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30 Apr 2010

# OPERATION AND MAINTENANCE MANUAL
# FOR THE
# TRACKPOINT 3 USBL TRACKING SYSTEM

## (Includes Models 4450A, 4451A and 4452B)

## (Also, Models 4610B, 4211A & 4740A)



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# Record TrackPoint System Configuration Data

Deck Unit Model: _____S/N: _____

Filter/Limiter S/N: _____ (Portable Only)

Hydrophone Model: _____S/N: _____

(Frequency Band: 8-14kHz [____]; 22-30kHz [____]; Other _____)

(NOTE: Filter/Limiter PCB's and Hydrophone are calibrated as a matched set. An unmatched set will operate but accuracy will be degraded. )

Beacon Model: _____ S/N: _____ Rcv Freq: _____ Xmt Freq: _____

Beacon Model: _____ S/N: _____ Rcv Freq: _____ Xmt Freq: _____

Beacon Model: _____ S/N: _____ Rcv Freq: _____ Xmt Freq: _____

Beacon Model: _____ S/N: _____ Rcv Freq: _____ Xmt Freq: _____

Beacon Model: _____ S/N: _____ Rcv Freq: _____ Xmt Freq: _____

Beacon Model: _____ S/N: _____ Rcv Freq: _____ Xmt Freq: _____

Beacon Model: _____ S/N: _____ Rcv Freq: _____ Xmt Freq: _____

Beacon Model: _____ S/N: _____ Rcv Freq: _____ Xmt Freq: _____

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# GLOSSARY OF TERMS

| NAME | DESCRIPTION |
|---|---|
| Azimuth | Typically used when referencing a target position with respect to North or a compass heading. (Could also refer to a compass heading referenced to north.) |
| Beacon | Any underwater sound source. Sometimes abbreviated as "BCN". |
| Bearing | Typically used when referencing target position with respect to local coordinates, for example with respect to the hydrophone or vessel bow. |
| Consecutive Tracking | Tracking of more than one target by alternating (cycling through) the interrogation signals between all of the targets. |
| Depression Angle | The downward angle measured from the plane of the hydrophone receive elements to the target. (0 deg. to 90 deg.) |
| EPROM | Erasable Programmable Read-Only Memory. Nonvolatile memory in which data can be read from. |
| Horizontal Range | The distance from the hydrophone or offset point to the target on the X, Y plane. (plan view) |
| Hydrophone | An underwater listening device. |
| Interrogate | To cause a response from an underwater device such as a transponder. |
| IPS | IPS is a Windows® based program that interfaces to DGPS and Trackman for lat/long positioning. (**I**ntegrated **P**ositioning **S**ystem) |
| Pinger | An underwater sound source which transmits at a fixed preset rate, asynchronously to a tracking device. |
| RS-232 Interface | A standard interface for serial communications. |
| Responder | An underwater sound source which responds to an electrical signal (interrogated via a hardwired link) and returns with an underwater acoustic reply. Sometimes abbreviated as "RSPDR". |
| Simultaneous Tracking | Ability to track more than one target at the same time, either by triggering synchronously or asynchronously as long as the replies do not arrive at the hydrophone at the same time. |
| Slant Range | The range from a target to the listening hydrophone. (Computed by the travel time from target to hydrophone multiplied by the speed of sound in water.) |
| Telemetering | Can either be a transponder or a responder. It outputs two replies in re- |

| | |
|---|---|
| Beacon | sponse to an interrogation. The first reply is the navigation pulse for the TrackPoint 3 and the second reply is the telemetry pulse. The time delay between the two replies is proportional to the sensor output on the telemetry beacon. |
| Trackman | ORE's Windows based TrackPoint Interface Software. Communicates with the TrackPoint Deck Units to allow modification of the target & system parameters and also outputting of processed data to Navigation packages. |
| TrackPoint 3 | ORE Offshore's Model 4450A USBL Tracking System. A high accuracy survey quality acoustic navigation system. |
| Transponder | An underwater sound source which responds to an underwater signal (device is interrogated acoustically) and returns with an underwater acoustic reply. Sometimes abbreviated as "XPDR". |
| Turn Around Time | A preset time delay, built into a transponder or responder, between when a device is interrogated and when it replies. The delay is calibrated at the xponder to compensate for variations in receiver propagation delays. |
| USBL | Ultra Short BaseLine - A type of acoustic navigation system which utilizes an array of receiving elements spaced very close together (within inches). (As opposed to Long Baseline Systems) |
| VRU | Vertical Reference Unit - Used to compensate for pitch and roll motion of the ship. |
| X | The port (-) to starboard (+) direction which the target is referenced to (e.g., bow of vessel or north). |
| Y | The aft (-) to bow (+) direction which the target is referenced to. (e.g., bow of vessel or north) |
| Z | The targets depth. Referenced from the plane of the hydrophone elements or offset point to the target. |

A "NOTE" message is used to emphasize a certain operation or condition.

**NOTE:** "_____."

A "CAUTION" message is noted where an operational hazard to the equipment could exist.

| C A U T I O N |
| --- |
| |

A "WARNING" is used where an injurious or life threatening condition to an operator, installer or troubleshooter could occur.

| * * * * * * * * * * * * * **W A R N I N G** * * * * * * * * * * * |
| --- |
| |

**NOTE:** Routinely this system is a commercial target tracking system and should not be used as a life saving device with manned submersibles.

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# SECTION ONE

# GENERAL INFORMATION

# 1. GENERAL INFORMATION

The TrackPoint 3 top-side Command/Display Module consists of three 2U chassis' (3.5 inches high each). See Figures 1-1 and 1-2. A 2U TrackPoint Signal Interface Module (Pre-Processor) a 2U TrackPoint Processor running Windows® software along with ORE's "Trackman" (TrackPoint Manager) Software and a 2U Keyboard & LCD monitor. The TrackPoint 3 system is compatible with the existing TrackPoint II components such as the Hydrophone Model 4610B, 4740A/4211A combination Filter/Amplifier & Hydrophone and the deck cable Model 4110B. If upgrading from an older TrackPoint II System, the top-side Command/Display Module (Model 4410) is replaced with this set of rack mounted electronics that fit into the existing space.

The heart of the system is the ORE TrackPoint Model 4450A **Signal Interface Module.** It is an integrated, **U**ltra-**S**hort **B**ase**L**ine (USBL) acoustic signal processor designed to operate with up to four targets simultaneously (Model TP3-S) for a wide range of subsea navigation and relocation tasks. It is contained in a 2U rack mount chassis and interfaces to the Hydrophone and also the Processor Module (running Windows software). It contains the CPU & Signal Processor Cards, Transmitter and power supplies. This module receives signals **from** the Hydrophone's three listening elements and also Transmits signals **to** its interrogation transducer.

The Signal Interface Module interfaces to the ORE USBL Hydrophone Model 4610B via its deck cable Model 4110B. (It can also interface to the Models 4740A VRU/Amplifier and 4211A Hydrophone for improved pitch/roll performance and faster vessel operation (Through-Hull Installation).) The Signal Interface Module receives the signals from the Hydrophone and sends the raw data to the Processor Module for calculation of target position. The target types consist of transponders, responders or free running pingers.

The **Keyboard & LCD Monitor** (Model 4452A) are an integrated unit packaged in a 2U (3.5 inch height) rack mount chassis. It allows the separate use of either device. The keyboard can be pulled out and used to setup TrackPoint parameters, slid back in place and then locked with key to prevent tampering with software/setup. The LCD monitor can be folded down and slid back inside rack if setup or grid display is not required or kept vertical for continuous target viewing.

The **Processor Module** (Model 4451A) is a 2U rack mount chassis containing a P3 Processor (minimum), Windows XP operating system and the new TrackPoint MMI (Man Machine Interface) software, "Trackman" (TrackPoint Manager - ORE's Windows based TrackPoint Interface Software. Communicates with the TrackPoint Deck Units to allow modification of the target & system parameters and also outputting of processed data to Navigation packages.). The Processor Module communicates with the Signal Interface Module (Model 4450A) via one of its RS232 ports. The Processor sends commands / parameter setup data **to** the Signal Interface Module and receives raw beacon-positioning data **from** the Signal Interface Module. The Processor sends the formatted beacon data out another of its other RS232 ports to interface to a Navigation System. It sends video signals to the LCD Monitor to display the target position on the screen. The Keyboard/Mouse provide user interface to the Trackman program.

The TrackPoint 3 Signal Interface Module can also be operated from a laptop instead of the Models 4451A and 4452A. Laptop requires a minimum of one built–in RS232 communications port.

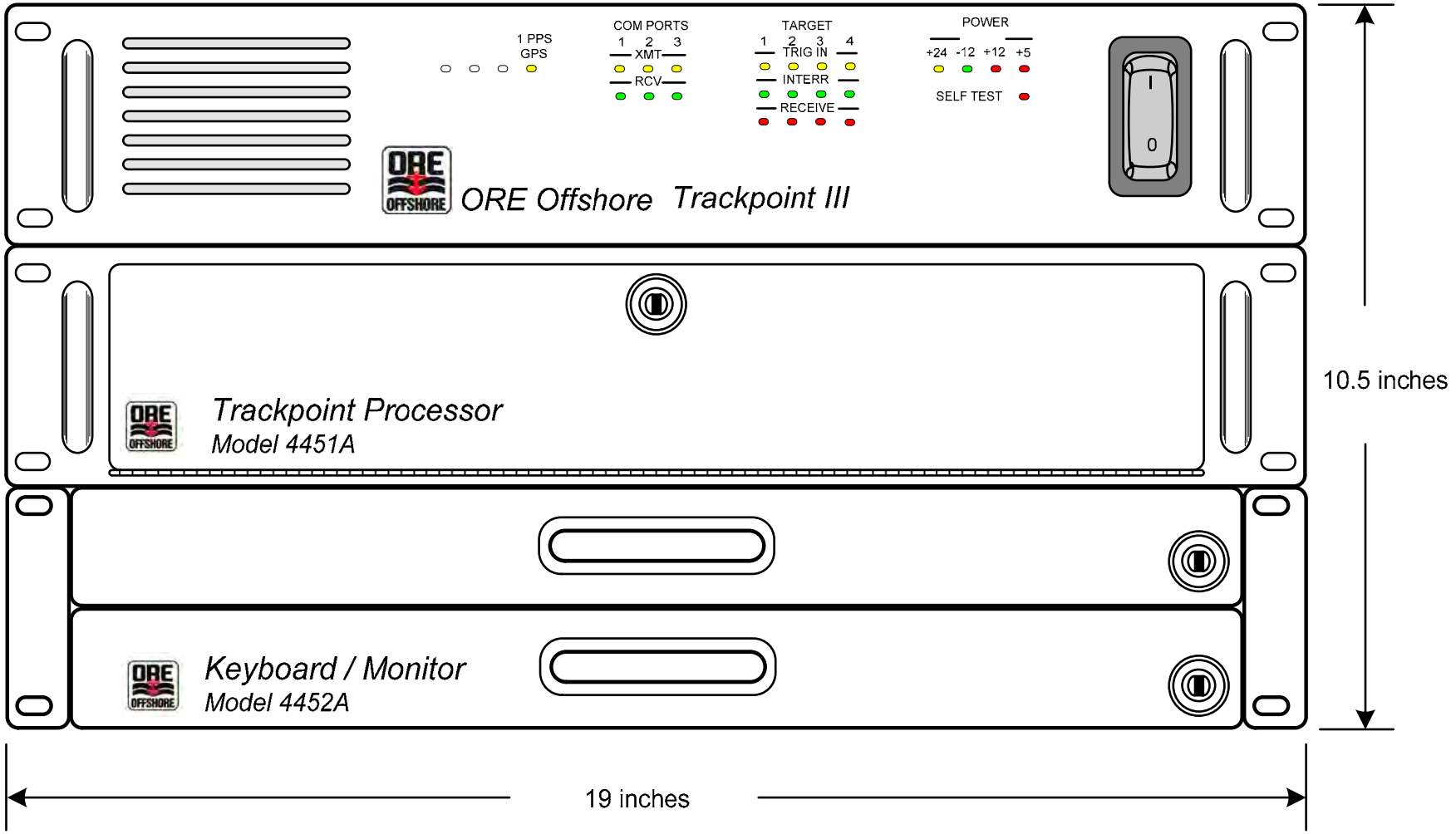
## 1.1 LIST OF TYPICAL TRACKPOINT EQUIPMENT

A typical Rack Mount TrackPoint 3 system consists of the following equipment. See Figure 1-3.

| ITEM | PART NUMBER | DESCRIPTION | QTY |
|---|---|---|---|
| Shipboard: | | | |
| 1. | TP3 CONSOLE | (1) MODEL 4450A TRACKPOINT USBL SIGNAL INTERFACE MODULE<br>(1) MODEL 4451A PROCESSOR MODULE<br>(1) MODEL 4452A KEYBOARD/LCD MONITOR<br>(1) RACK ENCLOSURE | 1 |
| 2. | 4610B | MODEL 4610B HYDROPHONE (22-30 kHz) | 1 |
| 3. | 4110B | MODEL 4110B DECK CABLE | 1 |
| Subsea: | | | |
| 4. | 4330B | MODEL 4330B MULTIBEACON | 1 |
| 5. | 4324C | MODEL 4324C CHARGER | 1 |

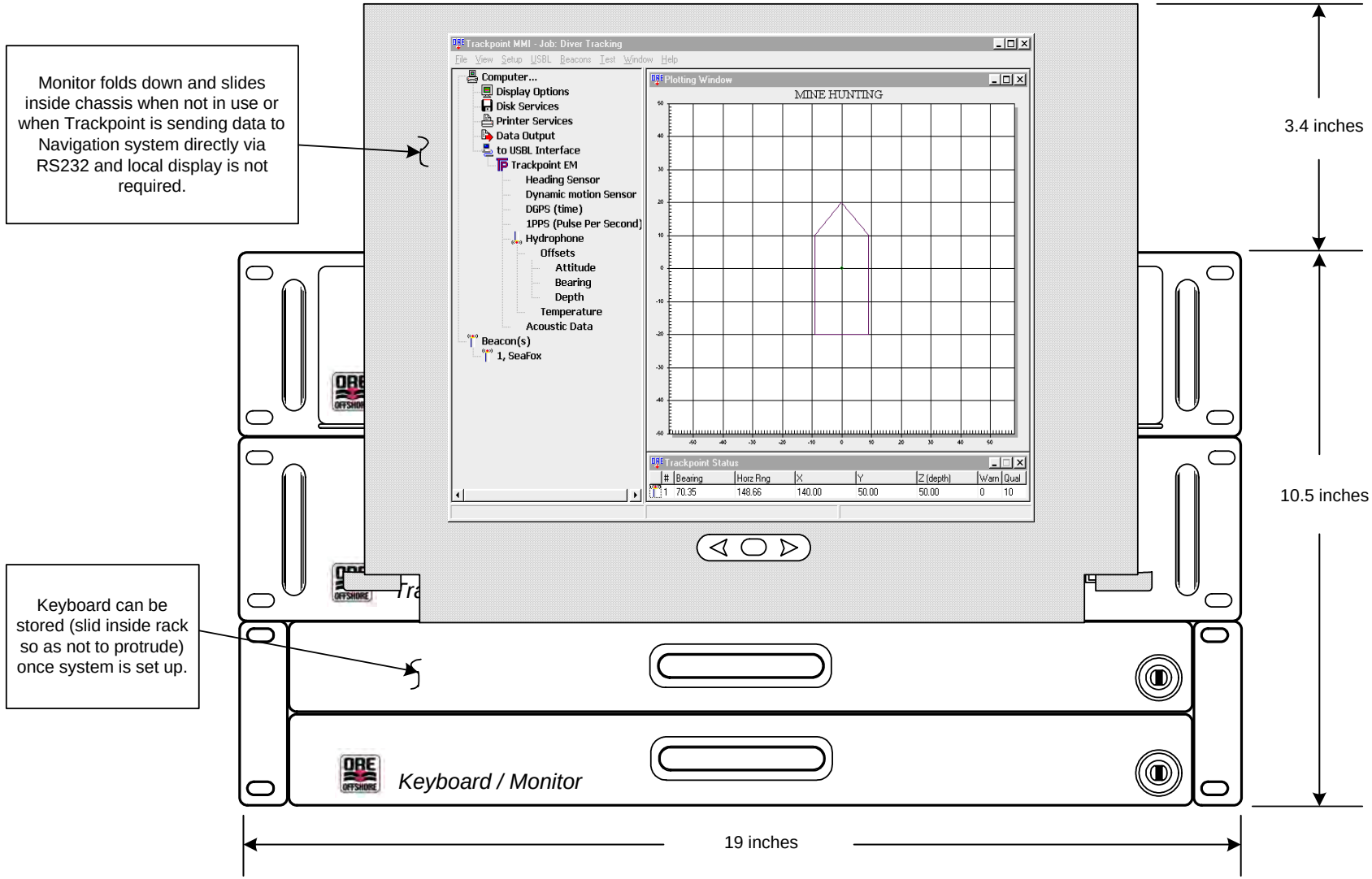
or… System configured as a desk top unit with customer furnished Laptop or PC.

| ITEM | PART NUMBER | DESCRIPTION | QTY |
|---|---|---|---|
| Shipboard: | | | |
| 1. | TP3 CONSOLE | (1) MODEL 4450A TRACKPOINT USBL SIGNAL INTERFACE MODULE | 1 |
| 2. | 4610B | MODEL 4610B HYDROPHONE (22-30 kHz) | 1 |
| 3. | 4110B | MODEL 4110B DECK CABLE | 1 |
| Subsea: | | | |
| 4. | 4330B | MODEL 4330B MULTIBEACON | 1 |
| 5. | 4324C | MODEL 4324C CHARGER | 1 |



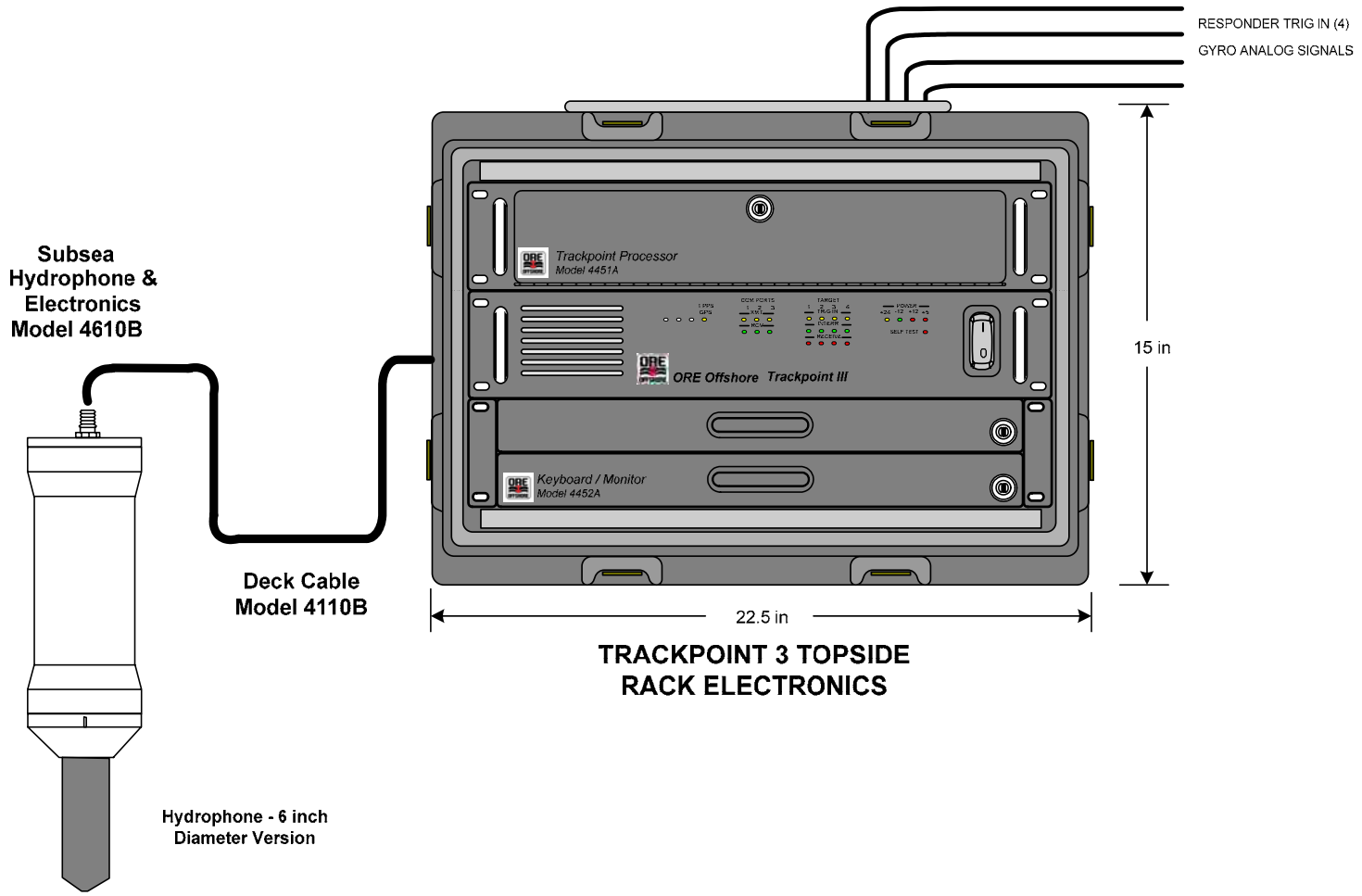

**TRACKPOINT 3 CONSOLE - FRONT VIEW**

**FIGURE 1-1**




**TRACKPOINT 3 CONSOLE, VIEW WHEN IN OPERATION**

**FIGURE 1-2**




**TRACKPOINT 3 TOPSIDE RACK ELECTRONICS**

**TRACKPOINT 3 SYSTEM COMPONENTS**

**FIGURE 1-3**


ORE Offshore
COM 1
COM 2
DEPTH IN
KEY OUT
COMPASS IN
KEY IN
Com3
Com4
Printer
Com2
K/M Combo
Video
Network
Com1

**FIGURE 1-4**

## 1.2 SYSTEM SPECIFICATIONS

| TRACKPOINT 3 SYSTEM | SPECIFICATION: |
|---|---|
| SYSTEM ACCURACY | **SYSTEM** |
| Pinger - Dep angle >45° from Horizontal. Absolute Accuracy in Horizontal Position | +/- 0.75% RMS of Slant Range |
| Transponder/Responder - Absolute Accuracy in Horizontal Position (over entire hemisphere) | ± 0.5% RMS of Slant Range |
| Repeatability Accuracy | ± 0.3% RMS of Slant Range |
| Slant range accuracy | ± 0.5meter RMS (assuming correct speed of sound) |
| Slant Range Resolution | 0.2 meters |
| HYDROPHONE | |
| VRU (STATIC CONDITIONS - NO ACCELERATION) | |
| Range | ± 40° |
| Accuracy 0-10° | ± 0.1° |
| Accuracy 10-45° | ± 1% of angle |
| RECEIVE SIGNAL SPEC | |
| Frequency | 22-30kHz in 500Hz increments |
| Pulse Duration | 1.33ms min; 10ms typ |
| Signal to Noise Ratio | >40dB @ WB filter |
| SIGNAL INTERFACE MODULE | **MODEL 4450A** |
| Processor: | TMS320CV5402 |
| RS232 Ports: | 3 |
| Chassis: | 2U rack Height, Black |
| Dimensions: | ≈ 18.9” (W) x 3.46” (H) x 20” (D) |
| Weight: | 21 lbs (9.5kg) |
| Power: | 100-240 VAC, 50-60Hz, 50 W |
| Sub-assemblies: | CPU, Target Acquisition Module (1), Peripheral Interface Card, Transmitter & Power Supply |

| | |
|---|---|
| Sequential or Consecutive Tracking | Up to 4 Targets |
| DIFF KEY INPUT – RESPONDER (4) | |
| Via rear panel Synchronization connector | Accepts single ended or differential signal input to an opto-coupler.<br>pulse widths min = 200 micro-seconds<br>pulse width max = up to the width of the transmit-out burst |
| TRIGGER OUT | |
| Via rear panel Synchronization connector | Sync for Responder operation;<br>Differential Output (0-5VDC) Either side can be used as a positive or negative TTL pulse when used with GND. |
| ANALOG INPUTS | |
| Analog Voltage input for Depth | Uni-polar 0-6VDC |
| Analog Voltage input for Compass | Uni-polar 0-6VDC |
| Analog Voltage input for Pitch & Roll | ±10VDC input |
| Absolute Accuracy (±10VDC, -10° to 50°C) | 0.27% |
| Resolution of A/D Converter | A/D converter = 16-bits |
| SIGNAL INTERFACE MODULE RS-232 PORTS | |
| Comport #1 | Used for Communications with Processor Module for setup of parameters and sending of target data. |
| Comport #2 | Compass Input, typically |
| Comport #3 | GPS Input for timing, typically |
| 1-PPS INPUT | |
| Via rear panel BNC | Accepts a 1-PPS trigger from GPS ; Opto-coupler input. (future) |
| SIGNAL INTERFACE MODULE TRANSMITTER SPECS | |
| Frequency | 8 - 30kHz in 500Hz increments |
| Pulse Width | 1-15ms in 0.1 ms increments |
| Repetition Rate | 0.5 to 20 seconds |
| Output Power | 100 or 400 Watts into 300Ω Load |
| Sound Pressure Level | 17-20kHz, @ 400W - Nominal 192dB re 1μPa @ 1m |

| | |
|---|---|
| (Hydrophone Interrogator) | |
| SLANT RANGE COUNTER | |
| Slant Range Counter | 0.2 meter resolution |
| | |
| KEYBOARD / LCD MODULE | **MODEL 4452B** |
| LCD Panel: | 17" LCD Panel |
| Display type: | TFT/LCD active matrix color |
| Display Area: | 337.9mm (H) X 270.3mm (V) |
| Viewing angle: | 160 $^{o}$ (H) 160 $^{o}$ (V) |
| Resolution: | 1280 X 1024 (60/70/75Hz) |
| Contrast ratio: | 1000:1 typical |
| Brightness: | 280cd/m cd/$m^2$ typical |
| Pixel pitch: | 0.264mm (H) x 0.264mm (W) |
| Panel color: | 16.2 million display colors |
| Back Light: | 4 CCFTs (Cold Cathode Fluorescent tube) |
| Storage temp.: | -25ºC to 60ºC |
| Operating temp.: | 0ºC to 50ºC |
| MTBF: | 50,000 hours |
| Video Input Signal: | Analog RGB 0.7Vp-p |
| Video Input Conn: | 15-pin D-Sub connector |
| Chassis: | 2U rack Height, Black |
| Dimension: | 19.0 (48.3cm) (W) X 3.5" (8.9cm) (H) X 13.25" (33.7cm) (D) |
| Weight: | 39 lbs (17.7 kg) |
| Power supply: | 100-240V 2A, 50-60Hz, 12V 5A Output (≈75W) |
| PROCESSOR MODULE | **MODEL 4451A** |
| Power Supply: | 300 Watt ATX Power Supply |
| Processor: | Minimum: Intel P3 or P4 - 1GHz + Socket 370 |
| Single Board Computer: | Socket 370 Single Board Computer, P3, 100MHz FSB, w/ |

| | |
|---|---|
| | AGP Video, Ethernet, 2-RS232 ports, 1-Parallel port, PS2-Key\Mouse |
| Memory: | Minimum: 256MB PC133, 32x64 DIMM |
| Hard Drive: | Minimum: 40 GB IDE Hard Drive, 7200 RPM |
| Floppy Drive: | 1.44 MB, 3 1/2" |
| CD ROM: | 56X CD-R0M |
| RS232 Ports: | 4 total |
| Comport #1 | Used for command/setup of TrackPoint and output of data to PINS. Baud Rates adjustable from 2400 to 115k |
| Comport #2 | Used for Communications with Signal Interface Module (19,200 typical) |
| Parallel Port: | 1 |
| Operating System: | MS Windows 2000 Professional SP3 |
| Ethernet Port: | 1 |
| Chassis: | Industrial 2U Rack Height, Black, Fan & Filter, Front door protects disk drives Front panel supports keylock and power switch, reset button & keyboard connector Automatic fan-failure detection |
| Dimensions: | 18.9” (W) x 3.4” (H) x 17.1” (D) |
| Weight: | ≈ 25 lbs (11.4 kg) |
| Power: | 115/230 VAC, 200 W |
| Shock: | 10 G acceleration peak to peak (11 ms) |
| Vibration: | 5~17Hz, 0.1 ”double amplitude displacement; 17~640Hz, 1.5 G acceleration peak to peak |
| MISCELLANEOUS | |
| CONSOLE PHYSICAL SPECIFICATIONS | **NOT INCLUDING RACK ENCLOSURE** |
| Height | 10.5 inches (26.7cm) |
| Width | 17 inches (43 cm) |
| Depth | 20 inches (51 cm) |
| Weight | Estimate : 95 lbs (43kg) |
| | |

| CONSOLE PHYSICAL SPECIFICATIONS | **INCLUDING RACK ENCLOSURE** |
|---|---|
| Weight (including 6U Rack Enclosure, 4450A, 4451A & 4452A) | 107 lbs (48.5kg) |
| ENVIRONMENTAL SPECS | |
| TP3 Console Temperature Rating | Operating: -0° to 50° C |
| | Storage: -25° to 60° C |
| Hydrophone Temperature Rating | Operating: -4° to 40° C |
| | Storage: -40° to 70° C |
| POWER REQUIREMENTS | |
| Voltage | 115-230 AC (auto switching) |
| Frequency | 50-60 Hz |
| Power | 300 Watts |

## TrackPoint Processor to Signal Interface Module S/W Requirement Spec

Set up of parameters for the TrackPoint 3 is via Windows based software. Command and configuration via a menu driven parameter listing. This Windows based software will perform many of the functions the TrackPoint II does today, including data display and plotting, command and configuration setup, and beacon position output to a Navigation Processor. The software receives the raw phase / timing data from the Signal Interface Module, processes it to determine the final X, Y & Z position of each target. This calculated position is typically sent to a Navigation software package / processor for positioning of targets in latitude /longitude coordinates.

# SECTION TWO

# INSTALLATION

# 2. INSTALLATION

This section includes instructions for designing and implementing a 4610B hydrophone mounting assembly, making proper attachment of the deck cable and back panel interconnects. It also includes suggested mounting arrangements for the Model 4211A (3" Hydrophone) and Model 4740A VRU/Amplifier Assembly. The Model 4211A Hydrophone and Model 4740A VRU/Amplifier are calibrated as a set and perform the same function as the complete Model 4610B Hydrophone assembly. Both configurations have the same performance specifications.

Hydrophone bearing, X, Y, Z offsets and pitch/roll offsets are generally determined at the time of installation. This section includes sample procedures for determining those offsets.

## 2.1 HYDROPHONE INSTALLATION

The manner and location in which the hydrophone assembly is mounted on the vessel is the single most crucial element in the overall performance of the tracking system. In choosing a mounting location, the operator should keep in mind that the TrackPoint II is by nature an extremely sensitive acoustic system. The hydrophone assembly must be in a position to "hear" the acoustic pulses coming from the pinger, transponder, or responder in use. Mount the hydrophone as far as possible from noise sources, such as, thrusters, echo-sounder transducers, main engines, generators and other acoustic systems.

Ideally, the hydrophone should be mounted far enough from the nearest reflector to allow the direct arrival of a signal from the acoustic source before a reflected signal arrives. The minimum recommended distance between the hydrophone array and the nearest reflector (which is usually to the vessel's hull or keel) is one meter*. It is also important to keep the hydrophone below the level of the vessel's keel for 360-degree coverage.

System performance can be degraded by "multi-path," or underwater signal reflections and reverberation. To minimize the possible effects of multi-path, choose a hydrophone location that is as far away as possible from any surface that would make a good reflector of an acoustic pulse. Any hard plate or structure near the hydrophone has the potential to reflect pulses into the hydrophone. The air-water interface is also an extremely efficient acoustic reflector. Avoid any mounting locations that would place the hydrophone in the proximity of bubbles.

* 1 meter = (1.33 milliseconds x 1500 meters/second) ÷ 2 way travel time

Consult the nearest ORE representative for additional information on a specific installation.

### 2.1.1 4610B SUGGESTED HYDROPHONE MOUNTING ASSEMBLY

The main function of the mounting assembly is to support the hydrophone vertically in the water. Mount it at reasonable distance from the vessel's hull and below the level of the keel. The mounting should be rugged enough to withstand the expected forces during the planned operation, and easy to raise and lower. The type and size of the mounting recommended for the TrackPoint 3 hydrophone varies with the size of the surface vessel and the intended application.

The Model 4610B Hydrophone is supplied with a universal mounting bracket. The mounting bracket attaches to the end of a suitable length of pipe. Choose the size and material of the pipe according to the application. With the system in operation and underway at several knots, a five or six-inch schedule 80 steel pipe with angle-iron fairings is recommended. On small vessels, the TrackPoint 3 has been used with the hydrophone mounted to a two-inch aluminum pipe. Figure 2-1 illustrates a suggested mounting arrangement typical for slow-speed operation. Refer to drawing 100909 for mounting flange dimensions.

In the suggested mounting illustrated in Figure 2-1, a length of pipe with an inner diameter slightly greater than 3 inches is permanently attached to the deck. A length of pipe with a 3-inch outer diameter, permanently attached to the mounting pole, is fitted into the larger pipe and secured with a locking pin. This secures the mounting pipe to the vessel for use, but allows the pipe to be removed if necessary.

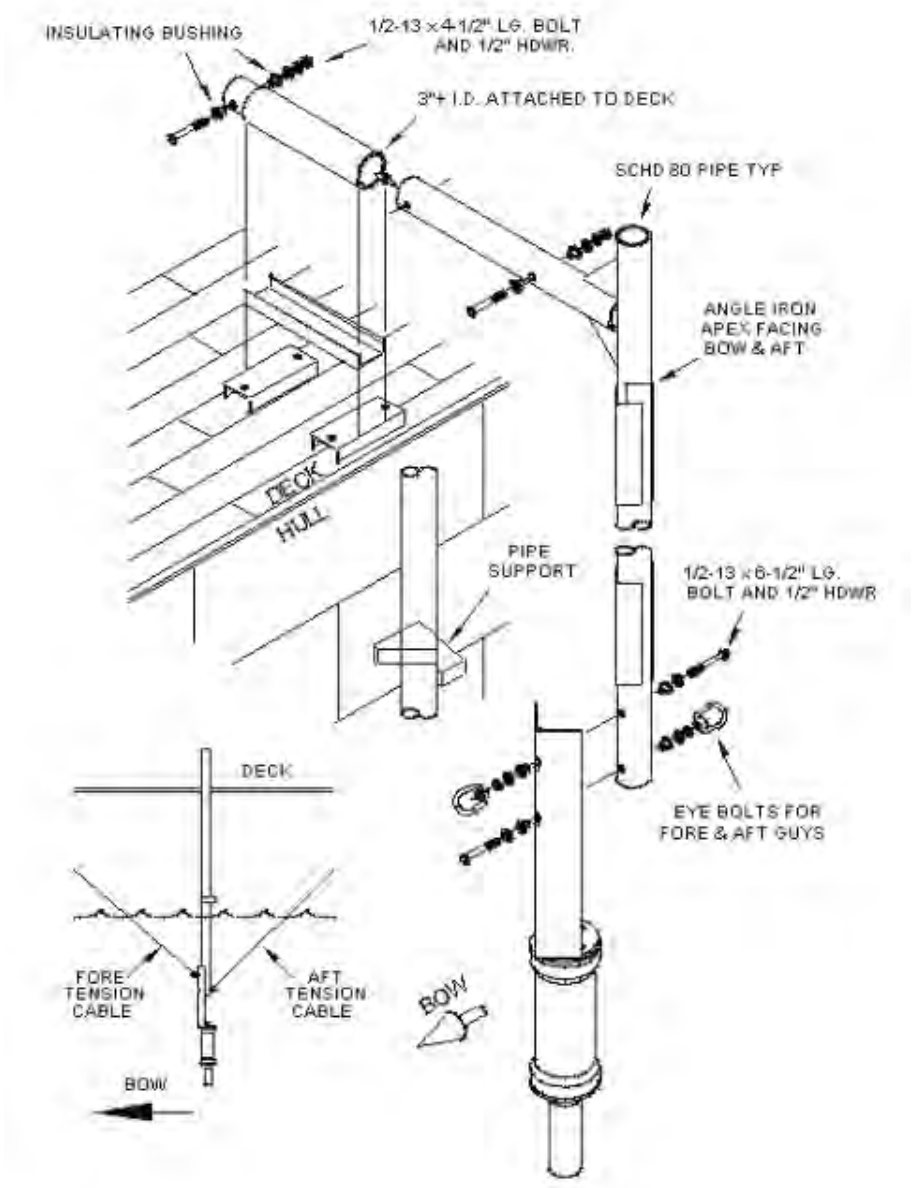
A support plate near water level helps secure the pipe in a vertical position. The angle iron on the underwater portion of the pipe adds stiffness and reduces vibration.

The mounting bracket and hydrophone are attached to the lower end of the pipe with eye bolts. The pipe has forward and aft guys leading from the point of attachment and secured on deck to prevent bending or swaying.

In general, consider the following when designing the hydrophone mounting.

1. The mounting pipe should be long enough to position the hydrophone below the vessel keel when in the vertical position.
2. The pipe used should be stiff enough to prevent vibration or strumming when the vessel is underway.

**FIGURE 2-1**




3. Attach the pipe to the side of the vessel so that the pipe and hydrophone assembly can be easily removed and set on board, if required, to tie the vessel up alongside other vessels or at dockside.

4. The entire assembly should be easy to raise and lower with available manpower or winches.

5. Hydrophone heading (appointed by the index mark) should align with vessel heading.

6. Forward and aft guys are used to hold the mounting pipe in vertical position.

7. A cradle or stop should be used to ensure that the hydrophone returns to the same position each time it is deployed.

#### 2.1.1.1 ATTACHING MOUNTING BRACKET TO PIPE

The hydrophone mounting bracket typically attaches to the mounting pipe by drilling two 1/2-inch (13-mm) holes through the end of the pipe. Space the holes six inches (15.3 cm) apart, and align parallel to the centerline of the vessel. The fore and aft alignment is important in determining hydrophone offsets (section 2.3).

When drilling the lower hole, keep in mind that you need enough space between the end of the pipe and the connector on the top of the hydrophone itself to connect and disconnect the cable. For this reason, we recommend that the lower mounting hole be no more than two inches (5 cm) from the end of the pipe.

If you are using a mounting pipe with a sufficient inside diameter to allow the hydrophone cable to be fed through to the hydrophone, remember to run the cable through the pipe before placing the 1/2-inch (13-mm) bolts in the mounting holes, as the connector will not pass when the bolts are in place.

#### 2.1.1.2 ATTACHING HYDROPHONE TO MOUNTING BRACKET

The index mark on the hydrophone assembly (see Figure 2-2) indicates the hydrophone heading. The "spine" of the mounting bracket should be aligned with the index mark on the hydrophone. The face of the mounting bracket fits over the hydrophone end cap and is bolted on as shown.

### 2.1.2 4211A SUGGESTED MOUNTING INSTRUCTIONS

The model 4211A Hydrophone is intended for installation through a hull mounted gate valve. The hydrophone is first installed in a mounting staff and the mounting staff is projected through a gate valve. This allows for ease of deployment, recovery and maintenance of the hydrophone. An example of a gate valve type installation is shown in Figure 2-3. For information on the Model 4630D Motorized Gate Valve System contact ORE Offshore.

Figure 2-4 (4211AE0008) shows the suggested machining dimensions necessary for mounting the hydrophone to a staff.

NOTE: The hole next to the alignment slot in the staff is the BOW reference point.

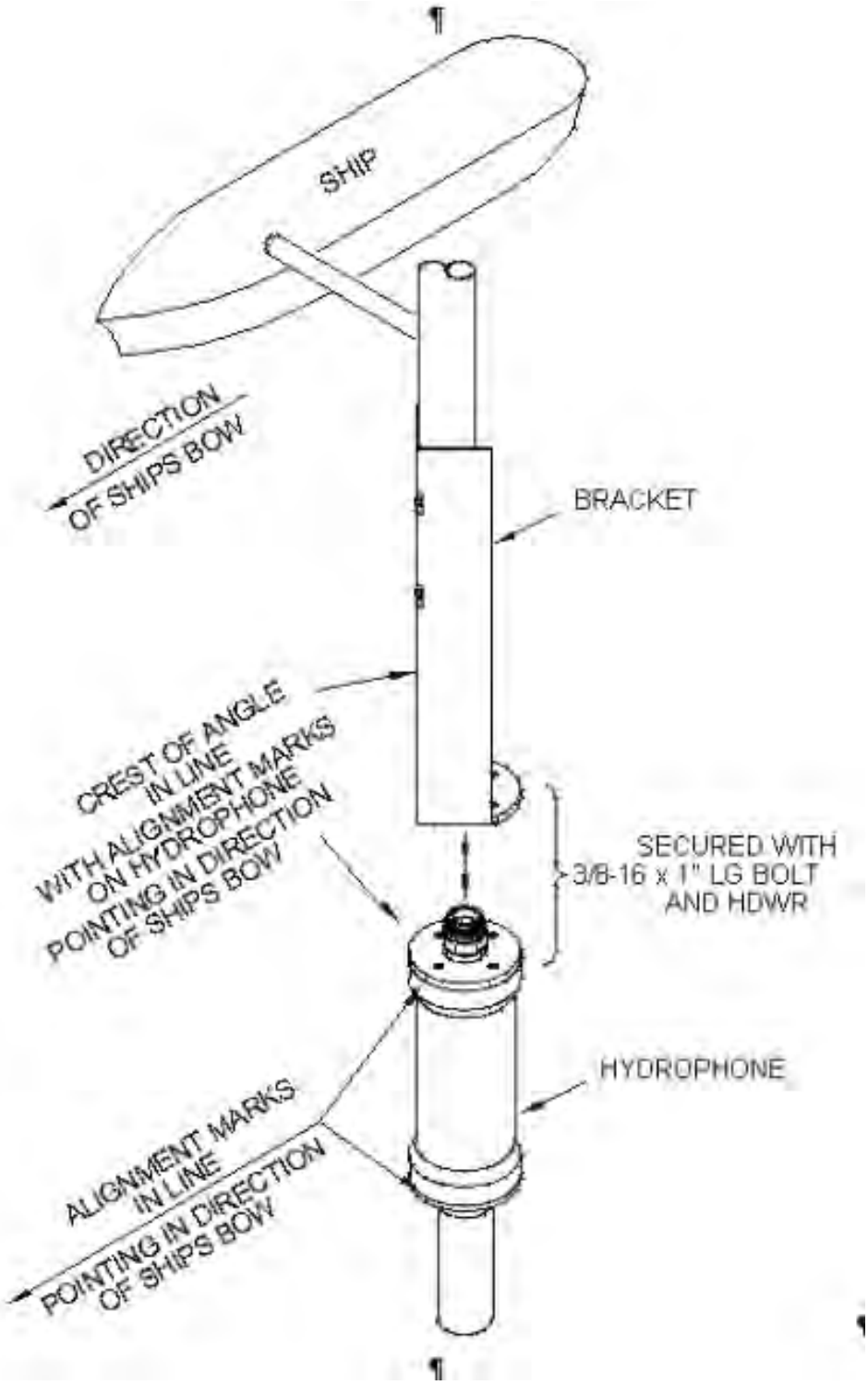
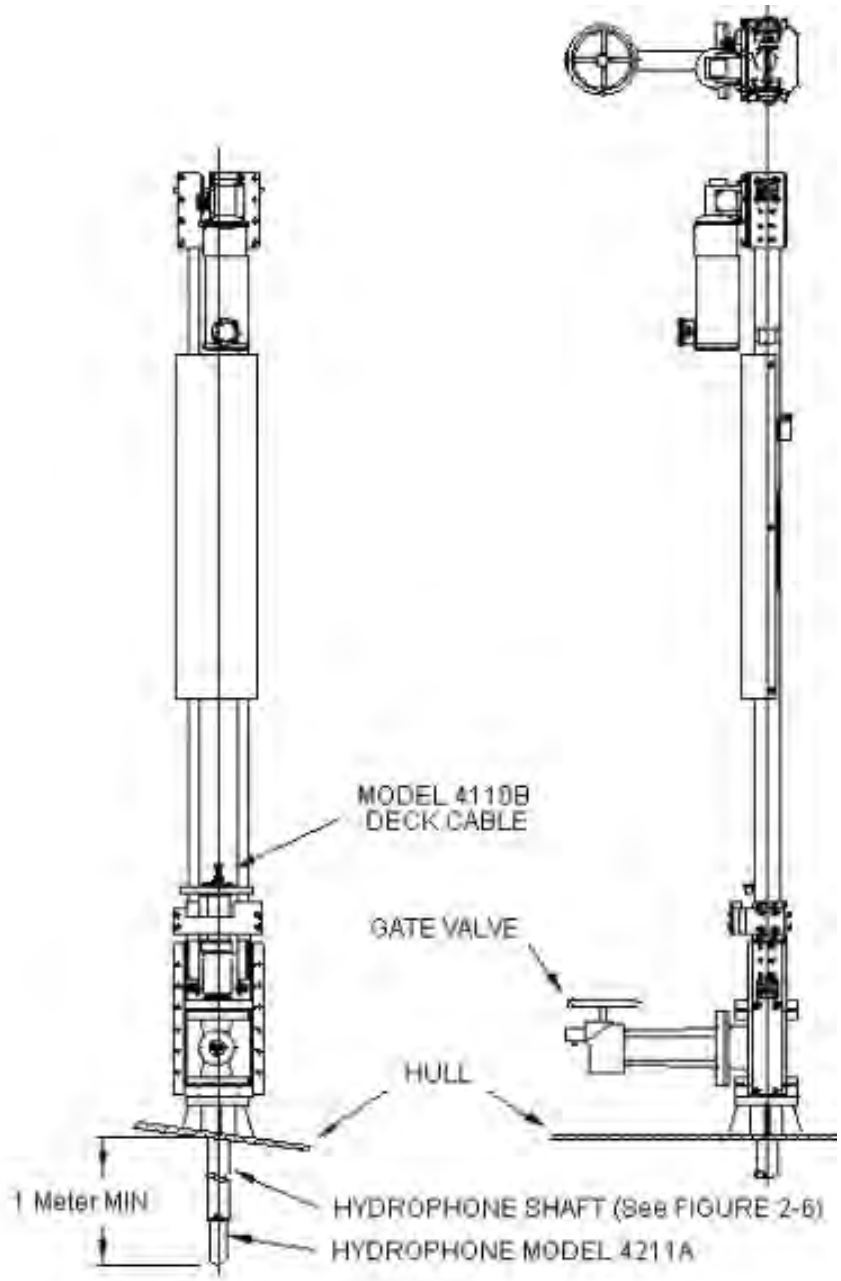
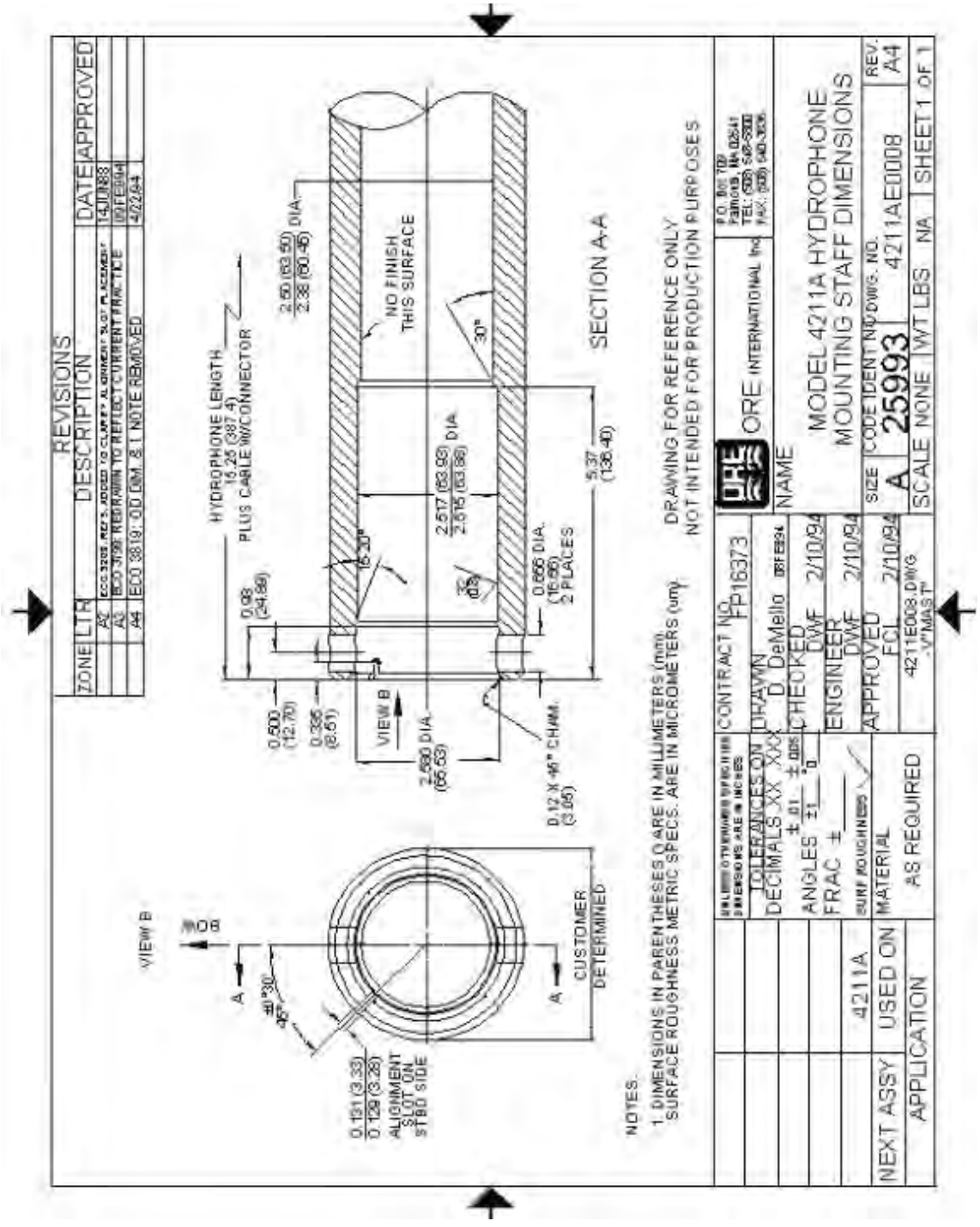

SHIP
DIRECTION OF SHIPS BOW
BRACKET
CREST OF ANGLE IN LINE WITH ALIGNMENT MARKS ON HYDROPHONE POINTING IN DIRECTION OF SHIPS BOW
SECURED WITH 3/8-16 x 1" LG BOLT AND HDWR
HYDROPHONE
ALIGNMENT MARKS IN LINE POINTING IN DIRECTION OF SHIPS BOW

**FIGURE 2-2**




GATE VALVE TYPE INSTALLATION

**FIGURE 2-3**




Hydrophone Mount Machining Diagram

**FIGURE 2-4**

The hydrophone mounting staff must extend the hydrophone far enough from the nearest reflector, allowing the direct arrival of a signal from the acoustic source before a reflected signal arrives. This

distance is a minimum of 1 meter. It is also important to keep the hydrophone below the level of the ship's keel for good 360 degree coverage.

When designing the hydrophone mount/deployment system keep in mind that the shaft be keyed to allow a repeatable bearing orientation. This ensures that the bow reference always returns to the same fixed position when the hydrophone is deployed.

The gate valve/mounting staff assembly should be installed in as close to a vertical position as possible.

The hydrophone mount can be installed offset from the centerline of the vessel. An X and Y offset can be input to the C/DM to correct for these offsets. Refer to section 2.3.

### 2.1.3 4740A VRU/AMPLIFIER SUGGESTED INSTALLATION

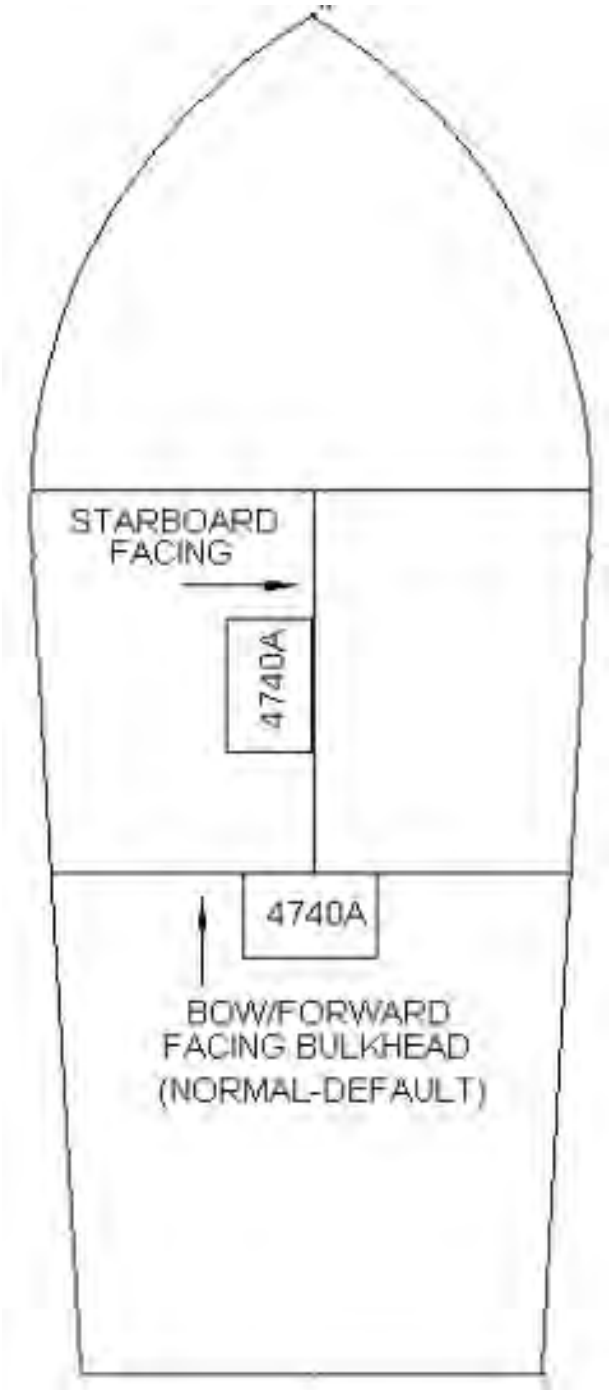
The Model 4740A VRU/Amplifier should be installed as close to the pitch and roll center of the vessel as possible. This reduces positional errors introduced by the VRU due to the horizontal acceleration the unit experiences. It is typically mounted to an interior bulkhead or other convenient vertical structure. The normal installation configuration is with the 4740A mounted on a bow (forward) facing bulkhead. Refer to Figure 2-5. If the 4740A cannot be mounted in this configuration then it can be mounted 90°,180° or 270° offset from it. The menu parameter VRU/ORIENTATION compensates for this offset by switching between NORM (bow facing bulkhead mtg), STARBOARD, AFT or PORT. Refer to section 2.3.

Keep in mind that the deck cable lengths are typically 100ft. This allows the C/DM to be mounted a maximum of 100ft from the VRU/Amplifier and the VRU/Amplifier mounted 100ft from the hydrophone.

### 2.1.4 CONNECTING DECK CABLE

Before connecting the deck cable to the hydrophone end cap, check that both the O-ring in the end cap and the O-ring in the connector are in place. Clean thoroughly both the end cap and the cable connection with a cotton swab or tissue, and lubricate the O-rings. Refer to Figure 2-6, Deck Cable Diagram.

A barium-based O-ring lubricant* is supplied for this purpose and is recommended over silicone-based lubricants. Exercise care to avoid contamination of the hydrophone by any type of grease or oil.




MODEL 4740A INSTALLATION

**FIGURE 2-5**

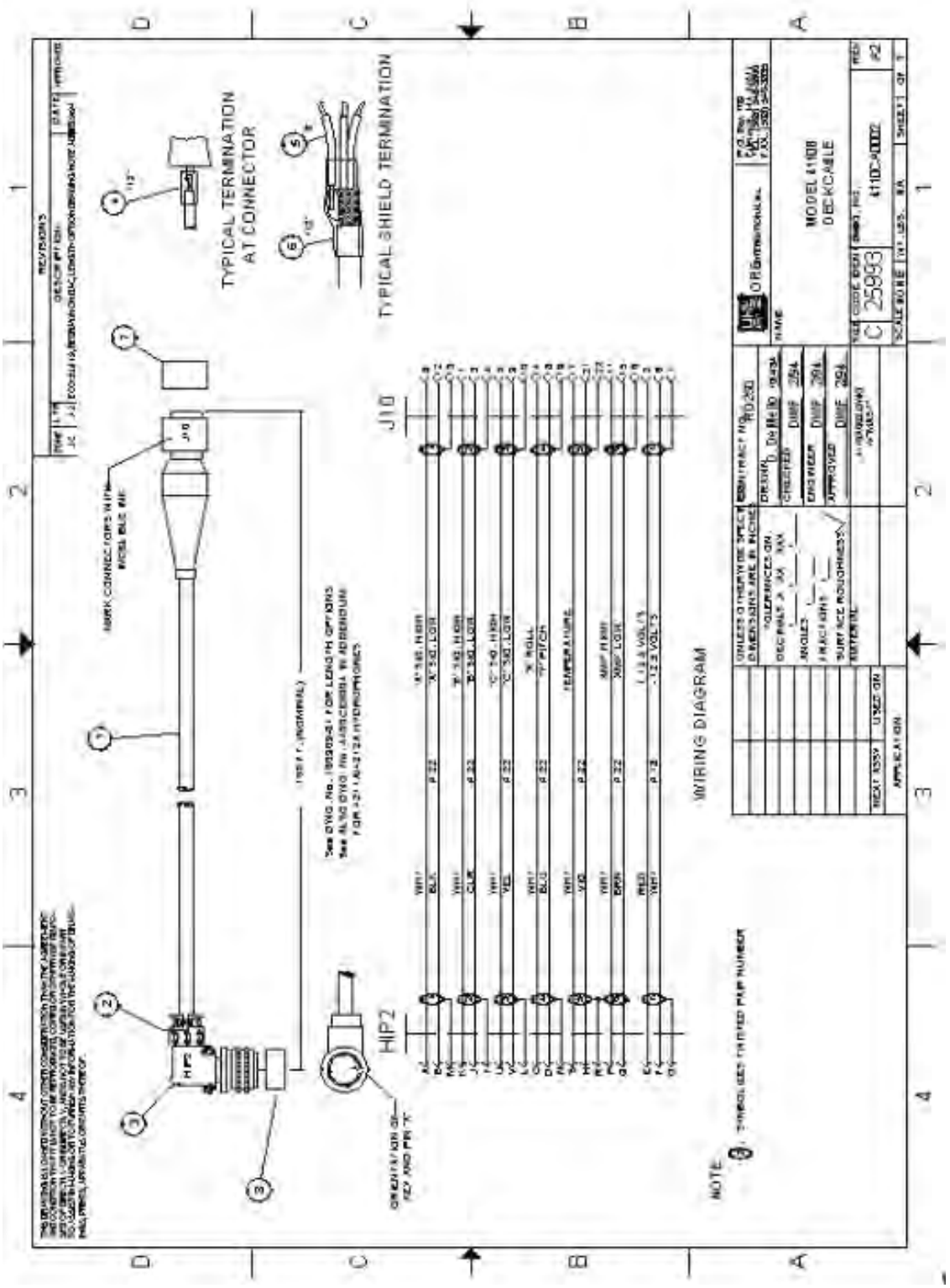



**FIGURE 2-6**

CAUTION

DO NOT use silicone grease to lubricate the O-rings. Should silicone come in contact with the hydrophone potting, proper sound transfer from water to hydrophone will be prevented. Attempting to remove silicone from the hydrophone can damage the potting material.

The cable connection fits into upper and lower guides in the end cap, tighten securely by hand.

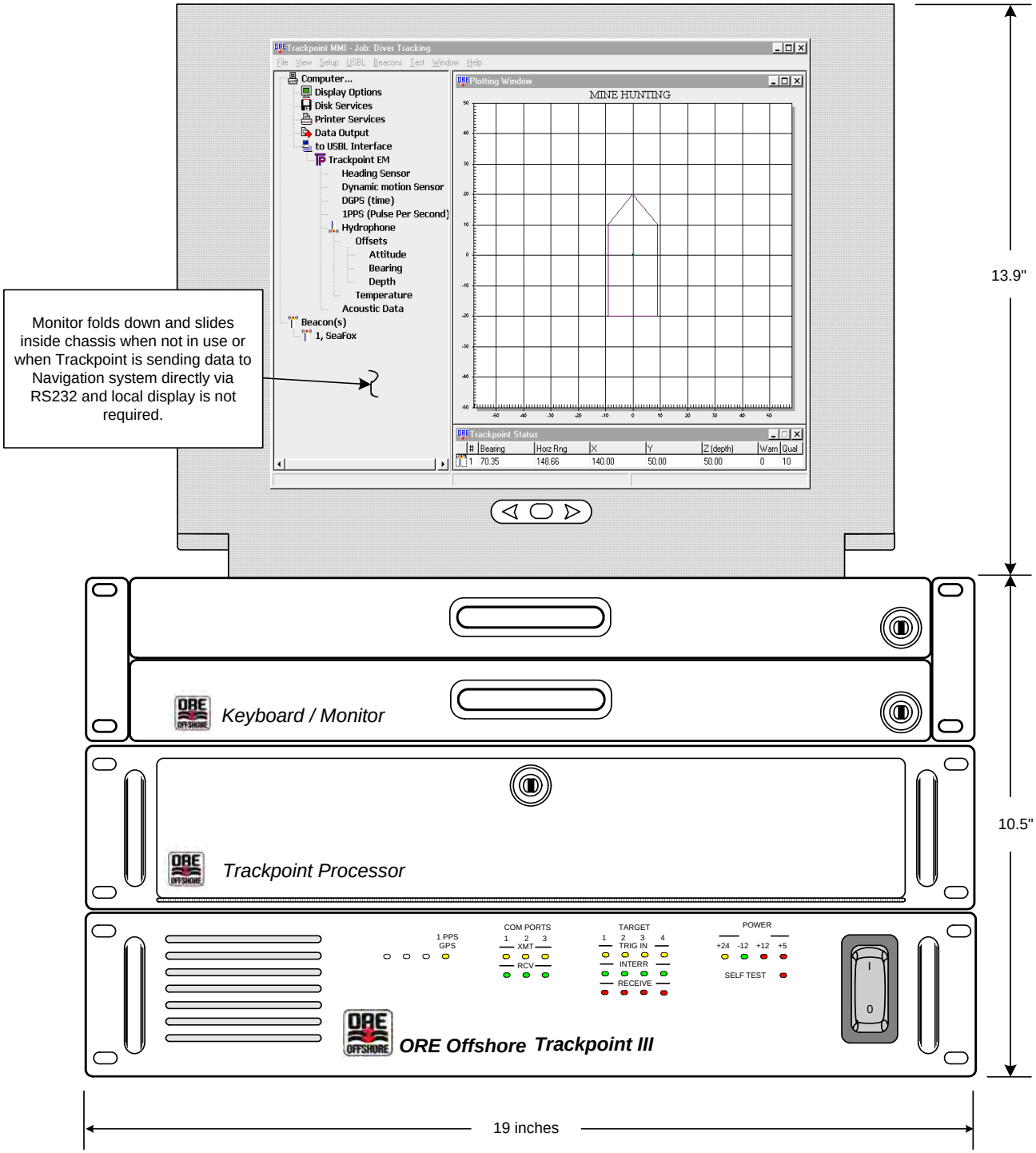
NOTE: To ease Cable-to-Hydrophone connector mating, once guides line up, apply force with one hand on the Cable potted section while threading the stainless steel locking sleeve over the Hydrophone connector. This is to prevent overstressing the molded threads, thus stripping the connector or galling of the stainless threads (if applicable).

* Parker O-ring lubricant.
Parker Seal
P.O. Box 11751
Lexington, KY 40512

## 2.2 TRACKPOINT 3 CONSOLE

The convenience and comfort of the operator are the primary considerations for installing the rack mounting console. The system consists of three separate 2U enclosures (3.5 inches high each); Model 4450A Signal Interface Module, Model 4451A Processor Module and Model 4452A Keyboard/Display Module. Place the unit where it is most conveniently operated and protected from foul weather and sea spray. E.g., Indoors in a 19 inch rack mounting enclosure. If space permits the Keyboard/Display can be configured as shown in Figure 2-7, with the Display at the top. This allows the Display to be locked into position to keep from sliding and also allows operator to view the Signal Interface Module's LED's. For an alternate configuration see Figure 1-2; the Display is on the bottom which has the least impact on equipment mounted above the system, but requires a hold-down bracket to keep Display from sliding with the motion of the vessel.

The system requires the following inter-connections along with a suitable power source and free access for connecting the deck cable.




**TRACKPOINT 3 CONSOLE WITH DISPLAY AT TOP**

**FIGURE 2-7**

Inter-module connections:

- Video out from Processor Module to Keyboard/Display
- Keyboard Input from Keyboard/Display to Processor
- Mouse Input from Keyboard/Display to Processor
- RS232 from Processor to Signal Interface Module
- Hydrophone Deck Cable to Signal Interface Module

### 2.2.1 LINE VOLTAGE (IEC CONNECTOR)

The TrackPoint 3 Module's line voltage can be in the range of 98 to 132 or 170 to 264; 50 or 60 Hz. The unit automatically switches to the higher range when the voltage is sensed. If the voltage goes below the high range minimum or 170, the system does not automatically switch to the lower range, it must be turned off and on again. Connect the three modules to a suitable power source.

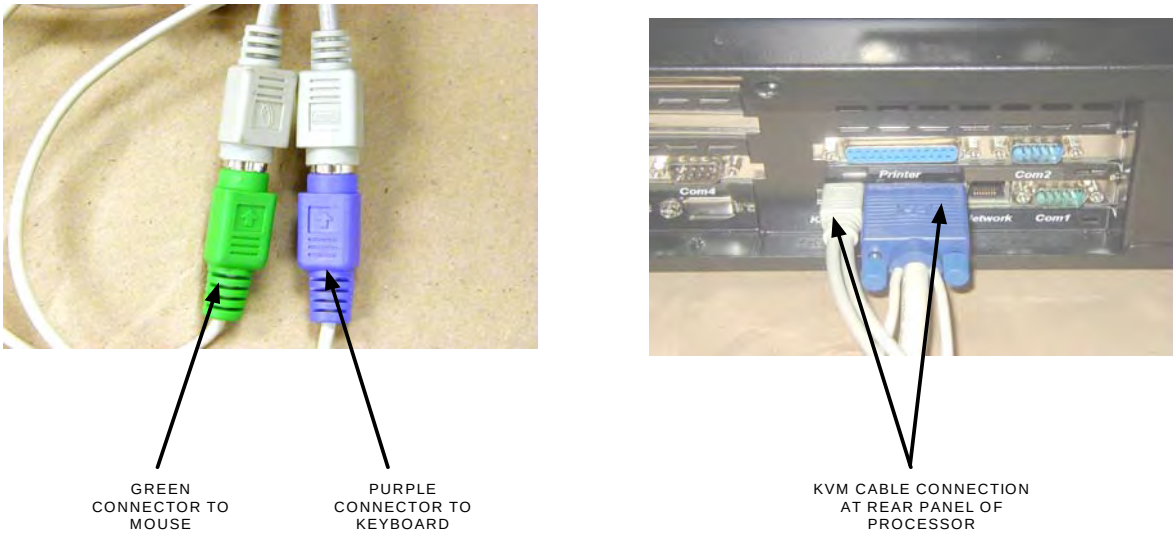
### 2.2.2 VIDEO

Connect the "Y" cable from the Processor K/M Combo connector to the Keyboard/Display Mouse connector and Keyboard connector. The Green Keyboard/Display cable goes to the Mouse connector on the Processor's K/M Combo cable and the Blue goes to the Keyboard connector on the Processor's K/M Combo cable. See Figure 2-8.

### 2.2.3 RS-232 CABLE WIRING (BETWEEN SIM & PM)

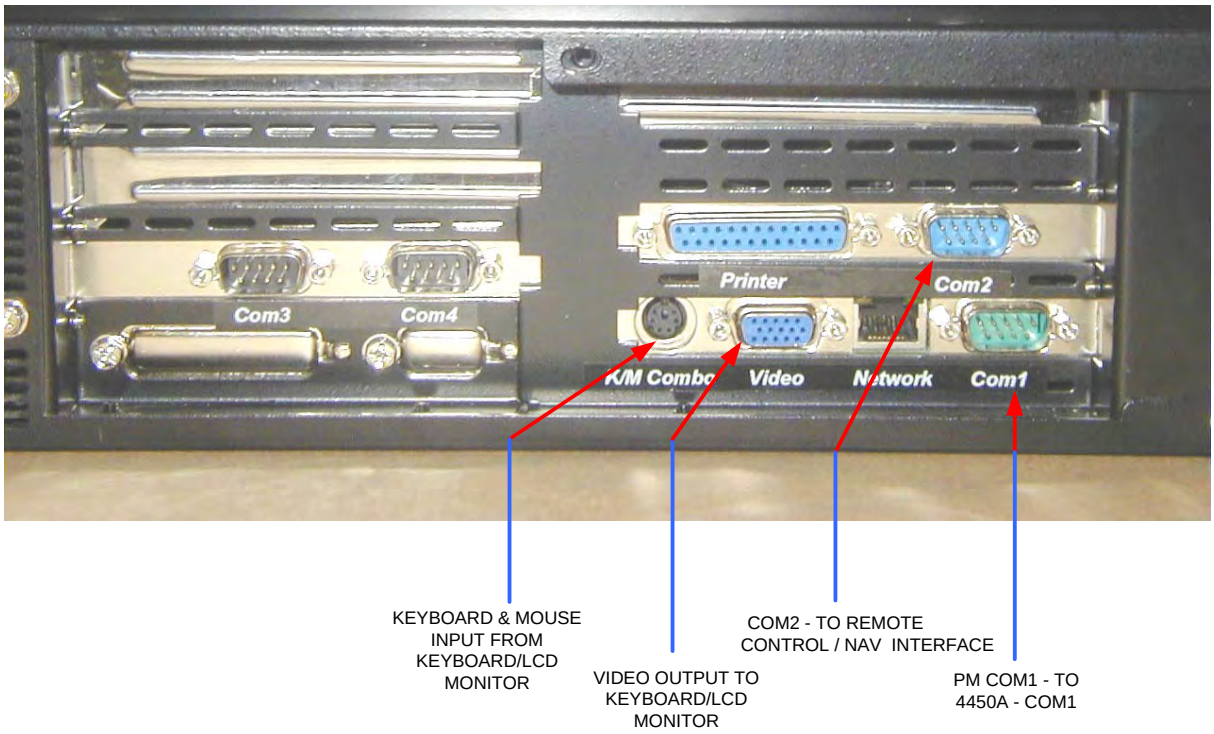
Connect the Processor Module's 9-pin COM1 connector to the Signal Interface Modules 9-pin COM1 connector. Refer to Figures 2-9, 2-10 and 2-11. The TrackPoint (SIM) RS-232 interface is designed to act as a "DCE" (Data Communication Equipment) device. It does NOT require a NULL modem to connect between the two units. This communication link configures the Signal Interface Module (target & system parameters using SPC packets) via commands from the Processor's Trackman (Windows® program) and also sends target data to the Processor Module for further processing.

