80-1402-02
Rev. 01

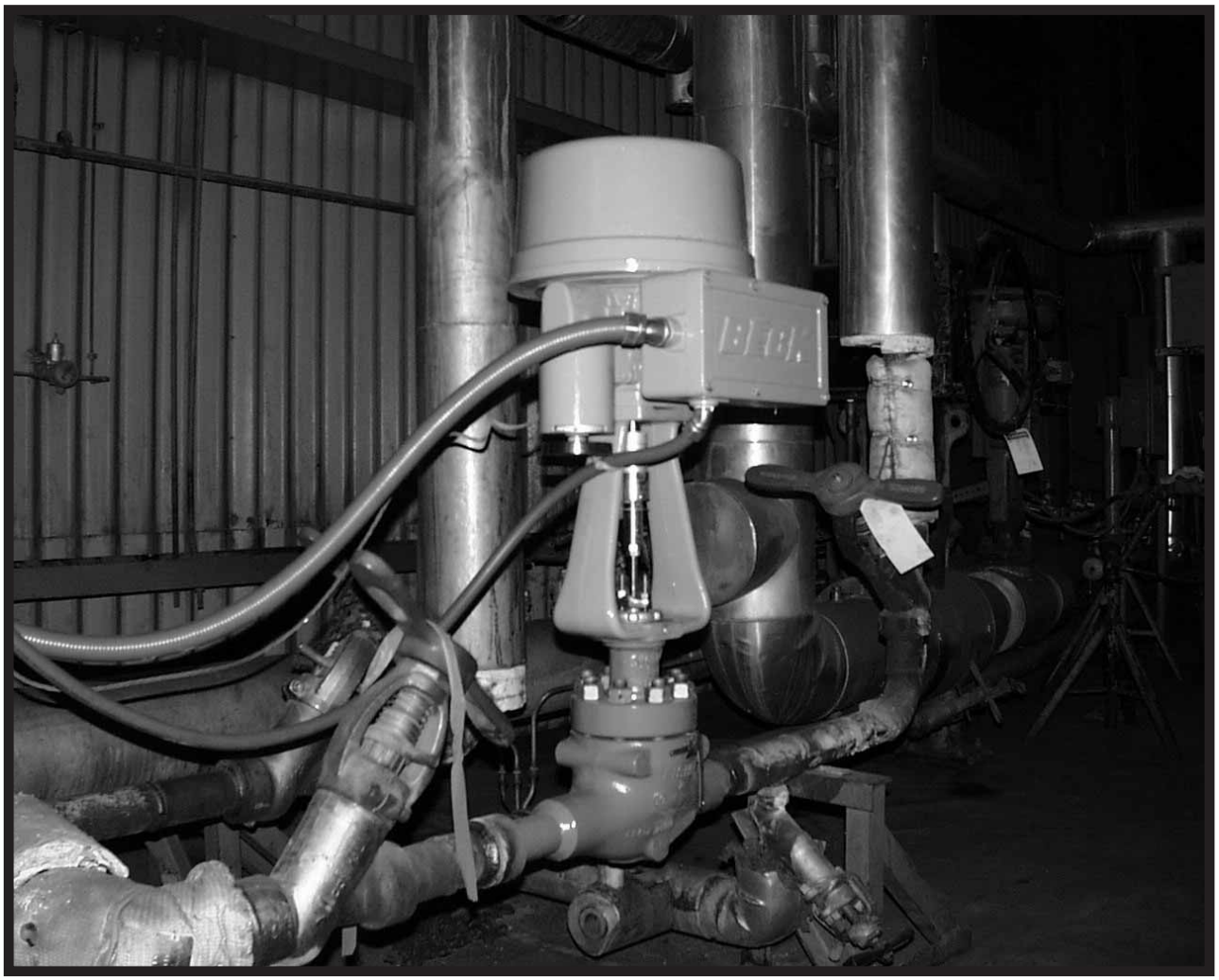
MODEL GROUP 14

DCM-L EQUIPPED

BECK ELECTRONIC

CONTROL DRIVES

INSTRUCTION MANUAL



BECK®

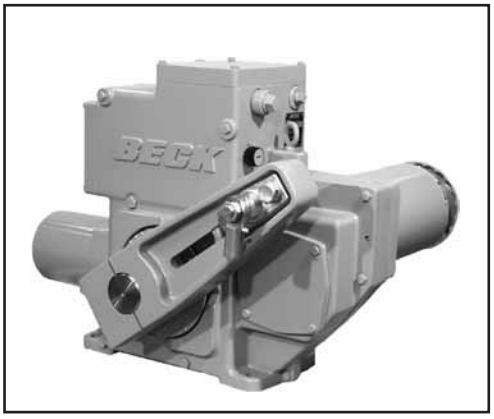
INTRODUCTION TO THE MANUAL

This manual contains the information needed to install, operate and maintain Beck Model Group 14 Electronic Control Drives equipped with the Local interface version of the Digital Control Module (DCM-L), 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.

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

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

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

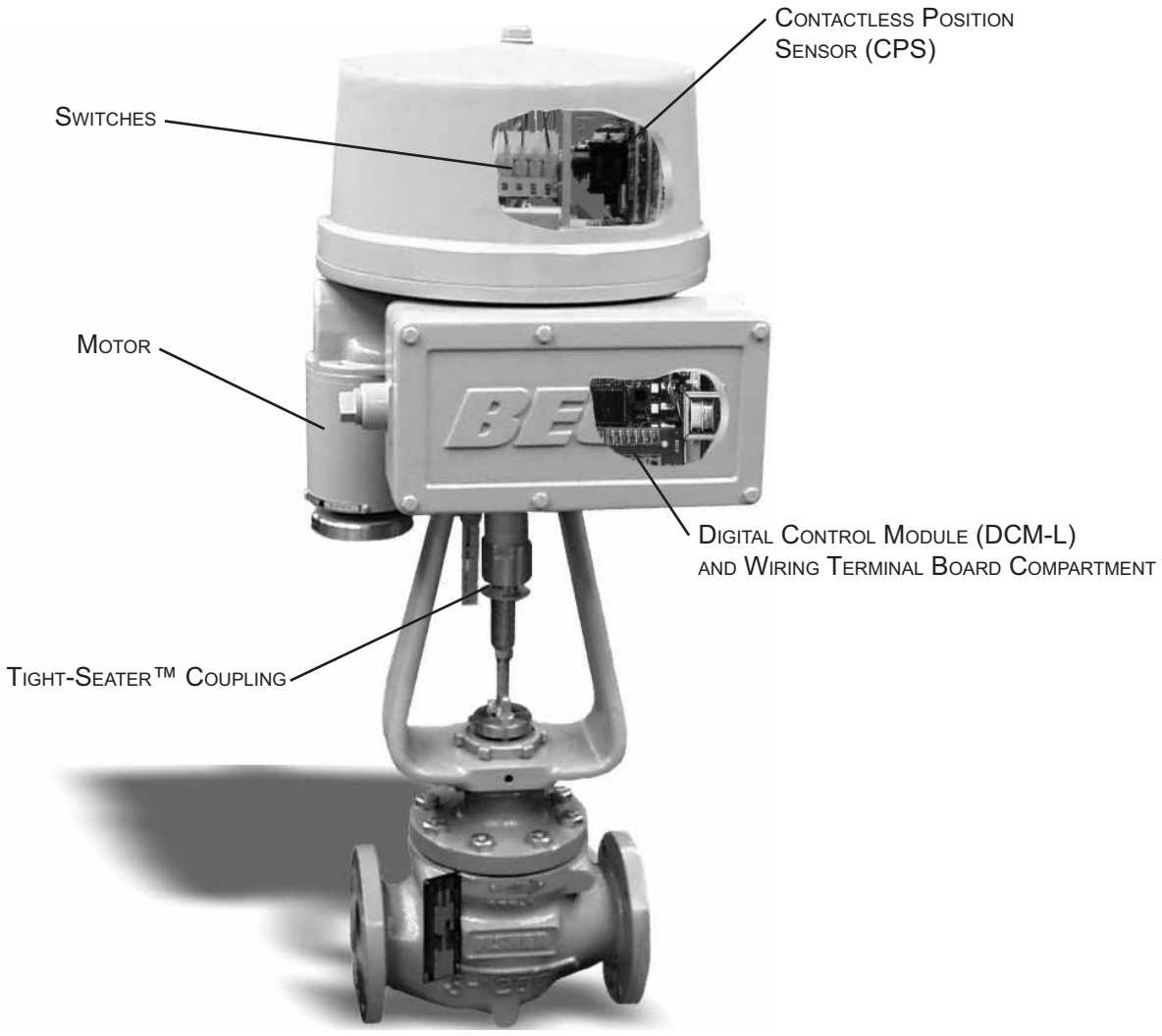
TYPICAL APPLICATIONS

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

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

TABLE 1:
GROUP 14 MECHANICAL AND ELECTRICAL SPECIFICATIONS

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



PRODUCT DESCRIPTION

GENERAL SPECIFICATIONS

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

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

Operating Conditions	-40° to 85°C (-40° to 185°F) 0 to 99% relative humidity
Demand Input Signal Range (Digital Control Module)	4–20 mA 1–5 V dc
Adjustability for Split Range Operation	0%: 0.1 V to 4 V dc 100%: 0% + 1 V min., 5 V max.
Deadband	0.6% of span. (Contact the factory if a different value is desired).
Minimum Step	0.1% typical.
Hysteresis	0.25% of span at any point
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
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)	Drives to any preset position—factory set according to customer specifications.
Stall Protection and Annunciation	If the motor tries to run in one direction for more than 300 seconds, the DCM will shut off power to the motor and an error light will activate indicating a stall. Time to stall indication can be factory configured down to 30 seconds according to specifications at time of order.

GENERAL SPECIFICATIONS (cont'd)

Over-travel Limit Switches	Two SPDT switches (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 over-travel during automatic or manual operation.
Enclosure	Precision-machined aluminum alloy castings, painted with corrosion-resistant polyurethane paint, provide a rugged, dust-tight, weatherproof enclosure.
Stroke Adjustment	Calibar simultaneously adjusts the stroke length, position feedback signal, over-travel limit switches and auxiliary switches. The new stroke displacement is produced by the full input signal.

