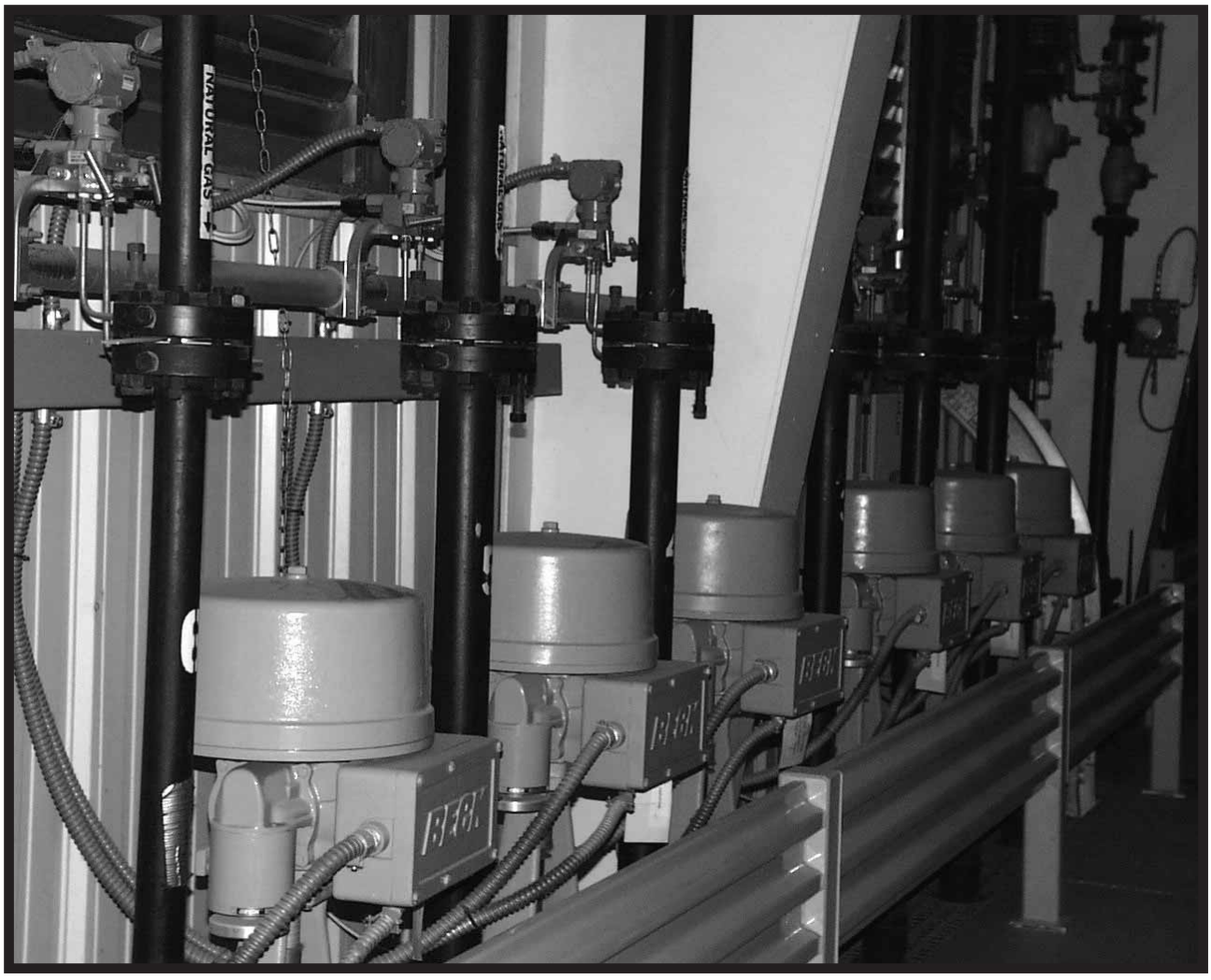
80-1402-01
Rev. 01

MODEL GROUP 14
DCM-H EQUIPPED
BECK ELECTRONIC CONTROL DRIVES

INSTRUCTION MANUAL



BECK®

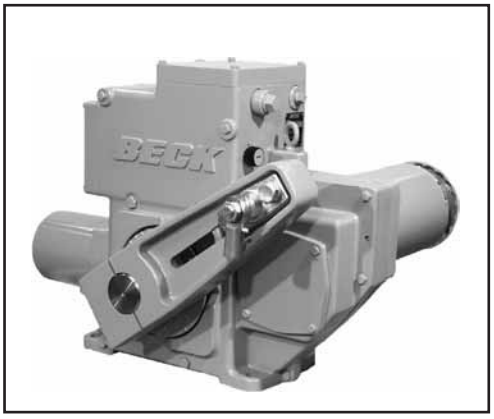
INTRODUCTION TO THE MANUAL

This manual contains the information needed to install, operate and maintain Beck Model Group 14 Electronic Control Drives equipped with the HART® interface version of the Digital Control Module (DCM-H), manufactured by Harold Beck & Sons, Inc. of Newtown, Pennsylvania.

The Group 14 linear drive is a powerful control package designed to provide precise position control of globe valves and other devices requiring up to 4,000 lb of thrust.

NOTICE: This manual contains information that will make installation simple, efficient and trouble-free. Please read and understand the appropriate sections in this manual before attempting to install or operate your drive.

Group 22 digital control drives ...
are designed for accurate, reliable, digital control in high torque applications. The drive is ideal for use in large boiler applications, such as ID/FD fan dampers.



Group 11 rotary drives ...
provide precise position control of dampers, quarter-turn valves, fluid couplings, and other devices requiring up to 1,800 lb-ft drive torque.

CONTENTS

PRODUCT DESCRIPTION

Beck Group 14 linear control drives are engineered for precise, reliable operation of globe valves requiring up to 4,000 lbs of thrust. The cool, stable operation of Beck's control motors coupled with the powerful gear train provide the tight, responsive control required by modern control loops to keep operating costs low. The motor can withstand occasional accidental stalls of up to four days without failure, and will resume instant response to control signals immediately upon removal of the condition. Electrical limit switches and fixed mechanical stops on the output shaft prevent over-travel.

An easy-to-turn, spoke-free Handwheel is incorporated into the Group 14 design to allow manual operation during installation or power outages. The Handwheel can be used to open and close valves smoothly and easily under full load conditions.

The Beck Tight-Seater™ coupling is a part of the Group 14 linear drive. This preloaded disk coupling is mounted on the drive output shaft and provides positive seating of the valve plug up to the rated thrust of the drive. It eliminates high-pressure leakage, which can cause erosion of the valve seat. A patented self-locking mechanism holds the drive output shaft in position when the motor is deenergized.

A Calibar index allows simple, single-point adjustment of the length of the stroke to match valve requirements. When this adjustment is made, the position feedback signal, over-travel limit switches, and any auxiliary switches are all automatically adapted to the new stroke setting.

Valves may also be operated at their individual locations with a built-in electric Handswitch.

Beck's Digital Control Module provides precise drive control from either conventional analog or computer-based control systems. It also provides intelligent calibration, easy drive setup changes, and diagnostic information. The DCM-H allows remote access of all features and information with the HART® communications interface.

Beck's CPS-2 Contactless Position Sensor provides accurate position measurement in demanding environmental conditions, with no contacting or wiping surfaces to wear or intermittently lose contact. The CPS-2 provides infinite resolution with linearity error of less than ±1% of span over full control drive travel.

Beck Group 14 electronic control drives are designed with individual weatherproof enclosures to protect the main components.

Although the Group 14 drive is normally installed in the upright position, the drives may be installed in any orientation. For installations where the piping will not support the weight of the control drive, holes are provided for mounting hardware.

TYPICAL APPLICATIONS

Beck Group 14 linear control drives are suitable for steam flow control, combustion gas control, and any other application that requires precise valve position control. A drive may be applied to any globe, cage, or diaphragm valve with a rising stem that has a stroke within the capability of the drive. An integral mounting yoke is part of each linear drive.

Beck Group 14 drives are available in stroke ranges from 5/16" to 4 1/2", and in a variety of thrust and timing combinations. See Table 1 for thrust and timing options.

TABLE 1:
GROUP 14 MECHANICAL AND ELECTRICAL SPECIFICATIONS

Basic Model	Thrust (Lbs.)	Timing (sec. / in.)		Dimensional Data
		@ 60 Hz	@ 50 Hz	
14-100	340	4	5	Pages 9 & 10
	425	11	13	
	600	16	19	
	650	8	10	
	800	11	13	
	1,000	27	32	
	1,100	16	19	
	1,620	48	57	
	1,800	27	32	
14-200	2,700	16	20	Pages 9 & 10
	4,000	24	29	

PRODUCT DESCRIPTION

GENERAL SPECIFICATIONS

Input Power	120 V ac single-phase 50 or 60 Hz; 48, 72 or 180 watts 240 V ac single-phase 50 or 60 Hz			Allowable Tolerance	+10% -15%

Model	Max. Current and Power			
	120 V ac		240 V ac	
14-109	.56 A	72 W	.33 A	80 W
14-209	1.5 A	180 W	.86 A	210 W

Operating Conditions	-40° to 85°C (-40° to 185°F) 0 to 99% relative humidity
Demand Input Signal Range (Digital Control Module)	4–20 mA 1–5 V dc
Adjustability for Split Range Operation	0%: 0.1 V to 4 V dc 100%: 0% + 1 V min., 5 V max.
Deadband	0.6% of span. (Contact the factory if a different value is desired).
Minimum Step	0.1% typical.
Demand Input Signal Characterization	Linear: Drive output shaft moves proportionally to the input signal Square: Drive output shaft moves proportionally to the square of the input signal
Position Feedback Signal for Remote Indication (Optional)	4–20 mA
Output Stability	0.25% of span from 102 to 132 V ac ±0.03% of span/°C for 0 to 50°C, ±0.05% of span/°C for -40° to 85°C
Linearity	±1% of span, max. independent error
Hysteresis	0.25% of span at any point
Isolation	Max. leakage of 10 µA at 60 V rms, 60 Hz from output to ground
Action on Loss of Power	Stays in place
Action on Loss of Input Signal (Power On)	Stays in place or drives to any preset position (configurable).
Stall Protection and Annunciation	If the motor tries to run in one direction for more than 300 seconds, the DCM will shut off power to the motor. Time to stall indication is configurable from 30 to 300 seconds.

GENERAL SPECIFICATIONS (cont'd)

Over-travel Limit Switches	Two SPDT (Retract and Extend) provide over-travel protection.
Auxiliary Switches	Up to four 6 A, 120 V ac switches available. Switches are labeled S1 to S4 and are cam-operated, field-adjustable.
Handswitch	Permits local electrical operation, independent of controller signal. Standard on all units.
Handwheel	Provides manual operation without electrical power.
Motor	120 V ac, single-phase, no-burnout, non-coasting motor has instant magnetic braking. Requires no contacts or moving parts.
Gear Train	High-efficiency, precision-cut, heat-treated alloy steel and ductile iron gears and bronze nut. Interchangeable gear modules permit field change of timing.
Mechanical Stops	Prevent overtravel during automatic or manual operation.
Enclosure	Precision-machined aluminum alloy castings, painted with corrosion-resistant polyurethane paint, provide a rugged, dust-tight, weatherproof enclosure.
Stroke Adjustment	Calibar simultaneously adjusts the stroke length, position feedback signal, over-travel limit switches and auxiliary switches. The new stroke displacement is produced by the full input signal.

TABLE 2:
SUMMARY OF CONTROL OPTION 9,
DCM-H BOARD OPTIONS AND PART NUMBERS

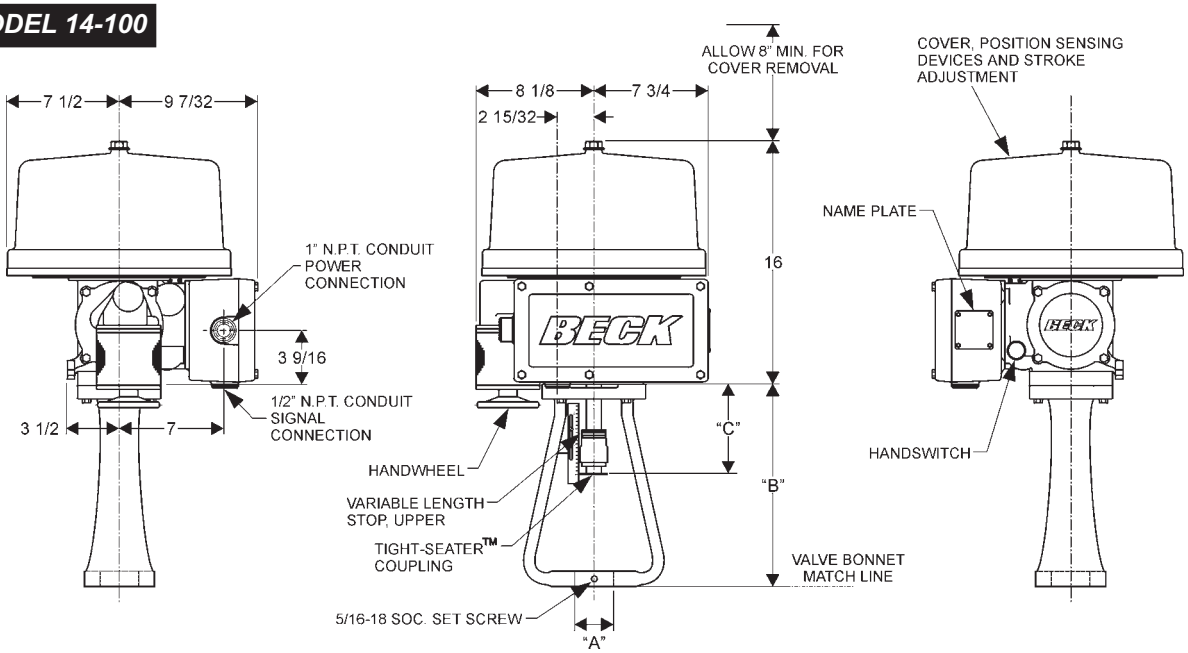
DCM-H Part Number	Demand Input Signal Range*	Contactless Position Sensor Part Number	External Position Feedback Signal	Auxiliary Switch Options
22-5009-04	4–20 mA	20-3400-09	No	None 2 4
22-5009-05	4–20 mA		Yes	
22-5009-14	1–5 V dc		No	
22-5009-15	1–5 V dc		Yes	

*Boards of either input signal range are convertible from one range to the other by adding or removing a 250 ohm input resistor.

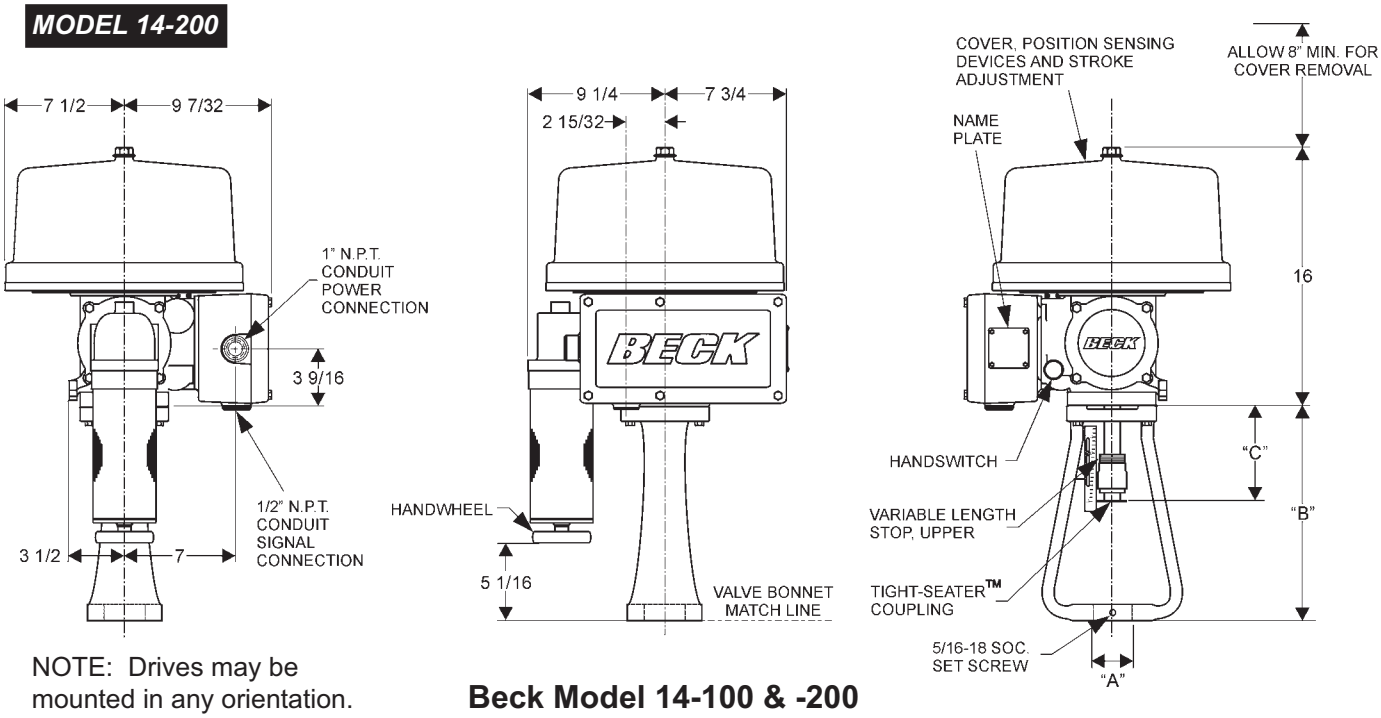
OUTLINE DIMENSION DRAWINGS

OUTLINE DRAWING -- 5/16” to 2 1/8” travel (ALL DIMENSIONS IN INCHES)

MODEL 14-100



MODEL 14-200



NOTE: Drives may be mounted in any orientation.

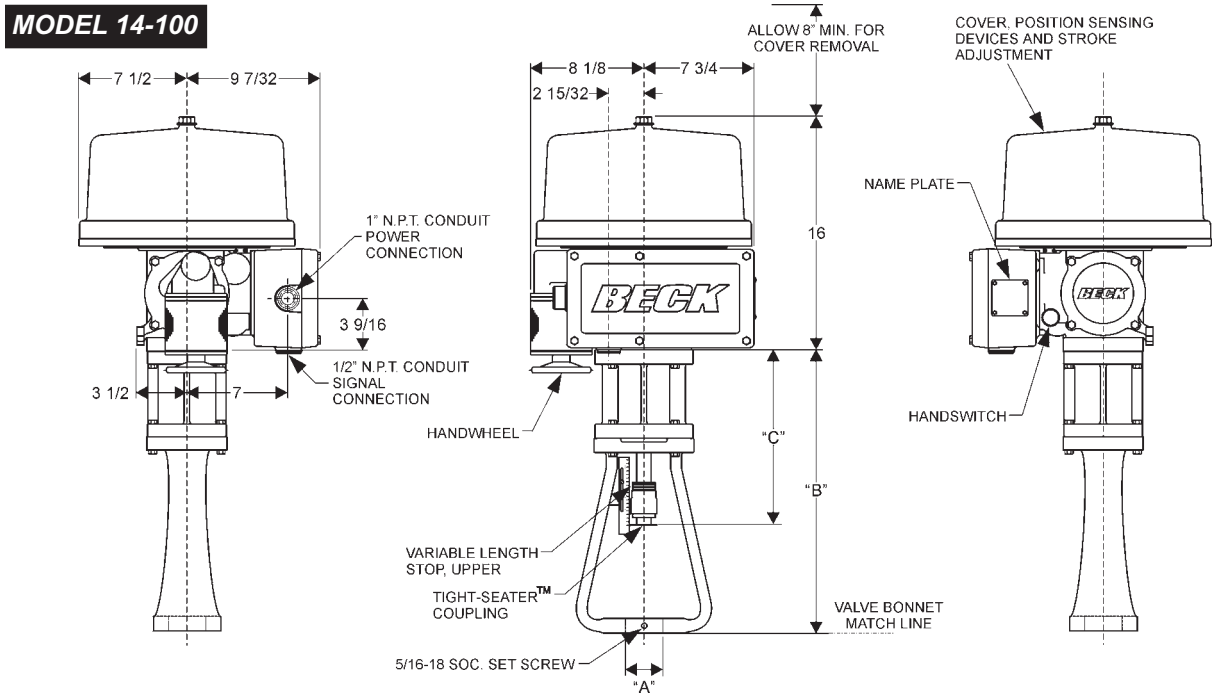
Beck Model 14-100 & -200

Beck Drive Model No.	Drive Shaft Travel Range In.	"A" Valve Boss Dia. Range In.	"B" Yoke Height In.	"C" Nominal Drive Shaft Extension In.	Max. Valve Stem Extension (Valve Stem Retracted) In.	Approx. Weight Lbs.
14-100	5/16 - 1 3/4	1 - 2 5/8	8	4 3/16	5 1/2	80
	3/4 - 2 1/8	1 3/8 - 3 3/4	13 1/2	6	9 1/4	92
14-200	5/16 - 2 1/8	1 3/8 - 3 3/4	13 1/2	6 11/16	9 1/4	105

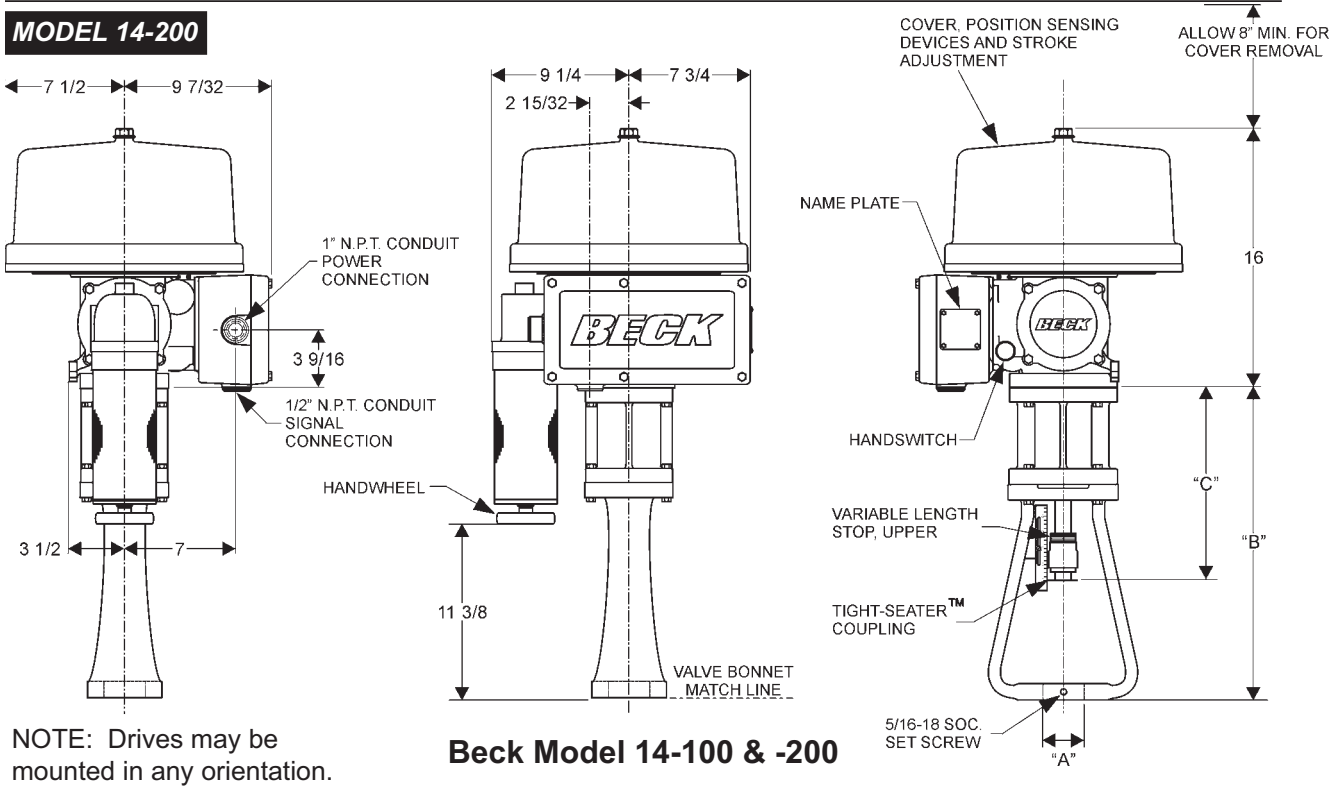
OUTLINE DIMENSION DRAWINGS

OUTLINE DRAWING -- 3/4” to 4 1/2” travel (ALL DIMENSIONS IN INCHES)

MODEL 14-100



MODEL 14-200



NOTE: Drives may be mounted in any orientation.

