TELEDYNE RD INSTRUMENTS
A Teledyne Technologies Company

Ocean Observer

Fixed-mount System Configuration and Sales Information – January 2009

General Product Information

The Ocean Observer (OO) product family is intended to provide long-range current profiling when permanently mounted on fixed structures, such as oil rigs and production vessels.

- The 38kHz Ocean Observer is our longest-range profiler, providing 800m to > 1000m of current profiling range. The OO family also offers both 75kHz and 150kHz models for applications requiring less range.
- All OO systems use Teledyne RD Instruments (RDI) patented phased-array technology, which creates 4 acoustic beams simultaneously, from a single compact transducer.
- Proper installation is a critical factor in the realization of optimal system performance. The OO phased-array transducer allows one of the four acoustic beams to be turned off, so that one section of the transducer can be oriented toward the structure, allowing the other beams to avoid underwater obstructions.
- OO Transducers contain a fluxgate compass to provide transducer heading, when the transducer is installed by being freely-suspended, over-the-side, on a cable. If the transducer is fixed to the structure, the heading must be input to the ADCP software from an external reference.
- OO systems are capable of both narrowband processing, for long range operation, and Broadband processing, for high-precision measurement. Broadband and narrowband pings can be interleaved, for simultaneous operation.
- OO systems provide bottom-track reference for direct vessel speed measurement. Vessel speed can be output from the system computer to a network, or input to another system, such as dynamic positioning.
- The OO system includes 100m of Transducer cable to connect the Transducer to the Electronics Chassis.

Following are specific answers to common questions on details for the Ocean Observer product family.

Frequently Asked Questions

What should be considered for a complete OO system?

Ultimately, the system must meet its performance expectations when in use at the customer's site. While that may seem obvious, satisfactory system performance is critically dependent upon proper installation. As a system manufacturer, Teledyne RDI can only guarantee the performance of its products, *as shipped*. Unless every effort is made to insure proper installation, the performance of the *as-installed* system may be compromised. The OO system should ALWAYS be considered as part of a complete package, to insure the best results.

The total package should consist of:

- The OO model appropriate for the user application
- The recommended computer system, or equivalent
- Commissioning Services
- Extended Warranty
- Spare Parts
- Consideration of the provision and quality of external data input from non-TELEDYNE RDI sources (eg: heading)
- Discussion of design services for mounting structures and system installation.

What is included in the System Hardware?
The product hardware consists of (3) major pieces; the Transducer, Transducer Cable, and Electronics Chassis.

- The product selection consists of (3) fixed-frequency models: 38kHz, 75kHz and 150kHz.
- The OO transducer is a round, flat-faced, 32x32 (or 36 x 36) element phased-array. The Transducers are frequency-specific; they cannot be interchanged. Transducer cases are naval bronze. The Transducer housings are (nominally) depth-rated to 200m. NO high-pressure option is available. The OO fixed-mount Transducer contains heading and tilt sensors.
- The Transducer cable is not frequency-specific. The STANDARD Transducer Cable is supplied in a 100m length, with both connectors installed as straight, molded connectors. The wet-end connector can be 90 degree angle, if so specified with the order. The dry-end (Chassis) connector may be delivered unattached, for ease of cable installation, and may be supplied in an angled configuration, if so specified with the order. The Transducer Cable length should be specified at the time of order, if a longer cable is required.
- The Electronics Chassis are frequency-specific; they cannot be interchanged. Chassis are 19" rack-mount, NOT weather resistant, sealed or waterproof. The Chassis accepts 85VAC to 250VAC, 45-65Hz input power.
- External heading data, from a customer-supplied device, may be input to the OO system software (included), running on a customer-supplied computer.

Optional Sub-sea Hardware Configuration
An alternative configuration is available (OO-DR) to substitute a sub-sea housing containing the electronics that otherwise would be in the topside Electronics Chassis. This allows the electronics to be deployed underwater, next to the Transducer. This arrangement allows the use of a simpler power/serial communications cable from the underwater instrumentation, to the topside computer/power interface, enabling longer cable runs and less opportunity for system damage should the underwater cable be cut or shorted.

