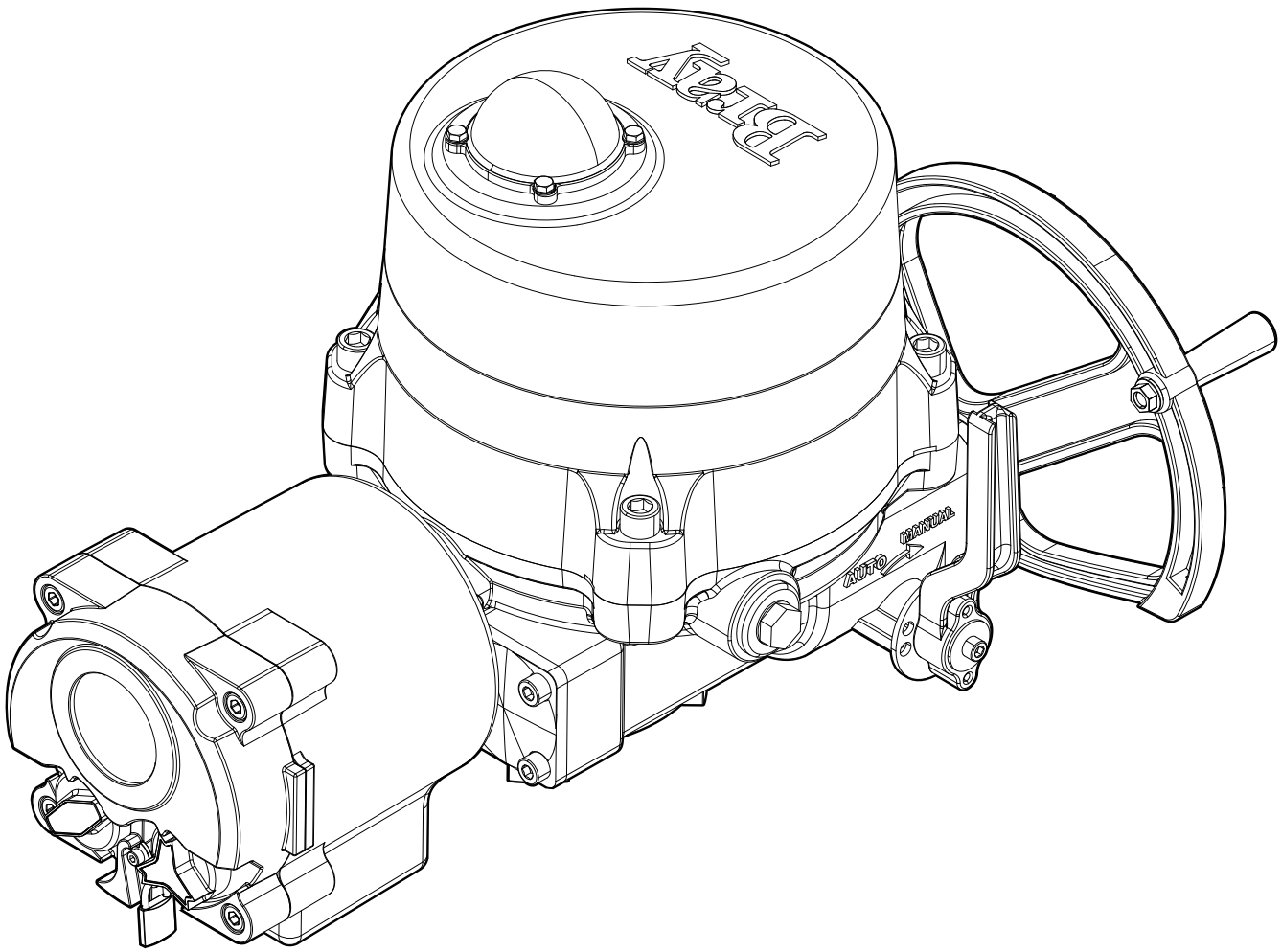
SERIES 76

LOCAL CONTROL STATION (MODULATING)

Installation, Operation, and Maintenance Manual



Bray®

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READ AND FOLLOW THESE INSTRUCTIONS CAREFULLY.
SAVE THIS MANUAL FOR FUTURE USE
FOR THE LATEST IOM VERSION, VISIT BRAY.COM

1.0 DEFINITION OF TERMS

All information within this manual is relevant to the safe operation and proper care of your Bray valve. Please understand the following examples of information used throughout this manual.

1.1 Safety Statements

The terms DANGER, WARNING, CAUTION, and NOTICE are used in this document to prevent unwanted consequences. Standard symbols and classifications are:



DANGER

Indicates an immediate hazardous situation which if not avoided, **will** result in death or serious injury and/or property damage.



WARNING

Indicates a potentially hazardous situation which if not avoided, **could** result in death or serious injury and/or property damage.



CAUTION

Indicates a potentially hazardous situation which if not avoided, **may** result in minor or moderate injury and/or property damage.



NOTICE

Indicates and provides additional technical information which may not be obvious, even to qualified personnel. The term is not used for personal injury hazards or warnings, but can be used to indicate possible equipment or property damage.

NOTE: Provides important information related to a procedure.

Compliance with other notes — regarding transport, assembly, operation & maintenance, and about technical documentation (e.g. in the operating instructions, product documentation, or on the product itself) — is essential, to avoid conditions which can directly or indirectly cause severe personal injury or property damage.

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2.0 INTRODUCTION

The Bray Series 76 Local Control Station (LCS) offers comprehensive control and monitoring capabilities for all sizes of the Bray Series 76 weatherproof and explosion-proof industrial electric actuators.

NOTICE

The explosion-proof Series 76 electric actuator requires special machining to mount the LCS. Machining of this housing and field installation of the explosion-proof LCS is not permitted. This option must be ordered with the actuator, directly from the factory.

2.1 Principles of Operation

The Bray Series 76 LCS provides a Local-Remote-Stop control switch, an Open-Close control switch, LED indication, and a motor-starter/reversing contactor (used for 3-Phase motors). It has both a local mode enabling direct operation from a local control point, and a remote mode for operation from a process controller.

For modulating operation, the LCS positions the Series 76 actuator in response to a command signal from a process controller. The process controller contains a desired process set point entered by the user and continually monitors the process variable (such as flow rate, tank level, etc.) through some type of sensor.

Varying the command signal to the actuator will cause it to change position, which will move the associated control valve to modify the process variable. The process controller continually calculates and transmits the appropriate command signal to the LCS Control Board to maintain the process at the desired set point.

The Series 76 LCS consists of a mounting bracket, main body, and cover. The mounting bracket is used to mount the main body of the LCS to the weatherproof housing. Explosion-proof models use a sealing bushing between the main body of the LCS and the actuator.

The LCS cover is mounted to the main body using four bolts. The LCS cover utilizes a spigot joint and O-ring which creates a tight seal between it and the LCS body.

The explosion proof version of the LCS utilizes a gasket and sealing gland between the LCS body and the main actuator body.

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2.2 Electrical Operation

Series 76 electric actuators rated for 220VAC through 440VAC, 3-Phase power, use a power board in addition to a control board to control the motor direction. Series 76 electric actuators rated for 460VAC, 3-Phase power, use a dedicated reversing contactor. 1-Phase and 24VDC units directly control the motor from the control board.

Various actuator connections for limit switches, torque switches, and the potentiometer, terminate directly into headers on the control board. Connections are also made to a transformer, power electronics card, and/or reversing contactor when required for the model.

2.3 Approved Locations and Certifications

The Bray Series 76 LCS is listed as part of the general actuator certification and must be assembled to the actuator for the certification to apply. It is designed and certified to operate as outlined below:

NOTICE

Each certificate type contains limitations in model availability.

The weatherproof Bray Series 76 LCS is certified for use in North America and complies with applicable EU directives (CE) when installed on the weatherproof Series 76 industrial electric actuator.

CSA Certificate: 80153557

NOTICE

See the Series 76 Industrial Electric Actuator Weatherproof IOM for additional details.

The explosion-proof Bray Series 76 LCS is certified for ATEX, IECEx, PESO and InMetro hazardous locations when installed on a Series 76 industrial electric actuator with any of the above certifications.

ATEX Certificate: DEKRA 23ATEX0092 X

IECEx Certificate: IECEx DEK 23.0064X

PESO Certificate: P637877/1

INMETRO Certificate: NCC 25.0117 X

NOTICE

See the Series 76 Industrial Electric Actuator Explosion-proof IOM for full details.

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3.0 HAZARD FREE USE

This device left the factory in proper condition to be safely installed and operated in a hazard-free manner. The notes and warnings in this document must be observed by the user to ensure hazard-free operation of this device.

Configuration and setup procedures for this device are described in this manual. Proper configuration and setup are required for the safe operation of this device.

The control system in which this device is installed must have proper safeguards to prevent injury to personnel, or damage to equipment, should a failure of system components occur.

WARNING

Equipment controlled by the device can generate large mechanical forces during normal operation.

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4.0 QUALIFIED PERSONNEL

WARNING

The actuator must only be installed, commissioned, operated and repaired by qualified personnel.

Installation, commissioning, operation and maintenance must be performed under strict observation of all applicable codes, standards and safety regulations.

As per this document, a qualified person is one who is trained in:

> The operation and maintenance of electric equipment and systems in accordance with established safety practices.

> Procedures to energize, deenergize, ground, tag and lock electrical circuits and equipment in accordance with established safety practices.

> The proper use and care of Personal Protective Equipment (PPE) in accordance with established safety practices.

> First Aid.

> In cases where the device is installed in a potentially explosive (hazardous) location – is trained in the operation, commissioning, operation and maintenance of equipment in hazardous locations.

WARNING

Reference is specifically made here to observe all applicable safety regulations for actuators installed in potentially explosive (hazardous) locations.

