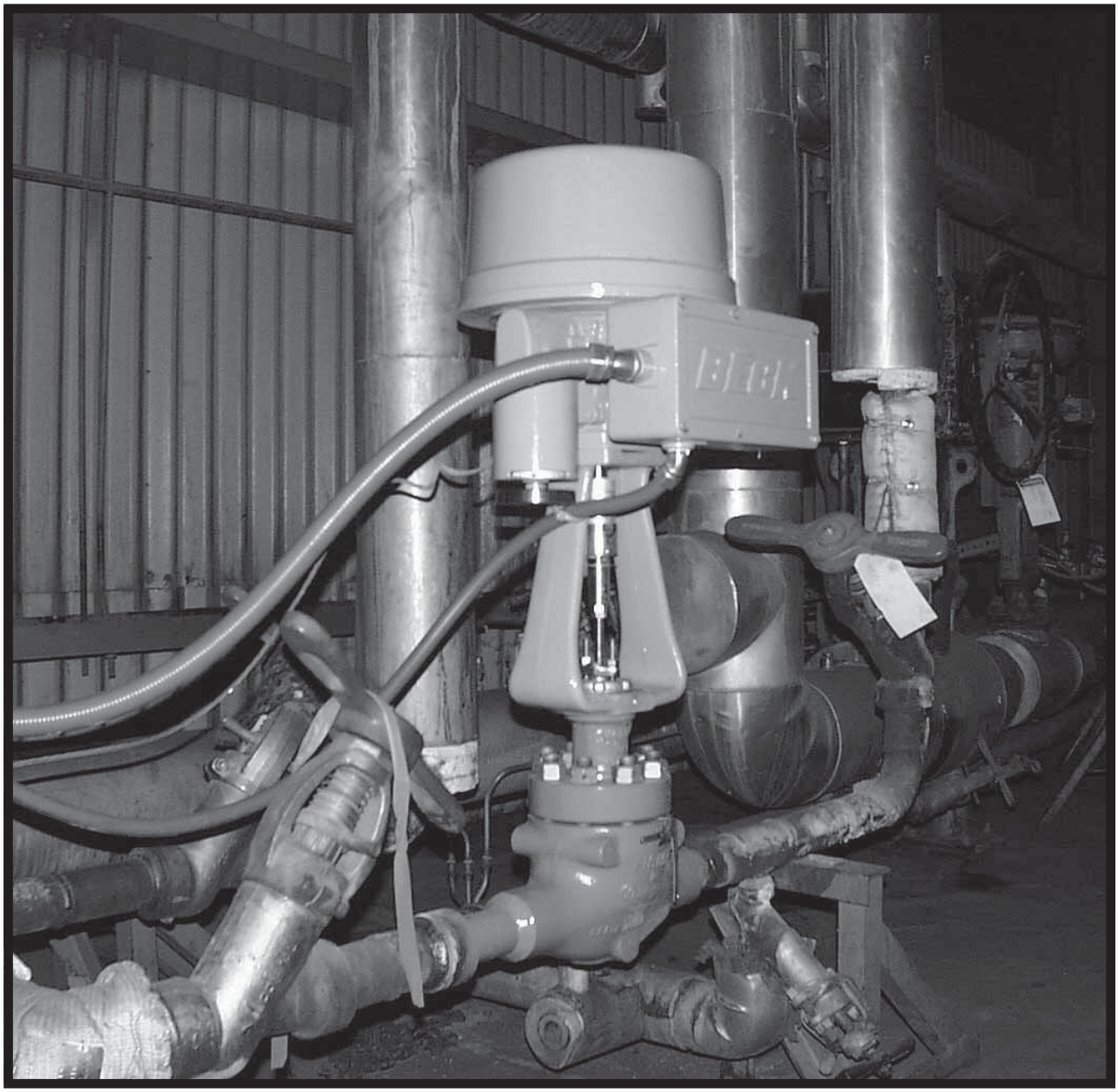
80-1402-03
Rev. 01

MODELS 14-109
14-209

BECK®

INSTRUCTION MANUAL



ELECTRIC ACTUATORS FOR INDUSTRIAL PROCESS CONTROL

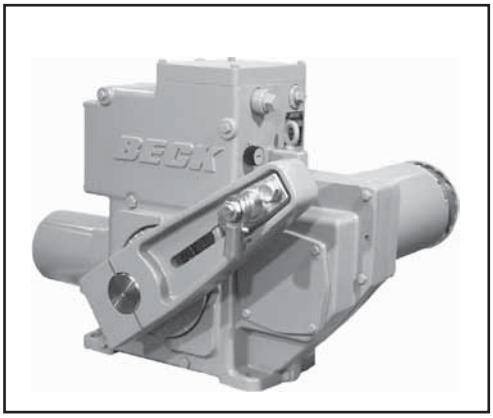
INTRODUCTION TO THE MANUAL

This manual contains the information needed to install, operate and maintain Beck Model Group 14 Electronic Control Drives equipped with the Digital Control Module (DCM-2), 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 provides intelligent calibration, easy drive setup changes, and diagnostic information. The DCM-2 also 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.

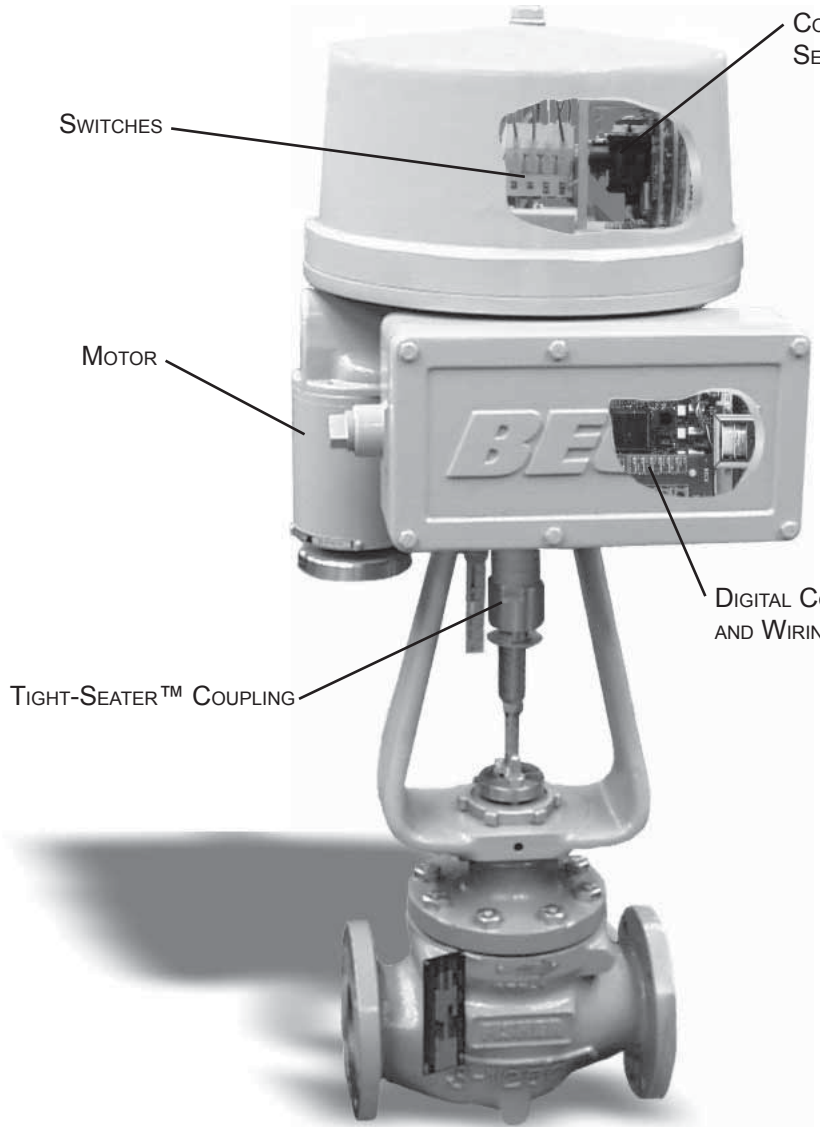
TYPICAL APPLICATIONS

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 on opposite page for thrust and timing options.

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	



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 14-209	.56 A 1.5 A	72 W 180 W	.33 A .86 A	80 W 210 W	

Operating Conditions	-40° to 185°F (-40° to 85°C) 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.
Step Size	0.15% typical (configurable).
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 (Optional)	If the motor tries to run in one direction for more than 300 seconds, the DCM-2 will shut off power to the motor. Time to stall indication is configurable from 30 to 300 seconds (feature can be enabled/disabled).
Alarm Annunciation	Available at terminal E.
Temperature Indication	Measures the internal temperature of the drive and triggers an alarm when the temperature exceeds the rating range.

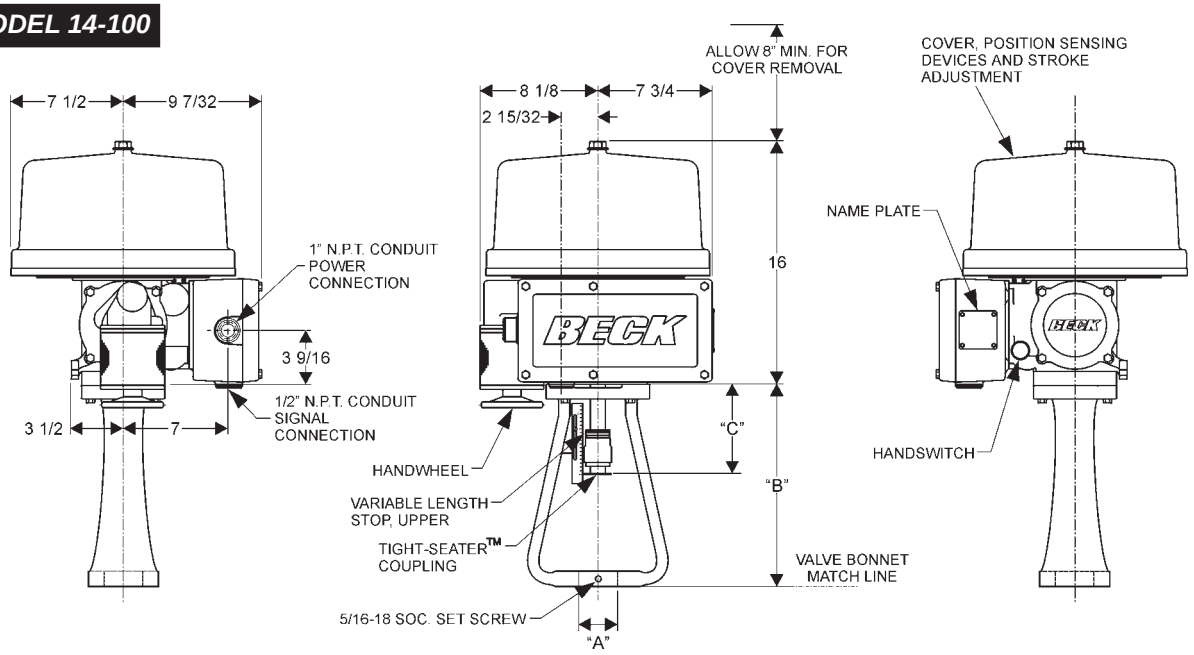
GENERAL SPECIFICATIONS (cont'd)

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.

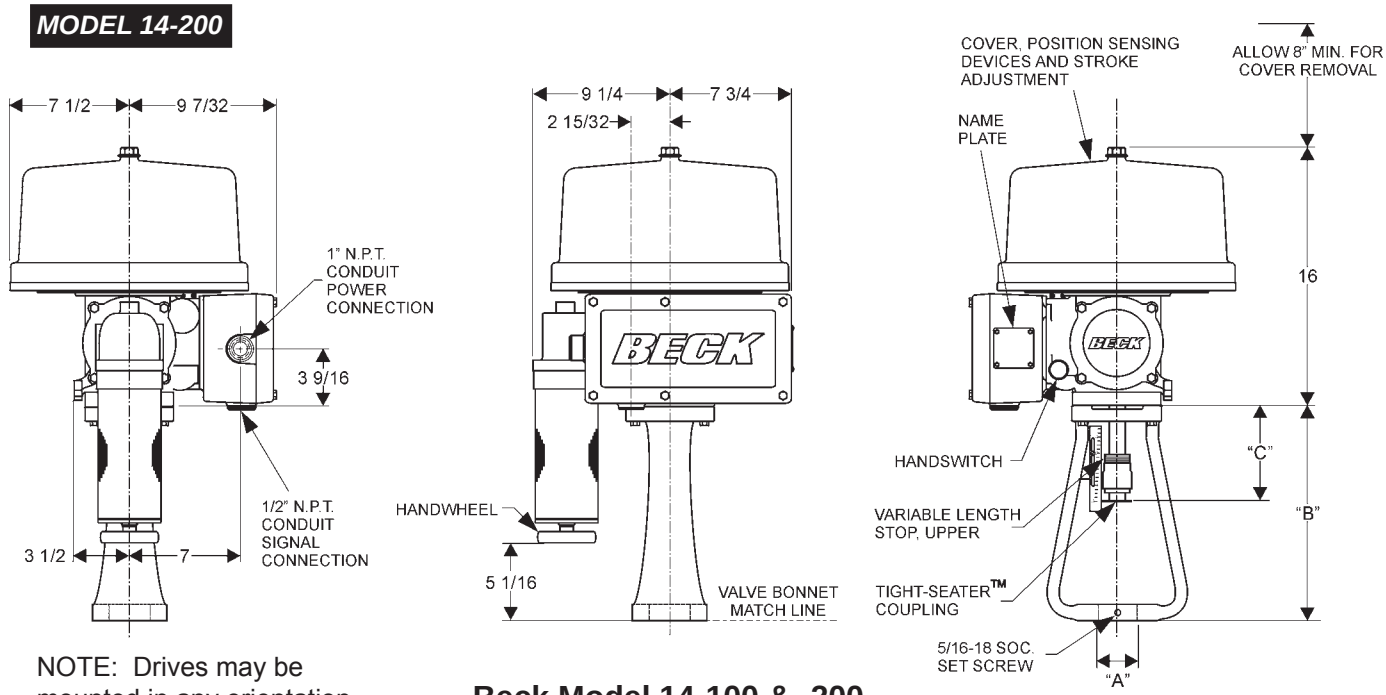
OUTLINE DIMENSION DRAWINGS

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

MODEL 14-100



MODEL 14-200



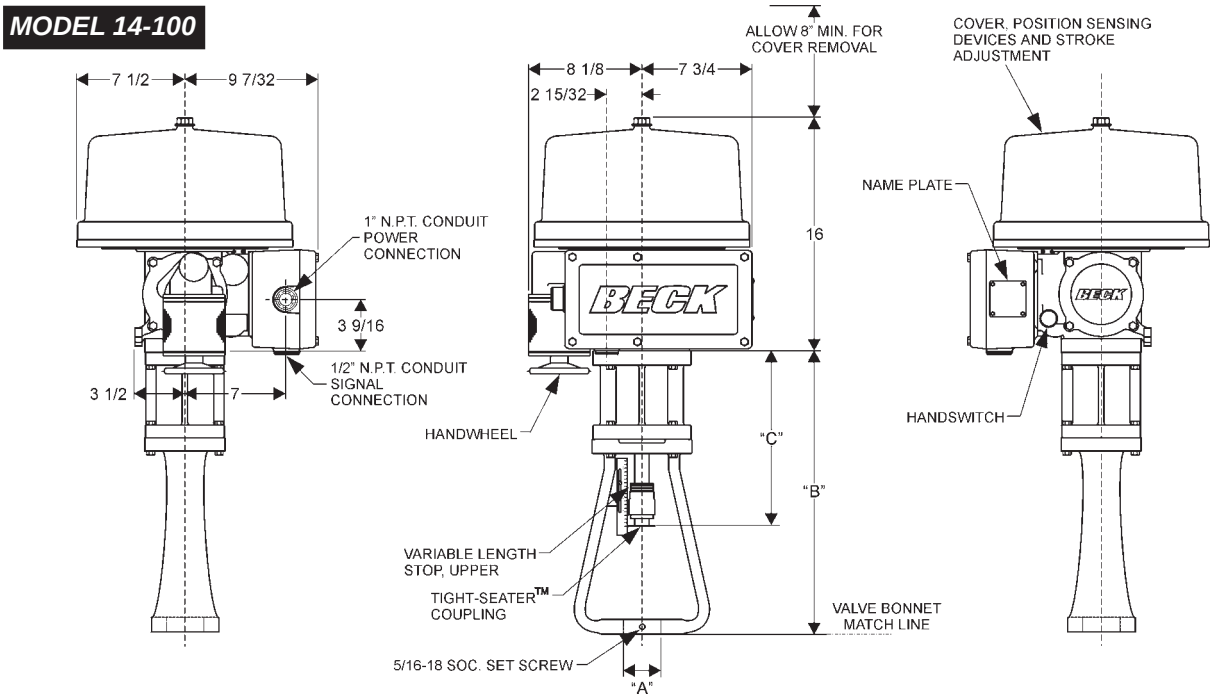
NOTE: Drives may be mounted in any orientation.

Beck Model 14-100 & -200

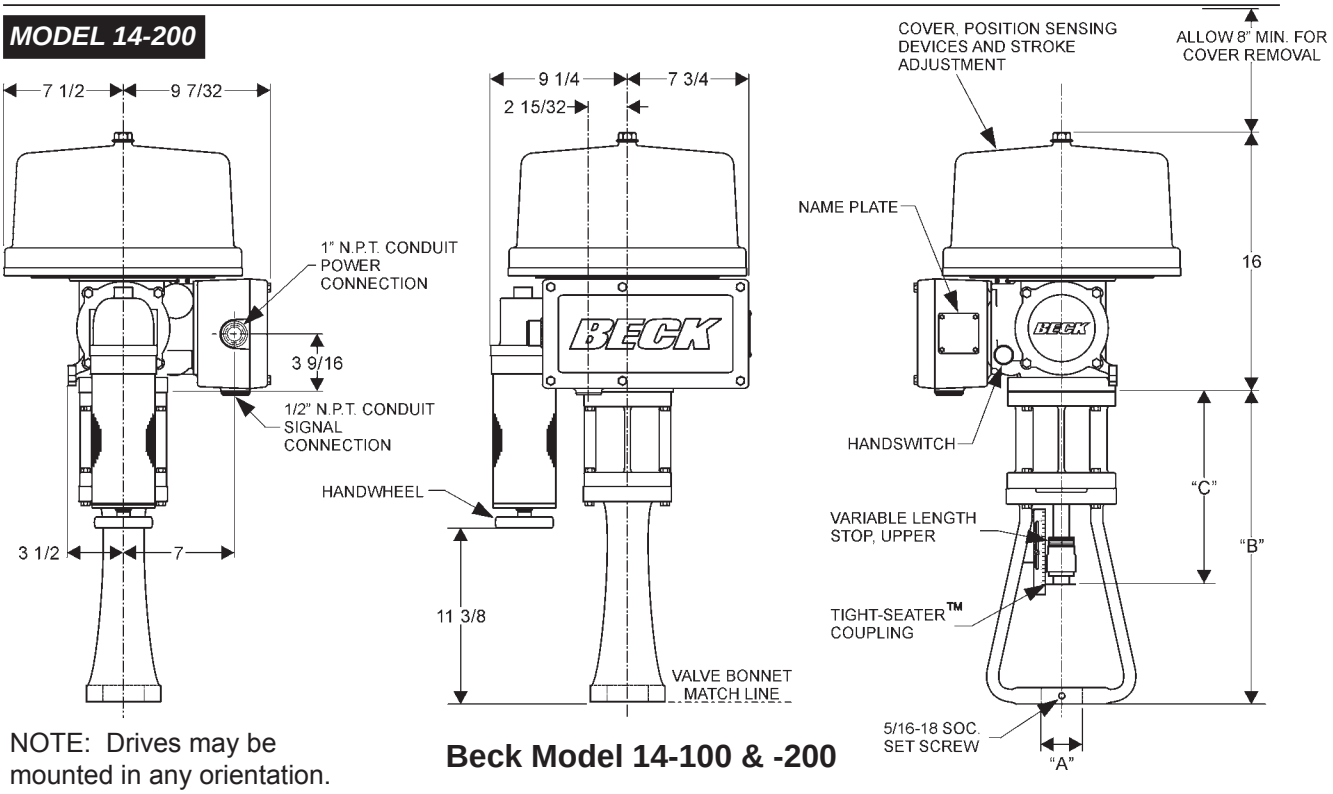
Beck Drive Model No.	Drive Shaft Travel Range In.	"A" Valve Boss Dia. Range In.	"B" Yoke Height In.	"C" Nominal Drive Shaft Extension In.	Max. Valve Stem Extension (Valve Stem Retracted) In.	Approx. Weight Lbs.
14-100	5/16 - 1 3/4	1 - 2 5/8	8	4 3/16	5 1/2	80
	3/4 - 2 1/8	1 3/8 - 3 3/4	13 1/2	6	9 1/4	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 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 are for use by qualified personnel only. To avoid injury and electric shock, do not perform any servicing not described in this manual.