NOTE: Connect the RS-232 cables between each device before turning on the TrackPoint or the terminal. If the RS-232 cable is connected after Signal Interface Module is turned on, the unit may experience microprocessor malfunctions. Turn power off and then on again to reset unit. The cable wiring is shown in Figure 2-11.



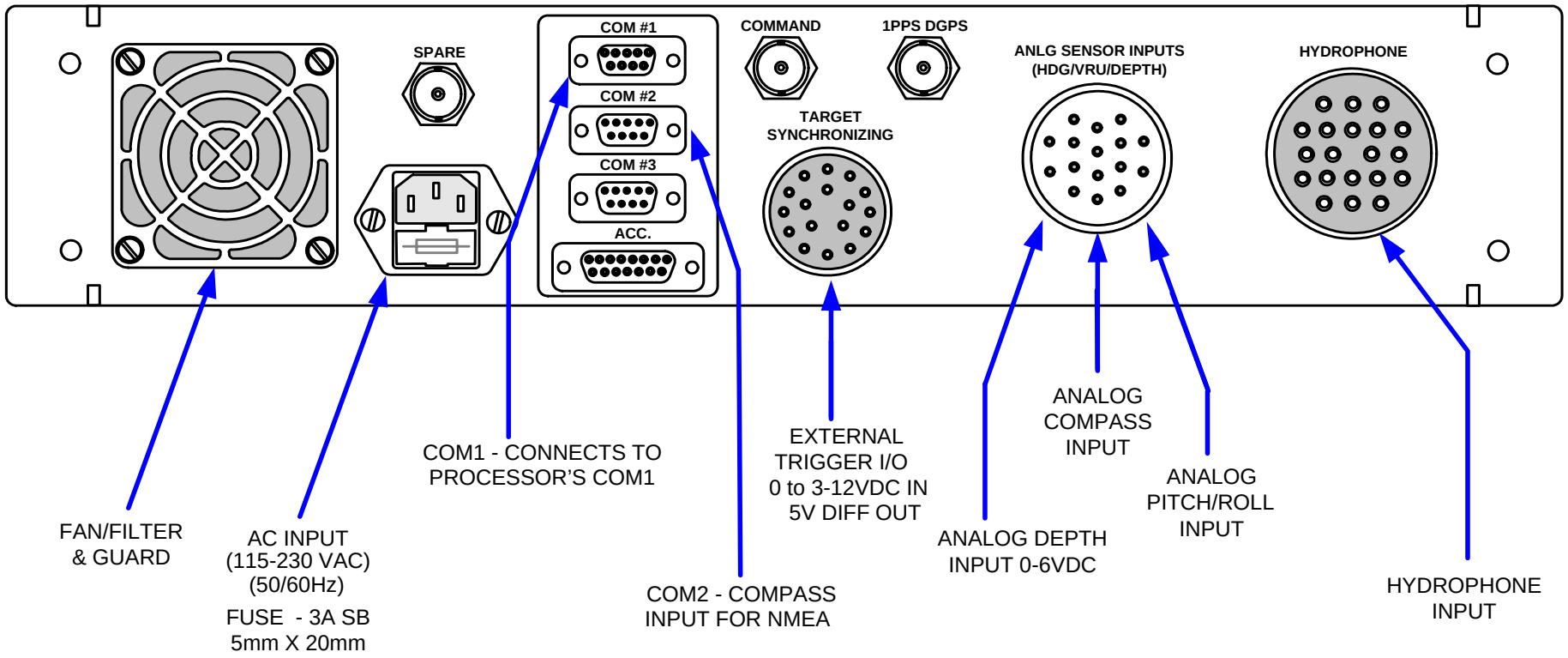

**PROCESSOR MODULE MODEL 4451A KVM CABLE INSTALLATION**

**FIGURE 2-8**




**TRACKPOINT PROCESSOR MODULE MODEL 4451A REAR PANEL**

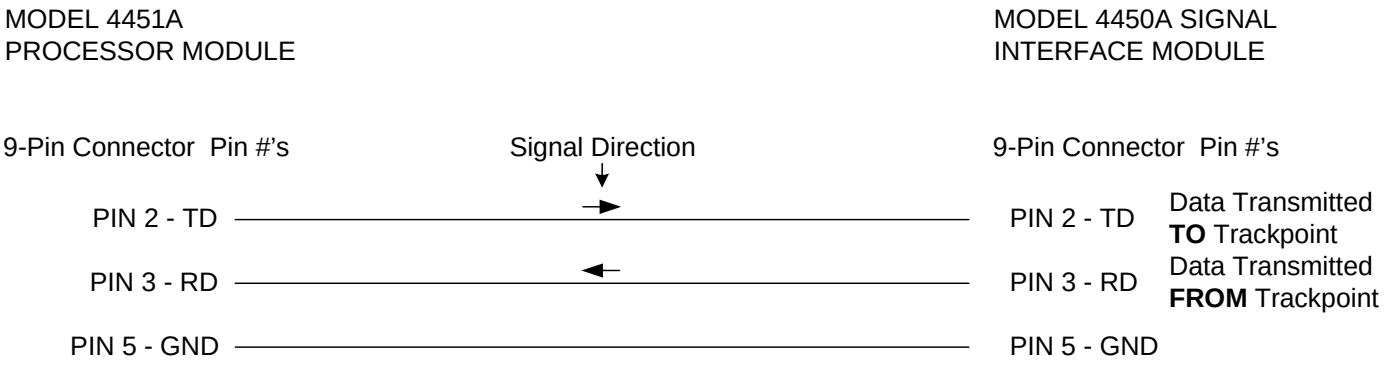
**FIGURE 2-9**




**TRACKPOINT SIGNAL INTERFACE MODULE REAR PANEL CONNECTIONS**

**FIGURE 2-10**

**RS232 CABLE CONFIGURATION**




**TRACKPOINT COM#1 INTERFACE**

**FIGURE 2-11**

### 2.2.4 HYDROPHONE CABLE

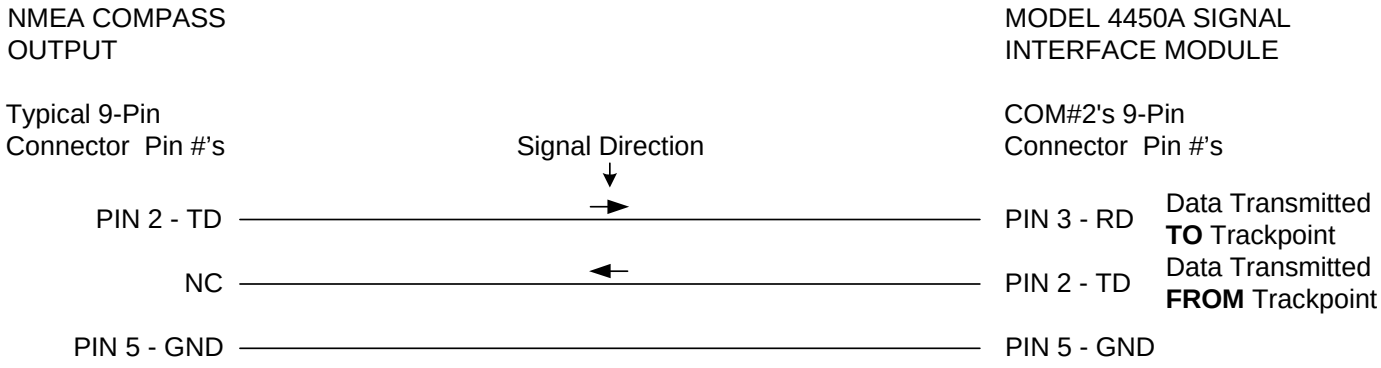
Connect the Hydrophone Deck Cable Model 4110B from the Hydrophone to the Signal Interface Module, Model 4450A.

## OPTIONAL INTERFACE INTER-CONNECTS...

### 2.2.5 SIM - COM#2 COMPASS NMEA INPUT

The Signal Interface Module (Model 4450A) COM #2 I/O port is wired the same as a PC ("DTE", Data Terminal Equipment). It is used for the input of NMEA compass data. See Figure 2-10 for Rear Panel location and Figure 2-12 for wiring.

**COM#2 RS232**
**CABLE CONFIGURATION**




**TRACKPOINT COM#2 INTERFACE**

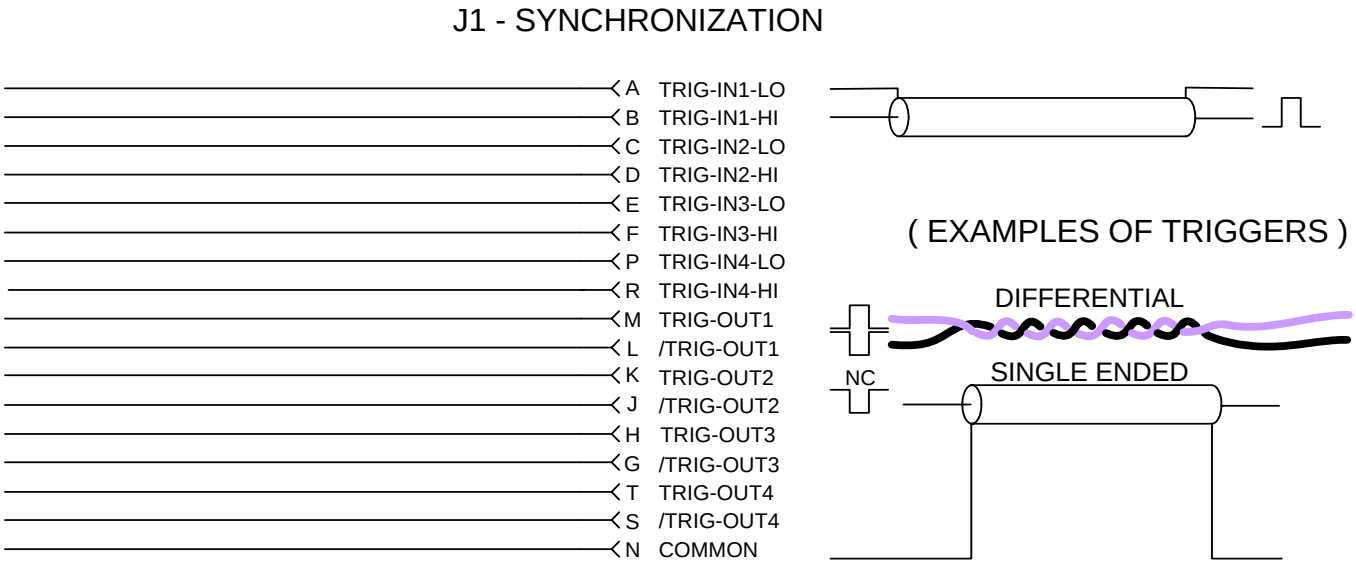
**FIGURE 2-12**

## 2.2.6 SIM - SYNCHRONIZATION INTERFACE

### 2.2.6.1 SIM - REMOTE-IN TRIGGER

The TrackPoint can be externally triggered via the rear panel SYNCHRONIZATION connector (MS-3102A-20-29S). A mating connector (MS-3106A-20-29P) can be connected between an external key source (trigger source can range from TTL to +15V) and the TrackPoint Interface Module. See Figure 2-13. Each Target Acquisition Module (4) can be triggered independently of the other. Connect the external trigger between the IN-LO and the IN-HI.

NOTE: The REMOTE-IN trigger is optically coupled.




**TRACKPOINT TRIGGER SYNCHRONIZATION INTERFACE**

**FIGURE 2-13**

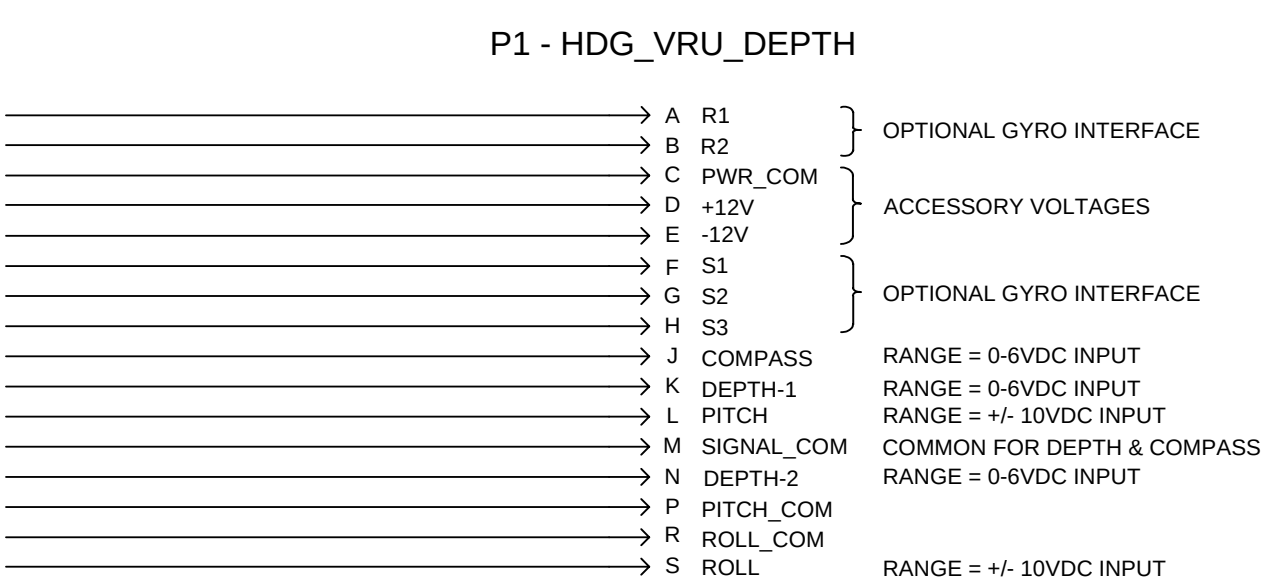
### 2.2.6.2 SIM - TRIGGER-OUT

The TRIGGER-out is a differential TTL-compatible pulse occurring at the time of interrogation for a transponder or a responder. This TRIGGER out pulse is present simultaneously with the leading edge of each interrogation pulse. The output can be configured as either differential or positive / negative single ended when used the COMMON line.

## 2.2.7 SIM - HDG/VRU/DEPTH ANALOG INTERFACE

The ANALOG SENSOR input connector is a 16-pin MS/AN type, P/N MS3102A24-5P, and is labeled **"HDG/VRU/DEPTH"**. This connector allows input of both the synchro and reference signals from an external gyro compass, an analog signal from a compass, the pitch and roll analog signals from an external dynamic motion sensing system, such as the ORE Model 4414A, and also the depth signal from an underwater vehicle. The mating connector required is a MS3106B24-5S with AN3057-16 strain relief (not supplied). The connector pin designations are shown in Figure 2-14.

NOTE: The +/-12 VDC accessory output has limited current capabilities. If this supply is utilized maintain current drain at these pins below 0.350 Amperes each.




**TRACKPOINT HDG/VRU/DEPTH INTERFACE**

**FIGURE 2-14**

### 2.2.7.1 DEPTH INPUT

The analog output voltage from a depth sensor (typically located on a vehicle being tracked) connects to the HDG/ VRU / GYRO DEPTH input connector (MS3102A-24-5P) located on the rear panel (See Figure 2-14). The TrackPoint converts this analog voltage (0 - 6 VDC maximum) to a target depth. A mating connector MS-3106A-24-5S with AN3057-16 strain relief (not supplied) can be connected between an external analog depth input and the TrackPoint Interface Module.

### 2.2.7.2 ANALOG COMPASS INPUT

The analog output voltage from a compass (0 - 6 VDC maximum) connects to the COMPASS input pin “J”. The TrackPoint converts this analog voltage to a vessel heading in degrees.

### 2.2.7.3 GYRO INTERFACE (OPTIONAL)

The gyro interface consists of a PC Board, P/N 4410-0049, mounted inside the TrackPoint SIM. This PC board converts the gyro's synchro signals to an analog voltage, 0 - 5VDC (zero volts represents a bearing of 0° and 5 volts represents a bearing of 359.9°). The analog voltage is input to the Signal Processor board where an A/D is sampled at the time of target signal detection. This ensures that the heading information coincides with the target's reply. Connections to the rear panel gyro compass interface are shown below.

NOTE: The analog signal from the synchro converter is connected in parallel with the COMPASS input at pin “J”. See the "CAUTION" note below.

C A U T I O N

DO NOT apply voltage to the rear panel COMPASS INPUT CONNECTOR with the gyro modification on the TrackPoint. This may damage the internal GYRO converter or the external compass.

NOTE: Make sure the gyro signals are compatible with the converter installed within the TrackPoint SIM. I.e., check that the synchro voltage and frequency matches the TrackPoint's installed option.

CAUTION

Before wiring gyro confirm that the REFERENCE voltage sent from the gyro to the C/DM is within tolerance of the S/AC specified, e.g., an option 114 S/AC requires the reference voltage be less than 28.6 VAC. This voltage can be measured with a DVM.

The gyro's synchro output and its reference voltage connect to the TrackPoint's rear panel GYRO/VRU connector. Refer to the gyro manufacturer's Technical/Installation Manual for connection to its synchro output and reference voltage. The type of cable used to connect the gyro to the converter is typically a five conductor #22 AWG with an overall shield (not supplied) (An example of a mil-spec shipboard cable for use with gyro signals up to 400 Hz is the 1XMSO-7 (MIL-C-24640/7), which has seven (7)-#22 gauge conductors with an overall shield). Connect the S1 terminal of the gyro to pin-F of the GYRO/VRU interface connector. Connect S2 and S3 to pin-G and pin-H respectively. Connect the reference voltage Rl and Rh to pin-A and pin-B.

*** * * * * * * * * * WARNING * * * * * * * * * * ***

MAKE CERTAIN ALL POWER TO THE GYRO/SYNCHRO IS TURNED OFF BEFORE MAKING CONNECTIONS TO THE TP-II. HIGH VOLTAGES ARE PRESENT AT THE SYNCHRO AND REFERENCE (LINE) TERMINALS.

### 2.2.7.4 ATTITUDE SENSOR

**ANALOG:** The VRU input of the GYRO/VRU connector accepts PITCH and ROLL analog signals from an external dynamic motion sensing system, such as the ORE Model 4414A. The pitch and roll signals compensate target position for vessel motion. The analog inputs can accept voltages up to +/- 10 VDC. The normal vessel motion for a positive voltage pitch is BOW UP and the normal vessel motion for a positive voltage roll is PORT UP. The polarity of the analog input signals to the SIM can be reversed and compensated for in the USBL ATTITUDE SENSOR menu. Normal polarity for pitching bow up is (+) and for rolling port side up is (+). The VRU scaling can also be modified under the USBL ATTITUDE SENSOR menu. Normal scaling is 0.222 V/degree (+/- 10VDC = +/-45°). For Model 4414B set scaling to 0.2V/Degree.

NOTE: For a Remote VRU the normal Voltage polarity for pitching BOW UP is [+]. The normal voltage polarity for rolling PORT UP is [+]. The RS232 Format STD W/PR (standard format with pitch and roll at end of data string) also outputs data with this

same protocol. The RS232 Format NMEA ORE (NMEA 0183 type format string that is proprietary to ORE Offshore and includes pitch and roll data at end of string) is different in that it outputs data in the same polarity as its incoming voltage. This allows pass-through of signals from remote VRU to integrated navigation system without modification of polarities.

Refer to section 2.4.3 for description of Hydrophone/VRU offset.

On the mating connector to the HDG/GYRO/VRU connector, wire the pitch signal to pin-L and the roll signal to pin-S. Connect the analog commons to pin-P and/or pin-R.

**RS232:** The Pitch and Roll data can also be RS232 and in various formats. The data can either be input to the TP3 Deck Unit or the Trackman PC. Typically, the pitch and roll data is input the RS232 port on the Trackman PC. If a port is not available then connect the Pitch and Roll to the TP3 rear panel of the Trackpoint (USBL) DB-9 connectors, either COM2 or COM3. See section 3.3.3, ***Setup → Attitude Sensor Setup,*** for setup of the Attitude Sensor Data.

## 2.3 HYDROPHONE OFFSETS

TrackPoint 3 computes range and bearing relative to the hydrophone, unless the system is instructed to add or subtract corrections (offsets) which relate range and bearing to some other reference point on the vessel. The hydrophone centerline, or zero bearing, is indicated by the index mark (see Figure 2-2), and is generally aligned so that it corresponds to the vessel heading.

It is difficult and time consuming to fabricate a mounting in which the hydrophone heading is aligned to within a degree of the vessel centerline, unless the vessel is in drydock. If you have the facilities to perform an exact mechanical alignment, or if the installation is to be permanent, consider fabricating a mount that will repeatedly return the hydrophone to the same physical location aligned to within 0.5 degrees of the vessel centerline.

Most operations requiring a portable tracking system will be on various vessels of opportunity, and require a quick and temporary mounting. In this case align the hydrophone with the vessel centerline as closely as possible. Use some variation of the following procedure to determine hydrophone offsets.

### 2.3.1 BEARING OFFSET

The bearing offset must be determined before X, Y and Z offsets can be measured.

1. Measure the distance (d) from the vessel centerline to the hydrophone location as shown in Figure 2-15.

NOTE: Almost all vessels have a centerline weld or plank that runs down the deck that can be used for alignment purposes. If your vessel has a seamless deck, you have to measure the vessel beam and determine the true centerline.

2. Weight a line to suspend the acoustic tracking source vertically in the water.

3. As far forward on the vessel as possible, hang the weighted acoustic beacon over the side at the same distance from the vessel centerline as the hydrophone. (position B1 in Figure 2-15.) It may be necessary to use a length of pipe or a boathook to extend the weighted line the required distance. The beacon should be slightly deeper than the hydrophone.

4. Turn the System on and set it up to track the beacon in use. If you have aligned the mounting bracket correctly, the system will track the beacon at or very near a 0.0-degree bearing.

5. If you have designed a mounting that can rotate while in the vertical position, you can rotate the hydrophone until you obtain the correct reading. If you cannot rotate the pipe it will be necessary to enter a bearing correction at the time of operation. Bearing Offset can be entered under the USBL HYDROPHONE PARAMETER menu.

   The bearing value is the number of degrees that you need to add or subtract to the displayed target bearing to bring it to 0.0 degrees. For example, a minus 5 degrees would subtract 5 degrees from the target (beacon) bearing while a positive 5 degrees would add to the present target bearing. See Figure 2-16.

6. To check the bearing value determined in step 5, take the weighted beacon line to the stern of the vessel and again hang it straight down at the same distance from the vessel centerline as the hydrophone (position B2 in Figure 2-15).

   The target bearing should now be 180 degrees on the TrackPoint II display.

7. A further cross check can be performed by taking the weighted beacon to a position directly across the vessel from the hydrophone (position B3 in Figure 2-15). The target bearing display should now read either 090 or 270 degrees, depending on which side of the vessel the mounting is located.

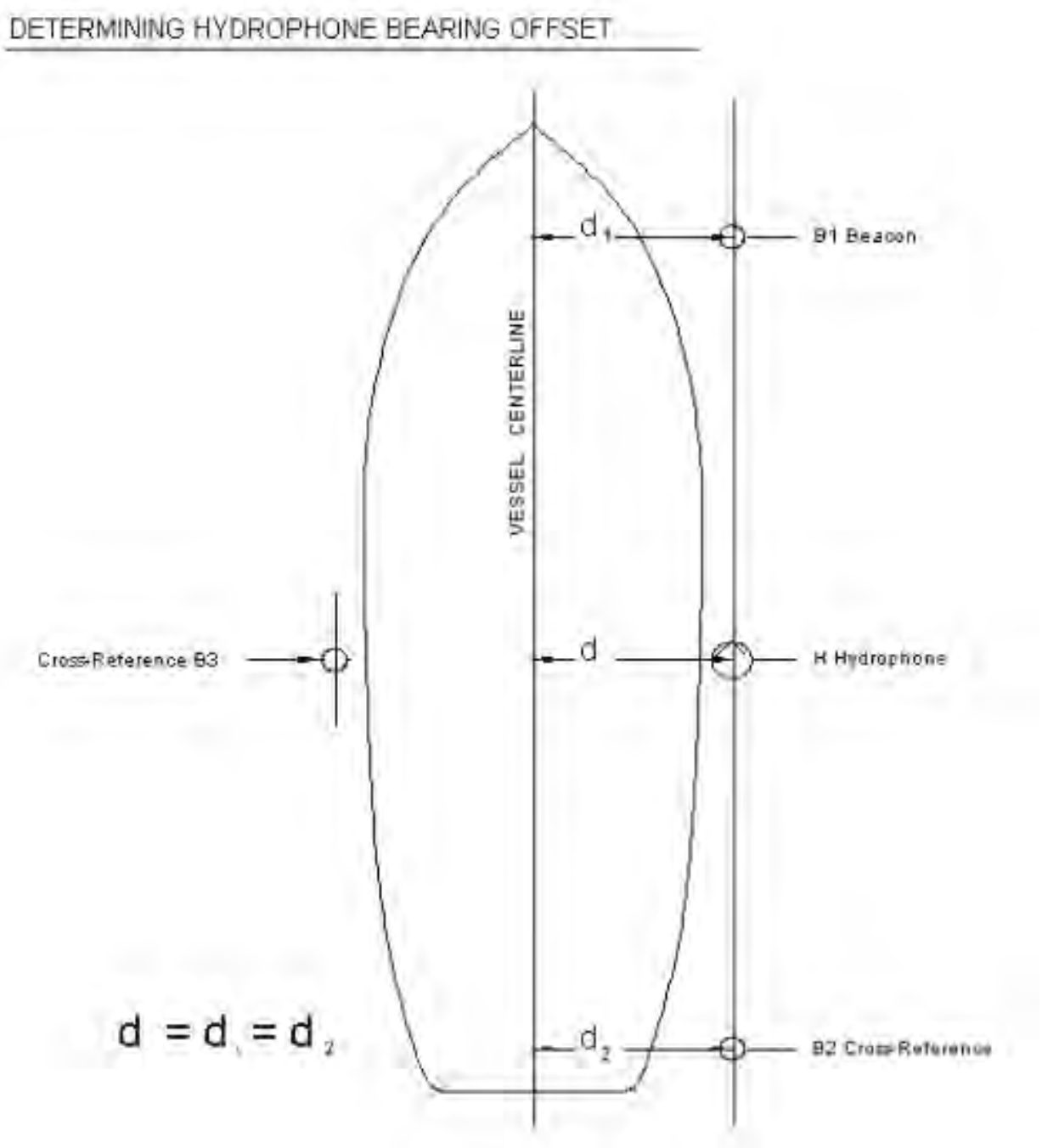

DETERMINING HYDROPHONE BEARING OFFSET
VESSEL CENTERLINE
d1
B1 Beacon
Cross-Reference B3
d
H Hydrophone
d = d1 = d2
d2
B2 Cross-Reference

**FIGURE 2-15**

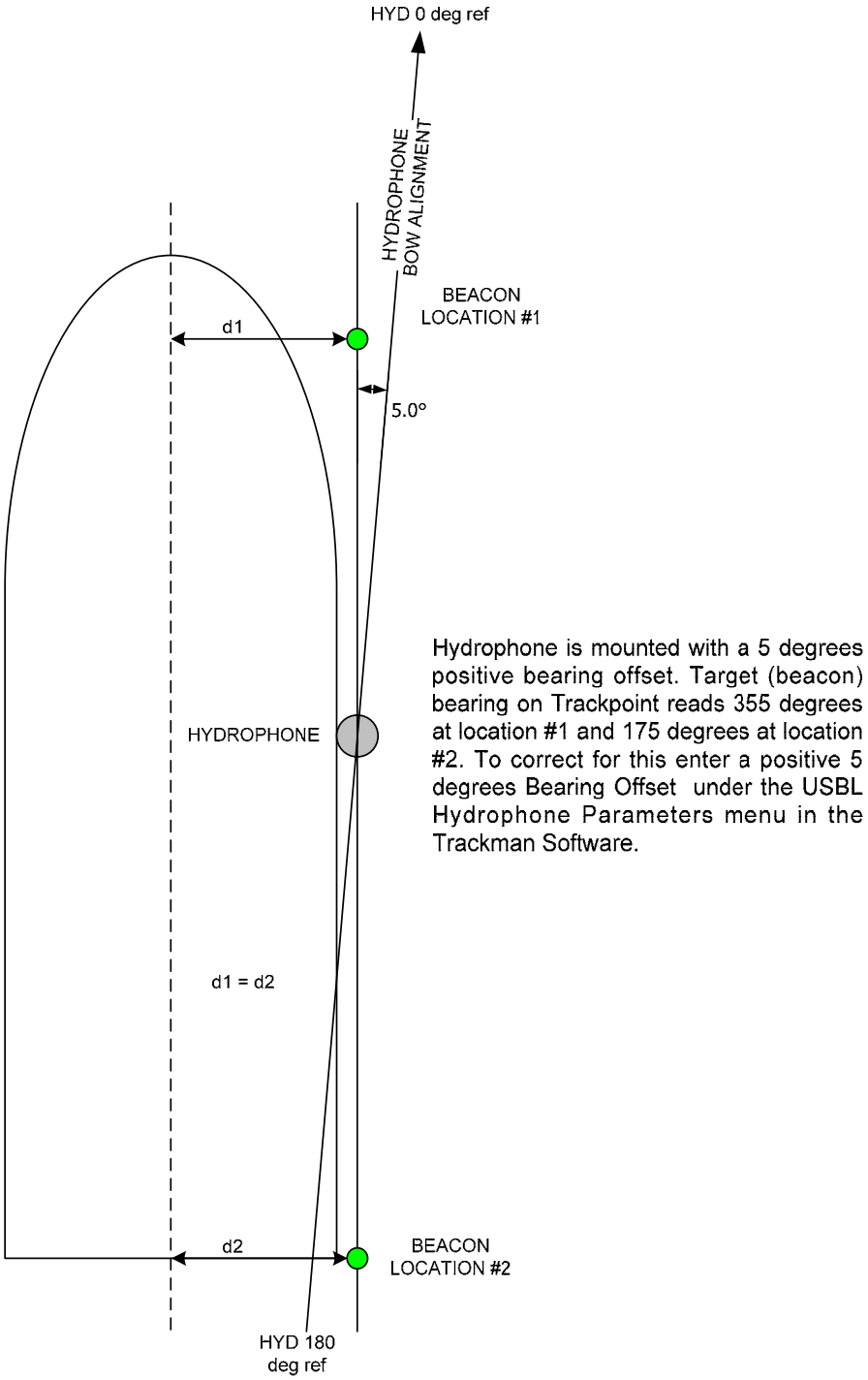

HYD 0 deg ref
HYDROPHONE BOW ALIGNMENT
BEACON LOCATION #1
d1
5.0°
HYDROPHONE
d1 = d2
d2
BEACON LOCATION #2
HYD 180 deg ref
Hydrophone is mounted with a 5 degrees positive bearing offset. Target (beacon) bearing on Trackpoint reads 355 degrees at location #1 and 175 degrees at location #2. To correct for this enter a positive 5 degrees Bearing Offset under the USBL Hydrophone Parameters menu in the Trackman Software.

**FIGURE 2-16**

## 2.3.2 HYDROPHONE X AND Y OFFSETS AND HYDROPHONE DEPTH

Hydrophone Offsets are used to reference the target position to the pitch / roll center of the vessel and also to correct for the hydrophones dynamic motion. Hydrophone motion is due to the pitching and rolling of the vessel when it is not on the pitch or roll center of the vessel. ( It is assumed the hydrophone is rigidly mounted to the vessel. ) The hydrophone, when mounted offset from the vessel's pitch / roll center, swings in an arc about the pitch / roll center causing variations in the hydrophone depth, X and Y offsets as the vessel experiences dynamic motion. These variations cause the target to appear at a different depth, depression angle and bearing than it actually is. By entering in X, Y and Z offsets the system can correct for this dynamic motion if a survey grade Motion Sensing System is interfaced to the TrackPoint. See ORE Model 4414B Motion Sensing System. Connect the analog outputs from the Motion Sensor to the rear panel Gyor/VRU input connector.

Hydrophone X and Y offsets are entered with respect to the pitch / roll center of the vessel. ( It is assumed that the vertical reference for the pitch / roll center is the water-line of the vessel or the entered "DEPTH OFFSET". )

NOTE: The TrackPoint outputs the target position (X & Y) with respect to the pitch / roll center of the vessel graphically in the Display, numerically in the Status Block and also on the RS-232 serial communications port.

In Figure 2-16, horizontal distance and bearing (X & Y) for the beacon are determined relative to the pitch / roll center of the vessel (C). (Note that the slant range remains relative to the Hydrophone.) Determine the Hydrophone X and Y offsets as follows:

A. Measure the distance between the hydrophone (H) and the pitch / roll center of the vessel (C) in terms of X and Y coordinates on a horizontal plane at water level.

   The X coordinate is the distance perpendicular to the centerline ($dx_H$ in Figure 2-17). The Y coordinate is the distance parallel to or along the centerline ($dy_H$ in Figure 2-17).

   Distance along the X-axis from the centerline towards a starboard direction has a positive value. In this example, the X offset is 7 meters. Distance towards the port side of the vessel has a negative value.

   The hydrophone's distance along the Y-axis, forward of the pitch / roll center, is a positive value. In Figure 2-17, the hydrophone is aft of the pitch / roll center, and the Y offset is -10 meters.

B. Enter the offsets at the Trackman and observe the display to verify that the hydrophone is being offset in the proper directions. Figure 2-17 illustrates the tracking window display as the X and Y offsets determined above are entered.

The hydrophone is represented in the tracking window by a small H. Note that the H shifts to the right along the X-axis when the positive X offset (7 meters) is entered. The H moves down, parallel to the Y-axis, when the negative Y offset (-10 meters) is entered.

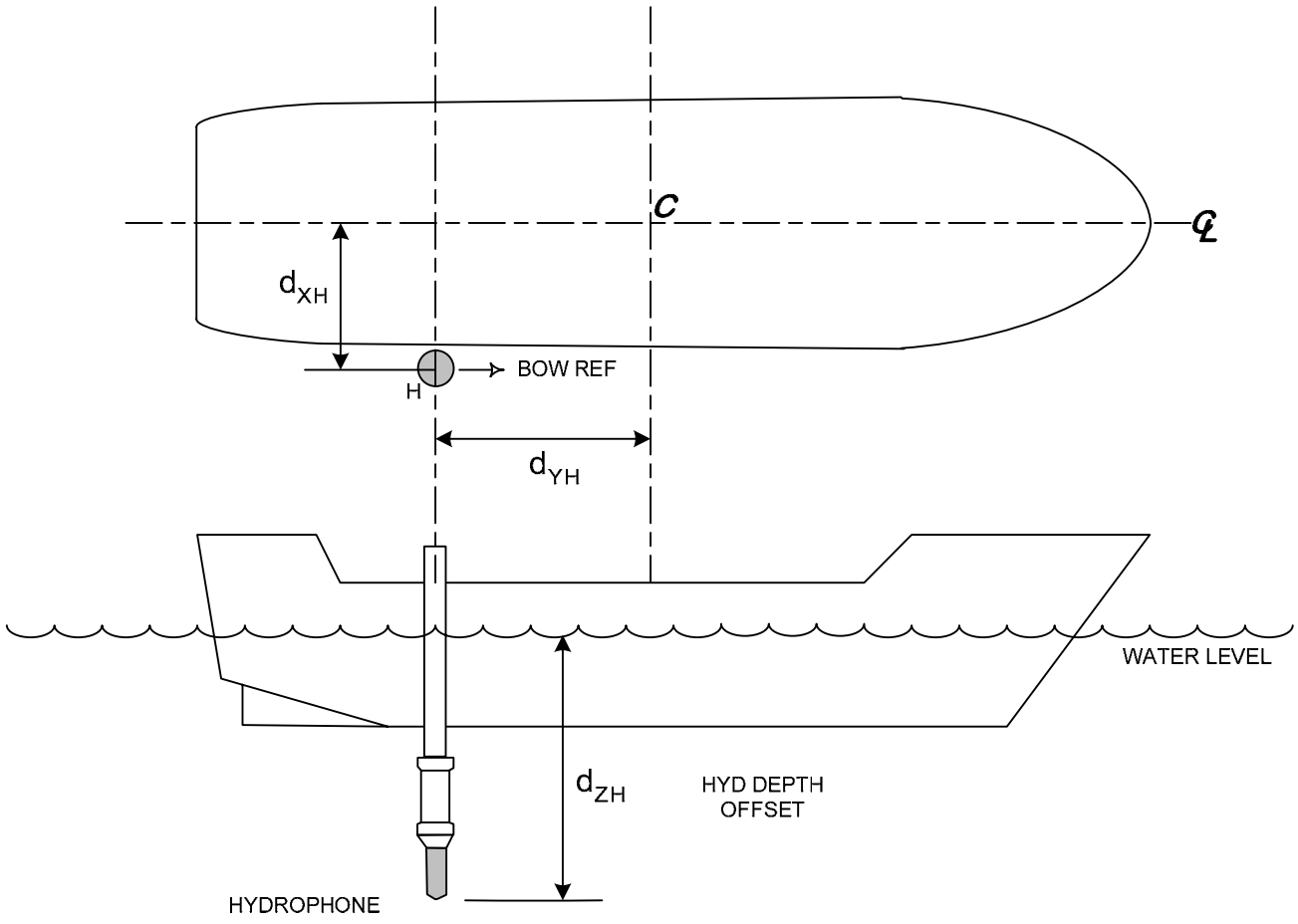
The target continues to be tracked and now displays X and Y data in relation to the pitch / roll center of the vessel.

C. Hydrophone Depth is the depth of the hydrophone below the surface of the water. (Refer to Figure 2-17.) Depth is entered as a positive value.

The TrackPoint 3 is ready for operation when the hydrophone is in position and the necessary offsets have been determined, and the acoustic sources to be tracked are active and in the water.

NOTE: If a pinger is at a depression angle of less than 20 degrees, the measured depression angle and, therefore, the horizontal range of the beacon are impossible to measure accurately. Consequently, the bearing of the source, relative to some offset position, is impossible to determine. If this combination of circumstances occurs (pinger; depression angle less than 20 degrees; and hydrophone offsets entered), TrackPoint ignores the entered X and Y offsets so that it can display a correct bearing relative to the hydrophone. Refer to section 3.6, error code 51.

## DETERMINING X, Y & Z HYDROPHONE OFFSETS




C = PITCH/ROLL CENTER OF VESSEL
H = HYDROPHONE
dXH = +7M ; HYDROPHONE "X" OFFSET
dYH = -10M ; HYDROPHONE "Y" OFFSET
dZH = 6M ; HYDROPHONE "Z" OFFSET

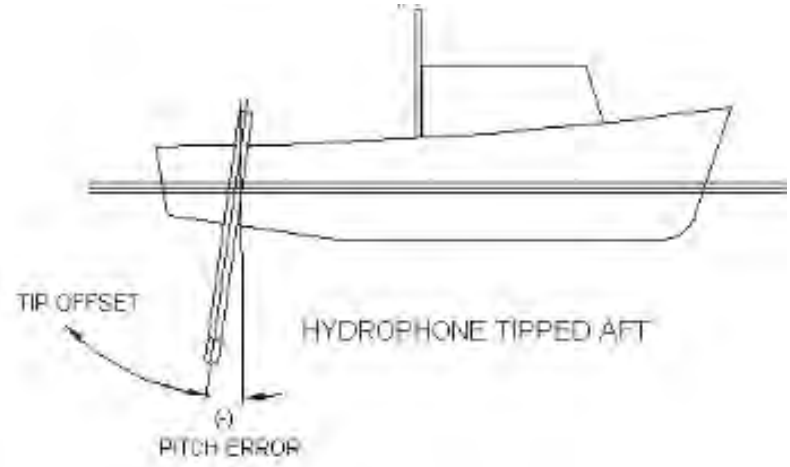
**FIGURE 2-17**

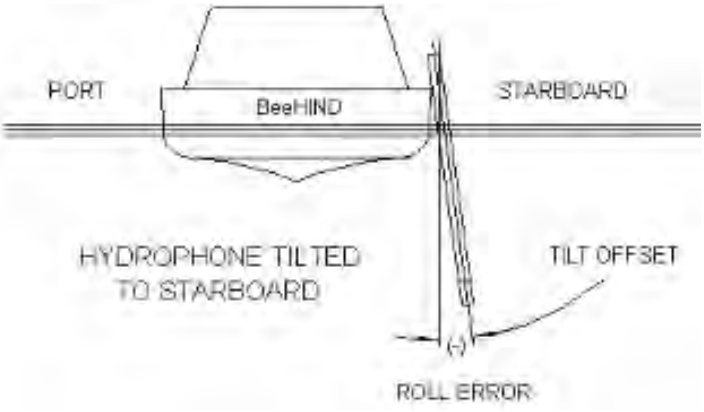
### 2.3.3 HYDROPHONE-VRU OFFSET

The VRU offset is the difference in angle between the installed hydrophone and vertical (static offset). (It can also represent the offset between the Remote Dynamic Motion Sensor and the Hydrophone.) Offsets can occur either due to a mis-aligned hydrophone or from changes in trim to the vessel. The system allows for either manual entry of attitude error corrections or auto correction via the hydrophone's internal VRU for offsetting the static tilt of the hydrophone/staff. The attitude (pitch/roll) offsets are error constants that subtract from the remote or external dynamic motion sensing system data to compensate for the non-vertical installation of the Hydrophone shaft (or difference between DMS and Hydrophone).

ENTERED OFFSETS: For manual entry the operator must measure the angle of the shaft with respect to vertical and enter the data in the PITCH-ROLL ERROR menu. The vessel should be in a harbor or at dock to perform this measurement. Pitch and roll errors are entered in degrees. The system accepts and displays data with a precision of 0.01 degrees.

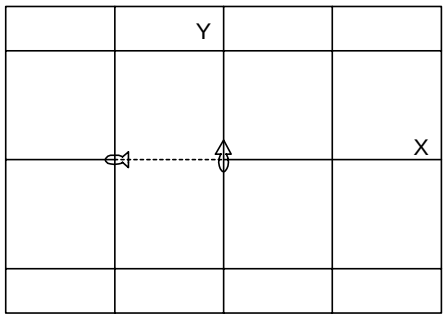
ORIENTATION: Change the VRU ORIENTATION if the Model 4740A VRU/Amplifier is mounted on a surface other than bow facing. For example, if the arrow at the top of the unit is pointing towards starboard then change the ORIENTATION parameter to starboard.



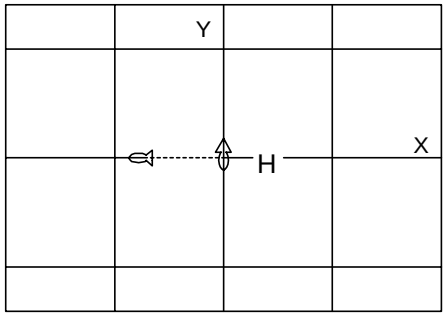
# ENTERING X AND Y OFFSETS

## TRACKING WINDOW
## GRID SPACING 25yd



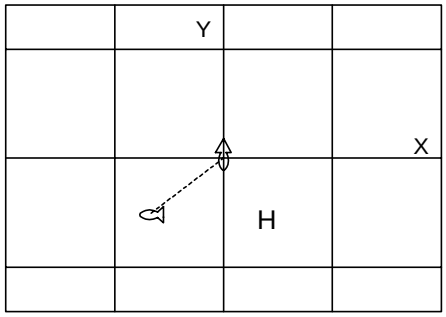

X OFFSET = 0yd
Y OFFSET = 0yd

STD. DISPLAY, NO OFFSETS




X OFFSET = 7yd
Y OFFSET = 0yd

X OFFSET ENTERED




X OFFSET = 7yd
Y OFFSET = -10yd

Figure 2-10

Y OFFSET ENTERED

⇧ = REFERENCE POINT
◅ = BEACON
H = HYDROPHONE

**FIGURE 2-18**

## 2.4 SOFTWARE INSTALLATION

The TrackPoint control and display software, “trackman”, is provided on a cd. The minimum hardware requirements are…

| | |
|---|---|
| Operating System | Windows® 98SE, ME, Win-2000 and XP (XP recommended) |
| Hardware Platform | A PC with Pentium-2 or better processor, SVGA graphics (the software will run on 640 x 480 VGA, but this is not recommended) and at least 128 Megabytes of RAM is required as a minimum or 256 Megabytes recommended for optimal performance of the TRACKMAN software. One available RS-232 serial (COM) port at 19.2k baud. A CD ROM drive in order to install the software. |

### 2.4.1 INSTALLATION FROM CD

Boot up pc and insert the “trackman” cd into cd-rom drive.

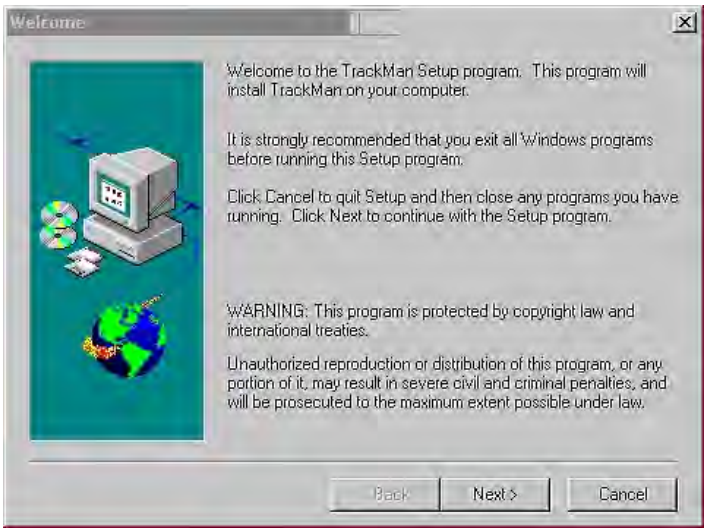
The “TRACKMAN” CD contains the following files for installation.

```
_SETUP.1
_SETUP.DLL
_INST32I.EX_
_ISDEL.EXE
SETUP.EXE
DISK1.ID
AUTORUN.INF
SETUP.INI
SETUP.INS
SETUP.ISS
_SETUP.LIB
SETUP.PKG
```

As long as the CD drive recognizes the “auto-run.inf” file the installation program will begin automatically. If not, then from the “RUN” line in Windows, type in the drive letter of the CD ROM drive and the file name “setup.exe”. E.g., E: setup.exe.

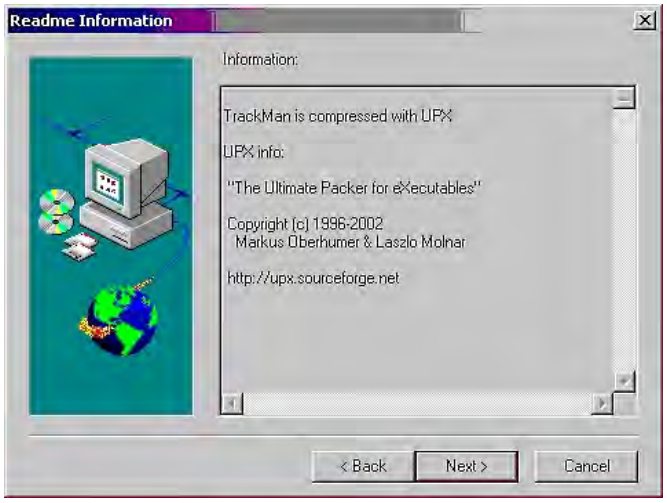
Once the installation program has started you will see the following dialog boxes.

Welcome screen with note on exiting all programs prior to installation.



Readme information on the Packer used to compress the files.

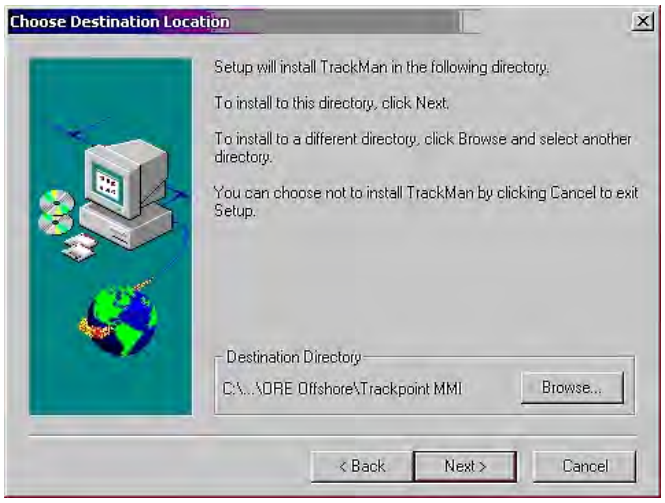
Hit Next button to continue.




Destination of the files to be installed. You can either use the default folder of C:\PROGRAM FILES\ORE OFFSHORE\ TRACKPOINT MMI or the folder of your choice. Hit Browse button to select different folder.

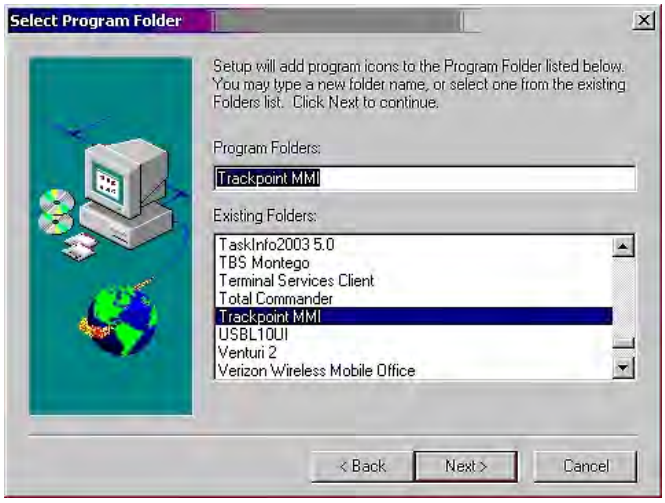
(Note: MMI = Man Machine Interface)

Hit Next Button to continue.

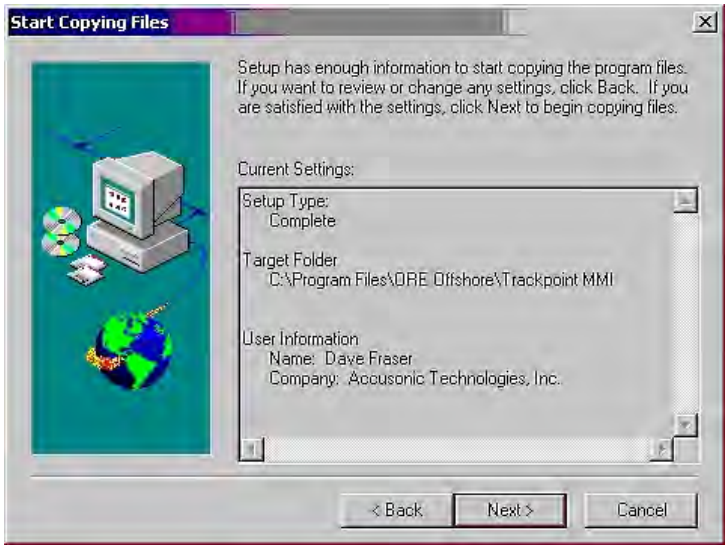



The name for the Program Folder that the Trackman application will be installed under is shown next. The Default Folder name is TRACKPOINT MMI. Type in a new folder name under the Program Folders: edit box to change the Program Folder name. (The default name is recommended for ease of upgrading in future.)

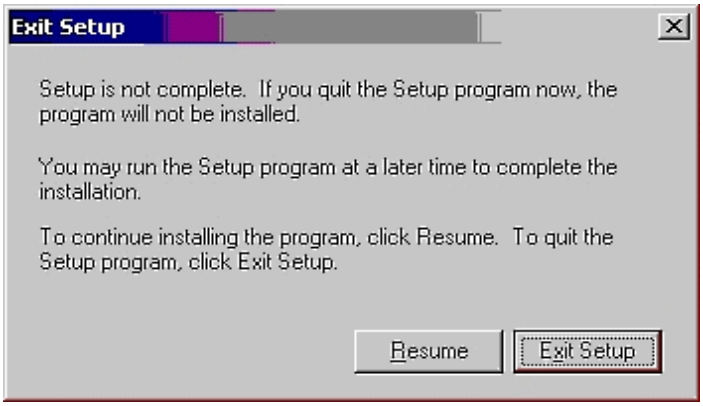
HIT NEXT BUTTON TO CONTINUE.



The installation program displays the Target Folder path that it will create and install program into. If these settings are OK then hit the Next button to continue.




Once installation begins you still have the option to cancel the install prior to it finishing. Click the Cancel button to stop the install. You then have the option of Resuming the install or Exiting the install program.




The installation program creates a TrackPoint MMI item under the Programs menu.



# SECTION THREE

# OPERATION

# 3. OPERATION

Once all cables are connected as per section 2;

Open up display panel and keyboard. Turn on Display/Keyboard from rear of unit.

Turn on Signal Interface Module from front of unit.

Turn on Processor from rear of unit and then open up front panel access with key. Press momentary switch at left. See Figure 3-1.




**MODEL 4451A "ON" SWITCH**

**FIGURE 3-1**

The Windows® operating system will boot-up and start the ORE Offshore TrackPoint Interface (TRACKMAN) program. The program queries the status of the TrackPoint's Signal Interface Module Model 4450A to obtain its present parameters (NOTE: This takes a while to transfer all data). (Also, see "Get TrackPoint Config" under SETUP menu)

**NOTE:** It takes approximately 35 seconds for the Signal Interface Module to boot-up. Wait at least 30 seconds after booting the Processor before setting parameters within TRACKMAN.

**NOT**E: The Hydrophone calibration data is stored in FlashROM on the DSP board located within the Signal Interface Module (4450A). Changing of Hydrophone calibration data requires that the two files that comprise the data be sent down to the Signal Interface Module. See Section 5.

**NOTE:** If power is removed from the units, the PC automatically starts and boots into the TRACKMAN program without operator intervention. It automatically sets up the SIM from its previous parameters.

The TrackPoint Model 4450A Signal Input Module (SIM) Front Panel is shown in Figure 3-2. It contains an ON/OFF switch and LED indicators for troubleshooting system. The LED indicators are described as follows…

**POWER**

| | |
|---|---|
| +5 | When illuminated, indicates that the +5V supply is operational. |
| +12 | When illuminated, indicates that the +12V supply is operational. |
| -12 | When illuminated, indicates that the -12V supply is operational. |
| +24 | When illuminated, indicates that the +24V supply is operational. |

**SELF TEST**

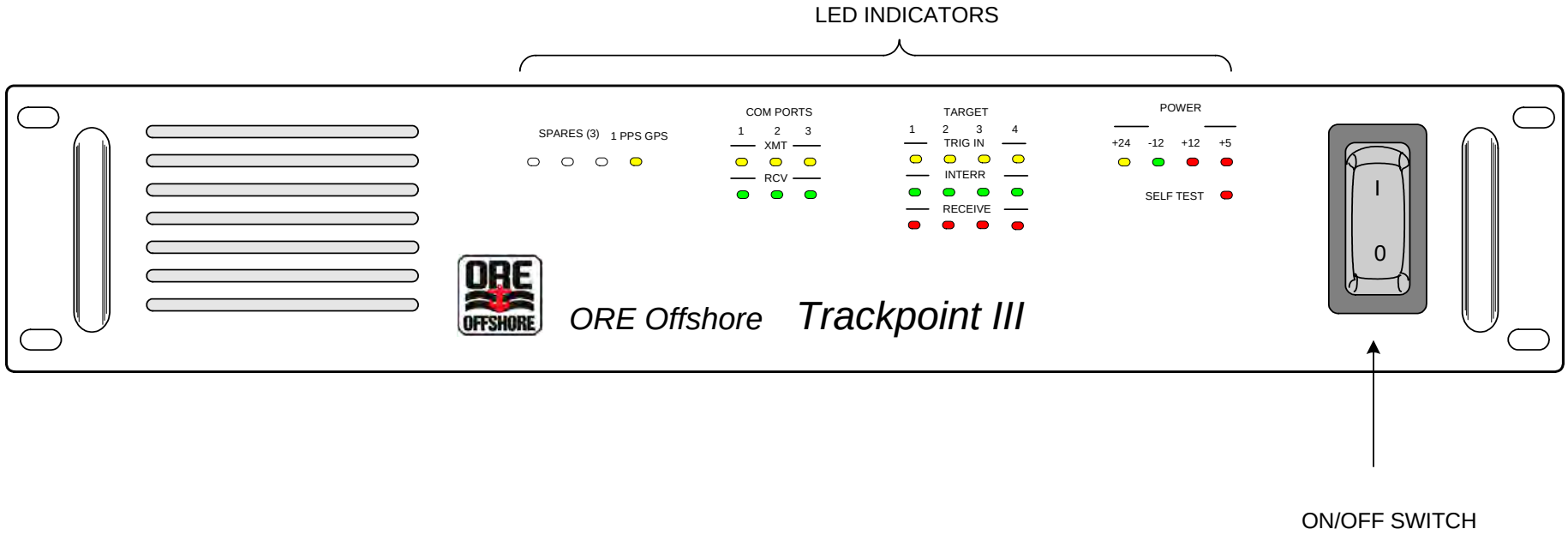
When illuminated, indicates when performing its internal self test function.

**TARGETS**

| | |
|---|---|
| TRIG IN (1,2,3,4) | When illuminated (yellow), indicates that a trigger has been received from an external source for the indicated Target Acquisition Module (1, 2, 3 or 4). |
| INTERR (1,2,3,4) | When illuminated (green), indicates when a beacon has been interrogated, either Internally or Externally, from the indicated Target Acquisition Module (1, 2, 3 or 4). |
| RECEIVE (1,2,3,4) | When illuminated (red), indicates when a beacon reply has been received from the indicated Target Acquisition Module (1, 2, 3 or 4). |

**COM PORTS**

| | |
|---|---|
| XMT (1,2,3) | When illuminated (yellow), indicates that the Model 4450A has Transmitted data from its COM PORT #1, 2 or 3. |
| RCV (1,2,3) | When illuminated (green), indicates that the Model 4450A has Received data in to its COM PORT #1, 2 or 3. |
| 1PPS GPS | When illuminated (yellow), indicates that the Model 4450A has received the 1 PPS signal from a GPS timing sync module. *(future)* |




**MODEL 4450A FRONT PANEL**

**FIGURE 3-2**

## 3.1 "TRACKMAN" SOFTWARE PHILOSOPHY

I know from experience that sometimes you can just run a program and everything seems intuitive from the start. Other programs you struggle through and nothing makes sense as far as the menu structure. I am going to give a brief overview of our design philosophy and how and why it was developed this way. So, when you are plucking through the menus saying to yourself "What was that person thinking?" maybe this will help! If not, send us an email. Criticism accepted! NOTE: This software has been designed and tested on various computers and operating systems. It can run under Windows[R] 95, 98, ME, NT, 2000, and XP. Even given all our testing, I am sure there are some combinations of hardware and software that will cause some quirks in its operation, but for the majority of machines it is stable. See section 2 for recommended hardware and operating systems.

The "Trackman" (**TrackPoint** Data/Control **Man**ager) software evolved from ORE's earlier TrackPoint II USBL system. It was designed to allow an interface between any of our new or future USBL products. It also has a means to communicate with Navigation software (e.g., IPS) on the same PC using UDP, that is sending the USBL data to a software port and having the Navigation software read it directly without having to go through hardware ports. This Trackman program can then be hidden once the USBL System has been setup and the Navigation software run as the primary display. NOTE: There is a feature that allows the Trackman software to not update the plotting while hidden. This saves a lot of processing power for use in other programs such as the Integrated Navigation programs. Trackman's main function is then to just collect and process data and pass it on to an Integrated Navigation Software package. See SETUP menu. The basic menu structure is shown below.

- **File Menu** Similar Window environment FILE pull down menu. Controls typical PC interface items such as disk services and printer, etc. Exit also.
- **View Menu** Having to do with the viewing of the screen either plotting or setup.
- **Setup Menu** This is for system setup not related to the USBL system or TrackPoint 3 Deck Unit. Beacons, PC, etc.
- **USBL Menu** Allows setup of items pertaining to the USBL Deck Unit.
- **Test Menu** Built-in test or simulated target.
- **Window Menu** Allows various modes of tiling (Tile Custom & Auto Tile Custom) the windows, Tracking, Project, etc.
- **Help** Various Help Topics

**Menu Structure:**

File Menu

| | |
|---|---|
| Create New Job | Creates a new job configuration |
| Open Existing Job | Opens an existing job configuration |
| Disk Services | Open Disk Services dialog |
| Printer Services | Open Printer Services dialog |
| Exit | Exits the application |

View Menu

| | |
|---|---|
| Display Options | Open Display Options dialog |
| Project | Brings the Project Tree into view when not docked |
| Clear Grid | Clear the Plotting Grid |
| Clear Status Bar | Clear all Status Bar messages |

Setup Menu

| | |
|---|---|
| Beacon List | Opens the Beacon List |
| Devices List (ports) | Open the Device List |
| Data Output | Opens to Output section of Device List |
| Attitude Sensor Setup | Opens up the Pitch/Roll Sensor Setup dialog |
| Compass Setup | Opens the Compass Setup dialog |
| Reset Devices/Ports | Shuts down and re-enables all Devices |
| Reset Grid/Graphics | Clears the graphics in the Grid Area |
| Audio (Ping) | Enable/Disable Audio |
| Hints (Tool Tips) | Enable/Disable Tool Tips |
| Update While Hidden | When Trackman is hidden (tool bar) shuts down the graphics to reduce processing overhead and sends only updates out its communications ports. |

USBL Menu

| | |
|---|---|
| GPS/TimeSync | Open GPS/TimeSync dialog |
| Hydrophone | Open Hydrophone dialog |
| Acoustic Data | Open Acoustic Data dialog |
| Get TrackPoint Config | Gets current config from TrackPoint (use carefully) |
| Send TrackPoint Config | Sends configuration to TrackPoint |
| Get Sensor Data | Retrieves Sensor Data from TrackPoint 3 |
| Get Status | Obtains the Status of the TrackPoint 3 Deck Unit |
| Download Code | Downloads new software to TrackPoint 3 Console |
| Download CAL | Downloads CAL data to TrackPoint 3 Console |
| Speaker Volume | Adjusts TrackPoint 3 audio volume |

Window Menu (All) — Enhanced Windows MDI 'Window' menu

Help Menu

| | |
|---|---|
| Contents | Display Help File contents page |
| Error Codes | Display Error Code info |
| About | Display the About Box |

Other items of interest…

**Jobs:** Stores all the setup parameters to a "Jobs" folder/file.

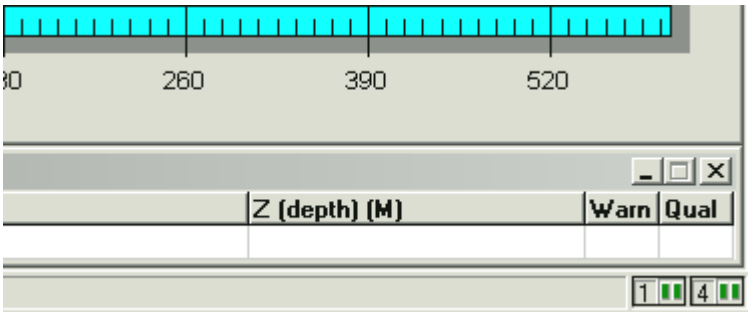
**Project Tree:** A Project Tree was developed as a graphical view of the parameters that normally would change via the standard menus. It is a drag & drop window that can be moved or hidden. The Computer icon is shown at the top as the primary unit. This is the hardware platform that runs this software. Under the Computer are it peripherals, display, disk services, printer, etc. The Device List shows all the peripheral ports that communicate with the PC including the USBL System (TrackPoint 3). A device can be any peripheral associated with the USBL System. It can communicate via its serial ports or TCP, UDP or UDP Broadcast. NOTE: When the table is displayed the "Trackman" GUI is minimized. The Data Output icon brings up the same Device table but goes directly to the Device output line within the table. Just click on the line or hit Enter and the setup dialog box will be displayed to allow setup of a port to output the tracking data. (We could have left this out and just showed the Device List but felt this brings attention to the operator to make sure the Data Output port is setup for the job.) The "to USBL Interface" is only for graphical representation of a port going to a USBL device (COM port). The "TrackPoint 3" is only for graphical representation of the Deck Unit. Under the "TrackPoint 3" are the items associated directly with it. It shows the typical items that the operator should setup for USBL operation; GPS/TimeSync (format of data input), Hydrophone parameters, Acoustic Data (Speed of sound in water, temperature, etc.). The GPS is used for time syncing only. It does not reference the data to Latitude /Longitude. Typical ZDA sentence received uses the first character in sentence as the sync pulse for the time received in the sentence. This sets the clock within the Deck Unit to better than 50ms accuracy. The time that is on each beacon's output sentence is the time that each reply was received.

**Sensor Setup:** This is a system input setup dialog. Sensor inputs can be either from Heading Sensor (an analog or serial input to the Deck Unit or serial only to the PC) or an Attitude Sensor (internal to TrackPoint Hydrophone if applicable or a remote analog sensor input to the Deck Unit).

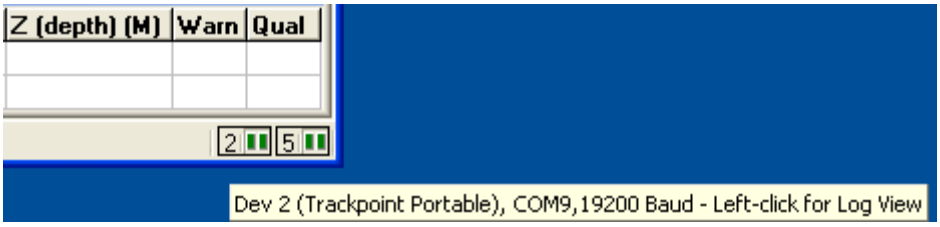
**Beacons:** Clicking on the Beacon(s) icon brings up a table for beacon entry. It also provides a quick view of the Beacon parameter settings. Click on any line within the Beacon Setup Table to bring up its dialog setup box.

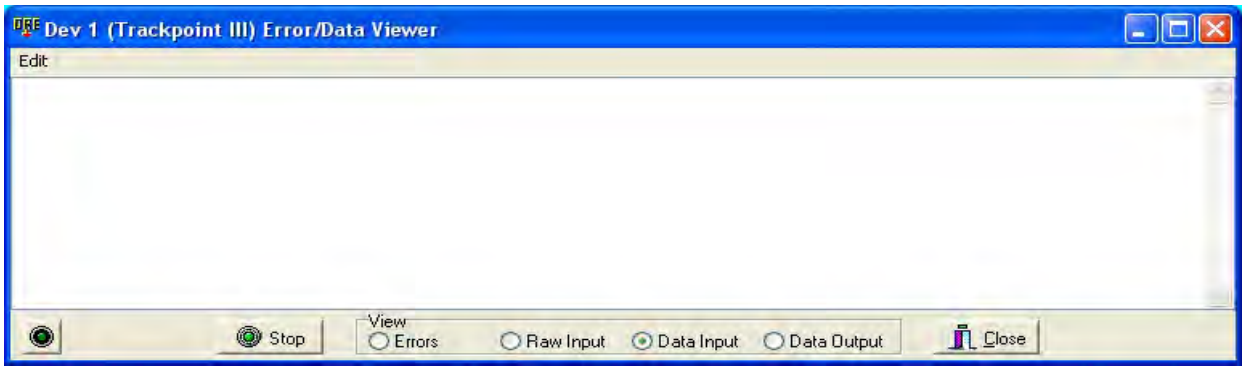
**ORE ICON:** Right clicking on the ORE icon on the task bar brings up a menu to allow closing of Trackman, showing the About box, or disabling the screen saver. For example, disabling the screen saver can be useful when tracking your ROV and the screen saver decides to start the starfield$^{R}$ display just when you are trying to see where your ROV is with respect to the boats prop! Click on "Disable Screen Saver" to prevent screen saver from turning on.

**Device List Status Blocks:** 




The communication function within Trackman is an ActiveX module. Internal to Trackman it is called the “TrakComX” module (TrakComX.ocx). It is used for communication with various "devices" over Serial (COM) Ports or TCP_IP Sockets. Each "device" (TrackPoint, depth sensor, compass, gyro, GPS, etc.) that Trackman connects to creates a 'copy' of TrakComX for that "device". (See Technical Note below.) A “Status Block” for each of the devices is shown in the lower right corner of the screen (Trackman Status Bar). It shows the Device number along with a simulated “LED” that blinks with the input or output of data. For example, two of these are shown above, one for “device” 1 and one for “device” 4: The two small green rectangles on the right side of each window act as transmit and receive indicators (left is transmit, right is receive) that ‘flash’ to indicate activity. The yellow background behind a number indicates an error has occurred on that device. Left-clicking on the number brings up the Error/Data Viewer window which can be used to display a running list of errors of the received data. Putting cursor over the device number shows a tool tip for that device giving device name, port number and baud rate.




**Error/Data Viewing Window**

**Technical Note:**

A software function within Trackman called TrakComX (aka a 'WinPort'), handles both Serial Ports and Sockets, each WinPort can handle a single Serial Port or Socket. Due to hardware constraints in Windows, if a Serial Port is already in use by an existing copy of WinPort an attempt to create a

new copy using the same Serial Port will fail. This means that two copies of WinPort can NOT share a Serial Port!

Unfortunately, since many of the "devices" that we want to connect to are in fact individual pieces of hardware, they often share a common serial or network "bus" with many different style packets from the different "devices" running down the same wire. This means that some of the different "devices" we are trying to connect to may be on the same Serial Port such that if we were to try and use a separate copy of WinPort for each copy of TrakComX on that Serial Port all but the first one will fail.

Our way around this is to manage a 'pool' of WinPorts that allow copies of TrakComX, that require the same Serial Port, to share a copy of WinPort. Each time a TrakComX copy is created, the "pool" is checked to see if an existing copy of WinPort is already handling the new TrakComX copy's desired Serial Port, and if so, the existing WinPort is 'shared' by the new copy of TrakComX.

## 3.2 "TRACKMAN" MAIN WINDOW

### Application Overview

The TrackPoint TrackMan Windows application provides a user-friendly interface for managing ORE TrackPoint USBL (Ultra Short Base Line) underwater navigation systems. It can interface with both TrackPoint 3 and TrackPoint II+ systems.

The interface to the TrackPoint system may be a COM (serial) port connection or a TCP/IP socket. This interface is handled by the TrakComX ActiveX control.

From the application, the user can enter parameters by clicking on items displayed on a convenient tree diagram (the Project Tree) on the left side of the main screen. Data is displayed in one or more MDI child windows, such as the Plotting Grid, on the right side of the main screen.

If the application is being used only as an interface between TrackPoint and another navigation application, it can be hidden from view via a left-click on the Tray Icon (the ORE icon in the System Tray area at the right end of the Task Bar). When hidden, a left-click on the Tray Icon will bring it back into view. Right-clicking the Tray Icon brings up a menu providing the ability to view the undocked Project Tree, view the About Box, or close the application.

