, CB102, CB103, CB104	Circuit Breaker	49
CV-1, CV-2	Check Valve	14
CV-3, CV-4	Check Valve	15
CV-105, CV-106, CV-107	Check Valve	16
DSP101	Display	73, 74, 121, 122, 123
F110, F111, F112	Fuse	25
HPU #1, HPU #2	Hydraulic Power Unit	59
K110, K112, K113, K114, K115, K116, K118, K119, K120	Relay	27 - 37
K101, K102, K103	Relay	70 - 72
K121, K122, K123, K124, K128, K129	Relay	38 - 45
K31, K36	Relay	46, 47, 48
LT115	Indicating Lamp	50
LT102, LT101, LT104, LT103, LT106, LT105	Indicating Lamp	51 - 57
MS101, MS102	Magnetic Motor Starter	58
PB101, PB102, PB103, PB104	Push Button Switch	60 - 67
PB105	Push Button Switch	68, 69
PM101	Power Line Monitor	50
PRRV-101	Pressure Reducing / Relieving Valve	17
PRV-1, PRV-2	Pressure Reducing Valve	18

Table 6-9 FTHE System Troubleshooting Procedures Index - *continued*

ID TAG	DESCRIPTION	REFER TO TABLE 6-10 ITEM NO.
PSH-101, PSH-102, PSH-104	Pressure Switch	19, 20
SOV-105, SOV-106	Solenoid Operating Valve	22, 23, 24
---	**HC ASSEMBLY**	---
BV-25, BV-26	Ball Valve	80
CB6, CB7, CB8, CB9	Circuit Breaker	86, 88
CV-10, CV-11, CV-12, CV-13, CV-14, CV-15	Check Valve	81
ENC8	High Voltage Enclosure	95 - 98
F7	Fuse	87
HTR-3	Heater	88
K23, K24	Relay	101, 102
K24	Relay	88, 102
K25, K26, K27, K28, K29, K30	Relay	106 - 111
K32, K33	Relay	83, 84
K34 K35, K38	Relay	112 - 114
LT29, LT30, LT31, LT32, LT33	Indicating Lamp	89 – 93, 194
MS3	Magnetic Motor Starter	94
MS4	Magnetic Motor Starter	82
PB10, PB11	Push Button Switch	99, 100
PM2	Power Line Monitor	89
PS4	DC-DC Converter	105
SOV-13, SOV-14, SOV-15, SOV-16	Solenoid Operating Valve	85
SOV-17	Solenoid Operating Valve	75
SOV-20	Solenoid Operating Valve	76
SOV-6	Solenoid Operating Valve	77
SOV-7, SOV-18	Solenoid Operating Valve	78
SOV-9, SOV-10, SOV-11, SOV-12, SOV-19	Solenoid Operating Valve	79
SW10	Switch	103, 104
---	**A-FRAME ASSEMBLY**	---
CV-4, CV-105	Check Valve	118
PRV-1	Pressure Reducing Valve	119
SC1	Signal Conditioning Unit	115
SOV-5	Solenoid Operating Valve	120
XS11	Proximity Sensor	117

Table 6-9 FTHE System Troubleshooting Procedures Index - *continued*

ID TAG	DESCRIPTION	REFER TO TABLE 6-10 ITEM NO.
---	**CONTROL STATION – LOCAL**	---
---	**PEDESTAL**	---
CH101	Joystick	143
CH102	Joystick	144
CH103	Joystick	145
CH104	Joystick	146
DSP101	Display	73, 74, 121, 122, 123
LT107, LT108, LT109, LT110, LT111, LT112, LT113, LT114, LT115, LT116, LT117	Indicating Lamp	124 - 139
PB106	Push Button	147, 148
PB107	Push Button	149, 150
SW103	Toggle Switch	151
SW108	Toggle Switch	158
SW104	Toggle Switch	152
SW105	Toggle Switch	153, 154
SW106	Toggle Switch	155
SW107	Toggle Switch	157
---	**CONTROL STATION – REMOTE**	---
--	**MONITOR**	---
--	**CONTROL VAN PANEL**	---
CH5	Joystick	174
DSP1	Display	159, 160, 161
LT13, LT14	Indicating Lamp	162, 163, 169, 189, 190
LT15	Indicating Lamp	172, 191
LT16	Indicating Lamp	164
LT17	Indicating Lamp	173, 192
LT19	Indicating Lamp	165
LT20	Indicating Lamp	166
LT21, LT22	Indicating Lamp	167, 168, 193
LT35	Indicating Lamp	170
LT36	Indicating Lamp	171
PB8	Push Button Switch	175
PB9	Push Button Switch	176

Table 6-9 FTHE System Troubleshooting Procedures Index - *continued*

ID TAG	DESCRIPTION	REFER TO TABLE 6-10 ITEM NO.
--	**COMPUTER**	---
CI-GUI	Computer Interface	177 - 188
--	**KEYBOARD**	---
--	**SIGNAL INTERFACE ENCLOSURE**	---
SC3	Signal Conditioning Unit	195
--	**VME ENCLOSURE**	---
--	**UPS**	---

6.9 TROUBLESHOOTING PROCEDURES - FTHE GENERAL

This paragraph provides troubleshooting procedures to aid the maintenance personnel in a logical procession of steps to quickly and correctly identify faulty equipment down to the LRU level. Refer to the Troubleshooting Procedures Index (section 6.8) to find the appropriate LRU Item Number. Once the LRU Item Number is known, return to this paragraph. Find the Item Number listed in the Item No. column (Table 6-10) under the associated major unit (assembly) and that is the LRU troubleshooting procedure.

Table 6-10 FTHE System Troubleshooting Procedures

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
UMBILICAL WINCH ASSEMBLY			
1	Winch Brake	Brake not releasing BK-101, BK-102	Verify the levelwind pump pressure. This is the source used to release the brake. If no pressure is present, troubleshoot, repair or replace pump. Verify the brake release pressure is equal to or greater than 1500 psi. Install a pressure gauge at the brake, if necessary, to check the pressure. If the pressure is low, increase the pressure at the pressure reducing valve on the levelwind hydraulic panel. Note: the maximum brake pressure must not exceed 3000 psi. Verify the electrical signal to the brake release solenoid. If no signal is present, troubleshoot per the electrical schematic. Verify the solenoid is switching. If the solenoid is not switching, troubleshoot, repair or replace as required.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
LEVELWIND ASSEMBLY			
2	Not Used		
3	Not Used		
4	Gearbox	Gearbox Failure, Excessive Noise GB-102	Visually inspect for damage or transmission drive obstructions. Remove any obvious obstructions or foreign material from the drive train. Verify proper lubrication. Verify proper implementation of maintenance schedule in accordance with manufacturer's recommendations. Consult with manufacturer for factory service, repair or replacement recommendations.
		WINCH & LEVELWIND HYDRAULIC PANEL	
5	Valve Fault	Servo Valve SVV-101 located on MANF-103 SVV-102 located on MANF-104	Ref: 1088-8211-01 If the valve fails to operate, check the electrical supply and verify the voltage agrees with the rating. Verify pressure complies with the rating. Replace valve if necessary.
6	Switch Fault	Pressure Switch, PSH-103for Brake BK-102	Ref. 1088-8211-01 Verify voltage at the switch. If correct voltage is present then replace the switch. If no voltage is measured, continue troubleshooting via schematic.
		LEVELWIND ENCLOSURE (ENC105)	
7	Faulty Levelwind Controller	Levelwind Controller PCB102	Ref 1088-9001-05 Verify input and output voltage of PCB102. If not correct troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.
8	Electro-Active Levelwind Sensor Faulty	Proximity Sensor XS107	Ref 1088-9001-05 Verify input and output voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.
9	Levelwind Right End of Travel Sensor Faulty	Proximity Sensor XS109	Ref 1088-9001-05 Verify input and output voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
10	Levelwind Left End of Travel Sensor Faulty	Proximity Sensor XS110	Ref 1088-9001-05 Verify input and output voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.
11	Levelwind Line Count Sensor Faulty	Proximity Sensor XS111, XS112	Ref 1088-9001-05 Verify input and output voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.
12	Diamond Screw Levelwind Sensor Faulty	Proximity Sensor XS108	Ref 1088-9001-05 Verify input and output voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.
13	Diamond Follower Sensor Faulty	Proximity Sensor XS113	Ref 1088-9001-05 Verify input and output voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.

(excerpt from DYNACON manual as follows)

1. LEVELWIND TOTALLY INOPERATIVE

a. Check fuses F1, F2, and F3 on printed circuit card DY96000-102-03.

b. If fuses OK, connect voltmeter across T19 and T20 and press Corrector switch B. Check for approximately +/- 2 Volts.

c. If voltage OK, check levelwind hydraulics.

d. Check to see that Levelwind PCB is ENABLED when brake is released.

e. If no voltage, problem is in circuit card, refer to electrical schematic # DY9600-01.

2. Levelwind Out Of Adjustment

The levelwind is shipped in a calibrated or adjusted condition and should not need adjustment. Should adjustment be required, refer to adjustment procedures on enclosed Drawing DY9600-01.

3. Problems

If one or more of the functions on the levelwind are backward, it is best to start from the beginning and make sure that the electrical part of the system is correctly hooked up.

a. Check to see if the levelwind carriage drives in the correct direction when the "T-BAR" is moved over the levelwind sensor block. Remember to enable the levelwind PCB. If the carriage drives in the right direction, proceed to #2. If it does not reverse the hydraulic lines feeding the levelwind motor.

b. Next, make sure that the levelwind sensor signal and the levelwind corrector pushbuttons move the levelwind carriage in the same direction. If they do not, then reverse the levelwind correctors.

c. Confirm that the right EOT sensor stops the levelwind carriage when it is moving right and that the left EOT sensor stops the levelwind carriage when it is traveling left. If they do not, then reverse the EOT sensor signals to the levelwind PCB.

d. Re-check the above steps to confirm setup okay.

4. Sensor Assembly And End-Of-Travel Adjustments

The following adjustments are done when cable is first loaded on the winch. We attempt to adjust this as close as possible but until the actual end-user cable is being wrapped onto the drum, final adjustment is difficult, particularly with small cables.

There are two mechanical adjustments that may need to be made on the levelwind system. The first is the tracing adjustment which is made by loosening the pivot bolt that the sense arm assembly swings on and the bolt that is installed through an arched slot. After loosening both of these bolts, the mounting plate can be pivoted, changing the tracking position of the levelwind. The proper adjustment will allow for a slight lagging of the levelwind in BOTH directions of travel. At no time should the cable lead the wraps on the drum as it moves across.

The second set of adjustments is the "End-of-Travel" stops. There are two proximity sensors on the levelwind carriage that sense the passing of a metal rod sticking out to the inside of both sides of the levelwind frame. These rods are moved in/out to cause the levelwind carriage to stop when the cable is approximately one-half cable diameter from the edge of the drum flange. If the carriage travels too far so the cable comes up against the drum flange, the cable may stack up against the flange and not roll off the start back across the drum. If the carriage stops too far away from the drum flange, gaps may appear at the flanges that will get progressively worse as cable is wound on the drum.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
HPU ASSEMBLY			
		HPU HYDRAULIC PANEL – SCHEMATIC	
14	Valve Leakage	Check Valve, CV-1, CV-2	Ref. 1088-8331-01 If leaking at the end connection, verify the connection is not cross threaded and is properly tightened. If leakage continues, replace the valve. If leakage is internal, the valve is stuck “open” replace the valve.
15	Valve Leakage	Check Valve, CV-3, CV-4	Ref. 1088-8331-01 If leaking at the end connection, verify the connection is not cross threaded and is properly tightened. If leakage continues, replace the valve. If leakage is internal, the valve is stuck “open” replace the valve.
16	Valve Leakage	Check Valve, CV-105, CV-106, CV-107	Ref. 1088-8331-01 If leaking at the end connection, verify the connection is not cross threaded and is properly tightened. If leakage continues, replace the valve. If leakage is internal, the valve is stuck “open” replace the valve.
17	Valve Fault	Pressure Reducing Valve, PRRV-101	Ref: 1088-8331-01 If the valve fails to operate or has erratic pressure: Check the valve for proper adjustment. Verify the cleanliness of the oil.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			Inspect the poppet or seat for excessive wear. Verify the orifice or balance hole is not restricted. Verify the spool does not bind in the body Inspect the spool bore for excessive wear. Replace the valve if necessary.
18	Valve Fault	Pressure Reducing Valve, PRV-1 & PRV-2	Ref: 1088-8331-01 If the valve fails to operate or has erratic pressure: Check the valve for proper adjustment. Verify the cleanliness of the oil. Inspect the poppet or seat for excessive wear. Verify the orifice or balance hole is not restricted. Verify the spool does not bind in the body Inspect the spool bore for excessive wear. Replace the valve if necessary.
19	Winch Pressure Switch Fault	Pressure Switch, HPU #1 and HPU #2, PSH-101, PSH-102	Ref. 1088-9001-03 Displays on PSH-101, PSH-102 Verify voltage at the switch. If correct voltage is present then replace the switch. If no voltage is measured, continue troubleshooting via schematic.
20	B-Port Switch Fault	Pressure Switch, PSH-104	Ref. 1088-9001-03 Verify voltage at the switch. If correct voltage is present then replace the switch. If no voltage is measured, continue troubleshooting via schematic.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
21	Not Used		
22	Constant Tension Solenoid Fault	Solenoid Operating Valve, SOV-105	Ref. 1088-9001-03, 1088-8331-01 If HPU #1 shuts down then verify circuit functionality (K122, F101, F102, CB101, CB102, and CB103). Blown fuse F102 possibly indicates short in SOV-105 or SOV-106.
23	Constant Tension Solenoid Fault	Solenoid Operating Valve, SOV-106	Ref. 1088-9001-03, 1088-8331-01 If HPU #2 shuts down then verify circuit functionality (K122, F101, F102, CB101, CB102, and CB103). Blown fuse F102 possibly indicates short in SOV-105 or SOV-106.
24	Valve Fault	Solenoid Operating Valve, SOV-105, SOV-106	Ref: 1088-8331-01 If the valve fails to operate, then check the electrical supply and verify the voltage agrees with the rating. Check the coil with an ohmmeter for shorted or opened coil. Verify the pressure complies with the rating. If the valve is sluggish or is inoperative, disassemble the valve and clean out extraneous matter. The plunger must be free to move without binding. Check for excessive wear or broken components. If the valve is leaking externally, verify that all sleeve and/or cover screws are torqued to specifications. Check o-rings for damage and replace if necessary. If the valve is leaking internally, disassemble the valve and remove extraneous matter and/or clean parts. Examine sealing surfaces for dirt. Remove all foreign particles. Examine orifice for nicks or excessive wear. Check the plunger spring for damage. If the valve is “chattering” or “buzzing” when energized, remove power from the coil. Inspect the plunger and sleeve for excessive wear or contamination. Replace the valve if necessary.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
		HPU LOW VOLTAGE ENCLOSURE (ENC103)	
25	Blown Fuse	Fuse F110, F111, F112	Ref. 1088-9001-03 Verify the fuse has blown. Continue to troubleshoot via the circuit diagram to locate the short or overload condition. Once the condition is located and corrected, replace the fuse.
26	HPU Startup	Panel, HPU Startup without Control Van Panel ENC5 Connected	Ref. 1088-9001-03 Verify each Control Van Panel ENC5 cable has conductors isolated (protective connector caps installed) and install a temporary jumper across HPU LV ENC103 **TB103-230 and TB103-231**.
27	Indicator Lamp Not Illuminated	Relay, K110	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
28	Indicator Lamp Not Illuminated	Relay, K112	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
29	Indicator Lamp Not Illuminated	Relay, K113	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
30	Indicator Lamp Not Illuminated	Relay, K114	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
31	Indicator Lamp Not Illuminated	Relay, K115	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
32	Indicator Lamp Not Illuminated	Relay, K116	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
33	Indicator Lamp Not Illuminated	Relay, K119	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
34	Indicator Lamp Not Illuminated	Relay, K120	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
35	Indicator Lamp Not Illuminated	Relay, K118	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
36	Not Used		
37	Not Used		
38	Indicator Lamp Not Illuminated	Relay, K129	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
39	Indicator Lamp Not Illuminated	Relay, K128	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
40	Indicator Lamp Not Illuminated	Relay, K121	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
41	Indicator Lamp Not Illuminated	Relay, K122	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
42	Indicator Lamp Not Illuminated	Relay, K118	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
43	Not Used		

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
44	Indicator Lamp Not Illuminated	Relay, K123	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
45	Indicator Lamp Not Illuminated	Relay, K124	Ref 1088-9001-03 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
46	Indicator Lamp Not Illuminated	**Relay, K31** **HC Cylinder Lock**	Ref 707-9001-01 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
47	Indicator Lamp Not Illuminated	**Relay, K36** **Cursor Winch Payout Limit**	Ref 707-9001-01 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
48	Not Used		
		HPU HIGH VOLTAGE ENCLOSURE (ENC102)	
49	Tripped Circuit Breaker	Circuit Breaker, CB101, CB102, CB103, CB104	Ref. 1088-9001-02 Verify the circuit breaker has been tripped. To find out whether the problem has corrected itself, reset the breaker. If the problem persists, the breaker will shut itself off again. Verify that the circuit breaker is in good working condition. Replace the circuit breaker as required. If the circuit breaker keeps tripping continue troubleshooting via the circuit diagram.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
50	Power Fault Lamp LT101 Illuminates	Indicating Lamp, Power Line Monitor, LT115, PM101	Ref 1088-9001-02 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
51	Power OK Lamp (OFF=Fault)	Indicating Lamp, LT102 (24VAC)	Ref. 1088-9001-02 Verify 460VAC, 3-phase supply power (generator running and breakers ON) and each Emergency Stop switch is OUT (PB107, PB105, PB8). Measure voltage across lamp (24VAC). If voltage present replace bulb, otherwise, secure power and verify functionality of MS101, MS102, CB101, CB102, CB103, PM101, SW101, SW102, F101, F102.
52	Lamp Not Illuminated	Indicating Lamp, LT101	Ref 1088-9001-02 Verify input voltage to lamp. If voltage is not correct, troubleshoot using circuit diagram. If voltage input is correct, replace unit.
53	Power Fault Lamp (ON=Fault)	Indicating Lamp, LT101 (24VAC)	Ref. 1088-9001-02 Verify 460VAC, 3-phase supply power and phases are correct.
54	HPU #2 Running Lamp (OFF while running = Fault)	Indicating Lamp, LT104 (24VAC)	Ref. 1088-9001-02 Compare redundant indications (HPU, Pedestal ENC104, and Control Van Panel ENC5). Determine if specific indication differs. Verify circuit functionality by measuring voltage across lamp (24VAC). Replace lamp or repair circuit (MS102, CB101, CB102, CB103, K102, CT102, F101, and F102) as necessary.
55	HPU #1 Running Lamp (OFF while running = Fault)	Indicating Lamp, LT103 (24VAC)	Ref. 1088-9001-02 Compare redundant indications (HPU, Pedestal ENC104, and Control Van Panel ENC5). Determine if specific indication differs. Verify circuit functionality by measuring voltage across lamp (24VAC). Replace lamp or repair circuit (MS101, CB101, CB102, CB103, K101 CT101, F101, and F102).

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
56	Hydraulic Oil Heating Lamp (ON = Heating)	Indicating Lamp, LT106 (24VAC)	Ref. 1088-9001-02, -04 Compare redundant indications (HPU panel and Pedestal ENC104). If lamp remains on continuously verify functionality of temperature sensors (TSH101, TSH102), heaters (HTR101), and circuits (K103, MS101, MS102), CB104). If never lit, measure voltage (24VAC) across lamp and replace lamp if faulted.
57	Hydraulic Oil Cooling Lamp (OFF=Fault)	Indicating Lamp, LT105 (24VAC)	Ref. 1088-9001-02, -04, HPU High Voltage ENC102 and Pedestal ENC104 Compare redundant indications (HPU, Pedestal ENC104, and Control Van Panel ENC5). Verify inlet and exit water flow. If no supply flow: turn ON, fix, or repair pump. If no exit flow, located/clear blockage. If exit flow is sufficient, measure voltage (24VAC) across lamp and replace lamp if faulted. Verify water pressure and voltage at PSH-4. If pressure and voltage present adjust/replace pressure switch. If no voltage is measured, verify CB101, CB102, CB103, F101, F102, MS101, MS102 functionality.
58	Faulty Contactor	Magnetic Motor Starter MS101, MS102	Ref 1088-9001-02 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
59	HPU #1 or HPU #2 Slow to Start	Power, HPU #1, HPU #2	Ref. 1088-9001-02, 1088-8331-01 Verify 460VAC, 3-phase supply power. Check Hydraulic line-up (BV1, BV2, BV3, BV4 – should be shut at startup). Verify oil level, PSH-101, PSH-102 functionality.
60	Push Button Not Functioning	Push Button Switch, PB101	Ref 1088-9001-02 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
61	HPU #1 Stop Push Button (Press to Stop)	Push Button Switch, PB101	Ref. 1088-9001-02 HPU #1 fails to stop when pressed. Use PB105 to shut off HPU(s). Secure power and perform PB101 continuity measurements and verify K101 functionality.
62	Push Button Not Functioning	Push Button Switch, PB102	Ref 1088-9001-02 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified, replace unit.
63	HPU #1 Start Push Button (Fails to Start)	Push Button Switch, PB102	Ref. 1088-9001-02, -03, -04 Verify PB106 on Pedestal ENC104 is OUT. Attempt HPU #2 startup. If HPU #2 starts, verify HPU #1 start switch circuit functionality (K101, MS101, SS1, CB101, CB102, CB103, F101, and F102). If HPU #2 fails to start, verify each STOP (HPU, Pedestal ENC104) switch (PB107, PB105) is in the OUT position and verify Pedestal ENC104 joysticks are in neutral position(s). Otherwise, verify STOP switches (PB101, PB103), joysticks centered (CH101, CH102, CH103, CH104), start switch (PB102), and CT101 circuit functionality.
64	Push Button Not Functioning	Push Button Switch, PB103	Ref 1088-9001-02 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified, replace unit.
65	HPU #2 Stop Push Button (Press to Stop)	Push Button, PB103	Ref. 1088-9001-02 HPU #2 fails to stop when pressed. Use PB105 to shut off HPU(s). Secure power and perform PB103 switch continuity measurements and verify K102 functionality
66	Push Button Not Functioning	Push Button Switch, PB104	Ref 1088-9001-02 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
67	HPU #2 Start Push Button (Fails to Start)	Push Button, PB104	Ref. 01088-9001-02, -04 Verify PB106 on Pedestal ENC104 is OUT. Attempt HPU #1 startup. If HPU #1 starts, verify HPU #2 start switch circuit functionality (K102, MS102, SS2, CB101, CB102, CH103, F101, and F102). If HPU #1 fails to start, verify each STOP (HPU, Pedestal ENC104) switch (PB107, PB105) is in the OUT position and verify Pedestal ENC104 joysticks are in neutral position(s). Otherwise, verify STOP switches (PB101, PB103), joysticks centered (CH101, CH102, CH103, CH104), start switch (PB104), and CT102 circuit functionality.
68	Emergency Stop Button Fails to Work	Push Button Switch, PB105	Ref 1088-9001-02 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified, replace unit.
69	Emergency Stop Push Button (SW Out = Run)	Push Button, PB105	Ref. 1088-9001-02 and -04 Redundant function provided (PB107 on Pedestal ENC104 and PB8 on Control Van Panel ENC5) - verify each in Out position. Cycle switch to test functionality. If functional after cycling, power down system and inspect for loose connection, perform switch continuity measurements, replace switch, verify K101 and K102 functionality.
70	Indicator Lamp Not Illuminated	Relay, K101	Ref 1088-9001-02 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified, replace unit.
71	Indicator Lamp Not Illuminated	Relay, K102	Ref 1088-9001-02 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified, replace unit.
72	Lamp Not Illuminated	Relay, K103	Ref 1088-9001-02 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
		HPU POWER ISOLATION (ENC101)	
73	Display OFF, Switch ON	Display, DSP101	Ref. 1088-9001-02 Measure voltages within the A-Frame/Winch System High Voltage Enclosure. Verify 460VAC, 3 phase supply power is provided to the enclosure (generator running and breakers ON) and phases are correct. Check for input voltage to display. Check functionality of power circuits: breakers, fuses, switches, and power supplies.
74	Display ON, Fails to Start	Display, DSP101	Ref. 1088-9001-02 Verify phases are mapped correctly. Check for data signal to display from DSP101. Check functionality of power circuits: contactors, breakers, fuses, switches, and power supplies.
		HC ASSEMBLY	
		HC HYDRAULIC PANEL	
75	Valve Fault	Solenoid Operating Valve, SOV-17	Ref: 0707-8201-01 If the valve fails to operate, check the electrical supply and verify the voltage agrees with the rating. Check the coil with an ohmmeter for opened coil. Verify the pressure complies with the rating. If the valve is sluggish or is inoperative, disassemble the valve and clean out extraneous matter. The plunger must be free to move without binding. Check for excessive wear or broken components.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			If the valve is leaking externally, verify that all sleeve and/or cover screws are torqued to specifications. Check O-rings for damage and replace if necessary. If the valve is leaking internally, disassemble the valve and remove extraneous matter and/or clean parts. Examine sealing surfaces for dirt. Remove all foreign particles. Examine orifice for nicks or excessive wear. Check the plunger spring for damage. If the valve is “chattering” or “buzzing” when energized, remove power from the coil. Inspect the plunger and sleeve for excessive wear or contamination. Replace the valve if necessary.
76	Valve Fault	Solenoid Operating Valve, SOV-20	Ref: 0707-8201-01, Zone D4 If the valve fails to operate, check the electrical supply and verify the voltage agrees with the rating. Check the coil with an ohmmeter for opened coil. Verify the pressure complies with the rating. If the valve is sluggish or is inoperative, disassemble the valve and clean out extraneous matter. The plunger must be free to move without binding. Check for excessive wear or broken components. If the valve is leaking externally, verify that all sleeve and/or cover screws are torqued to specifications. Check o-rings for damage and replace if necessary. If the valve is leaking internally, disassemble the valve and remove extraneous matter and/or clean parts. Examine sealing surfaces for dirt. Remove all foreign particles. Examine orifice for nicks or excessive wear. Check the plunger spring for damage.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			If the valve is “chattering” or “buzzing” when energized, remove power from the coil. Inspect the plunger and sleeve for excessive wear or contamination. Replace the valve if necessary.
77	Valve Fault	Solenoid Operating Valve, SOV-6	Ref: 0707-8201-01, Zone A5 If the valve fails to operate, check the electrical supply and verify the voltage agrees with the rating. Check the coil with an ohmmeter for opened coil. Verify the pressure complies with the rating. If the valve is sluggish or is inoperative, disassemble the valve and clean out extraneous matter. The plunger must be free to move without binding. Check for excessive wear or broken components. If the valve is leaking externally, verify that all sleeve and/or cover screws are torqued to specifications. Check o-rings for damage and replace if necessary. If the valve is leaking internally, disassemble the valve and remove extraneous matter and/or clean parts. Examine sealing surfaces for dirt. Remove all foreign particles. Examine orifice for nicks or excessive wear. Check the plunger spring for damage. If the valve is “chattering” or “buzzing” when energized, remove power from the coil. Inspect the plunger and sleeve for excessive wear or contamination. Replace the valve if necessary.
78	Valve Fault	Solenoid Operating Valve, SOV-7, SOV-18	Ref: 0707-8201-01, Zone C7/D5 If the valve fails to operate, check the electrical supply and verify the voltage agrees with the rating. Check the coil with an ohmmeter for opened coil. Verify the pressure complies with the rating.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			If the valve is sluggish or is inoperative, disassemble the valve and clean out extraneous matter. The plunger must be free to move without binding. Check for excessive wear or broken components. If the valve is leaking externally, verify that all sleeve and/or cover screws are torqued to specifications. Check o-rings for damage and replace if necessary. If the valve is leaking internally, disassemble the valve and remove extraneous matter and/or clean parts. Examine sealing surfaces for dirt. Remove all foreign particles. Examine orifice for nicks or excessive wear. Check the plunger spring for damage. If the valve is “chattering” or “buzzing” when energized, remove power from the coil. Inspect the plunger and sleeve for excessive wear or contamination. Replace the valve if necessary.
79	Valve Fault	Solenoid Operating Valve, SOV-9, SOV-10, SOV-11, SOV-12, SOV-19	Ref: 0707-8201-01, Zone C6/C4 If the valve fails to operate, check the electrical supply and verify the voltage agrees with the rating. Check the coil with an ohmmeter for opened coil. Verify the pressure complies with the rating. If the valve is sluggish or is inoperative, disassemble the valve and clean out extraneous matter. The plunger must be free to move without binding. Check for excessive wear or broken components. If the valve is leaking externally, verify that all sleeve and/or cover screws are torqued to specifications. Check o-rings for damage and replace if necessary.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			If the valve is leaking internally, disassemble the valve and remove extraneous matter and/or clean parts. Examine sealing surfaces for dirt. Remove all foreign particles. Examine orifice for nicks or excessive wear. Check the plunger spring for damage. If the valve is “chattering” or “buzzing” when energized, remove power from the coil. Inspect the plunger and sleeve for excessive wear or contamination. Replace the valve if necessary.
		HC ASSEMBLY – GAS INTENSIFIER ENCLOSURE (ENC7)	
80	Valve Leakage	Ball Valve, BV-25, BV-26	Ref. 0707-8301-01 If leaking at the stem, the valve packing may be adjusted. To adjust the valve packing remove the handle and tighten the packing bolt clockwise in 1/16-turn increments until a leak-tight seal is achieved. If leaking at the end connection, verify the connection is not cross threaded and is properly tightened. If leakage continues, replace the valve.
81	Valve Leakage	Check Valve, CV-10, CV-11, CV-12, CV-13, CV-14, CV-15	Ref. 0707-8301-01 If leaking at the end connection, verify the connection is not cross threaded and is properly tightened. If leakage continues, replace the valve. If leakage is internal to the valve, replace the valve.
82	Faulty Contactor	Magnetic Motor Starter, MS4	Ref 0707-9001-09, Zone C-4 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified and outputs are still not correct, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
83	Indicator Lamp Not Illuminated	Relay, K32	Ref 0707-9001-09, Zone C-2 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified, replace unit.
84	Indicator Lamp Not Illuminated	Relay, K33	Ref 0707-9001-09, Zone C-2 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified, replace unit.
85	Valve Fault	Solenoid Operating Valve, SOV-13, SOV-14, SOV-15, SOV-16	Ref: 0707-8301-01 If the valve fails to operate, check the electrical supply and verify the voltage agrees with the rating. Check the coil with an ohmmeter for opened coil. Verify the pressure complies with the rating. If the valve is sluggish or is inoperative, disassemble the valve and clean out extraneous matter. The plunger must be free to move without binding. Check for excessive wear or broken components. If the valve is leaking externally, verify that all sleeve and/or cover screws are torqued to specifications. Check o-rings for damage and replace if necessary. If the valve is leaking internally, disassemble the valve and remove extraneous matter and/or clean parts. Examine sealing surfaces for dirt. Remove all foreign particles. Examine orifice for nicks or excessive wear. Check the plunger spring for damage. If the valve is “chattering” or “buzzing” when energized, remove power from the coil. Inspect the plunger and sleeve for excessive wear or contamination. Replace the valve if necessary.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
		HC HIGH VOLTAGE ENCLOSURE (ENC8)	
86	Tripped Circuit Breaker	Circuit Breaker, CB6, CB7, CB8, CB9	Ref. 0707-9001-08 Verify the circuit breaker has been tripped. To find out whether the problem has corrected itself, reset the breaker. If the problem persists, the breaker will shut itself off again. Verify that the circuit breaker in good working condition. Replace the circuit breaker as required. If the circuit breaker keeps tripping, continue troubleshooting via the circuit diagram.
87	Blown Fuse	Fuse, F7	Ref. 0707-9001-08, Zone C-5 Verify the fuse has blown. Continue to troubleshoot via the circuit diagram to locate the short or overload condition. Once the condition is located and corrected, replace the fuse.
88	HC Heater Not Responding	Heater, HC Oil Reservoir, HTR-3, TSH-5, K24, CB9	Ref 0707-9001-08 Zone B-7 Confirm circuit breaker (CB9) has not tripped. Verify voltage input to the relay (K24) and switch (TSH-5). If voltage is not correct, troubleshoot using circuit diagram. If voltage input is correct replace unit.
89	Power Fault Lamp Illuminates, LT29	Indicating Lamp, Power Line Monitor, LT29, PM2	Ref 0707-9001-08, Zone D-3 The lamp remains illuminated when a power fault (such as, but not limited to, a phase reversal) is present. If a fault persists, the HC HPU motor shuts down automatically. Locate and correct fault. If there is not a fault, verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
90	Power "OK" Indicator Not Illuminated	Indicating Lamp, Power OK Indicator, LT30	Ref. 0707-9001-08 Indicator is illuminated when power status is complete and power is OK. If not illuminated, verify power connections are correct. If connections are correct, verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified, replace unit.
91	Low Oil Indicator (Illuminated when Low)	Indicating Lamp, Low Oil Indicator Illuminated, LT31	Ref. 0707-9001-08 Indicator is illuminated when the hydraulic oil in the HC supply tank is below the minimum level. The HC HPU will not start when illuminated. Replenish/Fill the HC hydraulic oil supply tank. If still illuminated after filling to the required minimum, verify input voltage to lamp. If voltage is not correct, troubleshoot using circuit diagram. If voltage input is correct replace unit.
92	High Oil Temperature Indication (Temp. >150 F)	Indicating Lamp, High Oil Temperature Indicator Illuminated, LT32	Ref. 0707-9001-08 Indicator is illuminated when the hydraulic oil in the HC supply tank is more than 150 ºF. Initiate HC hydraulic oil supply tank cooling. If still illuminated after cooling of the tank is confirmed to be below 150 ºF, verify input voltage to lamp. If voltage is not correct, troubleshoot using circuit diagram. If voltage input is correct replace unit.
93	HC HPU Running Indicator not Illuminated	Indicating Lamp, HC HPU Running Indicator, LT33	Ref. 0707-9001-08 If the HC HPU motor is running but the indicator is not illuminated, verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
94	Faulty Contactor	Magnetic Motor Starter, MS3	Ref 0707-9001-08, Zone D-6 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
95	No Display, Switch ON	Power, Heave Compensator, High Voltage, ENC8	Ref. 0707-9001-08 Measure voltages within the Heave Compensator High Voltage Enclosure. Verify 460VAC, 3 phase supply power is provided to the enclosure (generator running and breakers ON) and phases are correct. Check functionality of power circuits: breakers, fuses, switches, and power supplies.
96	Display ON, Fails to Start	Power, Heave Compensator, High Voltage, ENC8	Ref. 0707-9001-08 Verify phases are mapped correctly. Check functionality of power circuits: contactors, breakers, fuses, switches, and power supplies.
97	High Oil Temperature Indication	Power, Heave Compensator, High Voltage, ENC8	Ref. 0707-9001-08 Verify inlet and exit water flow. If no supply flow: turn ON, fix, or repair pump. If no exit flow, check strainer basket (STR-7) and clear obstruction. If exit flow is sufficient, verify temperature switch and circuit functionality.
98	No Display, Switch ON	Power, Heave Compensator, High Voltage, ENC8	Ref. 0707-9001-08 Verify 460VAC, 3 phase supply power is provided to the enclosure (generator running and breakers ON) and phases are correct. Check functionality of power circuits: breakers, fuses, switches, and power supplies.
99	Push Button Not Functioning	Push Button Switch, PB10	Ref 0707-9001-08, Zone A-7 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct and outputs are still not correct, replace unit.
100	Push Button Not Functioning	Push Button Switch, PB11	Ref 0707-9001-08, Zone A-7 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified and outputs are still not correct, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
101	Indicator Lamp Not Illuminated	Relay, K23	Ref 0707-9001-08, Zone C-7 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
102	Indicator Lamp Not Illuminated	Relay, K24	Ref 0707-9001-08 Zone B-7 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
103	Compensator Raise/Lower Switch	Switch, SW10	Ref. 0707-9001-08 If compressor attempts to run or runs for a short period and stops, verify mode. If still no associated compensator response when switch toggled, then verify valve BV-21 is open. Verify High/Low pressure switch(s) are functional.
104	Switch SW10 does not work	Switch, SW10	Ref 0707-9001-08, Zone A-5 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.
		HC LOW VOLTAGE ENCLOSURE (ENC9)	
105	Dead Power Converter	DC-DC Converter, PS4	Ref 0707-9001-07, Zone D-5 Verify input and output of unit. If input voltage is not correct, troubleshoot via the circuit diagram. Once input voltage is verified check unit output voltage. If still incorrect then replace unit.
106	Indicator Lamp Not Illuminated	Relay, K25	Ref 0707-9001-07, Zone C-6 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
107	Indicator Lamp Not Illuminated	Relay, K26	Ref 0707-9001-07, Zone C-6 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
108	Indicator Lamp Not Illuminated	Relay, K27	Ref 0707-9001-07, Zone C-7 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
109	Indicator Lamp Not Illuminated	Relay, K28	Ref 0707-9001-07, Zone D-3 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
110	Indicator Lamp Not Illuminated	Relay, K29	Ref 0707-9001-07, Zone C-6 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
111	Indicator Lamp Not Illuminated	Relay, K30	Ref 0707-9001-07, Zone D-2 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
112	Indicator Lamp Not Illuminated	Relay, K34	Ref 0707-9001-07, Zone C-7 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
113	Indicator Lamp Not Illuminated	Relay, K35	Ref 0707-9001-07, Zone D-3 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.
114	Indicator Lamp Not Illuminated	Relay, K38	Ref 0707-9001-07, Zone C-5 Verify input voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified correct, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
A-FRAME ASSEMBLY			
		A-FRAME ACCELEROMETER ENCLOSURE (ENC11)	
115	Unit Not Working, Faulty Unit	Signal Conditioning Unit, SC1	Ref 0707-9001-06, Zone B-1 Verify voltage and signal output of unit. Verify input voltage and signals. If not correct, troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.
116	Sensor not sensing	Proximity Sensor, XS11	Ref 0707-9001-06, Zone B-2 Verify voltage and signal output of unit. Verify input voltage and signals. If not correct, troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.
		A-FRAME J-BOX (JB3)	
117	Levelwind Sensor Faulty	Proximity Sensor, XS1	Ref 0707-9001-06, Zone B-3 Verify voltage and signal output of unit. Verify input voltage and signals. If not correct, troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.
		A-FRAME MANUAL DCV STATION – HYDRAULIC PANEL	
118	Valve Leakage	Check Valve, CV-4, CV-105	Ref. 0707-8101-01 If leaking at the end connection, verify the connection is not cross threaded and is properly tightened. If leakage continues, replace the valve. If leakage is internal, the valve is stuck “open” replace the valve.
119	Valve Fault	Pressure Reducing Valve, PRV-1	Ref: 0707-8101-01, Zone C3 If the valve fails to operate or has erratic pressure.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			Check the valve for proper adjustment. Verify the cleanliness of the oil. Inspect the poppet or seat for excessive wear. Verify the orifice or balance hole is not restricted. Verify the spool does not bind in the body. Inspect the spool bore for excessive wear. Replace the valve if necessary.
120	Valve Fault	Solenoid Operating Valve, SOV-5	Ref: 0707-8101-01 If the valve fails to operate, check the electrical supply and verify the voltage agrees with the rating. Check the coil with an ohmmeter for opened coil. Verify the pressure complies with the rating. If the valve is sluggish or is inoperative, disassemble the valve and clean out extraneous matter. The plunger must be free to move without binding. Check for excessive wear or broken components. If the valve is leaking externally, verify that all sleeve and/or cover screws are torqued to specifications. Check o-rings for damage and replace if necessary. If the valve is leaking internally, disassemble the valve and remove extraneous matter and/or clean parts. Examine sealing surfaces for dirt. Remove all foreign particles. Examine orifice for nicks or excessive wear. Check the plunger spring for damage. If the valve is “chattering” or “buzzing” when energized, remove power from the coil. Inspect the plunger and sleeve for excessive wear or contamination. Replace the valve if necessary.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
CONTROL STATION - LOCAL			
		PEDESTAL ENCLOSURE (ENC104)	
121	Line Count (Monitor Display)	Display, DSP101	Ref., 1088-9001-02, -03, -04, 0707-9001-04 Redundant function: Serial Data is provided from Control Van Panel master display (DSP101). Determine if primary display (LCI-90) has same symptoms. If Yes – troubleshoot Control Van Panel display. Check proximity sensors (XS111 and XS112) and replace if necessary. If No – verify power to display and circuit functionality between primary and secondary displays. Repair circuit or replace display.
122	Line Tension (Monitor Display)	Display, DSP101	Ref. 1088-9001-02, -03, -04; 0707-9001-04 Redundant function: Serial Data is provided from Control Van Panel master display (DSP101). Determine if primary display (LCI-90) has same symptoms. If Yes – verify load pin (LP-1) and circuit functionality to control console display. If No – verify power to display and circuit functionality between primary and secondary displays. Repair circuit or replace display.
123	Line Speed (Monitor Display)	Display, DSP101	Ref. 1088-9001-02, -03, -04; 0707-9001-04 Redundant function: Serial Data is provided from Control Van Panel master display (DSP101). Determine if primary display (LCI-90) has same symptoms. If Yes – troubleshoot control console display. Check proximity sensors (Line Count: XS111 and XS112). If No – verify power to display and circuit functionality between primary and secondary displays. Repair circuit or replace display.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
123a	Display Not Illuminated	Display, DSP101	Ref. 1088-9001-04 Check fuse (F0) and replace if blown. Verify control cabinet and components are powered. Verify power to display terminals: TB1-96 +24 VDC; TB1-97 GND. If powered, replace display. If not powered, follow schematic and trace back to source.
124	Lamp Not Illuminated	Indicating Lamp, LT107	Ref 1088-9001-04 Verify voltage input to lamp. If voltage is not correct troubleshoot using circuit diagram. If voltage input is correct replace unit.
125	HPU #2 Running Lamp (OFF while running = Fault)	Indicating Lamp, LT108 (24VAC)	Ref. 1088-9001-04 Compare redundant indications (HPU, Pedestal ENC104, and Control Van Panel ENC5). Verify circuit functionality by measuring voltage across lamp (24VAC). Replace lamp, test circuit (K102, CT102), or repair circuit as necessary.
126	Winch Brake Released Lamp (ON = Released)	Indicating Lamp, LT109 (24VAC)	Ref. 1088-9001-04 Compare redundant indications (Pedestal ENC104 and Control Van Panel ENC5) - verify alternate indicators status. If indicator doesn't light during Released condition, verify circuit functionality by checking circuit voltage across lamp. Replace lamp or repair circuit. If indicator is lit, but brakes do not release: jog winch via joystick to attempt brake release and/or bleed air from Hydraulic brake circuit and verify functionality of PSH-103, K114, K115, PSH-101, PSH-102.
128	Remote Enabled Lamp	Indicating Lamp, LT110 (24VAC)	Ref. 1088-9001-02, -03, -04 Compare redundant indication (Pedestal ENC104 and Control Van Panel ENC5). Verify status of indicator in control console. Indication status differs: If Yes – check circuit voltage. If No – verify circuit functionality. Replace lamp, switch, or repair circuit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
130	Constant Tension Enabled Lamp	Indicating Lamp, LT111 (24VAC)	Ref. 1088-9001-02, -03, -04 Verify Constant Tension toggle switch SW104 and lamp circuit functionality. Replace lamp, switch, or repair circuit. Lamp should be illuminated when toggled to Enabled position.
131	A-Frame Outboard Lamp (ON = Luffed out to Stops)	Indicating Lamp, LT116 (12VDC)	Ref. 1088-9001-03, -04; 0707-9001-06 Verify circuit functionality by measuring voltage across lamp (24 VAC). Replace lamp or perform continuity measurement to verify (XS6) sensor states (open/closed) and circuit functionality.
132	Lamp Not Illuminated	Indicating Lamp, LT113	Ref 1088-9001-04 Verify input voltage to lamp. If voltage is not correct troubleshoot using circuit diagram. If voltage input is correct, replace unit.
133	HPU #1 Charge Pressure Low (Alarm) Lamp (ON = Fault)	Indicating Lamp, LT113 (12VDC)	Ref. 1088-9001-02, -03, -04; 0707-8101-01; 1088-8331-01 Compare redundant indications (Pedestal ENC104, and Control Van Panel ENC5). Determine if specific indication differs. Lamp ON indication provided if charge pressure (PSH-101) is below preset (310 psi). Verify status of HPU #2 pressure. If approximately the same, verify pressure switch (PSH-101 and PSH-102) circuit functionality. Verify system hydraulic pressure status (PG-104, PG-105), change filters FL105 to108, and inspect pumps HP1A and B, HP2A and B. If not approximately the same, adjust/replace pressure switch per manufacturer's instructions.
134	HPU #2 Charge Pressure Low (Alarm) Lamp (ON = Fault)	Indicating Lamp, LT114 (12VDC)	Ref. 1088-9001-02; 0707-8101-01; 1088-8331-01 Compare redundant indications (Pedestal ENC104, and Control Van Panel ENC5). Determine if specific indication differs. Lamp ON indication provided if charge pressure (PSH-102) is below preset (300 psi).

