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COMPLETE CONTROL
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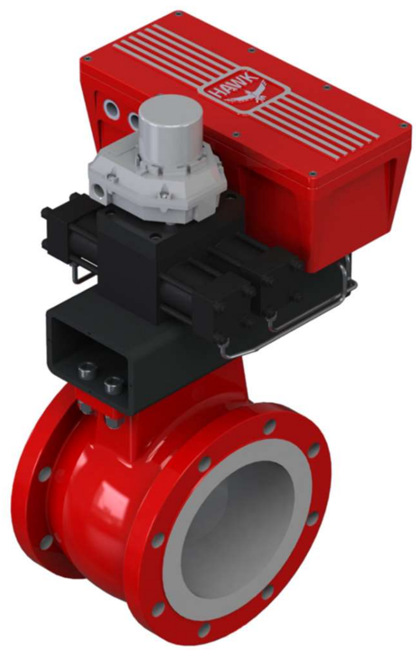
MEA Hawk

Instruction and Operation Manual



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i. Safety Information

As with any powered industrial equipment, when installing, operating, or servicing a Hawk actuator the technician or operator needs to be aware of potential safety risks prior to performing any operation. Hawk actuators contain hydraulic fluids under high pressure, hazardous electrical voltage, and can develop large forces. In addition, some units may have stored energy devices which must be taken into account when setting up, operating and servicing these particular units. It is highly recommended that the operator fully familiarizes themselves with this manual and its procedures prior to performing any operation on the Hawk actuator.

Attention

Important information follows. Material should be reviewed prior to proceeding.

Hazardous Voltage / Shock Hazard

Proper Lock out and Tag Out procedures must be followed prior to access.

Crush or Pinch Point Hazard:

Extreme caution must be taken when installing or performing any mechanical work on the actuator. Many areas presenting a pinch point hazard are present. Appropriate personal protection equipment and suitable clothing must be worn. Be sure to never place any part of your body in an area that presents a crush or pinch point hazard.

Shock Hazard:

High voltage levels are present in the control enclosure. Extreme caution must be taken when performing electrical work. It is highly advised that qualified technicians install and service any device.

Explosion Hazard:

Only remove the Hydraulic Power Source (HPS) cover when the area is free of ignitable concentrations.

Only disconnect wiring while the circuit is not live and when the area is free of ignitable concentrations.

Stored Energy, Spring Tension:

Some Hawk configurations incorporate compressed springs as fail-safe mechanisms. Any work performed with a compressed spring can result in personal injury and/or equipment damage if the proper safety precautions are not taken. The spring must be completely decompressed prior to beginning any work.

Stored Energy, Accumulator Pressure:

Some Hawk configurations incorporate pressurized accumulators to achieve stroking speed requirements, to act as fail-safe mechanisms, or as part of the Safe Seat feature. During normal operation, the accumulator will be pressurized. Failure to understand the operation of the accumulator system may lead to personal injury and/or equipment damage due to improper/inadvertent operation. Any work performed with a pressurized accumulator can result in personal injury if proper precautions are not taken. The accumulator must be de-pressurized prior to beginning any service work on the actuator.

Manual Handwheel Assembly:

When the Manual Hand Pump or Manual Handwheel Assembly is in use, be sure to use proper Lock Out and Tag Out procedures to prevent personal injury or process interruption.

ii. Intended Use of the Hawk Actuator

Under no circumstances should the Hawk actuator be used for any purposes outside of its intended use. Misuse of the unit can lead to harmful consequences including damage to critical components and serious injury to the operator.

iii. Environmental Considerations

This equipment is designed for the following environmental conditions:

Area	Outdoor Use
Ambient Temperature	-40 °F to +150 °F (-40 °C to +65 °C)
Humidity	90% relative humidity for temperatures up to +150 °F (+65 °C)
Supply Voltage Fluctuations	±10%
Dust and Water Protection	Per IP 66 requirements

1. GENERAL DESCRIPTION

1-1 About MEA Inc.

MEA INC has engineered, designed, and built custom hydraulic actuation solutions for over 50 years. Specializing in electro-hydraulic actuator control systems for critical valves and dampers, our integrated teams can build to nearly any requirement, delivering a robust and reliable solution built for decades of operation. Lifecycle support is a cornerstone of our business, offering innovative service solutions that facilitate ease of maintenance and dependability of critical equipment. Our global footprint gives us agility and expertise that is always close by.

1-2 Customer Support

MEA Inc. is led by professional and experienced personnel geared towards providing the full satisfaction of our clients with our state of the art product lines. In addition to our factory service and sales departments, MEA also employs a worldwide team of representatives to ensure help is never far away. For service, sales, warranty or technical support, please contact our facility at the following:

MEA Incorporated
2600 American Lane
Elk Grove Village, IL, 60007

T: (847) 766-9040
F: (847) 350-1951

For further information, visit our website at www.meaincorporated.com

1-3 The Hawk Actuator

The Hawk is a high-performance, rugged line of linear and rotary electro-hydraulic actuators and drives. It is ideal for applications requiring high duty cycles, large thrust and torques, or fast stroking speeds. The Hawk's modular electro-hydraulic system is easily configurable to suit specific valve or damper control requirements while at the same time providing safe and virtually maintenance free performance.

1-4 Hawk Design Features

- 100% continuously modulating duty cycle
- Low installation cost - simple power & control input connection, mounting flexibility
- High-speed operation
- Complete control – low dead-band, fast response, superior linearity & repeatability
- Automatic fail-safe position and ESD functions for safety applications
- Low power consumption, motor only runs when actuator moves
- Digital control electronics
- Programmable operating parameters such as speed, position limits, acceleration, deceleration, deadband
- Built in alarms and diagnostic features

1-4.1 Linear Actuator

- Stroke lengths up to 100"
- Thrust output up to 100,000 lbf
- Stroke speeds up to 0.2 sec/inch of travel depending on cylinder size and motor/pump selections

1-4.2 Rotary Actuator

- Rotation up to 180°
- Torque output up to 400,000 in-lbs
- Stroke speeds up to 0.5 sec/90° depending on cylinder size and motor/pump selections

1-5 Optional Features

1-5.1 Manual Override

Three levels of manual operators are offered:

- HMI Manual Mode – If hydraulic fluid pressure and electrical power are present the user may use the Manual mode to operate the actuator via the HMI.
- Hydraulic Handpump – If the hydraulic system of the actuator is operable the user may use a hydraulic handpump to bypass the control electronics and reposition the actuator.
- Mechanical Handwheel – If neither the hydraulic system nor the control electronics are operable the user may manually reposition the valve with a mechanical handwheel.

1-5.2 Fail to Position

The Hawk Actuator can be configured to fail in one of three positions: Extend/Clockwise, Retract/Counter-Clockwise, or Last Position. The Extend/Clockwise and Retract/Counter-Clockwise failure positions are achieved via compressed mechanical springs or charged hydraulic accumulators. Lower thrust/torque Hawk models typically utilize the mechanical spring option, while higher thrust/torque Hawk models utilize the hydraulic accumulator option.

Failure to the Extend/Clockwise and Retract/Counter-Clockwise positions may be initiated by a loss of control signal or by one of two power losses: Loss of Main Power or Loss of Emergency Shutdown (ESD) Power.

With the ESD Power loss option the end user must provide a separate, dedicated 2-wire ESD power supply (typically 24 VDC) in addition to the main power supply. If this ESD power is lost the actuator will move, depending on configuration, to either the Extend/Clockwise or Retract/Counter-Clockwise position. If the ESD Power loss configuration is present, the actuator will fail in last position on loss of main power supply loss. The end user must then trip the ESD Power to initiate the fail to position.

If the ESD Power loss configuration is not present, the actuator can be configured to move, depending on configuration, to either the Extend/Clockwise or Retract/Counter-Clockwise position on loss of main power.

1-5.3 Seat Protection

Electro-hydraulic actuation, such as the Hawk, can create extremely high seating thrust or torque. In some cases, applying excessive actuator force while in the seated position can permanently deform the seating surface, which may lead to process fluid leak by. The Hawk's Safe Seat feature protects the valve in two ways, by hydraulically limiting the maximum force the actuator applies to the valve in the seated position and by maintaining a constant force on the seated valve. Since the Safe Seat is a hydraulic system it is precise, adjustable, and rugged.