From the PC, start the Trackman application by navigating to the Program Folder [TrackPoint TRACKMAN] and clicking on the TrackMan application button. The main window is displayed. See figure below. It shows the Project Tree diagram on the left. The tree provides quick access to various configuration information. Clicking on most items will pop up a dialog window associated with that item.

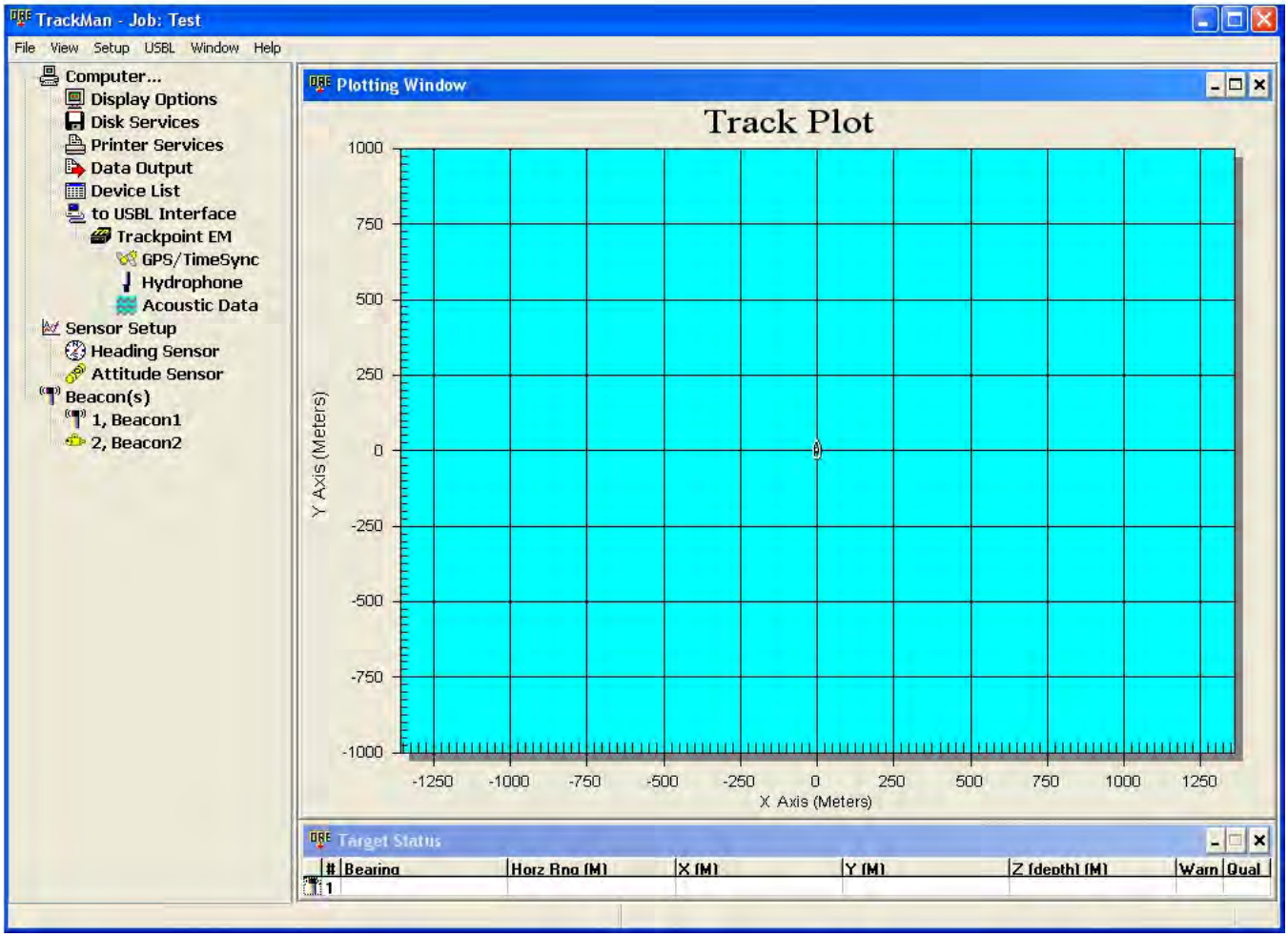



Trackman starts running the previous "Job" that was saved. The Trackman software is a Windows based application that provides a remote interface from a PC to the TrackPoint Deck Unit (SP/IM) providing target display and data output.

### Project Tree Window

The Project Tree Window provides the user with a tree-oriented view of the system. The tree's nodes indicate the relationships of the various components. Most of the nodes provide direct access (via the keyboard or via mouse double-clicks) to related setup dialog windows.

Computer Node - This node displays various sub-nodes (Display Options, Disk Services, etc.) that provide access to basic system services as well as sub-nodes for access to the USBL Interface dialogs.




**TRACKMAN BOOT-UP SCREEN**

Sensor Setup Node – Displays setup paths for the various input sensors such as Compass and Pitch/Roll.

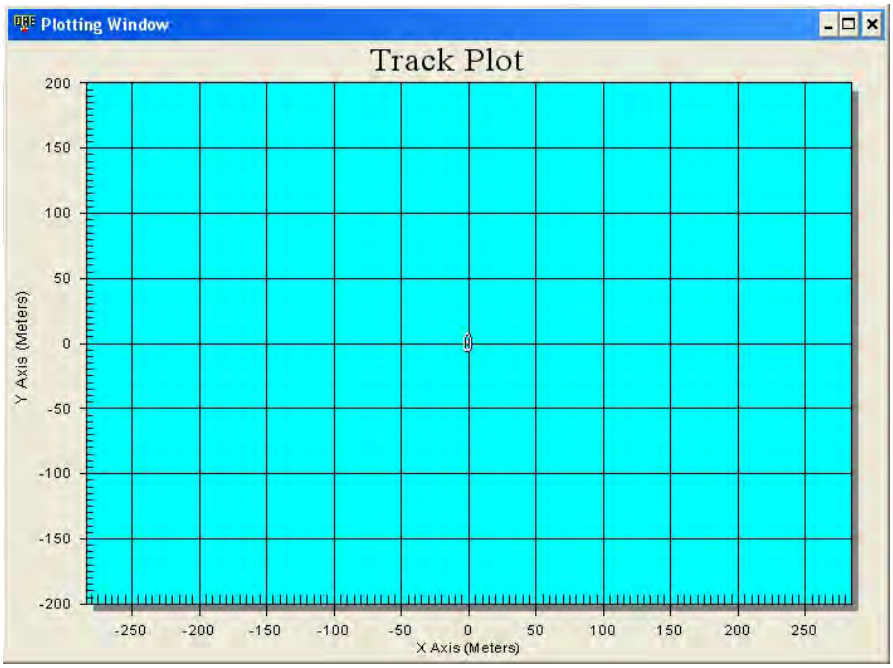
Beacon Node - The Beacon node provides access to the Beacon List window (via the 'Beacon(s)' entry) as well as individual access to the Beacon Setup dialog window for previously defined beacons whose names show as sub-nodes to the Beacon Node.

The Project Tree window can be undocked from the Main Window making the entire client area of the Main Window available for MDI Child Windows (such as the Plotting Grid). To undock hold down the right mouse button while over the Project Tree, move the mouse pointer outside the Main Window's boundary, and release the mouse button. To re-dock hold down the right mouse button while over the Project Tree, move the mouse pointer inside the Main Window's boundary, and release the button. The undocked ('floating') Project Tree window can be brought into view at any time via the 'Project' entry of the Main Menu's ' View' menu, or via the System Menu's or Tray Menu's 'View Project' entry.

**Project Tree:** Press and Hold right mouse button. Drag Project Block off to the side. The Block can then be closed out by clicking on the ☒ or hidden by changing the Trackman main screen to full ☐. It can be viewed again by selecting View from main menu and then "Project". Dragging Project Block back over grid area using right mouse button and releasing will cause block to re-position itself next to the grid. The project block menu is a quick way to access many of the setup parameters required within the USBL system. The Computer refers to the PC which can have many peripherals (shown as sub-sets) such as; Display, Disks, Printer, Data Output (Device List) and an interface to configure the USBL parameters (TrackPoint 3). The TrackPoint sub-set parameters consist of heading sensor, Hydrophone and Acoustic Data. Separate from the Computer and TrackPoint are the Beacons.



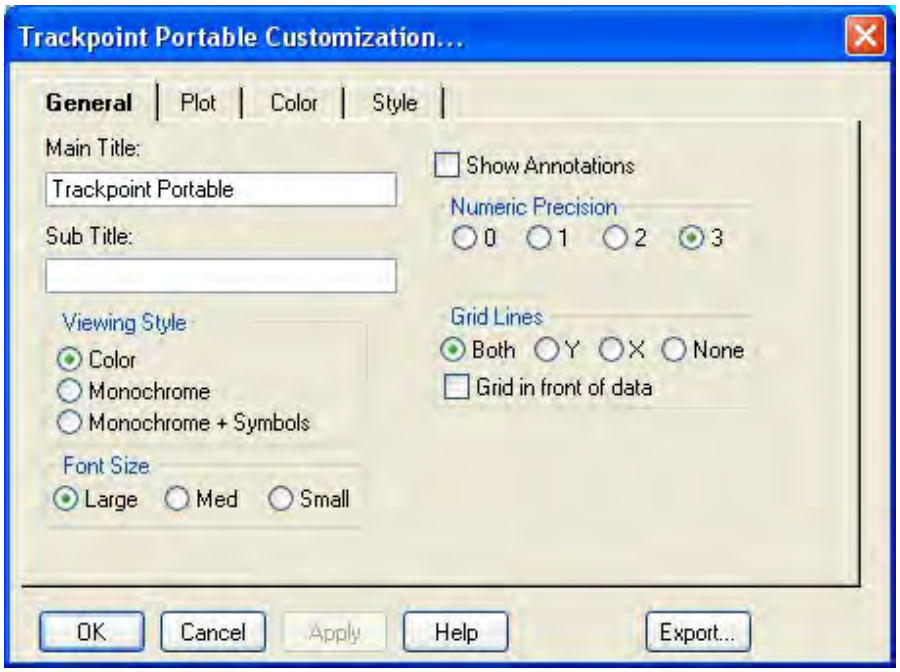

**Plotting Window:** The Plotting Window shows the vessel symbol, all target positions and also the Hydrophone position. The grid Full Scale and Spacing is settable via the View / Display Options menu along with vessel height and width. The Plotting Window can also be re-sized within the constraints of the main window area or minimized ▁, expanded ❐ or zoomed out to full screen ☐.



**Plot Screen Options:**

Right click on Plotting Window to bring up the Grid Customization dialog box. This allows entry of the main title of the grid area, Viewing Style, Font Size, Grid colors, Styles, etc.

NOTE: Some functions are not available within the Track Plot Customization window.




**TrackPoint/Target Status:** This block shows the processed USBL data for each target. This Block can be re-sized to show any number of targets at one time by right clicking on edge of window and dragging up or down. The Status Parameters consist of Target Symbol/ Number, Bearing, Horizontal Distance, X, Y, Depth, Warning Code and Quality Factor. If you right click on the Horz Rng header the field will toggle to Slant Range. Right clicking again changes it back to Horz Rng.



## 3.3 "TRACKMAN" MAIN & SUB-MENUS




The Trackman main menu Pull-Down Lists are shown above. The sub-menus are displayed once the main menus are selected with mouse or keypad. When using keypad… press and release the Alt key and the main menu is selected with the primary character underlined for each menu. For example, the File menu has the "F" underlined. Pressing the "F" key selects that menu. View = V, etc.

### 3.3.1 FILE MENU




***File*** **Create New Job Folder**

The Job entry dialog window is used to define a new job or to access and/or modify an existing job. Each job has it's own complete set parameter files saved in a separate sub-folder.

As a 'Job Name' is typed in, the 'Job Description' entry and the 'Job Folder' entry automatically update with the 'Job Folder' using the 'Job Name' as it's sub-folder name. A more complete Job Description can be typed in if desired.

To select an existing job, simply browse to it's folder in the folder tree at the bottom of the dialog and hit the OK button.

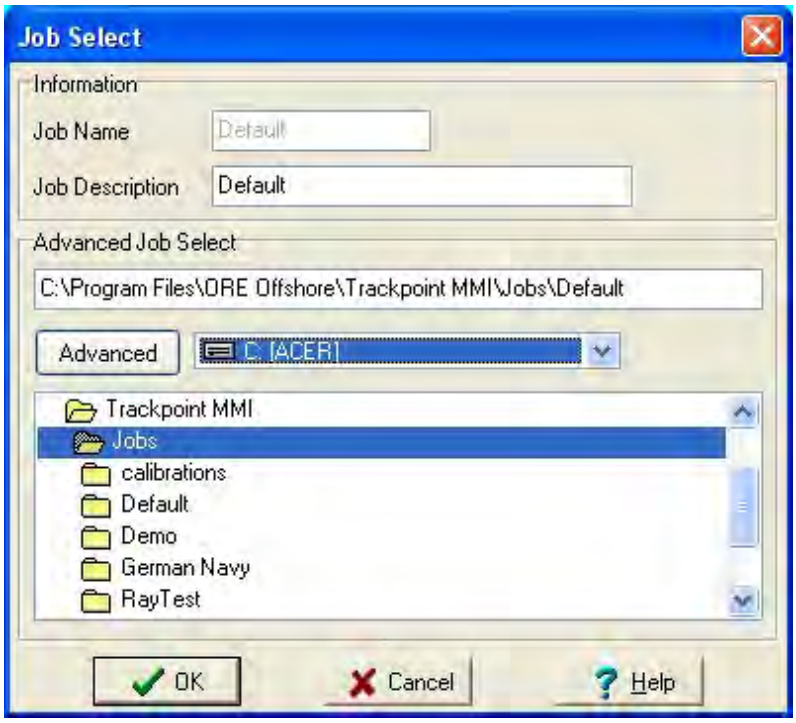


### *File* → Open Existing Job Folder

The Job entry dialog window is used to define a new job or to access and/or modify an existing job. Each job has it's own complete set of parameter files saved in a separate sub-folder.

As a 'Job Name' is typed in, the 'Job Description' entry and the 'Job Folder' entry automatically update with the 'Job Folder' using the 'Job Name' as it's sub-folder name. A more complete Job Description can be typed in if desired.

To select an existing job, simply browse to it's folder in the folder tree at the bottom of the dialog and hit the OK button.




The Job Description of the active job will appear in the Title Bar of Trackman's Main Window.

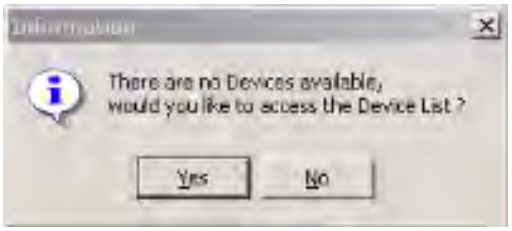


### *File* ➪ Disk Services



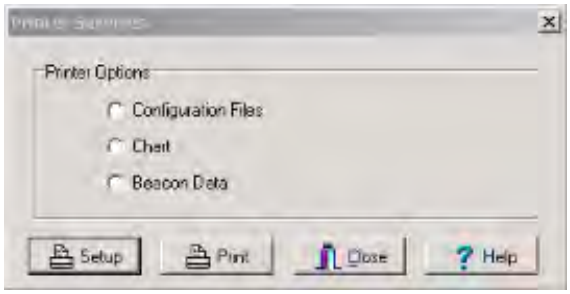

The Disk Services dialog controls the 'Record and Play' operations for saving and playing back an ORE specific data files. If a device is active then it will show up in the pull-down menu at right. If no devices are active then a Dialog box as shown below will be displayed. The system then prompts for display of the Device List, allowing operator to enable various I/O devices/RS232 port data. Once enabled the devices will be shown in the pull-down menu at the right. See Setup/Device List (ports) for setup of ports. Only one device can be enabled for saving to disk.

Click on "Open File" and the standard Windows® dialog box pops up. Enter in File name and click "Open". The data present on that port will now be saved to disk once the RECORD button is pressed. (Save Optional Data will be a future item.) At any time the saving to disk can be paused by clicking on the "Pause" button. "Resume" re-starts logging to disk again. The file is saved with a ".ore" extension. It is saved in the same directory that the "Job" was created under. To Playback target position, go into the DEVICE LIST and set the TrackPoint device to PLAYBACK mode. Go back into the DISK SERVICES and click on "Open File" under the Playback Beacon Data and select file. Click Open and then set Playback Rate. The data will be read at that rate and displayed in the grid.

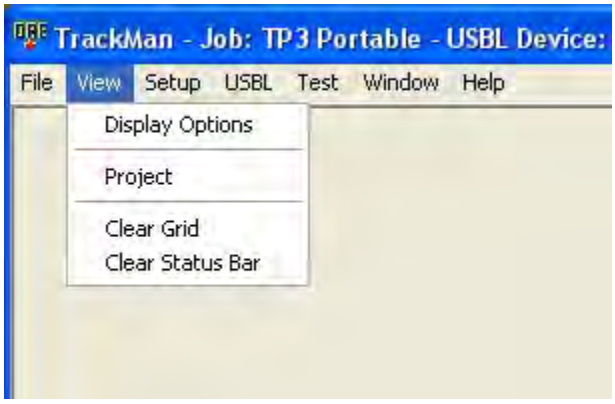



### *File* ➪ Printer Services

This dialog is used to select and set up a printer as well as to choose what information is to be printed. It calls the standard Windows Printer Selection and Setup dialogs.

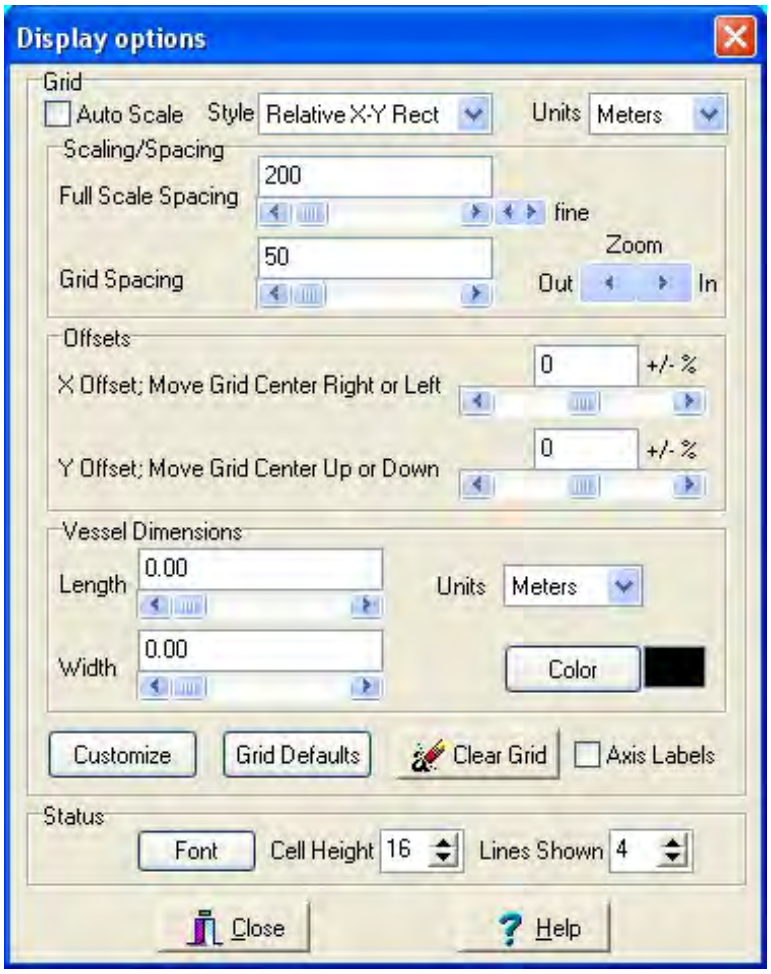


## 3.3.2 VIEW MENU




***View*** → **Display Options**

The Display Options dialog is used to control the Plotting Grid parameters. This dialog pops-up to the left of the Grid (if possible) such that the user can see the changes as they are being made.




**Grid / Auto Scale:** Select "Auto Scale" to have the system automatically adjust to changes in the Full Scale Spacing. The scale is dependent on the Horizontal Distance to the farthest target.

While in Auto Scale mode, the Full Scale Spacing value is updated such that the user can 'freeze' its value by shutting Auto Scale off when the Spacing looks right.

**Grid / Style:** Select the Grid Style either Relative X-Y Rectangular or Relative X-Y Polar.

**Grid / Units:** Select from the pull-down menu the units that you want the scale to be referenced to; either meters, feet, yards or fathoms.

**Grid / Scaling, Spacing & Zoom:** To manually select the Grid and Full Scale Spacing use the scroll bar arrows next to each of the parameters. To move the bar/value quickly point to the bar with the mouse, then click and hold the left mouse button down while 'dragging" bar right or left. Use the "fine" adjustment buttons as a vernier. Use the Zoom buttons to change the Full Scale and Grid Spacing values by 2 or 1/2.

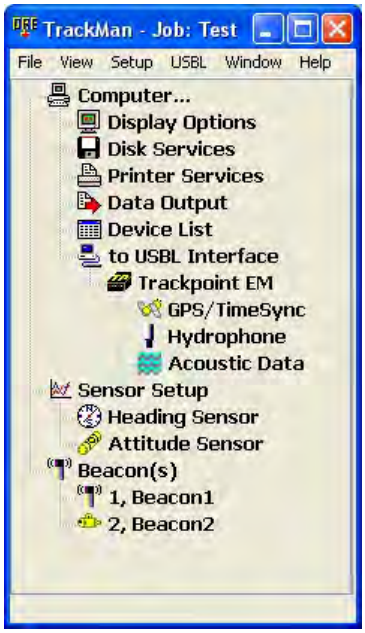
**Grid / Offsets:** The X-Offset parameter moves the grid center position to the right or left and the Y-Offset parameter moves the grid center position up or down. This is useful when tracking a target in only one quadrant of the vessel. Click on the buttons to change the percentage of movement about the center of the grid.

**Grid / Vessel Dimensions:** The outline of a ship/boat can be displayed in the center of the grid using the Vessel Dimension settings. Move the scroll bar or click the buttons to vary the Length and Width values. Select from the pull-down menu the units that the vessel is to be referenced to; either meters, feet or yards. Select the vessel symbol line color using the color button.




***View*** → **Project**

Brings up the Project Tree (if hidden).




***View*** → **Clear Grid**

Clears the target trails in the Plotting Window.

***View*** → **Clear Status Bar**

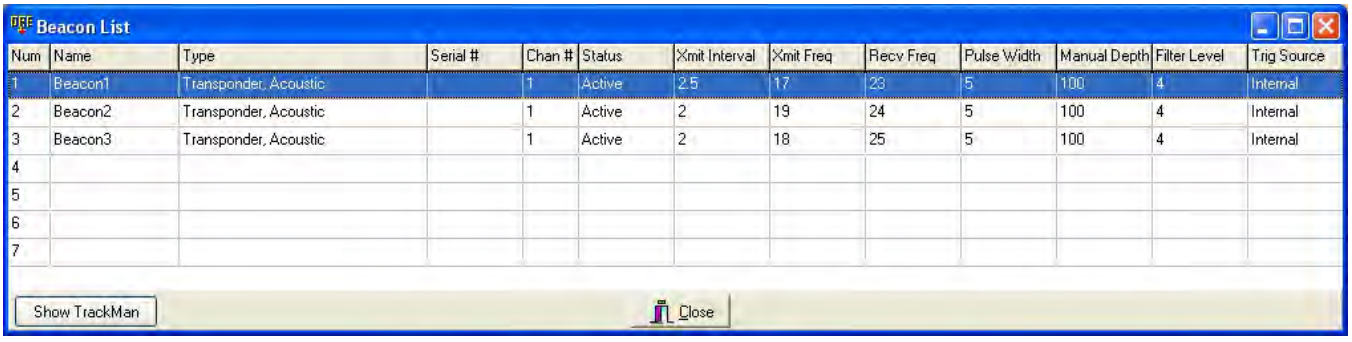
Clears Status Bar at bottom of page.

### 3.3.3 SETUP MENU




***Setup*** → **Beacon List**

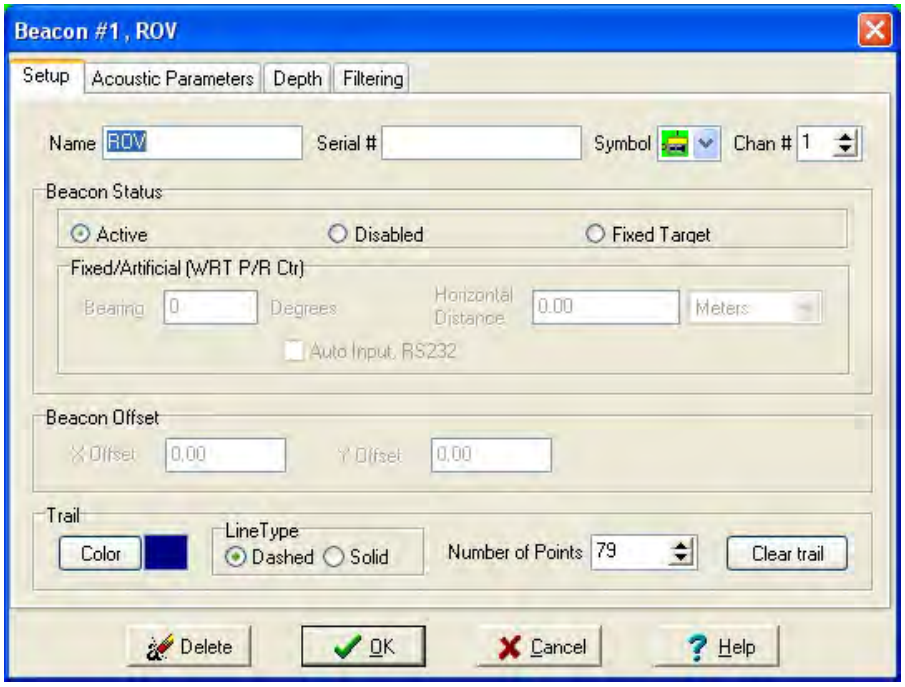
The Beacon List window displays all beacons at once, in a grid layout, showing their parameters of primary interest. (Clicking on the Beacon's icon within the Project Tree is a quick key to displaying the Beacon List. Beacon(s) ) Having a single window that allows the user to see the operating frequencies and parameters of all the available beacons makes it possible to compare parameters and change any that may conflict. Double-clicking on an entry in the list (or using the arrows keys to move to the desired entry and hitting 'Enter') displays up the Beacon Setup dialog for that entry. If the entry in the list was 'empty', the Setup dialog comes up in 'Adding a New Beacon' mode. Entries may be moved to a new position in the list (thereby obtaining a new beacon number) by cut-and-paste (Ctrl-X / Ctrl-V) keyboard operations. Cut-and-paste operation only available within beacons 1-4 or within beacons 5-7. (Cannot copy simultaneous to consecutive tracked beacons or vice versa.) **Refer to Section 3.4 for Beacon List examples.**




The 4450A can have up to 4 programmed beacons. All four can be active at any one time.

## Adding a new beacon, Dialog Box

### 🗀 Setup Tab




**Name:** This is the operators name for the beacon being tracked, e.g. Towfish. (NOTE: Cannot have two beacons with same name.)

**Serial Number:** Serial Number of the beacon as a record of use.

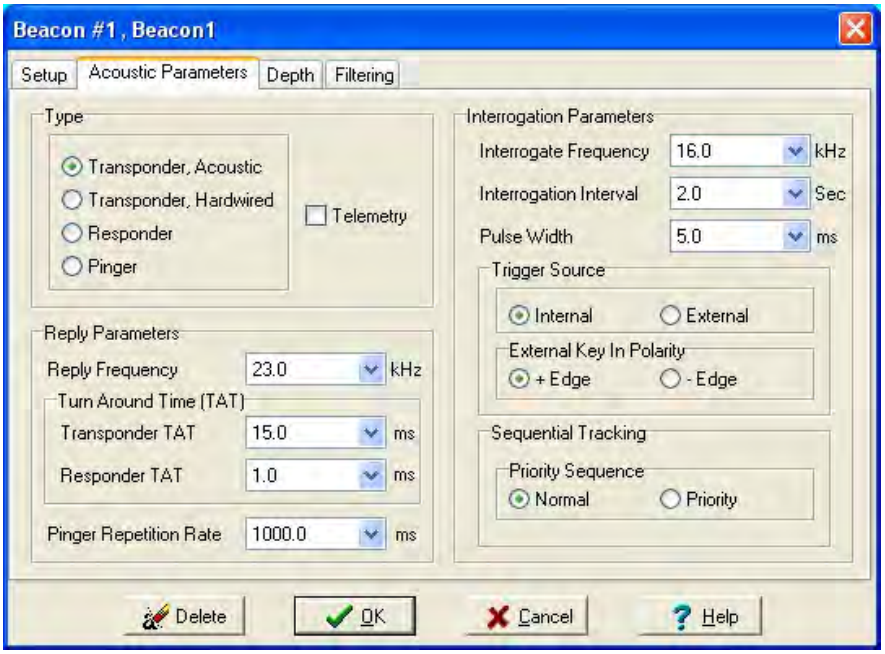
**Symbol:** Scroll bar allows selection of a symbol to represent the beacon in use.

**Beacon Status:** Selects either Active, Disabled or Fixed Target. For a fixed target to be displayed in the grid also enter in bearing and horizontal distance of the target. Enter in the position with respect to the center of the vessel (assumed f/roll center also).

**Beacon Offset:** If the beacon is mounted offset from the center of the vehicle being tracked or the center of a sonar array that is collecting image data then an offset position can be entered. Enter in X and Y offset position. (Not available in this version.)

**Trail:** The target positions are plotted and a line drawn from point to point. Select the color of the "trail", the line type and the number of points to store. To clear the trail click on the "Clear Trail" button. To have no trail then set to one.

### 🗀 Acoustic Parameters Tab




**Type:** Selects target type, either Transponder (acoustic), Transponder (Hardwired), Responder or Pinger. If the Transponder or Responder has Time-Decode Telemetry then click on the Telemetry box. If a Pinger is not received an error code #6 is displayed after 12 seconds.

**NOTE:** When a target is designated as a Pinger it is the only target that can be enabled at one time. Disable any other targets.

**Reply Parameters:** This is the Reply Frequency of the beacon. Enter value in kHz or use the scroll bar to select from a preset list. Enter the Burst Turn Around Time for a Transponder or a Pulse Turn Around Time for a Responder in milliseconds. Enter the Pingers Repetition rate in milliseconds.

**Interrogation Parameters:** Enter in the Interrogation Frequency of the Transponder in kHz or select from a preset list on the scroll bar. Enter in the Interrogation Interval (based on the slant range to the target) in seconds and the Pulse Width necessary to interrogate the beacon in milliseconds. (In high multi-path environments it may be beneficial to decrease pulse width to prevent multiple triggering of the transponders.) Select whether the beacon is being triggered internally by the TrackPoint or by an external source. If external then select the edge that the TrackPoint should synchronize the timing with (+) or (-). If multiple targets are enabled then a specific Beacon can be set as a “Priority” which alternates interrogations between all the other active targets.

**Trigger Source:** Select either Internal or External trigger source.

**NOTE**: Cannot use Depth Telemetry if in External Trigger Mode.

**NOTE:** The Internal Interrogation Interval must be set to a slower rate than the External Trigger Interval or an Error Code #6 will be displayed.

**NOTE:** Only one target can be enabled when in External Trigger mode.

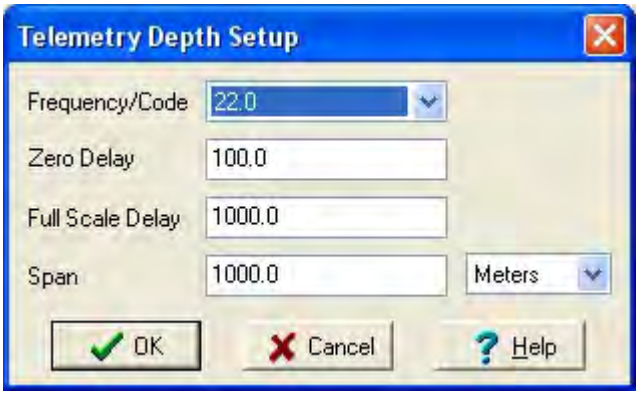
**External Key-In Polarity:** Select either (+) or (-) edge external trigger source.

**Sequential Tracking/Priority Sequence:** Select Normal to sequence through the enabled targets one after the other or select Priority to sequence back to this target on every other cycle. NOTE: Only one target can be enabled as a Priority.

### 🗀 Depth Tab




The Depth Tab configures the target depth function. Select the Mode in which the depth is input from; Telemetry, Analog, Serial Port (PC), Manual. If the Beacon is a (time-proportional) Depth Telemetry version then select "Telemetry" and then under "Depth Mode Setup" configure the Beacon's Telemetry parameters. If depth is via an analog sensor, e.g., an ROV or SSS vehicle, then select "Analog" and then under "Depth Mode Setup" configure the Beacon's Analog parameters. The analog port is available at the GYRO connector on the rear panel of the Unit. If the target's depth is available via a serial port, select "Serial Port" and then under "Depth Mode Setup" configure the Beacon's Comport parameters. Select the Depth Input sentence, DBS, DBT, PEIV1 or DPT. (See formats below.) This Serial port is available only at the PC's serial input not the Deck Units.




**NOTE:** If the entered depth is in-correct the calculated horizontal range will also be incorrect.

In the TELEMETRY mode the depth is taken from a depth telemetering transponder. The transponder sends two replies to the TrackPoint 3 per interrogation. The first reply signal is used to determine slant range and bearing, while the second reply (whose delay from the first is proportional to depth) is used in the depth calculation. Given these three parameters a three-dimensional position fix is calculated. The "Telemetry Depth Setup" menu is used in conjunction with "Telemetry Mode". It contains parameters to allow the operator to change the telemetry reply frequency, and also to change the zero delay, full-scale delay

and span. When Telemetry Depth is selected, a 'T' appears next to the depth value in the Status Block when the telemetered value is being used in the horizontal range calculations. If the system is using a calculated[1] depth then a `C' appears next to the depth value. If the depth telemetry replies are not received, the last valid telemetry reply is used for the depth. If telemetry replies return, system reverts back to depth telemetry. If not using a Telemetry Beacon then depth should be changed to Manual or Analog.

Serial Port Depth Input - DBS, DBT, PEIV1, DPT

**DBS - Depth Below Surface**

```
        1  2  3  4  5  6 7
        |  |  |  |  |  | |
$--DBS,x.x,f,x.x,M,x.x,F*hh<CR><LF>
```

Field Number:

1) Depth, feet (Referenced to Water surface)
2) f = feet
3) Depth, meters
4) M = meters
5) Depth, Fathoms
6) F = Fathoms
7) Checksum

**DBT - Depth below transducer**

```
        1  2  3  4  5  6 7
        |  |  |  |  |  | |
$--DBT,x.x,f,x.x,M,x.x,F*hh<CR><LF>
```

Field Number:

1) Depth, feet (Referenced to Water surface)
2) f = feet
3) Depth, meters
4) M = meters
5) Depth, Fathoms
6) F = Fathoms
7) Checksum

NOTE: The DBT format is referenced to the water surface.

---

[1] The System can only calculate depth when the depression angle is greater than 45° (Depression Angle is defined as 0° at surface and increases to 90° directly below the hydrophone.) When target is not within this 90° cone below the hydrophone an alternate depth must be used; Analog, Telemetry or Manual.

**PEIV1 - Depth of Target (EIVA Navipak)**

```
        1   2  3
        |   |  |
$PEIV1,x.x,yy*hh<CR><LF>
```

1) Depth, meters (Referenced to Water surface)
2) Target Number 01-99
3) Checksum

**DPT - Depth - Deviation & Variation**

```
         1   3  4
         |   |  |
 $--DPT,x.x,x.x*hh<CR><LF>
```

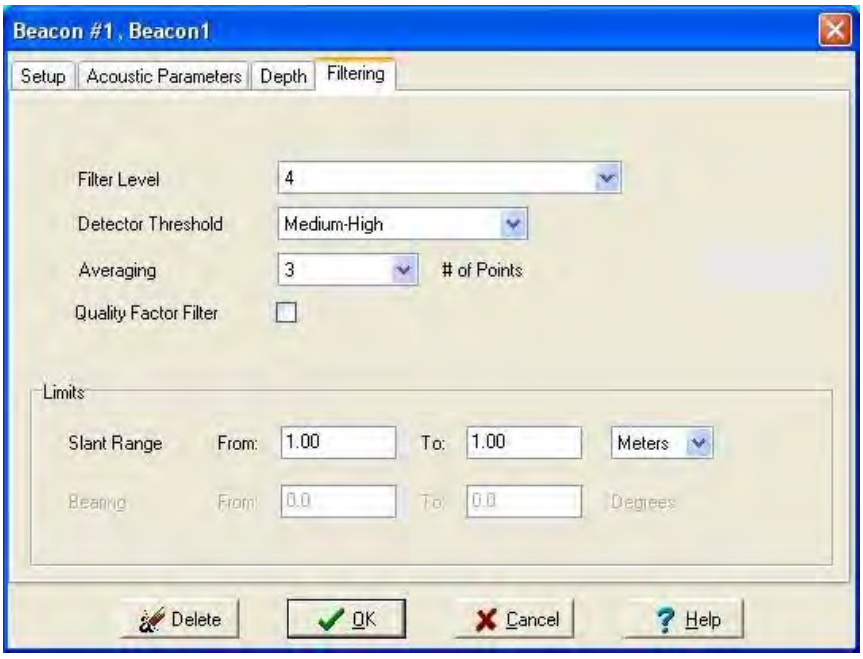
Field Number:

1) Depth, meters (Water depth below TP3 Hydrophone)
2) Offset from transducer, Positive means distance from transducer to water line negative means distance from transducer to keel
3) Checksum

**NOTE:** Offsets are not used. TrackPoint uses Depth to the transducer in its calculations.

### 🗀 Filtering Tab

The "Filtering Tab" allows each beacon to have individual filtering parameters, configuring each beacon for its own tracking scenario. Select Filter Level for the beacon in use. In the case of a fast moving target set the level between 1 and 5 with 1 being for minimal filtering and 5 being for moderate filtering. For slower moving targets set level between 6 and 10 with the filtering parameters increasing to maximum at 10. To set limits on known target locations modify the Slant Range and Bearing parameters.




When ✓ OK is selected the Trackman program sends the parameters to the TrackPoint 3 Deck Unit. This delay causes the dialog box to remain on screen for a few seconds following the command.

FILTERING provides operator a choice of various combinations of averaging, filtering, threshold settings and also limits on certain parameters. Filtering includes averaging, target velocity checking, range gating, signal threshold, minimum xponder range, maximum xponder range and signal rejection via signal quality checking. The filtering parameters are individual per target.

**Averaging:** The Averaging parameter is variable from 0 (off) to 10. It is independent of the Filter Level setting in that you can select the buffer size in which to average a number of replies over (1-10). This setting corresponds to the number of replies that are averaged along with the present reply. The averaging routine is used in conjunction with the QF (Quality Factor) and the Filter Level. With a high quality factor the target position is weighted heavily both on the present reply and on the previous replies in the averaging buffer. If the present reply has a high QF and the previous reply had a low QF then the position with the high QF remains heavily weighted within the averaging buffer. As new replies are received the high QF positions maintain their heavier weight while the positions with lower QF's have very little weight. The weights of the target positions are reduced as the newer replies are received. This approach biases the target position towards the better QF and also towards the most recent reply providing a better representation of target position than by using a mean or average of the target positions. At the higher filter levels (8-10) the averaging is almost linear across all replies while at the lower filter levels the weight is higher on the most recent reply. Averaging occurs on the target's position only (X, Y or HD, BRG), not on the displayed slant range. The slant range displayed in the status block and sent out the RS-232 is the actual value. Because of this there may be an apparent discrepancy between the displayed position and slant range.

**Filter Level:** The Filter Level setting is variable from 1 to 10. A Filter Level setting of 1-5 is recommended for most dynamic applications (e.g., ROV tracking). The higher settings of 6-10 are appropriate for static applications such as station keeping. The parameter settings for the range blanking gate and velocity filter "tighten up" as the Filter Level is increased with the premise that dynamic targets such as AUV's can change position quickly with respect to the vessel while static targets such as a tow fish or other moored targets do not. Filter settings 6-10 cause the analog or telemetry depth to average the last three readings. Filter settings 1-5 do not average the input depth. Also see error code #5.

The table below shows the relationship between the range gate, velocity filter and averaging weight Vs the Filter Level setting.

FILTER LEVEL/RANGE (blanking) GATE (Transponders & Responders Only)

If there is more than one sequential target the range blanking gate value is multiplied by the number of targets (e.g., filter level 2 with 4 targets enabled equates to a blanking gate of 80 meters before the average target range). If the blanking gate exceeds the current range average then it is set to a minimum (1m). The range average for each target is weighted based on the number of good replies for that target. If there are no recorded good replies then the routine uses 100% weight on the current value and is scaled down for up to 4 replies (e.g., if there have been 4 or

more consecutive good replies each new reply contributes 25% to the average). As replies are missed, more weight gets added to the new reply. If there are more than 2 missed replies, the blanking gate opens up by a factor of 2, until we exceed a maximum (currently 4) where it is wide open.

| TARGET FILTERING FUNCTION | | | |
|---|---|---|---|
| **Filter Level** | **Blanking Gate opens prior to average reply (meters)** (based on 1500m/s speed of sound) | **Velocity Filtering** (4.5 m/s = 10 knots; 2.3 m/s = 5 knots) | **Average Weighting** Ratio of the weight of the previous reply to the 10th reply Vs Filter Level [3] |
| 1 | -25 meters (-16 ms) x # Active targets [1] | OFF | 4.0:1 |
| 2 | -20 meters x # Active targets [1] | OFF | 3.3:1 |
| 3 | -15 meters x # Active targets [1] | OFF | 2.8:1 |
| 4 | -10 meters x # Active targets [1] | 4.5 m/s + X % SR [2] | 2.5:1 |
| 5 | -5 meters x # Active targets [1] | 4.5 m/s + X % SR [2] | 2.3:1 |
| 6 | -25 meters x # Active targets [4] | 4.5 m/s + X % SR [2] | 2.1:1 |
| 7 | -20 meters x # Active targets [4] | 2.3 m/s + X % SR [2] | 2.0:1 |
| 8 | -15 meters x # Active targets [4] | 2.3 m/s + X % SR [2] | 1.9:1 |
| 9 | -10 meters x # Active targets [4] | 2.3 m/s + X % SR [2] | 1.8:1 |
| 10 | -5 meters (-3.3 ms) x # Active targets [4] | 2.3 m/s + X % SR [2] | 1.8:1 |

NOTE 1: For Range Gate description see Transponders and Responder below. Pingers utilize a Time Gating system, see Pingers below.

NOTE 2: Total velocity = Target Velocity plus 5% (X) of the Slant Range if external compass is used; Plus 10% of Slant Range if not used. Used for both Xponders and Pingers.

NOTE 3: At the higher filter levels the averaging is almost linear across all replies (up to 1.8:1 depending on number of replies smoothed) while at the lower filter levels the weight is higher on the most recent reply (up to 4.0:1 depending on number of replies smoothed). The QF also contributes to the weight in the smoothing buffer. See chart and also QF FILTERING below.

NOTE 4: Settings 6-10 affect the auto-depth readings (analog or telemetry) by averaging the last three readings. Settings 1-5 do not affect these depth inputs.

| | **Weight on the Target's Position Vs the Quality Factor as used in the smoothing** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| QF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Weight | 0 | 0 | .04 | .08 | .12 | .16 | .2 | .4 | .6 | 1 |

RANGE GATE AND TELEMETRY (Transponders & Responders Only)

When telemetry is enabled the system also blank-gates on the telemetry reply. On the primary or navigation reply the TrackPoint accepts only the first signal arriving at the hydrophone following the opening of the blanking gate and ignores signals for ≈ 80 milliseconds following it. When the telemetry gate opens the TrackPoint accepts the first signal at the telemetry frequency and all other signals are ignored until after the next interrogation. This is advantageous when operating in a high multi-path environment, insuring that the system locks on to the correct reply.

FILTER LEVEL/TIME GATE (Pingers Only)

For pingers the system uses a Time Gating system based on the targets entered repetition interval instead of the slant range as used in the range gating. Time gating eliminates any unwanted signal detections that occur at a time when no response is expected. Since the pinger repetition rate is entered and the reply interval is known, TrackPoint II can determine, within some short time interval, when the next signal is expected and only allows signals which fall within their time window to be accepted for further processing. It depends upon accurate entry of repetition rates in the TARGET sub-menu for proper tracking. The time gate is a function that compares the time between replies against the entered repetition value. It accepts the first reply that arrives in a window 50 ms prior to the expected arrival of the signal (beginning of time window) and up to 50 ms after the expected arrival. It then ignores replies later than 50 ms after the calculated time gate window. If no replies are detected within a certain period, an error code #2 is flagged and the window opens up to find the reply.

FILTER LEVEL/VELOCITY FILTER

Velocity filtering is a technique of rejecting any target position changes that are unlikely due to an assumed maximum target velocity and elapsed time since last update. It is based on the difference between the previous X and Y position (averaged, if smoothing is enabled) and the present targets X and Y position. If the present calculated position passes the velocity filter test it is then sent to the smoothing function. If after a certain period of time there is no reply within the expected area then an error code #5 is flagged and the system opens up to find the reply.

NOTE: A fast-turning ship can cause the target to appear to be traveling at excessive speeds and be rejected by the velocity filter, when the compass option is not in use.

**Threshold:** The Threshold key steps through five threshold settings for each target: As the threshold level is increased, only stronger signals are accepted, and weak signals, which could be caused

by multi-path or extraneous noise in the water, are ignored. The lowest threshold setting increases the sensitivity of detection by recognizing smaller signals. In a high-noise environment this can lead to erratic readings. In a high-multi-path environment, lower settings result in earlier detection, reducing the inclusion of multi-path signals with the original signal. Higher threshold settings decrease the possibility of detecting on noise, but can lead to occasional missed valid signals and also late detections causing erratic bearings. A lower threshold setting is usually the best choice, but trial will lead to the optimum threshold setting for a given application. The default setting is Med-Low but can range from Low to Extra High depending on the ambient noise. If the RED detect LED is continuously illuminated on the front panel for that target then the threshold setting is too low and must be raised.

Threshold Settings: Low, Med-Low, Med-Hi, High, Extra-High

**NOTE:** Use the lowest possible threshold setting that will prevent noise from falsely triggering the detector. Med-Low is the default setting.

**Target Limits:** The Slant Range Limit (Minimum Transponder or Responder Range) function works in conjunction with the range gating (blanking) system based on the target slant range. The range (blanking) gate is a hardware lockout that “opens up” and allows signals to be detected from the hydrophone. The time that the blanking gate opens is based on the Filter Level and the time the last reply was received. If a condition occurs where the blanking gate end time is less than the Slant Range Limit’s (**from** value) then the blanking gate overrides the Slant Range Limit’s (**from** value). This in effect locks-out all signals from the hydrophone prior to the end of the blanking gate. If the system loses tracking due to the Slant Range Limit (**from** value) being greater than the actual slant range from the target the system shows an error code #7 (SR < Min Range). After 5 interrogations without a reply the system opens up the blanking gate and accepts the reply on the sixth (6th) interrogation (EC #6 may appear briefly prior to reception of signal). If the Slant Range is less than the Slant Range Limit’s (**from** value) then the error code #6 is changed to #7. The Slant Range Limit’s (**from** value) can vary from 1 to 1000 meters.

NOTE: If you are operating with a known minimum range, for example with an ROV near the bottom in 500 meters of water, then the Slant Range Limit’s (**from** value) could be set for 450 meters. This would provide an effective "range gate" without the attendant target acquisition and re-acquisition time of the normal range gate. Of course, as you recover the ROV you will have to reset the Slant Range Limit’s (**from** value) to track the ROV to the surface.

The Slant Range Limit’s (**to** value) (Maximum Slant Range) function compares the reply’s slant range against this value. If the slant range is greater than the entered value the last good reply remains on the display (target position on the screen doesn’t change) and the status block shows an error code #14. If the RS232 Format is set to an “EC” format it also outputs the last good position and tags it with an error code #14. The Slant Range Limit’s (**to** value) can vary from 0 m which is OFF to 10 to 10000 meters.

**QF Filtering:** QF Filtering is a toggle function that turns QF Filtering on or off. The Quality Factor (QF) is a value (1-10) determined by the system on each reply that is detected. The system uses the phase or time counts from each of the hydrophone elements to determine the quality of the signal. If the phase counts are consistent throughout the reply burst the quality factor is very high. If the phase counts have jitter or are inconsistent then the quality factor is low. The QF FILTERING function filters the data depending on the Quality Factor of the signal received. It compares the Quality Factor of the signal received to its previous five (5) average Quality Factors. The QF FILTERING function toggles Quality Factor checking on or off.

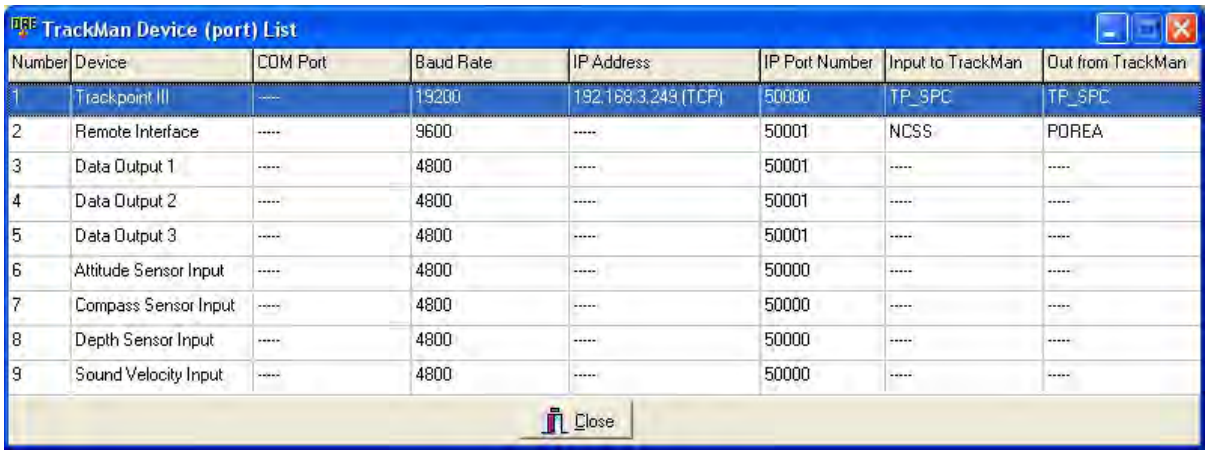
This function filters the data depending on the Quality Factor of the signal received. When “QF FILTERING” is “ON” and the Quality factor is less than the average of the last five QF’s the data is not plotted and causes an error code #4 to be displayed. In this case the error is considered a “fatal” error (similar to all other error codes under 20) and the reply is not added to the smoothing buffer. The target position is not updated on the screen and the positional data is not sent out the RS232 port unless the “EC” formats are chosen. If “EC” formats are chosen then a post processing navigation system could be used to determine if the reply was good or bad by searching for a 4 at the EC location within the data string. When “QF FILTERING” is “OFF” and the Quality factor is less than the average of the last five QF’s the data is plotted on the screen and sent out the RS232. The data is tagged with an error code #64 on both the display and RS232. In this case the error is considered a “warning” error (similar to all other error codes greater than 50). The data is still smoothed but its “weight” within the averaging buffer is decreased. Again, a post processing navigation system could then be used to determine if the reply was good or bad by searching for a 64 at the EC location within the data string.

## *Setup* → Device List (Ports)

When selected, the Device List dialog box is displayed and the main window minimizes. (This is the same as double-clicking on the Device List within the Project Box.) When closing the Device List window, the main window is displayed again.

The Device List shows the list of all peripherals or I/O to the Processor. (FYI: The Device List is read from a "devices.ini" file stored under the ORE TrackPoint folder within the Program Files folder. These are ORE configured files and should not require modification.)

**Device (ports) Setup dialog box**: This box allows setup of the various I/O to the Processor.



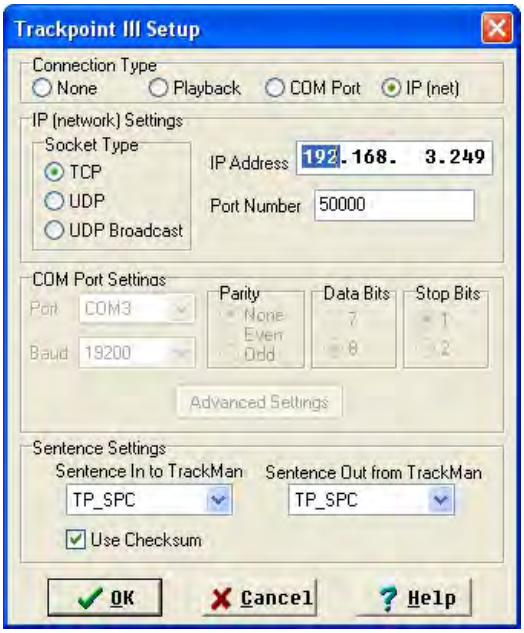

Double-clicking on an entry in the list (or using the arrows keys to move to the desired entry and hitting 'Enter') brings up the Device Setup dialog for that entry.

**TrackPoint 3:**

Click on the TrackPoint 3 "Device List" line and then double click to bring up the Setup Dialog Box.

Setup this dialog as listed below. This port is required to communicate with the TrackPoint 3 Deck Unit.

The **"Sentence Input to Trackman"** is the data format that is coming **from** the TrackPoint USBL Deck Unit to the PC. The **"Sentence Output from Trackman"** is the data format that is sent from the PC (on this same port) to the TrackPoint 3 Deck Unit.

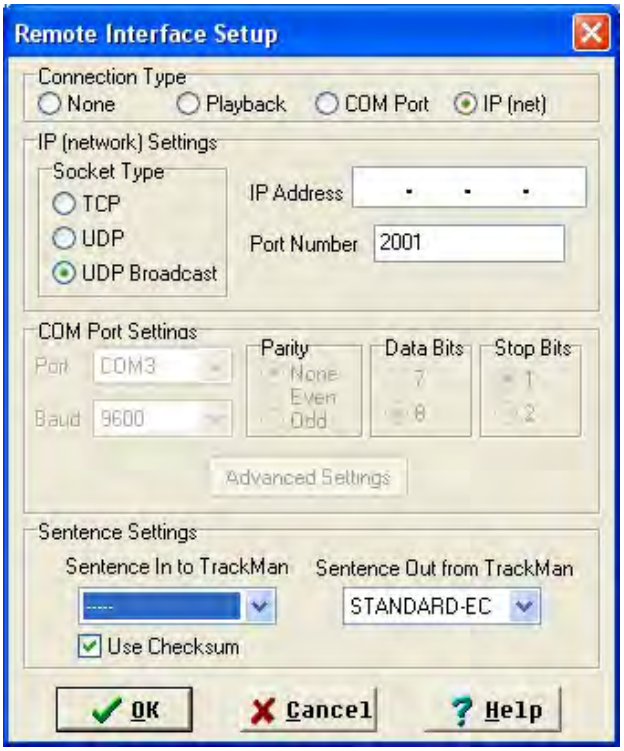


The setup parameters for the **TrackPoint 3** Device are…

- **Connection Type** COM Port
- **COM port settings** Your PC's available comport
- **Baud Rate** 19,200
- **Parity** None
- **Data Bits** 8
- **Stop Bits** 1
- **Advanced Settings** Default
- **Sentence Input to Trackman** TP_SPC (TrackPoint Signal Processor Console)
- **Use Checksum** Yes
- **Sentence Output from Trackman** TP_SPC

**Remote Interface:**

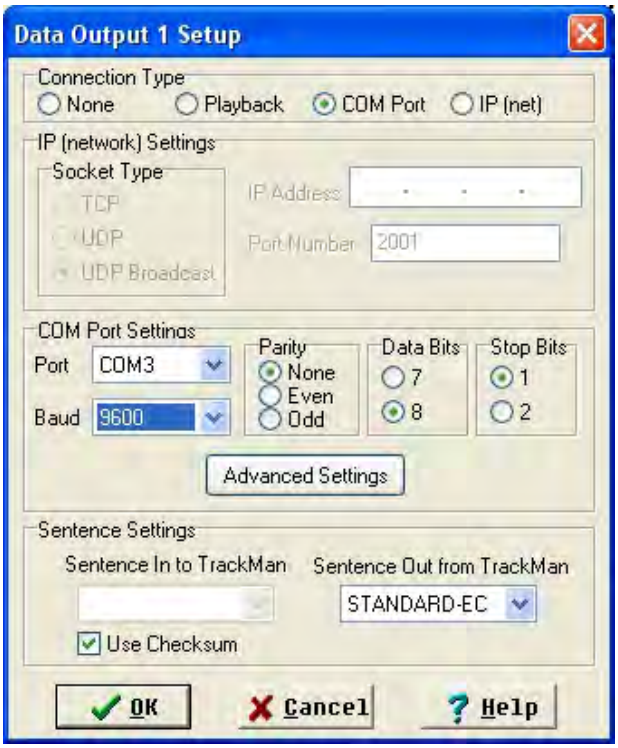
Not common. The Remote Interface port is typically for an output to a navigation system that also communicates with Trackman. Setup the Remote Interface device to output the format that will be compatible with the navigation software. The Connection Type can be either "COM Port" or "IP (net)".




**The Sentence Input to Trackman** can either be "NCSS" or SPC. This is the data format that is coming from the Remote Control Module (another PC) to this PC or laptop. These are not typical and are only used for special applications. Leave as "----". For data output only see **Data Output** below. **The Sentence Output from Trackman** is the data format sent from the PC to the Navigation System. The list of formats available are; PORE, POREB, POREG, SNTTM, STANDARD, STANDARD-EC, STD W/PR, STD-EC W/PR, NCSS, NCSS-EC, NUWC, NUWC-EC, REV 4 & REV 4-EC.

### ***Setup*** ➪ **Data Output**

Data Output Setup is similar to the Remote Device Setup. A separate COM port can be configured to only output data (no control input). There is no Sentence Input to Trackman as in the Remote Interface Setup.




Setup the **Data Output** dialog to output the format that will be compatible with the navigation software.

The Connection Type can be either “COM Port” or “IP (net)”.

**TCP/IP & UDP Protocols**

The global network we all know as the Internet transfers information between computers using a protocol (a set of rules) known by the acronym TCP/IP which stands for Transmission Control Protocol/Internet Protocol.

All Internet transfers use IP (Internet Protocol) as the basic underlying method of 'packaging' data to be transferred.

Above that underlying packaging 'layer' of operation there are two general methods of transferring data.

The first method, which is the one most of us know from 'surfing the Web', involves making a point-to-point connection when transferring data. This point-to-point connection uses the TCP (Transmission Control Protocol) part of TCP/IP. It's a lot like making a phone call, when the other person answers the phone your connection is acknowledged and you can transfer data back-and-forth (talk) point-to-point.

The second method, called a datagram or connection-less interface, is a simple 'pack it up and ship it out' technique that essentially works like mailing a letter. With a datagram you don't make a connection with the receiver, you simply send your data and assume that it will get where you're sending it. In the Internet world a protocol known as UDP (User Datagram Protocol) is used to transfer data in this way.

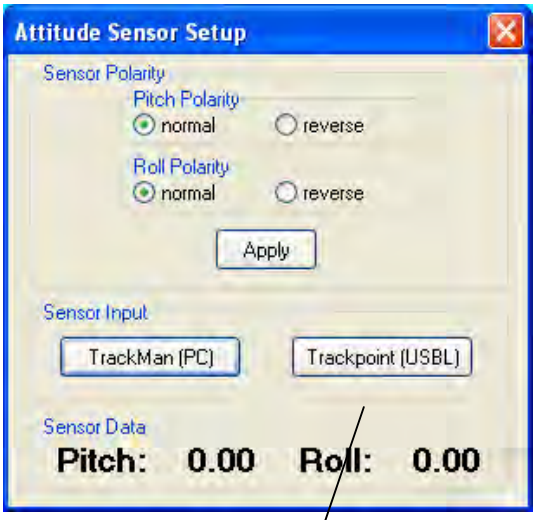
One of the advantages of UDP is that you can send data to more than one receiver at a time since there's no need to establish a point-to-point connection. This technique is known as UDP broadcast mode. Using UDP broadcast mode an application acts much like a radio station, it broadcasts data on a specific IP port and anyone who wants to 'listen' to the data 'tunes in' to that port. There's no

need to make a point-to-point connection so there's no connection to break when a listener stops listening.

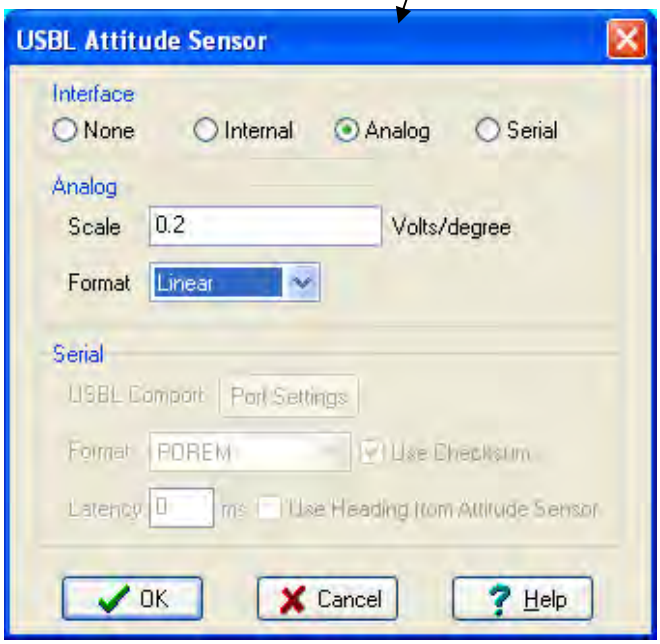
**The Sentence Output from Trackman** is the data format sent from the PC to the Navigation System. The list of formats available are; PORE, POREB, POREG, SNTTM, STANDARD, STANDARD-EC, STD W/PR, STD-EC W/PR, NCSS, NCSS-EC, NUWC, NUWC-EC, REV 4 & REV 4-EC.

### ***Setup ➪ Attitude Sensor Setup***

This is the System Level Attitude Sensor setup. (Same as clicking on the Attitude Sensor line in the Project Tree.)




The pitch and roll signals compensate target position for vessel motion. The analog inputs [Trackpoint (USBL)] can accept voltages up to +/-10 VDC. The normal vessel motion for a positive (+) Voltage pitch is BOW UP and the normal vessel motion for a positive (+) Voltage roll is PORT UP. The polarity of the analog input signals into the TP3 can be reversed and compensated for in the USBL ATTITUDE SENSOR POLARITY dialog box. Normal polarity for pitching bow up is (+) and for rolling port side up is (+). The VRU scaling can also be modified under the USBL ATTITUDE SENSOR menu. Normal scaling is 0.222 V/degree (+/- 10VDC = +/-45°). This dialog also allows the selection of the Compass Sensor Input to be either from Trackman (PC) or (TrackPoint (USBL)).




**NOTE:** For a Remote VRU the normal Voltage polarity for pitching BOW UP is [+]. The normal voltage polarity for rolling PORT UP is [+]. The RS232 Format STD W/PR (standard format with pitch and roll at end of data string) also outputs data with this same protocol. The RS232 Format NMEA ORE (NMEA 0183 type format string that is proprietary to ORE Offshore and includes pitch and roll data at end of string) is different in that it outputs data in the same polarity as its incoming voltage. This allows pass-through of signals from remote VRU to integrated navigation system without modification of polarities.

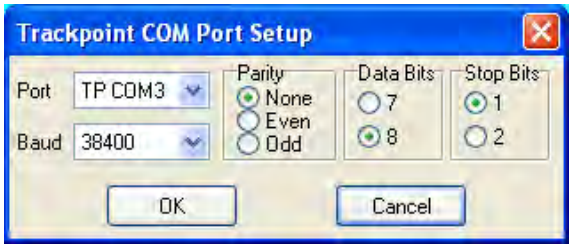
The three types of Attitude Sensors that can be interfaced to the system are; **Internal**, **Analog** or **Serial**.

Select INTERNAL when the Trackpoint is interfaced to either an ORE Model 4610B or 4211A/4740A Hydrophone/VRU-Amplifier combination. This connects the analog input directly to the Hydrophone and defaults the scaling to 0.222 Volts/degree. (+/- 10VDC = +/-45°)

Select ANALOG when using an external sensor with an analog output. The scaling can then be modified to be compatible with the external sensor. For example, a Model 4414B Pitch/Roll sensor.

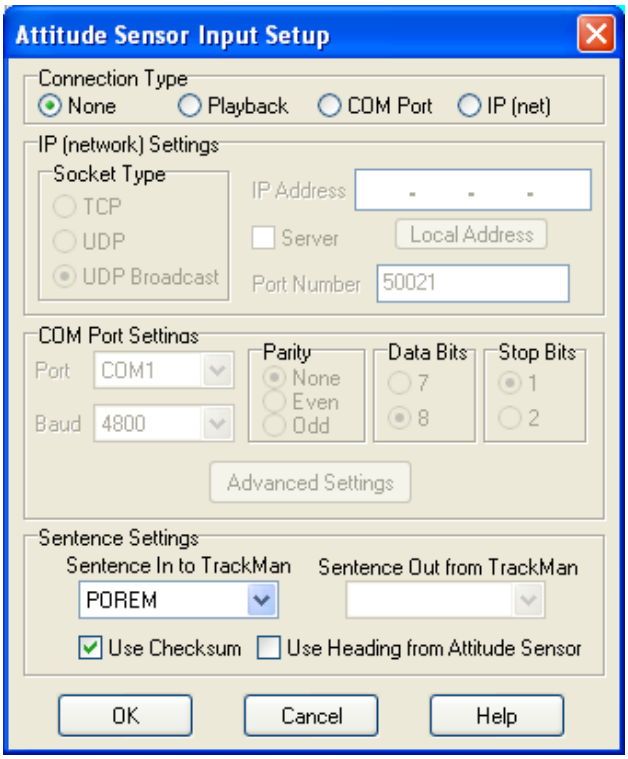
Select SERIAL when using a sensor that outputs the data serially. For example, an NMEA format from an ORE Model 4760A MRU. The various formats available at the Trackpoint (USBL) COM ports 2 or 3 are...

- TSS1
- TSS HHRP
- PRDID
- CDL/MDL
- PSXN (Seatex)
- POREM




Configure the Port Settings by selecting the COM Port that the data is input to the Trackpoint device. (COM 2 or COM3) Next select the Port #, Baud Rate, Parity, Data Bits and Stop Bits. Note that the baud rate is limited to 38400 and the data rate is limited to 12Hz on these ports.

**NOTE:** The SERIAL attitude data can be input either into the Trackpoint 3 Deck unit (Trackpoint USBL) or the PC that the Trackman software is installed (Trackman (PC).




If the data is input via the Trackman PC then select from the Attitude Sensor Setup box the Trackman (PC) button. The Attitude Sensor Input Setup box is displayed. Select COM Port button at the top and then select the COM Port settings. Port #, Baud Rate, Parity, Data Bits and Stop Bits. Next select the format from the Sentence Settings. The various formats available are...

- POREM
- POREI
- TSS1
- PRDID
- PSXN

The data on these ports can typically be up to 115,000 baud and rates greater than 100Hz.

**Sentence Formats:**

**POREM – Pitch, Roll and Heading**

```
           1        2        3        4      5     6     7 8
           |        |        |        |      |     |     | |
$POREM,+xxx.xx,+xxx.xx,+xxx.xx,+xxx.xx,xxx,+xx.xxx*CS<CR><LF>
```

Field Number:

1) Pitch (degrees)
2) Roll (degrees)
3) Temperature (degrees C)
4) Heading (degrees) [2]
5) Error Code
6) Heave (meters)
7) "*" end of sentence delimiter
8) CS = CheckSum

**TSS1 – Heave, Roll, and Pitch**

```
1 2   3 45   6 78   9 11   1
| |   | ||   | ||   | 01   2
| |   | ||   | ||   | ||   |
:XXAAAASMHHHHQMRRRRSMPPPP<CR><LF>
```

Field Number:

1) Start Character ":"
2) Horizontal Acceleration
3) Vertical Acceleration
4) Space Character
5) Space if positive, Minus if negative
6) Heave (centimeters) (N/A) (positive is above datum)
7) Status Flag
8) Space if positive, Minus if negative
9) Roll X 100 degrees [3]
10) Space Character
11) Space if positive, Minus if negative
12) Pitch X 100 degrees [1]

---

[2] If using heading also, make sure to check the "Use Heading From Attitude Sensor" box.

[3] Roll and pitch measurements are in degrees in the range –99.99° to +99.99°. Positive roll is port-side up, starboard down. Positive pitch is bow up, stern down.

**TSS HHRP2 –Heave, Roll, Pitch and Heading**

```
1   2 34   5 67   8 91   1 1
|   | ||   | ||   | |0   1 2
|   | ||   | ||   | ||   | |
:DDDDSMHHHHQMRRRRSMPPPPM<CR><LF>
```

Field Number:

1) Start Character ":"
2) Heading X 100 degrees [4]
3) Space Character
4) Space if positive, Minus if negative
5) Heave (centimeters) (N/A) (positive is above datum)
6) Status Flag
7) Space if positive, Minus if negative
8) Roll X 100 degrees [5]
9) Space Character
10) Space if positive, Minus if negative
11) Pitch X 100 degrees [2]
12) Heading Status (N/A)

**PRDID - Pitch, Roll and Heading**

```
          1        2      3     4
          |        |      |     |
$PRDID,+xx.xx,+xx.xx,xxx.xx*CS<CR><LF>
```

Field Number:

1) Pitch (+ or -)
2) Roll (+ or -)
3) Heading [3]
4) CS = CheckSum [6]

[4] If using heading also, make sure to check the "Use Heading From Attitude Sensor" box.

[5] Roll and pitch measurements are in degrees in the range –99.99° to +99.99°. Positive roll is port-side up, starboard down. Positive pitch is bow up, stern down.

[6] The TSS MAHRS and others may not use the Checksum field. Uncheck the "Use Checksum" box as required.

**PSXN - Pitch, Roll, Heading and Heave**

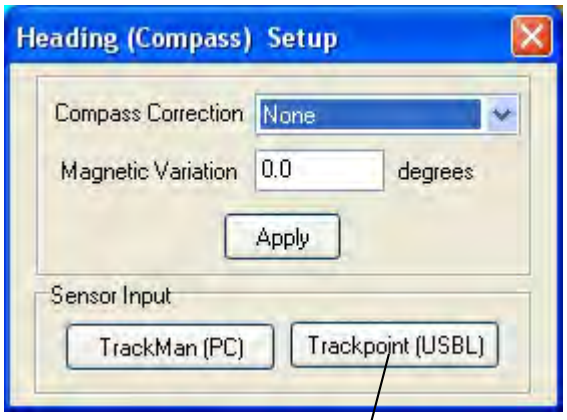
```
       1     2        3        4
       |     |        |        |
$PSXN,23,-xx.xx,-xx.xx,xxx.xx,,*CS<CR><LF>
```

Field Number:

1) Message 23
2) Roll (degrees) (Positive Port Side Up) (N/A)
3) Pitch (degrees) (Positive Bow Up) (N/A)
4) Heading, True (Degrees) [7]
5) Heave (meters) (Positive Up) (N/A)
6) CS = CheckSum

[7] If using heading also, make sure to check the “Use Heading From Attitude Sensor” box.

