Chirp III
Acoustic Profiling System

System Manual

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Changes

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Quick Start Guide

Use the 8-step procedure listed below to quickly set up, activate and deploy the Chirp III Acoustic Profiling System without having to read this entire manual. The page numbers in SECTION 3, "Setup and Deployment," where specific information and instructions regarding each step can be found, are included. When viewing this manual in Adobe Acrobat Reader, click the page number to go directly to the page.

Step 1: **Unpack and inspect the system components (page 3-3).**

Step 2: **Set up the DSP-665 Transceiver (page 3-5).**

Step 3: **Assemble the TTV-290 Tow Vehicle (page 3-6).**

Step 4: **Connect the DSP-365 Transceiver (page 3-7).**

Step 5: **Review the DSP-665 Transceiver operator functions (page 3-13).**

Step 6: **Select and install the sonar acquisition and display software on the client computer (page 3-15).**

Step 7: **Activate the system, configure the server parameters and perform the predeployment checks (page 3-15).**

Step 8: **Select and connect an armored coaxial tow cable and launch the tow vehicle (page 3-23).**

Preface

Congratulations on your purchase of the Chirp III Acoustic Profiling System! The Chirp III delivers high resolution subbottom profiling using advanced chirp and conventional continuous wave (CW) technologies.

This manual is divided into seven sections and two appendices:

Section 1 - Overview describes the major system components and explains chirp sonar technology.

Section 2 - Specifications lists the specifications for the shipboard component of the system, the available tow vehicles, and a hull mount system.

Section 3 - Setup and Deployment encompasses unpacking and setup of the system components; descriptions of the connections and operator functions; configuration of system parameters; and a system startup procedure that includes tow vehicle deployment.

Section 4 - Theory of Operation describes the circuit functions and signal flows at the circuit board level for the shipboard component of the system.

Section 5 - Maintenance covers routine maintenance and includes some troubleshooting recommendations and instructions on how to check cables and transducers.

Section 6 - Drawings includes assemblies, wiring diagrams and cable drawings for the system.

Appendix A - Hull Mount Installation Requirements includes a general overview of the requirements for installing a hull mount system.

Notes and Warnings

Where applicable, special notes and warnings are presented as follows:

NOTE A referral to another part of this manual or to another reference; a recommendation to check that certain criteria are met before proceeding further in a step or sequence; or general information applicable to the setup and operation of the Teledyne Benthos Chirp III Acoustic Profiling System.

WARNING A reminder that dangerous or damaging consequences could result if certain recommended procedures are not followed.

Customer Service

We welcome your comments and suggestions about this manual and about specific applications for the Chirp III Acoustic Profiling System and other Teledyne Benthos products. Therefore, please contact Customer Service should you have any comments or suggestions, or if you require service or support.

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SECTION 1

Overview

The Teledyne Benthos **Chirp III Acoustic Profiling System** is a fully integrated dual channel, dual frequency sonar system that employs both chirp and conventional continuous wave (CW) technologies to produce high resolution subbottom profiles of both the shallow and deep subbottom layers. The system is modular in design, as it can be configured with a variety of tow vehicles as well as a hull mounted transducer array. In addition, the system will process and display data from a non-chirp source, such as a boomer or sparker, in one channel while simultaneously processing data from the chirp source in the second channel.

The system comprises the Teledyne Benthos **DSP-665 Transceiver** shown in Figure 1-1 and a selection of tow vehicles, including the **TTV-170 Series Tow Vehicle** shown in Figure 1-2 and the **TTV-290 Series Tow Vehicle** shown in Figure 1-3. A hull mount transducer array with **AT-471** low frequency transducers and an **AT-12D7** high frequency transducer also is available and is shown in Figure 1-4. The tow vehicles and the hull mount transducer array are each designed for specific applications; hence together they serve a broad range of applications. This section provides a general description of the system and its various configurations and identifies some of its important features. A review of chirp technology also is presented and how the system makes use of its important advantages.

Main System Components

The DSP-665 Transceiver is the main surface component of the system. It is a dual channel (DSP-6652) or a single channel (DSP-6651) high power transmitter and receiver that generates amplified chirp and CW waveforms to drive the tow vehicle transducers or hull mounted transducer array and receive the subbottom echoes. The DSP-665 Transceiver also provides an Ethernet connection to a client computer running third party sonar data acquisition and display software. The client computer is optionally supplied, and the sonar data acquisition and display software is SonarWiz which is available from Chesapeake Technologies.

Figure 1-1 The DSP-665 Transceiver

Figure 1-2 The TTV-170 Series Tow Vehicle for Shallow Water Applications

Figure 1-3 The TTV-290 Series Tow Vehicle for Deep Water Applications

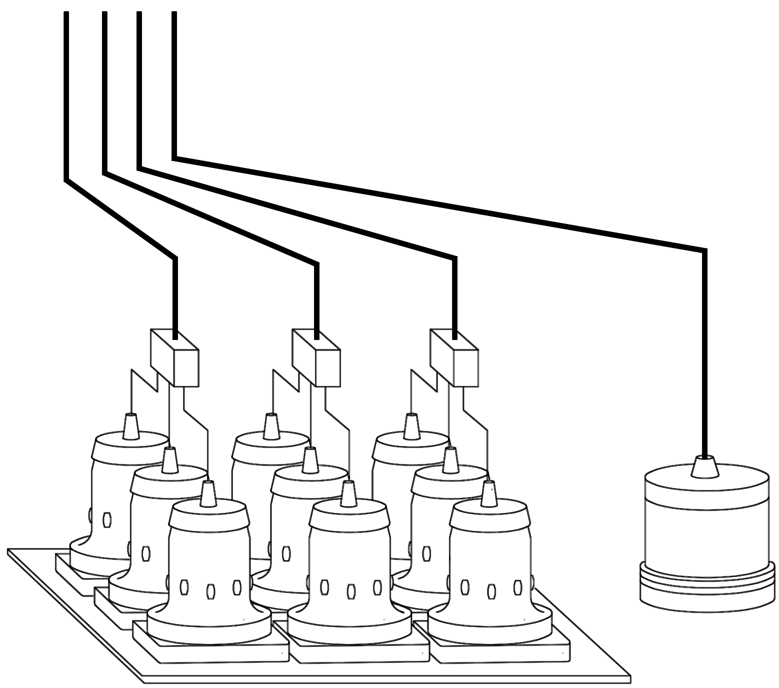

Figure 1-4 The Hull Mount Array with AT-471 and AT-12D7 Transducers

The Teledyne Benthos tow vehicles are the subsea components of the system and are each individually designed to meet specific applications including the following:

For shallow water surveys the TTV-170 Series Tow Vehicle *includes a choice of a dual channel TTV-172 with a single low frequency transducer, a multiple element high frequency transducer and two hydrophone arrays arranged in a dipole configuration for a narrow receive beam; or a single channel TTV-171 with a single low frequency transducer and the same hydrophone configuration.*

For deep water surveys the TTV-290 Series Tow Vehicle *includes a choice of a dual channel TTV-192 with four low frequency transducers, a multiple element high frequency transducer, and a linear hydrophone array consisting of eight transducer elements; or a single channel TTV-191 with four low frequency transducers and the same hydrophone configuration.*

A hull mount transducer array allows deep water surveys to be performed without the use of a tow vehicle. A complete hull mount system includes the following:

Multiple Teledyne Benthos AT-471 low frequency transducers *that are installed in a hull-mounted sea chest and provide narrow low frequency transmit and receive beams;*

A Teledyne Benthos At-12D7 High Frequency Transducer *that is installed with the low frequency transducers and contains multiple internal elements that provide narrow high frequency transmit and receive beams; and*

A Remote Controlled Transmit/Receive Module *that connects the transducer arrays to the workstation and includes a transmit/receive (T/R) network and programmable gain amplifiers, which optimize performance in shallow water as well as in deep water; and*

All required cables and a junction box *for installation and wiring of the hull mount transducer array.*

A system block diagram, which depicts the functional relationships of the shipboard processing electronics and the tow vehicle or hull mount transducer arrays and hydrophones, is shown in Figure 4-1 on page 4-4.

Advantages of Chirp Sonar

Chirp sonar technology employs swept FM transmitted signals along with digital signal processing for matched-filter processing of reflected energy. The chirp technology delivers the following performance features:

A greater dynamic range *is attained as long FM pulses provide an additional 20 dB to 30 dB of dynamic range over conventional subbottom sonar systems;*

Enhanced resolution *is achieved with matched-filter processing, as compared to systems using standard processing in the same frequency band, by correlating the return signals with a replica of the outgoing pulse;*

Transmitted waveforms are repeatable *from pulse to pulse;*

The temporal resolution is constant*, both with range and penetration;*

The pulse characteristics are programmable*, as the pulse length, span of frequency sweep and phase/amplitude calibration of the transmitted waveform can be varied without hardware changes; and*

The sonar data can be stored for off-line processing *in SEG-Y format on a hard drive, a DVD or other high-density storage device.*

DSP-665 Transceiver

The DSP-665 Transceiver incorporates two power amplifiers as well as filtering for separating the received signals. The chirp and CW waveforms are generated by the transceiver and are amplified by the power amplifiers which drive the transducers. Received signals are input to the transceiver, filtered and then processed using matched-filter digital signal processing, applying continuous Short Time Fourier Transforms (STFT) for each sweep or transmit cycle. The transceiver also includes a preamplifier with adjustable gain for amplifying the output of non-chirp systems, and two T/R networks which allow the transceiver to transmit *and* receive from the same transducer or transducer array.

External Connections

The DSP-665 Transceiver connects to the client computer over an Ethernet 10/100BaseT connection, allowing the computer to send commands to the transceiver while simultaneously receive sonar data from the transceiver. Although the client computer typically connects directly to the transceiver, these two components can also be connected through a hub or router on a local area network (LAN). In addition, the transceiver includes inputs for externally triggering the sonar, analog and preamplifier inputs and outputs, hydrophone inputs, the system’s main power switch, preamplifier gain controls, and transmit indicators.

TCP/IP Connection

For the client computer to communicate with the DSP-665 Transceiver, it must be running an operating system that can support a Transmission Control Protocol/Internet Protocol (TCP/IP) connection, such as Windows 98/NT/2000/XP, Linux, Unix, or Solaris, and have a Ethernet 10/100BaseT adaptor installed. In addition, an IP address must be assigned to the computer. To control the transceiver sonar on the tow vehicle, and to acquire, display and store sonar data, third party sonar data acquisition and display software that is compliant with the Teledyne Benthos Chirp III Server must be installed on the client computer. The Teledyne Benthos Chirp III Server runs on the DSP-665 Transceiver.

Client Computer

A client computer is optionally available from Teledyne Benthos. This computer is an industrial grade rack mount PC with dual core processors as shown in Figure 1-5. The computer includes a monitor, a keyboard and a mouse which are shown in Figure 1-6. The computer runs the sonar data acquisition and display software from any of the listed software manufacturers. The software, along with the required operating system, can be optionally factory installed for a complete turn-key system.

Figure 1-5 Industrial Grade Rack Mount PC

Figure 1-6 Monitor, Keyboard and Mouse

Tow Vehicles

The TTV-170 and TTV-290 Series Tow Vehicles are available for use with the Chirp III Acoustic Profiling System. Each tow vehicle is designed to function optimally in specific applications. In all the tow vehicles the low frequency transducers operate in the 2 kHz to 7 kHz band (Channel 1), and the high frequency transducers operate in the 10 kHz to 20 kHz band (Channel 2).

TTV-170 Series Tow Vehicle

The TTV-170 Series Tow Vehicle is designed for use on small boats in relatively shallow water; it will operate in depths of up to 600 meters. The tow vehicle is relatively small, with a length of 37.0 inches and a cross section of 12.7 by 17.1 inches, and is constructed of a two-part fiberglass shell and aluminum tow body. The TTV-172 Tow Vehicle is configured for dual frequency operation and includes an AT-471 low frequency transducer, an AT-14F7C high frequency 7-element transducer and two 8-element hydrophone arrays. The hydrophone arrays are positioned in parallel, thus forming a dipole configuration that provides a narrower beam in the athwart direction. The transducers and hydrophones are interconnected with a block mold assembly that connects to the tow cable with a single connector. The TTV-171 Tow Vehicle is configured with a single AT-471 transducer for single channel low frequency operation.

TTV-290 Series Tow Vehicle

The TTV-290 Series Tow Vehicle is designed to operate in depths up to 1000 meters. The body of the tow vehicle is 82 inches long with a cross section of 15.1 by 21.0 inches, and is composed of a 316 stainless steel frame to which the upper and lower halves of a polyethylene shell are attached. Three tail fins, which attach directly to the frame, provide stability while under tow. The frame also includes a selection of tow points which extend through the top of the upper shell. And the shell has four handles, two on each side, for carrying the tow vehicle. The TTV-192 Tow Vehicle is configured for dual frequency operation and includes four AT-471 low frequency transducers, an AT-14F7C high frequency 7-element transducer and an eight-element hydrophone array. The transducers and hydrophones are interconnected with a block mold assembly that connects to the tow cable with a single connector. The TTV-291 Tow Vehicle is configured with four AT-471 transducers for single channel low frequency operation.

Hull Mount Transducer Array

The Teledyne Benthos hull mount transducer array is configured in a hull-mounted sea chest and is permanently connected to the DSP-665 Transceiver. The system is designed primarily for deep water applications; however, the Remote Controlled Transmit/Receive Module, which is controlled by the transceiver, allows for shallow water applications as well, as it is configured with two remotely controlled gain stages that amplify weak return signals and attenuate strong return signals. The hull mounted systems incorporate from 4 to 16 AT-471 low frequency transducers, which operate in the 2 kHz to 7 kHz band, and an AT-12D7 multiple-element high frequency transducer that operates in the 10 kHz to 20 kHz band. The transducers are wired through a junction box that connects to the Remote Controlled Transmit/Receive Module and the transceiver. The hull mount systems do not use a separate hydrophone as the transducers perform both the transmit and receive functions through a T/R network in the module.

Chirp Technology

Chirp technology uses digitally produced linear FM acoustic transmissions to produce high resolution images of seafloor contours and subbottom layers.

In all sonar systems, higher frequency content is invariably associated with an increase in resolution and, in the case of a subbottom sonar, a decrease in bottom penetration. Chirp technology, as implemented in the Chirp III Acoustic Profiling System, reduces this trade-off, providing *both* high resolution and penetration.

Image Resolution

For subbottom sonar, sound energy transmitted to the seafloor is reflected off the boundaries between layers of different acoustic impedances. The first boundary is between the water and the seafloor itself. As layers of clay, sand and various other sediments succeed each other, they create other interfaces that reflect sound. It is the energy reflected from these boundaries that the system uses to build the image.