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

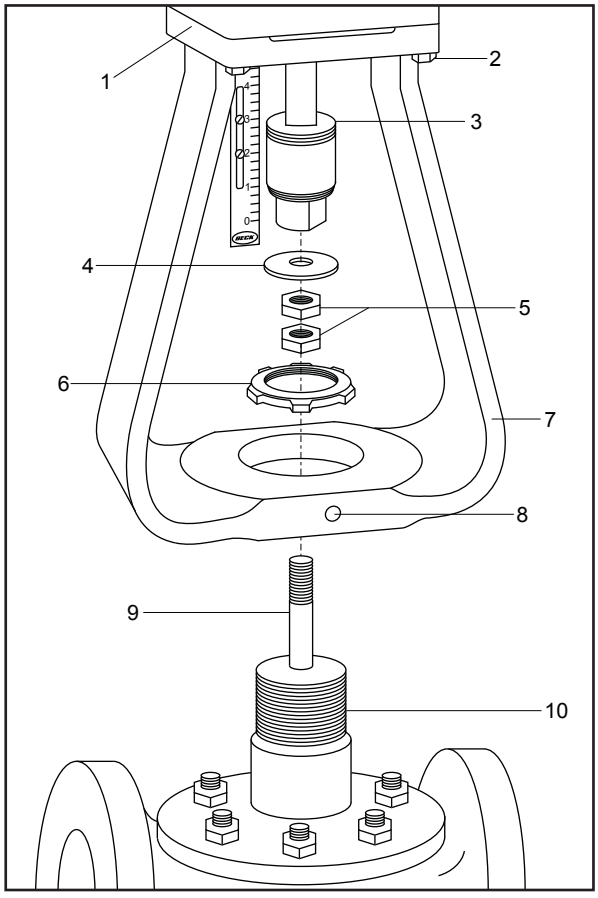
Whenever a control drive is being mounted on a valve, it is good practice to remove the valve from service. Observe the following precautions:

- **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.



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 13 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 12).

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.

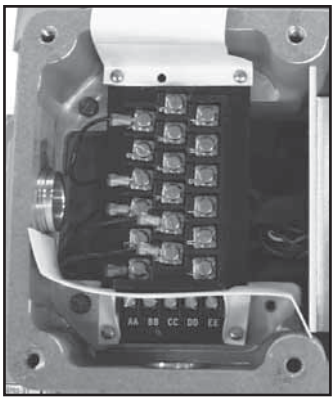
Your Beck drive has been supplied to match the signal source in your control loop. If it does not match, the input signal range is convertible by adding or removing a 250 ohm resistor—contact the factory for details.

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.

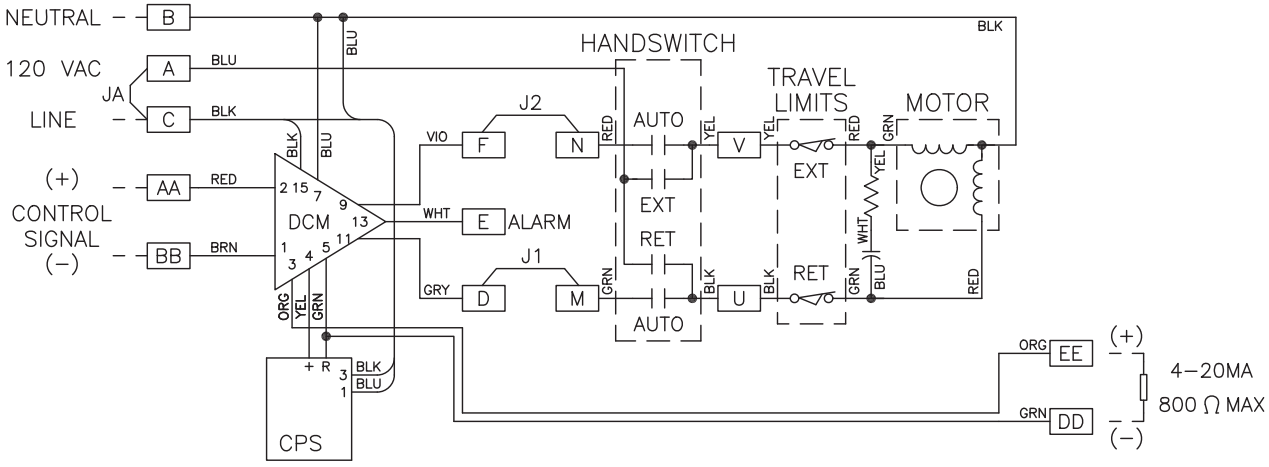
INSTALLATION *Signal Wiring*

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 21.



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 27).

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.

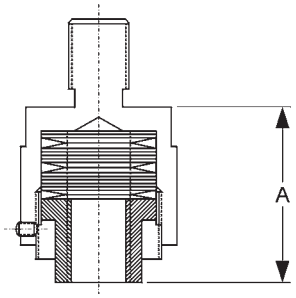
TIGHT-SEATER™

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-2 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.

LOSS OF DEMAND INPUT SIGNAL (L.O.S.)

When the Demand input signal drops to approximately –5%, the DCM-2 considers the Demand input signal to be invalid. DCM-2s are typically configured to stop the drive during L.O.S. conditions, but may be configured by the factory or by using the HART or Serial interface to run the drive to a predetermined position. Under the L.O.S. condition, the “STAT” and “DEMAND” LEDs will light. When the input signal is corrected, the drive will automatically resume normal operation. The value for LOS activation is configurable using the HART (see page 44) or Serial interface (see page 64). Alarm indication is available at terminal E.

POSITION: CONTACTLESS POSITION SENSOR (CPS)

The CPS provides the DCM-2 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-2 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. A 4–20 mA position feedback signal is available for remote position indication (see page 12). If the CPS Position signal to the DCM-2 is out of the calibrated range limits, the "STAT" and "POSITION" LEDs will light and the drive will not operate until the limits are adjusted or the CPS is corrected. Alarm indication is available at terminal E.

STALL PROTECTION AND ANNUNCIATION

If the drive output shaft cannot reach a desired position within approximately 300 seconds, the DCM-2 shuts off power to the motor and the “STAT” and “STALL” LEDs will light. The stall condition timing is factory configurable (or configurable using the HART or Serial interface) from 300 seconds to as low as 30 seconds and is initially set according to the specification at time of order.

A sensed stall condition is cleared by either reversing the Demand input signal from the controller (such that the drive tries to run in the direction opposite the blocked direction), performing a "Reset Stall" or "Board Reset" using the HART interface (see page 38), or by switching the drive power off and on. Alarm indication is available at terminal E.

TEMPERATURE

DCM-2s are equipped with a temperature sensing circuit. The “STAT” and “TEMP °F” LEDs will light when the drive’s ambient temperature exceeds the rating of the drive. Specific temperature readings are available using the HART (see page 36) or Serial (see page 66) interface. Alarm indication is available at terminal E.

FEEDBACK SIGNAL

The feedback sourcing module provides a 4–20 mA analog output signal that represents the drive output shaft position in terms of 0–100% of full travel (configurable via the HART (see page 51) or Serial (see page 65) interface). This signal can be remotely monitored or used by a controller or indicator. The “STAT” and “FB OPEN” LEDs will light if the function is enabled and there is no current in the loop. The Feedback signal can be factory configured as disabled, or disabled using the HART (see page 42) or Serial (see page 65) interface. Alarm indication is available at terminal E.

STOP/LIMIT INDICATION

The “STAT” and “STOP/LIMIT” LEDs will light if the Handswitch is in the “STOP” position. These LEDs will also light if the drive is at a limit and is not in balance. Alarm indication is available at terminal E.

DIGITAL CONTROL MODULE (DCM-2)

INPUT: DIGITAL CONTROL MODULE (DCM-2)

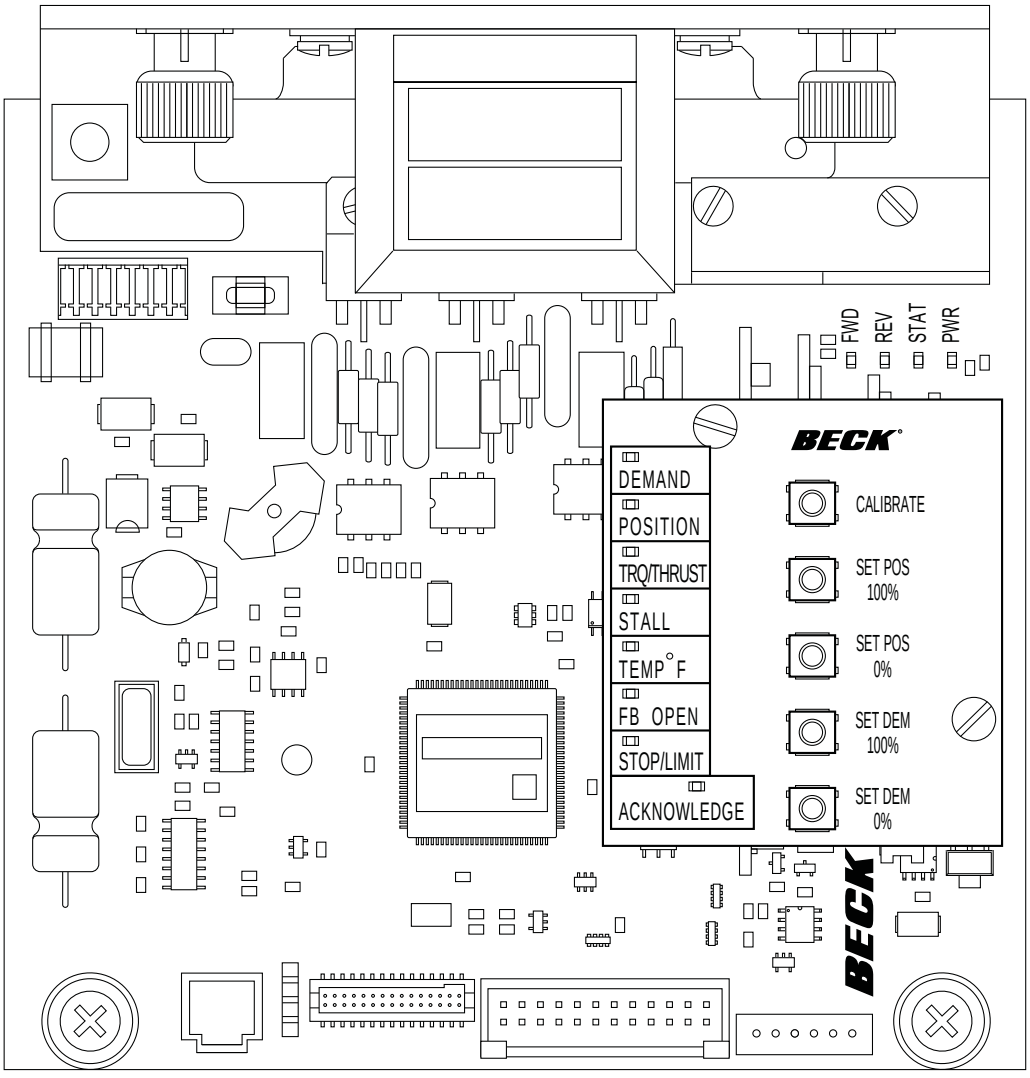
Beck modulating drives are equipped with a precision, Digital Control Module (DCM-2) designed to receive conventional 4–20 mA or 1–5 V dc control signals directly—eliminating the need for contact protection devices, relays, switches and reversing starters.

The DCM-2 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 (85ºC).

The DCM-2 provides intelligent calibration, easy drive setup changes, and diagnostic information. A **Local interface** provides quick pushbutton setup and diagnostics without the need for a handheld or remote device (see page 18). A **HART communications interface** allows remote access of all features and information (see page 32). A **Serial interface** also allows for drive configuration changes, drive information reporting and to assist in troubleshooting (see page 60).

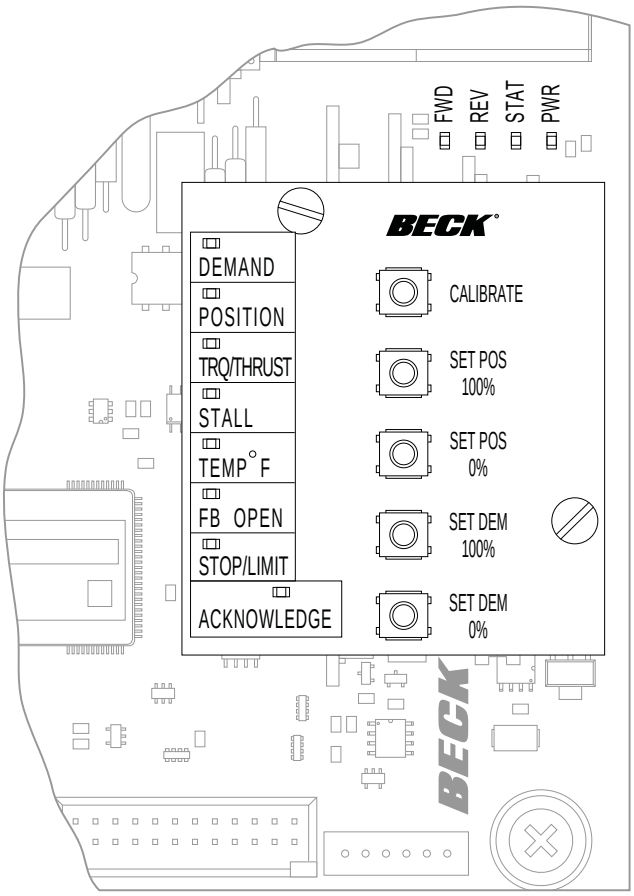
The DCM-2 permits two or more Beck drives to be operated by a single signal source. See pages 25 and 52 for details on split range operation.

A square function is available to position the drive's output shaft proportionally to the square of the input signal. This function is factory configurable (specify at time of order) or may be configured using the HART interface (see page 43) or Serial interface (see page 64).



OVERVIEW

The DCM-2 customer interface panel (pictured below) allows the user to easily calibrate the drive and troubleshoot conditions. The following information provides an overview of the DCM-2 customer interface panel features.



NOTE: Beck drives are shipped from the factory set up and calibrated to customer specifications placed at the time of order and are ready for installation.

Overview LEDs

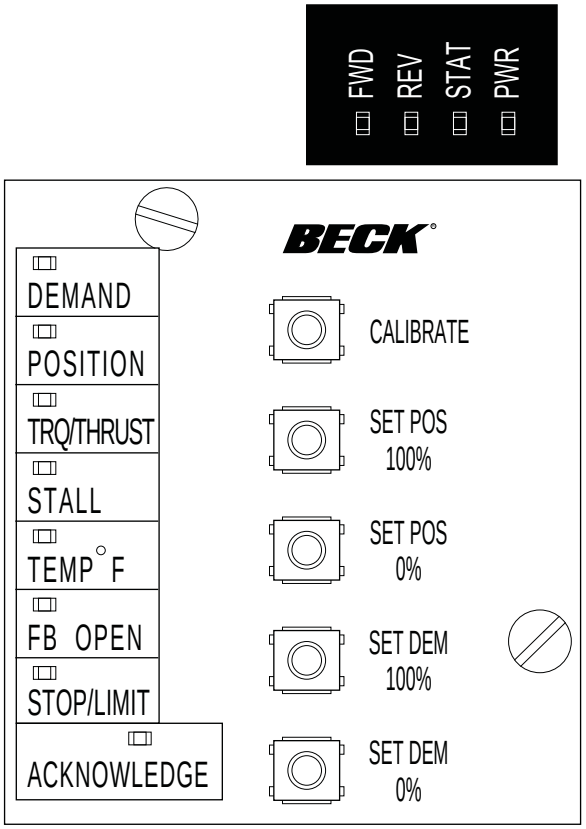
The four LEDs, as highlighted below, indicate the present state of the drive.

FWD
: This LED is lit when the drive is receiving a Demand signal greater than its position.

REV
: This LED is lit when the drive is receiving a Demand signal smaller than its position.

STAT
: This LED is lit when additional status is available. For details regarding possible conditions, see “Status Indication LEDs” on page 19.

PWR
: This LED is lit when power is applied to the drive. This LED pulses from bright to dim indicating the DCM-2 is fully operational.



Status Indication LEDs

When the "STAT" LED is lit, the applicable status indication LED(s) (pictured below) will light to reveal the condition(s) as described below. An alarm is also available at terminal E. When the condition is corrected, the status will automatically reset. Each status LED is described below, with a more detailed explanation of the function provided on page 16.

DEMAND
: Loss of the Demand input signal.

POSITION
: The CPS Position signal to the DCM-2 is out of the calibrated range limits. The lower limit is –5% and the upper limit is 105% of the calibrated range. This LED may also indicate a CPS or internal wiring failure.

TRQ/THRUST
: This LED is inactive for Group 14 drives.

STALL
: The drive is in a stall condition and stall protection has been activated.

TEMP °F.
: Drive's internal temperature is outside of rating.

FB OPEN
: External position Feedback signal is enabled, but not wired to an external load or the wiring has failed between the drive and the monitoring device.

STOP/LIMIT
: Handswitch is in "STOP" position or the drive is at a limit and is not in balance.

Pushbutton Controls

The five pushbuttons (pictured below) on the DCM-2 customer interface panel are used for calibration. When pressing a pushbutton, pressure should be maintained until the "ACKNOWLEDGE" LED lights; this confirms receipt of the pushbutton command. See the Calibration section, beginning on page 20, for further explanation of the calibration procedures. Pushbutton functions are as follows:

CALIBRATE
: A safety feature, this button must be pressed and held while pressing the pushbuttons described below to set the Position and Demand signal limits.

CAUTION

Pressing the following buttons may change calibration and cause the drive to reposition.

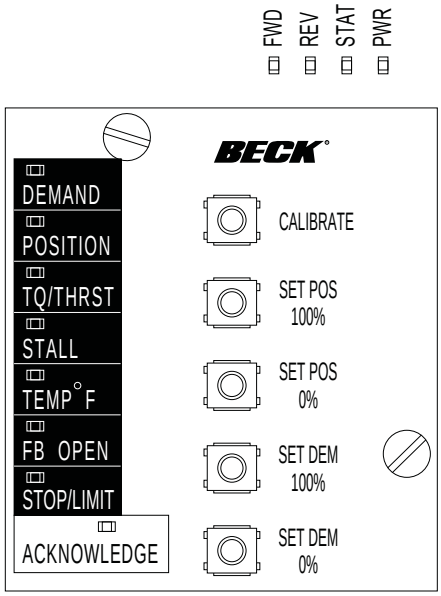
SET POS 100%
: Press to set the desired 100% position for drive movement (this will correspond to a 100% Demand signal).

