CD42-STS Operating Manual
Diver/ROV Pipeline Pig
Location & Tracking System

March 8, 2011

CDI
1801 North Juniper Avenue
Broken Arrow, Oklahoma 74012 USA
1 (800) 580-4234 USA & Canada Toll free
1 (918) 258-6068 Worldwide
1 (918) 251-9851 FAX

24-Hour Emergency Telephone Number
+1(918)645-0477
INTRODUCTION

This instruction manual explains step by step how to operate the CD42-STS Diver/ROV pipeline pig location and tracking system. Included as well are some generic methods of tracking and locating pigs in a pipeline using magnetic-based tracking equipment. Critical sections of this manual are highlighted yellow.

OVERVIEW

The CD42-STS receiver is used to display the pulsing signal emitted by electromagnetic transmitters in an underwater pipeline to an operator, often a diver or ROV operator. By locating and tracking these pulses one can know where in the pipeline a pig or pigs are.

**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.

SPECIFICATIONS

<table>
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<tr>
<th>Specification</th>
<th>Details</th>
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<tbody>
<tr>
<td>Approximate Weight</td>
<td>42 pounds</td>
</tr>
<tr>
<td>Length</td>
<td>36.5 inches</td>
</tr>
<tr>
<td>Certified Depth in Salt Water</td>
<td>8000 feet</td>
</tr>
<tr>
<td>Maximum Pressure Rating</td>
<td>3560 PSI (245 bar)</td>
</tr>
<tr>
<td>Battery Type</td>
<td>6 Alkaline D-Cell</td>
</tr>
<tr>
<td>Display</td>
<td>LED indicator</td>
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</table>
UNPACKING

PHYSICAL CHECKS

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.

OPERATIONAL CHECKS

When the unit is first powered on, the arc of LED lights that make up the display of the system will self check by scrolling from both ends of the display scale. When the light show is complete the display will indicate the last gain (sensitivity) setting stored in the memory by flashing 3 times before going steady on. The gain readout will remain on for 3 seconds then the display will go dark. The CD42-STS 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.

OPTIONS

The CD42-STS has two options that may or may not have shipped with your equipment.

FISHTAIL ROV HANDLES

Fishtail handle that can easily bolt onto the system and replace the diver handles that the system ships with by default. If you require such handles please contact CDI.
CLOSE PROXIMITY ANTENNA
The Close Proximity Antenna may be used when multiple pigs are extremely close to one another such as in launchers and receivers. It is designed to be sensitive only to very near signals.

The CPA may be attached to any CD42-STS system. If you have a job that you think may benefit from the CPA, please call CDI.

ANTENNA

CONSTRUCTION
The antenna on the CD42-STS receiver is 26.4 inches long and is made of stainless steel with a solid core. This is what allows it to withstand the salt-water pressure to the depths of 8000 ft. The antenna is sealed to the receiver body with an O-Ring seal and the bolts are tightened to a specified torque setting. Removing the antenna should not be necessary unless the optional Close Proximity Antenna is being fitted.

ANTENNA OPERATION
The receiver signal strength is directly affected by the orientation of the receiver’s antenna to the transmitter attached to the pig. The transmitter attached to the pig is positioned parallel to the pipe wall when the pig is running in the pipe. If the receiver antenna is placed perpendicular to the transmitter antenna, there will be minimal signal coupling between the transmitter antenna and the receiver antenna. Therefore there will be little or no signal observed on the LED indicator of the CD42-STS receiver.

To gain maximum coupling (strongest signal) between the transmitter and the receiver, the CD42-STS antenna must maintain a parallel orientation to the pipe wall. This orientation will give the operator the best signal for tracking and locating the pig.
OPERATION

ON /OFF

To power the CD42-STS receiver on, remove the large hexagonal plug located on the antenna side of the system. This will reveal a red pushbutton switch; pressing this switch will toggle system ON/OFF. Replace cap firm and tighten; there is a metal to metal seat of the plug to the system’s body, do not over-tighten.

When the unit is first powered on, the display will be dark for about 3 seconds then the system will perform a system self check by scroll flashing the LEDs from both ends of the display scale. When the light show is complete the display will indicate the last gain setting stored in the memory by flashing 3 times before going steady on. The gain readout will remain on for 3 seconds then the display will go dark. The CD42-STS receiver is now in the operational mode. To verify the unit is operating, jar the antenna with your hand. The display will light to confirm it is operating.

GAIN

Pressing the control button momentarily will display the current setting of the gain.

