Bulletin 120-11085
Issue 3/98

L120-85 Multi-Turn Actuator

Instruction &
Maintenance Manual

Limitorque

Regulatory Information
Declaration of Conformity

Application of Council Directive(s)
89/336/EEC; EMC Directive
89/392/EEC; Machinery Directive
Standard(s) to which Conformity is Declared
Machinery; EN 60204
EMC - Emmisions; EN 50081-1&2, EN 55011, CFR 47
Immunity; EN 50082-1&2, IEC 801-3 & IEC 801-6
ESD; IEC 801-2
EFT/Bursts; IEC 801-4
Surge Immunity; IEC 801-5, ANSI/IEEE C62.41
Mains (power) Harmonics; MIL-STD-462, Method CSO1 & CSO2
Manufacturer's Name
Limitorque Corporation
Manufacturer's Address
5114 Woodall Road
Lynchburg, VA 24502
Importer's Name
Limitorque International
Importer's Address
Trinity House
Kennet Side
Newbury
Berkshire, RG15 5EH
England
Type & Description of Equipment
Valve Actuators
Model Number
L120 Series
Note
Tested with Limitorque Corp. products only

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s). List as follows:

(Signature)

Thomas Ferdinand Paul May

(Full Name)

Managing Director, Limitorque International

(Title)

Newbury, England

Place

January 1, 1996

Date

Warning

Read this Instruction and Maintenance Manual carefully and completely before attempting to store,install, operated or troubleshoot your Limitorque actuator.Be aware of electrical hazards within the actuator and high pressure hazards of the attached valve or other actuated device when installing or performing maintenance on your L120-85 actuator.

Limitorque

Contents

Section Page

Product Identification

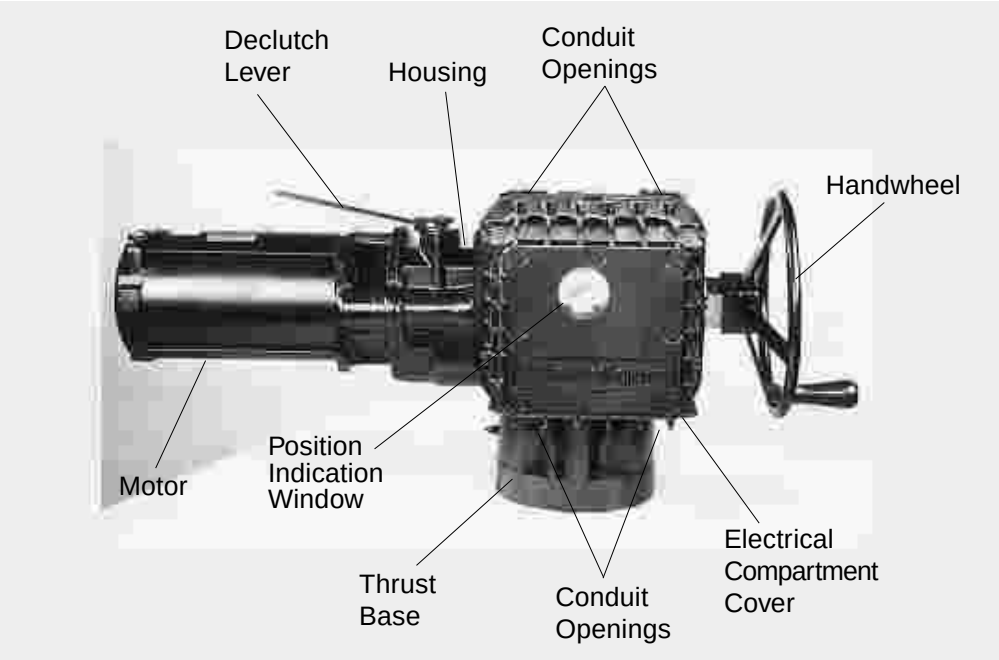


Figure 1 - Limitorque L120-85 Actuator

Product Description

Your L120-85 actuator controls the opening and closing travel of valves and other actuated devices. OPEN and CLOSED limits are protected by Limit Switches and output torque is measured and protected by the Torque Switches . As a result, all valve and other actuated devices are protected from potential damage from overload, improper seating and foreign obstructions.

Limitorque actuators may be mounted on any size valve in almost any position or location.

Microprocessor-based control and monitoring devices are also available for installation on your actuator. Contact your local Limitorque distributor or Limitorque sales office for further information.

Product Features

- ❑ 850 foot lb. torque capacity
- ❑ 3.25 inch threaded stem capacity
- ❑ Torque only (Drive 1) or Torque and Thrust (Drive 2) unit, with removable ductile iron thrust base assembly. Torque unit can be removed from thrust base while valve position is maintained.
- ❑ Standard cast iron gear case.
- ❑ All power gearing supported on anti-friction bearings.
- ❑ All gearing is alloy, heat treated steel or bronze.
- ❑ Speed range of 12-192 RPM (60 Hz), 10-160 RPM (50 Hz).
- ❑ Declutch force independent of load on valve stem.
- ❑ Non-backdriving motor.

How to Order Parts

To obtain further information or order parts for your Limitorque valve actuator, contact your local Limitorque distributor, sales office or write to:

Limitorque Corporation
5114 Woodall Road
P.O. Box 11318
Lynchburg, Virginia 24506-1318
Attn: Service Manager
Telephone (804) 528-4400
FAX (804) 845-9736

Before calling with inquiries on existing units, be sure to have the following information from your actuator nameplate available: *1) Unit Size and Type, 2) Serial Number, 3) Limitorque Corporation Order Number.*

Initial Inspection and Storage Instructions

⚠ Warning

Read this Instruction and Maintenance Manual carefully and completely before attempting to store, install, operate or troubleshoot your Limitorque valve actuator. Be aware of electrical hazards within the actuator and high pressure hazards of the attached valve or other actuated device when installing or performing maintenance on your L120-85 actuator.

Inspection and Recording Suggestions

Upon receipt of the actuator, several steps should be initially followed to ensure condition of equipment and to establish proper record keeping.

1. Carefully remove actuator from shipping carton or skid. Thoroughly examine for any physical damage which may have occurred during shipment. If you note any damage, immediately report the damage to the transport company.
2. A nameplate with important information is attached to each actuator. Record this information for future reference.

Figure 2 - L120-85 Nameplate

Initial Inspection and Storage Instructions (continued)

Short-Term Storage (less than 1 year)

Actuators can be considered weatherproof as shipped providing the Electrical Compartment Cover and Conduit Sealing Plugs are not removed prior to installation. Each actuator is shipped with a desiccant pack located within the Electrical Compartment Cover to help eliminate moisture build-up. This protection is estimated to have a one-year life expectancy. If possible, connect the internal heaters that are supplied with your unit.

> **Note:**
>
> If your unit incorporates a rising stem application, it may be shipped with a plastic cap over the Drive Sleeve Housing. If so, in order to store without possible corrosion occurring, install a pipe plug or protective stem cover to protect the Drive Sleeve Housing.

Recommended Storage

Actuators should be stored in a clean, dry, protected warehouse free from excessive vibration and rapid temperature changes.

Outdoor Storage

If actuators must be stored outdoors, they should be stored off the ground, high enough to prevent being immersed in water or buried in snow.

L120-85 Storage Orientation

All L120-85 units must be stored with the Motor and Electrical Compartment Cover in the horizontal position.

> **Note:**
>
> Failure to comply with recommended storage procedures could cause the warranty to be voided. For long-term storage procedures, consult the Limitorque Service Department. See address on page 5.

Unit Weight

The following table is an L120-85 representative weight chart. It provides the weight of several components that may be incorporated into a typical package. Use the chart as a guideline to estimate the weight of your particular actuator package.

Unit Weight (continued)

L120-85 approximate weight chart		
Components	lbs	kg
L120-85 with 40' lb 1700 RPM motor	253	558
18" Handwheel	7	15
Handwheel adapter	5	11
Minimum integral control package & compartment	34	75
Thrust Base Assembly (Drive 2)	67	148
Total Weight	366 lb	807 kg

Figure 3 - L120-85 approximate weight chart guideline

Installation Instructions

Initial Actuator Preparation

Your L120-85 is designed to perform actuation for *torque only* applications (drive 1) or *torque and thrust* applications (drive 2). If you are using a *torque only* configuration, before installing on the valve or other actuated device, you will need to verify that the Torque Drive Nut #95 is properly bored and keyed to fit your valve stem. If you are using a *torque and thrust* configuration, you will need to verify that the Thrust Base Drive Sleeve #101 is properly threaded to fit your threaded valve stem. Use the following procedures to check-out the Torque Drive Nut or the Thrust Base Drive Sleeve for proper fits.

Torque Only Applications (Drive 1)

1. Remove the Torque Drive Nut #95 and Retaining Ring #98 from actuator.

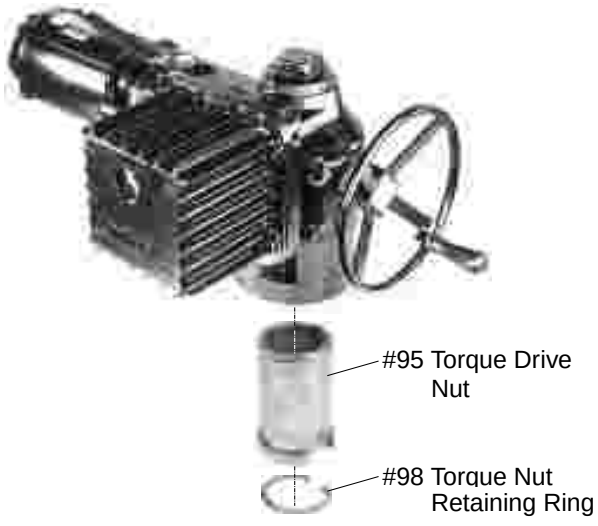


Figure 4 - Torque Nut and Retaining Ring removal from an L120-85

A) If Torque Drive Nut *has been* bored and keywayed by supplier, verify dimensions of keyway for proper compatibility with the valve stem.

B) If Torque Drive Nut *has not been* bored and keywayed by supplier, it is provided solid (blank) to allow customer to custom bore and key up to the maximum permissible sizes as listed:

Custom bore and key maximum allowable sizes			
Key Type	Maximum bore Inch/(Metric)	Maximum key - Inch/(Metric)	
		Rectangular	Square
Rectangular	2.750/(69.85 mm)	.625 x .4375/ (20 mm x 12 mm)	
Square	2.625/(66.67 mm)		.625 x .625 (N/A)

Figure 5 - Torque Drive Nut custom bore and keyway sizes

Torque and Thrust Applications (Drive 2)

Remove Socket Head Cap Screw #110 and Lockwasher #111 that holds the Thrust Base Housing Assembly to the actuator Housing #1.

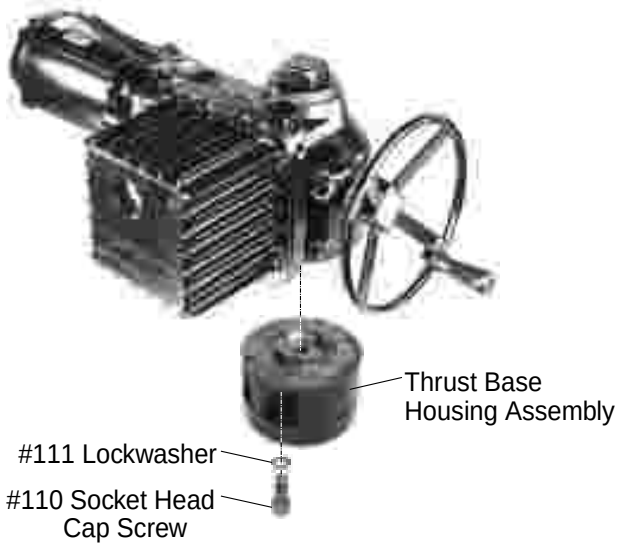


Figure 6 - Thrust Base removal from an L120-85

A) If the Thrust Base Drive Sleeve #101 *has been* threaded by supplier, verify thread compatibility with the threaded Valve Stem by screwing Thrust Base Housing Assembly onto the Valve Stem.

B) If Thrust Base Drive Sleeve #101 *has not been* threaded by supplier, it is provided solid (blank) to allow customer to custom thread. Maximum threaded stem diameter is 3.25" (82.5 mm).

Note:

If Thrust Base disassembly is required to thread blank Thrust Base Drive Sleeve, remove Quad Rings #107 before removing Thrust Washer #104 and Thrust Bearing #103. This will prevent damaging the Quad Rings #107. (See page 38 for Thrust Base disassembly instructions).

Stem Cover for Rising Stem Applications

Before putting your actuator into operational service, check the height of your valve stem at the full OPEN position and mount a suitable NPT stem cover to protect the valve stems and to prevent water entry into the actuator internals.

Installation Overview

⚠ Caution

Be sure to complete each step of the installation overview before electrically operating your actuator. If your actuator is already mounted to a valve or other actuated device from the manufacturer, verify that the actuator is mounted according to the following overview. Failure to follow the installation procedures could result in personal injury or may allow the actuator to operate improperly and could cause damage to your equipment.

1. Be sure you have completed the "Initial Actuator Preparation" procedures on pages 7 - 9.

⚠ Caution

Ensure Retaining Ring #98 is properly engaged in the Drive Sleeve #25 to secure the Torque Drive Nut #95 in place. If the Torque Drive Nut is not properly secured, it may fall from the bottom of the actuator when removed from customer Mounting Adapters.

2. A. Torque Only Applications (Drive 1)
   Mount Torque Drive Nut #95 in the actuator with the Torque Drive Nut axially aligned on the Drive Sleeve #25 so that the bottom of the nut is positioned inside the actuator Mounting Base . Secure Torque Drive Nut inside Drive Sleeve #25 with Retaining Ring #98. Refer to Illustrated Parts Breakdown on page 45 - 49 for actuator parts detail.

(Continued)

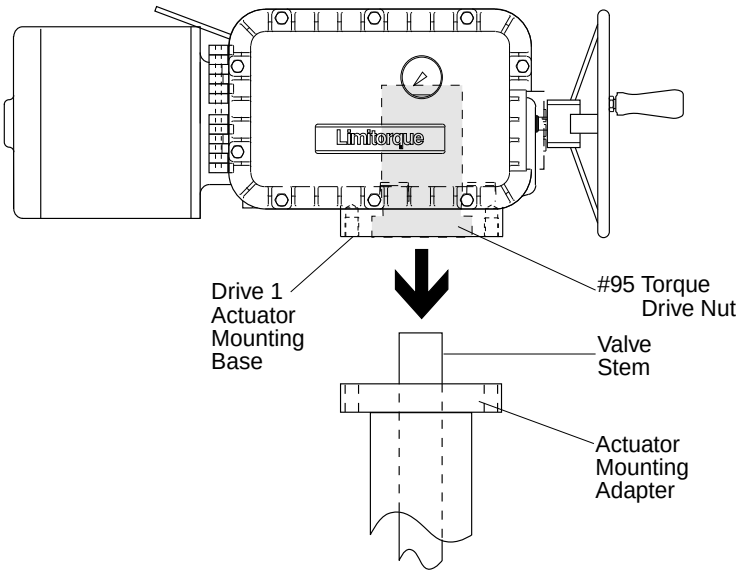


Figure 7 - L120-85 Torque Drive Nut orientation (Drive 1)

B. Torque and Thrust Applications (Drive 2)
Screw the Thrust Base Assembly onto the Threaded Valve Stem and secure the Thrust Base Assembly onto the actuator Mounting Base by using the Socket Head Cap Screws #110 and Lockwashers #111.

