

Technical Manual

ERS Version 2.0

Electric RS Overshot

Operating & Assembly Instructions

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ERS (Electric RS Overshot) Prototype, Version 2.0

Assembly and Operating Instructions

INTRODUCTION

The ERS is an adaptation of the standard 3-inch RS pulling tool designed to be run on the Schlumberger logging line. Its purpose is to enable running a downhole tool (with an up-looking RS overshoot) on the logging line through the drillpipe for downhole emplacement. A 24 VDC motor in the ERS is commanded from the surface to rotate causing the RS dogs to release the RS pulling neck on the downhole instrument, probe or tool string. This capability is to be used in place of using jarring action to shear off an RS connection, or undesirable use of Kinley cutters.

The ERS can also capture a tool with an appropriate up-looking pulling neck. To engage an RS pulling neck profile on deck (or downhole), the ERS still has the snap-lock feature of the original RS – the motorized action is only required to unlock the dogs (or, after unlock, to drive the Core piece back down to the dog lock position.) Capture of an RS pulling neck can also be accomplished by using the motor to close the dogs

NOTE: The ERS is designed to work with a slightly shortened RS pulling neck profile. The sketch in Figure 1 shows the modified RS pulling neck as it fits into the bottom of the ERS and engages the dogs properly. The maximum length from the top of the pulling neck to the sharp angle (15 deg) at the dog engagement profile is 1.080 inches, as shown.

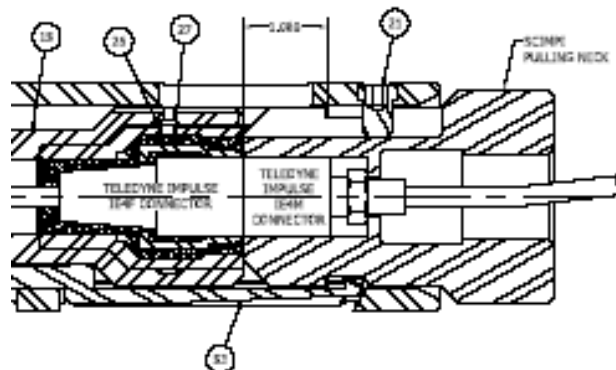


Figure 1. Example of modified RS pulling neck for use with ERS v.2.0

The following standard parts from any 3-inch RS can be used as spares: dogs (3), dog washer, and dog spring. All other parts in the ERS assembly are custom.

The DC motor operates in a container (Motor Can) filled with hydraulic oil and is pressure compensated to seawater hydrostatic pressure. The electronics required to provide proper power and control to the motor are housed in the pressure case at the top of the assembly, in a sub that serves as a crossover to a standard Schlumberger up-looking 31-pin field connection. Power for the DC motor is drawn from the ~300 VAC sent down the logging line. Signal to reverse direction of the DC motor (to lock or unlock the Dogs) comes down the logging line as a referenced 24 VDC on a separate set of wires. (See the instruction section on powering the ERS.)

DESIGN FEATURES (from bottom to top)

1. IE4F Connector (Teledyne Impulse) at the bottom of the ERS (potted into the potting cartridge within the Core Piece). This connector provides power and signal and data communication with an instrument or probe being deployed with the ERS (e.g. SCIMPI). The power and communication functionality are supplied by the MFTM. The IE4F connector resides within a fixed (potted) male locking sleeve. When the mated IE4 connectors are intended to separate at the time the downhole tool is released, the male locking sleeve has no function. However, when the IE4 connector pair is intended to remain together during probe deployment (e.g. T2P) a split female locking sleeve screws onto the male and holds the connector pair together until they are separated on deck.
2. Comm cable. A 4-wire comm cable, in 3 segments, runs thru the ERS assembly from the IE4F connector at the bottom to the 31-pin Schlumberger connector at the top.
3. Opening and closing of the RS dogs is accomplished by upward or downward axial movement of the Pulling Sleeve. The Pulling Sleeve is moved by a small Jack Screw driven by the Hansen 24 VDC gearmotor, which is reversible via the on-board electronics.
4. A small pair of ball bearings acts as thrust reaction bearings for the axial pull and push motion of the Pulling Sleeve. The bearings are stainless steel, sealed and “lifetime” lubricated -- until experience with the ERS proves otherwise, the ball bearings require no maintenance.
5. The Hansen brush-type gearmotor is housed in a sealed Motor Can which is filled with hydraulic oil. (Royal Purple Marine Hydraulic Oil, ISO Grade 22 is recommended but

other light hydraulic oils will suffice). The Motor Can is pressure-compensated to maintain hydrostatic pressure within the hydraulic fluid. This ensures that seawater cannot reach the terminals or brushes of the gearmotor. The Hansen motors are relatively inexpensive and expected to wear faster than when service is in air. However, actual motor running time when in oil should be limited in normal operations to a few minutes maximum. Experience with the ERS will teach how long the active life of the Hansen motors will be. Extra motors are provided.