Beck Model 14-100 & -200

Beck Drive Model No.	Drive Shaft Travel Range In.	"A" Valve Boss Dia. Range In.	"B" Yoke Height In.	"C" Nominal Drive Shaft Extension In.	Max. Valve Stem Extension (Valve Stem Retracted) In.	Approx. Weight Lbs.
14-100	3/4 - 4 1/2	1 3/8 - 3 3/4	19 13/16	12 5/16	9 1/4	100
14-200	3/4 - 4 1/2	1 3/8 - 3 3/4	19 13/16	13	9 1/4	115

INSTALLATION

SAFETY PRECAUTIONS

WARNING

Installation and service instructions for use by qualified personnel only. To avoid injury and electric shock do not perform any servicing other than contained in the operation instructions unless qualified.

STORAGE INFORMATION

The drive should be stored in its shipping carton in a clean, dry area.

If it is necessary to store the drive outdoors for a long period of time, it should be removed from its shipping carton and stored above ground. A waterproof cover should be securely fastened over it. Do not stack drives on top of one another. Stored drives should be periodically checked to make sure no condensation has formed in the control compartments. Damage due to moisture while in storage is not covered by warranty.

UNPACKING

Group 14 drives are packed in standardized cardboard shipping containers. Drives mounted on valves may be packed in cardboard containers or strapped to a skid and crated, depending on size. After unpacking, the wooden platform may be used to transport the drive to the installation site.

INSTALLATION—MECHANICAL

Beck drives can be furnished with valves mounted as unitized assemblies ready for pipeline installation.

CAUTION

Whenever a control drive is being mounted on a valve, it is good practice to remove the valve from service. Observe the following precautions:

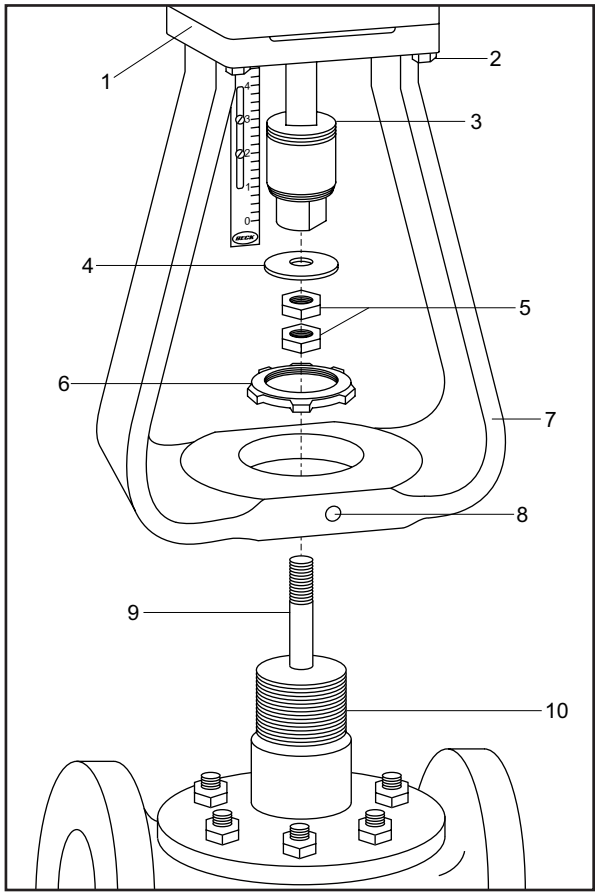
- **Know what fluid is in the line.**
- **Wear proper protective equipment.**
- **Disconnect the electrical power.**
- **Depressurize the pipeline.**
- **Refer to the valve maintenance manual for specific instructions.**

Mounting The Drive On A Valve

Refer to the figure below to identify the mounting parts and the steps to install the drive onto the valve.

1. Prepare the valve. It may be necessary to remove parts that are no longer used or to replace or adjust packing. Refer to the valve maintenance manual for specific instructions. Consult the Beck Valve Mounting Specification sheet that was shipped with the drive for any instructions regarding modifications to the valve stem that may be necessary.
2. Push the valve stem (9) into the valve body to the fully seated or stem down position.
3. Move the G-14 output shaft up into the drive body until the upper mechanical stop (3) is tight against the lower bearing plate (1).
4. Remove the four lower bearing plate bolts (2) that hold the bottom plate to the drive body (1/2" bolt heads). Pressure from the mechanical stop will hold the plate in place when the bolts are removed. Bolt the yoke (7) to the lower bearing plate using the longer bolts supplied with the yoke. Torque bolts to 10 lb-ft.

Continued



MOUNTING THE DRIVE, CONT'D.

5. Place the jam nuts (5) and travel index (4) over the valve stem (9) before mounting the drive on the valve.
6. Remove the boss nut (6) from the valve and place the drive and yoke over the stem and onto the boss (10). Secure the yoke with the boss nut, finger-tight.
7. Using the drive Handwheel, lower the drive output shaft to contact the valve stem. Thread the valve stem into the end of the drive output shaft. HINT: Rotate the whole yoke /drive assembly to get the valve stem started into the drive output shaft. Continue lowering the drive output shaft and threading the valve stem until the drive output shaft is fully down on the mechanical stop.
8. Tighten the boss nut to secure the yoke and tighten the yoke set screw (8).
9. Follow the valve seating adjustment procedure on page 14 to complete the mounting.

Removing the Drive from a Valve

1. Move the Group 14 output shaft up into the drive body until the mechanical stop (3) is tight against the lower bearing plate (1).
2. Turn off all electrical power and disconnect all electrical wiring from the drive.
3. Loosen the valve stem jam nuts (5). Loosen the boss nut (6) on the yoke and leave it finger tight. Loosen the yoke set screw (8).
4. Unthread the valve stem from the drive output shaft by turning the whole yoke / drive assembly.

Valve Installation

The Beck control drive can be mounted in any convenient orientation. There is no preferred operating position.

Inspect the valve body to be sure that it is clean. Be certain that other pipelines in the area are free from pipe scale or welding slag that could damage the gasket surfaces.

Tighten the flange bolts and ensure that all bolts are evenly torqued. Refer to the gasket manufacturer's instructions for specific information on tightening flange bolts.

NOTE: The valve may have experienced temperature variations in shipment. This could result in seepage past the stem seals. Refer to the valve manufacturer's maintenance instructions for packing adjustments.

INSTALLATION—ELECTRICAL

Two conduit connections are provided in every Beck Group 14 drive for supplying power and signal wiring to the unit. A sealant must be used on threaded conduit connections to keep moisture out. Conduit should be routed from below the drive so that condensation and other contaminants entering the conduit cannot enter the drive.

A large, clearly labeled terminal block on the side of the drive is enclosed in a gasketed metal enclosure. Terminals will accommodate up to 12 AWG wiring (see figure on page 13).

CAUTION

Always close covers immediately after installation or service to prevent moisture or other foreign matter from entering the drive.

Refer to the wiring diagram furnished with your Beck drive for proper AC power and signal connections. It is advisable to provide normal short circuit protection on the AC power line. A copy of the wiring diagram is shipped with each drive and is fastened to the inside of the terminal block cover. If there is no wiring diagram available, you may obtain a copy from Beck by providing the serial number of your drive.

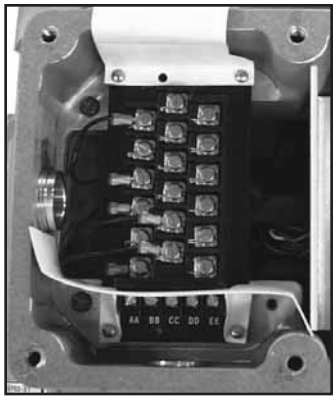
Your Beck drive has been supplied to match the signal source in your control loop. If it does not match, the input signal range is convertible by adding or removing a 250 ohm resistor—contact the factory for details.

For maximum safety, the Beck drive body should be grounded. Normally, the electrical conduit provides adequate ground protection. If not, a separate ground conductor should be connected to the drive body.

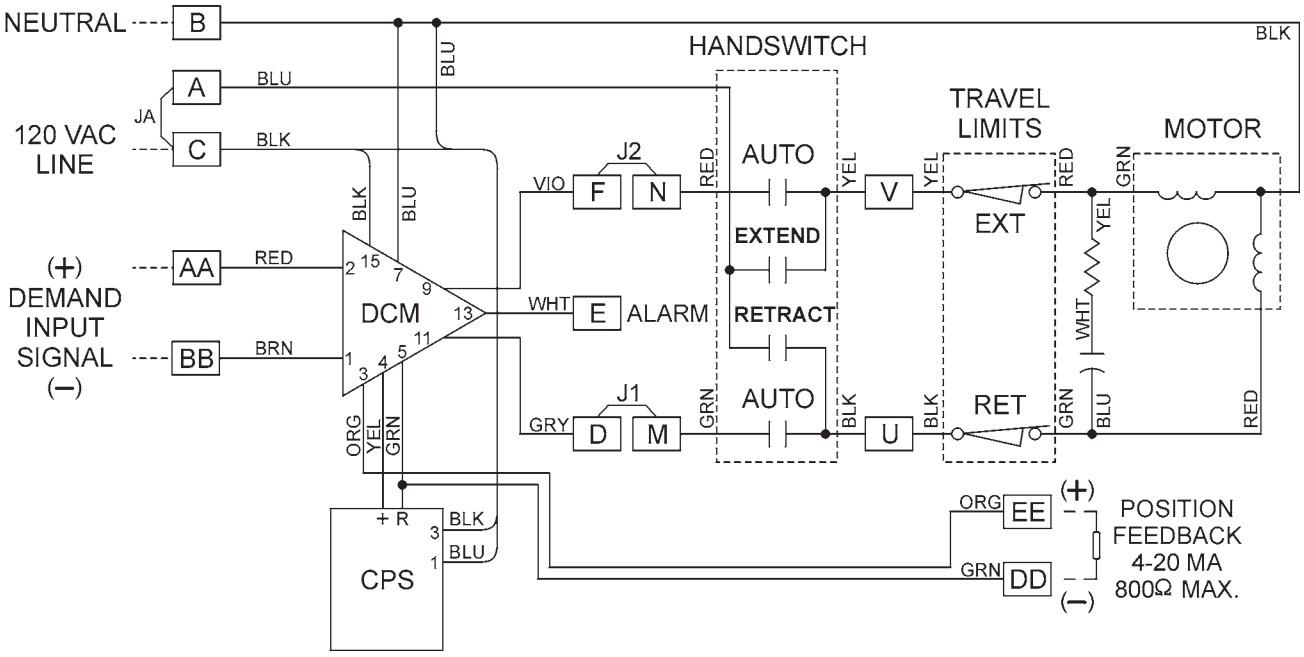
INSTALLATION *SIGNAL WIRING*

Each Beck drive is custom built to match the control requirements of your system specified at the time of order. Typical wiring connections are described below. Each drive has a specific wiring diagram attached to the inside of the wiring terminal cover.

A drive can be ordered with up to four optional auxiliary switches. Wiring connections for these are described on page 37.



Typical Wiring Connections



START-UP INSTRUCTIONS

After the drive is mounted and its wiring connections are made, it is ready to be tested for proper operation.

Turn on the power supply. Operate the drive with the Handswitch and run it through its full stroke, both directions. Observe that the driven device travels through its desired stroke. If satisfactory, set Handswitch at the “AUTO” position.

Turn on the controller and operate the drive by varying the control signal. Check that the valve strokes in the proper direction for a change in control signal. An increasing control signal retracts the shaft and opens the valve. With a 100% signal, the drive is fully retracted. If the valve does not stroke in the proper direction, first check for proper wiring connections and verify the control signal at the drive. If the wiring is correct, then reverse the direction of travel (see page 37).

Valve Seating Adjustment

The drive has a Tight-Seater™ attached to its output shaft. The Tight-Seater™ allows tight seating of the valve plug. It is a pre-loaded coupling that allows the valve plug to seat before the drive reaches its lower limit. The additional amount of travel compresses the thrust discs inside the Tight-Seater™, causing a controlled amount of thrust to hold the valve plug on its seat when the drive stem reaches its lower limit. The Tight-Seater™ is factory-set to produce a thrust matched to the valve and should never be disassembled. Control of the amount of valve stem threaded into the Tight-Seater™ may be used to adjust the valve seating.

If readjustment of valve seating is necessary, proceed as follows:

1. With the Handswitch, run the drive to a position above the 0% or lower limit position.
2. Loosen the lock nut on the valve stem and thread the valve stem into the Tight-Seater™.
3. Run the drive to the 0% position, using a Demand signal source.
4. Thread the valve stem out of the Tight-Seater™ until the plug seats in the valve.
5. Raise the drive shaft using the Handswitch until the plug is clear of the seat and there is sufficient clearance to make the following adjustment.
6. Thread the valve stem out of the Tight-Seater™ a fraction of a turn according to the valve stem thread as listed (1/32" travel):

Thread	Turn
3/8-24	3/4
7/16-18	5/8
1/2-20	5/8
3/4-16	1/2

7. Tighten the lock nut and index disc on the valve stem.
8. Run the drive to its lower limit using the Handswitch. The valve stem should stop before the drive shaft stops.
9. Reposition the travel index.

CAUTION

If the valve stem is threaded directly into the drive shaft without a Tight-Seater™, the valve stem should be at least 1/4 turn from the seated plug position when the drive shaft reaches the lower limit. This will prevent damage to the valve stem or seat. Do not attempt to obtain tight shut-off without a Tight-Seater™ as serious valve damage may result.

HOUSING

All models of the Beck Group 14 electronic control drive have individual, cast aluminum compartments for the main components: The control motor, wiring terminal board, drive train, digital control module, and feedback section. Gasketed covers and sealed shafts make this product ideally suited to outdoor and high-humidity environments.

CONTROL MOTOR

The Beck control motor is a synchronous inductor motor that operates at a constant speed of 72 RPM in synchronism with the line frequency.

Motors are able to reach full speed within 25 milliseconds and stop within 20 milliseconds; actual starting and stopping times vary with load.

Beck motors have double grease-sealed bearings and require no maintenance for the life of the motor.

DRIVE TRAIN

The Group 14 drive train consists of a control motor, SLM, Handwheel, reduction gears, main gear, and power screw output shaft. The ductile iron main gear and the bronze nut and stainless steel power screw output shaft are common to units of a particular range of thrust and timing. The steel reduction gears are part of the field changeable gear housing assembly. Different combinations of output gear, housing assemblies, and drive motors determine the drive's output thrust, timing and stroke adjustment.

The output shaft travel is limited by mechanical stops. The mechanical stop for the fully extended or lower limit of the output shaft travel is not adjustable. The position of the retracted or upward travel mechanical stop is determined by the number of washers on the output shaft between the Tight-Seater™ and the lower bearing plate. This is factory-set for the amount of travel specified at the time of the order and is generally not changed in the field.

The amount of output shaft travel is determined by the setting of the Calibar. Moving the Calibar block away from the output shaft increases the radius where the ball bearing contacts the sector gear lever. The longer the radius the longer the vertical stroke of the output shaft for the same amount of rotation of the control end shaft. Therefore, the Calibar changes the output shaft travel but makes it unnecessary to change the switch cams or CPS-2. Field Calibar adjustment is generally used to shorten the travel. Consult the factory if a longer stroke is required.

SELF-LOCKING MECHANISM (SLM)

An integral part of every Group 14 control motor is the self-locking mechanism. This mechanical device couples the motor to the gear train and transmits full motor torque when rotated in either direction. When the motor is de-energized, it instantaneously locks and holds the output shaft in position.

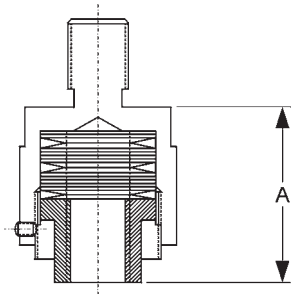
TIGHT-SEATER™

The Beck Tight-Seater™ assembly is a pre-loaded coupling that is installed between the drive output shaft and the valve stem. It produces a controlled positive pressure against the valve seat, independent of drive thrust.

The Tight-Seater™ consists of four parts: A housing attached to the output shaft, linear thrust discs contained in the housing, a flanged coupling attached to the valve stem, and a threaded ring to contain the flanged coupling in the housing and to allow adjustment of the pre-load on linear thrust discs.

The factory pre-load, by a threaded ring, ensures that no relative motion occurs between the flanged coupling and housing during normal valve operation until the pre-load thrust is exceeded in the seated plug position of the valve.

When the seated plug position of the valve is reached, the flanged coupling on the valve stem is stationary, and the output shaft exceeds the pre-load pressure of the Tight-Seater™. When the pre-loaded pressure is exceeded, the housing will compress the linear thrust discs, maintaining a controlled pressure on the valve seat, with the shaft stationary.



Tight-Seater™ Cross-Section

Tight-Seater™

HANDWHEEL

Every Beck Group 14 linear drive is furnished with a Handwheel for operation of the valve without electrical power. Its solid construction design includes no spokes or projections, and turns at a safe, slow speed. The Handwheel is located at the bottom of the control motor housing. The Handwheel is coupled directly to the motor shaft and rotates when the motor runs. Manual operation of the Handwheel (with electric Handswitch in STOP position) turns the motor and the rest of the drive train without incorporating a clutch.

HANDSWITCH

A local electric Handswitch is provided on Beck drives to permit operation at the valve, independent of the controller. As a safety feature, the Handswitch is designed so that the controller can operate the drive only when it is in the AUTO position. The sequence of the Handswitch is: AUTO, STOP, RETRACT, STOP, EXTEND.

In the AUTO position, two contacts are closed and the DCM contact completes the control circuit.

In the RETRACT or EXTEND positions, contacts are closed to operate the drive independently of the controller.

In the STOP position, all contacts remain open.

SWITCHES

Two over-travel limit switches and up to four optional auxiliary switches are provided on Group 14 drives. Switch cams are clamped onto the control shaft, which rotates in relation to the output shaft. Cam position is field-adjustable. Switches are enclosed in high-impact thermoplastic. Switches are rated 6 A, 120 V ac (0.5 A, 125 V dc). All auxiliary switch connections are made on the terminal board.

INPUT: DIGITAL CONTROL MODULE (DCM-H)

Beck modulating drives are equipped with precision digital control modules (DCM-H) to receive conventional 4–20 mA or 1–5 V dc control signals directly, eliminating the need for contact protection devices, relays, switches, and reversing starters.

The DCM-H modulates the drive output shaft in response to an analog demand input signal, and is designed to operate continuously in temperatures up to 185°F.

The DCM-H permits two or more Beck drives to be operated by a single signal source for series, parallel, or split range operation. See page 43 for details.

A square characterizer can be configured to position the drive's output shaft proportionally to the square of the input signal. See page 32 for details.

CONTACTLESS POSITION SENSOR (CPS-2)

The CPS provides the DCM with a continuous feedback signal proportional to the position of the drive's output shaft.

The position sensing function of the CPS is provided by a ferrite magnetic sensing element. An electronic circuit translates the signal from the ferrite magnetic sensor into a position signal used by the DCM to control the drive. The typical output voltage of the CPS ranges from 1.0 V at the EXTEND end of travel, to 5.0 V at the RETRACT end of travel. This specific signal is not available for external connections.

More details on setup and calibration are found in the "Configuration & Setup" and "Calibration" sections of this manual.

STALL PROTECTION

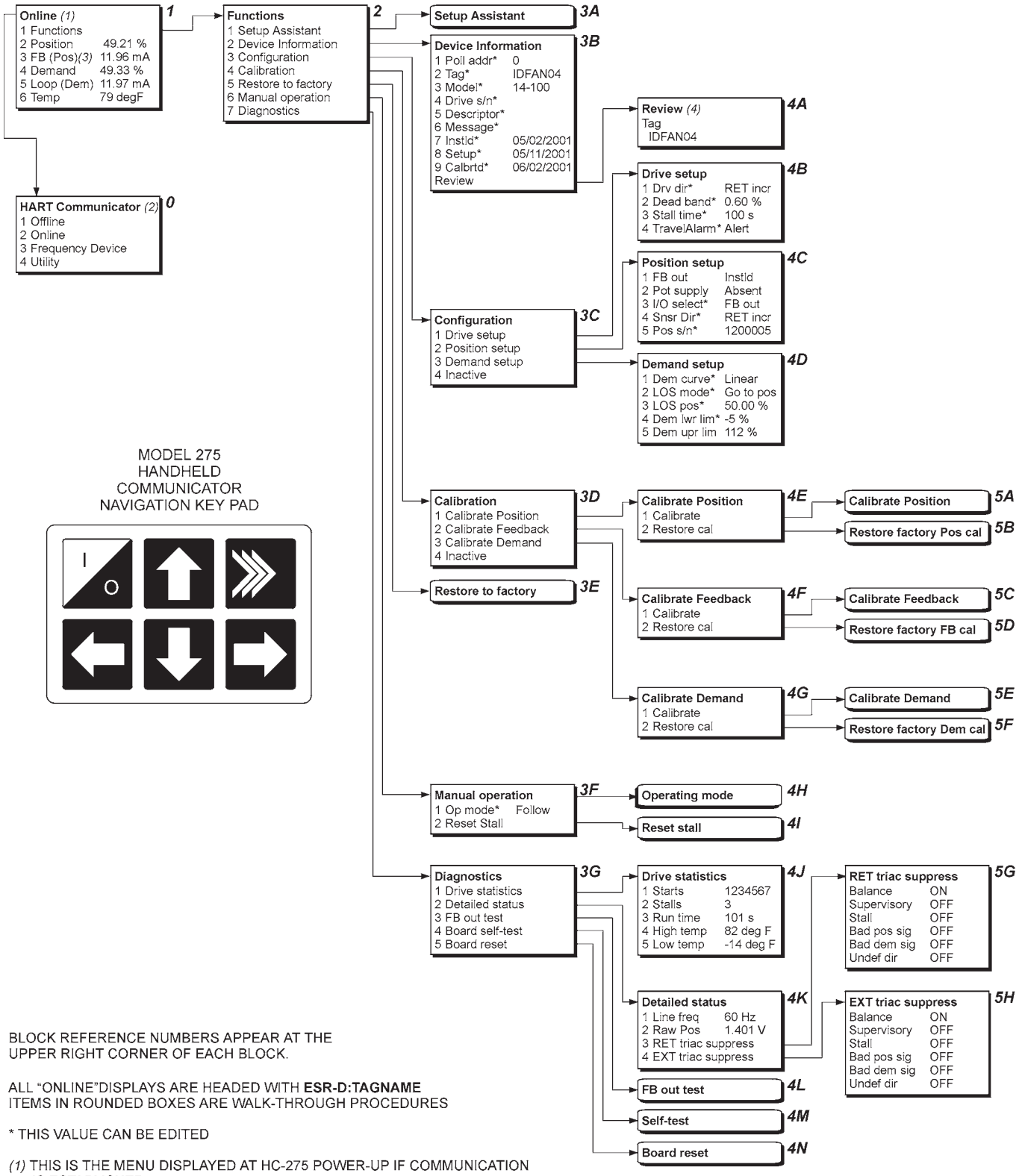
The DCM-H monitors the motor current to sense a stall condition. If during AUTO operation the drive output shaft cannot reach a desired position within approximately 300 (configurable from 30 to 300) seconds, the DCM-H shuts off power to the motor and the DCM-H's red "ERR" error light is lit. A sensed stall condition is cleared by either reversing the demand input signal from the controller (such that the drive direction of rotation is reversed), performing a DCM-H "Reset Stall" or "Board Reset" with the 275 handheld communicator, or turning the drive power off and on. For complete details, see page 31.

