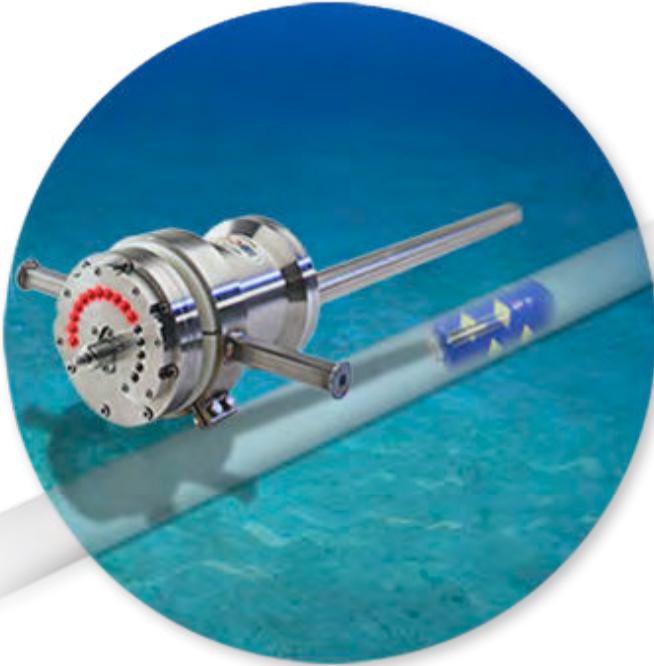


CD42-STS

Subsea Diver/ROV Pig Location and Tracking System

USER GUIDE



24-HOUR EMERGENCY TELEPHONE NUMBER

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SERVICES ASSOCIATION
member



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The CD42-ST5 is covered under United States Patent.



WARNING



Any operation involving work on pipelines containing gases or liquids under pressure is potentially hazardous. It is necessary, therefore, to follow correct procedures in the use of this equipment to maintain a safe working environment.

No person should use this equipment unless fully aware of potential hazards of working with pressurized pipelines and trained in the procedures stated in this manual.

The purchaser of this equipment is responsible for the training and competence of operators and the manner in which it is used.

Contact CDI immediately should any difficulty arise in the use of this equipment.



WARNING



Always use caution when opening any CDI transmitter that has been in a pressurized environment.

It is possible for pressurized liquid or gas to leak into a transmitter and remain there even after the transmitter has been removed from the pipeline.

Always point the transmitter away from yourself or others when opening a cover or end cap.

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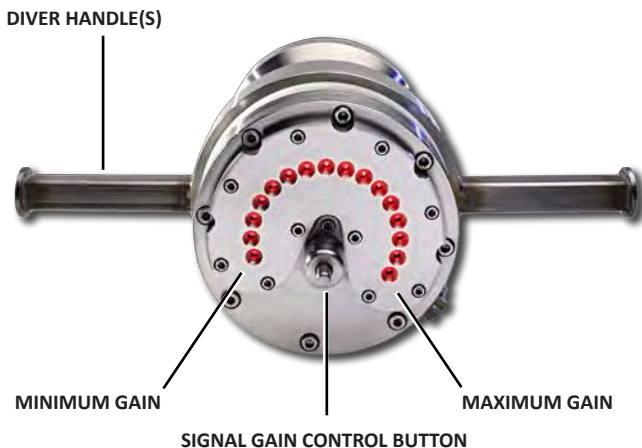
INTRODUCTION

The CD42-ST5 is a pipeline pig locating and tracking receiver that detects pulsing signals emitted by electromagnetic transmitters in a subsea pipeline.

The transmitter signal strength is displayed on an LED array which can be easily seen by a diver or ROV operator who is tracking moving pigs and/or locating a stationary or stuck pig.

DEPLOYMENT

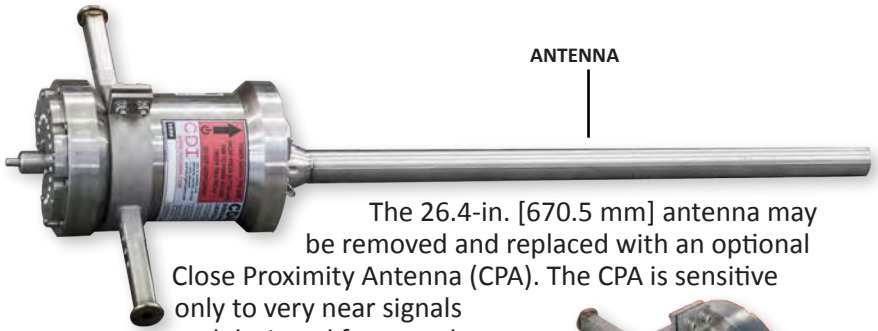
The CD42-ST5 may be deployed below the ocean to depths of 8,000 ft [2,439 m] and is designed to be either carried by a diver or ROV. It is rated for a maximum pressure of 3,650 psi [245 bar].



COMPONENTS

The CD42-ST5 is constructed of stainless steel. A control button adjusts antenna gain, which is displayed on an array of 16 light-emitting diodes (LED). The LEDs also indicate transmitter proximity when tracking or locating a pig. Diver handles may be removed and replaced with optional “fishtail” ROV handles (see pg. 24).





ANTENNA

The 26.4-in. [670.5 mm] antenna may be removed and replaced with an optional Close Proximity Antenna (CPA). The CPA is sensitive only to very near signals and designed for use where multiple pigs are extremely close to one another such as in launchers and receivers.



POWER

The CD42-ST5 is powered by six (6) D-cell alkaline batteries. The batteries are located in the unit's stainless steel housing. Changing these batteries requires disassembly of the housing (see pg. 18).

The CD42-ST5 will operate for up to 60 hours (2.5 days) on a change of batteries.

DETECTION METHODS

The CD42-ST5 can track and locate any pig or inline inspection (ILI) tool equipped with a 22 Hz electromagnetic transmitter. Shown here are some of the 22 Hz transmitters manufactured by CDI.



GETTING STARTED

Physical Checkout

The CD42-STS receiver is assembled at CDI and should be ready for operation upon receipt. The batteries are installed and the unit is sealed and tested for functionality just prior to shipment.

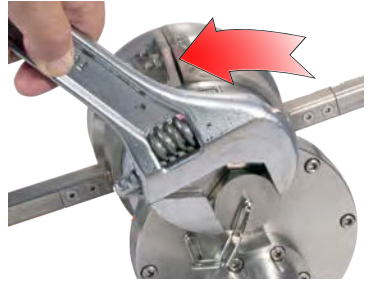
Check for any damage to the CD42-STS receiver after removal from the shipping container. Check the antenna for any bends, dents, or deformities.



Power ON

Remove the large hexagonal plug located on the antenna side of the system to access the power switch.

(You'll need a 1-5/8-in. open-end wrench or adjustable wrench to loosen plug).



Press the red pushbutton switch to toggle the system power ON/OFF.