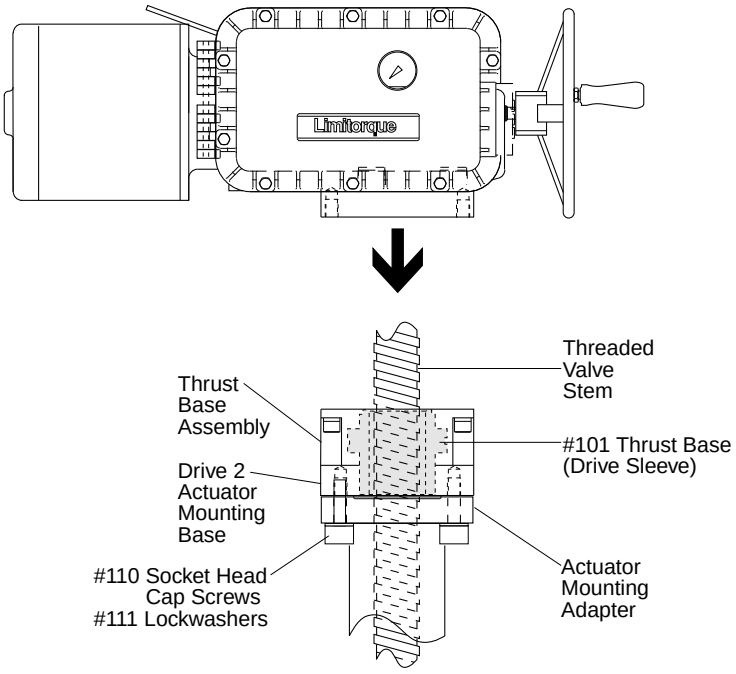


Figure 8 - L120-85 Thrust Base assembly orientation (Drive 2)

3. Mount the L120-85 actuator on the actuator Mounting Adapter (Drive 1) or on the Thrust Base Assembly (Drive 2). High strength (minimum Hex Head SAE-Grade 5 or ISO Metric Class Socket Head Cap Screws 8.8 Hex Head or Socket Head Cap Screws with Lockwashers are recommended. The quantity and thread size of the actuator mounting taps are as follows:

Actuator/Mounting Base tap size		
Unit Type	Quantity	Tap Size
Drive 1 (English) (Metric)	 4 4	 3/4-10 Tap x 1.0 Deep M20 x 2.5 mm x 1.0 Deep (Complies with F16 ISO mounting flange criteria)
Drive 2 (English) (Metric)	 4 4	 3/4-10 Tap x 1.0 Deep M20 x 2.5 mm x 1.0 Deep (Complies with F16 ISO mounting flange criteria)

Figure 9 - L120-85 mounting tap sizes

Note:

Limitorque has supplied 4 taps for the L120-85 English and Metric units. All 4 securing bolts are required to retain torque and or thrust reaction on these units.

⚠Danger

Hazardous Voltage. No electrical power should be conected until all wiring and Limit Switch adjustments have been completed. Once power is supplied to unit, exercise caution if cover is not installed.

4. Open the Electrical Compartment Cover #200-1 and the Conduit Pipe Plugs entry most conveniently located for your power leads and other cabling.

(Continued)

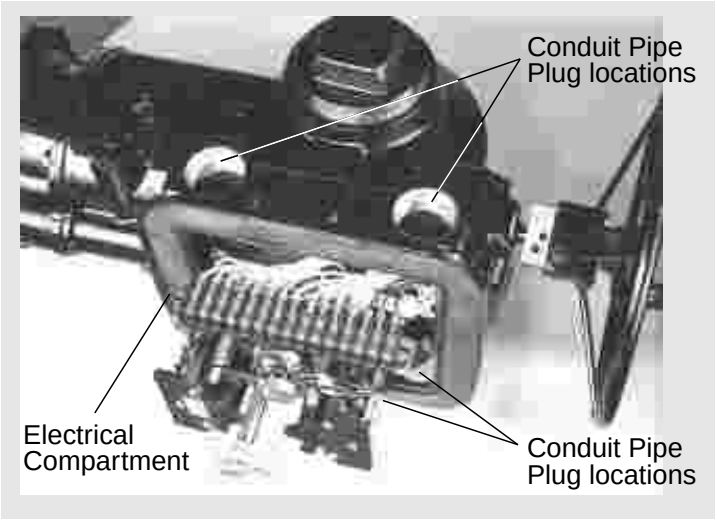


Figure 10 - Electrical Compartment and Conduit Pipe Plug openings

5. Adjust the Limit Switches , MDPI (Mechanical Dial Position Indicator) and Potentiometer following the procedures outlined on page 14 - 24.

6. Ensure Torque Switch is set properly for your application. In most cases, adjustments are not needed, but if changes are required, see page 28 - 31 "Torque Switch Settings".

7. Connect wiring to Terminal Strips provided on the actuator. Refer to the wiring diagram supplied with your specific actuator. "Fork-type" terminal connections are recommended.

8. If all wiring entering actuator uses only one of the conduit entrances, be sure any unused conduit entrances are plugged with Conduit Pipe Plugs .

Notes:

a) *Explosionproof* actuators require approved "sealing fittings" installed in accordance with the National Electric Code.

b) *Submersible* actuators require approved "sealing fittings" in order to eliminate water entering the actuator.

9. Attach grounding wire to Grounding Lug #14.

Installation Instructions (continued)

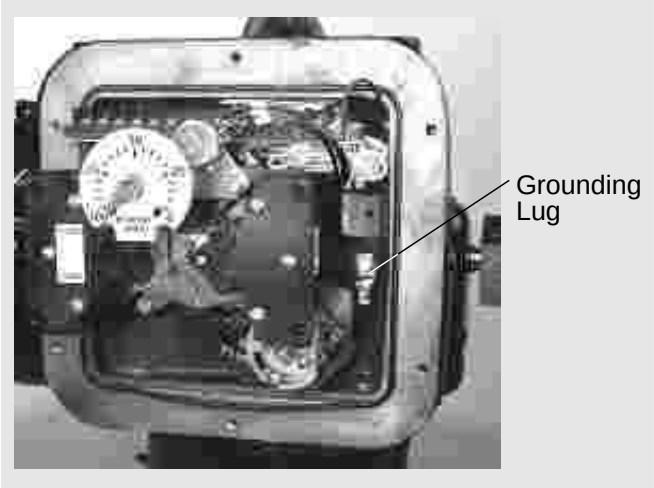


Figure 11 - Grounding Lug location

9. Verify that Motor rotation is operating in the proper direction; the Motor rotation will have a direct impact on the Limit Switch and Torque Switch functions. Follow the procedure "Verifying motor rotation direction" on page 25 - 27).

10. Close Electrical Compartment Cover #200-1.

11. Inspect actuator for proper lubrication. Refer to pages 31 - 33 for lubrication instructions.

12. Unit is now ready for electrical operation. Continue to "Electrical Startup" on page 33.

Limit Switch Settings

The *standard* Limit Switch is a 16 contact Limit Switch . The 8 OPEN/CLOSE (1st 8 contacts) Limit Switch has two Rotor Sets , one for the OPEN position and one for the CLOSED position. Each Rotor Set has 4 electrical contacts which can be arranged in any combination of normally OPEN and normally CLOSED contacts. The SPARE (2nd 8 contacts) Limit Switch has 2 additional Rotor Sets with 4 contacts each which can be set to operate any where between the OPEN and CLOSE positions. These can be used to stop the valve in mid-travel or to interlock with other equipment such as pumps, fans, mixers, etc.

The Limit Switch is *not preset* at the Limitorque factory, but must be set after mounting on the valve or other associated equipment. If your L120-85 actuator has been shipped already installed on your equipment, your actuator *should* have the Limit Switch set for your application. If your actuator is not already installed on your equipment or needs re-setting, use the following instructions to make the appropriate settings.

The following instructions for setting the Limit Switches are based on the typical orientation for *most* actuator applications (CCW↶ to OPEN & CW↷ to CLOSE). Refer to the wiring diagram on page 52 for reference and consult the applicable wiring diagram located in the actuator Electrical Compartment for your specific Limit Switch development.

Limit Switch Settings (continued)

Basic Theory of Operation

Your Limit Switch , #305, is driven directly by the Worm Shaft through the Limit Switch Pinion ; therefore the Limit Switch is directly connected to the output of the actuator. Once the Limit Switch is properly set, it measures valve or other equipment position in the ELECTRIC or MANUAL operating modes.

The OPEN Rotor consists of contacts #1 to #4. These switches are set to change state at the full OPEN position. The switch functions are as follows:

Contact #1 is the CLOSED Torque Switch by-pass circuit. It's purpose is to allow the electric actuator to apply it's full torque to unseat a backseated valve. When a valve is manually backseated to prevent packing leakage, it may stick momentarily when first operated. To prevent the CLOSE Torque Switch from stopping the actuator from going closed, this momentary by-pass is applied. The OPEN Rotor actuates at the full open position causing contact #1 to open as soon as the valve moves in the close direction, thus returning the Torque Switch function to the control circuit.

Contact #2 is normally used for a Remote Valve Position Indication Lamp . As shown in Figure 12, the lamp will be turned ON when the valve reaches the full OPEN position.

Contact #3 is for the Local Position Indication Lamp ; included as part of the actuator assembly when required. This switch turns the green lamp OFF in the full OPEN position, leaving the red lamp energized and indicating the valve is OPEN.

Contact #4 is the OPEN Limit Switch which opens the control circuit to de-energize the Motor at full OPEN position.

The CLOSE Rotor has contacts #5 to #8. This Rotor is set to change contact positions at the full CLOSE position. Switch functions are as follows:

Contact #5 is the OPEN Torque Switch by-pass. After the valve has been closed tight, it may stick when it is first opened which would cause the Torque Switch Contacts to break. To momentarily overcome this sticking, the OPEN Torque Switch is by-passed. This OPEN Torque Switch by-pass is part of the closed valve position rotor so that as soon as the valve moves in the OPEN direction, the by-pass contact opens and the OPEN Torque Switch control function is returned.

Contact #6 is normally used for a Remote Valve Position Indication Lamp . As shown in Figure 12, the lamp will be turned ON when the valve reaches the full CLOSE position.

Contact #7 is for the Local Position Indication Lamp ; included as part of the actuator assembly when required. This switch turns the red lamp OFF in the full CLOSE position, leaving the green lamp energized and indicating the valve is CLOSED.

Contact #8 is the CLOSE Limit Switch which opens the control circuit to de-energize the Motor at full CLOSE position.

Limit Switch Settings (continued)

VALVE SHOWN IN FULL OPEN POSITION

ROTOR	CONTACT	LIMIT SWITCH CONTACT DEVELOPMENT — VALVE POSITION: FULLY OPEN / A / B / FULLY CLOSED	FUNCTION
OPEN	1		BY-PASS CIR.
	2		INDICATION
	3		IND LIGHT
	4		OPEN LIMIT
CLOSE	5		BY-PASS CIR
	6		INDICATION
	7		IND LIGHT
	8		CLOSE LIMIT
INT.1	9		SPARE
	10		SPARE
	11		SPARE
	12		SPARE
INT.2	13		SPARE
	14		SPARE
	15		SPARE
	16		SPARE

(17) Closing Torque Switch interrupts control circuit if mechanical overload occurs during closing cycle

(18) Opening Torque Switch interrupts control circuit if mechanical overload occurs during opening cycle

NOTES
1. ----- Open contact
2. ▬ Close contact
3. All limit switch trip points are fully adjustable

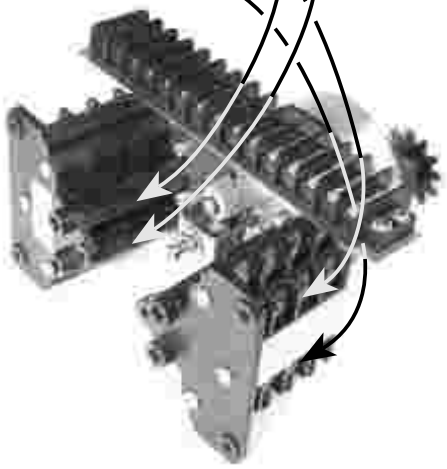


Figure 12 - Limit Switch Rotor development

⚠ Warning

Do not manually operate actuator with devices other than installed Handwheel and Declutch Lever. Using additive force devices (cheater bars, wheel wrenches, pipe wrenches or other devices of this nature) on the actuator Handwheel or Declutch Lever may cause serious personal injury and/or damage to the actuator or valve.

⚠ Danger

Hazardous Voltage. Make sure all power is OFF before opening the Electrical Compartment Cover or making the following settings.

(Continued)

Limit Switch Settings (continued)

Tools required:

- ❑ The cross-slotted Intermediate Shafts A, B, C and D have been designed for use with a 6" No. 2 Phillips screw driver shank chucked into a variable speed reversible electric drill. (See figure 13 for Limit Switch components).
- ❑ Phillips Head or Flat Head screwdriver.

⚠Danger

Potential Explosion Hazard. Do not use a variable speed reversible electric drill for setting the Limit Switch in an explosive environment.

⚠Caution

When setting Limit Switch Rotor Cams using a variable speed reversible electric drill, *Do Not* run drill at speeds higher than 200 RPM. Operating drill at high speeds can cause damage to gearing within the Limit Switch.

⚠Caution

The Worm on the Worm Shaft Assembly is available in two different ratios 19:1 and 38:1. To avoid damage to the gearing mechanisms, be sure you change the Limit Switch Drive Pinion gear if the Worm gear ratio is changed.

Note:

The Limit Switch is available with a 4 Gear Set or a 5 Gear Set within the Gear Frame Assembly. The number of Gear Sets built into your specific Limit Switch will determine the number of maximum Drive Sleeve rotations required to go the full range of the Limit Switch. A 4 Gear Set with 19:1 and 38:1 has a max rotation of 902.25 Drive Sleeve rotations. A 5 Gear Set with 19:1 and 38:1 has a max rotation of 9022.5 Drive Sleeve rotations.

Setting the OPEN Limit Switch

1. Open Electrical Compartment Cover # 200-1.

2. Put the actuator into MANUAL operation by moving the Declutch Lever in the direction of the arrow on the lever until the Declutch Lever locks in place.

Limit Switch Settings (continued)

3. Turn the Handwheel CCW↶ to move the valve to the full OPEN position. While turning the Handwheel , note the direction of the Intermediate Shaft that corresponds to the Open Rotor Group . (See figure 13).

> Note:
>
> Most applications require turning the Handwheel CW↷ to obtain the full CLOSE position and CCW↶ to obtain full OPEN position. The actuator Drive Sleeve rotates in a CW↷ direction to the CLOSE position and CCW↶ to the OPEN position. The Limit Switch Intermediate Shafts rotate in a CCW↶ direction to the CLOSE position and CW↷ to the OPEN position. If your application is configured differently, keep in mind the descriptions in this manual will describe rotation directions opposite of your application.

4. Once the valve is fully OPEN, turn the Handwheel back toward CLOSE approximately one full turn (less for MDPI gear sets with high gear ratios). This will allow for coasting during motor operation.

> ⚠Caution
>
> Do not operate the actuator when the Clutch Screw is in a fully depressed position; loss of the contact setting will occur and the Setting Rod will be damaged.

5. Push in Clutch Screw and turn CW↷ one quarter turn to latch in a depressed position.

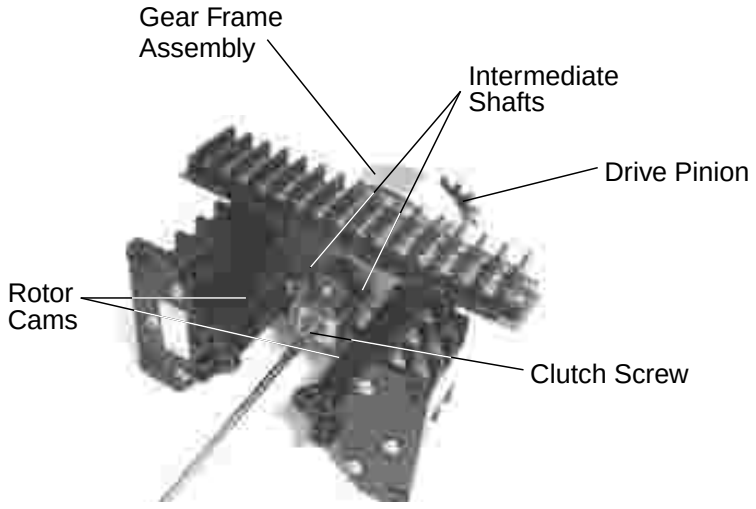


Figure 13 - L120-85 Limit Switch Components

Limit Switch Settings (continued)

6. A. If your Limit Switch Rotor Cams *did not* trip at the full OPEN position point, turn the Intermediate Open Shaft in a CW direction until the Open Limit Rotor Cam rotates 90° to make an OPEN contact (OPEN limit trip point = Rotor Cam in a vertical orientation to make an OPEN contact); see figure 14 for orientation. Once you have reached the full OPEN position point, use the Handwheel to rotate the Intermediate Shaft slowly in the CCW direction until the Rotor just trips again.