The resolution of an imaging system is measured by its ability to separate closely spaced objects, i.e., to detect discrete echoes returning from the interfaces between layers. The vertical resolution of an acoustic subbottom profiler refers to the minimum distance that can be visually distinguished in the image produced by the system. A sonar system with a 10 cm resolution will resolve layers that are at least 10 cm apart. Layers spaced closer than 10 cm will be resolved by the system as one layer. In a conventional single-frequency system, the limit of its resolution is determined by the pulse length of the transmitted waveform. In a multi-frequency system, such as the Chirp III Acoustic Profiling System, it is the bandwidth of the transmitted pulse that sets the system's theoretical resolution. The theoretical sonar range resolution of a conventional single frequency system is calculated by multiplying the length of the pulse by the speed of sound and then dividing the product by 2 to account for the pulse’s round trip.

range resolution = pulse length x speed of sound / 2

The pulse length equivalent of the de-chirped swept frequency pulse equals the inverse of the bandwidth.

pulse length = 1 / bandwidth

For example, the duration of a pulse with a bandwidth of 9 kHz, which is the bandwidth of a system configured to operate between 1 and 10 kHz, is approximately 100 μsec (1/9000 Hz = 0.0001 sec). Travelling at about 1540 m/sec, the sound will traverse approximately 15 cm in 100 μsec. Allowing for the round trip, this results is a one-way distance of 7.5 cm, which is the range resolution. In addition to the frequency and bandwidth of the insonifying beam, other interrelated factors that affect the system's resolution are:

- ***The horizontal width of the beam***
- ***The tow speed of the vehicle***
- ***The distance between the tow vehicle and the bottom***
- ***The nature of the signal processing***

Figure 1-7 illustrates the vertical resolution achieved with a wide beam transducer that insonifies a large area of the seafloor. The transducer produces a series of reflections that stretch the returned pulse length. The system can distinguish between pulses returning as Echo 1 and Echo 2, but cannot distinguish between Echo 2 and Echo 3.

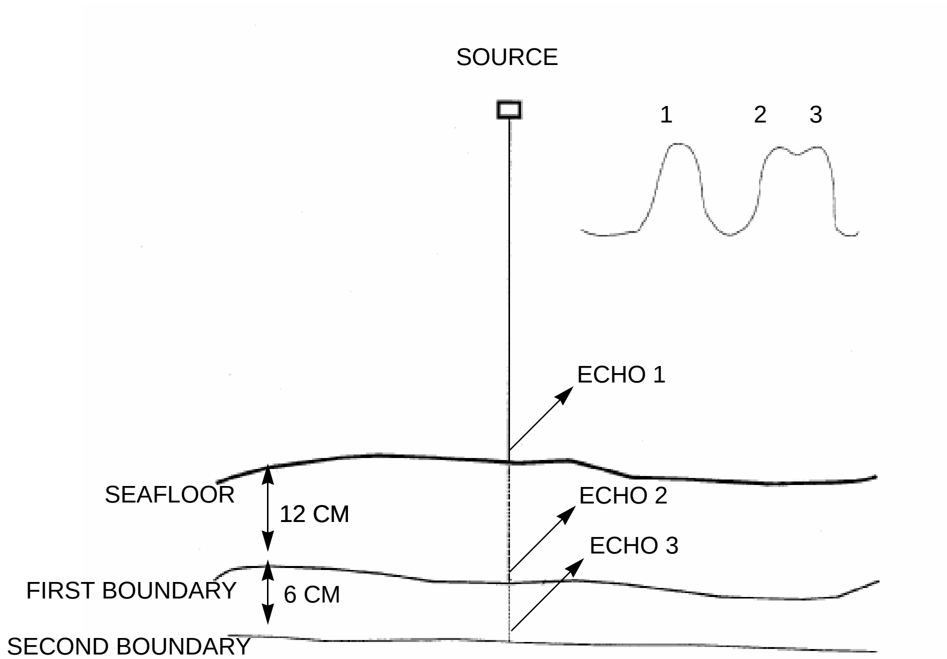

Figure 1-7 Resolving Closely Spaced Layers

The larger the area that is insonified, the more the return pulse will be stretched. A 1 millisecond pulse could be stretched to 1.5 or 2 milliseconds. The stretching of the pulse results in the smearing of features that are close together. The transmitted pulse of 1 millisecond corresponds to a 1 kHz bandwidth; but the received pulse, stretched to 1.5 millisecond, for example, corresponds to a 675 Hz bandwidth. This pulse stretching effectively reduces the bandwidth and with it, the system's ability to resolve layers or objects that are closely spaced. Therefore, narrower beams produce better resolution.

Signal processing improves resolution by eliminating or attenuating beam components that would otherwise degrade the resolution. All transmitted narrow beam sound pulses produce side lobes, which contain energy that stretches the pulse and produces undesired echoes from reflections not located in the primary beam. In conventional sidescan and subbottom sonar systems, resolution is lost to stretching by the side lobes. With chirp technology, the side lobes are greatly reduced through matched-filter processing, which attenuates signals that do not correlate well with the transmitted pulse.

The second factor that affects the image quality is the signal-to-noise ratio. As the transmitted pulse travels through the water, its amplitude becomes attenuated and falls below the noise level. The Chirp III uses matched-filter correlation processing to improve the signal-to-noise ratio and hence the quality of the sonar images.

Chirp Pulse Transmission and Reception

Both subbottom channels of the Chirp III Acoustic Profiling System operate according to the same principles, but one channel transmits and receives low frequency chirp pulses, and the other transmits and receives high frequency chirp pulses. The sequence of steps in the transmission and reception of the chirp pulses for both channels are summarized as follows:

1. Using a digital signal processor (DSP), a linear FM pulse is generated.
2. The signal is sent to a power amplifier which drives the subbottom transducer or transducer array.
3. The subbottom transducer or transducer array transmits the pulse and returns are received by the hydrophone array. Using separate transmitter and receiver arrays preserves linearity and allows simultaneous signal transmission and reception.
4. Reflections at the hydrophone array are filtered and amplified.
5. The sonar signals are digitized with a 16-bit A/D converter.
6. A digital processor in the transceiver, one for each channel, de-chirps (compresses the FM reflections using the matched-filter) the return signals from the subbottom hydrophone. This correlates the received reflections with a compensated replica of the outgoing pulse. The replica used in the matched-filter contains the predetermined phase correction and amplitude weighting to correct anomalies in the transmitting and receiving hardware. Signals that do not resemble the outgoing pulses are attenuated by this type of processing. Compressed returns can be further processed with adjustable Time Varied Gain (TVG) and selectable spreading loss correction for amplitude losses from attenuation and absorption by the water.

SECTION 2

Specifications

The information in this section encompasses the physical and performance specifications for the DSP-665 Transceiver, the TTV-170 and TTV-290 Series Tow Vehicles, and the hull mount system. The recommended minimum requirements for the client computer are also included. All specifications are subject to change without notification.

Client Computer Recommended Minimum Requirements

Any computer meeting the recommended minimum requirements listed below can be used as the client computer. A client computer is optionally available from Teledyne Benthos as described in "Client Computer" on page 1-8. The computer also requires a monitor, a keyboard and a mouse. The recommended screen size for the monitor is 17 inches, and the resolution, 1280 X 1024.

Software

Application:	Third party data acquisition and display
Operating system:	Microsoft® Windows® XP Professional

Processor

CPU:	Intel® 3.4 GHz Pentium® 4, 800 MHz FSB, 1MB L2 cache
Memory:	2GB DDR-667 SDRAM
I/O ports:	Keyboard PS/2 Mouse PS/2 USB (6) RS-232 serial (4) Parallel Ethernet 10/100/1000BaseT (2)
Graphics processor:	Intel Graphics Media Accelerator 950
Monitor:	20-inch LCD, 1680 x 1050 resolution
Data storage:	500GB SATA2 in removable carrier DVD R/W drive
Power input:	110/220 VAC

DSP-665 Transceiver

The DSP-665 Transceiver connects to both the client computer and the TTV-170 or TTV-290 Series Tow Vehicle or hull mount system. It provides communications with client computer over the Ethernet 10/100BaseT connection, powers the transducers on the tow vehicle or hull mount system and inputs the received sonar signals.

Power Requirements

Power input: 100–125 VAC or 220–240 VAC, 50–60 Hz, 350 watts, auto sensing

NOTE If a generator is to be used as the power source, a rating of 1500 watts is recommended.

Input/Output

Operator functions:

Chirp transmit pulse length, user selectable from 5.0 to 60.0 sec

Transmit repetition rate, user selectable from 0.062 to 8.000 sec

Transmit power control, user adjustable from 0 dB to 21 dB of attenuation

Preamplifier gain, user adjustable from 0 dB to 42 dB

Chirp or CW operation selection
CW frequency selections
Enable or disable channels
Server IP address entry
TCP port entry
Internal or external trigger selection
Rectified output selection
Connect or disconnect to client
Power switch

	Power indicator Channel 1 transmit indicator Channel 2 transmit indicator Channel 1 analog switch Channel 2 analog switch Auxiliary input select switch Preamp gain switch Channel 1 hydrophone/T/R switch Channel 2 hydrophone/T/R switch Fuse
External connections:	Channel 1 analog input Channel 2 analog input Low frequency auxiliary input High frequency auxiliary input External key input Key output Chirp hydrophone output Analog hydrophone output Preamplifier input Preamplifier output Channel 1 receive input Channel 2 receive input Hydrophone output Tow vehicle/hull mount input Ethernet 10/100BaseT Power

TTV-170 Series Tow Vehicle

The TTV-170 Series Tow Vehicle is designed for use on small boats in relatively shallow water. The TTV-172 is configured with a low frequency transducer, a high frequency transducer and two hydrophone arrays. The TTV-171 is configured for single frequency operation with the low frequency transducer and the hydrophone arrays.

Physical Characteristics

Construction:	Two-part fiberglass shell with 6061 aluminum tow body
Dimensions:	94 cm (37 in.) long and 32.4 cm (12.7 in.) by 43.4 cm (17.1 in.) in cross section
Weight in air (TTV-172):	75 lb (34 kg)
Weight in water (TTV-172):	45 lb (20 kg)
Tether system:	Either of two Industry-standard multi-conductor cables: Teledyne Benthos TWC-602, Kevlar reinforced, with three twisted/shielded pairs and three conductors—for use with separate steel tow cable, or Teledyne Benthos TWC-601, Rochester 301301 double-armored, with three coaxial pairs and three single conductors—for use with winch and slip rings
Operating depth:	600 meters
Towing speed:	1 to 6 knots operational

Low Frequency Sonar

Transmitter transducer:	Teledyne Benthos AT-471 low frequency transducer

Power output: 400 watts, 15% duty cycle at 3.5 kHz for 197 dB re 1 μPa @ 1 m nominal, 4 kw maximum at reduced duty cycle

Frequency range: Sweeps in the 2 kHz to 7 kHz band

Transducer radiation: 100° conical

High Frequency Sonar

Transmitter transducer: Teledyne Benthos AT-14F7C high frequency transducer

Power output: 90 watts, 15% duty cycle at 17 kHz for 205 dB re 1 μPa @ 1 m nominal, 4 kw maximum at reduced duty cycle

Frequency range: Sweeps in the 10 kHz to 20 kHz band

Transducer radiation: 30° conical

Sonar Receiver

Receiver hydrophone: Two 8-element hydrophone arrays

Frequency band: 2 kHz to 100 kHz

TTV-290 Series Tow Vehicle

The TTV-290 Series Tow Vehicle is designed for use in deep water. The TTV-292 is configured with four low frequency transducers, a high frequency transducer and a hydrophone array. The TTV-291 is configured for single frequency operation with the four low frequency transducers and the hydrophone array.

Physical Characteristics

Construction: Two-part aluminum reinforced fiberglass

Dimensions: 208.7 cm (82 in.) long and 38.4 cm (15.1 in.) by 53.3 cm (21.0 in.) in cross section

Weight in air (TTV-292): 330 lb (150 kg)

Weight in water (TTV-292):	210 lb (95 kg)
Tether system:	Either of two Industry-standard multi-conductor cables:
	Teledyne Benthos TWC-602, Kevlar reinforced, with three twisted/shielded pairs and three conductors—for use with separate steel, tow cable, or
	Teledyne Benthos TWC-601, Rochester 301301 double-armored, with three coaxial pairs and three single conductors—for use with winch and slip rings
Operating depth:	1000 meters
Towing speed:	1 to 8 knots operational

Low Frequency Sonar

Transmitter transducer:	Four Teledyne Benthos AT-471 low frequency transducers
Power output:	1.6 kw, 15% duty cycle at 3.5 kHz for 209 dB re 1 μPa @ 1 m nominal, 4 kw maximum at reduced duty cycle
Frequency range:	Sweeps in the 2 kHz to 7 kHz band
Transducer radiation:	45° conical

High Frequency Sonar

Transmitter transducer:	Teledyne Benthos AT-14F7C high frequency transducer
Power output:	90 watts, 15% duty cycle at 17 kHz for 205 dB re 1 μPa @ 1 m nominal, 4 kw maximum at reduced duty cycle
Frequency range:	Sweeps in the 10 kHz to 20 kHz band
Transducer radiation:	30°

Sonar Receiver

Receiver hydrophone: Teledyne Benthos AT-473D hydrophone

Frequency band: 1.5 kHz to 40 kHz

Hull Mount System

For deep water applications a hull mount array of 4 to 16 low frequency transducers and a high frequency transducer can be installed in a hull-mounted sea chest. The transducers perform both the transmit and receive functions. The transducers are wired to a junction box, which is permanently connected to the workstation through the Remote Controlled Transmit/Receive Module. The specifications that follow are for a hull mount system that incorporates 16 low frequency transducers and one high frequency transducer.

Low Frequency Sonar

Transmitter transducer: 16 Teledyne Benthos AT-471 low frequency transducers

Power output: 2.3 kw, 15% duty cycle at 3.5 kHz for 217 dB re 1 μPa @ 1 m nominal, 4 kw maximum at reduced duty cycle

Frequency range: Sweeps in the 2 kHz to 7 kHz band

Transducer radiation: 25°

High Frequency Sonar

Transmitter transducer: Teledyne Benthos AT-12D7 high frequency transducer

Power output: 1 kw, 15% duty cycle at 15 kHz for 214 dB re 1 μPa @ 1 m nominal, 4 kw maximum at reduced duty cycle

Frequency range: Sweeps in the 10 kHz to 20 kHz band

Transducer radiation: 27°

Remote Controlled Transmit/Receive Module

Control:	Software control through LPT2 parallel port
Preamplifier gain:	46 dB in 3 dB increments
Preamplifier attenuation:	46 dB in 3 dB increments

SECTION 3

Setup and Deployment

Setting up the Chirp III Acoustic Profiling System begins with the careful unpacking and inspection of the system components. Once this is complete, the DSP-665 Transceiver can be set up and connected to the tow vehicle and to a client computer. The system can then be activated, some predeployment checks made, and the tow vehicle deployed. This section encompasses these operations, describes the operator controls and indicators on the transceiver and includes a startup procedure for getting the system operational as quickly as possible. In addition, other system configurations are described for use with an alternate acoustic source.