1-6 General Specifications

Construction & Control	
Actuator Type	Electro-Hydraulic, Self-Contained, Servo Motor Powered
Duty Cycle	100% Continuously Modulating Duty Cycle
Power Supply	24-48 VDC, 1 PH, 50/60 HZ 110-120 VAC, 1 PH, 50/60 HZ 208-240 VAC, 1 PH, 50/60 HZ 208-240 VAC, 3 PH, 50/60 HZ 380-408 VAC, 3 PH, 50/60 HZ
Control Signal	4-20 mA Command Signal 24 VDC Pulse 115 VAC Pulse
Feedback Signal	4-20 mA Output
Feedback Type	4-20 mA Non-Contact Electromagnetic
Failure Mode	Loss of Signal Loss of Power
Hydraulic Pressure	2000 psig
Hydraulic Fluid	Synthetic Gear Oil (AGMA Grade 4)
Hydraulic Pump	Positive Displacement Gear Type
Pump Capacity	0.168 gpm (Small) 0.554 gpm (Medium) 1.12 gpm (Large) 2.24 gpm (XL) 3.33 gpm (Mega) 6.61 gpm (Mega XL)
Stored Energy	Spring or Accumulator
Internal Reservoir	Integral, Sealed and Pressurized (10-20 psi)
Electrical Protection	Fused
IP Rating	IP Rating 66

Accessories & Options	
Failure Positions	Fail Last Position (Standard) Fail Open Fail Closed
Failure Methods	Accumulator Spring
Emergency Shutdown (ESD)	Loss of 24 VDC ESD Signal
Limit Switches	Electronic Proximity Type, SPDT
Manual Override	Electronic HMI (Standard) Mechanical Handwheel Hydraulic Handpump

Performance	
Speed	Adjustable from 25% to 100% of Rated HPS Speed
Resolution	0.1% of Stroke
Repeatability	0.05% of Stroke
Deadtime	80 ms
Deadband	Adjustable from 0.05% to 5% of Stroke

1-7 Area Approvals

The Hawk actuator and control enclosure must only be installed in areas which are appropriate for each item's respective area approval.

Actuator
Cl 1, Div 2, Groups A, B, C, D (Standard)
Cl 1, Div 1, Groups B, C, D (Optional)

Note: Carries Intertek ETL Listed Mark and is tested to CSA standards

Control Enclosure
NEMA 4X (Standard)
Cl 1, Div 2, Groups B, C, D (Optional)
Cl 1, Div 1, Groups B, C, D (Optional)

1-8 Operating Temperatures

The Hawk actuator and control enclosure must only be installed in areas which are appropriate for each item's respective temperature rating.

Actuator	
Standard	-20 °F to +130 °F (-29 °C to +55 °C)
Cold Weather Package	-40 °F to +110 °F (-40 °C to +43 °C)
Cold Weather Package with Thermal Jacket & Heater	-75 °F to +110 °F (-60 °C to +43 °C)
High Temperature	-20 °F to +150 °F (-29 °C to +65 °C)

Operating the actuator outside of the rated temperature range may impact hydraulic fluid viscosity which will impact both actuator speed and thrust/torque output.

Control Enclosure	
Standard	-20 °F to +120 °F (-29 °C to +49 °C)
Cold Weather Package	-40 °F to +120 °F (-40 °C to +49 °C)

1-8.1 Thermal Jackets & Heat Tracing

Thermal jackets with integrated heat tracing are required for the Hawk actuator to operate in temperatures below -20 °F (-29 °C). Each thermal jacket provided by MEA Inc is manufactured with the actual actuator dimensions in mind. The heat tracing power supply, junction boxes, and fittings are not supplied by MEA Inc. and must be field wired by the user.

Thermal Jackets & Heat Tracing	
Insulation	1.5" Thickness, Teflon Impregnated Fiberglass Cloth
Temperature Regulation	Self-Regulating, No Thermostat Required
Power Supply	120 VAC, 50/60 HZ 240 VAC, 50/60 HZ
Field Connection	2-Wire, 16 AWG
Electrical Protection	20 Amp Fuse Recommended (Customer to Provide)
Maximum Temperature	150 °F (65 °C) when Energized 185 °F (85 °C) when De-energized
Area Approvals	Cl 1, Div 2, Groups B, C, D (Standard) [1]

Note 1: CSA and UL Rated

The heat output of the heat tracing, shown below, is self-regulating and dependent on ambient temperature.

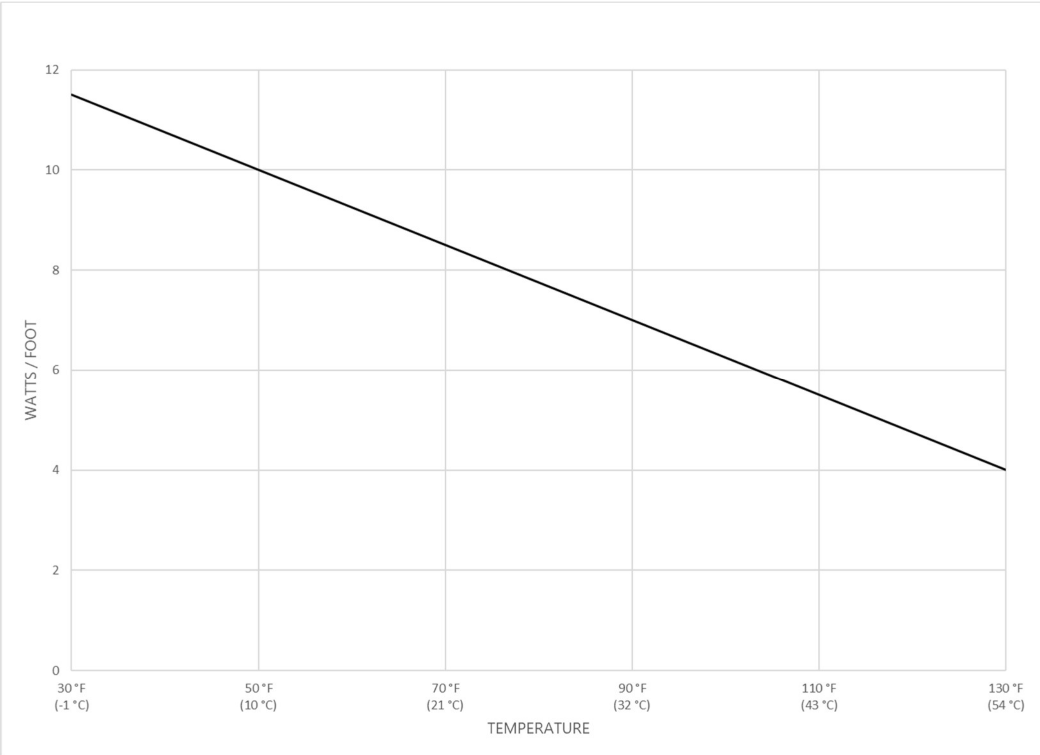


Figure 1-8.1 Heat Trace Output

1-9 Special Tool Requirements

The following tools required for Hawk installation and maintenance may be considered special. Standard hand tools are used for all other installation and maintenance procedures.

- Hydraulic Fluid Fill Gun
- Nitrogen Fill Kit (Only applicable to actuators with Accumulator or Safe Seat features)

2. SHIPPING, HANDLING, STORAGE

2-1 Delivery

For items that will be shipped parcel, a rigid box will be used to support the items during shipment. Each item within the box will be wrapped separately. The packing material used will be sufficient to prevent items from damage as a result of typical shipping conditions. The box shall be sealed with reinforced sealing tape.

For items that will be shipped freight, a pallet will be used to package the items/boxes together. The pallet will be sized to prevent overhang of items being shipped and with rigidity sufficient to support the load. Boxes that are being stacked on a pallet shall be packed per the above parcel packing. The items will be strapped or banded to the pallet and wrapped to prevent articles from being separated.

For items that require crating, the crating used will be sufficient to prevent items from damage as a result of typical shipping conditions via land or sea.

2-2 Receipt

MEA strives to package our products to avoid damage during shipment. However, do to unforeseen circumstances, at times damage may occur. When products are received inspect the shipping container and make note of excessive physical damage. If any products are believed to be damaged due to shipping, the shipment may be rejected, and the freight company should be contacted and a damage claim made.

2-3 Storage

It is highly recommended that all MEA products are stored in a controlled environment and remain in their original shipping container during the duration of storage. The recommended storage environment for all MEA products shall be clean, non-corrosive, dry, and at a temperature between +32 °F and +100 °F (0 °C and +38 °C).

2-4 Unpacking

When local shipping laws allow, the MEA Hawk actuator is shipped pre-filled with hydraulic fluid and fully prepared for installation. The system has been operated, tested, and inspected thoroughly to meet quality and performance requirements. After removing the actuator system from its packaging, please be sure to inspect for any indications of damage that may have occurred during shipping. If any signs of damage are detected, please contact MEA Inc immediately to determine the appropriate corrective action.