   B. If your Limit Switch Rotor Cams *did* trip before reaching the full OPEN position point, leave the valve at the full OPEN position point and turn the Intermediate Open Shaft in a CCW direction until the Rotor Cam rotates 90° to make an OPEN contact (OPEN limit trip point = Rotor Cam in a vertical orientation to make an OPEN contact). Once you have reached the full OPEN position point, rotate the Intermediate Shaft slowly in the CW direction until the Rotor just trips again.

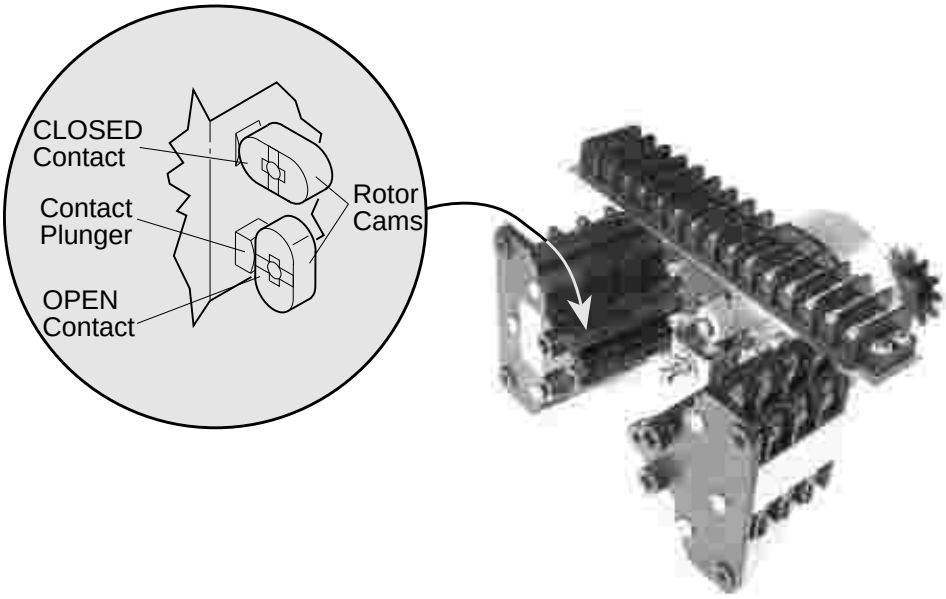


Figure 14 - Limit Switch OPEN/CLOSE Rotor Cam orientation

7. Before operating the actuator, depress and turn the Clutch Screw CCW one quarter turn to the spring release position. Insert a screwdriver into each of the Intermediate Shafts and "rock" them CW and CCW a few times to ensure all the gearing is interlocked well.

Setting the CLOSE Limit Switch

1. Open Electrical Compartment Cover #200-1 .

2. Put the actuator into MANUAL operation by moving the Declutch Lever in the direction of the arrow on the lever until the Declutch Lever locks in place.

Limit Switch Settings (continued)

3. Turn the Handwheel CW↷ to move the valve to the full CLOSED position. While turning the Handwheel , note the direction of the Intermediate Shaft that corresponds to the Closed Rotor Group .

> **Note:**
>
> Most applications require turning the Handwheel CW↷ to obtain the full CLOSE position and CCW↶ to obtain full OPEN position. The actuator Drive Sleeve rotates in a CW↷ direction to the CLOSE position and CCW↶ to the OPEN position. The Limit Switch Intermediate Shafts rotate in a CCW↶ direction to the CLOSE position and CW↷ to the OPEN position. If your application is configured differently, keep in mind the descriptions in this manual will describe rotation directions opposite of your application.

4. Once the valve is fully CLOSED, turn the Handwheel back toward OPEN approximately one full turn (less for MDPI gear sets with high gear ratios). This will allow for coasting during motor operation.

> **⚠ Caution**
>
> Do not operate the actuator when the Clutch Screw is in a fully depressed position; loss of the contact setting will occur and the Setting Rod will be damaged.

5. Push in Clutch Screw and turn CW↷ one quarter turn to latch in a depressed position. See figure 13 for Limit Switch nomenclature.

6. A. If your Limit Switch Rotor Cams *did not* trip at the full CLOSE position point, turn the Intermediate Close Shaft in a CCW↶ direction until the Close Limit Rotor Cam rotates 90° to make an OPEN contact (CLOSE limit trip point = Rotor Cam in a vertical orientation to make an OPEN contact). Once you have reached the full CLOSED position point, rotate the Intermediate Shaft slowly in the CW↷ direction until the Rotor just trips again.

   B. If your Limit Switch Rotor Cams *did* trip before reaching the full CLOSE position point, leave the valve at the full CLOSE position point and turn the Intermediate Close Shaft in a CW↷ direction until the Close Limit Rotor Cam rotates 90° to make an OPEN contact (CLOSE limit trip point = Rotor Cam in a vertical orientation to make an OPEN contact). Once you have reached the full CLOSE position point, rotate the Intermediate Shaft slowly in the CCW↶ direction until the Rotor just trips again.

Limit Switch Settings (continued)

Setting the MDPI (Mechanical Dial Position Indicator)

7. Before operating the actuator, depress and turn the Clutch Screw CCW one quarter turn to the spring release position. Insert a screwdriver into the Intermediate Shafts and "rock" them CW and CCW a few times to ensure all the gearing is seated well.

The MDPI is used to indicate the current position of the valve or other actuated devices. Adjustments must be done after mounting the actuator on the application. If your supplier has not set the MDPI or your application has changed and requires re-setting, use the following procedure to complete the MDPI settings.

⚠ Danger

Hazardous Voltage. Turn power OFF before opening the Electrical Compartment Cover, calibrating the MDPI or installing the Remote Voltmeter Indicator.

Local Position Indication

1. Turn all power to the actuator OFF.

2. Manually position the valve in the fully CLOSED position.

3. Loosen the Round Head Machine Screw #523 on the MDPI Pointer #522.

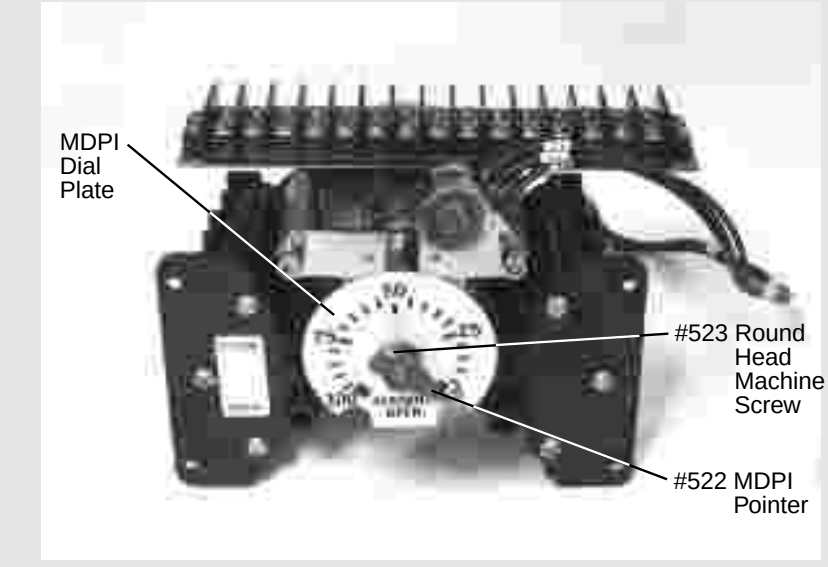


Figure 15 - Aligning MDPI Pointer with OPEN and

Setting the MDPI (continued)

4. Move the MDPI Pointer to the 0 (CLOSED) position.

> **Note:**
>
> If your application uses CW Handwheel rotation to OPEN, flip the MDPI Plate over to properly orient the OPEN and CLOSED position on the MDPI Plate.

5. Re-tighten the Round Head Machine Screw on the MDPI Pointer .

Remote Position Indication

> **Note:**
>
> Typical voltmeter remote indicators furnished by Limitorque are built to accept a maximum of 10 volts. In order to make voltmeter adjusments, you will need a separate voltmeter with a scale suitable for the maximum incoming control voltage.

1. Mount the Adjustable Resistor as close as possible to the Remote Voltmeter Indicator .

2. Turn power to actuator OFF and connect all wiring as shown in figure 16. For now, connect the wires leading to the Remote Voltmeter Indicator to your Test Meter so you can conduct voltage readings during the setup.

3. Move the Adjustable Resistor Slider to the extreme opposite end of the Resistor from the Power Connection .

4. Open the Electrical Compartment Cover #200-1. Loosen the Hex Head Retaining Nut at the base of the Potentiometer Bracket and dis-engage the Spur Gear from the Potentiometer Drive Gear . This will allow manual rotation of the Potentiometer Assembly . See figure 18 on page 24.

5. Manually position the valve in the fully CLOSED position. As you are rotating the Handwheel to the CLOSED position, notice the direction the Potentiometer Spur Gear *would* be turning the Potentiometer Shaft/ Wiper Arm inside the Potentiometer .

6. When the valve is CLOSED, turn the Potentiometer Shaft to the end-of-travel position that corresponds to the CLOSED position of the Potentiometer . Carefully reposition the Potentiometer Spur Gear onto the Potentiometer Shaft to re-engage with the gear train. Re-tighten Hex Head Retaining Nut at the base of the Potentiometer Bracket .

Setting the MDPI (continued)

⚠ Warning

Hazardous Voltage. Use extreme caution if power is ON and Electrical Compartment Cover is off the actuator.

7. Turn power to the actuator ON. Your Test Meter should read “0” or almost “0”. If not, go back through steps 1 to 7 to get your Potentiometer calibrated to the proper ends-of-travel. Proceed to Step 8.

8. Now manually position the valve in the fully OPEN position.

9. Move the Adjustable Resistor Slider toward the Power Connection end until the Test Meter reads 10 volts.

10. Turn actuator power OFF, disconnect the Test Meter and connect the leads to the Remote Voltmeter Indicator .

11. Turn actuator power ON. Your Remote Voltmeter Indicator should read full OPEN.

12. Further adjustment may be necessary. If the Remote Voltmeter Indicator reads less than full OPEN, carefully move the Adjustable Resistor Slider ahead being careful not to exceed the full OPEN position on the Remote Voltmeter Indicator . If the Indicator reads more than “0” when the valve is CLOSED, repeat this procedure starting with Step 2.

13. When the Indicator properly shows valve position, lock the Adjustable Resistor Slider in place.

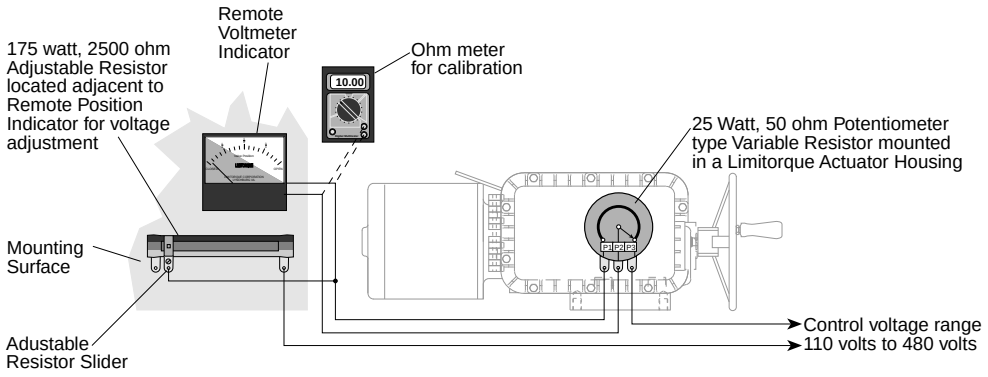


Figure 16 - Remote Position Indicator configuration

Setting the Potentiometer

If your L120-85 actuator includes a Feedback Potentiometer supplied for remote valve position indication, use an ohm meter to calibrate the position of the Potentiometer . Typically, the Potentiometer Spur Gear is shipped from the factory dis-engaged from the Potentiometer Drive Gear . If your supplier has not re-engaged and calibrated the Potentiometer , use the following procedure to complete the Potentiometer setup.

⚠Danger

Hazardous Voltage. Turn power OFF before opening the Electrical Compartment Cover or calibrating the Feedback Potentiometer. Use extreme caution if power is ON and the Electrical Compartment is OPEN.

1. Turn all power to the actuator OFF.

2. Using the Handwheel , position the actuator to mid-travel (valve at the 50% position).

3. Disconnect the Potentiometer Wiring Harness from the Interconnect Board or Terminal Strip .

4. Using an ohm meter verify that the potentiometer is in mid-travel. The resistance from each End Connection to the Center Connection should be half of the full resistance of the Potentiometer . Example: 1000 ohm potentiometer should read approximately 500 ohms from one of the End Connections to the Center Connection . If the reading is not correct, proceed to step 5. If the reading is correct proceed to step 6.

Figure 17 - Potentiometer calibration components

Setting the Potentiometer (continued)

5. A. If the Potentiometer Assembly *is engaged* with the Potentiometer Drive Gear :

Loosen the Hex Head Retaining Nut at the base of the Potentiometer Bracket and dis-engage the Spur Gear from the Potentiometer Drive Gear . This will allow manual rotation of the Potentiometer Spur Gear . Continue to step 5C.

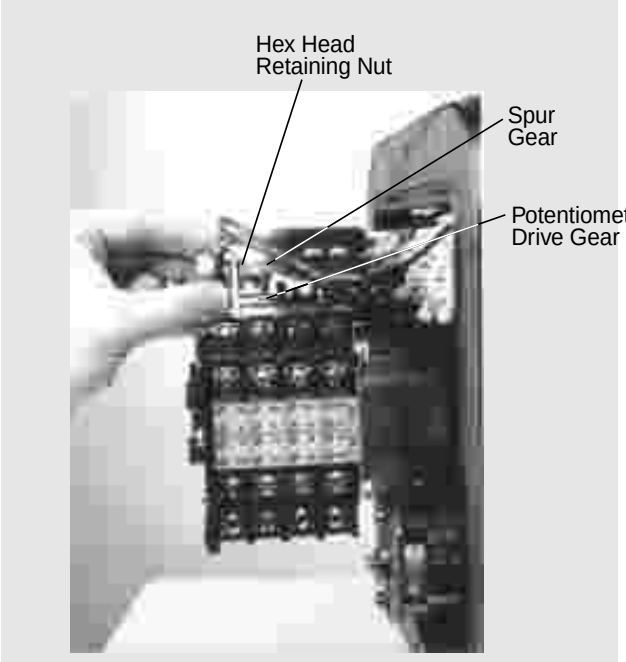


Figure 18 - Loosening Potentiometer Assembly

B. If the Potentiometer Spur Gear *is not engaged* with the Potentiometer Drive Gear continue to step 5C.

C. Rotate the Potentiometer Spur Gear until the correct readings are obtained as described in step 3.

D. Carefully reposition the Potentiometer Spur Gear to re-engage with the gear train.

E. Re-tighten Hex Head Retaining Nut at the base of the Potentiometer Bracket

F. Recheck ohm meter reading to assure Potentiometer adjustment was not changed when Potentiometer was tightened to Potentiometer Bracket . If Potentiometer setting is not accurate, repeat step 5. If ohm meter reading is accurate, proceed to step 6.

6. Disconnect the ohm meter and re-connect the Potentiometer wiring to the Interconnect Board or Terminal Strip.

Verifying Motor Rotation Direction

Verify correct motor rotation (phasing) and OPEN/CLOSE pushbutton operation

It is very important to check for correct motor rotation to insure that serious damage to your valve or other equipment does not occur. If the actuator motor rotates in the wrong direction, damage could occur by over-torquing equipment into a seated position.

