

# **DIGITRAK<sup>®</sup> CableLink<sup>®</sup>**

## **Connection System**

# **Operator's Manual**



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Please take the time to read this entire manual—especially the section on safety. Also, please fill in the product registration card provided with this equipment, and mail it to DCI headquarters or fax it to us at 253-395-2800; you can also complete and submit the form online at our website. We will add you to the DCI mailing list and send you product upgrade information and our *FasTrak*<sup>™</sup> newsletter.

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We welcome your questions, comments, and ideas.

Digital Control Incorporated  
Kent, Washington  
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## ***Introduction***



### ***Installing CableLink Connection System***

The CableLink Connection System is permanently installed into drill rods so that the time-consuming butt splicing process can be avoided. The system provides transmission of electrical power downhole for powering the instrument, and transmission of data back to the remote display at the drill rig.

The CableLink system is only suited for drill rods that have consistent internal dimensions at both the box and pin ends. It can reliably be installed into Vermeer Firestick 1 (FS1) and Firestick 2 (FS2) drill rods, which come in 15 ft (4.6 m) and 20 ft (6.1 m) lengths.

The system has different CableLink assemblies that are hydraulically press-fitted into the box and pin ends of each drill rod. These are described in the following section, *CableLink System and Accessories*.

To install the CableLink system you will need tools and parts that are *not* supplied by DCI, such as an air over hydraulic system, a heat gun, and a drill. The hydraulic system shown in this manual is made by Enerpac, but an equivalent system will work. Other non-DCI supplied parts are discussed in the next section under "Non-DCI Supplied Parts."

The final section of this manual provides installation and removal procedures. Also in this section are instructions for a procedure that is referred to as reaming, which is only required on the small FS1 CableLink box ends.

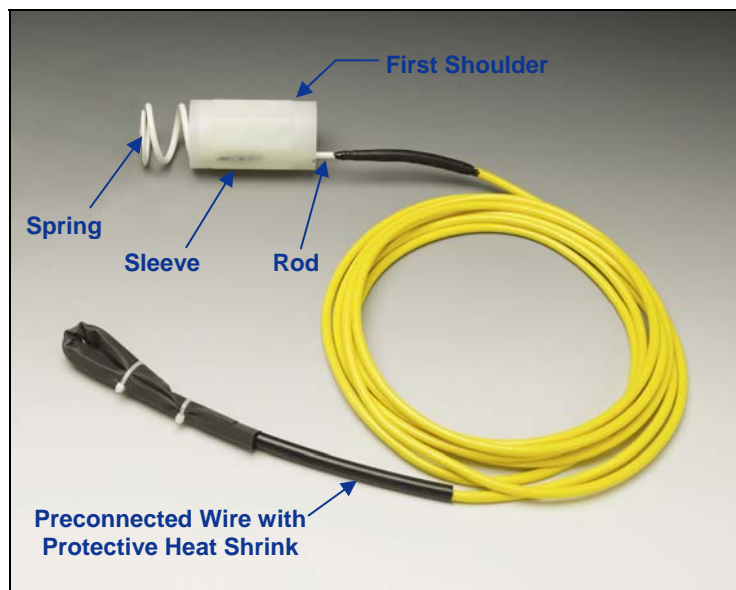
# CableLink System and Accessories

## CableLink Assemblies

The CableLink system has different CableLink assemblies that are hydraulically press-fitted into the box and pin ends of each drill rod. Each of the CableLink assemblies has a white nylon sleeve with characteristics that are used to describe if the sleeve is correctly positioned. The ends of the nylon sleeves are smooth, and the mid sections are octagonal. Where the smooth sections meet the octagonal sections is called a shoulder. These CableLink assemblies are discussed below.