LOSS OF CONTROL SIGNAL (LOS)

The DCM-H provides the ability to move to a predetermined position upon loss of the demand input signal. When the input signal drops to –5% (configurable—see "Dem lwr lim", page 33), the DCM-H senses a signal loss and provides the configured loss of signal action.

When the input signal is lost but the power remains on, the red "ERR" LED on the DCM-H board is lit. For complete details, see page 33.

HANDHELD COMMUNICATOR MENUS FOR THE DCM-H



BLOCK REFERENCE NUMBERS APPEAR AT THE
UPPER RIGHT CORNER OF EACH BLOCK.

ALL "ONLINE"DISPLAYS ARE HEADED WITH **ESR-D:TAGNAME**
ITEMS IN ROUNDED BOXES ARE WALK-THROUGH PROCEDURES

* THIS VALUE CAN BE EDITED

(1) THIS IS THE MENU DISPLAYED AT HC-275 POWER-UP IF COMMUNICATION IS ESTABLISHED
(2) THIS AND OTHER OFFLINE MENUS ARE COMMON TO ALL HC-275 APPLICATIONS - MANY SUBMENUS EXIST
(3) THESE ITEMS MAY NOT BE SHOWN DEPENDING ON DRIVE OPTIONS & SETTINGS
(4) THIS MENU SCROLLS THROUGH ALL DCM-H SETTINGS

NOTE: A foldout copy of this figure is located at the end of the manual for easy reference. **Figure 1**

275 HANDHELD COMMUNICATOR WIRING CONNECTIONS

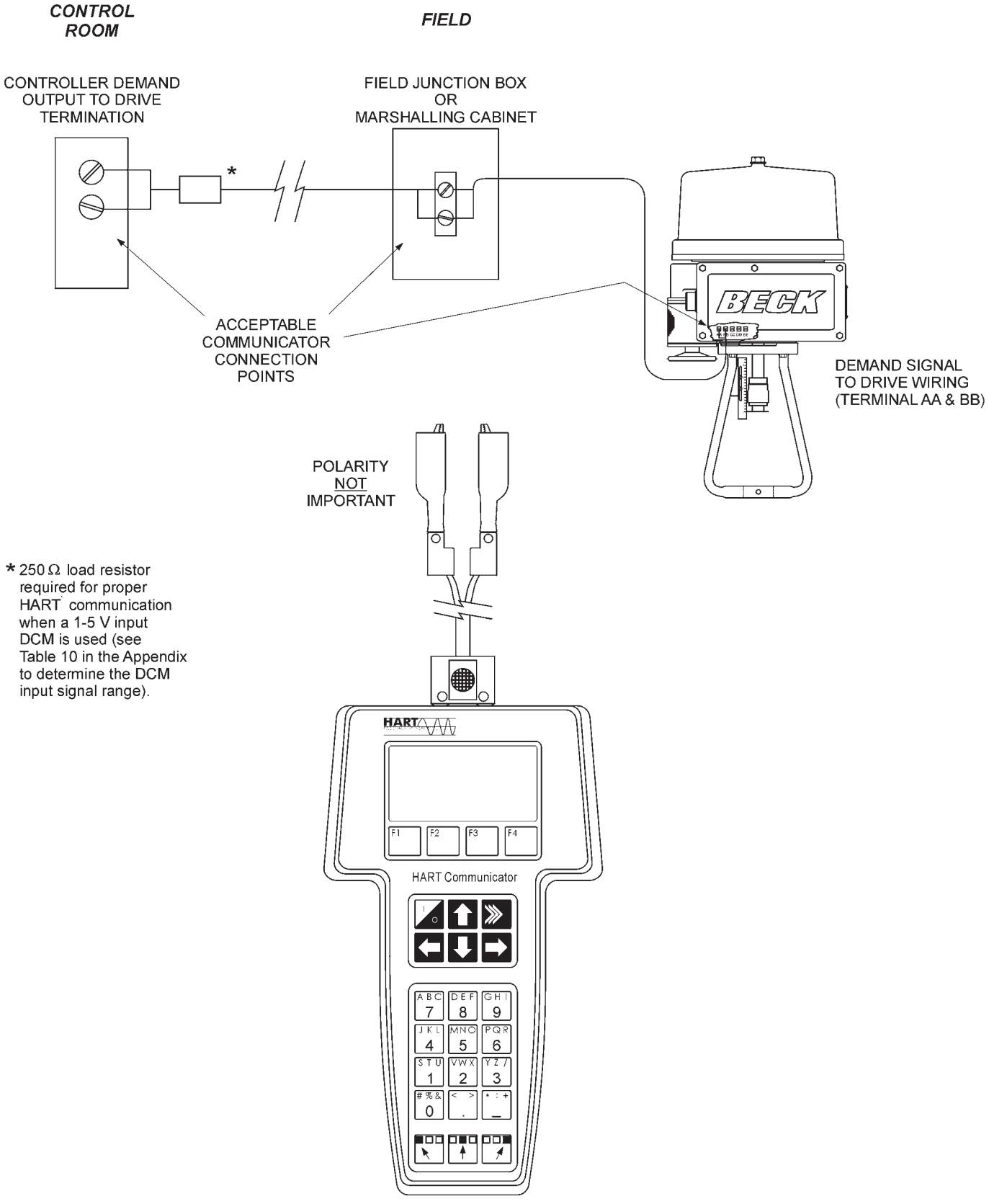


Figure 2

COMMUNICATION

The DCM is the control center of the drive. Drive configuration and calibration are accessed and set through the DCM. Interfacing to the DCM requires a HART® compatible communicator. Typically, a universal model 275 HART® communicator is used, but any device, computer or controller capable of communicating with HART® devices and supporting the Beck DCM device description can be used. **This instruction only covers the model 275 HART® Communicator.**

HART® INTERFACE

Figure 1, page 18, displays the interface menu tree for communicating with a DCM via a model 275 HART® communicator. This menu tree displays all the possible setup options, features and available information. Some of the features may not be available depending on how the DCM is ordered. If a particular feature is not available, a message to that effect will be displayed when an attempt to access or change the feature is made.

USING THE 275 COMMUNICATOR

The universal model 275 HART® Communicator leads should be connected in parallel with the analog demand signal wiring (see Figure 2, page 19). This allows the communicator to simultaneously communicate over the analog input wires. This does not disturb the analog command signal, or disrupt the DCM functions. However, any program changes to the DCM will momentarily suspend the operation of the board (maintains last state) while the change is implemented. Typically, this lasts a second or two.

With the communicator connected in parallel anywhere across the analog demand wires, it is ready to communicate. Turn on the communicator and wait for communications to be established. Once communicating, the “Online” display (Figure 1, menu block #1) will appear in the communicator window. If the drive is multidropped with other devices on a single HART® network, the first display screen will list all devices and require a selection before the “Online” display is shown. The “Online” display provides online information about the present drive operating conditions. Entering any of the menus shown in Figure 1 is accomplished by following the display and using the communicator’s arrow keys. **If the communicator is unable to communicate with the DCM, it will display the message, “No Device Found”. If this occurs, ensure the leads are securely connected to the demand wiring and retry. If communications still do not occur, the communicator polling setup may be improperly set. Check the “utility” menu and ensure communications polling is set to “always poll”.**

The communicator keypad and display is shown in Figure 2, page 19. There are four sections: 1) the liquid crystal message display, 2) four function keys beneath the LCD display, 3) six navigational keys in the center section, 4) alphanumeric entry keys at the bottom. For a complete description of the communicator , please see the HART® Communicator manual, MAN 4250, that is shipped with the communicator.

The LCD displays all the information and actions available. Without this display it would be impossible to perform any actions. In addition to the 21 character display that provides the communication between the user and the Beck drive, the bottom line of the LCD displays dynamic labels that define the purpose of the function keys directly below each label.

The function keys are used to perform certain actions like entering settings, accessing help screens, sending commands, paging up and down within methods and exiting methods. The function of each key may change depending on the menu or method selected. As functions change, so do the dynamic labels in the LCD.

The six navigational keys consist of a black and white on/off key, four blue and white arrow keys, and a single “hot key”. The hot key is not used for Beck drive applications, but can be configured by the user to select menus most often accessed. The right arrow key has two functions. It moves the cursor to the right when making or editing an entry, and it also is used to select a new menu. The left arrow key moves the cursor to the left and also backs out to a previous menu. Combined, these keys allow movement between menus as shown in Figure 1, page 18.

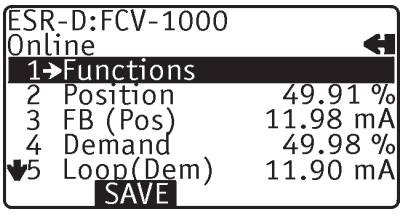
The alphanumeric keys are used to type in entries. Whenever a selected menu or method requires a value or description to be entered, this key pad is used. Since each key represents four different characters, three shift keys are provided at the bottom of the pad. A particular alphanumeric character is selected by pushing the appropriate shift key then pushing the alphanumeric key.

Before moving on, it is helpful to practice with the communicator. Connect the communicator as described, turn it on and establish communications. Then use the arrow keys to move through the various menus as shown in the menu tree (Figure 1).

MENU DESCRIPTIONS

(A foldout copy of Figure 1 (page 18) is located at the end of the manual for easy reference).

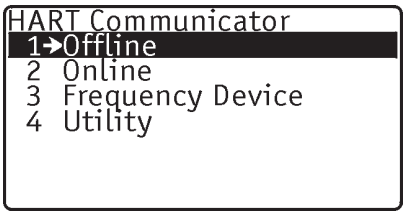
Online Menu (Figure 1, block 1)



DISPLAY ARROW INDICATES MORE INFO. AVAILABLE -- USE THE DOWN ARROW KEY ON THE HANDHELD TO ACCESS.

When communications are established with the communicator, the “Online” menu is displayed. This is the gateway to all the other menus and it also provides current information about the drive. Numbered items 2 through 6 provide live, dynamic values of the drive’s output position in percent, the external position feedback signal in milliamps (when equipped with the Feedback Sourcing module), the demand signal to the drive in percent, the demand signal in milliamps, the drive temperature, and the torque output of the drive in percent (when equipped with optional torque measurement). Select the first menu item, “Functions” (by first highlighting it and then using the right arrow key to select it), to gain access to the Functions menu. By backing out of the Online menu using the left arrow key, selection of the “Offline” menu is accomplished.

Offline Menu (Figure 1, block 0)



The Offline menu applies only to the 275 HART® Communicator setup and configuration. This, and the many submenus that exist, are typical to all model 275 HART® Communicator applications. **It is unlikely that this menu will need to be consulted unless it is impossible to establish communications with the drive; in which case the “Utility” menu should be selected.** Once within the “Utility” menu, use the right arrow key to select “Configure Communication”, then “Polling”, and finally “Always Poll”. Use the ENTER function key to select to implement the Always Poll change. Back out to the main “Offline” menu using the left arrow key. Once at the main menu, select “Online” and use the right arrow key to return to the Online menu.

Functions Menu (Figure 1, block 2)

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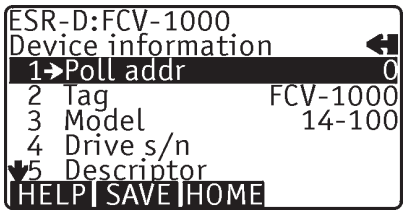
From the Functions menu, any of the DCM functional menus can be selected and accessed. Essentially, there are seven functional areas which include: Setup Assistant, Device Information, Configuration, Calibration, Restore to Factory, Manual Operation, Diagnostics.

The “**Setup Assistant**” (Figure 1, block 3A) is actually a procedure that allows the user to setup all the details necessary to get the drive up and running as desired. It sequentially walks the user through a series of questions and entries that enable the drive to be rapidly and completely setup. This method is entirely self-driven, and the user need only follow the questions and prompts to successfully complete the setup. The primary purpose of the Setup Assistant is to aid in the retrofit installation of a DCM into an existing drive. It is normally not necessary to go through the Setup Assistant if a drive was originally built with a DCM installed.

“**Restore to factory**” is also a procedure, which is used to set the DCM back to its original (as shipped from the factory) setup and calibration. By selecting the restore to factory procedure, every drive operating parameter that may be edited, and all calibrations, are returned to their factory settings.

The other five functional areas and menus are described in more detail as follows.

Device Information Menu (Figure 1, block 3B)



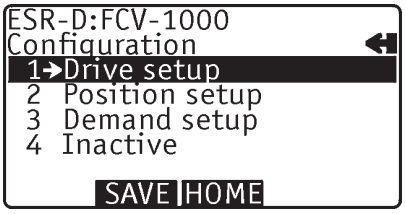
DISPLAY ARROW INDICATES MORE INFO. AVAILABLE -- USE THE DOWN ARROW KEY ON THE HANDHELD TO ACCESS.

The Device Information menu is strictly an informational page. By entering this menu, a selection of useful information can be viewed and/or edited. There are a total of nine information entries:

1. **Poll Address** - This entry can be edited; however, it is normally set to 0. A polling address from 1 to 15 can be entered if the drive resides on a common HART® network with other HART® devices.
2. **Tag** - This 8 character entry can be edited to reflect the loop tag number/name.
3. **Model** - This entry displays the model number of the drive in which the DCM board is installed. It normally is set at the factory if the board is installed in a drive. If the DCM is shipped as a spare or replacement, the model field will be blank. The user can edit the field if desired.
4. **Drive S/N** - This entry displays the serial number of the drive in which the DCM board is installed. It normally is set at the factory if the board is shipped in a drive. If the DCM is shipped as a spare or replacement part, the "Drive s/n" field will be blank. The user can edit the field if desired.
5. **Descriptor** - This entry is a 16 digit field that can be used to provide any description the user desires. This entry is normally blank when shipped from the factory unless the user specifies a description prior to shipment. The user can edit the field if desired.
6. **Message** - This entry is a 32 digit field that can be used to provide any message the user desires. This entry is normally blank when shipped from the factory unless the user specifies a message prior to shipment. The user can edit the field if desired.
7. **Installed** - This is a date entry that is normally used to indicate the date that the drive or DCM board was installed. The date format is month/day/year and it can be fully edited.
8. **Setup** - This is a date entry that is normally used to indicate the date that the DCM/drive setup was performed. Although this entry is viewed and can be edited in the "Device Information" menu, the user is prompted at the end of performing a "setup" to enter a date. Entering the date at the prompt automatically updates the date displayed. The date format is month/day/year, and it can be fully edited.
9. **Calibrated** - This is a date entry that is normally used to indicate the date that the DCM/drive was last calibrated. Although this entry is viewed and can be edited in the "Device Information" menu, the user is prompted at the end of performing any "calibration" method to enter a date. Entering the date at the prompt, automatically updates the date displayed here. The date format is month/day/year, and it can be fully edited.

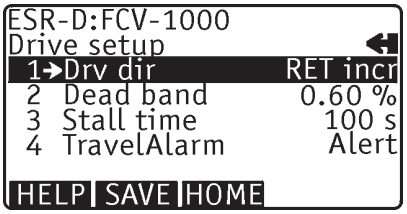
A final available selection is "**Review**" (Figure 1, block 4A). Selecting this item using the right arrow key allows for a quick scroll through all nine device information items, as well as all the other DCM settings, without accessing each item individually. This is an excellent tool for quickly determining how a particular drive is setup. To edit individual entries, the user must exit review and go to the appropriate menu and item.

Configuration Menu (Figure 1, block 3C)



The configuration menu serves as the gateway to all of the drive operating setup parameters. The user can select any of three different setup submenus that can be used to configure the drive based on the physical layout and the desired operation. The three area submenus are as follows:

Drive Setup Submenu (Figure 1, block 4B)

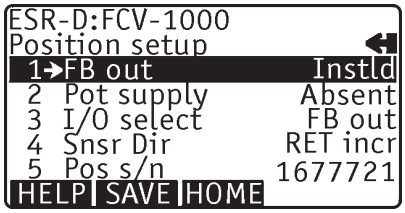


This menu is where drive operating parameters are set. The four parameter entries are as follows:

1. **Drive dir** - This parameter is where the direction of the drive is selected. The options available are retract (RET), or extend (EXT). Direction of travel always refers to the motion of the drive output shaft, given an increasing demand signal, looking at the output shaft.

   When the direction of travel parameter is changed, the DCM automatically reverses the analog position feedback signal such that it is 4 mA at the 0% input signal position and 20 mA at the 100% position. No recalibration of the CPS is required. This parameter is normally set to RET unless the user specified EXT prior to shipment of the drive. For editing procedure, see page 30.
2. **Dead band** - The drive dead band can be changed by selecting this entry. All drives and boards are shipped with a 0.6% dead band setting. This is typically the best setting to provide good control and stability. The dead band can be reduced to a 0.25% minimum value or increased. Caution should be used when changing the dead band. Reducing the dead band can cause instability under certain conditions and may subject the drive to an increase in the number of starts and stops without improving control. Conversely, increasing the dead band can reduce the control performance of the drive (see "Dead band", page 30 for more information). For editing procedure, see page 30.
3. **Stall time** - The DCM provides stall protection to the entire drive by shutting off power to the motor and providing a HART® alarm. This entry allows the stall time required to trigger the stall protection to be configured. At the factory it is normally set to 300 seconds, but can be edited and set for any value between 30 and 300 seconds. For editing procedure, see page 31.
4. **Travel Alarm** - This entry is set as either "Alert" or "Ignore". It is used to determine if an overtravel condition (i.e., hitting either over-travel limit switch) should produce a HART® alarm. It is normally set to "Alert", but the user can select either status. For editing procedure, see page 31.

Position Setup Submenu (Figure 1, block 4C)



This menu is where all position sensor and external position feedback signal setup is performed. The five parameter entries are as follows:

1. **FB out** - This parameter is used to indicate if an analog 4-20 mA position feedback signal is available from the drive. This parameter is informational only and cannot be edited. If the Feedback Sourcing module (P/N 22-4008-04) is installed on the DCM board, "FB out" will show an "instld" message in the display. If this module is not present, the message will display "absent". New drives equipped with a DCM from the factory would normally have the 22-4008-04 Feedback Sourcing module installed. For editing procedure, see page 32.
2. **Pot supply** - This parameter is used to indicate if power for a film potentiometer feedback device is present. This parameter is informational only and cannot be edited. If power is present, "Pot supply" will display "instld". If the power is not available, the message will read "absent". Depending on the combination of modules used on a particular DCM, power may be available, even if it isn't used. Potentiometer power is only required for control option 7 drives that utilize a film potentiometer. This would most typically be a DCM retrofit application.
3. **I/O select** - This parameter is used to select whether or not the position feedback signal is turned on. For example, if the position sourcing board is present (see "FB out" above), and an analog position feedback signal is available, this parameter is used to enable and disable the signal. Normally, it would

Continued

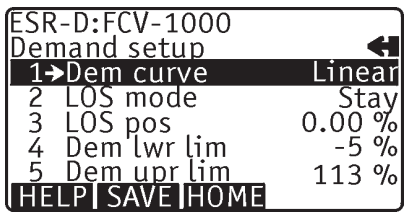
Position Setup Submenu, cont'd.

be enabled and the display message would read "FB out". When the signal is enabled, a HART® communicated error will be present if the signal is not wired to an external load. The error message is displayed when communicating with the drive via HART®. To eliminate this error, the feedback signal must be connected to a load, or disabled by using the right arrow key to select "I/O select" and entering the "none" selection. For editing procedure, see page 32.

Note that when installing a DCM into a drive using a film potentiometer (see "Pot power" on the previous page), the I/O select parameter will display a "Pot power" selection. This must be selected for these applications.

4. **Snsr Dir** - This parameter is used to select the appropriate position sensor (CPS or film pot) direction (i.e., the direction in which the drive output shaft moves to increase the position sensor output signal). It should only need to be accessed in the case of a DCM retrofit into an existing drive because all new drives built with a DCM board use RET direction for an increasing position signal. If this parameter is changed for any reason, an incorrect entry is automatically detected by the DCM and corrected.
5. **Pos s/n** - This parameter displays the serial number of the position sensor (CPS or film potentiometer) installed in the drive. New drives with DCM boards installed at the factory will have this information pre-entered. DCM boards shipped as spare parts or for retrofits will have this entry left blank. The user can enter the appropriate information if desired, but it is not required.