In addition, verify that the received items match the accompanying packing list. If any discrepancies exist, please contact MEA Inc immediately to determine the appropriate corrective action.

3. THEORY OF OPERATION & DESIGN

3-1 Design Principle

The Hawk's Hydraulic Power Source (HPS) design utilizes a bi-directional gear pump directly coupled to a servo motor. In conjunction with the pump & motor, electronically controlled solenoid valves are used to sequence flow operations. Servo motors are ideally suited for this application due to their ability to reverse direction, operate with variable speed, and maintain a fixed speed when being over-driven. When the actuator is moving, all fluid passes through the pump, permitting a controlled variable rate addition or dissipation of energy. The pump and servo motor control fluid flow rate and direction while the solenoids only perform lock in place functions, not fluid flow regulation. The speed of the unit is a function of pump displacement and cylinder volume only.

3-2 Linear Actuator

The linear version of the Hawk actuator consists of a single, double-acting, equal displacement cylinder, which in combination with pressurized fluid from the HPS, creates linear movement of the driven device. In Control mode, the actuator receives a desired position signal from the DCS. This signal is compared to the current position signal provided by the actuator's position feedback. The difference between the desired position and current position is the deviation. If this deviation exceeds the user defined deadband the servo driver begins the process of moving the actuator by first energizing the motor, which in turn spins the pump. For a brief period, less than 80 ms, the pump builds pressure in the system before the solenoids are energized. Once sufficient system pressure is generated, the solenoids open and the hydraulic fluid moves the cylinder and the driven device.

Ultimately, the actuator will move the driven device in the direction that will decrease the deviation to 0% ± the deadband. Once reaching this position the servo motor and solenoids will de-energize and the actuator will remain in place until the next deviation occurs.

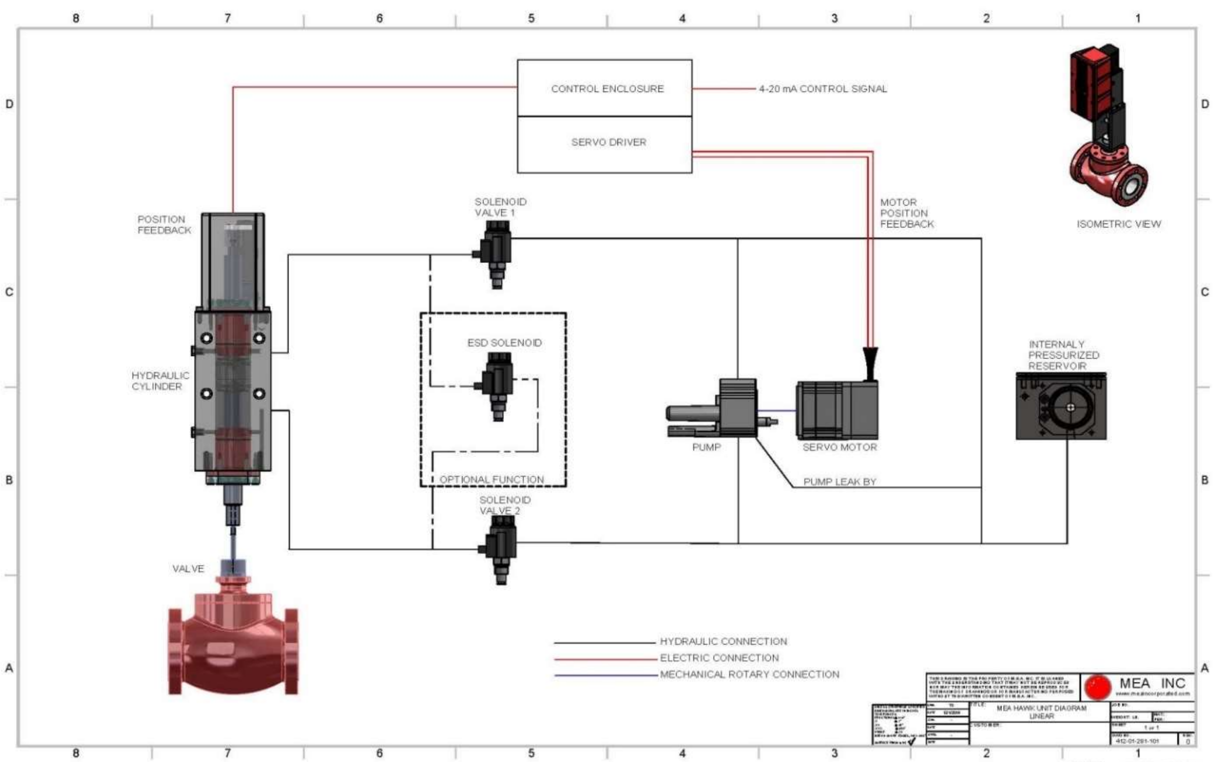


Figure 3-2.1 Linear Hawk Hydraulic Schematic

3-3 Rotary Actuator

The rotary version of the Hawk actuator consists, depending on required torque output, of either one or two double-acting, equal displacement cylinders which in combination with a rack and pinion linkage and pressurized fluid from the HPS, creates rotary movement of the driven device. In Control mode, the actuator receives a desired position signal from the DCS. This signal is compared to the current position signal provided by the actuator’s position feedback. The difference between the desired position and current position is the deviation. If this deviation exceeds the user defined deadband the servo driver begins the process of moving the actuator by first energizing the motor, which in turn spins the pump. For a brief period, less than 80 ms, the pump builds pressure in the system before the solenoids are energized. Once sufficient system pressure is generated, the solenoids open and the hydraulic fluid moves the cylinders and the driven device.

Ultimately, the actuator will rotate the driven device in the direction that will decrease the deviation to 0% ± the deadband. Once reaching this position the servo motor and solenoids will de-energize and the actuator will remain in place until the next deviation occurs.

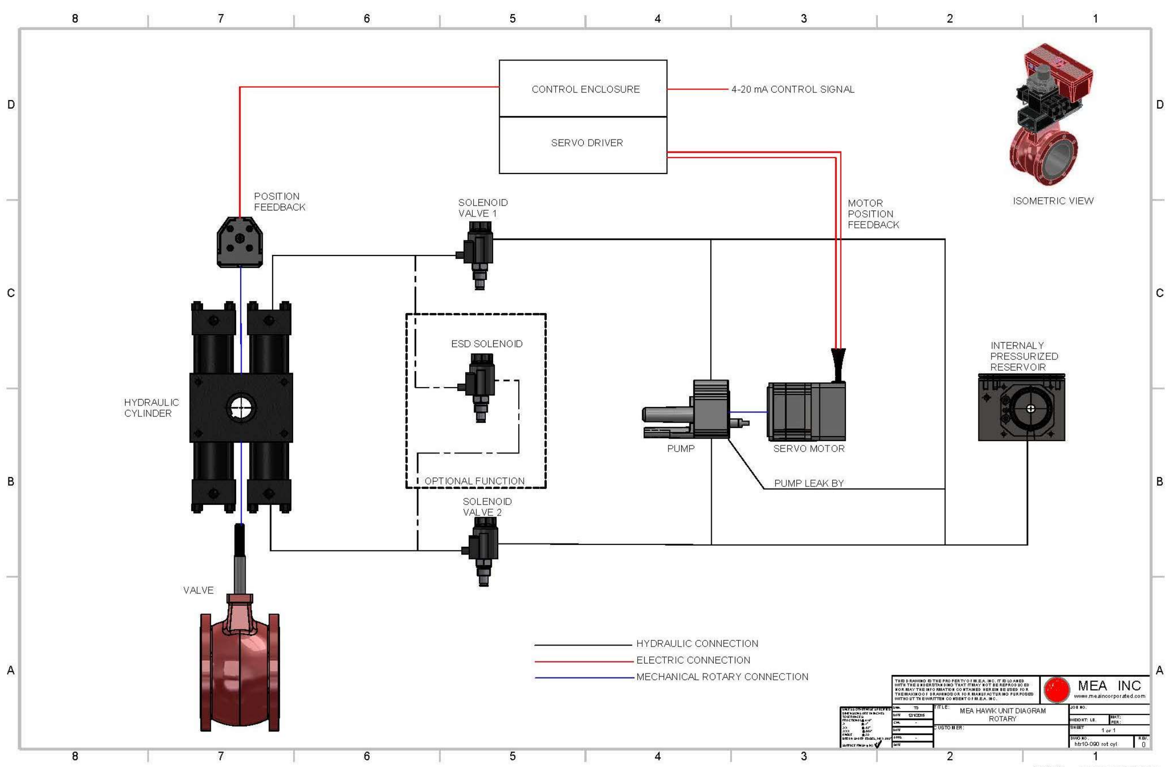


Figure 3-3.1 Rotary Hawk Hydraulic Schematic

3-4 Multiple Motor/Pump Units

For applications that require large thrust/torque output or fast stroking speeds it is possible a secondary motor/pump unit will be used in tandem with a standard HPS. The secondary power unit pumps a large volume of hydraulic fluid to move large displacement cylinders quickly, while the smaller displacement HPS pump maintains the ability to provide fine positioning.