### Box End Assembly

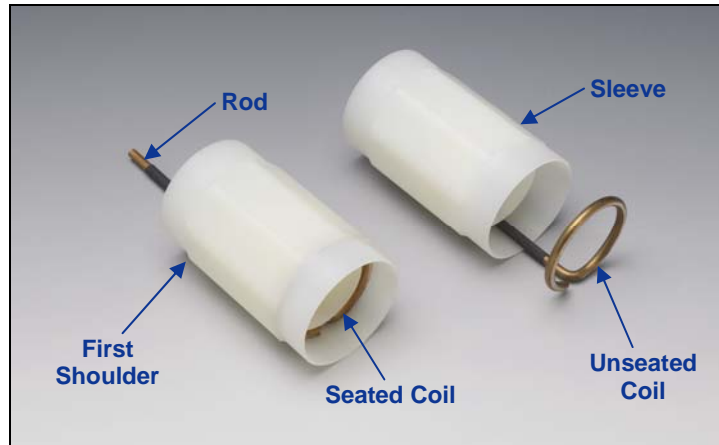
The box end assembly is installed into the drill pipe first, and it is installed into the box end of the drill rod. This assembly consists of a nylon sleeve with a spring that is preconnected to the wire. The other end of the wire has a protective heat shrink for connecting to the pin end assembly.



**Box End Assembly**

### Pin End Assembly

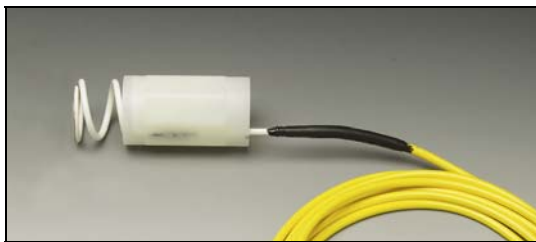
The pin end assembly consists of a nylon sleeve with one coil and a contact rod that is crimped onto the box end assembly. The pin end assembly is installed into the pin end of the drill rod.



***Pin End Assembly***

### ***Transition Assembly***

The transition assembly is the first piece of CableLink that connects to the SST or Eclipse cable transmitter wire. It consists of both a box end assembly with a preconnected wire and a pin end assembly with a preconnected wire; one or the other will be used.



***Box End Transition Assembly***



***Pin End Transition Assembly***

### ***Drive Shaft Assembly***

The drive shaft assembly consists of a specially sized pin end assembly with a preconnected wire. The drive shaft assembly is installed into the drive shaft/chuck. Two drive shaft assemblies are supplied with your CableLink system, since the amount of wear on the drive shaft assembly is much greater than on other CableLink pieces. The outside diameter of the wire is 0.25 in. (6.25 mm).



***Drive Shaft Assembly***

## DCI Supplied Items

There are five major tools that are provided with the CableLink system:

- Box end tool
- Box end inner tool
- Pin end tool – shows plunger end on left and shaft on right
- Pin end inner tool – shows plunger end on left and shaft on right
- Crimp tool



**Box End Tool**



**Pin End Tool**



**Inner Tools**

In addition to these tools, DCI also provides an accessory kit that contains small items and extra parts. The tools and accessory kit are described below.

### Box End Installation Tool

The box end installation tool consists of the box end tool and the box end inner tool.

- The box end tool has external threads at both ends. One end threads onto the box end of the drill rod, and the other end threads onto the hydraulic cylinder.
- The box end inner tool fits inside the box end tool and the hydraulic cylinder to push against the box end assembly during installation.



**Box End Tool Assembly**

## ***Pin End Installation Tool***

The pin end installation tool consists of the pin end tool and the pin end inner tool.

- The pin end tool has internal threads at both ends; one end threads onto the pin end of the drill pipe, and the other end threads onto the hydraulic cylinder.
- The pin end inner tool is a rod with a short plunger end and a shaft end. The short plunger end is inserted into the pin end tool assembly, while the hydraulic cylinder slides over the shaft of the plunger and threads into the back of the pin end tool.



***Pin End Tool Assembly***

## ***Crimp Tool***

The crimp tool (Nicopress No. 32 [Jaw VC/VG]) is specifically designed for installing the CableLink system's butt connectors. There are two gauge sizes—VC and VG. The type of connector will determine which gauge is used. See "Accessory Kit" section below for a discussion of the butt connectors and the gauge sizes.