6. Motor can pressure compensation is achieved with a compensation bladder filled with hydraulic oil attached to the top of the Motor Can Cap. The bladder is a half loop of tygon tubing containing about 10% of the volume of the fluid resident in the Motor Can. This is designed to be enough extra fluid to account for small air bubbles in the hydraulic fluid, thermal contraction of the fluid at sea bottom temperatures, and some small leakage. The hydraulic fluid in the Motor Can should be drained whenever the ERS is not in use and re-filled (checked and topped off) before every downhole run.
7. Power for the Hansen 24 VDC motor comes from the motor power and control electronic circuitry within the ERS pressure case via a 2-wire molded cable in two segments.
8. Above the motor section of the ERS is a 4-ft long sinker bar to give weight at the end of the logging cable after release of a downhole tool. The hollow sinker bar can be easily removed with quick release-type connections for ease of handling or testing the ERS on deck. The power/comm and motor control cables run thru the bore of the sinker bar.
9. The bulkhead feed-thru connection at the bottom of the pressure case is connected to a specially-molded Y-cable splitting into the 2-wire motor control cable and the 4-wire power/comm cable. The bulkhead connector is double sealed where it attaches to the pressure case. It is a 7-pin connector with one pin not used.
10. The pressure case contains the motor power and control electronics and simply passes through the wiring going from the 31-pin Schlumberger connector to the power/comm cable.
11. The ERS assembly ends at the top with an up-looking 31-pin standard Schlumberger field connection, which intended to mate with the LDEO MFTM module.

ASSEMBLY OF ERS v.2.0 – PART 1

1. Assembly of the ERS starts at the bottom.
2. The IE4F connector is potted permanently into the Potting cartridge, which, in turn is mounted in the cavity of the Core Piece with (8) small screws. This sub-assembly should normally be maintenance-free and not require disassembly, except for troubleshooting. The rotational orientation of the IE4F connector is fixed with the hole for the guide pin aligned with the Alignment Pin screwed into the Skirt. The Alignment Pin slides into the slot on the up-looking pulling neck to assure proper pin alignment with an IE4M (male) connector on the deployable instrument string (e.g., SCIMPI) in the same manner as the rotational orientation alignment of the APC.
3. Assemble the ERS Skirt, Alignment Pin, Dogs, Dog Washer, Dog Spring, and ERS Core Piece (with potted IE4F connector) the same as a standard 3-inch RS overshot tool.

NOTE: The ERS does not have the heavily pre-loaded Cylinder Spring of a conventional RS overshot. As such the ERS is much easier to assemble. Only the small Dog Spring must be compressed (slightly) to get the Core Piece and Dogs into their proper assembled positions. Do this by immobilizing the dogs with magnets as shown in the sketch in Figure 2.