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5.0 LOCAL USER INTERFACE

FIGURE 01: Local User Interface

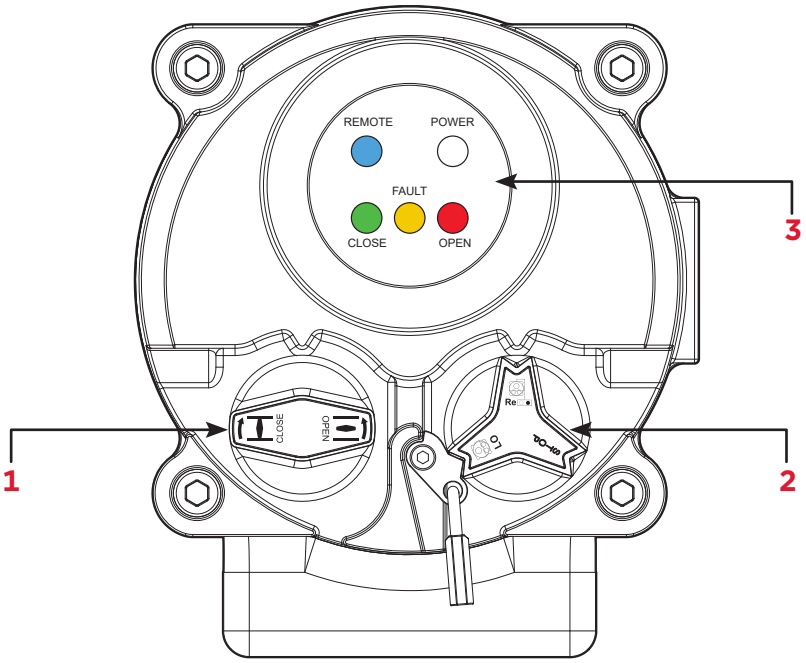


TABLE 01: Local User Interface

Item	Description
1	Open/Close Switch
2	Local (Lo)/Remote (Re)/Stop Switch
3	LED Indicator Display

The above are all accessible from the exterior of the cover. This control interface allows the customer to enable and disable control from the process controller, electrically command the actuator to a desired position, and evaluate operating conditions through LED diagnostics. The Local (Lo)/Remote (Re)/Stop Switch can be padlocked in place.

TABLE 02: LED Indicator Display

LED	Color	Description
Remote	Blue	Remote Mode Active
Power	White	Actuator Powered
Fault	Yellow	Fault Detected
Close	Green	Fully Close/Closing
Open	Red	Fully Open/Opening

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5.1 Advanced LED Status Indicators for LCS

TABLE 03: Local Mode

		LED Display				
Mode	**Status**	**White**	**Blue**	**Green**	**Yellow**	**Red**
Standard Local	Fully Close	On	Off	On	Off	Off
	Closing	On	Off	Flash	Off	Off
	Fully Open	On	Off	Off	Off	On
	Opening	On	Off	Off	Off	Flash
	Fault Close Over Torque	On	Off	On	Flash	Off
	Fault Open Over Torque	On	Off	Off	Flash	On

Note: See Appendix B for troubleshooting guidance

TABLE 04: Remote Mode

		LED Display				
Mode	**Status**	**White**	**Blue**	**Green**	**Yellow**	**Red**
Standard Remote	Fully Close	On	On	On	Off	Off
	Closing	On	On	Flash	Off	Off
	Fully Open	On	On	Off	Off	On
	Opening	On	On	Off	Off	Flash
	Stopped Mid-Travel	On	On	Off	Off	Off
	Fault Close Over Torque	On	On	On	Flash	Off
	Fault Open Over Torque	On	On	Off	Flash	On
	Fault Open & Close (engaged at the same time)	On	On	Off	Flash	Off

Note: See Appendix B for troubleshooting guidance

TABLE 05: Stop Mode

		LED Display				
Mode	**Status**	**White**	**Blue**	**Green**	**Yellow**	**Red**
Stop Mode	Fully Close	On	Off	On	Off	Off
	Fully Open	On	Off	Off	Off	On
	Mid Travel	On	Off	Off	Off	Off

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6.0 HARDWARE DESCRIPTION

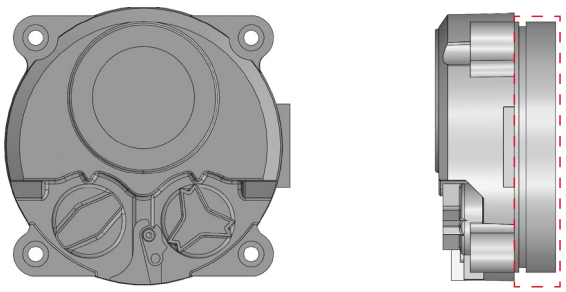
The Local Control Station comes with either a 3-Phase or a 1-Phase control board, depending on the actuator voltage. The 3-Phase LCS has a power board in addition to the control board. Please reference images below to identify which board(s) you have within your Local Control Station

The main control board is mounted to the inside of the LCS cover, and a transformer provides low voltage to the control board from the main actuator voltage supply. For custom setting adjustments via the control board, DIP switches and Rotary switches are provided.

WARNING

The LCS cover has a Spigot with an integrated flamepath. Treat the cover with care while handling, as the flamepath must not be damaged or dirtied in any way. Contact the factory if the spigot joint is damaged.

FIGURE 02: LCS Cover Spigot



Spigot

WARNING

The LCS cover mounting bolts are not retained by the cover. Bolts must be properly installed and only original equipment must be used to maintain certification. Contact the factory if a replacement is required.

WARNING

The transformer is specific to the actuator's rated supply voltage and cannot be used to power the LCS Control Board on an actuator with a different supply voltage.

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6.1 Modulating Control Board (AC)

FIGURE 03: Modulating Control Board (AC)

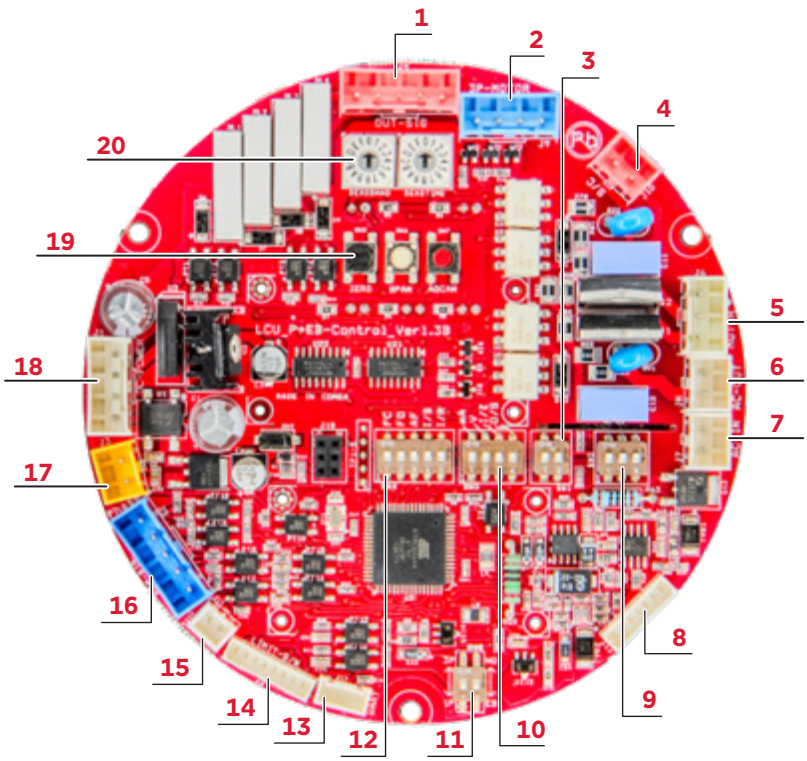


TABLE 06: Modulating LCS Control Board Parts (AC)

No.	Part
1	Relay Output Signal Header
2	**Not Used**
3	DIP Switches (SW1)
4	Capacitor Header (1-Phase)
5	1-Phase Motor Header
6	AC Output Header
7	AC Input header
8	Command, Feedback, and Potentiometer Signals Header
9	DIP Switches (SW2)
10	DIP Switches (SW3)
11	DIP Switches (SW8)
12	DIP Switches (SW4)
13	**Not Used**
14	Limit & Torque Switch Signal Header
15	**Not Used**
16	Remote Signal Header
17	Phase Check Header
18	28VAC & 10VAC Input Header
19	ZERO (Black), SPAN (White), & ASCAN (Red) Buttons
20	Deadband & Deadtime Rotary Switches

6.2 Modulating Control Board (DC)

FIGURE 04: Modulating Control Board (DC)

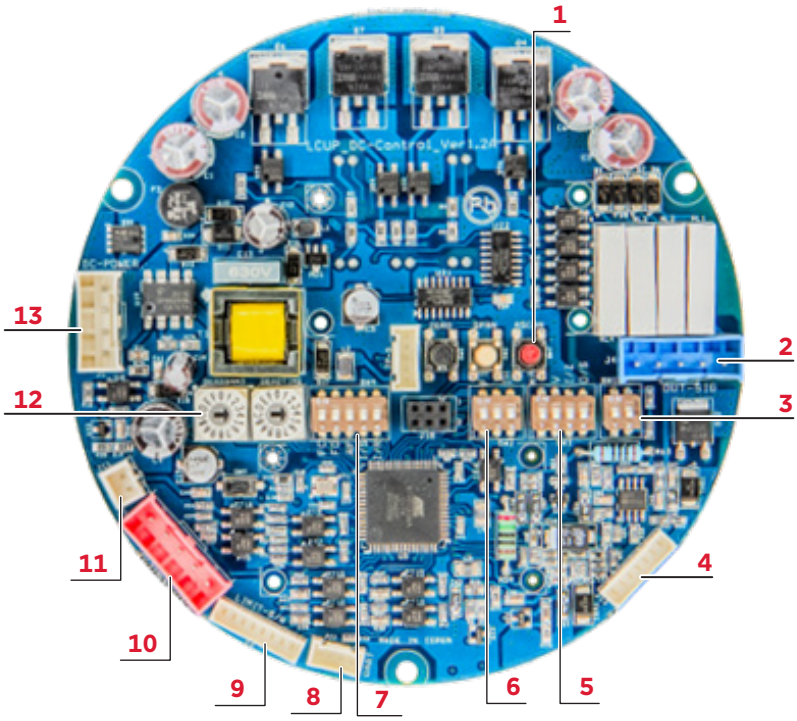


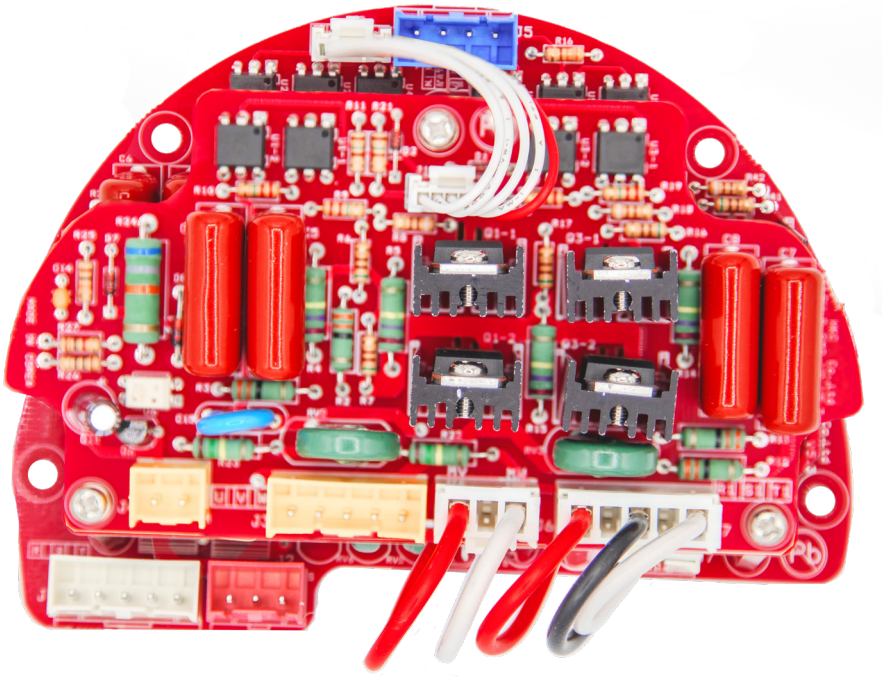
TABLE 07: Modulating LCS Control Board Parts (DC)