Inspect O-ring and O-ring groove before replacing plug (see pg. 21 for O-Ring inspection and maintenance information).

Replace plug. Tighten until snug (do not over-tighten).



Operational Checkout

When the unit is first powered on, the unit will perform a self-check. This is indicated by a rapid back and forth scrolling of the LED array. The LEDs on each side will flash in succession from bottom to top and back down five times as shown here.



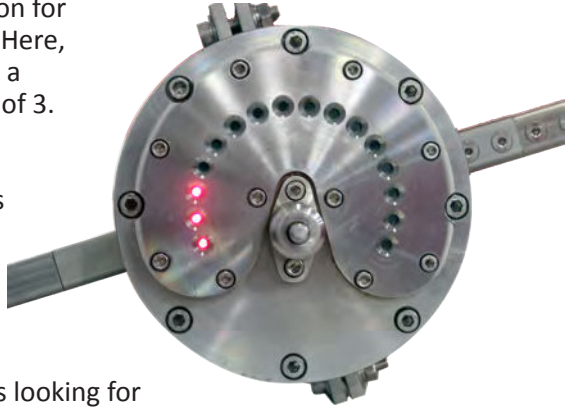
The CD42-ST5 is operational when the self-check has completed, but you may wish to adjust the signal gain before placing the unit into service. (See following pages.)

Signal Gain

When the self-check is complete, the display will indicate the last signal gain (sensitivity) setting stored in the memory by flashing three times and then remain on for another three seconds. Here, the unit has been set to a relatively low gain level of 3.

The gain readout will remain on for 3 seconds then the display will go dark.

The CD42-ST5 receiver is now in the operational mode and is looking for electromagnetic pulses. To verify that the unit is operating prior to deployment, bump the antenna with your hand. The displays LEDs will jump and confirm it is operating.



Gain Adjustment

Press and hold the control button momentarily to redisplay the current gain setting. To increase signal gain, continue to hold the button down. After approximately 3 seconds, you will see the LEDs light in succession from left to right as the gain level increases.

Each increment will be set in 1.25-second intervals.

After the gain control reaches the full-scale position it will cycle to the zero gain position. Keeping the button pressed will restart the gain increase cycle.

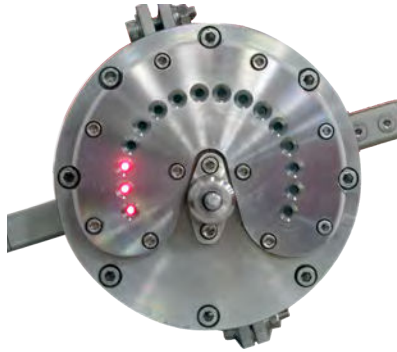


Gain Adjustment (cont.)

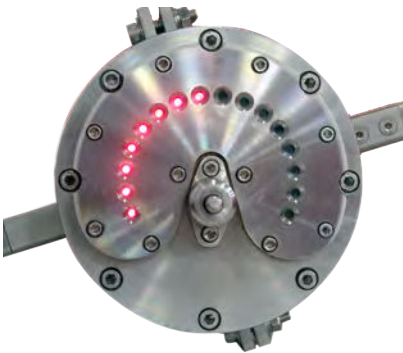
No LEDs lit indicate zero gain position. Low gain settings (1,2, and 3) are useful when the CD42-ST5 is used in very close proximity to a transmitter such as at a pig launcher or receiver.



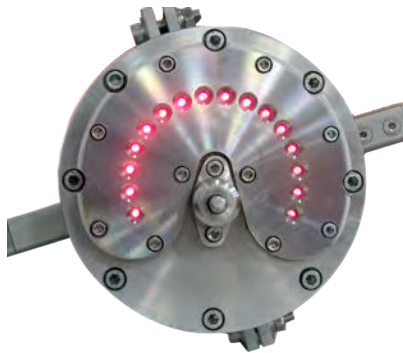
ZERO GAIN



GAIN LEVEL 3



GAIN LEVEL 8



MAXIMUM GAIN

The gain setting is stored in non-volatile memory. It is retained when the receiver is powered down and even if batteries are removed.

When the unit is powered back up your gain setting will be displayed in the power ON sequence.

OPERATION: TRACKING/LOCATING

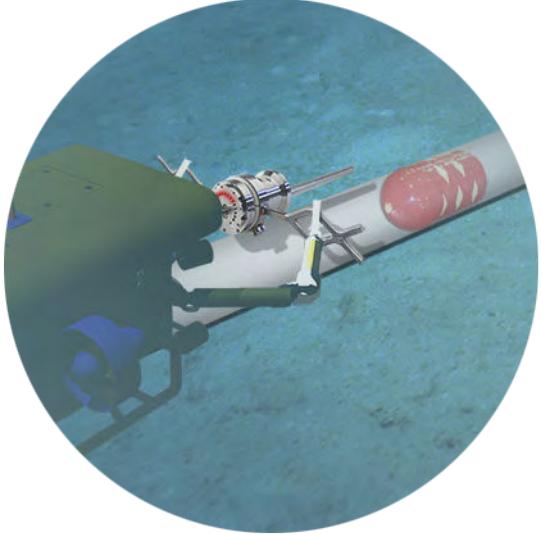
LED Array

The operator readout for tracking and locating is the 16-LED display. It is read from left to right (minimum to maximum). The LED behavior simulates the movement of the needle on an analog meter.

The display contains a peak hold indication whereby an LED will light to indicate the maximum averaged signal received by the CD42-STS receiver. As the signal level increases (or the transmitter gets closer) the peak LED will light and shift to the right and as the signal diminishes the peak LED will shift to the left. The LED indicators that are below the peak LED will pulse to indicate the pulses received by the transmitter.

Tracking a Moving Pig

The CD42-STS system must be within a few meters of a pipeline, with the antenna held parallel to the pipeline. Typically, the diver or ROV operator will set up with the antenna parallel to the pipeline in a location where he knows the pig will pass and wait.