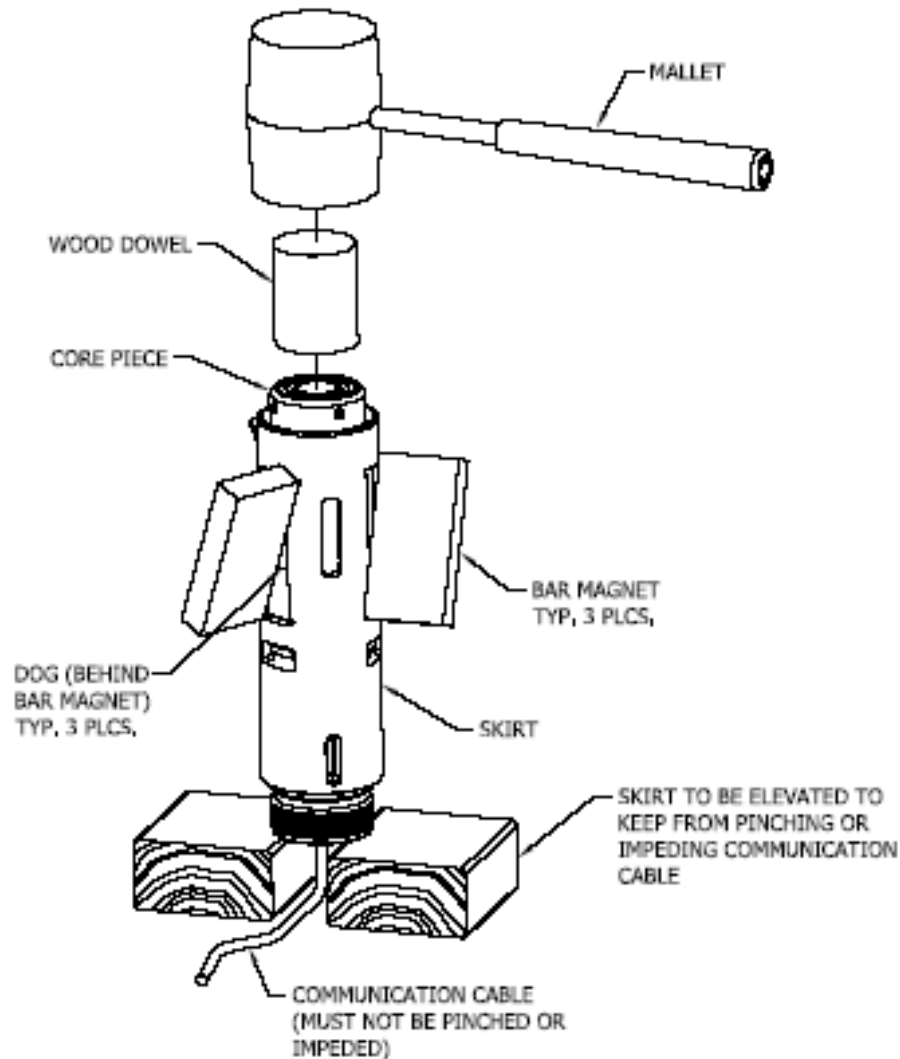


Figure 2. Technique for Assembling Dogs and Core Piece in ERS Skirt

3. Use (3) #10-32 UNF x 5/8" hex socket cap screws, screwed thru Skirt into the Core piece. These are special , high strength A-286 alloy screws.

NOTE: These screws are meant to seat in the Core piece without tightening against the Skirt. Their job is to prevent rotation of the Core piece but allow sliding of Core piece relative to the Skirt. Use thread lock compound (e.g. Loctite 242 Removable) on these screws at installation. Be sure their heads DO NOT bind against the Skirt. If necessary to prevent screw binding on the slot in the Skirt, cut tiny pieces of stainless wire (a paper clip may be used) and place in the threaded hole so that the screw seats with the head at the proper location/elevation, sticking out from the Skirt slot.

4. Mate an Inner Coupler, Outer Coupler, and two Coupler Springs, as shown in the assembly drawing.
5. Slide the IE55 connector on the comm cable thru the center of the Coupler sub-assembly. Screw the Coupler sub-assembly into the top of the Core piece. Install (2) thread-locking set screws.
6. Temporarily make up the Pull Sleeve to the Coupler sub-assembly and determine which Pull Sleeve window the power/comm cable will most easily pass through. Thread the IE55 connector and power/comm cable thru one window of the Pull Sleeve – use the Pull Sleeve window furthest from the Motor Can cover opening. With the power/comm cable in place, carefully screw the Pull Sleeve to the Coupler sub-assembly and lock with set screws.
7. Screw the Motor Housing-Skirt X/O onto the Skirt and install (2) thread locking set screws. The hole and slot in the X/O sub should be near the downhole end.
8. Slide one ball bearing on either end of the Drive Shaft. Slide the Jack Screw into the lower end of the Drive Shaft and attach with a #10-24 x 3/4” socket head cap screw (alloy steel, black oxide, 180 ksi UTS).
9. Assemble the two pairs of bearing holders over the Drive Shaft and bearings with the correct faces pointing downward (consult drawing). Make sure the power/comm cable is in the slot between the bearing holder pairs and is free to move a little (not pinched).
10. While holding the four bearing holders, screw the Jack Screw into the Pull Sleeve until the bearing holders are properly located within the Motor Housing Sub so that the screws that secure the bearing holders can be inserted. Mount the bearing holders with four #10-24 x 1/2” flat head alloy steel hex socket cap screws (140 ksi min UTS). Re-check that the power/comm cable passing behind the bearing holders is free to wiggle a little.
11. Hand rotate the Drive Shaft and Jack Screw to ensure the bearings operate smoothly and to take up the slack in the Pull Sleeve and linkage to the Core Piece.

FILLING A MOTOR CAN WITH HYDRAULIC OIL

NOTE: The Motor Can assemblies normally will NOT be filled with oil.

1. Remove Motor Housing Sub Cover Plate and remove the Motor Can assembly from the Motor Housing Sub by taking out the (6) #10-24 UNC flat head screws at the back side of the Motor Housing Sub.
2. The Motor Can assembly should have: the motor inside held by screws at the downhole end, the Motor Can Cap assembled to the Can, an electrical pigtail (two conductor) from the DC motor coming out thru the Cap, a pigtail seal (tygon tubing and hose clamps), and a compression bladder (u-loop of tygon tubing with hose clamps). Inside the Motor Can the motor shaft is sealed with a quad O-ring, and a standard larger O-ring at the bottom of the Can (see drawing). The motor is mounted in the Can with two #10-32 x ¾ flat head screws.
3. The Motor Can assembly **MUST** be filled with hydraulic oil before running into the ocean.
4. Special Royal Purple marine grade hydraulic oil is provided (but any light hydraulic oil would work in a pinch. Grease in the gearbox of Motor Can is NOT recommended because the viscous friction losses significantly degrade motor performance. The hydraulic fluid flooding the Motor Can will adequately lubricate the gearbox).
5. Fill the Motor Can completely full by pouring or injecting thru the fill port on the side of the Can. The fill port is sealed with a 1/8-inch NPT pipe plug. NOTE: All air bubbles must be removed from the Motor Can. Open the compression compensation bladder (remove hose clamps from one of the barb fittings) as needed to flow oil thru the Can, and/or to get all air out of the system. Re-install pipe plug and tygon tubing when the Can is full.