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			Verify status of HPU #1 pressure. If approximately the same, verify pressure switch (PSH-101 and PSH-102) circuit functionality. Verify system hydraulic pressure status, change filters FL105 to108, and inspect pumps HP1AandB, HP2AandB. If not approximately the same, adjust/replace pressure switch per manufacturer's instructions.
132	Lamp Not Illuminated	Indicating Lamp, LT113	Ref 1088-9001-04 Verify input voltage to lamp. If voltage is not correct troubleshoot using circuit diagram. If voltage input is correct, replace unit.
133	HPU #1 Charge Pressure Low (Alarm) Lamp (ON = Fault)	Indicating Lamp, LT113 (12VDC)	Ref. 1088-9001-02, -03, -04; 0707-8101-01; 1088-8331-01 Compare redundant indications (Pedestal ENC104, and Control Van Panel ENC5). Determine if specific indication differs. Lamp ON indication provided if charge pressure (PSH-101) is below preset (310 psi). Verify status of HPU #2 pressure. If approximately the same, verify pressure switch (PSH-101 and PSH-102) circuit functionality. Verify system hydraulic pressure status (PG-104, PG-105), change filters FL1-4, and inspect pumps HP101A & B, HP102A & B. If not approximately the same, adjust/replace pressure switch per manufacturer's instructions.
134	HPU #2 Charge Pressure Low (Alarm) Lamp (ON = Fault)	Indicating Lamp, LT114 (12VDC)	Ref. 1088-9001-02; 0707-8101-01; 1088-8331-01 Compare redundant indications (Pedestal ENC104, and Control Van Panel ENC5). Determine if specific indication differs. Lamp ON indication provided if charge pressure (PSH-102) is below preset (300 psi). Verify status of HPU #1 pressure. If approximately the same, verify pressure switch (PSH-101 and PSH-102) circuit functionality.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			Verify system hydraulic pressure status, change filters FL1-4, and inspect pumps HP101A & B, HP102A & B. If not approximately the same, adjust/replace pressure switch per manufacturer's instructions.
135	Lamp Not Illuminated	Indicating Lamp, LT114	Ref 1088-9001-04 Verify input voltage to lamp. If voltage is not correct, troubleshoot using circuit diagram. If voltage input is correct, replace unit.
136	HPU High Oil Temp. Alarm Lamp (Temp. >150° F) (ON = Fault)	Indicating Lamp, LT112 (12VDC)	Ref. 1088-9001-04 Verify heater is off. Compare redundant indications (HC, Pedestal ENC104, and Control Van Panel ENC5). Verify alternate indicators status. If Same: Verify inlet and exit water flow. If no supply flow: turn ON, fix, or repair pump. If no exit flow, located/clear blockage, or check/replace Flow Control Valve. If exit flow is sufficient, verify temperature switch, and circuit functionality. If single indicator contradictory, verify individual circuit functionality. CB, Switch, and valve.
137	Lamp Not Illuminated	Indicating Lamp, LT112	Ref 1088-9001-04 Verify input voltage to lamp. If voltage is not correct, troubleshoot using circuit diagram. If voltage input is correct, replace unit.
138	Lamp Not Illuminated	Indicating Lamp, LT115	Ref 1088-9001-04 Verify input voltage to lamp. If voltage is not correct, troubleshoot using circuit diagram. If voltage input is correct, replace unit.
139	HPU Low Oil Level (Alarm) Lamp (ON=Fault)	Indicating Lamp, LT115 (12VDC)	Ref. 1088-9001-04 Compare redundant indications (HC, Pedestal ENC104, and Control Van Panel ENC5). Verify alternate indicators status. If Same: Verify oil level. If low repair leak and refill tank. If oil level OK and both indicators are lit, verify level sensor and circuit functionality. If single indicator is lit, verify individual lamp/circuit functionality.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
143	Winch Pay Out/Haul-In Joystick	Joystick, CH101	Ref. 1088-9001-03,-04, 0707-9001-06 Verify A-Frame Manual DCV Station control valve (Section 1 and Section 2) is functional. If movement of joystick “In” or “Out” provides no corresponding winch movement, then verify power to joystick, and circuit functionality between joystick, control console and input to the Winch servo. Replace joystick, repair circuit, or replace servo valve as necessary. CH101, DCV-1. Secondary Control Primary at A-Frame DCV.
144	A-Frame Luff Out/Luff In Joystick	Joystick, CH102	Ref. 1088-9001-03,-04 Verify A-Frame Manual DCV Station control valve (Section 1 and Section 2) is functional. Remote (secondary) control, primary (manual) control at A-Frame station. Movement of joystick In or Out provides no corresponding A-Frame movement: Verify power to joystick, proximity switch operation, and circuit functionality between joystick and A-Frame station. Replace joystick, repair circuit, or replace servo valve as necessary. Secondary Control Primary at A-Frame DCV.
145	Cursor Winch Pay Out/Haul In Joystick	Joystick, CH103	Ref. 1088-9001-03,-04, 0707-9001-06 If Movement of Pedestal ENC104 joystick “In” or “Out” provides no corresponding Cursor movement, then 1st verify A-Frame station manual control valve is functional. If neither is functional, then inspect HPU system for fault. Switch to the secondary HPU, test the limit sensor XS11 and verify circuit functionality.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			Otherwise, verify power to Pedestal ENC104 joystick, and circuit functionality between joystick and Control Console, as well as input to Winch servo. Replace/repair joystick, switch, or circuit. Verify Hydraulic Circuit operation or replace servo valve as necessary.
146	Swing Frame Outboard/Inboard Joystick	Joystick, CH104	Ref. 1088-9001-03,-04, 0707-9001-06 Verify A-Frame station manual control valve is functional. Swing-frame swings in while variable control switch (joystick) is positioned Inboard and out for Outboard. Switch has locking collar to prevent inadvertent switch movement during operations. If swing frame not responsive with CH102 position: verify SW107 position, CH102 through SOV-8 circuit functionality. Repair/replace as necessary. Also, inspect system for Hydraulic leaks. If electrical circuits functional replace SOV-8. CH104, DCV-1 PVEH.
147	Winch/A-Frame HPU Stop Button (IN = Stop)	Push Button Switch, PB106	Ref. 1088-9001-02, -03, -04 Redundant STOP function provided (HPU panel and Pedestal ENC104). Determine if both stop buttons and Emergency Stop are pulled out. Verify switches, relay, and remaining circuit functionality.
148	Push Button Not Functioning	Push Button Switch, PB106	Ref 1088-9001-04 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified and outputs are still not correct, replace unit.
149	Emergency Stop Button Fails to Work	Push Button Switch, PB107	Ref 1088-9001-04 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified and outputs are still not correct, replace unit.
150	HC System Emergency Stop Push Button	Push Button Switch, PB107	Ref. 1088-9001-04 Redundant Button (switch) must be OUT for system operation and IN for shut down HC-HPU). Check switch, relay, and motor contactor/starter circuit functionality.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
151	Docking Head Latches not "Opening" or "Closing", SW103	Switch, Docking Head Latch Open/Close Switch, SW103	Ref. 1088-9001-03,-04, 0707-9001-06 If the docking head latches remain open when the switch is toggled to the CLOSE position, then verify the switch & circuit functionality. Verify hydraulic functionality. Replace switch, repair circuits as required.
152	Micro Toggle Switch does not work	Switch, SW104	Ref 1088-9001-04 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified and outputs are still not correct, replace unit.
153	Levelwind Corrector Switch Fault	Switch, SW105	Ref. 1088-9001-04, -05 3-position toggle switch: center - automatic transverse control, and bi-direction control. Verify circuit functionality: SW105, levelwind sensor (XS107), right end-of-travel (XS109), left end-of-travel sensor (XS110), servo valve (SVV-101), and LW Control (PCB102). Replace/repair as necessary. If circuit and sensor OK, verify hydraulic control functionality (refer to SVV-101 function). Automatic Levelwind does not track with winch. Verify power to levelwind PCB, and functionality of proximity switches. Repair or replace proximity switch, power circuit, or PCB.
154	Micro Toggle Switch does not work	Switch, SW105	Ref 1088-9001-04 Verify input and output voltage of unit. If not correct, troubleshoot via circuit diagram. Once input is verified and outputs are still not correct, replace unit.
155	Remote Enable Switch Fault	Switch, SW106	Ref. 1088-9001-04 Compare redundant indication. (Pedestal ENC104 and Control Van Panel ENC5)

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
157	Swing-Frame Control Switch	Switch, SW107	Ref. 1088-9001-03,-04, 0707-9001-06 Swing-frame should swing freely while toggled to Disable, and locked while toggled to Enable.
158	Heave Comp. Lock/Unlock Switch	Switch, SW108	Ref. 1088-9001-04 and 0707-8201-01 If Heave Comp. remains locked when switch toggled to Unlock position. Verify switch and circuit functionality. Replace switch, repair circuit, Replace switch, repair circuit, otherwise, and proceed to Hydraulic section. If Heave Comp remains unlocked when switch toggled to Unlock position. Verify switch and circuit functionality. Replace switch, repair circuit, otherwise, and proceed to Hydraulic section. Check functionality of Hydraulic components (NV5, SOV18, and SOV20). If Heave Comp. slowly Unlocks (cylinders extend) while in Locked position, Hydraulic circuit is leaking in NV5, SOV18, SOV20 path. Use NV5 to isolate SOV18, SOV20, and actuators CYL15, CYL16 after toggling to Lock. Replace SOV18 and SOV20. Test of LOCK/ UNLOCK can be performed by disconnecting Actuator linkages at BV9 and 11 and cycling switch.
CONTROL STATION - REMOTE			
		MONITOR	
		CONTROL VAN PANEL ENCLOSURE (ENC5)	
159	Line Count, Speed, Tension (Display)	Display, DSP1	Ref. 0707-9001-04 If the display is illuminated but has no data, check continuity between Control Van Panel ENC5 (DSP1) display and Pedestal ENC104 display (DSP101).
160	Display Not Illuminated	Display, DSP2	Ref. 0707-9001-04 Check fuse (F0) and replace if blown. Verify control cabinet and components are powered. Verify power to display terminals:

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			TB4-10 +24 VDC; TB4-17 GND. If powered, replace display. If not powered, follow schematic and trace back to source.
161	No Data in Display	Display, DSP1	Ref. 0707-9001-04 If the display is illuminated but had no data, check continuity between Control Van Panel ENC5 (DSP1) display and Pedestal ENC104 display (DSP101).
162	HPU #1 Running Lamp	Indicating Lamp, LT13 (24VAC)	Ref 0707-9001-04, Zone B-3 Compare redundant indications (HC, Pedestal ENC104, and Control Van Panel ENC5). Verify voltage and signal output of unit. Verify input voltage and signals. If not correct troubleshoot via circuit diagram. Once input is verified and outputs are still not correct replace unit.
163	HPU #2 Running Lamp	Indicating Lamp, LT14 (24VAC)	Ref 0707-9001-04, Zone B-3 Compare redundant indications (HC, Pedestal ENC104, and Control Van Panel ENC5). Verify input voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified correct, replace unit.
164	Remote Enabled	Indicating Lamp, LT16	Ref 0707-9001-04, Zone B-3 Compare redundant indications. Verify input voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified correct, replace unit.
165	High Oil Temperature (Alarm) Lamp (Temp. >150 F) (ON=Fault)	Indicating Lamp, LT19	Ref 0707-9001-04, Zone B-3 Compare redundant indications (HC, Pedestal ENC104, and Control Van Panel ENC5). Verify alternate indicators status. If Same: Verify inlet and exit water flow. If no supply flow: turn ON, fix, or repair pump. If no exit flow, located/clear blockage, or replace Flow Control Valve. If exit flow is sufficient, verify temperature switch, and circuit functionality. If single indicator is contradictory? Verify circuit functionality.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
166	Low Oil Level (Alarm) Lamp (On=Fault)	Indicating Lamp, LT20 (24VAC)	Ref 0707-9001-04, Zone B-2 Compare redundant indications (HC, Pedestal ENC104, and Control Van Panel ENC5). Verify alternate indicators status. If Same: Verify oil level. If low repair leak and refill tank. If oil level OK and both indicators are lit, verify level sensor and circuit functionality. If single indicator is lit, verify lamp/circuit functionality.
167	Computer Control Enabled Lamp	Indicating Lamp, LT21	Ref 0707-9001-04, Zone B-3 Verify input voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified correct, replace unit.
168	Computer Control Engaged Lamp	Indicating Lamp, LT22	Ref 0707-9001-04, Zone B-3 Lamp should light when computer compensation software is controlling HC. Compare redundant indication (GUI and Control Van Panel ENC5). Verify alternate indicators status. If same: computer/controller system is not engaging. Verify input status to controller. If GUI indicates Engaged, verify circuit functionality (24VAC to LT22 (replace bulb), 5VDC control signal to M0 opto-coupler, 24VAC supply to M0 (opto22), and 24VAC to LT22). If no 5VDC to M0 - replace CCA/interface cable, no 24VAC to M0 – check F101, F102, T1, T2, CB101, CB102, CB103, or repair circuit, no 24VAC to LT22 - replace M0/fuse or repair circuit.
169	HPU Running Lamp	Indicating Lamp, LT13, LT14	Ref 0707-9001-04, Zone B-3 Compare redundant indications (HC, Pedestal ENC104, and Control Van Panel ENC5). Verify input voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified correct, replace unit.
170	High Oil Temperature (Alarm) Lamp (Temp. >150° F	Indicating Lamp, LT35	Ref 0707-9001-04, Zone B-1 Compare redundant indications (HC, Pedestal ENC104, and Control Van Panel ENC5).

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
	(ON = Fault)		Verify input voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified correct, replace unit.
171	HC Low Oil Alarm Lamp (On=Fault)	Indicating Lamp, LT36	Ref 0707-9001-04, Zone B-1 Compare redundant indications (HC, Pedestal ENC104, and Control Van Panel ENC5). Verify alternate indicators status. If Same: Verify oil level. If low, repair leak and refill tank. If oil level OK and both indicators are lit, verify level sensor and circuit functionality. If single indicator is lit, verify lamp/circuit functionality.
172	Winch Brake Released	Indicating Lamp, LT15 (24VAC)	Ref. 0707-9001-04 Compare redundant indications (Pedestal Enclosure and Control Van Panel). Verify alternate indicators status. If indicator doesn't light during Released condition, verify circuit functionality by checking circuit voltage across lamp. Replace lamp or repair circuit. If indicator is lit, but brakes do not release: jog winch via joystick to attempt brake release and/or bleed air from hydraulic brake circuit.
173	Lamp Not Illuminated	Indicating Lamp, HPU #1 Discharge Pressure, Indicating Lamp, LT17	Ref 0707-9001-04, Zone B-3 Verify input voltage to lamp. If voltage is not correct troubleshoot using circuit diagram. If voltage input is correct, replace unit.
174	Traction Winch Control (Joystick)	Joystick, CH5	Ref. 0707-9001-04 Verify input voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified correct, replace unit.
175	Winch/A-Frame HPU Push button Not Functioning	Push button Switch, Winch/A-Frame HPU Stop Button, PB8	Ref 0707-9001-04 Zone B-3 Verify input voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified correct, replace unit.
176	HC Stop Button Push button Not Functioning	Push button Switch, HC Stop Button, PB9	Ref 0707-9001-04 Zone B-2 Verify input voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified correct, replace unit.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
		COMPUTER	
		CI-GUI	
177	Faulty Computer Interface	Computer Interface, CI-GUI	Ref. 0707-9001-04 The majority of problems associated with GUI signals can be correlated to I/O faults between the Signal Interface ENC10 and the computer DIO and DIG CCAs. Verify redundant signal indicators are providing correct status and verify continuity and/or voltage(s) of CCA signal(s). The four NI CCAs in the computer: (1) RT DAQ PCI-7041 (2) MIO daughter board 6040E, (3) DIO PCI-6527 (4) Multifunction DAQ PCI-6034E
178	No Pressure Indication or Status	Computer Interface, Intensifier – Decrease (Lower) Pressure, CI-GUI	Ref. 0707-9001-10, -09, -07, -04 If no indication shown while decreasing pressure, replace NI-6030E CCA. If indication provided but pressure not decreased, verify circuit functionality: 5VDC control signal to M7 (opto22), 24VAC supply to M7, and 24VAC through K26A to K33. If no 5VDC to M7 - replace CCA or interface cable, no 24VAC to M7 – check F101, F102, T1, T2, CB101, CB102, CB103 or repair circuit, no 24VAC to SOV-13 and 15 - replace M7/fuse or repair circuit. If 24VDC provided to SOV-13 and 15, verify K33, PSH-7 and PSH-8 functionality, and also normal/manual compressor operation (mechanical/electrical).
179	Incorrect Control State	Computer Interface, Mode Switching Valve, CI-GUI	Ref. 0707-9001-04, -10, -07

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
			GUI indication provided when computer is controlling HC in Active mode. Verify valid control state. If GUI indicates Active mode, verify circuit functionality 5VDC control signal to M1 (opto22), 24VAC supply to M1, and 24VAC to K38. If no 5VDC to M1 - replace CCA/interface cable, no 24VAC to M1 – check F101, F102, T1, T2, CB101, CB102, CB103 or repair circuit, no 24VAC to K38 - replace M1/fuse, no 24VDC to SVV2 failsafe valve – verify PS3, PS4, F5 or repair circuit.
180	Incorrect Pressure Indication or Status	Computer Interface, Intensifier – Increase (Raise) Pressure, CI-GUI	Ref. 0707-9001-10, -09, -07, -04 If no indication shown while raising pressure, replace NI-6030E CCA. If indication provided but pressure not raised, verify circuit functionality: 5VDC control signal to M6 (opto22), 24VAC supply to M6, and 24VAC through K26B to K32. If no 5VDC to M6 - replace CCA or interface cable, no 24VAC to M6 – check F101, F102, T1, T2, CB101, CB102, CB103 or repair circuit, no 24VAC to SOV-14, SOV-16 - replace M6/fuse or repair circuit. If 24VDC provided to SOV-14 and 16, verify K32, PSH-7 and PSH-8 functionality, and normal/manual compressor operation (mechanical/electrical).
181	Incorrect or Missing Accumulator Oil Indication	Computer Interface, Accumulator Oil Left Raise, CI-GUI	Ref. 0707-9001-10, -07, -04 If no indication shown while raising oil, replace NI-6030E CCA. If indication provided but oil not raised, verify circuit functionality: 5VDC control signal to M5 (opto22), 24VAC supply to M5, and 24VAC to SOV-9. If no 5VDC to M5 - replace CCA or interface cable, no 24VAC to M5 – check F101, F102, T1, T2, CB101, CB102, CB103 or repair circuit, no 24VAC to SOV-9 - replace M5/fuse or repair circuit. If 24VAC provided to SOV-9, replace SOV-9.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
182	Incorrect or Missing Accumulator Oil Indication	Computer Interface, Accumulator Oil Left Lower, CI-GUI	Ref. 0707-9001-10, -07, -04 If no indication shown while lowering oil, replace NI-6030E CCA. If indication provided but oil not lowered, verify circuit functionality: 5VDC control signal to M4 (opto22), 24VAC supply to M4, and 24VAC to SOV-10. If no 5VDC to M4 - replace CCA or interface cable, no 24VAC to M4 – check F101, F102, T1, T2, CB101, CB102, CB103 or repair circuit, no 24VAC to SOV-10 - replace M4/fuse or repair circuit. If 24VAC provided to SOV-10, replace SOV-10.
183	Incorrect or Missing Accumulator Oil Indication	Computer Interface, Accumulator Oil Right Raise, CI-GUI	Ref. 0707-9001-10, -07, -04 If no indication shown while raising oil, replace NI-6030E CCA. If indication provided but oil not raised, verify circuit functionality: 5VDC control signal to M3 (opto22), 24VAC supply to M3, and 24VAC to SOV-11. If no 5VDC to M3 - replace CCA or interface cable, no 24VAC to M3 – check F101, F102, T1, T2, CB101, CB102, CB103 or repair circuit, no 24VAC to SOV-11 - replace M3/fuse or repair circuit. If 24VAC provided to SOV-11, replace SOV-11.
184	Incorrect Computer Control Engaged Indication	Computer Interface, Computer Control Engaged Indicator, CI-GUI	Ref. 0707-9001-10, -04 Indicator should light when computer compensation software is controlling HC. Compare redundant indication (GUI and Control Van Panel ENC5). Verify alternate indicators status. If same and computer/ controller system is not engaging, verify input status' to controller. If Control Van Panel ENC5 indicates Engaged and controller is engaged, test/replace interface cable or CCA.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
185	Incorrect or Missing Accumulator Oil Indication	Computer Interface, Accumulator Oil Right Lower, CI-GUI	Ref. 0707-9001-10, -07, -04 If no indication shown while lowering oil, replace NI-6030E CCA. If indication provided but oil not lowered, verify circuit functionality: 5VDC control signal to M2 (opto22), 24VAC supply to M2, and 24VAC to SOV-12. If no 5VDC to M2 - replace CCA or interface cable, no 24VAC to M2 – check F101, F102, T1, T2, CB101, CB102, CB103 or repair circuit, no 24VAC to SOV-12 - replace M2/fuse or repair circuit. If 24VAC provided to SOV-12, replace SOV-12.
186	Incorrect "Haul-In" Indication Line Count Display Lin Speed Display	Computer Interface, CI-GUI, DSP1	Ref. 1088-9001-03, -04; 0707-9001-04, -10 Compare redundant indications (Control Van Panel ENC5 and Pedestal ENC104). If DSP101 is correct then verify power to display (DSP1) and troubleshoot control console display. If no DSP101 display, then verify circuit functionality between primary and secondary displays. Repair circuit or replace display. Line count sensor XS4and XS112.
187	Incorrect A-Frame LUFF Indication	Computer Interface, CI-GUI,	Ref. 1088-9001-03, -04; 0707-9001-04, -10 Verify A-Frame Manual DCV Station control valve (Section 1 and Section 2) is functional. Remote (secondary) control, primary (manual) control at A-Frame station. If movement of joystick "In" or "Out" provides no corresponding indication, then verify power to the proximity switch and circuit functionality. Replace sensor, repair circuit, or troubleshoot servo valve as necessary.
188	Incorrect or No Drum Count Indication	Computer Interface, CI-GUI	Ref. 1088-9001-03, -04; 0707-9001-04, -10 Compare redundant indications Pedestal Display (ENC104/DSP101). Determine if display has same symptoms. If Yes – troubleshoot control console display. If No – verify power to display and circuit functionality between primary and secondary displays. Repair circuit or replace display.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
189	Incorrect or Redundant HPU #1 Running Indication	Indicating Lamp, HPU #1 Running Indicator, LT13	Ref. 0707-9001-10, -04 Compare redundant indications (HPU panel and Pedestal ENC104) Determine if status for each agree. Verify circuit functionality or replace CCA.
190	Incorrect or Redundant HPU #2 Running Indication	Indicating Lamp, HPU #2 Running Indicator, LT14	Ref. 0707-9001-10, -04 Redundant indication provided (HPU panel and Pedestal ENC104) Determine if status for each agree. Verify circuit functionality or replace CCA.
191	Incorrect Control State	Indicating Lamp, Brake Release, LT15	Ref. 0707-9001-04, -10, -07 GUI indication provided when computer is controlling HC in Active mode and Brake is released. Compare redundant indications (Pedestal ENC104 and Control Van Panel ENC5). Verify alternate indicators status. If individual indication differs, verify circuit functionality: 5VDC control signal to M9 (opto22), 24VAC supply to M9, and 24VAC to K35. If no 5VDC to M9 - replace CCA/interface cable, no 24VAC to M9 – check F101, F102, T1, T2, CB101, CB102, CB103, no 24VAC to K124 – check K20A, K22A.
192	Incorrect or Redundant HPU #1 Charge Pressure Low Indication	Indicating Lamp, HPU #1 Charge Pressure Low, LT17	Ref. 0707-9001-10, -07, -04 Compare redundant indications (Control Van Panel ENC5 and Pedestal ENC104). Lit if charge pressure below preset (300psi). Verify status of 2nd indicator. If Same: Yes – verify Hydraulic Pressure or adjust/ replace pressure switch. Follow manuals instructions for adjustment/replacement. No - verify circuit functionality.

Table 6-10 FTHE System Troubleshooting Procedures - *continued*

ITEM NUM	FAULT ALERT	PHYSICAL/ FUNCTIONAL DESCRIPTION	RECOMMENDED ACTION/ TROUBLESHOOTING PROCEEDURE
193	"Control System Fault Indication", Audible Alarm	Indicating Lamp, Control System Computer looses Control in Active Mode, LT21, LT22	Ref. 0707-9001-04, -10, -07 GUI "Control System Fault" indication provided when computer looses control of Active mode and AS1 (Audible Alarm) sounds. If GUI indicates "Control System Fault", verify circuit functionality 5VDC control signal to M8 (opto22), 24VAC supply to M8, and 24VAC to K35. If no 5VDC to M8 - replace CCA/interface cable, no 24VAC to M8 – check F101, F102, T1, T2, CB101, CB102, CB103 or repair circuit, no 24VAC to K35 - replace M8/fuse, no 24VDC to AS1 – verify PS3, PS4, F5 or repair circuit.
194	Incorrect HC HPU Status	Indicating Lamp, HC HPU Running Indicator, LT33	Ref. 0707-9001-04, -10 Compare redundant indications (Control Van Panel ENC5 and Pedestal ENC104). If the HC HPU motor is running but the indicator is not illuminated, then verify input and output voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified and outputs are still not correct, replace unit.
		KEYBOARD	
		SIGNAL INTERFACE ENCLOSURE (ENC10)	
195	Unit Not Working, Faulty Unit	Signal Conditioning Unit, SC3	Ref 0707-9001-10, Zone A-5 Verify input and output voltage of unit. If not correct troubleshoot via circuit diagram. Once input is verified and outputs are still not correct, replace unit.
		VME ENCLOSURE	
		UPS	

6.10 TROUBLESHOOTING – UMBILICAL O/E POWER

The optical and electrical power to vehicle follow split paths until they reach the umbilical cable. All power to vehicle must traverse umbilical cable and is provided via the onboard generators.

There are two 3-phase power cables used to power the vehicle motors (thrusters) and 1 single phase power cable used to power the vehicle electronics that go between the generators and the winch drum slip rings.

Optical power is used to communicate between the vehicle, a network interface, and the Control Van. There are two optical cables that go between the Control Van and winch drum slip rings.

Should a fault occur, as indicated in Table 6-11, troubleshoot the optical failure using the procedures in section 6.10.1. If a power failure occurs, normal voltage testing along the path should identify the failed component. A schematic of the circuit, SDA113882, Rev A, Umbilical Assembly – Terminated – Schematic Diagram, can be found in Appendix 13, Other Drawings and Sketches.

Table 6-11 Fault Isolation Table – Umbilical O/E Power

SYMPTOM	POSSIBLE CAUSE
Optical power failure from the vehicle	• Broken optical fiber • Dirty optical connector • Poor contact from Umbilical Winch slip rings
Electrical power failure from the vehicle	• Broken 3-phase power lead • Broken 1-phase power lead • Poor contact from Umbilical Winch slip rings
No electrical power from generator	• Circuit breaker tripped • Generator stopped
Vehicle failure	• Vehicle Maintenance Manual

6.10.1 Optical Time Domain Reflectometer (OTDR)

The OTDR is a very useful test instrument for analyzing the light loss in an optical fiber during optical network troubleshooting. The OTDR injects a short, intense laser pulse into the optical fiber and measures the backscatter and reflection of light as a function of time. The reflected light characteristics are analyzed to determine the location of any fiber-optic breaks or splice losses.

The following general procedures were written to explain how to use an OTDR (in this case, the Agilent Technologies E6000C Mini-OTDR (PNE6033A) and their Visual Fault Finder submodule (PN E6007A) but the OTDR you use may be different) to determine at what point in the umbilical cable the fiber has parted and by using a visual light source, checking for end-to-end continuity.

6.10.1.1 Using the OTDR to Measure the Length of a Fiber Path

The procedures describe how to take traces on all fiber paths, with each path being checked from both ends: one end is at the Lower Junction Box connector (J7 or J8) and the other end is at a slip ring stationary side connector (connector OS). A “dark” fiber is one that cannot or does not pass light. The goal of these procedures is to determine how far the break is from the upper end (slip

ring end) of the umbilical cable so that it can be determined if the umbilical will be long enough for future use after it is cut at the “break.” The SDA113882, Umbilical Assembly – Terminated – Schematic Diagram can be found in Appendix 13, Other Drawings and Sketches, and may be useful showing the two ends of each path.

6.10.1.1.1 Set-Up OTDR for Operation

To set up the OTDR to measure the length of a fiber path, refer to Figure 6-1 for a description of the physical features of the OTDR and perform the following steps:

a. Install the battery into the OTDR as follows:
    - Remove the battery cap at the lower right corner of the OTDR.
    - Insert the battery, contact-end first, into the battery compartment.
    - Replace the battery cap onto the OTDR.
b. Turn on the OTDR using the blue button on the top-left surface of the OTDR. Watch the screen of the OTDR during the boot-up process to ensure that all self-checks pass.
c. After the boot-up process finishes, the “OTDR Mode” icon on the OTDR screen should illuminate. If not, press any top, bottom, left, or right corner of the Cursor Keys to navigate to the “OTDR Mode” icon.
d. Press the “Select” button to select “OTDR Mode.”
e. Press the Select button to display the Popup Menu. “Settings” should be highlighted. If not, use the Cursor Keys to highlight “Settings.”
f. Press the Select button.
g. Use the Cursor Keys to highlight “Avg. Time.” Press the Select button.
h. Highlight “30 sec” and press the Select button.
i. Highlight “Meas. Mode” and press the Select button.
j. Highlight “Averaging” and press the Select button.
k. Highlight “OK” and press the Select button.
l. Press the Select button to display the popup menu.
m. Highlight “View” and press the Select button.
n. If there is no check-mark next to “Event Table,” then highlight “Event Table” and press the Select button. If there is a check mark next to “Event Table,” then highlight “Close View Menu” and press the Select button.
o. Press the Select button to display the Popup Menu.
p. Highlight “Config” an depress the Select button.
q. Highlight “Length Unit.”
r. Highlight “Feet [ft]” and press the Select button. Note that the OTDR will actually display kilo feet (kft) for measurement, not feet.

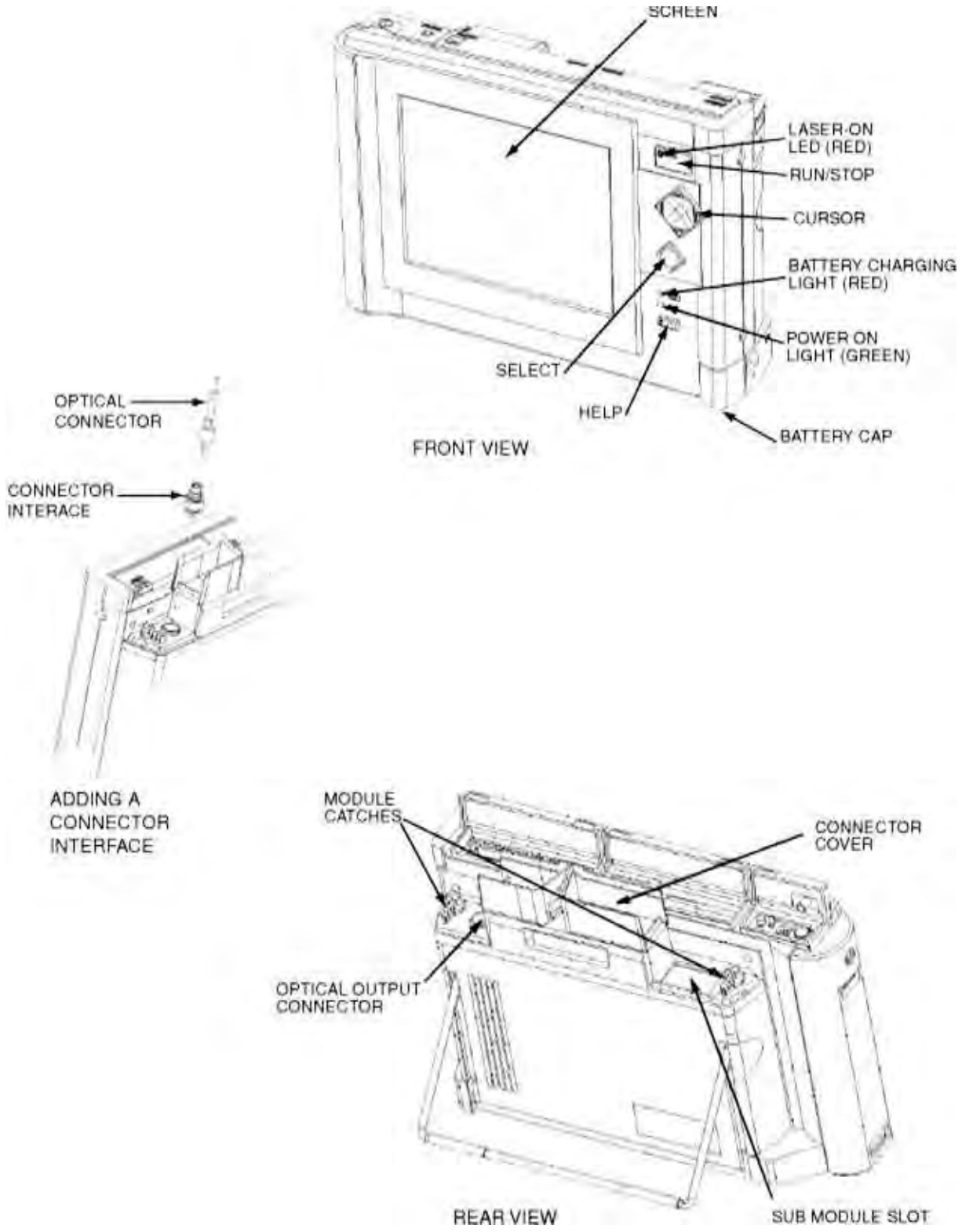


Figure 6-1 Mini-OTDR Features

6.10.1.1.2 Prepare Test Setup

CAUTION

The optical connector of each slip ring is a prototype connector, but the optical connectors (J7 and J8) on the lower junction box are production connectors. Both prototype and production optical test connectors are normally available. It is important that a prototype test connector be mated to the slip rings, and a production test connector be mated to the lower junction box.

The optical test connectors have been supplied in both 4-pin and 6-pin configurations. It is acceptable to mate a 6-pin test connector with either a 4-pin or 6-pin slip ring or lower junction box connector, just don't break the prototype vs. the production rule mentioned above.

CAUTION

When mating optical connectors, always clean the contacts prior to mating.

a. Connect the appropriate optical test connector to either a slip ring or the lower junction box (J7 or J8).

CAUTION

The prototype optical test connectors have ST connectors at the ends of their leads, but the production optical test connectors have FC connectors at the ends of their leads. The OTDR is supplied with both ST and FC connector interfaces for connecting to its optical output connector. The optical output connector is located under the blue hinged cover at the top-right-rear of the OTDR. The FC connector interface has a red screw-on cap. The ST connector interface has a black push-on cap. Three ST connector interfaces are supplied in the OTDR carrying case. They are located on the right side of the case, near the cover hinge. The interface connector currently on the OTDR is removed by unscrewing the collar of the connector interface and then pulling it straight off of the output connector. Installation is the reverse. Note that there is a key on the connector interface that must mate with a keyway on the output connector.

b. Connect the optical test connector lead corresponding to contact 1 to the optical output connector of the OTDR.

6.10.1.1.3 Measure the Fiber Path Length

To measure the fiber path length using the OTDR, perform the following steps:

NOTE

Soon after pressing the “Run/Stop” button, an error message may appear stating “something” about the front end connector. Just press the Select button and the error message disappears and the OTDR continues the process.

a. Press the blue “Run/Stop” button above the Cursor Keys to activate the laser and start the measurement process (the red lamp in the Run/Stop button should illuminate during the measurement process). A “seconds” counter can be seen in the bottom-right corner of the screen. When the counter reaches 30 seconds, the measurement process ends and the Event Table at the top of the screen indicates the distance to the end of the fiber path.