### ***Setup*** ➪ **Compass Setup**



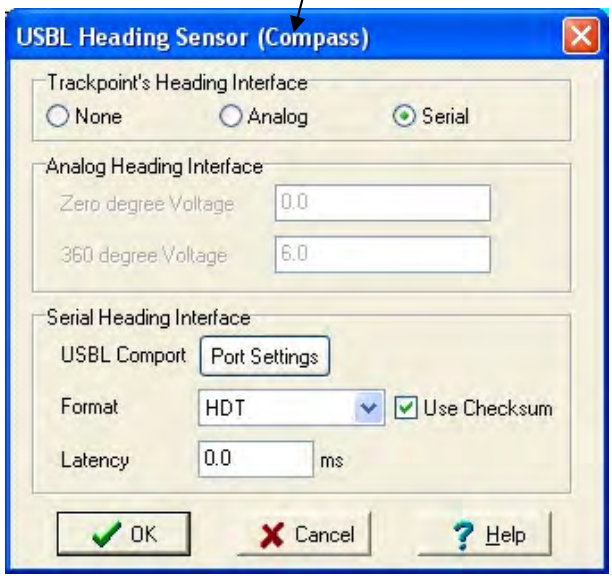

This is the System Level Heading sensor setup. (Same as clicking on the Heading Sensor line in the Project Tree.)

The heading data can be set to off (None), Grid Only, Data Output Only or Both Data Output and Grid. If for example, the Navigation System was to correct for compass heading and not TrackPoint then set the North Reference to Grid only. The RS-232 data would not be corrected for North but the Target position on the grid would be. The Compass Correction can either be...

- None
- Data O/P Only
- Grid Only
- Both Data O/P & Grid

Enter in the magnetic variation in degrees.

This dialog also allows the selection of the Compass Sensor Input to be either from Trackman (PC) or (TrackPoint (USBL)).




Clicking on the "TrackPoint (USBL)" button brings up the "USBL Heading Sensor (Compass)" dialog box. Select **None** (to turn off) or the interface required, either **Analog** as input Trackpoint 3 Desktop unit 's rear panel ANLG SENSOR INPUT connector or the **Serial** port which accepts NMEA compass sentences. The Serial input goes into the DB-9 connector located on the rear panel of the unit.

When the compass is enabled (either Analog or Serial, Trackman (PC) or TrackPoint (USBL) Deck Unit), the RS-232 target position data is automatically switched to north referenced. This means that the target data (bearing, X, Y) output to the RS-232 port is referenced to North instead of the bow of the vessel. The operator can override this by selecting Compass Setup from the main Setup Menu. Click the pull-down menu of the dialog box and select where the Compass Correction should be applied; **None, Data O/P Only, Grid Only, Both Data O/P & Grid**. The "Grid Only"

function is used in situations where the TrackPoint is interfaced to a navigation system and the navigation system already interfaces to a heading sensor such as a flux gate compass or gyro-compass. In this case, the TrackPoint's RS-232 data does not need to be corrected for North reference. However, the TrackPoint requires a compass input to compensate for vessel motion within its filtering algorithms. By selecting "Grid Only" the target data on the TrackPoint screen remains referenced to North while the RS-232 data is referenced to the bow of the vessel thus allowing both the TrackPoint II and the navigation system to function properly. To have the TrackPoint Heading correction applied along with the RS-232 Data Output then select "Both Data O/P & Grid".

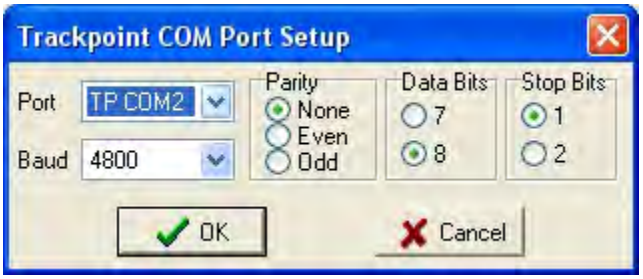
**NOTE:** When the Compass Correction function is set to "Data O/P Only", the RS-232 data is averaged (when Smoothing is enabled). However, the positional data on the screen of the TrackPoint is only smoothed or averaged prior to the target's compass correction resulting in positional changes directly related to the change in compass heading. When the Compass Correction function is set to "Grid Only" the target position is averaged after the compass has corrected the data for North Reference resulting in a more "smoothed" target position on the TrackPoint screen.

**Analog:** For the Analog Heading Sensor electrical interface see Installation, Section 2 above. The TrackPoint converts the analog Voltage to a ship's heading in degrees.

In the "Zero degree Voltage" box enter the minimum Voltage that corresponds to zero degrees. (Range 0 - 5.99VDC) In the "360 degree Voltage" box enter the maximum Voltage that corresponds to 359.99 degrees. (Range 0.1 - 6.0VDC)

When in analog compass mode the heading data is displayed at the top left of the screen and has a suffix "A" attached to indicate that the data is from the analog input.

**Serial:** See section 2 (Installation) for wiring the compass to the Deck Unit COMMS connector. Click on "Port Settings" to select the TrackPoint 3 Deck Unit comport that the compass connects to. (COM2 or COM3) Set the baud rate, Parity, Data Bits and Stop Bits to agree with the compasses serial port protocol. Refer to section 2 for COM Port wiring for the COMMS connector.




**Format:** The Input Format allows selection of either "HDT", "HDM" or "HDG" NMEA formats or the Precision Navigation (PNI) TCM-2 format. Press OK to use the set parameters or Cancel to ignore.

For further information on the NMEA standard contact; NMEA, 7 Riggs Ave., Severna Park, MD 21146 U.S.A., Tel: 410-975-9425, http://www.nmea.org, E-Mail: info@nmea.org

For further information on the TCM-2 format contact; PNI Corporation 133 Aviation Blvd, Suite 101 Santa Rosa, CA 95403 USA, Tel: 707-566-2260, Fax: (707)566-2261, http://www.pnicorp.com/, E-Mail: CustomerService@pnicorp.com

The following describes the format of each of the NMEA and the TCM-2 compass sentences. If the "Use Checksum" is checked, and the checksums do not agree, the data is ignored. If the "Use Checksum" is not checked then the data is accepted even if the checksum does not agree or is missing from the string. (The checksum is the 8-bit exclusive OR (no start or stop bits) of all characters in the sentence, including "," delimiters, between both, but not including, the "$" and the "*" delimiters.) On the RS-232 target output data sentence there is no compass heading identifier to distinguish between True and Magnetic heading information except on the NMEA ORE format.

The Heading data is continuously received from the ComPort but only updates when a valid target has been detected. If the compass heading has not changed by at least 0.1° in 10 seconds then an error code 55 is displayed. The maximum rate that the TrackPoint can receive the heading data is 8Hz at 4800 baud or 16Hz at 9600 baud.

If the RS232 output format (COM port #1 parameter) is set either to STD-EC or STD-EC W/P-R, and an error code #6 is encountered, the heading data from the NMEA device is sent out the ComPort #1. The TrackPoint waits approximately 16 seconds, after loss of replies, before generating an error code #6. The rate at which the RS232 is output is set by the COM1 Interval (minimum of two-second interval). If the NMEA sentence received on COM port#2 is from a Precision Navigation TCM-2 Compass Module and the sentence format is set to the standard TCM-2 format then the TrackPoint outputs the pitch and roll data also. This is only valid with the ComPort #1 output format, STD-EC W/P-R. The TrackPoint outputs the data as it is read from the sentence. That is to say, the remote VRU polarity switches have no affect on the RS232 data.

The various formats the system can receive are shown below;

**HDT - Heading, True**

```
        1   2 3
        |   | |
$--HDT,x.x,T*CS<CR><LF>
```

Field Number:

1) Heading, degrees True
2) T = True
3) CS = CheckSum

The TrackPoint displays the heading data on the screen and adds a suffix "T" to indicate heading is True.

**HDM - Heading, Magnetic**

```
          1   2 3
          |   | |
$--HDM,x.x,M*CS<CR><LF>
```

Field Number:

1) Heading, degrees Magnetic
2) M = Magnetic
3) CS = CheckSum

The TrackPoint displays the heading data on the screen and adds a suffix ”M” to indicate heading is Magnetic.

**HDG - Heading, Deviation and Variation**

```
          1    2   3   4   5 6
          |    |   |   |   | |
$--HDG,x.x,x.x,a,x.x,a*CS<CR><LF>
```

Field Number:

1) Magnetic sensor heading, degrees
2) Magnetic variation, degrees, E/W
3) E = east, W = west
4) Magnetic variation, degrees, E/W
5) E = east, W = west
6) CS = CheckSum

The TrackPoint calculates magnetic heading by adding Easterly deviation to, or subtracting Westerly deviation from, the magnetic sensor reading. It calculates true heading by adding Easterly variation to, or subtracting Westerly variation from, the magnetic heading. If the sentence structure only contains magnetic heading information then the TrackPoint displays an “M” after the heading data on the display screen. If the sentence contains variation information it calculates the true heading and the TrackPoint displays a “T” after the heading data indicating True heading.

TCM-2 is a proprietary sentence from Precision Navigation. Sentence consists of the following parameters;

**$C <COMPASS> P <PITCH> R <ROLL> X <BX> Y <BY> Z <BZ> T <TEMP> E <ERROR CODE> * CHECKSUM <CR> <LF>**

Example: $C328.3P28.4R-12.4X55.11Y12.33Z-18.43T22.3E001*CHECKSUM<CR><LF>

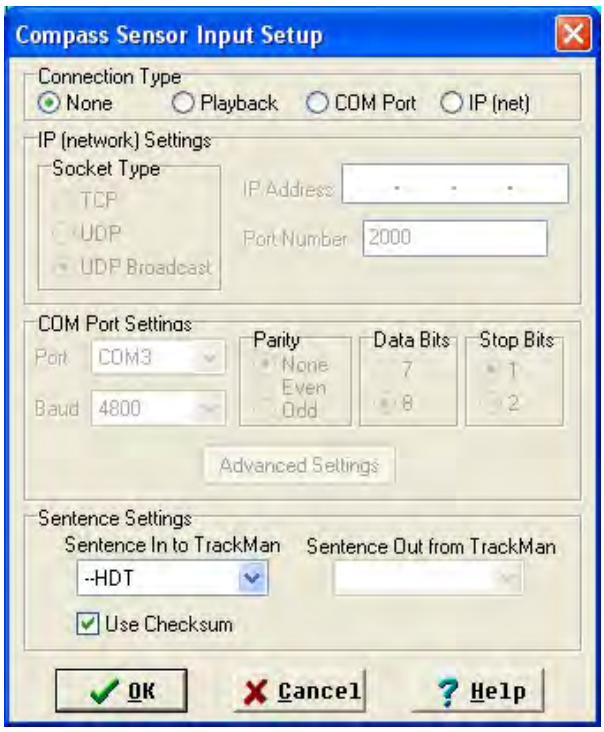
The TrackPoint reads the compass, pitch and roll data from the sentence. All other data is ignored.

**NOTE:** Any parameters not enabled in the TCM-2 Compass module are not included in the output word. For example, setup the unit to only output compass, pitch & roll. See following;

**$C328.3P28.4R-12.4*CHECKSUM<CR><LF>**

The pitch and roll received from this string can be used for either dynamic or static offsets depending on the Hydrophone - Offset - Status Command within the TrackPoint.

To setup a Compass Sensor that is input to the PC, (Trackman Software is installed on this PC) click on the "**Trackman (PC)**" button. (This is the same as clicking on the Device List and selecting Compass Setup.) A dialog box labeled "Compass Sensor Input Setup" is displayed. This only allows input via RS232 serial port or an IP socket. No Analog function. Setup the port to agree with the compass' parameters. See *Setup* ➪ Data Output above for IP (net) description.




**COM Port Settings:** See section 2 (Installation) for wiring the compass to the Deck Unit COMMS connector. Select the TrackPoint 3 Deck Unit comport that the compass connects to (COM2 or COM3). Set the baud rate, Parity, Data Bits and Stop Bits to agree with the compass' serial port protocol.

**Sentence:** The Input Format allows selection of either "HDM", "HDT", "HDG", "PRDID" or "PSXN" NMEA formats. Press OK to use the set parameters or Cancel to ignore.

**PRDID - Pitch, Roll and Heading**

```
          1       2      3     4
          |       |      |     |
$PRDID,+xx.xx,+xx.xx,xxx.xx*CS<CR><LF>
```

Field Number:

1) Pitch (+ or -)
2) Roll (+ or -)
3) Heading [8]
4) CS = CheckSum [9]

[8] This is typically a Pitch and Roll sentence with an optional Heading output. The data string will include gyro heading information only if it is available. If there is no heading information available, the heading field will be null.

**PSXN - Pitch, Roll, Heading and Heave**

```
       1     2        3        4
       |     |        |        |
$PSXN,23,-xx.xx,-xx.xx,xxx.xx,,*CS<CR><LF>
```

Field Number:

1) Message 23
2) Roll (degrees) (Positive Port Side Up) (N/A)
3) Pitch (degrees) (Positive Bow Up) (N/A)
4) Heading, True (Degrees)
5) Heave (meters) (Positive Up) (N/A)
6) CS = CheckSum

[9] The TSS MAHRS and others may not use the Checksum field. Uncheck the “Use Checksum” box as required.

***Setup*** ➪ **Reset Devices /Ports**

Resets the COM and TCP/IP ports within the Trackman PC.

***Setup*** ➪ **Reset Grids/Graphics**

Resets the graphics “engine” within the Trackman PC.

***Setup*** ➪ **Audio (ping)**

This provides an audible ping when a reply is detected on the COM port. Toggles on or off. Plays sound through the PC’s speaker (Not supplied).

***Setup*** ➪ **Hints (Tool Tips)**

Enables the tool tips. Toggles on or off.

***Setup*** ➪ **Update While Hidden**

When the Trackman application is minimized it can either continue plotting so that the data can be seen once it is resumed (✓ Update While Hidden) or the application can stop plotting the data and when resumed the screen will have no data points shown. This saves processing time when interfacing to a navigation program that is running on the same PC.

### 3.3.4 USBL MENU

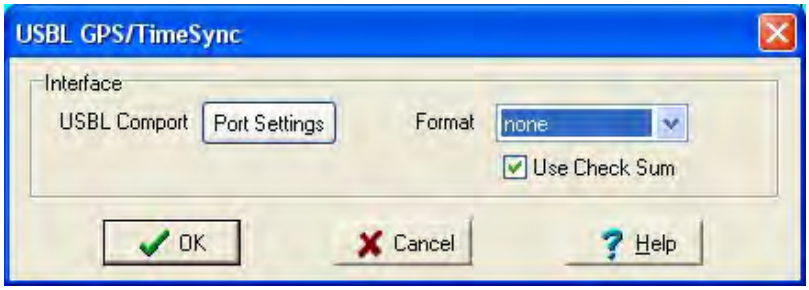
Pertains to functions/parameter settings on the TrackPoint 3 Deck Unit.

***USBL* ➔ GPS/Time Sync**

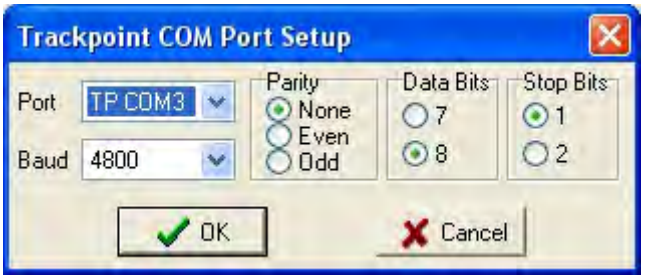
From the USBL main menu select **GPS/Time Sync** to bring up the USBL GPS/Time Sync setup parameter dialog box.

Select the USBL Comport, that the "Time" sentence is interfaced to by clicking on the "Port Settings" button.

Select either the ZDA format or the GGA format.




When ZDA or GGA is selected the Time coming from the SPC packet is ignored so that it does not update from the PC. "Time" on the Deck Unit will be synchronized with the GPS time. The Deck Unit synchronizes all sensor data and target detection to this time. For example, when the target reply is detected the raw data is automatically time-stamped to within 50ms of the GPS time. The same for all the analog sensor data and the compass serial port data.




Example of ZDA sentence.

**$--ZDA,hhmmss.ss,xx,xx,xxxx, xx,xx*hh**

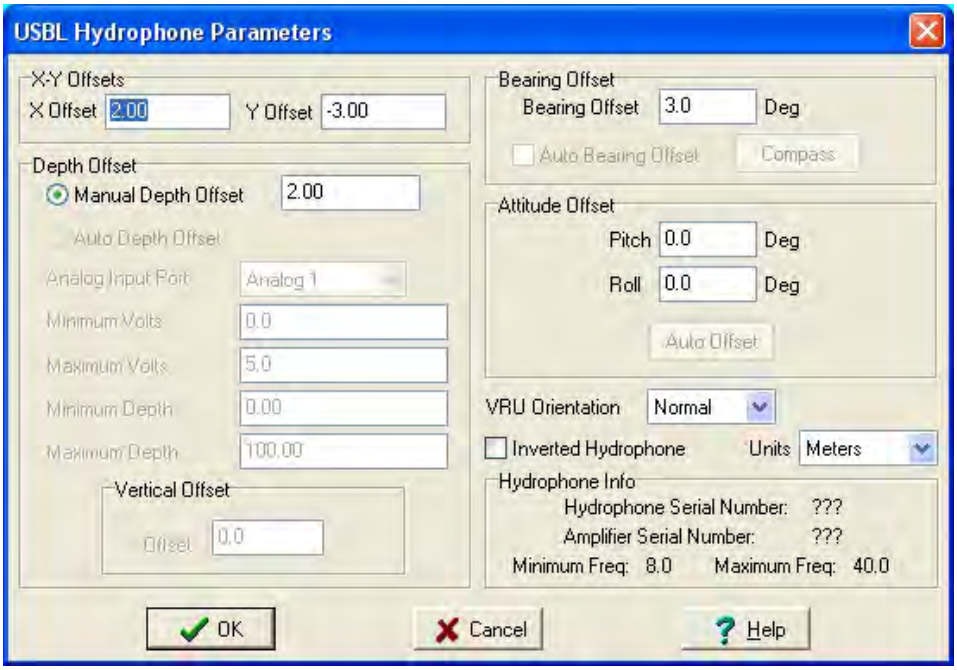
Example of GGA sentence.

**$GPGGA,174007,4131.4511,N,07040.3336,W,1,6,01.0,000003.1,M,-00033.7,M*hh**

All serial sensor data into the USBL or TrackPoint interface is time tagged and the closest point to the reply detection is used for motion compensation.

### *USBL* ➪ Hydrophone

From the USBL main menu select **Hydrophone** to bring up the USBL Hydrophone setup parameter dialog box.




Hydrophone Offsets are used to reference the target position to the pitch / roll center of the vessel. The system uses the hydrophone offsets to reposition the target with respect to the pitch/roll center of the vessel and also to correct for the hydrophone's dynamic motion. Hydrophone motion is due to the pitching and rolling of the vessel when it is not on the pitch or roll center of the vessel. ( The system assumes the hydrophone is rigidly mounted to the vessel. ) The hydrophone, when mounted offset from the vessel's pitch / roll center, swings in an arc about the pitch / roll center causing variations in the hydrophone depth, X and Y offsets as the vessel experiences dynamic motion. These variations cause the target to appear to be at a different depth, depression angle and bearing than it actually is. By entering in X, Y and Z offsets the system can correct for this dynamic motion if a survey grade Motion Sensing System is interfaced to the TrackPoint 3. See ORE Model 4414B Motion Sensing System.

At the time of installation, the hydrophone should have been oriented as nearly as possible in parallel with the centerline of the ship, and any remaining bearing offset determined (Refer to section 2).

**Bearing Offset:** The Bearing Offset is the rotational offset between the hydrophone's acoustic zero-degree line and the vessel's centerline. See section 2.4.1 for this installation setting. Enter the Bearing Offset as determined in Section 2.4.1.

**X & Y Offsets:** Determine X and Y offsets for the hydrophone in relation to the pitch / roll center as explained in section 2.4.2. To enter hydrophone offsets, select HYDROPHONE from the Project Tree. A dialog box consisting of X, Y, DEPTH and BEARING offsets are displayed. Enter the X and Y Offsets as determined in Section 2.4.2.

Hydrophone X and Y offsets are entered with respect to the pitch / roll center of the vessel. It is assumed that the vertical reference for the pitch / roll center is the water-line of the vessel or the entered “DEPTH OFFSET”. Once the X and Y Offsets are entered and the dialog box closed, a small "Hydrophone" symbol appears in the Plotting Window and moves in relation to the X and Y offsets that are input. This "Hydrophone" symbol represents the actual position of the hydrophone. The ships reference point remains in the center of the tracking display.

NOTE: The TrackPoint outputs the target position with respect to the pitch / roll center of the vessel graphically in the Display, numerically in the Status Block and also on the RS-232 serial communications port.

**Depth Offset:** Manually enter the depth offset as determined in section 2.4.2. This is the Depth of the hydrophone from the water surface (which is assumed to be on the same plane as the pitch/roll center of the vessel) to the tip of the hydrophone. Manual mode only. Auto Offset is used only in special cases, not applicable with TrackPoint Portable.

**Attitude Offset:** This is the (static) vertical offset of the hydrophone in degrees.

Enter the hydrophone attitude error corrections in degrees. It is used to offset the static attitude of the hydrophone/staff. The attitude (pitch/roll) offsets are error constants that compensate for the non-vertical installation of the hydrophone shaft and/or vessel trim. The operator must measure the angle of the shaft with respect to vertical and enter the data in this menu. Pitch and roll errors are entered in degrees. Maximum range is +/- 45°.

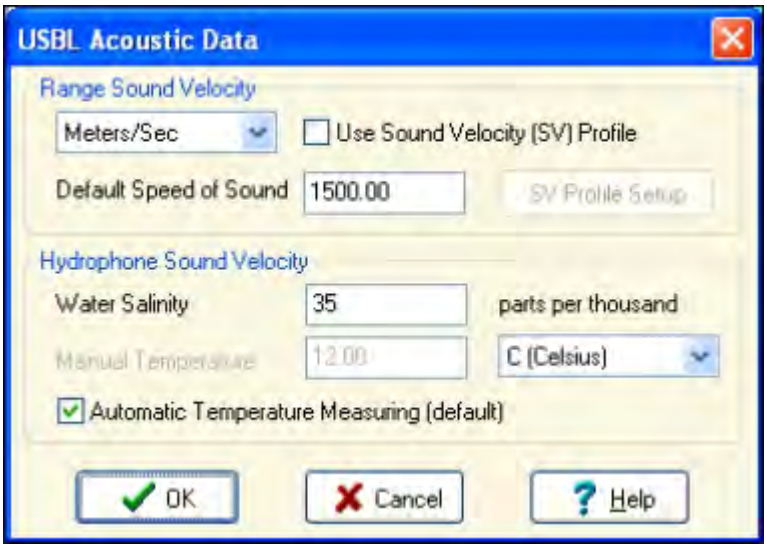
The attitude (pitch/roll) offset errors follow the polarity convention of; vessel Bow up = [+], Port up = [+]. For example, if the combined hydrophone shaft and vessel trim causes the Hydrophone (4610B or 4211A) mounted on the end of the staff) to tilt towards the port side (has the same affect as tilting so that the port side of the vessel is up), the roll error is entered as a positive value. And, if the Hydrophone is tilted towards the aft of the vessel (vessel attitude = bow down) the pitch error is entered as a negative value. Also, refer to section 2.4.3.

Pitch and Roll have also been referred to as Tip (fore/aft) and Tilt (port/starboard).

**Units:** Sets the units that the dimensional offsets are relative to; Meters, feet or Yards.

**Orientation:** If an ORE remote Pitch and Roll sensor is used, such as the Model 4730A, or 4740A the system can allow for different mounting configurations of these VRU assemblies. In some instances, when attempting to mount the VRU assembly as close to the pitch and roll center of the vessel as possible, a convenient (bow facing) mounting surface is not always available. The software can compensate for four different mounting arrangements. The VRU ORIENTATION function allows the VRU assemblies to be mounted in the NORMAL position with the assembly's directional arrow facing towards the bow, or mounted to STARBOARD, AFT or PORT.

### *USBL* Acoustic Data




Brings up Acoustics Data dialog box. (Same as Acoustic Data in Project Tree) This data is used within Trackman to correct positional data based on the acoustic parameters. Enter the average water column Speed of Sound in meters/ second or feet/ second or click the Use Sound Velocity (SV) Profile check box to enter in the profile or import a file containing the profile. The default value is 1500 m/s. The slant range is calculated using this value and the acoustic travel time. Enter the Water Salinity at the hydrophone in part per thousand. Default is 35 ppt. The TrackPoint hydrophone measures the temperature automatically. This box should be checked. If not available then a manual temperature at the hydrophone can be entered in degrees Celsius or Fahrenheit.

**NOTE:** When WATER TEMP-AUTO mode is selected the system only updates water temperature upon receipt of a valid acoustic signal.

**NOTE:** The WATER TEMPERATURE and SALINITY parameters do not affect speed of sound calculations. It is used for phase correction (depression angle) at the water / hydrophone interface.

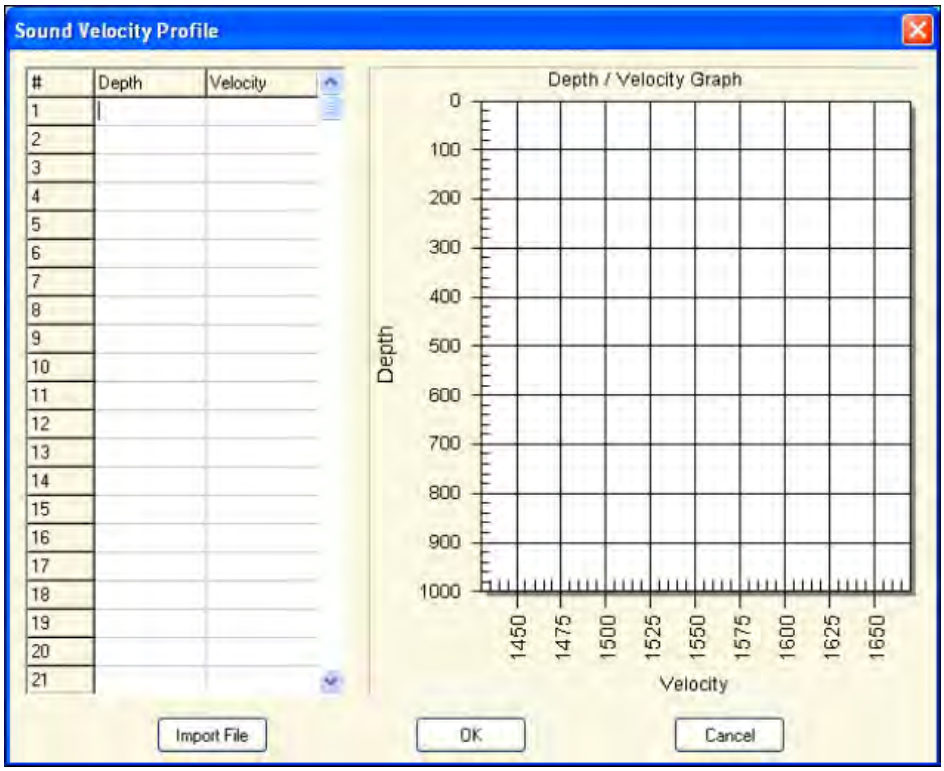
### Sound Velocity Profile

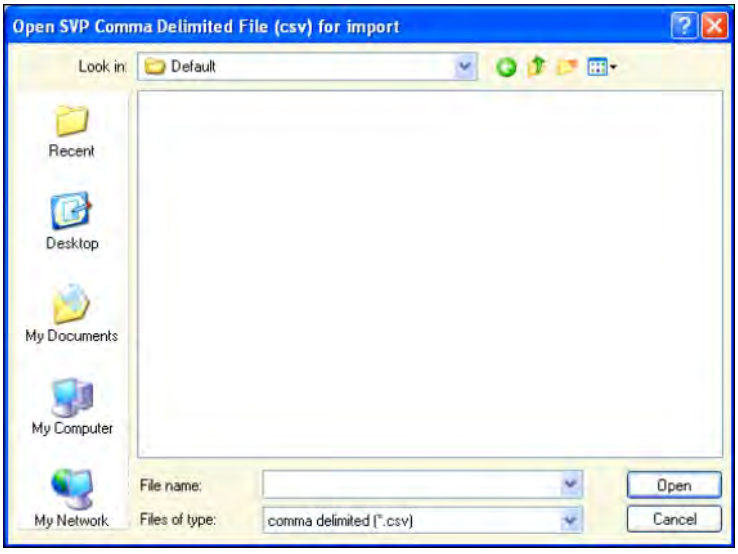
A single velocity profile can be entered by hand or loaded from a file. At each depth there is a sound velocity value. The data is being assumed to represent the sound velocity layers for the entire region within which you are operating. Therefore, it is assumed that there is no effect on bearing in this model. A non-direct sound wave segment could not be re-directed to the receive point (from a bearing point-of-view) since the effect is only on z-axis. The only two parameters that require correction are the **slant-range (SR)** and **depression angle (DA)**.

If the SVP data is available in a printout then manually enter the data within the Sound Velocity Profile chart below. For example, in layer #1 enter in the **Depth** and the **Velocity** associated with that layer. Continue entering data, filling in the chart down to the depth required. If the data entered for the Velocity is between 1400 and 1700 then it is assumed the data is in meters/second. If the Velocity values are between 4592 and 5576 then the data is assumed to be in feet/second.

The data entered will be shown in the corresponding Graph. The data entered will be saved as a csv file under the current Jobs folder. For example, ..\Jobs\TP3\CurrentSvp.csv.

If the profile is available in a csv formatted file then it can be imported, in most cases. Trackman makes some assumptions when importing the SVP files. If there are only 2 fields separated by commas (prior to a carriage return line feed), it assumes the data is in the format of Depth, Velocity. If there are 3 fields then it assumes the data is in the format of Index, Depth, Velocity



### *USBL* ➪ Get TrackPoint Config

This synchronizes the Trackman/PC with the parameters from the TrackPoint Signal Interface Module. (Takes a while!)

**C A U T I O N**

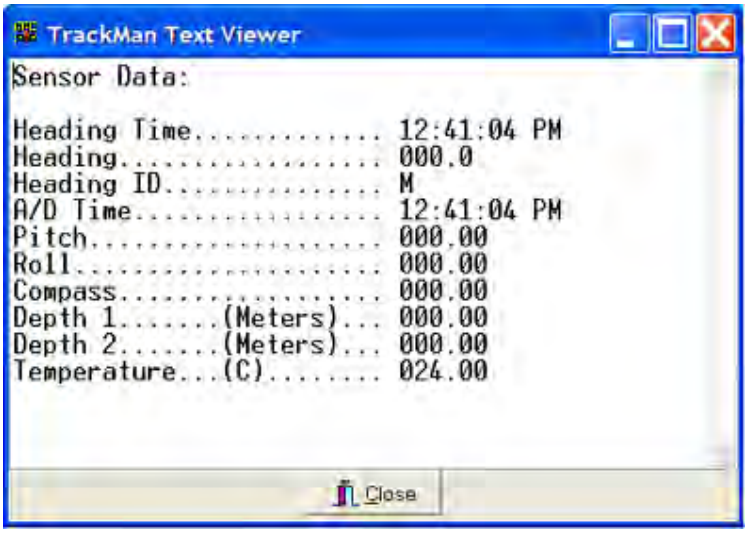
Do not use this unless you are swapping out topside processors and you want to maintain previous setup. No parameters are saved in the TrackPoint II Deck Unit when power is turned off. The unit starts up in a default mode when power is applied each time.

### *USBL* ➪ Send TrackPoint Config

Synchronizes the TrackPoint SP/IM using the Trackman saved parameters.

### *USBL* ➪ Get Sensor Data

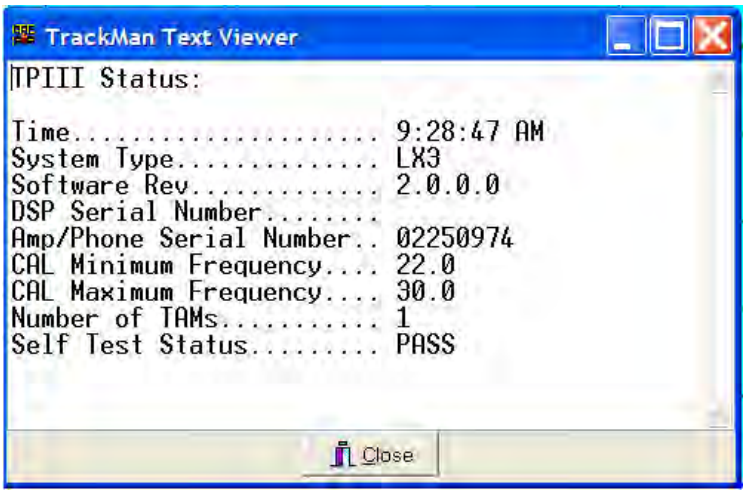
Queries the Deck Unit to read the analog sensor inputs and display their values. The A/D data is read once per command. It is possible to repeat the command while leaving the box on the screen.




Heading Time: The time the heading was received from the RS232 port.
Heading: The Heading value as received.
Heading ID: The heading reference, either Magnetic or True.
A/D Time: The time that the A/D read the values as shown. The A/D reads all sensor data within 0.2ms.
Pitch/Roll: The analog pitch value in degrees.
Compass: The analog compass in degrees.
Depth 1: The analog depth value in meters.
Depth 2: The analog depth value in meters.
Temperature: The temperature of the Hydrophone in degrees C.

### *USBL* Get Status

Obtains the Status of the TrackPoint 3 Deck Unit. Displays the Time, System Type (TP3P = LX3), Revision of the Software, DSP Serial Number, Filter/Amp & Hydrophone Serial Numbers, the calibration frequency band, the number of TAM's and a Self Test indication.




### *USBL* Download Code

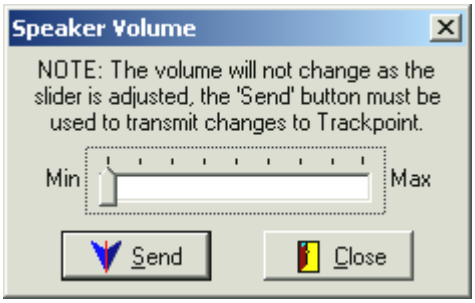
Refer to Section 5.2 for downloading Application Code to the SP/IM's DSP.

### *USBL* Download CAL

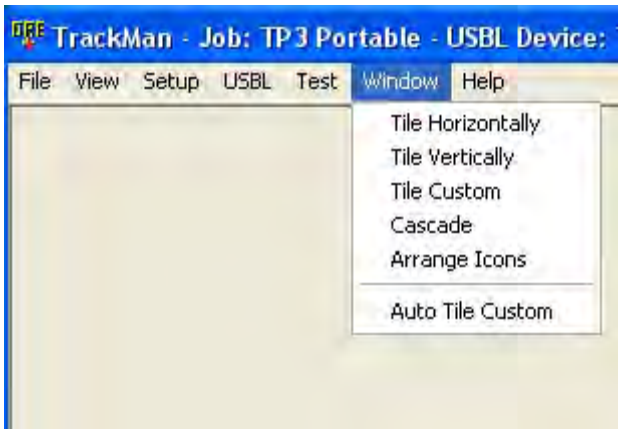
Refer to Section 5.1 for downloading Hydrophone calibration data to SP/IM.

### *USBL* Volume Control

Sends command to SP/IM to set volume of internal speaker. Move slider over with mouse and press send.



### 3.3.5 WINDOW MENU




***WINDOW*** **Tile Horizontally**

Tiles the Plotting Window and Status Block Horizontally.

***WINDOW*** **Tile Vertically**

Tiles the Plotting Window and Status Block Vertically.

***WINDOW*** **Tile Custom**

Tiles the Plotting and Status Blocks (child windows) to optimally fit the main window (client window).

***WINDOW*** **Cascade**

Places Plotting Window and Status Block one behind the other.

***WINDOW*** **Arrange Icons**

**Not available.**

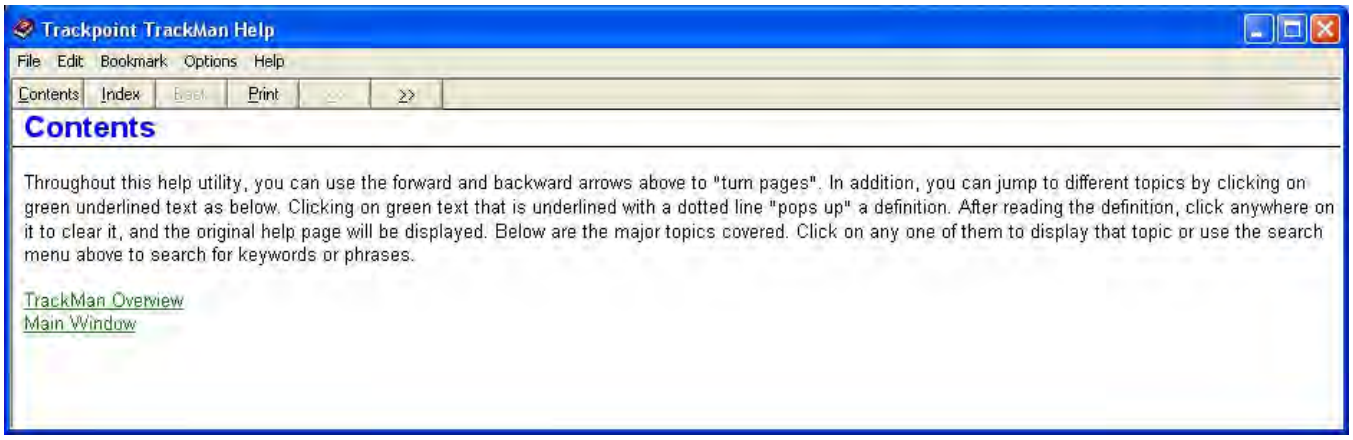
***WINDOW*** **Auto Tile Custom**

A check box to enable the Custom Tiling. If not checked, when main window is re-sized the plotting and status blocks will have to be re-sized manually to fit in the main window again.

### 3.3.6 HELP MENU




***HELP* Contents**




***HELP* About**

Shows the Trackman version number and the Processor's Physical Memory (RAM) in % used.



## 3.4 TRACKING TRANSPONDERS, RESPONDERS AND PINGERS

The TrackPoint 3 has the capability to track up to 4 targets **sequentially ("consecutively")** using a single receiver/detector channel. "Multiple Target Tracking" consists of a maximum of any of the following combinations of target types that can be enabled at one time (each transponder or responder can also include telemetry):

4 Transponders

1 Responder

1 Responder and 3 Transponders

1 Pinger

1 Externally Triggered Responder or Transponder

To track multiple targets the TrackPoint sequences through the various reply frequencies while interrogating on one frequency, or it can sequence through the interrogation frequencies and receive the same reply frequency, or a combination of the two. This capability provides the operator with the versatility to track various combinations of targets.

Example #1:

Transponder #1 - Interrogation Freq.: 17 kHz, Reply Freq.: 23 kHz

Transponder #2 - Interrogation Freq.: 17 kHz, Reply Freq.: 25 kHz

Transponder #3 - Interrogation Freq.: 17 kHz, Reply Freq.: 27 kHz

Transponder #4 - Interrogation Freq.: 17 kHz, Reply Freq.: 29 kHz

In the example above, a potential problem exists if any transponders are very close to one another, i.e., less than 2 meters (at a normal pulse width of 1.3 msec). This would cause acoustic interference resulting in erroneous position data. It would also decrease battery life as it would interrogate the beacons when their replies were not being tracked.

**NOTE:** If the repetition interval is set to 2 seconds, the TrackPoint updates each transponder position every 8 seconds.

Example #2:

Transponder #1 - Interrogation Freq.: 17 kHz, Reply Freq.: 25 kHz

Transponder #2 - Interrogation Freq.: 18 kHz, Reply Freq.: 25 kHz

Transponder #3 - Interrogation Freq.: 19 kHz, Reply Freq.: 25 kHz

Transponder #4 - Interrogation Freq.: 20 kHz, Reply Freq.: 25 kHz

Example #3:

Transponder #1 - Interrogation Freq.: 17 kHz, Reply Freq.: 23 kHz

Transponder #2 - Interrogation Freq.: 18 kHz, Reply Freq.: 25 kHz

Transponder #3 - Interrogation Freq.: 19 kHz, Reply Freq.: 27 kHz

Transponder #4 - Interrogation Freq.: 20 kHz, Reply Freq.: 29 kHz

### 3.4.1 TRANSPONDER MODE

**Acoustic Transponder Mode**

To establish tracking in the **Transponder** mode, you must have the proper interrogation transducer and transponder(s) must be operational and in the water.

NOTE: The interrogation transducer inside the Model 4610B hydrophone has an optimal frequency range of 17 to 20 kHz.

From the Beacon dialog box select the **SETUP** tab and then select Active target. Select the target symbol that you want the target to be represented by. Enter a name for the target. From the Beacon **ACOUSTIC PARAMETER** Tab set target type to Transponder, assign a Receive Frequency, Burst Turn Around Time, Interrogation Frequency, Interrogation Interval and Pulse Width. (This information is found the Multibeacon Label, 4330X, 435X) Select Trigger source, internal or external. From the DEPTH tab select depth mode or enter in depth manually.

Interrogation Interval for a transponder should not be less than 2 seconds; most transponders have a 1.5- to 1.75-second lock-out time built in to prevent interrogation echoes from retriggering the transponder. If interrogating two transponders at different frequencies then it's possible to decrease the Interrogation Interval to less than two seconds as the Interrogation Interval for a single target will be the total of the intervals. E.g., interrogate #1 at 17kHz every 1.5 seconds and #2 at 19kHz every 1.5 seconds, the sequence interval for the two targets is 3.0s which is still greater than the lockout time of the transponders. Also keep in mind that when using telemetering transponders the second (telemetry) reply may come in up to one second later than the primary (navigation) reply. Increase Interrogation Interval accordingly.)

NOTE: With ORE Model 4330 series of transponders, pulse widths of less than 5 msec may not properly interrogate the transponder. For Model 4350 transponders use a pulse width of 10 ms.

At a XMIT INTERVAL of 2 seconds, a transponder turnaround time of 15 ms and a speed of sound input of 1500 meters/second the maximum range the system could track the transponder would be about 1400 meters. [(1500m/s * (2s - .015s)) / 2 = 1489 m] If a telemetry transponder were used at its maximum range (telemetry delay of 1 second from primary reply) then the maximum range would be reduced further to about 700 meters. [(1500m/s * (2s - 1s - .015s)) / 2 = 738.75m]

**Input Speed Of Sound**

The correct speed of sound in the water column between the transponder and the hydrophone must be entered for accurate tracking in the transponder mode. From the Project Tree select "Acoustic data". Input the sound speed in meters per second or feet per second or yards per second, depending on the current unit of measure.

The speed of sound in the water column is used to determine the transponder range. The average water column temperature is usually different than near-surface temperature (the temperature

measured by the hydrophone), and therefore, this speed of sound generally differs from that computed by the operator from a reading of the hydrophone temperature. (The hydrophone temperature is used only to determine the target depression angle correction.)

**Target Depth**

The target depth parameter can either be manually entered, telemetered or input via analog-in Depth BNC. Choose the method used to update the depth parameter.

The system is now tracking in the transponder mode, and you should observe the following:

- Target position displayed in the tracking window, represented by the target designated as the transponder.
- The chosen target symbol shown in the status block with position data agreeing with the target position on the grid.
- Range and bearing information being updated for that target in the status block.
- The Target #1 green Interrogate LED flashing for each interrogate signal transmitted, and the red Receive LED flashing for each signal received.
- With a transponder at close range the Quality Factors should typically be 9's or 10's.

**Hardwired Transponder Mode**

The Hardwired Transponder mode feature is used where a burst or tone from the transmitter triggers a transponder via an umbilical. A high level transmit burst from a transmitter can be attenuated and impressed on an umbilical to trigger a hardwired transponder. This is useful in situations where there are not enough conductors available to trigger with the normal responder key out pulse or there is excess noise causing false triggers. When a target is set up as a Hardwired Transponder, the transmitter is enabled and the slant range is compensated for the one-way acoustic travel time. Set the Target Interrogation Frequency to the correct value for the hardwired transponder's receiver.

**NOTE:** The transponder lock-out time can be reduced in these circumstances to allow for a faster interrogation rate than the normal 2 seconds.

### 3.4.2 RESPONDER MODE

To establish tracking in the responder mode, the proper cable connection must be made at the Deck Unit. Connect the Trigger out signal from the SYNC connector of the Deck Unit to the Responder or Responder umbilical cable. To output a differential signal to the Responder connect the TRIG-OUT1 (pin-M) and /TRIG-OUT1 (pin-L) lines to the Responder. To send a positive going pulse connect the TRIG-OUT1 (pin-M) and COM (pin-N) signals to the Responder and to send a negative going pulse connect the /TRIG-OUT1 and COM signals to the Responder. The TRIG-OUT signal levels can either be +5 TTL or +12VDC, as selectable on the internal Peripheral Interface Card (PIC) within the Deck Unit. Default setting is +5V or TTL compatible.

The TRIG-OUT pulse NOT ISOLATED and it occurs on both the transponder (transmit) and responder trigger cycles.

The responder itself must be operational and in the water. Refer to the instruction manual for the particular responder in use. Follow the steps outlined in the TRANSPONDER section, 3.3.2, to choose a target, set the frequency, turn tracking on for that target and enter depth. The target TYPE must be designated as a responder and the Pulse Turn Around Time must be entered.

It is not necessary to set a transmitter frequency for a Pulse Mode responder. The Interrogation Interval must be set for the maximum range encountered to the responder. E.g., @ 1500 meters/second velocity of sound and an Interrogation Interval of 2 seconds, the maximum range is about 3000 meters. The Pulse Width must be set to be compatible with the responder in use. Select Trigger Source, either Internal or External.

### 3.4.3 FIXED (ARTIFICIAL) TARGET

From the Beacon Parameter dialog box select SETUP Tab and choose a target number/symbol. Under Beacon Status select Fixed Target. In the box below it enter in the target's bearing and horizontal distance. Select BEARING and enter a value between 0° and 359°, select HORZ RANGE and enter a value between 1 and 10000 meters.

The total number of targets allowed is six, therefore if two targets are actively being tracked then up to four Artificial targets can be enabled. A horizontal range and bearing to a target (with respect to the pitch/roll center of the vessel) is sent to the RS-232 port or entered from the keypad. The position information obtained for an artificial target could be from a sonar or radar system which detects a target (underwater or surface) and determines the range and bearing to it. The range and bearing information has to be corrected for the differences in position between the TrackPoint hydrophone and the sonar/radar transducer (E.g., an offset must be applied so that the data is relative to the vessel's pitch/roll center). This corrected data is then sent to the TrackPoint via the RS-232 port or manually updated from the keypad/mouse.

If the TrackPoint has an external compass input, the artificial target data is corrected for NORTH. For example, if the vessel heading is 30° and the bearing of the artificial target, relative to the bow of the vessel is 90°, then the artificial target is compass corrected and plotted at 120°.

NOTE: The compass heading is only updated if a xponder or pinger is being tracked otherwise the last compass heading received is displayed.

The artificial target data is shown in the Status Block at the bottom of the screen and also sent out the RS-232 port just as if it were a tracked target.

## 3.4.4 CONSECUTIVE VS SIMULTANEOUS

**Consecutive Tracking VS Simultaneous Tracking:**

The Model 4450A (aka TP3) contains only one Target Acquisition Module (TAM) and tracks up to four Beacon in sequence ("consecutively") while the Model 4450A-S (aka TP3-S) has four Target Acquisition Modules and tracks up to four Beacons simultaneously or consecutively or a combination of simultaneously/consecutive targets. There are stipulations in simultaneous tracking mode to prevent cross talking or multiple interrogations. For example, if a reply arrives within 20ms of a previous reply then the second reply will not be processed. When tracking simultaneously there is a chance of the beacon replies arriving at the hydrophone at the same time. In these cases the data will be corrupt and the result is typically a low quality factor which causes that errant data point to be filtered out. In a dynamic tracking environment this usually occurs sporadically and does not disturb the tracking of the targets. If it is a problem, and it's individually triggered, change the trigger interval on one or more of the targets . E.g., 2.0 seconds to 2.5 seconds. See examples below. In the Beacon List, Beacon numbers 1-4 are reserved for consecutive (sequential) tracking and Beacon numbers 5-7 are reserved for simultaneous tracking.

Consecutive Tracking (Sequential) (TP3)

| | |
|---|---|
| Acquisition Module | Channel 1 only. Beacons 1-4 (Consecutive tracking) |
| Front panel LED's | Beacon Interrogation and Receive LED's 1-4 represent Beacons 1-4. |
| External Trigger | Only one Beacon can be enabled when using an external trigger input. (If external trigger is negative going, the LED will be on constantly. E.g., a 10ms off pulse will not be seen.) |
| Internal Trigger | Four separate interrogation Intervals, individual for each Beacon. |
| Telemetry | No limitation. All Beacons, except pingers, can have their telemetry enabled. (ECR-874 and later) |
| Beacon Interrogation Freq | For consecutive (sequential) tracking all Beacons must be interrogated at different frequencies. E.g., 17, 18, 19 & 20kHz. |
| Beacon Reply Frequencies | For consecutive (sequential) tracking all Beacons can either reply with all the same frequencies or different. E.g., all can reply at 23kHz (as long as the interrogation frequencies are different) or individually at 23, 24, 25 & 26kHz. (best if all different) |

Simultaneous Tracking (TP3-S)

| | |
|---|---|
| Acquisition Modules | Channel 1 = Beacons 1-4 (Consecutive tracking); Channel 2-4 = Beacons 5-7 (Simultaneous tracking) NOTE: Channel 1 can also be configured to only track one Beacon, thus providing four separate (simultaneous) tracking channels. When tracking more than four beacons then channel one multiplexes beacons 1-4 while beacons 5-7 are simultaneous. When set to internally triggered each acquisition module triggers asynchronously (not in sync) with the others. |

| | |
|---|---|
| Front panel LED's | Beacon Interrogation and Receive LED's 1-4 represent TAM's (channels) 1-4. TAM1 can represent up to 4 Beacons (1-4). |
| External Trigger | Each channel has its own trigger input for Responder tracking. Channel 1 can also be externally triggered either as a Responder or as a Transponder in single target mode. (If external trigger is negative going, the LED will be on constantly. E.g., a 10ms off pulse will not be seen.) |
| Internal Trigger | Channel 1: Four separate interrogation Intervals, one for each beacon when consecutively tracking but the Trigger Out on rear panel is on Channel 1 only. The Channels 2, 3 & 4 each have their own internal triggers but is limited to Responder mode only as Channel 1 controls the Transmitter for acoustic interrogation. |
| Telemetry | No limitation. All Beacons, except Pingers, can have their telemetry enabled. (ECR-874 and later) |
| Beacon Interrogation Freq. | For simultaneous tracking all the beacons must be interrogated at the same frequency. E.g., beacon #1 interrogates the field of beacons all at 17kHz. For consecutive (sequential) tracking then all Beacons (on Channel 1 only) must be interrogated at different frequencies. E.g., 17, 18, 19 & 20kHz. |
| Beacon Reply Frequencies | For simultaneous tracking all the beacons must reply with different frequencies. E.g., 23, 24, 25 & 26kHz. For consecutive (sequential) tracking all Beacons can either reply with all the same frequencies or different. E.g., all can reply at 23kHz or individually at 23, 24, 25 & 26kHz. (best if all different) |

◎ Trackpoint 3 Beacon List setup when tracking 4 Transponders consecutively

Scenario: 4 Divers each have a Transponder attached to them and the system tracks in sequence to obtain an update of all divers in about 14 seconds. One Diver is set as a priority and will be tracked on every other cycle. Interrogation sequence becomes;

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Beacon# | 1 | 2 | 1 | 3 | 1 | 4 | 1 | etc. | |
| Time | 2 | 3 | 2 | 2.5 | 2 | 3.5 | 2 | etc. | seconds |
| Frequency | 17 | 19 | 17 | 18 | 17 | 20 | 17 | etc. | kHz |

- Beacon 1 is a Priority Target ("ACTIVE" is shown in CAPS in the Beacon List to indicate the Priority Target.)
- All Beacons are internally triggered. (Trigger-In 1 (External trigger) is not applicable with more than one Beacon.) Each Beacon's interrogation rate is adjusted for its maximum range. Xmit (interrogation) Interval must be longer than the maximum slant range to the target. E.g., A two-way travel time for a transponder at 1000m is approximately 1.4 seconds ((1000 meters / 1500 meter/second) * 2 ) = 1.33 seconds).
- Beacon 1 LED's (Trigger-In, Interrogate, Receive) show status as it sequences through all the Beacons at the XMT interval rate
- Trigger-Out 1 signal is transmitted at the time of each interrogation LED flash.

| Num | Target Name | Type | Serial# | Chan# | Status | Xmit Interval | Xmt Freq | Recv Freq | Pulse Width | Manual Depth | Filter Level | Trigger | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONSECUTIVELY TRACKED TARGETS (TARGET LED #1) | | | | | | | | | | | | | |
| 1 | Beacon1 | Transponder, Acoustic | | 1 | ACTIVE* | 2 | 17 | 23 | 5 | 10 | 4 | Internal | |
| 2 | Beacon2 | Transponder, Acoustic | | 1 | Active | 3 | 19 | 24 | 5 | 15 | 4 | Internal | |
| 3 | Beacon3 | Transponder, Acoustic | | 1 | Active | 2.5 | 18 | 25 | 5 | 20 | 4 | Internal | |
| 4 | Beacon4 | Transponder, Acoustic | | 1 | Active | 3.5 | 20 | 26 | 5 | 25 | 4 | Internal | |
| SIMULTANEOUSLY TRACKED TARGETS (TARGET LED's #2, #3, #4) **N/A for TP3** | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |

* Priority target designated by all CAPS.

◎ Trackpoint 3 Beacon List setup when tracking 1 Responder with an external trigger.

Scenario: Side Scan Sonar triggers the Responder at the rate as set by the side scan sonar transmitter. Trigger output from the SSS deck unit goes into Trigger In 1 of TP3.

- Only one Beacon can be enabled in external trigger mode. (Can be any one of the Beacons 1-4.)
- Beacon 1 LED's (Trigger-In, Interrogate, Receive) show status.
- Trigger-In 1 (External trigger) initiates interrogation of Beacon. Trigger-Out 1 signal is transmitted at the time of each interrogation LED flash. Trigger Input rate must be longer than the maximum slant range to the target. E.g., A one-way travel time for a responder at 1000m is approximately 0.7 seconds (1000 meters / 1500 meter/second = 0.66 seconds).

| Num | Target Name | Type | Serial# | Chan# | Status | Xmit Interval | Xmt Freq | Recv Freq | Pulse Width | Manual Depth | Filter Level | Trigger | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONSECUTIVELY TRACKED TARGETS (TARGET LED #1) | | | | | | | | | | | | | |
| 1 | Beacon1 | Responder | | 1 | Active | 1 | N/A | 23 | 5 | 10 | 4 | **External** | |
| 2 | | | | 1 | | | | | | | | | |
| 3 | | | | 1 | | | | | | | | | |
| 4 | | | | 1 | | | | | | | | | |
| SIMULTANEOUSLY TRACKED TARGETS (TARGET LED's #2, #3, #4) **N/A for TP3** | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |

◎ Trackpoint 3 Beacon List setup when tracking one pinger

Scenario: Tracking a lost Pinger on the seabed. (not common)

- Only one Beacon can be enabled when in Pinger mode (Can be any one of the Beacons 1-4)
- Beacon 1 LED (Receive) shows status
- Trigger-In 1 Not applicable. Trigger-Out 1 Not applicable.

| Num | Target Name | Type | Serial# | Chan# | Status | Xmit Interval | Xmt Freq | Recv Freq | Pulse Width | Manual Depth | Filter Level | Trigger | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONSECUTIVELY TRACKED TARGETS (TARGET LED #1) | | | | | | | | | | | | | |
| 1 | | | | 1 | | | | | | | | | |
| 2 | | | | 1 | | | | | | | | | |
| 3 | | | | 1 | | | | | | | | | |
| 4 | Beacon4 | Pinger | | 1 | Active | N/A | N/A | 25 | N/A | 25 | 4 | N/A | |
| SIMULTANEOUSLY TRACKED TARGETS (TARGET LED's #2, #3, #4) **N/A for TP3** | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |

◎ Trackpoint 3-S Beacon List setup when tracking 4 Transponders simultaneously.

Scenario: 4 Divers each have a Transponder strapped to them and the system tracks simultaneously to obtain an update of all divers in 2 seconds.

- Only one Beacon can be enabled in each of the 4 Channels (Target Acquisition Modules) when in simultaneous mode.
- Beacon 1 triggered internally but externally triggers 5, 6 & 7 from Channel 1's Interrogation Transmission (All Beacons are triggered by the same 17kHz interrogation from Beacon 1. Connect BNC from Trigger-Out 1 to Trigger-In 2, 3, 4.) Xmit (interrogation) Interval must be longer than the slant range of the furthest target. E.g., If the furthest diver is less than 1000m then a two-way travel time for a transponder at 1000m is approximately 1.4 seconds ((1000 meters / 1500 meter/second) * 2 ) = 1.33 seconds). NOTE: Most transponders lockout for at least 1.5 seconds. This would be the minimum interrogation interval possible.
- Beacon 1 LED's (Trigger In, Interrogate, Receive) show status for Channel 1 (Beacon1)
- Beacon 2 LED's (Trigger In, Interrogate, Receive) show status for Channel 2 (Beacon5)
- Beacon 3 LED's (Trigger In, Interrogate, Receive) show status for Channel 3 (Beacon6)
- Beacon 4 LED's (Trigger In, Interrogate, Receive) show status for Channel 4 (Beacon7)
- Trigger-Out 1 signal is transmitted at the time of each interrogation LED flash. (Trigger-In 1 (External trigger) is possible when tracking one Beacon on this channel but is not applicable when tracking Beacons consecutively on this channel.)

| Num | Target Name | Type | Serial# | Chan# | Status | Xmit Interval | Xmt Freq | Recv Freq | Pulse Width | Manual Depth | Filter Level | Trigger | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIMULTANEOUSLY TRACKED TARGET (TARGET LED #1) | | | | | | | | | | | | | |
| 1 | Beacon1 | Transponder, Acoustic | | 1 | Active | 2 | 17 | 23 | 5 | 10 | 4 | Internal | |
| 2 | | | | 1 | | | | | | | | | |
| 3 | | | | 1 | | | | | | | | | |
| 4 | | | | 1 | | | | | | | | | |
| SIMULTANEOUSLY TRACKED TARGETS(TARGET LED's #2, #3, #4) | | | | | | | | | | | | | |
| 5 | Beacon5 | Transponder, Acoustic | | 2 | Active | | N/A | 24 | N/A | 15 | 4 | Ext-Bcn1 | |
| 6 | Beacon6 | Transponder, Acoustic | | 3 | Active | | N/A | 25 | N/A | 20 | 4 | Ext-Bcn1 | |
| 7 | Beacon7 | Transponder, Acoustic | | 4 | Active | | N/A | 26 | N/A | 25 | 4 | Ext-Bcn1 | |

◎ Trackpoint 3-S Beacon List setup when tracking 3 Transponders and 1 Externally Triggered Responder

Scenario: 1 ROV with a Responder (Beacon 6) triggered externally and 3 seabed Transponders tracked simultaneously. Updates all targets in 2 seconds.

- Only one Beacon can be enabled in each of the 4 Channels (Target Acquisition Modules)
- Beacon 1 triggered internally but externally triggers 5 & 7 from Channel 1's Interrogation Transmission (All Transponders are triggered by the same 17kHz interrogation from Beacon 1. Connect BNC from Trigger-Out 1 to Trigger-In 2 & 4.)
- Trigger-In 3 is from ROV. Connect external responder trigger into Trigger-In 3.
- Beacon 1 LED's (Trigger-In, Interrogate, Receive) show status for Channel 1 (Beacon1)
- Beacon 2 LED's (Trigger-In, Interrogate, Receive) show status for Channel 2 (Beacon5)
- Beacon 3 LED's (Trigger-In, Interrogate, Receive) show status for Channel 3 (Beacon6)
- Beacon 4 LED's (Trigger-In, Interrogate, Receive) show status for Channel 4 (Beacon7)
- Trigger-Out 1 signal is transmitted at the time of each interrogation LED flash. (Trigger-In 1 (External trigger) is not applicable when tracking Beacons consecutively on this channel.) Trigger-Out 3 is transmitted at the time of the Responder interrogation.

| Num | Target Name | Type | Serial# | Chan# | Status | Xmit Interval | Xmt Freq | Recv Freq | Pulse Width | Manual Depth | Filter Level | Trigger | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIMULTANEOUSLY TRACKED TARGET (TARGET LED #1) | | | | | | | | | | | | | |
| 1 | Beacon1 | Transponder, Acoustic | | 1 | Active | 2 | 17 | 23 | 5 | 10 | 4 | Internal | |
| 2 | | | | 1 | | | | | | | | | |
| 3 | | | | 1 | | | | | | | | | |
| 4 | | | | 1 | | | | | | | | | |
| SIMULTANEOUSLY TRACKED TARGETS (TARGET LED's #2, #3, #4) | | | | | | | | | | | | | |
| 5 | Beacon5 | Transponder, Acoustic | | 2 | Active | | N/A | 24 | N/A | 15 | 4 | Ext-Bcn1 | |
| 6 | Beacon6 | Responder | | 3 | Active | 1 | N/A | 27 | 5 | 20 | 4 | External | |
| 7 | Beacon7 | Transponder, Acoustic | | 4 | Active | | N/A | 25 | N/A | 25 | 4 | Ext-Bcn1 | |

◎ Trackpoint 3-S Beacon List setup when tracking 2 Responders and 2 Transponders

Scenario: ROV with Responder (Beacon 5) and a docking station (Tether Management System) with Responder (Beacon 6) along with 2 seabed transponders. Responders are tracked simultaneously along with the Transponders. 4 Targets are updated in a total of about 3 seconds. (The Responders are triggered asynchronously with each other so that the ROV can be docked into the TMS without the replies arriving in the hydrophone at approximately the same time, causing poor tracking.)

- Only one Beacon can be enabled in each of the 4 Channels (Target Acquisition Modules)
- All Beacons triggered internally. Channel 1 (Beacon 1) triggers the its own transponder along with Channel 4 (Beacon 7). Connect BNC from Trigger-Out 1 to Trigger-In 4. Channels 2 triggers Beacon 5 Responder and Channels 3 triggers Beacon 6 Responder. The Transponders are interrogated asynchronously with respect to the Responders.
- Beacon 1 LED's (Trigger In, Interrogate, Receive) show status for Channel 1 (Beacon1)
- Beacon 2 LED's (Trigger In, Interrogate, Receive) show status for Channel 2 (Beacon5)
- Beacon 3 LED's (Trigger In, Interrogate, Receive) show status for Channel 3 (Beacon6)
- Beacon 4 LED's (Trigger In, Interrogate, Receive) show status for Channel 4 (Beacon7)
- Trigger-Out 1 signal is transmitted at the time of each interrogation LED flash. Trigger-Out 2 is transmitted at the time of the Responder interrogation.

| Num | Target Name | Type | Serial# | Chan# | Status | Xmit Interval | Xmt Freq | Recv Freq | Pulse Width | Manual Depth | Filter Level | Trigger | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIMULTANEOUSLY TRACKED TARGET (TARGET LED #1) | | | | | | | | | | | | | |
| 1 | Beacon1 | Transponder, Acoustic | | 1 | Active | 3 | 17 | 23 | 5 | 10 | 4 | Internal | |
| 2 | | | | 1 | | | | | | | | | |
| 3 | | | | 1 | | | | | | | | | |
| 4 | | | | 1 | | | | | | | | | |
| SIMULTANEOUSLY TRACKED TARGETS (TARGET LED's #2, #3, #4) | | | | | | | | | | | | | |
| 5 | Beacon5 | Responder | | 2 | Active | 1.5 | N/A | 24 | 5 | 15 | 4 | Internal | |
| 6 | Beacon6 | Responder | | 3 | Active | N/A | N/A | 25 | 5 | 20 | 4 | Internal | |
| 7 | Beacon7 | Transponder, Acoustic | | 4 | Active | N/A | N/A | 26 | 5 | 25 | 4 | Ext-Bcn1 | |

◎ Trackpoint 3-S Beacon List setup when tracking 7 Transponders

Scenario: 4 Simultaneously Tracked Transponders and 3 Consecutively Tracked Transponders; (all based on the Channel 1 internal trigger).

- With the Priority Target enabled on Beacon 1, all 7 Targets are updated in about 17 seconds with the 4 simultaneous ones updated approximately every 5 seconds.
- Channel 1 triggers beacons 5, 6 & 7. Connect BNC's from Trigger-Out 1 to Trigger-In 2, 3 & 4 (represents Beacons 5, 6 & 7). Beacons 5, 6 & 7 are triggered by the same 17kHz interrogation from Beacon 1.
- Beacon 1 LED's (Trigger-In, Interrogate, Receive) show status for Channel 1 (Beacon1, 2, 3 & 4)
- Beacon 2 LED's (Trigger-In, Interrogate, Receive) show status for Channel 2 (Beacon5)
- Beacon 3 LED's (Trigger-In, Interrogate, Receive) show status for Channel 3 (Beacon6)
- Beacon 4 LED's (Trigger-In, Interrogate, Receive) show status for Channel 4 (Beacon7)
- Trigger-Out 1 signal is transmitted at the time of each interrogation LED flash. (Trigger-In 1 (External trigger) is not applicable when tracking Beacons consecutively on this channel.)

| Num | Target Name | Type | Serial# | Chan# | Status | Xmit Interval | Xmt Freq | Recv Freq | Pulse Width | Manual Depth | Filter Level | Trigger | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONSECUTIVELY TRACKED TARGETS (TARGET LED #1) | | | | | | | | | | | | | |
| 1 | Beacon1 | Transponder, Acoustic | | 1 | ACTIVE | 2 | 17 | 23 | 5 | 10 | 4 | Internal | |
| 2 | Beacon2 | Transponder, Acoustic | | 1 | Active | 2.5 | 19 | 27 | 5 | 15 | 4 | Internal | |
| 3 | Beacon3 | Transponder, Acoustic | | 1 | Active | 3 | 18 | 28 | 5 | 20 | 4 | Internal | |
| 4 | Beacon4 | Transponder, Acoustic | | 1 | Active | 3.5 | 20 | 29 | 5 | 25 | 4 | Internal | |
| SIMULTANEOUSLY TRACKED TARGETS (TARGET LED's #2, #3, #4) | | | | | | | | | | | | | |
| 5 | Beacon5 | Transponder, Acoustic | | 2 | Active | N/A | N/A | 24 | 5 | 30 | 4 | Ext-Bcn1 | |
| 6 | Beacon6 | Transponder, Acoustic | | 3 | Active | N/A | N/A | 25 | 5 | 35 | 4 | Ext-Bcn1 | |
| 7 | Beacon7 | Transponder, Acoustic | | 4 | Active | N/A | N/A | 26 | 5 | 40 | 4 | Ext-Bcn1 | |

Sequence with Beacon 1 set as a Priority Target…

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Beacon #'s | 1,5,6,7 | 2 | 1,5,6,7 | 3 | 1,5,6,7 | 4 | 1,5,6,7 | |
| Time | 2 | 2.5 | 2 | 3 | 2 | 3.5 | 2 | seconds |
| Frequency | 17 | 19 | 17 | 18 | 17 | 20 | 17 | kHz |

Sequence with No Priority Target set…

| | | | | | | |
|---|---|---|---|---|---|---|
| Beacon #'s | 1,5,6,7 | 2 | 3 | 4 | 1,5,6,7 | |
| Time | 2 | 2.5 | 3 | 3.5 | 2 | seconds |
| Frequency | 17 | 19 | 18 | 20 | 17 | kHz |

◎ Trackpoint 3-S Beacon List setup when tracking 2 Pingers (not common)

Scenario: 2 seabed locating Pingers asynchronously tracked

- 2 Pingers (Channel 1 & Channel 4) (Could have up to four pingers enabled at one time.) All frequencies must be different.
- Only one Beacon can be enabled on any of the channels when in Pinger mode (Can be any one of the Beacons 1-4)
- Beacons 1 & 7 LED's (Receive) show status
- Trigger-In 1 & 4 not applicable. Trigger-Out 1 & 7 not applicable.

| Num | Target Name | Type | Serial# | Chan# | Status | Xmit Interval | Xmt Freq | Recv Freq | Pulse Width | Manual Depth | Filter Level | Trigger | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONSECUTIVELY TRACKED TARGETS (TARGET LED #1) | | | | | | | | | | | | | |
| 1 | | | | 1 | | | | | | | | | |
| 2 | | | | 1 | | | | | | | | | |
| 3 | | | | 1 | | | | | | | | | |
| 4 | Beacon4 | Pinger | | 1 | Active | N/A | N/A | 25 | N/A | 25 | 4 | N/A | |
| SIMULTANEOUSLY TRACKED TARGETS (TARGET LED's #2, #3, #4) | | | | | | | | | | | | | |
| 5 | | | | 2 | | | | | | | | | |
| 6 | | | | 3 | | | | | | | | | |
| 7 | Beacon7 | Pinger | | 4 | Active | N/A | N/A | 27 | N/A | 35 | 4 | N/A | |

## 3.5 ERROR AND WARNING CODES

A number of situations can occur which either prevent calculation of the position or can lead to misrepresentation of the data.

If calculations cannot be performed on the data received, a message is displayed in the Status Block and an ERROR CODE is sent out on the RS-232.