To increase the signal gain when the unit is operating, press and hold the control button. The gain will be displayed and start to increase after approximately 3 seconds. The gain will increment from left to right as the gain increases. Release the button and observe the signal levels on the display to view the change in gain effects.

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 and start to increase again while the control button is held down.

The zero position has no LEDs lit. In gain position 1, 2, and 3 there is very little gain by design and therefore the signal level may not be enough to give a good display indication. Low gain settings are useful when the
receiver is used in very close proximity to a transmitter such as at a launcher or receiver.

Figure 1 – The Controls

The gain is stored in non-volatile memory. This will hold the current gain control setting after the CD42-STS receiver is powered down and while the batteries are removed. When the unit is powered back up this gain setting will be displayed in the power up sequence.

LED READ OUT

The operator read out is a 16-LED display read from left to right with the minimum to the left and the maximum to the right. The behavior of the LEDs simulates the movement of a needle 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

Tracking a pipeline pig with a CD42-STS system requires proximity to within a few meters of a pipeline with the antenna held parallel to the pipeline. Typically to track a moving pig 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 waits.
As the pig approaches the signal will increase in strength, the pulses will get stronger, and the peak LED will shift to the right showing the increasing average strength.

After the pig passage the operator moves quickly to the next pre-determined spot to wait and monitor the signal for the approach of the pig.

Shown below in Figure 2 is a diagram representation of the signal strength that the LEDs will reflect as the transmitter passes.

![Figure 2 - Tracking moving pig with a parallel antenna orientation](image)

**Figure 2 – Tracking moving pig with a parallel antenna orientation**
LOCATING A STATIONARY PIG

Being able to locate accurately a stuck pig in a pipeline is probably more important than being able to track one. 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 pig does stick in a pipeline and the operator knows the last confirmed tracking location, then all the operator has to do 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-STS receiver is at its closest approach to the pig. This point on the pipeline can be marked for cutting or other remedial actions.

Shown below in Figure 3 is a diagram representation of the signal strength that the LEDs will reflect as the CD42-STS system passes near the transmitter.

![Locating a stationary pig with parallel antenna orientation](image-url)
PINPOINTING A STATIONARY PIG

Once the method above is used to roughly locate a stationary pig, 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 signal rather than the maximum.

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. This method is shown below in Figure 4.

![Figure 4 - Pinpointing stationary pig with perpendicular antenna orientation](image)

BATTERY REPLACEMENT

TYPE

The battery type installed in the CD42-STS receiver when shipped is an industrial Alkaline based 1.5 VDC D-Cell. This piece of equipment requires six (6) each D-Cells.

These batteries give the best performance for this application. It is recommended that if necessary to replace them they should be replaced with the same type.
REMOVAL

To remove the batteries; remove the eight (8) socket head cap screws (1/4 X 20 X 5/8) and the eight (8) split lock washers from the operator end of the housing (opposite the antenna end). Note the clocking orientation of the end cap to the antenna positioning.

CAUTION: Be careful not to damage the O-Ring under the plate and do not bump or drop the end plate. There is a circuit board attached to the back of the end plate. The end plate is heavier than it looks, use caution when handling.

There is a ribbon cable connected to the circuit board mounted to the end cap. Disconnect the ribbon cable by unlocking the connector end locks. Observe the orientation of the connector.

Figure 5 - Battery Replacement

Take note of the orientation of the batteries in the aluminum body and then slide them out of the case.
REPLACEMENT

Slide the new batteries into the aluminum interior body. Make sure the orientation of the battery polarity is identical to the orientation of the batteries that were removed.

Carefully reconnect the ribbon cable to the circuit board mounted to the end cap while observing the orientation of the connector. The connector pins can be easily bent. Make sure the connector is locked down with its side latches.

After the new batteries are inserted, inspect the O-Ring seal for damage. If it has been damaged replace it with a new one ([Parker # 2-222 90] N1059-90). Lightly lubricate the O-Ring seal with petroleum jelly or light grease and reinstall it into the housing groove.

Carefully orient the end cap exactly as it was previous to removal. Re-insert the eight (8) socket head cap screws (1/4 X 20 X 5/8) and the eight (8) split lock washers into the end plate mounting holes.

Tighten the cap screws by hand until they are just starting to snug down. Tighten the screws in a cross side pattern in 20-inch pound increments. 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.

**CAUTION:** Any deviation from this process could cause water to get into the electronics compartment and permanently damage the CD42-STS receiver.