No.	Part
1	ZERO (Black), SPAN (White), & ASCAN (Red) Buttons
2	Relay Output Signal Header
3	DIP Switches (SW1)
4	Command, Feedback, and Potentiometer Signals Header
5	DIP Switches (SW3)
6	DIP Switches (SW2)
7	DIP Switches (SW4)
8	**Not Used**
9	Limit & Torque Switch Signal Header
10	Remote Signal Header
11	**Not Used**
12	Deadband & Deadtime Rotary Switches
13	24V Motor Header

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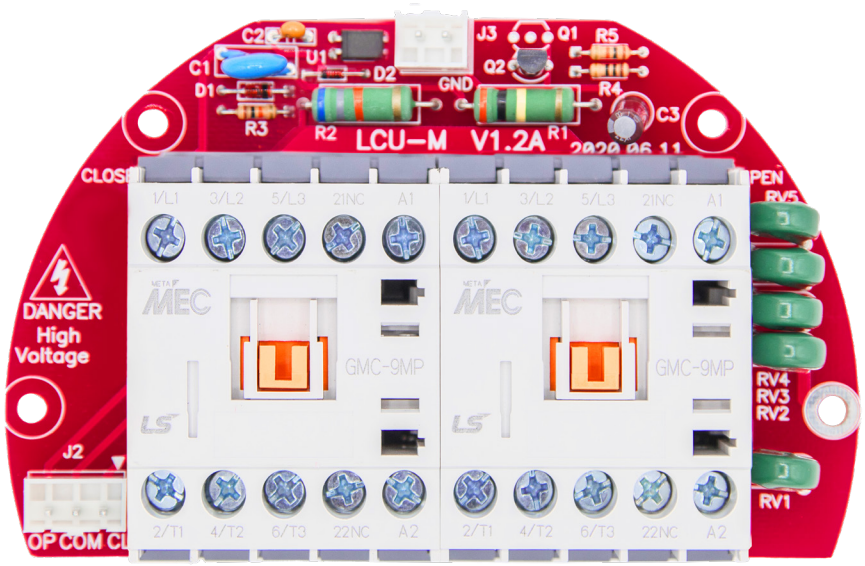
6.3 Solid-State Power Board (3-Phase)

FIGURE 05: Solid-State Power Board (240-440 VAC)



6.4 Contactor Power Board (3-Phase)

FIGURE 06: Contactor Power Board (460VAC)



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7.0 MODES OF OPERATION

This section provides the information necessary for the initial setup of the Series 76 Local Control Station. It also gives guidance on various operation modes and configurations. Series 76 Local Control Stations that are supplied with a Modulating board, do not require inspection of internal wiring as it is pre-wired for immediate use.

For Modulating operation, a process controller can be used to position the Series 76 actuator to its fully open or closed positions, and anywhere in between. The process controller can be overridden by switching the LCS to "Local" mode, allowing the use of the LCS Open/Close control knob instead.

7.1 Local Mode Operation

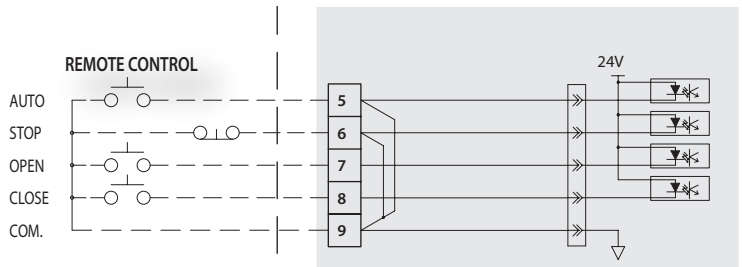
When the "Local/Remote/Stop" Switch is set to Local Mode, the actuator can be operated to the open or close position using the "Open/Close" Switch by turning the switch either in the clockwise or counterclockwise direction.

7.2 Remote Mode Operation

When the "Local/Remote/Stop" Switch is set to Remote Mode, the actuator can be operated to the open or close position remotely by a process controller.

Remote modulating operation is based on making or breaking an electrical connection from terminals 5, 6, 7, and 8 to terminal 9 as indicated in Figure 07 below. It operates the actuator to the open or close positions by establishing contact between terminal 9 (COM) and either terminal 7 (Open) or terminal 8 (Close). The remote open and closed commands can function in the Inching or Hold mode. See section 7.5 for additional information on these modes of operation.

FIGURE 07: Remote Control Wiring



Please reference FIELD WIRING DIAGRAMS - SAMPLE (Section 9.0) for full wiring diagrams.

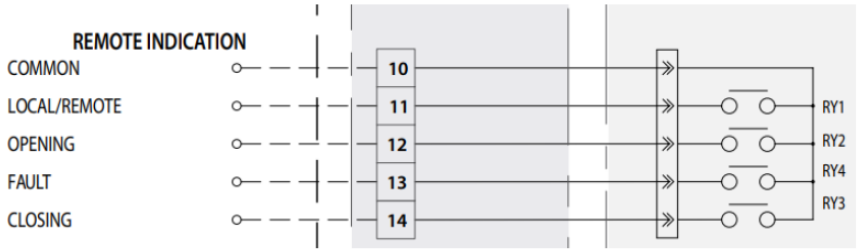
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7.3 Remote Status Signal Operation

Remote Status Signals are crucial for relaying information about the actuator's status to an external system, usually a control panel or another signaling device. This communication is facilitated through contacts that convey the actuator's condition to the external system. The state of these external output signal contacts changes in response to specific actuator conditions, such as movement to open or close, encountering a fault, or reaching a fully open or closed position.

For example, the LOCAL/REMOTE status can be verified using contact 10 (COMMON) and 11 (LOCAL/REMOTE). When the LCS's knob is set to "Remote", it closes the contact, signaling that the actuator is in remote mode. Please reference Figure 08 below.

FIGURE 08: Remote Indication Wiring



This principle is similarly applicable to the OPENING, FAULT, and CLOSING. Additionally, the auxiliary contacts are used to indicate whether the actuator is in a fully closed or fully opened position.

Note: The OPENING, FAULT and CLOSING remote indication would also be available while the actuator is operating in Local Mode.

7.4 Stop Mode Operation

When the "Local/Remote/Stop" Switch is set to Stop Mode, this stops the operation of the actuator. In order to have the actuator operational again, you would need switch back to either the "Local" or "Remote" Mode.

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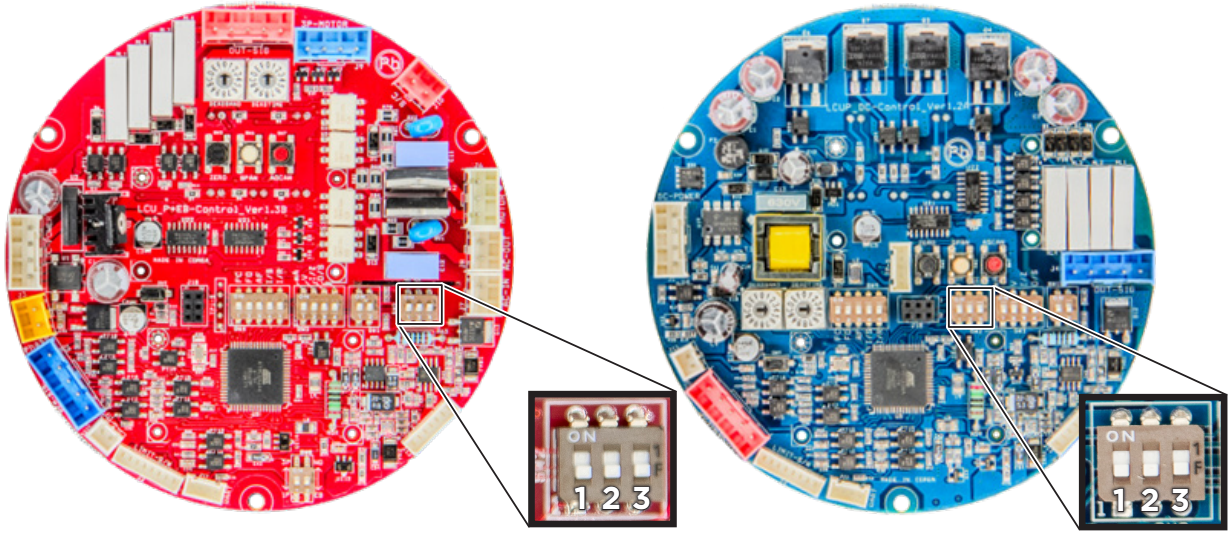
7.5 Inching/Hold Mode Operation

The “Inching” or “Hold” Mode feature allows for a “momentary” or a “maintained” operation of the Open/Close switch. How this operates is described below:

1. **Inching Mode:** In this mode, the actuator operates if the switch is held temporarily in either direction of travel using the Open/Close knob on the Local User Interface. This is considered the “momentary” operation, and it is activated by moving DIP Switch 2 on SW2 to the “up” position. See **Figure 09** below for SW2 location on the control board.
2. **Hold Mode:** In this mode, the actuator operates continuously in either direction of travel by toggling the Open/Close knob and keeping it in that state until the knob is released. Upon release of knob, the actuator stops its operation, allowing for mid-travel positioning to a desired position. This is considered the “maintained” operation, and it is activated by moving DIP Switch 2 on SW2 to the “down” position. See **Figure 09** below for SW2 location on the control board.

The Inching and Hold modes also affect Remote Mode Operation. Refer to section 7.2.

FIGURE 09: DIP Switches SW2 Location



7.6 Fault Relay NO/NC Mode Operation

DIP Switch 1 on SW2, shown in Figure 09 above, allows for the selection between A-Contact and B-Contact configurations:

A-Contact (Normally Open / N.O.): In this setting, a normally opened contact is used. When a fault occurs, an internal switch activates and provides continuity between terminals 10 and 13.

To activate this mode toggle DIP Switch 1 on SW2 to the “up” position.