6.10.1.1.4 Save the OTDR Trace

To save the trace on the OTDR internal hard drive, perform the following steps:

a. Press the Select button to display the popup menu.
b. Highlight “File.”
c. Press the Select button.
d. Highlight “Save As ….”
e. Press the Select button.
f. Highlight directory “DWT.”
g. Press the Select button.
h. Highlight directory “12-2005.”
i. Press the Select button.
j. Highlight “New Name.”
k. Press the Select Button.
l. The default filename is shown in the text box below, “Enter the Filename. Delete the default filename by highlighting the “Del” button and then pressing the Select button repeatedly until the default name is gone.
m. Enter the characters for the new filename one at a time by highlighting the desired character and then pressing the Select button. (Refer to Table 6-12: suggest using new filename SR1-OS-1 for the trace representing Slip Ring #1, Contact 1.)
n. Press the Select button.
o. Highlight “Save.”
p. Press the Select button.
q. Disconnect the test connector lead from the OTDR output connector.
r. Repeat steps a (except step l) through r for all Optical 1 and Optical 2 traces listed in Table 6-12.

CAUTION

When finished using OTDR, install FC connector interface onto the output connector. The height of the connector interface prevents the hinged cover from closing fully.

Remove the battery from the battery compartment and store in the carrying case for the next use.

Table 6-12 Upper E/O Junction Box Connectors to Slip Ring Connectors

SIGNAL TYPE	UPPER E/O JUNCTION BOX	SLIP RING	
		ROTATING SIDE	STATIONARY SIDE
3-PHASE POWER NO. 1	J4-1	SR1-AR-1	SR1-AS-1
	J4-2	SR1-AR-2	SR1-AS-2
	J4-3	SR1-AR-3	SR1-AS-3
	J4-4	SR1-AR-4	SR1-AS-4
3-PHASE POWER NO. 1	J5-1	SR2-AR-1	SR2-AS-1
	J5-2	SR2-AR-2	SR2-AS-2
	J5-3	SR2-AR-3	SR2-AS-3
	J5-4	SR2-AR-4	SR2-AS-4
1-PHASE POWER	J6-1	SR1-BR-1	SR1-BS-1
	J6-2	SR1-BR-2	SR1-BS-2
	J6-3	SR1-BR-3	SR1-BS-3
	J6-4	SR1-BR-4	SR1-BS-4
SPARE	J1-1	SR2-DR-1	SR2-DS-1
	J1-2	SR2-DR-2	SR2-DS-2
	J1-3	SR2-DR-3	SR2-DS-3
	J1-4	SR2-DR-4	SR2-DS-4
OPTICAL 2	J2-1	SR1-OR-1	SR1-OS-1
	J2-2	SR1-OR-2	SR1-OS-2
	J2-3	SR1-OR-3	SR1-OS-3
	J2-4	SR1-OR-4	SR1-OS-4
OPTICAL 1	J3-1	SR2-OR-1	SR2-OS-1
	J3-2	SR2-OR-2	SR2-OS-2
	J3-3	SR2-OR-3	SR2-OS-3
	J3-4	SR2-OR-4	SR2-OS-4

Notes:

1. Slip Ring 1 (SR1) is located on the *same* end (bow) of the umbilical winch drum as is the Upper E/O Junction Box and the ”SR1” designation is stenciled on the body of the slip ring.
2. Slip Ring 2 (SR2) is located on the *opposite* end (stern) of the umbilical winch drum as is the Upper E/O Junction Box and the ”SR2” designation is stenciled on the body of the slip ring.

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7.0 CHAPTER 7 - CORRECTIVE MAINTENANCE

7.1 INTRODUCTION

This chapter lists specific safety precautions to be observed, tools and test/support equipment, adjustment, alignment, and calibration procedures to be employed while performing corrective maintenance on the FTHE.

7.1.1 Purpose

This chapter provides O-Level maintenance personnel corrective maintenance procedures to assist them in the repair of FTHE at the component level.

7.1.2 Scope

The following paragraphs provide for the removal, replacement, and alignment/adjustment procedures for FTHE at the O-Level. Illustrations and other amplifying information are provided to aid maintenance personnel during these corrective maintenance procedures.

7.2 SAFETY PRECAUTIONS

7.2.1 Specific Hazards

All attempts have been made to reduce, if not completely eliminate, the hazardous conditions that can be a part of the FTHE environment both in port and out to sea. And yet with all the high visibility and attention to detail, there are still some risks that have not been depleted to zero. Specific hazards include high pressure nitrogen and hydraulic fluid, radiated energy from optical lasers, pinching or crushing hazards from lifting heavy equipment/packages, and because of the nature of the work, the opportunity to fall or be swept overboard.

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Hazards to equipment but more importantly to personnel have been mitigated to the fullest extent possible and where necessary, caution and warning signs have been posted to bring direct attention to a specific hazard. Warning signs are posted in various places alerting personnel of hazardous voltages, high pressure nitrogen and/or hydraulic oil systems, electrical enclosures must have their disconnect switch in the OFF position before opening the door. Signs warn about the radiated energy of lasers and not looking directly into any fiber cable due to severe eye damage even to blindness in only a matter of seconds to a few minutes. Other signs and physical barriers warn/prevent personnel from being around operating machinery such as the HC upper and lower levels during operation. And finally, while there’s always the risk of falling or being swept overboard especially in rough seas, rules are set up and strictly enforced such that all personnel shall not be on the after deck unless wearing a U. S. Coast Guard approved Personal Floatation Device.

7.3 TOOLS AND TEST/SUPPORT EQUIPMENT

A list of tools and test/support equipment required to perform troubleshooting, corrective maintenance, mobilization, and demobilization procedures for the FTHE is provided in Table 7-1. These tools are supplied with the FTHE and are identified to aid in the FTHE required maintenance.

Table 7-1 Tools and Test/Support Equipment

DESCRIPTION	MODIFIER	QTY	PURPOSE
JTK®-93 Tool Kit	Electro-Mechanical Service Kit, Jenson Tools	1 Each	Maintenance
Adjustable Wrenches	Standard Style, 6", 12" and 24"	1 Each	Maintenance
Open End Wrench	Combination 15/16" x 1"	2 Each	Maintenance
Open End Wrench	Combination 1” x 1-1/8”	2 Each	Maintenance
Open End Wrench	Combination 1-1/16" x 1-1/4"	2 Each	Maintenance
Open End Wrench	Combination 1-5/16" x 1-1/2"	2 Each	Maintenance
Multimeter	3-1/2 Digit, True RMS, 1000 AC/DC Voltage, 10 A	1 Each	Maintenance
Ratchet Web Assemblies	2-Piece Ratchet Web Assemblies W/Flat-Hook Ends, 5,000 lbs	4 Each	Secure Spare Parts Boxes
Flash Light	All-Direction, Battery Operated, Lantern	1 Each	Maintenance
ESD Wristband	Wrist Grounding Strap	1 Each	Maintenance
LAN Network Cable	Straight Pinned CAT5e Patch Cable (Black Box Network Services, PN EVNSL85-0020)	1 Each	VME (SBC CCA) to Network

7.4 ADJUSTMENTS, ALIGNMENTS, AND CALIBRATIONS

7.4.1 Adjustment Procedures

7.4.1.1 Brake Adjustment Procedures

The brake is designed to be used as a parking and emergency stopping brake only and has a maximum release pressure of 2465 psi (170 Bar). Maximum continuous rubbing speed is 21 m/sec and maximum continuous temperature of 300° C. • Maximum volume in pressurized brake is 43.51 in3 (713 cm3)

NOTE

The brake must be readjusted after each emergency stop in order to maintain maximum torque output.

WARNING

DANGER TO PERSONNEL! Death or injury can result when working around operating machinery. With hydraulic power applied to the brake cylinders, the brake is OFF and the winch drum can turn. Use caution when working on the brakes.

NOTE

The disk brake pads will lose friction if they are contaminated with oil or grease, be very careful when working on brakes to avoid contaminating the pads or brake disk surface. The brake pads should be replaced if the friction material has absorbed oil or grease.

To adjust the brake, perform the following steps (review Dellner manufacturer instructions in manual Component Support Literature):

s. Measure the distance between the backside surface of the cylinder housing and the surface of the piston.

a. Pressurize the disk brake. Apply pressure to the brake by moving the Pedestal Winch joystick (Figure 4-18, Item 17) off of the neutral position – enough to allow pressure to the brake but not enough to cause the winch drum to rotate.

b. Unlock and loosen the locking nut (KMT 7-nut) from the adjustment screw.

c. Adjust the braking force by turning the adjustment screw CW equal to the measured distance in step 1 (the adjustment screw moves 2mm per turn).

d. Depressurize the disk brake by returning the Pedestal Winch joystick back to neutral position.

e. Check that the backside surface of the cylinder housing and the surface of the piston are aligned. If not, repeat steps 1 to 6 until they are.

f. Tighten and lock the locking nut (KMT 7-nut) on the adjustment screw.

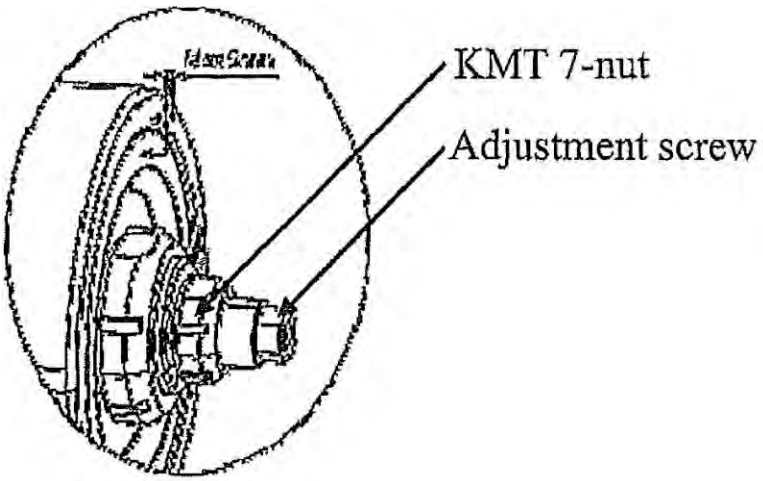


Figure 7-1 Dellner Brake Adjustment

WARNING

DANGER TO PERSONNEL! Death or injury can result when working around operating machinery. Use caution when bleeding the brakes.

To bleed the brake line of air (de-aeration), perform the following steps (review Dellner manufacturer instructions in manual Component Support Literature):

a. Attach a 3 foot piece of 3/8" tubing to the brake bleed nut and place the other end into a 1-gallon bucket. Repeat this procedure for each brake assembly.
b. With pressure applied to the brake, carefully open the bleeder at the top of the brake and allow hydraulic oil to flow into the bucket until no air bubbles are evident.
c. Close the bleeder, remove tubing, and wipe up any spilled oil.
d. Locate pressure switch (PSH-103) at the Winch Hydraulic Panel (Figure 7-7) and place an oil absorbent pad under it.
e. Crack open the hydraulic line at PSH-103 fitting and allow hydraulic oil to flow onto the oil absorbent pad until no air bubbles are evident.
f. Tighten PSH-103 fitting and wipe up any spilled oil.
g. Dispose of hydraulic oil and contaminated rags in accordance with local procedures.

7.4.1.2 Winch Closed-Loop Pump

7.4.1.2.1 High Pressure/Multi-Function Relief Valve Pressure Adjustment

Performed at the factory, adjustment of the two multifunction valves (Figures 7-2, 7-3, 7-4, and 7-5), each having a pressure limiter and high pressure relief valve, is accomplished simultaneously. The latter is automatically set approximately 500 psi above the former. The high pressure relief valve is set slightly above the pressure required to achieve maximum rated line pull. This setting should not require adjustment under normal circumstances. However, if adjustment is required, the following general procedure is recommended:

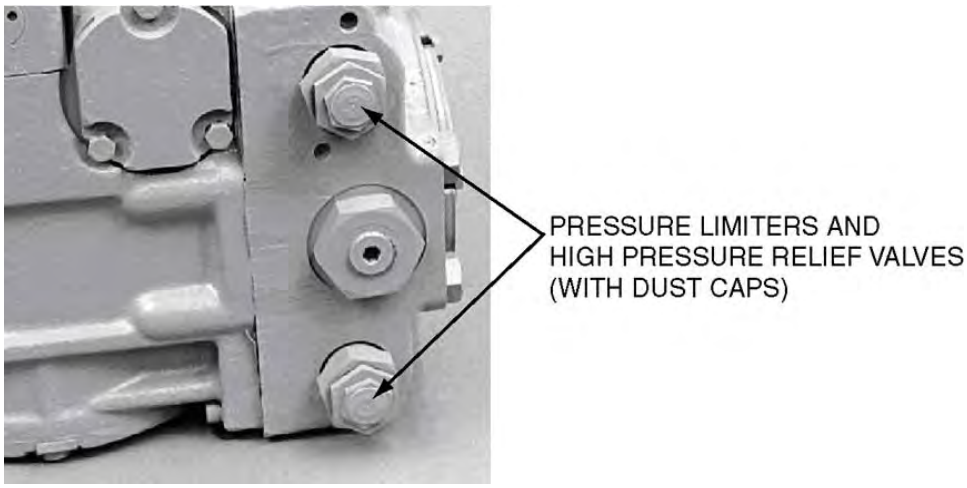


Figure 7-2 Multifunction Valves Pressure Adjustment 1

NOTE

Ensure the Pedestal Tension/Speed Select toggle switch (Figure 4-18 and Table 4-18, Item 12) is in the “High Tension/Low Speed Enabled” position (Item 10 illuminated) before beginning the adjustment procedure.

CAUTION

POSSIBLE DAMAGE TO EQUIPMENT! The motor shaft must remain stationary during the adjustment procedure or damage could result to the pump.

a. To determine or verify the current relief setting, remove the hydraulic hose quick disconnect to disable the brake release function.

b. With the HPU running at normal speed, move the Pedestal Winch joystick (Figure 4-18 and Table 4-18, Item 17) to the full “Haul In” position (winch drum should not turn) and read the System “A-Port” (PG-106 and PG-114) pressure gauges. (Use PG-107 and PG-109 for System “B-Port”)

c. Remove the dust plug to gain access to the pressure adjusting screw (Figure 7-3).

d. Loosen the locking nut (smallest hex nut on the multifunction valve) and insert an internal hex wrench into the pressure adjusting screw.

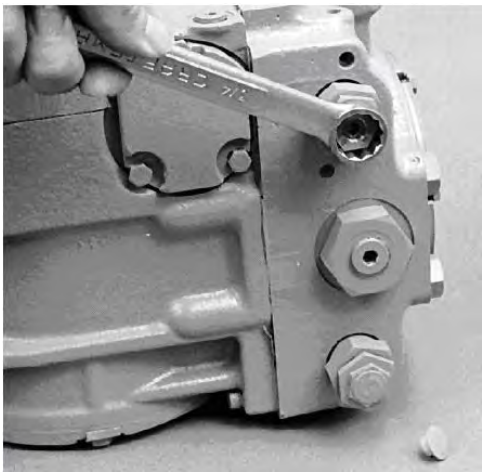


Figure 7-3 Multifunction Valves Pressure Adjustment 2

e. Move the Pedestal Winch joystick so that pressure increases in the high pressure closed-loop circuit to the pressure limiter pressure setting. The pressure limiter setting is reached when the pressure stops increasing and remains steady at a given pressure level (as shown on the gauges). The pressure limiter pressure setting is referenced to charge pressure.

NOTE

Rotating the pressure adjustment screw CW increases the pressure setting, and rotating it CCW decreases the pressure setting. Each full rotation of the adjusting screw changes the pressure setting by 1200 psi on the pump.

f. Rotate the pressure adjusting screw with the internal hex wrench (Figure 7-4) until the desired pressure level is established as read on PG-106 and PG-114 (or PG-107 and PG-109).

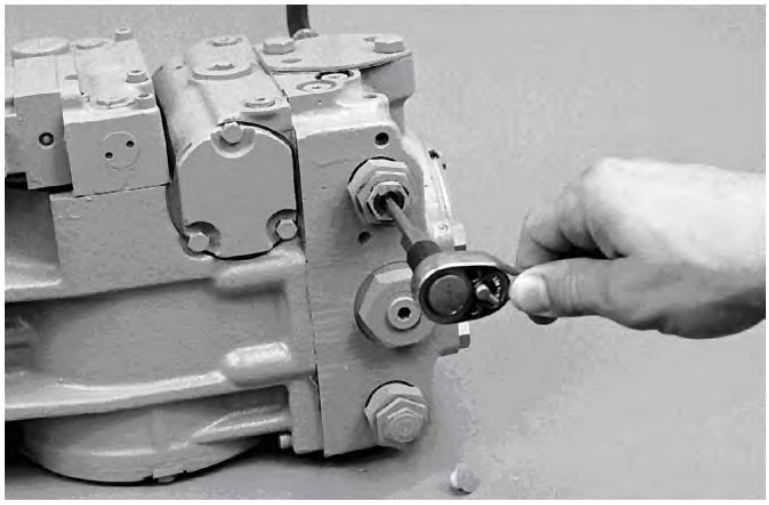


Figure 7-4 Multifunction Valves Pressure Adjustment 3

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Damage to the relief valve is possible if the pressure adjusting locknut screw is over tightened. Do not exceed torque value when tightening the pressure adjusting locknut screw.

g. While holding the internal hex wrench and pressure adjusting screw in the same position (Figure 7-5), tighten the pressure adjusting screw locknut to 30 ft-lbs on the pump.

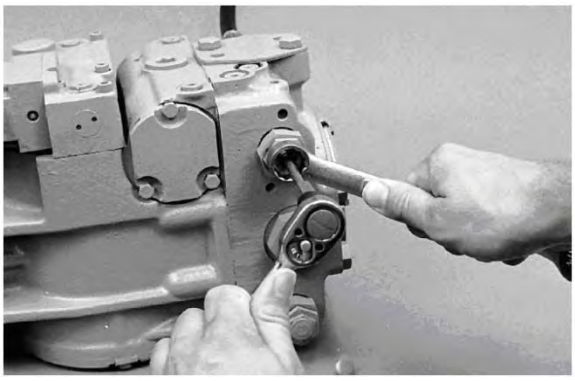


Figure 7-5 Multifunction Valves Pressure Adjustment 4

h. Return the Pedestal Winch joystick to the neutral position. The pressure in the high pressure circuit should return to the charge pressure setting PG-104 (or PG-105).

i. To verify the actual pressure setting, move the Pedestal Winch joystick so the pump develops pressure again in the high pressure circuit to the newly adjusted pressure limiter pressure setting. Then allow the pump to return to its neutral position.

j. Replace dust plugs and reconnect the brake hydraulic hose quick disconnect removed in the first step of this procedure.

k. Follow this same procedure to set the “B-Port” multifunction valve with the following exception: The Pedestal Winch control joy stick (input control signal) must be moved in the *opposite* direction (“Pay Out”) so that pressure develops in the opposite high pressure side (“B-Side”) of the closed circuit and is read on pressure gauges PG-107 and PG-109.

7.4.1.3 Levelwind Diamond Screw Setup Procedure

a. Haul In the winch to ensure there is tension on the wire rope. Use the Electro Active Levelwind Corrector to align the levelwind sheave with the wire rope coming off the winch drum. The wire rope must be perpendicular to the axis of the drum.
b. Use the Diamond Screw Levelwind Corrector to drive the diamond screw pawl to the diamond screw levelwind sensor. Re-engage the sense arm of the primary levelwind sensor with the pawl peg. The sense arm must be vertical (within 5 degrees).
c. Place the winch system in DIAMOND Levelwind Control then hold the Diamond levelwind AUTO Align toggle switch for 2 seconds. Sense arm will auto-align to vertical as shown in Figure 1 to activate the levelwind.
d. To activate the levelwind, move the winch control handle out of neutral so that the brake release light is on but the drum does not move.
e. Re-inspect the umbilical between the levelwind sheave and winch drum. The umbilical must be perpendicular to the axis of the drum.
f. If still misaligned, the diamond screw levelwind corrector can be used to realign the levelwind sheave with the umbilical coming off the winch drum, with the levelwind activated.
g. Monitor the levelwind action in both directions of travel during spooling/unspooling. If the levelwind carriage is leading the wire rope, repeat steps d. to f.

NOTE

A slight lag is acceptable.

7.4.1.4 Initial Adjustment Procedures

This section provides initial adjustment procedures required for the FTHE system.

7.4.1.5 Diamond and Electyro-Active Levelwind Sheave Mode Adjustment

The Levelwind Sheave Assembly must be initially adjusted to ensure proper operation. The following procedures are used to verify the proper operation of the Levelwind control in Diamond and Electro-Active modes:

a. Ensure the Levelwind Wire Rope Sensor Sense Arm is properly engaged with Pawl Peg.
b. Place the Levelwind Control switch, located on the Levelwind Control Enclosure, in the DIAMOND mode position.
c. HAUL IN (or PAY OUT) on the winch Control Handle until the diamond screw pawl is aligned with its end of travel on the bearing side of the winch drum.
d. Mark the drum rotational position. Continue to HAUL IN (or PAY OUT) on the winch Control Handle while counting drum revolutions. At 98 revolutions, the diamond screw pawl should be aligned with its end of travel on the drive end of the drum.
e. Verify pawl is located at end of travel.

f. Continue moving the drum in the same direction as step d. Count an additional 98 revolutions. The diamond screw pawl should be located at its end of travel on the bearing side of the winch drum. Note that the pawl should be at its starting end of travel location at the completion of this step.
g. Disengage the Levelwind Wire Rope Sensor Sense Arm from the Pawl Peg.
h. Place the Levelwind Control switch in the ELECTRO-ACTIVE position.
i. Disable the winch brake and enable the levelwind by holding the winch control handle out of neutral. On the Overhead Right-Angle LW sheave assembly, move the levelwind guide finger closest to the bearing housing in the direction of the bearing housing. The OHRALW sheave assembly should travel in the direction of the bearing housing.
j. Verify proper direction of travel.
k. Move the levelwind guide finger closest to the drive end in the direction of the drive end. The Overhead Right-Angle LW sheave assembly should travel in direction of drive end.
l. Verify proper direction of travel.
m. Move the levelwind guide finger closest to the drive end in the direction of the drive end. The Overhead Right-Angle LW sheave assembly should travel in direction of drive end.
n. Verify proper direction of travel.

7.4.1.6 Electro-Active Levelwind Control PC Board Alignment and Test Procedures

The alignment and test procedures for Electro-Active Levelwind Control PC Board (PCB102) require Dynacon Sensor Block DY97001-XXX-XX. To align and test the Electro-Active Levelwind Control PC Board, refer to DD DYN-9600-01 and perform the following steps:

NOTE

Supplemental guidelines to this procedure can be found in Electro-Active Levelwind Out of Adjustment (section 7.4.1.6.1.)

a. Connect Dynacon Sensor Block DY9600-XXX-XX.
b. Connect resistor of value equal to servo valve resistance to T19 with ammeter between other lead and T20. Connect:
   - +12 VDC to T2
   - -12 VDC to T3
   - RETURN to T1
c. With power on and the magnet removed from sensor target, approximately 2.6 VDC should be present at TP-A. (Approximately 2 VDC for blocks with internal diodes.)
d. Moving the magnet close to the target should change the voltage to 4.0 VDC for the North Pole intensity of 400 gauss and 0.8 VDC for South Pole intensity of -400 gauss.
e. Adjust R4 for 0 VDC at TP-B with the magnet removed. The signal will swing to ±12 VDC at TP-C with the initial error signal at TP-D at input inverted.
f. Energize Relay K110 by connecting T7 to T1 and T6 to T2. Move magnet across the sensor target. Current through the valve coil to test the resistor should swing ± maximum recommended coil current. If maximum current is not obtained, turn R13 CW to increase gain. If current exceeds coil rating, increase value of R16 and R17. Check corrector function by connecting:

- T8 to T1, voltage at TP-E should be positive.
- T9 to T1, voltage at TP-E should be negative.

g. Check EOT by connecting:
   - T10 to T1, voltage at TP-E should be negative.
   - T11 to T1, voltage at TP-E should be positive.

h. All resistors are ¼ watt unless specified. Where values are not given, refer to parts list for version used.
   - R15 is ½ watt – DYN96000-XXX-01, (02), (03)
   - R18 is ½ watt – DYN96000-XXX-01, (02)
   - R20 is ½ watt – DYN96000-XXX-01, (02)

7.4.1.6.1 Electro-Active Levelwind Out of Adjustment

The levelwind is shipped in a calibrated or adjusted condition and should not need adjustment. Should adjustment be required, refer to Electro-Active Levelwind Control PC Board Alignment and Test Procedures (section 7.4.1.6) and the following supplemental guidelines:

a. Remove the shroud covering the levelwind sensor block assembly.
b. Remove the hex head screws securing the sensor block only. Move the sensor block well away from the "T-BAR" that holds the magnet.
c. On the Electro-Active levelwind control PC Board (PCB102) located in the Levelwind Enclosure (ENC105), connect a multimeter across Servo Common (terminal 19) and Servo Signal out (terminal 20).
d. Apply ± 12 VDC power to PCB102.

NOTE

The levelwind PCB102 must be enabled throughout the adjustment procedure.

e. Enable PCB102 by moving the Pedestal Winch joystick (Figure 4-18) off of the neutral position.

NOTE

Ensure the output of the levelwind PCB102 is connected to the levelwind servo control valve or PCB102 will not "zero" properly, if at all.

f. Locate the potentiometer labeled "ZERO" on PCB102. Adjust this potentiometer slowly until the multimeter indicates zero volts. PCB102 should now be "zeroed".
g. Return the Pedestal Winch joystick to neutral.
h. Remove power to PCB102 and reinstall the levelwind sensor and shroud.
i. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
j. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).
k. By hand, move the "T-BAR" back and forth across the sensor block face with PCB102 enabled (Pedestal Winch joystick out of neutral), and observe the levelwind carriage assembly drives in the correct direction.

l. Test the LW Assembly Enclosure left and right push button correctors (Figure 4-4 and Table 4-4, Items 1 and 2). They should cause the levelwind carriage assembly to move in the direction indicated but slower than it would travel when normally driven by the levelwind sensor assembly.

7.4.1.6.1.1 EOT Sensors Test

Having completed the Levelwind Out of Electrical Adjustment procedures (section 7.4.1.6.1), test the EOT sensors by performing the following steps:

a. Use the Levelwind Control Panel (ENC105) toggle switch (Figure 4-3 and Table 4-3), to drive the LW carriage assembly left.
b. Place a ferrous metal tool or conductive metal object on the face of the left EOT sensor.
c. If the LW carriage assembly does not stop, place the metal object over the right EOT sensor.
d. If this does not stop the LW carriage assembly from moving left, then the EOT sensors are hooked up in reverse. The LW carriage assembly should resume movement when the metal object is removed.

7.4.1.6.1.2 Troubleshooting During This Procedure

If one or more of the functions on the LW Assembly are backward, it is best to start the procedures from the beginning and make sure the electrical part of the system is correctly hooked up.

NOTE

The levelwind PCB102 must be enabled throughout the adjustment procedure.

a. Verify the levelwind carriage assembly drives in the correct direction when the “T-BAR” is moved over the levelwind sensor block.
b. If the carriage drives in the proper direction, proceed to the next step. If it drives in the opposite direction from what it should, reverse the hydraulic lines feeding the levelwind motor (DD 1088-2005-01, Item 23).
c. Ensure the levelwind sensor signal and the levelwind corrector push buttons (Figure 4-4 and Table 4-4, Items 1 and 2) move the levelwind carriage assembly in the same direction. If they do not, then reverse the levelwind corrector push buttons.
d. Verify the right EOT sensor stops the levelwind carriage assembly when it is moving right and the left EOT sensor stops the levelwind carriage assembly when it is traveling left. If they do not, reverse the EOT sensor signals to the levelwind PCB102.
e. Re-check the above steps to confirm their operations work properly.

7.4.1.7 Electro-Active Levelwind Adjustment Procedures

The Electro-Active Levelwind adjustment is done at the manufacturer’s facility and only needs to be redone if either the levelwind sensor or the control board (PCB102) is replaced.

The Electro-Active Levelwind Control PC Board (PCB102) must be properly adjusted using the written procedures (section 7.4.1.6, and DD DYN-9600-01) before the Electro-Active Levelwind adjustment can be completed. A simple test to verify this is to:

a. Unbolt the levelwind sensor (DD 1088-2003-01, Item 14) and move it away from the T-Bar containing the magnet.

NOTE

The sensor must be loose and away from the magnet during the Electro-Active Levelwind adjustment.

b. With the Umbilical Winch Assembly running, move the Winch Pay Out/Haul In joystick (Figure 4-18 and Table 4-18, Item 17) out of the neutral position. The levelwind should remain stationary.
c. If the levelwind does move, this indicates the ZERO adjustment on PCB102 is faulty. Refer to the electrical schematic and adjust the ZERO potentiometer for 0 volts at pin 1 of the integrated circuit.
d. Recheck that the levelwind does not move when the Winch Pay Out/Haul In joystick is moved from neutral and then re-install the sensor to the Levelwind Assembly.

7.4.1.7.1 Mechanical Adjustments

There are two mechanical adjustments that may need to be made on the Levelwind Assembly: the Tracking adjustment and the EOT adjustment. These adjustments are normally accomplished at the manufacturer's facility when the umbilical cable is first loaded onto the winch drum.

7.4.1.7.1.1 Tracking Adjustment

To accomplish the tracking adjustment (refer to DD 377-2008-02, Levelwind Sensor that is Item 14 of DD 1088-2003-01), perform the following steps:

a. Loosen the sense arm assembly (Item 11) main pivot screw (Item 9) and the mounting screw (Item 26) that is installed through the arched slot.

CAUTION

POSSIBLE FOULED CABLE WRAPS! Cable wraps can become fouled on the winch drum if the umbilical cable is allowed to lead the wraps and thus prevent uniformly, tight. wraps. When a cable leads the wraps, it leaves gaps that on successive passes, allows the cable to be drawn into these gaps causing premature wear and stress. At no time should the umbilical cable lead the umbilical cable wraps on the winch drum as it moves across the drum.

b. The mounting plate can now be pivoted, as required, to change the tracking position of the levelwind in both directions of travel.
c. Operate the Levelwind Assembly and view the umbilical cable as it is wrapped onto the winch drum. If the umbilical cable leads the wraps on the winch drum, perform these steps again.

7.4.1.7.1.2 Left and Right End-of-Travel Adjustment

The left and right EOT sensors ensure the levelwind carriage assembly stops when there is approximately one umbilical cable width distance between the last wrap and the winch drum flange. To accomplish either the left or right EOT adjustment, perform the following steps.

a. Pay out the umbilical cable (or haul it in) until the cable is within one diameter's width of the left (or right) winch drum flange.

WARNING

POSSIBLE DEATH OR INJURY! Death or injury to personnel could result by unexpected movement of the Levelwind Carriage Assembly. Ensure the Pedestal Remote/Enable toggle switch is in the Disable position and that Pedestal Operator has moved away from the Pedestal Winch joy stick before EOT adjustments are made.

b. Loosen the Levelwind Drive Assembly EOT sensor rod tube nut that holds the sensor round rod in place.
c. Position the round rod such that the target end is approximately ½ inch from the levelwind sensor and tighten the nut.
d. Stand back from the unit and allow the Pedestal Operator to control the winch.
e. Bring the umbilical cable back towards the center of the winch drum by one wrap and then reverse the direction until the winch drum stops due to the left (or right) EOT sensor.
f. Inspect the umbilical cable on the winch drum to ensure the levelwind carriage assembly stopped by one width of umbilical cable from going into the winch drum flange.
g. If the width is determined to be unsatisfactory, repeat the procedures until the width is acceptable.
h. If the width is acceptable, repeat the steps in this procedure for the right (left) EOT sensor.

7.4.1.8 Valves Containing a Cartridge

Valves must be pressure tested and adjusted to the required set-point on a test bench during depot repair. This can be accomplished using a hand-operated hydraulic pump with appropriate fittings and pressure gauges.

Some system applications use the same model valve but at a different pressure setting. If these valves must be replaced at sea, there may be no means of accurately adjusting their set-point prior to installation. Therefore, to adjust the set-point of these valves *only* when at sea, and *only* when the proper procedure is unavailable, perform the following steps:

CAUTION

CRITICAL PRESSURE ADJUSTMENT! Course pressure setting adjustment is critical. Do not change failed valve pressure set-point until instructed to do so and ensure the number of turns is counted and temporarily recorded.

a. Remove the failed valve from the system and while holding the failed valve pressure adjusting screw stationary, loosen the pressure adjusting locking nut 1-2 revolutions.
b. Count the number of revolutions while turning the failed valve pressure adjusting screw CW until it “just” bottoms out.
c. Loosen the pressure adjusting locking nut on the replacement valve and carefully turn the pressure adjusting screw CW until it “just” bottoms out.
d. Turn the pressure adjusting screw of the replacement valve CCW the same number of revolutions as counted on the failed valve.
e. While holding the pressure adjusting screw stationary, tighten the pressure adjusting locking nut until it is snug.
f. Install the replacement valve into the system.

7.4.1.9 Pressure Switch Adjustment (PSH-101, PSH-102, PSH-103, PSH-105, PSH-9, PSH-10)

These pressure switches are electrically programmable to the appropriate pressure setting. For instructions on programming these switches refer to the manufacturer data sheets located in the FTHE Component Literature Manual, Section: “A-Frame/Docking Head/Cursor.”

7.4.1.10 Pressure Switch Adjustment (PSH-4, PSH-7, PSH-8)

These pressure switches are adjusted by turning a self-locking adjustment nut or screw clockwise to raise pressure and counter-clockwise to lower pressure. All dials on the units are calibrated. For instructions on programming these switches, refer to the manufacturer’s data sheets located in the FTHE Component Literature Manual, Section: “Gas Reclamation System.”

7.4.2 Alignment Procedures

There are no alignment procedures identified for FTHE at this time.

7.5 REPAIR PROCEDURES

This paragraph describes the removal and reinstallation procedures for the onboard Sea FTHE LRUs as identified in the Shipboard Maintenance Parts List, Table 8-2.

A list of the Depot FTHE LRUs is provided in the Depot Maintenance Parts List, Table 8-3, but no repair procedures are included in this technical manual since maintenance of these parts is beyond the scope of this document.

7.5.1 Repair Procedures Index

As an aid to the maintainer, a list of the repair procedures is provided in Table 7-2 and indicates the section number where it can be found as well as the table and figure numbers (if provided) associated with the repair. The repair procedures are grouped so that all the repairs to one FTHE major assembly can be found under that FTHE assembly heading.

Table 7-2 Repair Procedures Index

SECTION NUMBER	REPAIR PROCEDURE TITLE	TABLE NUMBER	FIGURE NUMBER
7.5.3.1	**GENERAL REPLACEMENT INSTRUCTIONS FOR COMMON PARTS**	---	---
7.5.3.1.1	Indicator Lamps (LTX)	4-9	4-9
7.5.3.1.2	Push Button Switches (PBX)	4-9	4-9
7.5.3.2	**UMBILICAL WINCH ASSEMBLY**	**4-1**	**4-1**
7.5.3.2.1	**Drum Speed Encoder ?**		
7.5.3.3	**LEVELWIND ASSEMBLY**	---	---
7.5.3.3.1	Proximity Sensor (LW Sensor, XS107)	4-2	4-2
7.5.3.3.2	Proximity Sensor (EOT Right, XS109 & EOT Left XS110)	4-2	4-2
7.5.3.3.3	Proximity Sensor (Line Count, XS111 and XS112)	4-2	4-2
7.5.3.3.4	**WINCH & LW HYDRAULIC PANEL**	7-4	**7-7**
7.5.3.3.4.1	Pressure Switch (PSH-103)	7-4	**7-7**
7.5.3.3.4.2	Check Valve (CV-102)	7-4	**7-7**
7.5.3.3.4.3	Servo Valve (SVV-101)	7-4	**7-7**
7.5.3.3.4.4	Servo Valve (SVV-102)	7-4	**7-7**
7.5.3.3.5	**LEVELWIND ENCLOSURE (ENC105)**	7-5	7-8
7.5.3.3.5.1	Fuse (F115, F116, F117)	7-5	7-8
7.5.3.4	**HPU ASSEMBLY**	---	---
7.5.3.4.1	**HPU HYDRAULIC PANEL**	**7-6**	**7-9**
7.5.3.4.1.1	Check Valve (CV-1, CV-2)	7-6	7-9
7.5.3.4.1.2	Check Valve (CV-3 and CV-4)	7-6	7-9
7.5.3.4.1.3	Solenoid Valve (SOV-105, SOV-106)	7-6	7-9
7.5.3.4.1.4	Not Used		

Table 7-2 Repair Procedures Index - *continued*

SECTION NUMBER	REPAIR PROCEDURE TITLE	TABLE NUMBER	FIGURE NUMBER
7.5.3.4.2	**HPU LOW VOLTAGE ENCLOSURE (ENC103)**	**7-7**	**7-10**
7.5.3.4.2.1	Fuse (F110)	7-7	7-10
7.5.3.4.2.2	Fuse (F111, F112)	7-7	7-10
7.5.3.4.2.3	Relay (K110, K112, K113, K15, K16, K123, **K36**)	7-7	7-10
7.5.3.4.2.4	Relay (K114, K115, K116, K119, K120, K121, K122, **K31**)	**7-7**	7-10
7.5.3.4.2.5	Relay (K118, K124)	**7-7**	7-10
7.5.3.4.3	**HPU HIGH VOLT. ENCLOSURE (ENC102)**	**7-8**	**7-11**
7.5.3.4.3.1	Circuit Breaker (CB101)	7-8	7-11
7.5.3.4.3.2	Circuit Breaker (CB102, CB103)	7-8	7-11
7.5.3.4.3.3	Circuit Breaker (CB104)	7-8	7-11
7.5.3.4.3.4	Fuse (F101)	7-8	7-11
7.5.3.4.3.5	Fuse (F102)	7-8	7-11
7.5.3.4.3.6	Relay (K101, K102)	7-8	7-11
7.5.3.4.3.7	Magnetic Motor Starter (MS101, MS102)	7-8	7-11
7.5.3.4.3.8	Line Power Phase Monitor (PM101)	7-8	7-11
7.5.3.4.3.9	Toggle Switch (SW101, SW102)	7-8	7-11
7.5.3.4.4	**HPU POWER ISOLATION (ENC101)**	**7-9**	**7-12**
7.5.3.4.4.1	Incorrect Phase	7-9	7-12
7.5.3.5	**HC ASSEMBLY**	**---**	**---**
7.5.3.5.1	Proximity Sensor (XS9, XS10) (HC Top, HC Bottom)	N/A	N/A
7.5.3.5.2	**HC HYDRAULIC PANEL**	**7-10**	**7-13**
7.5.3.5.2.1	Check Valve (CV-7, CV-8)	7-10	7-13
7.5.3.5.2.2	Needle Valve (NV-5)	7-10	7-13
7.5.3.5.2.3	Solenoid Operated Valve (SOV-7, SOV-18)	7-10	7-13
7.5.3.5.2.4	Solenoid Operated Valve (SOV-9 – 12 and SOV-19)	7-10	7-13
7.5.3.5.2.5	Solenoid Operated Valve (SOV-17)	7-10	7-13
7.5.3.5.2.6	Solenoid Operated Valve (SOV-20)	7-10	7-13
7.5.3.5.3	**HC GAS INTENSIFIER PANEL**	**7-11**	**7-14**
7.5.3.5.3.1	Check Valve (CV-10 through CV-15)	7-11	7-14
7.5.3.5.3.2	Solenoid Operated Valve (SOV-13, 14, 15, 16)	7-11	7-14
7.5.3.5.4	**HC GI ENCLOSURE (ENC7)**	**7-12**	**7-15**
7.5.3.5.4.1	Relay (K32, K33)	7-12	7-15
7.5.3.5.4.2	Magnetic Motor Starter (MS4)	7-12	7-15

Table 7-2 Repair Procedures Index - *continued*

SECTION NUMBER	REPAIR PROCEDURE TITLE	TABLE NUMBER	FIGURE NUMBER
7.5.3.5.5	**HC HIGH VOLTAGE ENCLOSURE (ENC8)**	**7-13**	**7-16**
7.5.3.5.5.1	Circuit Breaker (CB6)	7-13	7-16
7.5.3.5.5.2	Circuit Breaker (CB7, CB8)	7-13	7-16
7.5.3.5.5.3	Circuit Breaker (CB9)	7-13	7-16
7.5.3.5.5.4	Fuse (F7)	7-13	7-16
7.5.3.5.5.5	Relay (K23)	7-13	7-16
7.5.3.5.5.6	Relay (K24)	7-13	7-16
7.5.3.5.5.7	Magnetic Motor Starter (MS3)	7-13	7-16
7.5.3.5.5.8	Power Line Phase Monitor (PM2)	7-13	7-16
7.5.3.5.5.9	Toggle Switch (SW10)	4-15	4-15
7.5.3.5.5.10	Toggle Switch (SW11)	4-15	4-15
7.5.3.5.6	**HC LOW VOLTAGE ENCLOSURE (ENC9)**	**7-14**	**7-17**
7.5.3.5.6.1	Relay (K25, K26, K27, K28, K34, K38)	7-14	7-17
7.5.3.5.6.2	Relay (K29)	7-14	7-17
7.5.3.5.6.3	Relay (K30, K35)	7-14	7-17
7.5.3.5.6.4	Power Supply (PS4)	7-14	7-17
7.5.3.5.6.5	Signal Conditioner (SC2)	7-14	7-17
7.5.3.6	**A-FRAME ASSEMBLY**	**---**	**---**
7.5.3.6.1	Proximity Sensor (XS6) (A-Frame Outboard)	4-17	4-17
7.5.3.6.2	Proximity Sensor (XS11) (Cursor Winch Payout)	4-17	4-17
7.5.3.6.4	**MANUAL DCV STATION HYDRAULIC PANEL**	**7-15**	**7-18**
7.5.3.6.4.1	Check Valve (CV-4, CV-105)	7-15	7-18
7.5.3.6.4.2	Pressure Regulating Valve (PRV-1)	7-15	7-18
7.5.3.6.4.3	Solenoid Operating Valve (SOV-5)	7-15	7-18
7.5.3.6.5	**A-FRAME ENCLOSURE (ENC11)**	**N/A**	**N/A**
7.5.3.6.5.1	Signal Conditioner (SC1)	N/A	N/A
7.5.3.6.6	**A-FRAME J-BOX (JB3)**	**7-16**	**7-19**

Table 7-2 Repair Procedures Index - *continued*

SECTION NUMBER	REPAIR PROCEDURE TITLE	TABLE NUMBER	FIGURE NUMBER
7.5.3.7	**CONTROL STATION – LOCAL**	**---**	**---**
7.5.3.7.1	**PEDESTAL ENCLOSURE (ENC104)**	**7-17**	**7-20**
7.5.3.7.1.1	Control Handle (CH101)	4-18	4-18
7.5.3.7.1.2	Control Handle (CH102, CH103, CH104)	4-18	4-18
7.5.3.7.1.3	Fuse (F0)	7-17	7-20
7.5.3.7.1.4	Toggle Switch (SW103, SW105)	4-18	4-18
7.5.3.7.1.5	Toggle Switch (SW104, SW106)	4-18	4-18
7.5.3.7.1.6	Toggle Switch (SW107, SW108)	4-18	4-18
7.5.3.8	**CONTROL STATION – REMOTE**	**---**	**---**
7.5.3.8.1	**MONITOR**	**7-18**	**7-22**
7.5.3.8.2	**CONTROL VAN PANEL (ENC5)**	**4-22**	**4-24**
7.5.3.8.2.1	Control Handle (CH5)	4-22	4-24
7.5.3.8.2.2	Fuse (F0)	7-17	7-20
7.5.3.8.2.3	Switch (SW9)	4-22	4-24
7.5.3.8.3	**COMPUTER**	**7-18**	**7-23**
7.5.3.8.3.1	Real-Time DAQ Card/MIO Board (CCA1)	7-19	7-23, 7-24
7.5.3.8.3.2	Processor Card (CCA2)	7-19	7-23, 7-25
7.5.3.8.3.3	Multifunction DAQ Card	7-19	7-23, 7-26
7.5.3.8.3.4	DIO Card (CCA3)	7-19	7-23, 7-27
7.5.3.8.4	**KEYBOARD TRAY**	**4-24**	**4-26**
7.5.3.8.5	**SIGNAL INTERFACE ENCLOSURE (ENC10)**	**7-24**	**7-28**
7.5.3.8.5.1	Optical I/O Modules (M0 – M10)	7-24	7-28
7.5.3.8.5.2	Signal Conditioner (SC3)	7-24	7-28
7.5.3.8.5.3	Signal Conditioner (SC4)	7-24	7-28
7.5.3.8.6	**VME ENCLOSURE**	**7-27**	**7-30**
7.5.3.8.6.1	Single Board Computer CCA (Slot A1)	7-27	7-30
7.5.3.8.6.2	Digital-to-Analog CCA (Slot A3)	7-27	7-30
7.5.3.8.7	**UPS**	**4-27**	**4-29**

7.5.2 General Guidelines and Assumptions

This manual was designed for technicians/operators with prior experience in the use of umbilical handling systems and with at least a basic understanding of hydraulic and electrical systems. The following general guidelines and assumptions are provided as a means of defining a basic knowledge base.