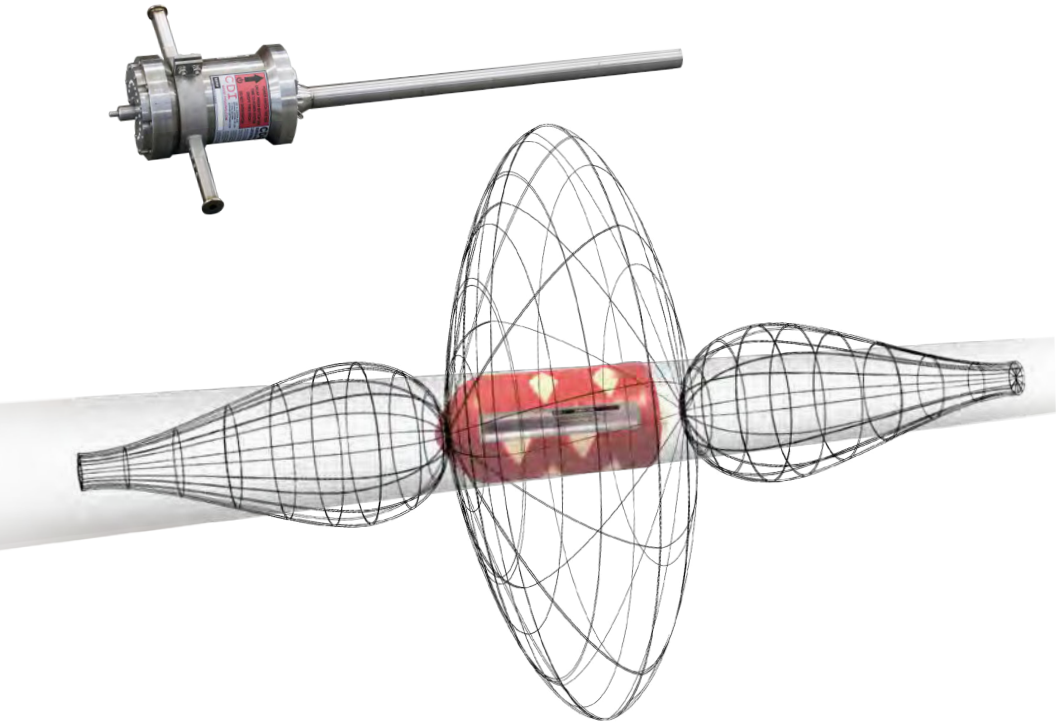


NOTE: When the CD42-STS receiver is used in conjunction with an ROV, the thruster motors will create large magnetic fields that will interfere with the operation of the CD42-STS receiver.

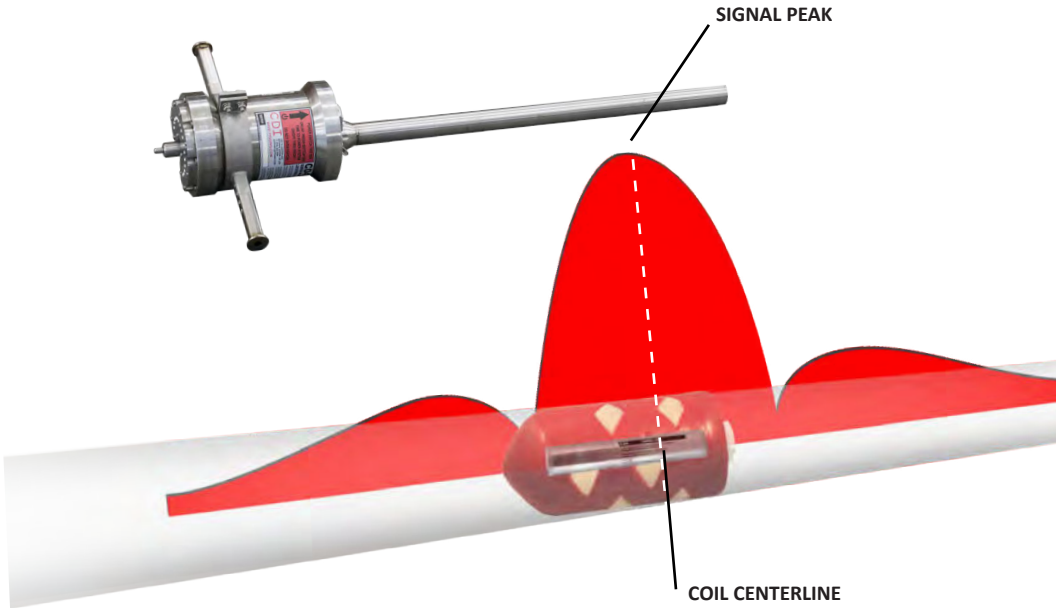


It may be necessary to park the ROV periodically to create a quiet electromagnetic environment for this system. This is an unavoidable side-effect of all magnetic-based pig location and tracking systems.

Electromagnetic fields are three-dimensional. A 3-dimensional rendering of a typical Signal field might resemble this. (Note STS antenna orientation parallel to pipe.)



As the pig approaches the unit, the measured signal strength increases. This is a two-dimensional representation of a signal peak:



The peak LED will shift to the right to indicate the increasing average strength as transmitter pulse strength increases.

After the pig passage, the operator moves quickly to the next predetermined spot to wait and monitor the signal for the approach of the pig.

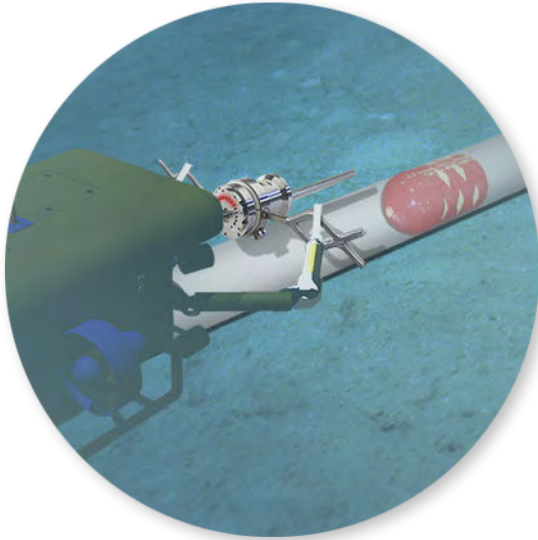
TRACKING/LOCATING (cont.)

Locating a Stationary Pig

Locating a stuck pig in a pipeline is one of the most useful features of the CD42-STS. The best way to minimize the amount of searching for a stuck pig is to properly track the pig in the pipeline so that when and if it does become stuck, the amount of pipeline in which it could be is at a minimum.

If the last confirmed tracking location is known, all the operator has to do to locate a stuck pig is back-track the pipeline until the receiver reads the signal.