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B-Contact (Normally Close / N.C.): In this setting, a normally closed contact is used. When a fault occurs, the internal switch deactivates and disconnects continuity between terminals 10 and 13.

To activate this mode toggle DIP Switch 1 on SW2 to the “down” position.

The choice of using the A-Contact or the B-Contact depends on the specific application.

For example, the A-Contact mode is typically used for monitoring signals, like an external LED that indicates there is a fault condition to a process controller. The B-Contact mode on the other hand could be used to cause an external safety device to turn off in the event of a fault condition on the actuator.

Note: These settings only apply to fault mode on contact 13 (FAULT) shown in Figure 08 above.

7.7 Close Limit Bypass (Torque Trigger) Operation

WARNING

Closed Limit Bypass will be default to the off position. Turning this on is not recommended. May cause damage to the actuator.

DIP Switch 3 on SW2, Figure 09 above, activates the Close Limit Bypass mode. This switch must not be activated, and should remain in the down “off” position.

7.8 Auto Calibration Mode Operation

The control board uses an automated calibration sequence to determine the operating points for the application in which it is installed. These operating points allow the LCS to calculate the correct feedback position of the product, making auto calibration an important step during commissioning. When assembling the valve and actuator, calibration is essential to establish the stroke positions corresponding to 0% and 100% of the valve’s range. The A-Scan mode facilitates automatic calibration of the actuator. Please follow these steps:

1. Ensure that the actuator is correctly mounted on the valve, and ensure that the cams have been set correctly. Also verify that the input signal, input power, and wiring are correctly set up.
2. Before initiating A-Scan mode, set the Local(Lo)/ Remote(Re)/Stop knob to the ‘STOP’ position.
3. Finally, press the red ‘ASCAN’ button (Figure 10 below) once to start the auto-calibration process, irrespective of the actuator’s current position.

After pressing the ASCAN button, the following occurs:

- The Blue LED on the LCS user interface will flash continuously.

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- The Green LED flashes while the actuator goes to the close position, and remains lit when it reaches the fully closed position. If the actuator was already closed, this closing operation will be skipped.

- The Red LED flashes while the actuator goes to the open position, and remains lit when it reaches the fully opened position.

- The Green LED starts to flash again and the actuator goes to the close position. The Green LED remains lit when it reaches the fully closed position.

The actuator will execute the following operations:

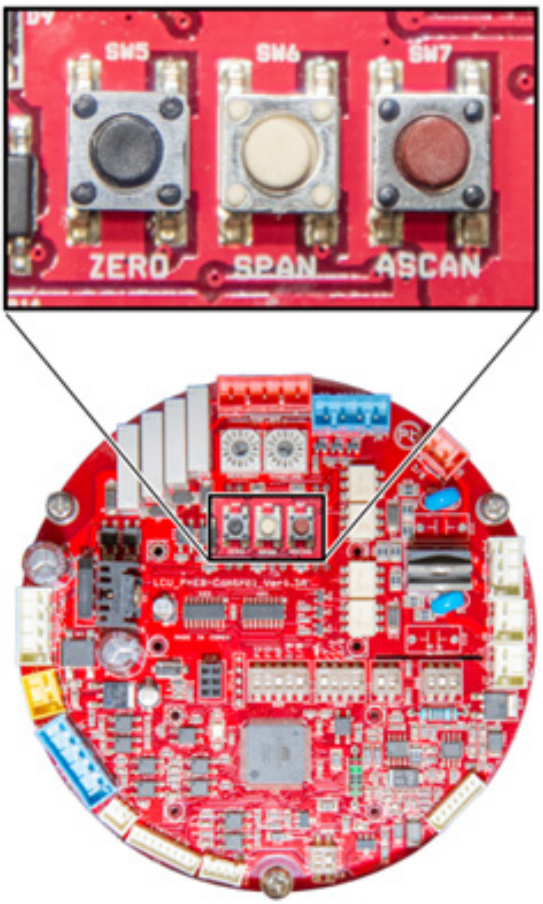
> Operate towards the close limit until the close limit switch is activated (ON).

> Move towards the open limit until the open limit switch is activated (ON).

> Return to the close limit until the close limit switch is activated (ON) again.

NOTE: Pressing any button or operating the knobs on the LCS User interface will cancel the auto-calibration process.

FIGURE 10: Calibration Buttons



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7.8.1 Auto Calibration - Using LCS User Interface

Alternatively, the user can perform an auto calibration of the actuator using the LCS user interface.

The procedure to perform this is as follows:

1. Ensure that the actuator is correctly mounted on the valve, and ensure that the cams have been set correctly. Also verify that the input signal, input power, and wiring are correctly set up.
2. Set the Local(Lo)/Remote(Re)/Stop knob to the 'STOP' position.
3. Turn the Open/Close knob to the 'CLOSE' position and hold for 5 seconds until the Blue light blinks. Release the knob, and perform Step 4 within 3 seconds after release.
4. Turn the Open/Close knob to the 'OPEN' position and hold for 5 seconds until the Blue light blinks. Release the knob, and perform Step 5 within 3 seconds after release.
5. Set the Local(Lo)/Remote(Re)/Stop knob to the 'LOCAL' position, and within 3 seconds perform Step 6.
6. Turn the Local(Lo)/Remote(Re)/Stop knob to the 'STOP' position, and the Autocalibration process will begin.

NOTE: Pressing any button or operating the knobs on the LCS User interface will cancel the auto-calibration process.

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7.9 Description of Settings

For custom setting adjustments, the control board includes DIP switches and rotary switches. These can be used to make changes such as input signal range and type, fail position, deadband, etc.

Figures 11 and 12 below show the location of the switches on the control board:

Figure 11: DIP Switches Location

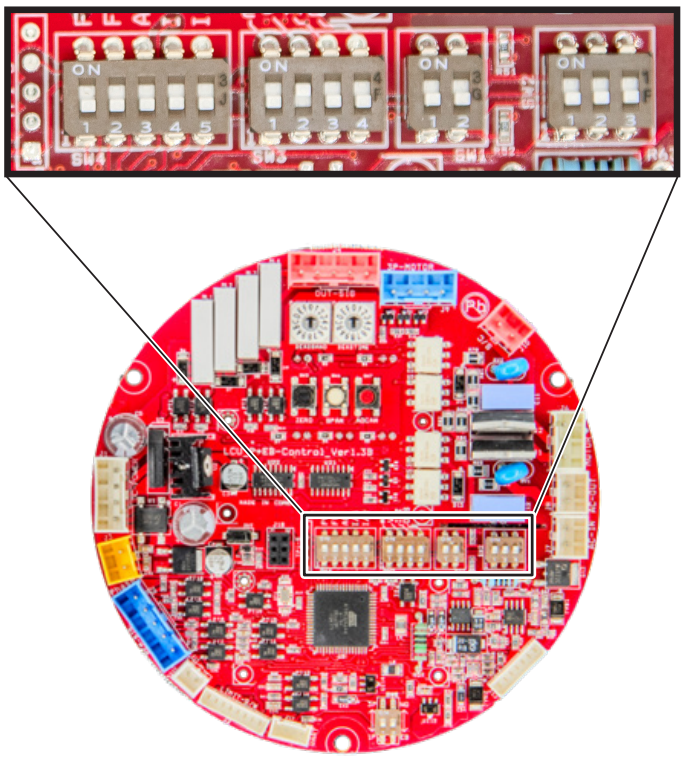
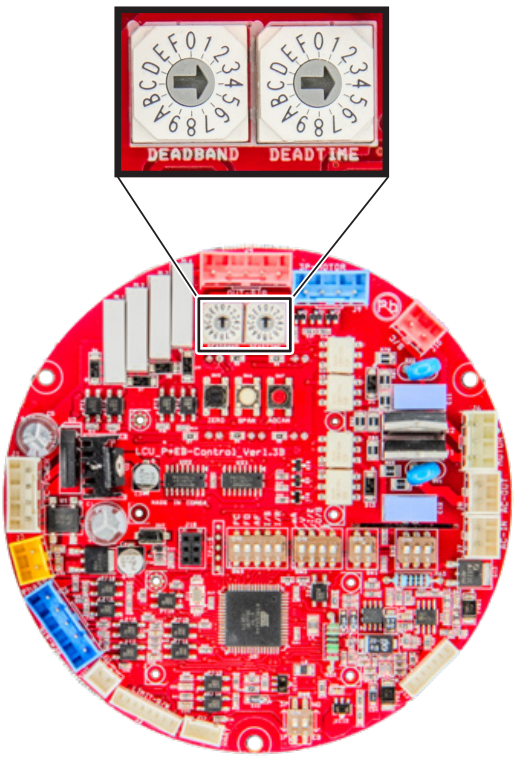


Figure 12: Rotary Switches Location



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7.9.1 Fail-Safe

The Failure Position determines how the control board positions the valve on the loss of command input signal. Loss of signal occurs when the command signal is outside the valid range, when the wrong command signal type is being used, or when there is no command signal present.

For minimum valid command input, refer to **Table 10.**

Users can select their preferred failure position by adjusting DIP Switch "SW4" located on the row of DIP switches on the control board, as indicated on **Figure 13.**

Note: For Fail-Safe settings, only DIP switches 1 and 2 are used.

Figure 13: SW4 DIP Switches

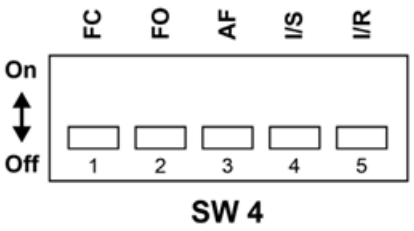
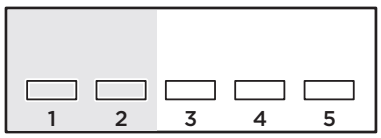
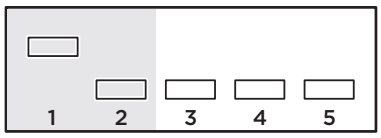
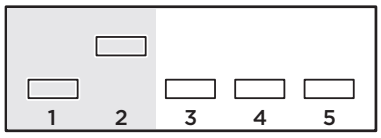


TABLE 08: Fail-Safe Settings

Setting Value	Description	SW4 DIP Switch Positions
Fail Stop (Default)	Actuator remains in its current position	
Fail Close	Actuator operates to the closed limit	
Fail Open	Actuator operates to the open limit	

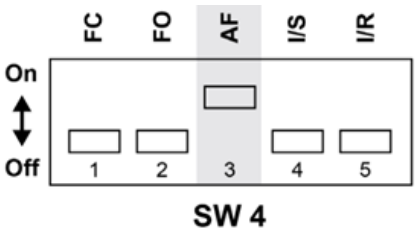
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7.9.2 Auto Full Action Setting

The Auto Full Action setting controls the valve's positioning in response to specific signal levels. Using an Input Signal of 4-20mA for example, when the signal drops to 4.3 mA or lower, the setting ensures that the valve moves to a fully closed position. Conversely, when the signal exceeds 19.7 mA, the valve will shift to a fully open position.