- Use the appropriate tools as identified in Table 7-1, Tools and Test/Support Equipment,
- Table 7-1, to perform all corrective maintenance.
- Use the appropriate consumables (oil absorbent pads, rags, buckets, etc.) as identified in the Consumable Items List, Table 8-4, to perform all corrective maintenance.
- All onboard Sea FTHE LRUs are identified in the Shipboard Maintenance Parts List, Table 8-2, and should be used to perform all corrective maintenance.
- Prior to any disassembly, note orientation of all fittings/tubing/electrical wires at unit body. All fittings/tubing/electrical wires must be reinstalled with the same orientation for the replacement unit.
- To aid alignment of replacement parts such as solenoid operated valves that have multiple fittings/connections, leave joints and mounting hardware loosely connected until all parts are in place, and then tighten securely as appropriate.
- Always inspect O-Rings (even new ones) for cuts, abrasions, flattening, or other abnormalities and replace as required. Ensure O-Rings are properly lubricated prior to reassembly.
- Identify and mark all replacement parts with a paint marker or other suitable marking tool when parts are replaced.
- Use hydraulic plugs and caps as required preventing excessive hydraulic oil from escaping hydraulic lines when the system is opened during remove/replace procedures.
- Male pipe threads should be cleaned using a brass wire brush and pipe compound applied prior to reassembly.
- Denzel tape is used to tightly wrap all hose and pipe connections to preclude the ever present and continuing corrosion that is a natural byproduct of the harsh ocean environment. When performing corrective maintenance and one of these fittings must be loosened or removed, unroll the tape and carefully set aside for later use. Once the maintenance activity is completed, reinstall the tape taking care to smooth out all wrinkles leaving a watertight wrapping that prevents the connection from corrosion.
- Never use pipe compound or tape on Stainless Steel threads/fittings.
- All hydraulic fittings and Stainless Steel ferrule nuts must be snug but do not over tighten.
- Always check for hydraulic leaks after performing maintenance on hydraulic components/piping.
- Always check for nitrogen leaks after performing maintenance on nitrogen components/piping.
- Prior to performing corrective maintenance on any hydraulic circuit, obtain a collection container and a sufficient quantity of oil absorbent pads and use as required. Dispose of any grease, hydraulic oil, or contaminated rags in accordance with local procedures.

7.5.3 Remove and Reinstall Procedures

The following paragraphs provide remove and reinstall procedures for the onboard Sea FTHE LRUs as identified in the Shipboard Maintenance Parts List, Table 8-2. The table has been sorted on the "ID Tag #" to make it easier to identify the part when looking in the spare parts boxes. The Item numbers in this table refer to the actual item number identified on the LRU description tag due to a previous numbering scheme.

7.5.3.1 General Replacement Instructions for Common Parts

Common replacement parts for the indicator lamps include light bulb, red, green, and amber lens, and the lamp base itself. Because of their simplicity, one general procedure is provided for all lamp items. Indicator lamp (LTX) is listed where "X" represents a particular lamp identifying number, i.e., LT101 (Figure 4-9 and Table 4-9, Item 13), the red POWER FAULT lamp located on the HPU High Voltage Enclosure (ENC102).

The same methodology is used for push button switches, PBXs, where "X" represents a particular push button switch identifying number, i.e., PB102 (Figure 4-9 and Table 4-9, Item 2), the HPU #1 STOP push button switch.

7.5.3.1.1 Indicator Lamps (LTX)

Parts required: Dialight Base, bulb, or lens (Spare Part Items 115, 116, 117, 118, 119, or 120.)

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the affected equipment is secured IAW the applicable paragraph in the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the appropriate enclosure or assembly and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect enclosure or assembly to ensure it is free of all tools and any foreign materials and then secure enclosure cover.

g. Complete the applicable paragraph in the Prestart Inspection (section 3.2.1) for the affected assembly.
h. Startup the appropriate assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.1.2 Push Button Switches (PBX)

Parts required: Furnas operators (Spare Part Items 124, 125, 126, 127, or 128.)

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the affected equipment is secured IAW the applicable paragraph in the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the appropriate enclosure or assembly and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect enclosure or assembly to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the applicable paragraph in the Prestart Inspection (section 3.2.1) for the affected assembly.
h. Startup the appropriate assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.2 Umbilical Winch Assembly

7.5.3.2.1 **Drum Encoder**? (RE102 (item on DYNACON spare list)

Parts required: Hagglunds 378 5036-801

Not in the Hagglunds manufacturer literature …

7.5.3.3 Levelwind Assembly

7.5.3.3.1 Proximity Sensor (XS107) (LW Sensor)

7.5.3.3.1.1 Remove and Reinstall Procedure

Parts required: Dynacon Levelwind Sensor (Dynacon Drawing, 377-2008-01, Item 13).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the Levelwind Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove LW sensor power cables from LW Carriage J-Box (JB107).
e. Remove LW sensor cover to gain access to the sensor.
f. Carefully mark location of failed unit so replacement unit is mounted in the same location.
g. Remove mounting bolts and failed unit from the LW Sheave Assembly.
h. Inspect replacement unit for damage, and install new unit taking care to ensure it is mounted in the same location as the failed unit. Securely tighten mounting screws.
i. Connect power cables to LW Carriage J-Box (JB107)..
j. Perform Tracking Adjustment procedure (section 7.4.1.7.1.1).
k. Fasten protective cover to LW Sheave Assembly.
l. Inspect Levelwind Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
m. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
n. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.3.2 Proximity Sensor (XS109, XS110) (EOT Right, EOT Left)

7.5.3.3.2.1 Remove and Reinstall Procedure

Parts required: Efector Proximity Sensor (Spare Part Item 146).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the Levelwind Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit, loosen two hex screws, and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Perform Left and Right End-of-Travel Adjustment (section 7.4.1.7.1.2).
g. Inspect Levelwind Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
h. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
i. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.3.3 Proximity Sensor (XS111 and XS112) (Line Count)

The Levelwind Assembly proximity sensors are located on the levelwind sheave.

7.5.3.3.3.1 Remove and Reinstall Procedure

Parts required: Efector Proximity Sensor (Spare Part Item 145) (Figure 7-6 and Table 7-3).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

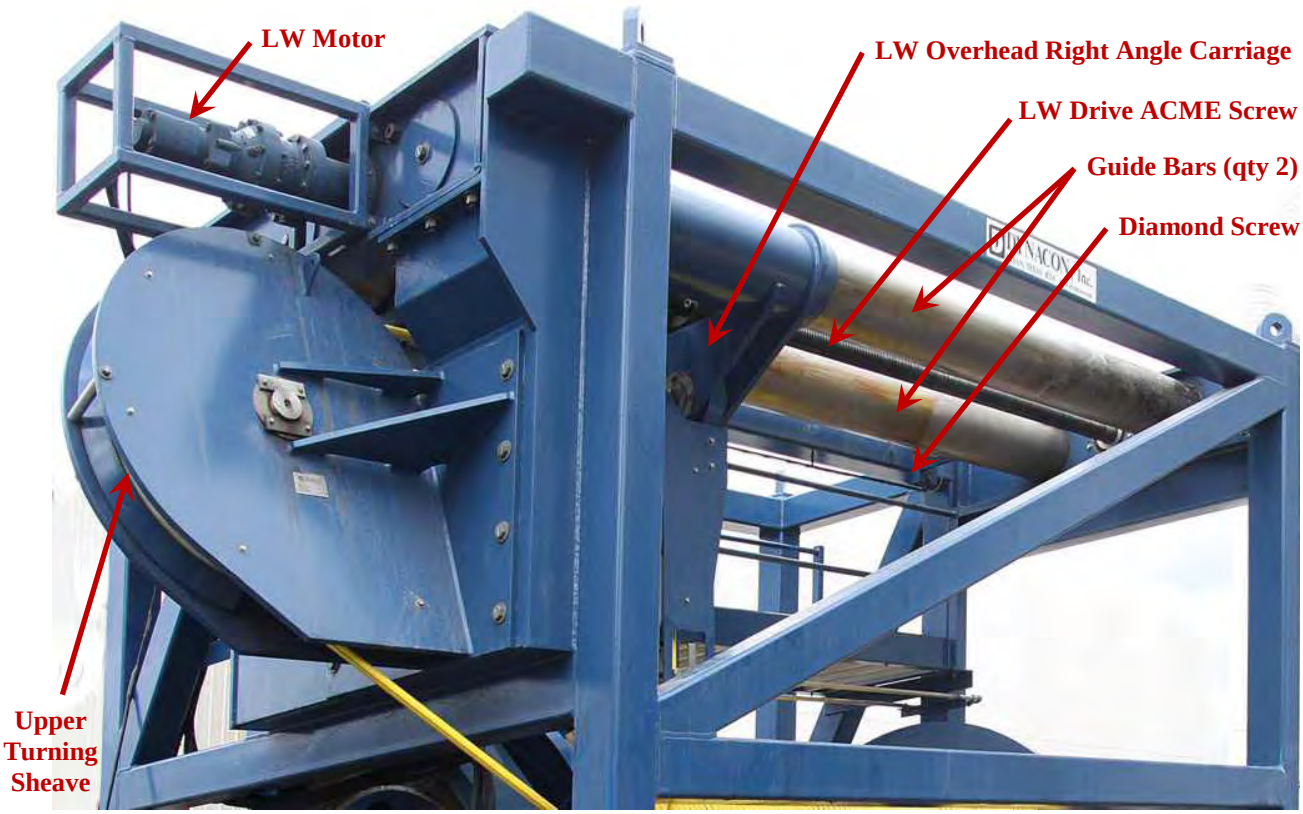


Figure 7-6 Levelwind Assembly (Partial View), Components

Table 7-3 Levelwind Assembly, Parts Identification

PANEL DESIGNATION	PHYSICAL DESCRIPTION
N/A	Proximity Sensor Targets
N/A	Proximity Sensors (Underneath Cover)
N/A	Guide Bars (quantity 2)
N/A	Levelwind Overhead Right Angle Carriage
N/A	Levelwind Drive ACME Screw
N/A	Levelwind Sheave Assembly
N/A	Levelwind Sensor Guide Fingers

c. Gain access to the Levelwind Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Gain access to the proximity sensors by removing the proximity sensor cover.

e. The unit has two mounting screws set into oblong holes that allow some movement for lateral adjustments. Do not loosen/remove these screws yet.
f. Carefully mark the position of the proximity switch to ensure the new switch will occupy the same specific location.
g. Two other screws are located catty-corner to the mounting screws. Remove these screws to remove the sensing cube and gain access to the internal wiring.
h. Remove wire lugs and cable from failed unit.
i. Remove mounting screws and failed unit.
j. Remove sensing cube from new unit and inspect for damage.
k. Install new unit taking care to ensure it is mounted in the same location as the failed unit.
l. Insert the power cable into the sensor and connect the wires.
m. Reinstall the sensing cube and tighten screws.
n. Check for safe functioning of the switch. The LED is illuminated when supply voltage is applied.
o. Verify the LCI-90 Line Data Display line count read-out at the Pedestal and the Control Van Panel increment and decrement as appropriate when the umbilical cable is paid out or hauled in on the umbilical winch drum.
p. Reinstall the proximity sensor cover.
q. Inspect Levelwind Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
r. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
s. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.3.4 Winch & LW Hydraulic Panel

As an aid to the maintainer, all the major components on the Levelwind Assembly Hydraulic Panel (Figure 7-7 and Table 7-4) are called out even though some are not necessarily considered sea replaceable units.

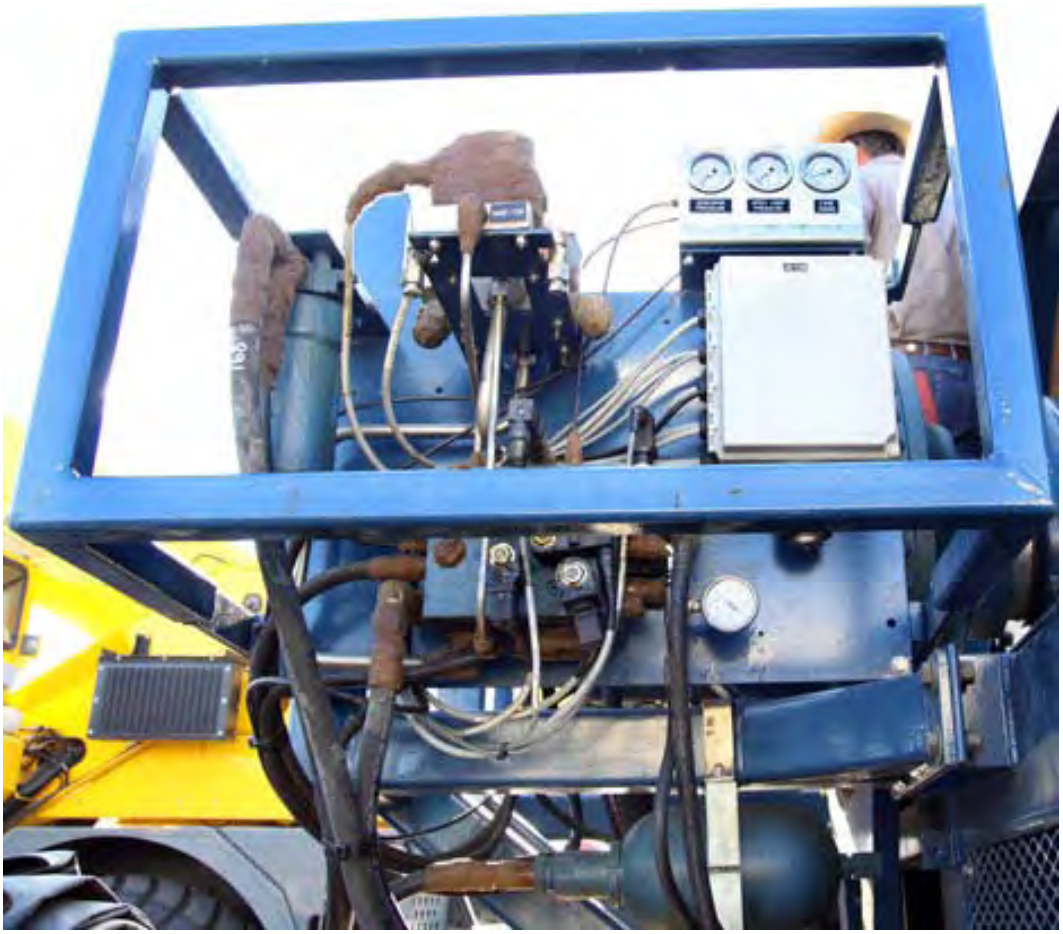


Figure 7-7 Winch & LW Hydraulic Panel, Components

Table 7-4 Winch & LW Hydraulic Panel, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	FL-111	Filter FL-111 with Indicator
2	MANF-103	Hydraulic Manifold-103
3	SVV-101	Servo Valve-101
4	MANF-104	Hydraulic Manifold -104
5	SVV-102	Servo Valve-102
6	N/A	Pressure Gauge Panel
7	JB106	Winch Junction Box
8	CV-1	Check Valve-102
9	PSH-103	Pressure Switch-103 for sensing pressure to brake BK-102
10	PSH-105	Pressure Switch-105 for sensing Open Loop pressure to Levelwind
11	MANF-102	Hydraulic Manifold-102
12	ACC-103	Accumulator-103

7.5.3.3.4.1 Pressure Switch (PSH-103)

7.5.3.3.4.1.1 Remove and Reinstall Procedure

Parts required: United Electric Controls (Spare Part, P/N 10F14M511) (refer to Figure 7-7 and Table 7-4).

a. Locate pressure switch (PSH-103) at the Winch Hydraulic Panel (Figure 7-7) and place an oil absorbent pad under it.
b. Ensure the HPU is powered off and the winch brake line is not pressurized.
c. Crack open the hydraulic line at PSH-103 fitting and allow hydraulic oil to flow onto the oil absorbent pad, then unhook the ¼ NPT male pressure connector.
d. Disconnect the electrical DIN connector and replace with new PSH-103 part.
e. Tighten new ¼ NPT pressure connector.
f. Turn on the HPU and apply pressure to the winch brake by moving the Pedestal Winch joystick off the neutral position – enough to allow pressure to the brake but not enough to cause the winch drum to rotate.
g. Crack open the hydraulic line at PSH-103 fitting and allow hydraulic oil to flow onto the oil absorbent pad until no air bubbles are evident (e.g.: bleed the brake line of air).
h. Tighten PSH-103 pressure fitting and wipe up any spilled oil.
i. Dispose of hydraulic oil and contaminated rags in accordance with local procedures.

7.5.3.3.4.2 Check Valve (CV-102)

7.5.3.3.4.2.1 Remove and Reinstall Procedure

Parts required: Sun Check Valve (Spare Part Item P/N CXCD-XDN) (refer to Figure 7-7 and Table 7-4).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Loosen the SS tubing ferrule nuts and install plugs as necessary to prevent excessive oil leakage.
d. Remove the mounting hardware from the check valve body and remove unit.
e. Remove brass fittings from the check valve body and reinstall on replacement unit. Do not tighten nuts at this time.
f. Remove hydraulic plugs from SS lines and reinstall the check valve by loosely attaching mounting bolts and SS tubing.
g. Once the check valve is in place and SS tubing is connected, tighten all fittings.
h. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
i. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).
j. Inspect check valve for leaks.

7.5.3.3.4.3 Servo Valve (SVV-101)

7.5.3.3.4.3.1 Remove and Reinstall Procedure

Parts required: Moog Servo Valve (Spare Part) (refer to Figure 7-7 and Table 7-4).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Remove power connector from the servo valve body.
d. Loosen tubing ferrule nuts and install plugs as necessary to prevent excessive oil leakage.
e. Remove the mounting hardware from servo valve body and remove unit from MANF-103
f. Remove brass fittings from the servo valve body and reinstall on replacement unit. Do not tighten nuts at this time.
g. Remove hydraulic plugs from SS lines and reinstall servo valve to MANF-103 by loosely attaching mounting bolts and SS tubing.
h. Once the servo valve is in place and SS tubing is connected, tighten all fittings.
i. Reattach power connector to servo valve body.
j. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
k. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).
l. Inspect servo valve for leaks.

7.5.3.3.4.4 Servo Valve (SVV-102)

7.5.3.3.4.4.1 Remove and Reinstall Procedure

Parts required: Moog Servo Valve (Spare Part) (refer to Figure 7-7 and Table 7-4).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Remove power connector from the servo valve body.
d. Loosen the SS tubing ferrule nuts and install plugs as necessary to prevent excessive oil leakage.
e. Remove the mounting hardware from servo valve body and remove unit from MANF-104.
f. Remove brass fittings from the servo valve body and reinstall on replacement unit. Do not tighten nuts at this time.
g. Remove hydraulic plugs from SS lines and reinstall servo valve to MANF-104 by loosely attaching mounting bolts and SS tubing.
h. Once the servo valve is in place and SS tubing is connected, tighten all fittings.
i. Reattach power connector to servo valve body.
j. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
k. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).
l. Inspect servo valve for leaks.

7.5.3.3.5 Levelwind Enclosure (ENC105)

As an aid to the maintainer, all major components on the Levelwind Enclosure (Figure 7-8 and Table 7-5) are called out even though some are not necessarily considered sea replaceable units.

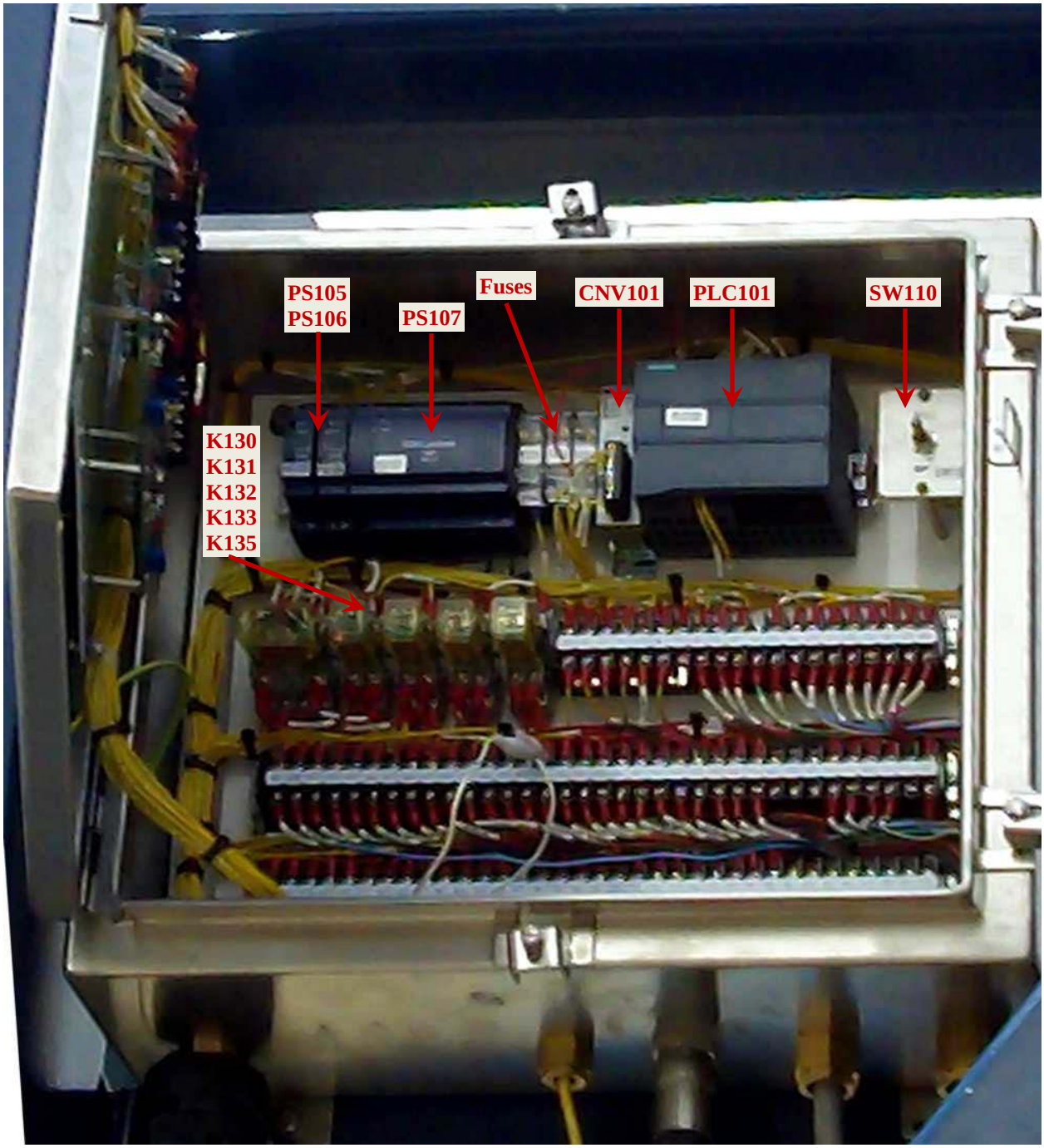


Figure 7-8 Levelwind Enclosure, Components

Table 7-5 Levelwind Enclosure, Parts Identification

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
PS105 & PS106	Power Supply	Power Supply, 0.83A at 12V (10W)
PS107	Power Supply	Power Supply, 4.2A at 24V (100.8W)
F115	Fuse, 1A	Protects PS105 from excessive current and shorts
F116	Fuse, 1A	Protects PS106 from excessive current and shorts
F117	Fuse, 3A	Protects PS107 from excessive current and shorts
K130	Relay	Diamond Follower Selected (24VAC)
K131	Relay	Diamond Follower Selected (24VAC)
K132	Relay	Levelwind Disabled (24VAC)
K133	Relay	Brake Interlock (24VAC)
K135	Relay	Hyd. Applied Brake Pressure Present (24VAC)

7.5.3.3.5.1 Fuse (F115, F116, F117)

7.5.3.3.5.1.1 Remove and Reinstall Procedure

Parts required: LittleFuse Fuse (Spare Part Item 104) (refer to Figure 7-8 and Table 7-5).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to Levelwind Enclosure and verify electrical components are de-energized.
d. Remove the failed fuse and replace with new fuse of similar rating.
e. Inspect Levelwind Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
f. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
g. Startup the HPU in accordance with the Start-Up procedures (section 3.2.2).

7.5.3.4 <u>HPU Assembly</u>

7.5.3.4.1 HPU Assembly Hydraulic Panel

As an aid to the maintainer, all the major components on the HPU Assembly Hydraulic Panel (Figure 7-9 and Table 7-6) are called out even though some are not necessarily considered sea replaceable units.

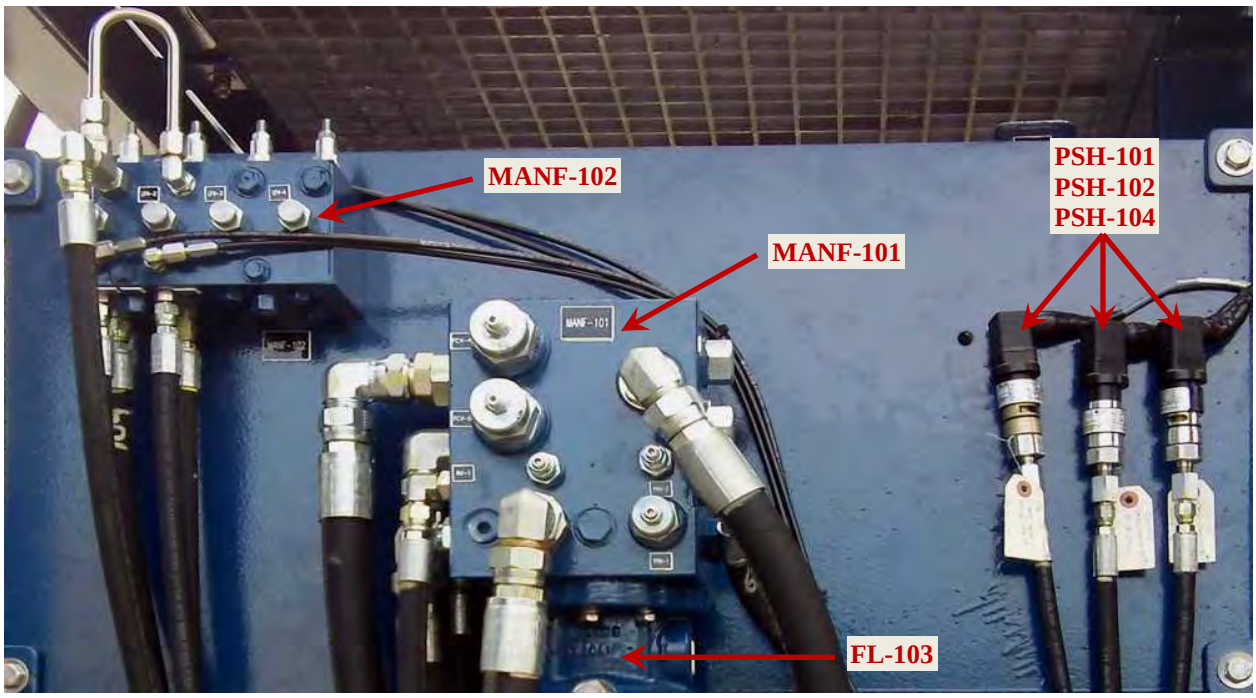


Figure 7-9 HPU Hydraulic Valve Panel, Components

Table 7-6 HPU Hydraulic Panel, Parts Identification

PANEL DESIGNATION	PHYSICAL DESCRIPTION	FUNCTIONAL DESCRIPTION
PSH-101	Pressure Switch	Pressure switch for HPU #1 Winch Pump (HP-101A) charge pressure.
PSH-102	Pressure Switch	Pressure switch for HPU #2 Winch Pump (HP-102A) charge pressure.
PSH-104	Pressure Switch	Pressure switch for Closed Loop B-Port.
FL-103	Filter, Manifold Mount type	Filter with 3000psi design pressure, 10µ
MANF-101 Counterbalance Valve Block		
CV-1, -2, -3, & -4	Check Valves	To only allow flow one way in line
FCV-4 & FCV-5	Flow Control Valves	To control hydraulic oil flow rate
PRV-1 & PRV-2	Pressure Reducing Valves	To reduce pressure downstream in line
RV-1	Relief Valve	To relieve pressure at set value (max.)
MANF-102 Winch Control Block		
LFV-1, -2, -3, & -4	Loop Flushing Valves	Operates so that charge pressure in the low pressure side of the loop is maintained by the relief valve incorporated in the flushing valve.
RV-2, -3, -4, & -5	Relief Valves	To relieve pressure at set value (max.)
SHV-3 & SHV-4	Shuttle Valves	Allows two different sources to provide pressure without the threat of backflow from one source to the other.

7.5.3.4.1.1 Check Valve (CV-1, CV-2)

7.5.3.4.1.1.1 Remove and Reinstall Procedure

Parts required: Parker Check Valve (Spare Part Item 2) (refer to Figure 7-9 and Table 7-6).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7-5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Loosen the SS tubing ferrule nuts and install plugs as necessary to prevent excessive oil leakage.
d. Remove the failed check valve and reinstall new one in its place.
e. Remove hydraulic plugs from SS lines and reinstall to check valve.
f. Once check valve is in place and SS tubing is connected, tighten all fittings.
g. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).
i. Check valve for leaks.

7.5.3.4.1.2 Check Valve (CV-3 and CV-4)

7.5.3.4.1.2.1 Remove and Reinstall Procedure

Parts required: Sun Check Valve (Spare Part Item L-6) (refer to Figure 7-9 & Table 7-6).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Remove the check valve from HDR-3 and install new one in its place.
d. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
e. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).
f. Check valve for leaks.

7.5.3.4.1.3 Solenoid Valve (SOV-105, SOV-106)

7.5.3.4.1.3.1 Remove and Reinstall Procedure

Parts required: Hydraforce Solenoid Valve (Spare Part Item 26) (refer to Figure 7-9 & Table 7-6).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Remove power connector from solenoid operated valve coil.
d. Loosen the SS tubing ferrule nuts and install plugs as necessary to prevent excessive oil leakage.
e. Remove mounting hardware from solenoid operated valve and remove unit from panel.
f. Remove brass fittings from solenoid operated valve body and reinstall on replacement unit. Do not tighten nuts at this time.

g. Remove hydraulic plugs from SS lines and reinstall solenoid operated valve to panel by loosely attaching mounting bolts and SS tubing.

NOTE

The torque value is 30 ft-lbs for the block fittings and 15 to 45 in-lbs maximum for the coil nut. Do not over tighten or damage to the solenoid could result.

h. Once the solenoid operated valve is in place and SS tubing is connected, tighten all fittings.

i. Reattach power connector to solenoid operated valve coil.

j. Complete the Prestart Inspection for the HPU (section 3.2.1.3).

k. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

l. Inspect solenoid operated valve for leaks.

7.5.3.4.1.4 Not Used

7.5.3.4.2 HPU Low Voltage Enclosure (ENC103)

As an aid to the maintainer, all the major components on the HPU Low Voltage Enclosure are called out on a representative drawing (Figure 7-10, 2 sheets and Table 7-7) even though some are not necessarily considered sea replaceable units.

Figure 7-10 HPU Low Voltage Enclosure, Components

Table 7-7 HPU Low Voltage Enclosure, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	PS101	Power Supply
2	PS102	Power Supply
3	PS103	Power Supply
4	PS104	Power Supply
5	F110, F11, & F112	Fuse, Class 3AG, 5Amp
6	LC101	Load Controller
7	K110	Start Disable Relay
8	K112	Local Brake Release Relay
9	K113	Remote Brake Release Relay
10	K114	HP #1 Running Relay
11	K115	HP #2 Running Relay
12	K116	Remote Enable Relay
13	K119	Computer Control Enable Relay
14	K120	Computer Control Enable Relay
15	K118	Dual EDC Select Relay
16	K129	Cursor Winch Payout Limit Relay
17	K128	Counter-Balance Relay
18	K121	Constant Tension Relay
19	K122	Constant Tension Relay
20	K118	Dual EDC Select Relay
21	K123	Winch Brake Pressure Switch Relay
22	K124	Brake Release From Computer Relay
23	K31	HC Cylinder Lock Relay

7.5.3.4.2.1 Fuse (F110)

7.5.3.4.2.1.1 Remove and Reinstall Procedure

Parts required: Littlefuse Fuse (Spare Part Item 103) (refer to Figure 7-10 and Table 7-7).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).

b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HPU Low Voltage Enclosure and verify electrical components are de-energized.

d. Remove the failed fuse and replace with new fuse of similar rating.
e. Inspect HPU Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
f. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
g. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.2.2 Fuse (F111, F112)

7.5.3.4.2.2.1 Remove and Reinstall Procedure

Parts required: Littlefuse Fuse (Spare Part Item 104) (refer to Figure 7-10 and Table 7-7).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HPU Low Voltage Enclosure and verify electrical components are de-energized.
d. Remove the failed fuse and replace with new fuse of similar rating.
e. Inspect HPU Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
f. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
g. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.2.3 Relay (K110, K112, K113, K123, **K36**)

7.5.3.4.2.3.1 Remove and Reinstall Procedure

Parts required: Idec Relay (Spare Part Item 106) (refer to Figure 7-10 and Table 7-7).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU Low Voltage Enclosure and verify electrical components are de-energized.
d. Identify the suspect relay and note mounting orientation.

e. To remove relay, pull out mounting clip with a flat blade screwdriver and lift socket out.
f. Inspect replacement unit for damage before installing.
g. Orient relay so that the end of the socket (end opposite of mounting clip) against the outer edge of the rail. Press the socket down firmly until the clip snaps onto the mounting rail.
h. Inspect HPU Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
i. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
j. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.2.4 Relay (K114, K115, K116, K119, K120, K17, K122, K31)

7.5.3.4.2.4.1 Remove and Reinstall Procedure
Parts required: Idec Relay (Spare Part Item 108) (refer to Figure 7-10 and Table 7-7).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU Low Voltage Enclosure and verify electrical components are de-energized.
d. Identify the suspect relay and note mounting orientation.
e. To remove relay, pull out mounting clip with a flat blade screwdriver and lift socket out
f. Inspect replacement unit for damage before installing.
g. Orient relay so that the end of the socket (end opposite of mounting clip) against the outer edge of the rail. Press the socket down firmly until the clip snaps onto the mounting rail.
h. Inspect HPU Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
i. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
j. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.2.5 Relay (K118, K124)

7.5.3.4.2.5.1 Remove and Reinstall Procedure
Parts required: Idec Relay (Spare Part Item 110) (refer to Figure 7-10 and Table 7-7).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU Low Voltage Enclosure and verify electrical components are de-energized.
d. Identify the suspect relay and note mounting orientation.
e. To remove relay, pull out mounting clip with a flat blade screwdriver and lift socket out.
f. Inspect replacement unit for damage before installing.
g. Orient relay so that the end of the socket (end opposite of mounting clip) against the outer edge of the rail. Press the socket down firmly until the clip snaps onto the mounting rail.
h. Inspect HPU Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
i. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
j. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.3 HPU High Voltage Enclosure (ENC102)

As an aid to the maintainer, all the major components on the HPU High Voltage Enclosure are called out on a representative drawing (Figure 7-11 and Table 7-8) even though some are not necessarily considered sea replaceable units.