The system operates on the principal that both motor/pumps operate when large actuator movements are required, but only the HPS motor/pump operates for smaller movements. In addition, even when the secondary motor/pump is used it is de-energized prior to completion of the actuator movement and the HPS alone is responsible for the final, fine positioning.

Using the large, secondary pump only would create excess mechanical gain in the actuator system and would require a proportionally larger deadband to maintain controllability, while using the HPS alone would provide the fine positioning required, but would not deliver the stroking speeds needed. The solution is to utilize both a large displacement and small displacement pump in the same system utilizing the advantages of both and neutralizing the disadvantages of using either individually.

3-5 Hawk Model Number

ACTUATOR

TYPE	
LINEAR	L
ROTARY	R

THRUST [LBF] / [N]	
[2,500] / [11,120]	002
[5,000] / [13,334]	005
[10,000] / [44,482]	010
[20,000] / [88,964]	020
[25,000] / [111,205]	025
[50,000] / [222,411]	050
[75,000] / [333,616]	075
[100,000] / [444,822]	100

TORQUE [LBF*In] / [m*N]	
[2,500] / [282]	002
[3,300] / [372]	003
[5,000] / [564]	005
[6,600] / [745]	006
[10,000] / [1,129]	010
[15,000] / [1,694]	015
[20,000] / [2,259]	020
[30,000] / [3,389]	030
[50,000] / [5,649]	050
[100,000] / [11,289]	100
[200,000] / [22,596]	200
[400,000] / [45,193]	400

LINEAR STROKE LENGTH [INCH]/[MM]	
[4.0] / [101.6]	04
[8.0] / [203.2]	08
[10.0] / [254.0]	10
[12.0] / [304.8]	12
[16.0] / [406.4]	16
[20.0] / [508.0]	20
[24.0] / [609.6]	24
[28.0] / [711.2]	28
[30.0] / [762.0]	30

ANGLE OF ROTATION [DEGREES]	
90	01
120	03
180	05

HYDRAULIC POWER SOURCE	
SMALL	S
MEDIUM	M
LARGE	L
EXTRA LARGE	X
MEGA	P
MEGA XL	G

SAFE SEAT DESIGN	
ACCUMULATOR LOADED SEATING	A
NOT REQUIRED	N

CERTIFICATION REQUIREMENTS	
CLASS 1, DIV 1	A
CLASS 1, DIV 2	B
ATEX ZONE 1	C
ATEX ZONE 2	D
GENERAL SERVICE	N

TEMPERATURE RATING [DEGREES F] / [DEGREES C]	
[-20F - 130F] / [-29C - 54.4C]	S
* [-40F - 110F] / [-40C - 43.3F]	H
* [-75F - 110F] / [-59.4C - 43.3C]	L
[80F - 200F] / [26.6C - 93.3C]	W

MANUAL OVERRIDE	
NOT REQUIRED	E
HYDRAULIC HAND PUMP	H
GEAR OPERATED MANUAL HANDWHEEL	M

FAIL SAFE	
FAIL CLOSE	S
FAIL OPEN	C
NOT REQUIRED	N

CONTROLS

POWER SUPPLY	
24 - 48 VDC	1
110 - 120 VAC SINGLE PHASE	2
208-240 VAC SINGLE PHASE	3
208-240 VAC MULTIPHASE	4
380-480 VAC MULTIPHASE	5
575-600 VAC MULTIPHASE	8

INPUT SIGNAL	
4-20 mA (4 mA Valve Close)	M
20-4 mA (20 mA Valve Close)	R
24 VDC Hold Open – Remove Open	C
24 VDC Hold Close – Remove Open	L
24VDC Momentary PULSE Open/Close	P
115V Momentary PULSE Open/Close	S
115V Hold Open – Remove Close	U
115V Hold Close – Remove Close	J

POSITION FEEDBACK	
SINGLE POSITION FEEDBACK (4-20 mA)	S
REDUNDANT POSITION FEEDBACK	E

CERTIFICATION REQUIREMENTS	
CLASS 1, DIV 1	A
CLASS 1, DIV 2	B
ATEX ZONE 1	C
ATEX ZONE 2	D
NEMA 4X	E
NEMA 4	F

ENCLOSURE MATERIAL	
COMPOSITE	C
STAINLESS STEEL	S
CASTED ALUMINUM	R

TEMPERATURE RATING [DEGREES F] / [DEGREES C]	
[-20F - 130F] / [-29C - 54.4C]	S
* [-40F - 110F] / [-40C - 43.3F]	H
* [-75F - 110F] / [-59.4C - 43.3C]	L

LIMIT SWITCHES	
NOT REQUIRED	N
OPEN/CLOSE - ELECTRONIC	E
LIMIT SWITCH - OPEN	A
LIMIT SWITCH - CLOSE	C
LIMIT SWITCHES - OPEN & CLOSE	B

4. Controls

4-1 Control Modes

It is important that users familiarize themselves with the functions of each mode of operation. Failure to understand the actuator operation can result in unexpected performance and an increased chance of personal injury. For more information on unit installation and start-up refer to Section 5.

Manual
In the Manual mode, the actuator will be under the control of the HMI only and will not respond to a DCS control signal. This mode provides manual jogging of the actuator for purposes of initial calibration, hydraulic fluid drain and fill, maintenance, etc.

Control
In Control mode, the actuator receives a desired position signal from the DCS. This signal is compared to the current position signal provided by the actuator's position feedback. If the difference between the desired position and current position exceeds the user defined deadband the actuator will move to the desired position. The Hawk actuator may be configured to receive 4-20 mA analog control signals or pulse control signals.

Standby
In Standby mode, the actuator is offline and will not respond to a DCS control signal.

Setup
In Setup mode, the actuator is offline and will not respond to a DCS control signal.

4-2 Speed and Response Tuning

The Hawk speed and response tuning can be configured by the user within the Setup menu.

Intermediate Window
All Hawk actuators operate in two speed modes. A faster speed for large position changes and a slower speed for fine-positioning. This setting determines the point at which the actuator switches from the faster to the slower speed and is entered as a percentage of actuator movement.

Run Intermediate
Sets the slower, fine-positioning actuator speed.

Run Min/Max
Sets the faster, large position change speed.

Jog Speed
Sets the actuator speed used for Manual and Setup mode operations.

Not in Position Alarm Time
The Hawk actuator controls monitor the duration of time needed for the actuator to move to a new position after receiving a control signal. If the actuator is unable to reach the new position the motor/pump are de-energized to prevent damage to the actuator or driven device. The duration of time before the controls fault and send an alarm is defined by the Not in Position Alarm Time setting.

4-2.1 Multiple Motor/Pump Speed & Response Tuning

For Hawk units that are configured with more than one motor/pump the speed and response tuning can be configured by the user within the Setup menu for each individual motor/pump.

Start
For small actuator movements typically only a single motor/pump is used to reposition the actuator, and the secondary motors/pumps are only activated for larger movements. The Start setting determines the minimum deviation required between the current position and the desired position point to activate the secondary motor/pump. For example, if the Start field was set to 2.0 mA and the actuator was at the 12 mA position the secondary motor/pump would be activated if a command signal of 14.1 mA was applied, but it would not be activated with a command signal of 13.9 mA.

Stop
To prevent overshoot, typically secondary motors and pumps are deactivated at the end of travel and only a single motor/pump is used for final positioning. The Stop setting determines the point at which a secondary motor/pump is deactivated and is defined as a deviation between the current position and the desired position. For example, if the Stop field was set to 1.0 mA and the actuator was moving towards a desired position of 20 mA, the secondary motor/pump would be deactivated when the actuator position reached 19 mA.

Run Intermediate
All Hawk motors/pumps have the ability to operate in two speed modes. A faster speed for large position changes and a slower speed for fine-positioning. The slower, fine-positioning speed is referred to as the

Intermediate Speed. The Run Intermediate field determines the percentage of maximum RPM a secondary motor/pump will run at while operating in the Intermediate Speed mode.