Prior to being shipped from the factory each actuator is inspected to verify proper operation of the Torque and position Limit Switch and to ensure that they function correctly (i.e. closes when the CLOSE pushbutton is depressed, opens with the OPEN pushbutton, etc.). These inspections are made with a properly phased power source connected as described in the actuator manual.

⚠ Caution

To ensure proper operation and to prevent your actuator or other actuated equipment from damage, verify that your unit is properly connected to its power source.

Note:

Your application may vary from the following standard wiring configurations for Three-phase, Single-phase and DC motors. Refer to your actuator wiring diagram for user specific wiring configuration.

Three Phase Motor

1. Using the Handwheel , move the valve to a midtravel position (midtravel position allows electrical operation in the valve "safe" area and keeps the OPEN and CLOSED Limit Switches from tripping while testing motor direction).

2. Test motor direction by momentarily pressing the OPEN pushbutton:
   A) If the actuator moves toward CLOSED, *immediately* turn all power OFF and reverse the motor leads T1 and T3.

Note:

Refer to your actuator wiring diagram for user specific wiring configuration.

Verifying Motor Rotation Direction (continued)

B) If the actuator moves toward OPEN, the motor is wired properly for the application.

Single-phase Motor

1. Using the Handwheel , move the valve to a midtravel position (midtravel position allows electrical operation in the valve "safe" area and keeps the OPEN and CLOSED limit switches from tripping while testing motor direction).

2. Test motor direction by momentarily pressing the OPEN pushbutton:

   A) If the actuator moves toward CLOSED, *immediately* turn power OFF and proceed with the following instructions that match your application.
      1. Permanent Split Capacitor single phase motors can be connected for opposite rotation by interchanging the leads T1 and T2 coming from the motor to the terminal strip.
      2. Single voltage, capacitor start, induction run, single phase motors interchange leads T2 and T3 coming from the motor to the terminal strip.
      3. Dual voltage, capacitor start, induction run, single phase motors can be connected for opposite rotation but the connection depends on whether the motor is operated on low voltage or operated on high voltage.
         a. Low voltage motors are connected for opposite rotation as shown in the changes between the *Standard Rotation* configuration and the *Reverse Rotation* configuration in Figure 19. This is accomplished by interchanging the two leads T1 and T3 coming from the motor with the two leads T6 and T8 also coming from the motor. No other changes are necessary.

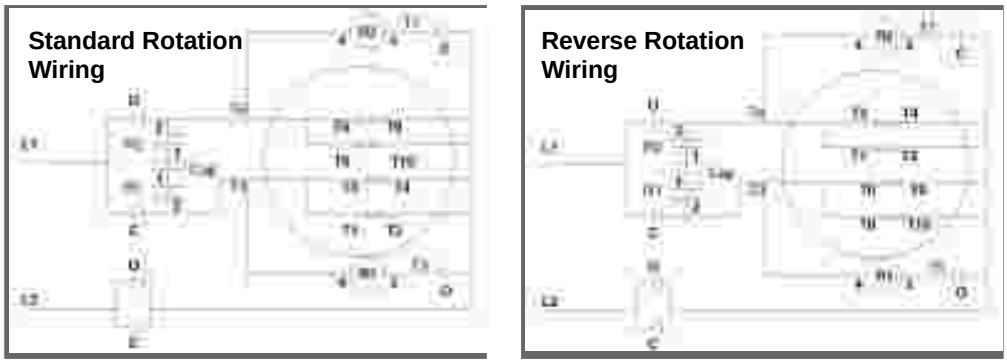


Figure 19 - Standard motor rotation and reverse motor rotation wiring diagrams for dual voltage, capacitor start, induction run, single phase low voltage motors

b. High voltage motors are connected for opposite rotation as shown in the changes between the *Standard Rotation* configuration and the *Reverse Rotation* configuration in Figure 20. This is accomplished by interchanging two set of leads. First, interchange the leads T1 and T8 coming from the motor. Second, interchange leads T3 and T6 at the starting relays R1 and R2. No other changes are necessary.

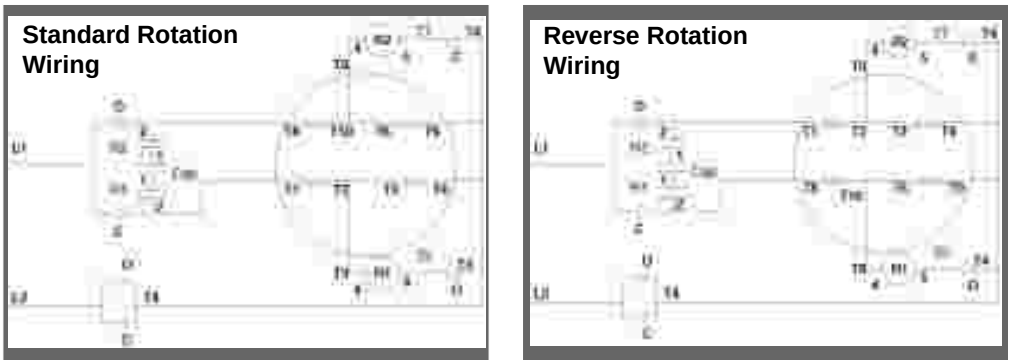


Figure 20 - Standard motor rotation and reverse motor rotation wiring diagrams for dual voltage, capacitor start, induction run, single phase high voltage motors

B) Test Motor direction again by momentarily pressing the OPEN pushbutton. If the actuator moves toward OPEN, the motor is wired properly for the application. If not, check your wiring diagram for proper wiring.

DC Motor

1. Using the Handwheel , move the valve to a midtravel position (midtravel position allows electrical operation in the valve “safe” area and keeps the OPEN and CLOSED limit switches from tripping while testing motor direction).

2. Test motor direction by momentarily pressing the OPEN pushbutton:

   A) If the actuator moves toward CLOSED, *immediately* turn all power OFF and reverse the motor leads A1 and A2.

> **Note:**
>
> Refer to your actuator wiring diagram for user specific wiring configuration.

   B) If the actuator moves toward OPEN, the motor is wired properly for the application.

⚠Danger

Hazardous Voltage. Turn power OFF before opening the Electrical Compartment Cover or making any adjustments to the Torque Switch.

Note:

Removal or modification of the Torque Switch Limiter Plate will void the actuator warranty. Do not exceed the torque setting indicated by the Torque Switch Limiter Plate without contacting the Limitorque Service Department.

The L120-85 unit is equipped with a double-acting Torque Switch that has been factory pre-set according to the required torque value provided by the valve manufacturer or other associated equipment supplier. Further Torque Switch adjustment *should not* be required; however, the Torque Switch can be re-set from positions 1 through 5 (5 being the highest input torque requirement) by adjusting the Torque Switch Adjustment Screws unless it is limited by the Limiter Plate . See figure 21 for Torque Switch nomenclature.

Basic Theory of Operation

As torque is developed by the actuator, the Worm moves axially and causes compression on the Disk Spring Pack Assembly (Components of the Worm Shaft Assembly #15). The Disk Spring Pack Assembly is calibrated so that a given amount of spring compression equates to a given amount of output torque. Axial Worm Shaft Assembly movement causes the Torque Switch Shaft #300-13 to move, therefore engaging the Torque Switch measurement device. Once the Torque Switch is properly set, it measures valve or other equipment torque output in the ELECTRIC or MANUAL operating modes.

Setting the Torque Switch

⚠Caution

Installing or adjusting the Torque Switch with the actuator in a loaded condition will result in loss of torque protection. Before adjusting or installing the Torque Switch, place the actuator in MANUAL mode and turn the Handwheel in the direction necessary to release the torque load on the Wormshaft Assembly.

Note:

If Torque Switch replacement is required, be sure to use the L120-85 Torque Switch rather than replacing with an L120-10 thru 40. The L120-85 Torque Switch Torque Arm is Rotated 10° from the position of the Torque Arm on the L120-10 thru 40 Torque Switch (the Red Dot on the Torque Switch Shaft indicates an L120-85 Torque Switch).

1. Turn all power to the actuator OFF.

2. Loosen the Torque Switch Adjustment Screws #300-4 on the OPEN or CLOSED side of the Torque Switch .

3. Move Index Arm #300-2 or #300-3 to desired torque setting. The higher number indicates an increased torque and/or thrust output requirement.

4. Re-tighten the Torque Switch Adjustment Screws #300-4.

5. Turn power ON and operate the valve electrically to seat the valve or other device and to ensure tight shut-off.

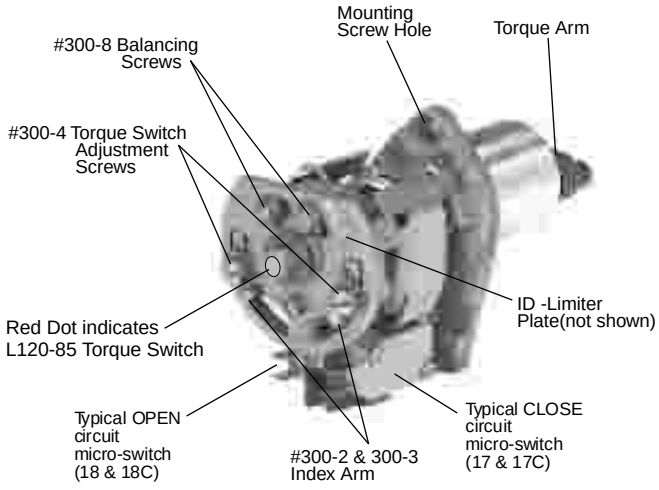


Figure 21 - Torque Switch Components

Balancing the Torque Switch

If the Torque Switch has been removed from the unit or if you are installing a new Torque Switch , it must be re-balanced using the following procedure:

1. Ensure that the actuator is in MANUAL mode and the load is removed from the Worm Shaft Assembly .

2. Make note of the current OPEN and CLOSED Torque Switch settings before reinstalling the Torque Switch .

Torque Switch Setting and Wiring (continued)

3. Loosen Torque Switch Adjustment Screws #300-4 and position both Index Arms #300-2 and #300-3 at the 1 setting; re-tighten the Torque Switch Adjustment Screws . Make sure the Index Marks are aligned. See figure 21.

4. Loosen Balancing Screws #300-8 and install the Torque Switch . When properly installed, the base of the Torque Switch is flush against the actuator Compartment and the hole for the Mounting Screw is aligned. Install the Mounting Screw .

5. Tighten the Balancing Screws . The Torque Switch is now balanced and ready for Index Arm #300-2 and #300-3 to be returned to their original settings.

6. Follow your wiring diagram to connect Torque Switch wiring.

Re-wiring the Torque Switch for Non-Standard Drive Sleeve Rotation

⚠Caution

Double check your wiring diagram to verify that your Torque Switch is wired appropriately for your application. The Torque Switch will not protect your valve from over-torque if you do not apply appropriate wiring for your application.

L120-85 actuators are typically supplied with a CCW↶ Drive Sleeve rotation to open a valve. The two Torque Switches are marked OPEN (CCW↶) and CLOSE (CW↷) based upon CCW↶ Drive Sleeve rotation to open the valve. The MDPI on the L120-85 is typically mounted for the full CCW↶ rotation to indicate the OPEN position (100%). If *opposite* drive sleeve rotation is required (CCW↶ to close a valve), the following torque switch modifications are required.

⚠Danger

Hazardous Voltage. Turn power OFF before opening the Electrical Compartment Cover or making any adjustments to the Torque Switch.

1. Turn power to the actuator OFF before changing Torque Switch wiring.

2. Reverse the OPEN and CLOSE Torque Switch labels on the ID Limiter Plate . See figure 21.

3. Interchange OPEN Torque Switch wires 18 and 18C with CLOSED wires 17 and 17C. (Refer to your wiring diagram for other Torque Switch wiring configurations).

Torque Switch Setting and Wiring (continued)

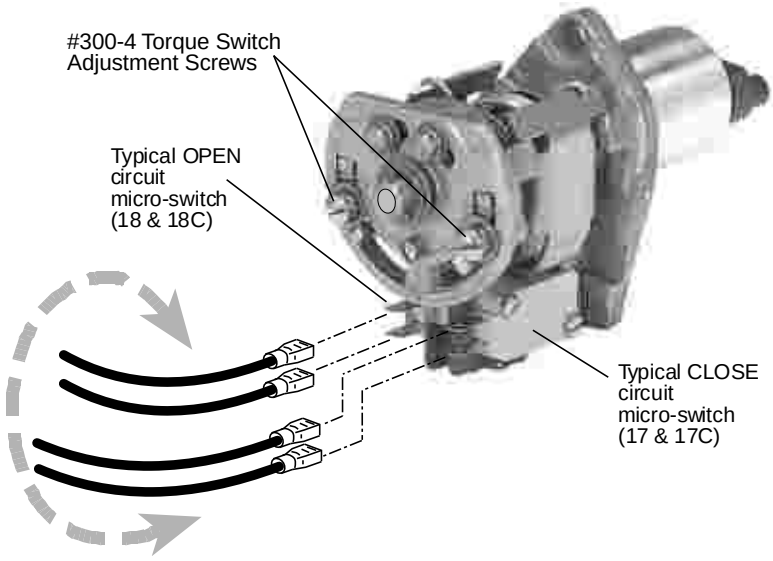


Figure 22 - Reversing Torque Switch wiring

4. Remove the Mechanical Dial Position Indicator Plate and flip over for indication of CCW rotation to the valve's CLOSED position. See figure 15 for MDPI Dial Plate .

5. Reverse the OPEN/CLOSE directional arrow on the Handwheel.

Lubrication

Lubrication Inspection

> **Note:**
>
> Before operating your actuator, inspect it for proper lubrication, (especially if it has been stored for a long period of time).

No seal can remain absolutely tight at all times; therefore, it is not unusual to find a very small amount of weeping around shaft seals – especially during long periods of idleness such as storage. Using grease minimizes this condition as much as possible. If you find a small amount of weeping at start-up, remove it with a clean rag. Once the equipment is operating, the weeping should stop.

Lubrication Frequency

Base the frequency of lubrication inspections on historical data of your installed equipment. Every actuator application has its own effect on lubricants. Pattern lubricant inspections based on the needs of your facility and its applications. The following schedule of lubrication inspection should be followed until operating experience indicates otherwise.

Lubrication (continued)

Gear Case : Inspect lubrication every 18 months or 500 cycles – whichever occurs first.

Inspection

The three primary considerations in a lubrication inspection are:

1. Quantity - L120-85 operators are built to operate on the immersion principle. The primary concern in the amount of lubricant is whether the "worm" is totally immersed in grease.
2. Quality - If dirt, water or other foreign matter are found during lubrication inspection, the units should be flushed with a commercial de greaser/cleaner such as Exxon Varsol #18 which is not corrosive and does not affect seal materials. Repack unit with fresh lubricant allowing room for grease thermal expansion.
3. Consistency - Lubricant should be slightly fluid approximating a standard NLGI-0 grade consistency or less. Thinners such as Amoco WAYTAC #31 oil may be added provided the volume of thinner does not exceed 20% of the total lubricant.

Factory Lubricants

Gear Case: **L120-85 with 1800 RPM motor** is factory lubricated with Exxon Nebula EP-0 calcium base grease, suitable for temperatures from -20°F (-29°C) to +175°F (+79°C). **L120-85 with 3600 and 1900 RPM motor** is factory lubricated with Exxon Nebula EP-00 calcium base grease, suitable for temperatures from -60°F (-51°C) to + 250°F (+121°C).

Geared Limit Switch: Exxon Beacon 325 (no substitute).

Limitorque Minimum Lubricant Qualities Required

⚠ Caution

Do not mix lubricants of a different base chemical. Mixing lubricant bases may cause lubricant properties to be ineffective.

The standard lubricants used by Limitorque have been proven extremely reliable over years of service. We do not recommend a particular lubricant substitute for our standard lubricants, but below is a list of minimum lubricant qualities required by Limitorque:

1) Should contain an "EP" additive.
2) Must be suitable for the temperature range intended.