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

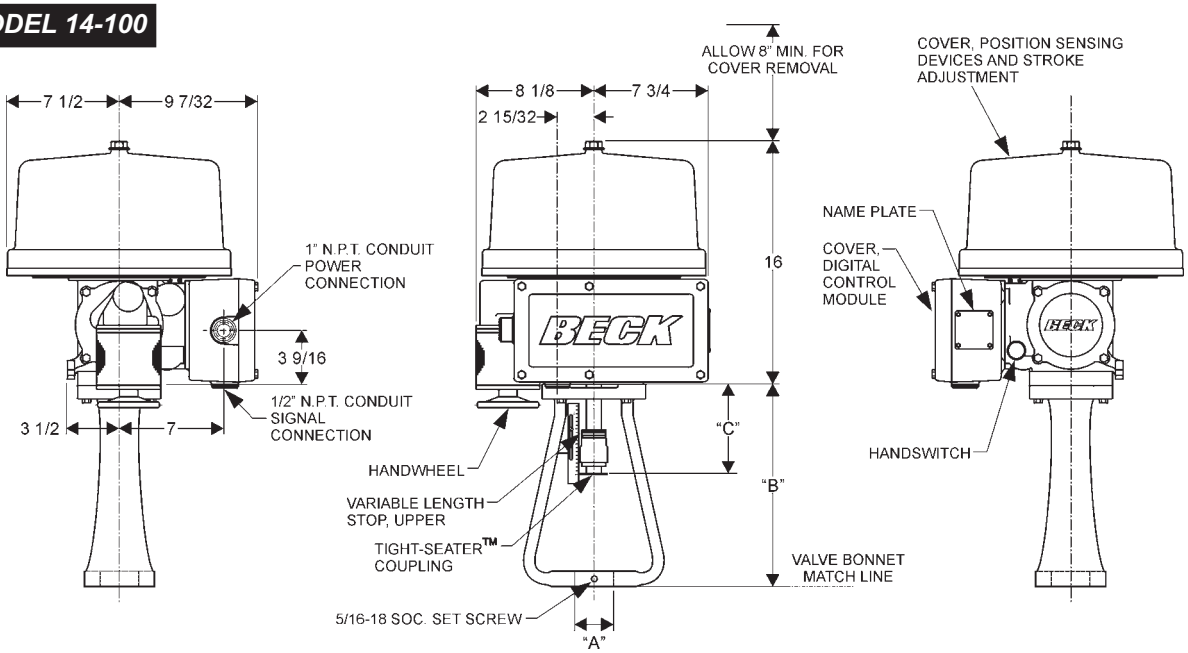
DCM-H Part Number	Demand Input Signal Range*	Contactless Position Sensor Part Number	External Position Feedback Signal	Auxiliary Switch Options
22-5009-34	4–20 mA	20-3400-09	No	None 2 4
22-5009-35	4–20 mA		Yes	
22-5009-44	1–5 V dc		No	
22-5009-45	1–5 V dc		Yes	

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

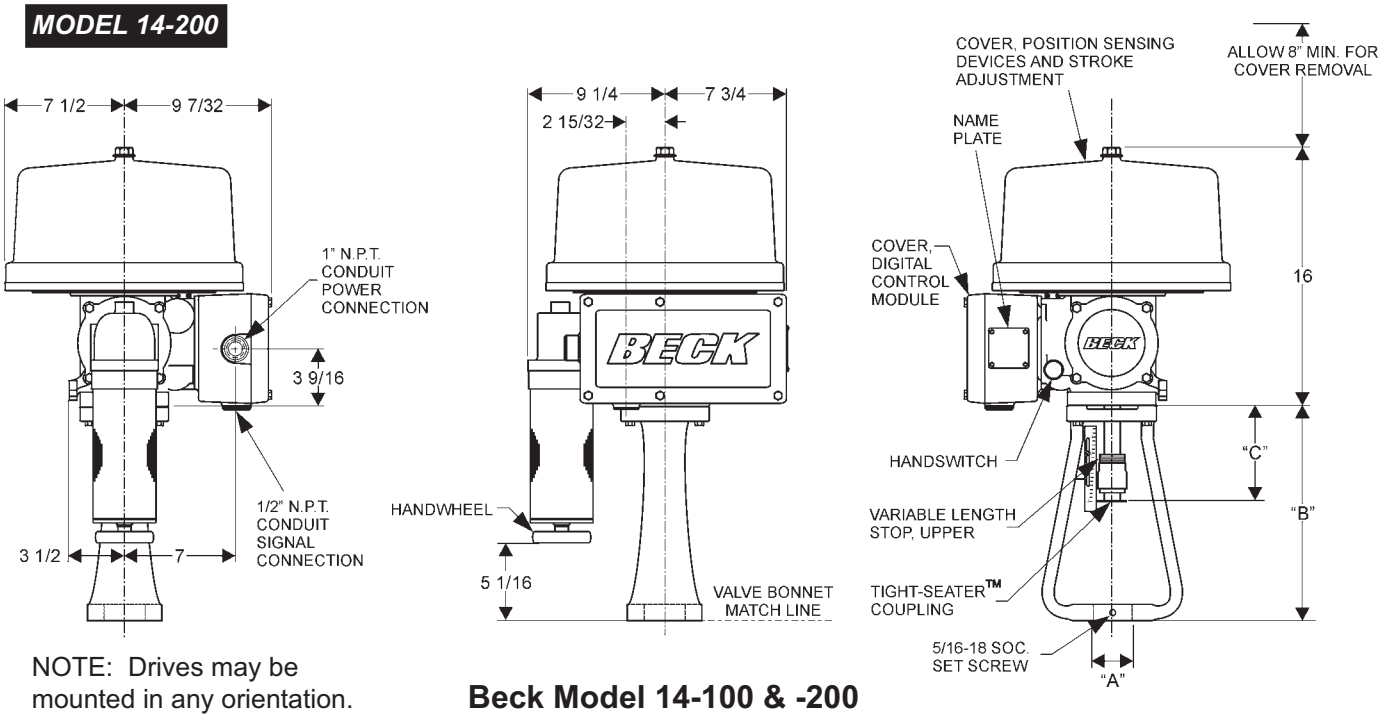
OUTLINE DIMENSION DRAWINGS

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

MODEL 14-100



MODEL 14-200



NOTE: Drives may be mounted in any orientation.

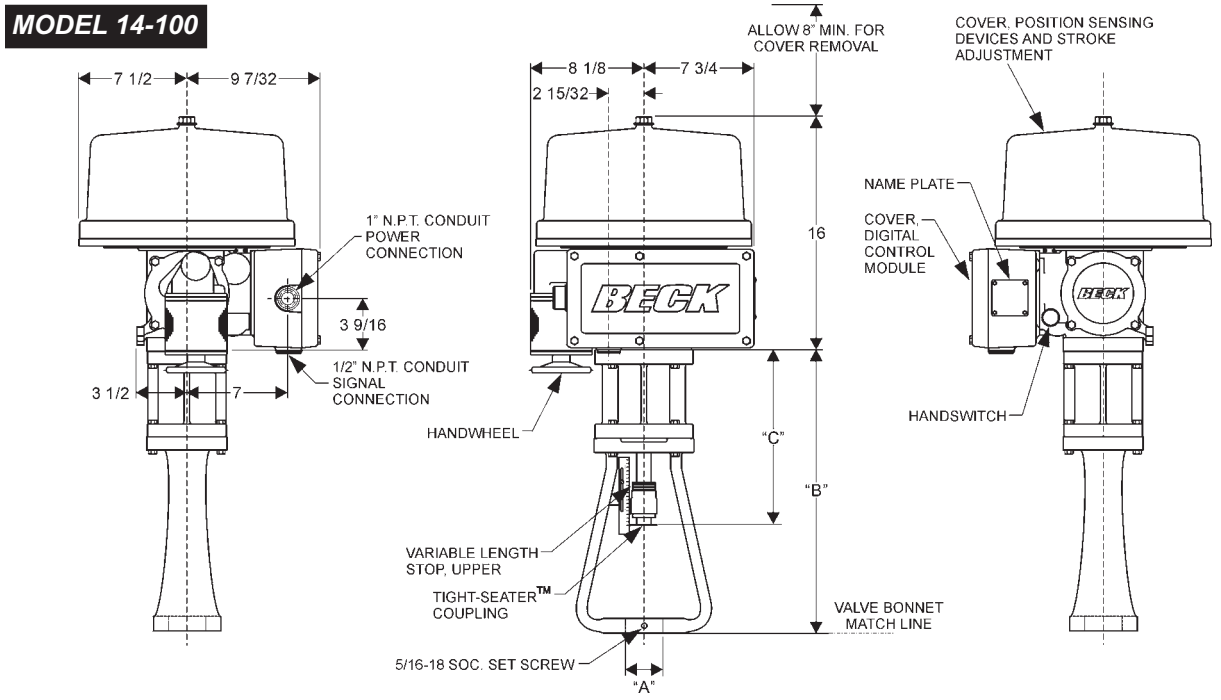
Beck Model 14-100 & -200

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

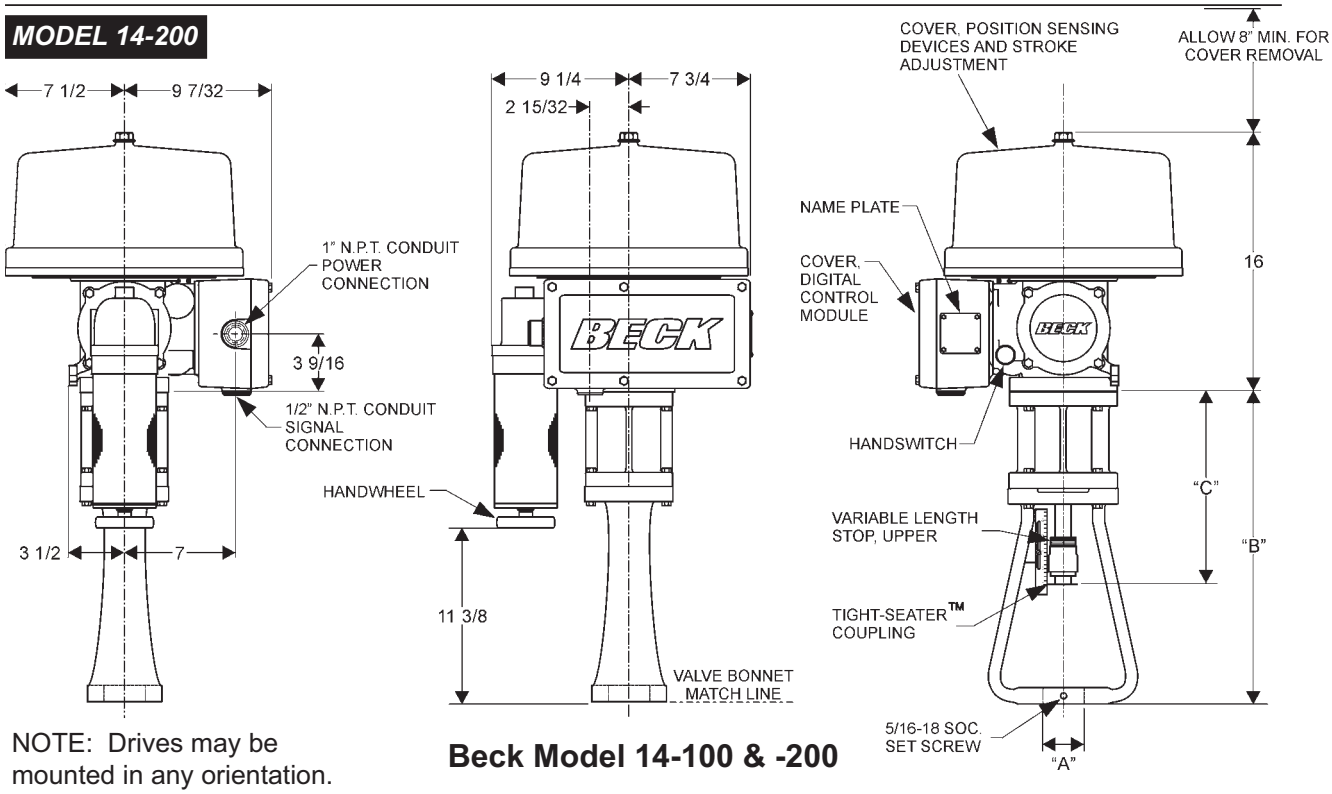
OUTLINE DIMENSION DRAWINGS

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

MODEL 14-100



MODEL 14-200



NOTE: Drives may be mounted in any orientation.