Run Max

All Hawk motors/pumps have the ability to operate in two speed modes. A faster speed for large position changes and a slower speed for fine-positioning. The faster, large position change speed is referred to as the Max Speed. The Run Max field determines the percentage of maximum RPM a secondary motor/pump will run at while operating in the Max Speed mode.

Max Start

The Max Start setting determines the interaction between the Intermediate Speed and the Max Speed.

If the deviation between the current position and the desired position is less than the Max Start setting the secondary motor/pump will run at the Intermediate Speed. If the deviation between the current position and the desired position exceeds the Max Start setting the secondary motor/pump will initially run at the Max Speed, but once the deviation drops below the Max Start setting the secondary motor/pump speed will switch from the Max Speed to the Intermediate Speed.

For example, if the Max Start field was set to 3 mA, the actuator was at the 12 mA position, and an 18 mA command signal was applied, the secondary motor/pump would run at the Max Speed until the 15 mA position and would then switch to the Intermediate Speed for the final 3 mA of travel. Conversely, if the Max Start field was set to 3 mA, the actuator was at the 12 mA position, and a 14 mA command signal was applied, the secondary motor/pump would only run at the Intermediate Speed until it reached the 14 mA position.

Delay Stop

The Delay Stop field determines the amount of time, in milliseconds, that the secondary motor/pump will continue running after the HPS solenoids are closed. It is recommended that the delay be set to 0 milliseconds.

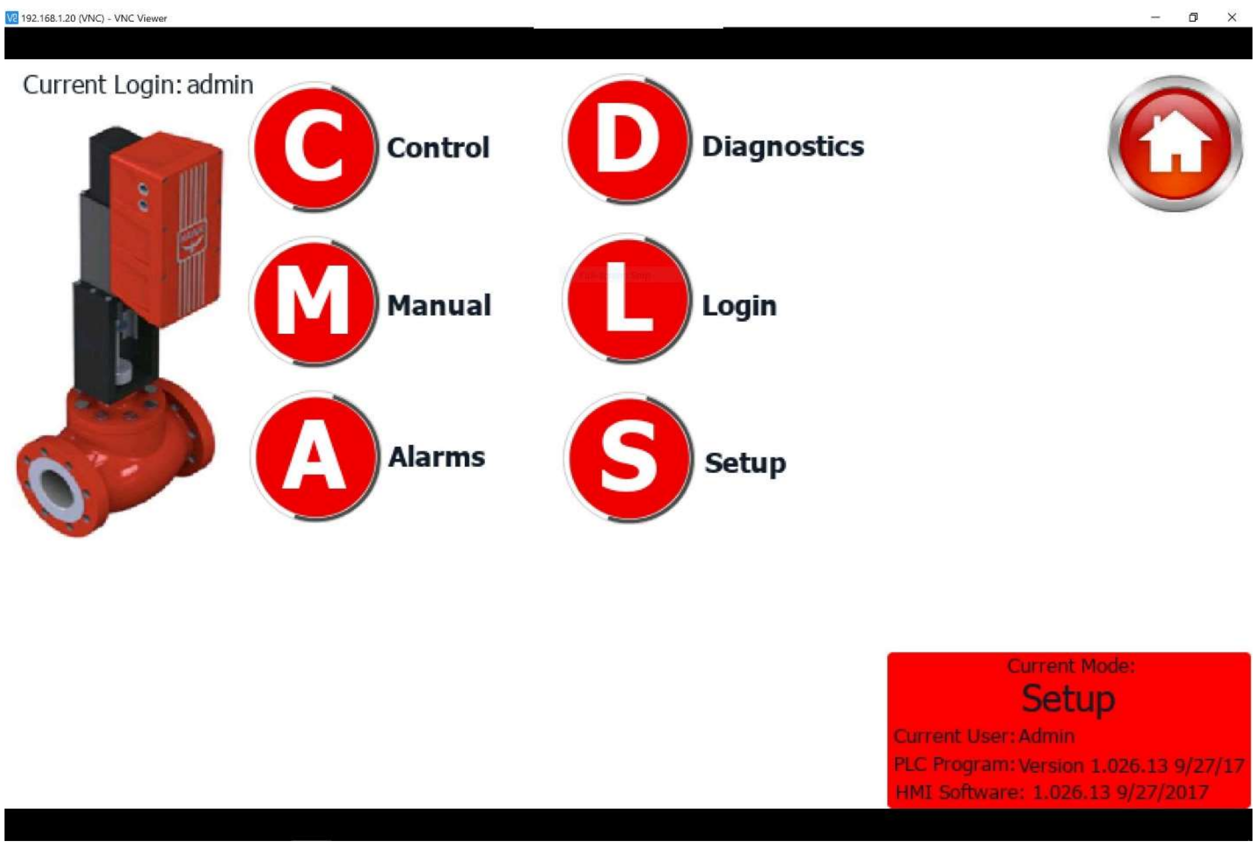
Operate in Manual

The Operate in Manual field allows the secondary motor/pump to be disabled while the HMI is operated in Manual mode.

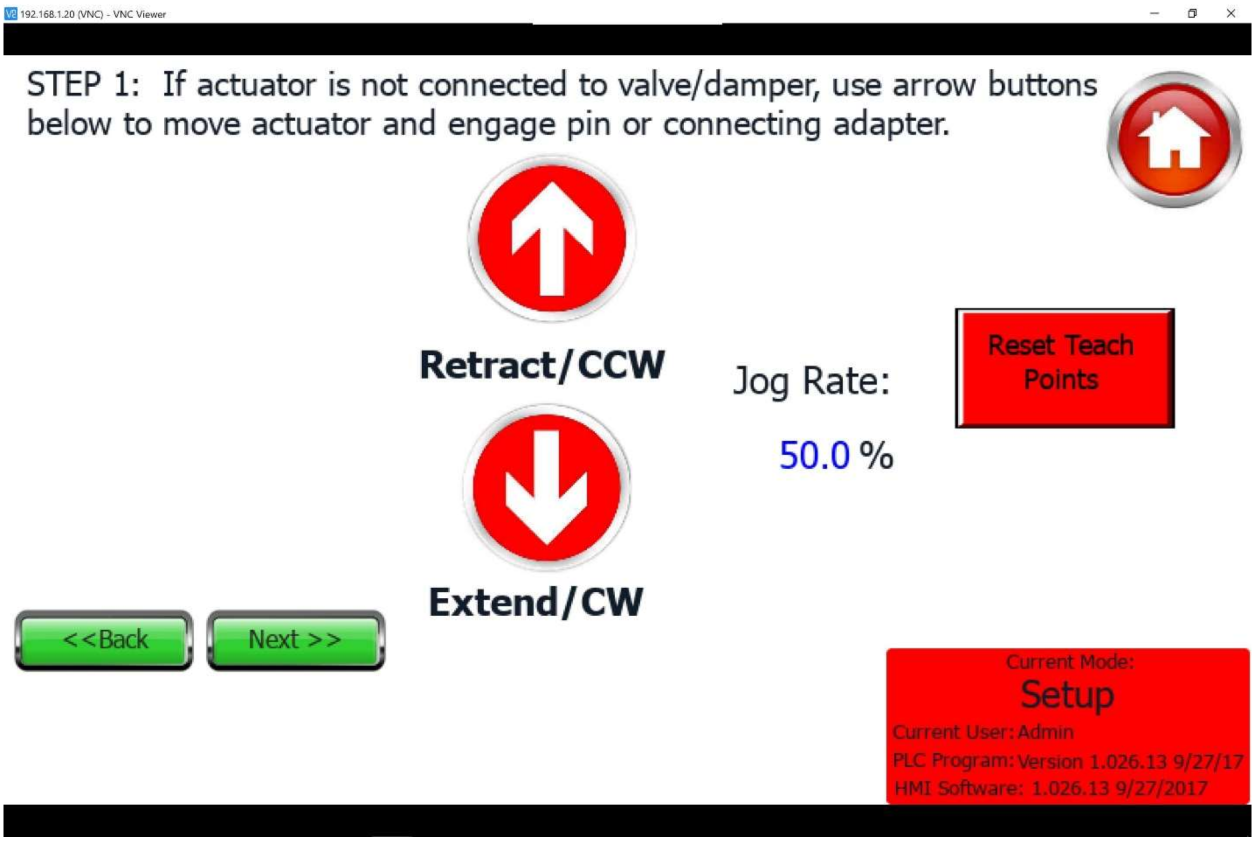
4-3 Control Signal and Position Calibration

Prior to operation the HAWK actuator stroke endpoints and corresponding control signal inputs must be calibrated. For units controlled by 4-20 mA analog control signals the control can be configured as open on increasing signal (20 mA = open, 4 mA = closed) or close on increasing (4 mA = open, 20 mA = closed). The Hawk controls will scale the input accordingly. To set the actuator position calibration perform the following procedure:

1) Power the Hawk Control Enclosure and confirm the HMI boots up. Press the Login button and login using the Admin username and password.
2) Return to the Home screen, which should now include a Setup button. Press the Setup button.