If a hull mount system is to be installed, refer to APPENDIX A, "Hull Mount System Installation Requirements," for an overview of the requirements for installing a hull mount system and connecting it to the DSP-665 Transceiver.

NOTE Once the tow vehicle is deployed and the system is operating, refer to the operating instructions provided with the third party sonar data acquisition and display software installed on the client computer.

Unpacking

The DSP-665 Transceiver and the tow vehicles are shipped in separate, reusable shipping containers. If an optional client computer is included, it is shipped in a third shipping container. The system documentation is included in one of the containers or shipped separately. The containers typically include the items listed below; however, be sure to check the packing list to verify the exact contents—especially for a hull mount system where the number of containers and their contents will vary, depending on the configuration.

Container (1 of 2):

- ***DSP-665 Transceiver***
- ***Network crossover cable***
- ***Network patch cable***
- ***AC power cable***

Container (2 of 2):

- ***TTV-170 Series Tow Vehicle***
- ***Kevlar reinforced deck cable***

or

- ***TTV-290 Series Tow Vehicle***
- ***Kevlar reinforced deck cable***
- ***Vertical tail fin***
- ***Horizontal tail fins***
- ***Tail fin mounting hardware***

Documentation package (may be included in a shipping container):

- ***"Chirp III Acoustic Profiling System—System Manual"***
- ***Software CD***
- ***Manuals for optional components***

NOTE The TTV-290 Series Tow vehicle requires some assembly and is shipped with all the required components within the shipping container. The TTV-170 Tow Vehicle is shipped complete.

Inspect the shipping containers for any signs of external damage. Do not operate or deploy any equipment that appears damaged. Immediately report any damage to Teledyne Benthos customer service and to the freight carrier.

NOTE For information on how to contact Teledyne Benthos customer service, refer to "Customer Service" on page vii.

Perform the steps below to unpack the DSP-665 Transceiver and the tow vehicle.

1. Carefully remove the DSP-665 Transceiver, along with the network and AC cables, from its shipping container.

For a TTV-290 Series Tow Vehicle only,

2. Using a screw driver, pry off the retaining clips on the lid of the wooden box containing the tow vehicle and remove the lid to expose the compartment in the cover of the box.
3. Remove the Kevlar reinforced deck cable, the vertical and horizontal tail fins, and the tail fin mounting hardware from the compartment.
4. Remove the lag bolts at the bottom of the box and lift the entire cover to access the tow vehicle.
5. Remove the tiedown straps that secure the tow vehicle.

NOTE WARNING Use the tow vehicle carrying handles when removing the TTV-290 Series Tow Vehicle by hand—with one person at each handle; use *only* the tow point when removing the tow vehicle with a crane.

6. Remove the tow vehicle from its container, manually or using a crane.

For a TTV-170 Series Tow Vehicle only, remove the Kevlar deck cable, then remove the tiedown straps and carefully remove the tow vehicle from its shipping container.

DSP-665 Transceiver Setup

Determine where the DSP-665 Transceiver and the optional client computer will be set up. Secure them in place, using tie-downs if necessary, near a 100–125 VAC or 220–240 VAC, 50–60 Hz power source. Be sure the back of each unit is accessible for connecting the cables. If mounting the transceiver and the client computer in a 19-inch rack, ensure that the rack is secure and that there is room behind the rack for proper air flow and for connecting the cables. Support the units inside the rack using appropriate mounting brackets and secure the front panels to the front of the rack using standard 19-inch rack front panel mounting hardware.

Assembling the TTV-290 Series Tow Vehicle

Only the TTV-290 Series Tow Vehicles require some assembly, as the tail fins must be installed onto the tow vehicle. The tail fins can be installed without removing the polyethylene shell. A 9/16-inch wrench is the only tool required.

Perform the steps below to install the tail fins.

1. Refer to Figure 3-1 and locate the anchor pins for the port and starboard tail fins and the pin for the top tail fin. The shell is shown removed in the figure for clarity. The pins serve to anchor the tail fins in place. With the shell on, the anchor pins can be seen by looking inside the aft end of the tow vehicle.

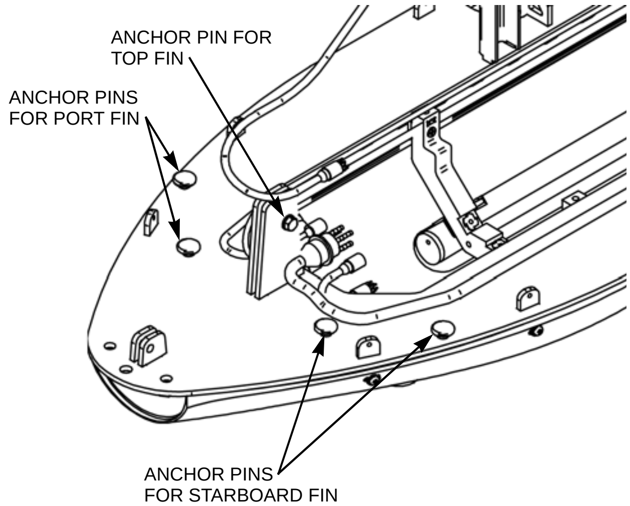

Figure 3-1 Location of Anchor Pins

2. Slide a tail fin, one that has two slots as shown in Figure 3-2, horizontally along the top of the frame such that the two slots in the fin slide over the two anchor pins.
3. Secure the tail fin with a supplied 3/8-inch hex bolt, flat washer and lock washer and tighten with the 9/16-inch wrench.
4. Repeat Steps 2 and 3 for the opposite tail fin.

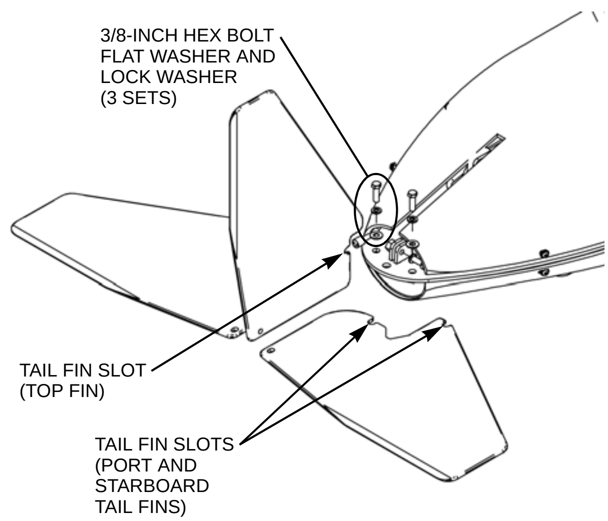

Figure 3-2 Mounting the Tail Fins

5. Slide the tail fin with the one slot, as shown in Figure 3-2, vertically along the top of the frame such that the slot in the fin slides over the anchor pin for the top fin.
6. Secure the tail fin with a supplied 3/8-inch hex bolt, flat washer and lock washer and tighten with the 9/16-inch wrench.

DSP-665 Transceiver Connections

Connectors are provided on the front and rear panels of the DSP-665 Transceiver for making all of the connections.

The front panel connectors are all BNC connectors and are shown in Figure 3-3. For information on the CH1 ANALOG IN, CH2 ANALOG IN and HF/LF switches called out below, refer to "DSP-665 Transceiver Operator Functions" on page 3-13. The front panel connectors are the following:

CH1 ANALOG IN:	Inputs an external analog signal of +/-3 volts maximum at greater than 1.5 kHz to Channel 1 when the CH1 ANALOG IN switch is switched to ON. Used to input analog signals from an alternate seismic source. Disabled when the HF/LF switch is switched to LF.
CH2 ANALOG IN:	Inputs an external analog signal of +/-3 volts maximum at greater than 1.5 kHz to Channel 2 when the CH2 ANALOG IN switch is switched to ON. Used to input analog signals from an alternate seismic source. Disabled when the HF/LF switch is switched to HF.
EXT KEY IN:	Inputs an external 0-5 volt, 100-μsec minimum pulse length signal that keys the transceiver.
KEY OUT:	Outputs a 0-5 volt, 100-μsec wide pulse at the start of each transmit cycle.
LF AUX IN:	Inputs signals of +/-3 volts maximum at 1.5 kHz or less from a boomer or a sparker to Channel 1 when the HF/LF switch is switched to LF. Disabled when the HF/LF switch is switched to OFF.
HF AUX IN:	Inputs signals of +/-3 volts maximum at 1.5 kHz or less from a boomer or a sparker to Channel 2 when the HF/LF switch is switched to HF. Disabled when the HF/LF switch is switched to OFF.

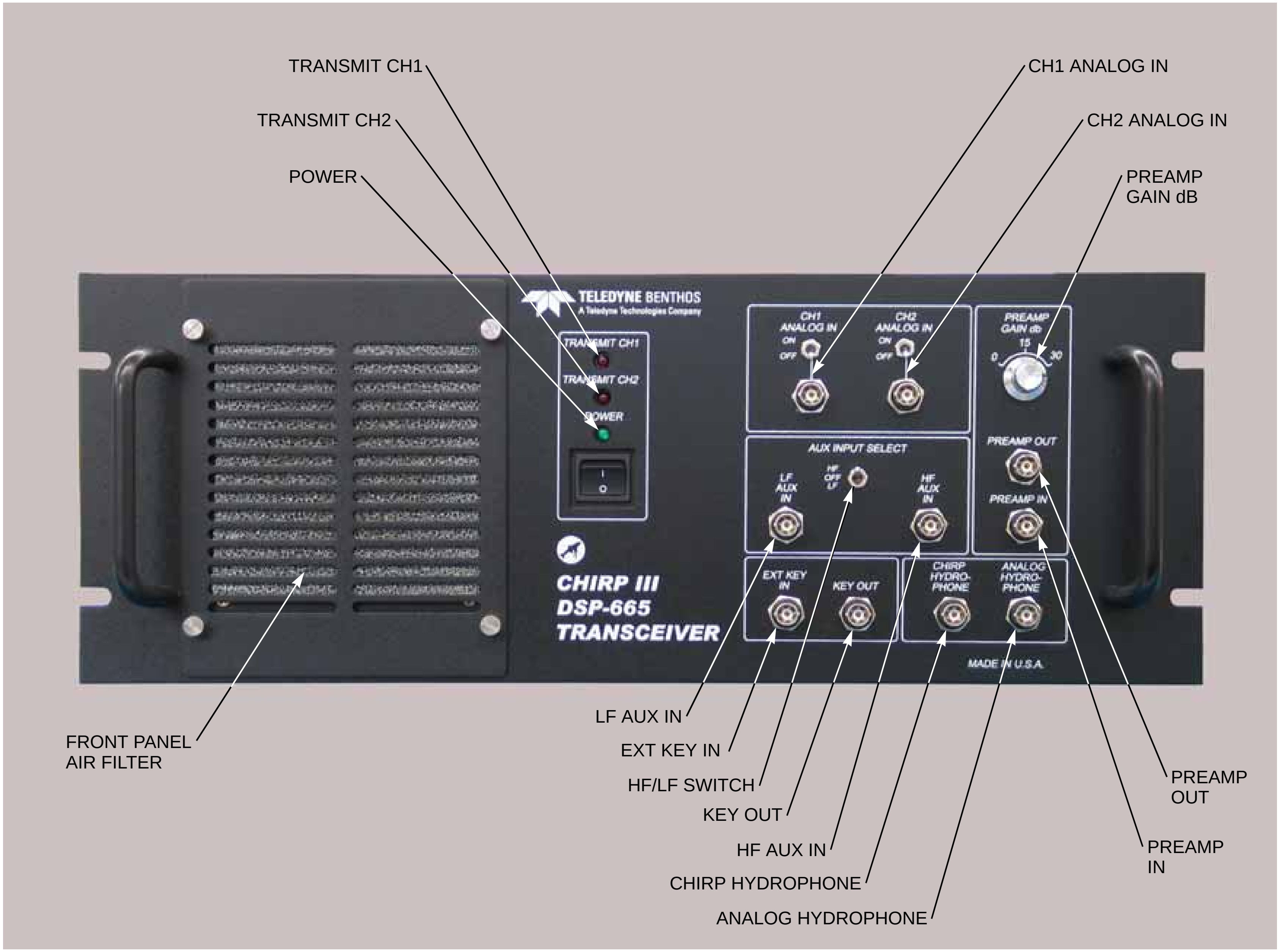

Figure 3-3 DSP-665 Transceiver Front Panel

CHIRP HYDROPHONE: Outputs the analog signals that are input from the hydrophone array connected to the TRANSDUCER connector on the rear panel. It is the same signal that is output on the HYDROPHONE connector on the rear panel. Can be used as the input to a preamplifier.

ANALOG HYDROPHONE: Outputs the analog signals that are input from the hydrophone array of legacy acoustic profiling systems if connected to the BPR connector on the rear panel. Can be used as the input to a preamplifier.

PREAMP IN: Inputs an analog signal. Can be used to input the ANALOG HYDROPHONE or the CHIRP HYDROPHONE output.

PREAMP OUT: Outputs the amplified analog input of PREAMP IN. Can be used as an input to the CH1 ANALOG IN, CH2 ANALOG IN, LF AUX IN, or HF AUX IN connector.

The rear panel connectors include 10-pin male and female Amphenol connectors, which are the BPR and TRANSDUCER connectors; an RJ-45 connector for the ETHERNET connector; and an IEC connector for the VAC IN connector. The rest of the connectors are BNC types. The rear panel connectors are shown in Figure 3-4 and are the following.

CH1 RECEIVE: Inputs an analog signal to the Channel 1 receiver input. Used for calibration, testing or troubleshooting the Channel 1 receiver.

CH2 RECEIVE: Inputs an analog signal to the Channel 2 receiver input. Used for calibration, testing or troubleshooting the Channel 2 receiver.

TRANSDUCER: Connects to the tow vehicle or to the Remote Controlled Transmit/Receive Module in a hull mount system.