Lubrication (continued)

3) Must be water and heat resistant and non-separating.
4) Must not create more than 8% swell in Buna N or Viton.
5) Must not contain any grit, abrasive or fillers.
6) Must slump–prefer NLGI grade .
7) Must not be corrosive to steel gears, ball or roller bearings.
8) Dropping point must be above 316° F for temperature ranges of -20°F (-29°C) to 150°F (66°C).

Electrical Start-up Procedure

1. Check that the actuator has been correctly lubricated. This is particularly important if the actuator has been in long-term storage.
2. Ensure that the Limit Switch and Torque Switch has been properly set.
3. If the valve stem is not visible, remove the Pipe Plug #45 to observe the output direction of the Drive Sleeve #25.
4. Engage MANUAL operation and hand crank actuator well away from the OPEN or CLOSED end of travel.
5. Turn power ON and push the OPEN button to electrically operate the actuator.
6. Check output rotation; if Motor rotation (phase) is correct, the valve will begin to open. If the valve begins to close — Stop Immediately .
7. Correct the Motor rotation by following the procedure "Verifying Motor Rotation Direction" on pages 25 - 27.
8. The actuator should operate correctly and will stop at the end of travel by the Torque and Limit Switch functions.
9. Replace Pipe Plug #45.
10. If your actuator configuration has a control package, consult you specific controls package Instruction and Maintenance Manual for proper set-up and calibration.

Typical L120-85 Operation & Disassembly

L120-85 actuators are always available for motor operation when the motor is energized. **Do not** force the Declutch Lever into the motor operation position. The Declutch Lever returns to motor operation position automatically when the motor is energized.

> Note:
>
> Refer to the Illustrated Parts Breakdown on pages 45 - 49 as you step through the Description of Operation and the Assembly/Disassembly procedures.

Description of Motor Operation

In motor operation, the Motor Cam #38 drives the Clutch Assembly #19-1, 2, and 3 which is splined on the outer diameter and mates with the internal splines of the Clutch Pinion Assembly #18-1, 2 and 3. The helical gear teeth on the Clutch Pinion #18-1 mate with the Wormshaft Gear #35 teeth. The Clutch Pinion and Wormshaft Gear are always engaged. The Wormshaft Gear is keyed to the Wormshaft #15-1 which is keyed to the Worm #15-2. Rotation of the Wormshaft/Worm Assembly turns the Worm Gear #21. Lugs on the Worm Gear engage lugs on the outer diameter of the Drive Sleeve #25. *Hammerblow* or *no lost motion* is selected by the assembly arrangement of the Worm Gear and Drive Sleeve Lugs. Lugs at the base of the Drive Sleeve can drive either a Torque Drive Nut (similar to L120-10 through 40) or they can drive the lugs of the Thrust Stem Nut contained in the type Drive 2 Thrust Base Assembly.

Description of Manual Operation

> ⚠ Warning
>
> Do not manually operate actuator with devices other than installed Handwheel and Declutch lever. Using additive force devices (cheater bars, wheel wrenches, pipe wrenches or other devices of this nature) on the actuator Handwheel or Declutch Lever may cause serious personal injury and/or damage to the actuator or valve.

The L120-85 actuator has a Handwheel #29 for manual operation. The unit can be manually operated any time the Motor is not energized. To manually operate the L120- 85, push the Declutch Lever #9 in the direction of the arrow until it latches in place. Pushing the Declutch Lever rotates the Declutch Shaft which is keyed to the Declutch Link #7-1. The Declutch Link engages the Clutch Ball Bearing #19-2 which disengages the Clutch from the Motor Cam and engages the Handwheel Lugs #3-1. The Clutch Latches #32 hold the Clutch Assembly in MANUAL operation until the Motor is energized. Lobes on the Motor Cam #38

Typical L120-85 Operation & Disassembly (continued)

cause the Clutch Latches to release when the Motor is energized. The spring loaded Clutch #19-1 reengages with the lugs on the Motor Cam . The Declutch Lever will automatically disengage when the Motor begins operating.

> ⚠Danger
>
> Hazardous Voltage. Turn power OFF before disassembling your L120-85 actuator.

> ⚠Danger
>
> Potential high pressure vessel. Before removing or disassembling your actuator, insure that the valve or other actuated device is isolated and is not under pressure.

> Note:
>
> Minor service may be performed with the actuator mounted on the valve or other actuated devices. Perform more complex service with the actuator removed from the valve or other actuated device.

> Note:
>
> Drive 2 units (Thrust only) will maintain the thrust of a valve without the actuator mounted on the Thrust Base. Before removing the actuator from the Thrust Base, ensure that all actuated devices are secured to appropriate positions while actuator is removed from the Thrust Base.

A. Rotate the Handwheel to the fully CLOSED position.
B. Drive 1 applications
   1. Loosen and remove customer installed Mounting Screws and Lockwashers that are holding the actuator to the Mounting Adapter .
   2. Remove Pipe Plug #45 from top of actuator Housing #1
   3. Lift the actuator enough to loosen Key from the Drive Sleeve #25.
   4. Remove Key from the Valve Stem and the Drive Sleeve #25.
   5. Proceed to step C.

   Drive 2 applications
   1. Loosen and remove Socket Head Cap Screws #110 and Lockwashers #111 at the Mounting Base of the actuator to remove the actuator from the Thrust Base Assembly .
   2. Proceed to step C.

C. Lift actuator completely off of the Mounting Adapter or Thrust Base Assembly .
D. (Drive 2 Only)
   Rotate the Thrust Base Assembly off the threaded Valve Stem .

Typical L120-85 Operation & Disassembly (continued)

Open Electrical Compartment Cover and disconnect Motor

1. Turn power to the actuator OFF.

2. Open or remove the Electrical Compartment Cover #200-1 by loosening hardware #s 200-2 and 200-3. See page 45.

3. Disconnect motor leads from the Terminal Strip (Refer to your wiring diagram to locate motor lead wiring numbers).

Remove Pipe Plug and Wiring

4. Slowly remove one of the Pipe Plugs #50-24 to release any air pressure built up within the actuator. See page 48.

5. If unit has an Integral Assembly , remove all Integral Assembly wiring that is connected to the Terminal Strip .

Remove Limit and Torque Switch

6. Remove the M6 Hex Head Cap Screws and Lockwashers #s 305-47 and 48 from the base of the Limit Switch #305. See page 45.
7. Remove the M6 Socket Head Cap Screw and Lockwasher #s 300-20 and 21 from the base of the Torque Switch #300.

8. Remove the Limit Switch #305 and Torque Switch #300 from the actuator with associated wiring in tact.

Remove Motor Assembly

9. Remove the M10 Hex Head Cap Screws and Lockwashers #s 50-3 and 50-4 to remove the Motor #31-1. See page 46.

10. Slide the Motor #31-1 away from the actuator and pull the motor leads through the conduit hole.

Remove Handwheel

11. Loosen Set Screw #29-1A from the Handwheel Hub Assembly #29-1 and remove Handwheel #29-2 and Handwheel Hub Assembly then remove Handwheel Shaft Key #2-1 from the Handwheel Shaft #2. See page 47.

Remove Handwheel Shaft Assembly

> **Note:**
>
> Before disassembling the Handwheel Shaft Assembly, make note of the number of Handwheel Shims #s 6-1 & 6-2 that are used on each side of the Handwheel Bushing #4-1. This will allow re-assembly of Handwheel Shims without need to re-measure gap between actuator Housing face #1 and Bushing #4-1 for shimming requirements.

12. Remove the M10 Hex Head Cap Screws and Lockwashers #s 50-3 and 50-4 to remove the Handwheel End Cap #5. See page 47.

13. Remove Handwheel Shaft Assembly comprised of #2 Handwheel Shaft , #3-1 Handwheel Lug , #3-2 Spring , #3-3 Roll Pin , #4-1 Handwheel Bushing, #4-2 Handwheel Spacer , #4-3 Retaining Ring , #6-1 Handwheel Shims, #6-2 Handwheel Shims , #43 O-Ring and #44 O-Ring (not shown).

Remove Declutch Lever Assembly

14. Before removing the Declutch Lever Assembly #9, loosen Hex Head Screws and Lockwashers #s 50-5 and 50-6 and rotate the Declutch Lever Stop Plate #11 in the CW direction to free up the Declutch Lever Assembly. See page 47.

15. Remove Socket Head Shoulder Screws #50-7 to remove the Clutch Latch Assembly #s 32 and Latch Spring # 33. See page 46.

Remove Clutch Assembly

16. Remove Clutch Assembly comprised of #s 19-1 Clutch , 19-2 Ball Bearing and 19-3 Retaining Ring . See page 46.

Remove Clutch Pinion Assembly

17. Use a socket wrench extension or another bar device to exert force against the face of the Clutch Pinion Assembly ; this will release some of the spring tension compressed behind the Clutch Pinion Assembly by the Declutch Compression Spring #30. With some of the tension released from the Clutch Pinion Assembly , use retaining ring pliers to remove Retaining Ring #41 that holds the Clutch Pinion Assembly in place.

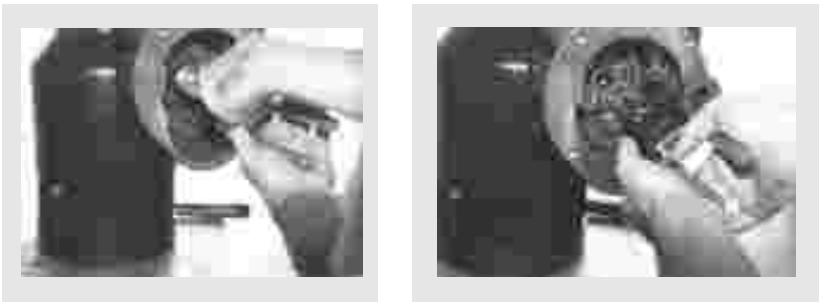


Figure 23 - Removing Clutch Pinion Assembly

18. Remove the Clutch Pinion Assembly #s 18-1, 18-2, 18-3 and the Declutch Compression Spring #30.

Remove Worm Shaft Assembly

19. Remove Flexloc Nut #37 by holding Flange Nut #15-10 (on opposite end of Worm Shaft Assembly) secure with a wrench. See page 47

20. Remove Washer #34 and Worm Shaft Gear #35.

Typical L120-85 Operation & Disassembly (continued)

21. Push the Worm Shaft Assembly through the opposite end of the actuator. The Worm Shaft Assembly is comprised of #15-1 Worm Shaft , #15-2 Worm , #15-3 Ball Bearing , #15-4 Ball Bearing , #15-5-1 Disc Spring , #15-5-2 Spring Pack Shim , #15-6 Disc Spring Spacer , #15-7 Disc Spring Mandrel , #15-9 Bearing Adapter , #15-10 Flange Nut , #15-11 Key, #15-12 Retaining Ring , #34 Washer , #35 Worm Shaft Gear , #36 Key and #37 Flexloc Nut .

> Note:
>
> The Disc Spring Pack is factory preloaded and should not be disassembled from the Worm Shaft Assembly; if Disc Spring Pack replacement is necessary, contact your Limitorque authorized dealer or the Limitorque Service Department for a complete Worm Shaft Assembly replacement.

Remove Thrust Base (if your unit uses Drive 2)

22. Remove Socket Head Cap Screws #110 and Lockwashers #111 to remove Thrust Base Assembly from actuator Housing #1. See page 49.

Remove Drive Sleeve

23. Remove Socket Head Cap Screws #50-1 and Lockwashers #50-2 to remove the Unit Base Plate #27 from the bottom of the actuator. See page 48.

24. Remove the Retaining Ring #22 and Ball Bearing #16 from the Drive Sleeve #25.

25. Remove the rest of the Drive Sleeve Assembly through the bottom of the actuator.

Thrust Base Disassembly (if your unit uses Drive 2)

1. After removing the Thrust Base Assembly from the actuator Housing and the Mounting Base , remove the Socket Head Cap Screw #112 and Lockwasher #113 to remove the Thrust Base Housing #100 from Thrust Base Plate #102. See page 49.

2. Remove the top Quad Ring #107, then remove the Thrust Bearing #103 and Thrust Washers #104.

> Note:
>
> Removing the Quad Rings #107 before removing the Thrust Bearing #103 and Thrust Washers #104 will prevent damaging the Quad Rings.

3. Lift the Drive Sleeve #101 out of the Thrust Base Plate #102.

4. Pull the bottom Quad Ring #107 off the Drive Sleeve, then remove the Thrust Bearing #103 an Thrust Washers #104.

Typical L120-85 Assembly

Assembly should be conducted in the reverse order of the disassembly procedures noting the following points:

Handwheel Shaft Assembly and Shimming

If you have disassembled the Clutch Latch Assembly (#s 32-1, 32-2 & 33) or have replaced the Handwheel Shaft Assembly , Clutch Pinion Assembly #18, Clutch Assembly #19 or Motor Cam #38 you need to re-shim the Handwheel Assembly using the following procedure:

1. Remove the Retaining Ring #4-3, Handwheel Spacer #4-2 Handwheel Shims #s 6-1 and 6-2, Handwheel Bushing #4-1, O-Rings #s 43 and 44 and second group of Handwheel Shims #s 6-1 and 6-2 from the Handwheel Shaft Assembly . Refer to the Illustrated Parts Breakdown on page 45-49 for additional views of piece parts.

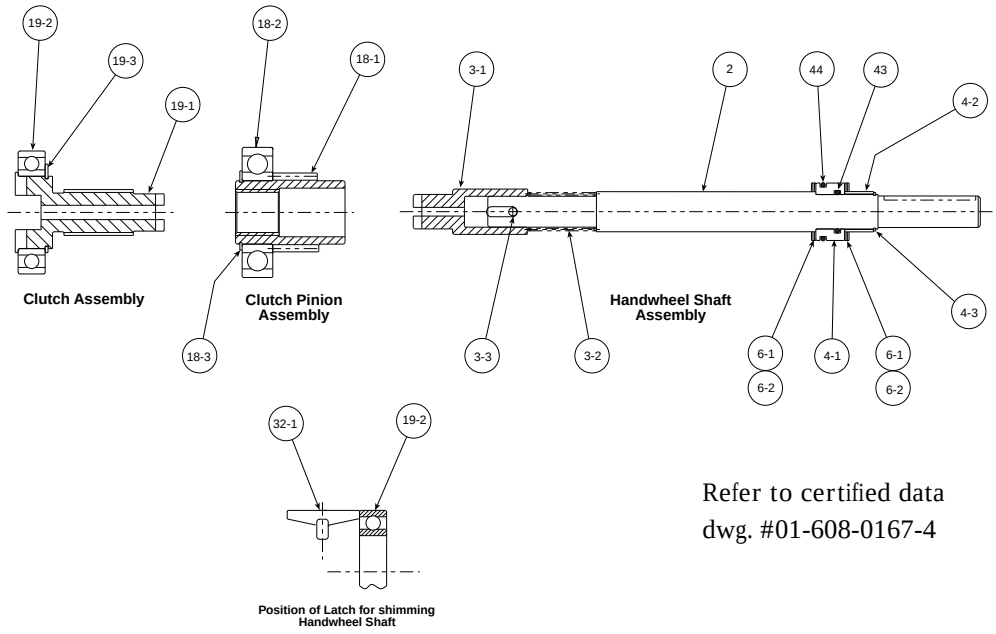


Figure 24 - Key components affected by Handwheel shimming (Motor Cam not shown)

2. Before shimming the Handwheel Assembly and to assure proper Handwheel Lug #3-1 engagement with the Clutch #19-1, push the Declutch Lever into the MANUAL mode until Latch 32-1 is engaged with Clutch Bearing 19-2 as shown in figure 24 and 25, once Clutch is engaged leave the Declutch Lever in the declutch position during the shimming procedure.