3) The first screen of the Setup menu is devoted to the actuator tuning parameters. This screen is covered in detail in Section 4-1. Press the "Next" button to access the position calibration screens.

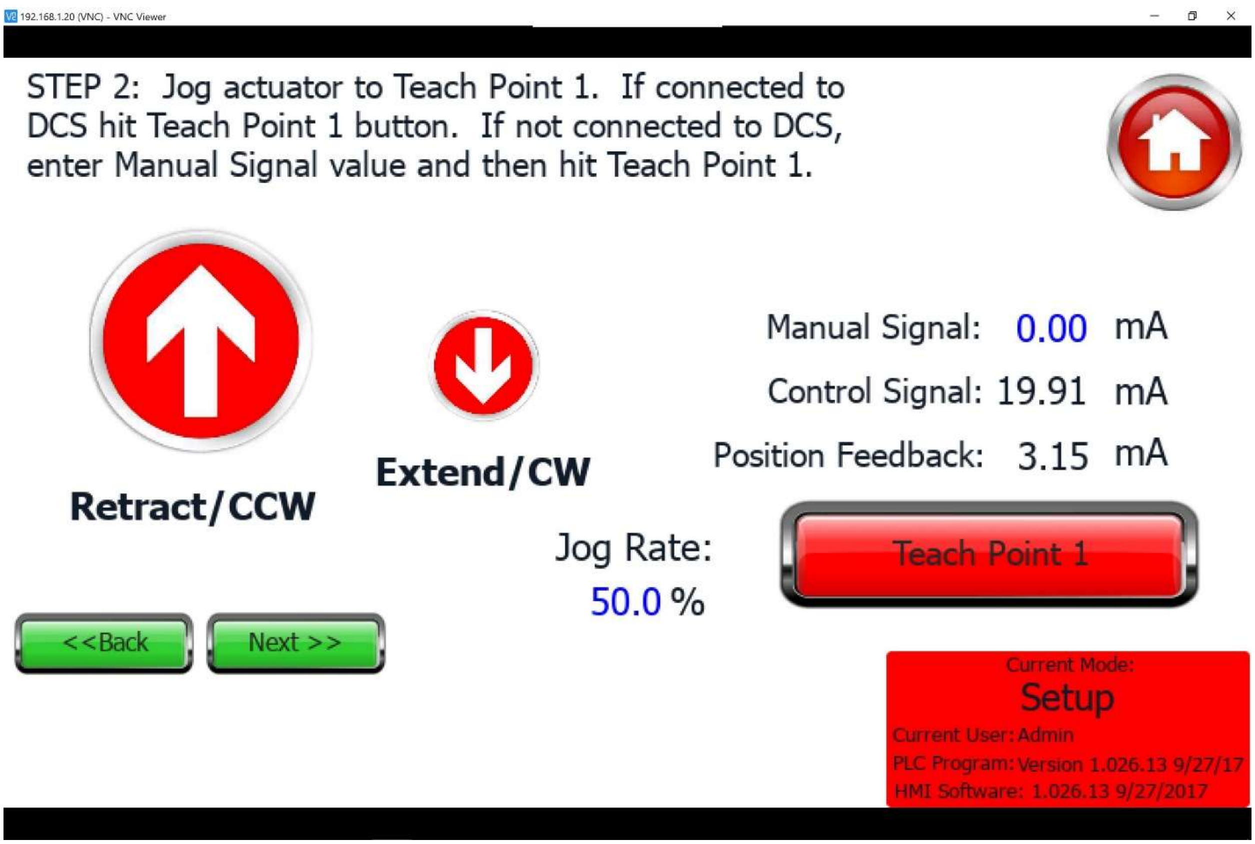


4) If the actuator has not already been coupled to the valve/damper use the arrow buttons to move the actuator into place and align with the valve/damper according to Section 5-2.
5) Press the "Reset Teach Points" button and then press the "Next" button.
6) Use the arrow buttons to move the actuator to the Retracted (or Counter-Clockwise) endpoint. If a control signal is being applied, it will appear in the "Control Signal" field on the right of the screen. Change the control signal to match the desired signal for this actuator position. (For example, if the actuator was Retract on Increasing signal, set the control signal to 20 mA)

Alternatively, if a command signal is unavailable, the user can manually enter the appropriate signal for this actuator position by pressing the blue 0.00 digits in the "Manual Signal" field on the right of the screen.

Press the "Teach Point 1" button to calibrate the Retracted (or Counter-Clockwise) actuator position. If successful a yellow "Teach Complete" box will appear in the upper right of the screen. Press the "Next" button.

Note: It is possible that the Position Feedback display will not match the Control Signal (or Manual Signal) display. That is normal. The Hawk controls will scale the input accordingly after both calibration teach points are set.

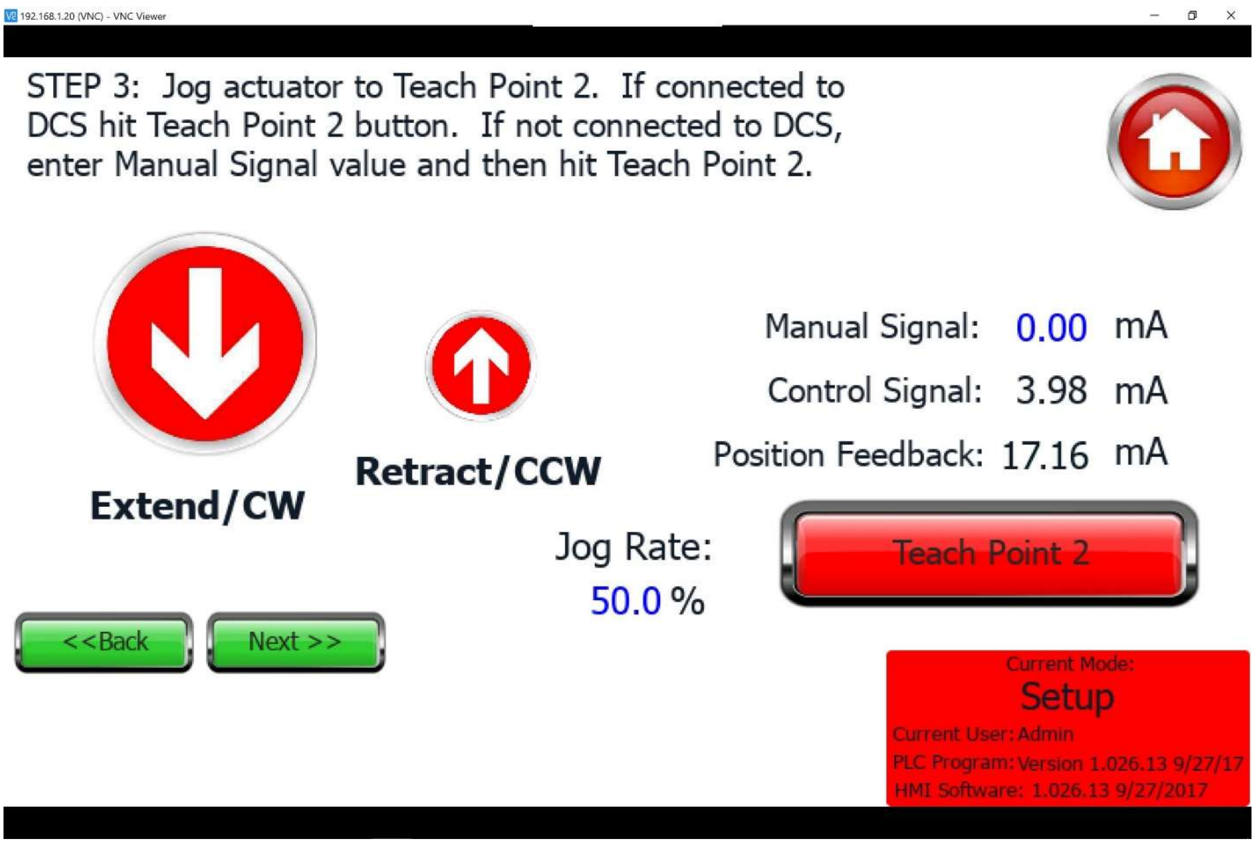


7) Use the arrow buttons to move the actuator to the Extended (or Clockwise) endpoint. Change the control signal to match the desired signal for this actuator position. (For example, if the actuator was Retract on Increasing signal, set the control signal to 4 mA)

Alternatively, if a command signal is unavailable, the user can manually enter the appropriate signal for this actuator position by pressing the blue 0.00 digits in the "Manual Signal" field on the right of the screen.