Other error codes that are displayed on the status line and sent out on RS-232 are warnings.

| BRIEF ERROR CODE LISTING | |
|---|---|
| **CODE** | **TARGET ERROR DESCRIPTION** |
| 0 (null character) | No errors detected. |
| 1 | Unusable signal received. |
| 2 | |
| 3 | Range cannot be determined. (Usually 0m slant range) |
| 4 | Low Quality Factor. |
| 5 | Target velocity excessive. |
| 6 | No recent replies. |
| 7 | Minimum range error. |
| 8 | Simultaneous reply error. |
| 9 | |
| 10 | Travel time less than turn around time (No reply received) |
| 14 | Measured Slant Range > MAX SLANT RNG parameter |
| 15 | Measured Bearing outside BEARING LIMITS parameter |
| | **TELEMETRY ERRORS:** |
| 22 | Telemetry Signal Timing Error. |
| 23 | Telemetry timing out of range. |
| 24 | Telemetered depth greater than slant range. |
| 26 | |
| | **WARNINGS:** |
| 50 | Target input depth not within normal limits of the calculated depth. |
| 51 | Pinger D.A. < 20°, with hydrophone offsets. |
| 52 | Pinger D.A. < 20°. |
| 53 | Pinger D.A. 20° - 45°. Position " ≈ ". |
| 54 | Target Centered Mode Canceled. |
| 55 | |
| 56 | Transponder or Responder D.A. < 45° (Cannot calculate depth). |
| 57 | Depth > Slant Range. |
| 59 | No External Key Received within wait period. Target has been internally keyed. |
| 60 | System ignores the phase count depression angle and uses the slant range and input |

| BRIEF ERROR CODE LISTING | |
|---|---|
| **CODE** | **TARGET ERROR DESCRIPTION** |
| | depth to calculate horizontal range. |
| 61 | Horizontal range calculated to be greater than slant range. |
| 62 | |
| 64 | Low Quality Factor |

NOTE: Error codes less than 20 result in no new position updates, while error codes of 21 or greater are warnings. Error conditions 1 - 9 signify that the output data is not valid. These error codes appear on the RS-232 port if the selected Format is either 1EC or 2EC. If any of these errors are detected, the error data is sent out the RS-232 under the assumption that the interfacing communications system has been programmed to ignore this data and extract only the possible good data, such as compass heading or slant range. Only Formats 1 and 2 output data when it is valid (no errors 1 - 9). Formats 1 and 2 show warnings only.

| EXPLANATION OF ERROR CODES | |
|---|---|
| **CODE** | **DESCRIPTION** |
| 0 | No error. The error code zero (0) does not appear on the screen or sent out the RS-232 interface, but is a null character, indicating no error. |
| 1 | Unusable signal received. Signal received, but TrackPoint unable to calculate a position. This could have been due to acoustic noise contaminating the incoming signal or to other causes. The red LED and the audio may show valid detection of a signal. No position is plotted. |
| 2 | Not Used. |
| 3 | Range cannot be determined. This occurs in transpond or respond mode if the calculated range is zero. This can happen if a pinger is designated as a responder or transponder and the transmitter is not turned on. No position is plotted. |
| 4 | Low Quality Factor. The signal of the present reply had a quality factor that was lower than the average of the previous five replies. No position is plotted. |
| 5 | Target velocity excessive. Target velocity, based on the change in horizontal position since the last up-date exceeds 10 knots. This filter takes advantage of the fact that tracked targets cannot move very fast. This error can occur at filter levels 5 to 10. No position is plotted. |
| NOTE: | A rapidly turning ship can make the target appear to move fast and can cause this error. To alleviate this, integrate a compass into TrackPoint. |
| 6 | No recent replies. This message appears if, in any mode, no detected signal has occurred for 16 seconds. |

| EXPLANATION OF ERROR CODES | |
|---|---|
| **CODE** | **DESCRIPTION** |

| # | TOD | HDG | BRG | S.R. | X | Y | Z | TEL | ERR |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 02:12:04 | | -.- | -.- | -.- | -.- | -.- | -.- | 6 |
| 1 | 02:12:06 | | -.- | -.- | -.- | -.- | -.- | -.- | 6 |

When an Error Code 6 occurs, -.- lines are sent out the RS-232 as shown above to indicate invalid data within those data fields.

7 Minimum range error. This occurs when in transponder or responder modes. If the measured slant range is less than the entered MIN XPONDER RANGE, the message "SLANT RANGE < ENTERED MIN" is displayed in the status area. No position is plotted.

10 Travel time less than turn around time. Either the reply was detected within a time period less than the entered turnaround time or no reply was detected. Check turn around time setting within SIM & beacon.

14 Maximum Slant Range Exceeded: The MAX SLANT RNG filtering function compares the reply's slant range against this value. If the slant range is greater than the entered value the status block shows an error code #14. If the RS232 Format is set to an "EC" format it also outputs the last good position and tags it with an error code #14. See section 3.7

15 Bearing Limit Exceeded: The BEARING LIMIT function is enabled only in Fish Track mode, when the angle to the target is fairly well known. The system checks to see whether the target is within the parameters as set by the BEARING LIMITS. This function is only applicable to targets with a depression angle of less than 45°. If a target is outside the set limits then the system displays an error code #15, "BEARING LIMIT EXCEEDED". These limits are always referenced to the vessel, whether compass mode is ON or OFF.

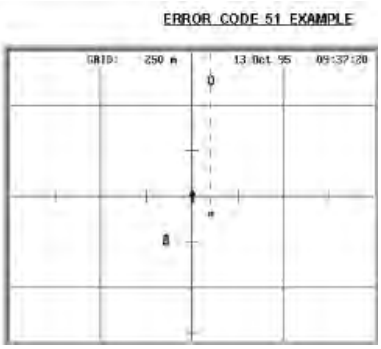
22 Signal timing error. Telemetry signal was received but 6 consecutive signals were outside of the range gate timing window. Flags operator to check parameter set up of telemetry signal timing (depth or data).

23 Telemetry timing out of range. Telemetry time is either less than the entered '0' Delay or greater than the full scale span.

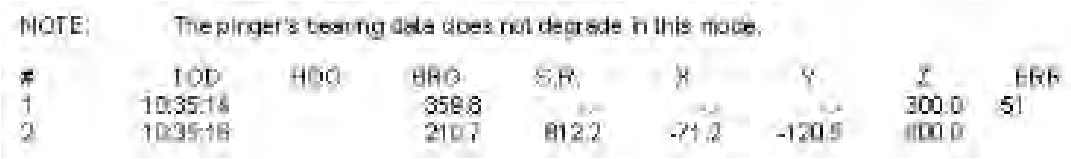
26 No recent telemetry replies. No telemetry signal has been received for at least 16 seconds.

50 This warning occurs in transponder or responder mode when the target input depth is not within 10% of the calculated depth, when in calculated depth mode, or within 2% of the calculated depth when in the input depth mode. The warning is triggered when the target depression angle is greater than 40° (from the horizontal). The system calculates the depth at that point and compares it to the input depth (manual, analog or telemetered); if in error the warning 50 appears to alert the operator that the input depth may be in error and that a large excursion of the target position may occur.

| EXPLANATION OF ERROR CODES | |
|---|---|
| **CODE** | **DESCRIPTION** |
| 51 | Pinger Only: This warning applies only when hydrophone offsets are entered and when tracking a pinger where its depression angle is < 20° from the horizontal. Its purpose is to notify the on-line computer system, via the RS-232, that all ranges and x or y coordinates to that target are minimum values and generally do not indicate actual ranges. I.e., use this data cautiously. At small depression angles (less than 20 degrees from the horizontal), measurement of depression and subsequent calculation of horizontal range is highly inaccurate; as a result, the X and Y hydrophone offsets are ignored for the pinger only, and its bearing is displayed relative to the actual hydrophone location (and North if the compass is enabled). Its actual range cannot be computed. See Figure 3-31 for an example. This warning applies to the individual target only. |

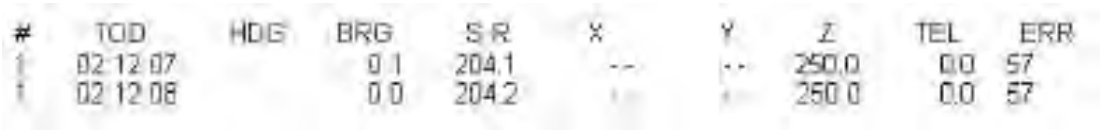



NOTE: The pinger's bearing data does not degrade in this mode.




When a pinger depression angle is < 20° from the horizontal, the pinger's position cannot be determined. The TrackPoint shows its bearing accurately with respect to the hydrophone and places the pinger off-screen along with the trailing dotted line. The transponder position remains with respect to the reference point. The error code 51 warns that the pinger's position can no longer be calculated, so refer to its bearing value as an indication of position.

| | |
|---|---|
| 52 | This warning is set when the target is a pinger and the depression angle is less than 20 degrees from the horizontal. Its purpose is to notify the on-line computer system, via the RS-232, that all ranges and x or y coordinates to that target are minimum values and generally do not indicate actual ranges. I.e., use this data cautiously. The status block and RS-232 data show the same format as in error code 51. The bearing is referenced to the hydrophone location (and North if compass is enabled). This warning applies to the individual target only. |
| 53 | This warning is set when the target is a pinger and the depression angle is between 20° and 45°. In this condition, position accuracy is degraded and the ranges in the status block are preceded by an approximate "≈" symbol. This warning applies to the individual target only. |

| EXPLANATION OF ERROR CODES | |
|---|---|
| **CODE** | **DESCRIPTION** |
| 56 | When tracking a transponder or responder in calculated depth mode and the target's depression angle is < 45° from the horizontal, this error code warns that the system is no longer calculating depth in determining target position. The system is using the input depth (manual, analog or telemetered) and the measured slant range to determine target position. (Also see warning code 50.) Refer to section 3.4.3 for explanation of depth MODE. |
| 57 | This warning occurs when the input depth of the target is greater than the measured slant range. This can occur when the target depression angle is between 0 and 45° in calculated depth mode or between 0 and 70° when in input depth mode.<br>When an Error Code 57 occurs, a -.- is sent out the RS-232 as shown above to indicate invalid data within the x and y data fields.<br><br>#  TOD  HDG  BRG  S/R  X  Y  Z  TEL  ERR<br>1  02:12:07  0.1  204.1  --  --  250.0  0.0  57<br>1  02:12:08  0.0  204.2  --  --  250.0  0.0  57 |
| 58 | Reserved. |
| 59 | Reserved in revision 8.05. |
| 60 | This warning occurs if in INPUT mode and either ANALOG or TELEMETRY depth is selected. If the system calculates a depression angle using the slant range and the input depth to be less than 45° but the measured depression angle given the phase counts from the hydrophone is > 70° (sound appears to be coming from below the hydrophone due to high multi-path environment, e.g., directional beacon pointing up in shallow water) then the system ignores the phase count depression angle and uses the slant range and input depth to calculate horizontal range. |
| 61 | Horizontal range greater than slant range. |
| 64 | Low Quality Factor. The signal of the present reply had a quality factor that was lower than the average of the previous five replies. |
| 70 | No recent GPS time sync received. |

## 3.6 TROUBLESHOOTING ACOUSTIC PROBLEMS

### 3.6.1 TRANSPONDER MODE

A transponder emits an acoustic signal of a known frequency in response to an acoustic interrogation pulse sent from the TrackPoint II transmitter. The primary advantage of using a transponder is that the target range can be measured directly from the round-trip travel time of the acoustic signals. A transponder, therefore, is **NOT** subject to the "cone of operation" limitation that applies when a pinger is used.

A potential (minor) disadvantage in using a transponder is that both the interrogate pulse and the transponder's response may be subject to multi-path.

A high noise and/or multi-path environment may cause any of the following situations:

A. Transponder cannot "hear" interrogate pulse.

In an extremely noisy environment, it may be impossible for the transponder to distinguish an interrogate pulse in the noise flooding its receivers. In the worst case, the transponder simply won't reply, and is essentially lost for tracking purposes. A pinger or responder is a better choice for such an environment.

B. Transponder accepts noise or extraneous signals at the correct interrogate frequency.

In this case, transponder replies will be random and uncoordinated with the interrogate pulses. The operator may observe correct bearing information although range is random and incorrect. To determine whether this is the case, turn the TrackPoint II transmitter off and observe whether the transponder is still replying. If it is, the operator should try to identify and eliminate the source of the false interrogate signal or noise. If the source cannot be eliminated, it will be necessary to change the interrogate frequency, or switch to pinger or responder operation, or possibly reduce the sensitivity or frequency of the transponder receiver. It is also possible that there is an interference signal from some other sound source that is the multiple of the Multibeacon frequency causing the detection rather than the Multibeacon triggering on noise. If it is another sound source then it usually is of a repetitive nature, whereas if the Multibeacon is triggering on noise the detection is more random.

C. Reflected interrogate signals cause extra transponder replies.

Most transponders are designed with a 'lock-out' (usually 1.5 - 1.75 seconds), or limit on the rate at which the transponder can reply, to prevent this from occurring. The operator should be aware of such a limitation, so that he does not interrogate at a rate too fast for the transponder.

In rare circumstances, the transponder can be replying to a distant reflection of the interrogate signal in addition to the direct signal. (The reflected signal comes in after the lock-out.) If this is the case, the operator will observe correct bearing values with erratic ranges as above, but the transponder will stop replying when the TrackPoint II transmitter is turned off, and begin replying

when the transmitter is turned back on, still with erratic ranges. If this is occurring, the operator should lower the output power of the TrackPoint transmitter by changing the output jumper on the transmitter board, or increase the transponder's lock-out time and use a longer interrogate interval.

D. Transponder replies accurately, but signals are distorted by multi-path.

When multi-path is affecting transponder replies, try the following:

1. Lower the hydrophone further from the hull or away from the reflecting object.

Usually multi-path comes from a reflection off the hull or from an object close to the hull and arrives at the hydrophone within one millisecond or two of the direct arrival.

2. Lower the threshold setting.

A higher threshold setting causes the signals to detect later. This causes the system to process data that has a higher probability of contamination due to a reflection.

If the reflector is very close, the multi-path signal may be interfering with the original signal, and a lower threshold may improve the situation by detecting earlier, before the reply pulse is corrupted by multi-path. (See MIN XPONDER RANGE.)

3. Lower the transponder output power.

If changing the threshold does not eliminate the problem, lowering the transponder output, if possible, may allow the reflected signal to attenuate to a level where it is rejected by the system, but still receive the direct signal. This is usually only a problem in fresh water where there is less sound absorption than in sea water.

NOTE: In operation with a transponder, you may see more than one flash of the detected signal LED following each flash of the TrackPoint II transmit LED. The audio may sound like a series of echoes, or a quick double pulse (like the double report of a rifle shot). These are indications of multi-path but do not necessarily indicate a problem, since in transponder or responder mode, with filtering on, TrackPoint II ignores all but the first signal received within the range gate window (provided the range is greater than the MIN XPONDER RANGE).

E. Transponder responds inaccurately (case B or C) and hydrophone receives reflected signals.

If the operator observes both erratic range and erratic bearing values, the problem is most likely some combination of multi-path interference, and the operator should try the following:

1. Lower the interrogation repetition rate. In most cases, one signal every three seconds should give any transmitted or received multi-path bounces time to fade out before the next signal is initiated.

2. If a slower repetition rate does not solve the problem (or if the repetition rate is already slower than two or three seconds), the operator should try to isolate the sources of multi-path and resolve the independent factors using the above guidelines.

F. Transponder responds correctly and hydrophone receives correctly giving accurate slant ranges but erratic bearings.

This is usually a sign of low signal to noise ratio at the hydrophone. The hydrophone receives the signal and causes a valid detection but the data processing performed on the wideband signal is not consistent enough for a bearing calculation. In this case the detected signal is usually flagged with a low quality factor. To improve Signal to Noise ratio at the hydrophone:

1. Use a “louder” sound source. If the configuration is fixed can a directional beacon with higher source level be used?
2. Lower the hydrophone to reduce ship radiated noise.
3. Check that hydrophone shaft is not strumming or vibrating excessively. This causes excess noise at hydrophone. If hydrophone pole is vibrating but not strumming try shock mounting hydrophone. (rubber bushings between top of Hydrophone Model 4610B and shaft). If pole is strumming, change configuration (shorten the shaft, but watch out for reflections) or add fairing to shaft.

### 3.6.2 ACOUSTIC PROBLEMS IN RESPONDER MODE

A responder replies acoustically to an electrical interrogation pulse from the TrackPoint II transmitter. Like a transponder, a responder provides the timing information needed to measure horizontal range directly, but the interrogation pulse is not subject to the acoustic interference associated with a transponder. However, because a responder must be electrically connected to the tracking system, it may not be a feasible option for some operations.

When operating in the responder mode, multi-path interference is limited to cases where the direct arrival of the acoustic reply is blocked or reflected.

If this occurs, it may be necessary to reconfigure the system so that the C/DM hydrophone is in a position to receive the direct signal. For example, the hydrophone may not be mounted far enough below the ship's keel to receive a direct signal from a responder on the other side of the ship.

Avoid an operation where a towfish is tracked behind the vessel near the water surface, so that the direct signal from the beacon is reflected or attenuated by the ship's wake. Either tow the fish off-center, out of the ship's wake, or sink the responder below the wake.

When operating in and around subsea structures, there is always a number of locations where there is no direct path between the responder and the hydrophone, and the operator should expect occasional multi-path interference in these situations. A lower filter setting may help somewhat under these conditions by detecting earlier.

## 3.7 RS-232C INTERFACE

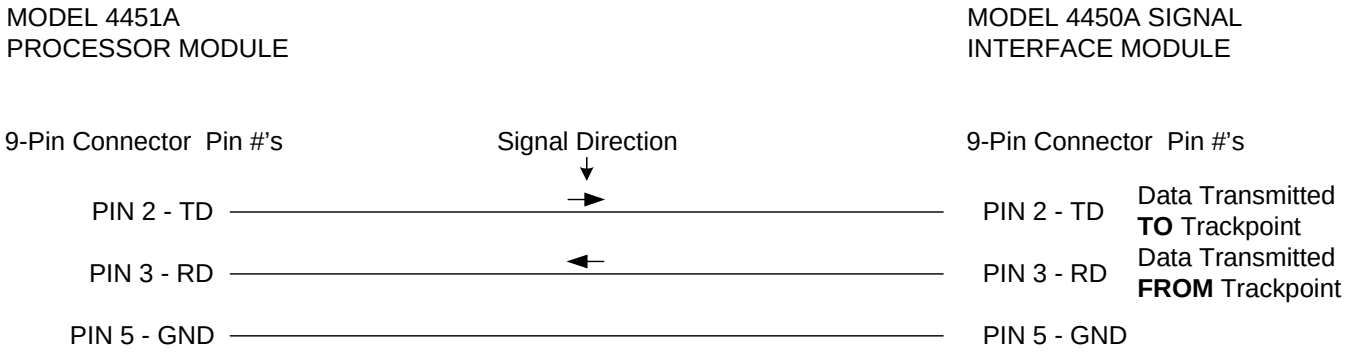
"TrackPoint Signal Interface Module"

### 3.7.1 GENERAL

**COM#1 "USBL to PC"**

The TrackPoint 3 Console uses the standard EIA RS-232C serial communications interface to communicate with the PC. This can be configured from the DEVICE LIST "TrackPoint 3" dialog box by setting the BAUD RATE, the number of DATA BITS required and the number of STOP BITS. **Normally = 19,200 BAUD, 8 DATA BITS, 1 STOP BIT.** Connect the COMMs Interface cable (9-pin DEC) between the Console and the PC.

**RS232 CABLE CONFIGURATION**




In transponder or responder mode the data is output when the acoustical reply is received.

Do not plug or unplug the RS-232 connector from the TrackPoint while it is operating. This may halt the unit, thus causing loss of tracking.

The RS-232C Typical Cable Configuration, illustrates the RS-232C data lines used by TrackPoint Console.

**COM#2 "Sensor to USBL"**

The NMEA mode allows input of various NMEA compass sentences, with or without checksum verification, "HDT", "HDM", "TCM-2" or "HDG" NMEA formats. Set up COM port #2 for Compass input under the menu SETUP/COMPASS SETUP/TRACKPOINT (USBL). Select Serial and then Port Settings. This allows the operator to configure the port's Baud Rate, Data Bits and Stop Bits.

**COM#3 "Sensor to USBL"**

GPS Interface typically.

### 3.7.2 HARDWARE

**COM#1 "USBL Deck Unit"**

The TrackPoint COM#1 interface is designed to act as a "DCE" (Data Communication Equipment) device. This means that it will interface directly to "DTE" (Data Terminal Equipment) device (E.g. Processor Module or PC), with the TrackPoint acting as if it were a modem. That is to say, a Null modem is NOT required between the Processor (PC) and the TrackPoint 3 Console.

**COM#2 "USBL Deck Unit"**

The COM#2 port is used typically for a compass input. No data is transmitted from this port. The hardware is setup for bi-directional communications but the TrackPoint does not utilize its transmit capabilities.

The TrackPoint's COM#2 interface is designed to act as a "DTE" (Data Terminal Equipment) device (Data terminal or PC). This means that the interface is the same as a "PC" and requires a null modem if connecting to a device whose output is compatible with one.

The COM#2 port does not have hardware or software flow control capability. The hardware handshake lines (RTS & DTR) are disabled and do not use the XOFF & XON protocol. If an overrun in data occurs the data is lost and only the most recent is accepted. (In the case of a gyro or compass input you would not want the old data but rather accept only the most recent.)

**COM#3 "USBL Deck Unit"**

The COM#3 port is used typically for a GPS time input. No data is transmitted from this port. The hardware is setup for bi-directional communications but the TrackPoint does not utilize its transmit capabilities.

The TrackPoint's COM#2 interface is designed to act as a "DCE" (Data Communication Equipment) device. This means that it will interface directly to "DTE" (Data Terminal Equipment) device (E.g. PC), with the TrackPoint acting as if it were a modem.

The COM ports do not have hardware or software flow control capability. The hardware handshake lines (RTS & DTR) are disabled and do not use the XOFF & XON protocol. If an overrun in data occurs the data is lost and only the most recent is accepted. (In the case of a gyro or compass input you would not want the old data but rather accept only the most recent.)

### 3.7.3 USBL DECK UNIT TO PC COMMUNICATIONS

From the DEVICE LIST table select TrackPoint 3. From the subsequent dialog box set the **BAUD RATE** to 19,200, the number of **DATA BITS** to 8 and **STOP BITS** to 1. For the **Sentence In To Trackman** select TP-SPC and for the **Sentence Out From Trackman** select TP-SPC.

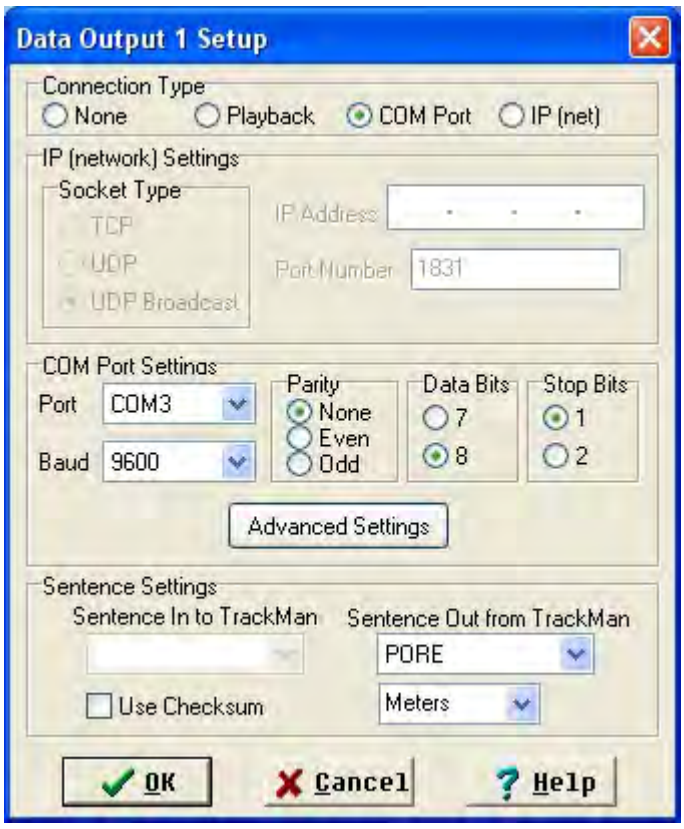
**TP-SPC format**

This TrackPoint-Signal Processor Console format communicates with the Processor to send commands back and forth. Is is a binary format that is proprietary.

### 3.7.4 TRACKMAN (PC) RS-232 DATA OUTPUT FORMATS

Trackman (PC) can output various target data formats. From the Trackman Device (port) List select Data Output1 and then from the dialog box select “Sentence Output from Trackman”. A List of available output formats are shown below.

- PORE (NMEA ORE)
- POREB
- POREG
- SNTTM
- STANDARD
- STANDARD-EC
- STD W/PR
- STD-EC W/PR
- NCSS
- NCSSS-EC
- NUWC
- NUWC-EC
- Rev 4
- Rev 4-EC




Some of the formats can have their range parameters changed from either Meters, Feet, or yards.

**NMEA Formats**

General Statement on NMEA Formats: The TrackPoint NMEA data sentences are output in accordance with the NMEA standard. The electrical protocol can either be RS232 or RS422 depending on the output device of the transmitting unit. Not discussed here. Complete NMEA specification is available in "NMEA 0183, version 3.0". Standard is published by National Marine Electronics association, http://www.nmea.org/0183.

The output sentences are a proprietary message which is denoted by the “P” character following the start of message “$” sign. The “ORE” is the manufacturers three character mnemonic code. The letter following the ”ORE” is the specific output message identifier for particular format shown.

Data fields in the sentence follow a “,” delimiter and consist of ASCII characters (from 20 – 127 decimal or from HEX 14 to HEX 7E). Because of the presence of variable fields and null fields, specific data fields may only be located within a sentence by observing the field delimiters “,”. Therefore, it is essential for the LISTENER to locate fields by counting delimiters rather than counting total number of characters received from the start of the sentences.

The Checksum is the 8-bit exclusive OR (no start or stop bits) of all characters in the sentence, including ”,” delimiters between but not including the “$” and the “*” delimiters. The hexadecimal value of the most significant and least significant 4 bits of the result are converted to two ASCII characters (0-9, A-F) for transmission. The most significant value is transmitted first. The receiving application should calculate the checksum of the message and compare it to the received checksum.

### 3.7.4.1 “PORE” DATA OUTPUT PARAMETER DESCRIPTION

Format “PORE” or NMEA ORE is a NMEA 0183 string length of 70 characters not including <CR><LF>. It follows the sentence structure for a NMEA 0183 version 2.1 proprietary sentence. The system automatically switches to this format when the AUTO OFFSET function is initiated. This allows greater resolution for reading of pitch and roll data. The system reverts back to the previous format once AUTO OFFSET has been completed.

Sample…

```
Example of Format: NMEA ORE
$PORE,##,HHMMSS,,, BRG,    X (m) ,     Y (m) ,    Z (m),   ROLL,   PTCH,WC,QF*CS
$PORE,01,072450,,,300.8,-00001.0,000000.6,00505.4,000.00,000.00,00,10*18
...with compass heading enabled
$PORE,##,HHMMSS,HDG,ID, BRG,      X (m),     Y (m) ,     Z (m),   ROLL, PTCH,WC,QF*CS
$PORE,01,072537,125.8,M,125.5,000000.2,-00000.2,00505.4,-00.03,-00.02,00,10*16
```

| TRACKING DATA MESSAGE FOR FORMAT "NMEA ORE" | | | | | |
|---|---|---|---|---|---|
| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
| 1 | 1 | $ | ASCII "$" CHARACTER | NA | NA |
| 2 | 1 | P | ASCII "P" CHARACTER | NA | NA |
| 3 | 1 | O | ASCII "O" CHARACTER | NA | NA |
| 4 | 1 | R | ASCII "R" CHARACTER | NA | NA |
| 5 | 1 | E | ASCII "E" CHARACTER | NA | NA |
| 6 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 7-8 | 2 | TARGET NUMBER | ASCII | 01-09 | NA |
| 9 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 10-11 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 12-13 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 14-15 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 16 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| | (WITH HEADING ENABLED) | | | | |
| | (17-21) 5 | HEADING | ASCII | 000.0-359.9 | DEGREES |
| 17 | (22) 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| | (23) 1 | HEADING IDENTIFIER | ASCII CHARACTER | T, M, A SEE NOTE 1 | NA |
| 18 | (24) 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 19-23 | (25-29) 5 | TARGET BEARING | ASCII | 000.0-359.9 | DEGREES |
| 24 | (30) 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 25-32 | (31-38) 8 | HORIZ RGE X | ASCII | -00000.0-009999.9 | METERS SEE NOTE 2 |
| 33 | (39) 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 34-41 | (40-47) 8 | HORIZ RGE Y | ASCII | -00000.0-009999.9 | METERS SEE NOTE 2 |
| 42 | (48) 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 43-49 | (49-55) 7 | DEPTH Z | ASCII | 00000.0-09999.9 | METERS SEE NOTE 2 |
| 50 | (56) 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 51-56 | (57-62) 6 | ROLL | ASCII | -50.0-050.0 | DEGREES |
| 57 | (63) 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 58-63 | (64-69) 6 | PITCH | ASCII | -50.0-050.0 | DEGREES |
| 64 | (70) 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 65-66 | (71-72) 2 | WARNING CODE | ASCII | Null-99 SEE NOTE 3 | NA |
| 67 | (73) 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 68-69 | (74-75) 2 | QUALITY FACTOR | ASCII | 01-10 | NA |
| 70 | (76) 1 | EOS CHARACTER | ASCII "*" CHARACTER | NA | NA |
| 71-72 | (77-78) 2 | CHECK SUM | ASCII | 00-FF | NA |
| 73 | (79) 1 | CARRIAGE RETURN | ASCII CRG RET CHAR. | | NA |
| 74 | (80) 1 | LINEFEED | ASCII LINEFEED CHAR. | | NA |

NOTE 1: T = True heading, M = Magnetic heading, A = heading via Analog input
NOTE 2: The X,Y & Z data can either be in meters, yards or feet. See SYSTEM/RS-232 UNITS.
NOTE 3: Error Code 0 = Null Character

### 3.7.4.2 "POREB" DATA OUTPUT FORMAT

**Applicable To:** TP3 Model 4450A & TP3P Model 4430C

**Message Name:** **POREB**

Sample;

$POREB,TG,HHMMSSHH,QF,EC,-BRG-,-DA-,--SR--,-SS-,TP,-TELM-*CS$^{C}{}_{R}{}^{L}{}_{F}$

$POREB,01,07253784,10,50,075.2,39.1,1572.5,1510,18,0328.4*16

### "$POREB" RS-232 PARAMETER DESCRIPTION

**TARGET NUMBER:** The ***TARGET NUMBER*** (#) represents the various target symbols and can range from 0 to 10. The zero is output when in the self-test mode to indicate that the RS-232 data is simulated.

**TIME:** The ***TIME*** value is related to the time of signal reception. It is synchronous with the 24-hour time on the screen of the TrackPoint display. The accuracy of the time as output is within 1 second of the actual time of reply. (In future this will be interfaced to the GPS 1PPS and will be accurate to within approximately 20ms.)

**QUALITY FACTOR:** The ***QUALITY FACTOR*** is a value (1-10) determined by the system on each reply that is detected. The system uses the phase or time counts from each of the hydrophone elements to determine the quality of the signal. If the phase counts are consistent on all three channels throughout the reply burst the quality factor is very high. If the phase counts have jitter or are inconsistent then the quality factor is low.

**ERROR CODE:** The ***ERROR CODE*** or ***WARNING CODE*** is a one- or two- digit error code indicating that the data received could not be used for a valid position fix, or it can represent a warning to let an operator know that the position accuracy could be compromised.

**TARGET BEARING:** The ***BEARING*** output in degrees is a relative bearing from the Hydrophone to the target. The target bearing is corrected for the entered hydrophone offsets, when target is referenced to the pitch roll center of the vessel or if Antenna Offsets are entered, it is corrected again to the Antenna offset point.

**DEPRESSION ANGLE:** The ***DEPRESSION ANGLE*** is the angle from the horizon to the point directly below the hydrophone. It is in degrees.

**SLANT RANGE:** The ***SLANT RANGE*** is the measured travel time between the hydrophone and the transponder. It is only output in meters. The Slant Range is the actual measured slant range to the

transponder or responder. In transponder or responder mode no hydrophone offsets are applied to the data. If in Pinger mode it is a calculated value with offsets applied if applicable. (See NOTE below.)

**SPEED OF SOUND:** The ***SPEED OF SOUND*** is the entered value from either the keyboard or the RS232.

**TEMPERATURE:** The ***TEMPERATURE*** is the value as measured at the Hydrophone by the temperature sensor.

**TELEMETRY DATA:** The ***TELEMETRY*** data is independent of the position data. Its value is dependent upon the parameters set under each target's menu. It is an instantaneous value. If telemetered DEPTH is selected for that target instead of telemetered DATA, the TELEMETRY number is the instantaneous depth value, while Z is the averaged depth value used for positioning calculations.

| TRACKING DATA MESSAGE FOR FORMAT "NMEA" $POREB | | | | | |
|---|---|---|---|---|---|
| BYTE SEE NOTE 1 | LENGTH | DATA WORD | REPRESENTATION | DATA FIELD RANGE | UNITS |
| 1 | 1 | $ | ASCII "$" CHARACTER | NA | NA |
| 2 | 1 | P | ASCII "P" CHARACTER | NA | NA |
| 3 | 1 | O | ASCII "O" CHARACTER | NA | NA |
| 4 | 1 | R | ASCII "R" CHARACTER | NA | NA |
| 5 | 1 | E | ASCII "E" CHARACTER | NA | NA |
| 6 | 1 | B | ASCII "B" CHARACTER | NA | NA |
| 7 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 8-9 | 2 | TARGET NUMBER | ASCII | 00→99 | NA |
| 10 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 11-12 | 2 | HOURS | ASCII | 00→23 | HOURS |
| 13-14 | 2 | MINUTES | ASCII | 00→59 | MINUTES |
| 15-16 | 2 | SECONDS | ASCII | 00→59 | SECONDS |
| 17-18 | 2 | 1/100 SECONDS | ASCII | 00→99 | 1/100 SEC. |
| 19 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 20-21 | 2 | QUALITY FACTOR | ASCII | 01→10 | NA |
| 22 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 23-24 | 2 | ERROR CODE | ASCII | Null→99 SEE NOTE 2 | NA |
| 25 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 26-30 | 5 | TARGET BEARING | ASCII | 000.0→359.9 | DEGREES |
| 31 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 32-35 | 6 | DEPRESSION ANGLE | ASCII | 00.0→89.9 | DEGREES |
| 36 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 37-43 | 7 | SLANT RANGE | ASCII | 0000.00→9999.99 | METERS |
| 44 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 45-48 | 4 | SPEED OF SOUND | ASCII | 1300→1600 | METERS/SEC |
| 49 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 50-53 | 4 | TEMPERATURE | ASCII | -10→40 | ° CELSIUS |
| 54 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 55-60 | 6 | TELEMETRY DATA | ASCII | 0000.0→9999.9 | METERS |
| 61 | 1 | EOS CHARACTER | ASCII "*" CHARACTER | NA | NA |
| 62-63 | 2 | CHECK SUM | ASCII | 00→FF | NA |
| 64 | 1 | CARRIAGE RETURN | ASCII CARR RET CHAR. | | NA |
| 65 | 1 | LINEFEED | ASCII LINEFEED CHAR. | | NA |

NOTE 1: The data field byte length shown is the maximum length. Be aware that each Data field may vary in the number of characters/length or could be nulled.

NOTE 2: Error Code 0 = Null Character

Example of Format: ($POREB)

$POREB,TG,HHMMSSHH,QF,EC,-BRG-,-DA-,--SR--,-SS-,TP,-TELM-*CS$^{C}{}_{R}{}^{L}{}_{F}$

$POREB,01,07253784,10,50,075.2,39.1,1572.5,1510,18,0328.4*16

With no error code, field is nulled…

$POREB,01,07253784,10,,075.2,39.1,1572.5,1510,18,0328.4*16

### 3.7.4.3 "POREG" DATA OUTPUT FORMAT

**Applicable To:** TrackPoint 3 and TrackPoint 3P (Models 4450A, 4430C)

Output sentence for Format NMEA "G" (Trackman Out Only)

**Message Name:** **POREG**

**$POREG RS-232 Parameter Description**

**TARGET NUMBER:** The ***TARGET NUMBER*** (#) represents the various target symbols and can range from 00 to 99. ("00" is the simulated target.) The zero is output when in the self-test mode to indicate that the RS-232 data is simulated.

**TIME:** The ***TIME*** value is related to the time of signal reception. The accuracy of the time as output is within 1 second of the actual time of reply. (In future this will be interfaced to the GPS 1PPS and will be accurate to within approximately 20ms.)

**PHASE A, B, C:** The Phase is the time-counts between each element based on the element spacing and the phase counter clock (50MHz).

**TARGET QUALITY FACTOR:** The ***TARGET QUALITY FACTOR*** is a value (1-10) determined by the system on each reply that is detected. The system uses the phase or time counts from each of the hydrophone elements to determine the quality of the target's signal. If the phase counts are consistent on all three channels throughout the reply burst the quality factor is very high. If the phase counts have jitter or are inconsistent then the quality factor is low.

**ERROR CODE:** The ***ERROR CODE*** or ***WARNING CODE*** is a one- or two- digit error code indicating that the data received could not be used for a valid position fix, or it can represent a warning to let an operator know that the position accuracy could be compromised.

**TARGET SLANT RANGE:** The Target ***SLANT RANGE*** is the measured travel time between the hydrophone and the transponder. It is output only in meters. The Slant Range is the actual measured slant range to the transponder or responder. In transponder or responder mode no hydrophone offsets are applied to the data. If in Pinger mode it is a calculated value with offsets applied if applicable. (See NOTE below.)

**TARGET DEPRESSION ANGLE:** The Depression Angle encompasses the angle starting from the horizontal plane of the hydrophone (0 degrees) and continuing to the point directly below the hydrophone (90 degrees). The ***TARGET DEPRESSION ANGLE*** is the angle measured from the hydrophone's horizontal plane to the target line of sight.

**TARGET BEARING:** The ***TARGET BEARING*** output in degrees is a relative bearing from the Hydrophone to the target. The target bearing is corrected for the entered hydrophone offsets, when target is referenced to the pitch roll center of the vessel or if Antenna Offsets are entered, it is corrected again to the Antenna offset point.

**X, Y, Z:** Horizontal position and depth of Target output in Meters.

**HEADING:** NMEA or ANALOG.

**PITCH:** Pitch Angle [ Pitch of vessel, 0 is horiz, bow up is positive Pitch]

**ROLL:** Roll Angle [ Roll of vessel, 0 is horiz, port up is positive Roll ]

**TEMPERATURE:** The ***TEMPERATURE*** is the value as measured at the Hydrophone by the temperature sensor. In degrees Celsius.

| TRACKING DATA MESSAGE FOR FORMAT "POREG" (ORE special for analyzing data) | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **DATA FIELD RANGE** | **UNITS** |
| 1 | 1 | $ | ASCII "$" CHARACTER | NA | NA |
| 2 | 1 | P | ASCII "P" CHARACTER | NA | NA |
| 3 | 1 | O | ASCII "O" CHARACTER | NA | NA |
| 4 | 1 | R | ASCII "R" CHARACTER | NA | NA |
| 5 | 1 | E | ASCII "E" CHARACTER | NA | NA |
| 6 | 1 | G | ASCII "G" CHARACTER | NA | NA |
| 7 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 8-9 | 2 | TARGET NUMBER | ASCII | 00 to 99 | NA |
| 10 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 11-12 | 2 | TIME TAG HRS | ASCII | 00 to 23 | Hours |
| 13-14 | 2 | TIME TAG MIN | ASCII | 00 to 59 | Minutes |
| 15-16 | 2 | TIME TAG SEC | ASCII | 00 to 59 | Seconds |
| 17 | 1 | PERIOD | ASCII " . " CHARACTER | NA | NA |
| 18-19 | 2 | TIME TAG 1/100 SEC | ASCII | 00 to 99 | Hundredths of Sec. |
| 20 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 21-24 | 4 | PHASE "A" DATA | ASCII | 0000 to 4096 | Counts $A_0 \Rightarrow A_{11}$ |
| 25 | 1 | COMMA | ASCII "," CHARACTER | NA | " , " |
| 26-28 | 4 | PHASE "B" DATA | ASCII | 0000 to 4096 | Counts $B_0 \Rightarrow B_{11}$ |
| 30 | 1 | COMMA | ASCII "," CHARACTER | NA | " , " |
| 31-34 | 4 | PHASE "C" DATA | ASCII | 0000 to 4096 | Counts $C_0 \Rightarrow C_{11}$ |
| 35 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 36-37 | 2 | QUALITY FACTOR | ASCII | 01-10 | NA |
| 38 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 39-40 | 2 | ERROR CODE | ASCII | 00 to 99 | NOTE 1 |
| 41 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 42-49 | 8 | SLANT RANGE | ASCII | 00000.00 to 99999.99 | Meters |
| 50 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 51-55 | 5 | DEPRESSION ANGLE | ASCII | 00.00 to 89.99 | Degrees (NOTE 2) |
| 56 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 57-62 | 5 | BEARING | ASCII | 000.00 to 359.90 | Degrees (NOTE 3) |
| 63 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 64-72 | 9 | X | ASCII | -09999.99 to 009999.99 | Meters |
| 73 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 74-82 | 9 | Y | ASCII | -09999.99 to 009999.99 | Meters |
| 83 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 84-91 | 8 | Z | ASCII | 00000.00 to 09999.99 | Meters |
| 92 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 93-98 | 6 | HEADING | ASCII | 000.00 to 359.99 | Degrees (NOTE 3) |
| 99 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 100-105 | 6 | PITCH | ASCII | -89.99 to 89.99 | Degrees (NOTE 4) |
| 106 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 107-112 | 6 | ROLL | ASCII | -89.99 to 89.99 | Degrees (NOTE 5) |
| 113 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 114-116 | 3 | TEMPERATURE | ASCII | -10 to +50 | Degrees C |
| 117 | 1 | EOS CHAR | ASCII "*" CHARACTER | NA | EOS CHAR |
| 118-119 | 2 | CHECKSUM | ASCII | 00 to $FF_{(H)}$ | NOTE 6 |
| 120 | 1 | CARRIAGE RETURN | ASCII | ASCII CAR RET CHAR | |
| 121 | 1 | LINE FEED | ASCII | ASCII LINE FEED CHAR | |

Example of Format: NMEA ORE"G" Sentence

$POREG,##,HHMMSS.SS,PHSA,PHSB,PHSC,QF,EC,SLANT_RG,-DPA-,-BRNG-,--X (m)--,--Y (m)--,
--Z(m)--,-HDNG-,-PTCH-,-ROLL-,TMP*CS $C_R L_F$

$POREG,01,235959.99,0780,0230,0000,10,00,01024.40,29.54,101.51,000874.22,-00172.33,
00505.44,125.88,-00.03,-00.02,-05*16 $C_R L_F$

NOTE 1: Error Codes [ 0 = null character ]

NOTE 2: Degrees [Depression Angle as measured from Horizontal]

NOTE 3: NMEA or analog

NOTE 4: Pitch Angle [ Pitch of vessel, 0 is horiz, bow up is positive Pitch]

NOTE 5: Roll Angle [ Roll of vessel, 0 is horiz, port up is positive Roll ]

NOTE 6: The Checksum is the 8-bit exclusive OR (no start or stop bits) of all characters in the sentence, including "," delimiters between but not including the "$" and the "*" delimiters.

NOTE 7: The data field byte length shown is the maximum length. Be aware that each Data field may vary in the number of characters/length or could be nulled.

### 3.7.4.4 "TTM" DATA OUTPUT FORMAT

**Applicable To:** TrackPoint 3 and TrackPoint 3P (Models 4450A, 4430C)

**Message Name:** **SNTTM**

| TRACKING DATA MESSAGE FOR FORMAT "NMEA TTM" | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **RANGE** | **UNITS** |
| 1 | 1 | $ | ASCII "$" CHARACTER | NA | NA |
| 2 | 1 | S | ASCII "S" CHARACTER | NA | NA |
| 3 | 1 | N | ASCII "N" CHARACTER | NA | NA |
| 4 | 1 | T | ASCII "T" CHARACTER | NA | NA |
| 5 | 1 | T | ASCII "T" CHARACTER | NA | NA |
| 6 | 1 | M | ASCII "M" CHARACTER | NA | NA |
| 7 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 8-9 | 2 | TARGET NUMBER | ASCII | 01-09 | N/A |
| 10 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 11-16 | 6 | HORIZONTAL RANGE | ASCII | 0.0000-9.9999 | KILOMETERS |
| 17 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 18-22 | 5 | TARGET BEARING | ASCII | 000.0-359.9 | DEGREES |
| 23 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 24 | 1 | R | ASCII "R" CHARACTER | NA | NA |
| 25-30 | 6 | COMMA | ASCII "," CHARACTER | NA | NA |
| 31 | 1 | K | ASCII "K" CHARACTER | NA | NA |
| 32 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 33 | 1 | T | ASCII "T" CHARACTER | NA | NA |
| 34 | 1 | P | ASCII "P" CHARACTER | NA | NA |
| 35 | 1 | I | ASCII "I" CHARACTER | NA | NA |
| 36 | 1 | I | ASCII "I" CHARACTER | NA | NA |
| 37 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 38 | 1 | T | ASCII "T" CHARACTER | NA | NA |
| 39 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 40 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 41-42 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 43-44 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 45-46 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 47 | 1 | COMMA | ASCII "," CHARACTER | NA | NA |
| 48 | 1 | A | ASCII "A" CHARACTER | NA | NA |
| 49 | 1 | * | ASCII "*" CHARACTER | NA | NA |
| 50-51 | 2 | CHECK SUM | ASCII | 00-FF | NA |
| 52 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 53 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

Example:

```
$SNTTM, ##, _HZRNG, _BEAR, R , , , , , , K, TPII , T , , HHMMSS , A*CS
$SNTTM , 01 , 0.0002 , 080.5 , R , , , , , , K , TPII , T , , 072432 , A*4A
```

### 3.7.4.5 "STANDARD" DATA OUTPUT FORMAT

**Applicable To:** TrackPoint 3 and TrackPoint 3P (Models 4450A, 4430C)

**Message Name:** **STANDARD**

| TRACKING DATA MESSAGE FOR FORMAT "STANDARD" | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **RANGE** | **UNITS** |
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-4 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 5 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 6-7 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 8 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 9-10 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 11 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 12-14 | 3 | COMPASS HEADING | ASCII | 0-359 | DEGREES |
| 15 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 16-20 | 5 | TARGET BEARING | ASCII | 0.0-359.9 | DEGREES |
| 21 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 22-28 | 7 | SLANT RANGE | ASCII | 0.0-10000.0 | METERS [1] |
| 29 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 30-37 | 8 | X | ASCII | +/- 10000.0 | METERS [1] |
| 38 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 39-46 | 8 | Y | ASCII | +/- 10000.0 | METERS [1] |
| 47 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 48-54 | 7 | Z | ASCII | 0.0-10000.0 | METERS [1] |
| 55 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 56-63 | 8 | TELEMETRY | ASCII | +/- 99999.9 | UNITS |
| 64 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 65-66 | 2 | WARNING CODE | ASCII | Null, 20-99 [2] | N/A |
| 67 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 68 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

NOTE 1: The Slant Range X,Y & Z data can either be in meters, yards or feet. See SYSTEM/RS232 UNITS. Leading zeroes following the ones digit are suppressed and replaced by spaces (except for the time).

NOTE 2: Error Code 0 = Null Character

Example:

```
O.R.E. TRACKPOINT II Model 4410  Rev # 9.05  15 Oct 97  15:32:38
#   TOD       HDG    BRG    S.R.(m)      X (m)       Y (m)       Z (m)   TEL WARN
1 15:32:40     359   356.3       196.3        -11.1       169.1       100.0    0.0   50
```

### 3.7.4.6 "STANDARD-EC" DATA OUTPUT FORMAT

**Applicable To:** TrackPoint 3 and TrackPoint 3P (Models 4450A, 4430C)

**Message Name:** **STANDARD**

| TRACKING DATA MESSAGE FOR FORMAT "STANDARD-EC" | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **RANGE** | **UNITS** |
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-4 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 5 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 6-7 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 8 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 9-10 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 11 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 12-14 | 3 | COMPASS HEADING | ASCII | 0-359 | DEGREES |
| 15 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 16-20 | 5 | TARGET BEARING | ASCII | 0.0-359.9 | DEGREES |
| 21 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 22-28 | 7 | SLANT RANGE | ASCII | 0.0-10000.0 | METERS [1] |
| 29 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 30-37 | 8 | X | ASCII | +/- 10000.0 | METERS [1] |
| 38 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 39-46 | 8 | Y | ASCII | +/- 10000.0 | METERS [1] |
| 47 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 48-54 | 7 | Z | ASCII | 0.0-10000.0 | METERS [1] |
| 55 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 56-63 | 8 | TELEMETRY | ASCII | +/- 99999.9 | UNITS |
| 64 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 65-66 | 2 | WARNING AND ERROR CODE | ASCII | Null-99 [2] | N/A |
| 67 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 68 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

NOTE 1: The Slant Range X,Y & Z data can either be in meters, yards or feet. See SYSTEM/RS232 UNITS. Leading zeroes following the ones digit are suppressed and replaced by spaces (except for the time).

NOTE 2: Error Code 0 = Null Character

Example:

```
O.R.E. TRACKPOINT II Model 4410  Rev # 9.05  15 Oct 97  15:32:51
#       TOD      HDG BRG     S.R.(m)    X (m)      Y (m)      Z (m)      TEL     ERR
1    15:32:53    359    356.1    196.6        -11.5      169.4      100.0        0.0      50
```

| TRACKING DATA MESSAGE FOR FORMAT "STANDARD-EC" WITH EC#6 | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **RANGE** | **UNITS** |
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-4 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 5 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 6-7 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 8 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 9-10 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 11 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 12-14 | 3 | COMPASS HEADING | ASCII | 0-359 | DEGREES |
| 15 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 16-17 | 2 | TARGET BEARING | ASCII SPACE CHARACTER | | N/A |
| 18 | 1 | TARGET BEARING | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 19 | 1 | TARGET BEARING | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 20 | 1 | TARGET BEARING | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 21 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 22-25 | 4 | SLANT RANGE | ASCII SPACE CHARACTER | | N/A |
| 26 | 1 | SLANT RANGE | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 27 | 1 | SLANT RANGE | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 28 | 1 | SLANT RANGE | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 29 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 30-34 | 5 | X | ASCII SPACE CHARACTER | | N/A |
| 35 | 1 | X | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 36 | 1 | X | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 37 | 1 | X | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 38 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 39-43 | 5 | Y | ASCII SPACE CHARACTER | | N/A |
| 44 | 1 | Y | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 45 | 1 | Y | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 46 | 1 | Y | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 47 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 48-51 | 4 | Z | ASCII SPACE CHARACTER | | N/A |
| 52 | 1 | Z | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 53 | 1 | Z | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 54 | 1 | Z | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 55 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 56-60 | 5 | TELEMETRY | ASCII SPACE CHARACTER | | N/A |
| 61 | 1 | TELEMETRY | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 62 | 1 | TELEMETRY | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 63 | 1 | TELEMETRY | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 64 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 65-66 | 2 | ERROR CODE | ASCII | 06 | N/A |
| 67 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 68 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

When an error code #6 is detected the unit displays only the known data while replacing unknown data with “-.-“.

### 3.7.4.7 "STD W/PR" DATA OUTPUT FORMAT

**Applicable To:** TrackPoint 3 and TrackPoint 3P (Models 4450A, 4430C)

**Message Name:** **STD W/PR**

| TRACKING DATA MESSAGE FOR FORMAT "STD W/PR" | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **RANGE** | **UNITS** |
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-4 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 5 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 6-7 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 8 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 9-10 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 11 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 12-14 | 3 | COMPASS HEADING | ASCII | 0-359 | DEGREES |
| 15 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 16-20 | 5 | TARGET BEARING | ASCII | 0.0-359.9 | DEGREES |
| 21 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 22-28 | 7 | SLANT RANGE | ASCII | 0.0-10000.0 | METERS [1] |
| 29 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 30-37 | 8 | X | ASCII | +/- 10000.0 | METERS [1] |
| 38 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 39-46 | 8 | Y | ASCII | +/- 10000.0 | METERS [1] |
| 47 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 48-54 | 7 | Z | ASCII | 0.0-10000.0 | METERS [1] |
| 55 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 56-63 | 8 | TELEMETRY | ASCII | +/- 99999.9 | UNITS |
| 64 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 65-66 | 2 | WARNING CODE | ASCII | Null, 20-99 [2] | N/A |
| 67 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 68-72 | 5 | ROLL | ASCII | +/- 0.0-45.0 | DEGREES |
| 73 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 74-78 | 5 | PITCH | ASCII | +/- 0.0-45.0 | DEGREES |
| 79 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 80 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

NOTE 1: The Slant Range X,Y & Z data can either be in meters, yards or feet. See SYSTEM/RS232 UNITS. Leading zeroes following the ones digit are suppressed and replaced by spaces (except for the time).

NOTE 2: Error Code 0 = Null Character

Example:

```
O.R.E. TRACKPOINT II Model 4410  Rev # 9.05  15 Oct 97  15:32:57
#   TOD        HDG  BRG      S.R.(m)    X (m)     Y (m)     Z (m)       TEL  WARN     RL    PT
 1 15:32:59    359      356.3      196.0       -11.0     168.7     100.0        0.0       50      0.0  -0.0
```

### 3.7.4.8 "STD-EC W/PR" DATA OUTPUT FORMAT

**Applicable To:** TrackPoint 3 and TrackPoint 3P (Models 4450A, 4430C)

**Message Name:** **STD-EC W/PR**

| TRACKING DATA MESSAGE FOR FORMAT "STD-EC W/PR" | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **RANGE** | **UNITS** |
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-4 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 5 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 6-7 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 8 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 9-10 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 11 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 12-14 | 3 | COMPASS HEADING | ASCII | 0-359 | DEGREES |
| 15 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 16-20 | 5 | TARGET BEARING | ASCII | 0.0-359.9 | DEGREES |
| 21 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 22-28 | 7 | SLANT RANGE | ASCII | 0.0-10000.0 | METERS [1] |
| 29 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 30-37 | 8 | X | ASCII | +/- 10000.0 | METERS [1] |
| 38 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 39-46 | 8 | Y | ASCII | +/- 10000.0 | METERS [1] |
| 47 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 48-54 | 7 | Z | ASCII | 0.0-10000.0 | METERS [1] |
| 55 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 56-63 | 8 | TELEMETRY | ASCII | +/- 99999.9 | UNITS |
| 64 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 65-66 | 2 | WARNING AND ERROR CODE | ASCII | Null-99 [2] | N/A |
| 67 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 68-72 | 5 | ROLL | ASCII | +/- 0.0-45.0 | DEGREES |
| 73 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 74-78 | 5 | PITCH | ASCII | +/- 0.0-45.0 | DEGREES |
| 79 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 80 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

NOTE 1: The Slant Range X,Y & Z data can either be in meters, yards or feet. See SYSTEM/RS232 UNITS. Leading zeroes following the ones digit are suppressed and replaced by spaces (except for the time).

NOTE 2: Error Code 0 = Null Character

Example:

```
O.R.E. TRACKPOINT II Model 4410  Rev # 9.05  15 Oct 97  15:32:57
#   TOD        HDG    BRG       S.R.(m)    X (m)     Y (m)     Z (m)       TEL     ERR     RL    PT
1 15:32:59    359     356.3      196.0      -11.0     168.7     100.0       0.0      50     0.0  -0.0
```

| TRACKING DATA MESSAGE FOR FORMAT "STD-EC W/PR" WITH EC#6 | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **RANGE** | **UNITS** |
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-4 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 5 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 6-7 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 8 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 9-10 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 11 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 12-14 | 3 | COMPASS HEADING | ASCII | 0-359 | DEGREES |
| 15 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 16-17 | 2 | TARGET BEARING | ASCII SPACE CHARACTER | | N/A |
| 18 | 1 | TARGET BEARING | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 19 | 1 | TARGET BEARING | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 20 | 1 | TARGET BEARING | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 21 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 22-25 | 4 | SLANT RANGE | ASCII SPACE CHARACTER | | N/A |
| 26 | 1 | SLANT RANGE | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 27 | 1 | SLANT RANGE | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 28 | 1 | SLANT RANGE | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 29 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 30-34 | 5 | X | ASCII SPACE CHARACTER | | N/A |
| 35 | 1 | X | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 36 | 1 | X | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 37 | 1 | X | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 38 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 39-43 | 5 | Y | ASCII SPACE CHARACTER | | N/A |
| 44 | 1 | Y | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 45 | 1 | Y | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 46 | 1 | Y | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 47 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 48-51 | 4 | Z | ASCII SPACE CHARACTER | | N/A |
| 52 | 1 | Z | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 53 | 1 | Z | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 54 | 1 | Z | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 55 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 56-60 | 5 | TELEMETRY | ASCII SPACE CHARACTER | | N/A |
| 61 | 1 | TELEMETRY | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 62 | 1 | TELEMETRY | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 63 | 1 | TELEMETRY | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 64 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 65-66 | 2 | ERROR CODE | ASCII | 06 | N/A |
| 67 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 68-69 | 2 | ROLL | ASCII SPACE CHARACTER | | N/A |
| 70 | 1 | ROLL | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 71 | 1 | ROLL | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 72 | 1 | ROLL | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 73 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 74-75 | 2 | PITCH | ASCII SPACE CHARACTER | | N/A |
| 76 | 1 | PITCH | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 77 | 1 | PITCH | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 78 | 1 | PITCH | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 79 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 80 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

When an error code #6 is detected the unit displays only the known data while replacing unknown data with “-.-“.

### 3.7.4.9 "NCSC" DATA OUTPUT FORMAT

**Applicable To:** (Models 4410C-V1302)

**Message Name:** **NCSC**

| TRACKING DATA MESSAGE FOR FORMAT "NCSC" | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **RANGE** | **UNITS** |
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHARACTER, 02h | | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 4 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 5-6 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 7 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 8-9 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 10 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 11-12 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 13 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 14-18 | 5 | COMPASS HEADING | ASCII | 0.0-359.0 | DEGREES |
| 19 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 20-24 | 5 | TARGET BEARING | ASCII | 0.0-359.9 | DEGREES |
| 25 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 26-32 | 7 | SLANT RANGE | ASCII | 0.0-10000.0 | METERS [1] |
| 23 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 34-41 | 8 | X | ASCII | +/- 10000.0 | METERS [1] |
| 42 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 43-50 | 8 | Y | ASCII | +/- 10000.0 | METERS [1] |
| 52 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 53-59 | 7 | Z | ASCII | 0.0-10000.0 | METERS [1] |
| 60 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 60-67 | 8 | TELEMETRY | ASCII | +/- 99999.9 | UNITS |
| 68 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 69-70 | 2 | WARNING AND ERROR CODE | ASCII | Null-99 [2] | N/A |
| 71 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 72-73 | 2 | CHECKSUM | 16-BIT BINARY SUM OF BYTES | 00-FF | N/A |
| 74 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 75 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

NOTE 1: The Slant Range X,Y & Z data can either be in meters, yards or feet. See SYSTEM/RS232 UNITS. . Leading zeroes following the ones digit are output, maintaining a fixed field length.

NOTE 2: Error Code 0 = Null Character

Example:

```
  TG  TIME    HDG  BRG       SR       X          Y          Z         TEL      EC   CS
☺ 1 10:28:31     210.7   00009.5   -00004.6   -00007.8   00002.0   000000.0   56   CS
```

The ASCII Start Of Text Character, "☺", is equal to 2 decimal or 02 hexadecimal. If a numeric field has more bytes than required to represent the ASCII number then leading zeroes are inserted in the data string. If the heading is not enabled the data field is filled with spaces.

### 3.7.4.10 "REV-4" DATA OUTPUT FORMAT

**Applicable To:** Standard TrackPoint's

**Message Name:** **REV-4**

| TRACKING DATA MESSAGE FOR FORMAT "REV 4" | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **RANGE** | **UNITS** |
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 4-8 | 5 | TARGET BEARING | ASCII | 0.0-359.9 | DEGREES |
| 9 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 10-13 | 4 | DEPRESSION ANGLE | ASCII | 0.3-90.0 | DEGREES |
| 14 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 15-19 | 5 | SLANT RANGE | ASCII | 0.0-09500 | METERS |
| 20 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 21-26 | 6 | X | ASCII | +/- 0.0-10000 | METERS |
| 27 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 28-33 | 6 | Y | ASCII | +/- 0.0-10000 | METERS |
| 34 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 35-40 | 6 | Z | ASCII | 0.0-010000 | METERS |
| 41 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | N/A | |
| 42 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

NOTE: Format REV 4 only outputs data in meters. Leading zeroes following the ones digit are suppressed and replaced by spaces.

Example of Format REV 4 RS232 output is shown below:

```
O.R.E. TRACKPOINT II  REV # 9.05 15 Oct 97 15:32:21
#        BRG     DEPA     S/R     X       Y       Z
1       356.3   30.3    196.1  -11.1  168.9  100.0
```

| TRACKING DATA MESSAGE FOR FORMAT "REV 4-EC" | | | | | |
|---|---|---|---|---|---|
| **BYTE** | **LENGTH** | **DATA WORD** | **REPRESENTATION** | **RANGE** | **UNITS** |
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 4-8 | 5 | TARGET BEARING | ASCII | 0.0-359.9 | DEGREES |
| 9 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 10-13 | 4 | DEPRESSION ANGLE | ASCII | 0.3-90.0 | DEGREES |
| 14 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 15-19 | 5 | SLANT RANGE | ASCII | 0.0-09500 | METERS |
| 20 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 21-26 | 6 | X | ASCII | +/- 0.0-10000 | METERS |
| 27 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 28-33 | 6 | Y | ASCII | +/- 0.0-10000 | METERS |
| 34 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 35-40 | 6 | Z | ASCII | 0.0-010000 | METERS |
| 41 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 42-43 | 2 | ERROR CODE | ASCII | 0-99 | N/A |
| 44 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 45 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

NOTE: Format REV 4-EC only outputs data in meters. Leading zeroes following the ones digit are suppressed and replaced by spaces.

Example of Format REV 4-EC RS232 output is shown below:

```
O.R.E. TRACKPOINT II  REV # 9.05 15 Oct 97 15:32:33
#      BRG    DEPA    S/R      X     Y       Z    ERR
1      356.3  30.3   196.3  -11.0  169.1  100.0  50
```

## 3.7.4.11 "NUWC-1" DATA OUTPUT FORMAT

**Applicable To:** Special NUWC TrackPoint Format – (Modified from the TP2 version)

**Message Name:** **NUWC-1**

**TRACKING DATA MESSAGE FOR FORMAT "NUWC-1"**

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-4 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 5 | 1 | COLON | ASCII COLON CHARACTER ":" | | N/A |
| 6-7 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 8 | 1 | COLON | ASCII COLON CHARACTER, ":" | | N/A |
| 9-10 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 11 | 1 | PERIOD | ASCII PERIOD CHARACTER, "." | | N/A |
| 12-13 | 2 | TIME TAG 1/100 SEC | ASCII | 00 to 99 | HUNDREDTHS of SEC. |
| 14 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 15-17 | 3 | COMPASS HEADING | ASCII | 0-359 | DEGREES |
| 18 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 19-23 | 5 | TARGET BEARING | ASCII | 0.0-359.9 | DEGREES |
| 24 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 25-28 | 4 | DEPRESSION ANGLE | ASCII | 0.0-89.9 [1] | DEGREES |
| 29 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 30-36 | 7 | SLANT RANGE | ASCII | 0.0-10000.0 | METERS [2] |
| 37 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 38-45 | 8 | X | ASCII | +/- 10000.0 | METERS [2] |
| 46 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 47-54 | 8 | Y | ASCII | +/- 10000.0 | METERS [2] |
| 55 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 56-62 | 7 | Z | ASCII | 0.0-10000.0 | METERS [2] |
| 63 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 64-71 | 8 | TELEMETRY | ASCII | +/- 99999.9 | UNITS |
| 72 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 73-74 | 2 | WARNING CODE | ASCII | 20-99 [3] | N/A |
| 75 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 76-80 | 5 | ROLL | ASCII | +/- 0.0-45.0 | DEGREES |
| 81 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 82-86 | 5 | PITCH | ASCII | +/- 0.0-45.0 | DEGREES |
| 87 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 88 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

NOTE 1: Depression Angle is the raw value before offset correction.

NOTE 2: The Slant Range X,Y & Z data can either be in meters, yards or feet. Leading zeroes following the ones digit are suppressed and replaced by spaces (except for the time).

NOTE 3: Error Code 0 = Null Character

Example:

| # | TOD | HDG | BRG | DEPA | S.R.(m) | X (m) | Y (m) | Z (m) | TEL | WARN | RL | PT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15:32:59.83 | 359 | 356.3 | XX.X | 196.0 | -11.0 | 168.7 | 100.0 | 0.0 | 50 | 0.0 | -0.0 |

## TRACKING DATA MESSAGE FOR FORMAT "NUWC-1 EC"

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-4 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 5 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 6-7 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 8 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 9-10 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 11 | 1 | PERIOD | ASCII PERIOD CHARACTER, "." | | N/A |
| 12-13 | 2 | TIME TAG 1/100 SEC | ASCII | 00 to 99 | HUNDREDTHS of SEC. |
| 14 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 15-17 | 3 | COMPASS HEADING | ASCII | 0-359 | DEGREES |
| 18 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 19-23 | 5 | TARGET BEARING | ASCII | 0.0-359.9 | DEGREES |
| 24 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 25-28 | 4 | DEPRESSION ANGLE | ASCII | 0.0-89.9 [1] | DEGREES |
| 29 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 30-36 | 7 | SLANT RANGE | ASCII | 0.0-10000.0 | METERS [2] |
| 37 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 38-45 | 8 | X | ASCII | +/- 10000.0 | METERS [2] |
| 46 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 47-54 | 8 | Y | ASCII | +/- 10000.0 | METERS [2] |
| 55 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 56-62 | 7 | Z | ASCII | 0.0-10000.0 | METERS [2] |
| 63 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 64-71 | 8 | TELEMETRY | ASCII | +/- 99999.9 | UNITS |
| 72 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 74-75 | 2 | WARNING AND ERROR CODE | ASCII | 01-99 [3] | N/A |
| 75 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 76-80 | 5 | ROLL | ASCII | +/- 0.0-45.0 | DEGREES |
| 81 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 82-86 | 5 | PITCH | ASCII | +/- 0.0-45.0 | DEGREES |
| 87 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 88 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

NOTE 1: Depression Angle is the raw value before offset correction.

NOTE 2: The Slant Range X,Y & Z data can either be in meters, yards or feet. Leading zeroes following the ones digit are suppressed and replaced by spaces (except for the time).

NOTE 3: Error Code 0 = Null Character

Example:

| # | TOD | HDG | BRG | DEPA | S.R.(m) | X (m) | Y (m) | Z (m) | TEL | WARN | RL | PT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15:32:59.83 | 359 | 356.3 | XX.X | 196.0 | -11.0 | 168.7 | 100.0 | 0.0 | 50 | 0.0 | -0.0 |

## TRACKING DATA MESSAGE FOR FORMAT "NUWC-1 EC" WITH EC#6

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | TARGET NUMBER | ASCII | 1-9 | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-4 | 2 | HOURS | ASCII | 00-23 | HOURS |
| 5 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 6-7 | 2 | MINUTES | ASCII | 00-59 | MINUTES |
| 8 | 1 | COLON | ASCII COLON CHARACTER | | N/A |
| 9-10 | 2 | SECONDS | ASCII | 00-59 | SECONDS |
| 11 | 1 | PERIOD | ASCII SPACE CHARACTER, "." | | N/A |
| 12-13 | 2 | TIME TAG 1/100 SEC | ASCII | 00 to 99 | HUNDREDTHS of SEC. |
| 14 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 15-17 | 3 | COMPASS HEADING | ASCII (could be -.- or blank or hdg) | -.-, 0-359,null | DEGREES |
| 18 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 19-20 | 2 | TARGET BEARING | ASCII SPACE CHARACTER | | N/A |
| 21 | 1 | TARGET BEARING | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 22 | 1 | TARGET BEARING | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 23 | 1 | TARGET BEARING | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 24 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 25 | 1 | DEPRESSION ANGLE | ASCII SPACE CHARACTER | | N/A |
| 26 | 1 | DEPRESSION ANGLE | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 27 | 1 | DEPRESSION ANGLE | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 28 | 1 | DEPRESSION ANGLE | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 29 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 30-33 | 4 | SLANT RANGE | ASCII SPACE CHARACTER | | N/A |
| 34 | 1 | SLANT RANGE | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 35 | 1 | SLANT RANGE | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 36 | 1 | SLANT RANGE | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 37 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 38-42 | 5 | X | ASCII SPACE CHARACTER | | N/A |
| 43 | 1 | X | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 44 | 1 | X | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 45 | 1 | X | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 46 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 47-51 | 5 | Y | ASCII SPACE CHARACTER | | N/A |
| 52 | 1 | Y | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 53 | 1 | Y | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 54 | 1 | Y | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 55 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 56-59 | 4 | Z | ASCII SPACE CHARACTER | | N/A |
| 60 | 1 | Z | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 61 | 1 | Z | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 62 | 1 | Z | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 63 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 64-68 | 5 | TELEMETRY | ASCII SPACE CHARACTER | | N/A |
| 69 | 1 | TELEMETRY | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 70 | 1 | TELEMETRY | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 71 | 1 | TELEMETRY | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 72 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 73-74 | 2 | ERROR CODE | ASCII | 06 | N/A |
| 75 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 76-77 | 2 | ROLL | ASCII SPACE CHARACTER | | N/A |
| 78 | 1 | ROLL | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 79 | 1 | ROLL | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 80 | 1 | ROLL | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 81 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 82-83 | 2 | PITCH | ASCII SPACE CHARACTER | | N/A |
| 84 | 1 | PITCH | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 85 | 1 | PITCH | ASCII PERIOD CHARACTER (2E h) | . | N/A |
| 86 | 1 | PITCH | ASCII MINUS CHARACTER (2D h) | - | N/A |
| 87 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A |
| 88 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

When an error code #6 is detected the unit displays only the known data while replacing unknown data with "-.-".

### 3.7.4.12 RS-232 PARAMETER DESCRIPTION

These are the descriptions of the parameters used in the Format Sentences above unless otherwise listed.

The **TARGET NUMBER** (#) represents the various target symbols and can range from 0 to 9. The zero is output when in the self-test mode to indicate that the RS-232 data is simulated.

The **TIME** (TOD) is output at the beginning of each target's data. It is synchronous with the 24-hour time on the screen of the TrackPoint. It is equal to the time that the TrackPoint received the acoustic reply. When synchronized with the GPS clock the accuracy of the time as output is within 50 milliseconds of the actual time of reply.

The **HEADING** (HDG) is only displayed when a compass interface is used. The HEADING can either be the Magnetic heading of the vessel or the True heading, if the NMEA heading data has been determined to be corrected for True North. The NMEA ORE output sentence shows an identifier in the string to show whether data is Magnetic (M), True (T) or from an Analog source (A). The heading is also displayed on the upper left corner of the TrackPoint's screen.

The **BEARING** (BRG) output in degrees is a relative bearing from the ship to the target. When the compass interface is in use, and the SYSTEM / COMPASS / RS232 TGT DATA is set to North Ref., the target bearing is referenced to North. The target bearing is corrected for the entered hydrophone offsets (target is referenced to the pitch roll center of the vessel) or if Antenna Offsets are entered it is corrected again to the Antenna offset point. The SYSTEM / COMPASS / RS232 TGT DATA switch can be set to either NORTH REF or BOW REF. See section 3.4.2.

The **DEPRESSION ANGLE** output on REV4 formats is the depression angle calculated from the final horizontal distance and the depth (either input or calculated depth). The depression angle output on the **NUWC** formats is the angle as measured by the hydrophone's three elements but it has been corrected for pitch and roll motion. It is not compensated by the hydrophone X,Y,Z deviation, caused by the offset between hydrophone and vessel pitch / roll center. (I.e., the arc that the hydrophone swings through during vessel motion.) System takes wherever the hydrophone was when the reply was received and reconverts depression angle based on a gravity level measurement at that position.