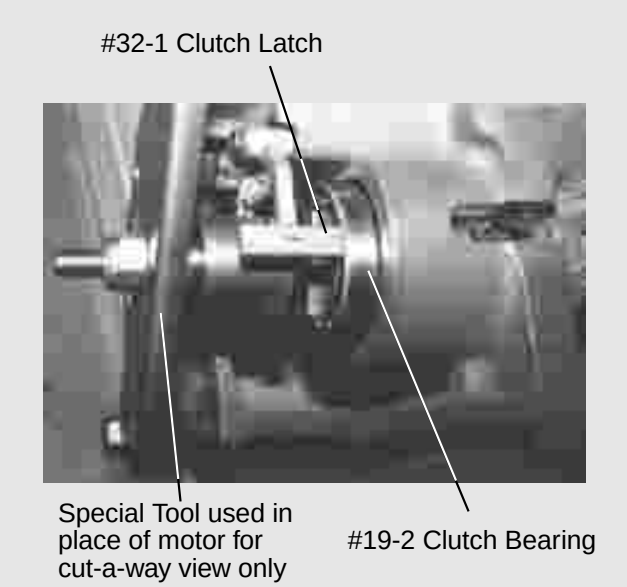


Figure 25 - Cut-a-way view of L120-85 actuator with Clutch Latch positioned on face of Clutch Bearing

3. Now insert the Handwheel Shaft Assembly #s 2, 3-1, 3-2 and 3-3 (without the parts of the Handwheel Shaft Assembly removed in step 1) into the actuator (see figure 24). Assure the Handwheel Lug #3-1 is fully seated into the Clutch Assembly #19 by rotating the Handwheel Shaft Assembly until you feel it seat into engagement with the Clutch #19-1.

4. After Clutch Latch #32-1 is positioned on the Clutch Bearing #19-2 as described in step 2 and the Handwheel Shaft Assembly is inserted into the actuator Housing as described in step 3, insert the Handwheel Shaft Washer #52 (see figure 29) into the actuator Housing.

5. Once the Handwheel Shaft is installed and fully seated, use a feeler gauge to measure the gap that is identified as Dimension "A" in figure 27. Dimension "A" must be within the range of .000 to .180 inches (.00 mm 4.57 mm) prior to shimming. If dimension "A" is not within the range of .000 to .180 inches (.00 mm 4.57 mm), the assembly is in error and Steps 1 through 5 should be repeated.

Note:

When measuring the gap, verify that Spring #3-2 is at the "installed height" that is determined by the Handwheel Shaft #2, Handwheel Lugs #3-1 and Roll Pin #3-3. If Spring #3-2 is compressed an additional amount due to forcing the Handwheel Shaft into the Housing the gap measurement will be incorrect (see figure 24 on page 39).

Figure 26 - Using feeler gauge to measure gap between actuator Housing face and Handwheel Bushing

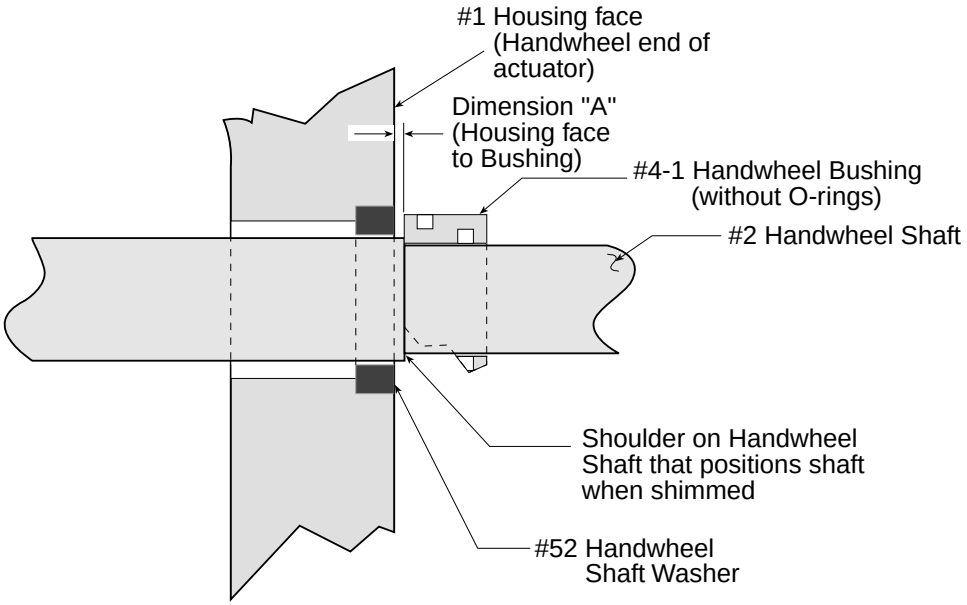


Figure 27 - Gap between Housing face and Handwheel Bushing shown as dimension "A"

6. Select a shim Thickness to satisfy the following chart (each shim is .030 of an inch in thickness):

Shim thickness for gap "A"					
Dimension "A" Greater than		Less than or equal to		Nominal shim thickness at gap "A"	
0 "	0 mm	.030"	0.76 mm	.03"	0.76 mm
.030"	0.76 mm	.060"	1.52 mm	.06"	1.52 mm
.060"	1.52mm	.090"	2.29 mm	.09"	2.29 mm
.090"	2.29 mm	.120"	3.05 mm	.12"	3.05 mm
.120"	3.05 mm	.150"	3.81 mm	.15"	3.81 mm
.150"	3.81 mm	.180"	4.57 mm	.18"	4.57 mm

Figure 28 - Gap "A" shim thickness selection chart

7. Install O-Rings #43 and #44 on Bushing #4-1. Install the proper thickness of shims, based on step 6, on the Handwheel Shaft #2. The shims must rest on the major shaft diameter and be held in place by installing the Handwheel Bushing #4-1 with O-Rings #43 and #44. The shims that fill gap "A" must lie between the Handwheel Bushing #4-1 and the Handwheel Shaft Washer #52. Refer to figure 24 for assembly parts drawing.

8. Install Handwheel Spacer #4-2 and Retaining Ring #4-3 on the Handwheel Shaft #2 and insert Handwheel Shaft Assembly into actuator Housing .

9. Install the remaining shims (that were not used at gap "A") over the Handwheel Spacer #4-2 and against Handwheel Bushing #4-1. The proper thickness for shims at gap "B" is determined based on the total shim thickness for gap "A" and gap "B" combined being .18 inches (4.57 mm) total. See figures 30 & 31.

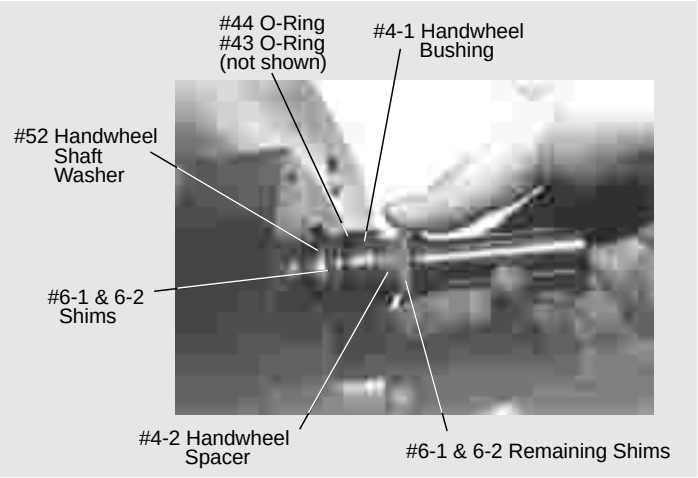


Figure 29 - Shimming parts & their order of assembly

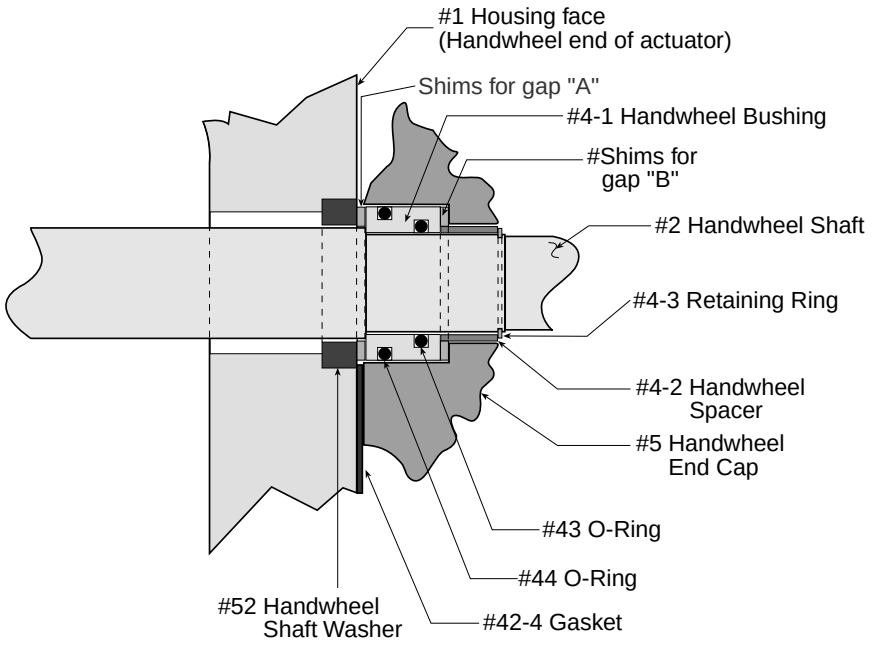


Figure 30 - Shim location for gap "B" dimension

Shim thickness for gap "B"			
Nominal Used at gap "A"		Shim Thickness Required for gap "B"	
.03"	0.76 mm	.15"	3.81 mm
.06"	1.52 mm	.12"	3.05 mm
.09"	2.29 mm	.09"	2.29 mm
.12"	3.05 mm	.06"	1.52 mm
.15"	3.81 mm	.03"	0.76 mm
.18"	4.57 mm	0"	0 mm

Figure 31 - Gap "B" shim thickness selection chart

10. Install Gasket #42-4 and Handwheel End Cap #5. Secure these pieces with 4 Hex Head Cap Screws #50-3 and Lockwashers #50-4. Handwheel Shaft end play can be examined but is not required. According to dimensional tolerances, the Handwheel end play with proper shimming techniques will be .000 to .034 inches (.0 mm to 0.86 mm).

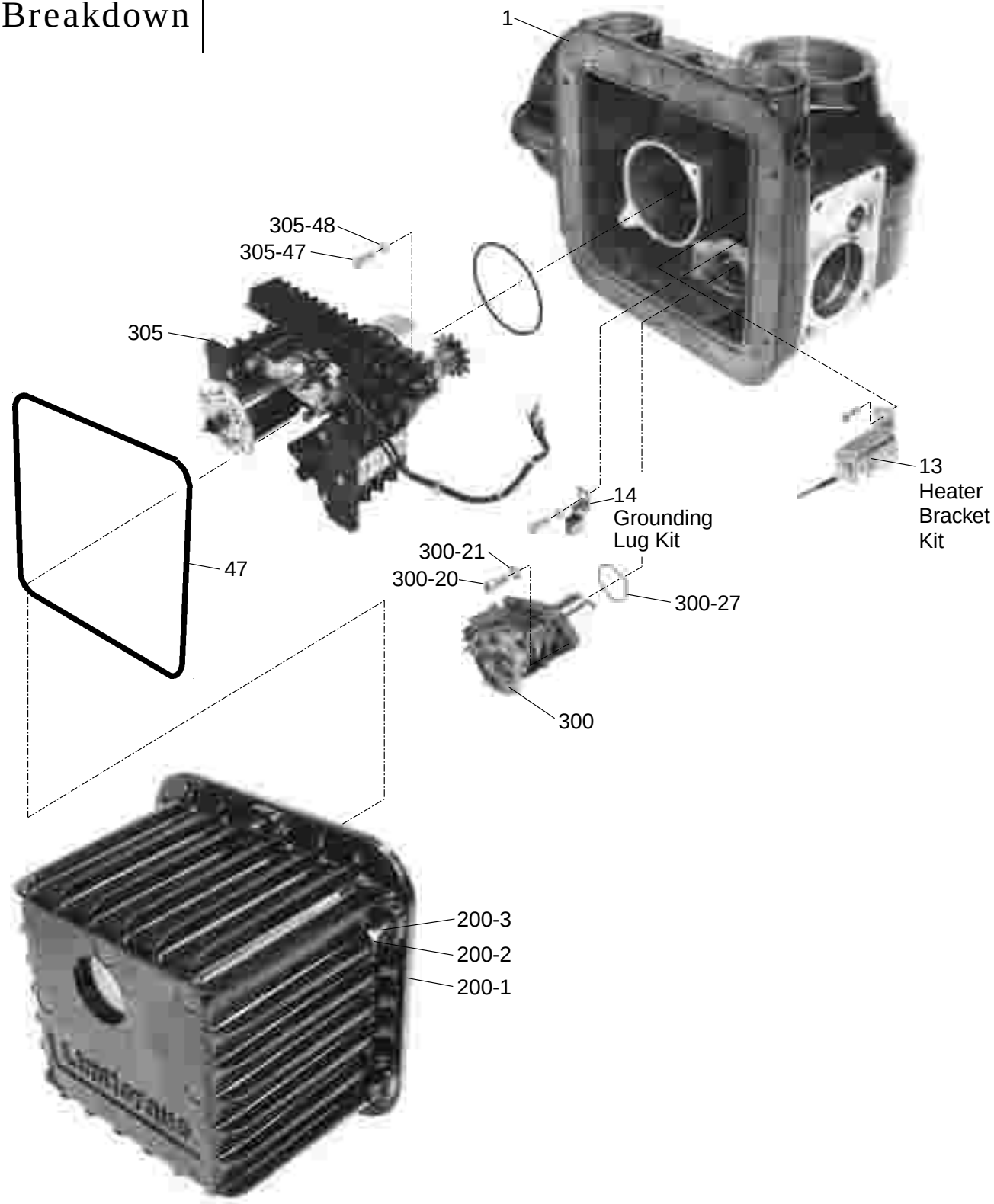
Typical L120-85 Assembly (continued)

Verifying Handwheel operation

After your actuator is completely assembled, test the Handwheel for MANUAL operation. Put the Declutch Lever in MANUAL mode, turn the Handwheel in either direction to insure MANUAL operation is turning the Drive Sleeve mechanism. If there is resistance to turning the Handwheel, the Declutch Lever Assembly is not properly dis-engaging the Motor Cam from the Clutch Pinion Assembly. If this occurs, review the Handwheel shimming procedure to insure Handwheel shimming is accurate. If you determine the shimming procedure was correctly followed, call the Limitorque Service Department for further assistance.