Beck Model 14-100 & -200

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

INSTALLATION

SAFETY PRECAUTIONS

WARNING

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

STORAGE INFORMATION

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

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

UNPACKING

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

INSTALLATION—MECHANICAL

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

CAUTION

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

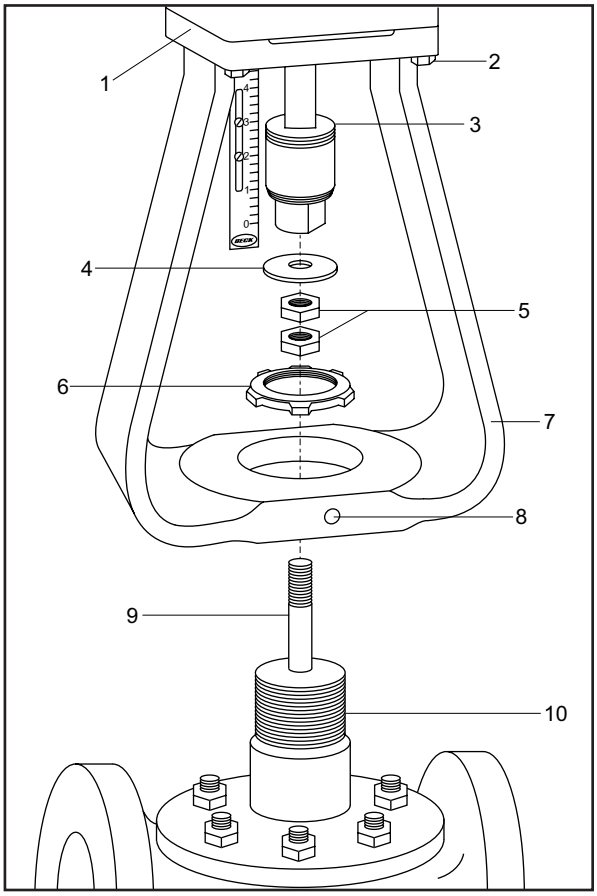
- **Know what fluid is in the line.**
- **Wear proper protective equipment.**
- **Disconnect the electrical power.**
- **Depressurize the pipeline.**
- **Refer to the valve maintenance manual for specific instructions.**

Mounting The Drive On A Valve

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

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

Continued



MOUNTING THE DRIVE, CONT'D.

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

Removing the Drive from a Valve

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

Valve Installation

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

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

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

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

INSTALLATION—ELECTRICAL

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

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

CAUTION

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

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

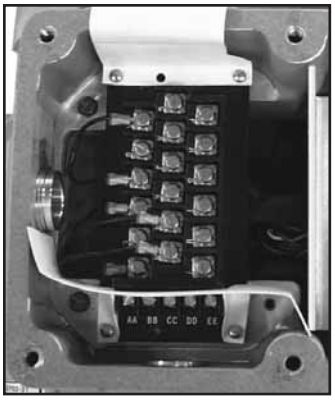
Your Beck drive has been supplied to match the signal source in your control loop. If it does not match, the input signal range is convertible by adding or removing a 250 ohm resistor—contact the factory for details.

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

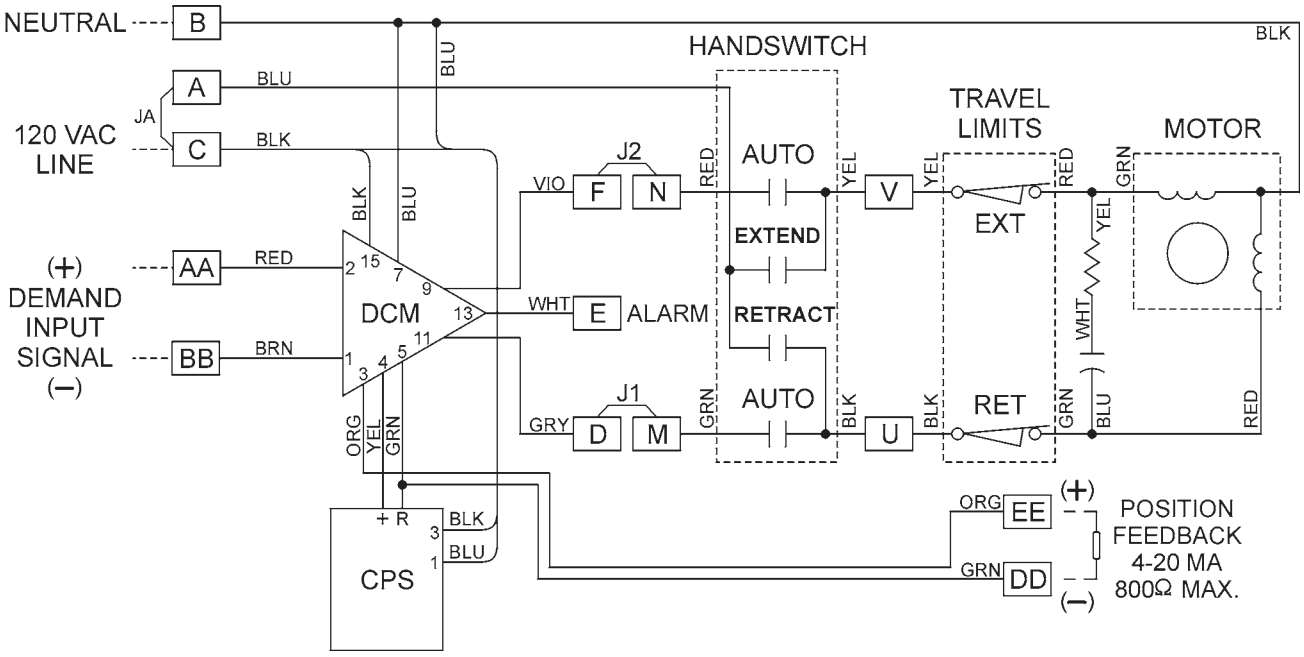
INSTALLATION *SIGNAL WIRING*

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

A drive can be ordered with up to four optional auxiliary switches. Wiring connections for these are described on page 22.



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. For example, if an increasing control signal retracts the shaft and opens the valve, a 100% signal will fully retract the drive. 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 28).

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. Ensure that the DCM is properly calibrated (see the “Calibration” section of this manual).
2. With the Handswitch, run the drive to a position above the 0% or lower limit position.
3. Loosen the lock nut on the valve stem and thread the valve stem into the Tight-Seater™.
4. Run the drive to the 0% position, using a Demand signal source.
5. Thread the valve stem out of the Tight-Seater™ until the plug seats in the valve.
6. 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.
7. 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

8. Tighten the jam nut and travel index on the valve stem.
9. Run the drive to its lower limit using the Handswitch. The valve stem should stop before the drive shaft stops.
10. 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.

OPERATION

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 50 milliseconds and stop within 25 milliseconds; actual starting and stopping times will 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.

OPERATION

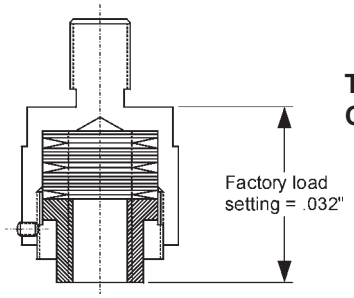
TIGHT-SEATER™

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

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

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

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



Tight-Seater™ Cross-Section

Tight-Seater™

HANDWHEEL

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

HANDSWITCH

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

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

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

In the STOP position, all contacts remain open.

SWITCHES

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

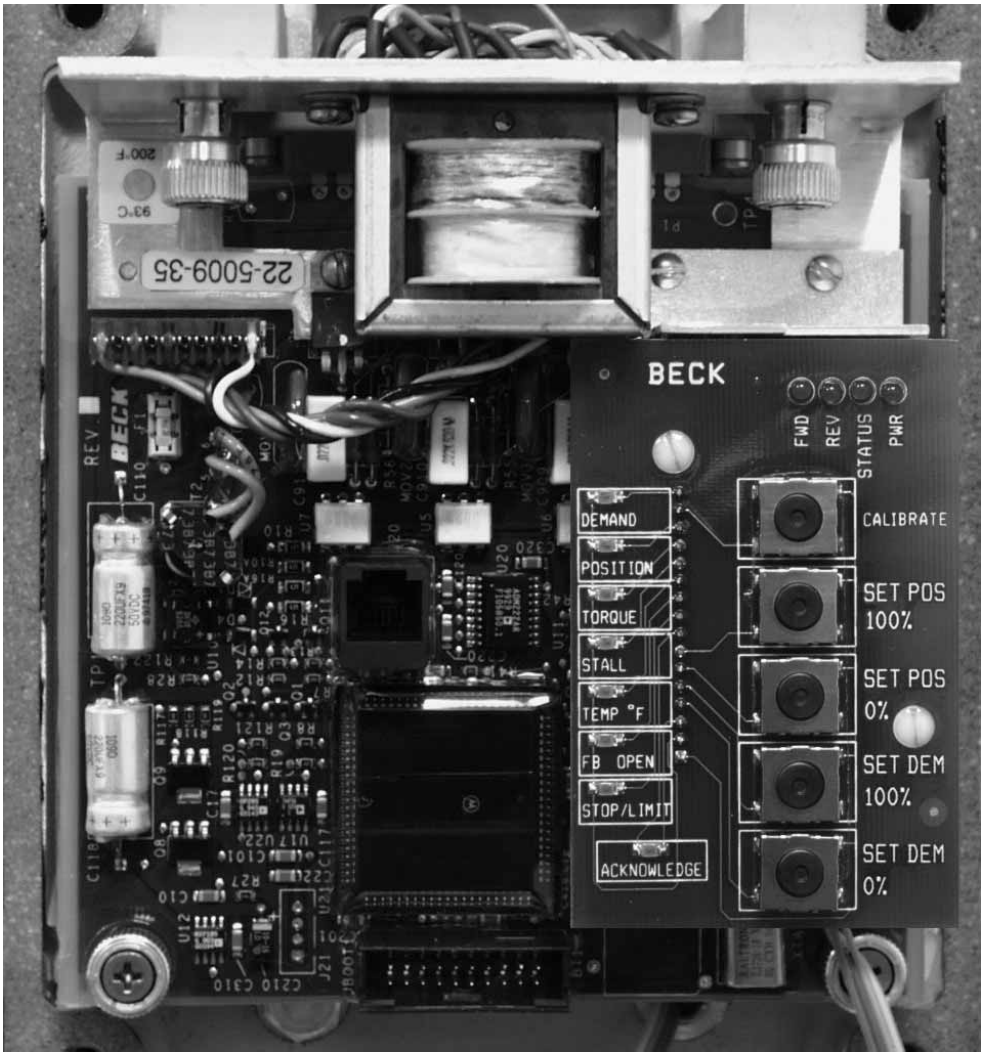
INPUT: DIGITAL CONTROL MODULE (DCM)