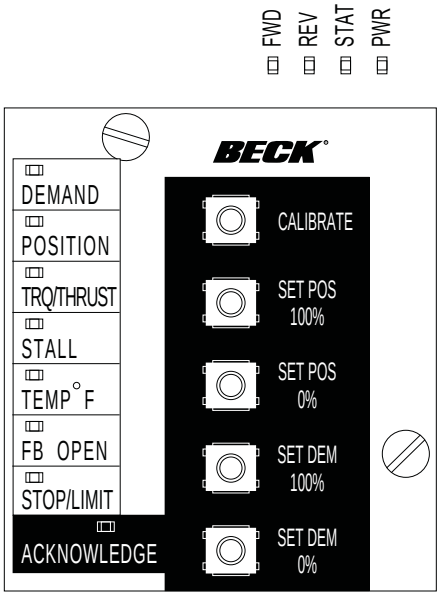
SET POS 0%
: Press to set the desired 0% position for drive movement (this will correspond to a 0% Demand signal).

SET DEM 100%
: Press to set the Demand input signal that corresponds to 100% Demand.

SET DEM 0%
: Press to set the Demand input signal that corresponds to 0% Demand.

Status Indication LEDs





Pushbutton Controls

All Beck drives are shipped completely calibrated to the customer's specifications that were written into the equipment order and are ready to be installed. If the need arises to change the drive calibration, first confirm that the drive is installed as specified and operating properly before proceeding with the change.

Position reference and Demand calibration are performed using the DCM-2 customer interface panel, but may also be configured using the HART or Serial interface. Calibration of over-travel limit and auxiliary switches must be performed using the procedure beginning on page 21.

CALIBRATION PRIORITY

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

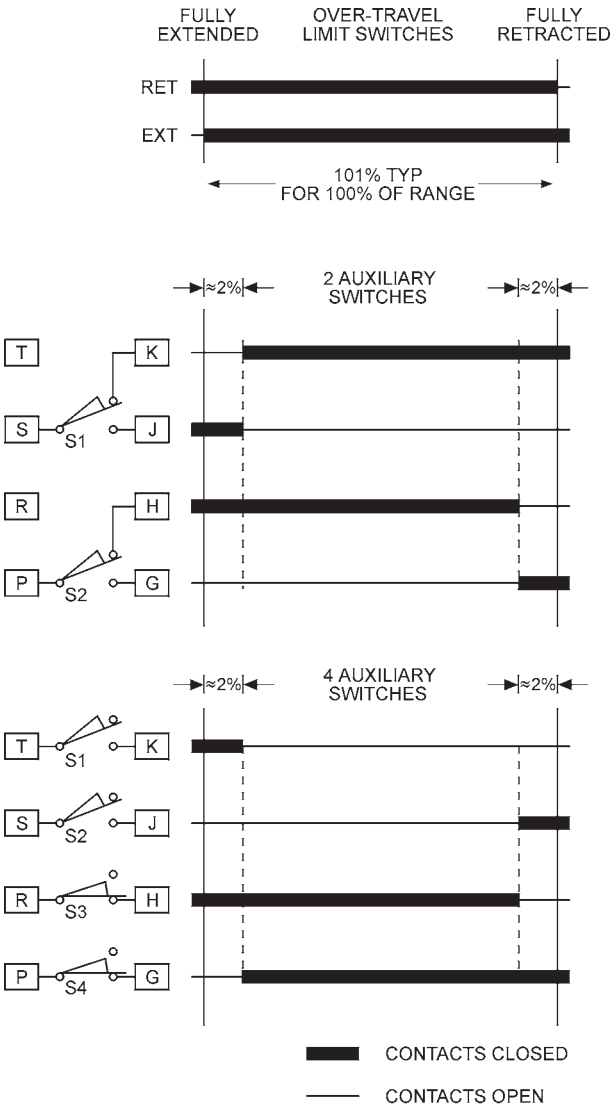
The over-travel limit switches are used to limit the electrical control range of the drive. These switches are cam operated, and are set slightly wider apart than the drive's intended full range of electronic operation. With this range, the limit switch cams are each set inside the mechanical stops, 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 23), the limit switches are simultaneously adjusted.

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.

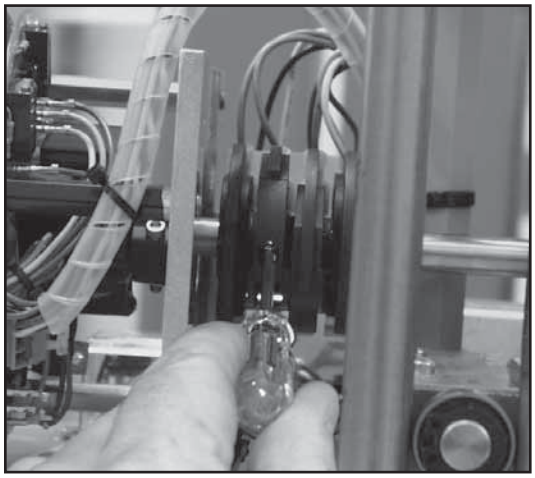
Switches are operated by cams which are clamped onto the control shaft. Setting a switch involves loosening the cam, moving the drive's output shaft to the desired position, and positioning the cam so that it operates the switch at that point. In the following procedure, the use of a continuity meter 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:

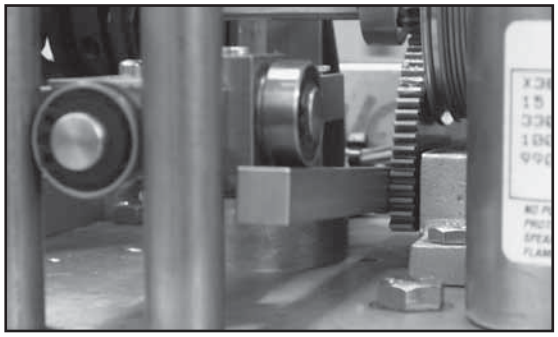


Switch Adjustment

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 on page 21.
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 below for location of lever and bearing plate.



Lever and Bearing Plate

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 21. 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 drive wiring diagram or the diagram on page 12. 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 (see figure, 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, 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 and the Calibar index plate notch should be enlarged to accommodate the adjustment of the Calibar block to the new stroke.

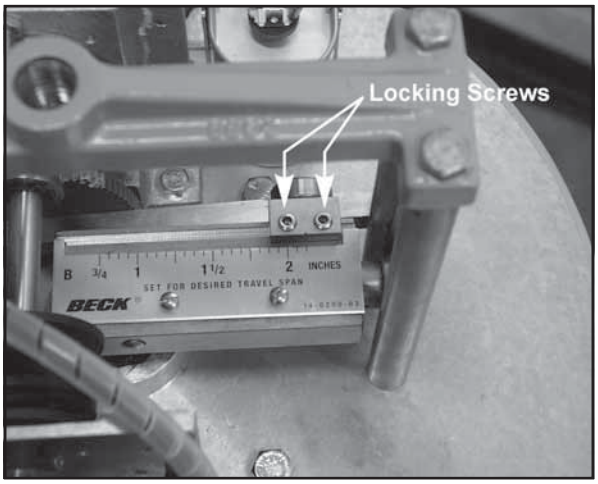
5. Use the Handswitch to operate the drive and check the stroke on the travel index of the valve yoke.
6. Replace the top cover after making adjustments. Tighten the top cover just enough to compress the O-ring seal.

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-2 position reference to match the Calibar setting. See page 26.

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-2 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).



Calibar Block

DEMAND CALIBRATION

DCM-2 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 (see page 25). The input comes calibrated from the factory for the full 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 DCM-2 pushbutton controls (or HART or Serial interface) and a signal source. Following this procedure is only necessary to compensate for slight differences between the signal source calibration and the DCM-2 factory calibration, or if reduced range calibration is desired for special operating scenarios such as split ranging.

Calibration Procedure

1. Remove the DCM-2 cover (1/2" bolt heads).
2. Ensure the Handswitch is in the "STOP" position. This will prevent the drive from repositioning during this procedure.
3. Apply the desired 0% Demand input signal to the drive (e.g., 4 mA for 4–20 mA input). If the drive has not been wired, the Demand input signal is connected at terminals AA (+) and BB (–) as shown in the diagram on page 12.
4. Press and hold the "CALIBRATE" pushbutton on the DCM-2 customer interface panel, then press the "SET DEM 0%" pushbutton until the "ACKNOWLEDGE" LED is lit.*
5. Apply the desired 100% Demand input signal to the drive (e.g., 20 mA for 4–20 mA input).
6. Press and hold the "CALIBRATE" pushbutton on the DCM-2 customer interface panel, then press the "SET DEM 100%" pushbutton until the "ACKNOWLEDGE" LED is lit.*
7. Turn the Handswitch to the "AUTO" position. NOTE: The drive may reposition.
8. Run the drive through its full operating range to ensure proper response to the Demand input signal.
9. Replace the compartment covers and tighten the cover bolts to 10 lb-ft (14 N•m) torque.

* If the "ACKNOWLEDGE" LED does not light, but the "DEMAND" LED does light, the signal is out of acceptable range and was not accepted by the DCM-2. This is typically caused by trying to set 0% and 100% values too close together (i.e., less than 4 mA difference).

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 250 Ohm R11 resistor (see DCM-2 illustration on page 72) must be removed from one of the two drive DCM-2 boards to allow HART® communications. If more than two drives are split ranged, the R11 resistor must be removed from all the DCM-2 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.

To set up a split range operation, follow the steps listed below (see page 19 for location of pushbutton controls).

NOTE: Ensure that the L.O.S. (Loss of Demand input signal) settings of the drives are appropriate for the configuration. See page 16 for information on changing L.O.S. settings.

1. Remove the DCM-2 cover (1/2" bolt heads).
2. Ensure the Handswitch is in the "STOP" position. This will prevent the drive from repositioning during this procedure.
3. Apply the desired 0% Demand input signal to the drive. (Following the example above, the minimum signal for the first drive would be 4 mA. The second drive's minimum signal would be 12 mA). If the drive has not been wired, the Demand input signal is connected at terminals AA (+) and BB (–) as shown in the diagram on page 12.
4. Press and hold the "CALIBRATE" pushbutton on the DCM-2 customer interface panel, then press the "SET DEM 0%" pushbutton until the "ACKNOWLEDGE" LED is lit.*
5. Apply the desired 100% Demand input signal to the drive. (Following the example above, the maximum signal for the first drive would be 12 mA. The second drive's maximum signal would be 20 mA).
6. Press and hold the "CALIBRATE" pushbutton on the DCM-2 customer interface panel, then press the "SET DEM 100%" pushbutton until the "ACKNOWLEDGE" LED is lit.*
7. Repeat this process for the remaining drives to be split-ranged.
8. Run the drive through its full operating range to ensure proper response to the Demand input signal.
9. Replace the DCM-2 cover. Tighten the cover bolts to 10 lb-ft torque.

* If the "ACKNOWLEDGE" LED does not light, but the "DEMAND" LED does light, the signal is out of acceptable range and was not accepted by the DCM-2. This is typically caused by trying to set 0% and 100% values too close together (i.e., less than 4 mA difference).

Square Function

Beck drives can be set up to position the output shaft proportionally to the square of the Demand input signal (see table below). This function is factory configurable, or may be configured using the HART or Serial interface.

Demand Input Signal (mA)	Standard Output (% of Span)	Square Function Actual Output Position (% of Span)
4.0	0	0
5.6	10	1
12.0	50	25
15.2	70	49
18.4	90	81
20.0	100	100

POSITION CALIBRATION

In order to correctly position the drive output shaft in response to the Demand input signal, the DCM-2 receives a position signal from the drive's position sensor and compares this actual position to the Demand input. This process requires that the DCM-2 interprets the position signal appropriately for the full range of desired travel. This procedure will calibrate the DCM-2 to accept the position signal and interpret the appropriate 0–100% range. Note that all drives come factory calibrated and there is no need to recalibrate unless changes in operation are desired.

It is also possible to calibrate the position signal using the HART or Serial interface.

Calibration Procedure

NOTE: Prior to adjusting the travel range electronically (using the DCM-2), it is recommended that the over-travel protection switches be reset just outside the intended travel range (see page 21).

1. Remove the DCM-2 cover (1/2" bolt heads).
2. Position the drive at the desired minimum position (i.e., the desired physical position of the drive's output shaft corresponding to the 0% Demand input signal).
3. Ensure the Handswitch is in the "STOP" position. This will prevent the drive from repositioning during this procedure.
4. Press and hold the "CALIBRATE" pushbutton on the DCM-2 customer interface panel, then press the "SET POS 0%" pushbutton until the "ACKNOWLEDGE" LED is lit.*
5. Position the drive at the desired maximum position (i.e., the desired physical position of the drive's output shaft corresponding to the 100% Demand input signal).
6. Ensure the Handswitch is in the "STOP" position. This will prevent the drive from repositioning during this procedure.
7. Press and hold the "CALIBRATE" pushbutton on the DCM-2 customer interface panel, then press the "SET POS 100%" pushbutton until the "ACKNOWLEDGE" LED is lit.*
8. Optional: Adjust the over-travel limit switches (see page 21) just outside the 0% and 100% limits.
9. Verify that the drive's 0% and 100% positions are correct. If not, repeat this procedure.
10. Replace the compartment cover and tighten the cover bolts to 10 lb-ft torque.

* If the "ACKNOWLEDGE" LED does not light, but the "POSITION" LED does light, the signal is out of acceptable range and was not accepted by the DCM-2.

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.

Changing the direction of output shaft travel is easily accomplished using the DCM-2 customer interface panel (see page 19 for location of push-button controls). Follow the steps below.

1. Remove the DCM-2 cover (1/2" bolt heads).
2. Position the drive at the present 0% position.
3. Press and hold the "CALIBRATE" pushbutton on the DCM-2 customer interface panel, then press the "SET POS 100%" pushbutton until the "ACKNOWLEDGE" LED is lit.*

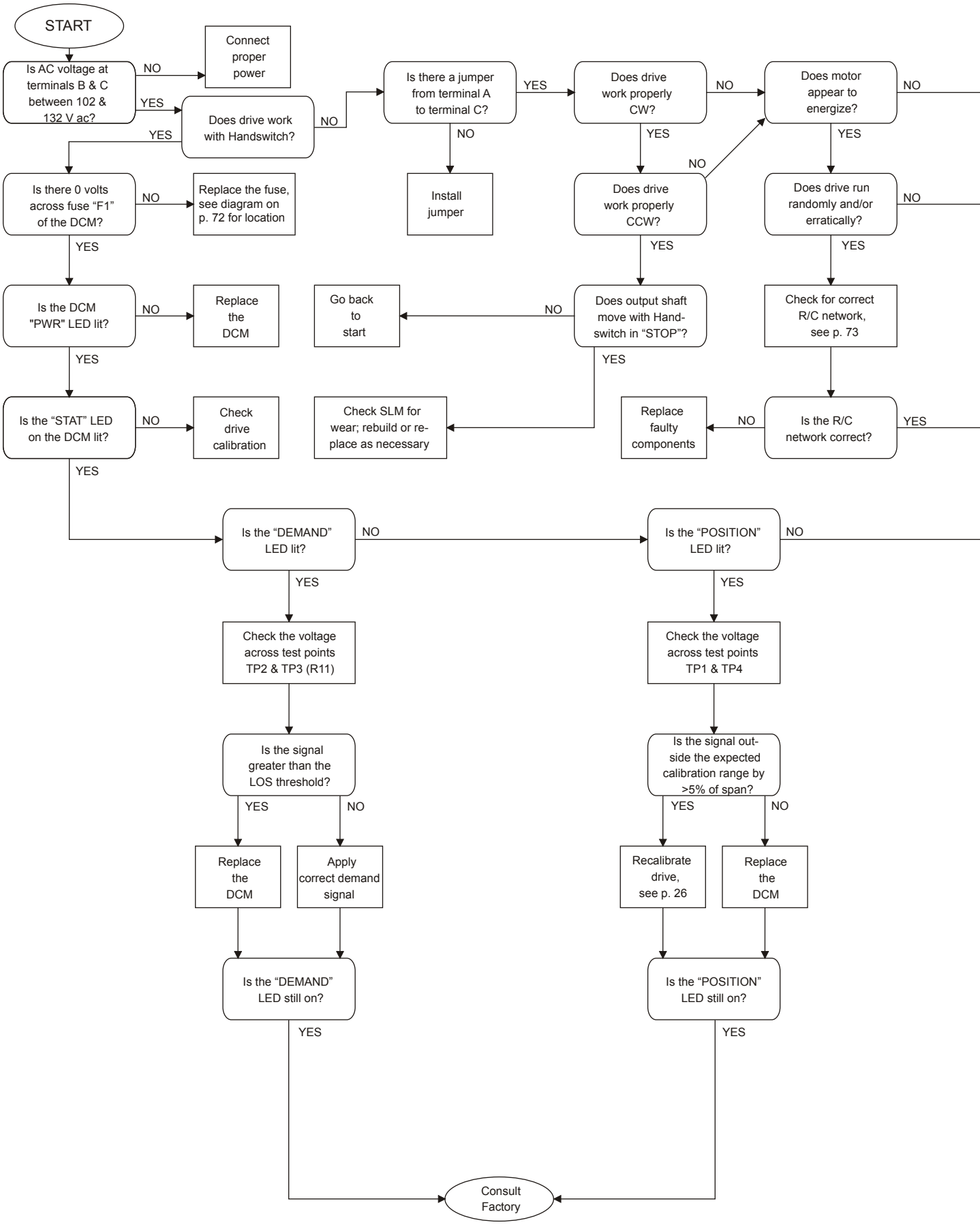
—OR—

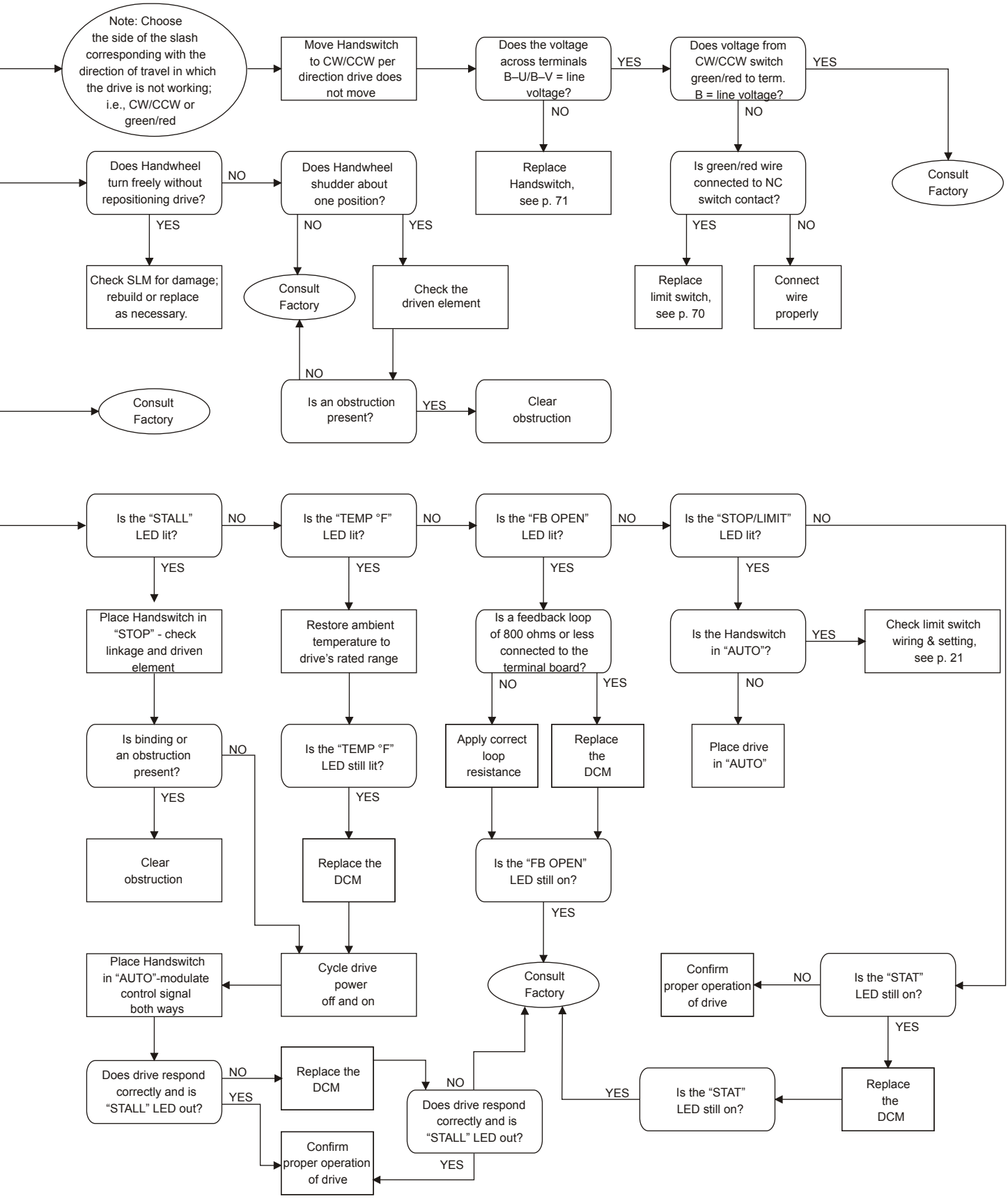
2. Position the drive at the present 100% position.
3. Press and hold the "CALIBRATE" pushbutton on the DCM-2 customer interface panel, then press the "SET POS 0%" pushbutton until the "ACKNOWLEDGE" LED is lit.*
4. Ensure the drive operates as desired.
5. Replace the DCM-2 cover and tighten the cover bolts to 10 lb-ft torque.