Press the "Teach Point 2" button to calibrate the Extended (or Clockwise) actuator position. If successful a yellow "Teach Complete" box will appear in the upper right of the screen.

Actuator position calibration is now complete. Press the "Next" button to proceed to the Failure Modes & Limit Switch Settings screen.



4-4 Failure Modes & Limit Switches

The Hawk behavior on loss of control signal and loss of main power can be configured by the user within the Setup menu.

Loss of Control Signal

Upon loss of control signal the Hawk actuator can be configured to fail to one of four positions:

- Fail to the 4 mA Position
- Fail to the 20 mA Position
- Fail to a User Defined Position – The fail position is configured as a mA signal in the Fail to Position field directly below the Loss of Control Signal dropdown
- Fail to the Last Position

Control Signal Recovery

If the control signal is lost, the actuator behavior upon restoration of that control signal can be configured to one of two modes:

- Control – The actuator will return to the Control mode and move to the current control signal
- Standby – The actuator will remain in the Loss of Control Signal failure position and be placed into Standby mode. The user will need to return to the Home screen and enter either the Control or Manual modes to move the actuator.

Power Recovery

If main power is lost, the actuator behavior upon restoration of power can be configured to one of two modes:

- Control – The actuator will return to the Control mode and move to the current control signal
- Standby – The actuator will remain in the actuator failure position and be placed into Standby mode. The user will need to return to the Home screen and enter either the Control or Manual modes to move the actuator.

Limit Switch Positions

High and low electronic limit switch positions may be set by the user.

5. INSTALLATION

Part of the process of mechanically coupling the Hawk actuator to the valve/damper requires stroking the actuator. Therefore, it is necessary that all electrical connections between the actuator and the Control Enclosure are completed prior to final mechanical connections being made.

5-1 Electrical Installation Checklist

Prior to initially powering the Hawk Control Enclosure, confirm the following:

- All wires and cables are firmly secured
- Terminals are properly tightened
- All motor encoder and power cable wiring is correctly tagged and connected per the MEA Field Wiring diagram
- All cable shields are properly grounded
- Incoming voltage is measured and verified

5-1.1 Proper Protective Earthing

If the MEA field wiring diagram is adhered to, the HPS will be grounded to the Control Enclosure. Grounding of the Control Enclosure must then be performed per applicable local electrical and hazardous area codes.

5-2 Actuator Alignment

It is extremely important that the Hawk actuator is properly aligned to the valve/damper. Any misalignment between the actuator, coupling, and driven device could cause damage to either the actuator or the valve/damper. This damage could present itself as premature wear to actuator cylinder rod and piston seals, scoring of cylinder walls, or in extreme cases bent valve stems.

5-2.1 Linear Actuator Alignment

For proper linear actuator alignment in the vertical position, perform the following procedure:

1) Place the actuator on the valve and couple the yoke to the valve, but do not tighten the mounting bolts or spud nut.

2) Using the HMI in Manual mode, stroke the actuator piston rod until it is near the valve stem.

3) Couple the actuator piston rod to the valve stem using the MEA provided coupling and securely tighten the coupling screws.
4) With actuator mounting bolts or spud nut still loose, use the HMI in Manual mode to stroke the actuator fully closed and fully open. The actuator should align itself with the valve.
5) Tighten the remaining mounting bolts or spud nut to firmly attach the yoke to the valve.
6) Stroke the actuator several more times fully closed and fully open to verify there are no signs of misalignment.

5-2.2 Rotary Actuator Alignment

For proper rotary actuator alignment, perform the following procedure:

1) Rotate the shaft of the valve to the fully closed position.
2) Using the HMI in Manual mode, stroke the actuator to the position that corresponds to the valve's fully closed position.
3) Couple the actuator to the valve
4) Stroke the actuator several times fully closed and fully open to verify there are no signs of misalignment.

5-3 Mechanical Installation Checklist

Prior to final commissioning of the Hawk actuator, confirm the following:

- The actuator is fastened securely to the valve/damper
- The coupling is properly installed and secured
- The actuator and valve/damper are aligned correctly
- All tubing and fittings are tight

5-4 Hydraulic Fluid Level Indicator

For proper performance the Hawk actuator must be filled with the appropriate volume of hydraulic fluid and be purged of any air that may be present in the hydraulic fluid system. The hydraulic fluid level indicator for each Hawk actuator is located inside the lower portion of the HPS enclosure. The HPS cover, which is secured by eight (8) ¼-20 x 1 socket head cap screws (3/16" hex Allen wrench required for removal), must be removed to access the level indicator.

When properly filled with hydraulic fluid the level indicator will extend approximately 1”. When the hydraulic fluid level is low, the level indicator will retract. To correctly check the hydraulic fluid level it is important to monitor the level indicator for the entire actuator stroke, in both directions of travel.

Properly Filled

Requires Fluid

Follow the Hydraulic Power Source (HPS) & Actuator Fluid Fill Procedure to ensure the actuator is properly filled with hydraulic fluid and purged of air.

5-5 Hydraulic Power Source (HPS) & Actuator Fluid Fill Procedure

1) If an accumulator system is present, close the shutoff ball valves located upstream of the accumulator and reservoir.
2) Remove the cover from the red Hydraulic Power Source (HPS) enclosure and locate the Schrader-style hydraulic fluid fill valve.
3) Remove the cap from the fill valve and connect an oil fill gun to the Schrader valve.
4) Fill with hydraulic fluid until the fluid level indicator is fully extended. It may take 2-3 pumps of the fill gun before the indicator begins moving.
5) Locate the fluid relief valve directly above the Schrader valve. Using a small, flat head screwdriver briefly lift the relief valve to let any trapped air exhaust. Trapped air may quickly exhaust or could present itself as foaming hydraulic oil.
6) Re-check fluid level indicator and add hydraulic fluid until it again moves to the fully extended position.

7) Repeat steps 4 and 5 (exhausting of the relief valve, checking of the level indicator, and adding fluid) until the level indicator no longer retracts after briefly opening the relief valve. At this point the HPS is purged of air.

8) Power up the unit.

9) Using the HMI put the actuator into Manual mode and move the actuator to the opposite direction of its current position (i.e. if the valve is closed, move it to the open position).

10) While the actuator is moving observe the fluid level indicator. When the fluid level indicator fully retracts, stop running the actuator, add hydraulic fluid to the HPS fluid fill valve until the level indicator fully extends again.

11) Continue to move the actuator in the same direction as in step 4 and repeat the process of checking the fluid level indicator and adding fluid until the actuator moves completely to the dead-end position.

12) Repeat steps 4 and 5, but now run the actuator in the opposite direction. Since a majority of the required fluid was added during steps 4 and 5, running in this direction will require much less additional fluid.

13) To verify that the actuator is completely filled with hydraulic fluid, move the actuator a full stroke in each direction while observing the fluid level indicator. If at any time the indicator retracts during travel add hydraulic fluid, as necessary, to fully extend the indicator again.

14) Once the actuator is completely filled, a small volume of hydraulic fluid needs to be bled off to allow for thermal expansion. Place a container under the relief valve and relieve fluid until the fluid level indicator retracts ¼” from the fully extended position. The container will catch approximately 1 cubic inch of hydraulic fluid.

15) The actuator is now properly filled with hydraulic fluid.

16) If applicable, re-open the accumulator system shutoff ball valves.

5-6 Accumulator/Reservoir System

An accumulator system is used as an energy storage device to drive the actuator to a failure position, either Extend/Clockwise or Retract/Counter-Clockwise, and may be initiated by a loss of control signal or by one of two power losses: Loss of Main Power or Loss of Emergency Shutdown (ESD) Power. An accumulator system is used in lieu of a spring where a spring would be impractical due to actuator thrust/torque constraints.

The accumulator system consists of four main components: accumulator, reservoir, solenoids, and pressure transducer. Both the accumulator and reservoir bottles have two sections divided by a sealed piston, one section is filled with hydraulic fluid while the other is filled with nitrogen. The exact volume and pressure of the hydraulic fluid and nitrogen differs by valve/actuator combination. Under normal operation the accumulator will be filled with pressurized hydraulic fluid while the reservoir is nearly empty.