Beck modulating drives are equipped with a precision, digital control module (DCM) 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 modulates the drive output shaft in response to an analog demand input signal and is designed to operate continuously in temperatures up to 185°F.

The DCM permits two or more Beck drives to be operated by a single signal source. See page 26 for details on split range operation.

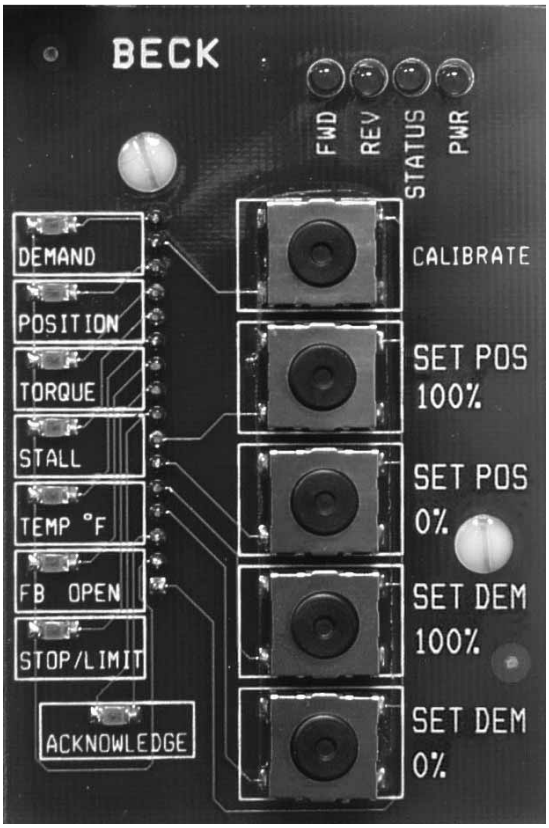
Beck drives can be set up to position the output shaft proportionally to the square of the input signal. This function is factory configurable only. See page 26 for details.



OPERATION

DCM OVERVIEW

The DCM 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 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

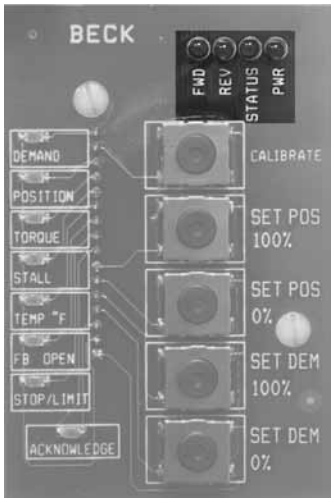
This LED is lit when the drive is receiving a Demand signal smaller than its position.

STATUS

This LED is lit when additional status is available. For details regarding possible conditions, see “Status Indication LEDs” on page 40.

PWR

This LED is lit when power is applied to the drive.



Status Indication LEDs

When the “STATUS” LED is lit, the applicable status indication LED(s) (pictured below) will light to reveal the condition(s) as described below. 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 20.

DEMAND
: Loss of the Demand input signal.

POSITION
: The CPS Position signal to the DCM 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.

TORQUE
: Not used with Model 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 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. If the “STATUS” LED lights instead of the “ACKNOWLEDGE” LED, this indicates a condition as described in the previous section, “Status Indication LEDs”. See the Calibration section, beginning on page 21, 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.

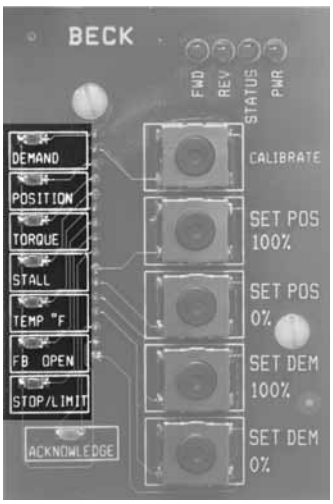
SET POS 100%
: Press to set the desired 100% position for drive movement (this will correspond to a 100% Demand signal).

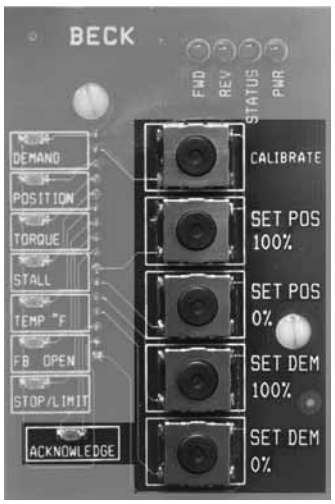
SET POS 0%
: Press to set the desired 0% position for drive movement (this will correspond to a 0% Demand signal).

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

OPERATION

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

When the Demand input signal drops to approximately 3.2 mA, the DCM considers the Demand input signal to be invalid. DCMs are typically configured to stop the drive during L.O.S. conditions, but may be factory configured to run the drive to a predetermined position. Under the L.O.S. condition, the “STATUS” and “DEMAND” LEDs will light. When the input signal is corrected, the drive will automatically resume normal operation.

POSITION: CONTACTLESS POSITION SENSOR (CPS)

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

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

STALL PROTECTION AND ANNUNCIATION

If the drive output shaft cannot reach a desired position within approximately 300 seconds, the DCM shuts off power to the motor and the “STATUS” and “STALL” LEDs will light. The stall condition timing is factory configurable from 300 seconds to as low as 30 seconds and is 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) or switching the drive power off and on.

TEMPERATURE

DCMs are equipped with a temperature sensing circuit. The “STATUS” and “TEMP °F” LEDs will light when the drive’s ambient temperature exceeds the rating of the drive.

FEEDBACK SIGNAL (OPTIONAL)

A feedback sourcing module may be installed in the DCM. This module provides a 4–20 mA analog output signal that represents the drive output shaft position in terms of 0–100% of full rotational travel. This signal can be remotely monitored or used by a controller or indicator. The “STATUS” 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.

STOP/LIMIT INDICATION

The “STATUS” 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.

CALIBRATION

All Beck drives are shipped completely calibrated to the customer's specifications 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 customer interface panel. Calibration of over-travel limit and auxiliary switches must be performed using the procedure beginning on page 22.

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 24), the limit switches are simultaneously adjusted.

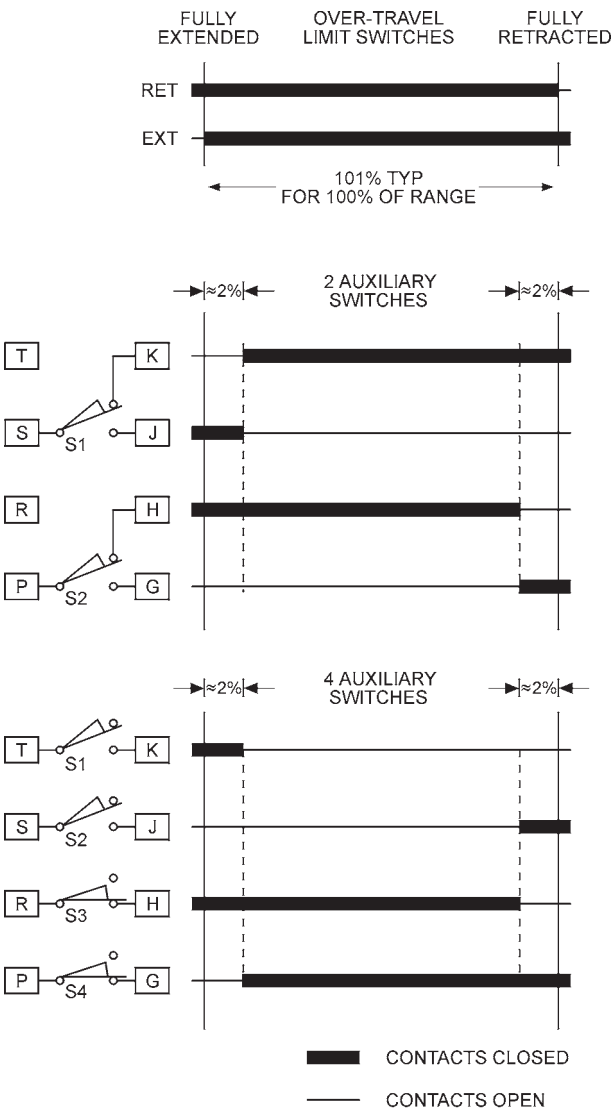
The auxiliary limit switches are also cam operated, but have no affect on drive and DCM operation. Therefore, they can be adjusted at any time without affecting performance or calibration.

CALIBRATION *SWITCHES*

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 over-travel limit switches. These switches are factory set to provide over-travel protection based on the specifications of your application. If you feel that a situation has caused the switches to require recalibration, contact the factory for assistance.