ASSEMBLY – PART 2

1. Install the Motor Housing Sub onto the Motor Housing-skirt XO Sub and insert (2) thread locking set screws.
2. Install the Motor Can assembly back into the Motor Housing Sub. Be sure the electrical pigtail for motor control, the comm cable, and pressure-compensation bladder (loop of tygon tubing) slip unobstructed into the up-looking part of the Motor Housing Sub. Do not secure the screws that mount the Motor Can assembly just yet.

3. Slip the D-shaped section of the motor shaft extending from the Motor Can into the D-shaped hole of the Drive Shaft . It may be necessary to rotate the Drive Shaft and Jack Screw slightly counterclockwise to achieve alignment of the D-shaped shaft and hole.
4. When Shaft Coupling and Motor Housing Sub are properly lined up, mount the Motor Can assembly finally into the Motor Housing Sub using the (6) #10-24 UNC flat head screws at the back side of the Housing Sub. NOTE: Be sure the power/comm cable resides in the gap on the backside of the Motor Can mounting faces, between the mounting screws without the cable getting pinched.

NOTE: In ERS V.2.0 both the power/comm and motor power jumper cables (that primarily reside within the bore of the Sinker Bar) are about 8-10 inches too long. The extra slack must eventually be folded up and stuffed into the space above the Motor Can in the Motor Housing Sub.

DECK TESTING OF THE MOTOR AND LOCKING ACTION (If Required)

--- To check the assembly to see that the Motor drives the Jack Screw properly, that the Pull Sleeve slides up or down caused by the Jack Screw, and that the Core Piece actuates the RS Dogs open or closed.

1. Use a DC power supply to apply 24 VDC to the contacts in the IE55 connector at the end of the motor pigtail sticking out the upper end of the Motor Housing. Change direction of the Motor by reversing the power leads.
2. Observe that the Core piece moves and engages or disengages the Dogs from an RS pulling neck.
3. DO NOT allow the Motor to sit with power in stall conditions for any longer than necessary.
4. Set the location of the Core piece at a point just below the point where it starts to engage the Dogs and force them open.
5. Install the Motor Housing Cover Plate using (6) #8-32 UNC 100 deg flat head screws x 1/4" long. Use Thread lock compound on these screws.

ASSEMBLY – PART 3

1. Slide the Sinker Bar Crossover sub over the motor and power/comm cables. The end of the Crossover sub with the prominent internal cone faces downhole.
2. Pass the power/comm and motor power jumper cables thru the Sinker Bar and mate the IE55 connectors to the motor pigtail and comm cable at the top of the Motor Housing. These are custom-molded electrical cables and connections that see full hydrostatic seawater pressure and must be mated completely to seal properly.
3. Attach the upper IE55 connectors on the jumper cables to the Y-cable where they exit the top of the sinker bar. The Y-cable connects to the bulkhead 7-pin bulkhead fitting at the bottom of the ERS Pressure Case/Crossover sub. (Also, known as the MFTM-ERS Crossover.) The electrical cable connection is exposed to seawater and must be completely screwed together to seal properly.
4. The jumper cables are longer than necessary. The excess length can be accommodated by doubling up the excess length in the upper end of the ERS Motor Housing, just above the ERS Motor Can. The recommended order of cable makeup is as follows:
 - Connect the two conductor and four conductor jumper cables to the “Y cable” and feed the jumper cables through the Sinker Bar. Do not make up the MHDG connector on the lower end of the ERS Pressure Case.
 - Bring the ERS Pressure Case and ERS Motor Housing into close proximity to the mating ends of the Sinker Bar.
 - Feed the lower ends of the jumper cables through the upper end of the ERS Motor Housing and bring them out of the window into which the ERS Motor Can fits.
 - Makeup the respective IE55 connections between the jumper cables and the ERS Motor lead and the four conductor cable that runs under the ERS Motor Can down to the IE4 connector in the ERS Core. Bring the slack out of the window.
 - Pull sufficient slack in the cables so as to allow them to be carefully “folded over”. The “doubling up” of the cables can be accommodated by the larger ID of the ERS Motor Housing. By taking up this slack, it will be necessary that the 7 pin MDHG connector be temporarily retracted a bit into the upper end of the Sinker Bar.