***Crimp Tool***

## Accessory Kit

The items in the accessory kit are provided for making the butt connections between the CableLink assembly and the wire. The butt connectors are used to connect the pin end assembly to the wire end of the box end assembly. There are two different kinds of butt connectors depending on whether you are using FS1 or FS2 drill pipe. The butt connector for FS1 is copper with two different internal diameters. The copper connector's smaller inside diameter (ID) crimps onto the CableLink assembly's pin, and the larger ID crimps onto the wire. The CableLink assembly for FS2 uses a silver butt connector that has a uniform ID. The VC gauge on the Crimp tool is used for the silver connectors. The VG gauge is used for crimping the copper connectors.



**Copper and Silver Butt Connectors**

The contents of the accessory kit are shown below, followed by a description of each item.



**Accessory Kit**

- **Glue** – There are five glue pouches in the Accessory Kit. Each of these pouches contains five packets of two-part epoxy. The clip at the top of the packet slides off so that the two parts inside can be mixed together and then emptied into the glue cup. The glue is applied to the area over the butt connection, which will be under the heat shrink. Each packet of glue should dress two or three rods, so a five-packet box should dress ten to fifteen rods. The glue dries rapidly, so it is recommended that you prepare several rods in advance of the glue step. Also, the dry time of the glue decreases with increased temperature.
- **Alcohol Packets** – The alcohol packets are used for cleaning the pin end assembly prior to applying glue for heat shrink.
- **Emery Cloths** – The emery cloths are used to remove sharp edges and oxidation from the rod on the pin end CableLink assembly.
- **Glue Applicators** – The glue applicators are used to spread the glue.
- **Glue Cup** – This cup is used to hold glue during the application process.
- **Heat Shrinks** – The heat shrinks are placed over glued areas with the use of a heat gun to seal against moisture infusion.
- **Rigid Tube** – This tube is used to provide rigidity to the wire.

## Non-DCI Supplied Items

The following items are not provided by DCI with the CableLink system.

- Enerpac or equivalent hydraulic system (cylinder with quick-disconnect hose attachment)
- Fish wire
- Heat gun (extreme care is required if using a torch)
- Drill with leverage handle (for reaming out small FS1 CableLink box ends)
- Needle nose pliers
- File
- Wooden mallet
- Lacquer thinner or paint thinner
- Optional drop cloth

## Installation and Removal Instructions

Prior to installing the CableLink system, inspect the entire length of each drill rod for any deformities or obstructions. DCI recommends cleaning the interior of the drill rods prior to installation. DCI also recommends installing the CableLink system in an environment that will not allow foreign matter into the drill rods; this could result in a poor CableLink installation and/or clogged tool mud port(s). To make the CableLink installation process go faster and easier, stage the drill rods so that they are elevated off the ground with like ends together. Two experienced installers can install an average of 50 rods/day.

DCI recommends that drill rods with CableLink assemblies are used only when drilling the pilot hole using an Eclipse cable transmitter or SST transmitter. Using the rods with CableLink for non-wireline drilling, or reaming, or pullbacks may reduce the life of the CableLink product. DCI also recommends that the rods with CableLink assemblies are cycled to reduce wear on the most frequently used rods.

There are a maximum number of 110 CableLink connections allowed. A maximum mud flow of 90 gpm (341 L/m) is used for the small FS1 CableLink units and 140 gpm (530 L/m) for the large FS1 and FS2 CableLink units.

### Box End Installation Procedure

Stage the box end CableLink assemblies, box end installation tools, and hydraulic equipment near the drill rod box ends. Stage the metal fishing tape at the pin ends of the rods.

The box end installation begins by assembling the box end tooling assembly, which consists of the box end tool, the box end inner tool, and the hydraulic cylinder with its quick-disconnect hose attachment. If this is your first time using the cylinder, remove any paint from the threads before starting.

1. Insert the shaft of the inner tool into the hydraulic cylinder and thread these together into box end tool. You should see about 1.5 in (3.8 cm) of the plunger extend past the front of the box end tool.
2. This is the box end tool assembly; set it aside until step 7.