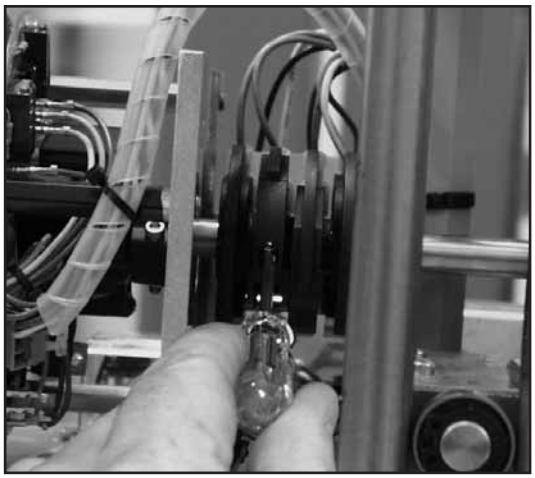
Standard Over-travel Limit and Auxiliary Switch Settings

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 are set inside the range of the built-in mechanical stops to prevent stalling of the motor. Over-travel limit switches should never require adjustment. If, however, you feel that a situation has caused the switches to require adjustment, contact the factory for assistance.

Optional auxiliary switches are set as shown in the illustration at left unless otherwise specified at time of order. The auxiliary switches may be adjusted at any time using the following procedure.

Switches are operated by cams which are clamped onto the control shaft. Setting a switch involves loosening the cam (see illustration below), 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.



Loosening Cams

Setting Auxiliary Switches

Standard switch settings for drives with 2 or 4 auxiliary switches are shown on the diagram on page 22. 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 diagram on page 13 or the drive wiring diagram. Rotate the cam until the meter shows no continuity (switch contacts open, switch clicks).
6. Tighten the cam locking screw to 5 lb-in torque.
7. Disconnect the meter and reconnect power.
8. Move the drive’s output shaft in the desired direction so the cam lobe moves away from the switch lever. If not correct, return to step 2 and reset the cam to proper orientation.
9. Reconnect the meter.
10. Move the output shaft again toward the desired switch position. If the contacts open, the switch is properly set.
11. Close covers and tighten the terminal cover bolts to 10 lb-ft torque. Tighten the top cover just enough to compress the O-ring seal.

STROKE CHANGE—CALIBAR

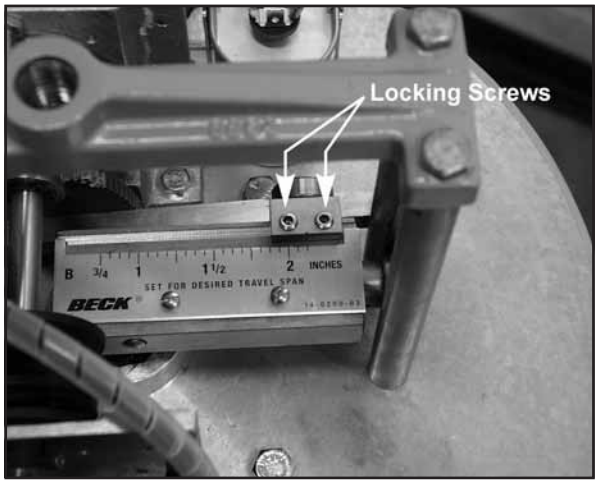
Adjustment of the total drive stroke within the factory-set travel range is easily accomplished by the use of the Beck Calibar as shown in the figure at right. The switches and feedback device are simultaneously adjusted to maintain full input span when the Calibar setting is changed. For stroke lengths 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 at right).
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 (or beyond) the factory-set travel range, a portion of the upper mechanical stop will have to be removed.
5. Use the Handswitch to operate the drive and check the stroke on the travel index of the valve yoke.
6. Replace the top cover after making adjustments. Tighten the top cover just enough to compress the O-ring seal.

NOTE: The limit switches and feedback device are adjusted automatically when the Calibar setting is changed. Do not adjust the limit switch cams to change the drive stroke. It is desirable, however, to calibrate the DCM position reference to match the Calibar setting. See page 27.

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).



Calibar

Adjusting the DCM Position Reference In Response to a Stroke Change

When drive stroke has been changed through Calibar adjustment, it is desirable to calibrate the DCM position reference to match this change (see page 27). Once this procedure has been completed, the DCM position reference for the output shaft will now match the new stroking distance.

CALIBRATION *DEMAND*

DCM boards are designed to accept a 4–20 mA (or 1–5 V dc) analog demand signal. Narrower spans within this range can also be accommodated for split range operation (see page 26). 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 pushbutton controls and a signal source. Following this procedure is only necessary to compensate for slight differences between the signal source calibration and the DCM factory calibration, or if reduced range calibration is desired for special operating scenarios such as split ranging.

Calibration Procedure

1. Remove the DCM 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 13.
4. Press and hold the "CALIBRATE" pushbutton on the DCM 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 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 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. 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

In applications where it is necessary (or preferable) to have more than one final control element controlling a single process, two to four Beck drives may be set up to respond to different portions of the Demand signal from the control system. The most common arrangement involves two drives; each operating on different halves of the input signal range. For example, if a 4–20 mA control signal is used, the first drive would move 100% of its stroke on a signal range of 4–12 mA, while the second operates on the 12–20 mA range.

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

1. Remove the DCM 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 13.
4. Press and hold the "CALIBRATE" pushbutton on the DCM 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 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 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. 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 input signal (see table below). This function is factory configurable only.

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

CALIBRATION *POSITION*

In order to correctly position the drive output shaft in response to the Demand input signal, the DCM 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 interprets the position signal appropriately for the full range of desired travel. This procedure will calibrate the DCM 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. If a change in drive stroke is desired, this is accomplished by adjusting the Calibar (see page 24). If, however, it becomes necessary to recalibrate (e.g., after replacing a DCM board), the procedure is as follows:

Calibration Procedure

1. Remove the DCM 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 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 customer interface panel, then press the "SET POS 100%" pushbutton until the "ACKNOWLEDGE" LED is lit.*
8. Verify that the drive's 0% and 100% positions are correct. If not, repeat this procedure.
9. 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.

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 rotation is easily accomplished using the DCM customer interface panel (see page 19 for location of push-button controls). Follow the steps below.

1. Remove the DCM cover (1/2" bolt heads).
2. Position the drive at the present 0% position.
3. Press and hold the "CALIBRATE" pushbutton on the DCM 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 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 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.

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.

MAINTENANCE *ROUTINE*

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

LUBRICATION

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

CAUTION

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

To inspect or lubricate the output gear, 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 30. 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 30.

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

Under normal service, seals should last for the life of the drive. If seals should become worn or damaged, however, they should be replaced. Contact the factory for assistance.

BEARINGS

Under normal service, bearings should last for the life of the drive. If bearings should become worn or damaged, however, they should be replaced. Contact the factory for assistance.

MOTOR

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

CAUTION

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

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

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

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

MOTOR RESISTOR AND CAPACITOR

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

OVER-TRAVEL LIMIT AND AUXILIARY SWITCHES

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

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

ADDING SWITCHES

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

Remove the top cover (15/16" bolt head). Install wiring onto the switch push-on lugs and route the wires into the control drive terminal area. Remove the terminal cover and solder wires to the underside of the terminal assembly according to the wiring diagram included with the new switch assembly. Install the new switch assembly and adjust according to the instructions above. See Table 4, page 36, for switch assembly part numbers.

SLM FRICTION SURFACE

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

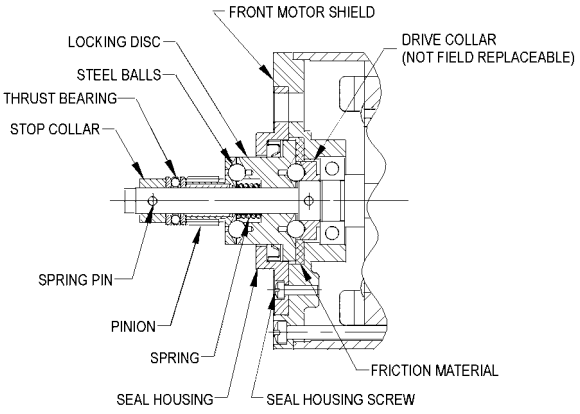
Turn the Handswitch to STOP. Carefully turn the Handwheel back and forth. If there is free play in the Handwheel (up to one tenth of a full Handwheel rotation) the SLM has sufficient wear life. If there is no free play in the Handwheel, the drive may not hold position and the friction surface may need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

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

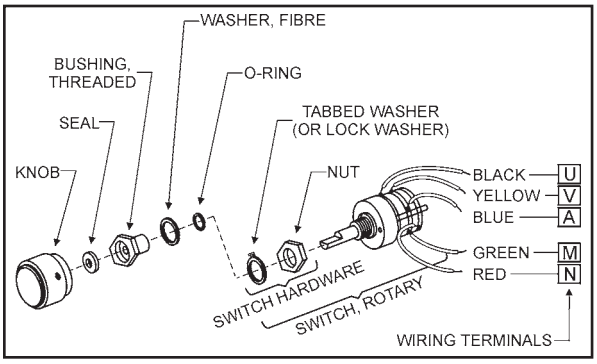
See the figure below, for identification of typical SLM components.

TABLE 3

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



SLM Components



Handswitch Components

HANDSWITCH

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

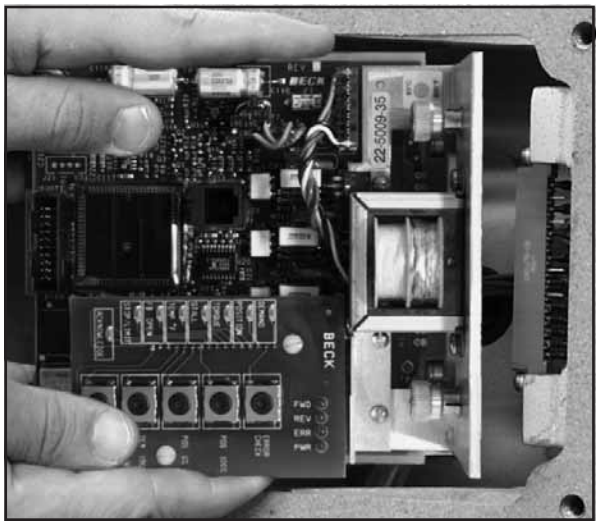
NOTE: The AUTO position on the Handswitch knob must be straight up when the switch is fully clockwise. Handswitch part number 20-3300-27.

DCM BOARD

CAUTION

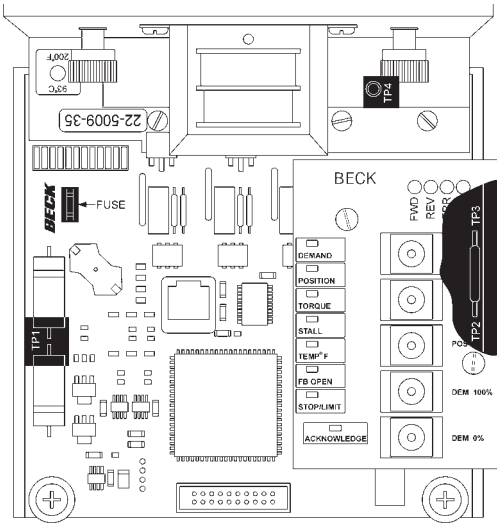
To prevent Electro-Static Discharge damage to the electronics, wear a grounding strap during this procedure.