What System Software is provided?
Teledyne RDI Windows-based software is supplied with the OO system at no additional charge, on CD-ROM media.

- VMDAS is the primary program, supplying system control, data acquisition, display and data logging functions. VMDAS is compatible with Windows 95/98, Windows 2000, XP and NT operating systems. No testing has been done on Windows ME or Vista. See recommended computer specification, below.
- WinADCP is supplied to provide the function of time-series display. WinADCP can be automatically invoked by VMDAS.
- Teledyne RDI Tools system utility support software.
- Free software updates are available from the Teledyne RDI website.

What are the requirements for a dedicated Computer System to support the OO?
Teledyne RDI recommends the use of a commercial PC, as the most economical approach to providing OO system support. Commercial PCs are generally suited for use in environmentally-controlled spaces, and should have a useful life of about 3 years. Industrial, ruggedized, rack-mount, or military-specified computer hardware is also acceptable, but generally is much more expensive for similar technology, and not necessarily more cost-effective.

The recommended computer system, described below, will support multiple sessions of VMDAS and WinADCP..

- Pentium® III Processor at 866MHz, (or similar, or more capable processor: ie: AMD, P4, etc.)
- Windows 95/98, 2000, XP or NT operating system (NOT Windows ME)
- 128MB RAM, (64MB minimum)
- 20GB HD, (12GB minimum)
- CDRW, (CD-ROM read-only, minimum)
- Ethernet Card,
- 4-port SIIG PCI Card,
- 19" Monitor. (15" minimum)

The price and availability of computer technology continues its' rapid change. A typical system, available as of January 2009, is the Dell OptiPlex® 740 Series PC. However, Teledyne RDI is not necessarily endorsing this brand of PC; it is just one example of a system that meets the PC capability requirements. RDI cannot evaluate the many brands of PC and accessories that provide similar capability. It is probably best to choose a PC manufacturer with a significant sales volume in your region, as any PC warranty & repair issues will be handled directly between the end-user and the PC manufacturer.

Can the customer use their existing computer system to support the OO?
So long as the system meets the minimum specifications, above, it should be adequate. Processor speed, memory, disk space and number of serial ports are important factors in operating the system. Monitor size is important in taking advantage of the capability to display several information windows simultaneously.

Can the customer use their existing vessel network to communicate with the OO computer?
The computer for the OO system should have an ethernet card installed. VMDAS software allows OO data to be saved to, or read from, any network drive the OO computer can see. OO system timing is set from the computer. If the computer has access to the network, or has it's own GPS timing card, the OO system computer time can be synchronized with the shipboard time, therefore allowing the OO system to be synchronized with shipboard time.

What performance can be expected from the Ocean Observer?
The Ocean Observer 38kHz ADCP system is our longest-range profiler, best suited for drilling application in depths exceeding 800m. Maximum range achievable from our 38Khz system has been reported to exceed 1400m, but varies greatly with water conditions and ambient acoustic noise (e.g.; DP thrusters produce noise that can reduce range to 800m). In water depth greater than 1500m, additional ADCPs must be used to obtain coverage of the lower depths.

What can be done to provide coverage in depths greater than 1000m?
There are two potential areas of interest for current measurement at depths beyond the range of the 38kHz Ocean Observer. The bottom boundary layer (~50m) directly adjacent to the seabed may be measured with short-range profiler, such as the Workhorse Sentinel 300kHz ADCP, to monitor the currents that may affect BOP-related operations. The middle of the water column, extending from near the bottom, upward to within about 1500m of the surface, is generally not a highly-differentiated current field, and also has water properties not well suited for acoustic measurement. Representative measurement of this "mid-water-column" region is most often accomplished using a near-bottom mounted, upward-looking 75kHz ADCP (Workhorse Long Ranger 75kHz ADCP). The 75kHz Long Ranger system can profile for a range of several hundred meters, up to 500m or more, again depending on local water conditions. Such bottom-mounted systems have some obvious logistic issues, namely ease of installation, power supply and data recovery. Using buoy-mountings of battery-powered ADCPs with acoustic modems to transfer the data to the surface is one technique to deploy these instruments. Another method is to place the system near the BOP, and use existing BOP facilities for power and data communication.