- Note that the four conductor cable passes through the ERS Motor Housing and runs in a channel machined into the ERS Motor Can. When the motor can is installed in the housing, this cable must be positioned in this channel to allow the proper fit of the ERS Motor Can
 - When this folding of the cables has been completed, the folds can be gently inserted into the housing and the ERS Motor Can may be inserted into the housing. When the motor can is inserted into the housing, the pressure compensation tubing loop will also have to be manipulated into the housing. There is sufficient space to do this without damaging the cables and tubing.
 - Once the motor can is placed in the proper position, install the six 10-24 82° flat head cap screws.
5. Mate the Pressure Case to the Sinker Bar using the appropriate half-rings and Upper Sinker Bar Nut. Add (2) thread locking set screws.
 6. Mate the ERS Motor Housing to the Sinker Bar using the appropriate half-rings and Lower Sinker Bar Nut. Add (2) thread locking set screws.
 7. Test the whole ERS and power thru the logging cable on deck to ensure that the Core Piece slides and the Dogs engage and disengage. Leave the ERS with the Core piece down far enough to allow the Dogs to engage with snap-lock action on an RS pulling neck.

After a Downhole Deployment

1. Following downhole deployment most of the ERS v.2.0 can remain assembled.
2. Removal of the Sinker Bar for ease of handling is optional. If it must be removed, be careful disengaging the IE55 electrical connections.
3. The Motor Can **MUST** be removed and serviced after **EVERY** deployment.
 - a. The seals around the motor shaft will allow some hydraulic fluid to weep out of the motor can. (This is a design weakness that will be fixed in v.2.1, someday.)
 - b. Removing the Motor Can prevents the oil weep from contaminating the rest of the ERS assembly when out of service.
 - c. Removal of the Motor Can is also required to allow the oil in the Can to be “topped off” before each new downhole deployment.

- d. Store the Motor Can in a zip lock bag between installations in the ERS for deployment to contain (and indicate) any oil leakage.
4. Many parts of ERS v.2.0 are non-stainless steel and must be protected from marine atmosphere corrosion during storage n deck.

OPERATION OF ERS V.2.0 -- DISCUSSION OF MOTOR CONTROL SYSTEM

NOTE: Please read this document completely prior to connecting or attempting to operate the ERS system.

The motor drive and control system is comprised of uphole and downhole components. The uphole components are a benchtop 24 VDC power supply and adapter leads to apply 24 VDC to the CIS panel on the ship in the logging cab. This 24 VDC power supply only supplies control voltage for the system in order to command the motor to run in the desired direction. The currents supplied to the downhole control circuit from this supply at the surface will be a few milliamps. Power to drive the motor (up to 75 watts at 24 VDC) is derived from AC power supplied from the logging cab and sent down the logging cable. The downhole components in the tool include a) a rectifier, b) a DC-DC converter, c) a motor voltage controller board, and d) the motor itself. The rectifier converts the AC power coming down the logging cable to a DC voltage. This high DC voltage is converted to 24 VDC using a DC-DC converter. There is a controller board that receives the control signals from the surface and reverses the polarity of the 24 VDC to make the motor either latch or release the ERS mechanism.

AC Power Considerations

1. We assume that an AC voltage of approximately 320 volts will be applied to pins 1 and 4 of the logging cable.
2. The tool has a single in-line 1 amp fuse on pin #1. There is no fuse on pin #4.
3. It is assumed that the AC power supply connected to the upper end of the logging cable is current fault protected. In the event of an adverse event, such as flooding of the pressure housing, it could be possible for power to couple on to the drill string leading to an unsafe condition.

Polarity/Direction Control of 24 VDC Power to Motor

The 24 VDC benchtop power supply must be plugged into 120 VAC in the logging cab. Before connecting the output leads, turn on the power supply and verify that the output is set to 24 V, +/- 0.5 V. The current requirements for the control lines are only a handful of milliamps. Therefore, the current limiting function can be set very low for safety considerations.

When it is desired to operate the ERS mechanism, connect the negative lead V- (i.e. the lead connected to the negative side of the 24 VDC supply) to Pin #10 of the logging cable via the CIS panel. If it is desired to run the ERS mechanism in the LATCH direction, connect the positive output lead V+ (i.e. the lead connected to the positive side of the 24 VDC supply) to Pin #5 of the logging cable via the CIS panel. If it is desired to RELEASE the mechanism, connect the positive output lead to Pin #6 of the logging cable via the CIS panel.

NOTE: Visually verify the direction of these operations on the deck. Because of the design speed of operation of the mechanism, do not operate the motor for more than five (5) seconds at a time. After each five second run, inspect (if the unit is on deck) or pull test the mechanism to verify full release or latching as appropriate. If the latch or release operation is not complete, inspect the mechanism and ensure no binding has occurred. Run the motor in the opposite direction for five seconds and try the operation again.

Additions for ERS V2.0

After the prototype ERS v.1.0 tools were run on Expedition 327, some changes were implemented. Note that some topics supersede what was published for the v.1.0 prototype tools.

Tool Assembly and Preparation for Use

The ERS v.2.0 is assembled in essentially the same fashion as the prototype system. There are several noteworthy differences that will be explained here.