Field service of the DCM board is not recommended. The factory maintains a stock of replacement boards for immediate shipment. To replace the DCM board, remove the Digital Control Module compartment cover (1/2" bolt heads). If applicable, disconnect the torque sensing wires from the bottom of the customer interface panel by gently pulling on the connector. Loosen the four captive 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 rocking motion. See illustration on this page.



DCM Board Replacement

To install a DCM board, lightly press the board connector into its receptacle until the mounting bracket is flush with its mounting surface. Tighten the four captive screws to 8 lb-in. Replace the compartment cover. Torque the cover bolts to 10 lb-ft.



DCM Test Points

CPS-2

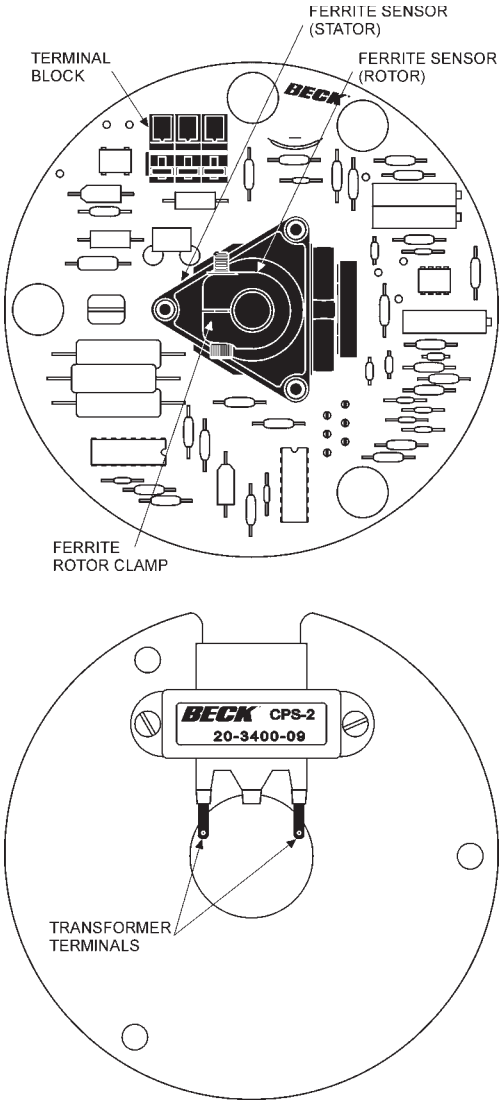
Field repair of the CPS-2 assembly is not recommended. The factory maintains a stock of replacement assemblies for immediate shipment. If it is necessary to replace the CPS-2, replace both the rotor and stator / circuit board assembly. When returning the CPS-2 to the factory for service, include the 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 and the hex studs should be reattached to the mounting plate for protection during shipment.

To remove the CPS-2:

1. Run the control drive to its 50% position (mid-point of travel) with the local Handswitch.
2. Disconnect 120 V ac power to the drive. Remove the terminal, DCM compartment and control end covers (1/2" bolt heads).
3. Record the wire colors on the terminal block of the CPS-2 (see illustration at right), then disconnect the wires. The terminals are spring-loaded. To remove a wire, press the tip of a 3/32” screwdriver into the slot at the top of the small lever. Push down to open the spring-loaded contact and release the wire.
4. Pull the wires from the transformer (see illustration at 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.

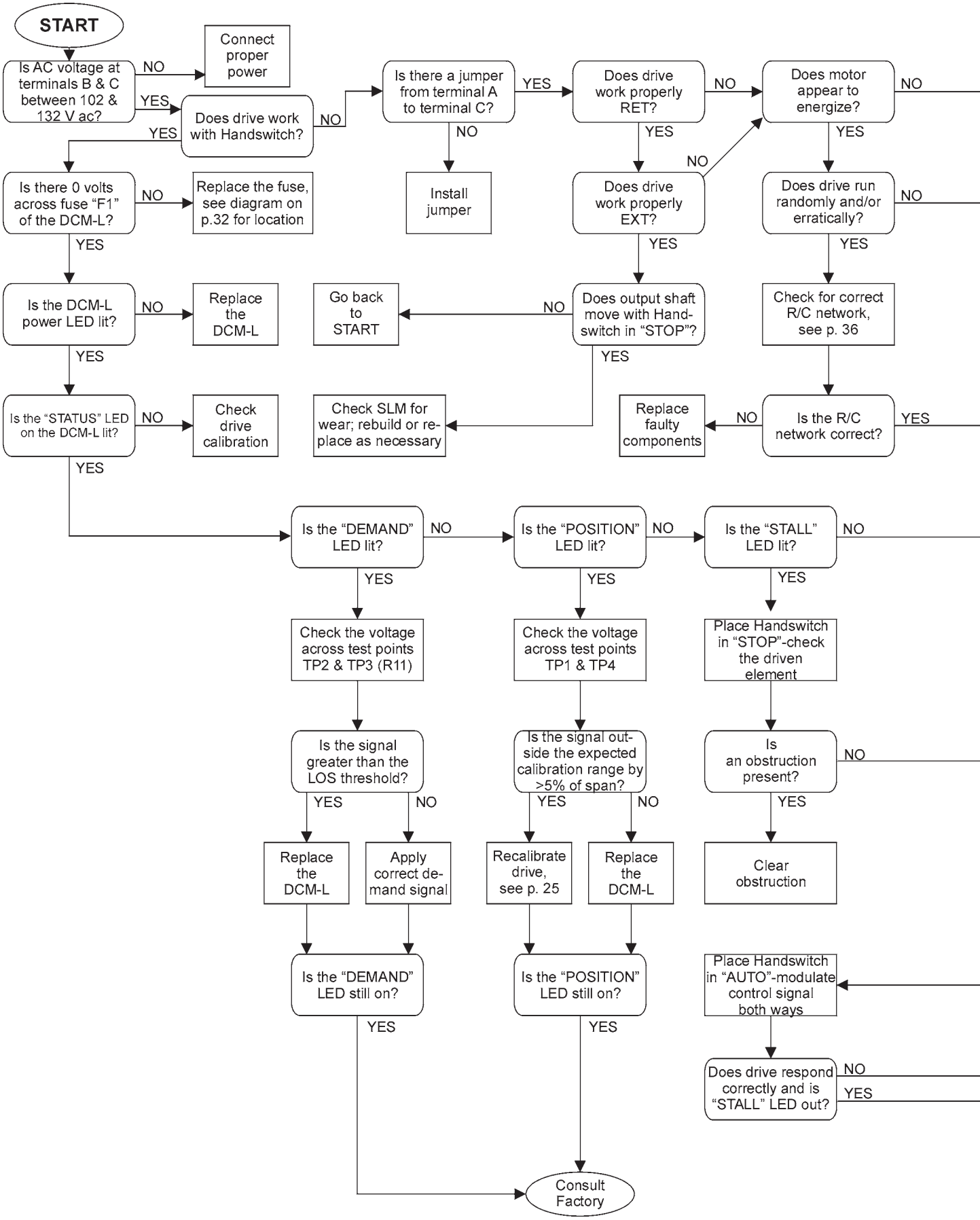
To install the new CPS-2:

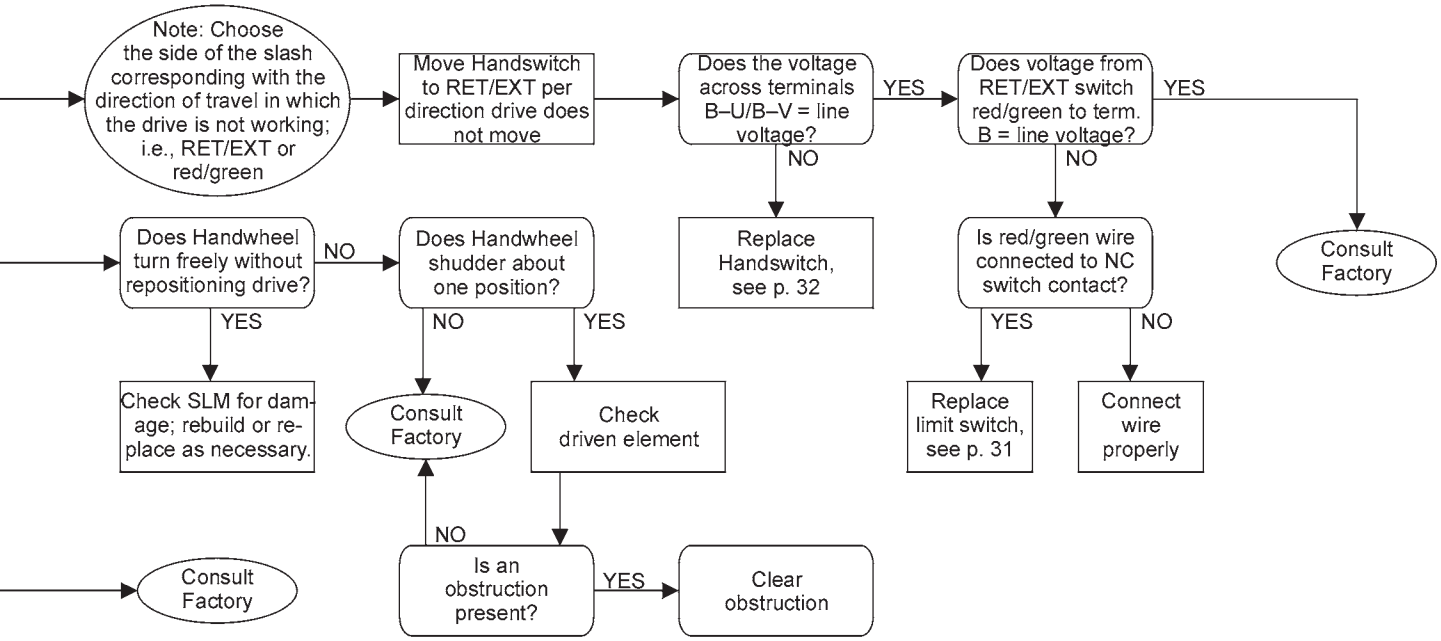
1. Remove the rotor from the replacement CPS-2 assembly. Slide the rotor, clamp end first, onto the control shaft as close to the mounting plate as possible. Leave the clamp loose. Position the clamp in the same general location as the one removed previously.
2. Slide the new CPS-2 assembly over the 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 on previous page) 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 27.