The **SLANT RANGE** (S.R.) is the measured travel time between the hydrophone and the transponder. It is output in meters, feet or yards, depending on RS-232 UNITS selection. The Slant Range is the actual measured slant range to the transponder or responder. In transponder or responder mode no hydrophone offsets are applied to the data. If in Pinger mode it is a calculated value with offsets applied if applicable. (See NOTE below.)

The **X** and **Y** position are the coordinates from the ship to the target. They are output in meters, feet or yards if STANDARD, STANDARD-EC, STD W/PR, STD-EC W/PR, NCSC or NMEA ORE is selected, or just meters if Format REV 4 or REV 4-EC is selected. If NMEA TTM is selected then the X and Y ranges are in kilometers.

NOTE: Smoothing occurs on the target position only (X, Y or Horizontal Distance, Brg), NOT the slant range. For non-pinger targets the slant range is displayed in the status block and sent out the RS-232 as the actual value. For pinger targets the slant range is calculated and smoothed.

The **Z** (depth) can be either a manually entered value, a telemetered value, an analog input value or a calculated value. Z is in meters, feet or yards if Format STANDARD or STANDARD-EC STD W/PR, STD-EC W/PR, NCSC or NMEA ORE, NUWC or NUWC-EC is selected, or just meters if Format REV 4 or REV 4-EC is selected. If NMEA TTM is selected then Z range is in kilometers.

NOTE: Filter settings 6-10 cause the analog or telemetry depth (Z) to average the last three readings. Filter settings 1-5 do not average the input depth.

The **TELEMETRY** (TELEM) data is independent of the position data. Its value is dependent upon the parameters set under each target's menu. It is an instantaneous value. If telemetered DEPTH is selected for that target instead of telemetered DATA, the TELEM number is the instantaneous depth value, while Z is the averaged depth value used for positioning calculations.

The **ERROR CODE** (ERR) or **WARNING CODE** (WARN) is a one- or two- digit error code indicating that the data received could not be used for a valid position fix, or it can represent a warning to let an operator know that the position accuracy could be compromised (see ERROR and WARNING CODES, section 3.15).

**PITCH** and **ROLL** is either from the PITCH and ROLL from the hydrophone VRU (Models 4610B Hydrophone or 4740A VRU/Amplifier) or a remote VRU (Dynamic motion monitoring sensor, such as the ORE Model 4414A). The units are in degrees. When the SYSTEM / OFFSETS / HYDROPHONE / VRU / STATUS function is set to ACTIVE a positive PITCH is output the RS232 when the BOW of the vessel is UP and a positive ROLL is when the vessel rolls to starboard or PORT side UP. If the internal VRU STATUS function is set to STATIC, configured for remote VRU sensing, the NMEA ORE format changes to follow the incoming voltage polarity instead of the BOW UP/PORT UP protocol.

The **QUALITY FACTOR** is a value (1-10) determined by the system on each reply that is detected. The system uses the phase or time counts from each of the hydrophone elements to determine the quality of the signal. If the phase counts are consistent on all three channels through-out the reply burst the quality factor is very high. If the phase counts have jitter or are inconsistent then the quality factor is low.

### 3.7.4.13 TRACKMAN REMOTE INTERFACE

The Trackman Program can accept commands from a remote PC along with sending target data out on the same port. From the DEVICE LIST select Remote Interface from the list. Set the connection Type, the IP settings or COM port settings, and the Sentence Settings. The command “Sentence In to Trackman” format can either be TP-SPC (ORE Proprietary) or NCSC. The “Sentence Out from Trackman” can be any of the ones from the DATA OUTPUT as shown above. (Future option.)

### 3.7.4.14 NCSC COMMAND STRUCTURE

The NCSC RS-232 control method uses predefined packets of information to control operational parameters. These packets are used to perform SYSTEM and TARGET setup modifications.

**NOTE:** The only setup that is not duplicated exactly to the NCSS specification is in the FILTER LEVEL setting. The new filtering method precludes using the same five codes to control the new filter level. A translation table takes the five codes and changes the new filter level to a setting that is close to its original. See Target Setup Command 3 below.

The following commands are in the process of being updated to fit in with the TrackPoint 3 parameters. Do not use at this time.

## TARGET SETUP COMMAND 1

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHAR | | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-5 | 3 | MESSAGE ID | ASCII CHARACTERS "TR1" | | N/A |
| 6 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 7 | 1 | TARGET NUMBER | ASCII | 0 TO 9 | N/A |
| 8 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 9-13 | 5 | TURN AROUND TIME | ASCII | 000.0 TO 125.0 | ms |
| 14 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 15-18 | 4 | REPLY FREQUENCY | ASCII | 22.0 TO 30.0 | kHz |
| 19 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 20-23 | 4 | INTERROGATE FREQUENCY | ASCII | 04.5 TO 30.0 | kHz |
| 24 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 25-26 | 2 | REPETITION INTERVAL | ASCII | 01 TO 20 | SEC |
| 27 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 28 | 1 | TRACKING | ASCII | 0=OFF, 1=ON | N/A |
| 29 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 30-31 | 2 | CHECKSUM | 16 BIT BINARY SUM OF BYTES | N/A | |
| 32 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 33 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHAR | N/A | |
| 34 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

## TARGET SETUP COMMAND 2

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHARACTER | N/A | |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-5 | 2 | MESSAGE ID | ASCII CHARACTERS "TR2" | | N/A |
| 6 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 7 | 1 | TARGET NUMBER | ASCII | 0 TO 9 | N/A |
| 8 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 9-13 | 5 | DEPTH | ASCII | 00000 TO 10000 | METERS |
| 14 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 15-19 | 5 | MIN. XPONDER RANGE | ASCII | 0000 TO 9500 | METERS |
| 20 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 21-22 | 2 | CHECKSUM | 16 BIT BINARY SUM OF BYTES | N/A | |
| 23 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 24 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | N/A | |
| 25 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

TARGET SETUP COMMAND 3

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHAR | | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-5 | 3 | MESSAGE ID | ASCII CHARACTERS "TR3" | | N/A |
| 6 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 7 | 1 | TARGET NUMBER | ASCII | 0 TO 9 | N/A |
| 8 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 9-12 | 4 | TELEMETRY FREQUENCY | ASCII | 21.0 TO 29.0 | kHz |
| 13 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 14-16 | 3 | ZERO DELAY | ASCII | 050 TO 500 | ms |
| 17 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 18-21 | 4 | FULL SCALE DELAY | ASCII | 0500 TO 1500 | ms |
| 22 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 23-26 | 4 | SPAN | ASCII | 0001 TO 5000 | UNITS |
| 27 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 28-29 | 2 | PULSE WIDTH | ASCII | 01-20 | ms |
| 30 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 31-34 | 4 | PINGER REP RATE | ASCII | 0400-1500 | ms |
| 35 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 36 | 1 | TYPE | ASCII 0=TRANS,1=RESP, 2=PINGER, 3=HW TRANS | ⇦ | N/A |
| 37 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 38 | 1 | DEPTH SELECT | ASCII 0=MANUAL,1=ANALOG,2=TELEMETRY | ⇦ | N/A |
| 39 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 40 | 1 | DEPTH MODE | ASCII 0=CALCULATED, 1=INPUT | ⇦ | N/A |
| 41 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 42 | 1 | TELEMETRY | ASCII 0=OFF, 1=ON | ⇦ | N/A |
| 43 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 44 | 1 | THRESHOLD LEVEL | ASCII 0=LOW,1=MD-LW, 2=MD-HI, 3=HIGH | ⇦ | N/A |
| 45 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 46 | 1 | FILTERING LEVEL | ASCII See Note Below | ⇦ | N/A |
| 47 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 48 | 1 | SMOOTHING | ASCII A-J = Averaging of 1-10 | ⇦ | N/A |
| 49 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 50 | 1 | KEYING | ASCII | 0=INT,1=EXT | N/A |
| 51 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 52-53 | 2 | CHECKSUM | 16 BIT BINARY SUM OF BYTES | N/A | N/A |
| 54 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 55 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | N/A | N/A |
| 56 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

#46 = A-J = Filter Level 1-10 w/o QF; Q-Z = Filtering Level 1-10 with QF on.

## SYSTEM SETUP COMMAND 1

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHARACTER | N/A | |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-5 | 3 | MESSAGE ID | ASCII CHARACTERS "SY1" | | N/A |
| 6 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 7-12 | 6 | X HYDROPHONE OFFSET | ASCII | -999.9 TO +999.9 M | METERS |
| 13 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 14-19 | 6 | Y HYDROPHONE OFFSET | ASCII | -999.9 TO +999.9 M | METERS |
| 20 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 21-26 | 6 | Z HYDROPHONE OFFSET | ASCII | -999.9 TO +999.9 M | METERS |
| 27 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 28-32 | 5 | BEARING OFFSET | ASCII | 000.0 TO 359.9 | DEG. |
| 33 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 34-39 | 6 | ANALOG DEPTH MIN DEPTH | ASCII | 0000.0 TO 9999.9 M | METERS |
| 40 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 41-47 | 7 | ANALOG DEPTH MAX DEPTH | ASCII | 00000.0 TO 10000.0 M | METERS |
| 48 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 49 | 1 | COMPASS OFF, ANAL,NMEA | ASCII 0=OFF, 1= Analog, 2= NMEA | 0 TO 2 | N/A |
| 50 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 51-52 | 2 | CHECKSUM | 16 BIT BINARY SUM OF BYTES | N/A | |
| 53 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 54 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | N/A | |
| 55 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

## SYSTEM SETUP COMMAND 2

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHARACTER | N/A | |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-5 | 3 | MESSAGE ID | ASCII CHARACTERS "SY2" | | N/A |
| 6 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 7-12 | 6 | VELOCITY OF SOUND | ASCII | 1000.0 TO 2000.0 M/S | M/Sec |
| 13 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 14-15 | 2 | SALINITY | ASCII | 00 TO 40 | PPT |
| 16 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 17-18 | 2 | CHECKSUM | 16 BIT BINARY SUM OF BYTES | N/A | |
| 19 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 20 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | N/A | |
| 21 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

SYSTEM SETUP COMMAND 3

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHARACTER | N/A | |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-5 | 3 | MESSAGE ID | ASCII CHARACTERS "SY3" | | N/A |
| 6 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 7-8 | 2 | HOURS | ASCII | 00 TO 23 | HRS |
| 9 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 10-11 | 2 | MINUTES | ASCII | 00 TO 59 | MIN |
| 12 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 13-14 | 2 | SECONDS | ASCII | 00 TO 50 | SEC |
| 15 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 16-17 | 2 | MONTH | ASCII | 01 TO 12 | MONTH |
| 18 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 19-20 | 2 | DAY | ASCII | 01 TO 31 | DAY |
| 21 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 22-23 (25) | 2 (4) | YEAR | ASCII | 00 TO 2099 | YEAR |
| 24 (26) | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 25-26 (28) | 2 | CHECKSUM | 16 BIT BINARY SUM OF BYTES | N/A | |
| 27 (29) | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 28 (30) | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | N/A | |
| 29 (31) | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

The numbers in parenthesis ( ) are the extended characters if the year is sent to the TrackPoint in 4 digits vs 2.

For data sent to TrackPoint IM, the “SY3” command has been modified to allow 4-digit entry of the year. The existing 2-digit year value remains valid also. If the system receives 4-digits within the year field (before the trailing space character is received) it will accept the value with the following rules applying. If the year is less than or equal to 1950 it assumes it is 20XX. If it is greater than 1950 then it assumes it is 19XX. If it receives only two digits that are less than or equal to 50 it assumes it is 20XX. If it is greater than 50 then it assumes it is 19XX.

SYSTEM SETUP COMMAND 4

| BYTE | LENGTH | DATA WORD | REPRESENTATION | | RANGE | UNITS |
|---|---|---|---|---|---|---|
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHAR | | | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 3-5 | 3 | MESSAGE ID | ASCII CHARACTERS "SY4" | | | N/A |
| 6 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 7-13 | 7 | ANALOG1 MIN. UNITS | ASCII | | 0 TO 9999.9 | N/A |
| 14 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 15-21 | 7 | ANALOG1 MAX. UNITS | ASCII | | 0 TO 9999.9 | N/A |
| 22 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 23-26 | 4 | ANALOG1 MIN. VOLTS | ASCII | | 0.00 to 5.99 | V |
| 27 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 28-31 | 4 | ANALOG1 MAX. VOLTS | ASCII | | 0.10 to 6.00 | V |
| 32 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 33-34 | 2 | ANALOG USE AS... | ASCII | See Note below | 00 to 02 | N/A |
| 35 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 36-42 | 7 | ANALOG1 MIN. UNITS | ASCII | | 0 TO 9999.9 | N/A |
| 43 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 44-50 | 7 | ANALOG1 MAX. UNITS | ASCII | | 0 TO 9999.9 | N/A |
| 51 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 52-55 | 4 | ANALOG1 MIN. VOLTS | ASCII | | 0.00 to 5.99 | V |
| 56 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 57-60 | 4 | ANALOG1 MAX. VOLTS | ASCII | | 0.10 to 6.00 | V |
| 61 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 62-63 | 2 | ANALOG USE AS... | ASCII | See Note Below | 00 to 10 | N/A |
| 64 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 65-66 | 2 | CHECKSUM | 16 BIT BINARY SUM OF BYTES | | N/A | N/A |
| 67 | 1 | SPACE | ASCII SPACE CHARACTER | | | N/A |
| 68 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | | N/A | N/A |
| 69 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | | N/A |

```
#33 = 0
#34 = 0=Off, 1=Compass, 2=Hydrophone

#62 = 0
#63 = 0-8 represents Target #’s 1-9; 10 = Hydrophone
```

## SYSTEM SETUP COMMAND 5

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHAR | | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-5 | 3 | MESSAGE ID | ASCII CHARACTERS "SY5" | | N/A |
| 6 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 7 | 1 | RS232 UNITS | ASCII 0=M,1=F, 2=Y | 0 to 2 | N/A |
| 8 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 9-10 | 2 | RS232 FORMAT | ASCII See Note Below. | 00 TO 99 | N/A |
| 11 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 12 | 1 | COMPASS SELECT | ASCII 0=Off, 1=Analog, 2=NMEA | 0 to 2 | N/A |
| 13 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 14-19 | 6 | COMPASS OFFSET | ASCII | 0.0 TO -359.9 | DEG |
| 20 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 21-22 | 2 | COMPASS NMEA FORMAT | ASCII 0=HDG,1=HDT, 2=HDM, 3=VHW, 4=VTG | 00 to 99 | N/A |
| 23 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 24 | 1 | TARGET REF (BOW/NORTH) | ASCII 0 = Bow, 1 = North | 0 TO1 | N/A |
| 25 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 26-31 | 6 | HYD VRU PITCH ERROR | ASCII | 0.00 TO -44.9 | DEG |
| 32 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 33-38 | 6 | HYD VRU ROLL ERROR | ASCII | 0.00 TO -44.9 | DEG |
| 39 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 40 | 1 | VRU STATUS | ASCII 0=Static, 1= Active | 0 TO 1 | N/A |
| 41 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 42 | 1 | HYD ORIENTATION | ASCII 0=Normal, 1=Starboard, 2=Aft, 3=Port | 0 TO 3 | N/A |
| 43 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 44-47 | 4 | REMOTE VRU SCALE | ASCII | 0.00 TO 9.99 | N/A |
| 48 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 49 | 1 | VRU FUNCTION | ASCII 0=Linear, 1=10*sin | 0 TO 1 | N/A |
| 50 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 51 | 1 | REM VRU BOW UP POL. | ASCII 0 = ( - ), 1 = (+) | 0 TO 1 | N/A |
| 52 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 53 | 1 | REM VRU PORT UP POL. | ASCII 0 = ( - ), 1 = (+) | 0 TO 1 | N/A |
| 54 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 55-56 | 2 | CHECKSUM | 16 BIT BINARY SUM OF BYTES | N/A | |
| 57 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 58 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | N/A | |
| 59 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

## SYSTEM SETUP COMMAND 6

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHAR | | N/A |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3-5 | 3 | MESSAGE ID | ASCII CHARACTERS "SY6" | | N/A |
| 6 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 7-12 | 6 | ANT X OFFSET **(N/A)** | ASCII | -999.9 TO 999.9 | UNITS |
| 13 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 14-19 | 6 | ANT Y OFFSET **(N/A)** | ASCII | -999.9 TO 999.9 | UNITS |
| 20 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 21 | 1 | HYD DEPTH SEL | ASCII 0=Manual, 1=Analog via Compass BNC Input, 2 = Analog via Depth BNC Input | 0 TO 2 | N/A |
| 22 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 23-24 | 2 | CHECKSUM | 16 BIT BINARY SUM OF BYTES | N/A | |
| 25 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 26 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | N/A | |
| 27 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

## ACK/NACK MESSAGE

| BYTE | LENGTH | DATA WORD | REPRESENTATION | RANGE | UNITS |
|---|---|---|---|---|---|
| 1 | 1 | START OF TEXT | ASCII START OF TEXT CHARACTER | N/A | |
| 2 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 3 | 1 | ACK/NACK | ASCII ACK=VALID RS-232 MESSAGE RECEIVED<br>ASCII NACK=INVALID RS-232 MESSAGE RECEIVED | N/A | |
| 4 | 1 | SPACE | ASCII SPACE CHARACTER | | N/A |
| 5-6 | 2 | CHECKSUM | 16 BIT BINARY SUM OF BYTES | N/A | |
| 7 | 1 | CARRIAGE RETURN | ASCII CARRIAGE RETURN CHARACTER | N/A | |
| 8 | 1 | LINEFEED | ASCII LINEFEED CHARACTER | | N/A |

ACK = ASCII 006 decimal = 06 hexadecimal

NAK = ASCII 021 decimal = 15 hexadecimal

## 3.8 SHUTDOWN

To turn off system, exit Trackman and then Shut Down PC via Windows “START” button. The power will automatically be shut off to the Processor, the Keyboard/Monitor goes into low power mode and the TrackPoint 3 can then be turned off from the front panel power switch.

# SECTION FOUR

# PRINCIPLES OF OPERATION

# 4. PRINCIPLES OF OPERATION

TrackPoint 3 measures and analyzes sound waves sent from an acoustic sound source that is attached to a target. The signal is received by a hydrophone to determine target position relative to the tracking ship. The hydrophone amplifies the received acoustic signals and sends them to the TrackPoint 3 Signal Processor/Interface Module and then to the PC for further processing by the Trackman Software.

The TrackPoint 3 system uses an ultra-short baseline, phased-array hydrophone containing sound transducing elements arranged at the vertices of an equilateral triangle. Each element is spaced less than half a wavelength away from each of the other elements in the array. When a sound wave impinges upon the array it strikes one element first, then one of its neighbors, and finally the remaining element. The sound wave, as sensed by any element in the array, will appear out of phase with the wave as sensed by the other elements in the array. The phase differences between the elements in the array provide the information required to calculate a three-dimensional vector from the array to the sound source.

Three types of sound sources are used with the TrackPoint 3 system: pingers, transponders and responders. A pinger emits a sound pulse at a predetermined frequency, repeated at a set interval. The hydrophone receives the pulse and determines bearing and depression angle. Transit time of the pulse is unknown.

A transponder emits a sound pulse in response to a specific acoustic interrogation pulse from the controller transmitter. A responder emits a sound pulse via a wire connecting the responder and the Signal Interface Module (SIM) when electrically triggered by the SIM. The system now has timing information to calculate directly the slant range of the target, assuming the average velocity of sound in the water column and the turnaround time of the transponder or responder are known.

In either pinger or transponder/responder mode, the relative bearing and depression angle of the target being tracked are determined by measuring the phase differences of the sound waves for each hydrophone element. The bearing of the target is measured in degrees relative to the hydrophone heading. The depression angle is formed by the intersection of a horizontal plane and a line drawn from the vessel reference point to the target. Once these values are determined, the rest of the positioning parameters can be calculated.

NOTE: The term "vessel reference point" denotes the point relative to which all measurements are calculated. The actual position of the vessel reference point is determined by hydrophone offsets entered into the system (see Figure 4-1). If no offsets are entered, the hydrophone itself is considered the vessel reference point. This is the case in Figure 4-2, which illustrates the positioning parameters that the system calculates.

The slant range is the straight line distance from the vessel reference point to the target. When a sound source other than a pinger is used, the travel time of the sound wave between the sound

source and the hydrophone is used to calculate the slant range directly. The horizontal range is the projection of the slant range on a horizontal plane.

In PINGER mode, horizontal range (HR) is calculated by:

$$HR = \frac{Z}{\tan \beta}$$

where Z is the target depth and $\beta$ is the depression angle.

Slant range (SR) is calculated by:

$$SR = \frac{Z}{\sin \beta}$$

where Z is the target depth and $\beta$ the depression angle.

In TRANSPONDER or RESPONDER mode, slant range (SR) is calculated from the known speed of sound in the water column (V), the transponder or responder turnaround time (D) and the measured time (T) between transmitted pulse and received reply by:

$$SR = V \times \frac{(T - D)}{2}$$ in transponder mode, and:

$$SR = V \times (T - D)$$ in responder mode.

Horizontal range (HR) is calculated by one of three methods, depending on the calculated value of the depression angle ($\beta$) from the horizontal and the depth MODE.

A. In CALCULATED depth MODE and when the target is within a 90 degree cone (value of ($\beta$) greater than 45 degrees), horizontal range (HR) is calculated by:

$$HR = SR \cos \beta$$

This is the normal situation, where the target is within a 45 degree angle from the vertical axis of the hydrophone.

B. In CALCULATED depth MODE and outside a 90 degree cone (values of ($\beta$) less than 45 degrees), as the target moves to positions which are between the hydrophone horizon and a 45 degree depression angle, the measured accuracy degrades due to physical constraints of the measuring hydrophone. (As the target approaches the horizon, the angle becomes unmeasurable.) In this situation, the input target depth (Z) (manual, analog or telemetry) is used to calculate horizontal range by:

Z

$$HR = SR \cos\left(\sin^{-1} \frac{\quad}{SR}\right)$$

C. In INPUT depth MODE and when the target is within a 40 degree cone (value of ($\beta$) greater than 70 degrees), slight variations between the slant range and the input depth will cause large horizontal position differences. In this situation the horizontal range is calculated by:

$$HR = \frac{Z}{\tan \beta}$$

D. In INPUT depth MODE and when the target is outside the 40-degree cone (value of ($\beta$) less than 70 degrees), the horizontal range is calculated by:

$$HR = SR \cos\left(\sin^{-1} \frac{Z}{SR}\right)$$

To eliminate the sharp boundary at 45- and 70-degree depression angles, hysteresis is incorporated into the software.

In Figure 4-2, the values X, Y, and Z are RS-232C outputs. (These values are distinct from the X, Y and Z offsets shown in Figure 4-1.) The distance X is the projection of the horizontal range on a vertical plane perpendicular to the centerline of the vessel and passing through the vessel reference point. The distance Y is the projection of the horizontal range on a vertical plane parallel to the centerline of the ship and passing through the target. X and Y and HR form a right triangle. Depth (Z) is the depth of the target below the water surface.

Under ideal conditions the transducing element plane is parallel to the surface of the water and perpendicular to a vertical plane through the vessel centerline. In a real application, the vessel and hydrophone will be in motion, and the system must therefore correct measurements taken from the hydrophone for pitch and roll.

The rotation of the vessel about its X-axis, a line drawn perpendicular to the vessel centerline at its midpoint, is known as pitch. Roll is the rotation of the vessel about the vessel centerline, or Y-axis. The Vertical Reference Unit measures pitch and roll in degrees, with zero degrees being the "at rest" position, and calculates the necessary compensation. For dynamic motion compensation an ORE Model 4414B Dynamic Motion Sensor is recommended.

The system microprocessors, located in the Signal Interface Module, receive information from the hydrophone array for each received pulse. They convert that information into a real-time graphic representation of the tracked target(s) relative to the vessel reference point, shown in the display-screen tracking window. Digital values are continuously updated in the status block.

Figures 4-3A & B, the SIM Block Diagram, presents an overview of the TrackPoint 3. The individual components of the system function as described in the following sections.

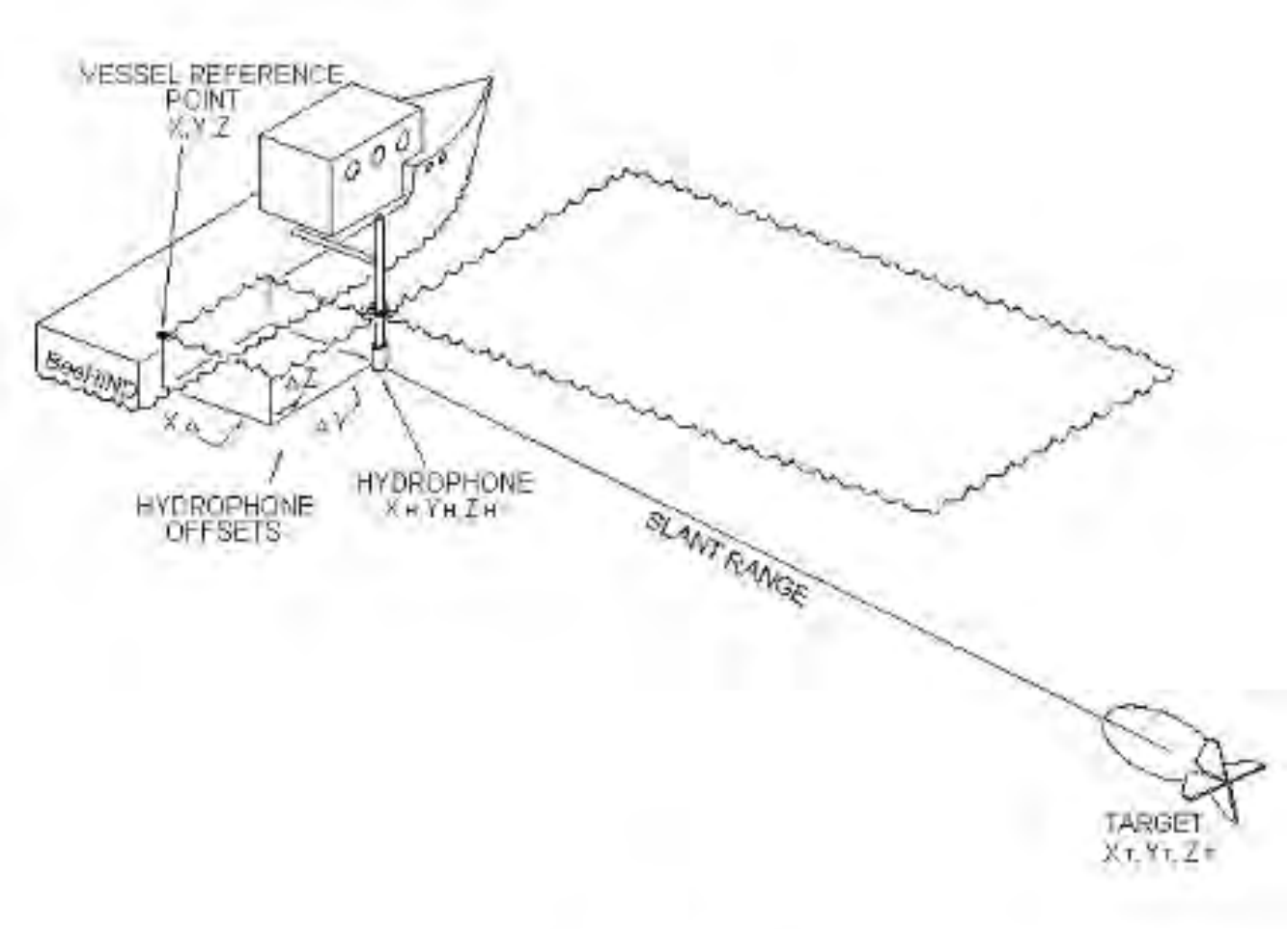



**Figure 4-1**

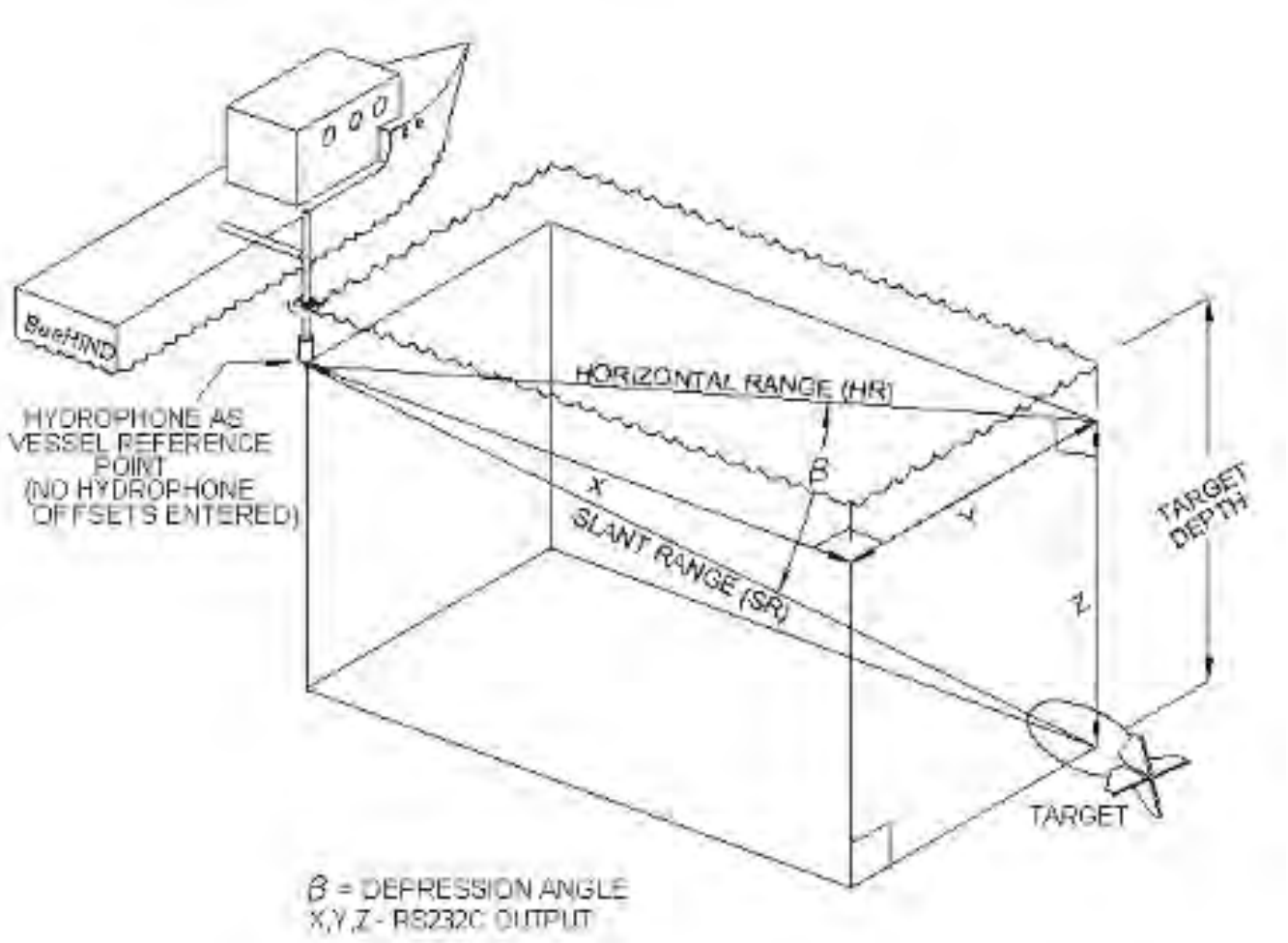

BuoHND
HYDROPHONE AS VESSEL REFERENCE POINT (NO HYDROPHONE OFFSETS ENTERED)
HORIZONTAL RANGE (HR)
β
X
Y
SLANT RANGE (SR)
Z
TARGET DEPTH
TARGET
β = DEPRESSION ANGLE
X,Y,Z - RS232C OUTPUT

**Figure 4-2**

## 4.1 HYDROPHONE/VRU ASSEMBLIES

Model 4610B Hydrophone & VRU Assembly

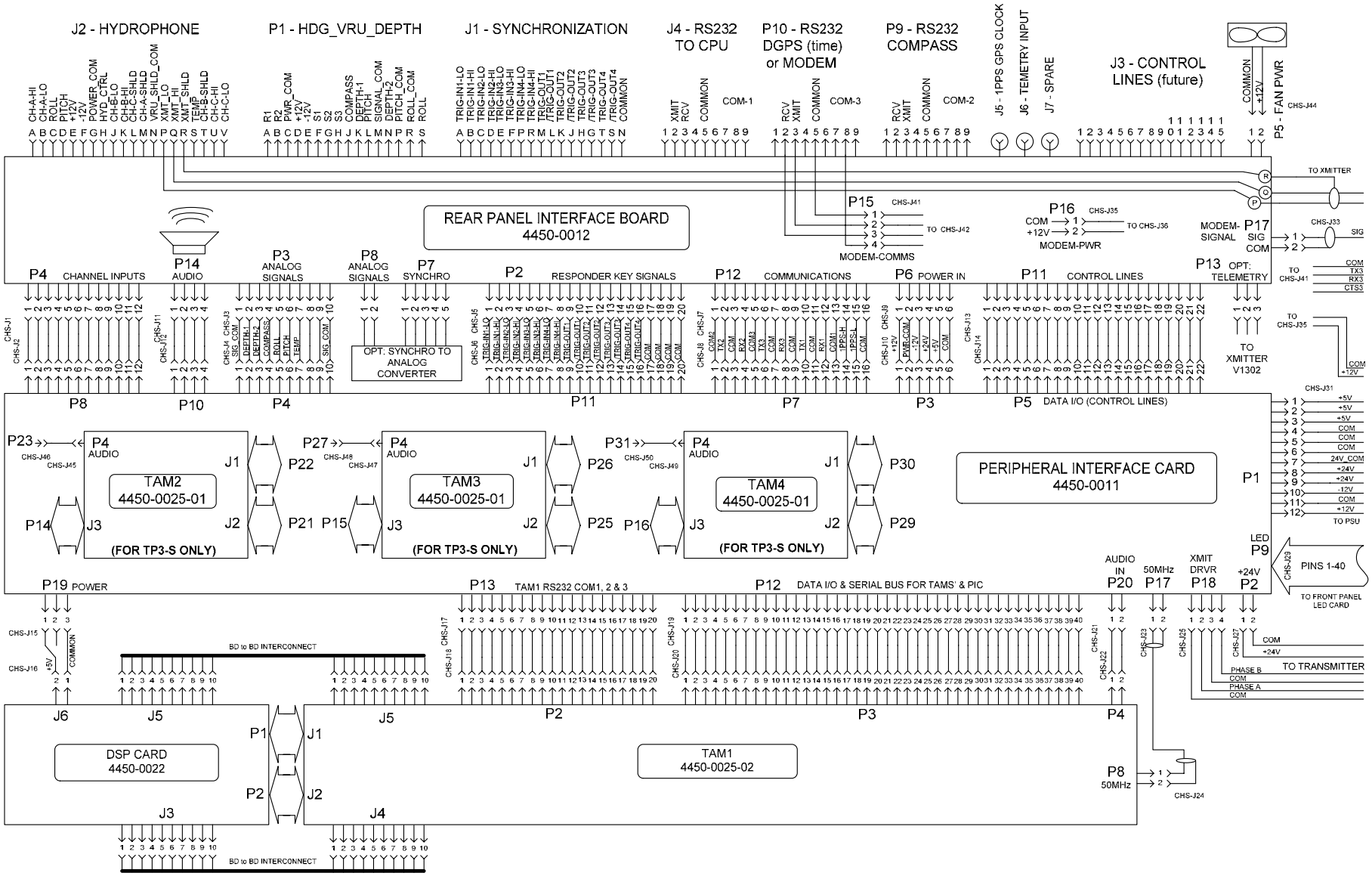
The hydrophone assembly (Figure 4-4) consists of the hydrophone and the pressure case/electronics. In the hydrophone, the three receiving elements, the transmitting element, and the temperature sensor are potted and attached to the PVC base, and connected to the electronics. In the pressure case/electronics package, each of the three elements feeds its own Amplifier Board. Each board consists of an amplifier stage, followed by a bandpass filter, set for 22 kHz - 30 kHz (or 8 kHz - 14 kHz for the low-frequency hydrophone, or 35 - 45 kHz for the hi-frequency hydrophone), followed by further gain. A precision temperature sensor, embedded in the PVC hydrophone base, provides an analog signal which is buffered and scaled on the Father Board and also sent to the Signal Processor Board (SPB). The internal Vertical Reference Unit (VRU) provides analog signals corresponding to pitch and roll that are also sent to the SPB (+/- 10 VDC). Power for the amplifiers and drivers is regulated on the Father Board from the raw power sent down from the SPB.

Model 4211A Hydrophone

The Model 4211A Hydrophone is approximately 3-inches in diameter. Refer to Figure 4-5. The potted end is the same as in the 4610B with three receiving elements, transmitting element and temperature sensor potted to an aluminum silicon bronze base. The only electronics internal to the hydrophone is a set of three preamplifiers with unity gain. These amplifiers drive the signal up the deck cable to the Model 4740A VRU/Amplifier unit. A precision temperature sensor, located on one of the Amplifier boards, provides an analog signal which is also sent to the 4740A.

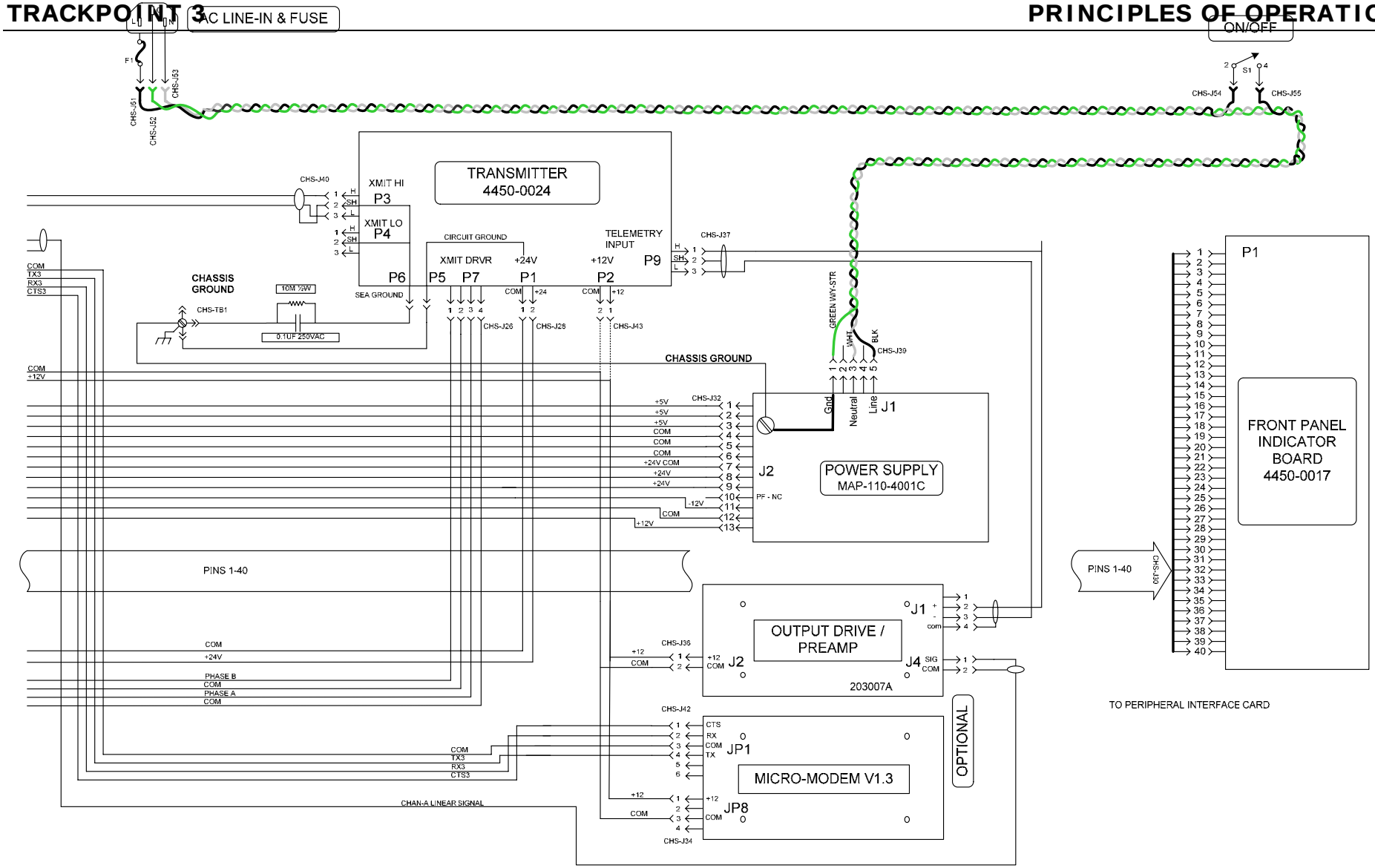
Model 4740A VRU/Amplifier

The Model 4740A VRU/Amplifier contains the same electronics as the 4610B Hydrophone consisting of three Amplifier Boards, a Father Board and an internal VRU but is packaged in a metal NEMA type enclosure for bulkhead mounting.



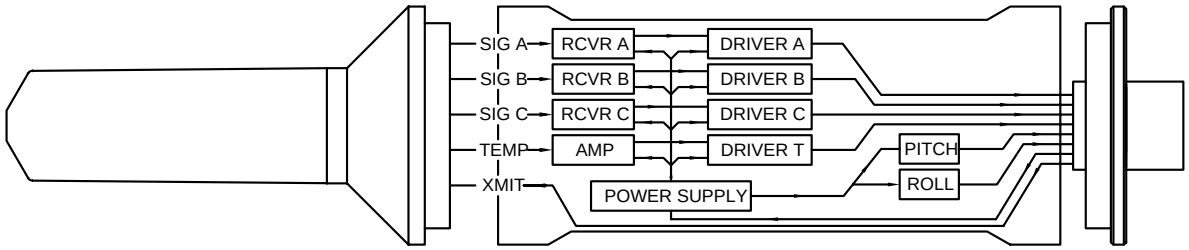

**TRACKPOINT BLOCK DIAGRAM**

**FIGURE 4-3A**



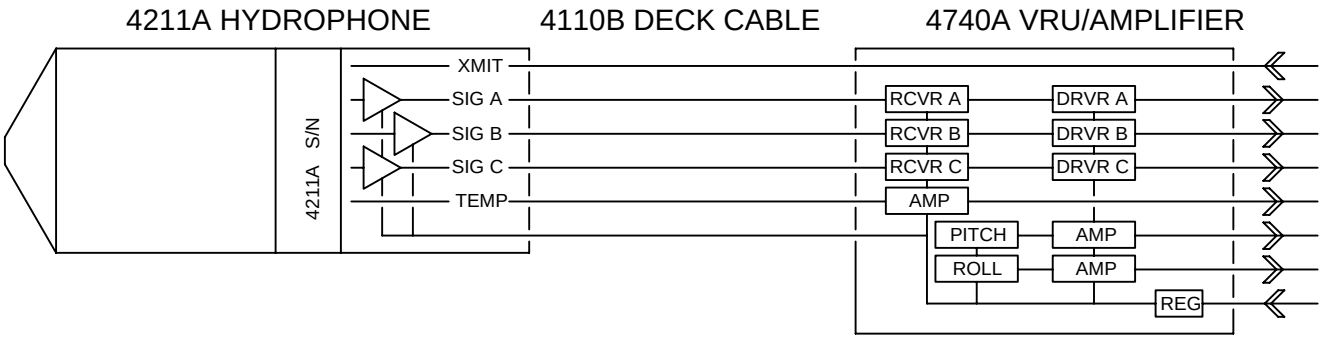

**TRACKPOINT BLOCK DIAGRAM**

**FIGURE 4-3B**




4610B HYDROPHONE BLOCK DIAGRAM

**Figure 4-4**




**HYDROPHONE & VRU BLOCK DIAGRAM**

**Figure 4-5**

## 4.2 TARGET ACQUISITION MODULE

Each of the three clipped signals is sent via current loop to the Peripheral Interface Card and then to each of the Target Acquisition Modules (4). The phase differences between the leading edges of the signals are measured and stored for later transmission to the main DSP Card. When a valid signal is detected (Section 4.3), the Target Acquisition Module transfers the RAM contents, starting with the most recent phase count data, to the main DSP for processing (Section 4.4.)

## 4.3 DETECTION CIRCUITRY

One of the input signals is used in the detection circuitry. It is mixed with a Local Oscillator, then fed to a sharply tuned filter. The filter outputs go to a peak detector/threshold system, which can generate an interrupt for the DSP. The detector outputs also control the front panel LED's, and the peak detector circuit provides signals for the audio generators. The audio circuitry provides an indication of the strength of the signal received at the chosen frequency.

## 4.4 DATA TRANSFER

When the interrupt generated by the detection circuitry is recognized by the DSP, the following sequence of events occurs, resulting in the transfer of all of the raw data over a high speed serial bus to the main DSP board. All counting and data collection is halted, the VRU, COMPASS, ANALOG DEPTH and TEMP signals are digitized and stored along with a time tag, and an interrupt is sent to the main DSP board to initiate data transfer. The main DSP board, when ready, will read the raw data, including VRU, COMPASS, ANALOG DEPTH and TEMP data. At the end of the transfer, data acquisition can begin again for any other channel (TAM).

## 4.5 TRANSMIT SIGNAL

Transmitter parameters, such as frequency, repetition rate, and pulse duration, are entered via the keyboard and immediately sent to the Main TAM, where generation of the transmit signals occurs. The frequency is latched, and a Phase Lock Loop generates the actual signal. The repetition rate and duration are controlled by a counters within the CPLD. An external input can also be used to trigger the transmitter (for transponder operation) or Trigger (key) out (for responder operation) in place of the internal repetition rate generator.

In transponder or responder mode, the transmit signal starts a timer, which is stopped and read after receipt of a valid reply. This timer determines the transit time which is translated by the main DSP Card into slant range.

# SECTION FIVE

# MAINTENANCE

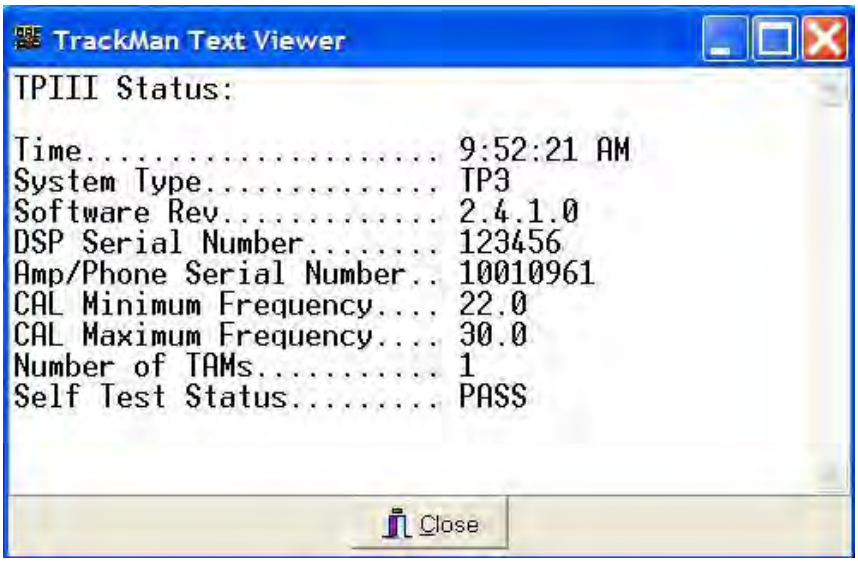
# 5. SYSTEM MAINTENANCE

## 5.1 SIGNAL INTERFACE MODULE MAINTENANCE

### 5.1.1 HYDROPHONE CALIBRATION FILES

The hydrophone assembly is calibrated at the factory. The calibration consists of generating a set of Files (2) that are burned into the FlashROM of the DSP card located inside the Signal Interface Module (SIM). These files contain offsets which compensate for the variances from hydrophone to hydrophone. When ordered as a system, these files are installed in the SIM at the factory. If a hydrophone assembly is ordered separately, it will come with a floppy or CD with a set of files on it, and must be installed into the SIM to which the hydrophone is connected.

To check what Calibration factors the unit has programmed into it, turn on the Deck unit and PC. Run Trackman and then from the main menu select USBL and then Get Status. The dialog box shown is displayed. The Amplifier and Hydrophone Serial Numbers are shown.




**NOTE**: When loading calibration files or updating the Deck Unit's software from Trackman, use only a direct PC serial port. Do not use a converter that goes from USB to serial or Ethernet to serial. These cause the check-summing of the binary data download to fail resulting in data not being programmed.

**NOTE:** If a model 4211A and separate Model 4740A VRU/Amplifier is being used, they are factory calibrated and shipped as matched sets. Replacement of the Files requires that the factory know the serial number of the 4740A also. It goes without saying that 4740A's cannot be interchanged (other than for testing/troubleshooting) without affecting system accuracy. Therefore, when servicing the Hydrophone with customer supplied spare parts, it is necessary to change out both the Hydrophone and the VRU/Amplifier, and, of course, download the correct Files to the SIM.

**NOTE:** The DSP must be placed into its program mode before data can be sent to it. Install the hydrophone calibration Files as follows:

**Download CAL Files TO SIM**

1. Close down Trackman software. Power-down the TrackPoint 3 Signal Interface Module.
2. Remove top cover of SIM.
3. Locate DSP card (4450DA0022). Refer to Figure 5-2.
4. Remove Jumper from pins 2 and 3 of JP7 and place on pins 1 and 2. Remove Jumper from pins 2 and 3 of JP3 and place on pins 1 and 2. Refer to Figure 5-1.
5. Power-up system. Stay clear of Line Voltages and Transmitter.
6. D3 on the DSP card will flash and then illuminate RED. Do not attempt to program until it is on continuously.
7. Place floppy or CD in the respective Model 4451A Processor module drive.
8. Run Trackman software.

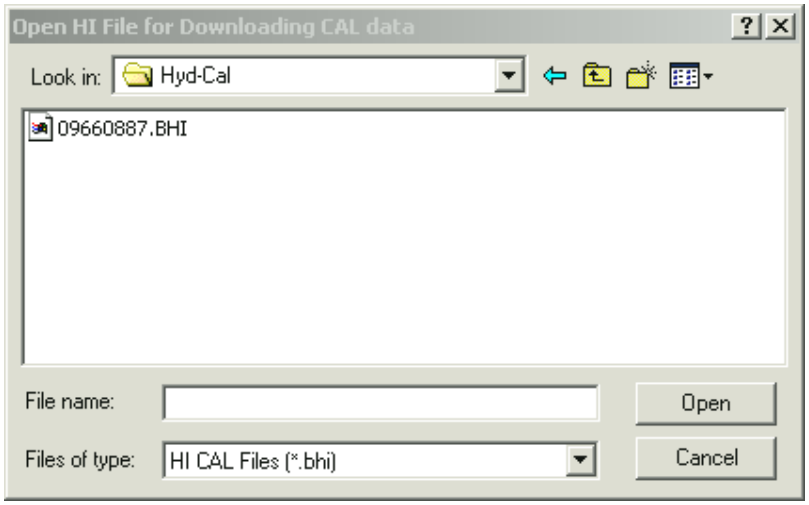
**NOTE:** When it asks if you want to send parameters to the Deck Unit click on “NO”.

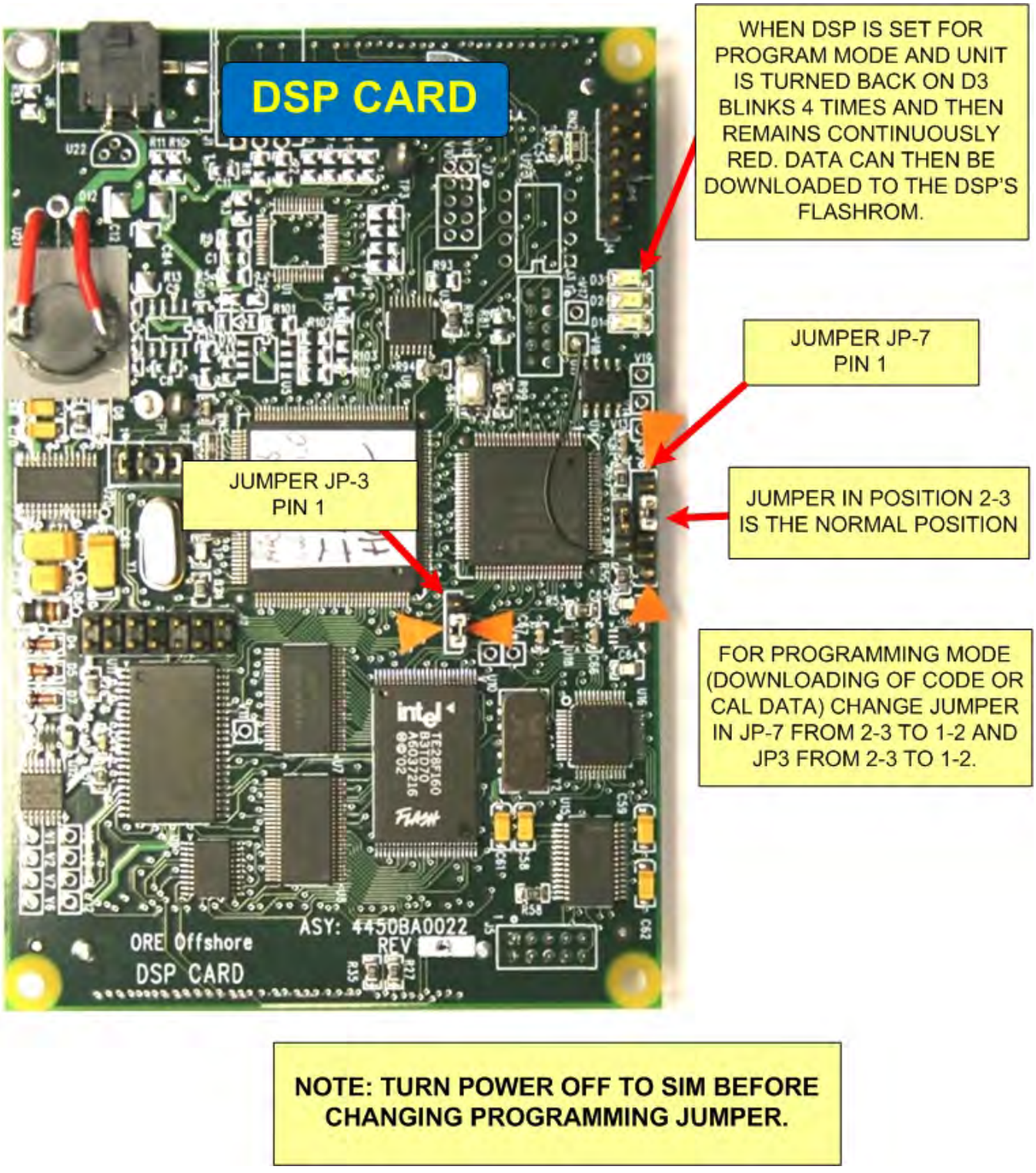
9. From the USBL menu in the Trackman software select “DOWNLOAD CAL”.
10. Trackman asks for the file name starting with the .BHI file. Navigate to either the Floppy drive or the CD ROM drive. Click on the file name corresponding to the Hydrophone in use and select “OPEN”.

The CAL file’s first 4 characters are the Deck Units Filter/Limiter PCB S/N and the last 4 are the Hydrophone S/N. The extensions of the two files are .blo and .bhi. (Binary Low byte 1-8 and Binary Hi byte 9-16.) For example…

09660887.bhi

09660887.blo

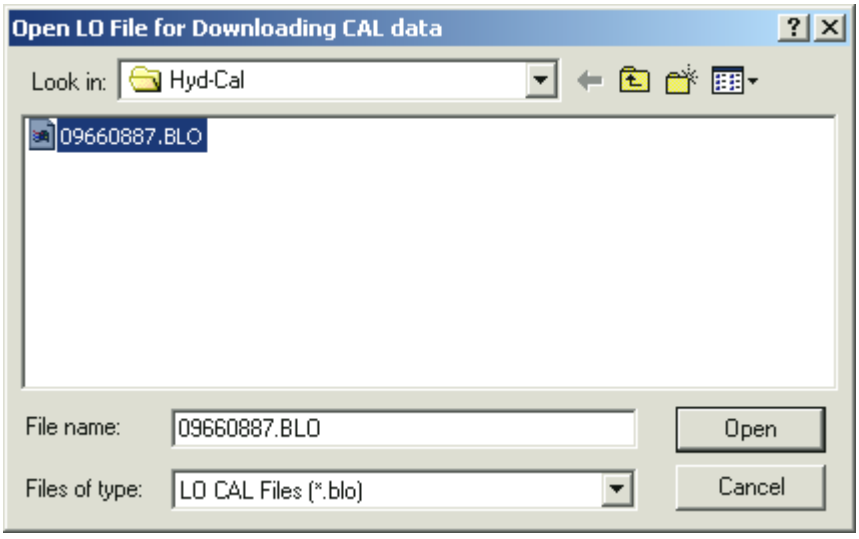





**DSP CARD PROGRAMMING MODE JUMPER**

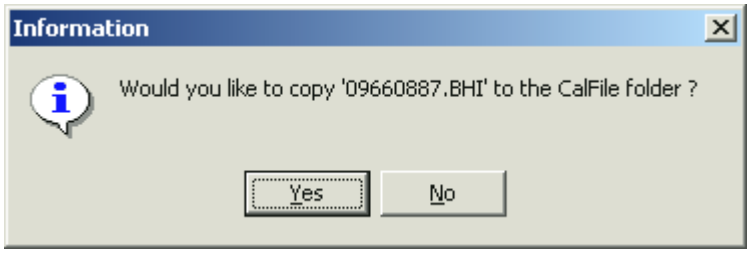
**FIGURE 5-1**

11. Repeat for the .BLO file. Click on the file name corresponding to the Hydrophone in use and select “OPEN”.

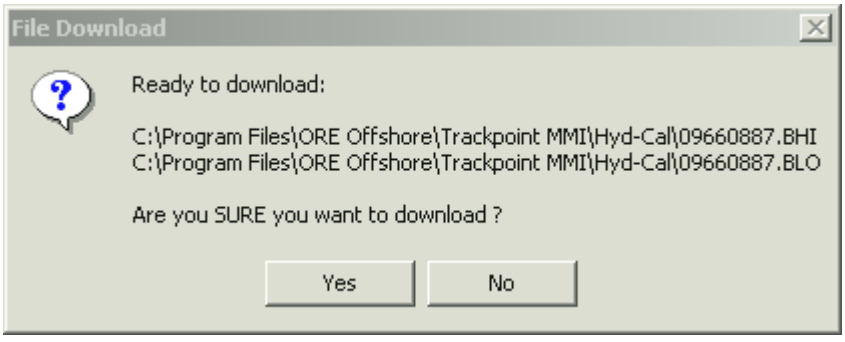



A message appears asking if you want to copy the Calibration files from either the floppy or CD to the PC’s hard-drive for archival. Select yes. If the directory called “CalFiles”* does not exist Trackman creates one and copies the calibration files to this directory. This will then keep a back-up copy of the calibration files on the Trackman PC.

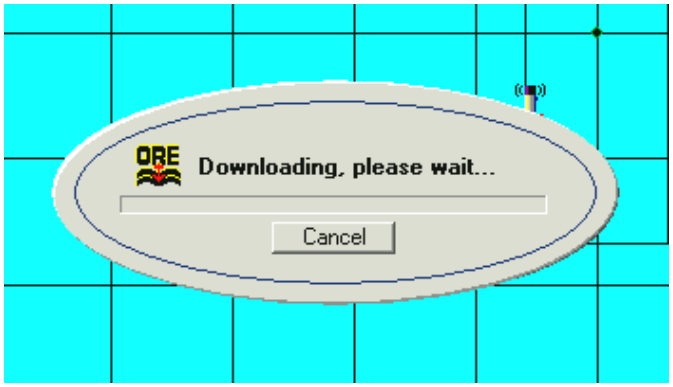
* C:\Program Files\ORE Offshore\TrackPoint MMI\CalFiles




12. Once both files are archived a message appears showing file names and asking if you are sure these are correct. If correct then click “YES”.



13. Trackman then sends the 4450A SIM the files in sequence to program into the FlashROM on its DSP card.




14. Power-down System.
15. Remove Jumper from pins 1 and 2 of JP7 and place on pins 2 and 3. Remove Jumper from pins 1 and 2 of JP3 and place on pins 2 and 3. Refer to Figure 5-1.
16. Power-up system.
17. D3 on the DSP card should flashe AMBER and then go off.
18. Replace top cover of the TrackPoint 3.

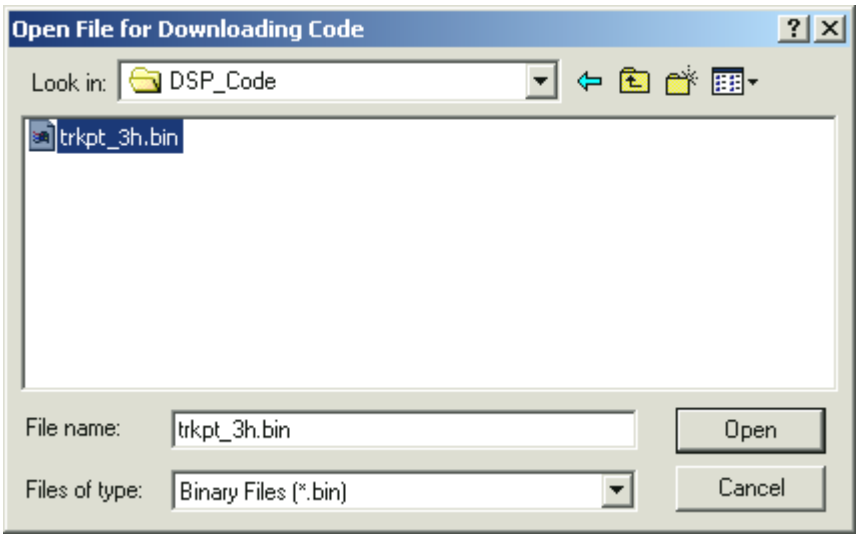
### 5.1.2 DOWNLOADING OF CODE TO SIM DSP

Upgrades to the DSP code can be downloaded from Trackman (via the PC) directly to the DSP card within the Signal Interface Module (SIM).

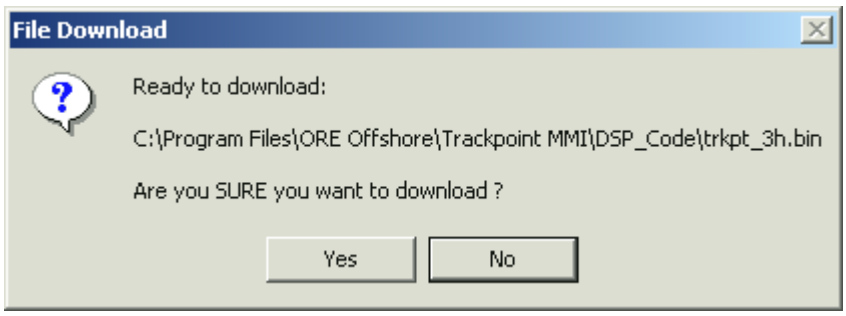
**NOTE:** The DSP must be placed into its program mode before data can be sent to it. Refer to Figure 5-1.

**Download Code File TO DSP CARD**

1. Close down Trackman software. Power-down the TrackPoint 3 Signal Interface Module.
2. Remove top cover of SIM.
3. Locate DSP card (4450DA0022). Refer to Figure 5-2.
4. Remove Jumper from pins 2 and 3 of JP7 and place on pins 1 and 2. Remove Jumper from pins 2 and 3 of JP3 and place on pins 1 and 2. Refer to Figure 5-1.
5. Power-up system. Stay clear of Line Voltages and Transmitter.
6. D3 on the DSP card will flash and then illuminate RED. Do not attempt to program until it is on continuously.
7. Place floppy or CD in the respective Model 4451A Processor module drive.
8. Run Trackman software.
9. From the USBL menu in the TRACKMAN software select “DOWNLOAD Code”.
10. Trackman asks for the file name with the extension .BIN. Navigate to either the Floppy drive or the CD ROM drive. Click on the file name corresponding to the DSP code.

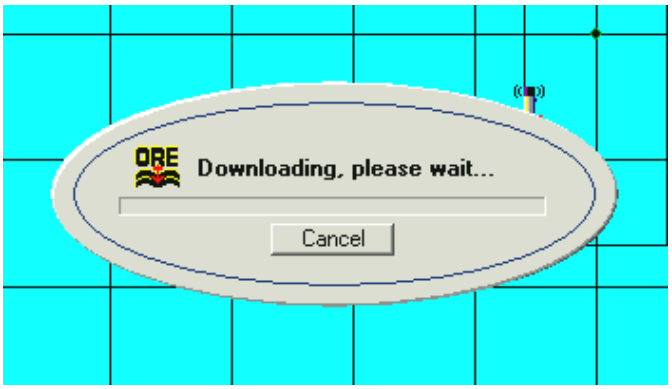


11. Once the file is selected a message appears showing file names and asking if you are sure these are correct. If correct then click “YES”.




12. Trackman then sends the 4450A SIM the file to program into the FlashROM on its DSP card.

13. Power-down System.




14. Remove Jumper from pins 1 and 2 of JP7 and place on pins 2 and 3. Remove Jumper from pins 1 and 2 of JP3 and place on pins 2 and 3. Refer to Figure 5-1.

15. Power-up system.

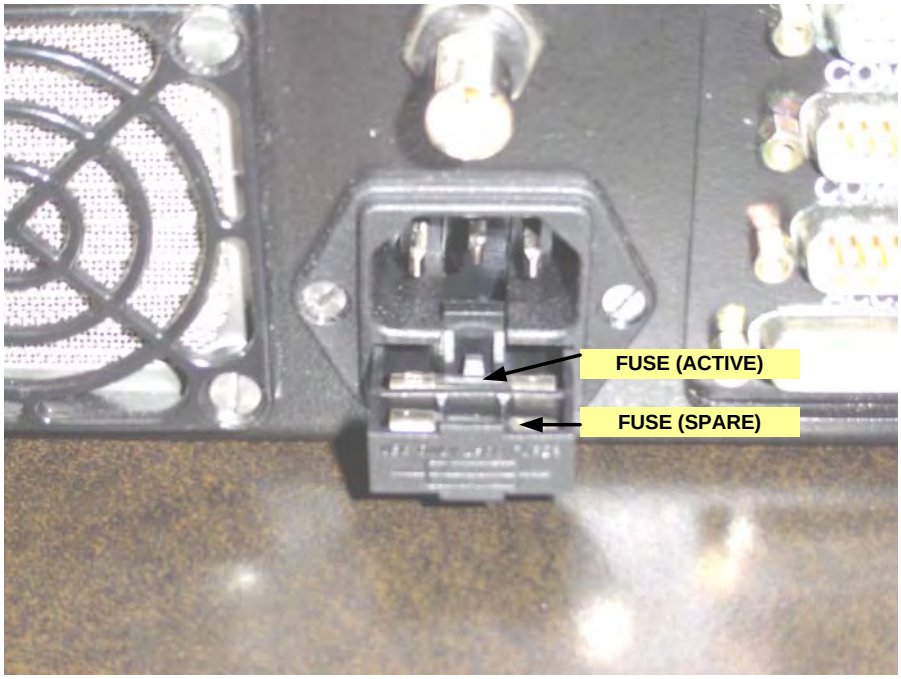
16. D3 on the DSP card should flash AMBER and then go off.

17. Replace top cover of SIM.

### 5.1.3 FUSE REPLACEMENT

The fuse is in the AC-IN plug on the rear panel. Disconnect the line cord before servicing the fuse. Snap open the cover located below the AC-IN plug to replace the fuse. Replace fuse with proper value as listed below.

3 Amp slow blow (5 x 20 mm)




### 5.1.4 PRINTED CIRCUIT BOARD (PCB) REMOVAL/REPLACEMENT

1. Remove the top cover from the SIM. See Figure 5-2.

2. Disconnect any connectors associated with the particular PCB or connectors that cross over the board preventing removal. Remove screws holding in PCB. Remove PCB.

**NOTE:** The Peripheral Interface Card (PIC) contains lithium back-up batteries for the clock. It is a 3.6v unit composed of $Li/SOCL_2$ and is hermetically sealed.

### 5.1.5 PCB HANDLING

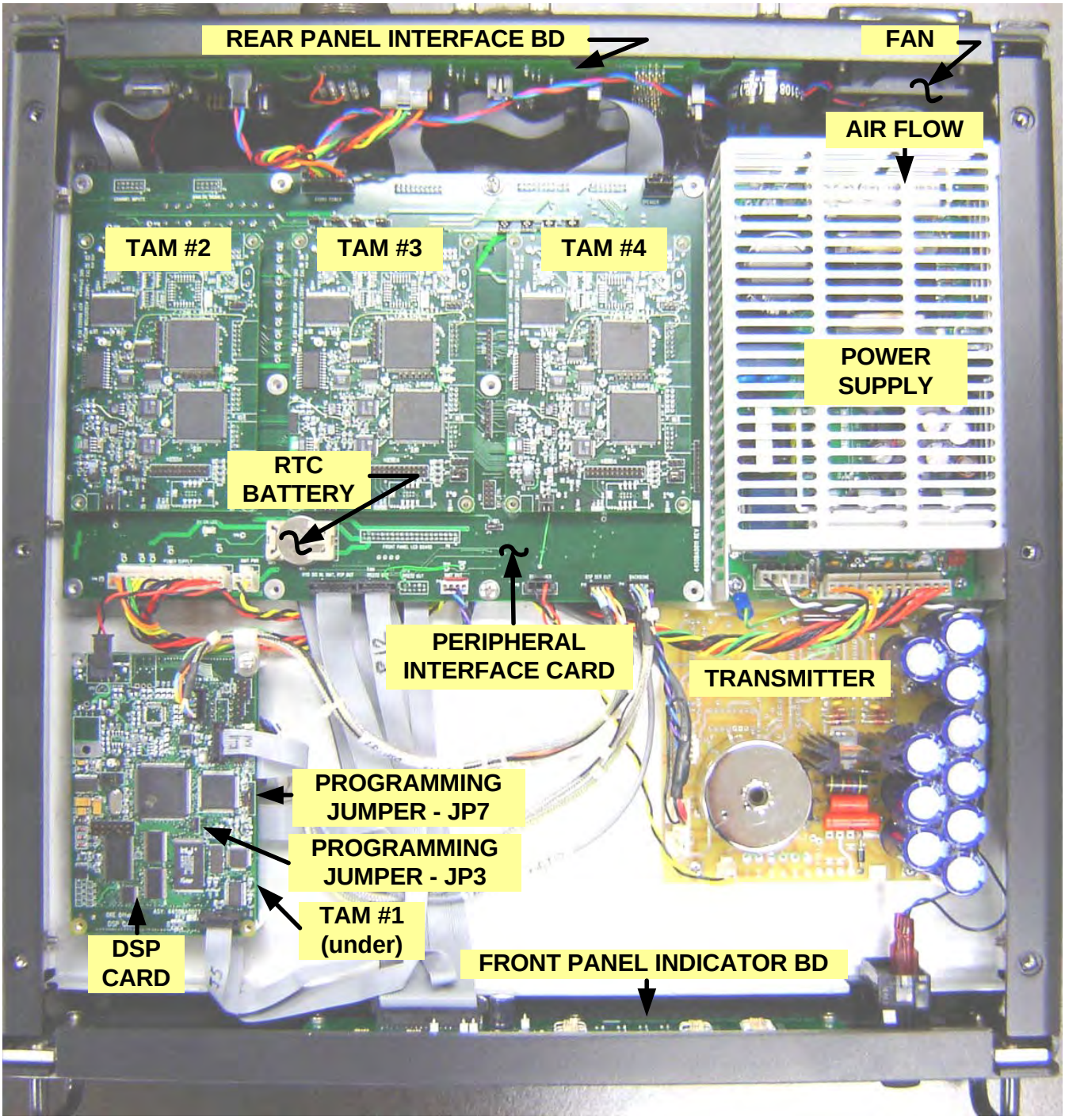
When removed from the Chassis, the PCB's should be stored or shipped in anti-static bags. Never stack one PCB on top of another. Always separate PCB's with suitable packing material.