**Box End Tool Assembly**

3. Run a fish tape from the pin end of the rod up to the box end.



***Pushing Fish Tape into Rod from Pin End to Box End***

4. Connect the fish tape to the looped end of the CableLink assembly.



***Attaching Box End to Fish Tape to Pull Through Rod***

5. Pull the wire through the rod so that the looped end is exiting the pin end.



#### ***Box End Wire Hanging from Rod's Pin End with Protective Heat Shrink***

6. Hand press the box end assembly into the rod's box end up to the first shoulder, while making sure that it is aligned with the drill rod. It should fit tightly and be straight. If not, you may need to remove the CableLink assembly and, using a file, chamfer the lead edge of the nylon sleeve so that the CableLink assembly can be inserted up to its first shoulder, or tap with wooden mallet.
7. Push the box end tool assembly's shaft into the cylinder so that it extends beyond the front of the box end tool so you can guide the plunger into the center of the CableLink spring.



#### ***Preparing to Press the CableLink Assembly into the Rod's Box End***

8. Screw the entire box end tool assembly into the rod's box end until it bottoms out. If there is a gap between the rod and the box end tool, you may need to apply hydraulic pressure once, then retighten the box end tool until it bottoms out against the rod and apply hydraulic pressure again.

**NOTE:** The box end tool assembly is hand-tightened to the shoulder of the drill pipe. The cylinder may need to be partially unthreaded to attain full rod thread engagement.

9. Attach the hydraulic hose to the cylinder, and pressurize the system completely – approximately 3,000 psi (200 bar). You may hear popping sounds as the CableLink is pressed in, this is normal.



### ***Pressing the CableLink Assembly into the Rod's Box End***

10. Note the position of the inner rod to the back of the cylinder to verify full insertion every time. Use of a wooden mallet on the tool's handles may be required to achieve full insertion.
11. Disconnect the hydraulic hose.
12. Unthread the box end tool assembly from the rod.

**NOTE:** Use caution when retracting the plunger end of the inner tool; the plunger fits tightly into the CableLink assembly and can damage the spring if not retracted carefully.

13. Inspect the CableLink assembly to verify that it is fully installed. The spring should be aligned parallel to the drill pipe, and you should see 0.125 in. (3.2 mm) of the sleeve extending beyond the inner shoulder of the drill pipe.
14. Remove any remnants of the nylon sleeve that got sheared off during installation using a knife or needle nose pliers.

Once all of the box ends have been installed, unthread the hydraulic cylinder from the box end tool, and place it near the pin ends.

**NOTE:** If you have the small FS1 CableLink you will need to use the reamer tool and ream out the ID of the box ends of the CableLink assemblies which will increase mud flow through the ID. See the section at the end of this manual entitled Reaming of Box End Assembly When Using FS1 Drill Rods.

## Pin End Installation Procedure

Stage the pin end tools, pin end CableLink assemblies, accessory kit, crimper tool, hydraulic system, heat gun, needle nose pliers, emery cloth, lacquer thinner, and drop cloth, if needed, adjacent to the pin ends of the drill rods. The first step is to assemble the pin end tool assembly.

1. Thread the hydraulic cylinder into the back of the pin end tool and hand tighten.
2. Slide the long end of the pin end inner tool into the pin end tool and through the ID of the cylinder.
3. This is the pin end tool assembly; set it aside until step 29.



***Pin End Tool Assembly***

4. Using an emery cloth, gently remove any sharp edges and oxidation from the rod on the pin end CableLink assembly, and set aside.



***Emery Cloth to Remove Oxidation and Sharp Edges from the Rod on the Pin End***

5. Remove and discard the protective heat shrinks hanging from all the pin ends.
6. Remove the piece of electric tape that holds the outer heat shrink to the rigid tube for all of the rods, making sure the two inner shrink tubes and hard tubing do not slide too far inside the rod's ID.

**NOTE:** Do not get any grease or grime on the surface of the inner shrink tubes or wire since they will be coated in glue later.