* If the "ACKNOWLEDGE" LED does not light, but the "POSITION" LED does light, the position signal is out of acceptable range and was not accepted by the DCM-2.

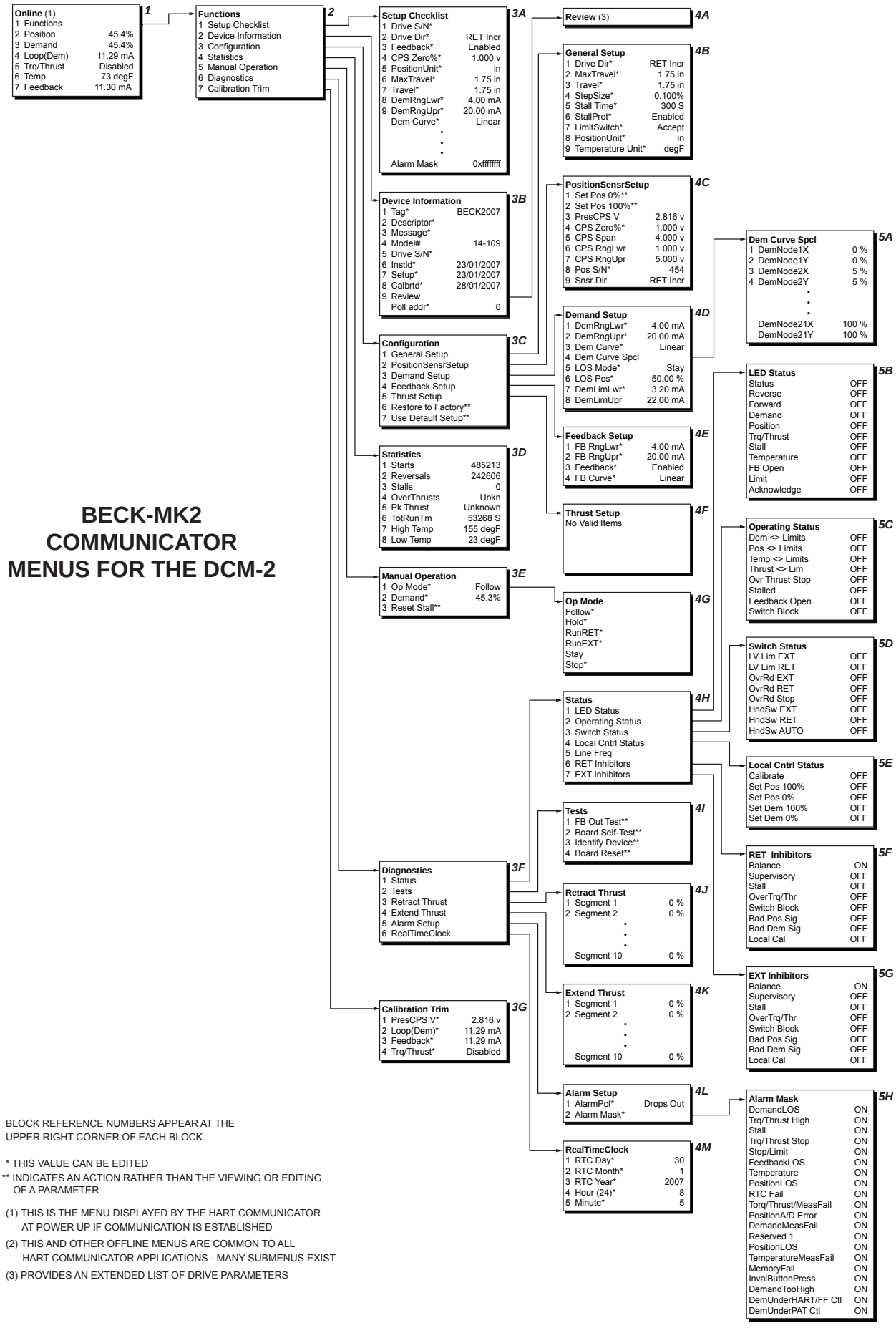
NOTE: For drives equipped with an external position feedback signal option, the signal is automatically reversed; such that 0% position corresponds to 4 mA and 100% position corresponds to 20 mA.

DCM-2 LOCAL INTERFACE *Troubleshooting*




Note: Choose the side of the slash corresponding with the direction of travel in which the drive is not working; i.e., CW/CCW or green/red
Move Handswitch to CW/CCW per direction drive does not move
Does the voltage across terminals B–U/B–V = line voltage?
YES
NO
Replace Handswitch, see p. 71
Does voltage from CW/CCW switch green/red to term. B = line voltage?
YES
NO
Is green/red wire connected to NC switch contact?
YES
NO
Replace limit switch, see p. 70
Connect wire properly
Consult Factory
Does Handwheel turn freely without repositioning drive?
NO
YES
Check SLM for damage; rebuild or replace as necessary.
Does Handwheel shudder about one position?
NO
YES
Consult Factory
Check the driven element
NO
Is an obstruction present?
YES
Clear obstruction
Consult Factory
Is the “STALL” LED lit?
NO
YES
Place Handswitch in “STOP” - check linkage and driven element
Is binding or an obstruction present?
NO
YES
Clear obstruction
Is the “TEMP °F” LED lit?
NO
YES
Restore ambient temperature to drive’s rated range
Is the “TEMP °F” LED still lit?
YES
Replace the DCM
Is the “FB OPEN” LED lit?
NO
YES
Is a feedback loop of 800 ohms or less connected to the terminal board?
NO
YES
Apply correct loop resistance
Replace the DCM
Is the “FB OPEN” LED still on?
YES
Consult Factory
Is the “STOP/LIMIT” LED lit?
NO
YES
Is the Handswitch in “AUTO”?
YES
NO
Check limit switch wiring & setting, see p. 21
Place drive in “AUTO”
Is the “STAT” LED still on?
NO
YES
Confirm proper operation of drive
Replace the DCM
Is the “STAT” LED still on?
YES
NO
Does drive respond correctly and is “STALL” LED out?
NO
YES
Replace the DCM
Confirm proper operation of drive
Cycle drive power off and on
Place Handswitch in “AUTO”-modulate control signal both ways
Does drive respond correctly and is “STALL” LED out?
NO
YES

BECK-MK2 COMMUNICATOR MENUS FOR THE DCM-2



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

* THIS VALUE CAN BE EDITED

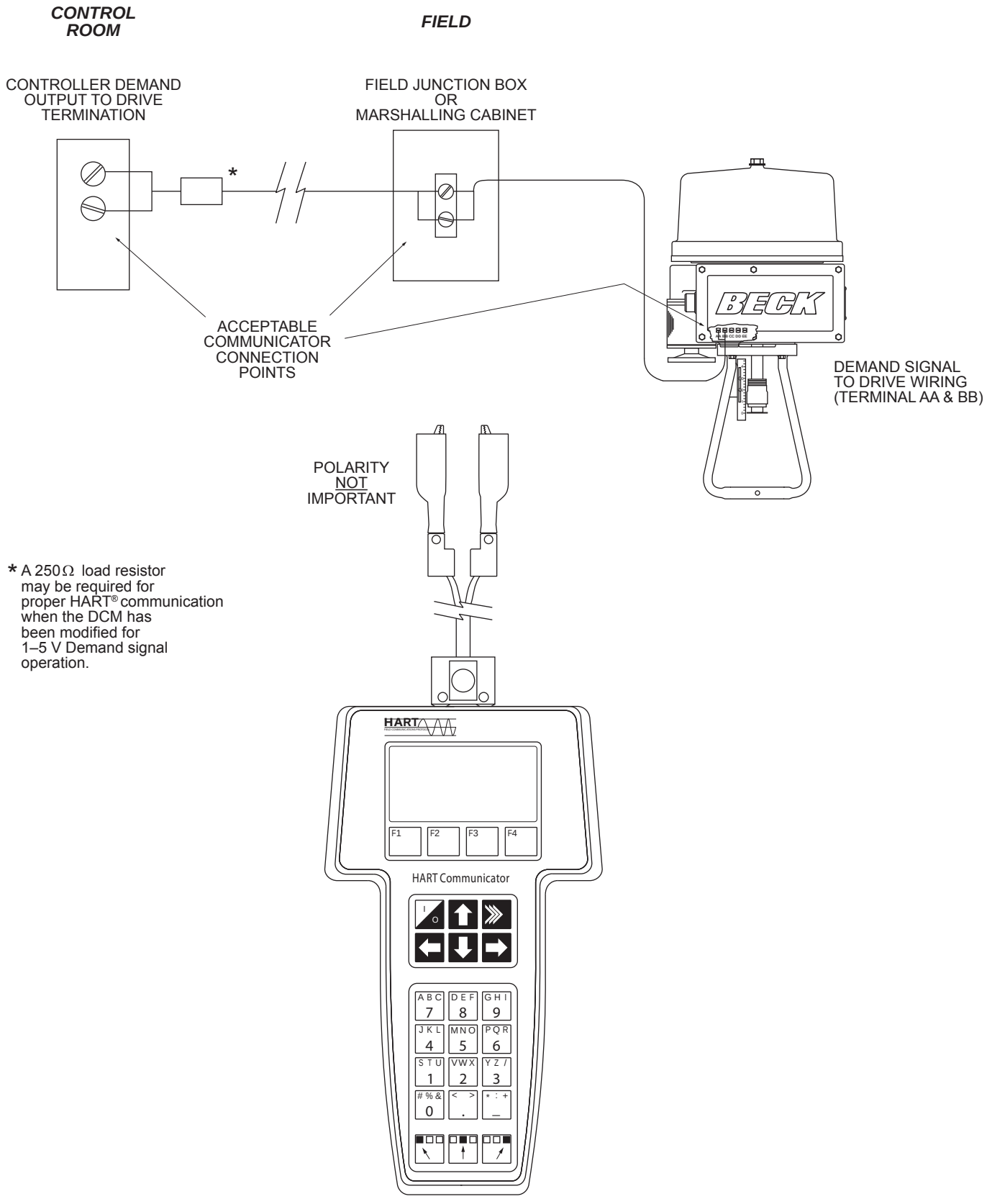
** INDICATES AN ACTION RATHER THAN THE VIEWING OR EDITING OF A PARAMETER

(1) THIS IS THE MENU DISPLAYED BY THE HART COMMUNICATOR AT POWER UP IF COMMUNICATION IS ESTABLISHED

(2) THIS AND OTHER OFFLINE MENUS ARE COMMON TO ALL HART COMMUNICATOR APPLICATIONS - MANY SUBMENUS EXIST

(3) PROVIDES AN EXTENDED LIST OF DRIVE PARAMETERS

HART COMMUNICATOR WIRING CONNECTIONS



* A 250Ω load resistor may be required for proper HART® communication when the DCM has been modified for 1–5 V Demand signal operation.

The DCM-2 board is the control center of the drive. Drive configuration and calibration are accessed and set through the DCM-2 board. Using the HART® interface requires a HART® compatible communicator. Typically, a universal model 275/375 HART® communicator is used, but any device, computer or controller capable of communicating with HART® devices and supporting the Beck DCM-2 device description can be used. **This instruction supports drives built after 12/1/06 equipped with a DCM-2 (p/n 22-5012-59). The DCM-2 is designed to interface using a new universal device description (BECK-MK2) but the firmware can be set to closely emulate older revisions thus allowing a HART communicator to interface with the new DCM-2 using an earlier revision device description. This is an emergency feature for when HART communications are necessary, but the user does not have a new DD. To access all DCM-2 features and ensure that all engineering units are correctly displayed, the user must load the BECK-MK2 device description to the communicator. See page 63 for the serial command required to set the firmware "HART type". Please contact the factory for instructions regarding setting the HART type using a handheld communicator.**

HART® INTERFACE

The figure on page 30 displays the interface menu tree for communicating with a DCM-2 using the BECK-MK2 Device Description. This menu tree summarizes possible setup options, features and available information.

HART® COMMUNICATORS FOR BECK-MK2

The BECK-MK2 Device Description requires a HART® Communicator that is fully HART 5 capable and has the ability to import Device Description Language Files (DDL) that are certified by the HART® Communications Foundation.

USING THE HART® COMMUNICATOR

The HART® Communicator leads should be connected in parallel with the analog Demand signal wiring (see figure on page 31). This allows the communicator to simultaneously communicate over the analog input wires. This does not disturb the analog command signal, or disrupt the DCM-2 functions. However, any program changes to the DCM-2 will momentarily suspend the operation of the board (maintains last state) while the change is implemented. Typically, this is only for 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, page 30, 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 the figure on page 30 is accomplished by following the display and using the communicator's arrow keys. **If the communicator is unable to communicate with the DCM-2, it will display the message, "No Device Found". If this occurs, check to make sure 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 make sure communications polling is set to "always poll".**

A communicator keypad and display is shown on page 31. 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 that is shipped with the communicator.

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 shift key then pushing the alphanumeric key.

MENU DESCRIPTIONS
(See figure on page 30)

Online Menu
(Block 1)

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 7 provide live, dynamic values of the drive's output position in percent, the Demand signal to the drive in percent, the Demand signal in milliamps, the thrust output is not present for Group 14 drives, the drive temperature, and the external position feedback signal in milliamps. Select the first menu item, "Functions", to gain access to the Functions menu. Backing out of the Online menu (using the left arrow key) results in selection of the Offline menu.

Functions Menu
(Block 2)

From the Functions menu, any of the DCM-2 functional menus can be selected and accessed. There are seven functional areas: Setup Checklist, Device Information, Configuration, Statistics, Manual Operation, Diagnostics, and Calibration Trim.

The Setup Checklist (Block 3A) is a menu that allows the user to setup the most important items necessary for basic drive operation. After completing the setup checklist, further setup can be accomplished using the configuration menu.

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

Device Information Menu
(Block 3B)

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 ten information entries:

1. **Tag** - This 8 character entry can be used as a unique label that correlates to a field device label.
2. **Descriptor** - This entry is a 16 digit field that can be used to provide any description desired.
3. **Message** - This entry is a 32 digit field that can be used to provide any message desired.
4. **Model** - This entry displays the model number of the drive in which the DCM-2 board is installed. It normally is set at the factory if the board is installed in a drive. The user can edit the field if desired.
5. **Drive S/N** - This entry displays the serial number of the drive in which the DCM-2 board is installed. It normally is set at the factory if the board is shipped in a drive. If the DCM-2 is shipped as a spare or replacement part, the "Drive S/N" field will be blank. The user can edit the field if desired.
6. **Installed** - This is a date entry that is normally used to indicate the date that the drive or DCM-2 board was installed. The date format is mm/dd/yyyy and it can be edited.
7. **Setup** - This is a date entry that is normally used to indicate the date that the DCM-2/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 mm/dd/yyyy, and it can be edited.
8. **Calibrated** - This is a date entry that is normally used to indicate the date that the DCM-2/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 mm/dd/yyyy, and it can be fully edited.
9. **Review** - Scrolls through all device information items, as well as all the other DCM-2 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 proceed to the appropriate menu and item.
10. **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.

Configuration Menu (Block 3C)

The Configuration menu serves as the gateway to all of the drive operating setup parameters. The user can select any of five different setup submenus that can be used to configure the drive based on the physical layout and the desired operation. The five setup submenus are described below. In addition to these five setup menus, there is a "Restore to Factory" selection which resets the drive configuration to its as-shipped settings. There is also a "User Default Setup" setting which resets the drive configuration to the settings typical of the applicable drive model type.

General Setup Submenu (Block 4B)

This menu sets drive operating parameters. The nine parameter entries are as follows:

1. **Drive dir** - Defines the rotation of the drive output shaft, given an increasing Demand signal, looking into the output shaft. Options available are RET Incr (retract on increasing signal) or EXT Incr (extend).

   When the drive direction parameter is changed, the DCM-2 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 retract on an increasing Demand signal unless the user specified extend prior to shipment of the drive.
2. **MaxTravel** - The maximum available travel distance of the output shaft in inches. This value is entered manually, and must correspond to the actuator design.
3. **Travel** - The number of inches of output shaft travel for 100% span. Edit this value to use a span shorter than the allowable "MaxTravel".
4. **StepSize** - The typical change in Demand signal that can occur before the output shaft will reposition (expressed in percent of span).
5. **Stall time** - The DCM-2 provides stall protection to the entire drive by shutting off power to the motor and providing a HART® alarm. This entry configures the stall time required to trigger the stall protection. At the factory, stall time is normally set to 300 seconds, but can be edited and set for any value between 30 and 300 seconds. This value should be longer than the timing for full drive travel.
6. **StallProt** - This entry is set as either “Enabled” or “Disabled". It is used to remove motor power if "Stall time" is reached.
7. **LimitSwitch** - This entry is set as either "Accept" or "Alert" and is used to define whether contacting a limit switch outside of the normal travel range (0% to 100%) will cause an error condition.
8. **PositionUnit** - Sets the numeric unit of measure for the output shaft position in inches ("in").
9. **Temperature Unit** - The unit of measure for temperature. May be set for Fahrenheit ("degF") or Celsius ("degC").

PositionSensrSetup Submenu (Block 4C)

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

1. **Set Pos 0%** - Selecting this parameter sets the present position of the drive to the minimum travel position. Equivalent to pushing the SET POS 100% pushbutton.
2. **Set Pos 100%** - Selecting this item sets the present position of the drive to the maximum travel position. Equivalent to pushing the SET POS 100% pushbutton.
3. **PresCPS V** - Displays the present value of the internal Position Sensor voltage, which may also be measured at TP4(+) and TP1(–) on the DCM-2 board. May be edited in the Calibration Trim menu for trimming the Position Sensor A/D converter.
4. **CPS Zero%** - Displays the CPS voltage at the zero percent output shaft position. May be edited to define the CPS voltage at the lowest operating point of travel.
5. **CPS Span** - Displays the CPS voltage span for the maximum allowable output shaft travel.
6. **CPS RngLwr** - Displays the CPS voltage at the lowest available point of travel. Normally set by the factory.
7. **CPS RngUpr** - Displays the CPS voltage at the highest available point of travel. Normally set by the factory.
8. **Pos S/N** - A number which uniquely identifies the position sensor. May be edited.
9. **Snsr Dir** - Displays which direction of output shaft movement will yield an increasing internal Position Sensor signal. Normally set at factory to "RET Incr" (signal increases as the output shaft retracts).