This setting can be turned on by toggling DIP Switch 3 on SW4, to the up position. Refer to **Figure 14**.

Figure 14: Auto Full Action (DIP Switch 3)

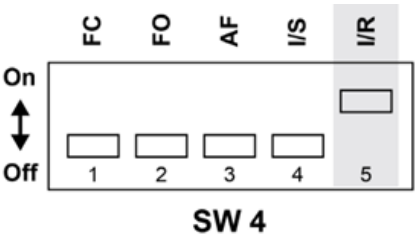


7.9.3 Reverse Acting Setting

Reverse Acting mode determines how the control board responds to a command signal. When this mode is turned on, the control board will treat the maximum command signal value as the close command and the minimum command signal as the open command.

This setting can be turned on by toggling DIP Switch 5 on SW4, to the up position. Refer to **Figure 15.**

Figure 15: Reverse Acting (DIP Switch 5)



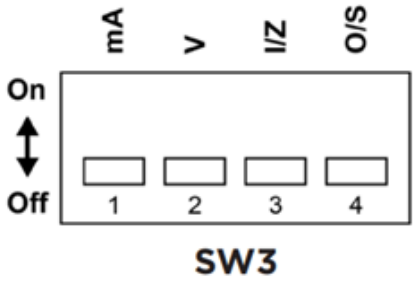
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7.9.4 Command Signal Type Setting

Command Signal Type defines the type of command signal used for valve control and works together with the Reverse Acting Input Setting to determine whether the minimum or maximum signal corresponds to the closed position. In normal operation, the minimum signal value drives the valve fully closed, while the maximum signal drives it fully open. Please note that only one command signal type can be set at any given time.

Users can select the desired command signal type by adjusting the DIP Switches on SW3 **Figure 16**.

Figure 16: SW3 DIP Switches



Instructions are provided in **Table 06** below on how to select the available command signal types.

TABLE 09: Command Signal Type Settings

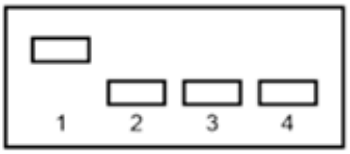
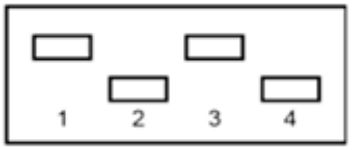
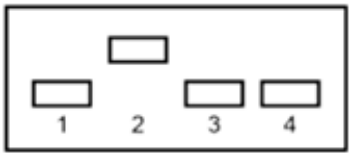
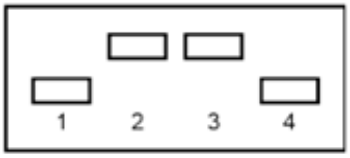
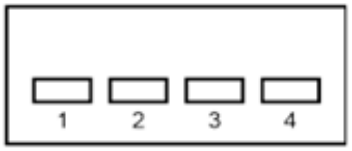
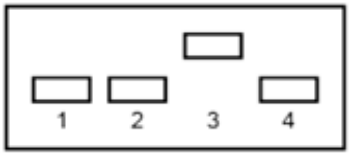
Command Signal Type	SW3 DIP Switch Positions
4-20mA (Default)	
0-20mA	
2-10V	
0-10V	
1-5V	
0-5V	

TABLE 10: Minimum Valid Command Signal

Command Signal Type	Minimum Valid Value
4-20mA	2mA
0-20mA	0mA
2-10V	1V
0-10V	N/A
1-5V	0.5V
0-5V	0V

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7.9.5 Feedback Signal Type Setting

The Feedback Signal Type setting defines the type of feedback signal used to indicate the current position of the controlled valve. In [NORMAL] operation, the minimum signal value represents the fully closed position, while the maximum value represents fully open. Only one type of feedback signal type can be active at a time.

Users can select their desired output signal type by adjusting DIP Switches on SW1. **Figure 17**.

NOTE: Command Signal type selection on SW3 determines the position of the "I/Z" switch. The position of the "I/Z" switch in turn determines the available options for Feedback Signal choices.

Instructions are provided in **Table 11** below on how to select the available command signal type.

Figure 17: SW1 DIP Switches

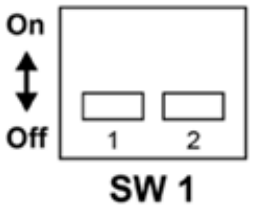
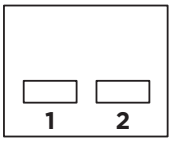
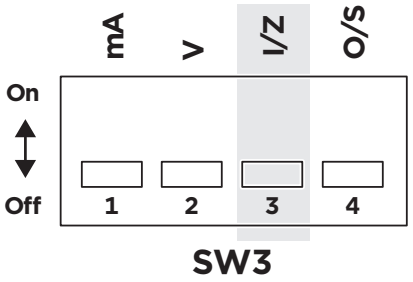
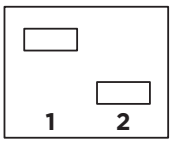
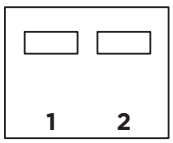
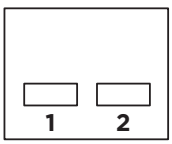
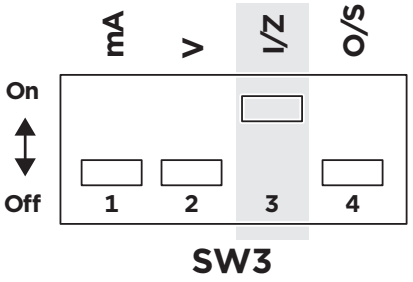
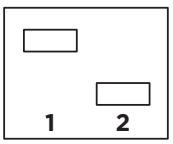
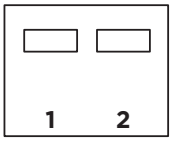


TABLE 11: Feedback Signal Type Settings

Feedback Signal Type	SW1 DIP Switch Positions	"I/Z" Switch Position - Based on Command Signal Type Selection
4-20mA (Default)		
2-10V		
1-5V		
0-20mA		
0-10V		
0-5V		

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7.9.6 Dead Band Setting

The Dead Band setting determines a range or interval where no action or response occurs, even if there are small changes in input. A deadband is used to prevent the actuator from moving back and forth near a setpoint (hunting). This value is a percentage of the full input range and creates an inactive area centered around the desired set point.

For example, for a 0-10V input command, a 1% Dead Band Control setting allows the actuator position to be offset from the desired set point by up to 0.05V in either direction, creating a dead band with a span of 0.1V. (Default 0.8%).

Users can adjust their preferred Dead Band level using the Dead Band Rotary Switch shown in **Figure 18.**

Figure 18: Dead Band Rotary Switch



7.9.7 Dead Time Setting

The Dead Time setting determines the minimum delay in which the actuator responds to a change in the command signal. Increasing the Dead Time may alleviate issues with continuous repositioning due to noise on the command signal. (Default 1.0 sec).

Users can adjust their preferred Dead Time level using the Dead Time Rotary Switch shown in **Figure 19** .

Figure 19: Dead Time Rotary Switch



TABLE 12: Dead Time Settings Range

Switch Position	Dead Band	Dead Time
0	0.4%	0.2 sec
1	0.5%	0.25 sec
2	0.6%	0.5 sec
3	0.7%	0.75 sec
4	0.8%	1 sec
5	1.0%	2.5 sec
6	1.2%	3 sec
7	1.4%	3.5 sec
8	1.6%	4 sec
9	1.8%	4.5 sec
A	5%	5 sec
B	5.5%	5.5 sec
C	6%	6 sec
D	6.5%	6.5 sec
E	7%	7 sec
F	7.5%	7.5 sec

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7.9.8 Input Signal Zero and Span Adjustment

The input signal zero and span adjustment is a manual process to specify the command signal value in which the LCS will send the actuator to the fully closed and fully opened position. The adjustable range for the Zero signal is 3mA to 8mA, and for the Span signal is 16mA to 21mA. To adjust the zero and span, follow the steps below:

1. Set the Local(Lo)/Remote(Re)/Stop knob to the 'STOP' position.
2. Toggle the 'I/S' DIP Switch 4 on SW4 to the up position. See **Figure 21.**
   a. Once initiated , both the red and green LEDs will flash.
   b. After 1.5 seconds, only the green LED will continue to flash.
3. Input the desired close command signal (3mA to 8mA) to the input terminal and press the 'ZERO' SW5 (Black) button shown in **Figure 20.**
   a. If the setting is successful, the yellow LED will flash once and the green LED will stay lit.
   b. The red LED will then begin flashing, indicating the system is ready for the span input adjustment.
4. Input the desired open command signal (16mA to 21mA) to the input terminal and press the 'SPAN' SW6 (White) button shown in **Figure 20**.
5. Upon successful setup, the yellow LED will flash once and the red LED will remain on.
6. The system will repeat this process after 1.5 seconds. To exit, turn off the 'I/S' DIP Switch 4 on SW4.

NOTE: If 'I/S' DIP Switch 4 on SW4 is turned off during the process, the settings are canceled. If no input is detected within 2 minutes, the setting process is also canceled.

Figure 20: Zero and Span Buttons Location

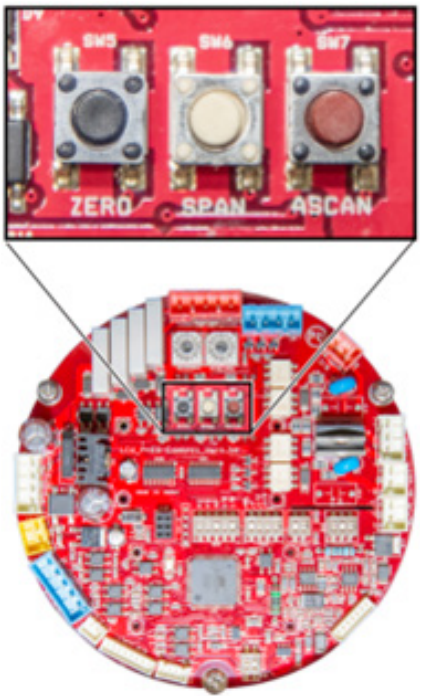
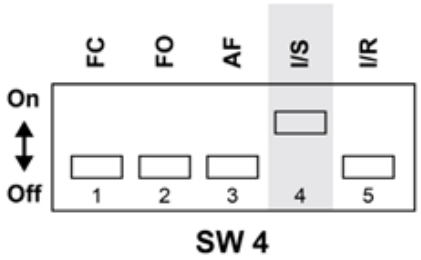


Figure 21: Input Signal "I/S" (DIP Switch 4)



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7.9.9 Output Signal Zero and Span Adjustment

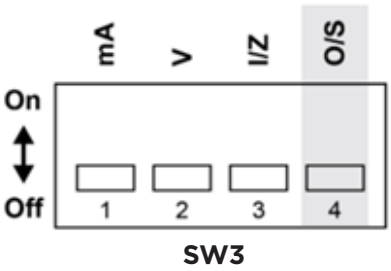
The output signal zero and span adjustment is a manual process to adjust or calibrate the fully closed or opened feedback signal.