Demand Setup Submenu (Figure 1, block 4D)



This menu is where all the demand input signal related drive parameters are set. The five parameter entries are as follows:

1. **Dem curve** - This is a dual choice entry that is used to set the demand input characterization. The two characterization choices are "Linear" and "Square". Linear means that the demand signal is interpreted linearly and the drive responds to the demand with a linear relationship. The square setting means that the demand signal is interpreted with a square function and the drive output positions in a square relationship with respect to demand. For example, at 25% demand the drive position equals 0.25^2 or 0.0625 (6.25%). At demands of 50%, 75% and 100% the position would be 25%, 56.25%, and 100% respectively. This nonlinear curve can be used to compensate for valves with quick opening characteristics. This entry will always be set to linear by the factory unless otherwise specified by the user. For editing procedure, see page 32.
2. **LOS mode** - This parameter is used to set the drive action upon loss of the demand input signal. Two options are available: "stay" or "go to pos". Selecting the "stay" option configures the drive such that the output shaft will stay in its last position if the demand signal is lost for any reason. Selecting the "go to pos" option configures the drive to move to a predetermined position (see **LOS pos** below) upon loss of the demand signal. This parameter is set to "stay" by the factory, unless otherwise specified by the user. For editing procedure, see page 33.
3. **LOS pos** - This parameter is used to set the predetermined position when the LOS mode described above is set to "go to pos". This parameter is normally shipped from the factory set at 50%, but it has no effect on loss-of-signal action unless the "go to pos" option is selected. The value can be edited and set anywhere between -5% and 105%. For editing procedure, see page 33.
4. **Dem lwr lim** - This parameter is used to set what the DCM interprets as the lower limit of the demand input signal range. Input signals below this setting are interpreted by the DCM as a lost signal, and the LOS mode function takes over drive operation. This value is set to -5% at the factory. It can be edited and set anywhere from 0% to -320%. The -320% allows split ranging up to four drives while maintaining the demand loss function. For editing procedure, see page 33.

5. **Dem upr lim** - This parameter determines what the DCM interprets as the upper limit of the demand input signal range. Demand signals above this value are ignored by the DCM. This is an informational only parameter and cannot be edited. For normal demand setup where 4–20 mA or 1–5 V dc demand signals represent 0–100% demand input, this parameter displays approximately 113%. For split range operation, the value increases proportionally.

Calibration Menu (Figure 1, block 3D)

The calibration menu serves as the gateway to all the various routines necessary to completely calibrate the drive. The user can select any of three different calibration submenus. Each submenu provides a method that, when followed, calibrates a particular drive area in a quick and easy fashion. These methods replace the need to make physical adjustments to the drive. Each submenu is described as follows:

Calibrate Position Submenu (Figure 1, block 4E)

This menu is used to calibrate the position end points of the drive such that the DCM board can determine the drive output shaft's full direction and position. Two procedures are available within this menu. They are as follows:

1. **Calibrate** - This procedure is used to calibrate or set the actual output shaft full travel limits (i.e., allow the DCM to determine the 0% and 100% travel points). Two methods are available: Full automatic calibration of both (0% and 100% travel) position travel limits; or a manual method which allows setting one limit at a time. Normally, the automatic method is the easiest calibration procedure. This method automatically strokes the drive and sets the end-of-travel limits based on the position of the mechanical over-travel limit switches. The manual method allows the user to set the 0% and 100% limits independently and provides the means to "short-stroke" the drive. See page 41 for more information on short-stroking.
2. **Restore cal** - This procedure allows the user to return the position calibration to the original factory calibration, regardless of any calibration changes made.

Calibrate Feedback Submenu (Figure 1, block 4F)

This menu is used to access the procedures for calibration of the 4–20 mA external position feedback signal. DCM boards which have the Feedback Sourcing module (P/N 22-4008-04) installed are calibrated at the factory to provide a 4–20 mA position feedback signal that can be monitored by a controller, indicator or some other device external to the drive. The 4–20 mA signal corresponds to 0–100% output shaft rotation. Two procedures are available within this menu. They are as follows:

1. **Calibrate** - This procedure is used to calibrate the 4–20 mA position feedback signal. The signal is only intended to support a 4–20 mA range, and is calibrated at the factory. Therefore, recalibration is normally not required, but can be performed to compensate for slight calibration differences between the signal calibration and the receiving device calibration.
2. **Restore cal** - This procedure allows the user to return the feedback calibration to the original factory calibration, regardless of any calibration changes made.

Calibrate Demand Submenu (Figure 1, block 4G)

This menu is used to access the procedures for the demand input signal calibration. The DCM is designed to operate with analog signal ranges up to 4–20 mA or 1–5 V dc. Two procedures are available within this menu. They are as follows:

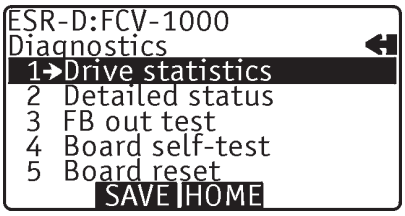
1. **Calibrate** - This procedure is used to calibrate the 4–20 mA position demand input signal. The DCM is intended to support a 4–20 mA (1–5 V dc) signal range or narrower. A narrower range is used when split range operation with multiple drives is desired. The standard factory calibration is 4–20 mA to represent 0–100% demand, unless otherwise specified by the user. Two methods are available: Calibration of the 0% and 100% points combined, or calibration of either the 0% or 100% point alone. The latter method is useful when split-ranging is desired.
2. **Restore cal** - This procedure allows the user to return the demand calibration to the original factory calibration, regardless of any calibration changes made.

Manual Operation Menu (Figure 1, block 3F)

This menu is used to allow manual drive operation with the HART® communicator. There are two manual operation procedures available. They are as follows:

1. **Op mode** - This procedure allows the user to select the operating mode of the DCM. There are four possible choices: "Follow", "Hold", "RunRET", "RunEXT". The "Follow" mode is the normal state of operation and allows the DCM to control the drive operation by responding to the analog input demand signal when the drive Handswitch is in the automatic position. The "Hold" mode forces the DCM to maintain the drive output shaft position regardless of the input demand signal. The user can select to hold the position just where it is, or alternately provide the drive a position to run to and hold. The "RunRET" and "RunEXT" modes of operation simply cause the drive to run to its RET and EXT extremes respectively, and hold.
2. **Reset stall** - This procedure resets normal drive operation after a stall condition has caused the drive to shut down. Selecting this option and following the prompts will restore operation. Note that stall conditions can also be reset by simply reversing the input demand signal or cycling the drive ac power.

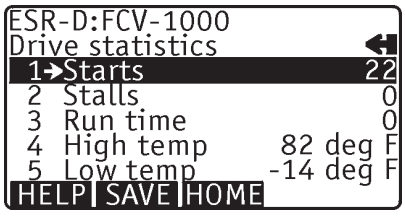
Diagnostics Menu (Figure 1, block 3G)



This menu provides access to all the DCM stored online diagnostic information about drive operation. The menu provides two submenus (**Drive statistics** & **Detailed status**) that provide stored drive statistics and online drive status. It also provides three procedures that allow the user to test and reset the DCM board. They are as follows:

1. **FB out test** (Figure 1, block 4L) - This procedure allows the user to test the 4–20 mA position feedback output signal on DCM boards equipped with the Feedback Sourcing module (P/N 22-4008-04). Following the prompts through this procedure allows the user to physically verify the output signal value at 4 mA, 20 mA, and anywhere in between.
2. **Board self-test** (Figure 1, block 4M) - This procedure runs an automatic board test that verifies the health of the DCM control board. It runs a checksum memory test and checks for the proper installation of the position sensor (CPS rotor). Running the test causes the drive to reposition temporarily, so it should only be run offline. The CPS test runs automatically as part of some calibration and setup procedures. Unless a DCM problem is suspect, there are few reasons to implement this test.
3. **Board reset** (Figure 1, block 4N) - This procedure resets the board without powering down the drive. There are many communicator procedures that implement the reset procedure automatically to ensure the proper initialization of the DCM board; however, few reasons to manually implement the reset procedure should arise.

Drive Statistics Submenu (Figure 1, block 4J)



This menu is where all the drive's stored operating statistics are available. There is a total of five different statistics available with DCM boards. The five possible statistics are as follows:

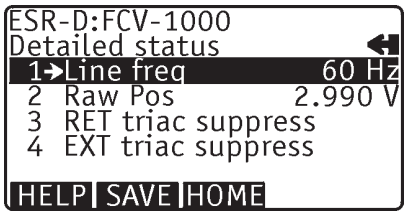
1. **Starts** - This statistic logs and displays the total number of starts the drive motor has made.
2. **Stalls** - This statistic logs and displays the total number of stalled conditions the drive has experienced. For the drive to register a stall, the DCM board must be unable to balance the drive position against the demand input signal for a period exceeding the **Stall time** set in the Drive setup menu.

Continued

Drive Statistics Submenu, cont'd.

3. **Run time** - This statistic logs and displays the total run time of the drive motor in seconds.
4. **High temp** - This statistic logs and displays the highest temperature in degrees Fahrenheit measured by a temperature sensor resident on the DCM board.
5. **Low temp** - This statistic logs and displays the lowest temperature in degrees Fahrenheit measured by a temperature sensor resident on the DCM board.

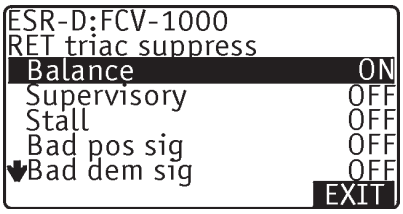
Detailed Status Submenu (Figure 1, block 4K)



This menu provides detailed information about the status of the drive power, raw position signal and motor control. The information displayed can be useful in troubleshooting operating problems. This submenu displays two values directly:

1. **Line freq** - This display value is the drive power line frequency in hertz (50 or 60 Hz). Line frequency is used within the DCM program to synchronize the data converter and reject AC line noise pickup, and also to determine the motor run time. These reasons, among others, make the line frequency important to drive operation.
2. **Raw pos** - This value is the true position signal from the position sensor to the DCM board. In new drives equipped with a DCM from the factory, the raw signal is normally 1–5 V dc for 0–100% of drive rotation. In older drives where DCM boards have been retrofitted, the range is approximately 0.5–2.6 V dc for either 0–100% or 100–0% depending on the drives original configuration. In all cases, drives that are short-stroked will have a proportionately smaller raw position signal range. This raw signal is what the Feedback Sourcing module uses to calculate the 4–20 mA position feedback output signal that can be monitored external to the drive. This value can be used to verify the health of the position sensor (CPS).

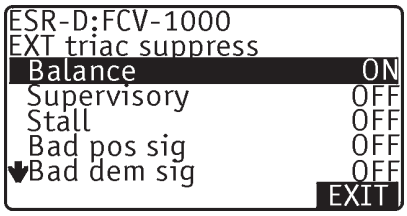
RET Triac Suppress Submenu (Figure 1, block 5G)



DISPLAY ARROW INDICATES MORE INFO. AVAILABLE -- USE THE DOWN ARROW KEY ON THE HANDHELD TO ACCESS.

This menu is a submenu of the Drive status submenu. It provides information about the retract (RET) motor control triac status. The RET triac controls the RET motor winding by conducting 120 V ac power in order to move the drive output shaft in the RET direction. Therefore, any number of conditions can occur to suppress the triac and prevent the output shaft from driving in the RET direction. These conditions include: The drive is at balance, a supervisory condition, a stall protection condition, a failed position signal, a failed demand signal, a program error has caused an undefined direction condition to exist. This submenu displays all these possible suppressing conditions that prevent the drive shaft from driving in the RET direction. Each of the conditions will display either an "OFF" or "ON" status. One or more conditions displaying the "ON" status means that those conditions are currently preventing the drive from driving its output shaft in the RET direction.

EXT Triac Suppress Submenu (Figure 1, block 5H)



DISPLAY ARROW INDICATES MORE INFO. AVAILABLE -- USE THE DOWN ARROW KEY ON THE HANDHELD TO ACCESS.

This menu is a submenu of the Drive status submenu. It provides information about the extend (EXT) motor control triac status. The EXT triac controls the EXT motor winding by conducting 120 V ac power in order to drive the output shaft in the EXT direction. Therefore, any number of conditions can occur to suppress the triac and prevent the output shaft from driving in the EXT direction. These conditions include: The drive is at balance, a supervisory condition, a stall protection condition, a failed position signal, a failed demand signal, a program error has caused an undefined direction condition to exist. This submenu displays all these possible suppressing conditions that prevent the drive shaft from driving in the EXT direction. Each of the conditions will display either an “OFF” or “ON” status. One or more conditions displaying the “ON” status means that those conditions are currently preventing the drive from driving its output shaft in the EXT direction.

CONFIGURATION & SETUP

All drives are shipped completely configured to the customer's specifications and are ready to be installed. If the need arises to change the configuration of the drive (i.e., change one or more of the setup parameters that define how the drive operates), this is done solely through the HART® interface and a communications tool (model 275 HART® Communicator) as described in the Communications section of this manual. This section of the manual covers how the drive is configured and gives instructions for changing each particular setup parameter available. It is intended to build upon the Communications Section, which provides a detailed description of the HART® Menu Tree and defines all the parameters and commands. **If unfamiliar with the HART® communicator and Beck drives, please review the Communications section before proceeding.**

There are a number of configuration setup parameters that can be changed to custom tailor the drive's operation to the application needs. The remainder of this section provides instructions for changing each of these parameters. The instructions below assume that the user has a model 275 HART® Communicator attached to the demand wiring (at drive terminals AA and BB or anywhere across the wires all the way back to the source of the demand signal), has established communications with a particular drive, and has a copy of the HART® Menu Tree (Figure 1, page 18) available.

DRIVE SHAFT DIRECTION

Drive shaft direction refers to the direction the output shaft of the drive moves in response to an increasing demand input signal. The direction is either retract (RET) or extend (EXT). The control loop operation and physical design of the final control element determine the drive direction suitable for an application. If the drive direction needs to be changed, this is easily accomplished by changing the DCM configuration.

Changing Drive Shaft Direction

STEP 1 - From the HART® communicator "Online" menu, move to the "Drive setup" menu and select the "Drv dir" parameter. This is accomplished by using the up and down arrow keys to select the appropriate item in each menu and then moving forward by pressing the right arrow key. Follow the Menu Tree (Figure 1, page 18) to navigate.

STEP 2 - With the "Drv dir" parameter selected, press the right arrow key to display the two entry choices: "RET incr" and "EXT incr". Use the up and down arrow keys to select the desired parameter.

STEP 3 - With desired parameter selected, push the F4 function key, which is defined as the **ENTER** key at the bottom of the display. Pushing this key enters the value and reverts the display back to the "Drive setup" main menu.

STEP 4 - At the bottom of the "Drive setup" menu, the F2 function key should now be defined as the **SEND** key. Push this key to execute the change.

WARNING

Carefully follow the on-screen warnings and messages when proceeding, because changing this parameter will cause the drive to reposition. This can adversely affect the process and cause potentially dangerous conditions.

DEAD BAND

The width of the dead band, or the ability of the drive to respond to small signal changes, can be adjusted through the DCM configuration. The standard dead band setting is 0.6%, which produces a good balance between control sensitivity and rejection of erroneous signal changes. Reducing the dead band causes the drive to respond to smaller changes, while increasing the dead band has the opposite effect. The dead band can be adjusted from 0.25% up to 5%. Neither extreme is typically warranted, and caution should be exercised when the dead band is changed. Under certain conditions, reducing the dead band too much can cause self-induced drive instability.

Changing the Dead Band

STEP 1 - From the HART® communicator "Online" menu, move to the "Drive setup" menu and select the "Dead band" parameter. This is accomplished by using the up and down arrow keys to select the appropriate item in each menu and then moving forward by pressing the right arrow key. Follow the Menu Tree (Figure 1, page 18) to navigate.

STEP 2 - With the "Dead band" parameter selected, again press the right arrow key to display the modifiable entry box, and using the alphanumeric keypad, type in the desired dead band value. Values between 0.25% and 5% are valid.

STEP 3 - With the desired value correctly typed into the entry box, push the F4 function key which is defined as the **ENTER** key at the bottom of the display. Pushing this key enters the value and reverts the display back to the "Drive setup" main menu.

STEP 4 - At the bottom of the "Drive setup" menu, the F2 function key should now be defined as the **SEND** key. Push this key to execute the change.

WARNING

Carefully follow the on-screen warnings and messages when proceeding, because changing drive setup parameters can cause the drive to reposition. This can adversely affect the process and cause potentially dangerous conditions.

STALL PROTECTION

The DCM board provides protection of the drive motor and gearing in the event of a stalled condition. The board accomplishes this by sensing that the drive is unable to balance for a set period of time known as the "stall time". If the DCM is unable to balance the drive for a period greater than the stall time, it shuts off power to the motor and prevents the drive from continuing to operate against the stall. Resetting the drive and restoring normal operation is achieved in several ways: Reversing the demand signal to the drive, performing a stall reset procedure (see Manual Operation Menu, Figure 1, page 18), performing a board reset procedure (see Diagnostics Menu, Figure 1, page 18), or cycling the drive ac power.

Changing Stall Time

STEP 1 - From the HART® communicator "Online" menu, move to the "Drive setup" menu and select the "Stall time" parameter. This is accomplished by using the up and down arrow keys to select the appropriate item in each menu and then moving forward by pressing the right arrow key. Follow the Menu Tree (Figure 1, page 18) to navigate.

STEP 2 - With the "Stall time" parameter selected, again press the right arrow key to display the modifiable entry box, and using the alphanumeric keypad, type in the desired stall trigger time value. It is normally set to a maximum of 300 seconds, but can be changed to a minimum of 30 seconds.

WARNING

It is possible that the stall time can be set to a value less than the full stroking time of some drives. This could lead to false stall conditions when making very large changes. Typically, this would only occur during start-up, shut down or some other condition that might require a large change in demand from the controller.

STEP 3 - With the desired value correctly typed into the entry box, push the F4 function key which is defined as the **ENTER** key at the bottom of the display. Pushing this key enters the value and reverts the display back to the "Drive setup" main menu.

STEP 4 - At the bottom of the "Drive setup" menu, the F2 function key should now be defined as the **SEND** key. Push this key to execute the change.

WARNING

Carefully follow the on-screen warnings and messages when proceeding, because changing drive setup parameters can cause the drive to reposition. This can adversely affect the process and cause potentially dangerous conditions.

TRAVEL ALARM

When communicating with the DCM via the 275 HART® Communicator, a number of different informational messages may be displayed for certain conditions that may exist. One such message is "H/S in STOP or drive at limit sw". This is displayed anytime the DCM is attempting to reposition the output shaft, but is unable to due to a break in the electrical power to the motor. This can happen if the Handswitch is put in STOP or if an over-travel limit switch is open. Normally, this is a useful message that should be displayed; however, in certain situations like split range operation (see split ranging, page 44), it can become a nuisance. For example, in a split range operation one or more of the drives will be interpreting the demand input signal as out of range (i.e., either above 100% demand or below 0% demand) and will be against an over-travel limit switch at any given time. Since this is normal for split range operation, the message will be a nuisance rather than informational.

Setting the "TravelAlarm" feature to "Ignore" will eliminate the message, but only when the demand signal is above 100% or below 0% and an

Continued

OVERTRAVEL ANNUNCIATION, CONT'D.

over-travel limit switch is open. This eliminates the nuisance message, but does not eliminate the message for other scenarios like the Hand-switch being in the STOP position.

POSITION FEEDBACK SIGNAL

DCM boards that are equipped with a Feedback Sourcing module (P/N 22-4008-04, see Figure 3, page 35, for location of module) provide a 4–20 mA analog output signal that represents the drive output shaft position in terms of 0–100% of full directional travel. This signal can be remotely monitored or used by a controller or indicator. For boards so equipped, the user has the option of enabling or disabling the signal. Normally, the signal should be enabled , but in a situation where the feedback is present, but unused (i.e., not wired to a load) a HART® alarm message will be present while communicating using the 275 Communicator. This message is helpful in alerting the user to open feedback wiring, but it is a nuisance when the feedback is purposely disconnected or unused. Disabling the feedback signal turns off the output and eliminates the message.

Enabling / Disabling Position Feedback Signal

STEP 1 - From the HART® communicator "Online" menu, move to the "Position setup" menu and select the "I/O select" parameter. This is accomplished by using the up and down arrow keys to select the appropriate item in each menu and then moving forward by pressing the right arrow key. Follow the Menu Tree (Figure 1, page 18) to navigate.

STEP 2 - With the "I/O select" parameter is selected, press the right arrow key to display the two entry choices: "FB out" or "None". (A third choice, "Pot power", is also available when pot power is installed). Use the up and down arrow keys to select the desired parameter. "FB out" enables the output signal, while "None" disables the output.

STEP 3 - With the desired choice selected, push the F4 function key which is defined as the **ENTER** key at the bottom of the display. Pushing this key enters the selected parameter and reverts the display back to the "Position Setup" main menu.

STEP 4 - At the bottom of the "Position setup" menu, the F2 function key should now be defined as the **SEND** key. Push this key to execute the change. This change should not effect drive positioning but, as with all configuration changes, **carefully follow the on-screen warnings and messages when proceeding.**

DEMAND SIGNAL CHARACTERIZATION

The Beck DCM is designed to receive a 4–20 mA (1–5 V dc) input demand signal and respond by repositioning the drive output shaft in proportion to the signal. There are two ways in which the DCM can interpret the demand signal: Linearly, or in a non-linear square relationship. The linear interpretation, which is most commonly employed, simply causes the drive to position the output shaft in a one-to-one relationship with the demand. For example, a 1% change in demand always causes a 1% position response. The square relationship produces a non-linear drive response proportional to the square of the demand signal. For example, a 25% input demand is interpreted as 0.25^2 or 0.0625 (6.25%). The square relationship helps to linearize flow response of final control elements that have quick opening characteristics.

Changing Characterization

STEP 1 - From the HART® communicator "Online" menu, move to the "Demand setup" menu and select the "Dem curve" parameter. This is accomplished by using the up and down arrow keys to select the appropriate item in each menu and then moving forward by pressing the right arrow key. Follow the Menu Tree (Figure 1, page 18) to navigate.

STEP 2 - With the "Dem curve" parameter selected, press the right arrow key to display the two entry choices: "Linear" or "Square". Use the up and down arrow keys to select the desired parameter.

STEP 3 - With desired choice selected, push the F4 function key which is defined as the **ENTER** key at the bottom of the display. Pushing this key enters the selected parameter and reverts the display back to the "Demand setup" main menu.

STEP 4 - At the bottom of the "Demand setup" menu, the F2 function key should now be defined as the **SEND** key. Push this key to execute the change.

WARNING

Carefully follow the on-screen warnings and messages when proceeding, because changing this parameter online will cause the drive to reposition. This can adversely affect the process and cause potentially dangerous conditions.

LOSS OF DEMAND INPUT SIGNAL

The DCM board has the capability of determining when the demand input signal to the drive is lost, and then responding in the method most appropriate for the application. There are three setup parameters that must be configured in order to define this capability: "LOS mode", "LOS pos", and "Dem lwr lim". The "LOS mode" parameter determines how the drive should respond to the loss of the demand input signal. It can be configured as "Stay" or "Go to pos", which means the drive holds its position when the signal is lost, or it goes to a predetermined position. If the "go to pos" option is selected, the "LOS pos" parameter is used to determine what output shaft position the drive must achieve when the input is lost. Finally, a loss of signal is sensed by the DCM when the signal drops below the value set by the "Dem lwr lim" parameter. This value is represented as a percentage of the demand input signal range. Therefore, the standard -5% value normally used for this parameter suggests that when the demand input signal drops 5% below the calibrated 0% value, the DCM senses a lost demand input and executes the configured loss-of-signal action.