Demand Setup Submenu (Block 4D)

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

1. **DemRngLwr** - The value of the Demand signal (in mA) that corresponds to 0%. Normally set to "4.00 mA", this value should be set above the "DemLimLwr" value.
2. **DemRngUpr** - The value of the Demand signal (in mA) that corresponds to 100%. Normally set to "20.00 mA", this value should be set below the "DemLimUpr" value.
3. **Dem Curve** - Allows a choice in the relationship between the applied Demand signal and the desired position of the output shaft. Choices are: Linear, Square Root, Dem Curve Special, & Square.
4. **Dem Curve Spcl** - When "Dem Curve" above is set to "Special", this command allows access to a submenu to setup the preferred Demand curve.
5. **Los Mode** - Sets the output shaft response to a loss of Demand signal condition. Can be set to "Stay" or "Go-to-Pos".
6. **Los Pos** - If "Los Mode" has been set to "Go-to-Pos", this parameter allows the user to define the position (in percentage of travel) to where the output shaft will move during Loss of Signal conditions. May be set between -5.00% and 105.00%.
7. **DemLimLwr** - Sets the minimum usable value of Demand. Below this value, the Loss of Signal condition will be set. Values between 0 mA and 12 mA may be selected. This value should be set lower than the low Demand Range ("DemRngLwr").
8. **DemLimUpr** - Sets the maximum usable value of Demand. This value should be set higher than the upper Demand Range ("DemRngUpr").

Feedback Setup Submenu (Block 4E)

This menu is where all the Feedback signal related drive parameters are set. The four parameter entries are as follows:

1. **FBRngLwr** - The value of the Feedback signal (in mA) that corresponds to a 0% output shaft position. This value can range between 3.0 mA and 16.0 mA.
2. **FBRngUpr** - The value of the Feedback signal (in mA) that corresponds to a 100% output shaft position. This value can range between 7.0 mA and 21.0 mA.
3. **Feedback** - Enables or Disables the Feedback signal.
4. **FB Curve** - Allows a choice in the relationship between the applied Feedback signal and the actual position of the drive. Choices are: Linear & Inverted Demand ("InvDem").

Thrust Setup Submenu (Block 4F)

This menu is inactive for the Group 14 drive.

Statistics Menu (Block 3D)

This menu is where all the drive's stored operating statistics are available. There are eight different statistics available:

1. **Starts** - Logs and displays the total number of starts the drive motor has made.
2. **Reversals** - Logs and displays the total number of times the motor started in a direction opposite to the previous start.
3. **Stalls** - Logs and displays the total number of stalled conditions the drive has experienced. For the drive to register a stall, the DCM-2 board must be unable to balance the drive position against the Demand input signal for a period exceeding the **Stall Time** set in the General Setup menu.
4. **OverThrusts** - Absent for Group 14 drives.
5. **Pk Thrust** - Absent for Group 14 drives.
6. **TotRunTm** - Logs and displays the total run time of the drive motor in seconds.
7. **High temp** - Logs and displays the highest temperature in degrees Fahrenheit measured by a temperature sensor resident on the DCM-2 board.
8. **Low temp** - Logs and displays the lowest temperature in degrees Fahrenheit measured by a temperature sensor resident on the DCM-2 board.

Manual Operation Menu (Block 3E)

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

1. **Op mode** (Block 4G) - This procedure allows the user to select the operating mode of the DCM-2. There are four possible choices: "Follow", "Hold", "Stay" and "Stop". The "Follow" mode is the normal state of operation and allows the DCM-2 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 causes positioning according to the HART Interface Demand Value. The "Stay" mode causes the output shaft to remain stationary and maintain its present position. Note that in "Stay" mode, the Handwheel cannot be freely turned. The "Stop" mode removes power from the motor. Note that in "Stop" mode the Handwheel can be freely turned. All operating modes can be overridden by the drive Handswitch.
2. **Demand** - This procedure sets the effective Demand signal. If **Op mode** is set to "Hold", entering a valid value (-5% to 105%) will control the motor. If **Op mode** is set to "Follow", the value will follow the Demand analog signal (unless an alarm condition exists).
3. **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 (Block 3F)

This menu provides access to all the DCM-2 stored online diagnostic information about drive operation. The menu provides six submenus accessing drive statistics and online drive status.

Status Submenu (Block 4H)

This menu provides access to six submenus displaying various drive status settings: LED Status, Operating Status, Switch Status, Local Cntrl Status, RET Inhibitors, and EXT Inhibitors.

LED Status Submenu (Block 5B)

This menu displays the ON or OFF status of each of the LEDs on the DCM-2. See below.

LED NAME	HART NAME	DESCRIPTION
STAT	"Status"	"ON indicates that an operating condition is inappropriate see Operating Status menu'"
REV	"Reverse"	"ON indicates that the Demand signal is less than the Position signal"
FWD	"Forward"	"ON indicates that the Demand signal is greater than the Position signal"
DEM_ERR	"Demand"	"ON indicates that a Demand error condition exists check the operating mode settings"
POS_ERR	"Position"	"ON indicates that the Position signal may be out of range or saturated"
TORQ_ERR	"Trq/Thrust"	"The Trq/Thrust option is not installed.
STALL_ERR	"Stall"	"ON indicates that the motor may be stalled"
TEMP_ERR	"Temperature"	"ON indicates that a temperature fault exists"
FB_ERR	"FB Open"	"ON indicates that the feedback loop is open or out of range"
STOP_ERR	"Limit"	"ON indicates that a limit switch has been triggered"
ACKN_ERR	"Acknowledge"	"Acknowledge indicator is active"

Operating Status Submenu (Block 5C)

This menu displays the ON or OFF status of eight drive parameters: Dem Limits, Pos Limits, Temp Limits, Torq Limits, Over-Torq Stop, Stalled, Feedback Open, and Switch Block. See below.

CONDITION	DESCRIPTION
DEMAND_LOS	"The Demand Signal is outside of the intended limits (see Demand Setup menu)"
TRQ_THRUST_OVERRANGE	"The Torque/Thrust option is not installed"
STALL	"Stall condition has been detected (see General Setup menu)"
OVERTRQ_THRUST_ PROTECTION	"The Torque/Thrust option is not installed"
STOP_OR_LIMIT	"Motor power is blocked check switches"
FEEDBACK_ DISCONNECTED	"The Feedback signal is enabled but the loop is open"
TEMPERATURE_ OVERRANGE	"The temperature is outside of –40F to 185F"
POSITION_OVERRANGE	"The Position signal is less than –5% or greater than 105%"

Switch Status Submenu (Block 5D)

This menu displays the ON or OFF status of the eight switch parameters: LV Lim EXT, LV Lim RET, OvrRd EXT, OvrRd RET, OvrRd Stop, HndSw EXT, HndSw RET, and HndSw AUTO. The Switch Status menu displays the status of the RET/EXT control override input, the STOP control override or if the Handswitch is in the RET/EXT or AUTO position.

Local Control Status Submenu (Block 5E)

This menu displays the ON or OFF status of five local interface drive parameters: Calibrate, Set Pos 100%, Set Pos 0%, Set Dem 100%, and Set Dem 0%. The Local Control Status submenu indicates which buttons on the Local Control board are pressed.

RET Inhibitors Submenu (Block 5F)

This menu displays the ON or OFF status of the contributing sources of retract movement inhibitors of motor operation: Balance, Supervisory, Stall, OverTrq/Thr, Switch Block, Bad Pos Sig, Bad Dem Sig, Local Cal. See below.

CONDITION	DESCRIPTION
Balance	"ON indicates that the Demand and Position are at balance"
Supervisory	"ON indicates that the DCM is initializing"
Stall	"ON indicates a Stall condition"
OverTrq/Thr	"The Torque/Thrust option is not installed"
Switch Block	"ON indicates that the Handswitch, Override, or Limit Switch is inhibiting movement"
Bad Pos Sig	"ON indicates that the Position signal is out of range"
Bad Dem Sig	"ON indicates that the Demand signal is out of range"
Local Cal	"ON indicates that a Local Calibration button is pressed"

EXT Inhibitors Submenu (Block 5G)

This menu displays the ON or OFF status of the contributing sources of extend movement inhibitors of motor operation: Balance, Supervisory, Stall, OverTrq/Thr, Switch Block, Bad Pos Sig, Bad Dem Sig, Local Cal. See table above.

Tests Submenu (Block 4I)

This menu provides procedures that allow the user to test, identify and reset the DCM-2 board. They are as follows:

1. **FB out test** - This procedure allows the user to test the 4–20 mA position feedback output signal. 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** - This procedure runs an automatic board test that verifies the health of the DCM-2 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. This test should be implemented only if a DCM-2 problem is suspected.
3. **Identify Device** - This command will cause the Acknowledge LED to blink for two seconds. Used to verify proper HART communications as well as an aid in identifying which drive is being addressed when configuring multiple drives for split range operation.
4. **Board reset** - 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-2 board; however, manually implementing the reset procedure is not typically necessary.

RET Torque Submenu (Block 4J)

This menu is inactive for the Group 14 drive.

EXT Torque Submenu (Block 4K)

This menu is inactive for the Group 14 drive.

Alarm Setup Submenu (Block 4L)

This menu allows customization of alarm indication:

1. **AlarmPol** - This determines whether the alarm relay "Drops Out" or "Pulls In" to indicate an alarm.
2. **Alarm Mask** - This leads to a submenu where alarm conditions may be set.

Alarm Mask Submenu (Block 5H)

This menu allows alarm conditions to be ignored; such as DemandLOS, Stall FeedbackLOS, or other conditions which may occur under normal operation and that may prove a nuisance during normal HART operation.

RealTimeClock Submenu (Block 4M)

This menu allows the date and time to be set. The settings are as follows:

1. **RTC Day** - Numerical entry sets the day of the month.
2. **RTC Month** - Numerical entry sets the month.
3. **RTC Year** - Numerical (4 digit) entry sets the year.
4. **Hour (24)** - Numerical entry sets the hour of the day (1–24).
5. **Minute** - Numerical entry sets the minute of the hour.

Calibration Trim Menu (Block 3G)

This menu displays/sets drive calibration values:

1. **PresCPS V** - Displays the present value of the internal Position Sensor voltage. This value can also be measured at TP4(+) and TP1(–) on the DCM-2 board. This value can be edited to trim the Position Sensor.
2. **Loop(Dem)** - Displays the Demand signal as measured at the field wiring terminals. When the Demand control loop signal is being overridden by a special mode of operation, the effective Demand will not correspond to the mA value. This value can be edited to trim the Demand to ensure accurate measurement of the analog signal. Demand can only be trimmed at 4.0 mA and 20.0 mA.
3. **Feedback** - Displays the mA signal representing the output shaft position as measured at the field wiring terminals. This value can be edited.
4. **Trq/Thrust** - This item is inactive for the Group 14 drive.

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 may be accomplished utilizing the HART® interface and a communications tool (model 275 or 375 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 (see page 30) available.

DRIVE SHAFT TRAVEL

Drive shaft travel refers to the direction the output shaft of the drive moves in response to an increasing Demand input signal. The travel is either retract (RET) or extend (EXT). The control loop operation and physical design of the final control element determine the drive travel suitable for an application. If the drive travel needs to be changed, this is easily accomplished by changing the DCM-2 configuration.

Changing Drive Shaft Travel

STEP 1 - From the HART® communicator "Online" menu, move to the "General Setup" menu and select the "Drive 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 (see page 30) to navigate.

STEP 2 - With the "Drive 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 "General Setup" main menu.

STEP 4 - At the bottom of the "General 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.

STEP SIZE

The step size is the incremental movement of the drive shaft in response to signal changes. The step size is factory set at 0.15% unless otherwise specified at the time of order. The step size is adjustable from 0.1% to 2.5%. To adjust the step size, please follow the steps below.

Changing the Step Size

STEP 1 - From the HART® communicator "Online" menu, move to the "General Setup" menu and select the "StepSize" 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 (see page 30) to navigate.

STEP 2 - With the "StepSize" parameter selected, 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 0.1% and 2.5% 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 "General Setup" main menu.

STEP 4 - At the bottom of the "General 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-2 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-2 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, page 30), performing a board reset procedure (see Diagnostics Menu, page 30), or cycling the drive ac power.

Changing Stall Time

STEP 1 - From the HART® communicator "Online" menu, move to the "General 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 (see page 30) 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 travel 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 "General Setup" main menu.

STEP 4 - At the bottom of the "General 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.

OVERTRAVEL ANNUNCIATION

When communicating with the DCM-2 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-2 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 52), 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 “Overtravel Annunciate” feature to “Ignore” will eliminate the message, but only when the Demand signal is above 100% or below 0% and an over-travel limit switch is open. This eliminates the nuisance message, but does not eliminate the message for other scenarios like the Handswitch being in the STOP position.

Changing Overtravel Annunciation

STEP 1 - From the HART® communicator “Online” menu, move to the “General Setup” menu and select the “LimitSwitch” 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 (see page 30) to navigate.

STEP 2 - With the “LimitSwitch” parameter selected, again press the right arrow key to display the modifiable entry box, select either "Accept" to turn off the HART warning or "Alert" to ensure the HART warning is transmitted.

STEP 3 - With the desired selection highlighted, 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 "General Setup" main menu.

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

POSITION FEEDBACK SIGNAL

DCM-2 boards are equipped with a Feedback Sourcing module that provides 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. 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 275/375 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 “Setup Checklist” menu and select the “Feedback” 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 (see page 30) to navigate.

STEP 2 - With the “Feedback” parameter selected, press the right arrow key to display the two entry choices: “Enabled” or “Disabled”. Use the up and down arrow keys to select the desired parameter. “Enabled” enables the output signal, while “Disabled” disables the output.

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 “Setup Checklist” main menu.

STEP 4 - At the bottom of the “Setup Checklist” 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-2 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 four ways in which the DCM-2 can interpret the Demand signal: Linear, Square Root, Dem Curve Special and Square. 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 Root relationship produces a response proportional to the square root of the Demand Signal. The Dem Curve Special relationship allows a customized Demand curve to be setup through a special submenu. 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 (see page 30) to navigate.

STEP 2 - With the "Dem Curve" parameter selected, press the right arrow key to display the four entry choices: "Linear", "Square Root", "Dem Curve Special" 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. If "Dem Curve Special" is selected, proceed to the "Dem Curve Special" sub-menu to setup the desired curve.

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-2 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 "DemLimLwr". The "LOS Mode" parameter determines how the drive should respond to the loss of the Demand input signal. It can be configured as "STAY" (which means the drive holds its current position when the signal is lost) or "GO-TO-POSITION" (which means the drive moves 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-2 when the signal drops below the value set by the "DemLimLwr" parameter. This value is represented in mA of the Demand input signal range. Therefore, the standard 3.2 mA value normally used for this parameter suggests that when the Demand input signal drops 5% below the calibrated 0% value, the DCM-2 senses a lost Demand input and executes the configured loss-of-signal action.

Changing Loss of Signal (LOS) 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 (see page 30) 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 travel. 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 "DemLimLwr" 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 (see page 30) to navigate.

STEP 2 - With the "DemLimLwr" 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 in mA outside 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.

All Beck drives are shipped completely calibrated to the 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 reviewing the settings in the Configuration menu.

With the exception of the settings for the over-travel limit switches, auxiliary limit switches and CPS, all calibration is performed using the HART interface and a communications tool (model 275/375 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.

The DCM-2 can be calibrated by using the "Position Setup" and "Demand Setup" menus.

Normally, calibration should not require adjustment; however, if the Position or Demand requires minor adjustment, the "Calibration Trim" menu may be used.

Any calibration changes that are made using any of the above described methods, can be reversed by using the “Restore to Factory” feature in the "Configuration" menu. Note that implementing the “Restore to Factory” feature returns all settings to the as-shipped factory settings.

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.

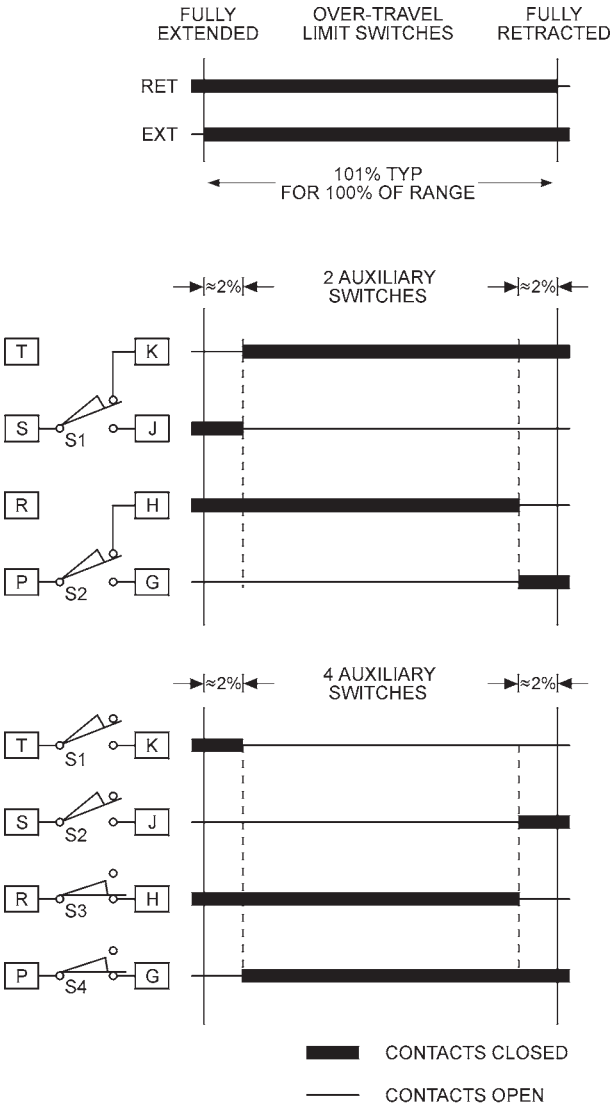
The over-travel limit switches are used to limit the electrical control range of the drive. These switches are cam operated, and are set slightly wider apart than the drive's intended full range of electronic operation. With this range, the limit switch cams are each set inside the mechanical stops, 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 49), 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-2 calibration procedures.

The auxiliary limit switches are also cam operated, but have no affect on drive and DCM-2 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.

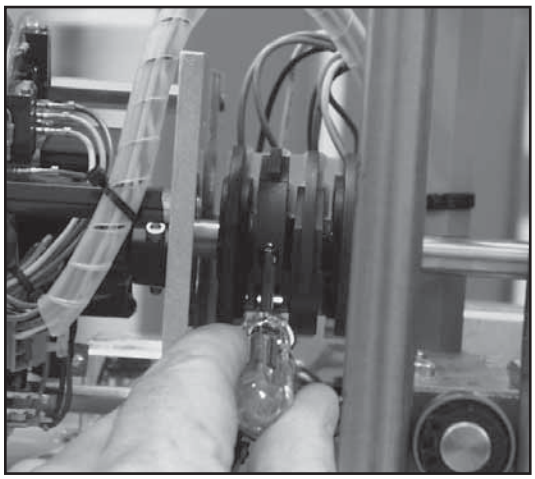
Switches are operated by cams which are clamped onto the control shaft. Setting a switch involves loosening the cam, moving the drive's output shaft to the desired position, and positioning the cam so that it operates the switch at that point. In the following procedure, the use of a continuity meter 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:

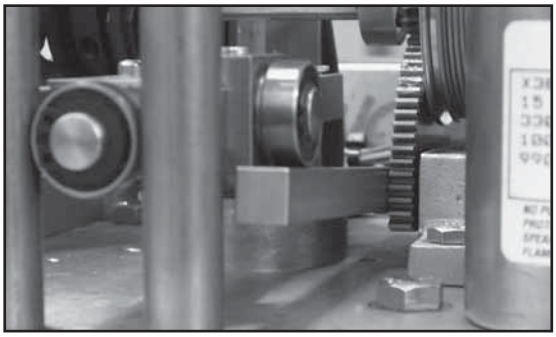


Loosening/Tightening Switch Cam

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 on page 47).
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 below for location of lever and bearing plate.