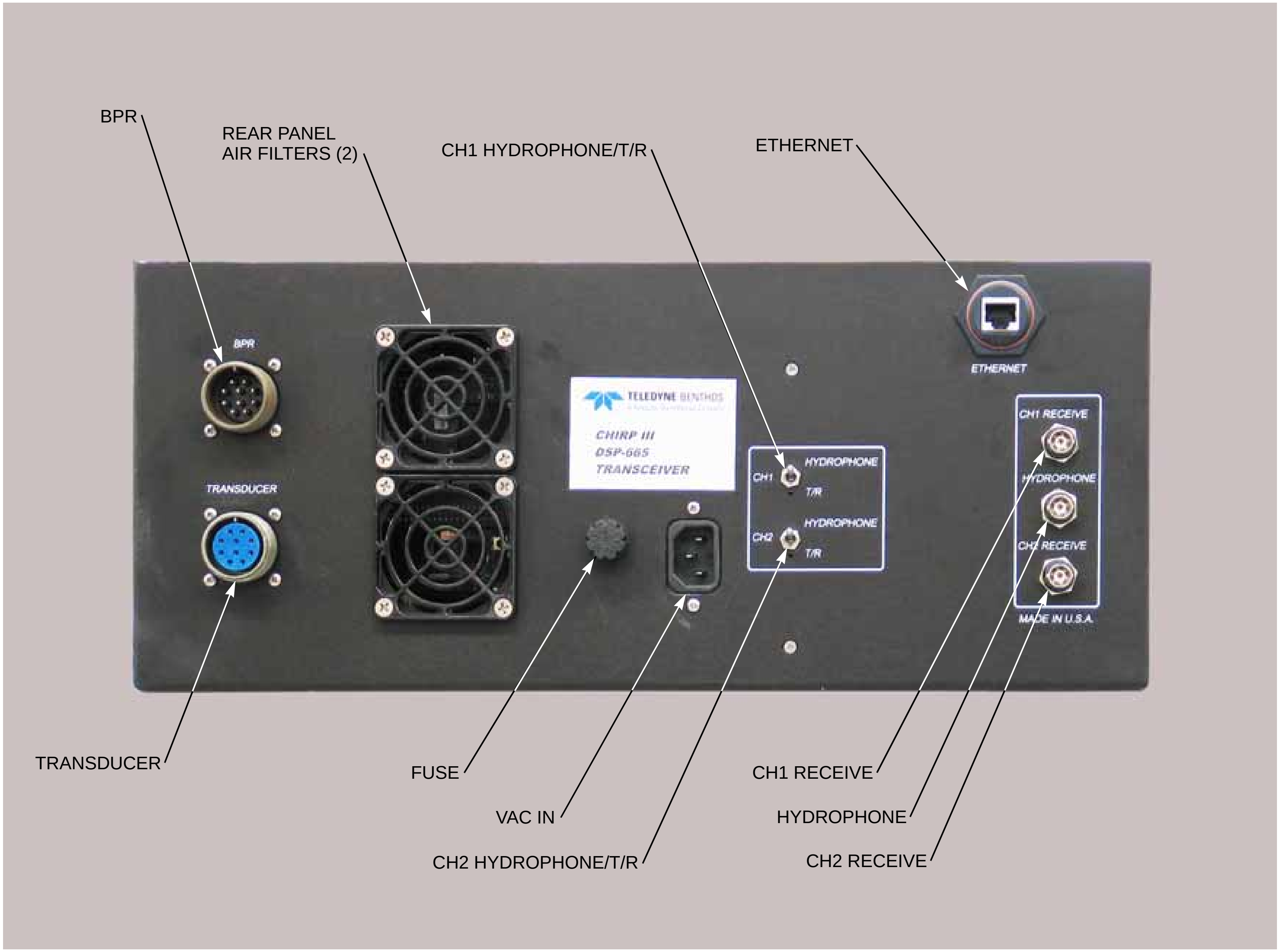

Figure 3-4 DSP-665 Transceiver Rear Panel

HYDROPHONE: Outputs the analog signals that are input from the hydrophone array connected to the TRANSDUCER connector. It is the same signal that is output on the CHIRP HYDROPHONE connector on the front panel. Can be used as the input to a preamplifier.

BPR: Connects to the hydrophone array of legacy acoustic profiling systems and supplies power to the array preamplifier. Used to connect the hydrophone array output to the ANALOG HYDROPHONE connector on the front panel.

ETHERNET: Connects to a client computer or to a Ethernet 10/100BaseT local area network (LAN).

VAC IN: Connects to the AC power source.

Connecting the Transceiver

Perform the steps below to make the connections to the DSP-665 Transceiver. If a client computer will be connected to the transceiver, refer to its user manual for the setup instructions.

WARNING Before making any connections to the DSP-665 Transceiver, be sure it is turned off by verifying that the POWER switch on the front panel is off. Refer to "DSP-665 Transceiver Operator Functions" on page 3-13 for a description of the front panel controls.

NOTE To communicate with the DSP-665 Transceiver over the Ethernet 10/100BaseT connection, the IP address of the client computer must be correctly set. The default setting is 192.168.0.24.

1. If connecting the transceiver to a client computer, connect a network crossover cable to the ETHERNET connector on the transceiver and to the network connector on the client computer.

   If connecting the transceiver to a LAN, connect a network patch cable to the ETHERNET connector on the transceiver and to the hub or router.

NOTE The DSP-665 Transceiver is autosensing and does not require special switch settings for 110 VAC or 220 VAC operation. The transceiver will operate properly using either of these standard VAC power sources.

2. Connect an AC power cable to the VAC IN connector on the transceiver and to the 100–125 VAC or 220–240 VAC, 50–60 Hz power source.

The following connections are optional:

3. Connect the shipboard navigation system output to the assigned RS-232 serial port on the client computer.
4. If an external source is to provide the sonar key, connect its key output to the EXT KEY IN connector on the transceiver.

Connecting the Tow Vehicle

One end of the Kevlar reinforced deck cable connects to the DSP-665 Transceiver, and the other end connects to the tow vehicle. Perform the steps below to connect the deck cable.

NOTE When connecting a different tow vehicle or an AT-471 transducer array, refer to "Changing the Transformer Jumpers" on page 5-7 for instructions on how to reconfigure or verify the Transformer Jumper board jumper configuration for the new tow vehicle or the transducer array.

1. Connect the Kevlar reinforced deck cable 10-pin male Amphenol connector to the TRANSDUCER connector on the rear panel of the transceiver.
2. If either the TTV-170 Series or the TTV-290 Series Tow Vehicle is to be connected, connect the opposite end of the deck cable to the tow vehicle block mold assembly connector. Note that the tow cable will be attached later.

DSP-665 Transceiver Operator Functions

The DSP-665 operator functions are accessible on the front and rear panels.

The front panel operator functions are shown in Figure 3-3 on page 3-8. For information on the CH1 ANALOG IN, CH2 ANALOG IN, EXT KEY IN, and PREAMP IN connectors called out below, refer to "DSP-665 Transceiver Connections" on page 3-7. The front panel operator functions are the following:

POWER switch: A rocker switch that turns the transceiver on or off. The transceiver turns on when "I" is pressed, and off when "0" is pressed.

POWER indicator: A green LED that is illuminated when the transceiver is on.

TRANSMIT CH1 indicator: A red LED that flashes at the repetition rate of the Channel 1 transmitter.

TRANSMIT CH2 indicator: A red LED that flashes at the repetition rate of the Channel 2 transmitter.

CH1 ANALOG IN switch: A toggle switch that enables the CH1 ANALOG IN input when switched to ON. When switched to OFF, the CH1 ANALOG IN input is disabled and signals are input from the tow vehicle or the hull mount system.

CH2 ANALOG IN switch: A toggle switch that enables the CH2 ANALOG IN input when switched to ON. When switched to OFF, the CH2 ANALOG IN input is disabled and signals are input from the tow vehicle or the hull mount system.

HF/LF switch: A toggle switch that when switched to LF, enables the LF AUX IN input and disables the CH1 ANALOG IN input. When switched to HF, enables the HF AUX IN input and disables the CH2 ANALOG IN input. When switched to OFF, the CH1 ANALOG IN and CH2 ANALOG IN inputs function as described in "DSP-665 Transceiver Connections" on page 3-7.

PREAMP GAIN dB switch: A rotary switch that selects either 0, 15, or 30 dB of gain which is applied to the PREAMP IN input.

The rear panel operator functions are shown in Figure 3-4 on page 3-10 and are the following:

CH1 HYDROPHONE/ T/R switch: A toggle switch that activates the Channel 1 Transmit/Receive function when switched to T/R. This allows the transceiver's Channel 1 to transmit *and* receive from the same transducer, hence providing increased sensitivity for deep water applications. When switched to HYDROPHONE, the transceiver inputs the tow vehicle's hydrophone output.

CH2 HYDROPHONE/ T/R switch: A toggle switch that activates the Channel 2 Transmit/Receive function when switched to T/R. This allows the transceiver's Channel 2 to transmit *and* receive from the same transducer, hence providing increased sensitivity for deep water applications. When switched to HYDROPHONE, the transceiver inputs the tow vehicle's hydrophone output.

FUSE: 3-amp, 250-volt fuse.

Selecting and Installing the Sonar Data Acquisition and Display Software

Data can be acquired, displayed and saved using third party sonar data acquisition and display software installed on the client computer. Refer to "Main System Components" on page 1-3 for a list of software manufacturers. These manufactures provide data acquisition and display software that is compliant with the Teledyne Benthos Chirp III Server. Select and install the software in accordance with the installation instructions provided with the software.

Contact Teledyne Benthos for more information about the available software and how to contact the manufacturers.

NOTE A client computer with the selected sonar data acquisition and display software and required operating system factory installed can be provided for a complete turn-key system.

System Startup

After all the connections have been made, the client computer is ready to be turned on and the DSP-665 Transceiver activated. When activated, the Benthos Chirp III Server parameters can be configured, the predeployment checks performed, and the tow vehicle launched.

Activating the DSP-665 Transceiver

If not already done so during prior use of the system, it may be necessary to set the front and rear panel switches on the DSP-665 Transceiver to their default settings. Perform the steps below to activate the transceiver and set or verify the switch settings.

1. Turn on the transceiver by pressing "I" on the POWER switch.

The POWER indicator will illuminate and the tow vehicle’s transducers will begin transmitting.

WARNING Do not allow the tow vehicle to transmit continuously on deck for more than one half hour.

2. On the front panel of the transceiver, switch the CH 1 ANALOG IN switch to OFF.
3. Switch the CH2 ANALOG IN switch to OFF.
4. Switch the HF/LF switch to OFF.
5. Switch the PREAMP GAIN dB switch to 0.
6. On the rear panel of the transceiver, switch the CH 1 HYDROPHONE/T/R switch to HYDROPHONE.
7. Switch the CH 2 HYDROPHONE/T/R switch to HYDROPHONE.

Configuring the Chirp III Server Parameters

Perform the steps below to configure the Chirp III Server parameters.

1. Start the sonar data acquisition and display software.

NOTE Depending on the sonar acquisition and display software installed, the following step may be different than what is described.

2. In the sonar data acquisition and display software main window, choose Recording Parameters from the File menu.

   The Benthos Chirp III Server dialog box opens as shown in Figure 3-5.

NOTE The Chirp III Server dialog box does not have to be closed for any changes made to the settings in the dialog box to take effect. Changes are applied immediately with the dialog box open.

3. If required, in the Benthos Chirp III Server dialog box, enter an IP address for the DSP-665 Transceiver in the Server IP Address text box. The default address is 192.168.0.24.
4. If required, enter a TCP port address in the TCP Port text box. The default port address is 5009.
5. Select the transmit repetition rate from the Sonar Rep Rate drop-down list box in accordance with Table 3-1.

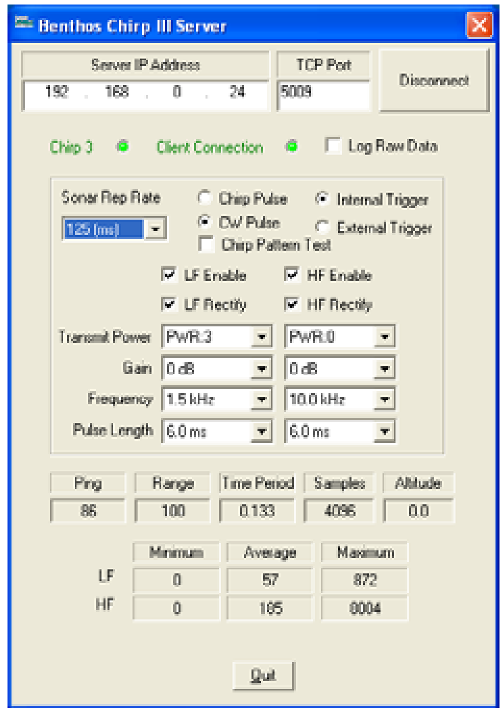

Figure 3-5 The Benthos Chirp III Server Dialog Box

Table 3-1 Recommended Transmit Repetition Rate vs. Depth Below Transducer

Transmit Repetition Rate (seconds)	Depth Below Transducer (meters)
0.062	45
0.125	90
0.250	180
0.375	270
0.500	375
0.750	555
1.000	750
1.500	1125
2.000	1500
4.000	3000
8.000	6000

6. Select the Chirp Pulse option to operate in chirp mode, or select the CW option to operate in continuous wave (CW) mode.
7. Select the Internal Trigger option to use an internal key to trigger the sonar, or select the External Trigger option to use an external key.
8. Select the LF Enable check box to operate in the low frequency band.
9. Select the HF Enable check box to operate in the high frequency band.

NOTE For dual frequency operation, select both the LF Enable and HF Enable check boxes.

10. Select the LF Rectify check box to rectify the output for a low frequency external analog signal input to CH1 ANALOG IN.
11. Select the HF Rectify check box to rectify the output for a high frequency external analog signal input to CH2 ANALOG IN.

NOTE For the Transmit Power, Gain, Frequency, and Pulse Length selections described below, the left drop-down list box corresponds to the low frequency channel (Channel 1); the right, to the high frequency channel (Channel 2).

12. Select the transmit power from the Transmit Power drop-down list boxes.

    The power level selections are from 0 for no transmitter attenuation to 7 for 21 db of transmitter attenuation, in 3 db increments per step.
13. Select the preamplifier gain from the Gain drop-down list boxes.

    The gain selections are from 0 for no gain to 7 for 42 db of gain in 6 db increments per step.

14. Select the operating frequencies from the Frequency drop-down list boxes.

The frequency selections for operation in chirp mode are 2–7 kHz for the low frequency channel and 10–20 kHz for the high frequency channel. For an expanded system other frequency selections are also available.

The frequency selections for operation in CW mode are 1.5 kHz, 2.5 kHz, 3.5 kHz, and 5.0 kHz for the low frequency channel and 10 kHz, 12 kHz, 14 kHz, 16 kHz, and 20 kHz for the high frequency channel.

15. Select the pulse length from the Pulse Length drop-down list boxes. The available selections are listed in Table 3-2.

Table 3-2 Chirp and CW Pulse Length Selections

Chirp Pulse Lengths (ms)	CW Pulse Lengths (ms)
5.0	0.5
10.0	1.0
15.0	1.5
20.0	2.0
30.0	3.0
40.0	4.0
50.0	5.0
60.0	6.0

16. If the tow vehicle is not to be deployed immediately, click Quit to close the Benthos Chirp III Server dialog box and turn off the DSP-665 Transceiver by pressing "O" on the POWER switch.