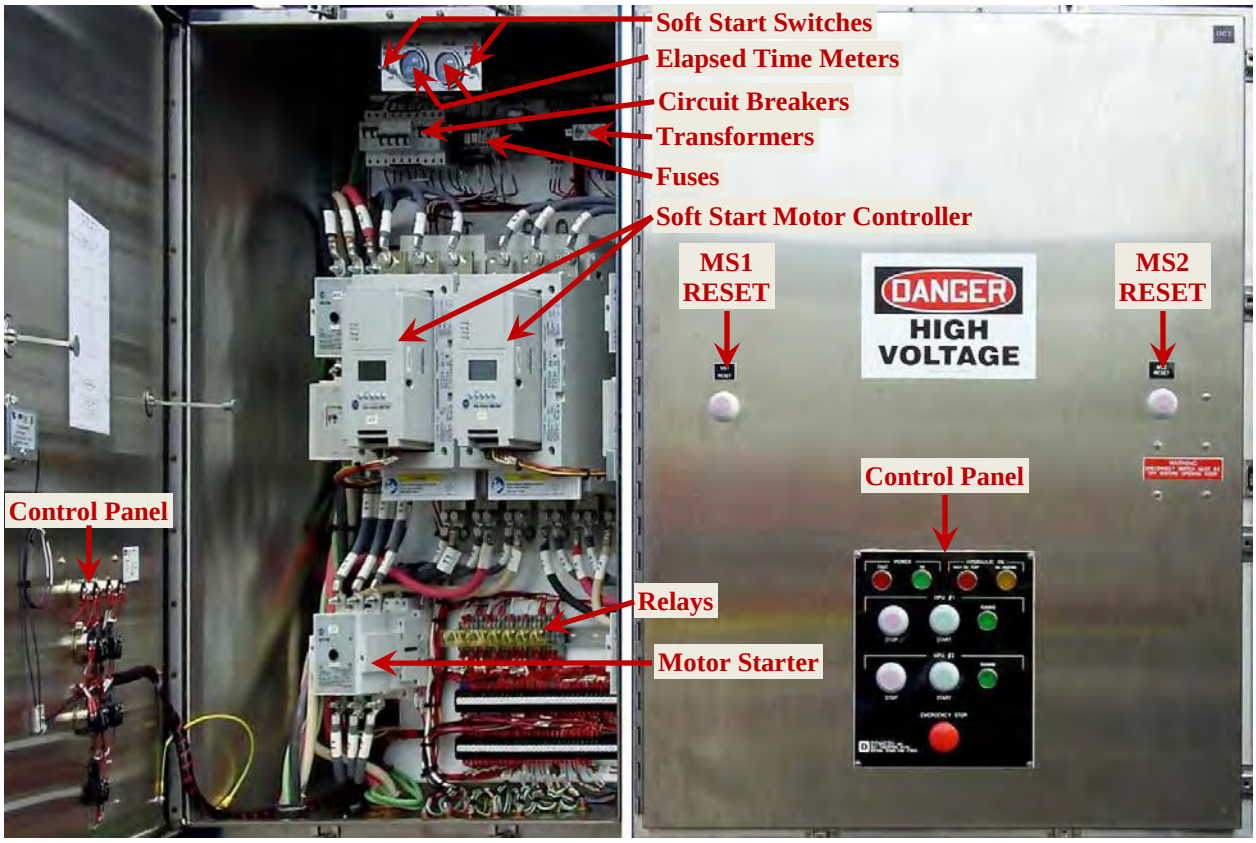


Figure 7-11 HPU High Voltage Enclosure, Components

Table 7-8 HPU High Voltage Enclosure, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	CB101	Circuit Breaker, 3-pole
2	CB102	Circuit Breaker, 2-pole
3	CB103	Circuit Breaker, 2-pole
4	CB104	Circuit Breaker, 3-pole
5	T101 & T102	Transformers
6	F101 & F102	Fuses
7	MS101	Magnetic Motor Starter with overload relay
8	MS102	Magnetic Motor Starter with overload relay
9	SS101	Soft Start Controller 101
10	SS102	Soft Start Controller 102
11	K101	HP #1 Start Relay
12	K102	HP #2 Start Relay
11	K103	Oil Tank Heater Relay
12	PM101	Line Power Phase Monitor 101
11	SW101	Soft Start HPU #1 Bypass Switch
12	SW102	Soft Start HPU #2 Bypass Switch
11	HM101	Elapsed Time Meter HPU #1
12	HM102	Elapsed Time Meter HPU #2
11	CT101	Bypass Contactor 101
12	CT102	Bypass Contactor 102

7.5.3.4.3.1 Circuit Breaker (CB101)

7.5.3.4.3.1.1 Remove and Reinstall Procedure

Parts required: Siemens Circuit Breaker (Spare Part Item 94) (refer to Figure 7-11 & Table 7-8).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Remove wires from existing unit, remove unit and reconnect wires to new unit being careful to connect them to the proper terminals.
h. Complete the Prestart Inspection for the HPU (section 3.2.1.3).
i. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.3.2 Circuit Breaker (CB102, CB103)

7.5.3.4.3.2.1 Remove and Reinstall Procedure

Parts required: Siemens Circuit Breaker (Spare Part Item 95) (refer to Figure 7-11 & Table 7-8).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HPU (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.3.3 Circuit Breaker (CB104)

7.5.3.4.3.3.1 Remove and Reinstall Procedure

Parts required: Siemens Circuit Breaker (Spare Part Item 96) (refer to Figure 7-11 and Table 7-8, Items 2 and 9).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HPU (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.3.4 Fuse (F101)

7.5.3.4.3.4.1 Remove and Reinstall Procedure

Parts required: Littlefuse Fuse (Spare Part Item 101) (refer to Figure 7-11 and Table 7-8).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU High Voltage Enclosure and verify electrical components are de-energized.
d. Remove the failed fuse and replace with new fuse of similar rating.
e. Inspect HPU High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
f. Complete the Prestart Inspection for the HPU (section 3.2.1.3).
g. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.3.5 Fuse (F102)

7.5.3.4.3.5.1 Remove and Reinstall Procedure

Parts required: Littlefuse Fuse (Spare Part Item 102) (refer to Figure 7-11 and Table 7-8).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU High Voltage Enclosure and verify electrical components are de-energized.
d. Remove the failed fuse and replace with new fuse of similar rating.
e. Inspect HPU High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
f. Complete the Prestart Inspection for the HPU (section 3.2.1.3).
g. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.3.6 Relay (K101, K102)

7.5.3.4.3.6.1 Remove and Reinstall Procedure

Parts required: Idec Relay (Spare Part Item 108) (refer to Figure 7-11 and Table 7-8).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HPU (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.3.7 Magnetic Motor Starter (MS101, MS102)

7.5.3.4.3.7.1 Remove and Reinstall Procedure

Parts required: Siemens Contactor/Starter (Spare Part Item 121) (refer to Figure 7-11 & Table 7-8).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HPU (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.3.8 Line Power Phase Monitor (PM101)

7.5.3.4.3.8.1 Remove and Reinstall Procedure

Parts required: Siemens Power Monitor (Spare Part Item 130) (refer to Figure 7-11 and Table 7-8).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU High Voltage Enclosure and verify electrical components are de-energized.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HPU (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.3.9 Toggle Switch (SW101, SW102)

7.5.3.4.3.9.1 Remove and Reinstall Procedure

Parts reqred: Microswitch Toggle Switch (Spare Part Item 140) (refer to Figure 7-11 & Table 7-8).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HPU High Voltage Enclosure and verify electrical components are de-energized.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HPU (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.4.4 HPU Power Isolation Enclosure (ENC101)

As an aid to the maintainer, all the major components on the HPU Power Isolation Enclosure(ENC101) (Figure 7-12 and Table 7-9) are called out even though some are not necessarily considered sea replaceable units.

Figure 7-12 HPU Power Isolation Enclosure, Components

Table 7-9 HPU Power Isolation Enclosure, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	L1	Line 1 (Phase A)
2	L2	Line 2 (Phase B)
3	L3	Line 3 (Phase C)
4	IS101	Isolator Switch 1

7.5.3.4.4.1 Incorrect Phase

7.5.3.4.4.1.1 Remove and Reinstall Procedure

Parts required: None (Figure 7-12 and Table 7-9).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Request ship's personnel secure the ship's service generator and open the circuit breakers providing AC power to the HPU Assembly and the HC Assembly.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

d. Gain access to the HPU Power Isolation Enclosure (ENC101) and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

e. Disconnect and remove the leads (L1, L2, and L3) that have been miswired and reconnect so that L1 is connected to T1, L2 is connected to T2, and L3 is connected to T3.
f. Inspect HPU Power Isolation Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure door.
g. Complete the Prestart Inspection for the HPU (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5 HC Assembly

7.5.3.5.1 Proximity Sensor (XS9, XS10) (HC Top, HC Bottom)

Parts required: Efector Proximity Sensor (Spare Part Item 146A)

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HC to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HC (section 3.2.1.5).
h. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.2 HC Hydraulic Panel

As an aid to the maintainer, all the major components on the HC Assembly Hydraulic Panel (Figure 7-13 and Table 7-10) are called out even though some are not necessarily considered sea replaceable units.

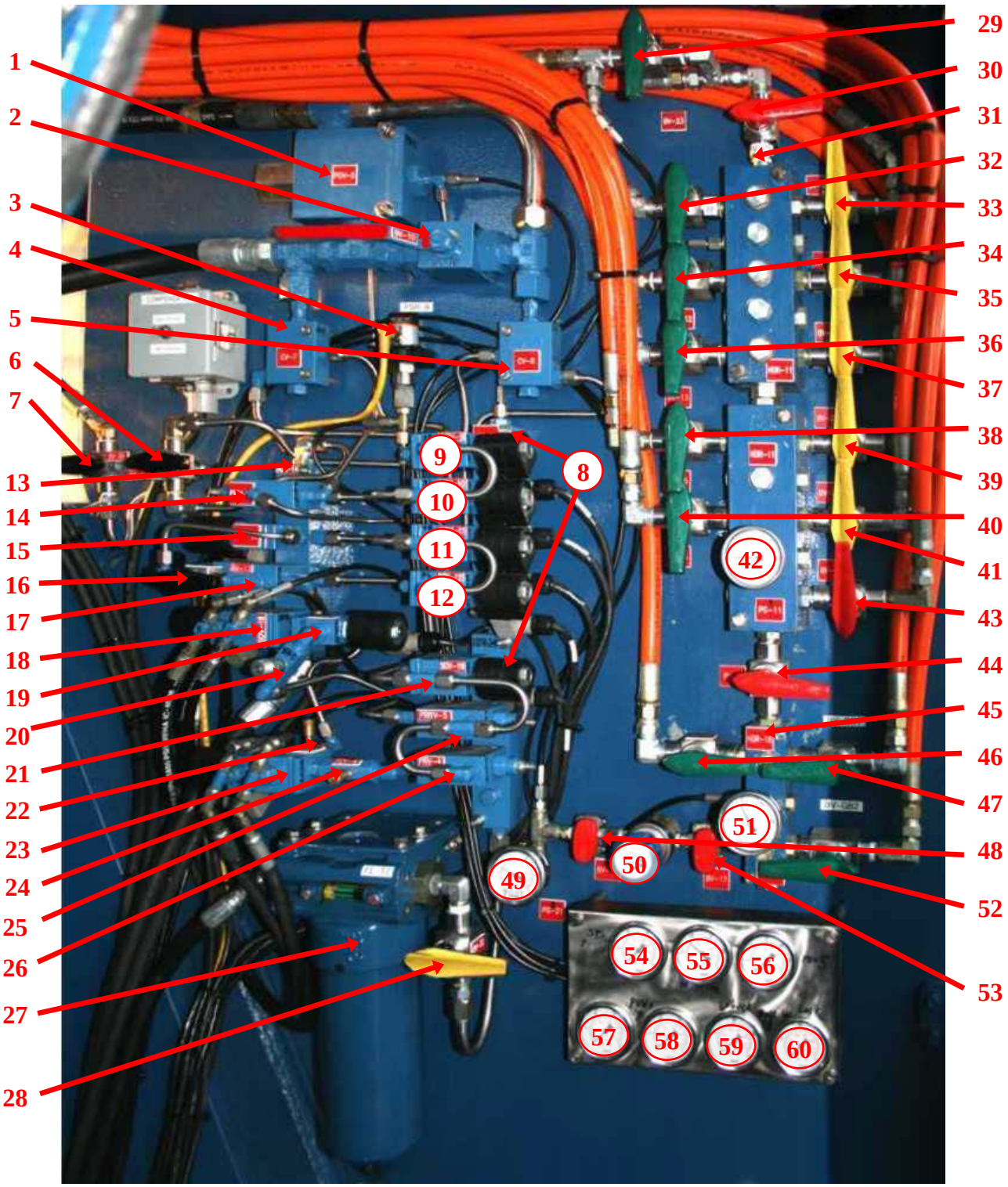


Figure 7-13 HC Hydraulic Panel, Components

Table 7-10 HC Hydraulic Panel, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	POV-5	Pilot Operated Valve
2	BV-10	Ball Valve-10 [equalizes pressure between ACC-1 & ACC-2]
3	PSH-9	Pressure Switch-9
4	CV-7	Check Valve-7
5	CV-8	Check Valve-8
6	BV-31	Ball Valve-31 [used to manually raise or lower Flying Head]
7	BV-30	Ball Valve-30 [lock valve for BV-31]
8	HDR-24	Hydraulic Header-24
9	SOV-9	Solenoid Operated Valve-9
10	SOV-10	Solenoid Operated Valve-10
11	SOV-11	Solenoid Operated Valve-11
12	SOV-12	Solenoid Operated Valve-12
13	HDR-14	Hydraulic Header-14
14	PRV-5	Pressure Reducing Valv-5
15	SOV-17	Solenoid Operated Valve-17
16	BV-19	Ball Valve-19 [hydraulic]
17	RV-13	Relief Valve-13
18	SOV-18	Solenoid Operated Valve-18
19	SOV-20	Solenoid Operated Valve-20
20	NV-5	Needle Valve-5
21	SOV-19	Solenoid Operated Valve-19
22	FCV-5	Flow Control Valve-5
23	SOV-7	Solenoid Operated Valve-7
24	FCV-6	Flow Control Valve-6
25	PRRV-5	Pressure Reducing/RelievingValve-5
26	PRV-4	Pressure Reducing Valve-4
27	FL-17	Filter-17 (with indicator) *NEW
28	BV-32	Ball Valve-32 (yellow) [locks valves to secure Flying Head]
29	BV-23	Ball Valve-23 (green) [from Intensifier]
30	BV-29	Ball Valve-29 (red) [from Storage Bottles]
31	HDR-11	Pneumatic Header-11
32	BV-22	Ball Valve-22 (green) [to Intensifier]
33	BV-24	Ball Valve-24 (yellow) [from high pressure bottle]
34	BV-12	Ball Valve-12 (green) [ACC-1]
35	BV-25	Ball Valve-25 (yellow) [from high pressure bottle]
36	BV-13	Ball Valve-13 (green) [ACC-1]
37	BV-26	Ball Valve-26 (yellow) [from high pressure bottle]
38	BV-15	Ball Valve-15 (green) [ACC-2]
39	BV-27	Ball Valve-27 (yellow) [from high pressure bottle]

Table 7-10 HC Hydraulic Panel, Parts Identification - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
40	BV-16	Ball Valve-16 (green) [ACC-2]
41	BV-28	Ball Valve-28 (yellow) [from high pressure bottle]
42	PG-11	Pressure Gauge-11
43	BV-20	Ball Valve-20 (red) [to Gas Make-up Bottles]
44	BV-TF	Ball Valve-TF (red) [cross-connect for HDR-11 & HDR-16]
45	HDR-16	Pneumatic Header-16
46	BV-14	Ball Valve-14 (green) [ACC-3]
47	BV-GB1	Ball Valve-GB1 (green) [to GB-1 servicing ACC-3]
48	BV-18	Ball Valve-18 (red) [isolates PR-1]
49	PG-21	Pressure Gauge-21
50	PR-1	Pressure Regulator [controls flow rate to Tank]
51	PG-20	Pressure Gauge-20
52	BV-GB2	Ball Valve-GB2 (green) [to GB-2 servicing ACC-3]
53	BV-17	Ball Valve-17 (red) [isolates PR-1]
54	PG-22	Pressure Gauge-22 [HC Hydraulic System Pressure]
55	PG-23	Pressure Gauge-23 [Storage Gas Pressure]
56	PG-24	Pressure Gauge-24 [POV-5 Control Pressure]
57	PG-25	Pressure Gauge-25 [SOV-7 Operating Pressure “A”]
58	PG-26	Pressure Gauge-26 [SOV-7 Operating Pressure “B”]
59	PG-27	Pressure Gauge-27 [SOV-18 Unlock Flying Head]
60	PG-28	Pressure Gauge-28 [SOV-18 Lock Flying Head]

7.5.3.5.2.1 Check Valve (CV-7, CV-8)

7.5.3.5.2.1.1 Remove and Reinstall Procedure

Parts required: Sun check valve (Spare Part Item 52) (refer to Figure 7-13 and Table 7-10, Items 6 and 3).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Ensure BV-17 & BV-18 are closed and then bleed off the HC supply tank nitrogen pressure by opening NV-28 on the top of the tank.
d. Verify tank pressure is zero by observing pressure gauge PG-21.
e. Loosen the SS tubing ferrule nuts and hardware holding CV to panel.
f. Install plugs as necessary to prevent excessive oil leakage.
g. Remove brass fittings from CV body and reinstall on replacement unit. Do not tighten nuts at this time.
h. Remove hydraulic plugs from SS tubing and install check valve to HC Hydraulic Panel by loosely attaching mounting bolts and SS tubing.

i. Once check valve is in place and SS tubing is connected, tighten all fittings.

CAUTION

HC Supply Tank pressure should not exceed 5 psi.

j. Repressurize HC Supply Tank by closing NV-28, opening BV-17, BV-18 and BV-TF, and observing PG-21.
k. Secure BV-17, BV-18 and BV-TF when pressure gauge PG-21 reads 5 psi.
l. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
m. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).
n. Check valve for leaks.

7.5.3.5.2.2 Needle Valve (NV-5)

7.5.3.5.2.2.1 Remove and Reinstall Procedure

Parts required: Parker Needle valve (Spare Part Item 60) (refer to Figure 7-13 and Table 7-10, Item 21).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Ensure BV-17 & BV-18 are closed and then bleed off the HC supply tank nitrogen pressure by opening NV-28 on the top of the tank.
d. Verify tank pressure is zero by observing pressure gauge PG-21.
e. Loosen the SS tubing ferrule nuts and remove NV body since it is not physically mounted to the hydraulic panel.
f. Install plugs as necessary to prevent excessive oil leakage.
g. Remove brass fittings from NV body and reinstall on replacement unit. Do not tighten nuts at this time.
h. Remove hydraulic plugs from SS tubing and install NV by attaching the SS tubing to the hydraulic panel by loosely attaching mounting bolts and SS tubing.
i. Once NV is in place and SS tubing is connected, tighten all fittings.

CAUTION

HC Supply Tank pressure should not exceed 5 psi.

j. Repressurize HC Supply Tank by closing NV-28, opening BV-17, BV-18 and BV-TF, and observing pressure gauge PG-21. Adjust flow with pressure regulator PR-1.
k. Secure BV-17, BV-18 and BV-TF when PG-21 reads 5 psi.
l. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
m. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).
n. Inspect needle valve for leaks.

7.5.3.5.2.3 Solenoid Operated Valve (SOV-7, SOV-18)

7.5.3.5.2.3.1 Remove and Reinstall Procedure

Parts required: Delta SOV (Spare Part Item 77) (refer to Figure 7-13 and Table 7-10, Items 15 and 20).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Ensure BV-17 & BV-18 are closed and then bleed off the HC supply tank nitrogen pressure by opening NV-28 on the top of the tank.
d. Verify tank pressure is zero by observing PG-21.
e. Remove power connector from SOV coil.
f. Loosen the SS tubing ferrule nuts and remove SOV body since it is not physically mounted to the hydraulic panel.
g. Install plugs as necessary to prevent excessive oil leakage.
h. Remove brass fittings from SOV body and reinstall on replacement unit. Do not tighten nuts at this time.
i. Remove hydraulic plugs from SS tubing and install solenoid operated valve to HC Hydraulic Panel by loosely attaching mounting bolts and SS tubing.

NOTE

The torque value is 30 ft-lbs for the block fittings and 15 to 45 in-lbs maximum for the coil nut. Do not over tighten or damage to the solenoid could result.

j. Once SOV is in place and SS tubing is connected, tighten all fittings.
k. Reattach power connector to SOV coil.

CAUTION

HC Supply Tank pressure should not exceed 5 psi.

l. Repressurize HC Supply Tank by closing NV-28, opening BV-17, BV-18 and BV-TF, and observing pressure gauge PG-21. Adjust flow with pressure regulator PR-1.
m. Secure BV-17, BV-18 and BV-TF when pressure gauge PG-21 reads 5 psi.
n. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
o. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).
p. Inspect solenoid operated valve for leaks.

7.5.3.5.2.4 Solenoid Operated Valve (SOV-9, SOV-10, SOV-11, SOV-12 and SOV-19)

7.5.3.5.2.4.1 Remove and Reinstall Procedure

Parts required: Delta Solenoid Operated Valve (Spare Part Item 78) (refer to Figure 7-13 and Table 7-10, Items 2, 7, 5, 4, and 34).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).

b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Ensure BV-17 & BV-18 are closed and then bleed off the HC supply tank nitrogen pressure by opening NV-28 on the top of the tank.
d. Verify tank pressure is zero by observing pressure gauge PG-21.
e. Remove power connector from solenoid operated valve coil.
f. Loosen the SS tubing ferrule nuts and install plugs as necessary to prevent excessive oil leakage.
g. Remove the mounting hardware from solenoid operated valve body and remove unit from HC Hydraulic Panel.
h. Remove brass fittings from solenoid operated valve body and reinstall on replacement unit. Do not tighten nuts at this time.
i. Remove hydraulic plugs from SS tubing and install solenoid operated valve to HC Hydraulic Panel by loosely attaching mounting bolts and SS tubing.

NOTE

The torque value is 30 ft-lbs for the block fittings and 15 to 45 in-lbs maximum for the coil nut. Do not over tighten or damage to the solenoid could result.

j. Once solenoid operated valve is in place and SS tubing is connected, tighten all fittings.
k. Reattach power connector to solenoid operated valve coil.

CAUTION

HC Supply Tank pressure should not exceed 5 psi.

l. Repressurize HC Supply Tank by closing NV-28, opening BV-17, BV-18 and BV-TF, and observing pressure gauge PG-21. Adjust flow with pressure regulator PR-1.
m. Secure BV-17, BV-18 and BV-TF when pressure gauge PG-21 reads 5 psi.
n. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
o. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).
p. Check valve for leaks.

7.5.3.5.2.5 Solenoid Operated Valve (SOV-17)

7.5.3.5.2.5.1 Remove and Reinstall Procedure

Parts required: Hydraforce SOV (Spare Part Item 79) (refer to Figure 7-13 and Table 7-10, Item 19).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Ensure BV-17 & BV-18 are closed and then bleed off the HC supply tank nitrogen pressure by opening NV-28 on the top of the tank.
d. Verify tank pressure is zero by observing pressure gauge PG-21.
e. Remove power connector from SOV coil.

f. Loosen the SS tubing ferrule nuts and remove SOV body since it is not physically mounted to the hydraulic panel.
g. Install plugs as necessary to prevent excessive oil leakage.
h. Remove brass fittings from SOV body and reinstall on replacement unit. Do not tighten nuts at this time.
i. Remove hydraulic plugs from SS tubing and install solenoid operated valve to HC Hydraulic Panel by loosely attaching mounting bolts and SS tubing.

NOTE

The torque value is 30 ft-lbs for the block fittings and 15 to 45 in-lbs maximum for the coil nut. Do not over tighten or damage to the solenoid could result.

j. Once SOV is in place and SS tubing is connected, tighten all fittings.
k. Reattach power connector to SOV coil.

CAUTION

HC Supply Tank pressure should not exceed 5 psi.

l. Repressurize HC Supply Tank by closing NV-28, opening BV-17, BV-18 and BV-TF, and observing pressure gauge PG-21. Adjust flow with pressure regulator PR-1.
m. Secure BV-17, BV-18 and BV-TF when pressure gauge PG-21 reads 5 psi.
n. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
o. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).
p. Inspect solenoid operated valve for leaks.

7.5.3.5.2.6 Solenoid Operated Valve (SOV-20)

7.5.3.5.2.6.1 Remove and Reinstall Procedure

Parts required: Delta SOV (Spare Part Item 154) (refer to Figure 7-13 and Table 7-10, Item 35).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Ensure BV-17 & BV-18 are closed and then bleed off the HC supply tank nitrogen pressure by opening NV-28 on the top of the tank.
d. Verify tank pressure is zero by observing pressure gauge PG-21.
e. Remove power connector from SOV coil.
f. Loosen the SS tubing ferrule nuts and remove SOV body since it is not physically mounted to the hydraulic panel.
g. Install plugs as necessary to prevent excessive oil leakage.
h. Remove brass fittings from SOV body and reinstall on replacement unit. Do not tighten nuts at this time.
i. Remove hydraulic plugs from SS tubing and install solenoid operated valve to HC Hydraulic Panel by loosely attaching mounting bolts and SS tubing

NOTE

The torque value is 30 ft-lbs for the block fittings and 15 to 45 in-lbs maximum for the coil nut. Do not over tighten or damage to the solenoid could result.

j. Once SOV is in place and SS tubing is connected, tighten all fittings.

k. Reattach power connector to SOV coil.

CAUTION

HC Supply Tank pressure should not exceed 5 psi.

l. Repressurize HC Supply Tank by closing NV-28, opening BV-17, BV-18 and BV-TF, and observing pressure gauge PG-21. Adjust flow with pressure regulator PR-1.

m. Secure BV-17, BV-18 and BV-TF when pressure gauge PG-21 reads 5 psi.

n. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).

o. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

p. Inspect solenoid operated valve for leaks.

7.5.3.5.3 HC Gas Intensifier Panel

All the major components on the HC Gas Intensifier Panel are called out even though some are not necessarily considered sea replaceable units (Figure 7-14, Table 7-11).

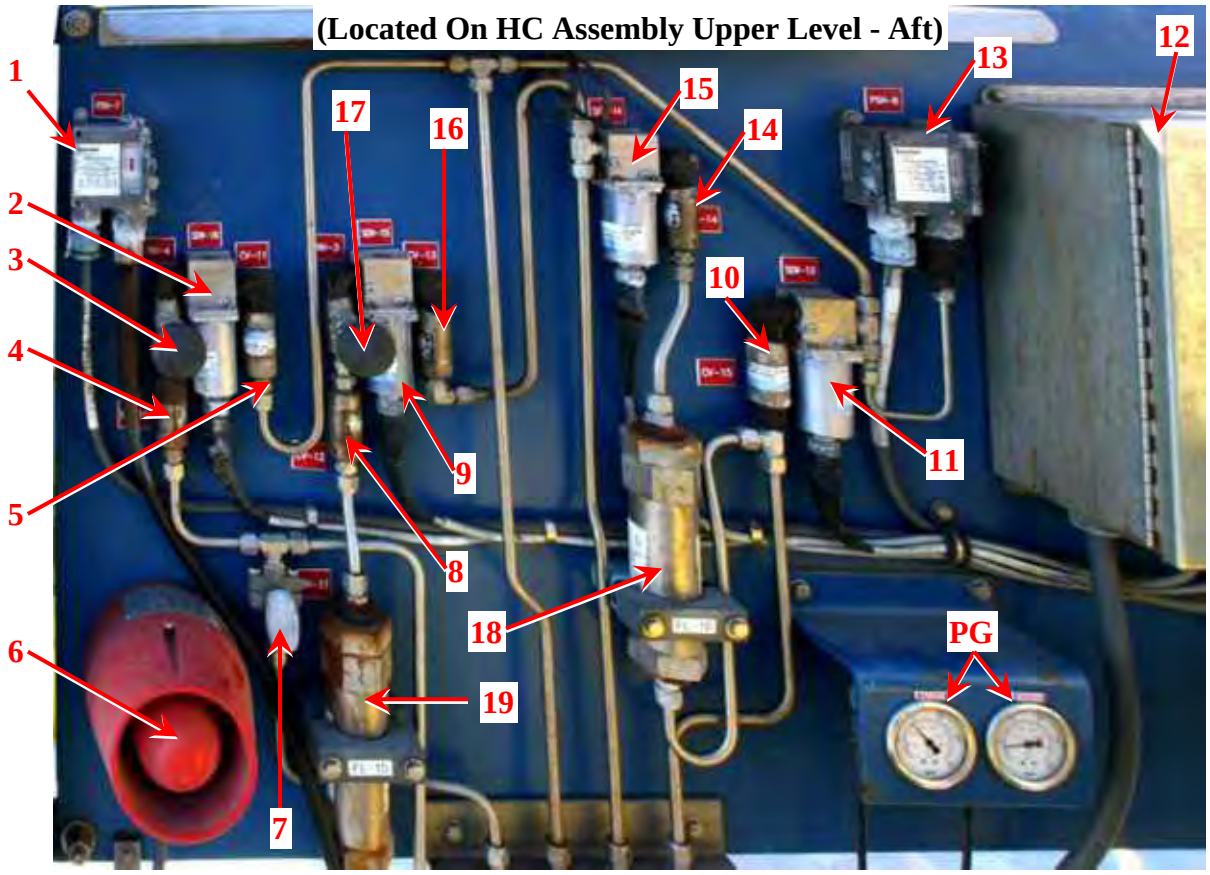


Figure 7-14 HC Gas Intensifier Panel, Components

Table 7-11 HC Gas Intensifier Panel, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	PSH-7	Pressure Swith-7
2	SOV-16	Solenoid Operated Valve-16
3	NV-4	Needle Valve-4
4	CV-10	Check Valve-10
5	CV-11	Check Valve-11
6	AS-11	Audible Alarm-1
7	BV-21	Ball Valve-21
8	CV-12	Check Valve-12
9	SOV-15	Solenoid Operated Valve-15
10	CV-15	Check Valve-15
11	SOV-13	Solenoid Operated Valve-13
12	ENC-7	Enclosure 7
13	PSH-8	Pressure Switch-8
14	CV-14	Check Valve-14
15	SOV-14	Solenoid Operated Valve-14
16	CV-13	Check Valve-13
17	NV-3	Needle Valve-3
18	FL-16	Air filter cartridge
19	FL-15	Air filter cartridge

7.5.3.5.3.1 Check Valve (CV-10, CV-11, CV-12, CV-13, CV-14, CV-15)

7.5.3.5.3.1.1 Remove and Reinstall Procedure
Parts required: Circle Seal Check valve (Spare Part Item 85) (refer to Figure 7-14 and Table 7-11, Items 3, 5, 8, 16, 14, 10).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Close nitrogen low pressure BV-23 and nitrogen high pressure BV-22 and close cross-connect BV-24 if it is not already closed.
d. Loosen one of the check valve SS tubing ferrule nuts and carefully allow the nitrogen pressure to bleed to zero.
e. Loosen both SS tubing ferrule nuts and remove check valve.
f. Replace check valve and tighten SS tubing ferrule nuts.
g. Slowly open BV-22 and BV-23 and ensure BV-24 remains closed.
h. Apply a leak detector fluid and check valve for leaks.
i. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
j. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.3.2 Solenoid Operated Valve (SOV-13, SOV-14, SOV-15, SOV-16)

7.5.3.5.3.2.1 Remove and Reinstall Procedure

Parts required: Circle Seal Solenoid Operated Valve (Spare Part Item 92) (refer to Figure 7-14 and Table 7-11, Items 11, 15, 9, and 4).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3-2.5).
c. Close nitrogen low pressure BV-23 and nitrogen high pressure BV-22 and close cross-connect BV-24 if it is not already closed.
d. Loosen one of the solenoid operated valve SS tubing ferrule nuts and carefully allow the nitrogen pressure to bleed to zero.
e. Loosen both SS tubing ferrule nuts and remove solenoid operated valve.
f. Replace solenoid operated valve and tighten SS tubing ferrule nuts.
g. Slowly open BV-22 and BV-23 and ensure BV-24 remains closed.
h. Apply a leak detector fluid and check valve for leaks.
i. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
j. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.4 HC Gas Intensifier Enclosure (ENC7)

All the major components on the HC Gas Intensifier Enclosure (ENC7)are called out even though some are not necessarily considered sea replaceable units (Figure 7-15, Table 7-12).

Figure 7-15 HC Gas Intensifier Enclosure, Components

Table 7-12 HC Gas Intensifier Enclosure, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	K32	Raise Pressure Relay
2	K33	Lower Pressure Relay
3	TB10-1 thru 14	Terminal Board-1 through 14
4	TB10-15 thru 28	Terminal Board-15 through 28
5	MS4	Magnetic Motor Starter 4

7.5.3.5.4.1 Relay (K32, K33)

7.5.3.5.4.1.1 Remove and Reinstall Procedure
Parts required: Idec Relay (Spare Part Item 110) (refer to Figure 7-15 and Table 7-12, Items 1 and 2).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly Gas Intensifier Enclosure and verify electrical components are de-energized.
d. Identify the suspect relay and note mounting orientation.
e. To remove relay, pull out mounting clip with a flat blade screwdriver and lift socket out.
f. Inspect replacement unit for damage before installing.
g. Orient relay so that the end of the socket (end opposite of mounting clip) against the outer edge of the rail. Press the socket down firmly until the clip snaps onto the mounting rail.
h. Inspect HC Assembly Gas Intensifier Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
i. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
j. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.4.2 Magnetic Motor Starter (MS4)

7.5.3.5.4.2.1 Remove and Reinstall Procedure
Parts required: Siemens Magnetic Motor Starter (Spare Part Item 123) (refer to Figure 7-15 and Table 7-12, Item 5).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HPU Assembly High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HC Assembly Gas Intensifier Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
h. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.5 HC High Voltage Enclosure (ENC8)

As an aid to the maintainer, all the major components on the HC High Voltage Enclosure (ENC8) are called out on a representative drawing (Figure 7-16 and Table 7-13) even though some are not necessarily considered sea replaceable units.

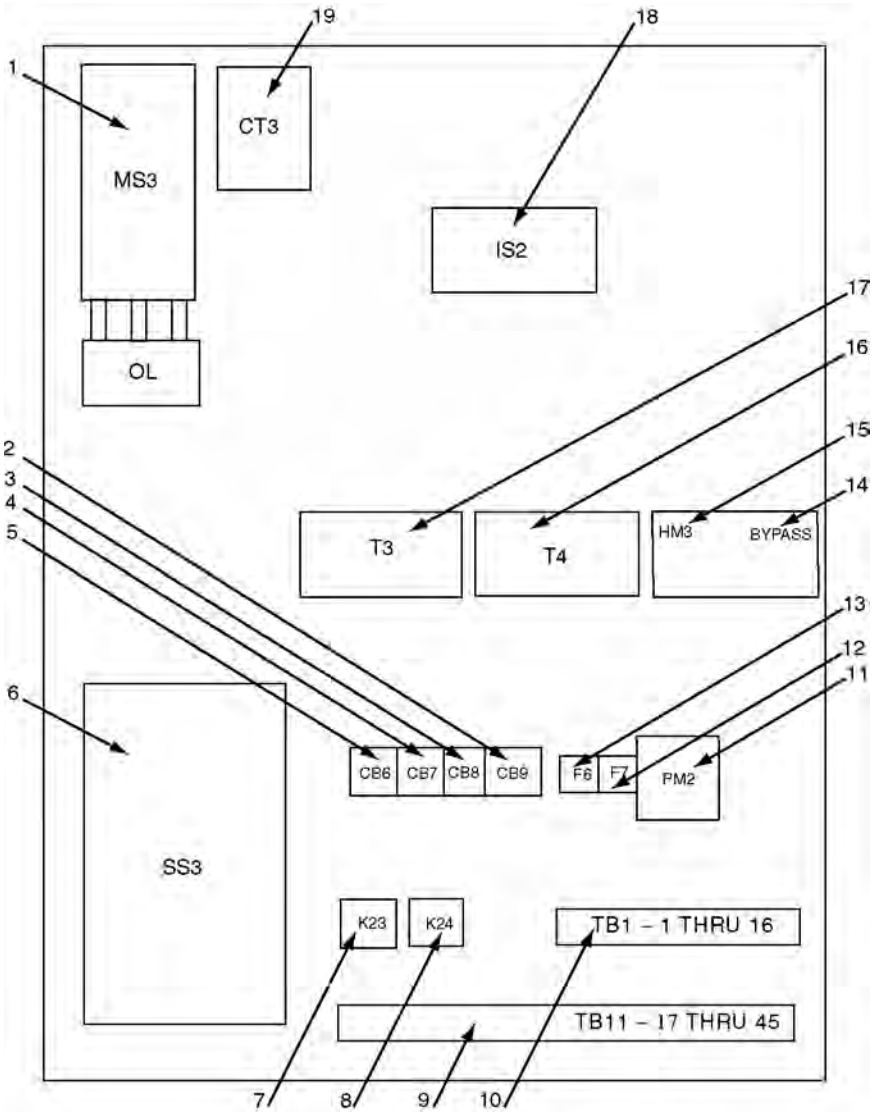


Figure 7-16 HC High Voltage Enclosure, Components

Table 7-13 HC High Voltage Enclosure, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	MS3	Magnetic Motor Starter 3
2	CB9	Circuit Breaker 9
3	CB8	Circuit Breaker 8
4	CB7	Circuit Breaker 7
5	CB6	Circuit Breaker 6
6	SS3	Soft Start Controller 3

Table 7-13 HC High Voltage Enclosure, Parts Identification - *continued*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
7	K23	HPU Start Heave Compensator Relay
8	K24	Oil Reservoir Heater Relay
9	TB11-17 thru 45	Terminal Board 17 through 45
10	TB11-1 thru 16	Terminal Board 1 through 16
11	PM2	Line Power Phase Monitor
12	F7	Fuse 7
13	F6	Fuse 6
14	BYPASS	Soft Start Bypass Switch (SW10)
15	N/A	Elapsed Time Meter (HM3)
16	T4	Transformer 4
17	T3	Transformer 3
18	IS2	Isolator Switch 2
19	CT3	Contactor 3

7.5.3.5.5.1 Circuit Breaker (CB6)

7.5.3.5.5.1.1 Remove and Reinstall Procedure

Parts required: Siemens Circuit Breaker (Spare Part Item 94) (refer to Figure 7-16 and Table 7-13, Items 5).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.

f. Inspect HC Assembly High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
h. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.5.2 Circuit Breaker (CB7, CB8)

7.5.3.5.5.2.1 Remove and Reinstall Procedure

Parts required: Siemens Circuit Breaker (Spare Part Item 95) (refer to Figure 7-16 and Table 7-13, Items 4 and 3).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HC Assembly High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
h. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.5.3 Circuit Breaker (CB9)

7.5.3.5.5.3.1 Remove and Reinstall Procedure

Parts required: Siemens Circuit Breaker (Spare Part Item 96) (refer to Figure 7-16 and Table 7-13, Item 2).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HC Assembly High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
h. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.5.4 Fuse (F7)

7.5.3.5.5.4.1 Remove and Reinstall Procedure

Parts needed: Littlefuse Fuse (Spare Part Item 105) (refer to Figure 7-16 & Table 7-13, Item 12).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove the failed fuse and replace with new fuse of similar rating.
e. Inspect HC Assembly High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
f. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
g. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.5.5 Relay (K23)

7.5.3.5.5.5.1 Remove and Reinstall Procedure

Parts required: Idec Relay (Spare Part Item 108) (refer to Figure 7-16 and Table 7-13, Item 7).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly High Voltage Enclosure and verify electrical components are de-energized.
d. Identify the suspect relay and note mounting orientation.
e. To remove relay, pull out mounting clip with a flat blade screwdriver and lift socket out.
f. Inspect replacement unit for damage before installing.
g. Orient relay so that the end of the socket (end opposite of mounting clip) against the outer edge of the rail. Press the socket down firmly until the clip snaps onto the mounting rail.
h. Inspect HC Assembly High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
i. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
j. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.5.6 Relay (K24)

7.5.3.5.5.6.1 Remove and Reinstall Procedure

Parts required: Ideac Relay (Spare Part Item 114) (refer to Figure 7-16 and Table 7-13, Item 8).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HC Assembly High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
h. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.5.7 Magnetic Motor Starter (MS3)

7.5.3.5.5.7.1 Remove and Reinstall Procedure

Parts required: Siemens Contactor/Starter (Spare Part Item 122) (refer to Figure 7-16 and Table 7-13, Item 1).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly High Voltage Enclosure and verify electrical components are de-energized.
d. Identify the suspect relay and note mounting orientation.

e. To remove relay, pull out mounting clip with a flat blade screwdriver and lift socket out.
f. Inspect replacement unit for damage before installing.
g. Orient relay so that the end of the socket (end opposite of mounting clip) against the outer edge of the rail. Press the socket down firmly until the clip snaps onto the mounting rail.
h. Inspect HC Assembly High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
i. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
j. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.5.8 Power Line Phase Monitor (PM2)

7.5.3.5.5.8.1 Remove and Reinstall Procedure
Parts required: Siemens Power Monitor (Spare Part #130) (refer to Figure 7-16 & Table 7-13).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the HC High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HC High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HC (section 3.2.1.5).
h. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.5.9 Toggle Switch (SW10)

7.5.3.5.5.9.1 Remove and Reinstall Procedure
Parts required: Microswitch Toggle Switch (Spare Part Item 138) (refer to Figure 4-15 and Table 4-15, Item 24).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HC Assembly High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
h. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.5.10Toggle Switch (SW11)

7.5.3.5.5.10.1 Remove and Reinstall Procedure

Parts required: Microswitch Toggle Switch (Spare Part Item 140) (refer to Figure 4-15 and Table 4-15, Item 17).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly High Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HC Assembly High Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
h. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.6 HC Low Voltage Enclosure (ENC9)

As an aid to the maintainer, all the major components on the HC Low Voltage Enclosure (ENC9) are called out on a representative drawing (Figure 7-17 and Table 7-14) even though some are not necessarily considered sea replaceable units.