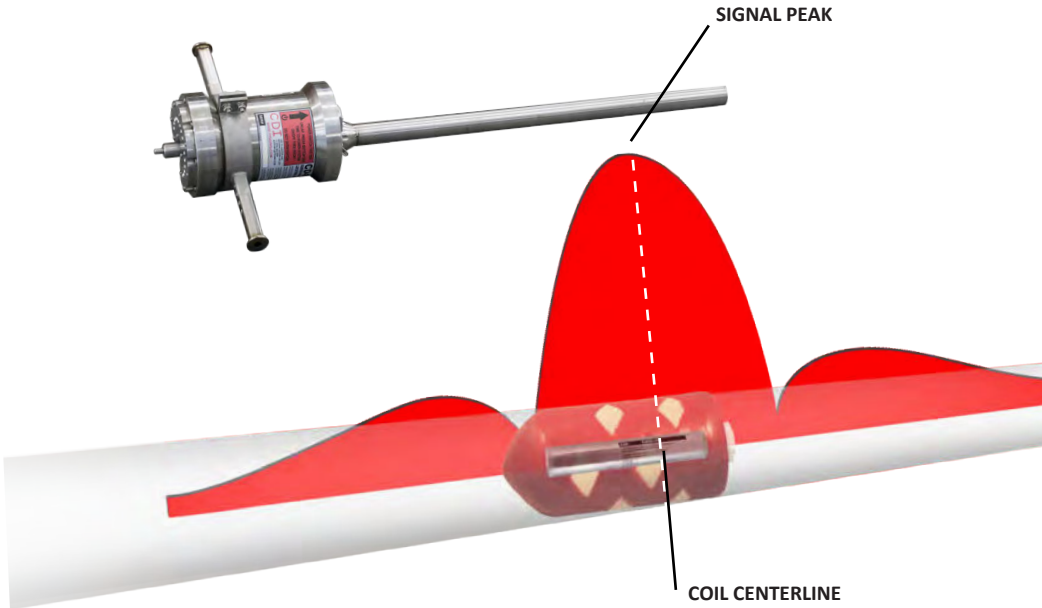
To locate a stationary pig, the diver or ROV operator moves along the pipeline with the antenna held parallel to the pipeline.



The peak signal indicator will shift right as the operator approaches the stuck pig. If the peak signal starts to diminish in strength (peaks start falling toward the left) the operator has passed the stuck pig.



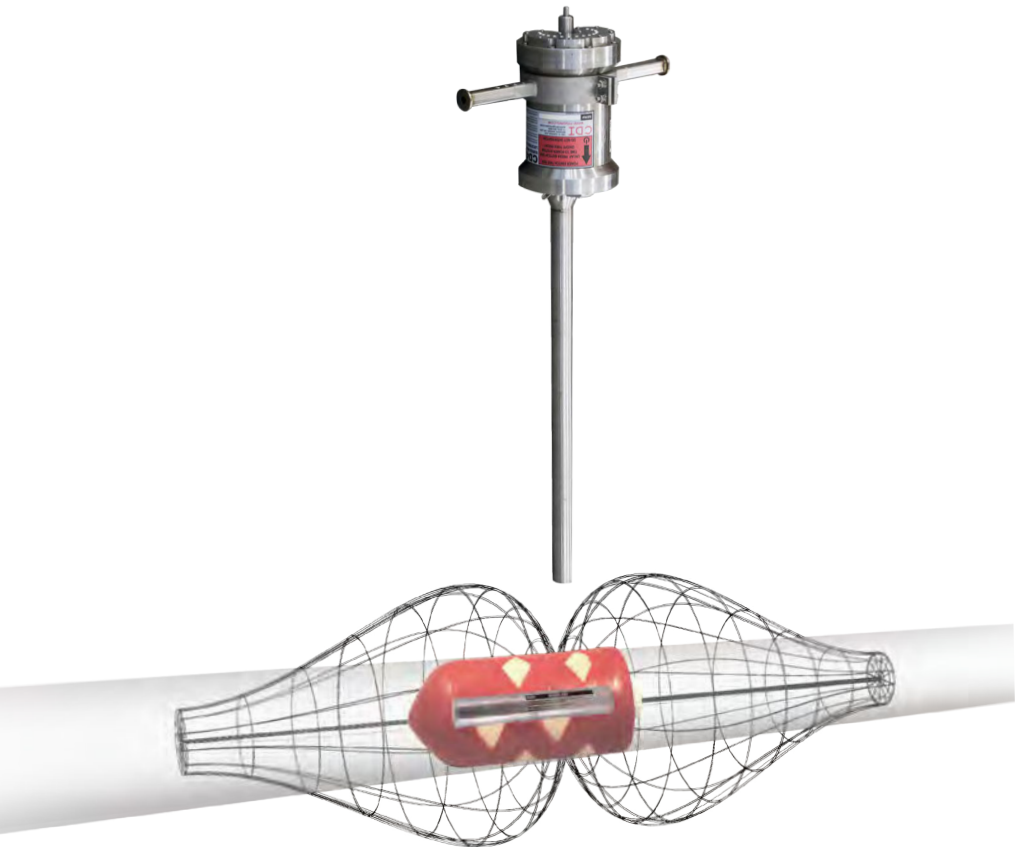
Back-track again until the perceived maximum signal is received. At this point the CD42-ST5 receiver is at its closest approach to the pig. This point on the pipeline can be marked for cutting or other remedial actions. (See next section, *Pinpointing*.)



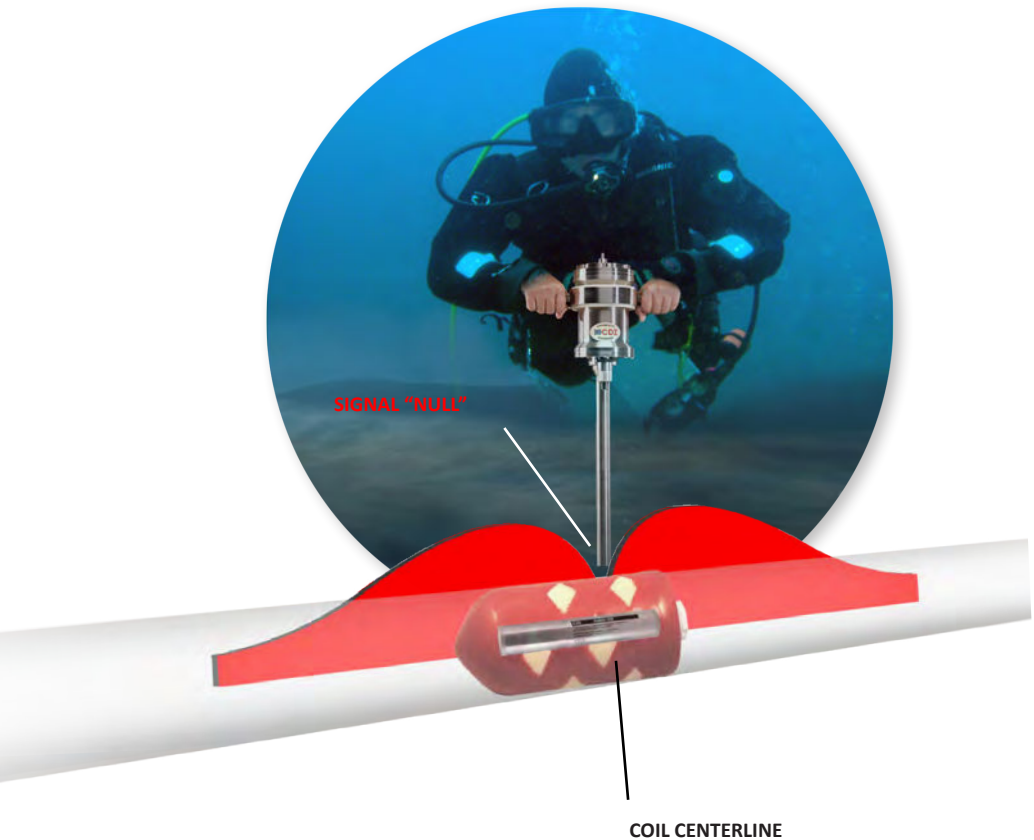
Pinpointing a Stationary Pig

Once the approximate location of a stationary pig is known, a more precise method known as “pinpointing” can be used to further increase the location accuracy. With the pinpointing method, the antenna of the CD42-STS is rotated to be perpendicular to the pipeline rather than parallel. Once rotated, the operator looks for the minimum (“null”) signal rather than the maximum.