Anti-Rotation Features between Pressure Case, Sinker Bar, and ERS Motor Housing:

To prevent inadvertent rotation among these parts, a set screw was added to each end of the sinker bar. At the corresponding mating locations on the pressure case and ERS motor

housing, there are slots into which these set screws must fit in order for the connections to be made up properly. This feature prevents rotation of the Sinker Bar and inadvertent twisting of the wires going through it.

ERS Motor Can: The ERS motor runs in a pressure balanced oil-filled “can” that mounts into the ERS Motor Housing. The can must be filled with oil prior to each run of the ERS. This is necessary since the seal around the motor output shaft seeps a little bit and through repeated runs, oil is lost. If the oil volume falls below a certain level, seawater may infiltrate the motor can and cause short circuiting of the motor. This oil should be Royal Purple Marine Hydraulic Oil ISO Grade 22 for lowest viscosity at ocean temperatures.

This motor can is mounted to the ERS Motor Housing via six #10-24 x 1/2” 82° flat head cap screws. By removing these six screws, the motor can assembly can be removed from the housing. The motor output shaft fits into a “D hole” machined into the drive shaft. By sliding the motor can in the uphole direction about 3/8”, the motor shaft will clear the drive shaft and the motor can may be lifted out of the housing. The motor can will have attached to it a) a tubing loop (or “bladder”) for pressure compensation, and b) the motor power lead cable which is surrounded by a segment of tubing, also part of the pressure compensation system. The motor can may be pulled out far enough to expose the connection between the motor lead and the jumper cable. When this connection is unmated, the motor can assembly can be removed as a unit.

The motor can has in it a hex socket pipe plug. This plug can be removed to add oil to the motor can. By slowly adding oil and rocking the motor can, it may be filled and bled of air. It is mandatory that the air be bled from this volume to ensure proper operation of the pressure compensation function. When filling and bleeding the motor can, make sure that all air is bled from the tubing sections and from around the motor body. When full, replace the plug and re-install the motor can, reversing the operation above. Note that the extra length of the jumper cables must be “folded over” into the upper portion of the ERS Motor Housing. This process will be discussed in the following paragraphs. If the rotational position of the ERS mechanism has not been altered (this would be extremely unlikely), the motor output shaft should fit right back into the D-hole.

Cables through Sinker Bar: There are two jumper cables that send a) power to the ERS motor and b) power and signal from the MFTM and the device to which the ERS may be mated. The ERS pressure case now utilizes a more robust 7 pin Teledyne Impulse MHDG connector with piston and face seals. There is a molded “Y cable” that mates to this connector and in turn splits out a two conductor cable for the ERS motor and a four conductor cable that terminates in a potted IE4 connector in the ERS core for mating with the device below the ERX. Therefore, two small diameter cables must be fed through the Sinker Bar and connected down at the ERS Motor Housing.

The jumper cables that extend through the Sinker Bar are longer than necessary. The excess length can be accommodated by doubling up the excess length in the upper end of the ERS Motor Housing, just above the ERS Motor Can. The recommended order of cable makeup is as follows:

- a) Connect the two conductor and four conductor jumper cables to the “Y cable” and feed the jumper cables through the Sinker Bar. Do not make up the MHDG connector on the lower end of the ERS Pressure Case.
- b) Bring the ERS Pressure Case and ERS Motor Housing into close proximity to the mating ends of the Sinker Bar.
- c) Feed the lower ends of the jumper cables through the upper end of the ERS Motor Housing and bring them out of the window into which the ERS Motor Can fits.
- d) Makeup the respective IE55 connections between the jumper cables and the ERS Motor lead and the four conductor cable that runs under the ERS Motor Can down to the IE4 connector in the ERS Core. Bring the slack out of the window.
- e) Pull sufficient slack in the cables so as to allow them to be carefully “folded over”. The “doubling up” of the cables can be accommodated by the larger ID of the ERS Motor Housing. By taking up this slack, it will be necessary that the

7 pin MDHG connector be temporarily retracted a bit into the upper end of the Sinker Bar.

- f) Note that the four conductor cable passes through the ERS Motor Housing and runs in a channel machined into the ERS Motor Can. When the motor can is installed in the housing, this cable must be positioned in this channel to allow the proper fit of the ERS Motor Can
- g) When this folding of the cables has been completed, the folds can be gently inserted into the housing and the ERS Motor Can may be inserted into the housing. When the motor can is inserted into the housing, the pressure compensation tubing loop will also have to be manipulated into the housing. There is sufficient space to do this without damaging the cables and tubing.
- h) Once the motor can is placed in the proper position, install the six 10-24 82° flat head cap screws.

Electrical and Electronic Considerations

Addition of Power And Data Feed through Lines – The v.1.0 prototype tools did not supply power or communication feed through to any tools below the ERS to/from the MFTM. The ERS v.2.0 tools do provide this functionality. The connectivity is shown below.