If the tow vehicle is to be deployed immediately, either click Quit to close the Benthos Chirp III Server dialog box or leave the dialog box open. Changes can be made to the settings in the dialog box while acquiring data.

Performing the Predeployment Checks

The predeployment checks are recommended to verify that the system is functioning properly on deck before the tow vehicle is deployed. The checks are easy to perform and involve several procedures: activating the system diagnostics which produces a chirp pattern test that checks the receivers, listening for the transmitted pulses from each of the transducers—one at a time, and tapping under the tow vehicle to induce an acoustic signal in the hydrophone array. To begin the predeployment checks, first verify that the tow vehicle transducers are transmitting, and then perform the steps below.

1. Start the sonar data acquisition and display software.
2. In the sonar data acquisition and display software main window, choose Recording Parameters from the File menu.

   The Teledyne Benthos Chirp III Server dialog box opens as shown in Figure 3-5 on page 3-17.
3. In the Teledyne Benthos Chirp III Server dialog box, select the Chirp Pattern Test check box.

   The tow vehicle will stop transmitting.
4. Activate the sonar displays and select a range of 200 meters or greater for both channels in accordance with the instructions provided with the sonar data acquisition and display software.

   Examine the sonar displays. A chirp pattern will begin to scroll across the display for both channels, and after several minutes the displays should look similar to those shown in the example in Figure 3-6 with black and gray horizontal bars of gradually increasing intensity.
5. To return to normal operation, clear the Chirp Pattern Test check box in the Teledyne Benthos Chirp III dialog box, and then click Quit.

For the remaining steps, if the TTV-290 Series Tow Vehicle is the connected tow vehicle, refer to Figure 3-7 for the specific location of the transducers and the hydrophone array.

6. Turn off the Channel 1 transmitter.
7. Listen for the transmitted pulses from the high frequency transducer in the tow vehicle. When the transmissions have been verified, turn the Channel 1 transmitter back on.
8. Turn off the Channel 2 transmitter.

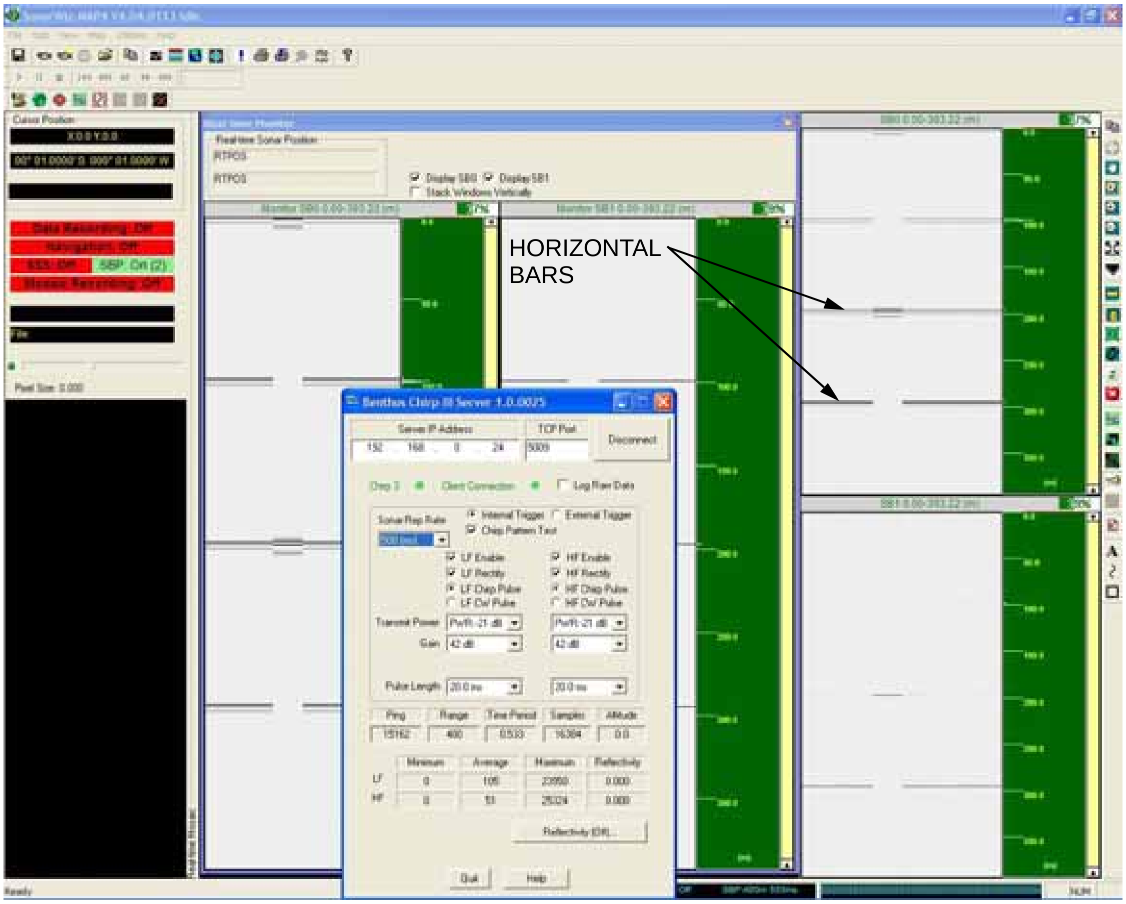

Figure 3-6 Example Chirp Pattern Test Display

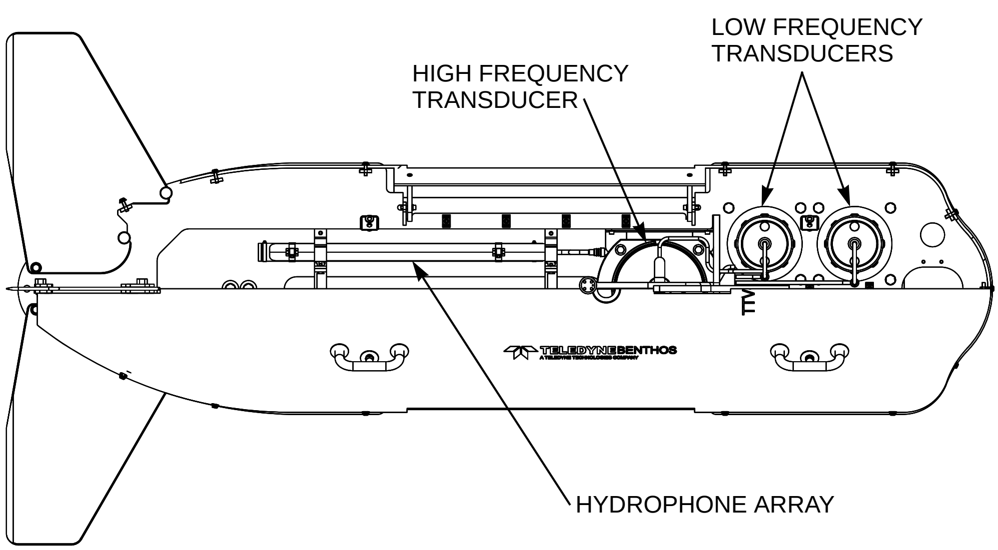

Figure 3-7 Location of TTV-290 Series Transducers and Hydrophone Array

9. Listen for the transmitted pulses from the low frequency transducers in the tow vehicle. When the transmissions have been verified, turn the Channel 2 transmitter back on.

10. With a wrench or similar blunt object, perform the tap test by rapidly tapping the underside of the tow vehicle for 15 to 20 seconds in the area of the hydrophone arrays.

11. Examine the sonar displays. They should look similar to those shown in Figure 3-8 with vertical streaks displayed for both channels.

    If the vertical streaks cannot be seen, temporarily increase the receiver gains of both channels. If required, also increase the TVGs. After the vertical streaks have been verified, return receiver and TVG settings back to their original settings.

The predeployment checks are complete and the tow vehicle can be deployed. However, if it is not deployed immediately, turn off the transceiver.

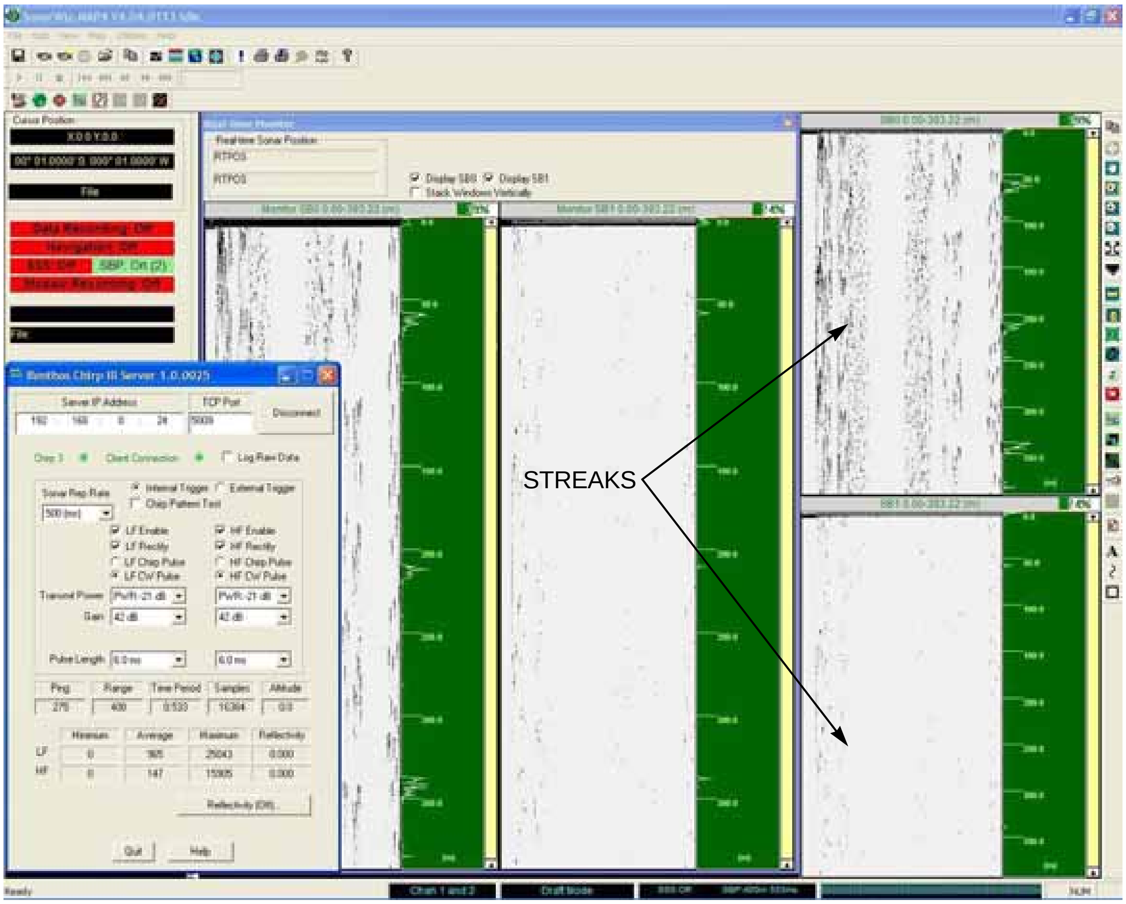

Figure 3-8 Example Tap Test Display

Tow Vehicle Deployment

Before deploying the tow vehicle, a choice of tow cable and its length must be made based on the desired operating depth of the tow vehicle. Once a tow cable is selected, the cable is attached to the tow vehicle's tow point, and the tow vehicle is hoisted and checked for proper balance. When the proper balance is achieved, the tow vehicle is launched from the stern of the vessel using a boom or an A-frame and a winch. Then the tow vehicle is lowered to a depth of only a few meters while its operation is verified.

WARNING Do not use the deck cable to hoist or tow the tow vehicle. Although the cable is Kevlar reinforced and has a strength member, it is not to be used for towing. Only a separate steel cable or armored multi-conductor tow cable may be used for this purpose.

Selecting a Tow Cable

If the desired tow vehicle towing depth exceeds that which the tow vehicle can connect to the processor with the standard Kevlar reinforced deck cable, either a longer deck cable or an armored multi-conductor tow cable must be used. The required length of the armored multi-conductor tow cable depends on the anticipated towing speed and tow vehicle depth. For relatively shallow applications the standard Teledyne Benthos TWC-601, 150-meter armored multi-conductor tow cable can be used. Table 3-3 lists the approximate operating depth at which the tow vehicle is expected to tow for various towing speeds using this cable.

Table 3-3 Tow Speed vs. Depth

Tow Speed (knots)	Tow Vehicle Depth (meters)
2	100
3	75
4	60
5	50

For towing at deeper depths a longer armored multi-conductor tow cable is required. Table 3-4 provides a rough guide for determining the required armored multi-conductor tow cable length verses towing speed for towing the tow vehicle at a depth of 600 meters. For more shallow applications, calculate the required cable length by using the ratio of the desired tow vehicle operating depth in meters to 600 meters, then multiply this ratio by the cable length for the selected tow speed shown in the table.

For example, if the towing depth is to be 300 meters, then the ratio is 300/600, or 0.5. Next, if the towing speed is to be 4 knots, multiply this ratio by 1500 meters. Therefore, the required cable length is 750 meters.

Table 3-4 Tow Speed vs. Cable Length

Tow Speed (knots)	Cable Length (meters)
2	900
3	1200
4	1500
5	1800

Connecting the Tow Cable

If the standard Kevlar reinforced deck cable *is not* to be used to connect to the tow vehicle, begin with Step 1 below to disconnect the deck cable and connect the armored multi-conductor tow cable. If the deck cable *is* to be used to connect to the tow vehicle, leave the cable connected and begin with Step 2. In addition, be sure to use a steel tow cable, not the Kevlar reinforced deck cable, to tow the tow vehicle.

WARNING If the deck cable is to be disconnected from the tow vehicle, be sure the transceiver is turned off by verifying that the POWER switch on the front panel of the transceiver is off. Refer to "DSP-665 Transceiver Operator Functions" on page 3-13 for a description of the front panel controls.

1. After turning off the transceiver, disconnect the deck cable from the tow vehicle and the transceiver. Connect, but do not yet attach, the armored multi-conductor tow cable to the tow vehicle and connect the winch's deck cable to the transceiver.
2. For a TTV-170 Series Tow Vehicle, attach the steel tow cable or the armored multi-conductor tow cable to the forwardmost hole on the tow point at the top of the tow vehicle using the supplied shackle or tow cable retention bolt. For a TTV-290 Series Tow Vehicle, use the second hole from the forwardmost one. Do not secure the tow cable at this time, as depending on the distributed weight of the tow vehicle, it may be necessary to use a different hole to balance the tow vehicle properly before deployment.

WARNING Do not use any of the carrying handles to hoist the TTV-290 Series Tow Vehicle. Only the tow point should be used for this purpose.