Changing Loss (LOS) of Signal Action

STEP 1 - From the HART® communicator "Online" menu, move to the "Demand setup" menu and select the "LOS mode" parameter. This is accomplished by using the up and down arrow keys to select the appropriate item in each menu and then moving forward by pressing the right arrow key. Follow the Menu Tree (Figure 1, page 18) to navigate.

STEP 2 - With the "LOS mode" parameter selected, press the right arrow key to display the two entry choices: "Stay" or "Go to pos". Use the up and down arrow keys to select the desired parameter.

STEP 3 - With desired choice selected, push the F4 function key which is defined as the **ENTER** key at the bottom of the display. Pushing this key enters the selected parameter and reverts the display back to the "Demand setup" main menu. If the "Go to pos" choice was selected, go to **STEP 4,** if "Stay" was selected, go to **STEP 6.**

STEP 4 - After entering "Go to pos", select the "LOS pos" parameter and use the right arrow key to display the modifiable entry block. Unless otherwise specified, this value is set to 50% at the factory. Using the alphanumeric keypad, enter the desired loss of signal position as a percentage of full output shaft rotation. Values from -5% to 105% are valid.

STEP 5 - With desired value correctly typed into the entry box, push the F4 function key which is defined as the **ENTER** key at the bottom of the display. Pushing this key enters the value and reverts the display back to the "Demand setup" main menu.

STEP 6 - At the bottom of the "Demand setup" menu, the F2 function key should now be defined as the **SEND** key. Push this key to execute the change.

WARNING

Carefully follow the on-screen warnings and messages when proceeding, because changing this parameter online could cause the drive to reposition. This can adversely affect the process and cause potentially dangerous conditions.

Changing LOS Trip Point

STEP 1 - From the HART® communicator "Online" menu, move to the "Demand setup" menu and select the "Dem lwr lim" parameter. This is accomplished by using the up and down arrow keys to select the appropriate item in each menu and then moving forward by pressing the right arrow key. Follow the Menu Tree (Figure 1, page 18) to navigate.

STEP 2 - With the "Dem lwr lim" parameter selected, press the right arrow key to display the modifiable entry block. Using the alphanumeric keypad, enter the desired demand signal lower limit value as a percentage of the demand signal range.

STEP 3 - With desired value correctly typed into the entry box, push the F4 function key which is defined as the **ENTER** key at the bottom of the display. Pushing this key enters the value and reverts the display back to the "Demand setup" main menu.

STEP 4 - At the bottom of the "Demand setup" menu, the F2 function key should now be defined as the **SEND** key. Push this key to execute the change.

WARNING

Carefully follow the on-screen warnings and messages when proceeding, because changing this parameter online could cause the drive to reposition. This can adversely affect the process and cause potentially dangerous conditions.

CALIBRATION

All Beck drives are shipped completely calibrated to customer specifications, and are ready to be installed. If the need arises to change the drive calibration, confirm that the drive is installed as specified and operating properly before proceeding with the change. It is also helpful to verify the drive configuration. This can be done by running the "Setup Assistant" feature available under the "Functions" menu of the HART® communicator.

With the exception of the settings for the overtravel limit switches, auxiliary switches and CPS, all calibration is performed using the HART® interface and a communications tool (model 275 HART® Communicator), as described in the Communications section of this manual. If unfamiliar with the HART® communicator and Beck drives, please review the Communications section of this manual before continuing.

There are two standard DCM calibration procedures available: Position calibration, and Demand calibration. There is potentially one other calibration procedure available depending on how the DCM board is equipped. This procedure is Feedback calibration. Feedback calibration is available for drives equipped with the optional Feedback Sourcing module (p/n 22-4008-04) installed on the DCM board.

Any calibration changes that are made, using any of the three calibration procedures can be reversed by using the "Restore cal" feature in the specific calibration procedure menu. Implementing the "Restore cal" feature returns the calibration to the original factory calibration.

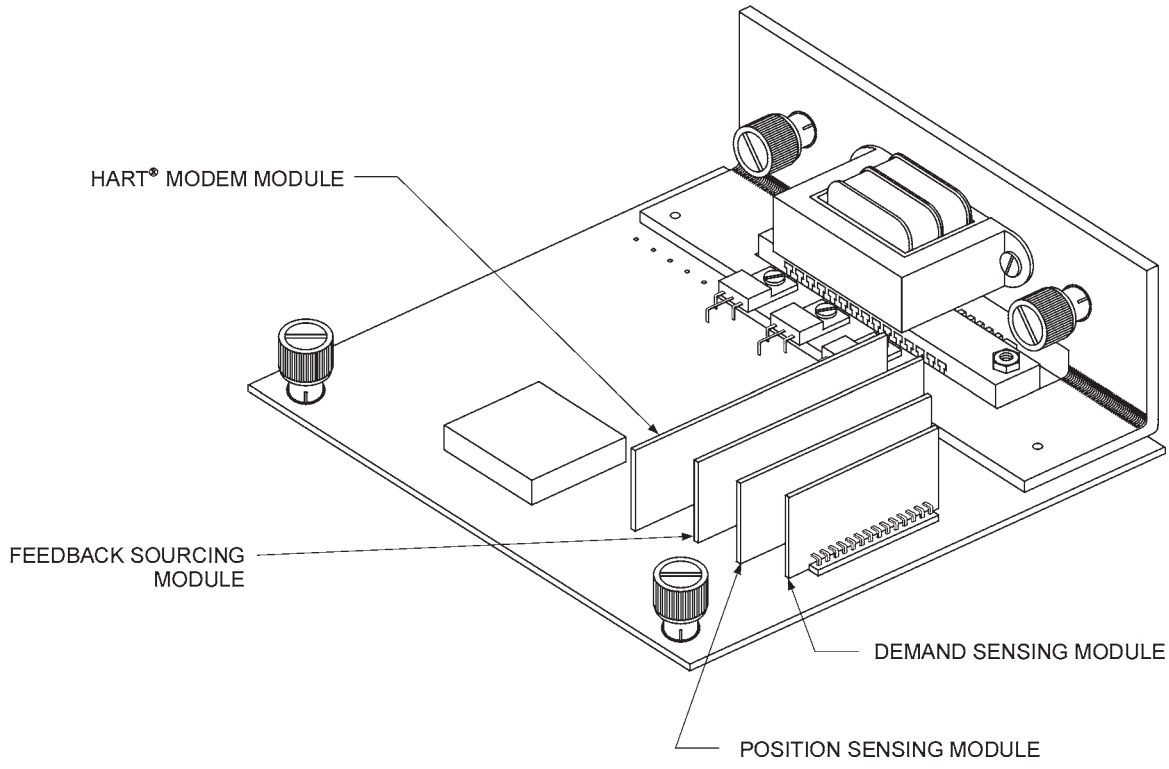


Figure 3

CALIBRATION

DIRECTION OF OUTPUT SHAFT TRAVEL (RET VERSUS EXT)

Travel direction of the drive is determined when looking at the output shaft. Direction of travel is defined as the direction of output shaft movement produced by an increasing demand signal. Unless otherwise specified at the time of order, the output shaft is factory-set to retract in response to an increasing signal.

CALIBRATION PRIORITY

Standard Group 14 drives are equipped with built in mechanical stops. All output shaft movement must occur within these stops.

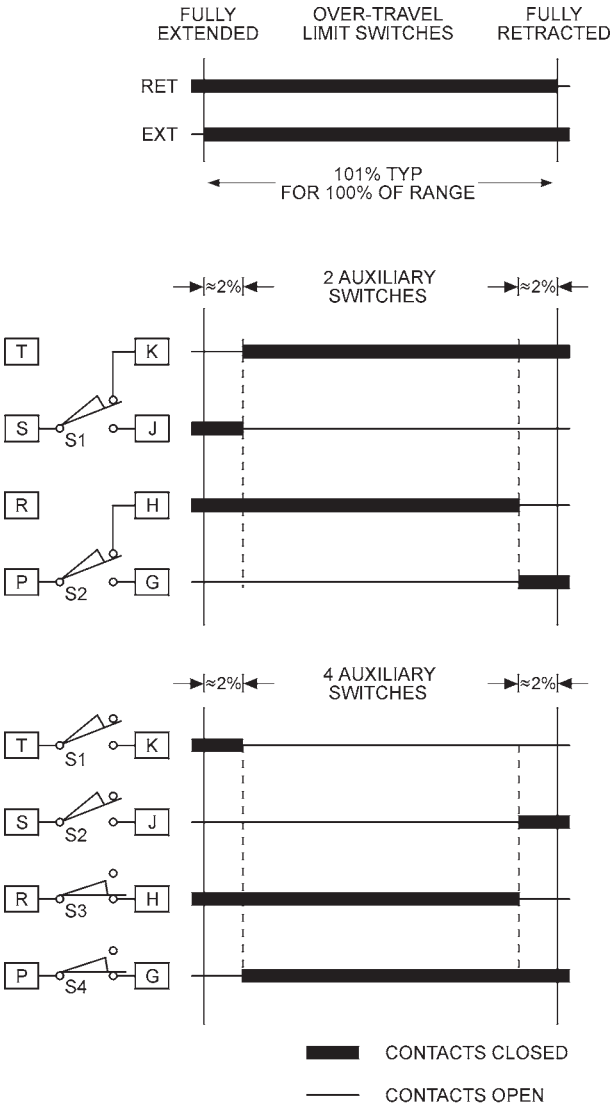
The over-travel limit switches are used to limit the electrical control range of the drive. These switches are cam operated, and are set slightly wider apart than the drive's intended full range of electronic operation. With this range, the limit switch cams are each set inside the mechanical stops, and are positioned to provide an electrical over-travel protection without opening in the normal operating range. If the drive stroke is changed by adjusting the calibar (see page 39), the limit switches are simultaneously adjusted. If, however, it is necessary to change the over-travel limit switch settings without adjusting the calibar, the switch settings should be adjusted before performing DCM calibration procedures.

The auxiliary limit switches are also cam operated, but have no affect on drive and DCM operation. Therefore, they can be adjusted at any time without affecting performance or calibration.

SWITCH CALIBRATION

NOTE: Your Beck drive was shipped from the factory ready for installation; no electrical adjustments are required before placing it in operation. Each drive is set up and calibrated to the customer's specifications that were written into the equipment order.

Under normal operating conditions there is no need to recalibrate the control drive. However, if the application requirements change or are different than specified on the equipment order, the drive should be recalibrated according to the following procedures.



Standard Over-travel Limit and Auxiliary Switch Settings

Switch Adjustments

All control drives are shipped with over-travel limit switches factory-set for 101% of travel unless otherwise specified at time of order. Limit switches must be set inside the range of the built-in mechanical stops to prevent stalling of the motor. Limit switches can be reset to limit travel of the output shaft. Optional auxiliary switches are set as shown in the illustration at left unless otherwise specified at time of order.

Switches are operated by cams which are clamped onto the control shaft. Setting a switch involves loosening the cam, moving the drive's output shaft to the desired position, and positioning the cam so that it operates the switch at that point. In the following procedure, the use of a continuity meter is recommended to determine when the switch opens or closes. If such a meter is not available, it is possible to hear the switch click as the contacts open and close.

CAUTION

Do not attach the meter or attempt to move the switch cams until the drive is disconnected from the line voltage and auxiliary switches are disconnected from external power sources.

Setting Over-travel Limit Switches RET and EXT

This procedure should be used if the factory over-travel switch settings must be changed in the field. It is advisable to operate the drive fully in each direction—using the electric Handswitch—to check switch settings before attempting to change them. Use the following instructions if they require adjustment:

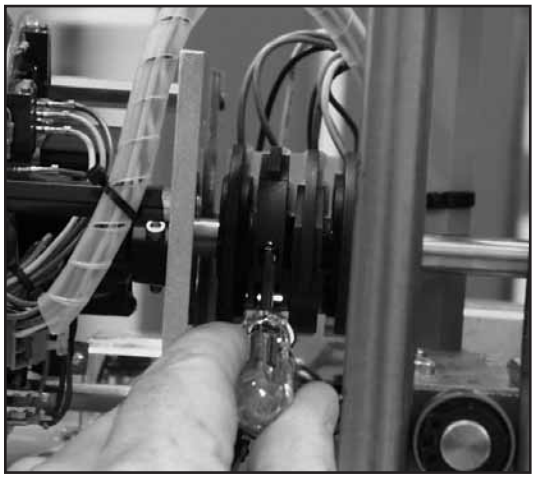


Figure 4

Continued

Setting Over-travel Switches, cont'd.

1. Remove the top cover (15/16" bolt head). The O-ring seal will remain in the rim of the top cover when removed. Open the terminal block cover (1/2" bolt head).
2. Use the electric Handswitch to drive the control shaft so that the EXT switch cam is accessible. Using a 7/64" hex wrench, loosen the screw so that the cam is just snug to the shaft. See Figure 4, page 37.
3. Use the Handwheel to position the control shaft so that the lever of the sector-lever gear assembly is parallel with the upper bearing plate. See Figure 5, below for location of lever and bearing plate.

Figure 5

4. Disconnect power from the drive.
5. Connect the continuity meter across terminals B and V. Rotate the cam until the meter shows no continuity (a switch contact opens; switch clicks).
6. Tighten the cam locking screw to 5 lb-in torque.
7. Disconnect the meter and reconnect switch wires and drive power.
8. Using the Handswitch, drive the output shaft to the fully retracted position. Note the direction of rotation of the lobe of the cam. The correct cam lobe motion is away from the switch lever with the switch lever on the lower part of the cam. If this is not correct, return to step 2 and reset the cam to the proper orientation.
9. Drive the output shaft again to the fully extended travel limit. If the correct stopping point is reached (lever parallel with the upper bearing plate), the switch is properly set.
10. Manually position the control shaft position indicator dial to zero.
11. With the Handswitch, move the control shaft until the position indicator dial reaches the 150° position.
12. Repeat the instructions for setting the RET travel limit except that the direction of motion is opposite to that used for the EXT switch setting. Connect the continuity meter across terminals B and U.
13. Close the covers and tighten the terminal cover bolt to 10 lb-ft. Tighten the top cover bolt just enough to compress the O-ring seal.

Setting Auxiliary Switches

Standard switch settings for drives with 2 or 4 auxiliary switches are shown on the diagram on page 37. The operating point of all auxiliary switches is defined as a percentage of output shaft travel. 100% is defined as the retracted limit of shaft travel. The heavy line indicates a closed circuit. Follow these instructions to change the operating point of auxiliary switches:

NOTE: In the following procedure, it is assumed that switch settings are to be adjusted so that contacts are open when the desired position is achieved. If they are to be adjusted to close, it may be necessary to reverse the operating mode of the switch by reversing the leads on the switch itself. Be sure to disconnect power from the switch terminals first.

1. Remove the top cover (15/16" bolt head). The O-ring seal will remain in the rim of the cover when removed. Open the terminal block cover (1/2" bolt heads).
2. Use the electric Handswitch to drive the shaft so that the switch cam is accessible. Using a 7/64" hex wrench, loosen the screw so that the cam is just snug on the shaft.
3. Move the output shaft to the desired position.
4. Disconnect power from the drive.
5. Connect the continuity meter across the appropriate terminals. See the chart on page 22 or the drive wiring diagram. Rotate the cam until the meter shows no continuity (switch contacts open, switch clicks).
6. Tighten the cam locking screw to 5 lb-in torque.
7. Disconnect the meter and reconnect power.
8. Move the drive's output shaft in the desired direction so the cam lobe moves away from the switch lever. If not correct, return to step 2 and reset the cam to proper orientation.
9. Reconnect the meter.
10. Move the output shaft again toward the desired switch position. If the contacts open, the switch is properly set.
11. Close covers and tighten the terminal cover bolts to 10 lb-ft torque. Tighten the top cover just enough to compress the O-ring seal.

STROKE CHANGE—CALIBAR

Adjustment of the total drive stroke within the factory-set travel range is easily accomplished by the use of the Beck Calibar, Figure 6, this page. The switches and feedback device are simultaneously adjusted to maintain full input span when the Calibar setting is changed. For stroke lengths longer than factory-set travel limits, consult the factory. Adjust drive stroke as follows:

1. Remove the top cover. The protective O-ring seal will remain in the rim of the top cover when removed.
2. The Calibar index is graduated directly in inches, which corresponds to the drive travel span.
3. Loosen the two locking screws on the Calibar block with an 1/8" hex wrench (See Figure 6, this page).
4. Slide the Calibar block, aligning the notch with the desired travel span on the Calibar index. Tighten the set screws.
   NOTE: If increasing the travel span within the factory-set travel range, a portion of the upper mechanical stop will have to be removed.
5. Use the Handswitch to operate the drive and check the stroke on the travel index of the valve yoke.
6. Replace the top cover after making adjustments. Tighten the top cover just enough to compress the O-ring seal.

NOTE: The limit switches and feedback device are adjusted automatically when the Calibar setting is changed. Do not adjust the limit switch cams to change the drive stroke. It is desirable, however, to calibrate the DCM position reference to match the Calibar setting. See page 41.

STROKE AND SPAN ADJUSTMENTS

The Calibar adjustment is designed to allow field changes of the total drive stroke with the same maximum input signal applied (e.g., a change from 1 1/2" stroke with 20 mA input signal to a 1“ stroke with 20 mA input signal).

The span adjustment on the DCM board is used to maintain the drive stroke when a change in input signal (or span) is required (e.g., a change from 3/4" stroke with a 20 mA maximum input signal applied to 3/4" stroke with an 18 mA maximum input signal applied).

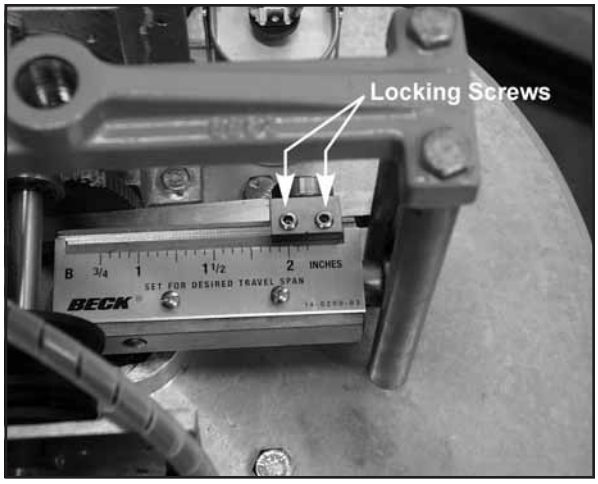


Figure 6

POSITION REFERENCE CALIBRATION

In order to correctly position the drive output shaft in response to the input demand signal, the DCM board receives a position signal from the drive's position sensor (CPS) and compares this actual position to the desired demand input. This process requires that the DCM interprets the CPS signal appropriately for the full range of desired travel. The position reference calibration procedure is used to calibrate the DCM to accept the CPS position signal and interpret the appropriate 0–100% range.

There are two procedures available: Fully automatic and manual. The automatic procedure strokes the drive to both over-travel limit switches, interprets those two extreme positions as -0.5% and 100.5% of full travel, and then automatically interprets the CPS signal for the 0–100% travel range.

The manual calibration procedure allows the user to select the lower and upper position limits and perform the same calibration. This procedure makes it possible to customize the stroke of the drive, and provides the ability to short-stroke such that the full 0–100% of travel corresponds to less than 100% of shaft movement. It also makes it possible to calibrate the full travel in situations where an installed drive cannot be stroked through its entire range. This is done by stroking the drive as far as possible and entering the relative position in terms of 0–100% of full travel.

Calibration Procedure

CAUTION

When following this calibration procedure, be aware that the drive will be required to reposition during the procedure. Additionally, as with any change in the DCM configuration, the drive may reposition when restored to normal operation.

STEP 1 - With the model 275 HART® Communicator communicating with the appropriate Beck drive, move from the "Online" menu to the "Calibration" menu and select the "Calibrate Position" procedure. This is accomplished by using the up and down arrow keys to select a particular menu item, and using the right and left arrow keys to move forward and back between menus. Follow the Menu Tree (Figure 1, page 18) to navigate.

STEP 2 - With the "Calibrate position" procedure selected, press the right arrow key to display the technique selections: "Auto 0–100%", "Select lower pt", and "Select upper pt". Use the up and down arrow key to select the desired technique. The automatic technique is the best choice if the drive is to be calibrated to full 100% travel. If "Automatic" is selected, go to **STEP 6**.

STEP 3 - With either the "Select lower pt" or "Select upper pt" selected, push the F4 function key, which is defined as the **ENTER** key at the bottom of the display. Pushing this key will initiate the calibration procedure. The display will prompt the user to move the drive to a position less than 50% if the "Select lower pt" procedure is selected or to a position greater than 50% if the "Select upper pt" procedure is selected.

STEP 4 - Once the drive is positioned as per the request, the F4 **ENTER** key should be pushed again. The display will ask the user to enter the value, as a percentage of full travel, that this position represents. The default value for this value will be displayed. It is -0.5% for the lower point procedure and 100.5% for the upper point. These values represent the extreme end of travel. If the position the user moved the drive to is different than the desired extreme travel limits, enter the appropriate value in the modifiable entry box.

STEP 5 - With the desired position value entered, the F4 function key must again be pushed to complete the calibration of the lower or upper position calibration point. Depending on the user's calibration objectives, only the lower, only the upper, or both position points can be calibrated. If both limits are to be calibrated manually, perform **STEP 3** through **5** again for the other choice. If calibration is complete, go to **STEP 7**.

STEP 6 - With the "Auto 0–100%" technique selected, push the F4 function key, which is defined as the **ENTER** key at the bottom of the display. Pushing this key will alert the user that continuing the procedure will cause the drive to reposition automatically. If this is not a problem, press the F4 function key, now defined as the **OK** key, to initiate the calibration procedure. Otherwise, push the F3 function key to abort. With the procedure initiated, the drive will reposition and calibrate automatically.

STEP 7 - With the calibration procedure complete, the display will prompt the user to enter the date. Follow the prompts and use the function keys and alphanumeric keys to make the entry. This date is stored and can be referenced under the "Device information" menu to determine when the last calibration was performed. Continue to follow the prompts carefully to return to normal operation.

Adjusting the DCM Position Reference In Response to a Stroke Change

When drive stroke has been changed through Calibar adjustment (see page 39), it is desirable to calibrate the DCM position reference to match this change.

Begin at calibration **STEP 1** on the previous page. Move to **STEP 2** and choose the "Select lower pt" technique, then move to **STEP 3**. When prompted, use the drive Handswitch to position the drive at the 0% position. At **STEP 4**, enter 0% when prompted. Move to **STEP 6**. Repeat **STEPS 3–5** for the "Select upper pt" technique and enter 100% when prompted in **STEP 4**. Continue through **STEP 7** and the procedure will be complete. The DCM position reference for the output shaft will now match the new stroking distance.

POSITION FEEDBACK SIGNAL CALIBRATION

DCM boards equipped with a Feedback Sourcing module have the capability of providing a 4–20 mA output signal so that the drive's true output shaft position can be monitored remotely. The signal comes calibrated from the factory to provide a precise 4–20 mA signal corresponding to 0–100% drive position. Normally, calibration is not required even if the position reference calibration or direction of travel are changed, because the DCM automatically compensates for these changes and appropriately scales the position feedback signal. Running the calibration procedure, therefore, is only necessary if there is a small calibration mismatch between the 4–20 mA output signal and the 4–20 mA interpretation of the receiving device (e.g., controller, recorder, display, etc.). Calibration can be used to fine tune the relationship.