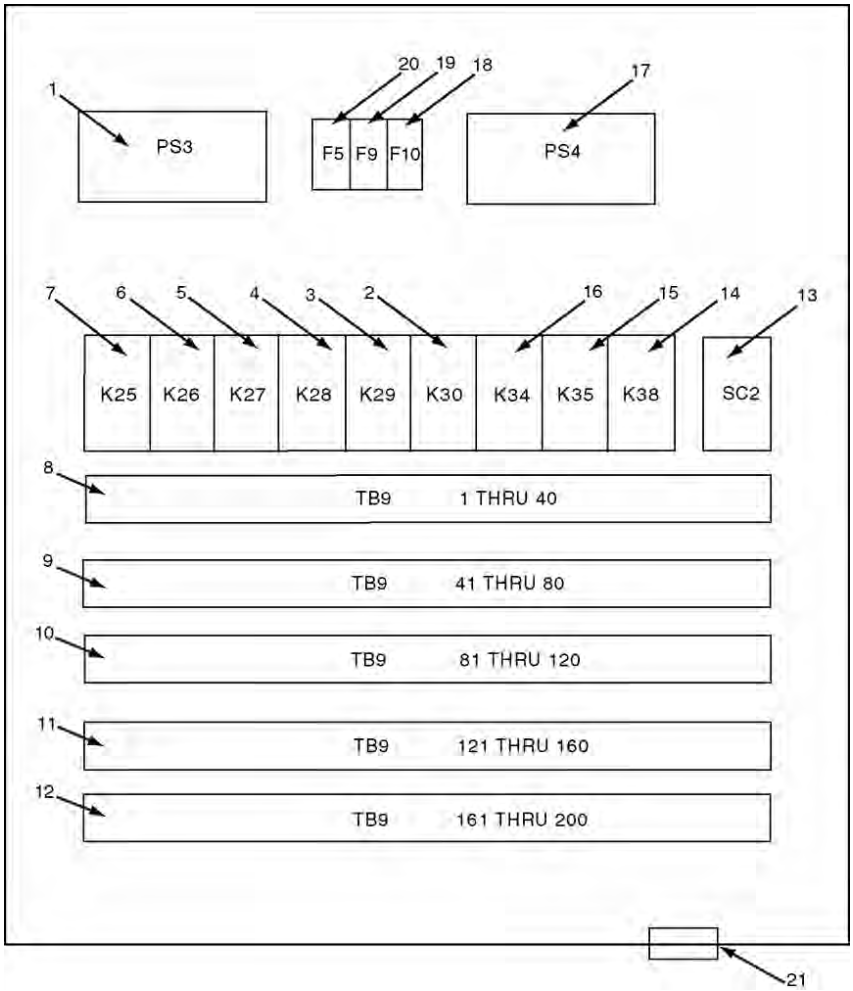


Figure 7-17 HC Low Voltage Enclosure, Components

Table 7-14 HC Low Voltage Enclosure, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	PS3	Power Supply 3
2	K30	Loop Valve Latch Relay
3	K29	Compensator Ball Valve Open Relay
4	K28	Active Mode Enable Relay
5	K27	Low Oil Level Relay
6	K26	Gas Intensifier Interlock Relay
7	K25	HC HPU Running Relay
8	TB9-1 thru 40	Terminal Board 1 through 40
9	TB9-41 thru 80	Terminal Board 41 through 80
10	TB9-81 thru 120	Terminal Board 81 through 120
11	TB9-121 thru 160	Terminal Board 121 through 160
12	TB9-161 thru 200	Terminal Board 161 through 200
13	SC2	Signal Conditioner
14	K38	Active Mode Enable Relay
15	K35	Control System Fault Relay
16	K34	High Oil Temperature Relay
17	PS4	Power Supply 4
18	F10	Fuse 10
19	F9	Fuse 9
20	F5	Fuse 5
21	N/A	Electrical Cable Connector (P39/J39)

7.5.3.5.6.1 Relay (K25, K26, K27, K28, K34, K38)

7.5.3.5.6.1.1 Remove and Reinstall Procedure

Parts required: Ideac Relay (Spare Part Item 110) (refer to Figure 7-17 and Table 7-14, Items 7, 6, 5, 4, 16, and 14).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly Low Voltage Enclosure and verify electrical components are de-energized.

d. Identify the suspect relay and note mounting orientation.
e. To remove relay, pull out mounting clip with a flat blade screwdriver and lift socket out.
f. Inspect replacement unit for damage before installing.
g. Orient relay so that the end of the socket (end opposite of mounting clip) against the outer edge of the rail. Press the socket down firmly until the clip snaps onto the mounting rail.
h. Inspect HC Assembly Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
i. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
j. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.6.2 Relay (K29)

7.5.3.5.6.2.1 Remove and Reinstall Procedure

Parts required: Ideac Relay (Spare Part Item 106) (refer to Figure 7-17 and Table 7-14, Item 3).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly Low Voltage Enclosure and verify electrical components are de-energized.
d. Identify the suspect relay and note mounting orientation.
e. To remove relay, pull out mounting clip with a flat blade screwdriver and lift socket out.
f. Inspect replacement unit for damage before installing.
g. Orient relay so that the end of the socket (end opposite of mounting clip) against the outer edge of the rail. Press the socket down firmly until the clip snaps onto the mounting rail.
h. Inspect HC Assembly Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
i. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
j. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.6.3 Relay (K30, K35)

7.5.3.5.6.3.1 Remove and Reinstall Procedure

Parts required: Ideac Relay (Spare Part Item 108) (refer to Figure 7-17 and Table 7-14, Items 2 and 15).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).

b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly Low Voltage Enclosure and verify electrical components are de-energized.
d. Identify the suspect relay and note mounting orientation.
e. To remove relay, pull out mounting clip with a flat blade screwdriver and lift socket out.
f. Inspect replacement unit for damage before installing.
g. Orient relay so that the end of the socket (end opposite of mounting clip) against the outer edge of the rail. Press the socket down firmly until the clip snaps onto the mounting rail.
h. Inspect HC Assembly Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
i. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
j. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.6.4 Power Supply (PS4)

7.5.3.5.6.4.1 Remove and Reinstall Procedure

Parts required: Power One DC_DC Converter (Spare Part Item 134) (refer to Figure 7-17 and Table 7-14, Item 17).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly Low Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HC Assembly Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HC Assembly (section 3.2.1.5).
h. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.5.6.5 Signal Conditioner (SC2)

7.5.3.5.6.5.1 Remove and Reinstall Procedure

Parts required: API Signal Conditioner (Spare Part Item 135) (Figure 7-17 and Table 7-14, Item 13).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HC Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HC Assembly Low Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Record wire locations/connections and remove wires from the failed unit.
e. Loosen the mounting bracket screw on one side of SC2 and slide bracket away from unit.
f. Pull red release handle straight down at base of SC2 to release unit from mounting rails and remove unit.
g. Inspect replacement unit for damage.
h. Install unit on to mounting rails so the red release handle is facing down.
i. Slide the mounting bracket against the unit and tighten the mounting screw.
j. Reconnect wires to SC2.
k. Inspect HC Assembly Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure door.
l. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).

m. Startup the HC Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.6 A-Frame Assembly

7.5.3.6.1 Proximity Sensor (XS6) (A-Frame Outboard)

7.5.3.6.1.1 Remove and Reinstall Procedure

Parts required: Efector Proximity Sensor (Spare Part Item 146) (Figure 4-17, Sheet 5 and Table 4-17, Item 16).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the A-Frame Proximity sensor area and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. The unit has two mounting screws set into oblong holes that allow some movement for lateral adjustments. Do not loosen/remove these screws yet.
e. Carefully mark the position of the proximity switch to ensure the new switch will occupy the same specific location.
f. Two other screws are located catty-corner to the mounting screws. Remove these screws to remove the sensing cube and gain access to the internal wiring.
g. Remove wire lugs and cable from failed unit.
h. Remove mounting screws and failed unit.
i. Remove sensing cube from new unit and inspect for damage.
j. Install new unit taking care to ensure it is mounted in the same location as the failed unit.
k. Insert the power cable into the sensor and connect the wires.
l. Reinstall the sensing cube and tighten screws.
m. Check for safe functioning of the switch. The LED is illuminated when supply voltage is applied.
n. Inspect A-Frame Assembly area to ensure it is free of all tools and any foreign materials.

o. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).

p. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.6.2 Proximity Sensor (XS11) (Cursor Winch Payout Limit)

7.5.3.6.2.1 Remove and Reinstall Procedure

Parts required: Efector Proximity Sensor (Spare Part Item 146A) (Figure 4-17, sheet 3, and Table 4-17, Item 7).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).

b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Open the A-Frame Enclosure (ENC11) area and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Measure distance between sensor and target so the replacement unit, once mounted, retains this value.

e. Remove sensor wires from failed unit at ENC11 terminal block and remove sensor cable from enclosure.

f. Loosen and remove two flat mounting nuts from sensor and remove sensor from cursor winch snubber arm mounting bracket.

g. Inspect replacement unit for damage, install unit, and adjust sensor gap to the value measured in step d above. Use two nuts to lock sensor in place. Remeasure the gap to ensure this value did not change while tightening sensor.

h. Reinstall sensor cable into ENC11 and reconnect sensor wires to terminal block.

i. Inspect A-Frame Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.

j. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).

k. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

l. To test the new sensor for operation, tie a length of rope to the target arm. As the Cursor Assembly is lowered, pull on the target arm so the target moves away from the sensor and causes the cursor winch to stop. Test is complete.

7.5.3.6.3 Manual DCV Station Hydraulic Panel

As an aid to the maintainer, all the major components on the Manual DCV Station Hydraulic Panel (Figure 7-18, 2 sheets and Table 7-15) are called out even though some are not necessarily considered sea replaceable units.

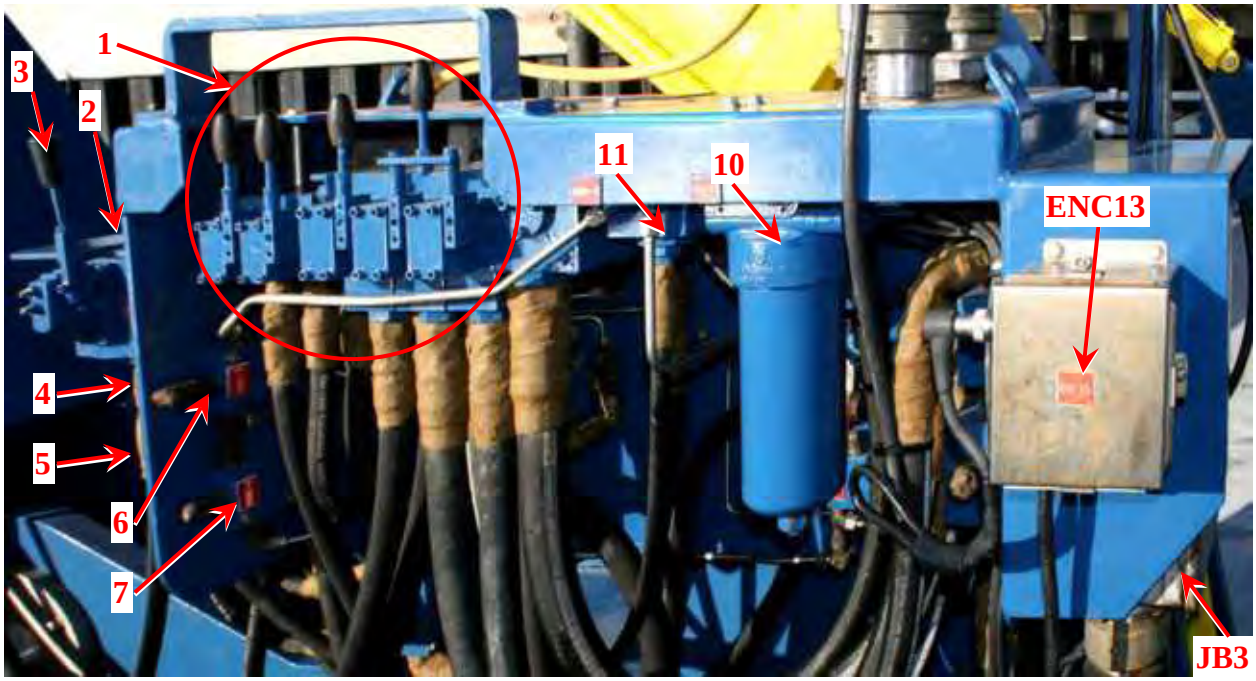


Figure 7-18 Manual DCV Station Hydraulic Panel, Components (1 of 2)

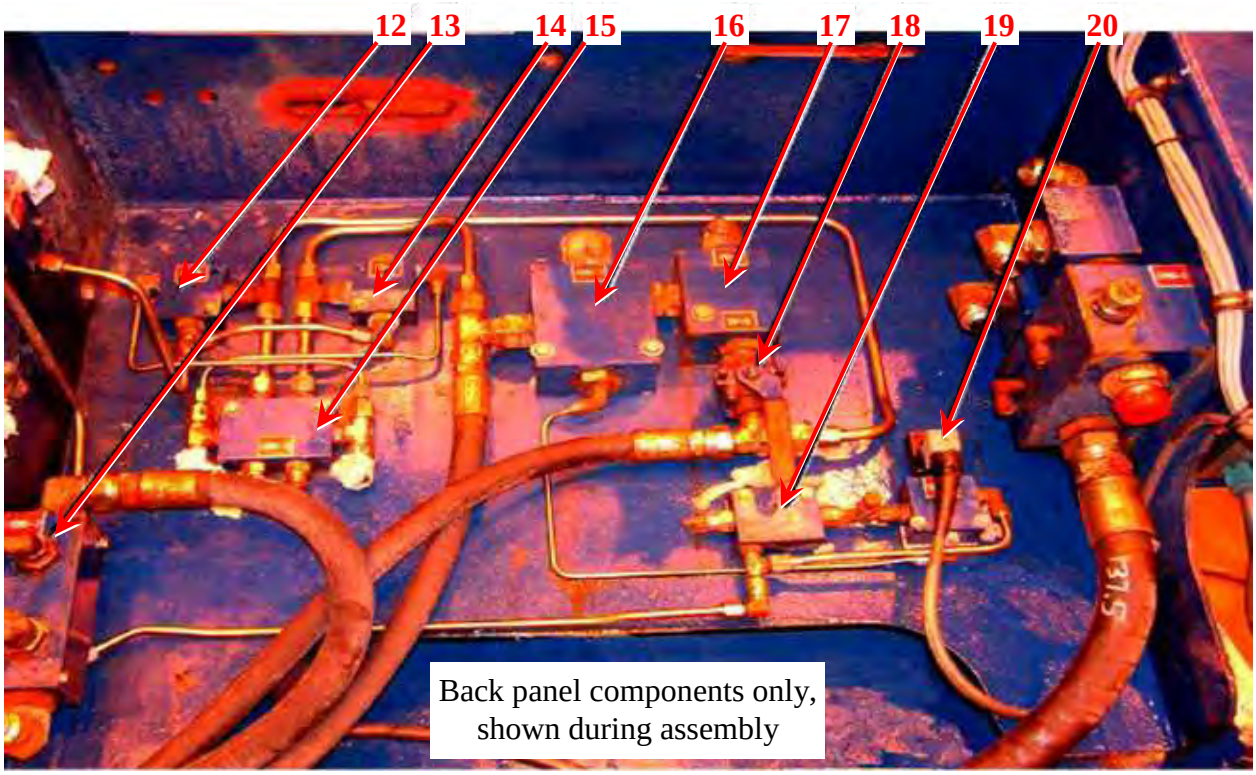


Figure 7-18 Manual DCV Station Hydraulic Panel, Components (2 of 2)

Table 7-15 Manual DCV Station Hydraulic Panel, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	DCV-1	Directional Control Valve-1
2	PG-22	Pressure Gauge-22 (Not shown in this view)
3	DCV-2	Directional Control Valve-2
4	Deleted	Deleted
5	PRV-6	Pressure Regulating Valve-6
6	PRRV-4	Pressure Regulating/reducingValve-4
7	PRV-3	Pressure Regulating Valve-3
8	N/A	A-Frame Junction Box (JB3) Electrical Cable Connector (P2/J2)
9	CPRV-1	Cross Port Relief Valve (Double Relief Valve-Pilot Operated)
10	FL-11	Filter-11
11	HDR-8	Hydraulic Header-8
12	CV-4	Check Valve-4
13	HDR-7	Hydraulic Header-7
14	CV-105	Check Valve-105
15	CBV-2	Counter-Balance Valve-2 (Dual Body)
16	POV-1	Pilot Operated Valve-1
17	NV-1	Needle Valve-1
18	BV-8	Ball Valve-8
19	PRV-1	Pressure Regulating Valve-1
20	SOV-5	Solenoid Operated Valve-5

7.5.3.6.3.1 Check Valve (CV-4, CV-105)

7.5.3.6.3.1.1 Remove and Reinstall Procedure

Parts required: Sun check valve (Spare Part Item L-6) (refer to Figure 7-18 and Table 7-15, Items 12 and 14).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Loosen the SS tubing ferrule nuts and hardware attached to the check valve.
d. Install plugs as necessary to prevent excessive oil leakage.
e. Remove brass fittings from check valve body and reinstall on replacement unit. Do not tighten nuts at this time.
f. Remove hydraulic plugs from SS tubing and install check valve to the SS tubing by loosely attaching SS tubing.
g. Once check valve is in place and SS tubing is connected, tighten all fittings.
h. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
i. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).
j. Check valve for leaks.

7.5.3.6.3.2 Pressure Regulating Valve (PRV-1)

7.5.3.6.3.2.1 Remove and Reinstall Procedure

Parts required: Sun pressure reducing valve (Spare Part Item L-45) (refer to Figure 7-18 and Table 7-15, Item 19).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Loosen the SS tubing ferrule nuts and hardware attached to the pressure regulating valve.
d. Install plugs as necessary to prevent excessive oil leakage.
e. Remove brass fittings from pressure regulating valve body and reinstall on replacement unit. Do not tighten nuts at this time.
f. Remove hydraulic plugs from SS tubing and install the pressure regulating valve by loosely attaching SS tubing.
g. Once the pressure regulating valve is in place and SS tubing is connected, tighten all fittings.
h. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
i. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).
j. Inspect pressure regulating valve for leaks.

7.5.3.6.3.3 Solenoid Operating Valve (SOV-5)

7.5.3.6.3.3.1 Remove and Reinstall Procedure

Parts required: Delta Solenoid Operated Valve (Spare Part Item L-17) (refer to Figure 7-18 and Table 7-15, Item 20).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Remove power connector from the solenoid operated valve coil.
d. Loosen the SS tubing ferrule nuts and remove solenoid operated valve body since it is not physically mounted to the hydraulic panel.
e. Install plugs as necessary to prevent excessive oil leakage.
f. Remove brass fittings from solenoid operated valve body and reinstall on replacement unit. Do not tighten nuts at this time.
g. Remove hydraulic plugs from SS tubing and install the solenoid operated valve by loosely attaching SS tubing.

NOTE

The torque value is 30 ft-lbs for the block fittings and 15 to 45 in-lbs maximum for the coil nut. Do not over tighten or damage to the solenoid could result.

h. Once solenoid operated valve is in place and SS tubing is connected, tighten all fittings.

i. Reattach power connector to solenoid operated valve coil.
j. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
k. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).
l. Inspect solenoid operated valve for leaks.

7.5.3.6.4 A-Frame Enclosure (ENC11)

The A-Frame Enclosure is physically mounted on the aft end of the Docking Head Sheave Assembly. It contains the Signal Conditioner (SC1) and the A-Frame Accelerometer (AC1).

7.5.3.6.4.1 Signal Conditioner (SC1)

7.5.3.6.4.1.1 Remove and Reinstall Procedure

Parts required: API Signal Conditioner (Spare Part Item 135)

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the A-Frame Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Record wire locations/connections and remove wires from the failed unit.
e. Loosen the mounting bracket screw on one side of SC1 and slide bracket away from unit.
f. Pull red release handle straight down at base of SC1 to release unit from mounting rails and remove unit.
g. Inspect replacement unit for damage.
h. Install unit onto mounting rails so the red release handle is facing down.
i. Slide the mounting bracket against the unit and tighten the mounting screw.
j. Reconnect wires to SC1.
k. Inspect A-Frame Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure door.
l. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
m. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.6.5 A-Frame Assembly J-Box (JB3)

As an aid to the maintainer, all the major components on the A-Frame Assembly J-Box (JB3) (Figure 7-19 and Table 7-16) are called out even though some are not necessarily considered sea replaceable units.

Figure 7-19 A-Frame Assembly J-Box, Components

Table 7-16 A-Frame Assembly J-Box, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	TB6-1 thru 20	Terminal Board 1 through 20
2	TB6-21 thru 40	Terminal Board 21 through 40
3	N/A	Electrical Cable Connector (P2/J2)

7.5.3.7 Control Station – Local

7.5.3.7.1 Pedestal Enclosure (ENC104)

As an aid to the maintainer, all the major components on the Pedestal Enclosure (Figure 7-20 and Table 7-17) are called out even though some are not necessarily considered sea replaceable units.

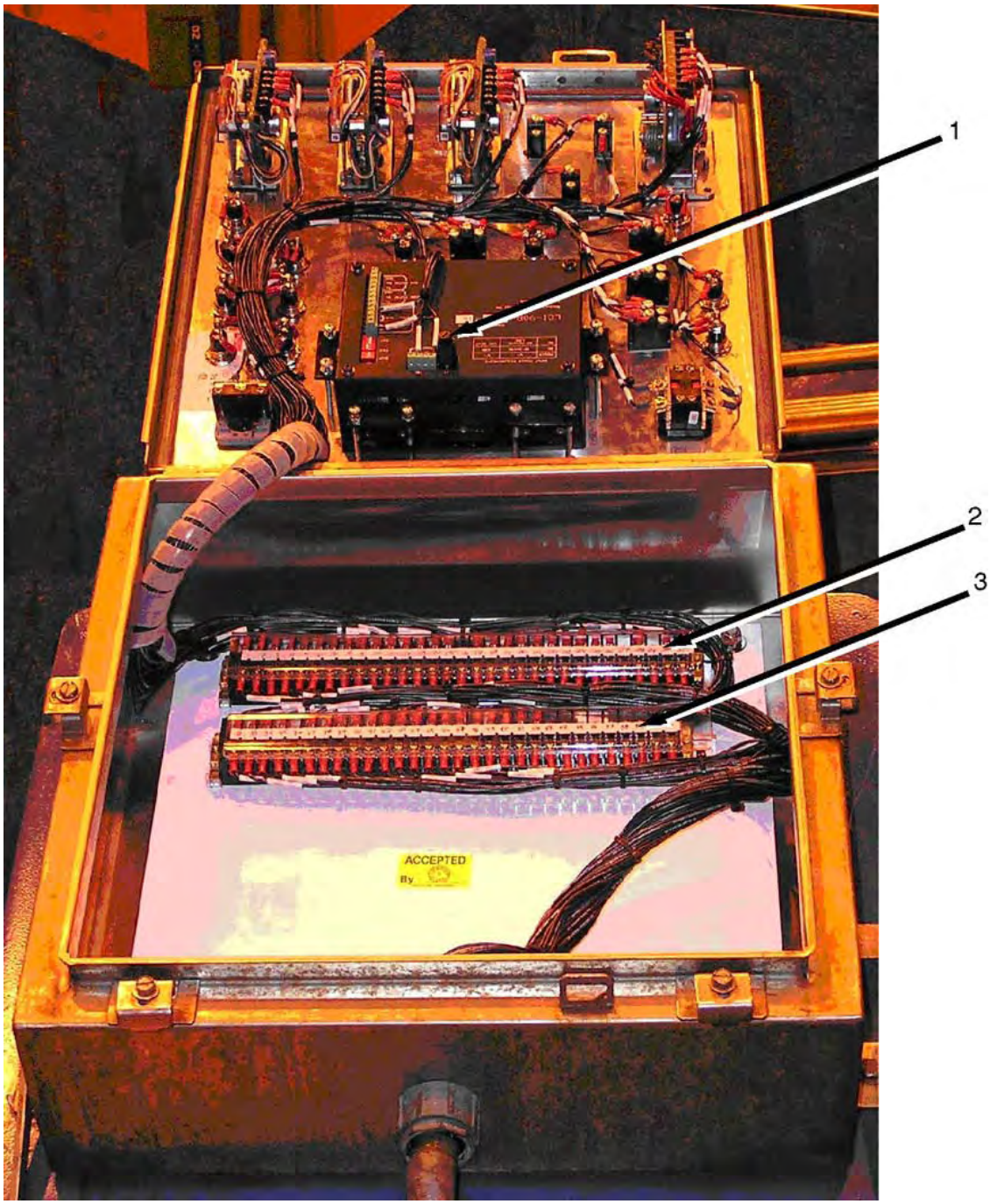


Figure 7-20 Pedestal Enclosure, Components

Table 7-17 A Pedestal Enclosure, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	N/A	LCI-90R Fuse (No Designation)
2	TB2-1 thru 31	Terminal Board 1 through 31
3	TB2-32 thru 61	Terminal Board 32 through 61

7.5.3.7.1.1 Control Handle (CH101)

7.5.3.7.1.1.1 Remove and Reinstall Procedure

Parts required: Sundstrand Control Handle (Spare Part Item 97) (Figure 4-18 and Table 4-18, Item 17).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HPU Pedestal Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.

WARNING

PERSONAL INJURY OR DAMAGE TO EQUIPMENT! Failure to null potentiometer may result in an uneven output in each direction. The Umbilical Winch Assembly controlled by the handle may be faster in one direction than in the other. Possible personal injury or damage to equipment could result.

f. The potentiometer must be electrically nulled any time work is done to the control handle. Place the handle in the center or detented position. If the handle has a center off switch, connect a jumper wire from"+" on the terminal strip to potentiometer terminal #1.
g. Connect the power lead from the winch to "+" on the terminal strip and the ground lead from the winch to "-" on the terminal strip.
h. Using a voltmeter, connect the "+" on the meter to the "A" on the terminal strip, and the "-" on the meter to "B" on terminal strip.
i. Rotate the potentiometer until the meter reads 0 ± .1 volts and tighten the setscrew on spur gear.
j. Recheck the value at the center position. If not in specification, repeat the nulling procedure.
k. If a jumper wire was used between potentiometer terminal #1 and "+", remove it.
l. Inspect HPU Pedestal Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
m. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
n. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.7.1.2 Control Handle (CH102, CH103, CH104)

7.5.3.7.1.2.1 Remove and Reinstall Procedure

Parts required: JR Merritt Control Handle (Spare Part Item 98) (Figure 4-18 and Table 4-18, Items 9, 11, 13).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HPU Pedestal Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.

WARNING

PERSONAL INJURY OR DAMAGE TO EQUIPMENT! Failure to null potentiometer may result in an uneven output in each direction. The Umbilical Winch Assembly controlled by the handle may be faster in one direction than in the other. Possible personal injury or damage to equipment could result.

f. The potentiometer must be electrically nulled any time work is done to the control handle.

NOTE

The threshold setting and full output setting are factory adjusted for your specific valve coil. Additional field adjustments are recommended to tune each machine function to the desired operation. Turning a potentiometer CW increases the output while turning a potentiometer CCW decreases the output. Some interaction occurs between adjustments of the trim pots and some re-adjustment of the trim pots may be required to achieve the optimum setting. The trim pots are multi-turn devices and will require several turns before an appreciable change in response is observed.

Adjustment Priority

1. **Threshold (Thres)**: Deflect handle slowly about 5i from off to adjust where the LED turns on then adjust the threshold trim pot CW to increase the start speed of the function you are controlling. (CH102: A-Frame Luff Out/Luff In; CH103: Cursor Winch Pay Out/Haul In; CH104: Swing Frame Outboard/Inboard.) To obtain a slower speed at this position, turn the threshold trim pot CCW until the desired speed is observed.
2. **Full Output Adjust Trim Pot (Max. 1)**: With the handle fully deflected, adjust the Max. 1 trim pot CW until the desired speed is achieved. Caution: Do not over adjust. To ensure that the full speed adjustment is not saturated, back the handle off from full travel 5-10i, a change in performance should be observed. If no change is noticed, Max. 1 is saturated (over-adjusted). Turn Max. 1 CCW 5 turns and recheck for a response change just off the end of the travel again. Recheck start speed and readjust Thres again to the desired start speed. A correctly adjusted controller will start the function moving when the handle is initially deflected and reach full speed just at the end of travel.

g. Inspect HPU Pedestal Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.

h. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).

i. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.7.1.3 Fuse (F101)

7.5.3.7.1.3.1 Remove and Reinstall Procedure

Parts need: Littlefuse Fuse (Spare Part Item 105A) (refer to Figure 7-20 & Table 7-17, Item 1).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HPU Pedestal Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove the failed fuse and replace with a new fuse of similar rating.
e. Inspect HPU Pedestal Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
f. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
g. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.7.1.4 Toggle Switch (SW103, SW105)

7.5.3.7.1.4.1 Remove and Reinstall Procedure

Parts required: Microswitch Toggle Switch (Spare Part Item 137) (refer to Figure 4-18 and Table 4-18, Items 16 and 20).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HPU Pedestal Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU Pedestal Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.7.1.5 Toggle Switch (SW104, SW106)

7.5.3.7.1.5.1 Remove and Reinstall Procedure

Parts required: Microswitch Toggle Switch (Spare Part Item 139) (refer to Figure 4-18 and Table 4-18, Items 24 and 22).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HPU Pedestal Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU Pedestal Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).

h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.7.1.6 Toggle Switch (SW107, SW108)

7.5.3.7.1.6.1 Remove and Reinstall Procedure

Parts required: Microswitch Toggle Switch (Spare Part Item 140) (refer to Figure 4-18 and Table 4-18, Items 12, 15 and 19).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HPU Pedestal Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU Pedestal Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.8 Control Station – Remote

A representation of the Electronics Cabinet individual unit electrical interconnect is shown in Figure 7-21, Sheet 1, and the ROV Altitude and Tension D/A conversion signal path is shown in Figure 7-21, Sheet 2.

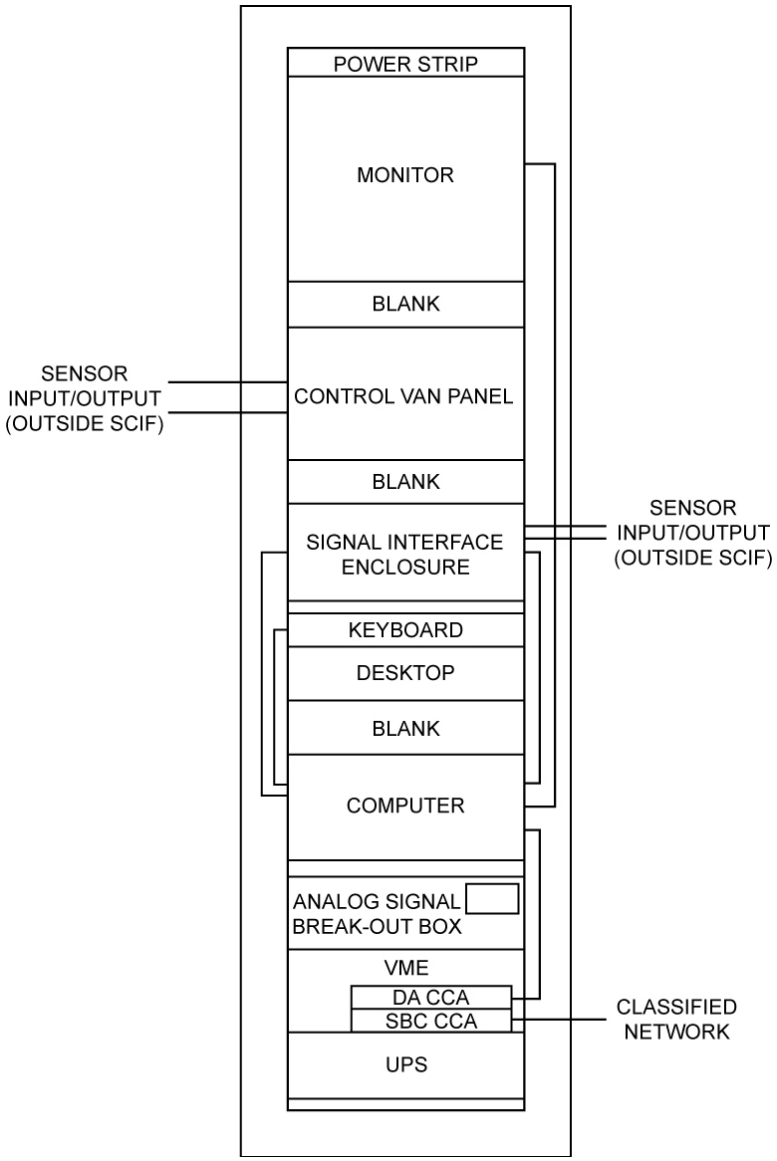


Figure 7-21 Electronics Cabinet Electrical Interconnect (Sheet 1 of 2)

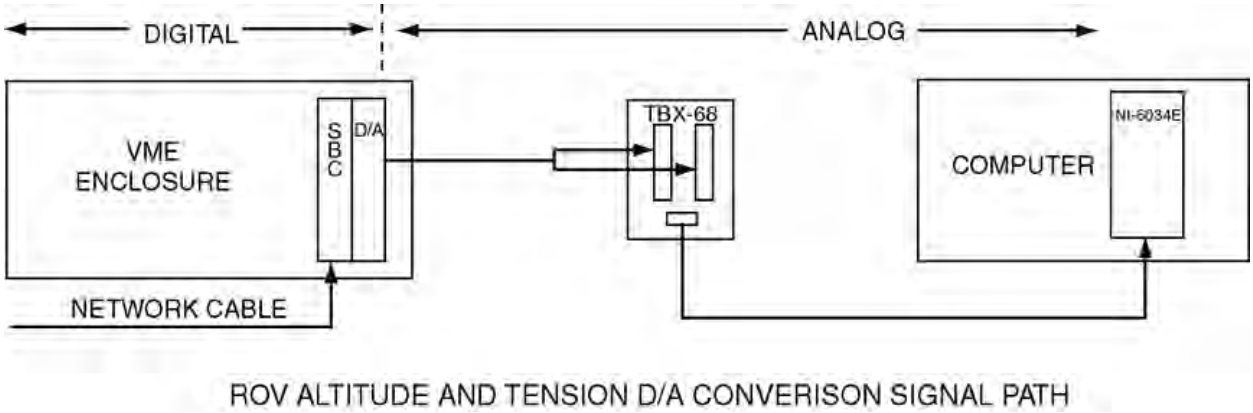


Figure 7-21. Electronics Cabinet Electrical Interconnect (Sheet 2 of 2)

7.5.3.8.1 Monitor

7.5.3.8.1.1 Remove and Reinstall Procedure

Part required: CYRAQ 19" Flat Panel Monitor (Spare Item not supplied) (Figure 7-22 and Table 7-18)

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the Electronics Cabinet equipment is secured IAW the Electronics Cabinet (UPS, VME, and PC) procedure (section 3.2.5.3).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the Electronics Cabinet. Verify the Electronics Cabinet is de-energized prior to performing any corrective maintenance.

c. Gain access to the rear of the Electronics Cabinet and verify electrical components are de-energized. If the monitor power indicator LED is blinking, depress the power button to secure power to the monitor (Figure 7-22, Item 5).
d. Remove the power cord and then the signal cables from their respective connectors (Figure 7-22, Items 1, 2, 3, and 4) and set aside.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! The monitor could fall to the deck and shatter when being removed from the Electronics Cabinet if not careful. Two people are required when removing the monitor from the Electronics Cabinet.

NOTE

Do not confuse the eight 10/32" button head nuts (Figure 7-22, Item 6) holding the mounting plate (Figure 7-22, Item 10) to the Electronics Cabinet. The mounting plate remains firmly secured to the cabinet side rails.

e. With one person at the front of the monitor and the other at the rear of the monitor, loosen and remove the fourteen 10/32" nuts from the threaded mounting studs (Figure 7-22, Item 7).
f. Remove the monitor/gasket (Figure 7-22, Items 8 and 9) from the Electronics Cabinet and return it and the mounting nuts to stock for disposition.

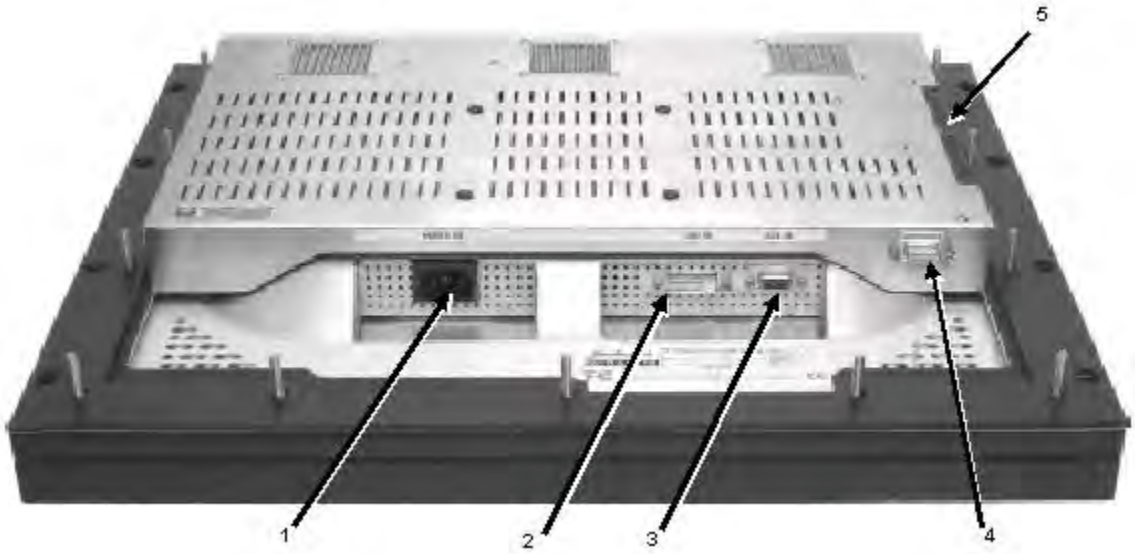
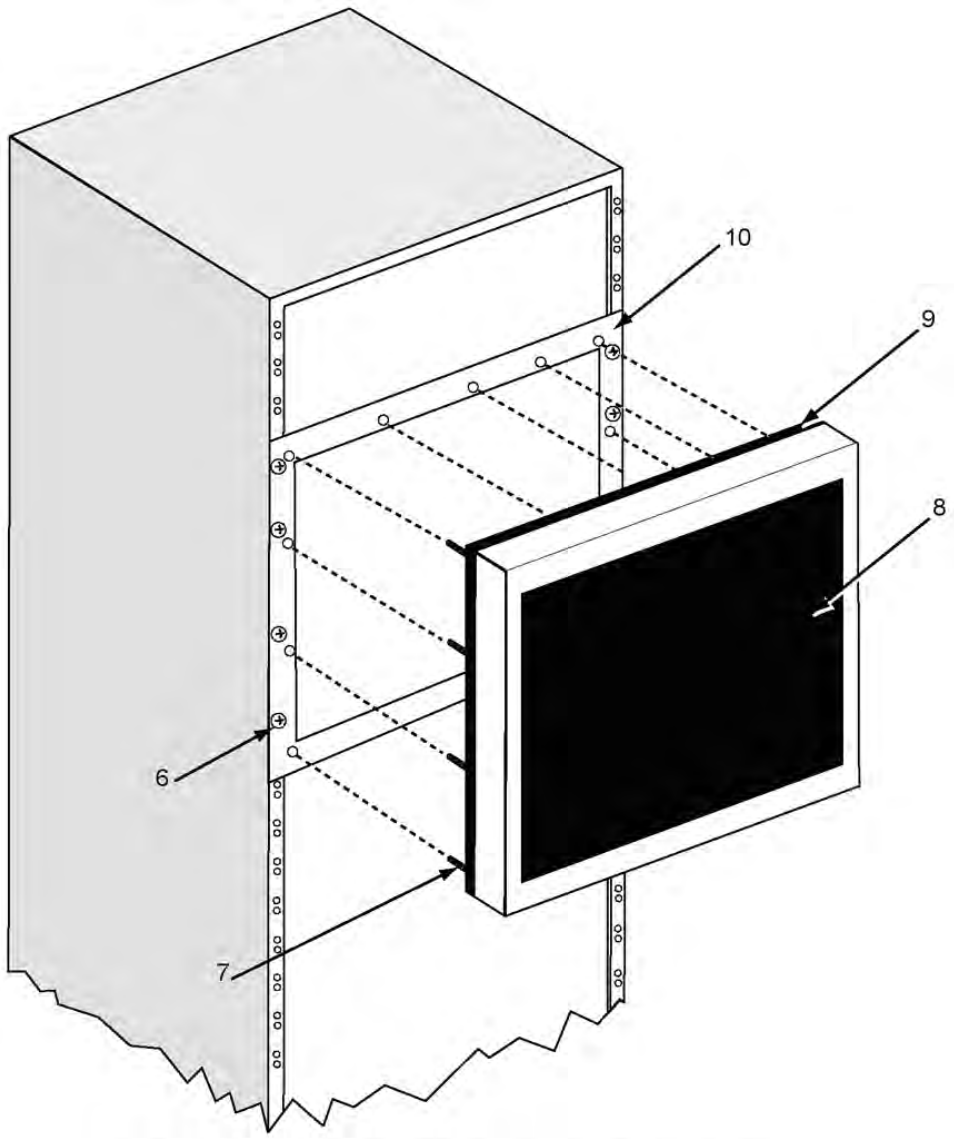


Figure 7-22 Monitor Assembly, Components (Sheet 1 of 2)



MOUNTING MONITOR TO ELECTRONICS CABINET

Figure 7-22. Monitor Assembly, Components (Sheet 2 of 2)

Table 7-18 Monitor Assembly, Parts Identification

ITEM	DESCRIPTION
1	Power Connector
2	DVI Video Connector
3	VGA Video Connector
4	Serial Touchscreen Connector
5	Monitor Function Buttons
6	Eight 10/32” x 1/2" Button Head Screws
7	Threaded Mounting Studs (w/fourteen 10/32” nuts)
8	Monitor
9	Gasket
10	Universal Mounting Plate

g. Inspect replacement unit with factory installed gasket for damage (Figure 7-22, Item 9).