3. Hoist the tow vehicle and check for proper balance. The tow vehicle should hang with its nose slightly above the tail. Reconnect the tow cable to the forwardmost hole on the tow point if the nose is down, or the next hole aft, if the nose is much higher than the tail.
4. When the tow vehicle is properly balanced, secure the tow cable to the tow point by tightening the shackle bolt or tow cable retention bolt. If a shackle bolt is used, secure the bolt to the shackle with tie-wraps or seizing wire to prevent the bolt from dropping out should it loosen.
5. If the deck cable is used to connect to the tow vehicle, secure it to the tow cable with a shackle and tie wraps.

Launching the Tow Vehicle

Perform the steps below to launch the tow vehicle and verify its stability and operation. The tow vehicle should be launched from the stern of the vessel using a boom or an A-frame.

1. Turn on the client computer.
2. Turn on the transceiver by pressing "I" on the POWER switch.

   The POWER indicator will illuminate and the tow vehicle's transducers will begin transmitting.

WARNING Do not allow the tow vehicle to transmit continuously on deck for more than one half hour.

3. Lower the tow vehicle into the water. For the TTV-290 Series Tow Vehicle loop lines through the forward port and starboard carrying handles to stabilize the tow vehicle while it is suspended.
4. Run the sonar data acquisition and display software.
5. Submerge the tow vehicle to a depth of two or three meters, and then begin cruising at two to four knots.
6. Check the attitude and stability of the tow vehicle. If it is not stable, it may be in the ship's prop wash and it may be necessary to lower the tow vehicle to a deeper depth.

   If the tow vehicle still does not stabilize when lowered to a deeper depth, it may be necessary to move the tow cable to another hole on the tow point.
7. If the tow vehicle is stable and is operating correctly, it can be lowered to its operational depth and the recording of data can begin.

Connecting an Alternate Seismic Source

The Chirp III Acoustic Profiling system can be configured with non-chirp alternate seismic sources. For example, an alternate non-chirp seismic source can be connected to receive, process, record and display profile data. These devices all connect to the DSP-665 Transceiver. Refer to "DSP-665 Transceiver Connections" on page 3-7 for a description of the connectors and their functions. Connect the alternate seismic source after making all of the connections to the transceiver as described in "Connecting the Transceiver" on page 3-11.

There are four alternate seismic source inputs:

- ***CH1 ANALOG IN (for source frequencies greater than 1.5 kHz)***
- ***CH2 ANALOG IN (for source frequencies greater than 1.5 kHz)***
- ***LF AUX IN (for source frequencies of 1.5 kHz or less)***
- ***HF AUX IN (for source frequencies of 1.5 kHz or less)***

Therefore, connect higher frequency seismic sources to the CH1 ANALOG IN and CH2 ANALOG IN connectors. The transceiver will receive and process either one or both of these inputs simultaneously as selected by the operator. Connect lower frequency seismic sources, such as boomers and sparkers, to the LF AUX IN and HF AUX IN connectors. The transceiver will receive and process one of these two inputs at any one time as selected by the operator.

Connecting the Internal or External Trigger Source

The alternate seismic source can be keyed by the transceiver, or the transceiver can be keyed by the alternate seismic source. If it is required that the *source key the transceiver*, connect EXT KEY IN on the transceiver to the key output of the source. If it is required that the *transceiver key the source*, connect KEY OUT on the transceiver to the key input of the source.

NOTE If the alternate seismic source is to trigger the transceiver, be sure to select External Trigger in the Benthos Chirp III Server dialog box.

Connecting and Adjusting the Preamplifier

One alternate seismic source can first be amplified by the preamplifier. Perform the steps below to connect this source and adjust the preamplifier.

1. Connect the alternate seismic source to PREAMP IN.
2. Connect PREAMP OUT to the desired alternate seismic source input—CH1 ANALOG IN, CH2 ANALOG IN, LF AUX IN, or HF AUX IN as described below.
3. Switch the PREAMP GAIN dB switch to the required gain setting.

Connecting One or Two Seismic Sources Operating at Greater than 1.5-kHz

Perform the steps below to connect one or two alternate seismic sources operating at greater than 1.5 kHz. Both seismic sources can be input simultaneously.

1. Connect the alternate seismic source hydrophone to CH1 ANALOG IN or to CH2 ANALOG IN, or connect a separate source to each. CH1 ANALOG IN is Channel 1; CH2 ANALOG IN is Channel 2.
2. Switch the HF/LF switch to OFF.
3. Switch the corresponding CH1 ANALOG IN or CH2 ANALOG IN switch to ON, or switch both switches to ON if two seismic sources are connected.

Connecting One or Two Seismic Sources Operating at 1.5-kHz or Less

Perform the steps below to connect one or two alternate seismic sources operating at 1.5 kHz or less. Only one seismic source can be input at a time.

1. Connect the alternate seismic source hydrophone to LF AUX IN or to HF AUX IN, or connect a separate source to each. LF AUX IN is Channel 1; HF AUX IN is Channel 2.
2. Switch the HF/LF switch to HF or LF, depending on which seismic source to input.

NOTE With the HF/LF switched to HF, CH1 ANALOG IN is disabled; when switched to LF, CH2 ANALOG IN is disabled.

SECTION 4

Theory of Operation

An overall understanding of how the Chirp III Acoustic Profiling System produces the high resolution sidescan sonar images is an important factor in ensuring the system is properly maintained and its maximum performance realized. This section provides an overall functional description of the system components, signal flows and processing, from the generation of the transmit signals to the processing of the received signals. Refer to SECTION 6, "Drawings," for the circuit board assembly drawings called out in this section.

NOTE The descriptions in this section specifically encompass the dual channel system (DSP-6652 Transceiver and TTV-172 Tow Vehicle). However, the descriptions also apply to the single channel system (DSP-6651 Transceiver and TTV-171 Tow Vehicle) except that in this system there is only one Transmitter board and one Transformer Jumper board compared to two each in the dual channel system.

The main components of the system are the DSP-665 Transceiver and the TTV-170 or TTV-290 Tow Vehicle. They are connected with a single coaxial cable, either directly or through an optional winch and slip rings. A third component, the client computer, is also optionally supplied and runs third party sonar data acquisition and display software.

DSP-665 Functional Description

A functional block diagram of the DSP-665 Transceiver is shown in Figure 4-1, and the DSP-665 Transceiver chassis is shown in Figure 4-2. The transceiver communicates with the client computer over the Ethernet 10/100BaseT connection and connects to the tow vehicle over the coaxial cable.

The DSP-665 Transceiver amplifies the Channel 1 and Channel 2 chirp transmit waveforms and filters the hydrophone array or transducer output. The transceiver also includes a preamplifier with adjustable gain for amplifying the output of an alternate non-chirp source before it is input to one of the analog input channels of the transceiver. In addition, a transmit/receive (T/R) network is included which allows the transceiver to both transmit and receive from the same transducer. The main functional components of the transceiver are the circuit boards, all of which are located in the transceiver chassis.

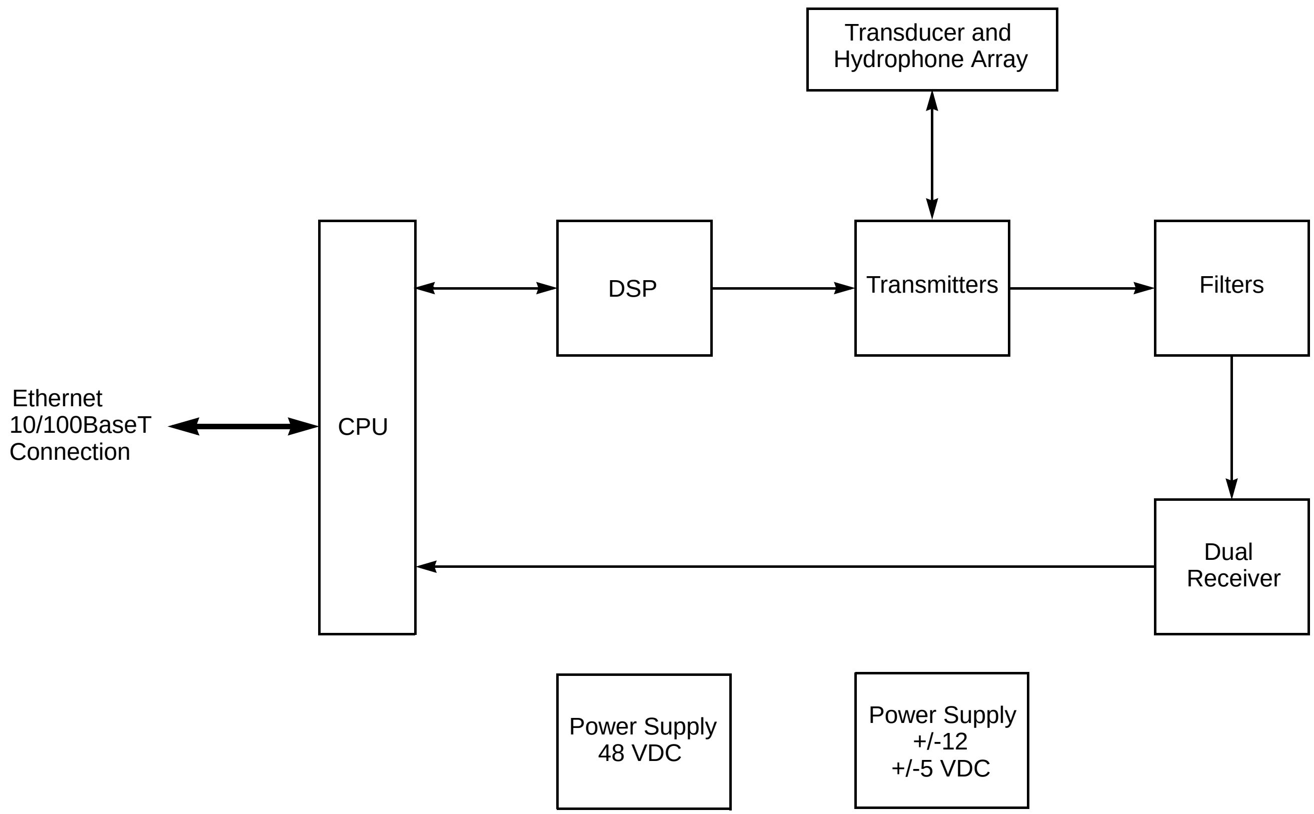

Figure 4-1 DSP-665 Transceiver Functional Block Diagram

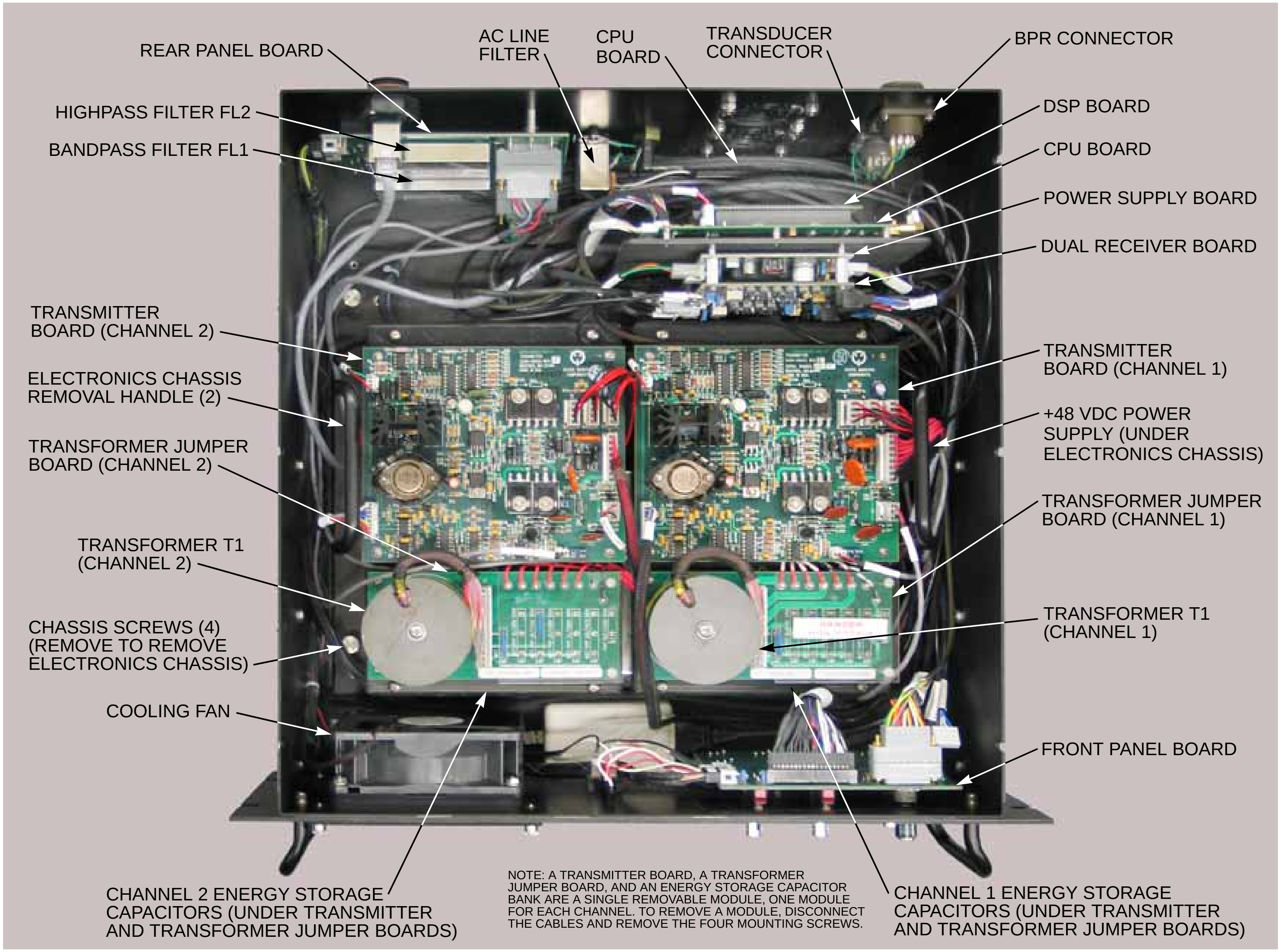

Figure 4-2 DSP-665 Transceiver Chassis

Circuit Board Description

Listed below are the circuit boards that are included in the transceiver along with their assembly drawing numbers.