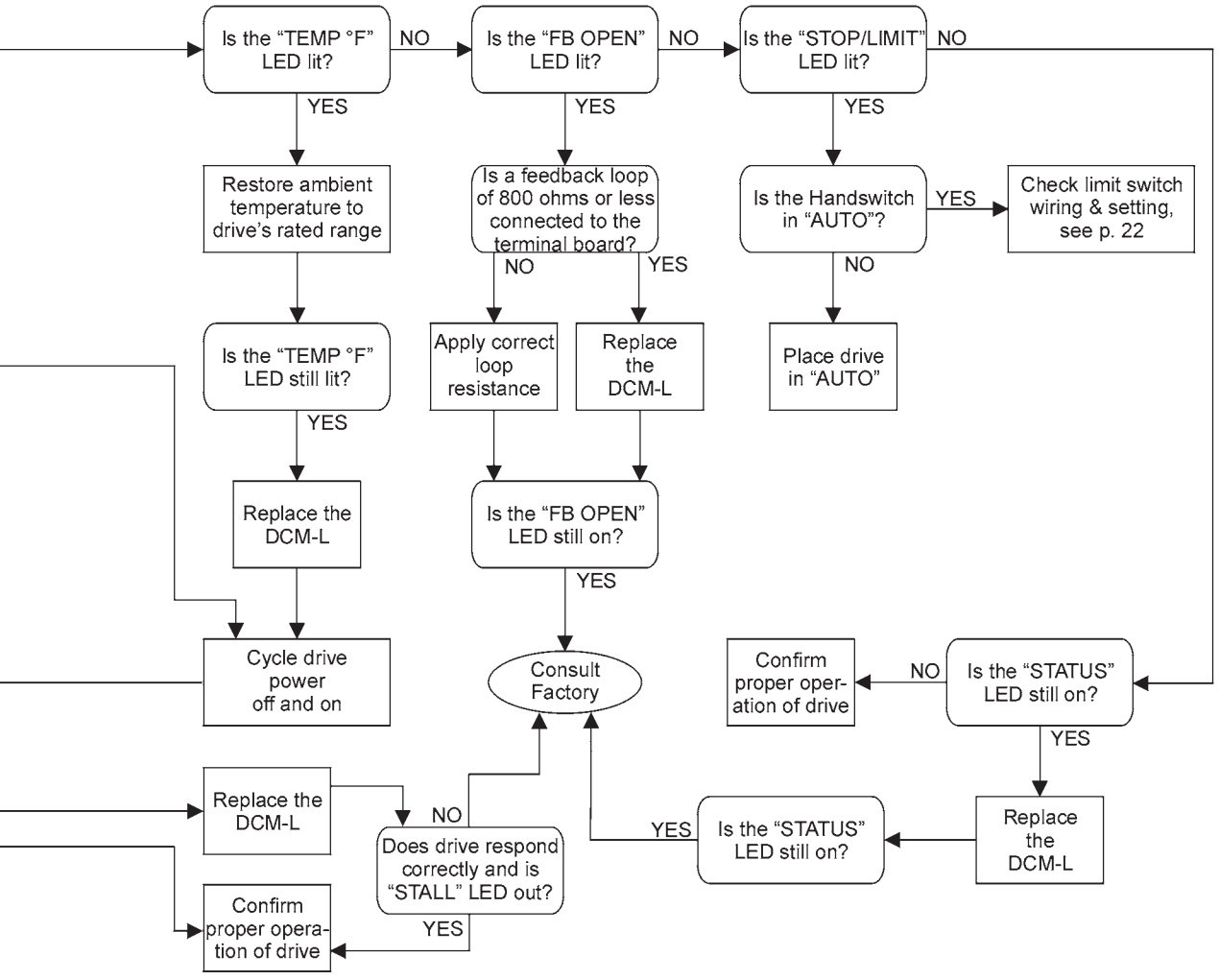


CPS-2 Components

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


START
Is AC voltage at terminals B & C between 102 & 132 V ac?
NO
Connect proper power
YES
Does drive work with Handswitch?
NO
YES
Is there a jumper from terminal A to terminal C?
YES
Does drive work properly RET?
NO
Does motor appear to energize?
NO
NO
YES
YES
Install jumper
Is there 0 volts across fuse "F1" of the DCM-L?
NO
Replace the fuse, see diagram on p.32 for location
Does drive work properly EXT?
NO
Does drive run randomly and/or erratically?
NO
YES
YES
YES
Is the DCM-L power LED lit?
NO
Replace the DCM-L
Go back to START
NO
Does output shaft move with Hand-switch in "STOP"?
Check for correct R/C network, see p. 36
YES
YES
Is the "STATUS" LED on the DCM-L lit?
NO
Check drive calibration
Check SLM for wear; rebuild or re-place as necessary
Replace faulty components
NO
Is the R/C network correct?
YES
YES
Is the "DEMAND" LED lit?
NO
Is the "POSITION" LED lit?
NO
Is the "STALL" LED lit?
NO
YES
YES
YES
Check the voltage across test points TP2 & TP3 (R11)
Check the voltage across test points TP1 & TP4
Place Handswitch in "STOP"-check the driven element
Is the signal greater than the LOS threshold?
Is the signal out-side the expected calibration range by >5% of span?
Is an obstruction present?
NO
YES
NO
YES
NO
YES
Replace the DCM-L
Apply correct de-mand signal
Recalibrate drive, see p. 25
Replace the DCM-L
Clear obstruction
Is the "DEMAND" LED still on?
Is the "POSITION" LED still on?
Place Handswitch in "AUTO"-modulate control signal both ways
YES
YES
Does drive respond correctly and is "STALL" LED out?
NO
YES
Consult Factory


Note: Choose the side of the slash corresponding with the direction of travel in which the drive is not working; i.e., RET/EXT or red/green
Move Handswitch to RET/EXT per direction drive does not move
Does the voltage across terminals B–U/B–V = line voltage?
YES
NO
Does voltage from RET/EXT switch red/green to term. B = line voltage?
YES
NO
Consult Factory
Replace Handswitch, see p. 32
Does Handwheel turn freely without repositioning drive?
NO
YES
Does Handwheel shudder about one position?
NO
YES
Is red/green wire connected to NC switch contact?
YES
NO
Check SLM for damage; rebuild or replace as necessary.
Consult Factory
Check driven element
Replace limit switch, see p. 31
Connect wire properly
NO
Consult Factory
Is an obstruction present?
YES
Clear obstruction


Is the “TEMP °F” LED lit?
NO
Is the “FB OPEN” LED lit?
NO
Is the “STOP/LIMIT” LED lit?
NO
YES
YES
YES
Restore ambient temperature to drive’s rated range
Is a feedback loop of 800 ohms or less connected to the terminal board?
Is the Handswitch in “AUTO”?
YES
Check limit switch wiring & setting, see p. 22
NO
YES
NO
Is the “TEMP °F” LED still lit?
Apply correct loop resistance
Replace the DCM-L
Place drive in “AUTO”
YES
Replace the DCM-L
Is the “FB OPEN” LED still on?
YES
Cycle drive power off and on
Consult Factory
Confirm proper operation of drive
NO
Is the “STATUS” LED still on?
YES
Replace the DCM-L
NO
Does drive respond correctly and is “STALL” LED out?
YES
Is the “STATUS” LED still on?
YES
Replace the DCM-L
Confirm proper operation of drive

APPENDIX *SPARE PARTS*

RECOMMENDED SPARE PARTS

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

HOW TO ORDER SPARE PARTS

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

TABLE 4: RECOMMENDED SPARE PARTS

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

TABLE 5: MOTORS, CAPACITORS, AND RESISTORS

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

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

TABLE 6: GEARS

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

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

APPENDIX *COMPONENTS*

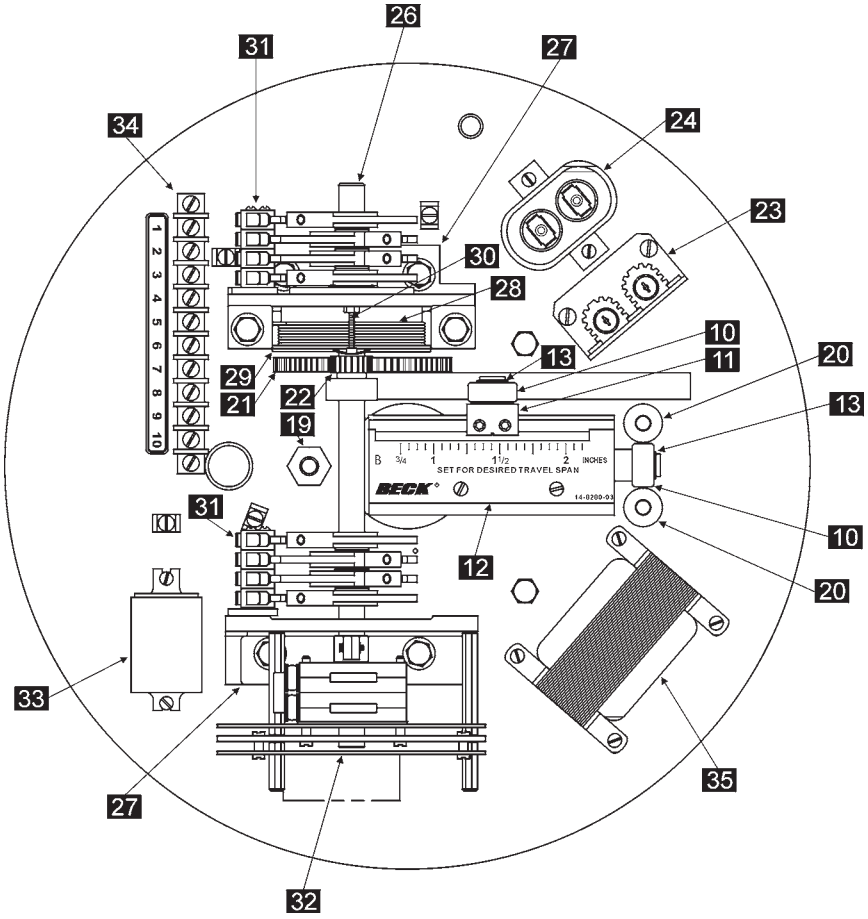
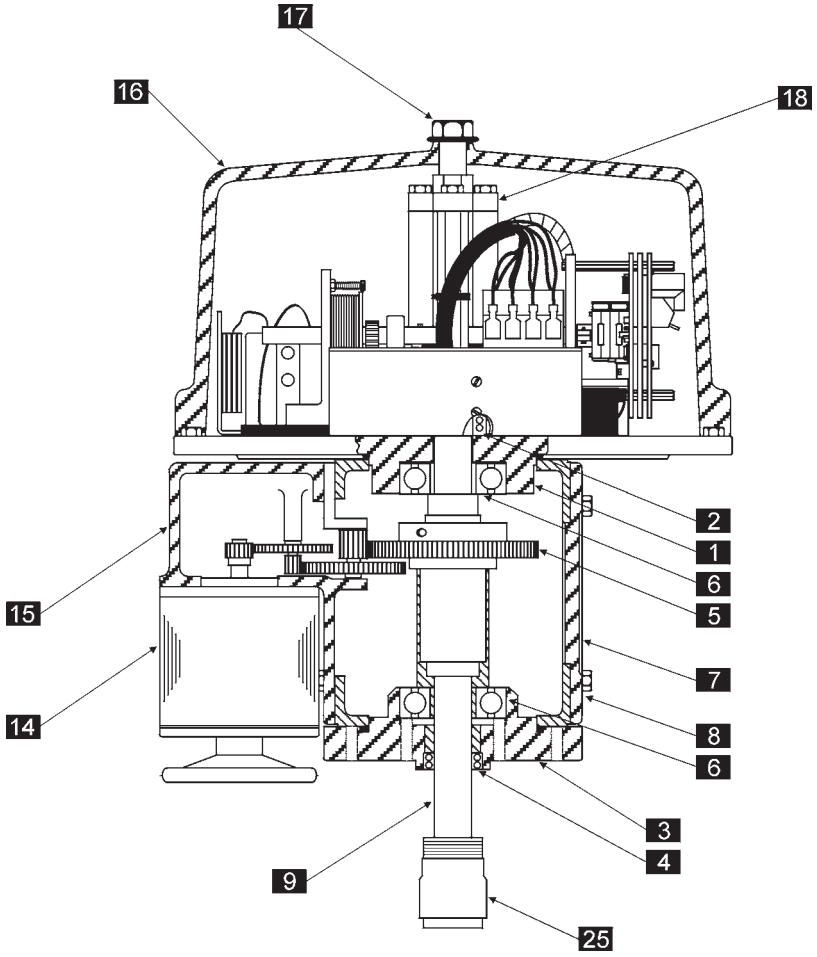