Please visit our website: www.rdinstruments.com, and take a look at the article: "Real-time Ocean Current Data from 3000m and beyond" on our Library web page (http://www.rdinstruments.com/pdfs/offshore_eng402.pdf). This article describes how the bottom-mount system has been used along with the surface mounted system, to get an extended-range measurement. RDI does not directly offer these system integration services, but there are several service companies with experience in designing and performing the installations.

What affects the performance of the OO system?
The Ocean Observer is a Doppler sonar system, which transmits acoustic signals and listens to the echoes of those signals returned from materials floating with the currents throughout the water column. The performance of the system is generally related to the amount of energy transferred into the water, and the strength of the returned echoes in relation to other, unwanted, acoustic energy (noise). Nominal system performance, as represented in advertised specifications, can be expected so long as reasonable care is taken in system installation, good quality external sensor data (vessel heading & navigation) is provided, and environmental conditions (backscatter material concentration) are typical. The most common cause of poor system

performance is inadequate installation, or excessive noise (e.g: dynamic positioning thrusters). Excessive shipboard mechanical noise, water flow noise, bubble-layer interference, mutual interference with other shipboard acoustic sensors, poor navigation data, improper transducer alignment, and other similar chronic conditions can be minimized with proper attention to system installation. With adequate installation, system performance should be consistent with advertised specifications under typical vessel operating conditions. System performance, generally in terms of profiling range, will vary with density and distribution of backscatter material present in the water column, and with vessel attitude dynamics. Advertised performance specifications can be expected under typically-experienced conditions of sea state, backscatter intensity, and vessel operations.

What are the choices for OO system installation?
Proper transducer mounting is critical to system performance. There are several basic variations for fixed-mount system installation: (1) Fixed to a bracket or carriage, (2) within a moonpool, (3) on a stem or pole, over-the side, (4) on a cable, over-the side, or (5) within an acoustic well in the hull. The strongly preferred method is mounting on a carriage or other fixture, which allows rigid support and ease of retrieval for maintenance. This results in optimal system performance, along with ease of maintenance. Moonpool mounting can be acceptable, if care is taken to prevent excessive water movement (sloshing) around the transducer. Moonpools tend to be larger than a properly designed acoustic well, and may therefore resonate with the transducer ping (ringing), resulting in velocity measurement error. Stem (or pole) mounting is acceptable, however, if a stem is built to be extended and retracted, care must be taken to prevent the rotation of the transducer when the stem moves. Changes in transducer orientation will cause errors in water velocity measurements. Freely-suspending the transducer on a cable & frame assembly, properly designed to avoid excessive rotation, is a common method. Regardless of the method, all installations must be carefully designed to isolate the transducer from mechanical hull noise, be positioned away from DP thrusters and outfalls, and avoid beam interference from underwater structures.

Does Teledyne RDI provide structure installation designs?
Teledyne RDI provides generic, conceptual drawings for various types of ADCP mountings, and general advice on mounting criteria affecting ADCP operation. These are simple drawings, provided to illustrate basic ideas for acoustic well arrangement and transducer mounting. Each structure is unique as to hull design, machinery layout, and instrument location. RDI cannot supply specific, certified, mechanical design drawings, because we are not prepared to offer professional marine architectural services at the level required to enter into contractual relationships with shipyards. Refer to the OS Installation Guide for details.

What are the installation issues regarding ADCP placement and orientation?
The OO phased-array transducer projects 4 narrow acoustic beams. Nothing should interfere with the beams, or the performance of the system may be compromised. Each beam is oriented at an angle of 30 degrees from the vertical. The 4 beams are arranged at in opposite pairs, so every beam is 90 degrees from its adjacent beams. Each beam is about 4 degrees in beam width.