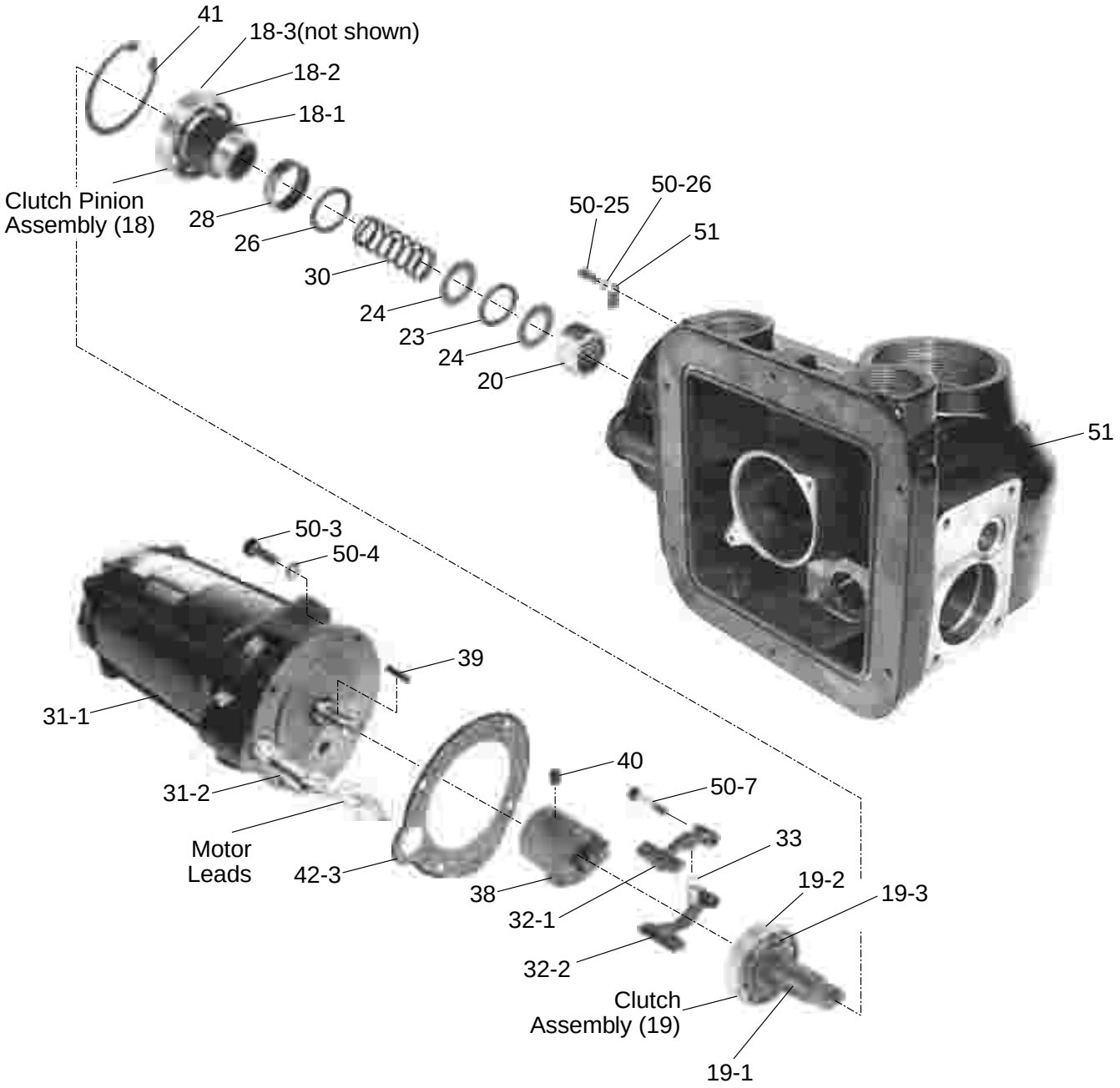
L120-85 Illustrated Parts Breakdown

Electrical Compartment



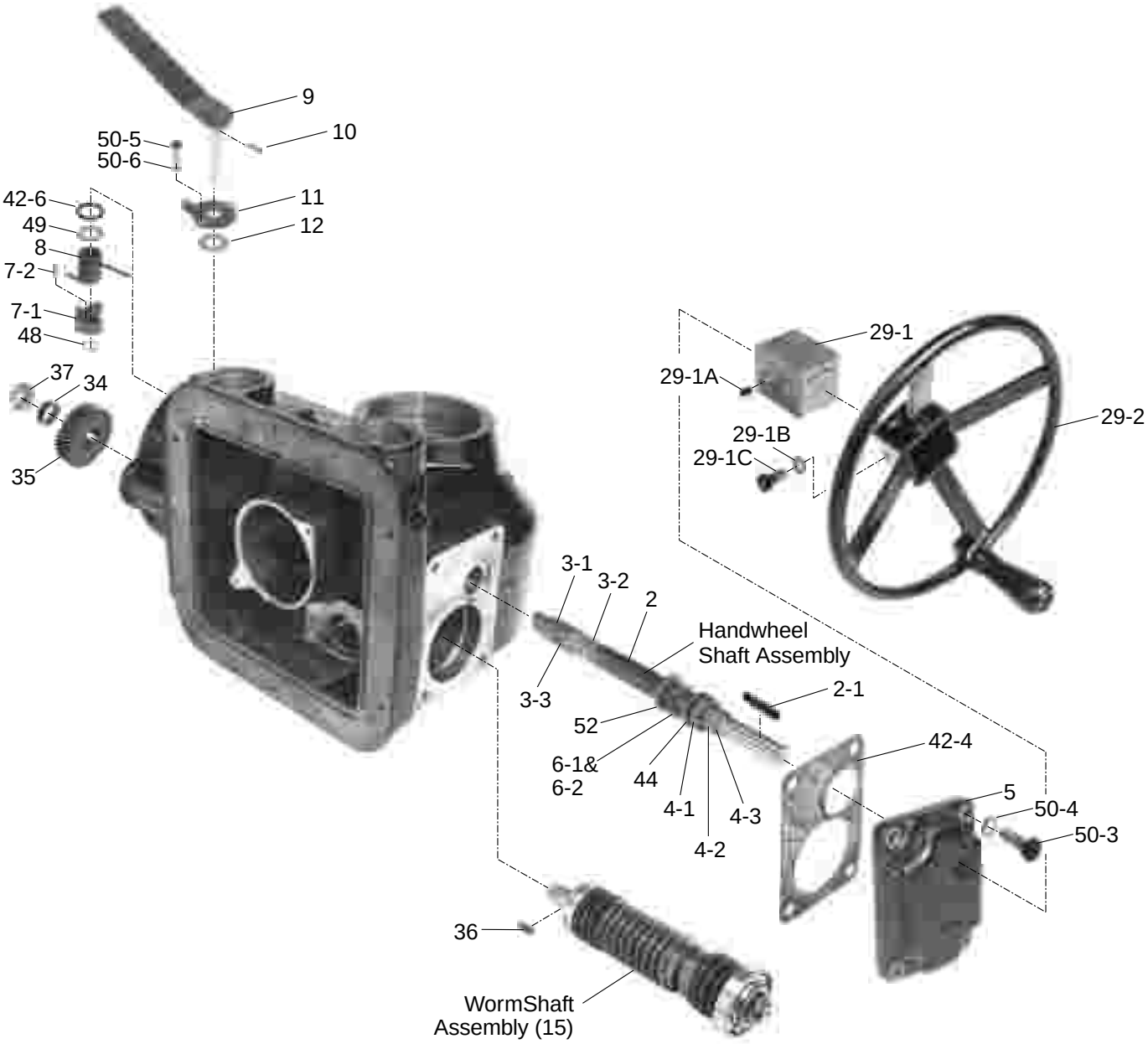
L120-85 Illustrated Parts Breakdown (continued)

Motor and Motor Drive Components



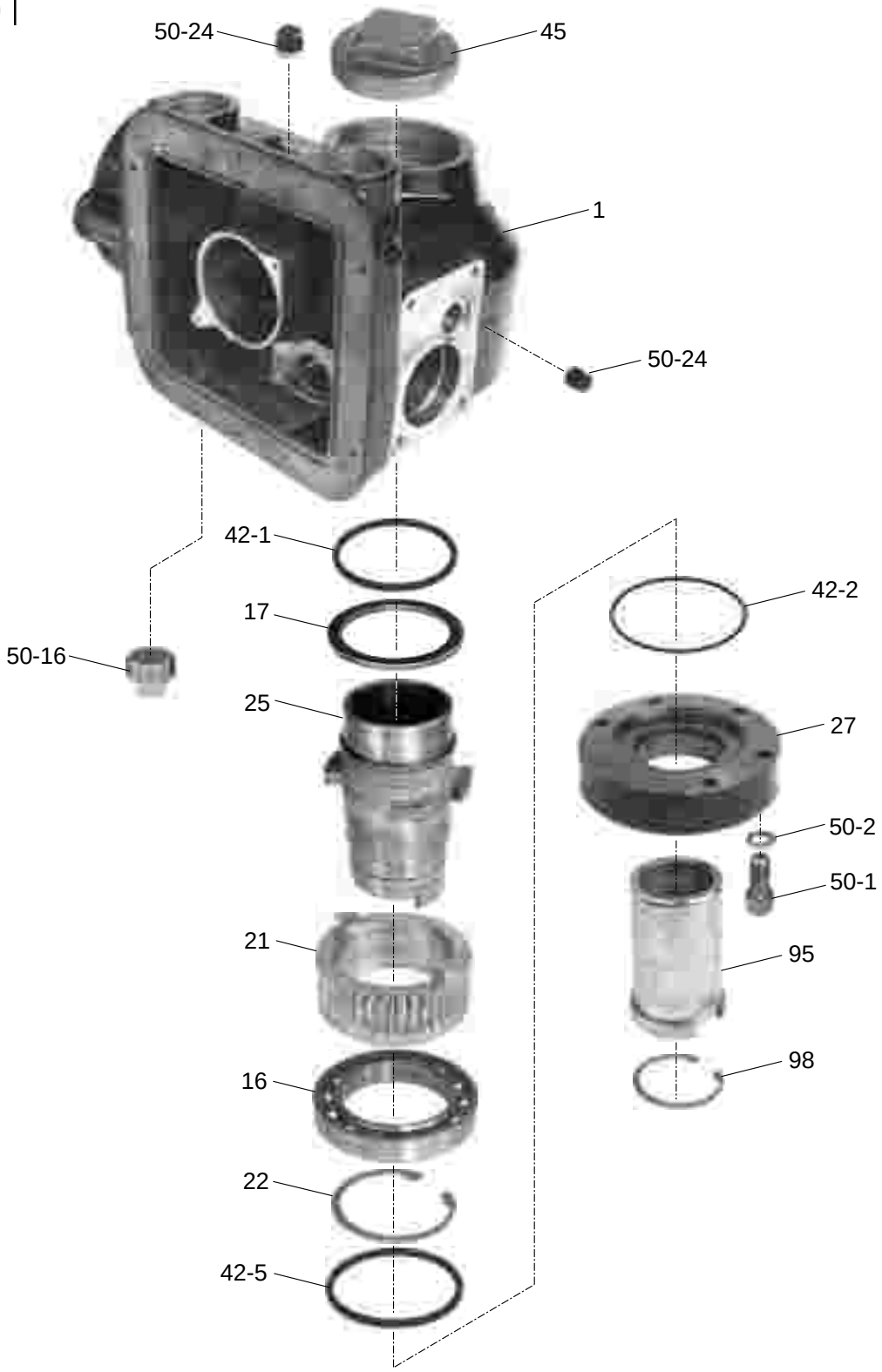
L120-85 Illustrated Parts Breakdown (continued)

Handwheel Shaft and Associated Components



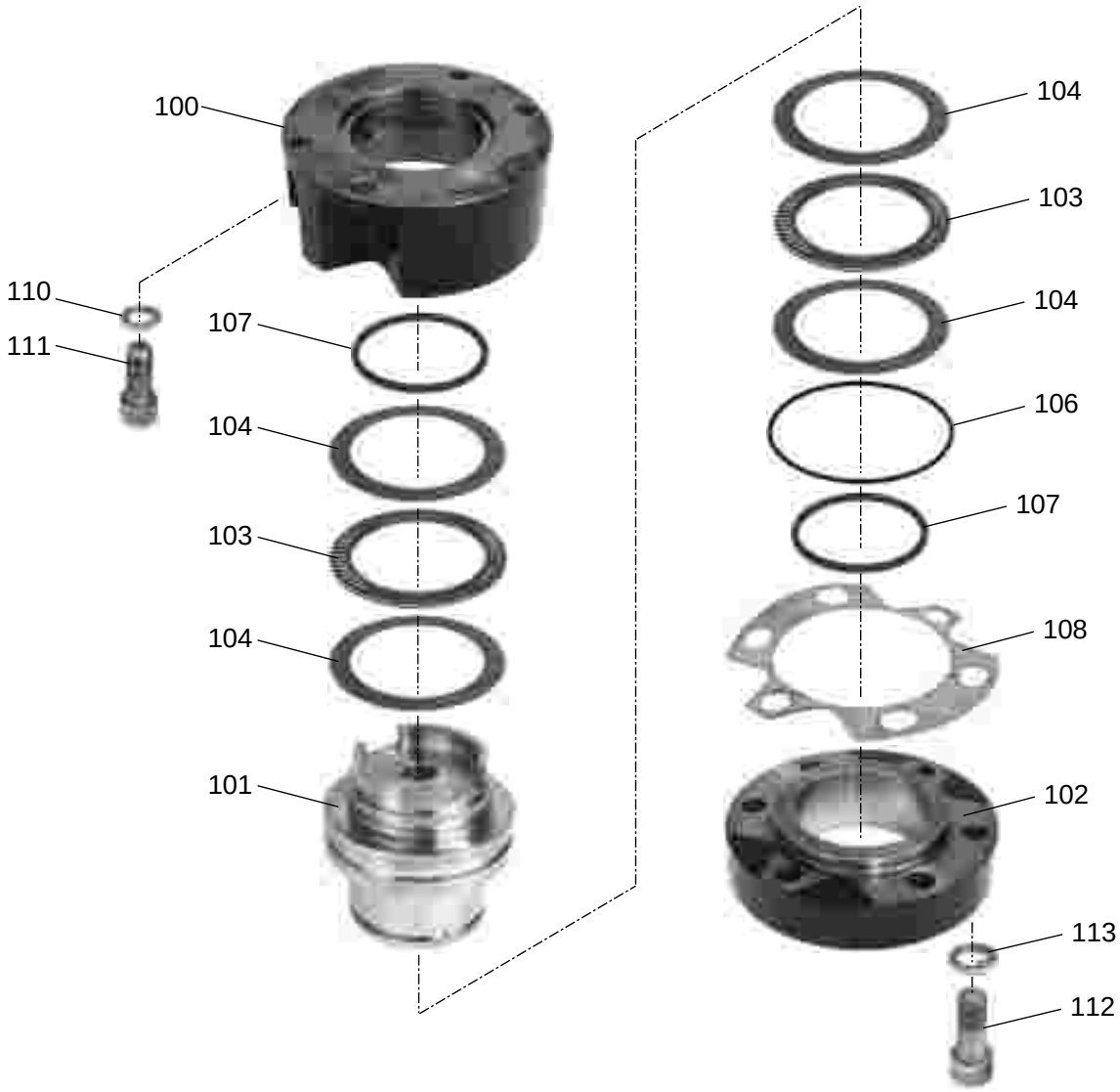
L120-85 Illustrated Parts Breakdown (continued)

Drive Sleeve Group



L120-85 Illustrated Parts Breakdown (continued)

Thrust Base Group



L120-85 Parts List

Pc. #	Description	Qty.	Pc. #	Description	Qty.
1	Housing	1	15-10	Flange Nut	1
2	Handwheel Shaft	1	15-11	Key	1
2-1	Handwheel Shaft Key		15-12	Retaining Ring	1
3-1	Handwheel Lugs	1	16	Ball Bearing	1
3-2	Spring	1	17	Drive Slv.Top Bearing	1
3-3	Roll Pin	1	18-1	Clutch Pinion	1
4-1	Handwheel Bushing	1	18-2	Ball Bearing	1
4-2	Handwheel Spacer	1	18-3	Retng. Ring (not shown)	1
4-3	Retaining Ring	1	19-1	Clutch	1
5	Handwheel End Cap	1	19-2	Ball Bearing	1
6-1	Handwheel Shim	6	19-3	Retaining Ring	1
6-2	Handwheel Shim	4	20	Needle Bearing	1
7-1	Declutch Link	1	21	Worm Gear	1
7-2	Key	1	22	Retaining Ring	1
8	Declutch Return Spring	1	23	Thrust Bearing	1
9	Declutch Lever Assy.	1	24	Thrust Bearing Washer	2
10	Roll Pin	1	25	Drive Sleeve	1
11	Declutch Lever Stop Plate	1	26	Bearing Backup Washer	1
12	Declutch Lever Washer	1	27	Unit Base Plate	1
13	Heater Bracket Kit	1	28	Needle Bearing	1
14	Grounding Lug Kit	1	29-1	2" Square. Nut Assy.	1
15-1	Worm Shaft*	1	29-2	Handwheel	1
15-2	Worm*	1	30	Declutch Comp. Spring	1
15-3	Ball Bearing*	1	31-1	Motor	1
15-4	Ball Bearing*	1	31-2	Conduit Nipple	1
15-5-1	Disc Spring*	12	32-1	Clutch Latch	1
15-5-2	Spring Pack Shim*	12	32-2	Clutch Latch	1
15-6	Disc Spring Spacer*	2	33	Latch Spring	1
15-7	Disc Spring Mandrel*	1	34	Washer*	1
15-8			35	Worm Shaft Gear*	1
15-9	Bearing Adapter*	1			

**Worm Shaft Assembly Component*

L120-85 Parts List (continued)