Function	31 Pin Connector Pin Number	IE4 Connector Pin Number	Wire Color in ERS Pressure Case	MHDG-FCR Pin Number
V+	26	2	Red	3
V-	30	4	Blk	6
232 Xmit/485A	11	1	Wht	2
232 Gnd/485B	13	3	Grn	5

Addition of New Bulkhead Connector On Lower End Of Pressure Case – The lower bulkhead electrical connector on the ERS pressure case was changed to a 7 pin Teledyne/Impulse unit, the MHDG-FCR series. There are two 16 AWG connections and five 20 AWG connections. The connector incorporates double seals (a piston seal and a face seal) for redundancy. Both pressure cases were successfully pressure tested to 10,000 psig. Note that the 7th pin is not used. Two of the pins are used for the power to the ERS motor and four of them are used for power and comm to a device below the ERS. Such devices could be SCIMPI or T2P. See below for connectivity details. Additionally, new cables were made for extending through the sinker bar. A molded connector splits out the ERS motor power leads into a two conductor cable and the power and comm for the tool below the ERS into a four conductor cable. This four conductor cable connects to a Teledyne Impulse IE4 connector which is permanently potted into the ERS Core.

Operation: Latching and Releasing the ERS – This procedure will be followed for both testing on deck and running the ERS while subsea.

The V- terminal from the standalone 24 VDC power supply must be connected to Pin 10 on the Schlumberger 31 pin connector. This pin is connected to the V- pin on the Vicor module in the ERS pressure case and it also connects to the armor in the logging cable either in the MFTM or in the cable head. To cause the ERS to LATCH, the +24 V must be applied to Pin 5 on the Schlumberger 31 pin connector. This pin connects to solder pad “REV” on the ERS Motor Controller Board. To cause the ERS to RELEASE, the +24 V must be applied to Pin 6 on the Schlumberger 31 pin connector. This pin connects to solder pad “FWD” on the ERS Motor Controller Board.

Recommended Care for Post-Run and Storage – It is recommended that the ERS system always be flushed with clean water after each run. This will ensure that debris will not remain in the tool and cause problems when the system is run after a time in storage. As outlined above, the ERS Motor Can must always be filled with oil prior to each run to ensure proper motor operation and pressure balancing. Because the ERS Motor Can seals around the motor shaft are not perfect, oil seepage will occur. This could cause difficulties during a long time in storage. Therefore, it is highly recommended that the ERS Motor Can be removed from the ERS Motor Housing and stored in a plastic bag or similar in order to prevent oil from seeping through the tool during storage.