## 5.2 PROCESSOR MODULE

The Model 4451A Processor Module is a P3 or P4 PC running a Windows® 2000 or XP Professional Operating System. It automatically logs on as “administrator” with a Password of “ORE”. The TRACKMAN software starts automatically as soon as the system has completed its boot process.

**CAUTION**

If an operator closes or minimizes the Trackman application the system resumes to the “Desktop” and the user has full rights to modify any Windows® settings.




**MODEL 4450A CHASSIS COMPONENTS**

**FIGURE 5-2**

# APPENDIX A

# CARE OF CABLES

## APPENDIX-A CARE OF CABLES

**GENERAL NOTES:**

Refer to caution below for disassembly of underwater cable connections.

**C A U T I O N**

Whenever underwater connectors are disassembled, or pressure cases opened, water is drawn into the cavity formed by the separating parts. This water, particularly salt water, enters as a fine spray and coats the electrical contacts and other parts inside. It is extremely important to minimize this buildup of moisture and salt, as it causes corrosion and voltage breakdown, particularly on power leads, which have high voltages present. Therefore a thorough cleaning is required, preferably immediately after opening the parts. It is also helpful to rinse in fresh water and remove excess water from parts prior to opening.

**NOTES FOR PROPER CARE OF UNDERWATER CABLES:**

| | |
|---|---|
| DO | Lubricate connectors before mating. |
| DO | Keep cables free from dirt and salt. |
| DO | Secure cables with tie wraps or tape so they won't work free. |
| DO | Route cables where they won't get pinched or crushed by deployment or moving machinery. |
| DO | Periodically clean cable contacts with a cleaner/degreaser. Lubricate with clean lubricant after cleaning. |
| DO | Check cables with a VOM & megger periodically for electrical integrity. |
| DON'T | Walk on cables. |
| DON'T | Bend cables near the connectors. |
| DON'T | Use damaged cables with bad or questionable contacts. They will damage their mating half. |
| DON'T | Hang things on cables. |
| DON'T | Use cables for towing or pulling. |
| DON'T | Bend the connectors when mating or disconnecting. |
| DON'T | Clean cables with light hydrocarbon solvents (i.e. acetone, lacquer thinner, paint thinner). |

# APPENDIX B

# STATIC DISCHARGE

# APPENDIX-B ELECTROSTATIC DISCHARGE (ESD)

The printed circuit boards within the TrackPoint 3 console can be damaged by ESD. Many of the electronic components are sensitive to electrostatic discharge. Some devices can be damaged by a potential as low as 30Volts. People are a prime source of device-damaging electrostatic potentials. Activities such as walking or working at a bench can generate thousands of Volts of static potential. This charge is transmitted to a person's conductive perspiration layer, and when a charged person handles a static sensitive device, the component may be damaged by either direct or indirect discharge of the static potential to the device.

NOTE: A person typically will not feel static discharge until the potential approaches 3500 Volts.

An electronic device exposed to static discharge may not be affected at all and will work perfectly throughout a normal life cycle. It may, however, function normally for a while, but because of degradation in the internal layers of the device, its life expectancy may be reduced. The ESD event initiates a device weakness that degrades and causes failure with continued use.

RULE 1: Assume all electronic (solid state) components are sensitive to ESD damage.

RULE 2: Never touch a sensitive component or assembly unless properly grounded. When handling circuit assemblies or when working with them, always use the appropriate grounding procedure: wrist strap connected to ground or heelstrap with a grounded dissipative floormat.

RULE 3: Never transport, store, or handle sensitive components or assemblies except in a static-safe environment. Use static shielding bags when transporting circuit boards.

---

If a grounded dissipative floor-mat or wrist-strap is not available then at the very least, when swapping out Printed Circuit Boards, discharge yourself to the chassis of the unit. Lift out circuit board from chassis and immediately put it on a conductive surface. Remove the new circuit board from its anti-static bag only after grasping the anti-static bag (with PCB inside) and the chassis. Remove board and place directly inside chassis. Put replaced board in the spare's anti-static bag for transport/storage.

# APPENDIX C

# WARRANTY

## APPENDIX-C WARRANTY STATEMENT

On standard catalogue products, ORE Offshore warrants the products delivered under this contract to be free from defects in material and workmanship at the time of delivery to the EXW point specified in this order, its liability under this warranty being limited to repairing or replacing, at ORE Offshore's option, items which are returned to it prepaid within twelve (12) months from delivery to the BUYER and found to ORE Offshore's satisfaction, to have been so defective. On services, ORE Offshore warrants that all work performed by its employees will be done in a workmanlike manner, ORE Offshore's liability under this warranty is limited to remedying at its expense any work found to ORE Offshore's satisfaction not so performed, provided however, ORE Offshore is notified of any claims within three (3) months from the date work is performed. Any products manufactured by others and resold by ORE Offshore shall bear the warranty of the original manufacturer, to the extent that such warranties may be legally transferred, assigned and passed on to BUYER. ORE Offshore assumes no responsibility for the performance of products manufactured to BUYER's design or specification, nor for defects in raw material, parts, or subassemblies furnished by BUYER or his agents.

This warranty is in lieu of, and excludes any other warranties, whether statutory, expressed or implied, and the goods are accepted by BUYER with that understanding. ORE Offshore MAKES NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, AND SPECIFICALLY, EDGETECH MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ORE Offshore's liability on any claim of any kind, including negligence, for loss or damages arising out of, connected with or resulting from this AGREEMENT, or from the performance or breach thereof, or from the manufacture, sale, delivery, resale, repair or use of any GOODS or services covered by or furnished under this AGREEMENT shall in no case exceed the price allocable to the item or service or part thereof which gives rise to the claim. In the event ORE Offshore fails to manufacture or deliver GOODS required to be manufactured or delivered hereunder, or manufactures such GOODS in a defective manner, ORE Offshore's exclusive liability and BUYER's exclusive remedy whether at law or in equity shall be the release of BUYER from the obligation to pay the purchase price. Any product or service repaired or replaced under this warranty shall be warranted for the unexpired portion of the original warranty period only.

IN NO EVENT SHALL ORE Offshore BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES.

# APPENDIX D

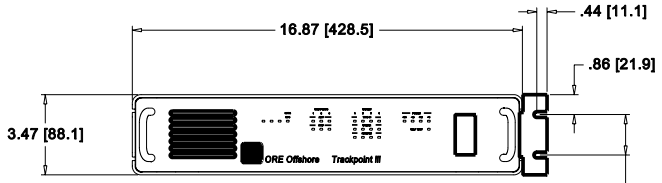
# DRAWINGS

## APPENDIX-D DRAWINGS

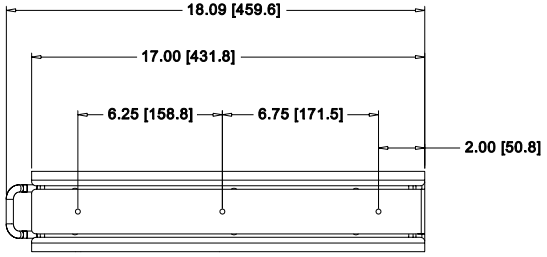
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|---|---|---|
| D1 | 4400CE0041 | TrackPoint 3 Mechanical Outlines |
| D2 | 4450BE0019 | 4450A Interconnection Diagram (2) |
| D3 | 4450DA0022 | DSP Card Assembly |
| D4 | 4450DA0025 | Target Acquisition Module Assembly |
| D5 | 4450DA0011 | Peripheral Interface Card Assembly (2) |
| D6 | 4450BS0012 | Rear Panel Schematic (3) |
| D7 | 4450DA0012 | Rear Panel Assembly (2) |
| D8 | 4450BS0017 | Front Panel Schematic (2) |
| D9 | 4450DA0017 | Front Panel Assembly (2) |
| D10 | 4410BS0024 | Transmitter Schematic (2) |
| D11 | 4450DA0024 | Transmitter Assembly (2) |
| D12 | 4110CA0002 | Deck Cable |
| D13 | 4110CA0002-01 | Deck Cable |
| D14 | 100437 | Model 4610B Hydrophone Assembly |
| D15 | 100925 | Model 4610B Interconnection Diagram |
| D16 | 4740CW0006 | Model 4740A Interconnection Diagram |
| D17 | 4211CW0003 | Model 4211A Hydrophone Wiring Diagram |
| D18 | 4410BA0123 | Cable, Remote Pitch / Roll Interface |
| D19 | 4450BA0079 | Cable, Synchronization TP3 |
| D20 | 4450BA0084 | Cable, Synchronization TP3-S |

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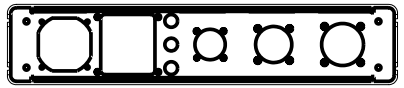
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| ECR# | REV | DESCRIPTION | DATE | APPROVED |
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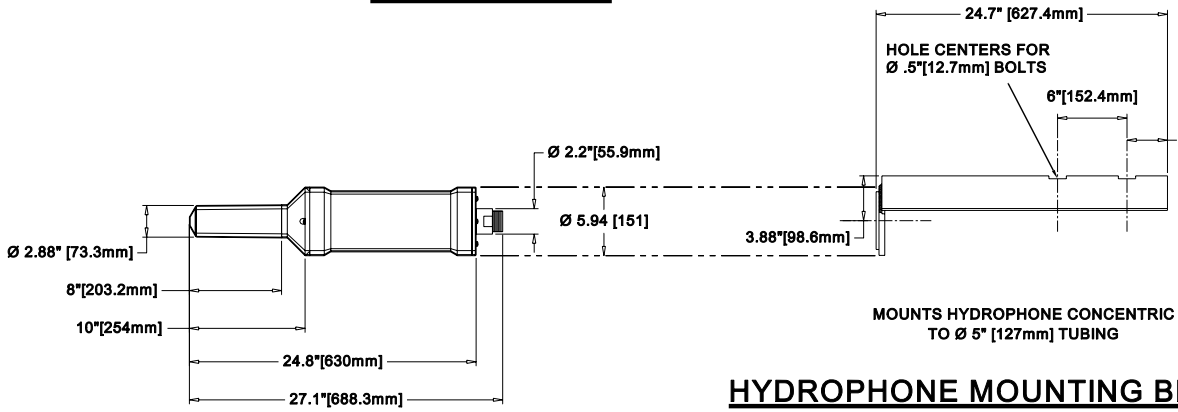

FRONT VIEW




SIDE VIEW

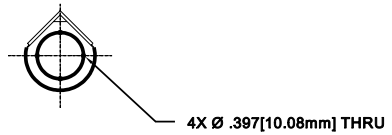


## TRACKPOINT III




## HYDROPHONE MODEL 4610B

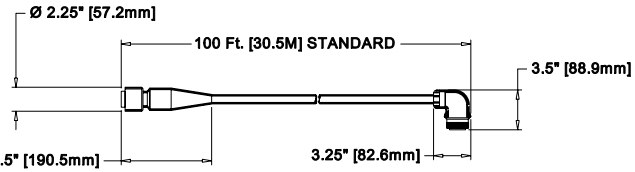
WT. 30 LBS. [13.6Kg]

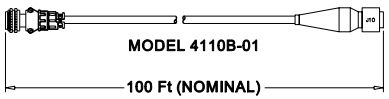



MOUNTS HYDROPHONE CONCENTRIC
TO Ø 5" [127mm] TUBING

## HYDROPHONE MOUNTING BRACKET

WT. 18 LBS [8.2Kg]




NOTE:
IF SYSTEM IS SUPPLIED WITH
MODEL 4211A/4212A HYDROPHONE
AND MODEL 4740A VRU/AMP
See ADDENDUM DWG No. 4400CE0012-01

## HYDROPHONE DECK CABLES

MODEL 4110A WT. 48LBS./100Ft. [21.8 Kg/30.5M]
MODEL 4110B WT. 35LBS./100Ft. [15.9 Kg/30.5M]
MODEL 4110B-V1183 = UNTERMINATED
MODEL 4110B-XXX = LENGTH IN FEET

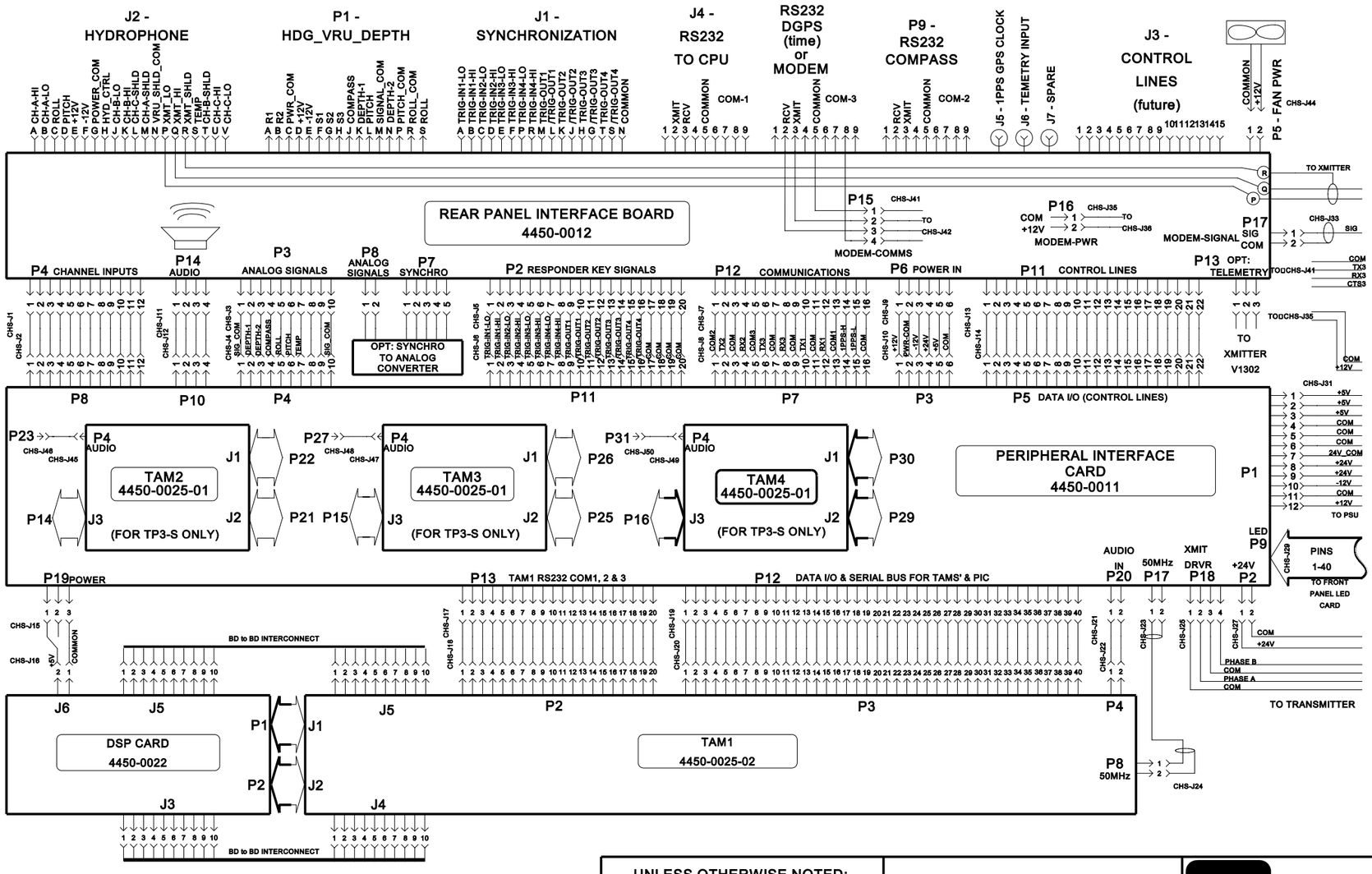
| | | | | | |
|---|---|---|---|---|---|
| MATERIAL | UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES, RESISTORS ARE IN OHMS, CAPACITORS ARE IN MICROFARADS | APPROVALS | SIGNATURE & DATE | ORE OFFSHORE | 4 LITTLE BROOK ROAD, WEST WAREHAM, MA 02576, WWW.ORE.COM, TEL. (508)291-0960 |
| | | DRAWN | T.D.DUCE 11/5/04 | | |
| FINISH | TOLERANCES | CHECKED | | TITLE | TRACKPOINT III SYSTEM, MECHANICAL OUTLINES |
| | DECIMALS: 2 PLACES .010; 3 PLACES .005; FRACTIONS 1/64; ANGLES 0.5° | MECH | | CADFILENAME: | DRAWING NO. 4400CE0041 REV A |
| | DO NOT SCALE PRINT | ELECT | | SCALE | |
| | REMOVE BURRS, BREAK SHARP EDGES | SYSTEM | | | |

DWG NO. 4400CE0041 REV A SH 1

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| ECR# | REV | DESCRIPTION | DATE | APPROVED |
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| | | | | |




| UNLESS OTHERWISE NOTED: | | | |
|---|---|---|---|
| DIMENSIONS ARE IN INCHES | | | |
| RESISTORS ARE IN OHMS | | | |
| CAPACITORS ARE IN MICROFARADS | | | |
| TOLERANCES | | | |
| DECIMALS | | FRACTIONS | ANGLES |
| 2 PLACES | 3 PLACES | | |
| +/-.010 | +/-.005 | +/-1/64 | +/-0.5° |
| DO NOT SCALE PRINT | | | |

| APPROVALS | SIGNATURE & DATE | |
|---|---|---|
| DRAWN | T. DUCE | 7/25/2006 |
| CHECKED | | |
| MECH | | |
| ELECT | | |
| SYSTEM | | |
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| REMOVE BURRS, BREAK SHARP EDGES | | |

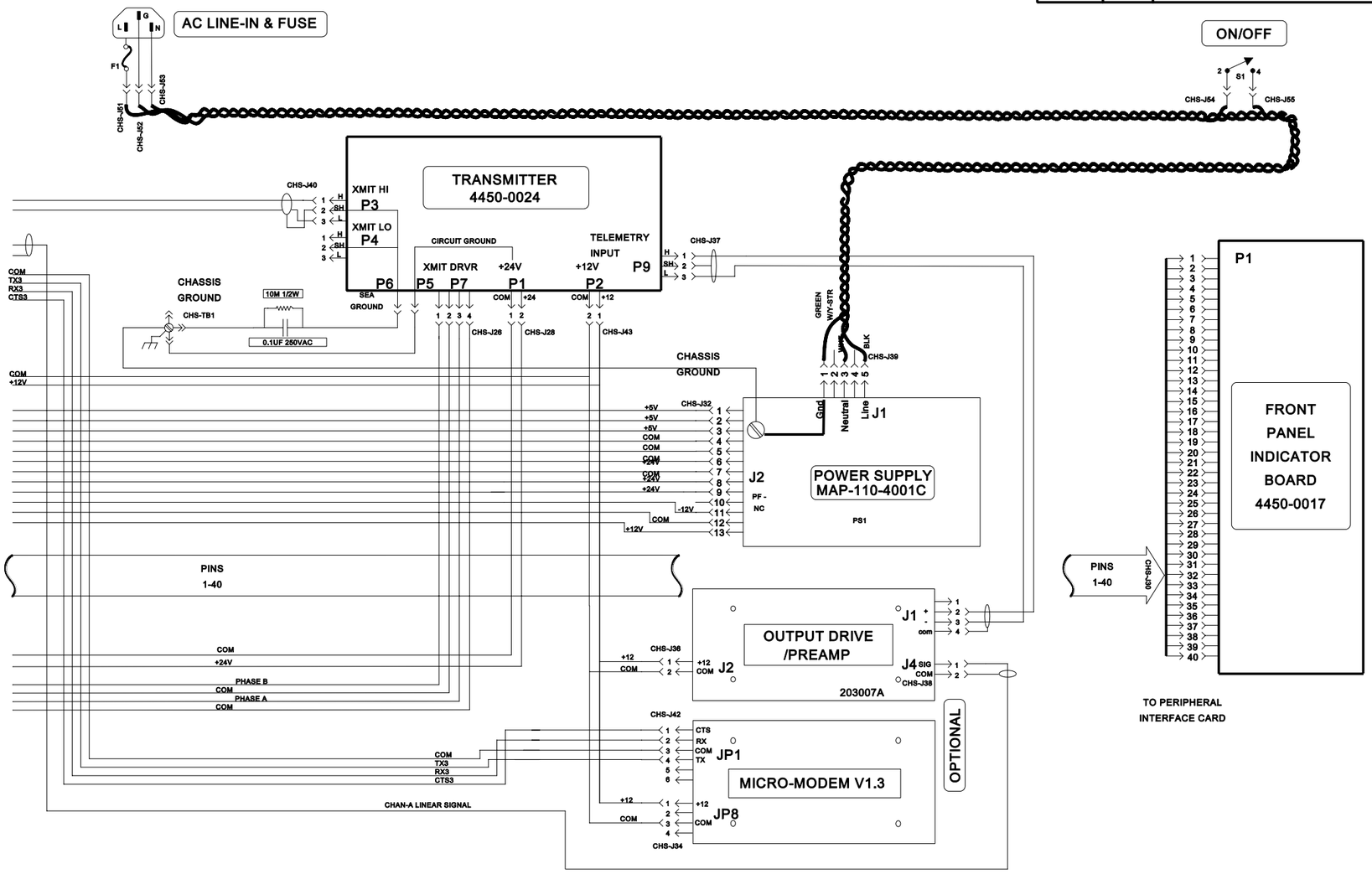
ORE OFFSHORE
4 LITTLE BROOK ROAD
WEST WAREHAM, MA 02576
WWW.ORE.COM
TEL. (508)291-0960

TITLE: INTERCONNECTION DIAG. (4450A)

| CADFILENAME: | SCALE | B | DRAWING NO. | REV |
|---|---|---|---|---|
| | | | 4450BE0019 | A |

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| REVISIONS | | | | |
|---|---|---|---|---|
| ECR# | REV | DESCRIPTION | DATE | APPROVED |
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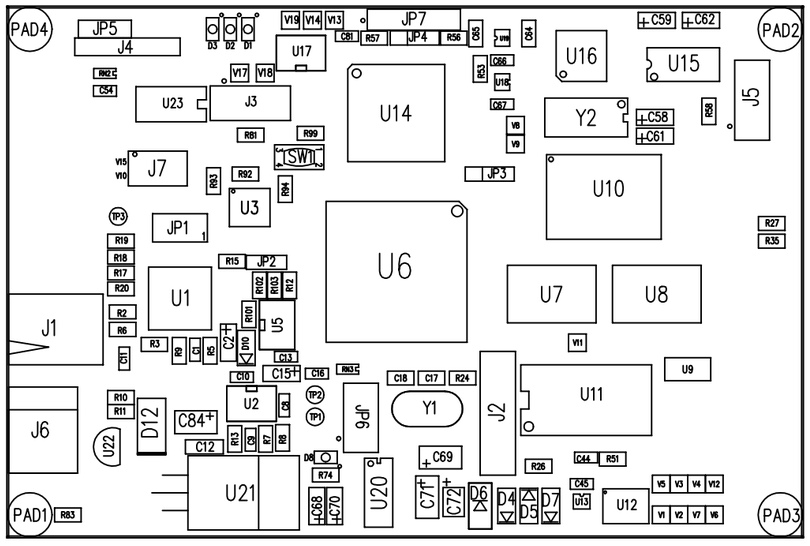

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| MATERIAL | UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES RESISTORS ARE IN OHMS CAPACITORS ARE IN MICROFARADS | APPROVALS | SIGNATURE & DATE | |
| | | DRAWN | T. DUCE | 7/25/2006 |
| | | CHECKED | | |
| FINISH | TOLERANCES | MECH | | |
| | DECIMALS: 2 PLACES +/-.010; 3 PLACES +/-.005; FRACTIONS +/-1/64; ANGLES +/-0.5° | ELECT | | |
| | | SYSTEM | | |
| | DO NOT SCALE PRINT | REMOVE BURRS, BREAK SHARP EDGES | | |

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WEST WAREHAM, MA 02576
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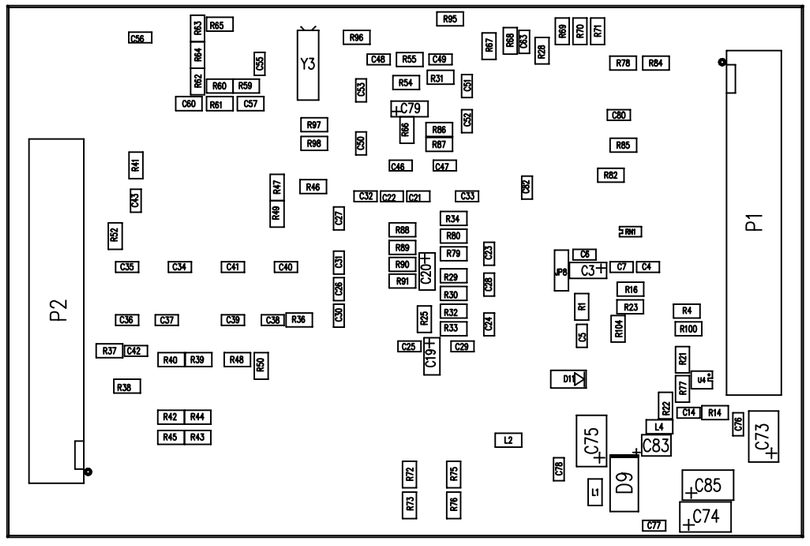
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| CADFILENAME: | SCALE | DRAWING NO. B 4450BE0019 | REV A |

| REVISIONS | | | | |
|---|---|---|---|---|
| | REV. | DESCRIPTION | DATE | APPROVED |
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NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.




COMPONENT SIDE




SOLDER SIDE

| APPLICATION | |
|---|---|
| USED ON | NEXT ASSY. |
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MATERIAL: SEE NOTE
FINISH: SEE NOTE

DO NOT SCALE DRAWING

CONTRACT NO.

UNLESS OTHERWISE SPECIFIED

1. TOLERANCES:
   LINEAR = ± 0.25 (.010)
   ANGULAR = ± 0.50°
2. ALL DIMENSIONS ARE IN MM (INCHES).
3. INTERPRET DRAWING IN ACCORDANCE WITH DOD-STD-100.

| | | |
|---|---|---|
| DWN: | CRTS | 02/09 |
| CHK: | | |
| P.E.: | | |
| DES.ENG.: | | |
| P.C.: | | |
| Q.C.: | | |
| C.M.: | | |
| REL: | | |
| MFG: | | |
| ENG.MGR: | | |
| OTHER: | | |
| OTHER: | | |
| OTHER: | | |

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TITLE:
ASSEMBLY DRAWING,
DSP CARD

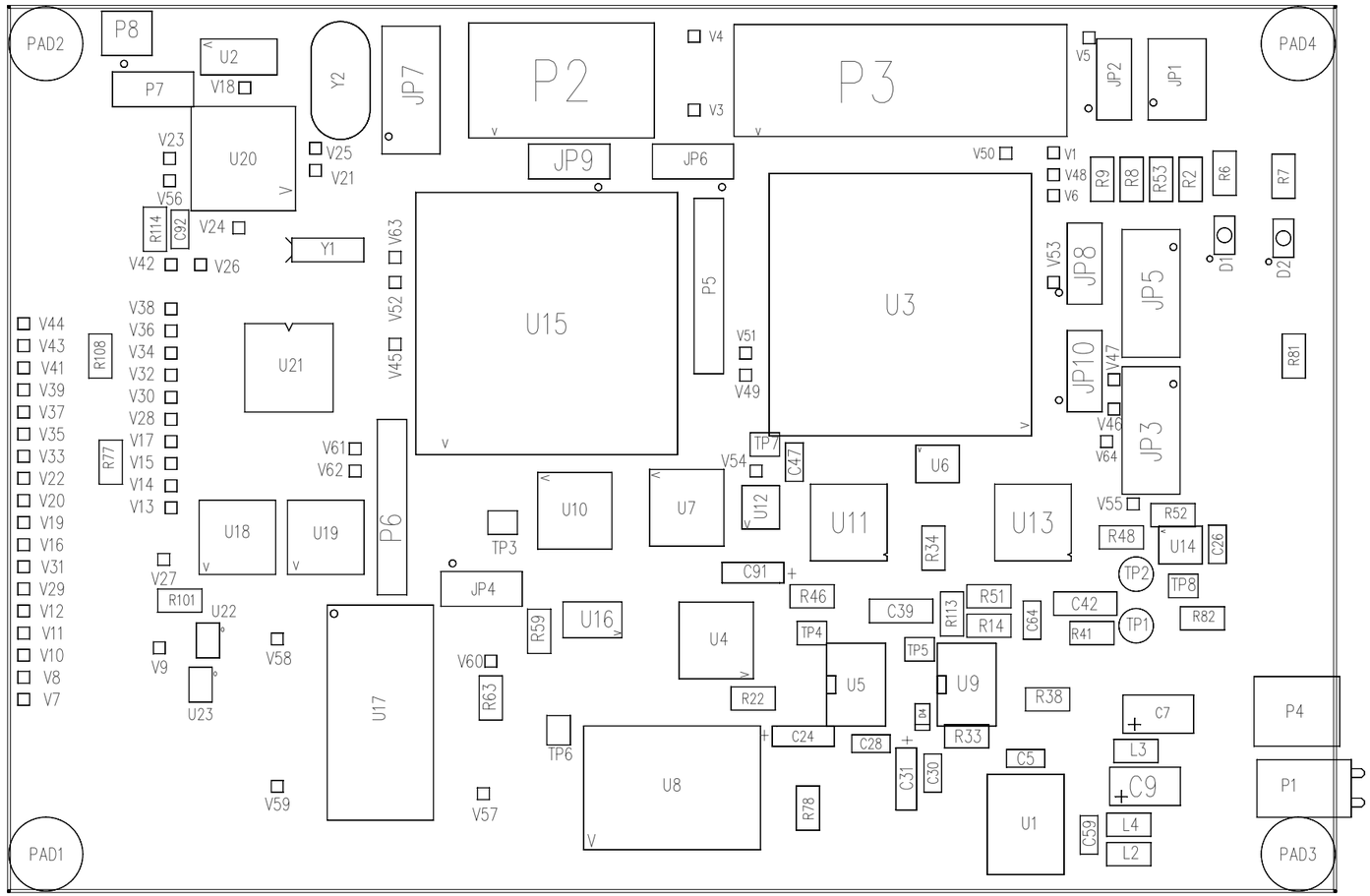
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|---|---|---|---|
| D | | 4450PC0022 | A |

SCALE: 2.5:1 SHEET 1 OF 1

| REVISIONS | | | | |
|---|---|---|---|---|
| | REV. | DESCRIPTION | DATE | APPROVED |
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NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.

COMPONENT SIDE

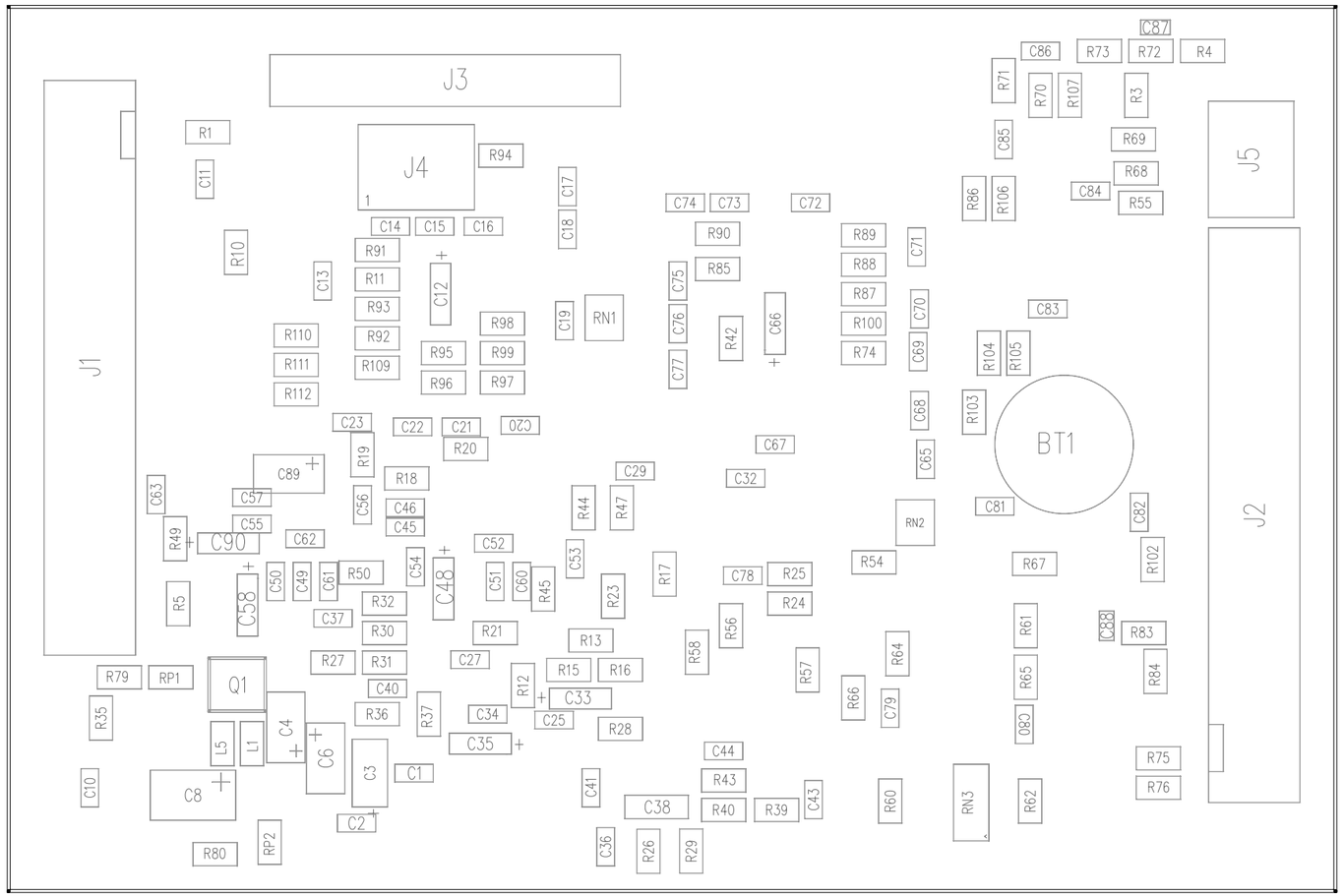



| APPLICATION | | CONTRACT NO. | DWN: CRTS | 3/2006 | ORE OFFSHORE | | | |
|---|---|---|---|---|---|---|---|---|
| USED ON | NEXT ASSY. | | CHK: | | | | | |
| | | UNLESS OTHERWISE SPECIFIED | P.E.: | | TITLE: ASSEMBLY DRAWING, TP3-TARGET ACQUISITION MODULE | | | |
| | | 1. TOLERANCES: LINEAR = ± 0.26 (.010) ANGULAR = ± 0.50° | DES.ENG.: | | | | | |
| | | 2. ALL DIMENSIONS ARE IN MM (INCHES). | P.C.: | | | | | |
| | | 3. INTERPRET DRAWING IN ACCORDANCE WITH DOD-STD-100. | Q.C.: | | | | | |
| | | | C.M.: | | | | | |
| | | | REL: | | | | | |
| | | | MFG: | | | | | |
| | | | ENG.MGR: | | | | | |
| | | | OTHER: | | | | | |
| | | | OTHER: | | | | | |
| | | | OTHER: | | | | | |
| MATERIAL: SEE NOTE<br>FINISH: SEE NOTE | | | | | SIZE: D | CAGE CODE NO. | DRAWING NO. 4450DA0025 | REV: |
| DO NOT SCALE DRAWING | | | | | SCALE: 4:1 | | SHEET 1 OF 2 | |

NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.

SOLDER SIDE

| REVISIONS | | | | |
|---|---|---|---|---|
| | REV. | DESCRIPTION | DATE | APPROVED |
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| APPLICATION | |
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| USED ON | NEXT ASSY. |
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MATERIAL: SEE NOTE
FINISH: SEE NOTE

DO NOT SCALE DRAWING

CONTRACT NO.

UNLESS OTHERWISE SPECIFIED

1. TOLERANCES:
   LINEAR = ± 0.26 (.010)
   ANGULAR = ± 0.50°
2. ALL DIMENSIONS ARE IN MM (INCHES).
3. INTERPRET DRAWING IN ACCORDANCE WITH DOD-STD-100.

| | | |
|---|---|---|
| DWN: | CRTS | 3/2006 |
| CHK: | | |
| P.E.: | | |
| DES.ENG.: | | |
| P.C.: | | |
| Q.C.: | | |
| C.M.: | | |
| REL: | | |
| MFG: | | |
| ENG.MGR: | | |
| OTHER: | | |
| OTHER: | | |
| OTHER: | | |

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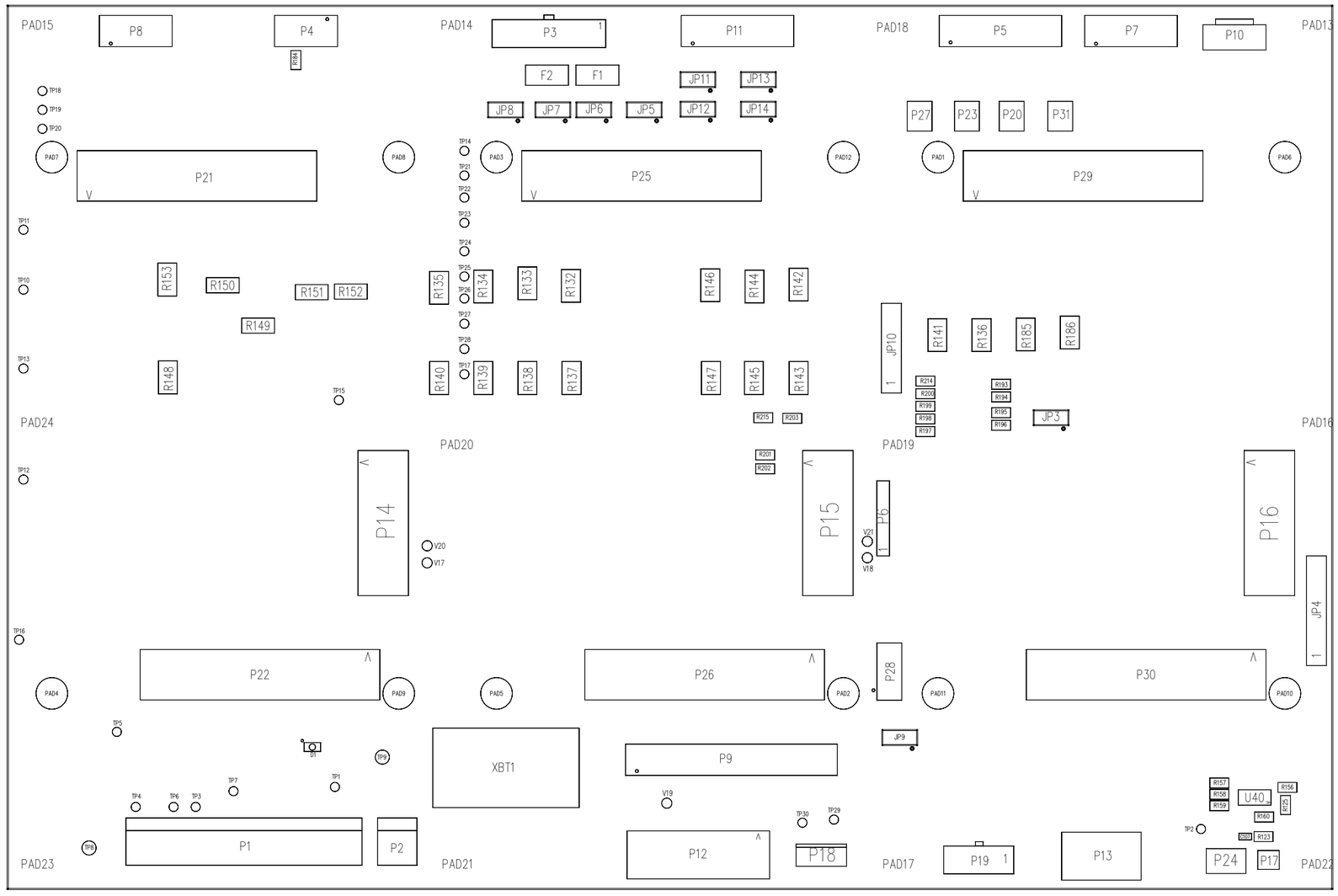
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ASSEMBLY DRAWING,
TP3-TARGET ACQUISITION MODULE

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| SCALE: 4:1 | | SHEET 2 OF 2 | |

| REVISIONS | | | | |
|---|---|---|---|---|
| | REV. | DESCRIPTION | DATE | APPROVED |
| | | | | |
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| | | | | |
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NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.

COMPONENT SIDE

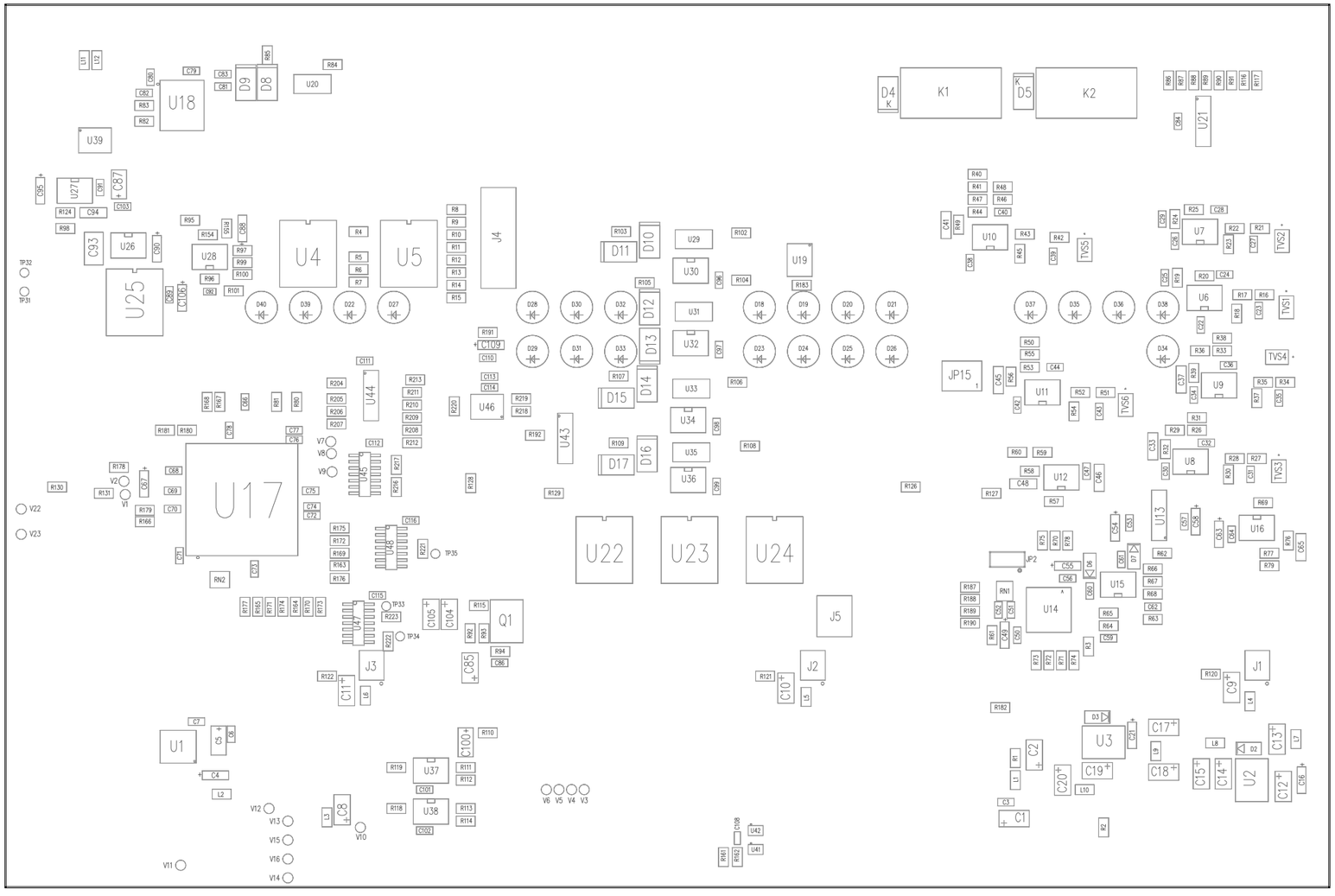



| APPLICATION | | CONTRACT NO. | DWN: CRTS | 3/2006 | ORE OFFSHORE | | | |
|---|---|---|---|---|---|---|---|---|
| USED ON | NEXT ASSY. | UNLESS OTHERWISE SPECIFIED | CHK: | | TITLE: ASSEMBLY DRAWING, PERIPHERAL INTERFACE CONTROLLER BOARD | | | |
| | | 1. TOLERANCES: LINEAR = ± 0.26 (.010) ANGULAR = ± 0.50° | P.E.: | | | | | |
| | | 2. ALL DIMENSIONS ARE IN MM (INCHES). | DES.ENG.: | | SIZE | CAGE CODE NO. | DRAWING NO. | REV: |
| | | 3. INTERPRET DRAWING IN ACCORDANCE WITH DOD-STD-100. | P.C.: | | D | | 4450BA0011 | |
| MATERIAL: SEE NOTE | | | Q.C.: | | SCALE: 2:1 | | SHEET 1 OF 2 | |
| FINISH: SEE NOTE | | | C.M.: | | | | | |
| DO NOT SCALE DRAWING | | | REL: | | | | | |
| | | | MFG: | | | | | |
| | | | ENG.MGR: | | | | | |
| | | | OTHER: | | | | | |
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| | | | OTHER: | | | | | |

| REVISIONS | | | | |
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| | REV. | DESCRIPTION | DATE | APPROVED |
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NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.

SOLDER SIDE




| APPLICATION | |
|---|---|
| USED ON | NEXT ASSY. |
| | |
| | |
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| | |

MATERIAL: SEE NOTE
FINISH: SEE NOTE

DO NOT SCALE DRAWING

CONTRACT NO.

UNLESS OTHERWISE SPECIFIED

1. TOLERANCES:
   LINEAR = ± 0.26 (.010)
   ANGULAR = ± 0.50°
2. ALL DIMENSIONS ARE IN MM (INCHES).
3. INTERPRET DRAWING IN ACCORDANCE WITH DOD-STD-100.

| | | |
|---|---|---|
| DWN: | CRTS | 3/2006 |
| CHK: | | |
| P.E.: | | |
| DES.ENG.: | | |
| P.C.: | | |
| Q.C.: | | |
| C.M.: | | |
| REL: | | |
| MFG: | | |
| ENG.MGR: | | |
| OTHER: | | |
| OTHER: | | |
| OTHER: | | |

ORE OFFSHORE

TITLE:
ASSEMBLY DRAWING,
PERIPHERAL INTERFACE CONTROLLER BOARD

| SIZE | CAGE CODE NO. | DRAWING NO. | REV: |
|---|---|---|---|
| D | | 4450BA0011 | |

SCALE: 2:1 SHEET 2 OF 2

# TP3 - REAR PANEL INTERFACE BOARD

1.) D1 and D2 silkscreen backwards

2.) Move Speaker to allow installation of BNC. Make holes for Speaker leads larger diameter.

3.) Move JP1 out from under J2 as the backside of the header leads shorts against the housing of the Amphenol aluminum connector body.

4.) P3 8 & 9 add wiring for Depth 3 & 4 if necessary. Allow jumpering to R1 and R2 of Synchro input as that would be the least likely to be used in conjunction with it.

5.) Use COM3 also as the Micromodem I/O port. Have jumper selectable. Use CTS line also.

6.) Add connector from Hydrophone for the linear output of Channel "A" for input to the micromodem.

7.) Move silkscreen lettering for TP5 as it gets cut off by hole next to it.

8.) P11 & P12 mating connectors hit end to end. Space out more.

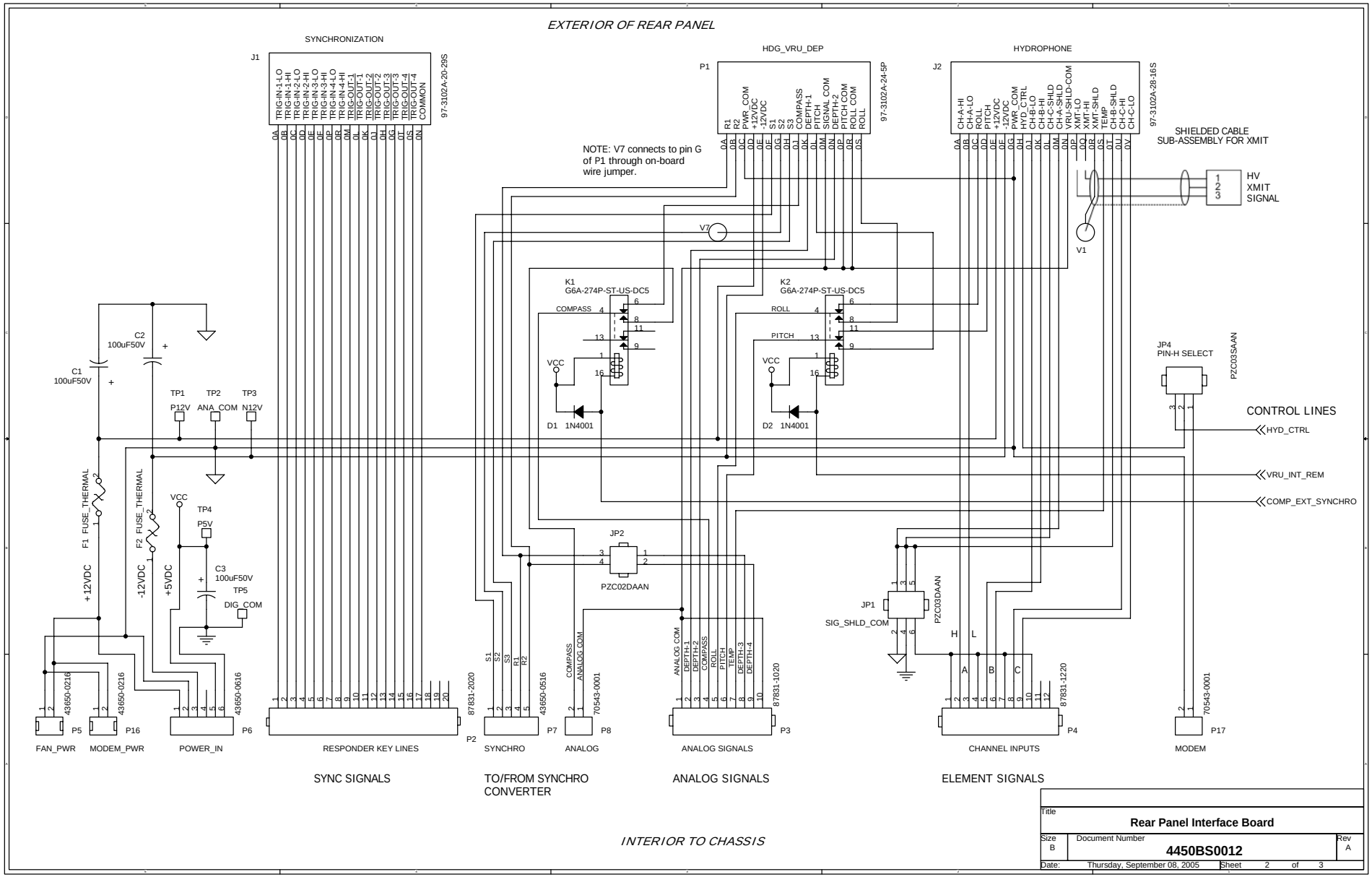
9.) Change schematic so the P1-G (pin 7 on layout) is wire jumpered to P7 pin 2. Add via.

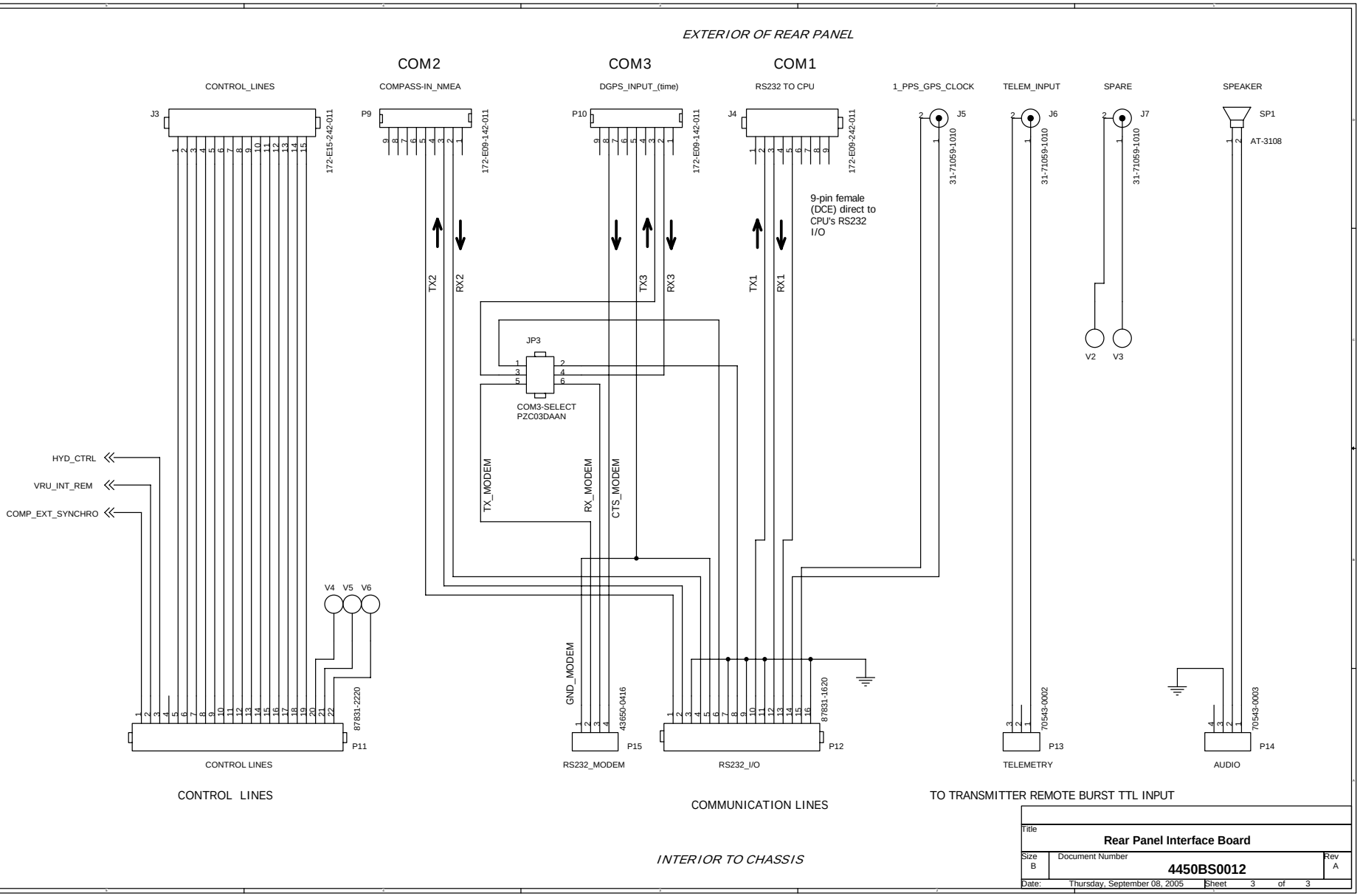
PCB = 4450PC0012 REV A

SCH = 4450BS0012 REV A

ASY = 4450BA0012 REV A

| | | |
|---|---|---|
| Title: **Rear Panel Interface Board** | | |
| Size: B | Document Number: **4450BS0012** | Rev: A |
| Date: Wednesday, September 07, 2005 | Sheet 1 of 3 | |

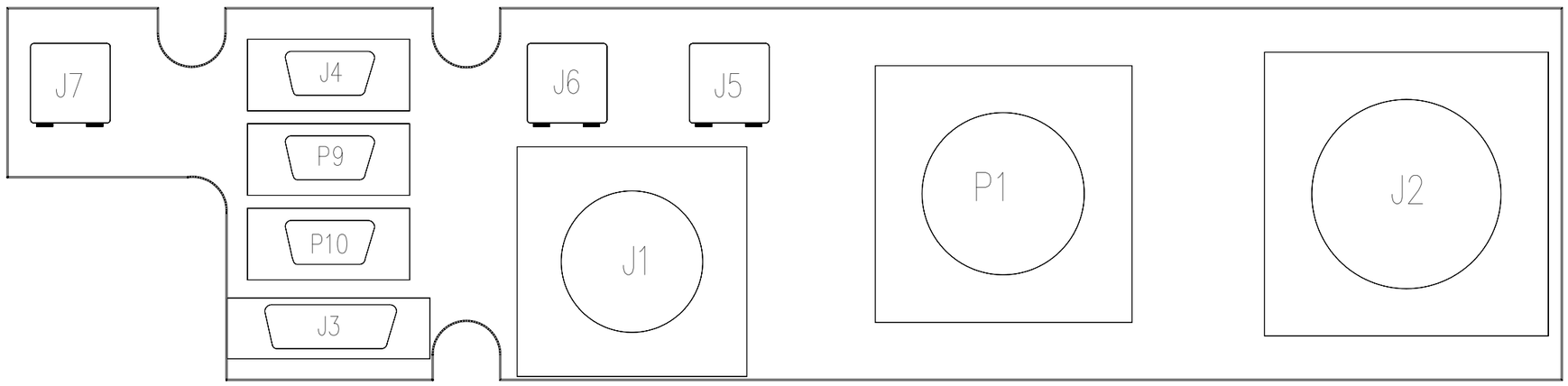

EXTERIOR OF REAR PANEL
SYNCHRONIZATION
J1
97-3102A-20-29S
HDG_VRU_DEP
P1
97-3102A-24-5P
HYDROPHONE
J2
97-3102A-28-16S
NOTE: V7 connects to pin G of P1 through on-board wire jumper.
SHIELDED CABLE SUB-ASSEMBLY FOR XMIT
HV XMIT SIGNAL
V7
V1
K1 G6A-274P-ST-US-DC5
K2 G6A-274P-ST-US-DC5
COMPASS
ROLL
PITCH
VCC
D1 1N4001
D2 1N4001
C1 100uF50V
C2 100uF50V
C3 100uF50V
TP1 P12V
TP2 ANA_COM
TP3 N12V
TP4 P5V
TP5 DIG_COM
F1 FUSE_THERMAL
F2 FUSE_THERMAL
+12VDC
-12VDC
+5VDC
JP4 PIN-H SELECT
PZC03SAAN
CONTROL LINES
HYD_CTRL
VRU_INT_REM
COMP_EXT_SYNCHRO
JP2
PZC02DAAN
JP1
PZC03DAAN
SIG_SHLD_COM
H
L
A
B
C
43650-0216
43650-0216
43650-0616
87831-2020
43650-0516
70543-0001
87831-1020
87831-1220
70543-0001
P5
P16
P6
P2
P7
P8
P3
P4
P17
FAN_PWR
MODEM_PWR
POWER_IN
RESPONDER KEY LINES
SYNCHRO
ANALOG
ANALOG SIGNALS
CHANNEL INPUTS
MODEM
SYNC SIGNALS
TO/FROM SYNCHRO CONVERTER
ANALOG SIGNALS
ELEMENT SIGNALS
INTERIOR TO CHASSIS
Title
Rear Panel Interface Board
Size B
Document Number
4450BS0012
Rev A
Date: Thursday, September 08, 2005
Sheet 2 of 3


EXTERIOR OF REAR PANEL
COM2
COM3
COM1
CONTROL_LINES
COMPASS-IN_NMEA
DGPS_INPUT_(time)
RS232 TO CPU
1_PPS_GPS_CLOCK
TELEM_INPUT
SPARE
SPEAKER
J3
P9
P10
J4
J5
J6
J7
SP1
172-E15-242-011
172-E09-142-011
172-E09-242-011
31-71059-1010
AT-3108
9-pin female
(DCE) direct to
CPU's RS232
I/O
TX2
RX2
TX3
RX3
TX1
RX1
JP3
COM3-SELECT
PZC03DAAN
V2
V3
HYD_CTRL
VRU_INT_REM
COMP_EXT_SYNCHRO
TX_MODEM
RX_MODEM
CTS_MODEM
V4
V5
V6
GND_MODEM
87831-2220
43650-0416
87831-1620
70543-0002
70543-0003
P11
P15
P12
P13
P14
CONTROL LINES
RS232_MODEM
RS232_I/O
TELEMETRY
AUDIO
CONTROL LINES
COMMUNICATION LINES
TO TRANSMITTER REMOTE BURST TTL INPUT
INTERIOR TO CHASSIS
Title
Rear Panel Interface Board
Size
B
Document Number
4450BS0012
Rev
A
Date:
Thursday, September 08, 2005
Sheet
3
of
3

| REVISIONS | | | | |
|---|---|---|---|---|
| | REV. | DESCRIPTION | DATE | APPROVED |
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NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.

COMPONENT SIDE




| APPLICATION | |
|---|---|
| USED ON | NEXT ASSY. |
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MATERIAL: SEE NOTE
FINISH: SEE NOTE

DO NOT SCALE DRAWING

CONTRACT NO.

UNLESS OTHERWISE SPECIFIED

1. TOLERANCES:
   LINEAR = ± 0.26 (.010)
   ANGULAR = ± 0.50°
2. ALL DIMENSIONS ARE IN MM (INCHES).
3. INTERPRET DRAWING IN ACCORDANCE WITH DOD-STD-100.

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|---|---|---|
| DWN: | CRTS | 9/2005 |
| CHK: | | |
| P.E.: | | |
| DES.ENG.: | | |
| P.C.: | | |
| Q.C.: | | |
| C.M.: | | |
| REL: | | |
| MFG: | | |
| ENG.MGR: | | |
| OTHER: | | |
| OTHER: | | |
| OTHER: | | |

ORE OFFSHORE

TITLE:
ASSEMBLY DRAWING,
4450A REAR PANEL BOARD

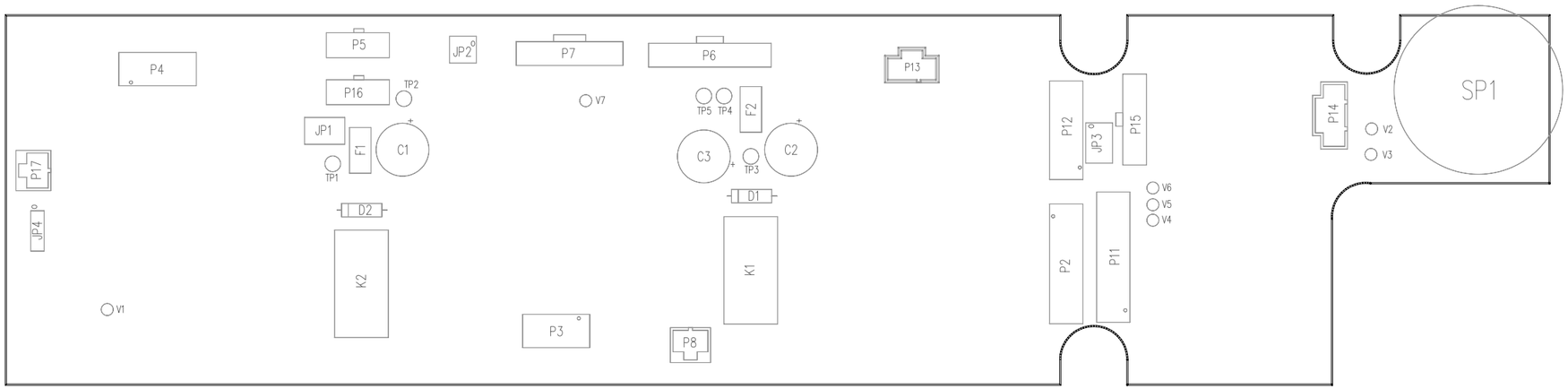
| SIZE | CAGE CODE NO. | DRAWING NO. | REV: |
|---|---|---|---|
| D | | 4450BA0012 | |

SCALE: 2:1 SHEET 1 OF 2

| REVISIONS | | | | |
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| | REV. | DESCRIPTION | DATE | APPROVED |
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NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.

SOLDER SIDE




| APPLICATION | |
|---|---|
| USED ON | NEXT ASSY. |
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MATERIAL: SEE NOTE
FINISH: SEE NOTE

DO NOT SCALE DRAWING

CONTRACT NO.

UNLESS OTHERWISE SPECIFIED

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   LINEAR = ± 0.26 (.010)
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2. ALL DIMENSIONS ARE IN MM (INCHES).
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| DWN: | CRTS | 9/2005 |
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| P.C.: | | |
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| C.M.: | | |
| REL: | | |
| MFG: | | |
| ENG.MGR: | | |
| OTHER: | | |
| OTHER: | | |
| OTHER: | | |

ORE OFFSHORE

TITLE:
ASSEMBLY DRAWING,
4450A REAR PANEL BOARD

| SIZE | CAGE CODE NO. | DRAWING NO. | REV: |
|---|---|---|---|
| D | | 4450BA0012 | |
| SCALE: 2:1 | | SHEET 2 OF 2 | |

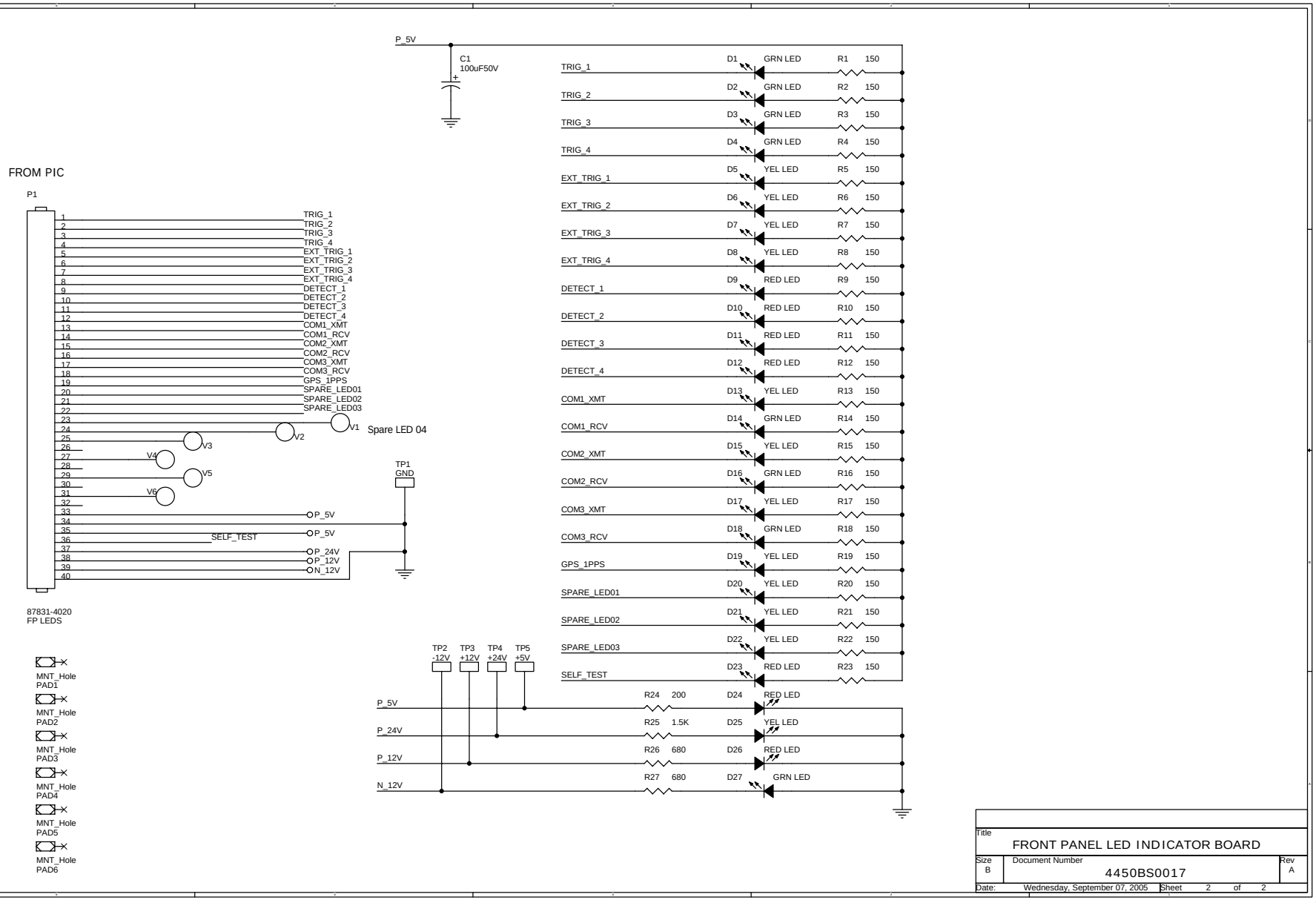
# FRONT PANEL LED INDICATOR BOARD

1.) Open holes up for mounting to 6-32 clear.

2.) Diode D27 reversed.

3.) Add wire trace from SPARE_LED_03 of connector to D23.

| | | |
|---|---|---|
| Title: FRONT PANEL LED INDICATOR BOARD | | |
| Size: B | Document Number: 4450BS0017 | Rev: A |
| Date: Wednesday, September 07, 2005 | Sheet 1 of 2 | |

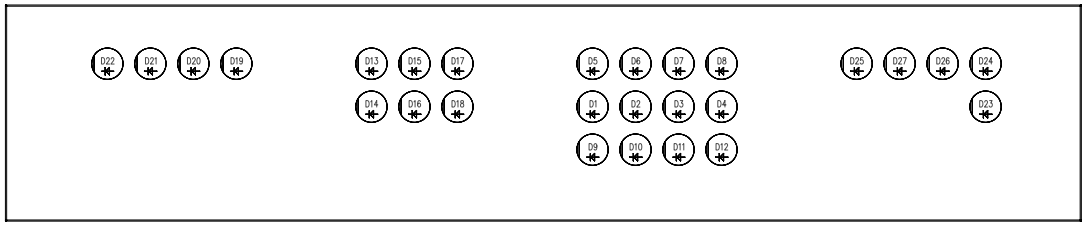



| | | |
|---|---|---|
| Title | FRONT PANEL LED INDICATOR BOARD | |
| Size B | Document Number 4450BS0017 | Rev A |
| Date: Wednesday, September 07, 2005 | Sheet 2 of 2 | |

NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.