As an example, let's set up 4 mA for the Zero output signal, and 20 mA for Span output signal.

1. Set the Local(Lo)/Remote(Re)/Stop knob to the 'STOP' position.
2. Toggle the 'O/S' DIP Switch 4 on SW3 to the up position. See **Figure 22.**
3. Once initiated , both the red and green LEDs will flash. After 1.5 seconds, only the green LED will continue to flash.
4. To Adjust the output signal value as 4 mA push the 'ZERO' black button to decrease the output signal or the 'SPAN' white button to increase the output signal. Then push the 'A-SCAN' SW7 red button.
5. The yellow LED should turn on and off, green LED should be on. Afterwards, the red LED should be flickering.
6. Adjust output signal value as 20 mA push the Zero or Span button, then push the 'A-SCAN' SW7 red button.
7. The yellow LED should turn on and off, and the red LED should be on. Afterwards, both red and green LEDs should start flickering at the same time, wait for the green LED to flicker only.
8. Turn off 'O/S' DIP Switch 4 on SW3.

NOTE: If 'O/S' DIP Switch 4 on SW3 is turned off during the process, the settings are canceled. If no input is detected within 2 minutes, the setting process is also canceled.

Figure 22: Output Signal "O/S" (Switch 4)



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8.0 DEFAULT SETTINGS

Below are the default settings that determine how the actuator will respond to commands from the process controller. These must be defined and verified before beginning operation. All units ship with the default settings below **(Table 10)** from the factory. These settings can be adjusted as described in the sections above.

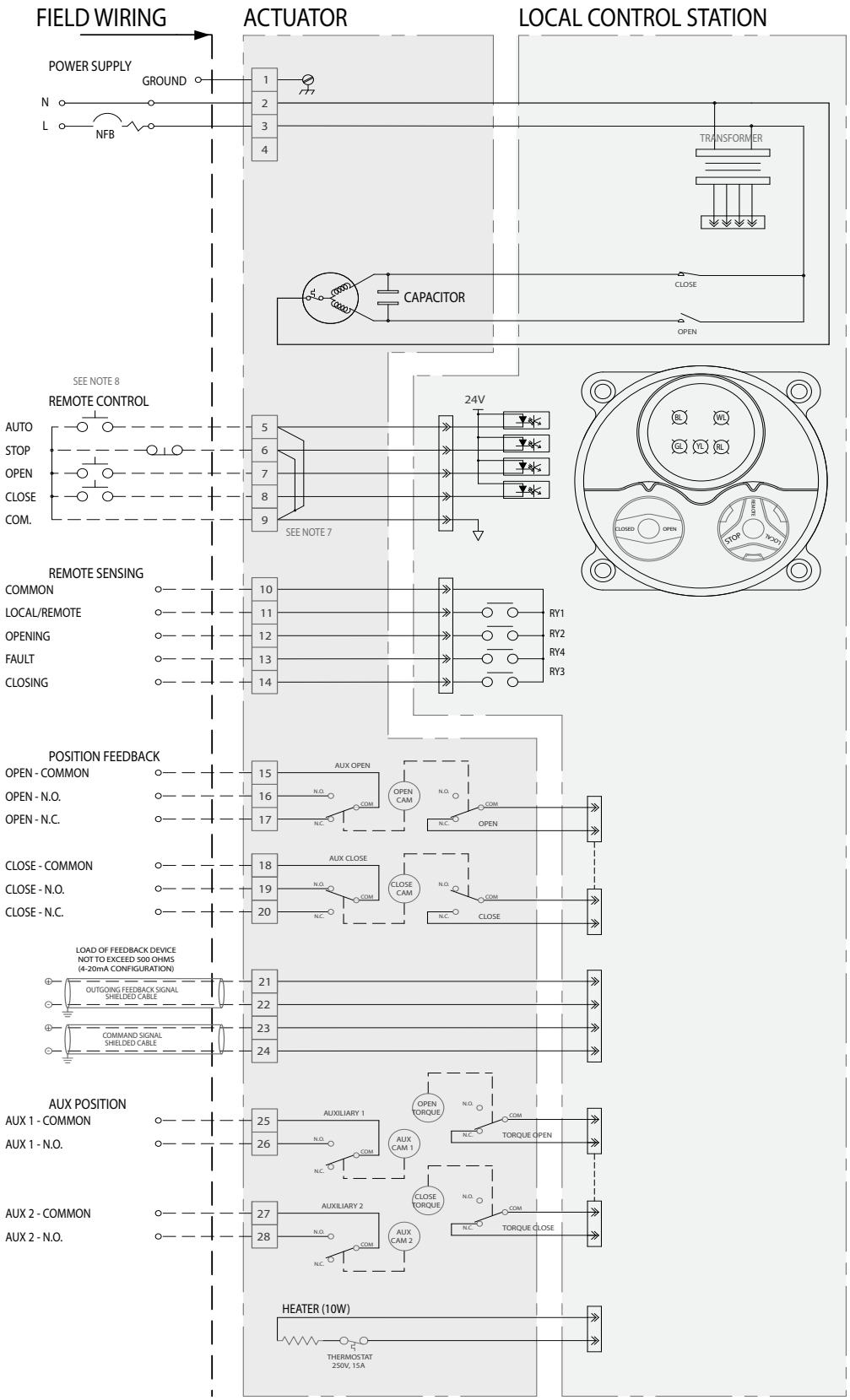
TABLE 13: Default Settings

Description	Default Value
Fail Position	Fail Stop
Auto Full Action	On
Reverse Acting Input	Off
Command Signal	4-20mA
Feedback Signal	4-20mA
Closed Limit Bypass	Off (Must not be changed)
Deadband	0.8% (Rotary Switch, Position 4)
Deadtime	1.0 Sec (Rotary Switch, Position 4)
Command Signal - Zero	4mA
Command Signal - Span	20mA
Inching/Hold Mode	Inching
Fault Relay Mode (N.O./N.C.)	N.O.

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9.0 FIELD WIRING DIAGRAMS (SAMPLE)

9.1 Wiring Diagram (1-Phase)



LEGEND:

- BL: BLUE LAMP - REMOTE MODE ACTIVE
- WL: WHITE LAMP - POWER
- GL: GREEN LAMP - CLOSE/CLOSING
- YL: YELLOW LAMP - FAULT PRESENT
- RL: RED LAMP - OPEN/OPENING
- RY: RELAY
- COM: COMMON CONTACT
- N.O.: NORMALLY OPEN CONTACT
- N.C.: NORMALLY CLOSED CONTACT
- NFB: NO FUSE BREAKER

NOTES:

1. THE ACTUATOR IS SHOWN IN THE CLOSED POSITION.
2. THE OPEN/CLOSED SELECTOR SWITCH IS SPRING RETURNED TO THE NEUTRAL POSITION.
3. CONTROLLER IS DEFAULT 4-20mA.
4. DEFAULTS CAN BE MODIFIED USING SWITCHES INSIDE THE LOCAL CONTROL STATION. SEE THE IOM FOR WARNINGS, SETTINGS, AND CALIBRATION INSTRUCTIONS.
5. THE FEEDBACK LOOP IS POWERED BY THE CONTROLLER, DO NOT SUPPLY EXTERNAL POWER.
6. SIGNAL NOISE MITIGATION
   - 6.1. DO NOT GROUND/EARTH REFERENCE THE COMMON OF THE COMMAND SIGNAL WHEN USING 0-5VDC, 0-10VDC, 1-5VDC, OR 2-10VDC MODES.
   - 6.2. ISOLATE THE COMMAND SIGNAL AND FEEDBACK SIGNAL FROM EACH OTHER AND ANY OTHER CIRCUITS TO REDUCE THE POSSIBILITY OF NOISE AND GROUND LOOPS.
   - 6.3. COMMAND SIGNAL & FEEDBACK SIGNAL WIRES SHOULD BE SHIELDED PROPERLY & SHIELD SHOULD BE GROUNDED/EARTHED ON ONE END ONLY, PREFERABLY THE CONTROLLER END.
7. JUMPERS ARE PROVIDED BETWEEN TERMINALS (5 & 9) AND (6 & 9). REMOVE JUMPERS IF REMOTE CONTROL FUNCTIONALITY IS REQUIRED.
8. SWITCHES CONNECTED TO TERMINALS 5- 9 MUST BE VOLTAGE FREE. APPLYING POWER TO THESE TERMINALS MAY CAUSE DAMAGE TO THE ELECTRONICS.