Calibration Procedure

CAUTION

When following this calibration procedure, be aware that the drive will be required to hold the last output during the procedure. Additionally, as with any change in the DCM configuration, the drive may reposition when restored to normal operation.

STEP 1 - With the model 275 HART® Communicator communicating with the drive, move from the "Online" menu to the "Calibration" menu and select the "Calibrate Feedback" procedure. This is accomplished by using the up and down arrow keys to select a particular menu item, and using the right and left arrow keys to move forward and back between menus. Follow the Menu Tree (Figure 1, page 18) to navigate.

STEP 2 - With the "Calibrate feedback" procedure selected, press the right arrow key to move to the "Calibrate feedback" submenu. Use the up and down arrow key to select the "calibrate" procedure, and press the right arrow key again to initiate the calibration procedure.

STEP 3 - Follow the display prompts and place the control loop in manual to reduce the risk of disturbing control. Press the F4 function key (**OK** key) to continue.

STEP 4 - Use the alphanumeric keys to enter the measured feedback signal value in milliamps. This requires measuring the signal current with a meter or other suitable device. The signal is available at the drive's wiring termination board on terminals EE(+) and DD(-). See the Wiring section of this manual for more detail. It will first require the 4 mA entry and then the 20 mA entry. Be sure to enter exactly what is measured to fine tune the calibration. The F4 function key (**ENTER** key) must be pushed after each entry.

STEP 5 - With the calibration procedure complete, the display will prompt the user to enter the date. Follow the prompts and use the function keys and alphanumeric key to make the entry. This date is stored and can be referenced under the "Device information" menu to determine when the last calibration was performed. Continue to follow the prompts carefully to return to normal operation.

DEMAND INPUT SIGNAL CALIBRATION

DCM boards are designed to accept a 4–20 mA (or 1–5 V dc) analog demand signal. Narrower spans within this range can also be accommodated for split range operation. The input comes calibrated from the factory for the desired range unless otherwise specified by the customer. It is not necessary to calibrate the demand input when the drive is installed; however, it can be easily accomplished using the 275 Communicator, and a signal source. Running the procedure is only necessary to compensate for slight differences between the signal source calibration and the DCM factory calibration, or it can be done if a reduced range calibration is desired for special operating scenarios such as split ranging. To accommodate special ranges, the calibration procedure allows the user to calibrate only one demand signal endpoint at a time. For example, if the standard calibration from the factory is set for 4–20 mA, but the user decides to operate the full stroke of the drive in response to a 4–12 mA signal instead, then it is only necessary to calibrate the upper point of the demand signal range such that 12 mA represents 100%.

Calibration Procedure

CAUTION

When following this calibration procedure, be aware that the drive will be required to hold last output during the procedure. Additionally, as with any change in the DCM configuration, the drive may reposition when restored to normal operation.

STEP 1 - With the model 275 HART® Communicator communicating with the drive, move from the “Online” menu to the “Calibration” menu and select the “Calibrate Demand” procedure. This is accomplished by using the up and down arrow keys to select a particular menu item, and using the right and left arrow keys to move forward and back between menus. Follow the Menu Tree (Figure 1, page 18) to navigate.

STEP 2 - With the “Calibrate demand” procedure selected, press the right arrow key to move to the “Calibrate demand” submenu. Use the up and down arrow key to select the “calibrate” procedure, and press the right arrow key again to initiate the calibration procedure.

STEP 3 - Follow the display prompts and place the control loop in manual to reduce the risk of disturbing control. Press the F4 function key (**OK** key) to continue.

STEP 4 - After continuing, the user is prompted to select one of three calibration techniques: 0%, 100% points; 0% point; 100% point. Use the up and down arrow keys to select the desired technique. The “0%, 100% points” technique allows both extremes of the demand signal to be calibrated, whereas the other two techniques allow either the upper or lower signal extreme to be calibrated. With the desired technique selected, press the F4 function key (**ENTER** key) to continue.

STEP 5 - With a known signal source connected to drive terminals AA(+) and BB(-), follow the display prompts, and set the signal source to the appropriate value. For example, if the display prompt reads, “Set demand signal to 0%”, the signal source should be adjusted to the value representing 0%, or 4 mA in a standard calibration. This procedure is the same regardless of the calibration technique selected in **STEP 4**. Press the F4 function key (**OK** key) to proceed.

STEP 6 - With the calibration procedure complete, the display will prompt the user to enter the date. Follow the prompts and use the function keys and alphanumeric keys to make the entry. This date is stored and can be referenced under the “Device information” menu to determine when the last calibration was performed. Continue to follow the prompts carefully to return to normal operation.

Split Range Operation

It is sometimes desirable or necessary to have more than one final control element controlling a single process. Often, this type of control strategy requires that two to four Beck drives each respond to different portions of one 4–20 mA demand signal from the control system.

This type of operation is called split range operation. For example, consider the most common split range scenario—two drives split ranged for 50% of the 4–20 mA demand signal input. Both drives are wired in parallel to receive the same 4–20 mA signal (note that the total loop resistance should be 250 Ohms as specified by the HART® communications protocol. The 250 Ohm R11 resistor must be removed from one of the two drive DCM boards to allow HART® communications. If more than two drives are split ranged, the R11 resistor must be removed from all the DCM boards but one), but each drive's interpretation of the signal must be different. One drive must interpret 4–12 mA as 0–100% demand, and one drive must interpret 12–20 mA as 0–100% demand. This requires that the drives have different demand signal calibrations.

Split-ranging is easily accomplished by determining the break points (12 mA in the example above) and following the demand calibration procedure discussed above. Any of the three calibration techniques will work. In the example above, one drive is calibrated for a 0% point of 4 mA and a 100% point of 12 mA, while the other is calibrated for a 0% point of 12 mA and a 100% point of 20 mA.

MAINTENANCE *ROUTINE*

The Beck Group 14 drive requires only minimal routine maintenance. Periodic lubrication of the gearing is recommended to extend gear life. Periodic visual inspections are recommended to verify that the connection to the valve is intact and operating normally. If vibration is present, check the electrical terminal connections and other hardware for tightness.

LUBRICATION

The drive train parts of the Beck control drive are factory lubricated and in normal service will not need relubrication for five years. Control drives in more active service will require more frequent relubrication. Any drive operating near its rated thrust and with a frequency of operation greater than one per minute on a 24 hour schedule should be inspected every two years.

CAUTION

Before removing the gear housing assembly, block the valve stem to prevent the gear train from moving when the housing assembly is removed.

To inspect or lubricate the output gear only, remove the cover plate (1/2” bolt heads) on the side opposite the motor. The output gear is not field replaceable.

To inspect all the gears, first remove the motor from the housing, following the instructions on page 46. Then, remove the housing assembly from the body (1/2” bolt heads). Clean all parts thoroughly, removing as much old lubrication as possible. Examine the gear teeth for signs of excessive wear, scoring, or other damage. Check for excessive free play of gears on shafts. The assembly is not field repairable and should be returned to the factory if excessive wear is noted.

Before reassembly, recoat the teeth with a heavy layer of Fiske Lubriplate GR-132 or equivalent. GR-132 is an E.P. grease with polymer additives. To reinstall the gear housing, carefully position the housing on the body’s alignment pins. Replace the bolts and tighten to 10 lb-ft.

Reattach the motor per the instructions on page 46.

This section covers replacement of many components of the Group 14 drive. Note that some components are not field repairable.

If it should ever be necessary to replace the output gear, shaft, or output shaft bearings, a major overhaul is required and the drive should be returned to the factory.

GASKETS

During routine service, inspect the gaskets and O-rings for wear or damage. In order to protect internal components, worn or damaged gaskets and O-rings should be replaced.

To remove the main gear cover, terminal compartment, or the motor gaskets, scrape all of the old adhesive and gasket material from the body housing and cover. Cement the new gasket to the drive body using a gasket cement such as 3M #847 Rubber and Gasket Adhesive, or equivalent.

O-ring seals are used between the body and the top and bottom bearing plates. Before installing a new O-ring, lubricate it with light machine oil.

The large top cover is sealed with rubber foam gasket material, 5/16” in diameter. To replace this material, scrape the old gasket material and cement from the groove. Cement the new foam gasket into the groove with 3M #847 Rubber and Gasket Adhesive, or equivalent. Cut the ends of the material on an angle and cement them together with this same adhesive.

SEALS

Worn or damaged output shaft and motor shaft seals should be replaced to prevent damage to internal bearings and drive train parts.

To remove the shaft seal, push the blade of a small screwdriver along the shaft and under the seal lip. CAUTION: The seal is approximately 1/4” wide. Do not force the screwdriver blade beyond the width of the seal; damage to the shaft bearing could result. Pry up on the seal and force it out of the housing. Clean the shaft and housing and press in the replacement seal with the closed side facing outward.

BEARINGS

There are some field replaceable bearings in the Group 14 drive. Consult the factory for details.

MOTOR

The control motor is not field-repairable. Disassembly of the motor will result in a loss of torque that can only be restored by returning the motor to the factory for remagnetizing.

CAUTION

Before removing the motor assembly, while the process is running, block the valve stem to prevent the gear train from moving when the motor is removed.

To remove the motor, first disconnect the motor wires in the terminal compartment of the control drive. The wiring is under the terminal board. Remove the black wire from the terminal post, cut the green motor wire near the green-yellow-red butt joint and disconnect the red wire from the re-green-blue butt connection. Remove the hardware that secures the motor (model 14-10_ has three 10-32 socket head cap screws and model 14-20_ has four 1/4-20 hex head bolts). Carefully slide the motor out of the drive body.

To install the motor, insert the three-wire sleeve through the wire hole in the motor mount and into the terminal compartment. Carefully slide the motor into the drive body, rotate the motor shaft if necessary to engage the pinion with the first combination gear. Install motor mounting hardware (screws or bolts) and torque to 6 lb-ft. Reconnect the motor wires.

NOTE: 14-100 models with 4 and 8 second timing have a spacer between the motor and gear module.

MOTOR RESISTOR AND CAPACITOR

The motor resistor assembly and capacitor are located in the top compartment beside the Calibar. To replace a resistor or capacitor, remove the top cover (15/16” bolt head). Remove the existing part and transfer the wires one at a time to the replacement part. Inspect the top cover gasket and replace if necessary. Replace the top cover. Tighten the top cover bolt just enough to compress the O-ring seal.

OVER-TRAVEL LIMIT AND AUXILIARY SWITCHES

Complete switch assemblies may be replaced. It is not possible to replace individual switches. To replace switch assemblies, remove the top cover (15/16" bolt head). Remove the #6-32 socket head cap screws holding the switch assembly to the plate.

Transfer the wires one at a time to the replacement assembly using the push-on lugs provided. Install the replacement assembly and note that it rotates around one screw to permit an adjustment of the cam-to-roller spacing and switch operating point. To properly set the switch, use a .030" shim between the cam and switch lever and loosely position the switch assembly so that the switch is just actuated. The switch lever should be on the low or minimum radius portion of the cam when setting the switches. DO NOT overstress the switch lever. Tighten both screws to 10 lb-in torque and remove the shim. When properly adjusted, the switch lever should remain in contact with the cam throughout the control drive travel.

ADDING SWITCHES

It is possible to add up to four switches to a control drive in the field. Consult the factory, giving the control drive model and serial number so that a correct list of parts required may be supplied to you.

Remove the top cover (15/16" bolt head). Install wiring onto the switch push-on lugs and route the wires into the control drive terminal area. Remove the terminal cover and solder wires to the underside of the terminal assembly according to the wiring diagram included with the new switch assembly. Install the new switch assembly and adjust according to the instructions above. See Table 4, page 58, for switch assembly part numbers.

SLM FRICTION SURFACE

In normal service, the SLM friction surface will last for five to ten years. Faster rates of wear can occur in any drive operating near its rated thrust and with a frequency of operation greater than one per minute on a 24 hour schedule. The following procedure can be used to determine the amount of wear life remaining on the friction surface.

Turn the Handswitch to STOP. Carefully turn the Handwheel back and forth. If there is free play in the Handwheel (up to one tenth of a full Handwheel rotation) the SLM has sufficient wear life. If there is no free play in the Handwheel, the drive may not hold position and the friction surface may need to be replaced—contact the factory for details.

Damage to the SLM may require the SLM Rebuild Kit shown in Table 3, below. The SLM Rebuild Kit consists of a spring, spring pin, thrust bearing, pinion, steel balls, locking disc, steel shims, control motor gasket, terminal joints, and instruction sheet.

See Figure 7, below, for identification of typical SLM components.

TABLE 3

Motor Part Number	SLM Rebuild Kit	Instruction Sheet Only
20-2702-31	12-8060-19	80-0016-09
20-2703-31	12-8060-19	80-0016-09
20-2703-34	12-8060-20	80-0016-09
20-2703-35	12-8060-22	80-0016-14

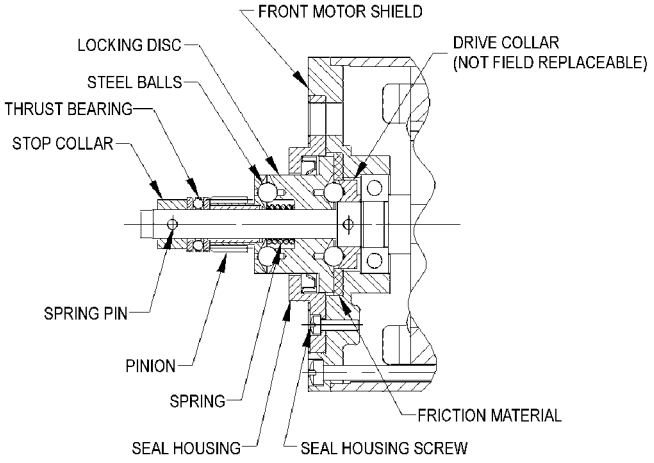


Figure 7

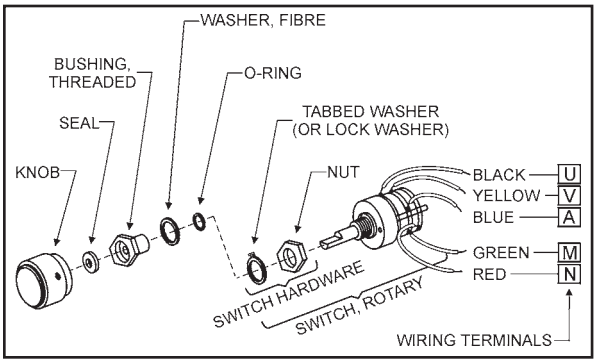


Figure 8

Handswitch

To replace the Handswitch, remove the terminal cover, DCM-H board and DCM-H bracket. Clip the five wires from the old Handswitch. Remove the knob and the nut under the knob to remove the switch. Install the new Handswitch as shown in Figure 8, above. Splice the wires color for color. Replace the DCM-H bracket, board and the terminal cover. Torque bolts to 10 lb-ft.

NOTE: The AUTO position on the Handswitch knob must be straight up when the switch is fully clockwise. Handswitch part number 20-3300-27.

DCM-H

Field service of the DCM-H board is not recommended. The factory maintains a stock of replacement boards for immediate shipment. To replace the DCM-H board, remove the terminal compartment cover (1/2" bolt heads). Loosen the four captive thumb screws holding the board to its mounting pads. Note the “L” shaped mounting bracket on the end of the board. To remove the board, pull the mounting bracket away from its mating surface with a gentle rocking motion. See Figure 9, below.

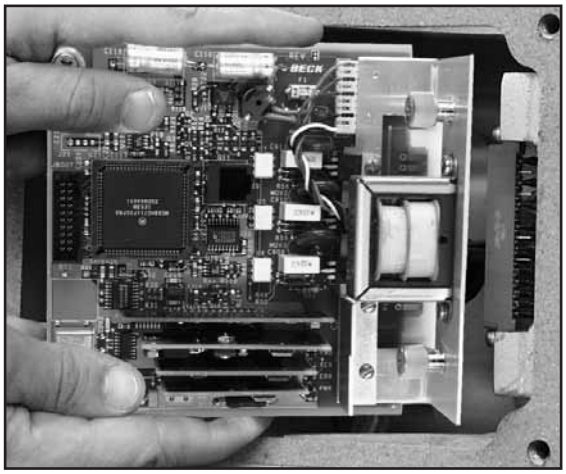


Figure 9

To install a DCM board, lightly press the board connector into its receptacle until the mounting bracket is flush with its mounting surface. Tighten the four captive thumb screws and replace the compartment cover. Torque cover bolts to 10 lb-ft.

CPS-2

Field repair of the CPS-2 assembly is not recommended. The factory maintains a stock of replacement assemblies for immediate shipment. If it is necessary to replace the CPS-2, replace both the rotor and stator / circuit board assembly. When returning the CPS-2 to the factory for service, include the rotor and stator / circuit board assembly. Do not separate the stator or circuit boards from their mounting plates. It is recommended that the rotor be held inside the stator with rubber bands and the hex studs be reattached to the mounting plate for protection during shipment.

To remove the CPS-2:

1. Run the control drive to its 0% position with the local Handswitch.
2. Disconnect 120 V ac power to the drive. Remove the top cover and terminal compartment covers (1/2" bolt heads).
3. Record the wire colors on the terminal block of the CPS-2 (see Figure 10, this page), then disconnect the wires. The terminals are spring-loaded. To remove a wire, press the tip of a 3/32” screwdriver into the slot at the top of the small, white lever. Push down on the lever to open the spring-loaded contact and release the wire.
4. Pull the wires from the monitor board and transformer back through the wire hole in the CPS-2.
5. Loosen and remove the 3 hex studs that clamp the CPS-2 in place. Support the inboard hex stud with a wrench as the outboard stud is loosened.
6. Slide the CPS-2 stator assembly off the three mounting bolts.
7. Note the position of the rotor clamp, then loosen the rotor clamp screw and remove the rotor from the shaft.

To install the new CPS-2:

1. Remove the rotor from the replacement CPS-2 assembly. Slide the rotor, clamp end first, onto the control shaft as close to the mounting plate as possible. Leave the clamp loose. Position the clamp in the same general location as the one removed previously.
2. Slide the new CPS-2 assembly over the studs and rotor. Replace the hex nuts but do not tighten. Carefully slide the rotor back into the CPS-2 assembly. Twist the rotor while sliding to prevent damage to the assembly. Tighten hex nuts to 5 lb-ft.
3. Thread the wires through the wire holes in the CPS-2 and reconnect them to the transformer and terminal block.
4. Restore 120 V ac power to the drive and connect a meter to the output.
5. Insert a 0.031" feeler gauge between the rotor clamp and stator. Position the clamp 0.031" from the stator.
6. Rotate the rotor on the control shaft until the output voltage measured across TP4 and TP1 (see Figure 11, page 54) reads 50% (approx. 3 volts) of signal span, then tighten the clamp to 5 lb-in torque.
7. Perform a position calibration procedure as described on page 40.
8. Check drive operation.