A 3-D representation of the signal “null” is shown here:



This method relies upon the physics of the coupling between the magnetic transmitter inside the pipeline and the receiving antenna on the outside of the pipeline.



CHANGING/INSTALLING BATTERIES

The CD42-ST5 is shipped with 1.5 VDC D-cell alkaline batteries installed. The estimated battery life is approximately 60 hours (2.5 days).



WARNING



Do not perform this procedure in a hazardous environment. Ensure that you are in a safe and non-explosive atmosphere prior to opening.

Always use caution when opening any device that has been in a high-pressure environment such as a deep-sea operation

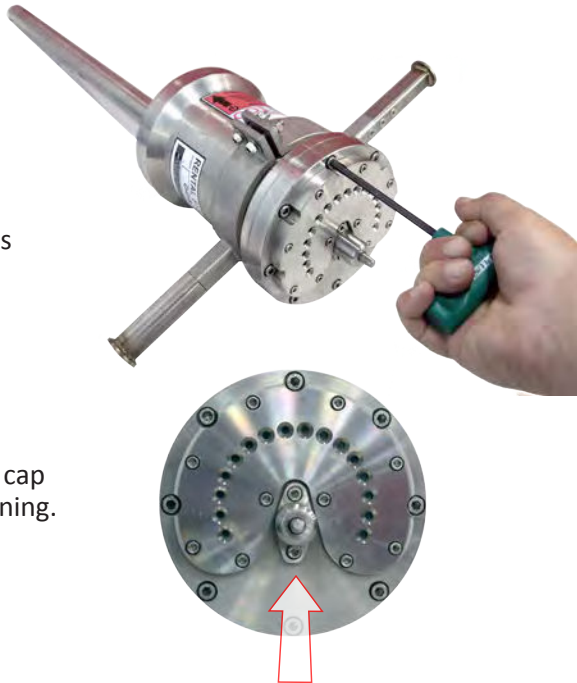
Always position the unit away from yourself or others when opening a cover or end cap.

To change batteries:

Tool required:
3/16-in Allen wrench

Remove the eight (8) socket head cap screws (1/4–20 x 5/8 in.) and lock washers from the operator end of the housing.

Note the clocking orientation of the end cap to the antenna positioning.

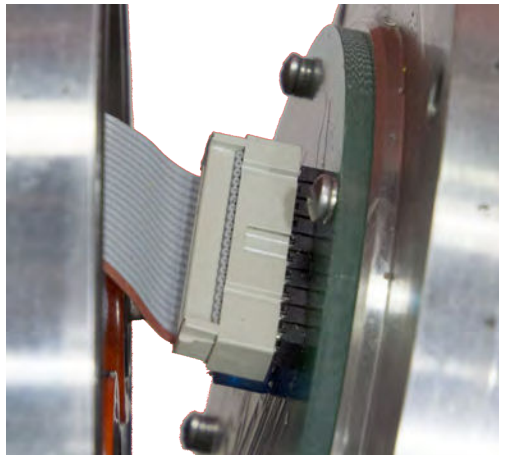


CAUTION: The end plate is heavier than it looks; be careful not to damage the O-ring or circuitry under the plate.

Do not bump or drop the end plate.



Avoid straining the ribbon cable or cable connections.



Carefully disconnect ribbon cable connector from circuit board on end plate.



Remove batteries.

Note battery polarity.
The four upper batteries are installed Positive (+) end facing out.



WARNING



When installing batteries, replace all batteries at the same time.

When replacing batteries, use batteries from the same package or manufacturing batch whenever possible.

**This device is designed for use with alkaline batteries.
Do not mix alkaline and lithium batteries.**

Always observe correct polarity when installing batteries.

The two lower batteries are installed Positive (+) side inward.



Before replacing end plate, remove and inspect O-ring and O-ring groove for

- dents
- deformities
- ruptures
- nicks
- scratches
- dirt
- foreign objects



or anything else that might interfere with a proper seal.

A brittle and/or deformed O-ring may not properly seal.

If in doubt, replace it.*

Lubricate O-ring with a light coating of high-temperature grease (such as Dow Corning MOLYKOTE® 44)



* End plate O-ring: CDI Part No. 700-50-2247-90

Carefully reattach cable connector to end plate circuit board.

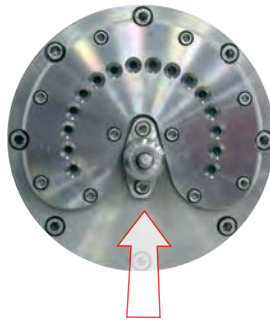
Ensure both rows of pins are seated properly and that none are bent or broken.



Ensure plate is lined up properly before installing fasteners.

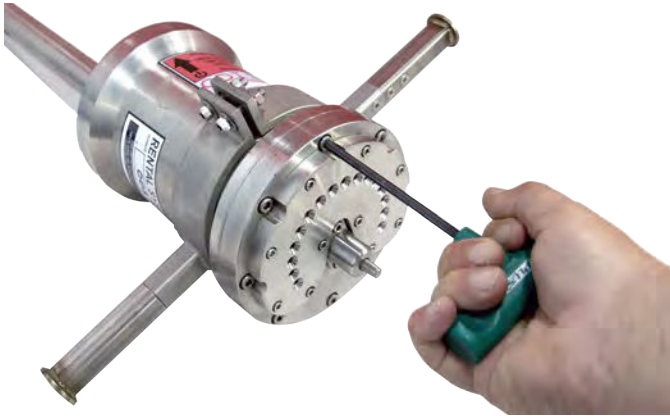


Note the clocking orientation of the end cap to the antenna positioning.

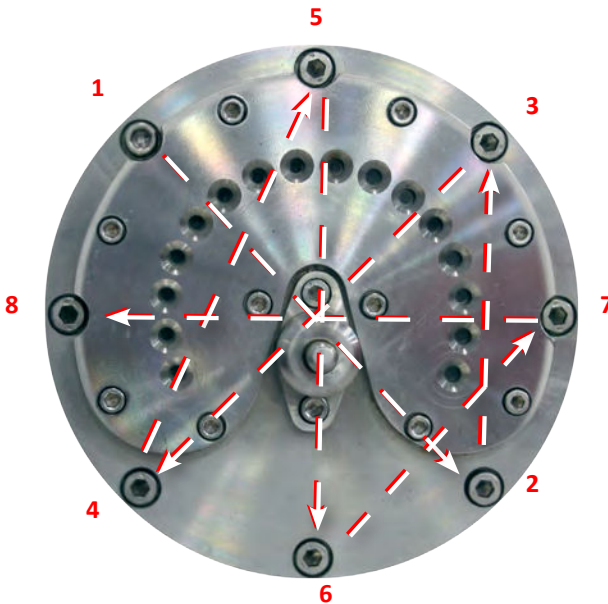


Reinsert the eight (8) socket head cap screws (1/4–20 x 5/8) and lock washers. See tightening sequence on next page.