Lever and Bearing Plate

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 (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 47. 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 drive wiring diagram or the chart on page 12. 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, see photo on 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:

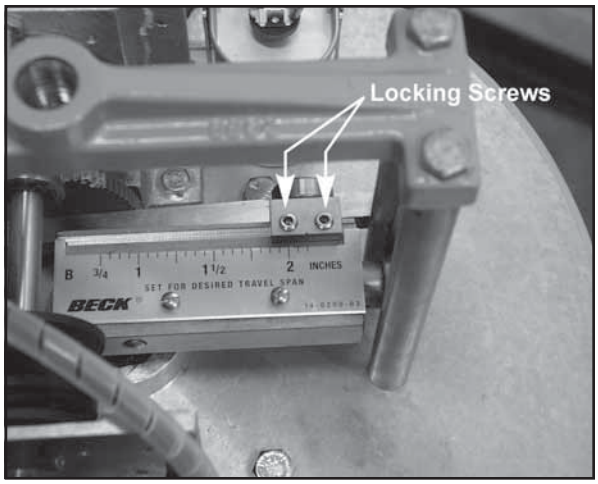
1. Remove the top cover. The protective O-ring seal will remain in the rim of the top cover when removed.
2. The Calibar index is graduated directly in inches, which corresponds to the drive travel span.
3. Loosen the two locking screws on the Calibar block with an 1/8" hex wrench (See photo this page).
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-2 position reference to match the Calibar setting. See page 50.

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-2 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).



Calibar Block

POSITION SENSOR SETUP

In order to correctly position the drive output shaft in response to the input Demand signal, the DCM-2 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-2 interprets the CPS signal appropriately for the full range of desired travel. The "PositionSensrSetup" submenu is used to set the DCM-2 to accept the CPS position signal and interpret the appropriate 0–100% range.

All Beck drives are shipped completely set and calibrated to the customer specifications and are ready for installation. Normally, no adjustments are necessary.

If, however, the position calibration needs to be changed, the "PositionSensrSetup" submenu must be used. The "PositionSensrSetup" is accessible through the "Configuration" menu.

The "PositionSensrSetup" submenu will allow resetting of the minimum travel position of the drive (Set Pos 0%) and the CPS voltage at the minimum travel position (CPS Zero%). Online help is available through the communication device.

Short-stroke Operation (Reducing Full Travel)

Typically, it is best to use the full 100% travel of the drive in response to the 0–100% Demand input signal.

In certain applications, as a last resort, it may become necessary to reduce the full travel of the drive. In these applications, the DCM-2 can be calibrated to accommodate reduced stroke. The recommended *minimum* full travel is 60%, although it is advisable to make the range as close to 100% as possible for the highest position resolution attainable with the CPS and to avoid possible reduction in torque.

Reducing the full travel is referred to as "short-stroking" the drive. This can be easily accomplished by using a HART communication device.

First, navigate to the Configuration menu. Select the General Setup submenu. Select the Travel parameter. Reduce the stroke by entering a percentage of full travel (not less than 60%) of the maximum travel of the drive.

FEEDBACK SIGNAL CALIBRATION

DCM-2 boards have the capability of providing a 4–20 mA output signal so that the drive's true output shaft travel can be monitored remotely. The signal comes calibrated from the factory to provide a precise 4–20 mA signal corresponding to 0–100% drive travel. Normally, calibration is not required even if the position reference calibration or direction of travel are changed, because the DCM-2 automatically compensates for these changes and appropriately scales the position feedback signal.

If the Feedback must be changed, it is accomplished by using a Hart communication device. First, navigate to the Configuration menu. Next, select the Feedback Setup submenu. Through this submenu, the Feedback range may be changed, as well as the curve. Online help is available through the communication device.

DEMAND SIGNAL CALIBRATION

DCM-2 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 (see explanation following). The input comes calibrated from the factory for the full range unless otherwise specified. It is not necessary to calibrate the Demand input when the drive is installed.

If the Demand must be changed, it is accomplished using a HART comunication device.

First, navigate to the Configuration menu. Select the Demand Setup submenu. Through this submenu, the Demand range limits and curve specifications may be changed. Online help is available through the communication device.

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 (see DCM-2 illustration on page 72) must be removed from one of the two drive DCM-2 boards to allow HART® communications. If more than two drives are split ranged, the R11 resistor must be removed from all the DCM-2 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 using a HART communication device.

First, navigate to the Configuration menu. Next, select the Demand Setup submenu. Change appropriate Demand range limit accordingly. In the example above, one drive's upper Demand range (DemRngUpr) would be changed from 20.00 mA to 12.00 mA; and the other drive's lower Demand range (DemRngLwr) would be changed from 4.00 mA to 12.00 mA.

NOTE: Ensure that the L.O.S. (Loss of Demand input signal) settings of the drives are appropriate for the new configuration. This would involve changing the appropriate Demand LOS limits (DemLimLwr or DemLimUpr). Typically, these settings are -5% and 105% of the Demand range. See page 16 for a description of the LOS function.

COMMON HART® MESSAGES

HART® protocol maintains both standard and device specific informational messages that are displayed on the 275/375 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
"Motor power is blocked, check switches"	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 over-travel 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 three HART® non-primary variables (Demand signal, Torque, 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 either the torque measurement (optional) or temperature measurement is outside the design or calibrated ranges. The Beck specific messages below provide more descriptive information.
"The Demand Signal is outside of the intended limits (see Demand Setup menu)"	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-2 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 accurate measurement 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-2 boards utilize a 250 Ohm input resistor to convert the current signal to voltage.

Demand Signal and Process Variable Messages (con't)

Message	Description
“The temperature is outside of –40F to 185F”	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 (-40º to 91ºC) range.
"Demand Signal is out of limit"	The Demand Signal has exceeded its measurable limits and has entered saturation. The value reported for Demand does not reflect the actual value.
"Loop Current Detected while under HART/FF Control"	This is a Beck specific alarm message that alerts the user that analog current is present on the Demand terminals while operating the drive using the HART configurator Manual Operation menu. It is used to avoid confusion when a board is left in one of the manual operation modes and is not properly restored to "FOLLOW" mode.
"Loop Current Detected while set for LOS PAT"	PAT mode (Proportional mode) is a special Demand mode where discrete logic inputs are used in place of the Analog Demand signal. When operating in PAT mode, no Demand current should be present. If current is detected, this alarm will be asserted.

Position Signal Messages

(*The position signal is defined as the signal from the position sensor (CPS) to the DCM-2*)

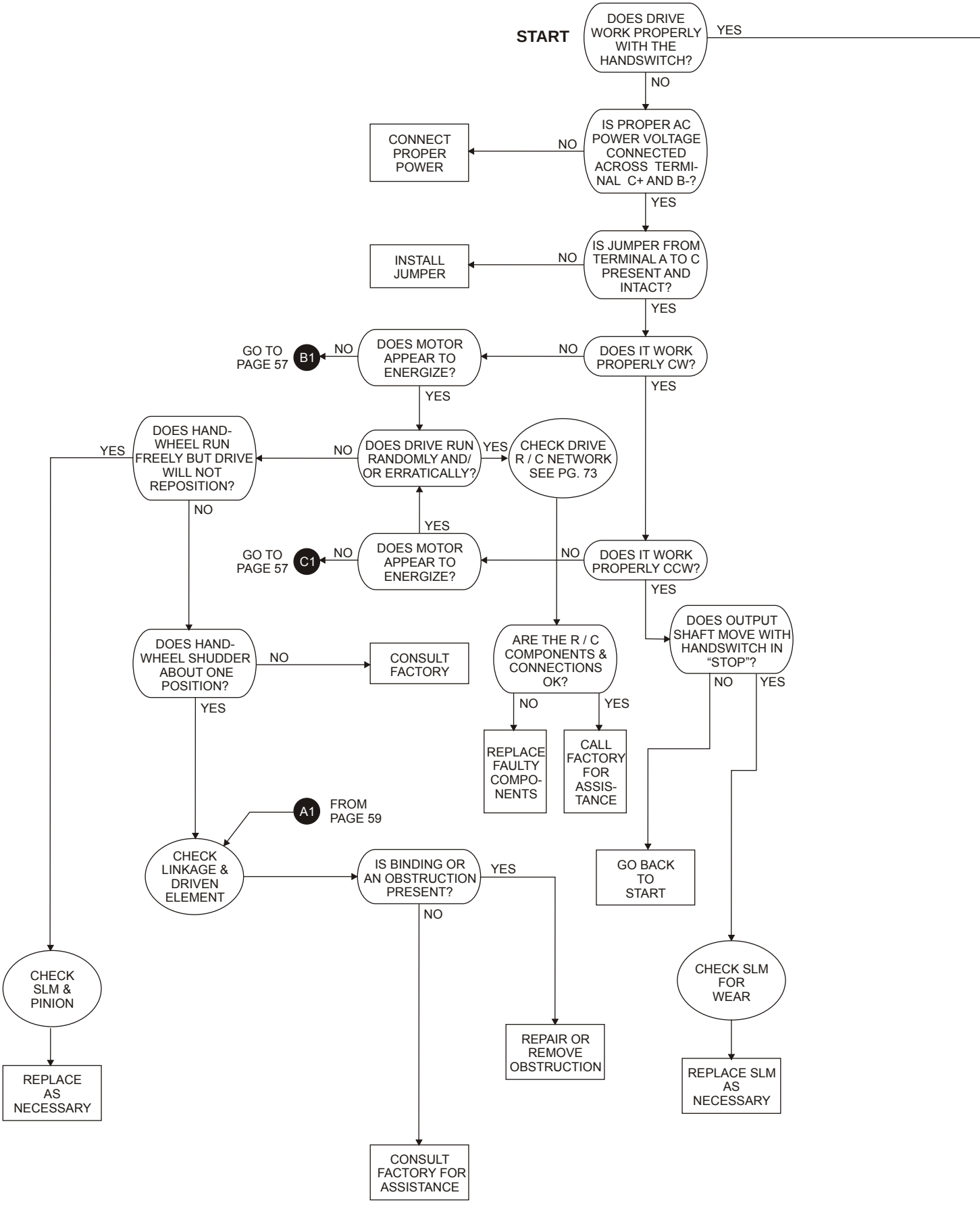
Message	Description
“Process applied to the primary variable is outside the operating limits of the field device”	This is a standard HART®-defined message that appears whenever the HART® primary variable (Position signal) is outside the design or calibrated range. The DCM-2 is designed to accept a maximum 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.
“The Position Signal is less than –5% or greater than 105%”	This is a Beck-specific message that appears after the HART®-defined messages above. It specifically pinpoints the position signal to the DCM-2 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.

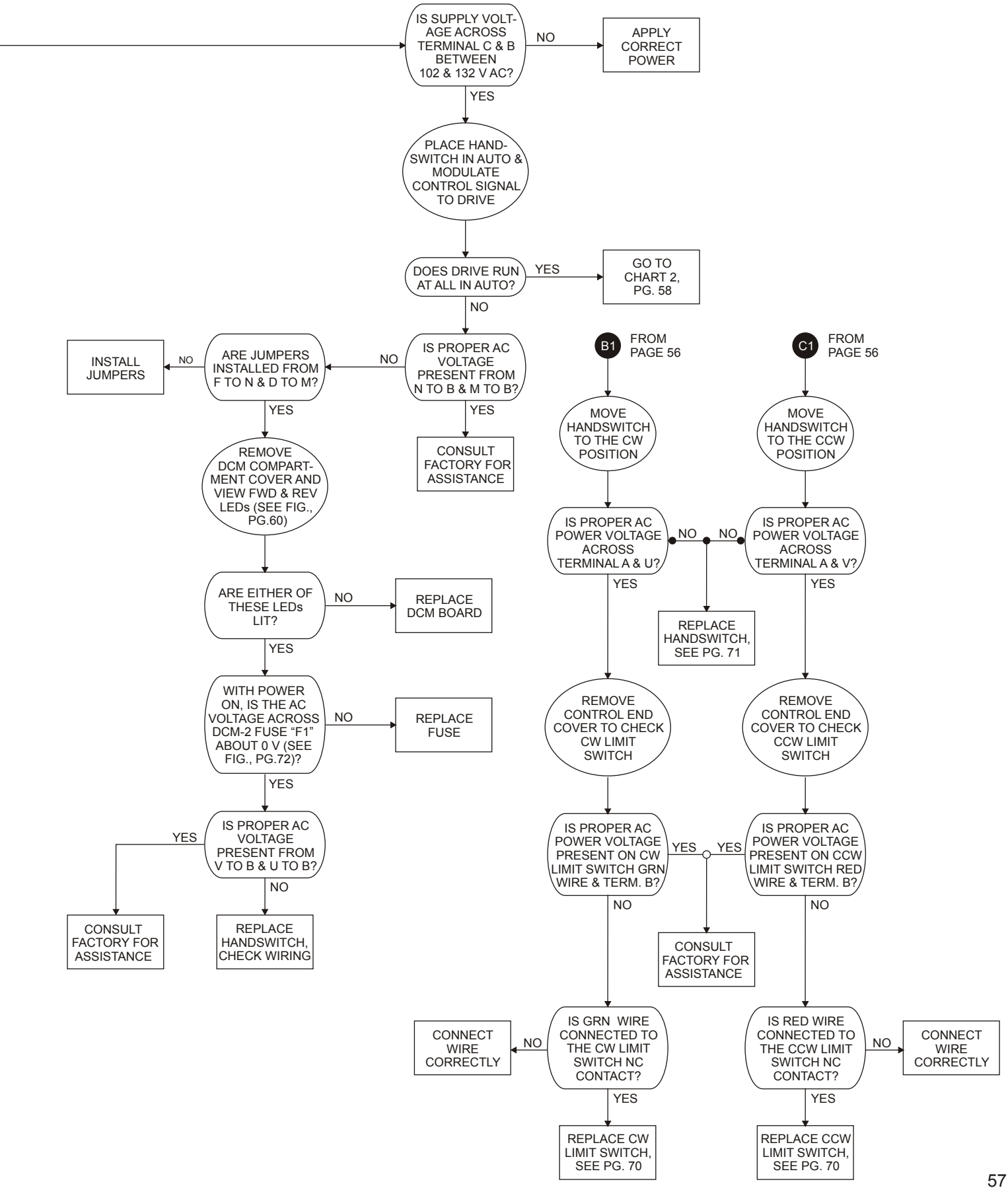
Message	Description
“Position signal in LOS”	This is a Beck-specific message that appears after the HART®-defined messages above. It specifically pinpoints the position signal to the DCM-2 as the problem source, and is intended to indicate a CPS or wiring failure. The message is triggered when the position 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 accurate measurement 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-2 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

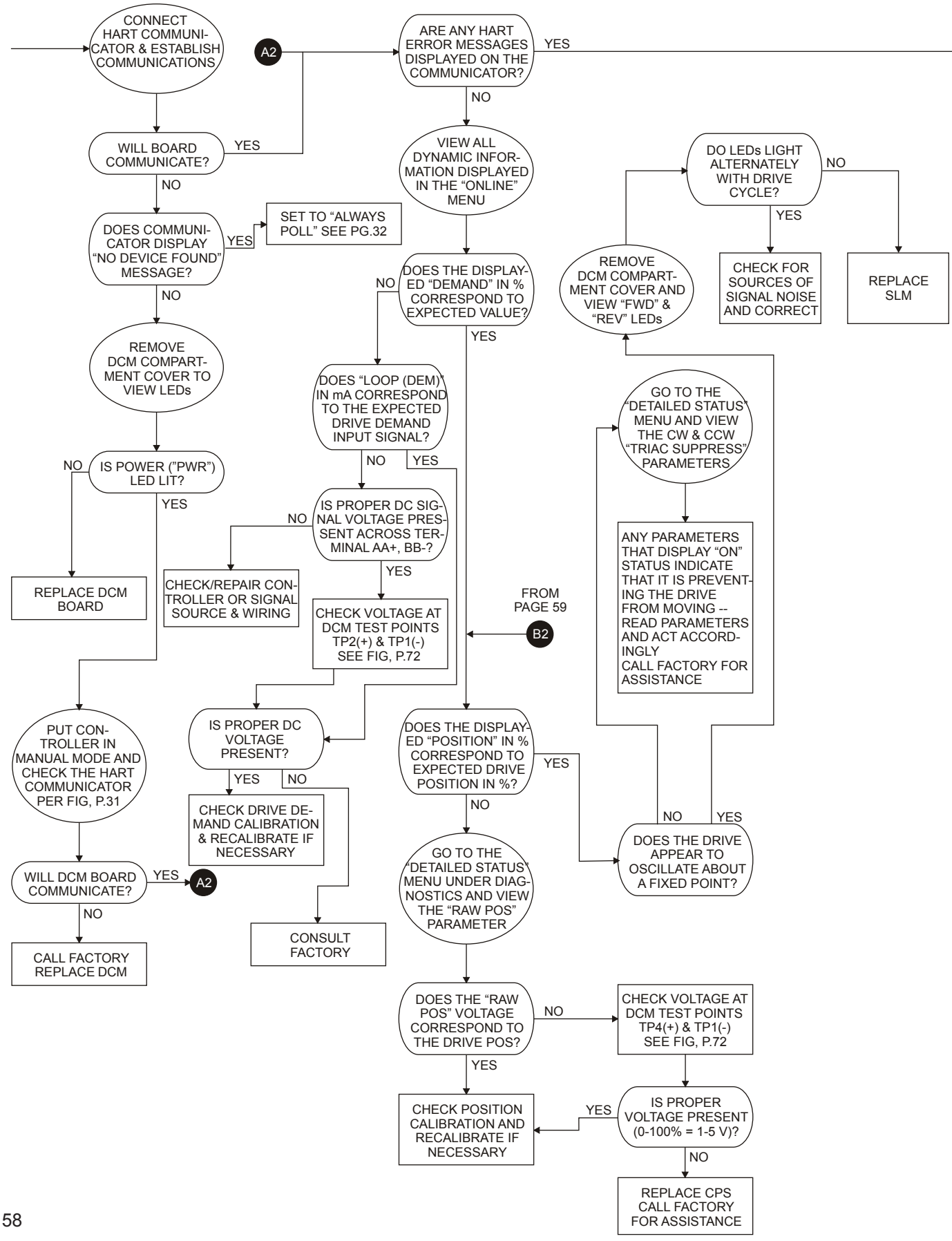
Message	Description
“The Feedback Signal is enabled but the loop is open”	This is a Beck-specific alarm message that alerts the user that external position feedback signal is installed and enabled, but not wired to an external load. If the signal is wired to an external load and this message appears, it implies that a wiring failure somewhere between the drive and the monitoring device has occurred. If the DCM-2 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.
“Stall condition has been detected (see 'Stall Time' in the 'General Setup' menu)”	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.).
"Feedback is in fixed mode"	The "FB Out Test" diagnostic allows the user to set Feedback to a fixed value, rather than the normal mode of having Feedback follow the Position value. If the Feedback value is left in the "fixed" mode, this error will be reported to alert the user that Feedback is not following the Position value.