FIELD WIRE RATINGS:
14-28 AWG, Cu, 105°C
300V MIN RATED WIRE

RELAY CONTACT RATINGS:
250VAC, 5A MAX

SWITCH CONTACT RATINGS:
250VAC, 10A MAX

SWITCH CONTACT POSITIONS

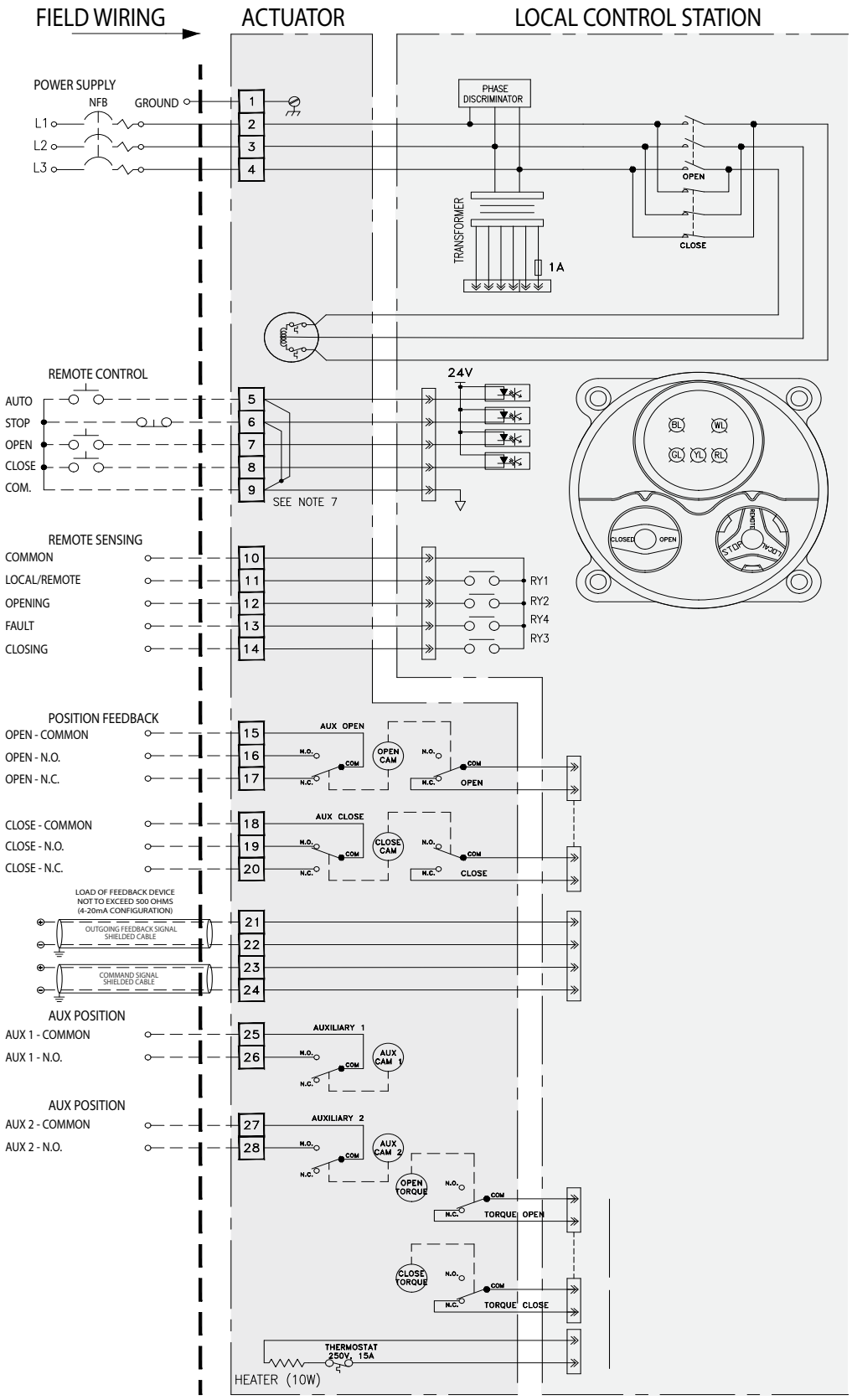
SWITCH	TERM	VALVE OPENING % 0	100
AUX OPEN	15-16		
	15-17		
AUX CLOSE	18-19		
	18-20		

SWITCH	TERM	VALVE OPENING % P1	P2
AUX LIMIT 1	21-22		
AUX LIMIT 2	22-24		

: CONTACT ON : CONTACT OFF

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9.2 Wiring Diagram (3-Phase)



LEGEND:

- BL: BLUE LAMP - REMOTE MODE ACTIVE
- WL: WHITE LAMP - POWER
- GL: GREEN LAMP - CLOSE/CLOSING
- YL: YELLOW LAMP - FAULT PRESENT
- RL: RED LAMP - OPEN/OPENING
- RY: RELAY
- COM: COMMON CONTACT
- N.O.: NORMALLY OPEN CONTACT
- N.C.: NORMALLY CLOSED CONTACT
- NFB: NO FUSE BREAKER

NOTES:

1. THE ACTUATOR IS SHOWN IN THE CLOSED POSITION.
2. THE OPEN/CLOSED SELECTOR SWITCH IS SPRING RETURNED TO THE NEUTRAL POSITION.
3. CONTROLLER IS DEFAULT 4-20mA.
4. DEFAULTS CAN BE MODIFIED USING SWITCHES INSIDE THE LOCAL CONTROL STATION. SEE THE IOM FOR WARNINGS, SETTINGS, AND CALIBRATION INSTRUCTIONS.
5. THE FEEDBACK LOOP IS POWERED BY THE CONTROLLER, DO NOT SUPPLY EXTERNAL POWER.
6. SIGNAL NOISE MITIGATION
   - 6.1. DO NOT GROUND/EARTH REFERENCE THE COMMON OF THE COMMAND SIGNAL WHEN USING 0-5VDC, 0-10VDC, 1-5VDC, OR 2-10VDC MODES.
   - 6.2. ISOLATE THE COMMAND SIGNAL AND FEEDBACK SIGNAL FROM EACH OTHER AND ANY OTHER CIRCUITS TO REDUCE THE POSSIBILITY OF NOISE AND GROUND LOOPS.
   - 6.3. COMMAND SIGNAL & FEEDBACK SIGNAL WIRES SHOULD BE SHIELDED PROPERLY & SHIELD SHOULD BE GROUNDED/EARTHED ON ONE END ONLY, PREFERABLY THE CONTROLLER END.
7. JUMPERS ARE PROVIDED BETWEEN TERMINALS (5 & 9) AND (6 & 9). REMOVE JUMPERS IF REMOTE CONTROL FUNCTIONALITY IS REQUIRED.
8. SWITCHES CONNECTED TO TERMINALS 5- 9 MUST BE VOLTAGE FREE. APPLYING POWER TO THESE TERMINALS MAY CAUSE DAMAGE TO THE ELECTRONICS.

FIELD WIRE RATINGS:
14-28 AWG, Cu, 105°C
600V MIN RATED WIRE

RELAY CONTACT RATINGS:
250VAC, 5A MAX

SWITCH CONTACT RATINGS:
250VAC, 10A MAX

SWITCH CONTACT POSITIONS

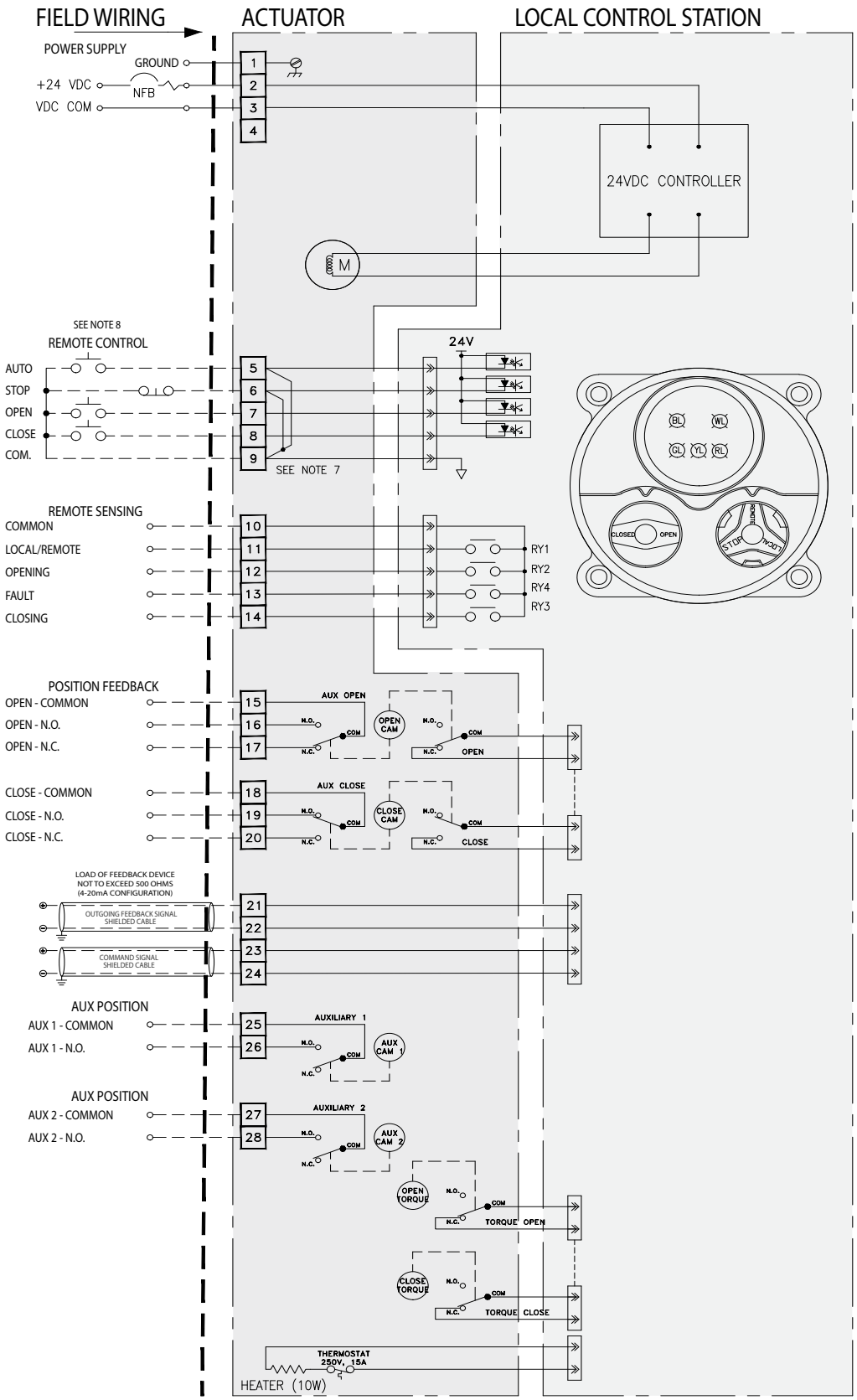
SWITCH	TERM	VALVE OPENING % 0	100
AUX OPEN	15-16		
	15-17		
AUX CLOSE	18-19		
	18-20		

SWITCH	TERM	VALVE OPENING % P1	P2
AUX LIMIT 1	21-22		
AUX LIMIT 2	22-24		

: CONTACT ON : CONTACT OFF

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9.3 Wiring Diagram (24 VDC)



LEGEND:

- BL: BLUE LAMP - REMOTE MODE ACTIVE
- WL: WHITE LAMP - POWER
- GL: GREEN LAMP - CLOSE/CLOSING
- YL: YELLOW LAMP - FAULT PRESENT
- RL: RED LAMP - OPEN/OPENING
- RY: RELAY
- COM: COMMON CONTACT
- N.O.: NORMALLY OPEN CONTACT
- N.C.: NORMALLY CLOSED CONTACT
- NFB: NO FUSE BREAKER

NOTES:

1. THE ACTUATOR IS SHOWN IN THE CLOSED POSITION.
2. THE OPEN/CLOSED SELECTOR SWITCH IS SPRING RETURNED TO THE NEUTRAL POSITION.
3. CONTROLLER IS DEFAULT 4-20mA.
4. DEFAULTS CAN BE MODIFIED USING SWITCHES INSIDE THE LOCAL CONTROL STATION. SEE THE IOM FOR WARNINGS, SETTINGS, AND CALIBRATION INSTRUCTIONS.
5. THE FEEDBACK LOOP IS POWERED BY THE CONTROLLER, DO NOT SUPPLY EXTERNAL POWER.
6. SIGNAL NOISE MITIGATION
   - 6.1. DO NOT GROUND/EARTH REFERENCE THE COMMON OF THE COMMAND SIGNAL WHEN USING 0-5VDC, 0-10VDC, 1-5VDC, OR 2-10VDC MODES.
   - 6.2. ISOLATE THE COMMAND SIGNAL AND FEEDBACK SIGNAL FROM EACH OTHER AND ANY OTHER CIRCUITS TO REDUCE THE POSSIBILITY OF NOISE AND GROUND LOOPS.
   - 6.3. COMMAND SIGNAL & FEEDBACK SIGNAL WIRES SHOULD BE SHIELDED PROPERLY & SHIELD SHOULD BE GROUNDED/EARTHED ON ONE END ONLY, PREFERABLY THE CONTROLLER END.
7. JUMPERS ARE PROVIDED BETWEEN TERMINALS (5 & 9) AND (6 & 9). REMOVE JUMPERS IF REMOTE CONTROL FUNCTIONALITY IS REQUIRED.
8. SWITCHES CONNECTED TO TERMINALS 5- 9 MUST BE VOLTAGE FREE. APPLYING POWER TO THESE TERMINALS MAY CAUSE DAMAGE TO THE ELECTRONICS.