Tighten the cap screws by hand until snug.



Tighten each screw in a rotating cross pattern (shown below) in 20 inch-pound increments. (If using a powered driver, avoid over-tightening).



Continue until the cap screws reach 60-inch pounds torque. After reaching the 60-inch pound level continue the torque pattern and torque to 70-inch pounds.

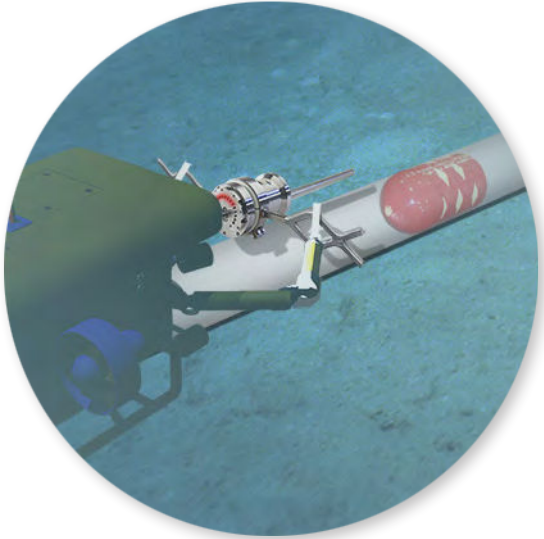
This is the final torque level.

OPTIONAL EQUIPMENT

ROV Handles

These easily-installed “fishtail” handles are designed for efficient ROV tooling

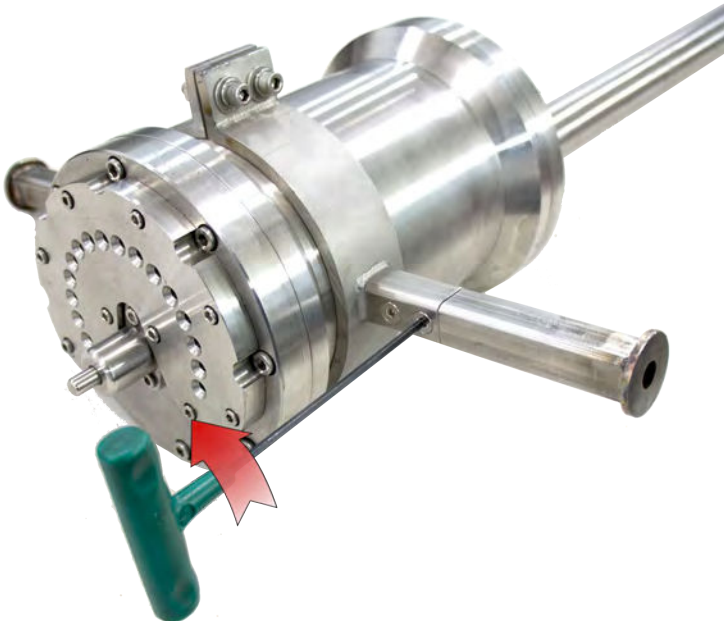
(CDI Part # 943-50-0003-01).



Installation

Tool required:
1/8-in. Allen wrench

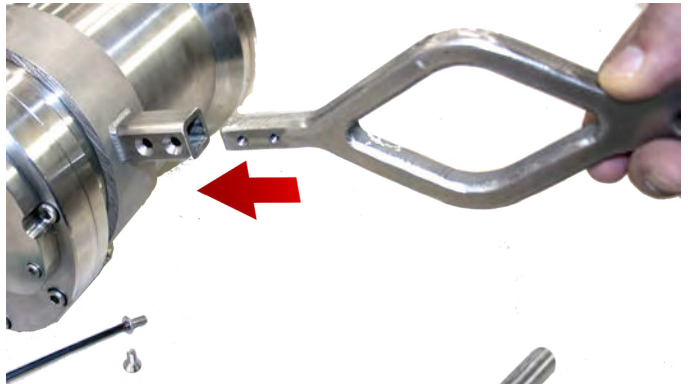
1. Remove flat socket head screws (two on each side).



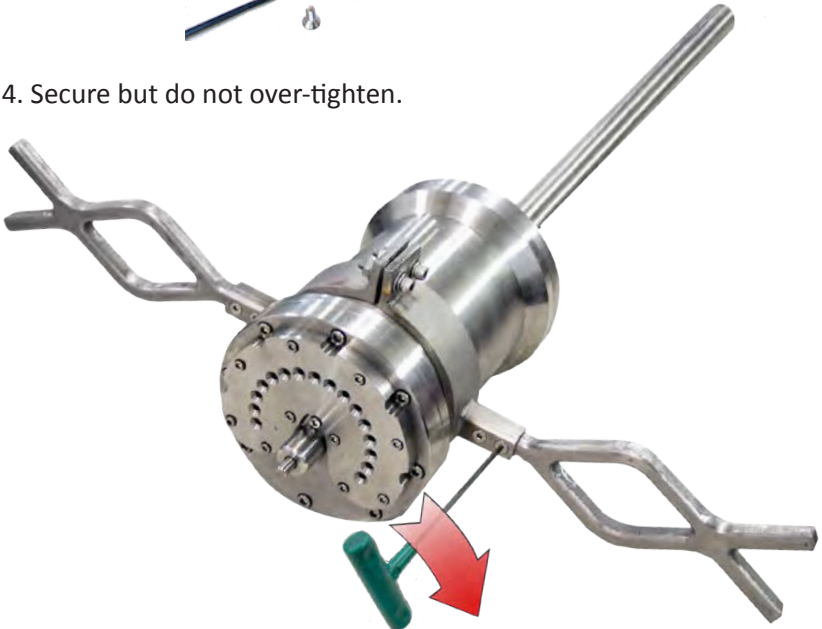
2. Remove stock handles.



3. Insert ROV handles.



4. Secure but do not over-tighten.



OPTIONAL EQUIPMENT (CONT.)

Close Proximity Antenna (CPA)

The Close Proximity Antenna (CPA)* is sensitive only to nearby signals. Where multiple pigs are in close proximity to one another, the CPA is useful to distinguish an individual PIG without cross-interference from adjacent pigs.