If you were standing above the transducer, looking down at it, and you could see the beams spreading down and out through the water, they might look like 4 flashlight beams looking down into the water. Using this example, the transducer should be installed so the beams do not "see" any underwater structures like risers or mooring lines within a 15 degree “buffer zone” around each of the beams, throughout the length of the beam. When mounting near the surface on a spar-type structure, there may be no way to orient the transducer for the beams to miss either the main structure or all of the risers. There are two options to deal with this situation: 1) turn off one of the 4 beams, orienting that beam toward the obstruction, or 2) tilt the transducer upward to miss the obstructions (note: this reduces vertical profiling range).

Avoid placing the transducer near sources of noise or severe disruptions of the water column. DP thrusters and effluent outfalls can inject bubble trains and acoustic noise within the field of the ADCP, causing degradation of the ADCP signal-to-noise, with resulting loss of profiling range. Avoid transducer cable runs over 100m, and cable runs in electrically noisy areas (mixed cable trays). Avoid breaking the transducer cable with junction boxes, whose connections will electrically degrade over time. Place the Electronics Chassis in a controlled environment to avoid overheating (> 40 degrees C) and weather damage. Supply clean AC power to the ADCP, by using a 2KW UPS. The *Optional Sub-sea Hardware Configuration (OO-DR)* allows the electronics to be deployed underwater, next to the Transducer. This arrangement allows the use of a simpler power/serial

communications cable from the underwater instrumentation, to the topside computer/power interface, enabling longer cable runs and less opportunity for system damage should the underwater cable be cut or shorted.

What installation support services are offered?
Teledyne RDI does NOT offer to perform the physical installation of the system hardware components. Teledyne RDI offers installation support services in the form of a "Commissioning Service". This service is quoted as a standard service product, consisting of 4 days of on-site engineer time, including travel and expenses. The price varies with the location. The standard Commissioning Service does not cover extended stays, or multiple visits, however services can be purchased on a day-rate basis. Extra days can be purchased at a day-rate. Teledyne RDI can also supervise the installation process in a short separate visit, prior to commissioning. However, each trip is a separate commissioning service.

Almost all installation work, in the past, has been done by service companies who have field engineers qualified to go out on oil rigs and do the installation work. The service companies also have designed the various mounting structures and other bits required to actually complete the installation for each particular vessel. Almost every rig is different. That is why Teledyne RDI does not have plans or parts to supply to help someone do the installation work themselves. Up until recently, this has worked out OK for Teledyne RDI. Teledyne RDI is in the business of manufacturing instruments, and the service companies are in the business of project design & management, installation, maintenance and data quality services. However, this separation of businesses also keeps Teledyne RDI from being able to provide much support to customers like shipyards, who have the capability to do the required work, but don't know how to design the installation. All we can really do is point out what factors affect the operation of the ADCP.

What if an end-user (not service company) customer declines to buy installation support services?
Often, end-user customers will insist on purchasing only the OO system, without commissioning, or a computer. The customer may be considering installation services separately, plan to do it themselves, and may already have an acceptable alternative to the computer. Commissioning support is so important, however, that it should be stressed that *without formal system start-up, Teledyne RDI cannot properly address reports of poor system performance.* It is in everyone's best interest to commission every OO system.

What is the Factory Warranty?
Teledyne RD Instruments offers a one-year, standard, limited warranty on the Ocean Observer. This warranty is intended to cover manufacturing defects, and is NOT an *as-installed* performance warranty. This warranty offers repair or replacement, at RDI's option, for covered defects in equipment returned to the factory, shipped at the owner's expense. An Extended Warranty is available, extending the period of the original factory warranty.

Are there any recommended spare parts?
No individual, board-level, spare parts are available for OO systems. Transducer Cables and Chassis are available as replacement parts, but are not usually recommended as spare parts. Transducers are the high-value part of the OO system. Transducers are available as replacement parts, only with the return of the old transducer. Transducers are not offered as spare parts. Teledyne RDI also offers an expedited Exchange Service through our Customer Support Department, as an alternative to carrying spare parts.

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