CPU:	C664-1283
DSP:	OEM supplied
Power Supply:	B664-1233
Transmitter:	C206-06523
Dual Receiver:	C664-1243
Front Panel:	C664-1263
Rear Panel:	B662-07777
Transformer Jumper:	B662-07747

CPU Board

The CPU board runs an embedded version of the Linux operating system and includes an A/D converter and a first-in-first-out (FIFO) memory. The A/D converter is a six channel, 16-bit analog to digital converter that inputs and digitizes the received low and high frequency sonar signals, including the analog and auxiliary input signals. The digitized chirp sonar data are then output to the DSP board for matched-filter processing. The FIFO memory inputs the processed sonar data from the DSP board, providing temporary memory for the data. The data are input in 32-bit wide format and output in first-in-first-out order to the CPU. The CPU board also commands and controls the DSP board and outputs all the data in TCP/IP packets to the client computer over the Ethernet 10BaseT connection. In addition, the CPU board also supports a number of individual input/output (I/O) connections for on/off control of the transmitters and the setting of the receiver gains. Additional I/O connections provide on/off control of diagnostics.

DSP Board

The DSP board provides the sonar key and transmit gates in accordance with the transmit repetition rate and includes a burst generator which generates the chirp or CW pulse transmit signals. The transmit signal frequencies sweep in the 2 to 7 kHz band for the low frequency channel (Channel 1) and in the 10 to 20 kHz band for the high frequency channel (Channel 2). The CW frequencies are 1.5 kHz, 2.5 kHz, 3.5 kHz, and 5.0 kHz for Channel 1 and 10 kHz, 12 kHz, 14 kHz, 16 kHz, and 20 kHz for Channel 2. The transmit gates, which control the pulse length of the transmitted signals, are output to the Transmitter board and are automatically set in accordance with the chirp or CW pulse information. The transmit waveforms are also output to the Dual Receiver board and function as the diagnostic signals to assist in the isolation of any system failures. The DSP board also inputs the digitized received sonar signals from the CPU board and, if the data are chirp based, performs matched-filter processing of the data. If the sonar data are CW based, the DSP board determines the power spectrum of the sonar data by calculating the absolute value squared. The DSP board then outputs the matched-filtered or power spectrum sonar data to the CPU board.

Power Supply Board

The Power Supply board provides +/-12 and +/-5 VDC power.

Transmitter Board

There are two Transmitter boards in the transceiver, one for the low frequency channel and one for the high frequency channel. They amplify the chirp and CW transmit waveforms and drive the transducers on the tow vehicle and provide the T/R network. The transmit power level control input from the Front Panel board sets each of the transmitter's output power level. On each board the chirp transmit waveforms, the transmit gate, and the transmit power level control signals are input on J4 from the Front Panel board. The Transmitter boards drive the transducers with the chirp transmit waveforms and are powered with +48 VDC, which is input on J2 from the Front Panel board. On each board the primary and secondary of output transformer T1 connect to J5 and J5 connects to J6 through a voltage divider and series resistor. The voltage divider allows monitoring of the voltage output at TP5 and TP6, and the series resistor allows monitoring of the output current at TP4 and TP6. The transformer's primary has a center tap that is output on J7 and connects to an energy storage capacitor bank. The output of the Transmitter on J6 connects to the transducers.

Received subbottom signals are input on J6 and applied to a differential amplifier through the T/R network composed of high voltage coupling capacitors and diodes. The diodes limit the input to the differential amplifier to 1.4 V peak to peak to protect the amplifier during the transmit burst. The output of the differential amplifier drives an isolation transformer which outputs the received signals on J8.

The Transmitter board includes several forms of protection: current limiting, thermal overload, low frequency input, and input isolation. The chirp transmit waveform, transmit gate input and transmit power level control are optically isolated.

Dual Receiver Board

The Dual Receiver board includes one low frequency channel and one high frequency channel. Each channel amplifies the signals received by the tow vehicle transducers or hydrophone array through bandpass and highpass filters FL1 and FL2, respectively. FL1 is for the high frequency channel (Channel 2) and has -3 db cutoff frequencies of 10 kHz and 20 kHz. FL2 is for the low frequency channel (Channel 1) and has a -3 db rolloff frequency of 1.5 kHz. This filter, combined with a lowpass filter on the Dual Receiver board, comprises a low frequency bandpass filter. The Dual Receiver board also inputs diagnostic signals from the DSP board. The gain of each receiver is controlled through the I/O connections from the CPU board. The gain can be set from 0 to 42 dB in 6 dB increments.

Front Panel Board

The Front Panel board performs four primary functions: the distribution of signals from the Rear Panel board to the DSP board; the distribution of DC power to the Transmitter boards and the Rear Panel board; the preamplification of the hydrophone array or transducer output; and the interfacing with the operator functions and connectors on the transceiver front panel. When keyed by the DSP board, the Front Panel board outputs the chirp transmit waveform and transmit gate, which are both input from the DSP board, to each of the Transmitter boards. In addition, separate power level controls, which also are input to the Front Panel board from the DSP board, are output to the Transmitter boards. The Channel 1 and Channel 2 received signals are input to the Front Panel board from the Rear Panel board, and then output to the DSP board. The DC power is input to the Front Panel board from the power supplies, and then output to the Transmitter boards and the

Rear Panel board. The preamplifier on the Front Panel board applies 0, 15, or 30 dB of gain to a signal that is applied to the PREAMP IN input. The output of the preamplifier is applied to the PREAMP OUT output. All the transceiver front panel operator functions, which include the switches and indicators as described in "DSP-665 Transceiver Operator Functions" on page 3-13, connect to the Front Panel board. In addition, all the transceiver front panel connectors as described in "DSP-665 Transceiver Connections" on page 3-7, connect to the Front Panel board.

Rear Panel Board

The Rear Panel board performs three primary functions: the distribution of power to the hydrophone array preamplifiers and amplified chirp transmit waveforms to the transducers; the filtering of the received signals from the hydrophone arrays or transducers; and the interfacing with the operator functions and connectors on the transceiver rear panel. DC power that is input to the Rear Panel board from the Front Panel board is output to the chirp hydrophone array preamplifiers. Both the Channel 1 and Channel 2 amplified chirp transmit waveforms are input to the Rear Panel board from the Transmitter boards and then output to the transducers. The hydrophone and transducer outputs are input directly to the Rear Panel board. If transducers are used to both transmit and receive the sonar signals, the CH1 HYDROPHONE/T/R switch or the CH2 HYDROPHONE/T/R switch or both are switched to T/R and the transducer outputs from the T/R network on the Transmitter board are input to the Rear Panel board. The hydrophone array and transducer output signals are filtered by FL2 and FL1 to separate the Channel 1 low frequency signals from the Channel 2 high frequency signals, respectively, and then output to the Front Panel board. All the transceiver rear panel operator functions, which include the switches as described in "DSP-665 Transceiver Operator Functions" on page 3-13, connect to the Rear Panel board. In addition, all the transceiver rear panel connectors as described in "DSP-665 Transceiver Operator Functions" on page 3-13, connect to the Rear Panel board.

Transformer Jumper Boards

The Transformer Jumper boards function with the Transmitter boards and allow jumper selection of different power levels. Each Transformer Jumper board includes a single multi-tapped transformer with a choice of seven available output power levels.

There are two Transformer Jumper boards in the transceiver. Each board interfaces a multi-tapped output transformer T1 with a corresponding Transmitter board. The primary voltage is input at TP1–TP6. Seven secondary taps are available for selection with jumpers JMP1–JMP7. With the low and high jumper positions selected, the secondary voltage is output at TP7 and TP8. The table on the Transformer Jumper board assembly contains the standard and maximum jumper settings.

SECTION 5

Maintenance and Troubleshooting

The routine maintenance of the Chirp III Acoustic Profiling System primarily involves periodically inspecting and cleaning the DSP-665 Transceiver and washing and inspecting the TTV-170 or TTV-290 Series Tow Vehicle. This section includes some simple procedures on how to perform these tasks and includes some troubleshooting recommendations that will assist in isolating and correcting problems encountered while setting up or operating system. Instructions are also provided on how check the cables and transducers.

DSP-665 Transceiver Periodic Maintenance

The only required maintenance for the DSP-665 Transceiver is the inspection and cleaning of the air filters and the removal of any accumulated dirt and dust on the inside of the box. The air filters should be inspected once a month and cleaned if necessary. The inside of the transceiver should be inspected and cleaned once a year.

NOTE Keeping the air filters clean is important. Dirty air filters will restrict the flow of cooling air to the hardware components which can cause heat damage, failure or both.

Removing and Cleaning the Air Filter

The transceiver has one air filter on the front panel and two air filters on the rear panel. Refer to Figure 3-3 on page 3-8 for the location of the front panel filter, and to Figure 3-4 on page 3-10 for the rear panel filters. To remove the front panel filters, remove the screws that hold the retention plate, and then remove the plate and the filter. To remove the filters on the rear panels, first remove the snap-in retention plates, and then remove the filters. Clean or replace the filters as required, and then replace the retention plates on the front and rear panels.

Cleaning the Inside of the Transceiver

To clean the inside of the transceiver, loosen the quarter-turn fasteners that secure the cover and remove the cover. Inspect for any loose boards or connectors inside the box, and then carefully vacuum any accumulated dirt and dust inside the box. Replace the cover and secure it with the fasteners.

Tow Vehicle Periodic Maintenance

Maintenance of the TTV-170 and TTV-290 Series Tow Vehicles is required after each use including washing and inspection of cables and connectors.

After the tow vehicle is retrieved from service, perform the steps listed below to clean and inspect the tow vehicle.

1. Wash down the tow vehicle, *inside and out*, with clean, *fresh* water and remove any debris that may have become trapped.
2. Inspect the face of the transducers and hydrophone arrays. Spray them with fresh water, and then clean them with a mild, non-abrasive detergent, being careful to remove any buildup. After cleaning, spray them again with fresh water.

NOTE Do not use an ammonia-based cleaner such as a glass cleaner to clean the transducers and hydrophone arrays.

3. Check for loose cable connections or other signs of damage. The underwater connectors in the tow vehicle and on the deck cable should be kept clean. Clean the connector pins and sockets with an alcohol wipe, and before reconnecting any of the cables, lubricate the pins with an O-ring quality silicone or barium based lubricant.

NOTE Be careful not to get any lubricant on the faces of the transducers or the hydrophone arrays as doing so will severely degrade their performance.

System Troubleshooting

If while setting up or operating the system, either the DSP-665 Transceiver or the TTV-170 or TTV-290 Series Tow Vehicle does not appear to be functioning properly, refer to the functional and circuit board descriptions in SECTION 4, "Theory of Operation," for assistance. The theory of operation will assist in tracing the source of the problem to the assembly or component level. In addition, refer to SECTION 6, "Drawings," for the assembly drawings and wiring diagrams. Instructions are also provided in this section on how to check the cables and connectors, how check the transducers and hydrophones, and how to change the jumper settings on the Transformer Jumper boards.

WARNING Before disconnecting any cables or removing any boards from the DSP-665 Transceiver, be sure the 100–125 VAC or 220–240 VAC, 50–60 Hz power source is disconnected.

Cable Checks

If it is suspected that a cable or connector is not functioning, there are three simple checks that can be performed: inspection for signs of arcing, checking continuity, and checking for a short circuit.

Arcing

Check the cable and mold connectors for signs of arcing. A black carbon material or voids in the rubber are signs of arcing. If a connector has arced, both the connector and its mating connector should be cleaned thoroughly to remove all carbon and dirt. If the rubber has significantly eroded, replace the connector. Inspect the mating connector and replace it also if it shows the same symptoms.

Continuity

Using an ohmmeter that can read 10 ohms or less, check each wire in the cable for continuity. Refer to SECTION 6, "Drawings," for the wiring diagrams. A reading of 1 ohm or less should be observed on short cables and connector molds. The reading for deck cables will be higher.

Short Circuit Test

Disconnect both ends of the cable and clean the connectors. Using a megometer or a digital multimeter on the highest ohm scale, measure the resistance of *each* pin of the cable or connector mold to every other pin. All measurements should read greater than 10 megohms; however, a value as low as 1 megohm will allow the system to work temporarily as the short circuit is still developing.

Transducer Checks

If it is suspected that a transducer or a hydrophone is not functioning, there are four simple checks that can be performed: inspection for signs of arcing, tapping the face of the transducer or hydrophone and checking for a signal output, checking for a short circuit, and applying a signal to the input of the transducer and listening for a transmitted pulse.

Arcing

For a transducer, check the connector on the connector pigtail of the transducer for signs of arcing. A black carbon material or voids in the rubber are signs of arcing. If a connector has arced, both the connector and its mating connector should be cleaned thoroughly to remove all carbon and dirt. If the rubber has significantly eroded, replace the connector. Inspect the mating connector and replace it also if it shows the same symptoms.

Tap Test

Connect an oscilloscope to the pins of the transducer’s connector. Refer to SECTION 6, "Drawings," for the wiring diagrams. Tap the face of the transducer with a screw driver handle or other smooth, light object and note the waveform on the oscilloscope. The peak voltage level should be in the hundreds of millivolts. Note that for a transducer or hydrophone array, the other transducers or hydrophones in the array should display a similar waveform and voltage for a similar tap; furthermore, if a *digital* oscilloscope is used, it should be possible to observe that the phases are the same.

The hydrophone arrays each contain a built in preamplifier. To perform the tap test, first supply a DC voltage across the power input and power ground pins. Refer to SECTION 6, "Drawings," for the wiring diagrams. A 9 volt radio battery is ideal for this purpose.

Short Circuit Test

Only the AT-14F7C high frequency transducers can be tested for a short circuit. The AT-471 low frequency transducers each have an internal transformer, which appears as a short circuit when tested. Disconnect the cable from the AT-14F7C high frequency transducer. Using a megometer or a digital multimeter on the highest ohm scale, measure the resistance of *each* pin of the cable or connector mold to every other pin. All measurements should read greater than 10 megohms; however, a value as low as 1 megohm will allow the system to work temporarily as the short circuit is still developing.

WARNING Do not use a megometer to check the hydrophone arrays for a short circuit. The hydrophone arrays each contain a built in preamplifier which could be damaged by the high voltage output of the megometer.

Before reconnecting any of the cables, clean the connector pins and sockets with an alcohol wipe, and then lubricate the pins with an O-ring quality silicone or barium based lubricant.

Transmit Test

Transmit into the transducer at full power. It should be possible to hear the transmit burst as a sharp, crisp pulse. Listen for voltage arcing or hissing which indicates a faulty transducer. It should also be possible to feel the transmit pulse with the hand.

Changing the Transformer Jumpers

Each of the tow vehicles and the AT-471 transducer array used with the Chirp III Acoustic Profiling System require a specific jumper configuration on the two Transformer Jumper boards. Hence when a different tow vehicle is connected to the DSP-665 Transceiver, the jumper configuration on the Transformer Jumper board may require changing.

Before connecting a different tow vehicle, refer to SECTION 6, "Drawings," for the assembly drawing of the Transformer Jumper board, which is Drawing B662-07747. In addition, refer to Figure 5-1 for the location of the Transformer Jumper boards, and then perform the steps listed below to reconfigure or verify the jumper configurations on both boards.