ELECTRO / MECHANICAL -- CHART 1

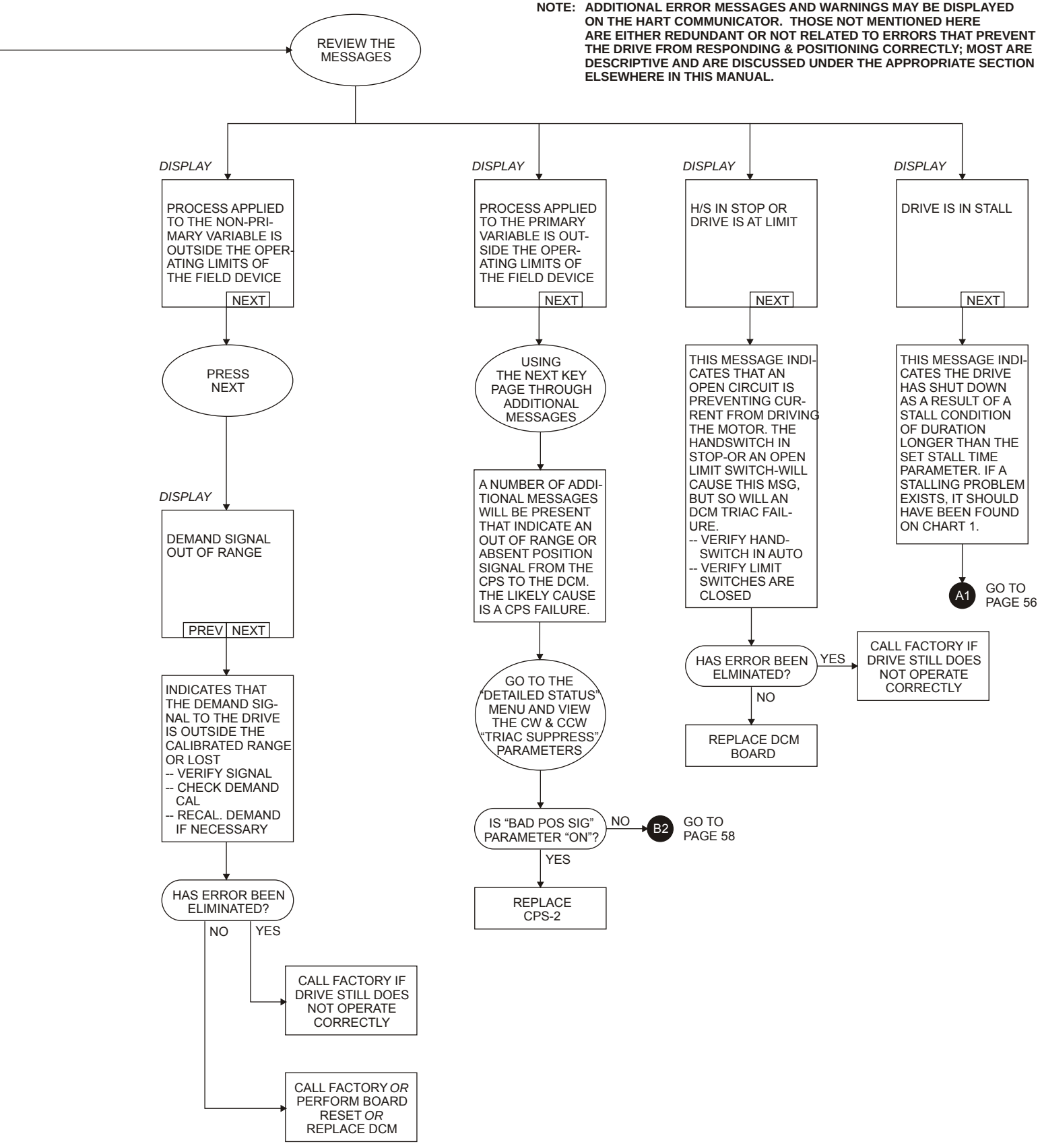



IS SUPPLY VOLTAGE ACROSS TERMINAL C & B BETWEEN 102 & 132 V AC?
NO
APPLY CORRECT POWER
YES
PLACE HAND-SWITCH IN AUTO & MODULATE CONTROL SIGNAL TO DRIVE
DOES DRIVE RUN AT ALL IN AUTO?
YES
GO TO CHART 2, PG. 58
NO
IS PROPER AC VOLTAGE PRESENT FROM N TO B & M TO B?
NO
ARE JUMPERS INSTALLED FROM F TO N & D TO M?
NO
INSTALL JUMPERS
YES
CONSULT FACTORY FOR ASSISTANCE
YES
REMOVE DCM COMPART-MENT COVER AND VIEW FWD & REV LEDs (SEE FIG., PG.60)
ARE EITHER OF THESE LEDs LIT?
NO
REPLACE DCM BOARD
YES
WITH POWER ON, IS THE AC VOLTAGE ACROSS DCM-2 FUSE "F1" ABOUT 0 V (SEE FIG., PG.72)?
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 56
MOVE HANDSWITCH TO THE CW POSITION
IS PROPER AC POWER VOLTAGE ACROSS TERMINAL A & U?
NO
REPLACE HANDSWITCH, SEE PG. 71
YES
REMOVE CONTROL END COVER TO CHECK CW LIMIT SWITCH
IS PROPER AC POWER VOLTAGE PRESENT ON CW LIMIT SWITCH GRN WIRE & TERM. B?
YES
CONSULT FACTORY FOR ASSISTANCE
NO
IS GRN WIRE CONNECTED TO THE CW LIMIT SWITCH NC CONTACT?
NO
CONNECT WIRE CORRECTLY
YES
REPLACE CW LIMIT SWITCH, SEE PG. 70
C1
FROM PAGE 56
MOVE HANDSWITCH TO THE CCW POSITION
IS PROPER AC POWER VOLTAGE ACROSS TERMINAL A & V?
NO
YES
REMOVE CONTROL END COVER TO CHECK CCW LIMIT SWITCH
IS PROPER AC POWER VOLTAGE PRESENT ON CCW LIMIT SWITCH RED WIRE & TERM. B?
YES
NO
IS RED WIRE CONNECTED TO THE CCW LIMIT SWITCH NC CONTACT?
NO
CONNECT WIRE CORRECTLY
YES
REPLACE CCW LIMIT SWITCH, SEE PG. 70

ELECTRONICS DIAGNOSTICS -- CHART 2



NOTE: ADDITIONAL ERROR MESSAGES AND WARNINGS MAY BE DISPLAYED ON THE HART 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.



COMMUNICATIONS

The Beck Digital Control Module (DCM-2) is equipped with a serial interface which allows for direct communication with a computer. Using a communication cable, connect the DCM-2 to the computer using the DCM-2's RS-232 (J20) connector (see illustration on this page) and the computer's COM port. Ensure that the COM port on the computer is active, and that the cable is plugged into the proper COM port if more than one is present (e.g., COM1, COM2, etc.). Note that a plug end adapter may be necessary for connection to the computer's COM port.

Once connected, communication can be established between the DCM-2 and the computer using a terminal emulation program, such as HyperTerminal®. This method of communication will allow for configuration, calibration and verification of drive DCM-2 settings without the use of custom software applications.

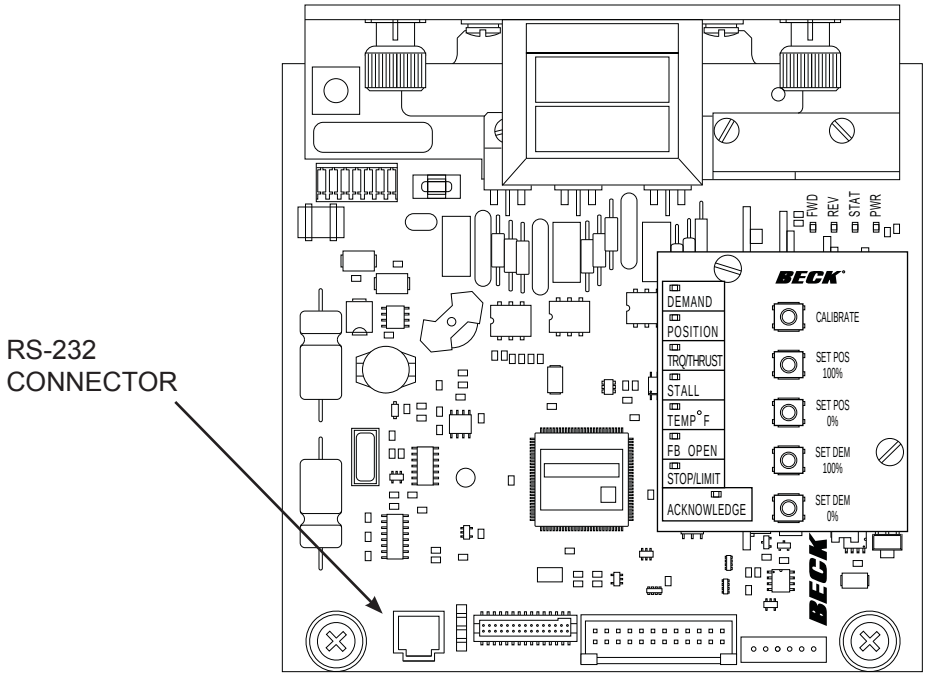
HyperTerminal® Software

HyperTerminal is the standard ASCII terminal emulation software provided with Microsoft® Windows®. If using HyperTerminal®, the following instructions will assist in setup. Note that some variation to these instructions may be necessary depending on the version of HyperTerminal® being used.

Once the computer has been connected to the DCM-2, access HyperTerminal® by clicking first on "Start", then "Programs", then "Accessories", then "Communications", then "HyperTerminal".

Double-click on the "Hypertrm.exe" icon to start the program. Once HyperTerminal® is running, it is necessary to set up a file with the proper settings to communicate with the DCM-2. Proceed as follows:

1. If prompted to install a modem, answer "no". Proceed to enter a name (e.g., "DCM-2") and select an icon (any will suffice) in the "Connection Description" box. Click the "OK" button.
2. The "Connect to" box should open next. At the bottom of the box, set the "Connect using" selection to the computer COM port that has been connected to the DCM-2. Click the "OK" button.
3. The COM port properties box should open next. This is where the communication settings are established. The correct settings are:
   a. Bits per second = "1200"
   b. Data bits = "8"
   c. Parity = "none"
   d. Stop bits = "1"
   e. Flow control = "none"
4. With the appropriate settings entered from Step 3, above, click "OK". Communications should now be enabled.
5. Press the "Enter" key twice. "Ok" should be displayed indicating that HyperTerminal® is communicating with the DCM-2.



Hyperterminal® is a product of Hilgraeve, Inc.

COMMANDS AND ARGUMENTS

Commands can be used for a variety of functions including changing the operating configuration of the drive, verifying operation settings, calibration and accessing diagnostic information. There are essentially four different types of commands:

1. Dual-purpose commands. These commands can be used to either modify drive configuration settings or display the settings already set in the drive. In order to set or make a change to the settings, the command requires an argument (*n*). If the command is used for display purposes only, the argument is omitted. Examples of these commands include "dead band" and "demlos".
2. Display only commands. These commands are used to display diagnostic or operating information like present signal values. No arguments are required. Examples include the "stat" command and the "signals" command.
3. Set only commands. These commands serve only to make a parameter change. Typically, they apply to the drive calibration. This type of command requires an argument, but unlike dual-purpose commands, they return an error message when entered without an argument. Examples include the "demis" and "posis" commands.
4. Execute action commands. These commands serve to reset, enable or disable features and do not require an argument. Entering these commands produces an immediate action. Examples include the "revert" and "torqen" command.

The available commands are listed on page 62 and each is described in more detail on pages 63 through 66. The command description explains the use or uses of the command, while the argument column describes the applicable arguments for those commands that require them. In the command tables, arguments are denoted as *n*. Note that the commands described as "sets and/or displays" signify dual purpose commands that can be used with or without an argument for setting or verifying configuration settings.

SERIAL COMMANDS

The following is a list of serial commands available through the RS-232 interface. Error codes associated with these commands are listed on page 67.

General Configuration Commands (p. 63)

stepsize
drvdir
stalltime
sernum

Reset Factory Settings Commands (p. 63)

restoremodes
harttype

Demand Signal Commands (p. 63 & 64)

dem0pctma
dem100pctma
trimdem4ma
trimdem20ma
demfunc
demlos
demlosgtp

Position & Feedback Signal Commands (p. 65)

posisd
psisp
fdbk0pctma
fdbk100pctma
trimfdbk4ma
trimfdbk20ma
fdbkfunc
travel

Diagnostic and Information Commands (p. 66)

signals
stat
tempf

Note: For specific information on the following functions, see the HART interface section of the manual.

General Configuration Commands

Command	Description	Argument *n* and Information
stepsize *n*	Sets and/or displays the size (in degrees) of one incremental movement of the output shaft.	*n* = stepsize in degrees. The minimum value that can be entered is "0.10"; which is also the standard value. The maximum value is "2.50".
drvdir *n*	Sets and/or displays the drive output shaft direction resulting from an increasing Demand signal.	*n* = "0" (indicates Extend); or *n* = "1" (indicates Retract).
stalltime *n*	Sets and/or displays the time allowed for the drive to reach its Demand target. If the drive cannot reach the target in the allotted time, a stall condition is initiated.	*n* = time in seconds. Time to stall is configurable from 30 to 300 seconds. The default value is 300 seconds.
sernum *n*	Sets the serial number of the drive in which the DCM-2 is installed. Model number information is derived from the serial number.	*n* = serial number.

Reset Factory Settings Commands

Command	Description	Argument *n* and Information
restoremodes 1	Resets the drive configuration back to the original factory settings.	No additional argument required.
harttype *n*	Sets and/or displays the DCM-2 HART device type.	*n* = "1" (ESR-D); *n* = "10" (DCM-2); or *n* = "239" (BECK-MK2)

Demand Signal Commands

Command	Description	Argument *n* and Information
dem0pctma *n*	Sets the Demand signal value that corresponds to 0% drive position.	*n* = the Demand signal as a decimal in milliamps. The minimum acceptable value is 0.50 mA. The maximum acceptable value is 100% Demand less 4.00 mA. For example, if the 100% Demand signal is 20.00 mA, then the 0% Demand signal must be 16.00 mA or less.

Note: For specific information on the following functions, see the HART interface section of the manual.

Demand Signal Commands (con't)

Command	Description	Argument *n* and Information
dem100pctma *n*	Sets the Demand signal value that corresponds to 100% drive position.	*n* = the Demand signal as a decimal in milliamps. The minimum acceptable value is the Demand at 0% plus 4.00 mA. For example, if the 0% Demand signal is 4.00 mA, then the 100% Demand signal must be 8.00 mA or greater. The maximum acceptable value is 21.00 mA.
trimdem4ma 4	Calibrates the Demand signal at 4 mA. This command should only be used when the Demand signal at the drive is 4 mA. If the Demand signal at the drive is greater or less than 4 mA, an error will be returned. Note: This parameter is factory configured and normally does not require recalibration.	A 4 mA Demand signal must be present at drive terminals 14 & 15.
trimdem20ma 20	Calibrates the Demand signal at 20 mA. This command should only be used when the Demand signal at the drive is 20 mA. If the Demand signal at the drive is greater or less than 20 mA, an error will be returned. Note: This parameter is factory configured and normally does not require recalibration.	A 20 mA Demand signal must be present at drive terminals 14 & 15.
demfunc *n*	Sets and/or displays the Demand signal input characterization function. The DCM-2 provides linear, square root, special curve or square function characterization.	*n* = "0" (linear) *n* = "1" (square root) *n* = "4" (special curve) *n* = "5" (square).
demlos *n*	Sets and/or displays the Demand signal threshold below which the DCM-2 recognizes that the signal is lost. The threshold is entered as a value in mA. This command also sets and/or displays the action initiated by the drive during LOS (Loss Of Signal). LOS action options are "sip" (stay in place) or "gtp" (go to position). Note that the command always reports both settings, but only sets one argument at a time. The command must be used twice to set the threshold and action. If the action is "gtp", then the command *demlosgtp* (see below) must also be set. The option "pat" is also available to prevent error messages if the DCM-2 is not being used with a Demand signal.	*n* = the Demand signal in mA below which LOS occurs. For example, in a 4–20 mA drive, if the desired LOS is 5% below the minimum signal, then *n* = "3.20" mA. — OR — *n* = "sip", "gtp" or "pat". Note: *n* values must be set separately.
demlosgtp *n*	Sets and/or displays the position to which the drive will run upon loss of the Demand signal (LOS). This command has no effect if the drive is set to "sip" (stay in place).	*n* = the desired position of the drive expressed as a percentage of drive travel (e.g., if the desired LOS position is 50%, then *n* = "50.00").

Position and Feedback Signal Commands

Command	Description	Argument *n* and Information
travel *n*	Sets and/or displays the value that represents 100% travel.	*n* = the desired length of travel in degrees.
fdbk0pctma *n*	Sets and/or displays the mA value of the Feedback signal that represents the 0% drive position.	*n* = the desired Feedback signal for 0% drive position in mA. The minimum value is 3 mA ("3.00") and the maximum value is at least 4 mA less than the Feedback signal value for the 100% drive position.
fdbk100pctma *n*	Sets and/or displays the mA value of the Feedback signal that represents the 100% drive position.	*n* = the desired Feeback signal for 100% drive position in mA. The minimum value must be at least 4 mA greater than the Feedback signal value for the 0% drive position. The maximum value is 21mA ("21.00").
fdbkfunc *n*	Sets and/or displays whether or not the drive Feedback signal is enabled.	*n* = "0" (no feedback) or "1" (feedback).
posis *n*	Sets the point of drive travel in relation to the drive's current position. This command should only be used when the drive is at a known position of travel.	*n* = the present drive position as a degree of full drive travel to establish where the 0% point of travel should be.
trimfdbk4ma *n*	Trims the Feedback signal at 4 mA. If the Feedback signal is not within 1 mA of 4 mA, an error will be returned. Note: The Feeback sourcing circuit is factory calibrated and normally does not require recalibration.	*n* = the present Feedback signal from the drive as measured in mA at terminals 16 & 17. The minimum value is 3 mA ("3.000") and the maximum value is 5 mA ("5.000").
trimfdbk20ma *n*	Trims the Feedback signal at 20 mA. If the Feedback signal is not within 1 mA of 20 mA, an error will be returned. Note: The Feeback sourcing circuit is factory calibrated and normally does not require recalibration.	*n* = the present Feedback signal from the drive as measured in mA at terminals 16 & 17. The minimum value is 19 mA ("19.000") and the maximum value is 21 mA ("21.000").

Note: For specific information on the following functions, see the HART interface section of the manual.

Diagnostic and Information Commands

Command	Description	Argument *n* and Information
signals	Displays the present Position signal of the drive in volts and the Demand signal in milliamps.	No argument.
stat	Displays information on the status of the drive, including: Time / Date Demand (% and settings) Position (% / inches) Error (%) Stepsize (inches / %) Deadband (inches / %) Motor Status Run Time Line Frequency Starts (ext./ret./total) Reversals/Stalls Overloads Positive & Negative Peak Load (%) Positive & Negative Peak Torque (% / inches) Extend and Retract Inhibit Setting Alarms	No argument.
tempf	Displays measured temperatures in the drive (°F.): Low extreme Present temperature High extreme	No argument.

Command Error Codes

When an error is encountered using the serial commands, an "ERROR XX" message is returned. The table below provides a description of the error codes ("XX").

Code	Description	Information
2	Invalid selection	Displayed when an unknown command has been entered.
3	Value too big	Displayed when an entered numeric value exceeds expected parameters.
4	Value too small	Displayed when an entered numeric value is less than expected parameters.
5	Data length error	Displayed when the wrong number of arguments is entered.
6	General error	Displayed when a combination of circumstances prevents a better description of the error.
9	Process too high	Displayed when the entered value exceeds acceptable parameters when calibrating a 0% value.
10	Process too low	Displayed when the entered value is less than acceptable parameters when calibrating a 100% value.
14	Span too small	Displayed when entered values for a 0% point and a 100% point are too close.
32	Busy	Displayed when a memory store is requested and another memory store is already in process.
64	Not implemented	Displayed when an entered command is defined, but cannot be implemented.

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 69. 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 69.

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 (10-32 screws at 20 lb-in or 1/4-20 bolts at 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 on page 73 for switch assembly part numbers.