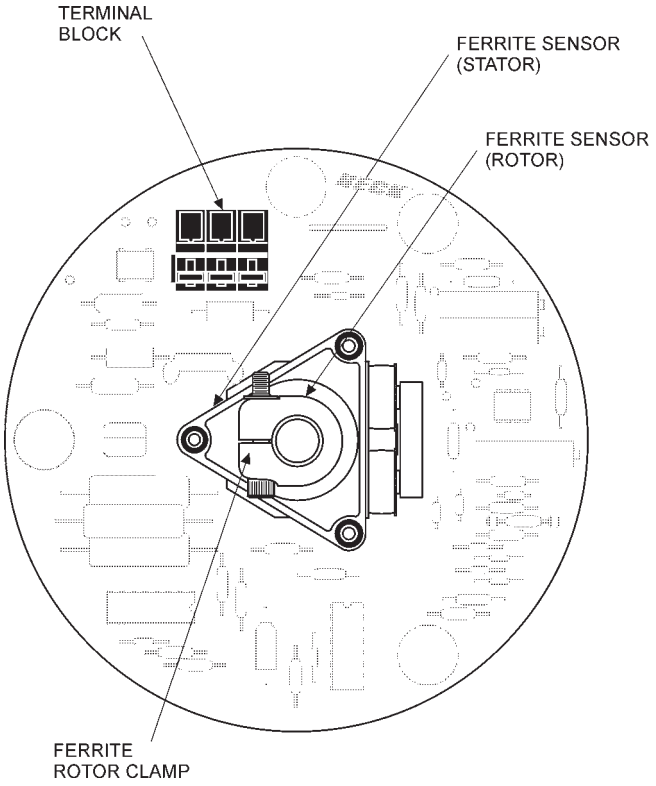
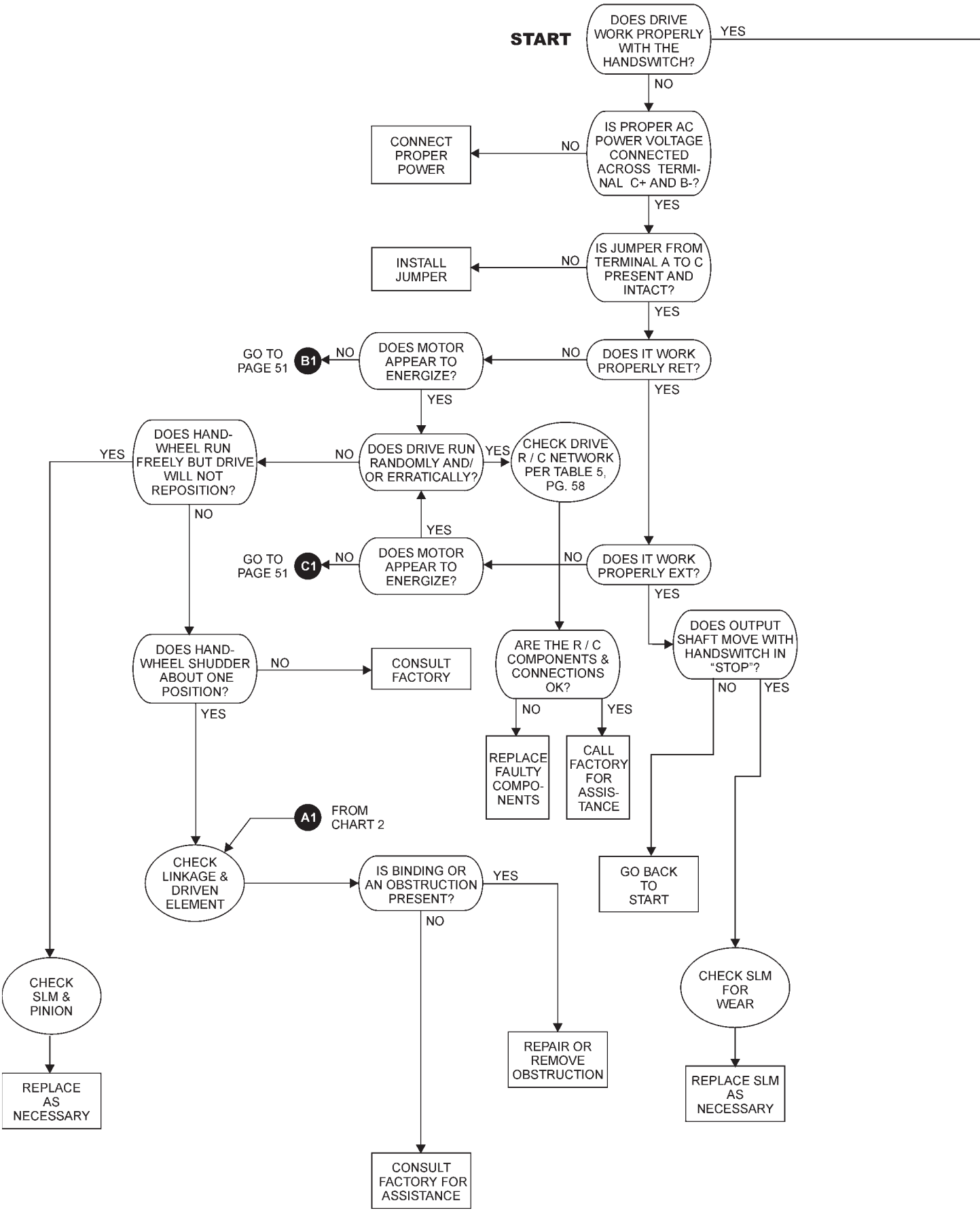
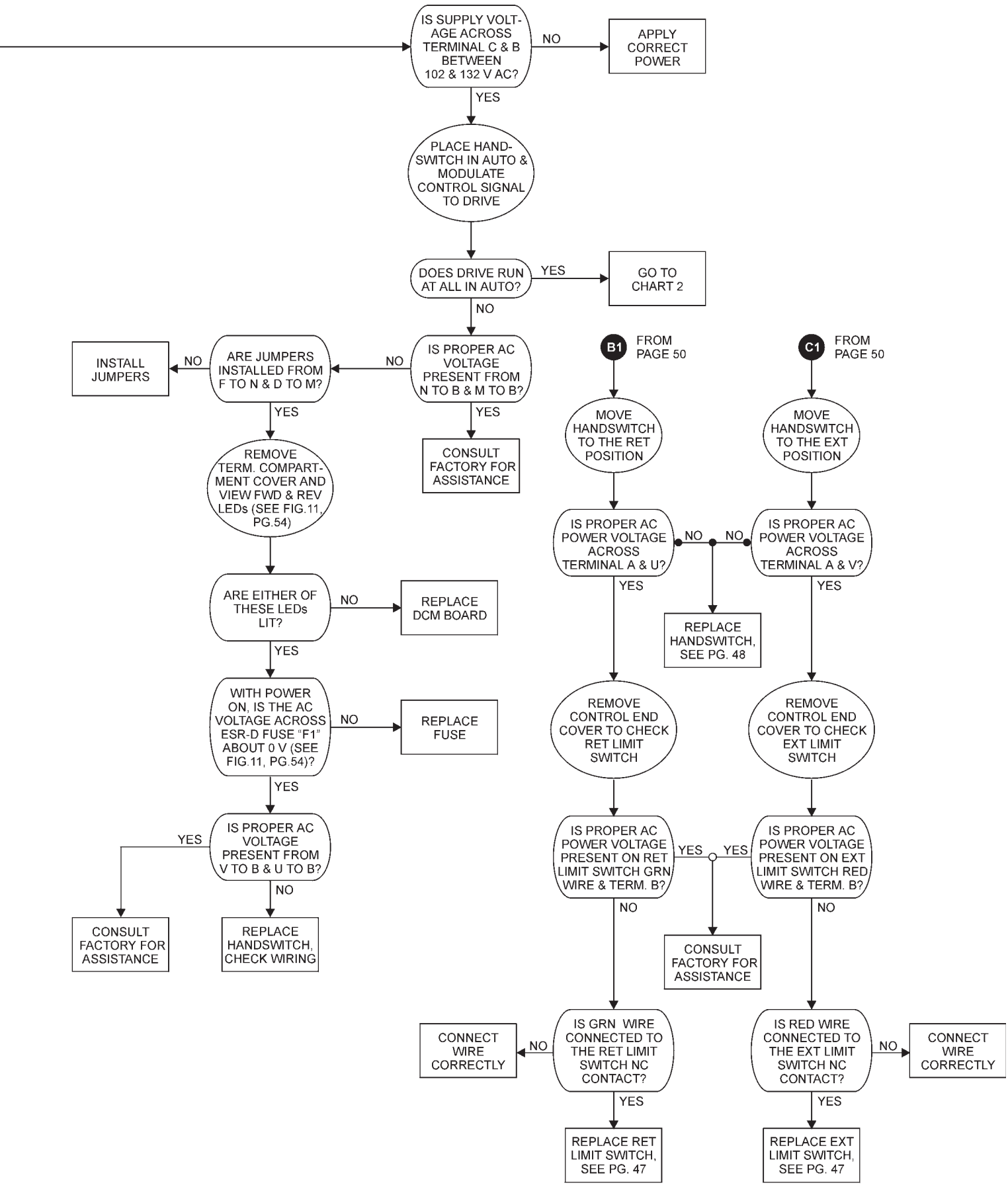


Figure 10

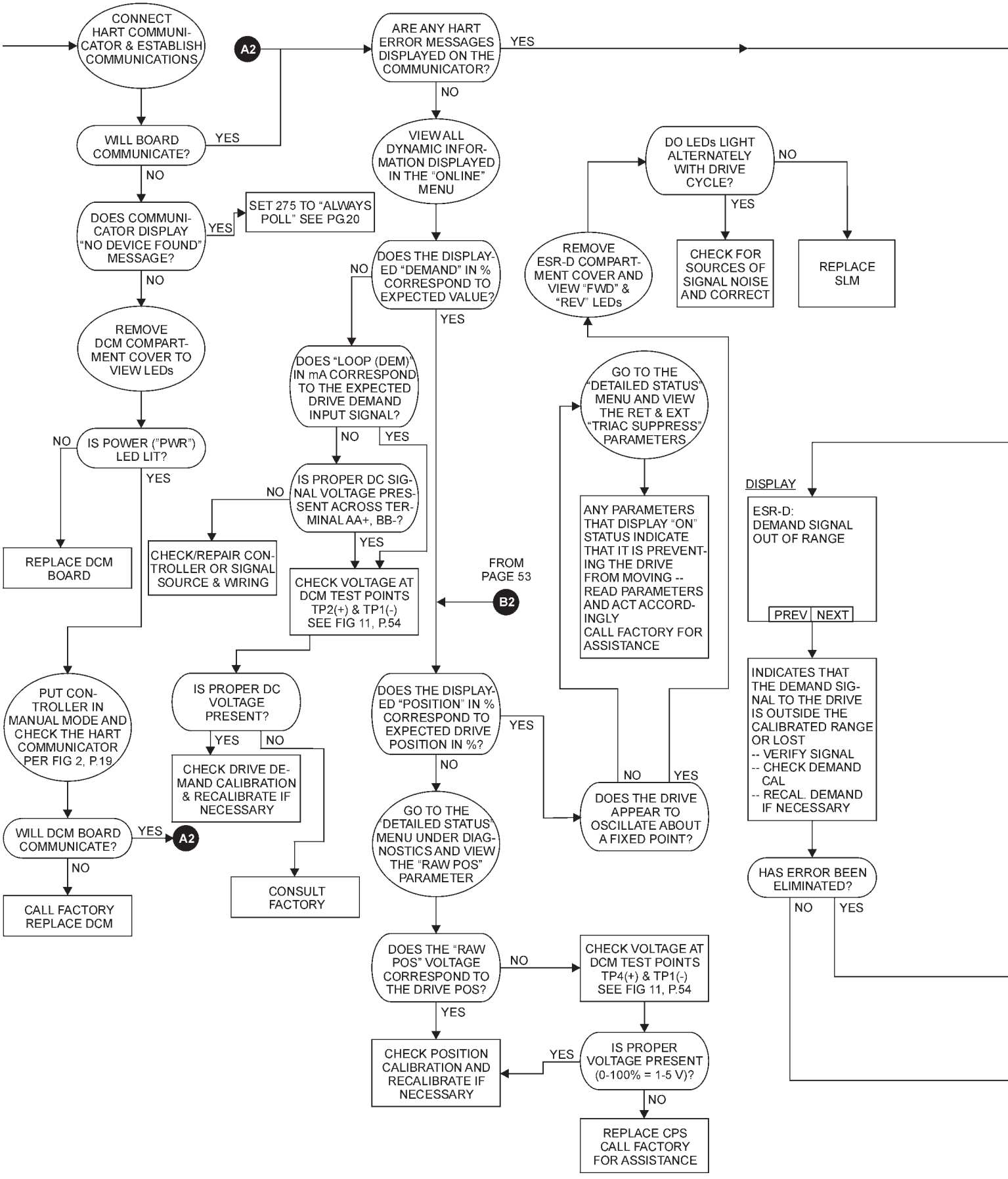
NOTE: A manual CPS calibration should not be required; however, if the CPS is improperly adjusted per this procedure, calibration may be required. Contact the factory for the proper calibration procedure.

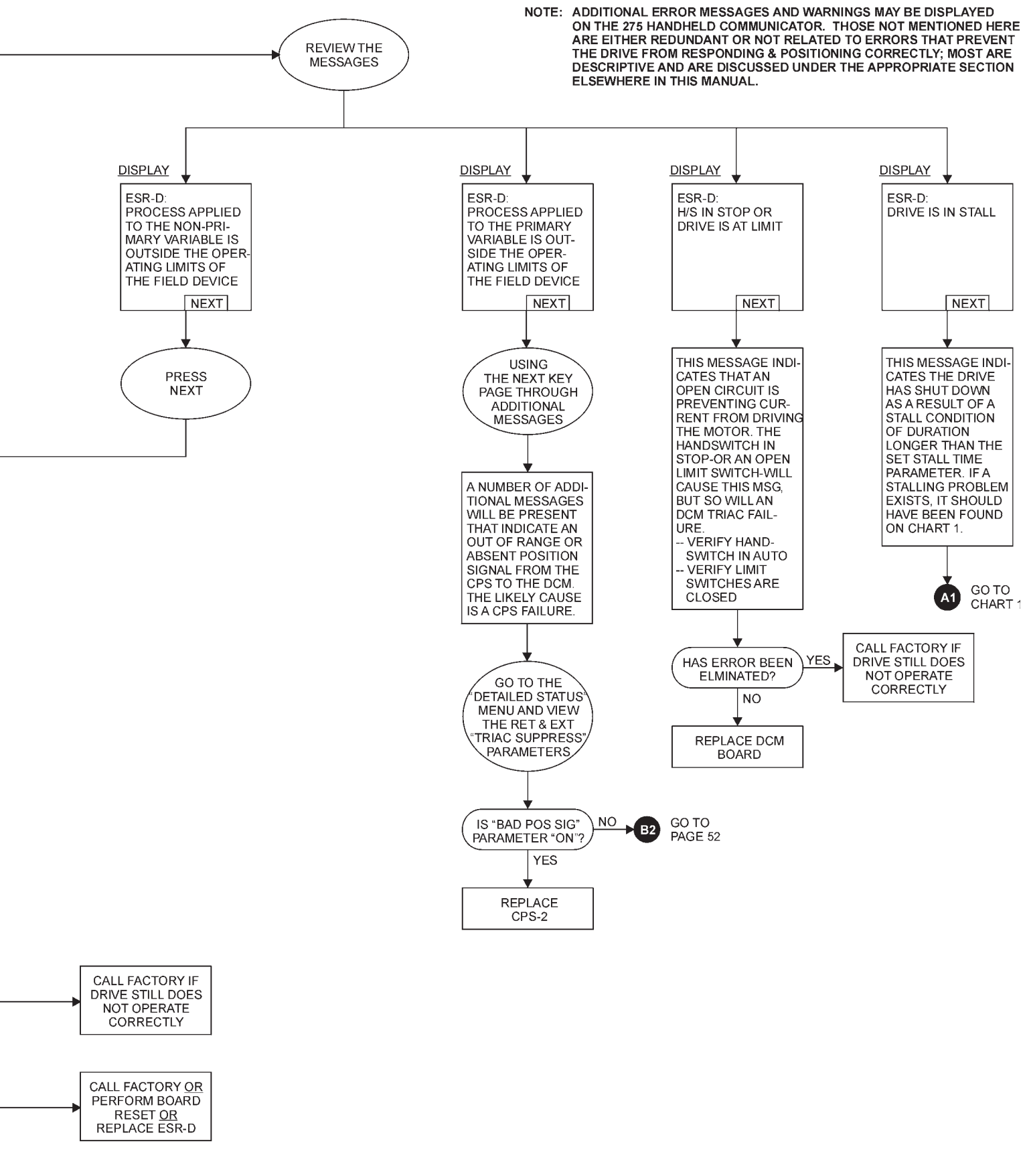
ELECTRO / MECHANICAL -- CHART 1




IS SUPPLY VOLTAGE ACROSS TERMINAL C & B BETWEEN 102 & 132 V AC?
NO
APPLY CORRECT POWER
YES
PLACE HAND-SWITCH IN AUTO & MODULATE CONTROL SIGNAL TO DRIVE
DOES DRIVE RUN AT ALL IN AUTO?
YES
GO TO CHART 2
NO
IS PROPER AC VOLTAGE PRESENT FROM N TO B & M TO B?
NO
ARE JUMPERS INSTALLED FROM F TO N & D TO M?
NO
INSTALL JUMPERS
YES
CONSULT FACTORY FOR ASSISTANCE
YES
REMOVE TERM. COMPART-MENT COVER AND VIEW FWD & REV LEDs (SEE FIG.11, PG.54)
ARE EITHER OF THESE LEDs LIT?
NO
REPLACE DCM BOARD
YES
WITH POWER ON, IS THE AC VOLTAGE ACROSS ESR-D FUSE "F1" ABOUT 0 V (SEE FIG.11, PG.54)?
NO
REPLACE FUSE
YES
IS PROPER AC VOLTAGE PRESENT FROM V TO B & U TO B?
YES
CONSULT FACTORY FOR ASSISTANCE
NO
REPLACE HANDSWITCH, CHECK WIRING
B1
FROM PAGE 50
MOVE HANDSWITCH TO THE RET POSITION
IS PROPER AC POWER VOLTAGE ACROSS TERMINAL A & U?
NO
YES
REPLACE HANDSWITCH, SEE PG. 48
REMOVE CONTROL END COVER TO CHECK RET LIMIT SWITCH
IS PROPER AC POWER VOLTAGE PRESENT ON RET LIMIT SWITCH GRN WIRE & TERM. B?
YES
NO
CONSULT FACTORY FOR ASSISTANCE
IS GRN WIRE CONNECTED TO THE RET LIMIT SWITCH NC CONTACT?
NO
CONNECT WIRE CORRECTLY
YES
REPLACE RET LIMIT SWITCH, SEE PG. 47
C1
FROM PAGE 50
MOVE HANDSWITCH TO THE EXT POSITION
IS PROPER AC POWER VOLTAGE ACROSS TERMINAL A & V?
NO
YES
REMOVE CONTROL END COVER TO CHECK EXT LIMIT SWITCH
IS PROPER AC POWER VOLTAGE PRESENT ON EXT LIMIT SWITCH RED WIRE & TERM. B?
YES
NO
IS RED WIRE CONNECTED TO THE EXT LIMIT SWITCH NC CONTACT?
NO
CONNECT WIRE CORRECTLY
YES
REPLACE EXT LIMIT SWITCH, SEE PG. 47

ELECTRONICS DIAGNOSTICS -- CHART 2




NOTE: ADDITIONAL ERROR MESSAGES AND WARNINGS MAY BE DISPLAYED ON THE 275 HANDHELD COMMUNICATOR. THOSE NOT MENTIONED HERE ARE EITHER REDUNDANT OR NOT RELATED TO ERRORS THAT PREVENT THE DRIVE FROM RESPONDING & POSITIONING CORRECTLY; MOST ARE DESCRIPTIVE AND ARE DISCUSSED UNDER THE APPROPRIATE SECTION ELSEWHERE IN THIS MANUAL.
REVIEW THE MESSAGES
DISPLAY
ESR-D: PROCESS APPLIED TO THE NON-PRIMARY VARIABLE IS OUTSIDE THE OPERATING LIMITS OF THE FIELD DEVICE
NEXT
PRESS NEXT
DISPLAY
ESR-D: PROCESS APPLIED TO THE PRIMARY VARIABLE IS OUTSIDE THE OPERATING LIMITS OF THE FIELD DEVICE
NEXT
USING THE NEXT KEY PAGE THROUGH ADDITIONAL MESSAGES
A NUMBER OF ADDITIONAL MESSAGES WILL BE PRESENT THAT INDICATE AN OUT OF RANGE OR ABSENT POSITION SIGNAL FROM THE CPS TO THE DCM. THE LIKELY CAUSE IS A CPS FAILURE.
GO TO THE "DETAILED STATUS" MENU AND VIEW THE RET & EXT "TRIAC SUPPRESS" PARAMETERS
IS "BAD POS SIG" PARAMETER "ON"?
NO
B2
GO TO PAGE 52
YES
REPLACE CPS-2
DISPLAY
ESR-D: H/S IN STOP OR DRIVE IS AT LIMIT
NEXT
THIS MESSAGE INDICATES THAT AN OPEN CIRCUIT IS PREVENTING CURRENT FROM DRIVING THE MOTOR. THE HANDSWITCH IN STOP-OR AN OPEN LIMIT SWITCH-WILL CAUSE THIS MSG, BUT SO WILL AN DCM TRIAC FAILURE.
-- VERIFY HAND-SWITCH IN AUTO
-- VERIFY LIMIT SWITCHES ARE CLOSED
HAS ERROR BEEN ELMINATED?
YES
CALL FACTORY IF DRIVE STILL DOES NOT OPERATE CORRECTLY
NO
REPLACE DCM BOARD
DISPLAY
ESR-D: DRIVE IS IN STALL
NEXT
THIS MESSAGE INDICATES THE DRIVE HAS SHUT DOWN AS A RESULT OF A STALL CONDITION OF DURATION LONGER THAN THE SET STALL TIME PARAMETER. IF A STALLING PROBLEM EXISTS, IT SHOULD HAVE BEEN FOUND ON CHART 1.
A1
GO TO CHART 1
CALL FACTORY IF DRIVE STILL DOES NOT OPERATE CORRECTLY
CALL FACTORY OR PERFORM BOARD RESET OR REPLACE ESR-D

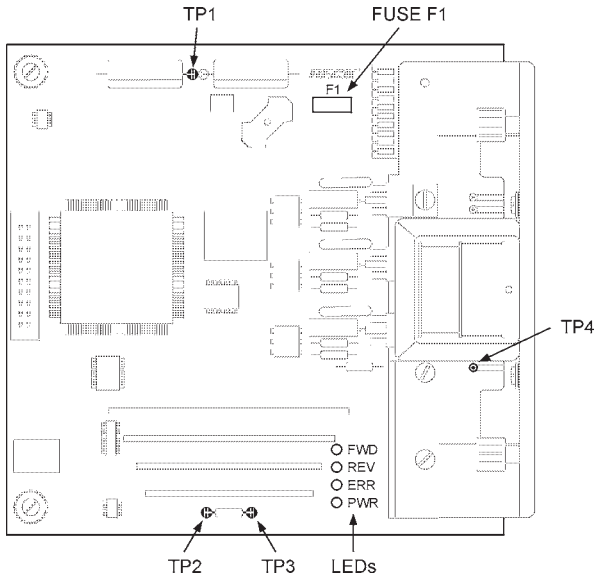


Figure 11

The DCM provides voltage test points allowing the verification of the demand signal and position signal at the DCM board.

Demand Signal is measured between TP2 (+) and TP3 (-). Typically, this will be 1–5 volts.

COMMON HART® MESSAGES

HART® protocol maintains both standard and device specific informational messages that are displayed on the 275 handheld communicator when various conditions occur. They can also be used to trigger alarms and messages in other HART® compatible monitoring systems. These messages alert the user to various alarm conditions and make it much easier to diagnose problems. Below is a table of typical Beck drive messages and message sequences. It does not include all possible messages, only the most common.

Handswitch and Limit Switch Messages

Message	Description
"H/S is in STOP or drive at limit sw"	This message will appear if a condition prevents current flow to the motor. Some of the most common conditions are: The drive Handswitch is put in the STOP position; either of the drive overtravel limit switches are open; or the motor control triacs fail.

Demand Signal and Process Variable Messages

Message	Description
"Process applied to the non-primary variable is outside the operating limits of the field device"	This is a standard HART®-defined message that appears whenever one of the two HART® non-primary variables (Demand signal and Temperature) are outside their design or calibrated ranges. The demand input signal to the drive is typically the problem source; however, the message can also appear if the temperature measurement is outside the design or calibrated ranges. The Beck specific messages below provide more descriptive information.
"Demand signal out of range"	This is a Beck-specific message that can appear after the HART®-defined message above. It specifically pinpoints the demand input signal to the DCM as the problem source, and indicates that the signal is outside the calibrated range limits. The lower limit is configurable as a percentage of the calibrated range (default is -5%). The upper range is the highest readable input voltage (5.5 VDC) expressed as a percentage of the calibrated range (e.g., approximately 112% for a 4–20 mA* or 1–5 V dc standard input range).
"Demand out of sensor range"	This is a Beck-specific message that can appear after the "Demand signal out of range" message above. It further defines the demand signal problem by indicating that the signal is not only out of the calibrated range, but also out of the design range of the drive. The lower and upper limits are 0.1 V dc and 5.55 V dc respectively.*

*Note that current input DCM boards utilize a 250 Ohm input resistor to convert the current signal to voltage.

Message	Description
"Temperature is out of range"	This is a Beck-specific message that can appear after the HART®-defined ("Process applied to the non-primary variable is outside the operating limits of the field device") message mentioned previously. It serves to further define the condition, and indicates that the drive's internal temperature is outside the -40° to 195° F range.

Position Signal Messages

(*The position signal is defined as the signal from the position sensor (CPS) to the DCM*)

Message	Description
"Process applied to the primary variable is outside the operating limits of the field device"	This is a standard HART®-defined message that appears whenever the HART® primary variable (Position signal) is outside the design or calibrated range. The DCM is designed to accept a maximum position signal range of 0.25 to 5.35 V dc, and can be calibrated anywhere within this range depending on the type of CPS and desired stroke of the drive. Normally, new drives would be calibrated for a 1–5 V dc position signal. Retrofit applications are typically calibrated for a 0.45–2.6 V dc range.
"Analog output 1 and its digital representation are outside the operating range limits, and not responding to input"	This is an additional standard HART®-defined message that appears whenever the HART® primary variable (Position signal) is outside the design or calibrated range. It accompanies the message above.
"Position is out of range"	This is a Beck-specific message that appears after the HART®-defined messages above. It specifically pinpoints the position signal to the DCM as the problem source, and indicates that the signal is outside the calibrated range limits. The upper and lower limits are -5% and 105% of the calibrated range respectively.