*CDI Part # 81-10-0075-00

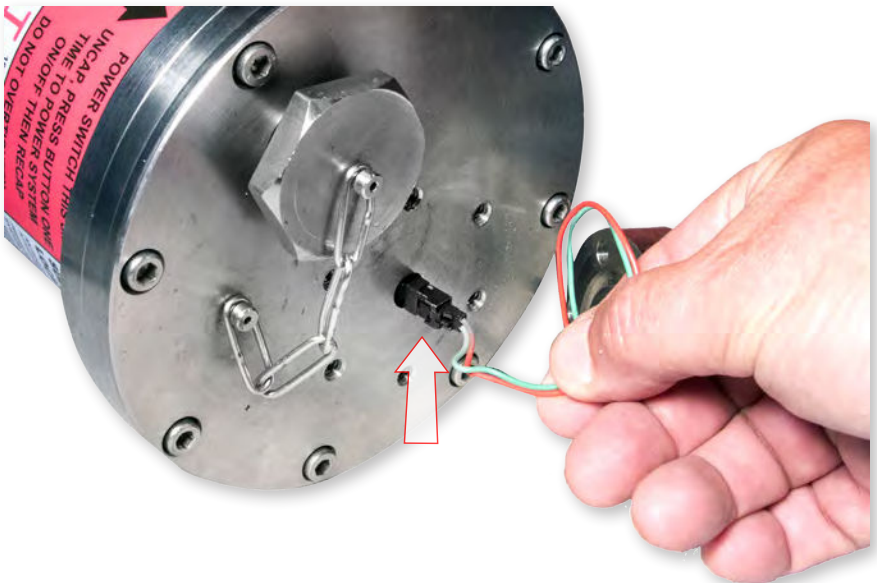
Installation

Tool required: 3/16-in. Allen wrench

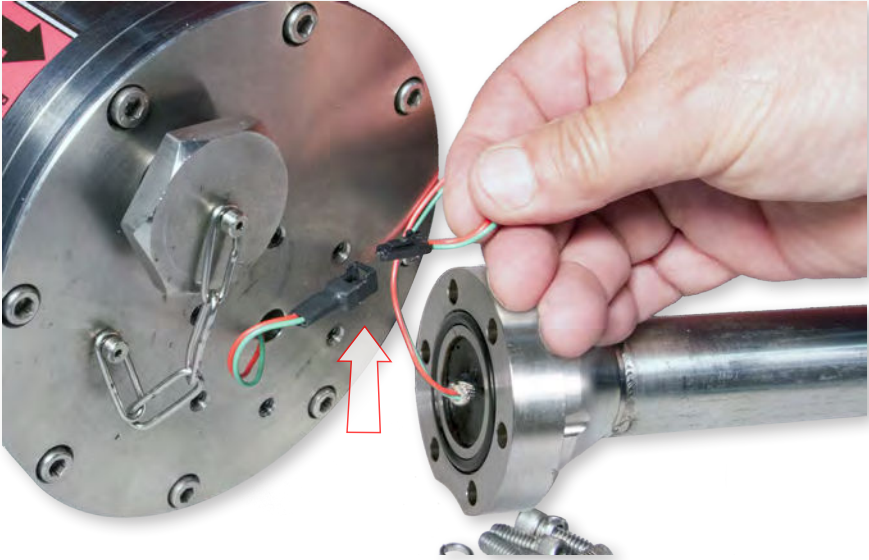
1. Remove the six (6) socket head cap screws (1/4–20 x 5/8) and lock washers from the standard 26.4-in. [670.5 mm] antenna mounting.



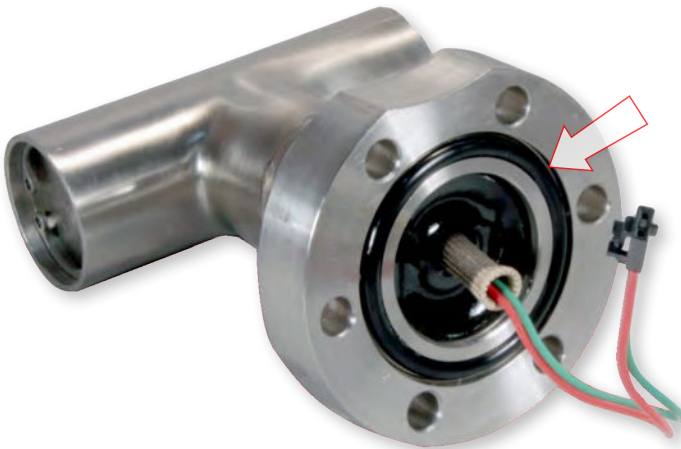
2. CAREFULLY retrieve the antenna wiring from the unit until you find the connector.



3. Disconnect standard antenna.

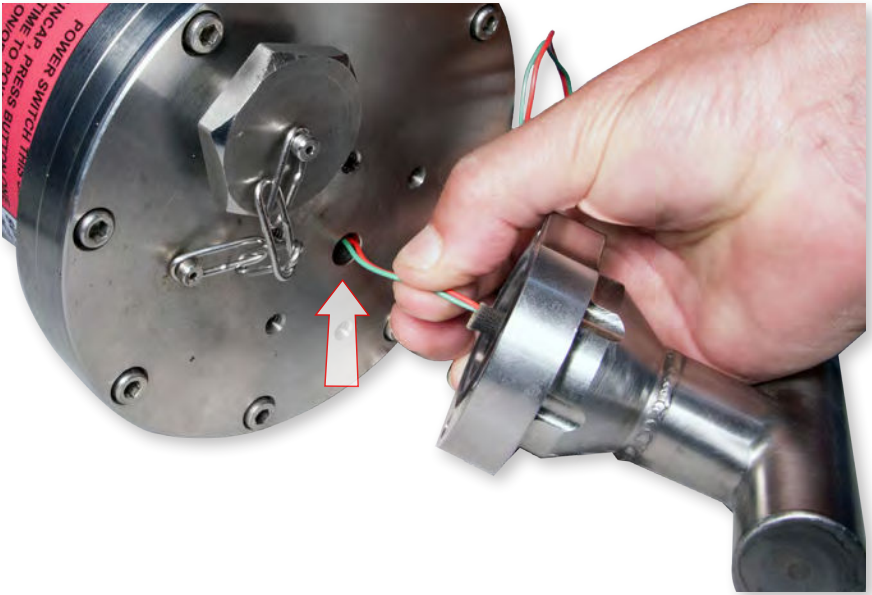


Inspect O-ring* and O-ring groove before installing or replacing antenna unit. (See pg. 21 for O-Ring inspection and maintenance information.)



*CDI Part No. 700-50-2222-90

4. Connect the CPA and thread the excess wiring back into the unit.



5. Line up CPA with unit as shown. Note orientation of cutout to Power Switch cap (if antenna is improperly installed, it will be difficult to remove cap to power up the unit).