COMPONENT SIDE

| REVISIONS | | | | |
|---|---|---|---|---|
| | REV. | DESCRIPTION | DATE | APPROVED |
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| APPLICATION | |
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| USED ON | NEXT ASSY. |
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MATERIAL: SEE NOTE
FINISH: SEE NOTE

DO NOT SCALE DRAWING

CONTRACT NO.

UNLESS OTHERWISE SPECIFIED

1. TOLERANCES:
   LINEAR = ± 0.26 (.010)
   ANGULAR = ± 0.50°
2. ALL DIMENSIONS ARE IN MM (INCHES).
3. INTERPRET DRAWING IN ACCORDANCE WITH DOD-STD-100.

| | | |
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| DWN: CRTS | 9/2005 | |
| CHK: | | |
| F.E.: | | |
| DES. ENG.: | | |
| P.C.: | | |
| Q.C.: | | |
| C.M.: | | |
| REL: | | |
| MFG: | | |
| ENG. MGR: | | |
| OTHER: | | |
| OTHER: | | |
| OTHER: | | |

ORE OFFSHORE

TITLE:
ASSEMBLY DRAWING,
FRONT PANEL LED CARD

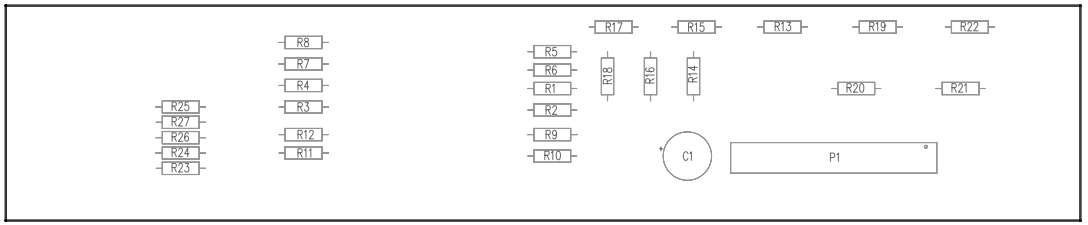
| SIZE | CAGE CODE NO. | DRAWING NO. | REV: |
|---|---|---|---|
| D | | 4450BA0134 | |

SCALE 2:1 SHEET 1 OF 2

NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.

SOLDER SIDE

| REVISIONS | | | | |
|---|---|---|---|---|
| | REV. | DESCRIPTION | DATE | APPROVED |
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| APPLICATION | |
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| USED ON | NEXT ASSY. |
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MATERIAL: SEE NOTE
FINISH: SEE NOTE

DO NOT SCALE DRAWING

CONTRACT NO.

UNLESS OTHERWISE SPECIFIED

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   LINEAR = ± 0.26 (.010)
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2. ALL DIMENSIONS ARE IN MM (INCHES).
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|---|---|---|
| DWN: | CRTS | 9/2005 |
| CHK: | | |
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| DES. ENG.: | | |
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| C.M.: | | |
| REL: | | |
| MFG: | | |
| ENG. MGR: | | |
| OTHER: | | |
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| OTHER: | | |

ORE OFFSHORE

TITLE:
ASSEMBLY DRAWING,
FRONT PANEL LED CARD

| SIZE | CAGE CODE NO. | DRAWING NO. | REV: |
|---|---|---|---|
| D | | 4450BA0134 | |

SCALE 2:1 SHEET 2 OF 2

# TRANSMITTER CARD

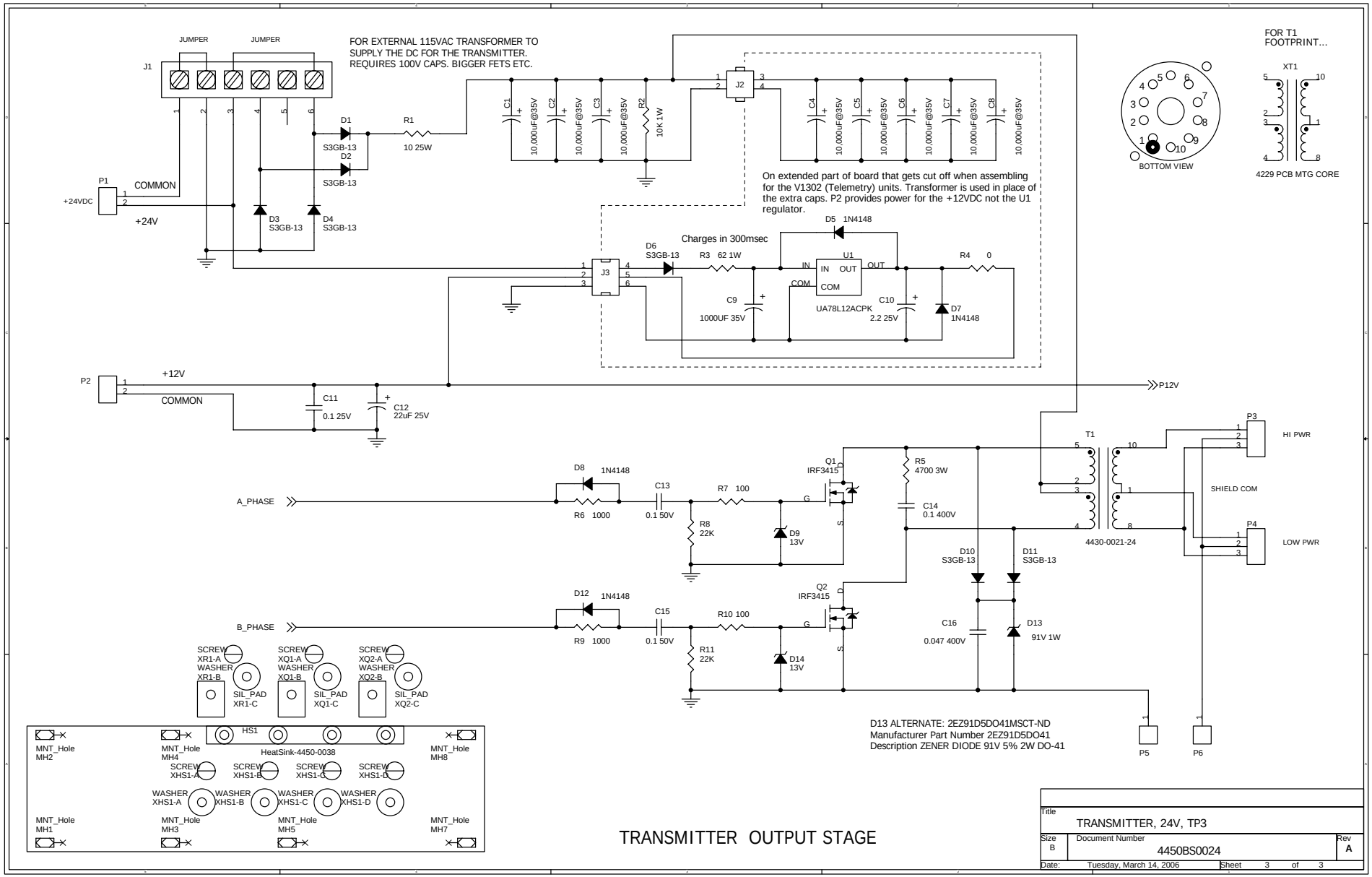
Next Rev...
1.) REV-A = Add gnds to input.

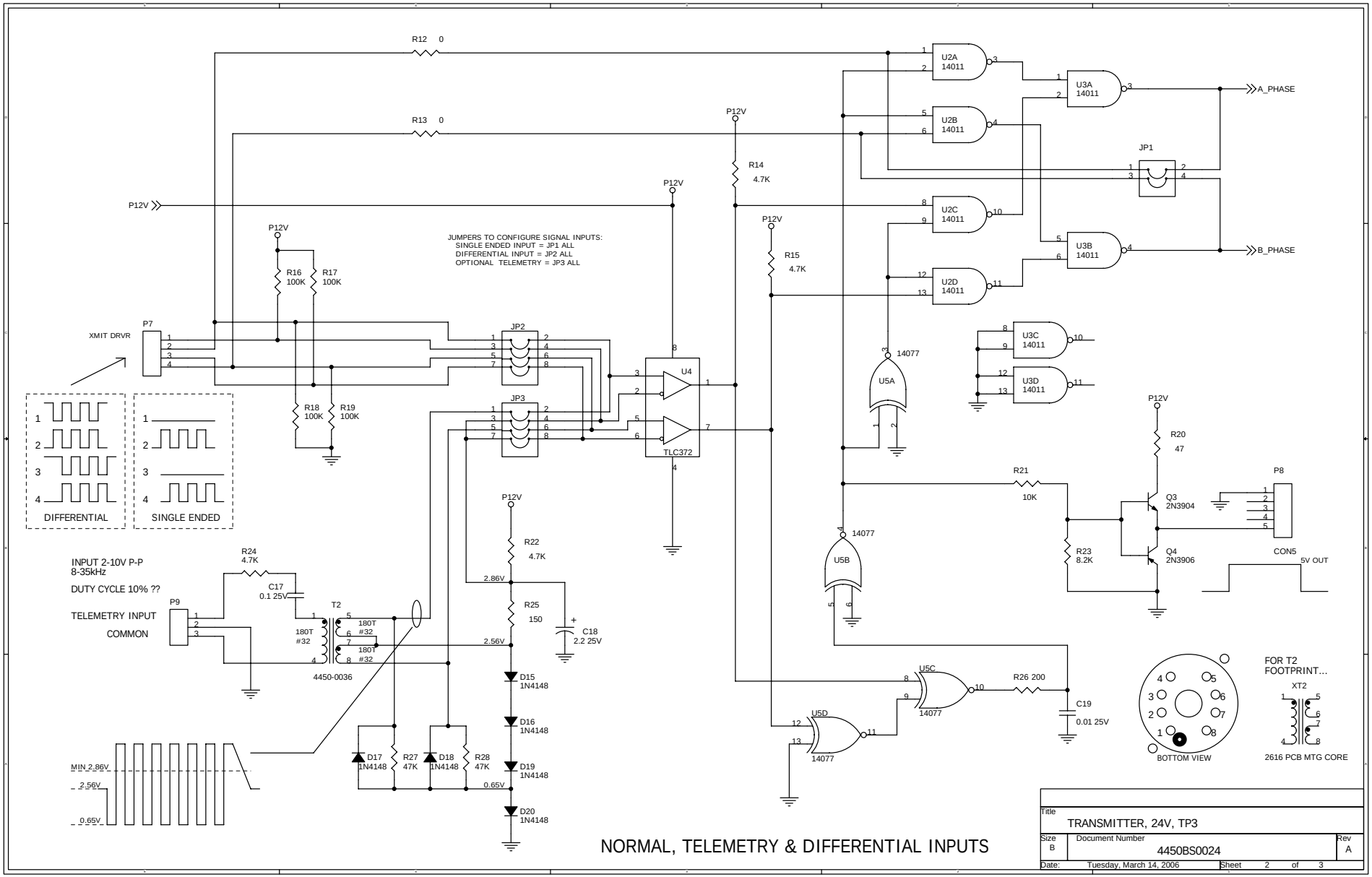
PCB: 4450PC0024 - REV A
SCH: 4450BS0024 - REV A
BOM: 4450AL0024-01 - REV A NO TELEMETRY
BOM: 4450AL0023-02 - REV A WITH TELEMETRY
ASY: 4450BA0023 - REV A

ORE Offshore
4 Little Brook Road
West Wareham, MA 02576
PH: 508-291-0960
FAX: 508-291-0975

COVER PAGE

| | | |
|---|---|---|
| Title: TRANSMITTER, 24V, P3 | | |
| Size: B | Document Number: 4450BS0024 | Rev: A |
| Date: Tuesday, March 14, 2006 | Sheet 1 of 3 | |


JUMPER
JUMPER
J1
FOR EXTERNAL 115VAC TRANSFORMER TO SUPPLY THE DC FOR THE TRANSMITTER. REQUIRES 100V CAPS. BIGGER FETS ETC.
D1
S3GB-13
D2
S3GB-13
R1
10 25W
C1
10,000uF@35V
C2
10,000uF@35V
C3
10,000uF@35V
R2
10K 1W
J2
C4
10,000uF@35V
C5
10,000uF@35V
C6
10,000uF@35V
C7
10,000uF@35V
C8
10,000uF@35V
P1
+24VDC
COMMON
+24V
D3
S3GB-13
D4
S3GB-13
On extended part of board that gets cut off when assembling for the V1302 (Telemetry) units. Transformer is used in place of the extra caps. P2 provides power for the +12VDC not the U1 regulator.
D5 1N4148
Charges in 300msec
D6
S3GB-13
R3 62 1W
J3
U1
IN
OUT
COM
UA78L12ACPK
C9
1000UF 35V
C10
2.2 25V
D7
1N4148
R4 0
P12V
P2
+12V
COMMON
C11
0.1 25V
C12
22uF 25V
BOTTOM VIEW
FOR T1 FOOTPRINT...
XT1
4229 PCB MTG CORE
T1
4430-0021-24
P3
HI PWR
SHIELD COM
P4
LOW PWR
A_PHASE
D8
1N4148
R6 1000
C13
0.1 50V
R7 100
R8
22K
Q1
IRF3415
D9
13V
R5
4700 3W
C14
0.1 400V
D10
S3GB-13
D11
S3GB-13
B_PHASE
D12
1N4148
R9 1000
C15
0.1 50V
R10 100
R11
22K
Q2
IRF3415
D14
13V
C16
0.047 400V
D13
91V 1W
SCREW XR1-A
WASHER XR1-B
SIL_PAD XR1-C
SCREW XQ1-A
WASHER XQ1-B
SIL_PAD XQ1-C
SCREW XQ2-A
WASHER XQ2-B
SIL_PAD XQ2-C
HS1
HeatSink-4450-0038
MNT_Hole MH1
MNT_Hole MH2
MNT_Hole MH3
MNT_Hole MH4
MNT_Hole MH5
MNT_Hole MH7
MNT_Hole MH8
SCREW XHS1-A
SCREW XHS1-B
SCREW XHS1-C
SCREW XHS1-D
WASHER XHS1-A
WASHER XHS1-B
WASHER XHS1-C
WASHER XHS1-D
D13 ALTERNATE: 2EZ91D5DO41MSCT-ND
Manufacturer Part Number 2EZ91D5DO41
Description ZENER DIODE 91V 5% 2W DO-41
P5
P6
TRANSMITTER OUTPUT STAGE
Title
TRANSMITTER, 24V, TP3
Size B
Document Number
4450BS0024
Rev A
Date: Tuesday, March 14, 2006
Sheet 3 of 3



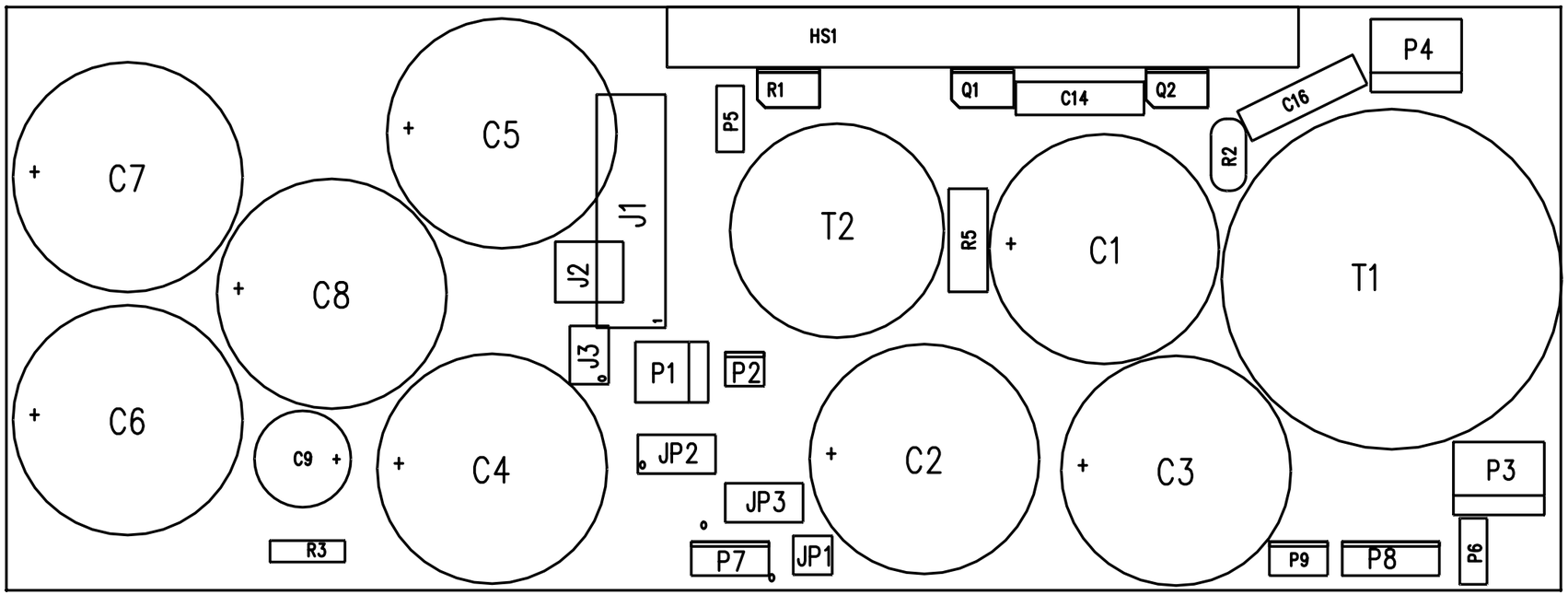

NORMAL, TELEMETRY & DIFFERENTIAL INPUTS

| | | |
|---|---|---|
| Title | TRANSMITTER, 24V, TP3 | |
| Size B | Document Number 4450BS0024 | Rev A |
| Date: Tuesday, March 14, 2006 | Sheet 2 of 3 | |

| REVISIONS | | | |
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| REV. | DESCRIPTION | DATE | APPROVED |
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NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.

COMPONENT SIDE



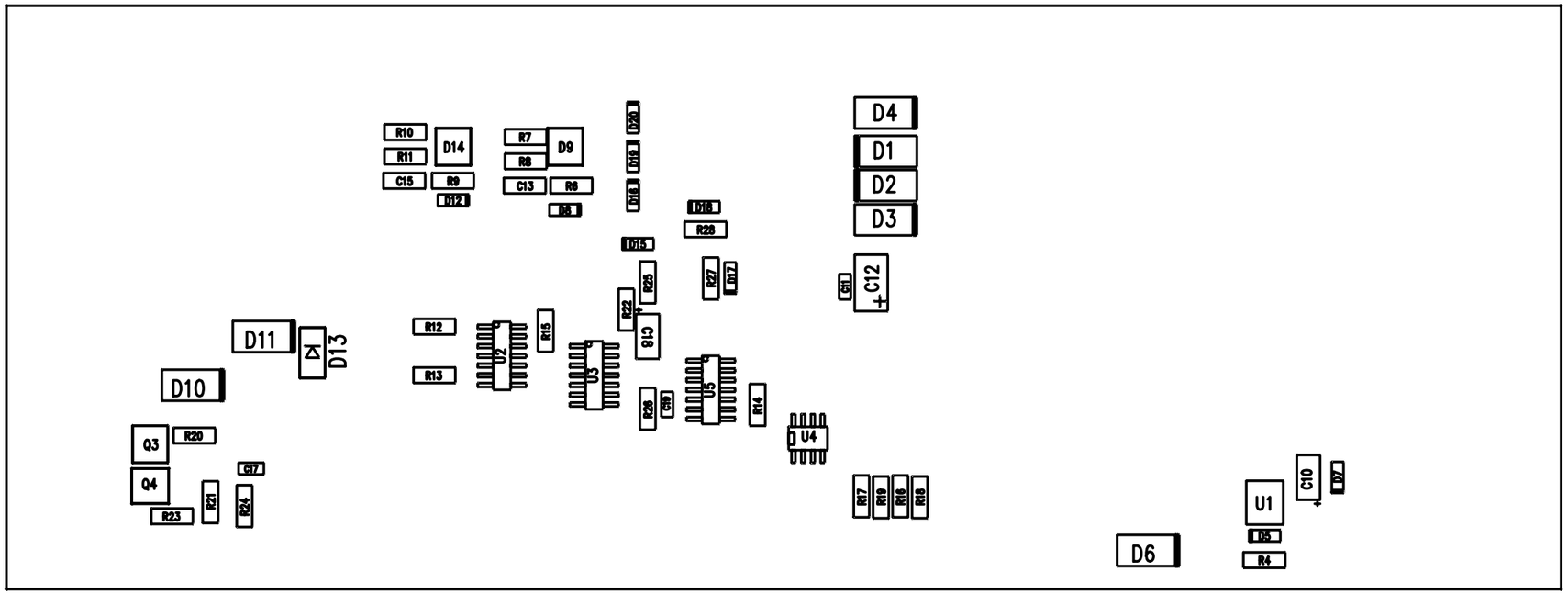

| APPLICATION | | CONTRACT NO. | DRN: CRTS | 10/2005 | ORE OFFSHORE |
|---|---|---|---|---|---|
| USED ON | NEXT ASSY. | | CHK: | | |
| | | UNLESS OTHERWISE SPECIFIED | P.E.: | | TITLE: ASSEMBLY DRAWING, TRANSMITTER BOARD |
| | | 1. TOLERANCES: LINEAR = ± 0.38 (.010) ANGULAR = ± 0.50° | DES.ENG.: | | |
| | | 2. ALL DIMENSIONS ARE IN MM (INCHES). | P.C.: | | |
| | | 3. INTERPRET DRAWING IN ACCORDANCE WITH DOD-STD-100. | Q.C.: | | |
| | | | CAL.: | | |
| | | | REL: | | |
| | | | MFG: | | |
| MATERIAL: SEE NOTE | | | ENG.MGR: | | |
| FINISH: SEE NOTE | | | OTHER: | | |
| DO NOT SCALE DRAWING | | | OTHER: | | |
| | | | OTHER: | | |

| SIZE | CAGE CODE NO. | DRAWING NO. | REV. |
|---|---|---|---|
| D | | 4450DA0024 | A |
| SCALE: 3/4 | | SHEET 1 OF 2 | |

NOTES:
1) OBSERVE POLARITY OF CAPS AND DIODES.
2) REFER TO BOM FOR STUFFING OPTIONS.

SOLDER SIDE

| REVISIONS | | | | |
|---|---|---|---|---|
| | REV. | DESCRIPTION | DATE | APPROVED |
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| APPLICATION | |
|---|---|
| USED ON | NEXT ASSY. |
| | |

MATERIAL: SEE NOTE
FINISH: SEE NOTE

DO NOT SCALE DRAWING

CONTRACT NO.

UNLESS OTHERWISE SPECIFIED

1. TOLERANCES:
   LINEAR = ± 0.38 (.010)
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|---|---|---|
| DWN: | CRTS | 10/2005 |
| CHK: | | |
| P.E.: | | |
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| P.C.: | | |
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| OTHER: | | |

ORE OFFSHORE

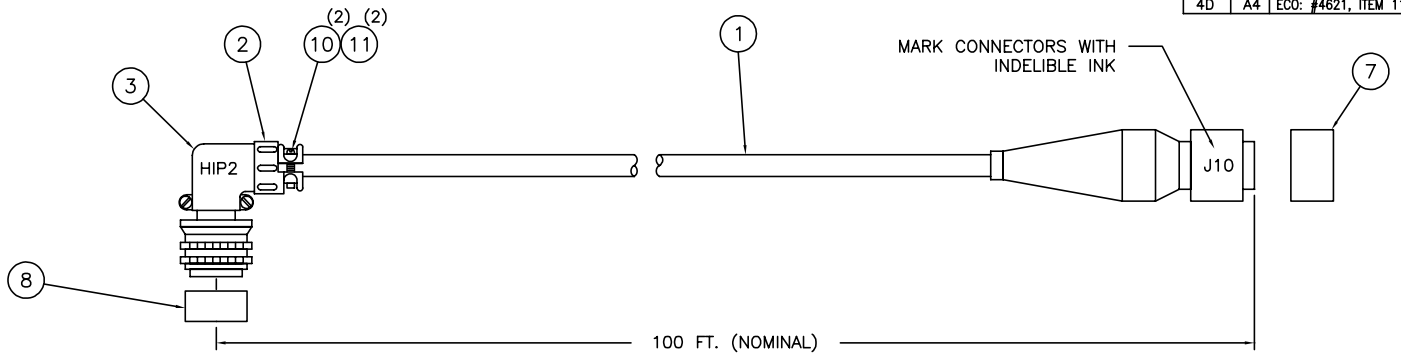
TITLE:
ASSEMBLY DRAWING,
TRANSMITTER BOARD

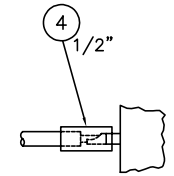
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|---|---|---|---|
| D | | 4450DA0024 | A |

SCALE: 3:1 SHEET 2 OF 2

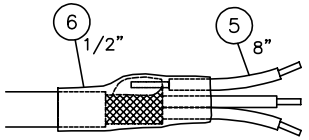
THIS DRAWING IS LOANED WITHOUT OTHER CONSIDERATION THAN THE AGREEMENT AND CONDITION THAT IT IS NOT TO BE REPRODUCED, COPIED, OR OTHERWISE DISPOSED OF, DIRECTLY OR INDIRECTLY, AND IS NOT TO BE USED IN WHOLE OR IN PART TO ASSIST IN MAKING OR TO FURNISH ANY INFORMATION FOR THE MAKING OF DRAWINGS, PRINTS, APPARATUS, OR PARTS THEREOF.

| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
| 3C | A2 | ECO: #3819, REDRAWN ON CAD, LENGTH OPTION DRAWING NOTE ADDED | 4/19/94 | |
| 4D | A3 | ECO: #4109, ITEM 10 QTY 2 ADDED | 1/16/97 | |
| 4D | A4 | ECO: #4621, ITEM 11 QTY 2 ADDED | 6/7/00 | MLE |



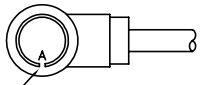




TYPICAL TERMINATION AT CONNECTOR

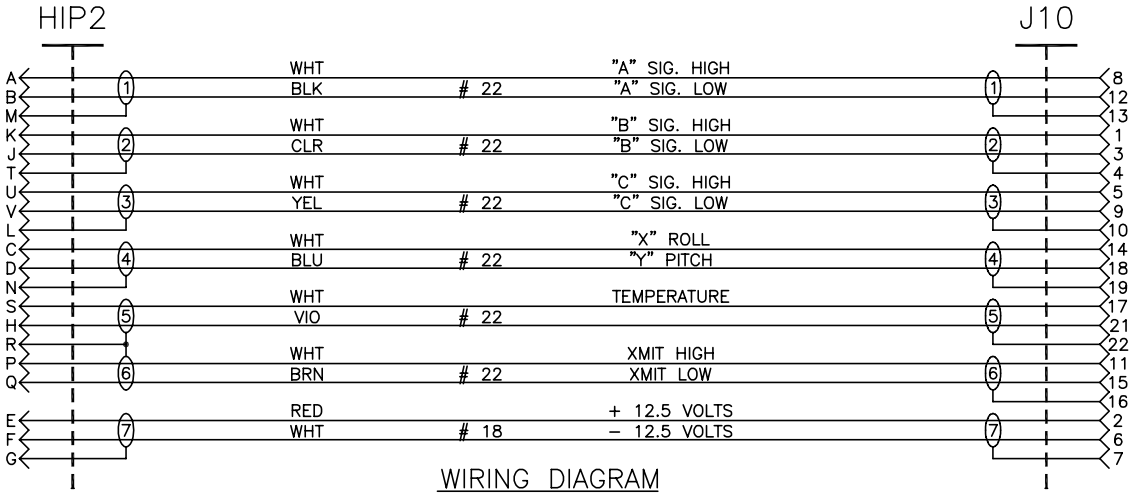



TYPICAL SHIELD TERMINATION

See DWG. No. 100909-01 FOR LENGTH OPTIONS
See ALSO DWG. No. 4400CE0004 IN ADDENDUM FOR 4211A/4212A HYDROPHONES




ORIENTATION OF KEY AND PIN "A"




WIRING DIAGRAM

NOTE:

1. (2) SYMBOLIZES TWISTED PAIR NUMBER

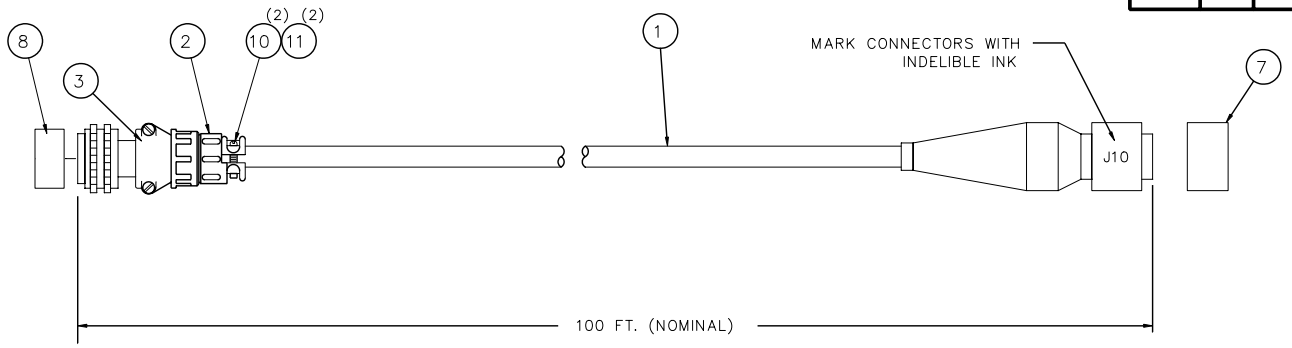
ORE / Accusonic Part No: 4110-0002

| | | | | |
|---|---|---|---|---|
| | | UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES | CONTRACT NO. RD250 | ORE Offshore Division / ACCUSONIC TECHNOLOGIES INC. — 25 Bernard St. Jean Drive, E. Falmouth, MA 02536, TEL: (508) 495-6600, FAX: (508) 495-6699 |
| | | TOLERANCES ON: | DRAWN D. DeMello 10/4/84 | NAME: *MODEL 4110B DECK CABLE* |
| | | DECIMALS .X ±____ .XX ±____ .XXX ±____ | CHECKED DWF 2/94 | |
| | | ANGLES ±___ ' ___ " | ENGINEER DWF 2/94 | |
| | | FRACTIONS ±___ | APPROVED DWF 2/94 | |
| | | SURFACE ROUGHNESS ✓ | DOCUMENT CONTROL ____ RELEASE DATE ____ | SIZE C · CODE IDENT. NO. 25993 · DWG. NO. *4110CA0002* · REV. A4 |
| NEXT ASSY | USED ON | MATERIAL | FILENAME 4110A002.DWG | SCALE NONE · WT. LBS. NA · SHEET 1 OF 1 |
| APPLICATION | | | | |

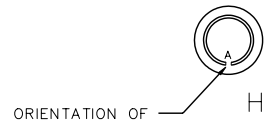
NOT A CONTROLLED DOCUMENT UNLESS MARKED CONTROLLED

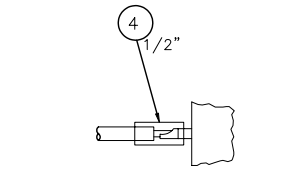
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| REVISIONS | | | | |
|---|---|---|---|---|
| ECR# | REV | DESCRIPTION | DATE | APPROVED |
| | | | | |

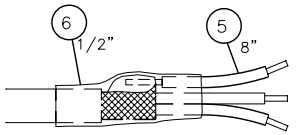



See DWG. No. 100909-01 FOR LENGTH OPTIONS
See ALSO DWG. No. 4400CE0004 IN ADDENDUM FOR 4211A/4212A HYDROPHONES

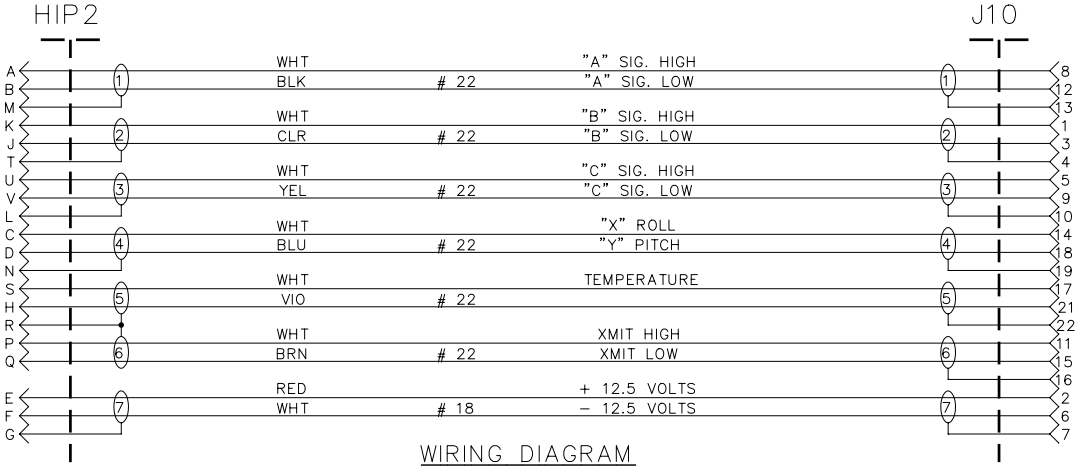



TYPICAL TERMINATION AT CONNECTOR




TYPICAL SHIELD TERMINATION




WIRING DIAGRAM

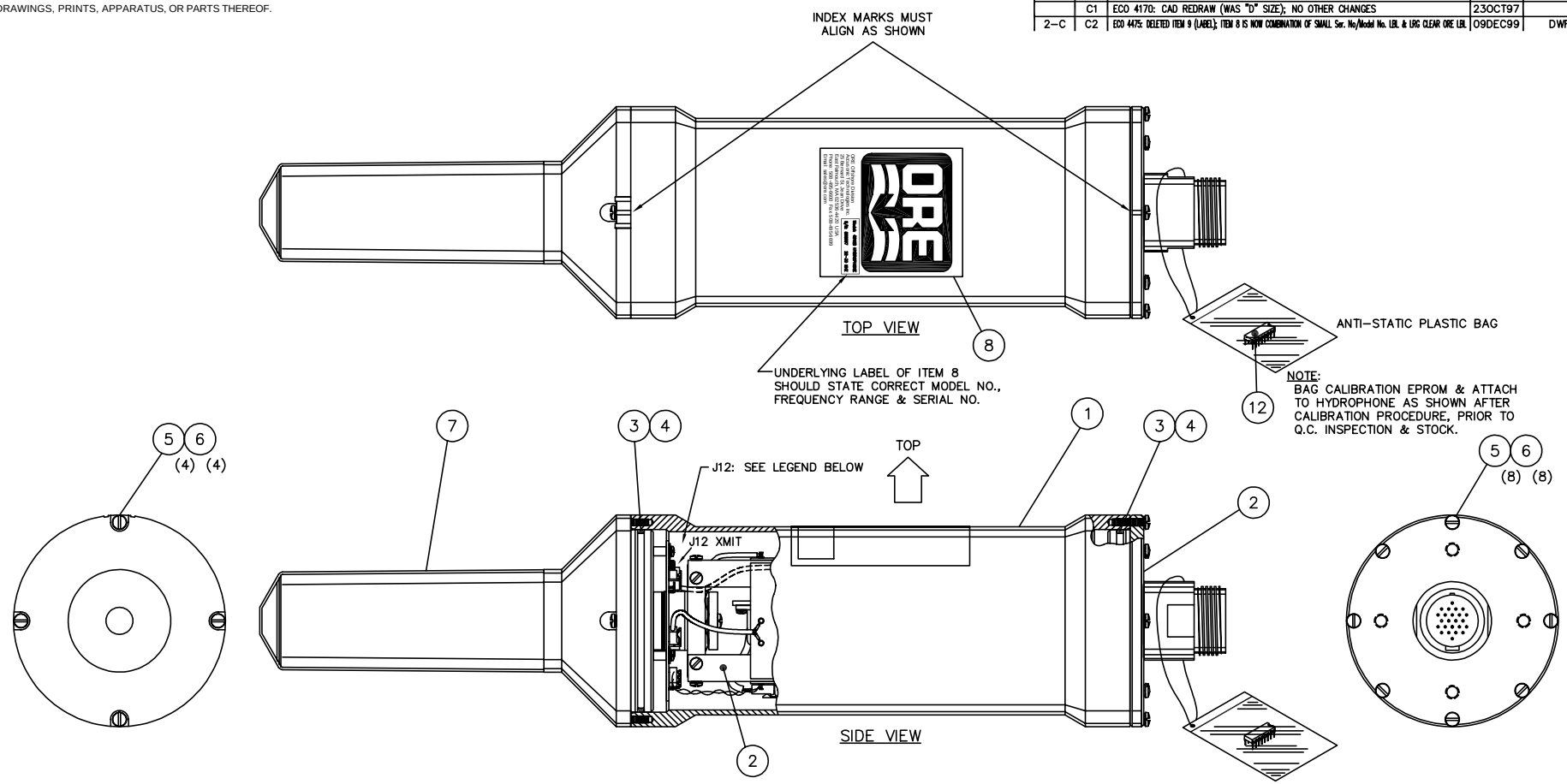
NOTE:

1. (2) SYMBOLIZES TWISTED PAIR NUMBER

| | | | | | |
|---|---|---|---|---|---|
| MATERIAL | UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES RESISTORS ARE IN OHMS CAPACITORS ARE IN MICROFARADS | | APPROVALS | SIGNATURE & DATE | ORE OFFSHORE 4 LITTLE BROOK ROAD WEST WAREHAM, MA 02576 WWW.ORE.COM TEL. (508)291-0960 |
| FINISH | TOLERANCES | | DRAWN | T. DUCE 7/27/2006 | TITLE: MODEL 4110B DECK CABLE |
| | DECIMALS: 2 PLACES +/-.010; 3 PLACES +/-.005 | FRACTIONS +/-1/64; ANGLES +/-0.5° | CHECKED | DWF 7/27/2006 | |
| | | | MECH | DWF 7/27/2006 | |
| | | | ELECT | DWF 7/27/2006 | |
| | | | SYSTEM | | CADFILENAME: |
| | DO NOT SCALE PRINT | | REMOVE BURRS, BREAK SHARP EDGES | | SCALE: B; DRAWING NO. 4110CA0002-01; REV A |

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| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
| | B1 | ECO 2269B: ADDED DASH NO. CHART FOR J12 CONNECTION & ADDED 4610B REF. TO DWG. TITLE | 05DEC85 | |
| | C1 | ECO 4170: CAD REDRAW (WAS "D" SIZE); NO OTHER CHANGES | 23OCT97 | |
| 2–C | C2 | ECO 4475: DELETED ITEM 9 (LABEL); ITEM 8 IS NOW COMBINATION OF SMALL Ser. No/Model No. LBL & LRG CLEAR ORE LBL | 09DEC99 | DWF |




LEGEND

| DASH NO. | DESCRIPTION |
|---|---|
| 01 | 8–14 KHz WITHOUT TRANSMITTER INTERROGATE J12 NOT CONNECTED |
| 02 | 22–30 KHz WITHOUT TRANSMITTER INTERROGATE J12 NOT CONNECTED |
| 03 | 8–14 KHz WITH TRANSMITTER INTERROGATE J12 CONNECTED |
| 04 | 22–30 KHz WITH TRANSMITTER INTERROGATE J12 CONNECTED |

| | |
|---|---|
| | |
| | |
| | |
| | |
| | 100436–05 |
| | 100436–04 |
| | 100436–03 |
| | 100436–02 |
| | 100436–01 |
| NEXT ASSY | USED ON |
| APPLICATION | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

DECIMALS .X ±____ .XX ±____ .XXX ±____

ANGLES ±___ ° ___ '

FRACTIONS ±___

SURFACE ROUGHNESS ✓

MATERIAL

CONTRACT NO. RD194

| | | |
|---|---|---|
| DRAWN | S. DeMello (Redraw) PJP (Original) | DATE 2/20/85 |
| CHECKED | WR | 2/85 |
| ENGINEER | d. johnson | 2/25/85 |
| APPROVED | CB | 9/85 |
| DOCUMENT CONTROL | | RELEASE DATE |

FILENAME 100437.DWG –V"MAST"

ORE Offshore Division
ACCUSONIC TECHNOLOGIES INC.
25 Bernard St. Jean Drive
E. Falmouth, MA 02536
TEL: (508) 495-6600
FAX: (508) 495-6699

NAME

*MODEL 4610A & 4610B HYDROPHONE ASSEMBLY*

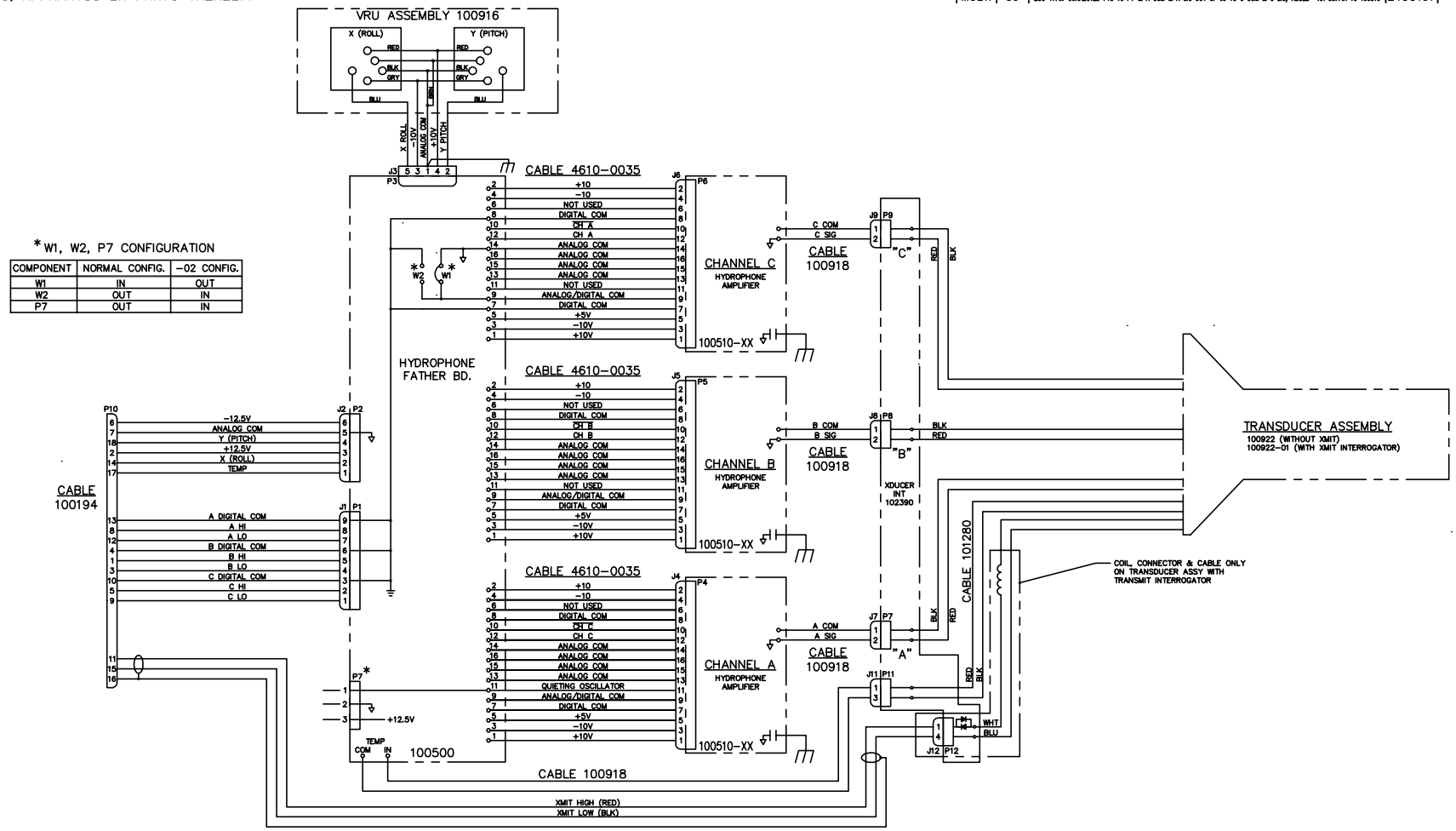
| SIZE | CODE IDENT. NO. | DWG. NO. | REV. |
|---|---|---|---|
| C | 25993 | *100437* | C2 |

SCALE NONE | WT. LBS. NA | SHEET 1 OF 1

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| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
| | C5 | ECO 3929: CAD REDRAW FROM D TO C SIZE W/CHG'S TO REFLECT NEW CABLE P/N 4610-0035; LAST ECO REF 3869 | 17NOV95 | MLE |
| MULTI | C6 | ECO 4170: CORRECTED P13 TO P7 & A COM & A SIG OUT OF J9 TO C COM & C SIG; ADDED -XX SUFFIX TO 100510 | 24OCT97 | |




| | |
|---|---|
| | |
| | |
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| | |
| | |
| | |
| | |
| | 100436-02 |
| 100490 | 100436-01 |
| NEXT ASSY | USED ON |
| APPLICATION | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

DECIMALS .X ±____ .XX ±____ .XXX ±____

ANGLES ±___° ___'

FRACTIONS ±___

SURFACE ROUGHNESS ✓

MATERIAL

CONTRACT NO. RD194

| | |
|---|---|
| DRAWN D. DeMello | 17NOV95 |
| CHECKED A.R. Marote | 2/21/85 |
| ENGINEER d. johnson | 2/21/85 |
| APPROVED C. B. | 2/22/85 |

100925.DWG -V"MAST"


ORE INTERNATIONAL Inc.
P.O. Box 709
Falmouth, MA 02541
TEL: (508) 548-5800
FAX: (508) 540-3835


NAME

# HYDROPHONE INTERCONNECTION DIAGRAM

| SIZE | CODE IDENT. NO. | DWG. NO. | REV. |
|---|---|---|---|
| C | 25993 | 100925 | C6 |

SCALE NONE | WT. LBS. NA | SHEET 1 OF 1

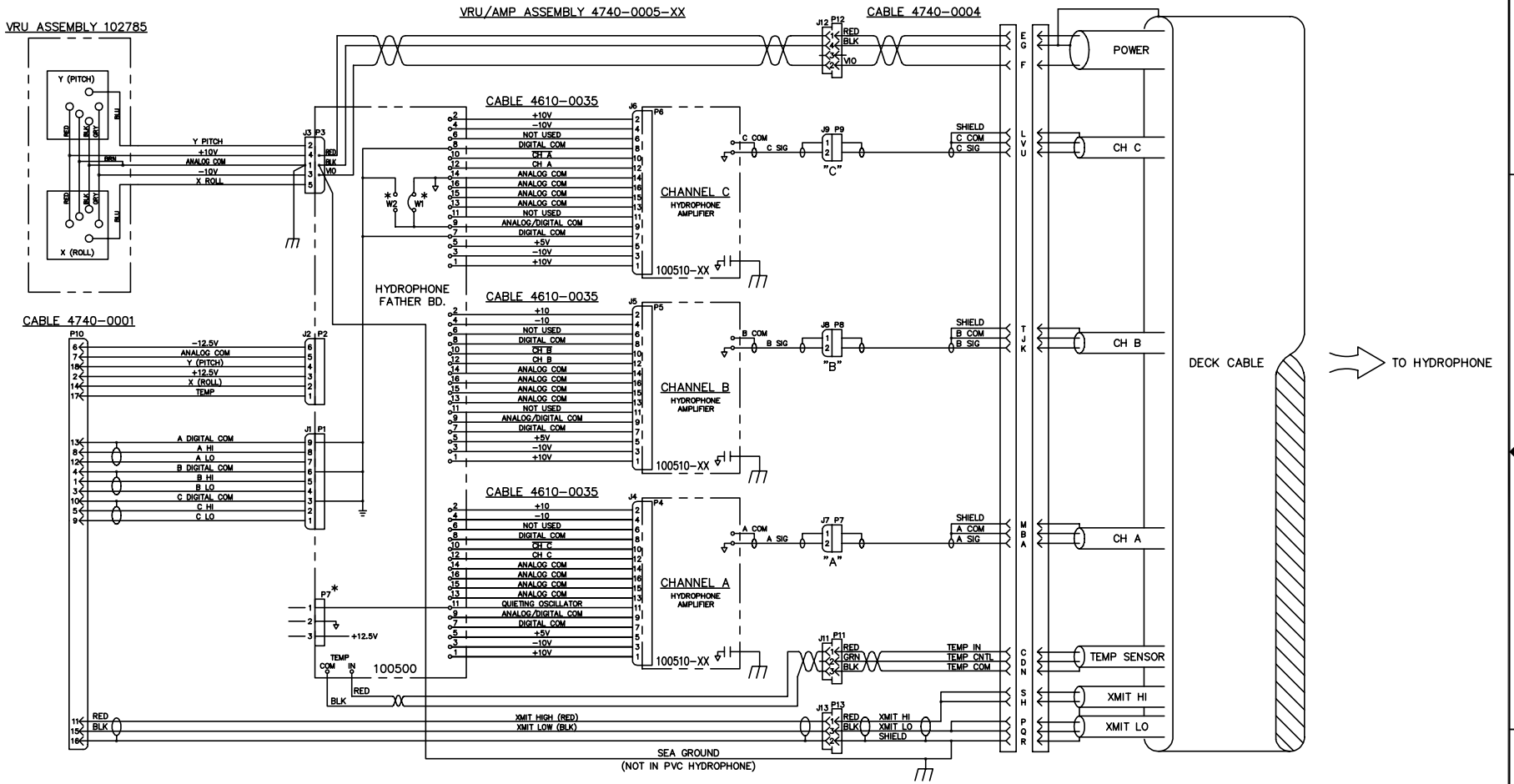
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-XX CONFIGURATIONS

| DASH XX # | FREQUENCY |
|---|---|
| -01 | 8-14 KHz |
| -02 | 22-30 KHz |
| -03 | 35-45 KHz |

REVISIONS

| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | B1 | ECO 3217: ADDED SEA GROUND FOR CHASSIS | 06SEP88 | |
| | B2 | SHIELD SYMBOL TO WIRE ON J1 CONN. CABLE | 15OCT89 | |
| | B3 | ECO 3869: ADDED FATHER BD-TO-SEA GROUND CONNECTION | 09SEP94 | |
| | C1 | ECO 4170: CAD REDRAW (WAS "D" SIZE); REFLECTS NEW CABLE P/N 4610-0035; CLERICAL UPDATES | 17OCT97 | |




*W1, W2, P7 CONFIGURATION

| COMPONENT | NORMAL CONFIG. | -02 CONFIG. |
|---|---|---|
| W1 | IN | OUT |
| W2 | OUT | IN |
| P7 | OUT | IN |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS .X ±____ .XX ±____ .XXX ±____
ANGLES ±___ ' ___ '
FRACTIONS ±___
SURFACE ROUGHNESS ✓
MATERIAL

NEXT ASSY | USED ON
APPLICATION

CONTRACT NO. EX15111

| | |
|---|---|
| DRAWN B. DiMatteo (Redraw) Apollo (Original) | 11/2/87 |
| CHECKED WR | 11/87 |
| ENGINEER DWF | 11/87 |
| APPROVED DWF | 11/87 |

4740W006.DWG -V"MAST"

ORE Offshore Division
ACCUSONIC TECHNOLOGIES INC
P.O. Box 709
Falmouth, MA 02541
TEL: (508) 548-5800
FAX: (508) 540-3835

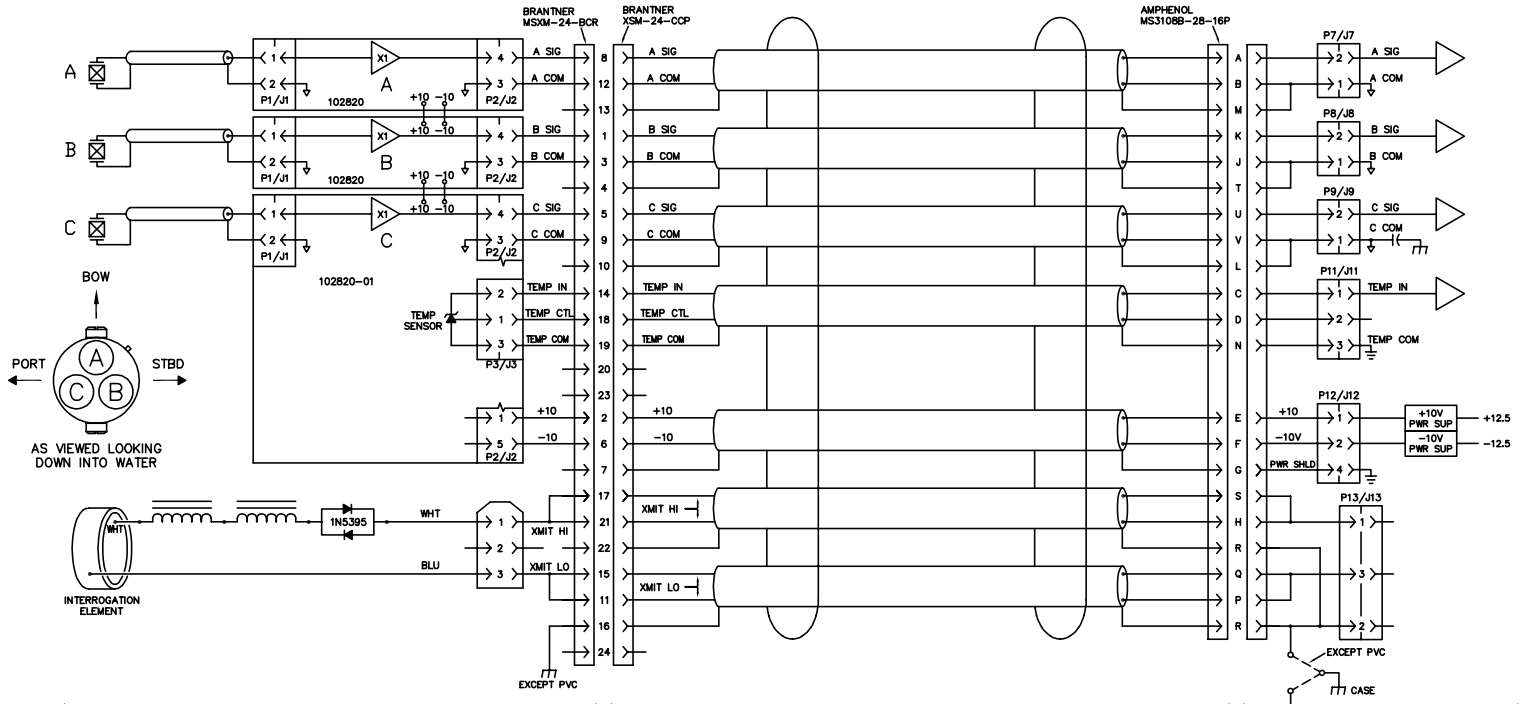
NAME
VRU/AMP INTERCONNECTION DIAGRAM

| SIZE | CODE IDENT. NO. | DWG. NO. | REV. |
|---|---|---|---|
| C | 25993 | 4740CW0006 | C1 |

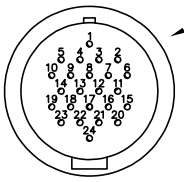
SCALE NONE | WT. LBS. NA | SHEET 1 OF 1

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| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
| | A2 | ECO 3206: UPDATED HYDROPHONE CONNECTOR PIN REF. & HYDROPHONE/DECK CABLE PIN OUT CHART | 10JUN88 | |
| | B1 | ECO 4170: CAD REDRAW (WAS "D" SIZE); UPDATED CONNECTOR P/N REFS. | 15OCT97 | |




| HYDROPHONE | PIN | CABLE |
|---|---|---|
| CH B SIGNAL | 1 | CH B SIGNAL |
| +10V | 2 | +10V |
| CH B COMMON | 3 | CH B COMMON |
| N.C | 4 | CH B SHIELD |
| CH C SIGNAL | 5 | CH C SIGNAL |
| -10V | 6 | -10V |
| N.C. | 7 | ±10V SHIELD |
| CH A SIGNAL | 8 | CH A SIGNAL |
| CH C COMMON | 9 | CH C COMMON |
| N.C. | 10 | CH C SHIELD |
| XMIT LO | 11 | XMIT LO |
| CH A COMMON | 12 | CH A COMMON |
| N.C. | 13 | CH A SHIELD |
| TEMP INPUT | 14 | TEMP INPUT |
| XMIT LO | 15 | XMIT LO |
| CHASSIS | 16 | XMIT LO |
| XMIT HI | 17 | XMIT HI |
| TEMP CONTROL | 18 | TEMP CONTROL |
| TEMP COMMON | 19 | TEMP COMMON |
| N.C. | 20 | N.C. |
| XMIT HI | 21 | XMIT HI |
| N.C. | 22 | XMIT HI SHIELD |
| N.C. | 23 | N.C. |
| N.C. | 24 | N.C. |




| | |
|---|---|
| NEXT ASSY | USED ON |
| APPLICATION | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

DECIMALS .X ±____ .XX ±____ .XXX ±____

ANGLES ±___° ___'

FRACTIONS ±___

SURFACE ROUGHNESS ✓

MATERIAL

CONTRACT NO. RD248

| | | |
|---|---|---|
| DRAWN | D. DeMello (Redraw) Apollo (Original) | 8/28/86 |
| CHECKED | WR | 11/87 |
| ENGINEER | D. FRASER | 10-13-87 |
| APPROVED | D. FRASER | 10-13-87 |

4211W003.DWG
-V"MAST"

ORE Offshore Division
ACCUSONIC TECHNOLOGIES INC
P.O. Box 709
Falmouth, MA 02541
TEL: (508) 548-5800
FAX: (508) 540-3835

NAME

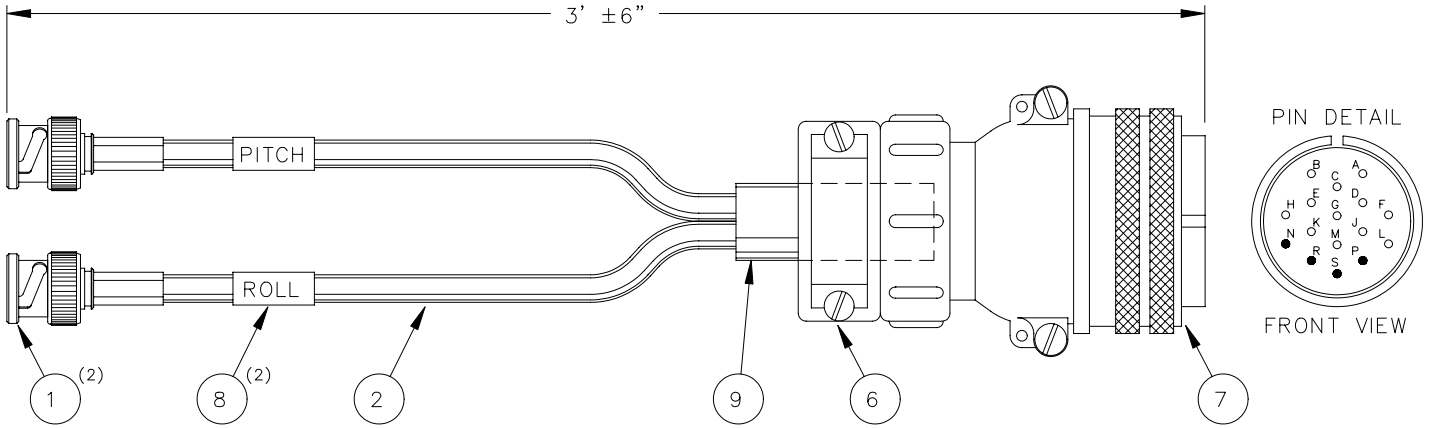
4211A, WIRING
HYDROPHONE and CABLE

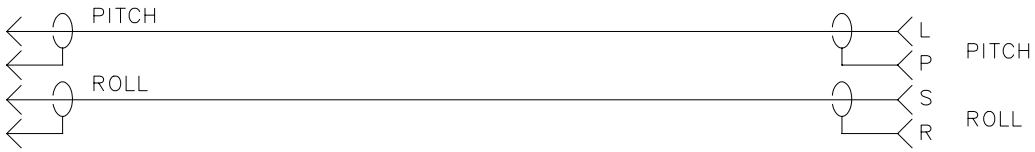
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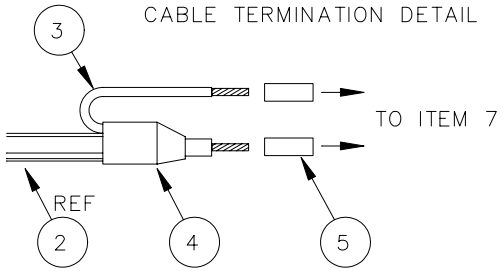
| SCALE | WT. LBS. | SHEET |
|---|---|---|
| NONE | NA | 1 OF 1 |

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| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
| | A2 | ECO #4600: DWG MEDIA UPDATED, ITEM 9 ADDED | 5/1/00 | MLE 5/00 |




**ORE / Accusonic Part No: 4410-0123**

| | |
|---|---|
| NEXT ASSY | USED ON |
| APPLICATION | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX .XXX
?___ ?___
ANGLES ?___?___'
FRAC ?_____
SURF ROUGHNESS ✓
MATERIAL
See BOM

| CONTRACT NO. | | |
|---|---|---|
| DRAWN | Apollo | DATE 7/1/97 |
| CHECKED | MLE | 7/97 |
| ENGINEER | DWF | 7.97 |
| APPROVED | DWF | 7/97 |
| DOCUMENT CONTROL | | RELEASE DATE |
| FILENAME | 4410A123.DWG | |

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ACCUSONIC TECHNOLOGIES INC.
25 Bernard St. Jean Drive
E. Falmouth, MA 02536
TEL: (508) 495-6600
FAX: (508) 495-6699

NAME
**CABLE, REMOTE PITCH/ROLL INTERFACE**

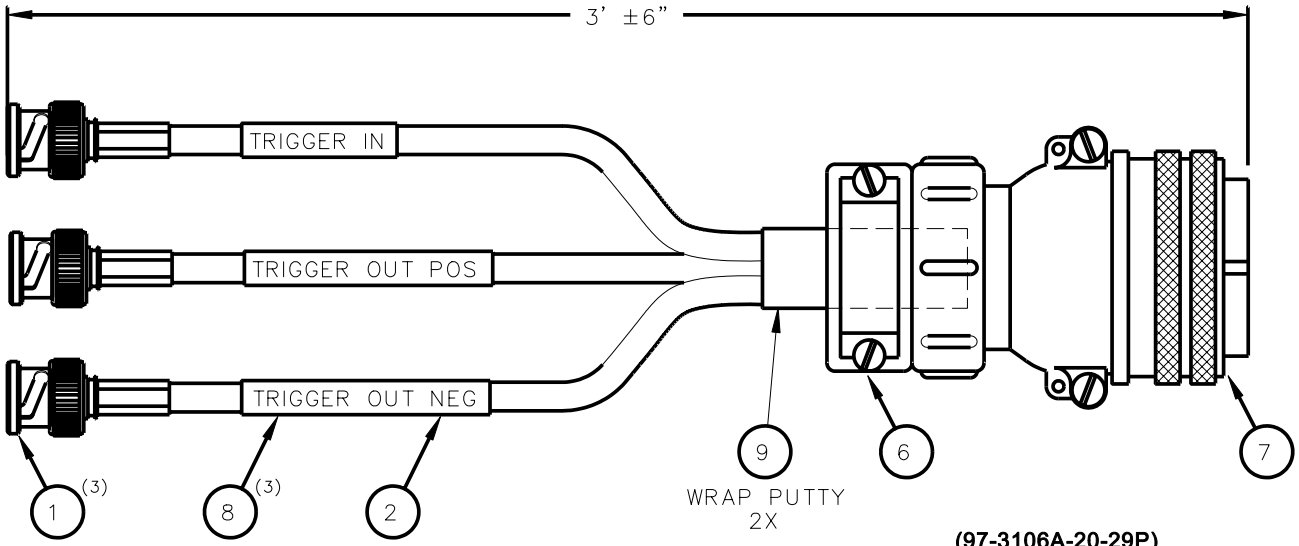
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|---|---|---|---|
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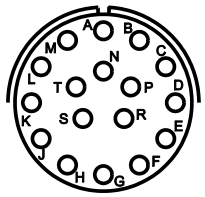
SCALE NONE | WT.LBS NA | SHEET 1 OF 1

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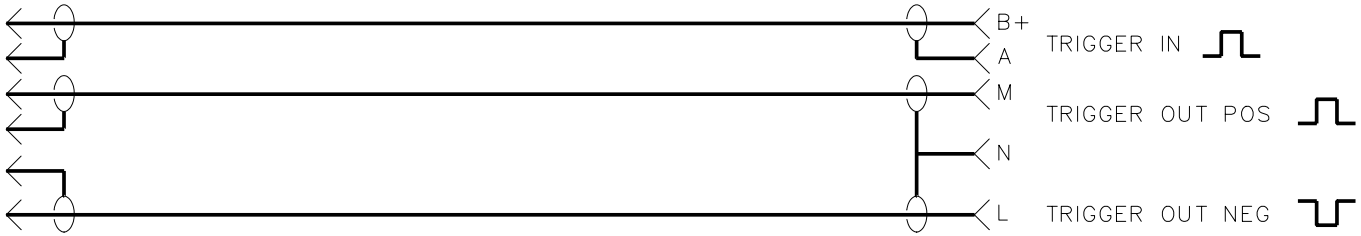
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|---|---|---|---|---|
| ECR# | REV | DESCRIPTION | DATE | APPROVED |
| | | | | |



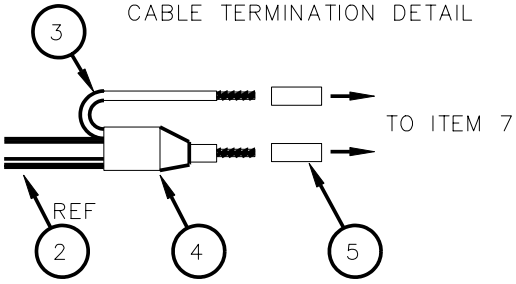




20-29

(97-3106A-20-29P)




CABLE TERMINATION DETAIL




| | | | |
|---|---|---|---|
| MATERIAL | UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES RESISTORS ARE IN OHMS CAPACITORS ARE IN MICROFARADS | APPROVALS | SIGNATURE & DATE |
| | | DRAWN | T. DUCE 5/22/06 |
| | | CHECKED | |
| FINISH | TOLERANCES | MECH | |
| | DECIMALS: 2 PLACES +/-.010; 3 PLACES +/-.005; FRACTIONS +/-1/64; ANGLES +/-0.5° | ELECT | |
| | | SYSTEM | |
| | DO NOT SCALE PRINT | REMOVE BURRS, BREAK SHARP EDGES | |

ORE OFFSHORE
4 LITTLE BROOK ROAD
WEST WAREHAM, MA 02576
WWW.ORE.COM
TEL. (508)291-0960

TITLE: CABLE, SYNC INTERFACE (TP3)

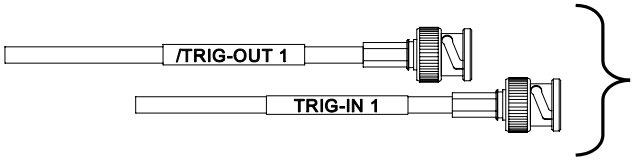
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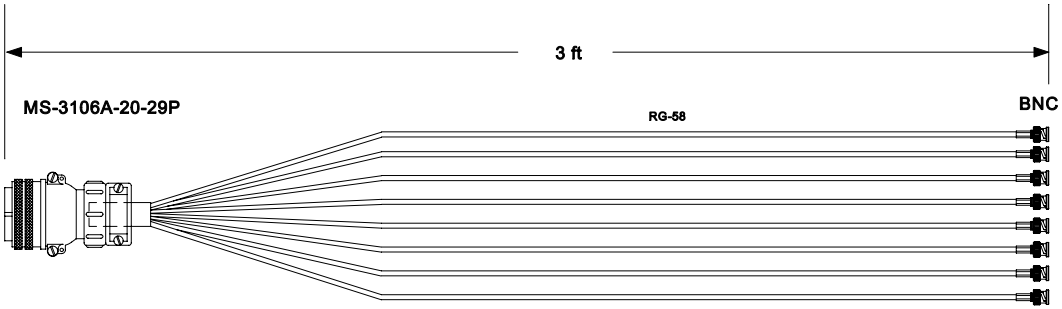
SCALE

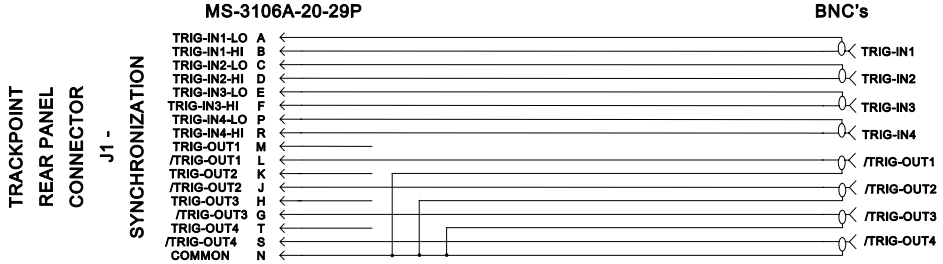
B | DRAWING NO. 4450BA0079 | REV 1

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|---|---|---|---|---|
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| | | | | |




| | | | |
|---|---|---|---|
| MATERIAL | UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES, RESISTORS ARE IN OHMS, CAPACITORS ARE IN MICROFARADS | APPROVALS | SIGNATURE & DATE |
| | | DRAWN | T. DUCE 7/25/06 |
| | | CHECKED | |
| FINISH | TOLERANCES | MECH | |
| | DECIMALS: 2 PLACES +/-.010; 3 PLACES +/-.005; FRACTIONS +/-1/64; ANGLES +/-0.5° | ELECT | |
| | | SYSTEM | |
| | DO NOT SCALE PRINT | REMOVE BURRS, BREAK SHARP EDGES | |

ORE OFFSHORE
4 LITTLE BROOK ROAD
WEST WAREHAM, MA 02576
WWW.ORE.COM
TEL. (508)291-0960

| | | | |
|---|---|---|---|
| TITLE | SYNC INTERFACE CONNECTOR TRACKPOINT 3-S CONSOLE | | |
| CADFILENAME: | SCALE | B | DRAWING NO. 4450BA0084 — REV A |

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