CAUTION

POSSIBLE EQUIPMENT DAMAGE! The monitor could fall to the deck and shatter when being removed from the Electronics Cabinet if not careful. Two people are required when removing the monitor from the Electronics Cabinet.

h. Install replacement monitor/gasket into the universal mounting plate already installed on the Electronics Cabinet and secure in place using fourteen 10/32" nuts provided.

NOTE

Install all signal cables to their respective connectors prior to connecting the power cord to its connector.

i. Install the signal cables and lastly the power cord to their respective connectors (Figure 7-22, Items 2, 3, 4, and 1).

j. Start-Up the Electronics Cabinet equipment IAW the Control Van Electronics Cabinet procedure (section 3.2.2.4) ensuring the monitor status indicator LED (Figure 7-22, Item 1) illuminates a steady green color.

7.5.3.8.2 Control Van Panel (ENC5)

7.5.3.8.2.1 Control Handle (CH5)

7.5.3.8.2.1.1 Remove and Reinstall Procedure

Parts required: Sundstrand Control Handle (Spare Part Item 97)

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).

b. Ensure the Pedestal Remote Enable, Disable/Enable toggle switch (SW106) (Figure 4-18, Table 4-18, Item 22) is in the Disable position.

c. Unscrew and remove the Control Van Panel Winch controller (Figure 4-22 and Table 4-21, Item 6) from the Control Van Panel.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Open controller box and remove wires from failed unit and remove unit.

e. Inspect replacement unit for damage, install unit, and reconnect wires.

f. Inspect controller box to ensure it is free of all tools and any foreign materials and then secure the box.

g. Reconnect the Control Van Panel Winch controller to the Control Van Panel.

h. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).

7.5.3.8.2.2 Fuse (F101)

7.5.3.8.2.2.1 Remove and Reinstall Procedure

Parts required: Littlefuse Fuse (Spare Part Item 105A) (Figure 7-20 (similar) and Table 7-17, Item 1).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Turn off the Electronics Cabinet UPS and unplug the AC input cord to completely the UPS.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

d. Gain access to the Control Van Panel Enclosure and verify electrical components are de-energized.
e. Remove the failed fuse and replace with a new fuse of similar rating.
f. Inspect Control Van Panel Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Plug the AC input cord for the UPS into the electrical outlet and turn on the UPS.
h. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
i. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.8.2.3 Switch (SW9)

7.5.3.8.2.3.1 Remove and Reinstall Procedure

Parts required: MicroSwitch Toggle Switch (Spare Part Item 139) (refer to Figure 7-10 and Table 7-7, Item 33).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

c. Gain access to the HPU Assembly Low Voltage Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

d. Remove wires from failed unit and remove unit.
e. Inspect replacement unit for damage, install unit, and reconnect wires.
f. Inspect HPU Assembly Low Voltage Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
g. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
h. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.8.3 Computer

The FTHE computer uses four CCAs and they are located in slots 1, 3, 5, and 7. All other slots are either blank or not used. Refer to Figures 7-23, 7-24, 7-25, 7-26, and 7-27, and Table 7-19 for parts identification.

FRONT VIEW

(DOOR OPENED FOR VIEWING INTERNAL DETAIL)

Figure 7-23 Computer, Parts Identification – Front (Sheet 1 of 2)

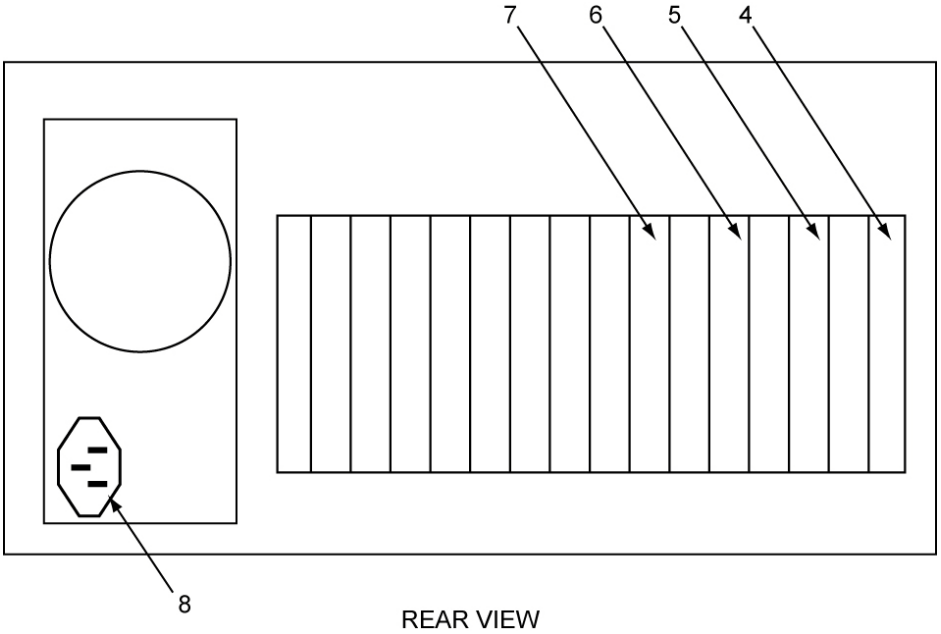


Figure 7-23. Computer, Parts Identification – Rear (Sheet 2 of 2)

Table 7-19 Computer, Parts Identification

ITEM	DESCRIPTION
1	Power Switch
2	Door Key Lock
3	Power Indication LED
4	Slot 1: Multifunction DAQ Card (NI 6034E). Cable goes to a terminal board yet to be mounted in the Electronics Cabinet and then on to the D/A CCA in the VME.
5	Slot 3: DIO Card (NI 6527) (CCA3). One connector with ribbon cables going to STB2 and STB3 in the Signal Interface Enclosure.
6	Slot 5: Real-Time DAQ Card with MIO Daughter-Board (NI 7041/6040E) (CCA1). Cable goes to STB1 in the Signal Interface Enclosure.
7	Slot 7: CyberResearch® Processor Card w/Ethernet and APB Video (CPPC P4-24-X) (CCA2). Cables go to the monitor and the keyboard/trackball.
8	120 VAC Power Receptacle

7.5.3.8.3.1 Real-Time DAQ Card with MIO Daughter-Board (CCA1) (Slot 5)

The Real-Time DAQ Card (also referred to as the “NI -7041 card”) along with the MIO Daughter-Board (also referred to as the “NI-6040E board”) is shown in Figure 7-24. They are replaced as one unit (PCI-7041/6040E). One cable is attached to this card and it goes to STB1 located in the Signal Interface Enclosure.

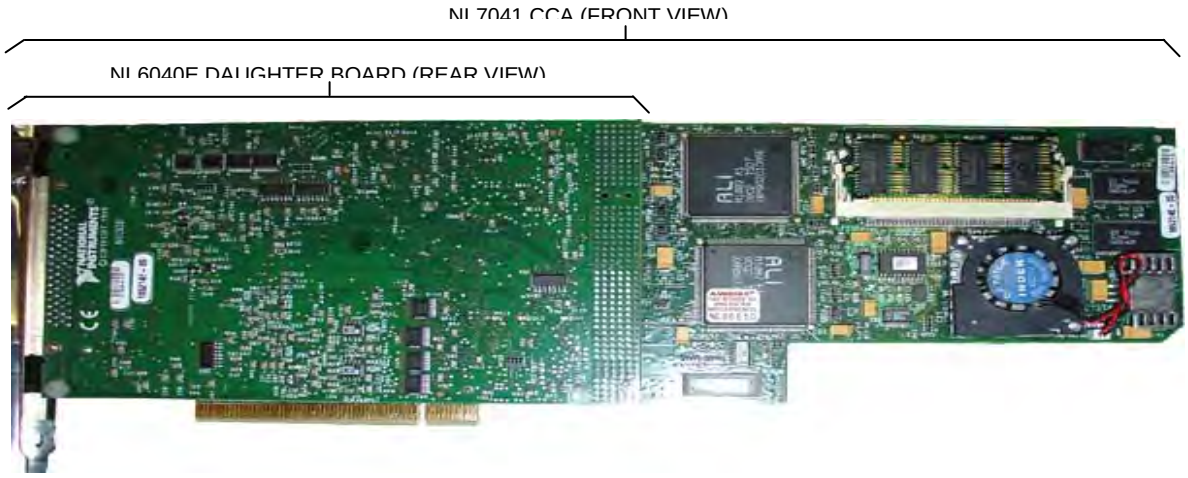


Figure 7-24 Real-Time DAQ Card with MIO Daughter Board

7.5.3.8.3.1.1 Remove and Reinstall Procedure

Parts required: National Instruments Real-Time DAQ (Not currently spared.)

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Turn off the Electronics Cabinet UPS and unplug the AC input cord to completely de-energize the UPS.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

d. Gain access to the Control Station Computer Enclosure and verify electrical components are de-energized.

CAUTION

Damage to electronic components may result from ESD. Ensure a properly grounded ESD wristband is worn at all times when handling CCAs and all work to the CCA is done on a properly installed and approved ESD surface.

e. Remove failed CCA from enclosure and put into a properly approved ESD bag.
f. Inspect replacement unit for damage and install into unit.
g. Inspect Computer Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
h. Plug the AC input cord for the UPS into the electrical outlet and turn on the UPS.
i. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
j. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.8.3.1.2 The Real-Time DAQ Card Pin Assignments

The CCA pin assignments are listed in Table 7-20.

Table 7-20 Real-Time DAQ Card Pin Assignments

DESCRIPTION	PIN	PIN	DESCRIPTION
AI 8	34	68	AI 0
AI 1	33	67	AI GND
AI GND	32	66	AI 9
AI 10	31	65	AI 12
AI 3	30	64	AI GND
AI GND	29	63	AI 11
AI 4	28	62	AI SENSE
AI GND	27	61	AI 12
AI 13	26	60	AI 5
AI 6	25	59	AI GND
AI GND	24	58	AI 14
AI 15	23	57	AI 7
AO 0[1]	22	56	AI GND
AO 1[1]	21	55	AO GND
AO EXT REF[1]	20	54	AO GND
P0.4	19	53	D GND
D GND	18	52	P0.0
P0.1	17	51	P0.5
P0.6	16	50	D GND
D GND	15	49	P0.2
+5 V	14	48	P0.7
D GND	13	47	P0.3
D GND	12	46	AI HOLD COMP
PFI 0/AI START TRIG	11	45	EXT STROBE
PFI 1/AI REF TRIG	10	44	D GND
D GND	9	43	PFI 2/AI CONV CLK
+5 V	8	42	PFI 3/CTR 1 SRC
D GND	7	41	PFI 4/CTR 1 GATE
PFI 5/AO SAMP CLK	6	40	CTR 1 OUT
PFI 6/AO START TRIG	5	39	D GND
D GND	4	38	PFI 7/AI SAMP CLK
PFI 9/CTR 0 GATE	3	37	PFI 8/CTR 0 SRC
CTR 0 OUT	2	36	D GND
FREQ OUT	1	35	D GND

TABLE KEY (Table 7-20)

[1] No connects appear on pins 20 through 22 of devices that do not support AO or use an external reference

7.5.3.8.3.2 Processor Card (CCA2) (Slot 7)

The Cyber-Research® Processor Card (CPPC P4-24-X) is shown in Figure 7-25.

COMPUTER – TOP VIEW, COVER REMOVED

Figure 7-25 Processor Card – Partially Removed and Upside Down

7.5.3.8.3.2.1 Remove and Reinstall Procedure

Parts required: Cyber Research Processor Card (not currently spared).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Turn off the Electronics Cabinet UPS and unplug the AC input cord to completely de-energize the UPS.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

d. Gain access to the Control Station Computer Enclosure and verify electrical components are de-energized.

CAUTION

Damage to electronic components may result from ESD. Ensure a properly grounded ESD wristband is worn at all times when handling CCAs and all work to the CCA is done on a properly installed and approved ESD surface.

e. Remove failed CCA from enclosure and put into a properly approved ESD bag.
f. Inspect replacement unit for damage and install unit.
g. Inspect Control Van Panel Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
h. Plug the AC input cord for the UPS into the electrical outlet and turn on the UPS.
i. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
j. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.8.3.3 Multifunction DAQ Card (Slot 1)

The Multifunction DAQ Card (also referred to as the “NI-6034E card”) is shown in Figure 7-26.

Figure 7-26 Multifunction DAQ Card

7.5.3.8.3.3.1 Remove and Reinstall Procedure

Parts required: National Instruments Multifunction DAQ Card CCA (Not currently spared.)

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Turn off the Electronics Cabinet UPS and unplug the AC input cord to completely de-energize the UPS.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

d. Gain access to the Control Station Computer Enclosure and verify electrical components are de-energized.

CAUTION

Damage to electronic components may result from ESD. Ensure a properly grounded ESD wristband is worn at all times when handling CCAs and all work to the CCA is done on a properly installed and approved ESD surface.

e. Remove failed CCA from enclosure and put into a properly approved ESD bag.
f. Inspect replacement unit for damage and install unit.

g. Inspect Control Van Panel Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
h. Plug the AC input cord for the UPS into the electrical outlet and turn on the UPS.
i. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
j. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.8.3.4 DIO Card (CCA3) (Slot 3)

A representation of the DIO Card (also referred to as the "NI-6527 card") is shown in Figure 7-27.

Figure 7-27 DIO Card

7.5.3.8.3.4.1 Remove and Reinstall Procedure

Parts required: National Instruments Digital DIO CCA (Spare Part Item 151).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. Turn off the Electronics Cabinet UPS and unplug the AC input cord to completely de-energize the UPS.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

d. Gain access to the Control Station Computer Enclosure and verify electrical components are de-energized.

CAUTION

Damage to electronic components may result from ESD. Ensure a properly grounded ESD wristband is worn at all times when handling CCAs and all work to the CCA is done on a properly installed and approved ESD surface.

e. Remove failed CCA from enclosure and put into a properly approved ESD bag.
f. Inspect replacement unit for damage and install unit.
g. Inspect Control Van Panel Enclosure to ensure it is free of all tools and any foreign materials and then secure enclosure cover.
h. Plug the AC input cord for the UPS into the electrical outlet and turn on the UPS.
i. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
j. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.8.3.4.2 DIO Card Pin Assignments

The DIO Card pin assignments are listed in Table 7-21.

Table 7-21 DIO Card Pin Assignments

DESCRIPTION	PIN	PIN	DESCRIPTION
DIG+2.7	1	51	DIG+5.7
DIG–2.7	2	52	DIG–5.7
DIG+2.6	3	53	DIG+5.6
DIG–2.6	4	54	DIG–5.6
DIG+2.5	5	55	DIG+5.5
DIG–2.5	6	56	DIG–5.5
DIG+2.4	7	57	DIG+5.4
DIG–2.4	8	58	DIG–5.4
DIG+2.3	9	59	DIG+5.3
DIG–2.3	10	60	DIG–5.3
DIG+2.2	11	61	DIG+5.2
DIG–2.2	12	62	DIG–5.2
DIG+2.1	13	63	DIG+5.1

Table 7-21 DIO Card Pin Assignments - *continued*

DESCRIPTION	PIN	PIN	DESCRIPTION
DIG–2.1	14	64	DIG–5.1
DIG+2.0	15	65	DIG+5.0
DIG–2.0	16	66	DIG–5.0
DIG+1.7	17	67	DIG+4.7
DIG–1.7	18	68	DIG–4.7
DIG+1.6	19	69	DIG+4.6
DIG–1.6	20	70	DIG–4.6
DIG+1.5	21	71	DIG+4.5
DIG–1.5	22	72	DIG–4.5
DIG+1.4	23	73	DIG+4.4
DIG–1.4	24	74	DIG–4.4
DIG+1.3	25	75	DIG+4.3
DIG–1.3	26	76	DIG–4.3
DIG+1.2	27	77	DIG+4.2
DIG–1.2	28	78	DIG–4.2
DIG+1.1	29	79	DIG+4.1
DIG–1.1	30	80	DIG–4.1
DIG+1.0	31	81	DIG+4.0
DIG–1.0	32	82	DIG–4.0
DIG+0.7	33	83	DIG+3.7
DIG–0.7	34	84	DIG–3.7
DIG+0.6	35	85	DIG+3.6
DIG–0.6	36	86	DIG–3.6
DIG+0.5	37	87	DIG+3.5
DIG–0.5	38	88	DIG–3.5
DIG+0.4	39	89	DIG+3.4
DIG–0.4	40	90	DIG–3.4
DIG+0.3	41	91	DIG+3.3
DIG–0.3	42	92	DIG–3.3
DIG+0.2	43	93	DIG+3.2
DIG–0.2	44	94	DIG–3.2
DIG+0.1	45	95	DIG+3.1
DIG–0.1	46	96	DIG–3.1
DIG+0.0	47	97	DIG+3.0
DIG–0.0	48	98	DIG–3.0
+5 V	49	99	+5 V
GND	50	100	GND

7.5.3.8.3.4.3 DIO Card Port Functionality

The DIO Card port functionality is listed in Table 7-22.

Table 7-22 DIO Card Port Functionality

PORT	FUNCTION
0	INPUT
1	INPUT
2	INPUT
3	OUTPUT WITH READBACK
4	OUTPUT WITH READBACK
5	OUTPUT WITH READBACK

7.5.3.8.3.4.4 D/A CCA to Real-Time DAQ Card I/O Adapter

The D/A CCA to Real-Time DAQ Card I/O Adapter pin connections are listed in Table 7-23.

Table 7-23 D/A CCA to Real-Time DAQ Card I/O Adapter Pin Connections

D/A CCA (CM-DA-40) DB-25 PIN	DESCRIPTON	TERM BD (TBX-68)	RT DAQ CCA (NI-6034E)
1	Vehicle Altitude (Conn A, CH 1+)	33	33+
2	Vehicle Altitude (Conn A, CH 2–)	66	66–
15	Vehicle Altitude Shield (Ground)	32	32
5	Vehicle Tension (Conn A, CH 5+)	68	68+
6	Ground, Vehicle Tension(Conn A, CH 6–)	34	34–
20	Vehicle Tension Shield (Ground)	67	67
7	HC Position (Conn A, CH 7+)	65	65+
8	HC Position(Conn A, CH 8–)	31	31–
18	HC Position Shield (Ground)	64	64
11	Ordered Altitude (Conn A, CH11+)	30	30+
22	Ground, Ordered Altitude	56/62	56/62
23	Ordered Altitude Shield (Ground)	29	29
12	Ordered Altitude Toggle (Conn A, CH12+)	28	28+
24	Ground, Ordered Altitude Toggle	61	61–
25	Ordered Altitude Toggle Shield (Ground)	27	27
3, 4, 9, 10, 13, 14, 16, 17, 19 & 21	No Connection	NC	NC

7.5.3.8.4 Keyboard Tray

There are no user repairable items in the keyboard tray. Repair consists of removal and replacement of the complete unit. The keyboard and tray are shown in Figure 4-26 and Table 4-24.

7.5.3.8.5 Remove and Reinstall Procedure

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. At the computer, depress the 0 (OFF) button (Figure 4-23 and Table 7-18, Item 1) and observe the computer POWER LED extinguishes.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

CAUTION

Damage to electronic components may result from ESD. Ensure a properly grounded ESD wristband is worn at all times when handling CCAs and all work to the CCA is done on a properly installed and approved ESD surface.

c. Gain access to the rear of the Electronics Cabinet and verify electrical components are de-energized.
d. Unplug the power cord in the back of the Keyboard.
e. Disconnect the keyboard cable from the back of the computer.
f. Have a helper support the keyboard and take out the four screws securing the computer to the Electronics Cabinet.
g. Remove the keyboard and set it aside. Hold the new one while the helper aids in getting the mounting hardware installed. Once all the screws are in the unit, tighten them firmly.
h. At the rear of the Electronics Cabinet, connect the keyboard to the keyboard cord.
i. Plug the power cord into the back of the Keyboard.
j. Power up the computer and verify that the keyboard functions properly.

7.5.3.8.6 Signal Interface Enclosure (ENC10)

As an aid to the maintainer, all the major components in the Signal Interface Enclosure (ENC10) (Figure 7-28 and Table 7-24) are called out even though some are not necessarily considered sea replaceable units.

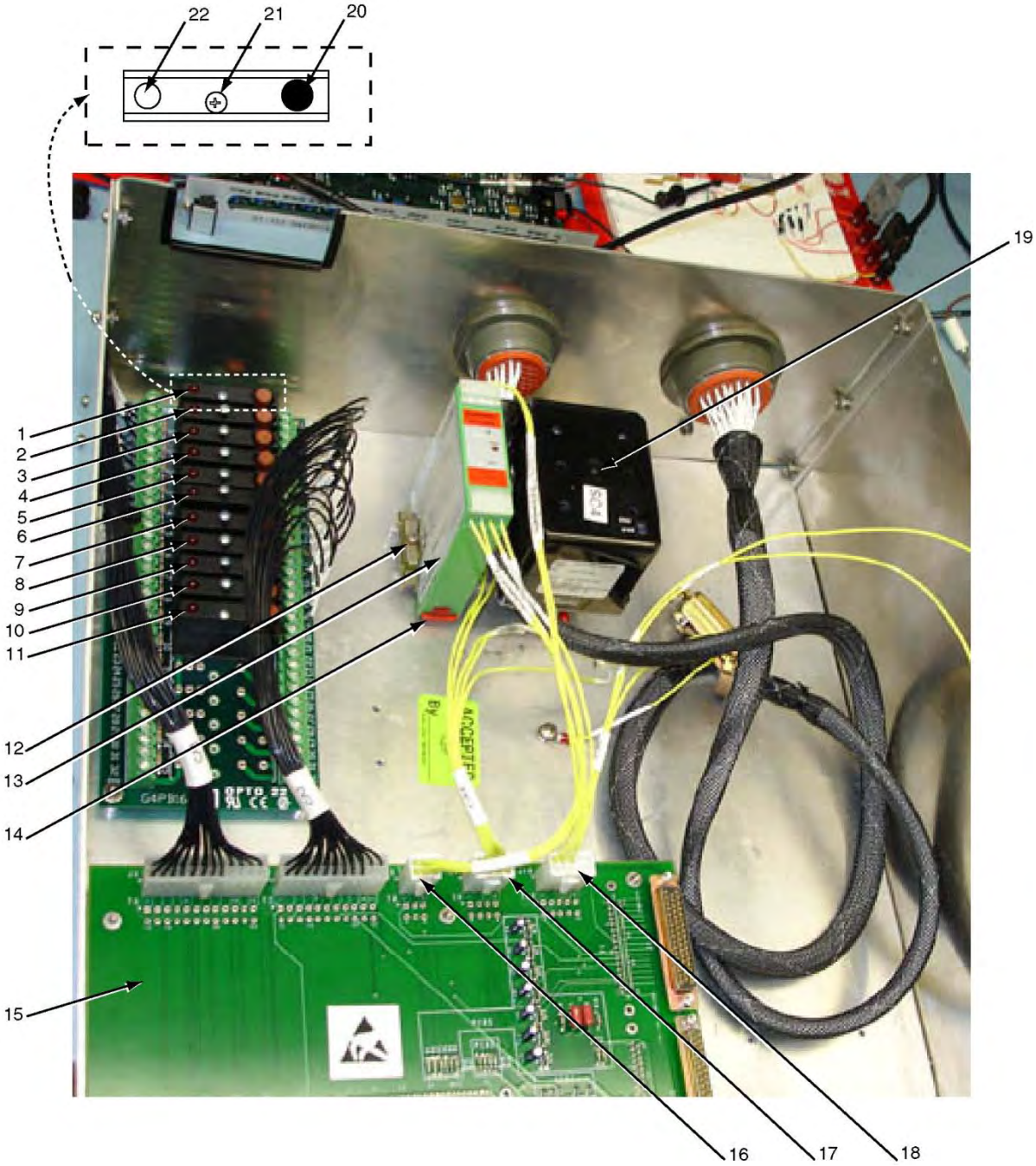


Figure 7-28 Signal Interface Enclosure, Components

Table 7-24 Signal Interface Enclosure, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	M0	Computer Control Engaged I/O Module
2	M1	Mode Switching Solenoid I/O Module
3	M2-	Lower Oil Right Solenoid I/O Module
4	M3	Raise Oil Right Solenoid I/O Module

Table 7-24 Signal Interface Enclosure, Parts Identification *(continued)*

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
5	M4	Lower Oil Left Solenoid I/O Module
6	M5	Raise Oil Left Solenoid I/O Module
7	M6	Intensifier Raise Pressure I/O Module
8	M7	Intensifier Decrease Pressure I/O Module
9	M8	Control System Fault I/O Module
10	M9	Brake Release I/O Module
11	M10	Spare I/O Module
12	N/A	Mounting Screw
13	SC3	SC3
14	N/A	Release Handle
15	N/A	Signal Conditioning CCA (A128308)
16	J8	Jack 8
17	J9	Jack 9
18	J10	Jack 10
19	SC4	SC4
20	N/A	Fuse
21	N/A	Mounting Screw
22	N/A	Red LED

7.5.3.8.6.1 Optical I/O Module (M0, M1, M2, M3, M4, M5, M6, M7, M8, M9, M10)

Parts required: Opto 22 Optical I/O Module (PN: G4OAC5) (A spare module is installed on the PWB.) (Figure 7-28, and Table 7-24, Items 1 through 10, Spare, Item 11).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. At the UPS, depress and hold for 1 second the ON/OFF/STANDBY switch (Figure 4-28 and Table 4-27, Item 1) until the UPS is powered OFF.
d. Unplug the UPS AC Power cord to ensure the UPS is completely de-energized.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

CAUTION

Damage to electronic components may result from ESD. Ensure a properly grounded ESD wristband is worn at all times when handling CCAs and all work to the CCA is done on a properly installed and approved ESD surface.

e. Gain access to the Signal Conditioning Enclosure and verify electrical components are de-energized.

NOTE

Each module has a fuse (Item 22) and there is one extra fuse mounted at the very end of the PWB beside module M0. Replacement is as simple as removing the failed fuse and replacing it with the spare fuse.

f. Locate the suspect I/O Module (Items 1 through 10), loosen captive mounting screw (Item 21) and remove I/O Module.
g. Remove spare I/O Module (Item 11) and insert it in the same slot where the failed I/O Module was removed.
h. Inspect Signal Conditioning Enclosure to ensure it is free of all tools and any foreign materials.
i. Return Signal Interface Enclosure to the Electronics Cabinet and secure face plate mounting screws.
j. Plug the UPS AC Power cord into the electrical wall outlet and turn UPS ON.
k. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
l. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.8.6.1.1 GUI DIO Indicators

The Digital I/O indicators (Figure 7-29) are displayed as a group on the GUI and map to the Optical I/O Modules as indicated in Table 7-25 and Table 7-26.

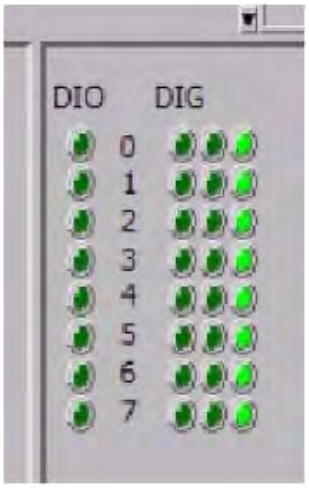


Figure 7-29 DIO Indicators

The DIO is a group of eight I/Os that are accessed through the Real-Time DAQ Card CCA that is connected directly to the PCI-7030 RT card group of 24 Inputs and Outputs that are accessed through the Digital I/O Card CCA.

Table 7-25 DIO Indicator Mapping to Optical I/O Modules

CH	I/O	DESCRIPTION	DEVICE	PIN	DEVICE	RELAY	PIN
0	Output	Decrease Intensifier Pressure	STB1	J52	RB1	M7	15
1	Output	Control System Fault	STB1	J17	RB1	M8	17
2	Output	Mode Switching Valve	STB1	J49	RB1	M1	3
3	Output	Brake Release	STB1	J47	RB1	M9	19
4	Output	Increase Intensifier Pressure	STB1	J19	RB1	M6	13
5	Input	HC HPU Motor Running	STB1	J51	R30	---	J18
6	Input	Drum Count 1	STB1	J16	R31	---	J50
7	Input	Drum Count 2	STB1	J48	R29	---	J15

The DIG is a group of 24 I/Os (from a total of 48 I/Os) that are accessed through the Digital I/O Card CCA. There are three groups of eight I/Os used (Groups 0, 1, and 3) and three groups of eight I/Os not used (Groups 2, 4, and 5). There are 3 groups of eight (0, 1, and 3 out of 6 groups of a total of 8).

Table 7-26 DIG Indicator Mapping to Optical I/O Modules

CH	I/O	DESCRIPTION	DEVICE	PIN	DEVICE	RELAY	PIN
GROUP 0							
0.0	Input	A-Frame Proximity Sensor	STB2	47, 48			
0.1	Input	Not Used	—	—	—	—	—
0.2	Input	Not Used	—	—	—	—	—
0.3	Input	Not Used	—	—	—	—	—
0.4	Input	Not Used	—	—	—	—	—
0.5	Input	Winch General Fault	STB2	37, 38			
0.6	Input	HC General Fault	STB2	35, 36			
0.7	Input	Computer Control Enable	STB2	33, 34			
GROUP 1							
1.0	Input	HPU #1 Running	STB2	31, 32			
1.1	Input	HPU #2 Running	STB2	29, 30			
1.2	Input	Not Used	—	—	—	—	—
1.3	Input	Not Used	—	—	—	—	—
1.4	Input	Not Used	—	—	—	—	—
1.5	Input	Not Used	—	—	—	—	—
1.6	Input	Not Used	—	—	—	—	—
1.7	Input	Not Used	—	—	—	—	—

Table 7-26 DIG Indicator Mapping to Optical I/O Modules - *continued*

CH	I/O	DESCRIPTION	DEVICE	PIN	DEVICE	RELAY	PIN
GROUP 3		Not Used	—	—	—	—	—
3.0	Output	Computer Control Engaged	STB3	47, 48 (97, 98)	RB1	M0	1
3.1	Output	Not Used	—	—	—	—	—
3.2	Output	Not Used	—	—	—	—	—
3.3	Output	Fluid Makeup – Left Raise	STB3	41, 42 (91, 92)		M5	11
3.4	Output	Fluid Makeup – Left Lower	STB3	39, 40 (89, 90)		M4	9
3.5	Output	Fluid Makeup – Right Raise	STB3	37, 38 (87, 88)		M3	7
3.6	Output	Fluid Makeup – Right Lower	STB3	35, 36 (85, 86)		M2	5
3.7	Output	Not Used	—	—	—	—	—

7.5.3.8.6.2 Signal Conditioner (SC3)

7.5.3.8.6.2.1 Remove and Reinstall Procedure

Parts required: Dataforth Signal Conditioner (Spare Part Item 136) (Figure 7-28 and Table 7-24, Item 13).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. At the UPS, depress and hold for 1 second the ON/OFF/STANDBY switch (Figure 4-27 and Table 4-26, Item 1) until the UPS is powered OFF.
d. Unplug the UPS AC Power cord to ensure the UPS is completely de-energized.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

e. Gain access to the Signal Conditioning Enclosure and verify electrical components are de-energized.

CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

f. Record wire locations/connections and remove wires from the failed unit.
g. Loosen the mounting bracket screw on one side of SC3 and slide bracket away from unit.
h. Pull red release handle straight out at base of SC3 to release unit from mounting rails and remove unit.
i. Inspect replacement unit for damage.
j. Install unit onto mounting rails so the red release handle is facing into the center of the enclosure.
k. Slide the mounting bracket against the unit and tighten the mounting screw.
l. Reconnect wires to SC3.
m. Inspect Signal Conditioning Enclosure to ensure it is free of all tools and any foreign materials.
n. Return Signal Interface Enclosure to the Electronics Cabinet and secure face plate mounting screws.
o. Plug the UPS AC Power cord into the electrical wall outlet and turn UPS ON.
p. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
q. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.8.6.3 Signal Conditioner (SC4)

7.5.3.8.6.3.1 Remove and Reinstall Procedure

Parts required: (Action Instruments, Model NEWI-4300M5153) (Spare Part Item: Not Listed) (Figure 7-28 and Table 7-24, Item 6).

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Ensure the HPU Assembly is secured IAW the Normal Shut-Down procedures (section 3.2.5).
c. At the UPS, depress and hold for 1 second the ON/OFF/STANDBY switch (Figure 4-27 and Table 4-26, Item 1) until the UPS is powered OFF.
d. Unplug the UPS AC Power cord to ensure the UPS is completely de-energized.

WARNING

HIGH VOLTAGE! Death or injury may result from contact with energized components inside the enclosure panel. Verify the enclosure is de-energized prior to performing any corrective maintenance.

e. Gain access to the Signal Conditioning Enclosure and verify electrical components are de-energized.

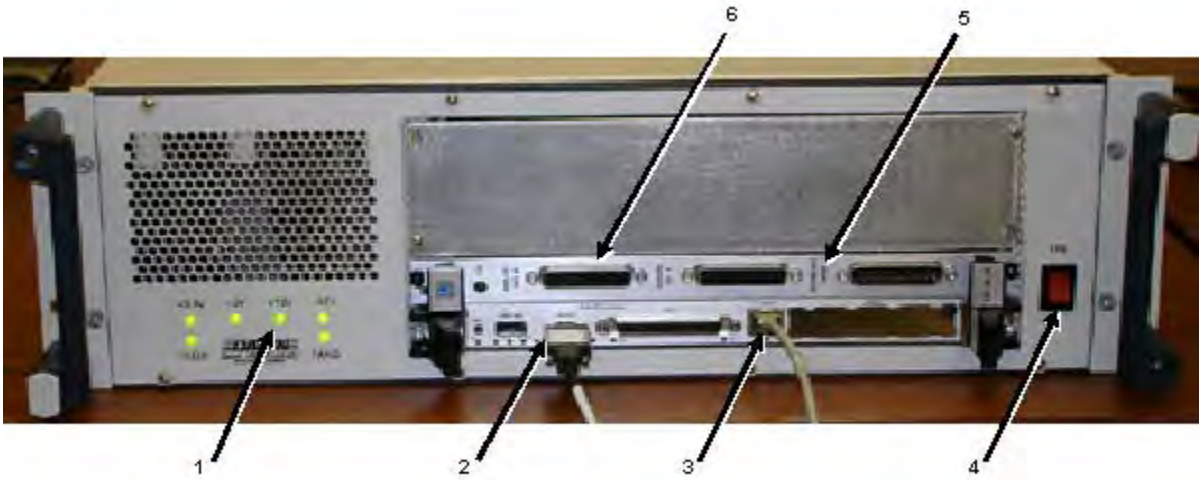
CAUTION

Before disconnecting any wires from components, take note of all wire markings and their connections. It is imperative that all wires are reconnected to their proper locations or damage to equipment or fire could result.

f. Record wire locations/connections and then remove wires from the failed unit.
g. Carefully cut the two tie wraps securing SC4 onto its electrical mounting base and remove SC4 by pulling straight up.
h. Inspect replacement unit for damage.
i. Orient SC4 mounting tab with the receptacle in the electrical mounting base and press into place.
j. Install two tie wraps around SC4, pull tight, and cut excess.
k. Reconnect wires to SC4.
l. Inspect Signal Conditioning Enclosure to ensure it is free of all tools and any foreign materials.
m. Return Signal Interface Enclosure to the Electronics Cabinet and secure face plate mounting screws.
n. Plug the UPS AC Power cord into the electrical wall outlet and turn UPS ON.
o. Complete the Prestart Inspection for the HPU Assembly (section 3.2.1.3).
p. Startup the HPU Assembly IAW the Start-Up procedures (section 3.2.2).

7.5.3.8.7 VME Enclosure

The FTHE VME Enclosure (Figure 7-30, 2 sheets) uses the first two slots of a five-slot VME chassis assembly: slot A1 contains the SBC CCA, slot A2 contains the D/A CCA, and the remaining empty slots are protected by a cover. Refer to Table 7-27 for identification of the components.



FRONT VIEW

Figure 7-30 VME Enclosure, Components (Sheet 1 of 2)

REAR VIEW

NOT USED

7

Figure 7-30. VME Enclosure, Components (Sheet 2 of 2)

Table 7-27 VME Enclosure, Parts Identification

ITEM NO.	PANEL DESIGNATION	PHYSICAL DESCRIPTION
1	N/A	DC Power LED Indicators
2	N/A	SBC CCA
3	N/A	FTHE Ethernet Cable
4	N/A	DC Power Supply Enable Switch
5	N/A	D/A CCA
6	N/A	LAN Network Cable with I/O Adapter (not shown)
7	N/A	AC Power Switch

7.5.3.8.7.1 Single Board Computer CCA (Slot A1)

7.5.3.8.7.1.1 Single Board Computer CCA Setup

The SBC CCA (Figure 7-31) occupies Slot A1 in the VME Enclosure backplane. An Erasable Programmable Read-Only Memory (EPROM) is mounted on the SBC CCA and must be programmed prior to using a replacement SBC CCA taken out of supply stock. The Enabling Links 1 through 5 (LK1 through LK5) are not identified on the CCA other than to show where pins 1, 2, 9, and 10 are located. Under normal operating conditions, all Enabling Links are removed from the CCA. Link settings are provided in Table 7-28.

- LK1 allows for self-tests by the manufacturer.
- LK2 allows software writes to the System Flash EPROM.
- LK3 allows software writes to the User Flash EPROM.
- LK4 and LK5 are not used.

NOTE

The Enabling Links 1 through 5 (LK1 through LK5) are not identified on the CCA other than to show where pins 1, 2, 9, and 10 are located. The word “In” means a Link is installed and the word “Out” means the Link is removed. Under normal operating conditions, all Enabling Links are out.

Table 7-28 Single Board Computer CCA Default Enabling Link Configuration

BACKPLANE LOCATION	LINK	LINK SETTING
A1	LK1	Out
	LK2	Out
	LK3	Out
	LK4	N/A
	LK5	N/A

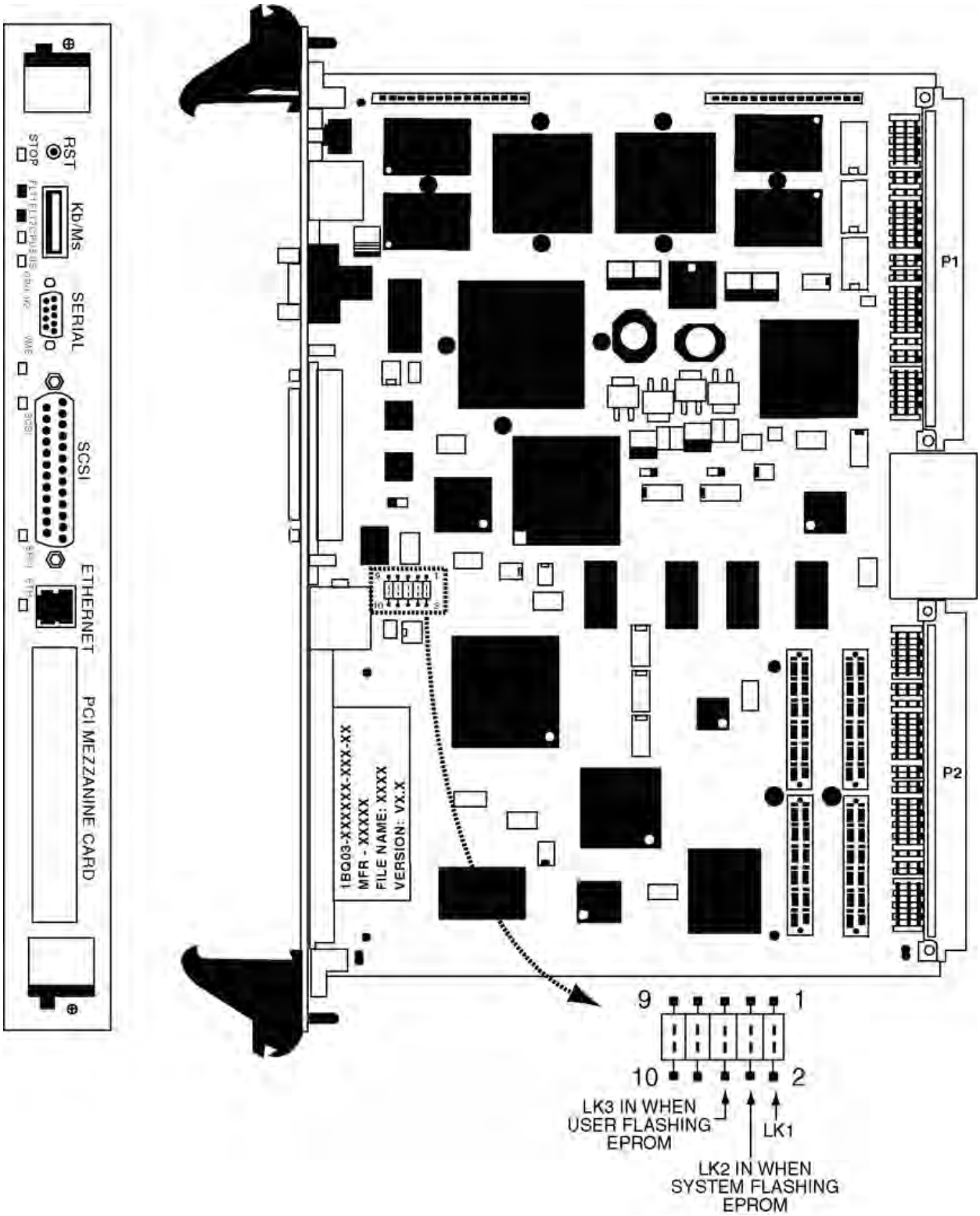


Figure 7-31 Single Board Computer CCA

7.5.3.8.7.1.1.1 FTHE Software Installation and IP Address Configuration

A new SBC CCA taken from supply stock must have FTHE software and IP address configuration installed on the EPROM prior to using the SBC CCA. The installation procedures must be followed exactly in order to have a successful download.