SELF-LOCKING MECHANISM (SLM)

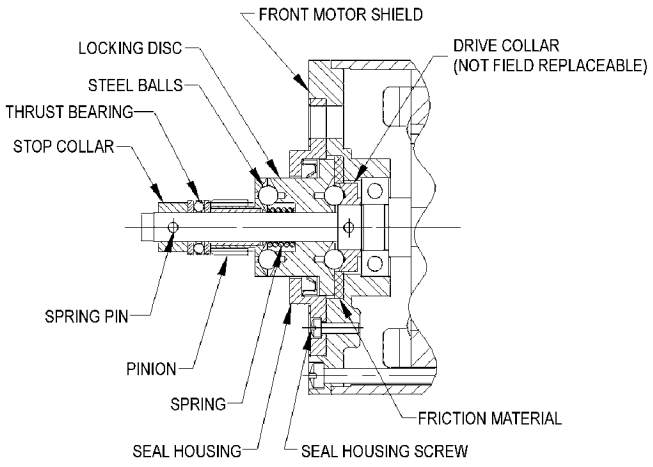
In normal service, the SLM friction surface should not require replacement; however, a combination of excessive modulation and load can cause wear to the SLM mechanism. If the SLM has been damaged, rebuild kits are available (see table below).

SLM Rebuild Kits typically consist of a spring, spring pin, thrust bearing, pinion, steel balls, locking disc, steel shims, control motor gasket, terminal joints, and instruction sheet.

See the figure below for identification of typical SLM components.

SLM KIT PART NUMBERS

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

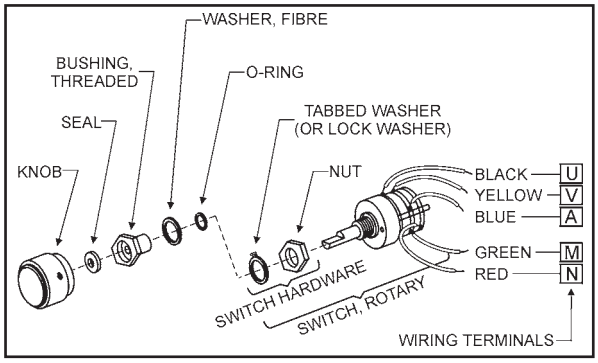


SLM Detail

Handswitch

To replace the Handswitch, remove the terminal cover, DCM-2 board and DCM-2 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 the figure below. Splice the wires color for color. Replace the DCM-2 bracket, board and the terminal cover. Torque bolts to 10 lb-ft.

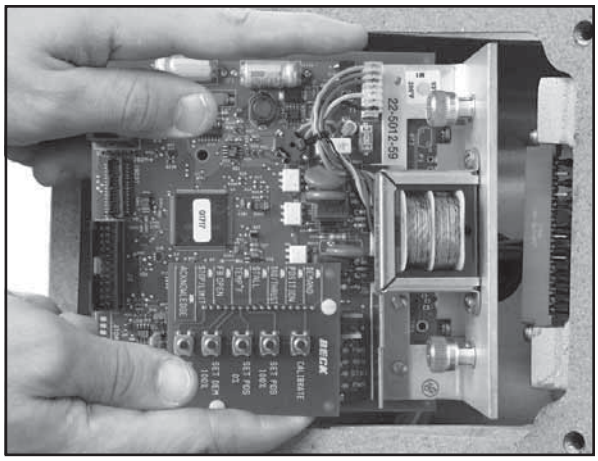
NOTE: The AUTO position on the Handswitch knob must be straight up when the switch is fully clockwise. Handswitch part number 20-3300-27.



Handswitch Detail

DCM-2

Field service of the DCM-2 board is not recommended. The factory maintains a stock of replacement boards for immediate shipment. To replace the DCM-2 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 image below.



DCM-2 Replacement

To install a DCM-2 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. The rotor should be held inside the stator with rubber bands for protection during shipment.

Continued

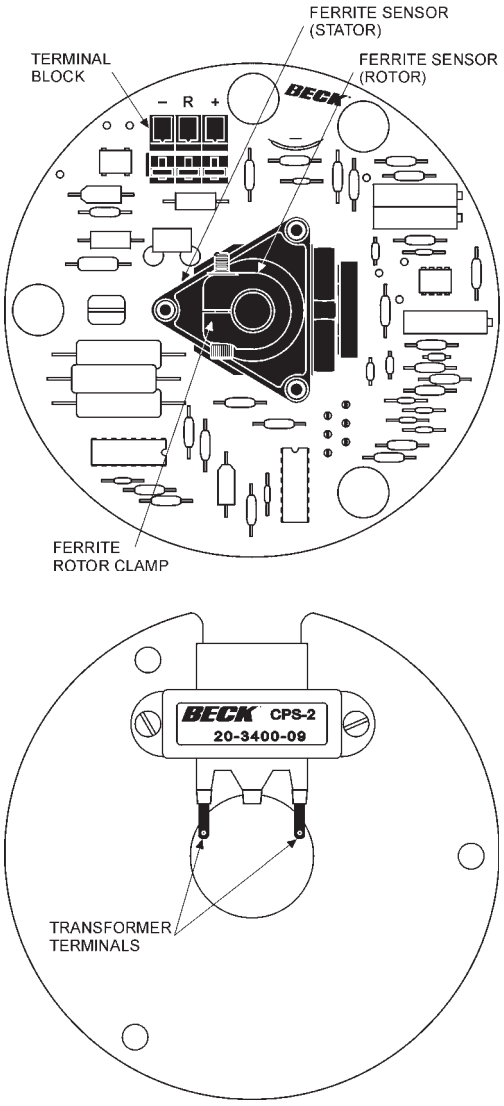
CPS-2, CONT'D.

To remove the CPS-2:

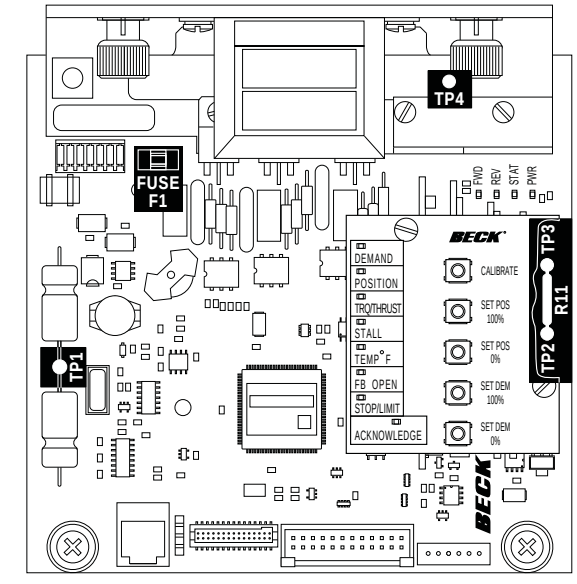
1. Run the control drive to its midpoint of travel with the local Handswitch. (If the standard rotation of 100° has been reduced to 80°, the midpoint of travel is 40°.)
2. Disconnect 120 V ac power to the drive. Remove the terminal, DCM-2 compartment and control end covers (1/2" bolt heads).
3. Record the wire colors on the terminal block of the CPS-2 (see illustration, upper right), then disconnect the wires. The terminals are spring-loaded. To remove a wire, press the tip of a small screwdriver into the slot at the top of the small lever. Push down to open the spring-loaded contact and release the wire.
4. Pull the wires from the transformer (see illustration, middle right) back through the wire hole in the CPS-2.
5. Loosen and remove the 3 hex studs that clamp the CPS-2 in place. Ensure that the inboard hex stud is not loosened 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 (only a minor adjustment should be necessary) on the control shaft until the output voltage measured across TP4 and TP1 (see illustration at right) reads 50% (approx. 3 volts) of the signal span. Tighten clamp to 5 lb-in torque.
7. Perform a position calibration procedure as described on page 26 or page 50.



CPS-2 Components



Location of DCM-2 Test Points and Resistor 11

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 the spare parts table 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).

RECOMMENDED SPARE PARTS

DESCRIPTION	PART NO.	DESCRIPTION	PART NO.
Limit switch assembly	20-3202-20	Motor resistor	See table below
Auxiliary switch assembly (2 switches) (4 switches)	 20-3202-21 20-3202-22	Motor capacitor DCM Board	See table below 22-5012-59
Gasket set	20-3110-13	Fuse, 7A, 125V	11-1373-01
Control motor	See table below	CPS-2	20-3400-09

MOTORS, CAPACITORS, AND RESISTORS

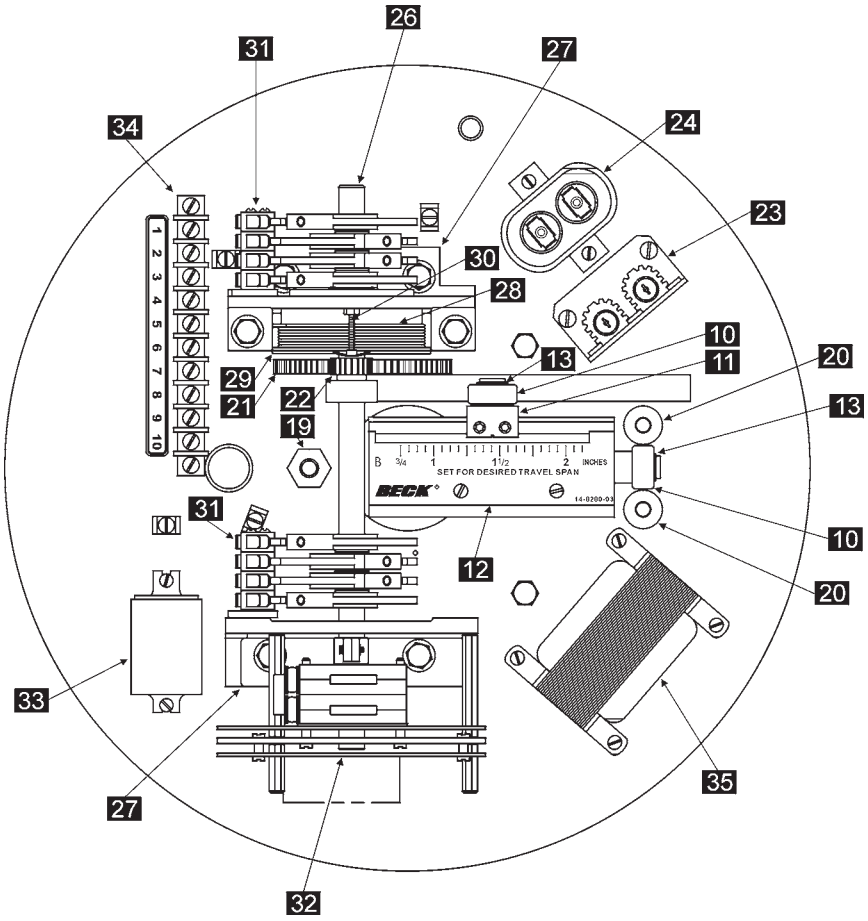
MODEL NO.	MOTOR PART NO.	FREQ. (HZ)	CAPACITOR PART NO.	VALUE	RESISTOR ASSEMBLY PART NO.	VALUE	USE ONLY WITH TIMING ...
14-100	20-2702-21, -31	60	14-2840-16	5 µf	20-1971-13	220W	10 sec. or higher
		50	14-2840-19	7 µf	20-1971-13	220W	10 sec. or higher
14-100	20-2703-21, -31	60	14-2840-05	8 µf	20-1971-12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

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

GEARS

MODEL NUMBER	SPUR GEARING RATIO / 1	NOMINAL SPEED SEC. / IN. 60 Hz 72 RPM	NOMINAL SPEED SEC. / IN. 50 Hz 60 RPM	GEAR HOUSING ASSEMBLY
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

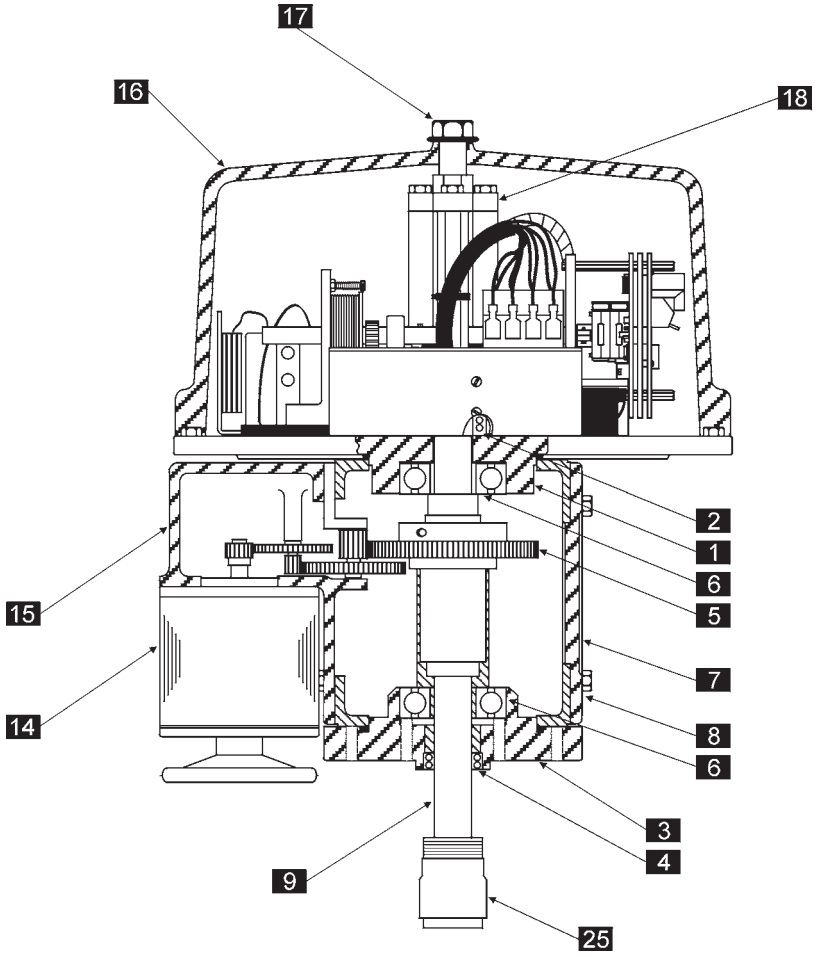
*Note: It is necessary to install a gear housing spacer with these modules.



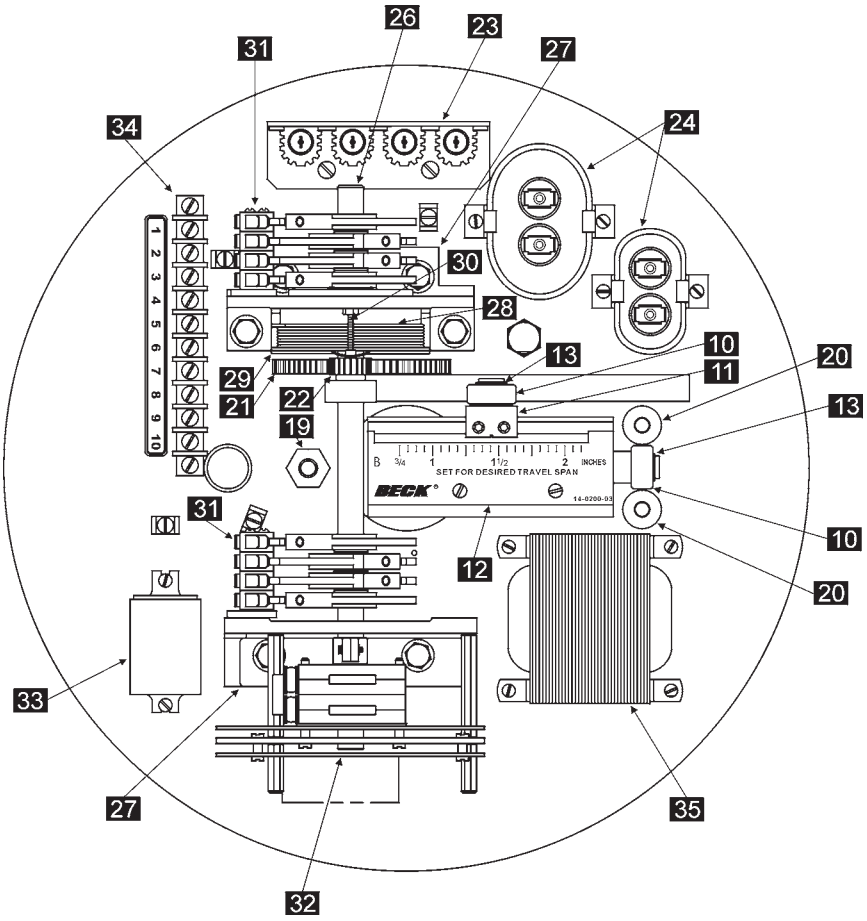
PARTS FOR MODEL 14-100 CONTROL ASSEMBLY AND DRIVE TRAIN

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.



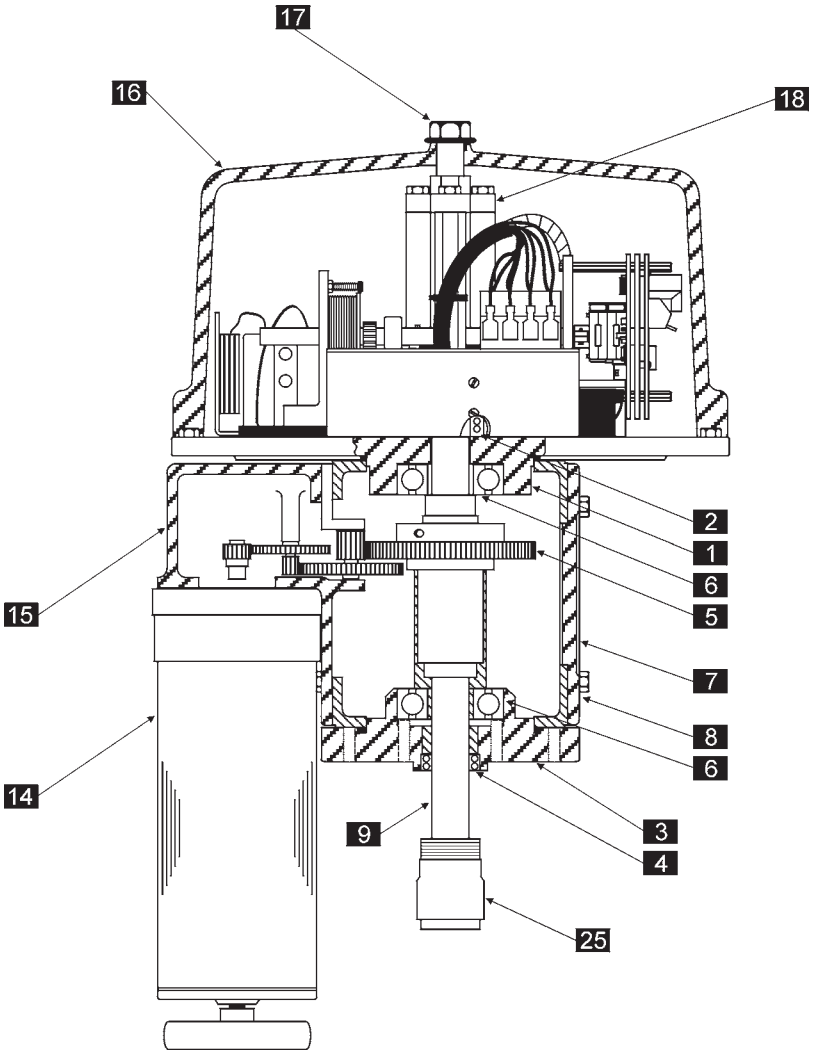
CONTROL ASSEMBLY AND DRIVE TRAIN



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

INDEX

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 work site. Beck's analysis at the job site 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.**

Beck Control Drives are covered by the following patents: 3,667,578; 4,690,168; 6,563,412 B2; 6,639,375 B2 and 6,769,527 B1 with other patents pending.

Serving the
Process
Industries
since
1936 ...

BECK® ***HAROLD BECK & SONS, INC.***
11 TERRY DRIVE • NEWTOWN, PENNSYLVANIA 18940 • USA
PHONE: 215-968-4600 • FAX: 215-860-6383 • www.haroldbeck.com

02/08