Pc. #	Description	Qty.	Pc. #	Description	Qty.
36	Key	1	50-26	Lockwasher	1
37	Flanged Lock Nut	1	51	Bearing Retaining Plate	1
38	Motor Cam	1	52	HW Shaft Washer	1
39	Key (Motor)	1	95	Torque Drive Nut	1
40	Socket Head Set Screw	1	98	Torque Drive Nut Retaining Ring	1
41	Retaining Ring	1	100	Thrust Base Housing	1
42-1	Quad Ring	1	101	Thrust Base Dr. Sleeve	1
42-2	O-Ring	1	102	Thrust Base Plate	1
42-3	Motor Gasket	1	103	Thrust Bearing	2
42-4	H.W. End Cap Gasket	1	104	Thrust Washer	4
42-5	Quad Ring	1	106	O-Ring	1
42-6	O-Ring	1	107	Quad Ring	2
43	O-Ring (not shown)	1	108	Shim Set	1
44	O-Ring	1	109	Grease Fitting (not shown)	1
45	Pipe Plug	1	110	Socket Head Cap Screw	4
46			111	Lockwasher	4
47	O-Ring	1	112	Socket Head Cap Screw	6
48	Retaining Ring	1	113	Lockwasher	6
49	Spring Retaining Washer	1	200-1	Elec. Compartment Cvr.	1
50-1	Socket. Head Cap Screw	5	200-2	Captive Screw	6
50-2	Lockwasher	5	200-3	Lockwasher	6
50-3	Hex Head Cap Screw	8^	300	Torque Switch	1
50-4	Lockwasher	8*	300-20	Socket Head Cap Screw	1
50-5	Hex Head Cap Screw	2	300-21	Lockwasher	1
50-6	Lockwasher	2	305	Geared Limit Switch	1
50-7	Soc. Hd. Shoulder Screw	2	305-47	Hex Head Cap Screw	2
50-16	Pipe Plug	4	305-48	Lockwasher	2
50-23	Drive Screw	4	999	Nameplate (not shown)	1
50-24	Pipe Plug	4	999	Nameplate (not shown)	1
50-25	Socket Head Cap Screw	1			

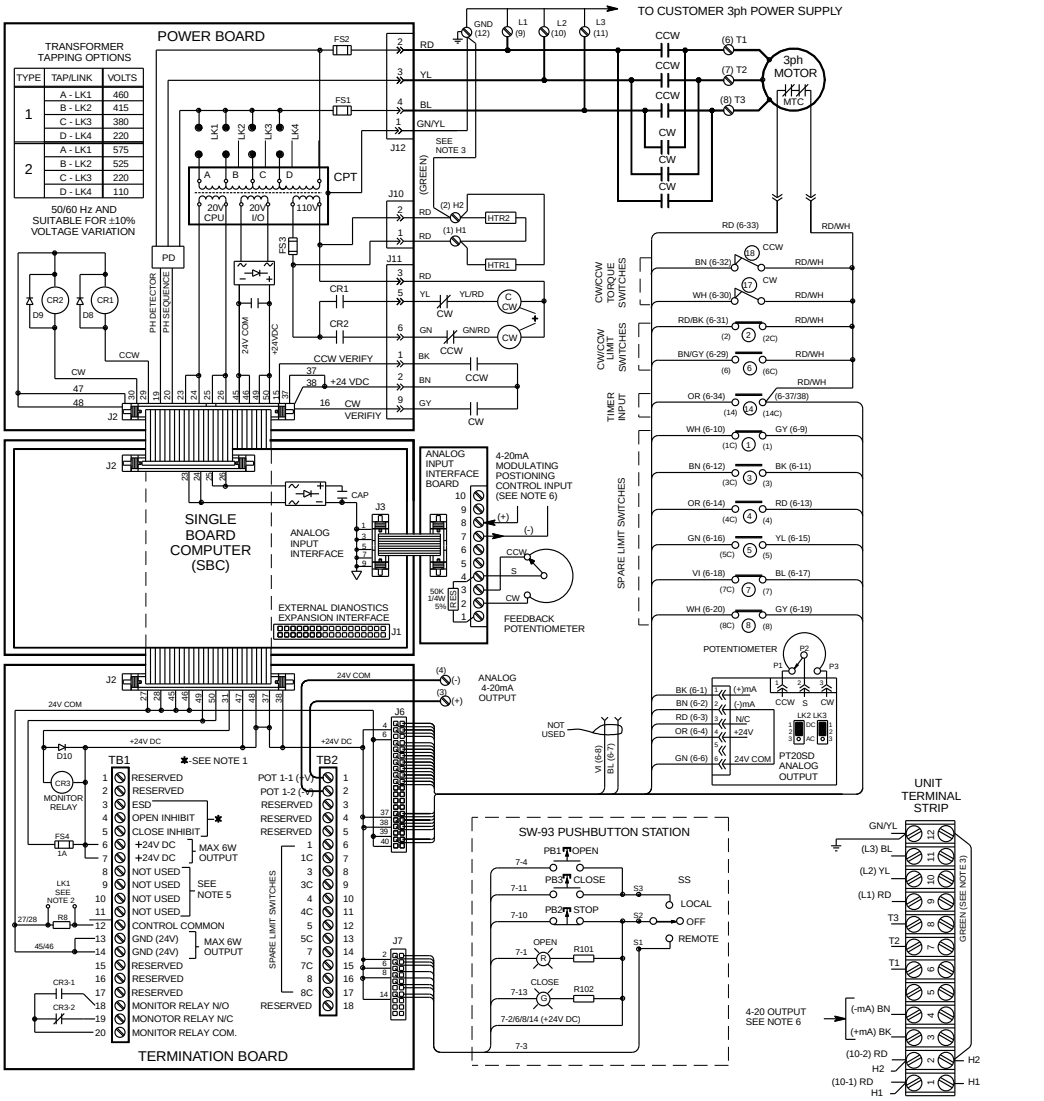
^4 used on Motor #31-1

**4 used on Handwheel End Cap #5*

Typical Wiring Diagram

Three-phase with control package:

The wiring diagram below is a representation of a typical application and may not be applicable to your specific actuator. Please refer to the wiring diagram supplied with your unit to confirm the actual equipment supplied.



NOTES

1. 24V TO 125V AC/DC MAXIMUM INPUTS.
2. REMOVE LINK LK1 ON TERMINATION BOARD IF CUSTOMER SUPPLIED REMOTE PUSHBUTTON POWER IS ABOVE 90 VOLTS.
3. IF GROUNDED CONTROL CIRCUIT IS UNDESIRED USER MAY REMOVE JUMPER ON TERMINAL STRIP FROM TERMINAL POINT 2 TO TERMINAL POINT 12.
4. FOR FEATURE SELECTION REFER TO INSTRUCTION AND MAINTENANCE MANUAL.
5. THE REMOTE 2, 3 AND 4 WIRE CONTROL INPUTS WILL NOT BE FUNCTIONAL ON THIS UNIT. REMOTE POSITIONING CONTROL WILL BE 4-20mA TO ANALOG INTERFACE BOARD AND LOCAL WILL BE SW93 PUSHBUTTON STATION.
6. DO NOT CONNECT ANALOG INPUT COMMON TO ANALOG OUTPUT COMMON.
7. CCW (COUNTER CLOCKWISE/ANTI-CLOCKWISE) OR CW (CLOCKWISE) ROTATION IS DEFINED AS THE ROTATION OF THE OUTPUT SHAFT AS VIEWED FROM TOP OF ACTUATED DEVICE.

LEGEND

CCW	:COUNTER (ANTI) CLOCKWISE CONTACT
CW	:CLOCKWISE CONTACT
	:COUNTER (ANTI) CLOCKWISE COIL
	:MECHANICAL INTERLOCK
	:CLOCKWISE COIL
CPT	:CONTROL POWER TRANSFORMER
	:RED INDICATING LIGHT
	:GREEN INDICATING LIGHT
SS	:SELECTOR SWITCH (LOCAL-OFF-REMOTE)
PB1	:OPEN PUSHBUTTON
PB2	:STOP PUSHBUTTON
PB3	:CLOSE PUSHBUTTON
	:LIMIT SWITCH NORMALLY OPEN
	:LIMIT SWITCH HELD CLOSED
	:TORQUE SWITCH
MTC	:MOTOR THERMAL CONTACTS
HTR1	:COMPARTMENT HEATER
HTR2	:MOTOR HEATER
CAP	:CAPACITOR
FS1	:FUSE 250mA 600V
FS2	:FUSE 250mA 600V
FS3	:FUSE 1A 250V
FS4	:FUSE 1A 250V
CR1	:CCW RELAY
CR2	:CW RELAY
CR3	:STOP RELAY (LOCKOUT)
PD	:PHASE DETECTOR
D_	:DIODE
R_	:RESISTOR
	:CPU POWER SUPPLY COMMOM
	:GROUNDING LUG

LIMIT SWITCH CONTACT DEVELOPMENT

OPEN CONTACT — CLOSE CONTACT

VALVE SHOWN IN FULL CCW POSITION

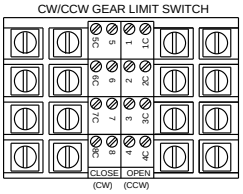
ROTOR	SWITCH NUMBER	VALVE POSITION: FULLY CCW	A	B	FULLY CW	FUNCTION
CCW	1					SPARE
	2					CCW LIMIT
	3					SPARE
	4					SPARE
CW	5					CW LIMIT
	6					SPARE
	7					SPARE
	8					SPARE
INT.1	9					SPARE
	10					SPARE
	11					SPARE
	12					SPARE
INT.2	13					SPARE
	14					TIMER LIMIT
	15					SPARE
	16					SPARE

(17) CW TORQUE SWITCH INTERRUPTS CONTROL CIRCUIT IF MECHANICAL OVERLOAD OCCURS DURING CW CYCLE

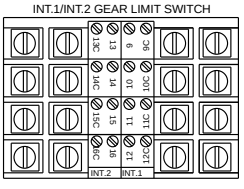
(18) CCW TORQUE SWITCH INTERRUPTS CONTROL CIRCUIT IF MECHANICAL OVERLOAD OCCURS DURING CCW CYCLE

ROTORS INT.1 & INT.2 CAN BE SET AT VALVE POSITION FULL CCW, FULL CW OR ANY POSITION IN BETWEEN AS INDICATED BY POINTS A AND B.

CW/CCW GEAR LIMIT SWITCH



INT.1/INT.2 GEAR LIMIT SWITCH



Refer to certified data dwg. #74-786-0152

Troubleshooting

⚠ Warning

Be aware of electrical and high pressure hazards when troubleshooting or performing maintenance on your L120-85 actuator.

Symptom	Possible Cause	Corrective Action
Unit will not operate electrically.	1. No power to unit.	1a. Verify power supply is electrically correct and present at actuator. 1b. Verify power leads are connected in accordance with the applicable wiring diagram. 1c. Inspect for blown fuse, tripped circuit breaker or overload or open disconnect switch.
	2. Loose or incorrect wiring.	2. Check wiring for proper wiring connection in accordance with the applicable wiring diagram. Check also for tight connections.
	3.Limit Switches not set or incorrectly set.	3. Check Limit Switch development for agreement with the applicable wiring diagram. If not set properly, follow instructions for "Setting Limit Switches" on pages 14 - 20.
	4. Foreign material on switch contacts preventing good electrical contact.	4. Check continuity of microswitch with an ohm meter.
Motor runs, but no output from unit.	1. Actuator not coupled properly to output.	1. Inspect Torque Drive Nut and Valve Shaft to verify key is in place and properly staked.

(Continued)

Troubleshooting (continued)

Symptom	Possible Cause	Corrective Action
	2. Worm gear worn out	2. Remove Worm Shaft Assembly (following Disassembly Instructions on page 34-39 inspect worm gear for unusual wear. If excessive wear has occurred, replace the Worm Shaft Assembly.
	2.Torque Drive Nut disengaged from Drive Sleeve.	2. Verify Torque Drive Nut is properly installed in accordance with step 1 of the Installation Overview on page 9.
	3. Damaged gearing.	3. Disassemble actuator following the Disassembly Instructions on page 34-39 and inspect gearing for rough or damaged spots. Replace as required. Most often, damaged spots are seen in motor gear set.
Unit operation is noisy	1. Inadequate lubrication (poor quality or not enough).	1. Inspect quality and quantity of lubrication in accordance with the Lubrication section on page 31-33. Add or replace lubricant as required.
	2. Worn or damaged bearings.	2. Disassemble unit and replace worn bearings, seals and lubricant.
Fuse blown.	1. Incorrect fuse size.	1. Verify fuses are sized correctly.

Troubleshooting (continued)

Symptom	Possible Cause	Corrective Action
	2. Pinched wire.	2. Inspect control compartment to insure Control Cover is not pinching or making contact with wiring when installed.
	3. Power surges.	3. Investigate control circuit for surges.
Premature Torque Switch trip.	1. Torque Switch setting too low.	1. Increase Torque Switch setting as required, up to but not exceeding maximum setting established by the Torque Switch Limiter Plate .
	2. Valve packing too tight.	2. Inspect valve packing for excessive tightness. Repair valve by replacing packing as required. Refer to your valve manufacturer for specific instructions.
	3. Unit is not properly aligned with valve.	3. Take bolts off between the unit and the valve and check for proper unit alignment.
	4. Valve needs lubrication.	4. Check valve lubrication
Torque Switch fails to stop actuator.	1. Output rotation not in agreement with unit wiring.	1. Consult Limitorque to verify design rotation. If actual rotation is opposite to design rotation, the Torque Switch needs to have contact wiring reversed. See "Rewiring the Torque Switch for Non-Standard Drive Sleeve Rotation" page 30-31.
	2. Under voltage going to unit.	2. Check incoming voltage supply.

(Continued)

Troubleshooting (continued)

Symptom	Possible Cause	Corrective Action
Reversing Starter failure.	1. Starter undersized.	1. Verify starter is sized correctly for application. Consult factory to evaluate.
	2. Excessive cycling (too frequent operation).	2. Review application to determine number of starts per hour and review with factory if more than 100 per hour.
Excessive current draw.	1. Valve running loads higher than expected.	1. Inspect valve for possible causes of high running load. In particular, check for excessive tightness of valve packing and for proper lubrication of valve. Consult Limitorque for review of application.
Motor overload tripping.	1. Excessive current draw.	1. Inspect valve for possible causes of high running load. In particular, check for excessive tightness of valve packing and for proper lubrication of valve. Consult Limitorque for review of application.
	2. Incorrect overloads.	2. Verify proper overloads selected for motor rating.
Excessive gear wear.	1. Excessive loads.	1. Verify actual loads are in accordance with both start and run capabilities of your actuator.
	2. Inadequate lubrication.	2. Inspect quality and quantity of lubrication in accordance with the Lubrication section on page 31-33. Add or replace lubricant as required.

Troubleshooting (continued)

Symptom	Possible Cause	Corrective Action
	3. Improper alignment.	3. Inspect worn gears for evidence of uneven wear pattern.
	4. Excessive operation (modulating units).	4. Review number of starts. Repeated frequent repositioning (oscillation) may indicate an unstable "loop" system. Review with Limitorque.
Excessive torque required to turn handwheel.	1. Valve running loads higher than expected.	1. Inspect valve for possible causes of high running loads. In particular, check for excessive tightness of valve packing, proper lubrication of valve stem, bent or damaged valve, tight Stem/Torque Drive Nut fit, worn or damaged stem nut.
	2. Unit is not properly aligned with valve.	2. Take bolts off between the unit and the valve and check for proper unit alignment.
Oil leaking from unit.	1. Infrequent operation of actuator resulting in grease separation.	1. Institute periodic operation of unit into a maintenance program to keep grease mixed. If not possible, schedule more frequent lubrication inspections to insure adequate lubrication of gearbox.
	2. Damaged or worn seals.	2. Replace seals.

Notes:

Notes:

Limitorque

Australian Distributor for Limitorque

Acrodyne Pty Ltd
14/11 Havelock Road
Bayswater, Victoria 3153
Australia
Phone 03-8727-7800
Fax 03-9729-8699