Message	Description
“Position signal in LOS”	This is a Beck-specific message that appears after the HART®-defined messages above. It specifically pinpoints the position signal to the DCM as the problem source, and is intended to indicate a CPS or wiring failure. The message is triggered when the position signal is outside the minimum and maximum limits of 0.25 V dc and 5.35 V dc respectively. In this case, the LOS message above will also be present.
“Position out of sensor range”	This is a Beck-specific message that appears after the HART®-defined messages previously mentioned. It specifically pinpoints the position signal to the DCM as the problem source, and indicates that the signal is outside the 0.25–5.35 V dc design range. The LOS message above will also be present when this message is present.

Miscellaneous Messages

Message	Description
“Feedback circuit is disconnected”	This is a Beck-specific alarm message that alerts the user that external position feedback signal is installed and enabled, but not wired to an external load. If the signal is wired to an external load and this message appears, it implies that a wiring failure somewhere between the drive and the monitoring device has occurred. If the DCM board is equipped with the feedback module, but the signal is not being used, this message can be eliminated by disabling the feedback in the configuration.
“Drive is in Stall”	This is a Beck-specific alarm message alerting the user that the drive is in a stalled condition and is no longer trying to fight the load. This condition occurs if the drive cannot reach the demand position in the ime allotted by the stall time setting (configurable from 30–300 seconds, default 300 sec.).

APPENDIX *SPARE PARTS*

RECOMMENDED SPARE PARTS

It is recommended that certain replacement parts be stocked for quick availability in the event that service of your Beck control drive is required. The types of parts are listed in Table 4, below.

HOW TO ORDER SPARE PARTS

Select the needed parts from the spare parts list given below. Specify the drive's model / serial number (example: 14-109-031891-01-02) given on the nameplate to allow the factory to verify the part selection. Parts may be ordered by mail, telephone or fax, with the confirming order sent to the factory (see back cover).

TABLE 4: RECOMMENDED SPARE PARTS

DESCRIPTION	PART NO.	DESCRIPTION	PART NO.
Switch assembly	20-3202-20	Motor capacitor	See Table 5, below
Auxiliary switch assembly (2 switches) (4 switches)	 20-3202-21 20-3202-22	Fuse, 7A, 125V DCM-H Board	11-1373-01 22-5009-XX--See Table 2, page 8, for part no. based on output signal
Gasket set	20-3110-13		
Control motor	See Table 5, below	CPS-2	20-3400-09
Motor resistor	See Table 5, below	SLM Friction Kit	See Table 3, page 47

TABLE 5: MOTORS, CAPACITORS, AND RESISTORS

MODEL NO.	MOTOR PART NO.	FREQ. (HZ)	CAPACITOR PART NO.	VALUE	RESISTOR ASSEMBLY PART NO.	VALUE	USE ONLY WITH TIMING ...
14-100	20-2702-21, -31	60	14-2840-16	5 µf	20-1971-13	220Ω	10 sec. or higher
		50	14-2840-19	7 µf	20-1971-13	220Ω	10 sec. or higher
14-100	20-2703-21, -31	60	14-2840-05	8 µf	20-1971-12	110Ω	10 sec. or higher
		50	14-2840-06	10 µf	20-1971-12	110Ω	10 sec. or higher
14-100	20-2703-24, -34*	60	14-2840-05	8 µf	20-1971-12	110Ω	8 sec. or lower
		50	14-2840-06	10 µf	20-1971-12	110Ω	8 sec. or lower
14-200	20-2703-35	60	14-2840-17	15 µf	20-1971-11	55Ω	All
		50	14-2840-17 14-2840-09	15 µf 6 µf	20-1971-11	55Ω	All

*Note: It is necessary to install a gear housing spacer with these modules.

TABLE 6: GEARS

MODEL NUMBER	SPUR GEARING RATIO / 1	NOMINAL SPEED SEC. / IN.		GEAR HOUSING ASSEMBLY
		60 Hz 72 RPM	50 Hz 60 RPM	
14-100	4.14	4	5	10-6670-36
	7.90	8	10	10-6670-26
	10.65	11	13	10-6670-24
	15.70	16	19	10-6670-13
	25.90	27	31	10-6670-23
	45.80	48	57	10-6670-07
14-200	15.61	16	20	10-6670-54
	22.86	24	29	10-6670-55

APPENDIX *COMPONENTS*

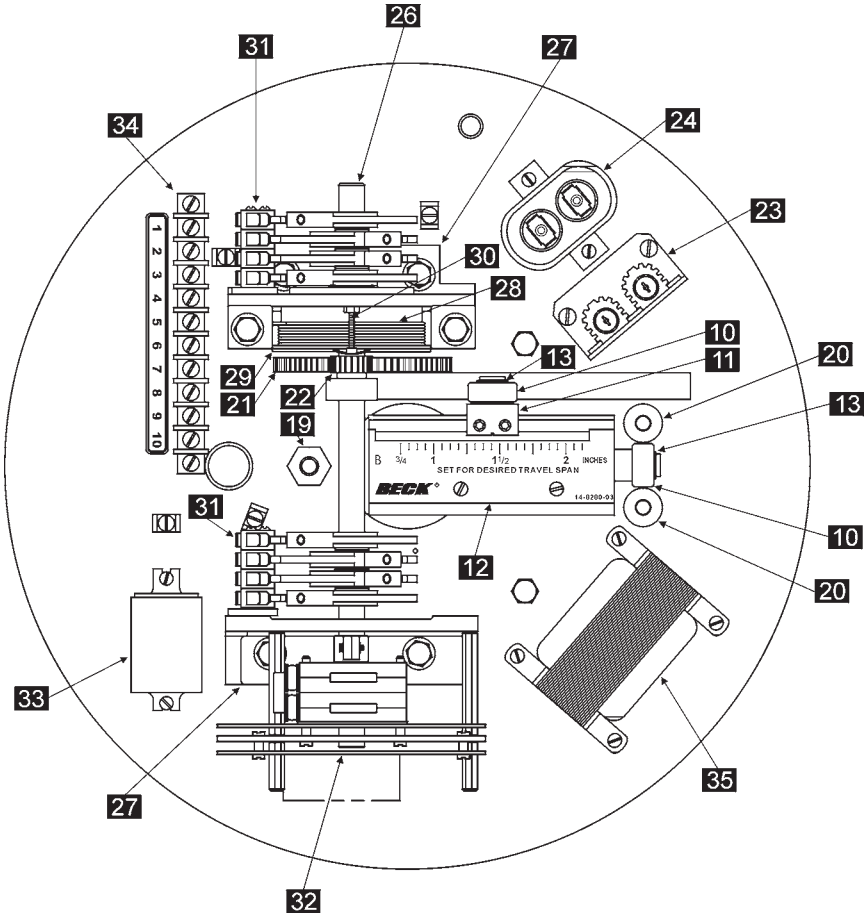
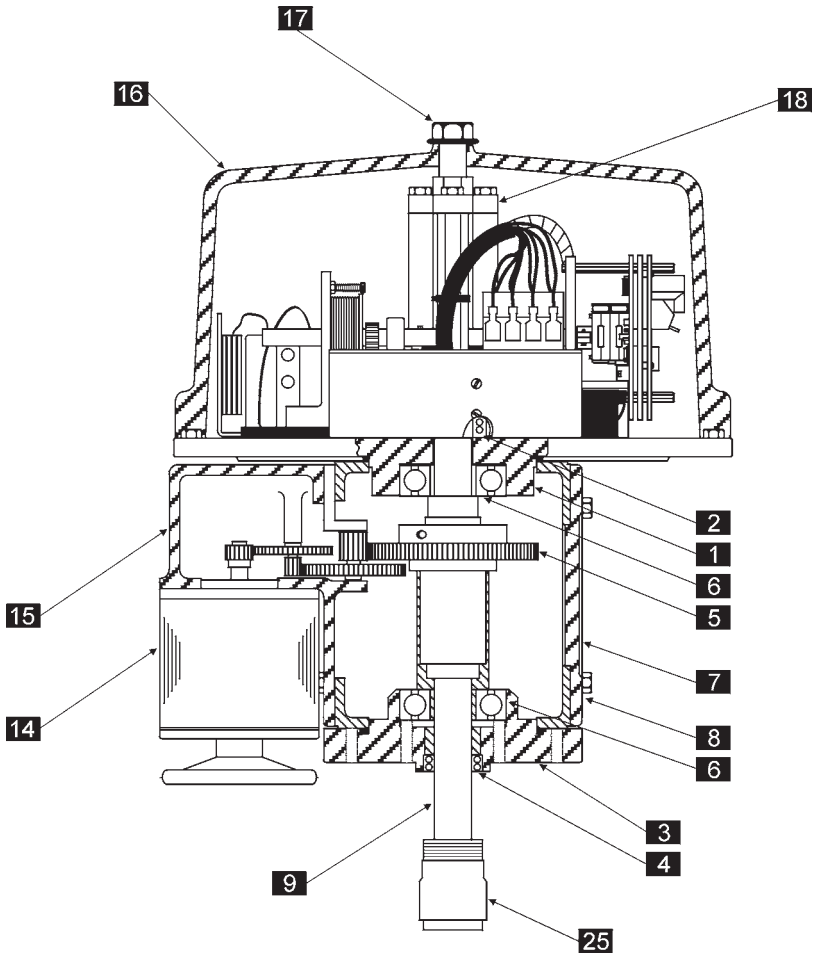


TABLE 7:
PARTS FOR MODEL 14-100 CONTROL ASSEMBLY AND DRIVE TRAIN

ITEM NO.	DESCRIPTION	ITEM NO.	DESCRIPTION
1	Top bearing plate with bushing and seals	18	Top bar
2	Seal for top bearing plate	19	Hex stud
3	Bottom bearing plate with bushing and seals	20	Guide bar (2)
4	Seal for bottom bearing plate	21	Sector-lever gear assembly
5	Maingear assembly	22	Pinion
6	Mainshaft bearing	23	Resistor; select from Table 5
7	Cover plate	24	Capacitors; select from Table 5
8	Cover plate gasket	25	Tight-seater
9	Shaft assembly	26	Shaft
10	Ball bearing (2)	27	Bracket (2)
11	Calibar slider	28	Spring
12	Calibar index	29	Mandrel
13	Retaining ring (2)	30	Switch shaft indicator
14	Motor assembly; select from Table 5 (sold only as complete assembly)	31	Switches; see Table 4
		32	CPS
15	Gear housing assembly; select from Table 6 (sold only as complete assembly)	33	Double-pole, double-throw relay (optional)
		34	Auxiliary terminal strip
16	Top cover with gasket	35	Transformer (50 Hz drive only)
17	Top cover bolt		

Note: To ensure exact replacement parts, include all nameplate data of the Beck drive with the order.



CONTROL ASSEMBLY AND DRIVE TRAIN

APPENDIX *COMPONENTS*

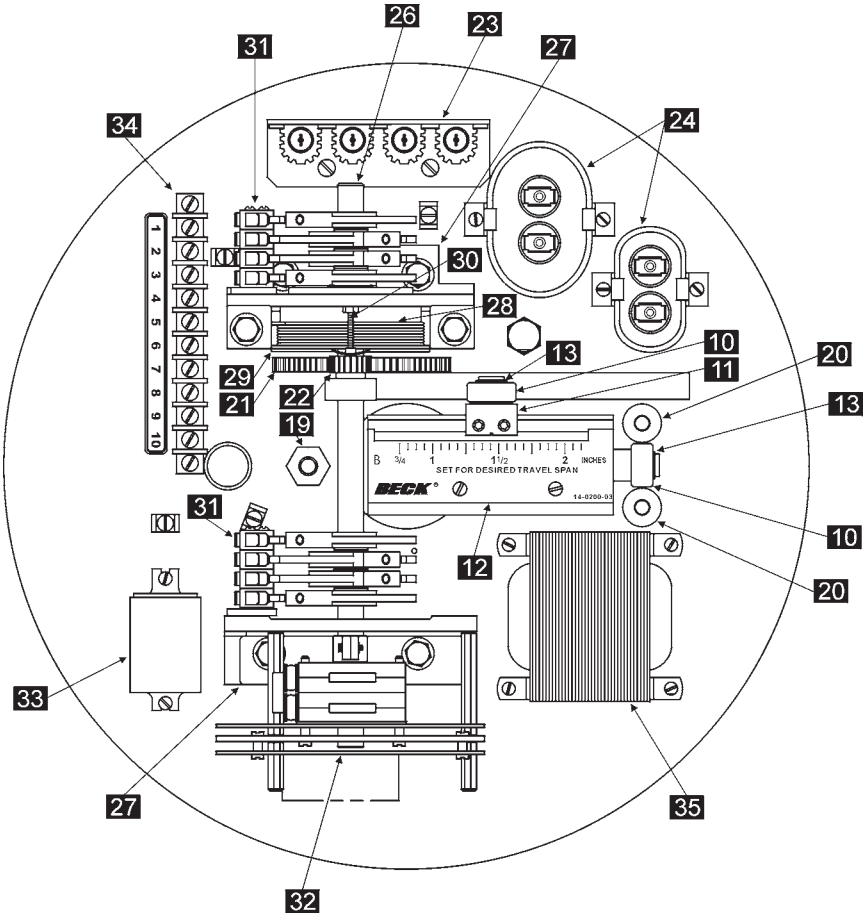
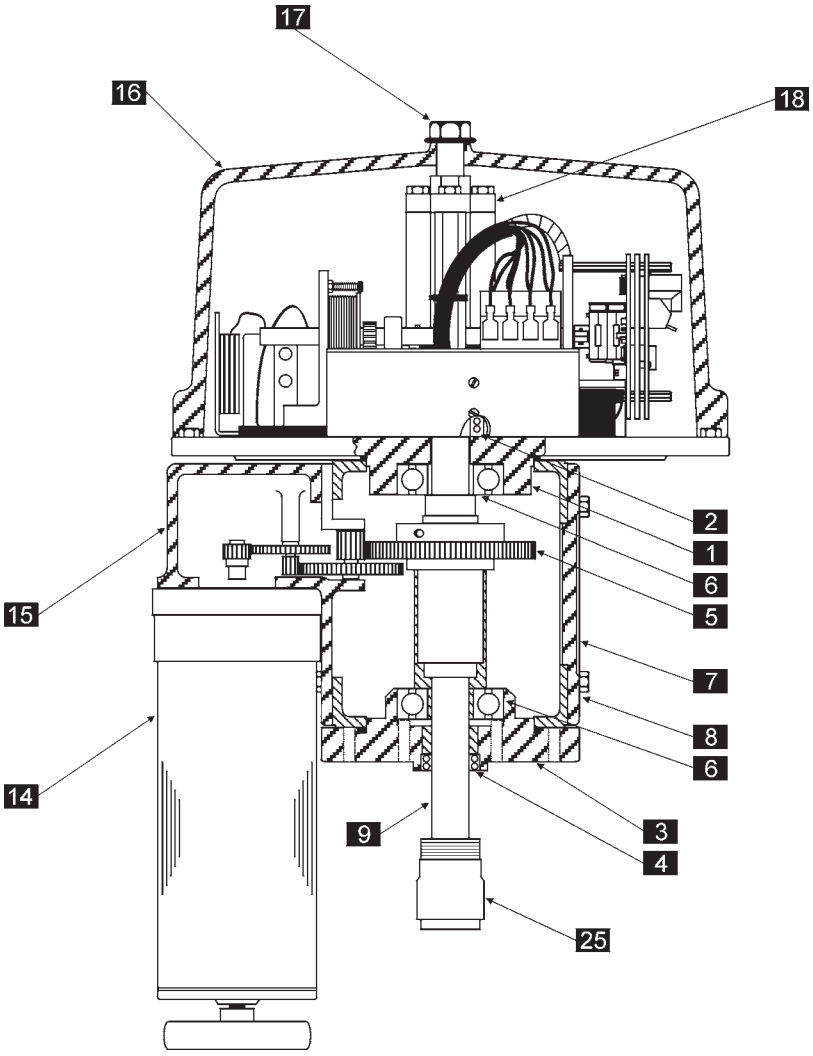


TABLE 8:
PARTS FOR MODEL 14-200 CONTROL ASSEMBLY AND DRIVE TRAIN

ITEM NO.	DESCRIPTION	ITEM NO.	DESCRIPTION
1	Top bearing plate with bushing and seals	18	Top bar
2	Seal for top bearing plate	19	Hex stud
3	Bottom bearing plate with bushing and seals	20	Guide bar (2)
4	Seal for bottom bearing plate	21	Sector-lever gear assembly
5	Maingear assembly	22	Pinion
6	Mainshaft bearing	23	Resistor; select from Table 5
7	Cover plate	24	Capacitors; select from Table 5
8	Cover plate gasket	25	Tight-seater
9	Shaft assembly	26	Shaft
10	Ball bearing (2)	27	Bracket (2)
11	Calibar slider	28	Spring
12	Calibar index	29	Mandrel
13	Retaining ring (2)	30	Switch shaft indicator
14	Motor assembly; select from Table 5 (sold only as complete assembly)	31	Switches; see Table 4
		32	CPS
15	Gear housing assembly; select from Table 6 (sold only as complete assembly)	33	Double-pole, double-throw relay (optional)
		34	Auxiliary terminal strip
16	Top cover with gasket	35	Transformer (50 Hz drive only)
17	Top cover bolt		

Note: To ensure exact replacement parts, include all nameplate data of the Beck drive with the order.



CONTROL ASSEMBLY AND DRIVE TRAIN

NOTES

SERVICES

PRODUCT DEMONSTRATIONS

Each of Beck's Sales Engineers has access to a complete set of drive models so that he can demonstrate virtually any of their features at your location. In order to arrange to see a Beck drive in your plant or office, contact Beck's Sales Department.

SITE SURVEYS

Beck Sales Engineers are available to discuss your process control requirements. Often a visit to your location is the best way to gain a thorough understanding of your needs, in order to meet them most accurately and completely.

Mounting hardware, torque requirements, linkage, control signal information, and optional equipment can be analyzed most effectively at the worksite. Beck's analysis at the jobsite can help ensure that specifications are accurate, especially in the case of complex applications.

APPLICATION REVIEWS

By sharing your needs with a Beck Sales Engineer you can take advantage of the best application advice for the type of control you need. This review will yield a better understanding of the versatility of Beck drives for your installations, as well as complete details on options and accessories to make the process as effective as possible.

SPECIFICATION WRITING

Beck provides specification writing assistance in order to help you specify and order the right drives for your applications. Beck Sales Engineers will work with you to make it easier for you to obtain the proper equipment and give you confidence that no details are overlooked.

HOW TO OBTAIN SERVICE

Factory repair of drives or subassemblies is available for both normal and emergency service. To assure prompt processing, contact the factory to receive a Returned Material Authorization (RMA) number. If a repair estimation is desired, please send the name and phone number of your contact for service authorization. It is helpful to include a description of the work desired with the shipment or, in the event of a problem, the malfunction being experienced.

THREE YEAR LIMITED WARRANTY STATEMENT

Harold Beck & Sons, Inc. (Beck) warrants that our equipment shall conform to Beck's standard specifications. Beck warrants said equipment to be free from defects in materials and workmanship. This warranty applies to normal recommended use and service for three years from the date on which the equipment is shipped. Improper installation, misuse, improper maintenance, and normal wear and tear are not covered.

The Buyer must notify Beck of any warranty issues within 37 months of original shipment date and return the goods in question, at Buyer's expense, to Beck for evaluation. If the product fails to conform to the warranty, Beck's sole obligation and the Buyer's exclusive remedy will be: 1) the repair or replacement, without charge, at Beck's factory, of any defective equipment covered by this warranty, or 2) at Beck's option, a full refund of the purchase price. In no event will Beck's liability exceed the contract price for the goods claimed to be defective.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER EXPRESS OR IMPLIED WARRANTY, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL OTHER OBLIGATIONS OR LIABILITIES OF BECK. In no case shall Beck be liable for any special, incidental or consequential damages based upon breach of warranty, breach of contract, negligence, strict tort, or any other legal theory. Such damages include, but are not limited to, loss of profits, loss of revenue, loss of use of the equipment or any associated equipment, cost of capital, cost of any substitute equipment, facilities or service, downtime, the claims of third parties including customers and injury to property.

Buyer acknowledges its responsibilities under OSHA, related laws and regulations, and other safety laws, regulations, standards, practices or recommendations that are principally directed to the use of equipment in its operating environment. Buyer acknowledges that the conditions under which the equipment will be used, its use or combination with, or proximity to, other equipment, and other circumstances of the operation of such equipment are matters beyond Beck's control. **Buyer hereby agrees to indemnify Beck against all claims, damages, costs or liabilities (including but not limited to, attorney's fees and other legal expenses), whether on account of negligence or otherwise, except those claims based solely upon the negligence of Beck and those claims asserted by Beck's employees which arise out of or result from the operation or use of the equipment by Beck's employees.**

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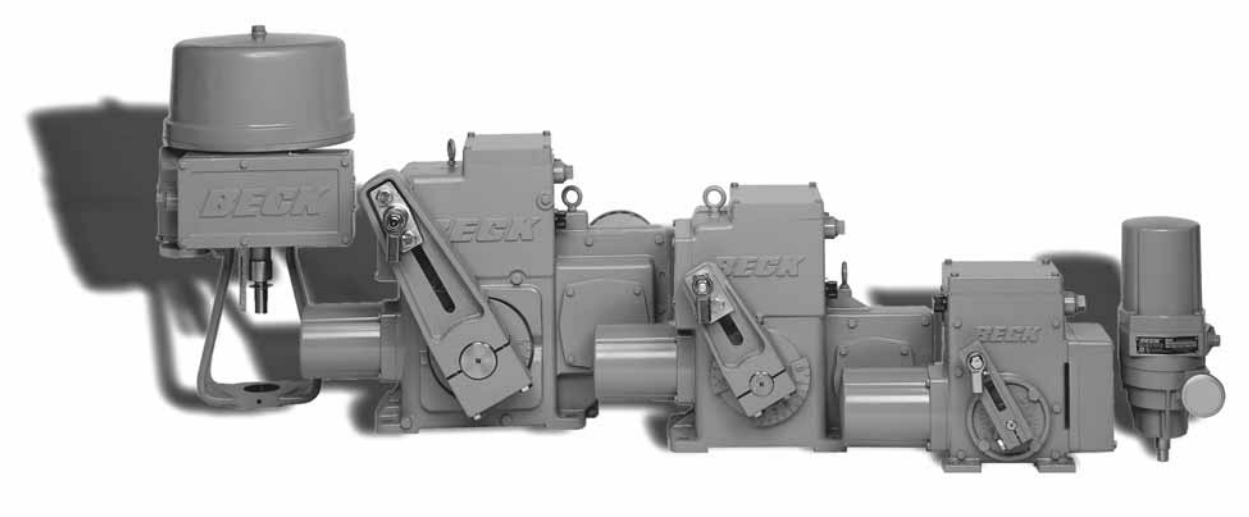
Beck Control Drives are covered by the following patents: 3,667,578; 4,690,168; and 6,563,412 with other patents pending.



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