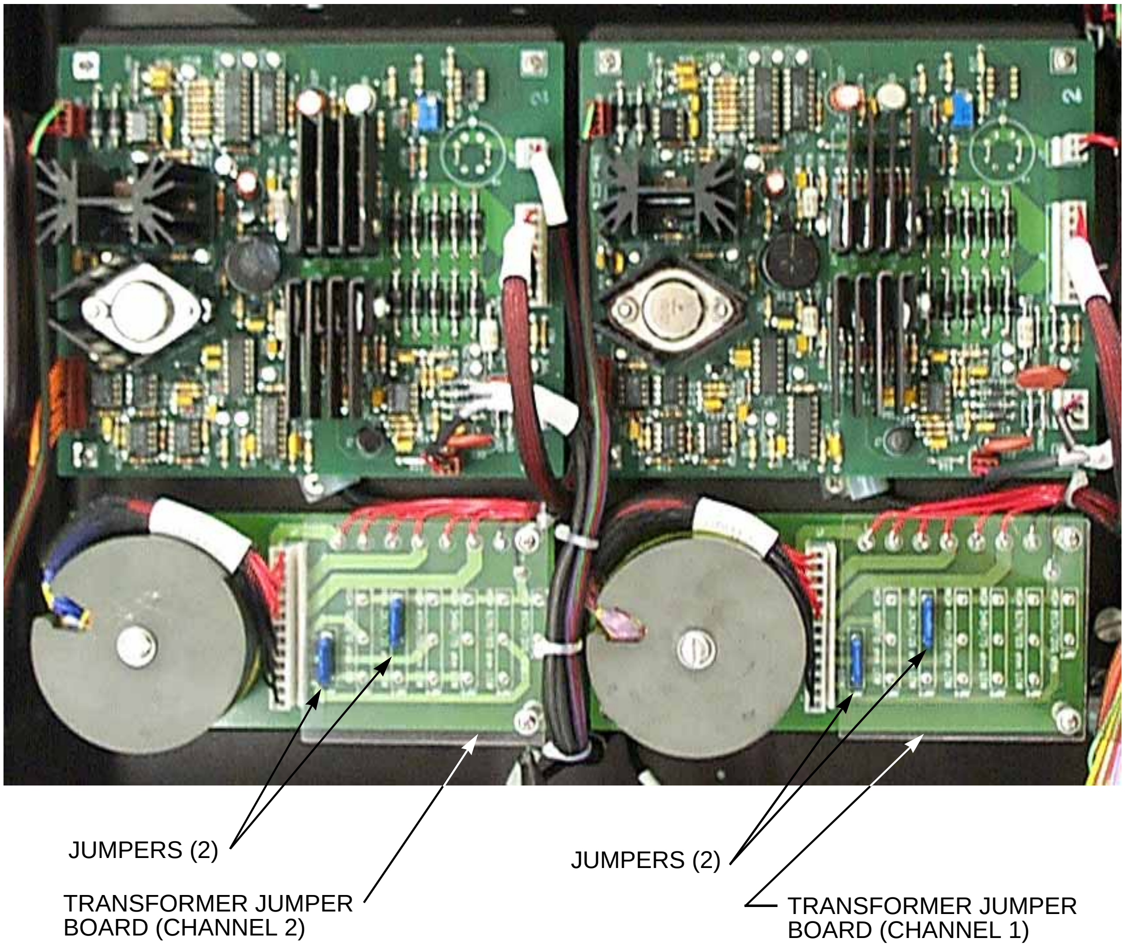

Figure 5-1 Location of the Transformer Jumper Boards

1. Turn off the DSP-665 Transceiver.
2. Loosen the quarter-turn fasteners that secure the cover and remove the cover.
3. Locate the two Transformer Jumper boards, one connecting to the Channel 1 Transmitter board, and the other to the Channel 2 Transmitter board.
4. Refer to the leftmost column in the table in Drawing B662-07747 and locate the model number of the tow vehicle that is to be connected.
5. In the STANDARD column under LOW FREQUENCY CHANNEL 1, determine the HIGH and LOW jumper settings for the tow vehicle.

6. Locate the jumper sockets (JMP1–JMP6) on the Transformer Jumper board that connects to the Channel 1 Transmitter board. Two of the jumper sockets should have a jumper already installed.
7. Reconfigure the jumper settings by removing and reinstalling as necessary the two jumpers in accordance with the HIGH and LOW jumper settings determined in Step 6.
8. In the STANDARD column under HIGH FREQUENCY CHANNEL 2, determine the HIGH and LOW jumper settings for the tow vehicle.
9. Locate the jumper sockets (JMP1–JMP6) on the Transformer Jumper board that connects to the Channel 2 Transmitter board. Two of the jumper sockets should have a jumper already installed.
10. Reconfigure the jumper settings by removing and reinstalling as necessary the two jumpers in accordance with the HIGH and LOW jumper settings determined in Step 9.
11. Replace the transceiver cover and the four cover screws.
12. Slide the transceiver back into the rack and replace the four front panel screws.

SECTION 6

Drawings

This section includes the assemblies and wiring diagrams for the DSP-665 Transceiver and the TTV-170 and TTV-290 Series Tow Vehicles. In addition, connection diagrams for the cabling in the TTV-170 and TTV-290 Series Tow Vehicles are included.

DSP-665 Transceiver Drawings

The drawings listed below apply to the DSP-665 Transceiver.

C664-1283	CPU Board Assembly
C664-1263	Front Panel Board Assembly
B662-07747	Transformer Jumper Board Assembly
C206-06523	Transmitter Board Assembly, 1–30 kHz
B664-1233	Power Supply Assembly, +/-5 VDC and 12 VDC, 1.8A
C664-1243	Dual Receiver Board Assembly
B662-07777	Rear Panel Board Assembly
B-250-199	Multi-tapped Transformer Assembly
D664-0091	DSP-665 Wiring Diagram

TTV-170 and TTV-290 Series Tow Vehicle Drawings

The drawings listed below apply to the TTV-170 and TTV-290 Series Tow Vehicles.

D602-04087	TWC-602 Deck/Tow Cable Wiring
B170-06784	TTV-170 Block Mold Wiring Diagram
B190-07486	TTV-290 Block Mold Wiring Diagram
B660-07935	BPR Hydrophone Interface Cable Wiring Diagram

Hull Mount System Drawings

Hull mount system drawings are supplied by Teledyne Benthos in accordance with the specific requirements of the installation. Contact Teledyne Benthos for more information. Also, refer to APPENDIX A, "Hull Mount System Installation Requirements," for a general overview of the installation requirements for a hull mount system.

APPENDIX A

Hull Mount System Installation Requirements

This appendix includes a general overview of the requirements for installing a typical hull mount system and connecting it to the DSP-665 Transceiver. A hull mount system consists of a transducer array of from 4 to 16 low frequency transducers and a high frequency transducer. The transducers are mounted external to the hull or within a hull-mounted sea chest. The transducers are connected to the transceiver through one or more junction boxes and the Remote Controlled Transmit/ Receive module. The major components of a typical hull mount system is shown in Figure A-1.

NOTE Hull mount systems require modification to the vessel and generally require specific engineering instructions and drawings, which are supplied by Teledyne Benthos. Contact Teledyne Benthos for instructions and recommendations with regard to the specific installation.

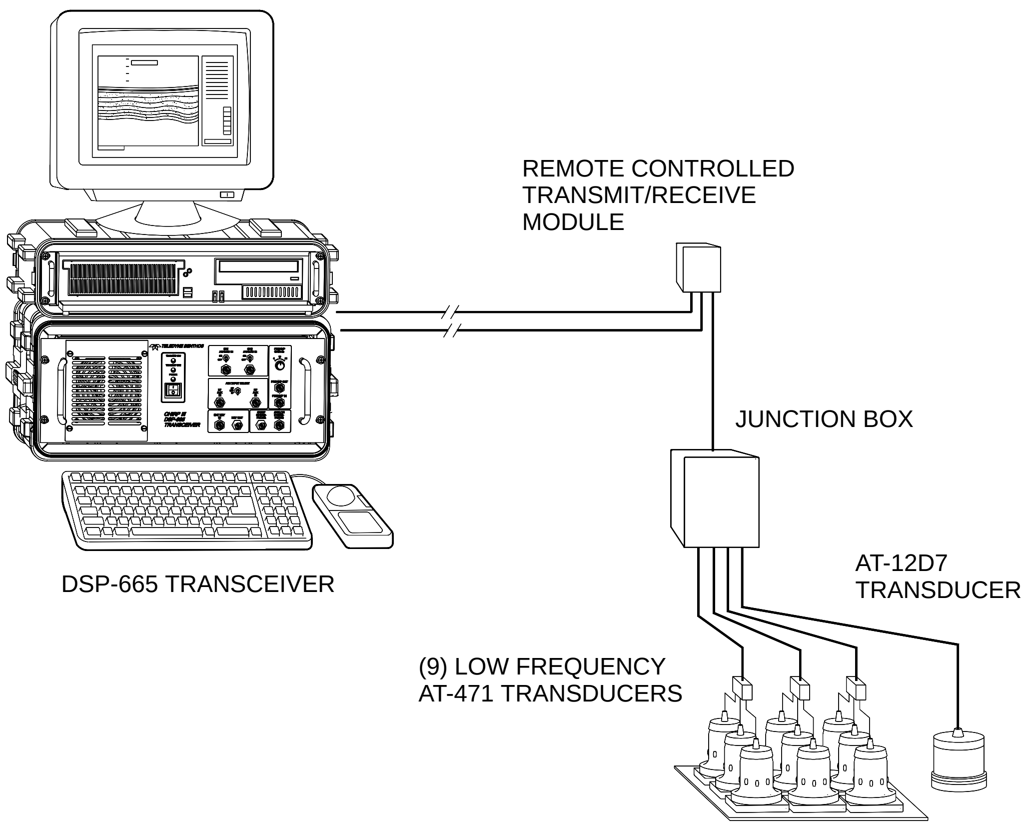

Figure A-1 Major Components of a Typical Hull Mount System

Transducer Array Configurations

Two general transducer configurations can be applied to the installation of the transducer array: the through-hull and inside-hull configurations. In a through-hull configuration the transducers penetrate the hull and are either flush mounted or protrude outside the hull. In this configuration a free flooding dome is used to protect and fair in the transducers. In an inside-hull configuration the transducers are mounted entirely within the hull in a sea chest, as shown in Figure A-2. In this configuration the sea chest is flooded and a stand pipe is used to subject the transducers to a hydrostatic pressure. The hydrostatic pressure allows more power to be applied to the transducers without causing cavitation, thereby increasing range and bottom penetration.

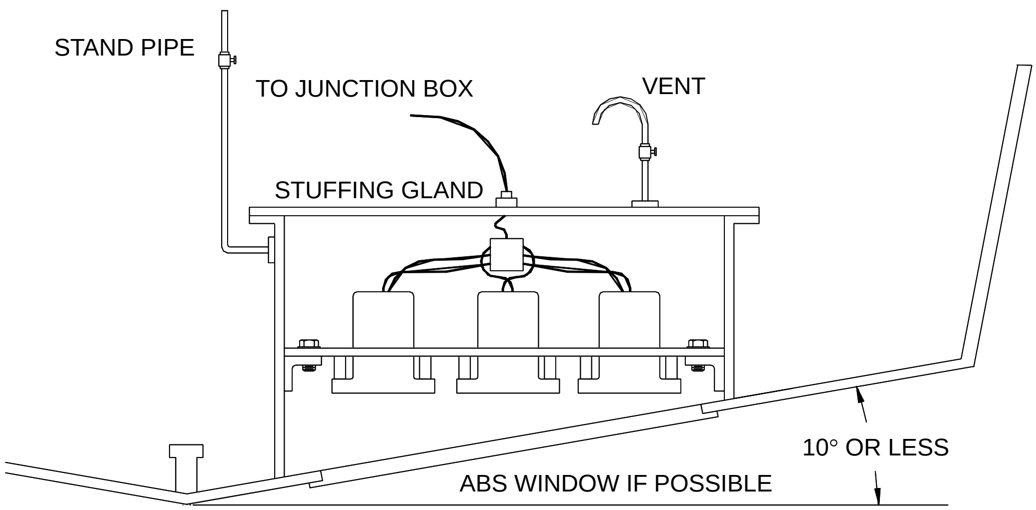

Figure A-2 Inside-Hull Transducer Array Configuration

Transducer Location

When determining the location for the transducers, consideration should be given to the presence of four typical sources of noise: hydrodynamic, which includes flow, turbulence, cavitation, bubbles, and splash; noise from the ship's propeller; acoustic sources from other bathymetric systems; and machinery, including turbines, pumps, and blowers. The location of the transducers should be in an area that is relatively quiet and as free as possible from all these noise sources. In addition, the transducers should be installed as far as possible from stabilizing fins or vanes, which can produce turbulence and bubbles. Generally the optimum location of the transducers is from 1/2 to 1/3 of the distance from the bow to the stern, and close to the keel.

NOTE If survey speeds exceeding 5 knots are anticipated, it is especially important to ensure the transducers will remain submerged at all times, and the area around the array will remain relatively free of hydrodynamic sources noise.

NOTE It is also recommended that the transducers be installed where the angle of the hull is 10° or less relative to the horizontal. This angle is shown in Figure A-2.

Transducer Installation

The transducers are mounted inside the sea chest on mounting plates in accordance with detailed installation drawings that can be obtained from Teledyne Benthos for the specific installation. When the transducers are installed, they are connected to the junction box, as shown in Figure A-1, with cables and block mold connectors, which are located inside the sea chest. After the installation is complete and the cables connected, the sea chest is flooded.

For further information on the installation of the transducers, including detailed drawings of typical installations, contact Teledyne Benthos.

System Wiring

Both the low frequency and high frequency transducers are individually wired to one or more junction boxes. In the junction box the low frequency transducers are wired in series/parallel and then wired, along with the high frequency transducer, to the Remote Controlled Transmit/Receive module. The Remote Controlled Transmit/Receive module includes a preamplifier for amplifying the received signals and an attenuator for controlling the transmit power level. Both the gain of the preamplifiers and the transmit power level are remotely controlled by the DSP-665 Transceiver.

Junction Box

The junction box should be mounted within 50 meters of the transducers and to a part of the ship’s structure that is relatively vibration free. It should not be mounted near or on any machinery. Do not mount the junction box in an area that is normally flooded and be sure that access to the junction box is available—the junction box cover opens from right to left. The junction box connects the transducers to the Remote Controlled Transmit/Receive module.

Remote Controlled Transmit/Receive Module

The Remote Controlled Transmit/Receive module should be mounted within 10 feet of the transceiver in accordance with the same mounting considerations used when installing the junction box. The module connects the transceiver to the junction box.

Transceiver

The DSP-665 Transceiver is installed in accordance with the procedures in SECTION 3, "Setup and Deployment.". The mounting considerations and connections are the same except that the transceiver is permanently connected to the Remote Controlled Transmit/Receive module.