7.5.3.8.7.1.1.2 Host System Requirements

To execute these procedures on a Cetia SBC CCA, the following minimum assets are required:

- 300 MHz Pentium processor or equivalent
- 1 GB Hard-drive
- 500 M RAM
- 1 serial COM port
- 1 serial COM1 cable
- 1 Ethernet Port
- 1 Ethernet Crossover cable
- 1 CD-ROM drive
- Windows™ 2000 or Windows™ XP installed
- HyperTerminal software
- Tornado software, Version 2.0 or later ftp and tftp servers installed
  - TORNADO\HOST\WIN-x86\bin\tftpd32.exe
  - TORNADO\HOST\WIN-x86\bin\wftpd32.exe

7.5.3.8.7.1.1.3 Single Board Computer CCA Hardware Configuration

The SBC CCA must be configured to accept writes to the System Flash EPROM while a COM1 serial cable and an Ethernet Crossover cable must be connected between the host computer and the SBC CCA before the software download can begin (Figure 7-31).

CAUTION

Damage to electronic components may result from ESD. Ensure a properly grounded ESD wristband is worn at all times when handling CCAs and all work to the CCA is done on a properly installed and approved ESD surface.

a. Obtain ESD wristband and connect to an appropriate grounding point.

NOTE

An SBC CCA withdrawn from supply stock already has the Enabling Links, LK2 and LK3, mounted (stored) when shipped from the manufacturer. LK2 is mounted when “System Flashing” the EPROM and LK3 is mounted when “User Flashing” the EPROM. Normal operation of the SBC CCA is to have all links removed.

b. Verify LK2 and LK3 are in and that there are no links in LK1, LK4, and LK5.

c. Visually inspect the SBC CCA connector to ensure it is free from debris and pins are not bent.

d. Install the SBC CCA into Slot A1 of the VME Enclosure.
e. Connect a COM1 serial cable between the host computer COM1 port and the SBC CCA faceplate Serial port.
f. Connect an Ethernet Crossover cable between the host computer Ethernet port and the SBC CCA faceplate Ethernet port.
g. Depress the VME Enclosure AC POWER switch to ON.

7.5.3.8.7.1.1.4 Computer Software Syntax

The syntax used in this manual for typing computer commands, viewing computer response, and any additional amplifying comments is described below:

- Type: is the instruction for the operator to type the command that follows.
- **bold:** represents the command to be typed.
- Response: indicates the next line is the computer response from the command just previously typed.
- normal: is the computer response.
- {Any words between brackets provide amplifying information.}
- <**CR**>: means to depress and release the Enter key.
- Ctrl: is the Control key.

7.5.3.8.7.1.1.5 Prepare Download Directory

During the installation process, tftp and ftp servers are used to download files to the SBC CCA. This procedure uses the ftp and tftp servers provided as part of Wind River's Tornado package running on a host computer with Windows™2000. The HyperTerminal program distributed with Windows™2000 is also used to communicate with the VMPCbug program on the SBC CCA. (If these programs are unavailable, then any ftp and tftp severs should work, but some details and figures may be different.) The following procedures create a new directory, "c:\download_<JD>", where <JD> is the Julian Date:

a. To create a new directory, c:\download_<JD>, do the following:
1. Start the host computer and wait until the Windows™2000 main screen appears.
2. Using the LEFT mouse button, open an instance of Windows Explorer by selecting **Start->Programs->Accessories->Windows Explorer.** {When the screen opens, My Documents is highlighted by default.}
3. Using the LEFT mouse button, double-click the cursor on **My Computer**-> **Local Disk (C:)**. {When the screen opens, Local Disk (C:) is highlighted.}
4. Using the LEFT mouse button, with the cursor, select **File->New->Folder**. {A new folder is created and highlighted with the words, "New Folder".}

Type:
download_<JD>
{<JD> is the Julian Date.}

Response:
download_<JD>

Type:
<CR>
{The new folder, download_<JD> is created.}

5. Obtain the latest release CD that contains the latest FTHE distribution.
6. Insert the CD into the CD drive on the host computer.
7. Using LEFT mouse button on the Windows Explorer screen, double-click the cursor on

   Removable Disk (D:). {(D) is whatever drive the Removable Disk is mapped to on the host computer. When the screen opens, identify the list of files below:

   - **Bootrom.prep** – This is the vxWorks bootloader. It is loaded into System Flash (not User Flash) and is used to Auto-Boot vxWorks applications.
   - **vxWorks** – This is the downloadable, bootable vxWorks kernel loader. This can be launched from the Auto-Boot menu, and loads the vxWorks kernel, the required library files and the FTHE Application into memory. This file is loaded into User Flash.
   - **makeflash** – A downloadable, bootable vxWorks utility used to erase user flash and build a DOS File System for downloading applications.}
8. While depressing the Ctrl key and using the LEFT mouse button, single-click the cursor on each of the files just listed. {This highlights all the files.}
9. Release the Ctrl key.
10. Move the cursor over any portion of the highlighted area.
11. Depress and hold the RIGHT mouse button while moving the cursor over the newly created download_<JD> folder.
12. Release the RIGHT mouse button. {A screen appears with several options.}
13. Using the LEFT mouse button, single-click on Copy Here. {The selected files will be copied from the latest release CD to the download_<JD> folder.}
14. When the download is completed, using the LEFT mouse button, double-click the download_<JD> folder. {The same files selected have now been copied into the download_<JD> folder.}

7.5.3.8.7.1.1.6 Configure HyperTerminal

A HyperTerminal connection is required to run on the host computer to provide I/O to the SBC CCA via serial connection during the setup process. (It is assumed the FTHE maintainer has a certain degree of computer experience and therefore the remaining portion of the procedures is written at a higher level.).

a. Check the host system to see if a Cetia connection has already been established. If it has, skip this portion of the procedures and go to “Start tftpd and swftp Servers” (section 7.5.3.8.6.1.1.7).

b. To start a HyperTerminal connection on the host computer, perform the following:

1. Select **Start->Programs->Accessories->Communications->HyperTermina**l. {The HyperTerminal Splash Screen (Figure 7-32) appears for a few seconds and then the HyperTerminal Connection Description Screen (Figure 7-33) appears.}

Figure 7-32 Hyper Terminal Splash Screen

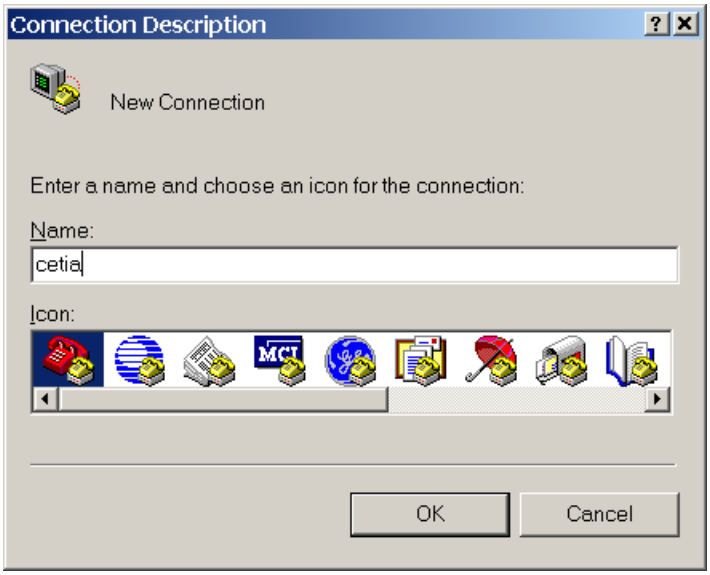


Figure 7-33 HyperTerminal connection Description Screen

2. In the “Name:” field:

   Type:

   cetia

   {Click OK. The HyperTerminal Connect To Screen (Figure 7-34) appears.}

3. In the “Connect Using:” field, select “COM1”and click OK. The HyperTerminal COM1 Properties Screen (Figure 7-35) appears.}

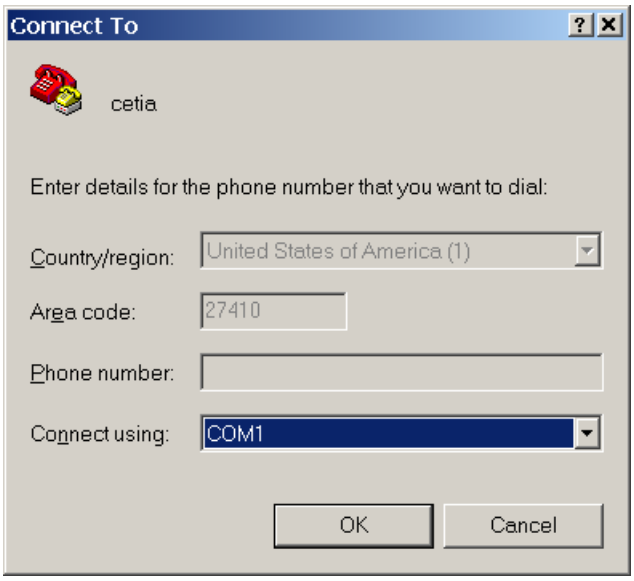


Figure 7-34 HyperTerminal Connect To Screen

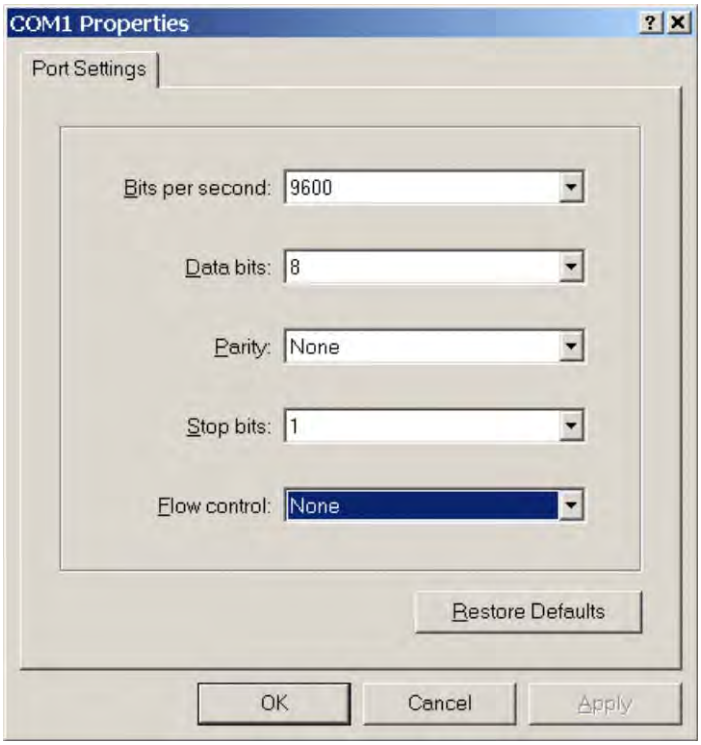


Figure 7-35 Hyper Terminal COM1 Properties Screen

4. Under the Port Settings tab, select the following connection parameters:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None {Click OK. The Cetia-HyperTerminal Screen (Figure 7-36) appears.

5. Select **File->Properties**. {The Cetia Connection Properties Screen (Figure 7-37) appears.}

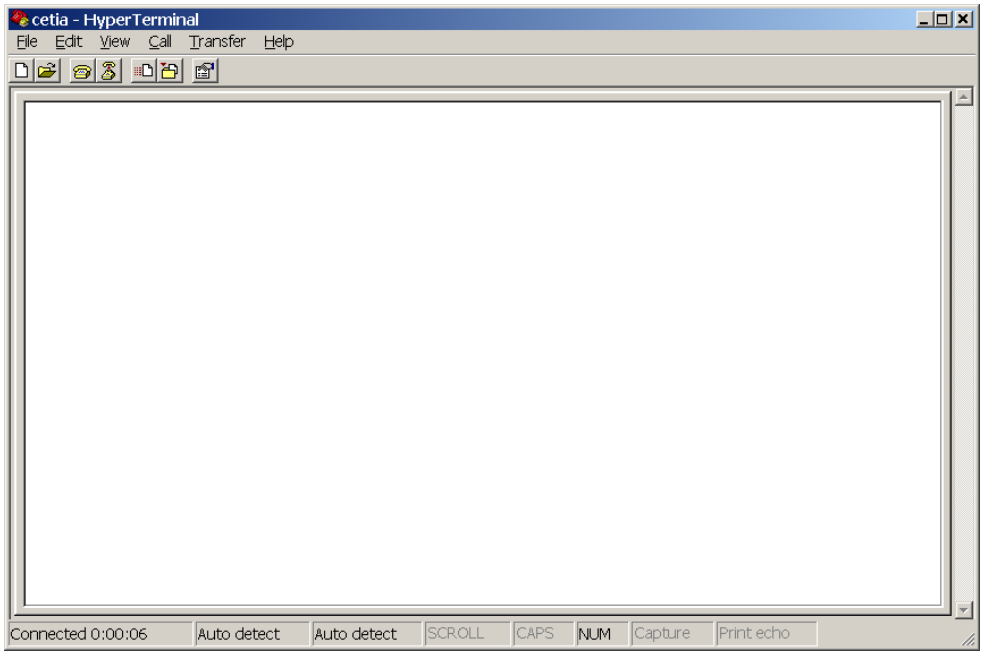


Figure 7-36 Cetia-HyperTerminal Screen

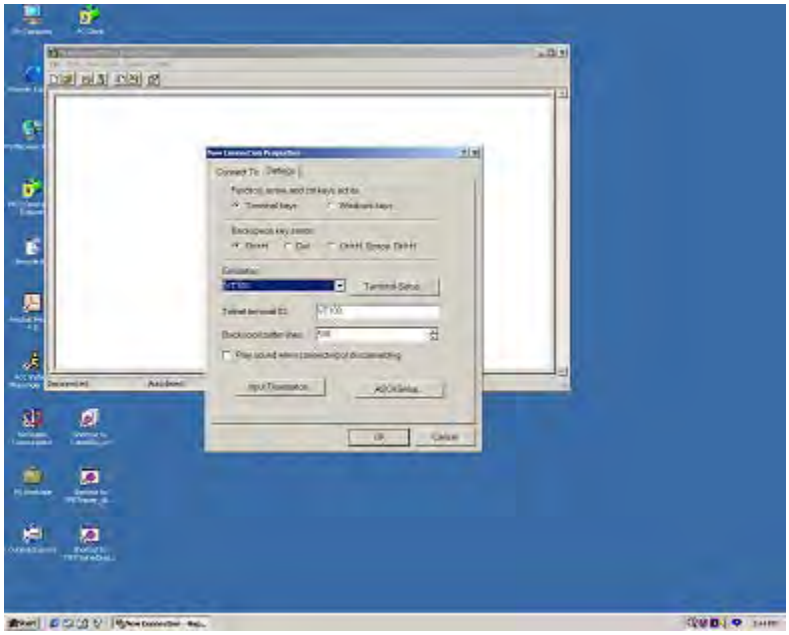


Figure 7-37 Cetia-HyperTerminal Screen – Connection Properties

6. Under the Settings tab, find the “Emulation:” field and select, “VT100”. {Click OK. The Cetia-Hyperterminal Screen reappears.

7.5.3.8.7.1.1.7 Start tftpd and wftp Servers

The tftp and ftp server programs must be started in order to eventually burn the Bootrom.prep file into System Flash.

a. To start the TFTP server program, perform the following:
b. Start the TFTP server program. {The TFTPD32 Server Screen (Figure 7-38) appears.}

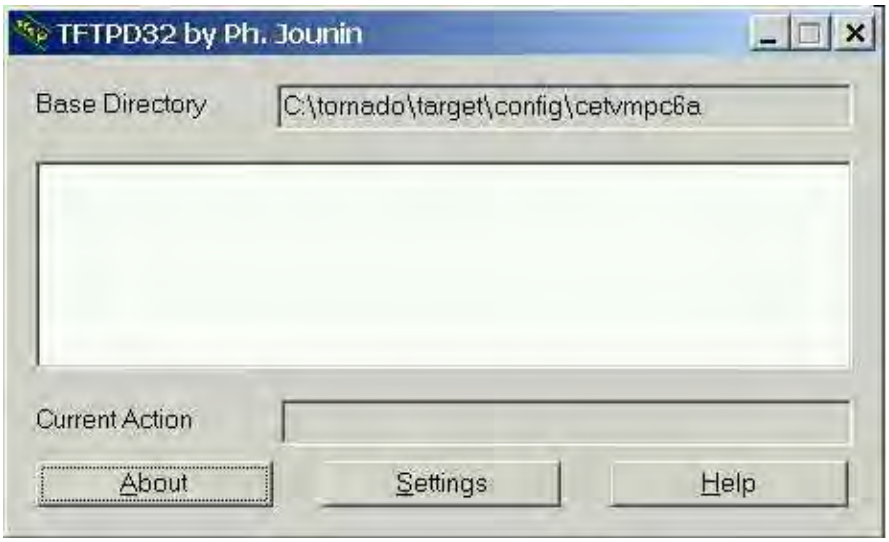


Figure 7-38 TFTPD32 Server Screen

1. Select “Settings” button. {The TFTPD32: Settings Screen (Figure 7-39) appears.

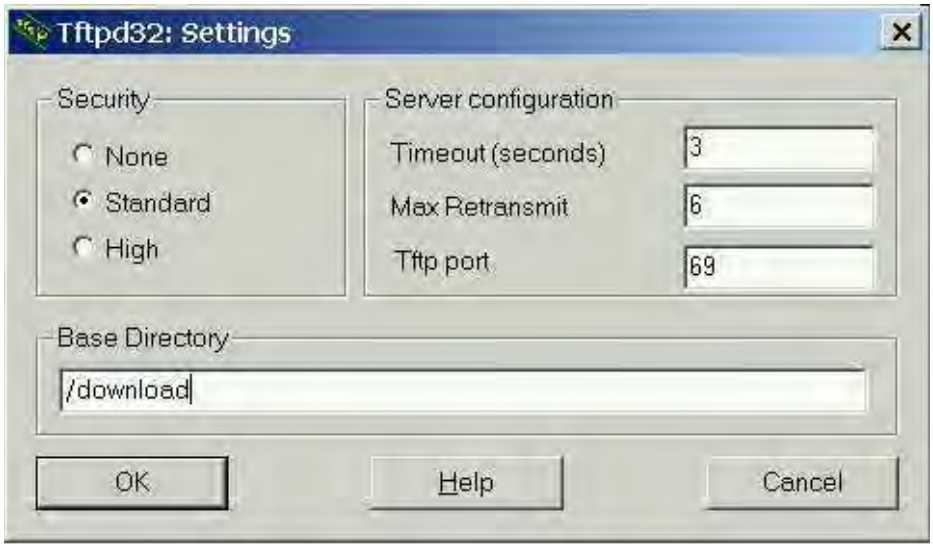


Figure 7-39 TFTPD32 Settings Screen

2. In the “Base Directory” field, replace the base directory to c:\download_<JD>.

c. To start the ftp server program, perform the following:

1. Start the ftp server program. {The FTP Server Screen (Figure 7-40) appears.}
2. Select **Security->General**. {The FTP Server General Security Screen (Figure 7-41) appears.}

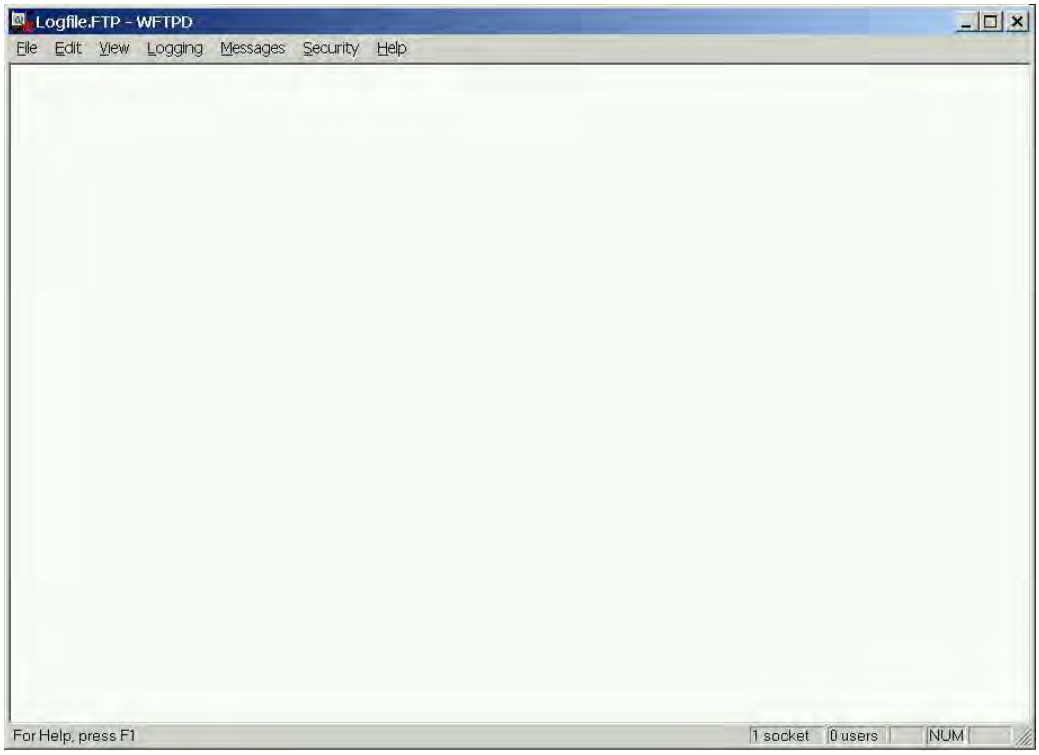


Figure 7-40 FTP Server Screen

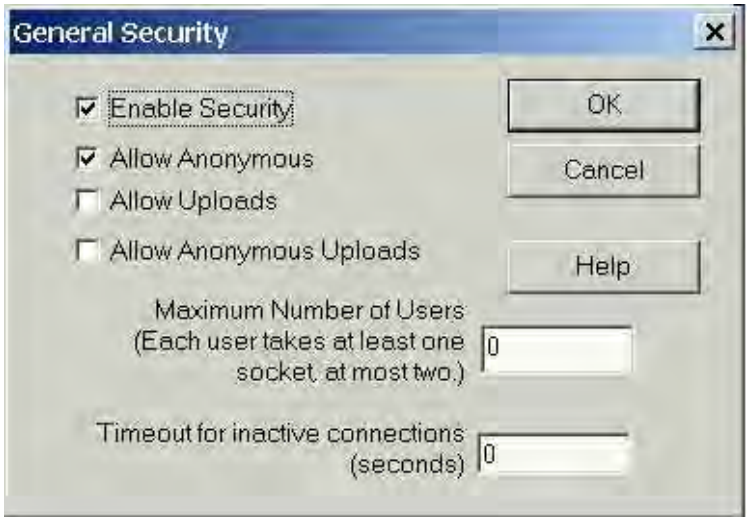


Figure 7-41 FTP Server General Security Screen

3. Enable anonymous downloads by checking the following boxes:

- Enable Security
- Allow Anonymous {Click OK. This closes the screen and returns to the FTP server screen.}

4. Select **Security->User/Rights**. {The User/Rights Security Dialog screen (Figure 7-42) appears.}

Figure 7-42 User / Rights Security Dialog Screen

5. In the "User Name" field, select "anonymous".
6. In the "Home Directory: field, select "c:\download_<JD>". {Select "DONE". This screen closes and returns to the ftp server screen.}

7.5.3.8.7.1.1.8 Burn Bootrom.prep Into System Flash

The Bootrom.prep file is the vxWorks bootloader. Burning the bootrom.prep file into System Flash first requires downloading the file from the Host via tftp server, then a copy to System Flash via the IOP Command.

a. To download the Bootrom.prep file, at the VMPCbug command prompt:

   Type:

   tftpget <Server IP address>:bootrom.prep,172.23.105.1;T

   {<Server IP address> is the host computer IP address.

   Type:

   md 0x200600 0x40

   {The data starts: 0x48000035 0x48000039 0x436f7079 … indicating the bootrom code loaded correctly}.

NOTE

The general procedure for programming flash memory on Cetia SBC CCAs is described in, VxWorks/Tornado 1.0.1 BSP On A VMPC6a Board Reference Manual, ID 99142, published by Cetia. The following procedures for FTHE software installation and IP address configuration have been developed using the aforementioned document.

b. To burn the downloaded bootrom.prep into System Flash memory, perform the following:

Type:
iop

Response:
(R)ead/(W)rite / (F)ormat/rewin(D) [R]?

Type:
W

Response:
Controller LUN = c ?

Type:
4
{This selects FLASH as the device to write to.}

Response:
Device LUN = 0 ?

Type:
1
{This selects FLASH 1 instead of FLASH 0.}

Response:
Memory address = 10000 ?

Type:
200600
{The start address of code.}

Response:
Sector number = 0 ?

Type:
0

Response:
Number of sectors = 1 ?

Type:
400

Response:
==>
{This is the command prompt and indicates the download is complete. The System Flash is programmed with the vxWorks bootloader (Bootrom.prep).}

c. The command to run bootrom.prep is: go ffe00000. To make that happen automatically when the card is powered up, enter the following commands:

Type:

bts 'go ffe00000'
btt 9

{This will cause the bootrom program to start 9 seconds after power-up. During that 9 second delay, one can stop the autoboot by depressing any key. Setting the time delay to zero will disable the autoboot.}

{When the VxWorks bootrom program starts, it may attempt to auto-boot an application. Stop it by depressing any key. The boot parameters for the VxWorks bootrom need to be set up now. The changes to the boot parameters described below will boot the camera application program from the ftp server.}

7.5.3.8.7.1.1.9 Downloading FTHE App To User Flash

7.5.3.8.7.1.1.9.1 Creating the Flash File System Using the MakeFlash Utility

A MakeFlash utility is provided in the FTHE distribution to create and mount a file system in User Flash memory. To start the MakeFlash utility, perform the following:

1. Reset the SBC CCA by depressing the VME Enclosure AC POWER switch to OFF, waiting 2 or 3 seconds (the time is not critical), and then depressing the AC POWER switch back to ON.
2. Stop the auto-boot sequence by pressing any key on the host computer during the auto-boot countdown.

Type:

c

Response:

Type:

dc

{This is the command to change boot parameters.}

Response:

'.' = clear field; '-' = go to previous field; ^D = quit
boot device :

Type:

dc

Response:

processor number :

Type:

0

{This is the number zero.}

Response:
host name :

Type:
host

Response:
file name :

Type:
makeflash

Response:
inet on ethernet (e) :

Type:
<SBC CCA IP address>
{ Enter the SBC CCA IP address: 172.23.105.1

Response:
inet on backplane (b):

Type:
.
{This is a period.}
Response:
host inet (h) :

Type:
<ftp server IP address>
{Enter the host computer IP address.}
Response:
gateway inet (g) :

Type:
.

Response:
user (u) :

Type:
anonymous

Response:
ftp password (pw) (blank = use rsh):

Type:

password
{Type the word “password”, not a specific password.}

Response:
flags (f) :

Type:
.

Response:
target name (target) :

Type:
.

Response:
startup script (s) :

Type:
.

Response:
other (o) :

Type:
dc

Response:
˜ —>
{This is the command prompt and indicates the download is complete. T
host inet (h) :

3. Reset the SBC CCA by depressing the VME Enclosure AC POWER switch to OFF, waiting 2 or 3 seconds (the time is not critical), and then depressing the AC POWER switch back to ON. This will load and run the MakeFlash utility.
4. When the MakeFlash utility runs, the following screen appears:

erasing usr flash memory

.....
.....
...creating flash device

flash disk creation successful

value = 0 = 0x0

7.5.3.8.7.1.1.9.2 Copy vxWorks Library File to FLASH Memory

The vxWorks library file must be copied to Flash Memory. To copy vxWorks library file to Flash Memory, perform the following:

Type:
copy ”host:vxWorks”,”flash/vxWorks”
{Type this command exactly as shown including the quote marks.
This command may take a few minutes to complete. Please be patient.}
Response:
value = 0 = 0x0

7.5.3.8.7.1.1.9.3 Configure Bootloader To Boot From User Flash

The bootrom must now be configured to boot the SBC CCA from flash memory. To configure the bootrom, perform the following:

a. Reset the SBC CCA by depressing the VME Enclosure AC POWER switch to OFF, waiting 2 or 3 seconds (the time is not critical), and then depressing the AC POWER switch back to ON.
b. During the auto-boot countdown:

Type:
c

Response:
boot device : dc0

Type:
flash

Response:
processor number : 0

Type:
<CR>

Response:
host name : host

Type:
<CR>

Response:
host name : host

Type:
<CR>

Response:
file name : vxWorks

Type:
flash/vxWorks

Response:
inet on ethernet (e) : <IP address>
{<IP address> is what happens to currently reside in Flash.}

Type:
<CR>

Response:
inet on backplane (b):

Type:
<CR>

Response:
host inet (h) : <IP address>
{<IP address> is what happens to currently reside in Flash.}

Type:
<CR>

Response:
gateway inet (g) :

Type:
<CR>

Response:
user (u) : anonymous

Type:
<CR>

Response:
ftp password (pw) (blank = use rsh): passwd

Type:
<CR>

Response:
flags (f) : 0x0

Type:

0
{This is the number zero.}

Response:
target name (target) :

Type:
<CR>

Response:
startup script (s) :

Type:
.

Response:
other (o) : dc

Type:
dc
{Typing “dc” enables Ethernet traffic to the SBC CCA. If the “dc” parameter is not set, the Ethernet network will not be available.}

Response:
==>
{This is the command prompt and indicates the boot parameters are now saved to nonvolatile memory.}

7.5.3.8.7.1.1.9.4 Single Board Computer CCA Normal Operating Configuration

The SBC CCA is now programmed and ready to be used by FTHE. To return the SBC CCA to normal operation, perform the following:

a. Secure power to the VME Enclosure by depressing the AC POWER switch to OFF.
b. Disconnect the Ethernet Crossover cable and the COTS serial cable from both the host computer and the SBC CCA.
c. Unseat the SBC CCA from the VME Enclosure backplane connector and pull the SBC CCA out far enough to gain access to the Enabling Links.
d. Remove LK2 and LK3 and store links is a safe location.
e. Reinstall the SBC CCA into the VME Enclosure backplane connector.
f. Connect the normally installed FTHE Ethernet cable to the SBC CCA faceplate Ethernet connector.

7.5.3.8.7.1.2 Remove and Reinstall Procedures

Parts required: CM Computer SBC CCA, Model VMPC6a-450-128-F1102 (GFE) (Figure 7-31).

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Damage to electronic components may result from ESD. Ensure a properly grounded ESD wristband is worn at all times when handling CCAs and all work to the CCA is done on a properly installed and approved ESD surface.

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Obtain ESD wristband and connect to an appropriate grounding point.
c. Remove the FTHE Ethernet cable installed on the SBC CCA faceplate Ethernet connector.
d. Locate and remove the SBC CCA from the VME Enclosure Slot A1.

NOTE

The EPROMs on the SBC CCA may contain classified information. The CCA and the EPROMs must be handled according to Navy procedures for the storage and disposal of classified material.

e. Insert the SBC CCA into a properly approved ESD bag, tag as defective, and return to stock for replacement/disposal.
f. Observe proper failure reporting procedure.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Damage to electronic components may result from ESD. Ensure a properly grounded ESD wristband is worn at all times when handling CCAs and all work to the CCA is done on a properly installed and approved ESD surface.

g. Remove the replacement SBC CCA from its shipping carton and inspect for damage.
h. Perform the FTHE Software Installation And IP Address Configuration procedures provided in the Single Board Computer CCA Setup (refer to section 6.5.1.1.7.1).
i. Configure the SBC CCA Enabling Links to match the removed CCA (refer to Table 7-25).
j. Install the SBC CCA into the VME Enclosure Slot A1 and secure in place.
k. Connect the normally installed FTHE Ethernet cable to the SBC CCA faceplate Ethernet connector.
l. Energize the VME Enclosure by depressing the AC Power switch and operate as normal.

7.5.3.8.7.2 Digital to Analog CCA (Slot A3)

7.5.3.8.7.2.1 Digital to Analog CCA Setup

The D/A CCA (Figure 7-43) occupies Slot A3 in the VME Enclosure backplane. The jumpers are labeled SW1through SW60, SW101 through SW120, SW121 through SW124, SW201 through SW224, and SW301 through SW324. There are no jumpers labeled SW31 through SW48.

The channels selected for Tension and Altitude outputs need to be set in #defineTENSION_CHANNEL and ALTITUDE_CHANNEL in the DA.h file.

All input signals available on the CCA faceplate are also wired to a second 160-pin VME64X DIN connector located at the VME-bus P2. The switch settings for the VMEbus P2 are listed in Table 7-x and defined as follows:

- SW103 through SW24 jumpers configure the polarity of the D/A output channels, allowing either unipolar or bipolar outputs. (The FTHE settings result in a unipolar polarity for the channels.)
- SW25 and SW26 jumpers provide selection of the VME address for the CCAs. (The FTHE settings result in a VME address I/O offset of 0xC00000.)
- SW49 through SW60 jumpers wire the analog grounds through the P2 connector.
- SW61 jumper wires the common external input reference to the P2 connector.
- SW101 (CH101) to SW124 (CH24) jumpers are used to select the input reference source. (The FTHE settings result in an internal reference voltage.)
- SW201 through SW224 jumpers wire the individual channels through the P2 connector. (The FTHE settings require that the jumpers be removed thereby preventing any possible contention between the 24 channel outputs and other devices connected to the bus.)
- SW301 through SW324 jumpers wire the external reference signals to the P2 connector. (Not used for FTHE application.)

Table 7-29 Digital to Analog CCA Jumper Configuration

BACKPLANE LOCATION	JUMPER BLOCK	JUMPER STATES
A1	SW103 – SW24	Pin A tied to B = On and no connection at C or D
	SW25	S0=On S1=On S2=On S3=On
	SW26	V0=On V1=On V2=Off V3=Off
	SW27 – SW30	On
	SW49 – SW60	On
	SW61	Off
	SW101 – SW120	Pin 1 tied to 2 = On
	SW121 – SW124	Pin 1 tied to 2 = On
	SW201 – SW224	Off
	SW301 – SW324	Off

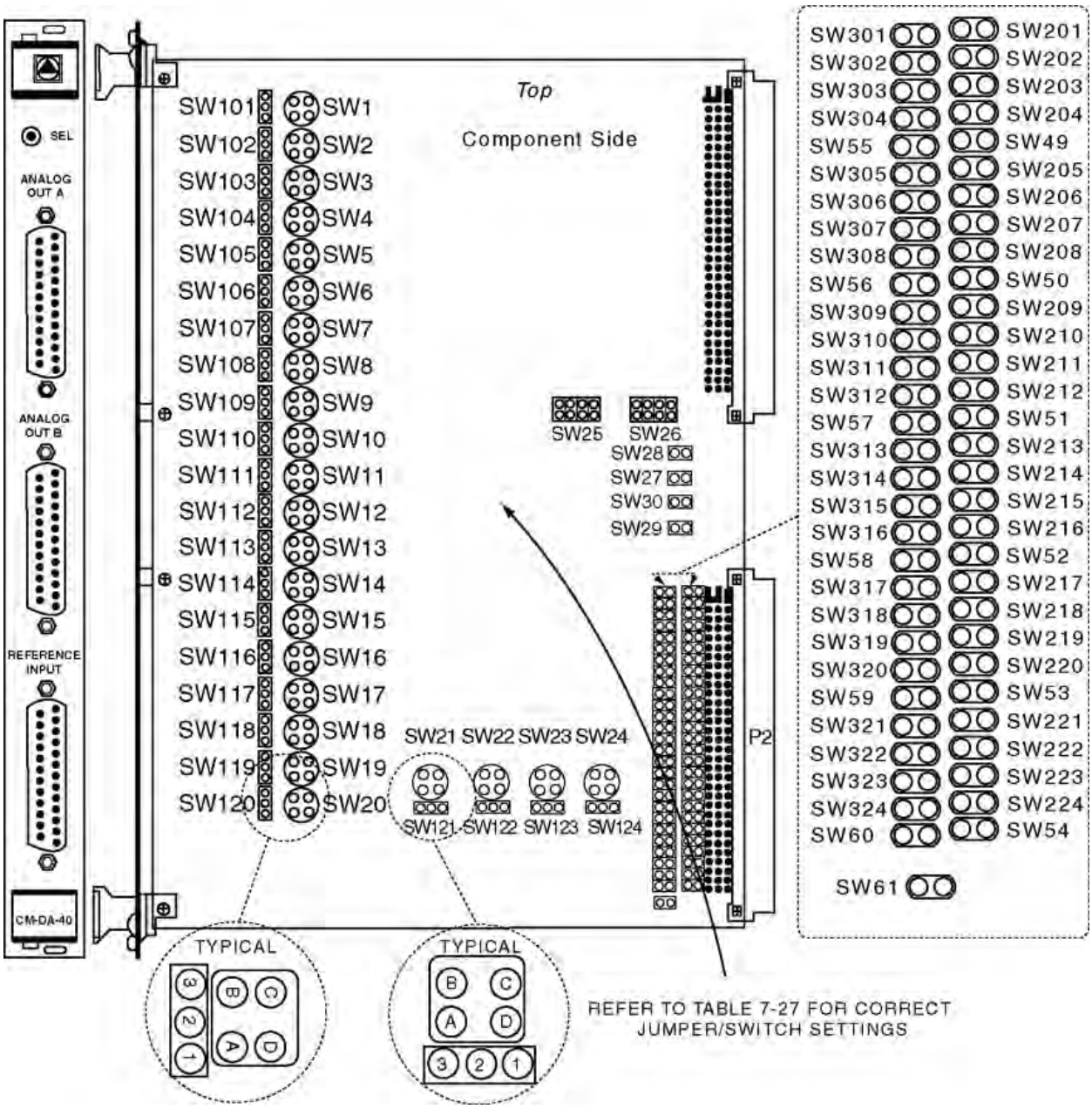


Figure 7-43 Digital To Analog CCA

7.5.3.8.7.2.2 Remove and Reinstall Procedures

Parts required: Cetia D/A CCA, Model CM-DA-40 (GFE) (Figure 7-43).

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Damage to electronic components may result from ESD. Ensure that a properly grounded ESD wristband is worn at all times when handling CCAs and that all work to the CCA is done on a properly installed and approved ESD surface.

a. Prior to performing any remove/reinstall procedure, read, become familiar with, and apply the General Guidelines and Assumptions (section 7.5.2).
b. Obtain an ESD wristband and connect to an appropriate grounding point.
c. Locate and remove the D/A CCA from the VME Enclosure Slot A1.
d. Insert the D/A CCA into a properly approved ESD bag, tag as defective, and return to stock for replacement.
e. Observe proper failure reporting procedure.

CAUTION

POSSIBLE EQUIPMENT DAMAGE! Damage to electronic components may result from ESD. Ensure that a properly grounded ESD wristband is worn at all times when handling CCAs and that all work to the CCA is done on a properly installed and approved ESD surface.

f. Remove the replacement D/A CCA from its shipping carton and inspect for damage.
g. Configure the replacement D/A CCA jumpers to match the removed CCA jumpers (refer to Table 7-29).
h. Install the D/A CCA into the VME Enclosure Slot A1 and secure in place.
i. Energize the VME Enclosure by depressing the AC POWER switch and operate as normal.