FIELD WIRE RATINGS:
14-28 AWG, Cu, 105°C
300V MIN RATED WIRE

RELAY CONTACT RATINGS:
250VAC, 5A MAX

SWITCH CONTACT RATINGS:
250VAC, 10A MAX

SWITCH CONTACT POSITIONS

SWITCH	TERM	VALVE OPENING % 0	100
AUX OPEN	15-16		
	15-17		
AUX CLOSE	18-19		
	18-20		

SWITCH	TERM	VALVE OPENING % P1	P2
AUX LIMIT 1	25-26		
AUX LIMIT 2	27-28		

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10.0 COMMISSIONING

10.1 Inspection Checklist

Before using the actuator:

1. Check that the actuator nameplate and wiring diagram match the application requirements (model number, power, control, options, etc.).
2. Check that the actuator and the valve are assembled securely.
3. Check the status of the limit switches, travel stop bolts, and indicator are set properly.
4. Check the electrical wiring matches the wiring diagram.
5. If the position of the limit switches or the potentiometer have been adjusted, perform the auto calibration routine.

WARNING

Do not modify or alter the wiring of the actuator. Do not disassemble, assemble, or modify the actuator without technical support or specific instructions from the factory. Please contact the factory in the case of any problems.

10.2 Potentiometer Adjustment

The potentiometer is rated 1kΩ ± 5% and is calibrated at the factory to the standard cam positions. If the 'closed' cam position is modified, then the following procedure must be performed when a potentiometer is installed.

WARNING

Ensure that electrical power is removed from the potentiometer before performing this procedure.

1. Manually operate the actuator clockwise until the valve reaches the 'closed' position and the 'closed' limit switch activates.
2. Loosen the set screw on the gear mounted to the indicator shaft.
3. Adjust the potentiometer.
   > Measure the resistance between the common terminal (P1) and the wiper terminal (P2) with a multimeter.
   > Gently rotate the potentiometer gear until the multimeter measures 100Ω ± 20Ω.
4. Gently tighten the set screw on the indicator shaft gear.
5. Verify the potentiometer measurement before completely tightening the set screw.

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NOTICE

The potentiometer assemblies installed in size 5 units travel 270 degrees due to the installation of the 3:1 gearbox. Size 5 potentiometer assemblies use different gearing to account for the larger range of travel and connot be used in other sized Series 76 actuators.

Figure 23: Potentiometer for Sizes 1 – 4

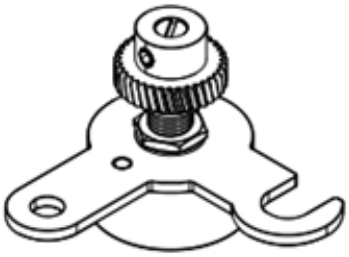


Figure 24: Potentiometer for Size 5

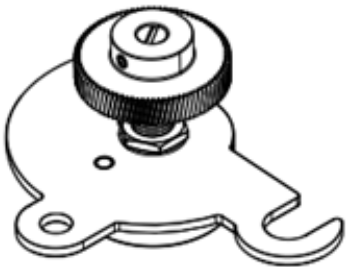
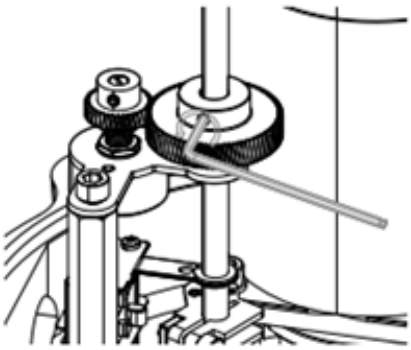


Figure 25 Potentiometer Adjustment



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12.0 APPENDIX A – BASIC TOOLS

Common To All Units	
Terminal Connections	Flathead screwdriver up to 3mm
Ground Screw	4mm hex
Handwheel Spinner	5mm hex
Conduit Blanks	18mm wrench
LCS Cover Bolts	6mm hex

Actuator Size	Cam Adjustment Bolts	Cover Screws	Travel Stop Adjustment		Bushing Mounting Bolts
	Hex Key	Hex Key	Hex Key	Wrench	Hex Key
1A, 1B, 1X, 1Y	3mm	6mm	4mm	13mm	3mm
2A, 2B, 2X, 2Y	4mm	8mm	5mm	17mm	4mm
3A, 3B, 3C, 3X, 3Y, 3Z	4mm	10mm	5mm	17mm	5mm
4A, 4B, 4X, 4Y	4mm	10mm	6mm	19mm	6mm
5A, 5B, 5X, 5Y	4mm	10mm	--	24mm	6mm
6A, 6B	4mm	14mm	30mm	30mm	6mm
7A, 7B, 7C	4mm	14mm	--	46mm	8mm

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13.0 APPENDIX B - TROUBLESHOOTING GUIDE

		LED Display					
Mode	**Fault Condition**	**White**	**Blue**	**Green**	**Yellow**	**Red**	**Possible Solution**
Local	Close Direction Over Torque	On	Off	On	On	Off	In Local Mode, initiate opening via the Open/Close switch on the Local User Interface or by rotating the handwheel in the open direction. **WARNING** It is important to investigate and correct the cause of the overtorque condition.
Local	Open Direction Over Torque	On	Off	Off	On	On	In Local Mode, initiate closing via the Open/Close switch on the Local User Interface or by rotating the handwheel in the close direction. **WARNING** It is important to investigate and correct the cause of the overtorque condition.
Remote	Close Direction Over Torque	On	On	On	On	Off	In Remote Mode, initiate opening by sending an 'Open' command or by manually turning the handwheel in the open direction. **WARNING** It is important to investigate and correct the cause of the overtorque condition.
Remote	Open Direction Over Torque	On	On	Off	On	On	In Remote Mode, initiate closing by sending a 'Close' command or by manually turning the handwheel in the close direction **WARNING** It is important to investigate and correct the cause of the overtorque condition.
Remote	Both Open and Close Limit Switches Detected	On	On	Off	On	Off	> Check Cams and ensure they are set correctly. > Check continuity of switches while manually activating/deactivating switches. > Check the switch wiring for a loose connection. > Ensure the switch connector is fully seated in its header on the Control Board. > Before performing any of the above, ensure power to the actuator has been removed.
Local	3-Phase Wire Reversed or Open Phase	On	Off	On	Flash	On	Flip any two of the 3-phase field wire connections, or ensure all 3-Phase field wires are connected.
Remote	3-Phase Wire Reversed or Open Phase	On	On	On	Flash	On	Flip any two of the 3-phase field wire connections, or ensure all 3-Phase field wires are connected.

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14.0 APPENDIX C - ADVANCED TROUBLESHOOTING GUIDE - LED FAULT CODE

If the fault light is flashing yellow on the Modulating LCS, the user will be able to access additional fault conditions which will be displayed on the LED interface as a sequence of lights.

The various sequence of lights and their corresponding fault condition are shown in the table below.

Follow the below steps to have the LED Interface show the specific fault code.

1. Set the Local(Lo)/Remote(Re)/Stop knob to the 'STOP' position
2. Turn the Open/Close knob to the 'OPEN' position and release.
   - All LEDs will turn off for 1 second.
   - The specific Fault Code lights as shown in table below flash in sequence.
   - All LEDS turn on
   - The LEDs turn on back to normal sequence

Note: The fault light will continue to flash yellow if the fault is still present.

		LED Display						
Mode	**Fault Condition**	**White**	**Blue**	**Green**	**Yellow**	**Red**	**Possible Causes**	**Possible Solutions**
All	"Mode" Selection Not Detected	Off	Off	Off	Off	On	> Mode Switch Failure	> Contact Factory
All	"Local" Selection Not Detected	Off	Off	Off	On	Off	> Mode Switch Failure	> Contact Factory
All	"Remote" Selection Not Detected	Off	Off	Off	On	On	> Mode Switch Failure	> Contact Factory
All	Both Limit Switches Detected	Off	Off	On	Off	Off	> Bad connection on board > Failed Switches > Improperly set Cams	> Contact Factory > Set Cams Correctly
All	Torque Switch Detected	Off	Off	On	Off	On	> Torque switch activated due to over-torque condition > Torque switches not set properly	> Resolve over-torque Condition > Contact Factory
All	3-Phase Wiring Issue	Off	Off	On	On	Off	> L1, L2, L3 3-Phase wires reversed > L1 wire not connected	> Connect 3-Phase wires correctly per wiring diagram
All	Memory Fault Detected	Off	Off	On	On	On	> EEPROM memory settings incorrect > Faulty board	> Perform auto-calibration > Contact Factory
All	Initial Calibration "Missing"	On	Off	Off	Off	On	> Factory calibration not performed > EEPROM error	> Perform auto-calibration > Contact Factory
All	Operation Reversal Error	On	Off	Off	On	On	> Motor wires reversed > Potentiometer wires reversed	> Correct wiring of motor > Correct wiring of potentiometer > Contact Factory
All	Potentiometer Error	On	Off	On	Off	On	> No feedback from potentiometer > Faulty potentiometer	> Check potentiometer wiring and ensure it is firmly seated on board contacts > Contact Factory
All	Stall Error-Open	On	Off	On	On	Off	> Motor wires disconnected > Damaged actuator gear	> Contact Factory
All	Stall Error - Close	On	Off	On	On	Off	> Motor wires disconnected > Damaged actuator gear	> Contact Factory

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