ERS v.2.0 PARTS LIST

BILL OF MATERIAL					
ITEM	QTY	DRAWING NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	ERS-001	UPPER SINKER BAR NUT	4130/4140/4142	2.90
2	1 PAIR	ERS-002	UPPER SINKER BAR SPLIT RING	316/321 SS	.47
3	1	ERS-003	SPECIAL SINKER BAR	1018 STEEL	69.48
4	1	ERS-004	LOWER SINKER BAR NUT	4130/4140/4142	2.49
5	1 PAIR	ERS-005	LOWER SINKER BAR SPLIT RING	316/321 SS	.34
6	1	ERS-006	SINKER BAR CROSSOVER	4130/4140/4142	4.44
7	1	ERS-007	MOTOR HOUSING SUB	17-4PH/15-5PH	13.24
8	1	ERS-008	COVER PLATE	321 SS	.37
9	1	ERS-009	MOTOR CAN CAP	316/321 SS	.70
10	1	ERS-010	MOTOR CAN	316/321 SS	1.83
11	1	ERS-012	PULL SLEEVE	17-4PH/15-5PH	.89
12	1	ERS-013	MOTOR HOUSING-SKIRT CROSSOVER	17-4PH/15-5PH	4.30
13	1	ERS-014	OUTER COUPLER	17-4PH/15-5PH	1.15
14	1	ERS-015	INNER COUPLER	17-4PH/15-5PH	.96
15	1	ERS-016	ERS CORE	17-4PH/15-5PH	3.55
16	1	ERS-017	ERS SKIRT	17-4PH/15-5PH	6.53
17	2	ERS-020	COUPLER SPRING	17-7 SPRING WIRE	
18	1	ERS-021	CIRCUIT BOARD CARRIER	6061-T6 ALUM. ALLOY	
19	1	ERS-022	X/O & PRESSURE CASE, ERS TO 31 PIN CONNECTOR (MODIFIED) ERS v.2.0 ONLY AS SHOWN	17-4PH/15-5PH	26.72
20	1	ERS-024	P-CASE BULKHEAD ADAPTER PLATE ERS v.2.0 ONLY	316/321 STAINLESS STEEL	.57
21	1	ERS-025	ERS ALIGNMENT SCREW	ALLOY STEEL	.02
22	1	ERS-027	JACK SCREW	Brass, Soft Yellow	.42
23	1	ERS-028	DRIVE SHAFT	17-4PH	.13
24	1 PAIR	ERS-029	UPPER BEARING HOLDER PAIR		.35
25	1 PAIR	ERS-030	LOWER BEARING HOLDER PAIR		.04
26	1	ERS-031	CONNECTOR POTTING CARTRIDGE	316/321 STAINLESS STEEL	.61
27	1	ERS-032	MALE LOCKING SLEEVE	316/321 STAINLESS STEEL	.19
28	8		MACHINE SCREW, 100° FLAT HEAD PHILLIPS, #8-32UNC-2A x 1/4" LG., McMASTER NO. 90471A250 OR EQ.	ZINC PLATED STEEL	
29	14		CAP SCREW, 82° FLAT HEAD, HEX SOCKET, SELF-LOCKING, #10-24UNC-2A x 1/2" LG. McMaster NO. 91266A242 OR EQ.	ALLOY STEEL	
30	3		SOCKET CAP SCREW, HEX SOCKET, #10-32UNF-2A x 5/8" LG. McMaster NO. 92423A508 OR EQ.	A-286 ALLOY	
31	1		PIPE PLUG, HEX SOCKET, 1/8" NPT, McMaster NO. 48805K222 OR EQ.	316 SS	
32	10		SET SCREW, FLAT POINT, 1/4-20UNC-2A x 1/4" LG. McMaster NO. 92313A533 OR EQ.	316 SS	
33	4		SET SCREW, FLAT POINT, #10-24UNC-2A x 3/16" LG. McMaster NO. 92313A237 OR EQ.	316 SS	
34	4		HX. HD. CAP SCREW, #10-24UNC x 3/4" LG.. McMaster 94081A144 W/ SS FLAT & LOCK WASHERS	TITANIUM	.01
35	1		SELF LOCKING SOCKET HD. CAP SCREW, HX. SOCKET, #10-24UNC x 3/4" LG., BLACK OXIDE, MIN. UTS=180.0 KSI, McMaster 91205A245 OR EQ.	ALLOY STEEL	.01
36	8		HX. SOCKET HD. CAP SCREW, #6-32UNC x 1/4" LG., McMaster 92185A144 OR EQ. W/ SS STAR LOCK WASHERS	316 SS	.00
37	2		SET SCREW, FLAT POINT, 1/4-20UNC-2A x 1/2" LG.	316 SS	.01
38	4		HX. HD. CAP SCREW, #5-40UNC x 1/2" LG., McMaster 92185A136 OR EQ. W/ STAINLESS STAR LOCK WASHERS	316 SS	.00
39	2		SELF LOCKING SOCKET CAP SCREW, HEX SOCKET, #10-24UNC-2A x 3/4" LG. McMaster NO. 91205A245 OR EQ.	ALLOY STEEL	.01
40	2		CAP SCREW, 82° FLAT HEAD, HEX SOCKET, #10-32UNF-2A x 3/4" LG. McMASTER 93791A518	18-8 SS	.01
41	1		2-032 O-RING	BUNA-N	
42	1		2-122 O-RING	BUNA-N	
43	1		5-254 O-RING	BUNA-N	.00
44	1		5-566 O-RING	BUNA-N	.00
45	1		2-124 O-RING	BUNA-N	.00
46	1		QUAD O-RING, McMaster #6540K132	VITON	.00
47	1		CIRCUIT BOARD, MOTOR POWER & CONTROL ELECTRONICS	-	
48	1		HANSEN GEARMOTOR, 24VDC, #116-42448-192	-	
49	3		BRASS BARBED HOSE FITTING ADAPTER FOR 1/4" HOSE ID x 1/8" NPTF MALE PIPE, McMaster 5346K13 OR EQ.	BRASS	
50	1		CONTRACTION BLADDER, PVC TYGON TUBING, 1/2" O.D. x 1/8" WALL x 9"-10" LG.	PVC	
51	1		MOTOR WIRE SEALING TUBE, PVC TYGON TUBING, 1/2" O.D. x 1/8" WALL x APPROX. 3" LG.	PVC	
52	5		HOSE CLAMP, STAINLESS, 3/8" BAND WIDTH	SS	
53	3		DOG, 3" RS OVERSHOT	4340	
54	1		DOG WASHER	INCONEL	
55	1		DOG SPRING	INCONEL	
56	2		DOUBLE SEALED BALL BEARING, McMaster #4648K16	440 SS	.10
57	1		SCHLUMBERGER 31-PIN CONNECTOR	-	
58	1		31 PIN CONNECTOR SPRING	-	
59	1		MHDG-FCR CONNECTOR, 7 PIN, TELEDYNE IMPULSE	-	.21
60	1		MHGD-CCP CONNECTOR	-	1.08
61	1		MOTOR CONTROL JUMPER CABLE (2 WIRE)	-	.12
62	1		COMM CABLE JUMPER (4 WIRE)	-	.25