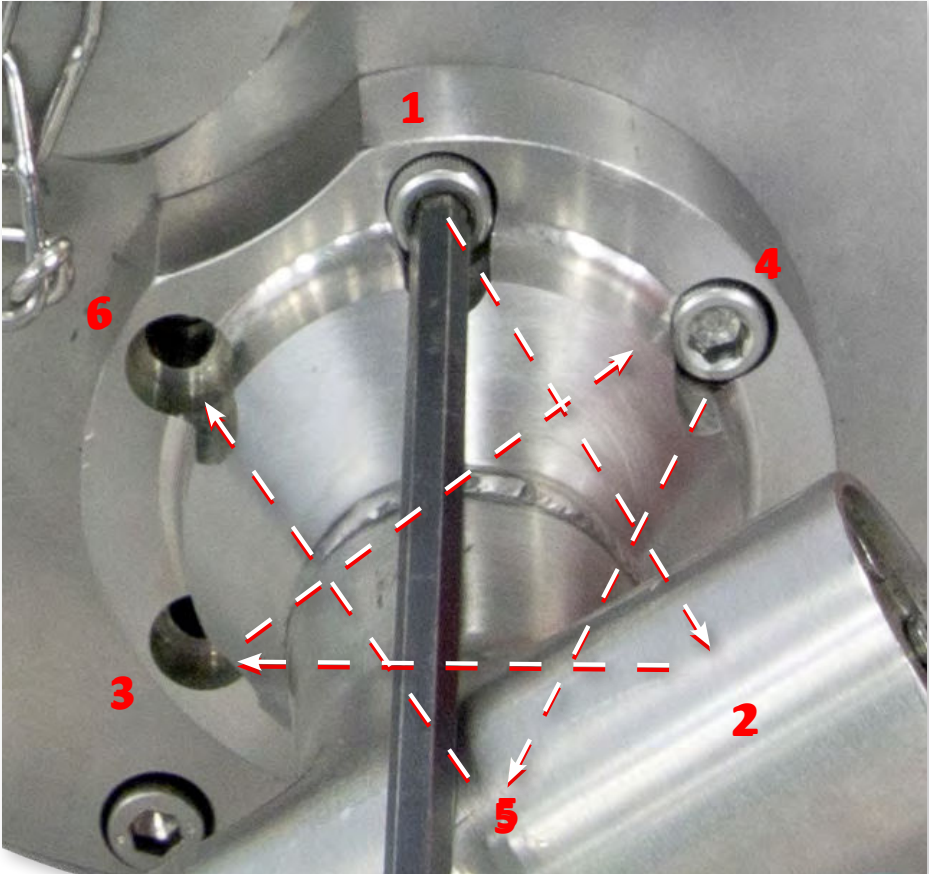


6. Reinsert the six (6) socket head cap screws (1/4–20 x 5/8 in.) and lock washers. See tightening sequence on next page.



Tighten the cap screws by hand until snug.

Tighten each screw with Allen wrench in a rotating cross pattern (shown below) in 20 inch-pound increments. (If using a powered driver, avoid over-tightening).



Continue until the cap screws reach 60-inch pounds torque. After reaching the 60-inch pound level continue the torque pattern and torque to 70-inch pounds. This is the final torque level.

The CPA configuration is complete.

Warranty

All equipment sold by Control Devices, Incorporated (CDI) is warranted for a period of one (1) year from the date of shipment to Purchaser, providing the instrument or equipment has not been modified, abused, or used for purposes which it was not designed for.

Batteries, probes, leads, magnets, and other consumables subject to wear are not covered by this warranty. CDI will repair or replace faulty equipment during the warranty period when the cause is a defect arising from faulty design, materials or workmanship.

Making a Warranty Claim

Equipment being considered for warranty repair, or a representative sample thereof, must be returned to CDI at the Purchaser's expense. The equipment must be accompanied by the Purchaser's written order* describing the defect(s) and authorizing CDI to invoice the Purchaser for any charges not covered by the warranty.

Upon receipt of the equipment and Purchase Order, CDI will examine the equipment and make a determination of the nature and cause of the defect. If the defect is not covered by the warranty, CDI will quote to Purchaser the cost for replacement or repair equipment, and will not proceed until Purchaser delivers a written acceptance of the quotation.

During the one year warranty, CDI will bear the cost to return units repaired under the warranty back to the Purchaser's domestic premises. CDI will return units to foreign countries at Purchaser's expense.

* Contact CDI at 1-800-580-4234, ext 143 for *CDI RMA Form FM-03-0089*

Care and Maintenance

Equipment designed by CDI is protected against the environment in which it is intended to operate. Much of the equipment is designed for prolonged use in the field without any special maintenance other than routine battery replacements. It is the Purchaser's responsibility to insure that proper precautions are taken during installation and operation so that weather seals are in place, routine maintenance occurs, etc. Failure to perform these operations nullifies this warranty.

CDI equipment should only be operated by qualified personnel who are familiar with any and all manuals and procedures for said equipment's operation.

Service and Repairs

Cost for repairs not covered by the warranty or carried out after the warranty period has expired will be charged at the current hourly or set service rate, plus the cost of materials, upon approval by Purchaser.

Equipment for repair must be sent at the Purchaser's expense and be accompanied by the Purchaser's written order describing the defect and authorizing CDI to invoice the Purchaser for labor, materials and return delivery cost.

No service or repair will be undertaken until an approved written order is received from the Purchaser.

Operating equipment while in a damaged condition nullifies this warranty.

SYSTEM SPECIFICATIONS

Detection Type:	Non-Intrusive Electromagnetic
Applications:	Tracking and/or Locating via Diver or ROV
Deployment:	Subsea (ROV or Diver)
Sensor:	Wire-wound Antenna
Detection Direction:	Bi-Directional
Devices Detected:	Electromagnetic Transmitters (Standard CD42 Family)
Detection Speed:	0.01 meter/sec to 20 meter/sec
Visual Indicator:	16 Super-bright LED array indicates transmitter signal strength
Power Source:	D-Cell (6) Alkaline Batteries
Battery Life:	60 hours (2.5 days)
Controls:	Gain Adjustment via Non-penetrating Pushbutton
Dimensions:	36.5 in. [927.1 mm] length x 6 in. [152.4 mm] diameter
Operational Temperature Range:	-4°F to +140°F [-20°C to +60°C]
Water Depth, Maximum:	8,000 ft [2,438.4 m]
Operating Pressure, Maximum:	3,560 psi [245 bar]
Housing:	316 Stainless Steel

ABOUT CDI

CDI is a family-owned and operated business located in Broken Arrow, Oklahoma, just 12 miles from downtown Tulsa. Incorporated in 1982, CDI has proudly been manufacturing products in the United States for more than 32 years. CDI currently employs 45 people in the areas of electronics and mechanical design, software and firmware programming, electronics manufacture, machining, and more.

All CDI products are designed and built completely in-house utilizing an on-premises machine shop boasting six fully-automated CNC machines as well as full-time electronics assembly personnel.