7. Fully insert the contact pin in the pin end assembly into the butt connector.



### ***Preparing to Crimp Butt Connector to Pin End CableLink Assembly***

8. Using the crimp tool, select the correct size of connector gauge, and crimp the connector to the contact pin.
9. Rotate the crimp tool 90 degrees, and crimp a second time.
10. Using the pliers, flatten out any sharp edges created on the connector to prevent them from cutting the shrink tube. Repeat steps 7 through 10 for all pin ends.
11. Using an emery cloth, gently roughen an area about 1.5 in. (3.81 cm) on either side of the connector to knock off the waxy glaze on the wire to ensure a good surface for glue adhesion.
12. Clean the connector and 3 in. (7.62 cm) of the wire assembly with the alcohol swabs provided in the accessory kit.
13. Slide the inner heat shrink (1/4") inside the nylon sleeve and the outer heat shrink (3/8") with rigid tube towards the drill rod to make room for glue application over the butt connector.
14. Prepare one or more glue packets, depending upon the ambient temperature and the number of rods—one packet dresses approximately two rods, according to the directions inside the glue pouch.
15. Spread an even layer of glue around the outer diameter of the connector and extending out about 1 in. (2.54 cm) on either side of the connector onto the rod and wire.



#### *Applying Glue to Rod, Butt Connector, and Wire*

16. Slide the smaller shrink tube, while rotating, over the connector and beyond.
17. Apply a bit more glue on the area just exposed.
18. Center this heat shrink over the connector so that one end is about ½ in. (1.27 cm) from the nylon sleeve.
19. Use the heat gun to fully shrink; glue should ooze from both ends. **NOTE:** Be careful to not apply excessive heat to the nylon sleeve.



#### *Heat Gun on First of Two Heat Shrinks*

20. Repeat steps 13 through 19 for all pin ends.
21. After the small heat shrink has cooled, spread glue on top of it and slide the larger shrink over the connector area and slightly beyond.
22. Apply a bit more glue near the end of the shrink, close to the drill rod.
23. Slide the hard tube up to the point at which 1 in. (2.54 cm) of it is in the glue.
24. Position the outer shrink so that it aligns about ½ in. (1.27 cm) from the nylon sleeve and the other end overlaps about 1 in. (2.54 cm) onto the hard tubing.
25. Use the heat gun to fully shrink, being careful to not apply excessive heat to the nylon sleeve.
26. Repeat steps 21 through 25 for all pin ends, be sure to allow time for shrink tubes and glue to cool.
27. Push the wire and pin end CableLink assembly into the drill pipe, making sure that the assembly's coil is seated into the sleeve. The CableLink assembly should be seated up to the first shoulder and aligned with the drill rod. Repeat this step for all pin ends.



***Aligning Pin End Inner Tool with CableLink Assembly***

28. Align the inner tool plunger onto the CableLink and thread the pin end tool assembly onto the drill pipe and hand tighten so that it is completely seated. If it is not, you may need to apply hydraulic pressure once, then tighten until pin end tool bottoms out against the rod and apply hydraulic pressure again.
29. Attach the hydraulic pump hose to the cylinder, and pressurize the system completely – approximately 3,000 psi (200 bar). You may hear popping sounds as the CableLink is pressed in, this is normal.
30. Note the position of the inner rod to the back of the cylinder to verify full insertion every time.
31. Disconnect the hose from the cylinder and unthread the pin end tool assembly from the rod.
32. Verify the CableLink sleeve is fully installed and remove any plastic remnants using a knife or needle nose pliers; the sleeve should recessed 0.125 in. (3.2 mm) below the inner shoulder of the drill pipe.
33. Repeat steps 28 through 32 for all pin ends.

## Reaming of Box End Assembly when Using FS1 Drill Rods

If using the small FSI CableLink assembly, one more step is required. You must carefully ream out the inner diameter of the box end's nylon sleeve, as follows.

1. Attach the reamer tool to the drill with the leverage handle.
2. Align the reamer tool with the ID of the nylon sleeve.
3. Slowly drill until the flat part of the reamer tool bottoms out. If the reamed depth exceeds 0.5 in. (1.27 cm), damage to the spring's integrity can occur.



**Reamer Tool**

## Removal Procedure

If removal of the CableLink system is required, DCI recommends a reciprocating saw with a 10 to 12 in. (25.4 to 30.48 cm) coarse-tooth blade to cut the CableLink assemblies from the ID of the drill rod. This process will render the CableLink assemblies permanently damaged.



**CableLink Removal Tool**