TABLE 7:
PARTS FOR MODEL 14-100 CONTROL ASSEMBLY AND DRIVE TRAIN

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

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



14-100 CONTROL ASSEMBLY AND DRIVE TRAIN

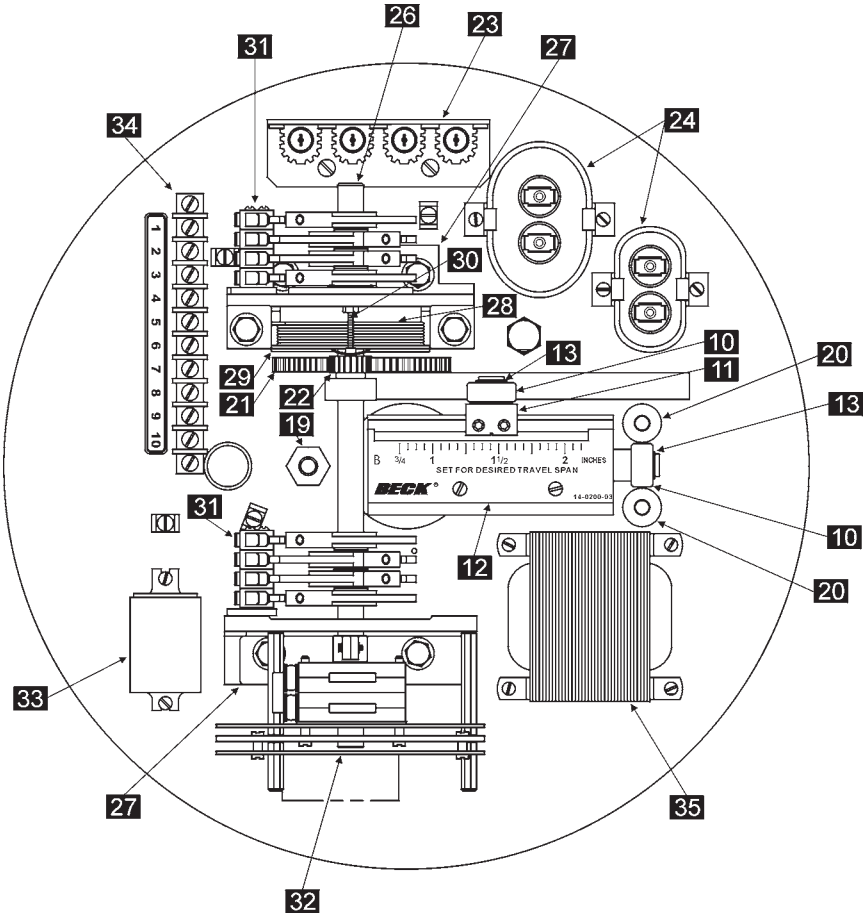
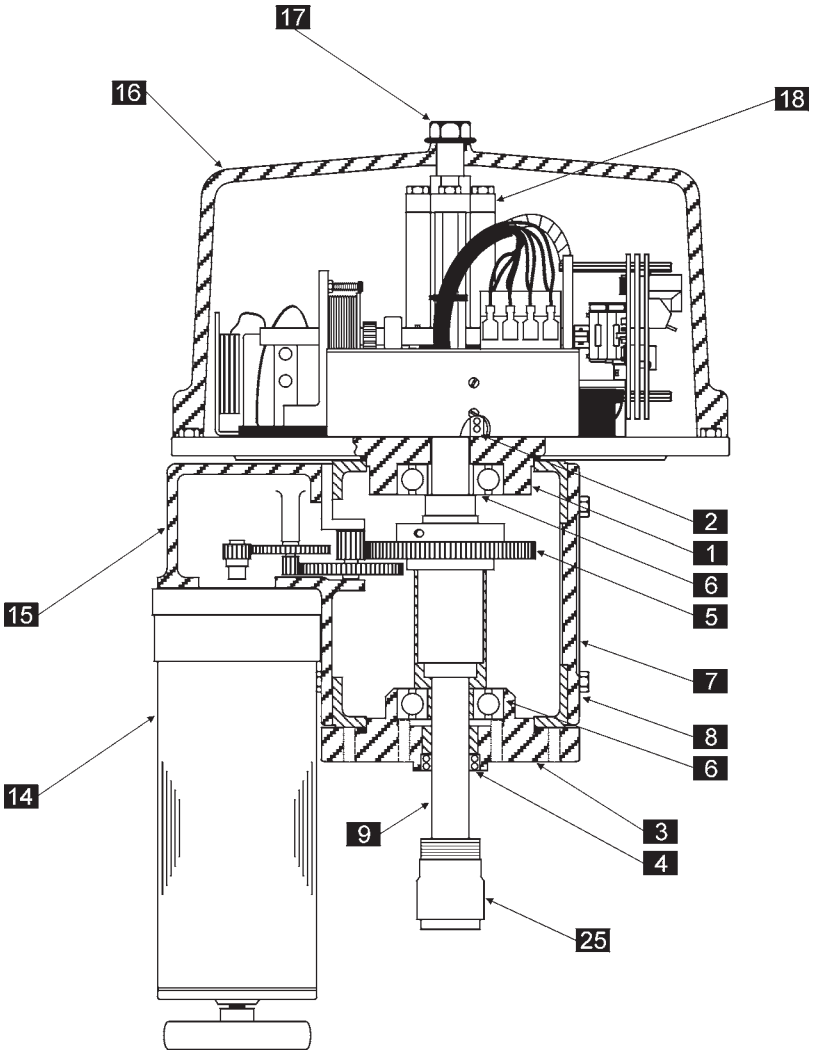


TABLE 8:
PARTS FOR MODEL 14-200 CONTROL ASSEMBLY AND DRIVE TRAIN

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

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



14-200 CONTROL ASSEMBLY AND DRIVE TRAIN

NOTES

SERVICES

PRODUCT DEMONSTRATIONS

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

SITE SURVEYS

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

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

APPLICATION REVIEWS

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

SPECIFICATION WRITING

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

HOW TO OBTAIN SERVICE

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

THREE YEAR LIMITED WARRANTY STATEMENT

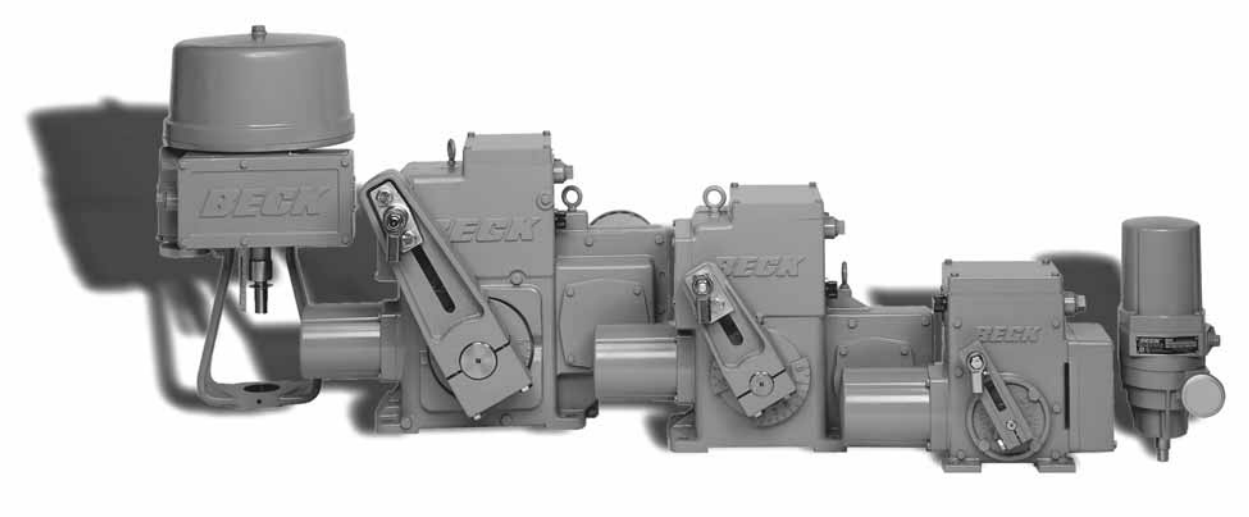
Harold Beck & Sons, Inc. (Beck) warrants that our equipment shall conform to Beck's standard specifications. Beck warrants said equipment to be free from defects in materials and workmanship. This warranty applies to normal recommended use and service for three years from the date on which the equipment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

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

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

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

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



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