When an accumulator is tripped, two failure solenoids open simultaneously. The first solenoid is located in a hydraulic tubing line connecting the accumulator and the actuator cylinder. The desired failure position, Extend/Clockwise or Retract/Counter-Clockwise, will determine which side of the actuator cylinder this tubing is connected to. Opening of this solenoid allows the pressurized hydraulic fluid in the accumulator to be released and enter the actuator cylinder, driving the cylinder piston into the desired failure position. Simultaneously, a second solenoid, located in a hydraulic tubing line connecting the reservoir and the opposite side of the actuator cylinder, opens. Opening of this solenoid allows hydraulic fluid to be pushed from the opposite side of the cylinder into the reservoir.

After an accumulator trip, or when power is restored, a pressure transducer indicates to the control electronics of a low pressure condition in the accumulator and that a recharge is required before the actuator can be returned to normal operation. In the interest of safety, the recharge process will only initiate after the actuator is placed into Control mode. As the actuator cylinder piston is already at the end of its travel and can move no further, running the motor/pump will draw hydraulic fluid from the now filled reservoir and refill the empty accumulator. When the pressure transducer informs the control electronics that the proper accumulator recharge pressure has been attained, both failure solenoids are closed and the motor/pump stops running. Normal operation will then resume and the actuator will travel to the control signal target position.

Note: The actuator is not available for control until completion of the recharge cycle. For Small, Medium, and Large HPS units the duration of the recharge cycle is roughly equal to the 1.5 times the normal stroke time of the actuator. For XL, Mega and Mega XL units, the larger, second pump does not run during the recharge cycle, only the HPS pump. Therefore, the recharge time will be roughly 1.5 times the stroke time stated for the same size unit with a Large HPS only.

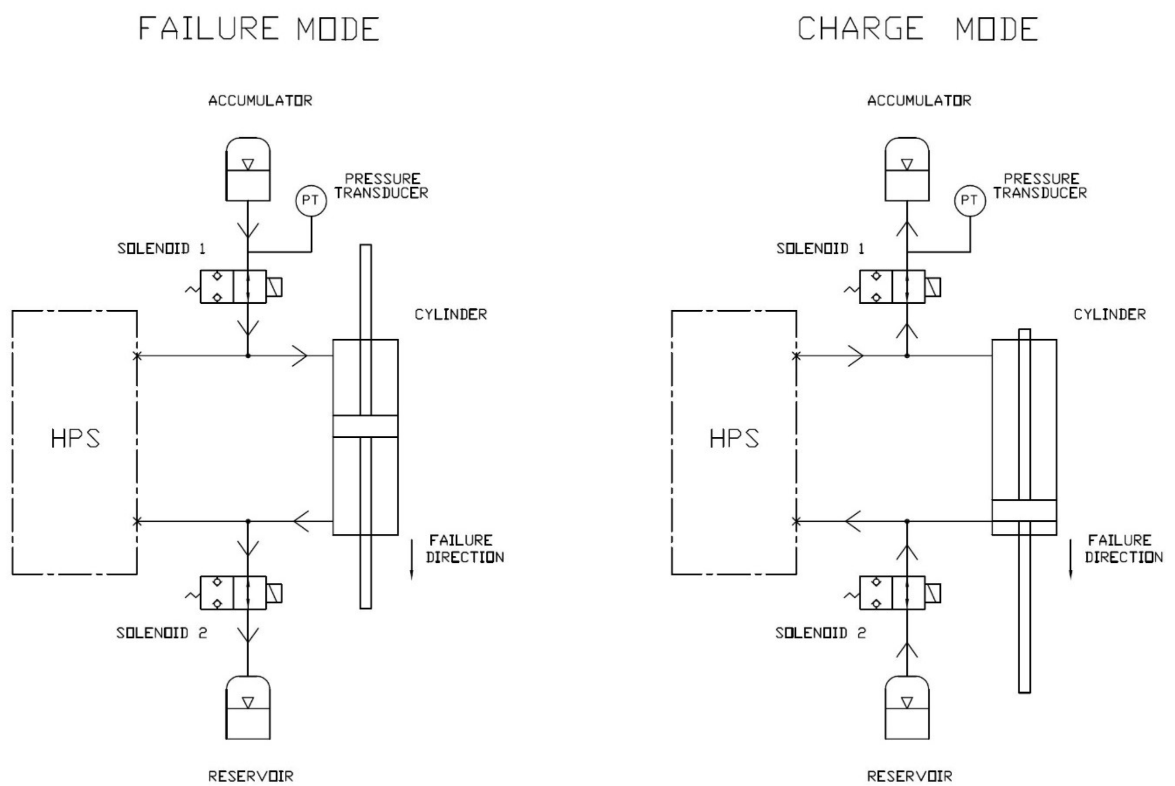


Figure 5-6.1 Accumulator/Reservoir Fluid Flow Diagram

5-7 Accumulator/Reservoir Fluid and Nitrogen Drain Procedure

Warning: Accumulators, gas bottles, and associated hydraulic fluid systems are inherently dangerous due to high pressure gasses and fluids. Do not attempt to operate these systems unless adequately trained, experienced with the items and systems, and can recognize the potential risks involved if mishandled. Failure to do so may result in severe injury or even death.

Warning: Always use dry inert gas (dry nitrogen – N_2) in the Accumulator/Reservoir system. **Never** use air or oxygen, due to the danger of combustion or explosion. In enclosed spaces, N_2 is an asphyxiant; always insure adequate ventilation when working with nitrogen gas. If leaking gas is discovered, extra care should be taken to avoid risk associated with ejection of fittings or hoses.

1) Close the shutoff ball valves located upstream of the accumulator and reservoir.

2) Remove the protective caps from the nitrogen fill ports of the accumulator and reservoir.
3) Measure and record the nitrogen pressure in both the accumulator and reservoir.
4) Vent nitrogen from both the accumulator and reservoir so that the internal pressure is roughly 0 psi.
5) Break tubing fitting on the accumulator and drain the stored hydraulic fluid. It may be necessary to apply low pressure air (0-10 psi) to the nitrogen fill port to move the accumulator piston until it dead ends, forcing hydraulic fluid out in the process.
6) Break tubing fitting on the reservoir and drain the stored hydraulic fluid. It may be necessary to apply low pressure air (0-10 psi) to the nitrogen fill port to move the reservoir piston until it dead ends, forcing hydraulic fluid out in the process.

5-8 Accumulator/Reservoir Fluid and Nitrogen Fill Procedure

Note: Before beginning the accumulator system filling process the Hydraulic Power Source (HPS) and actuator must be completely filled with hydraulic fluid. Refer to the Hydraulic Power Source (HPS) & Actuator Fill Procedure

Note: Before beginning the accumulator system filling process the accumulator and reservoir should be completely drained of hydraulic fluid. Refer to the Accumulator/Reservoir Drain Procedure.

1) Close the shutoff ball valves located upstream of the accumulator and reservoir.
2) Remove reservoir from its mounting bracket and position it so that its open hydraulic fluid fill port is facing upwards.
3) The reservoir piston must now be manually positioned such that the reservoir holds an appropriate amount of hydraulic fluid to completely fill the actuator cylinder during a failure. MEA recommends that the reservoir hold a volume of hydraulic fluid that is 1.25x the actuator cylinder volume. Using a spare piece of 3/8" tubing inserted into the hydraulic fluid fill port of the reservoir push the piston downward a distance equal to the "Reservoir Initial Piston Distance" listed on the actuator's specification sheet. For precision movement gently tap the end of the tubing with a hammer. Excessive force should not be necessary to move the piston.
4) With the reservoir piston repositioned, fill the reservoir with hydraulic fluid completely to the top of the fill port.
5) Temporarily cover the open hydraulic fill port while the reservoir is reinstalled in its mounting bracket.

6) Reattach all disconnected tubing. It is acceptable if a small amount of hydraulic fluid (~1/4 cup) escapes from reservoir during this process.

7) Charge accumulator and reservoir with nitrogen to pressures that are approximately 100 psi greater than their respective pre-charge pressures listed on the actuator's specification sheet.

8) Allow 10-15 minutes for the nitrogen temperature and pressure to stabilize. Check the nitrogen pressure in the accumulator and reservoir and bleed off excess pressure until the pressures are equal to their respective pre-charge pressures.

9) Power up the unit. Leave shutoff ball valves closed.

10) Login as the Admin user so that the accumulator pressure transmitter readings can be observed on the HMI.

11) Open shutoff valves.

12) Change the Accumulator Setpoint on the home screen of the HMI to be equal to accumulator pre-charge pressure + 50 psi (i.e. if the accumulator pre-charge pressure is 1900 psi, change the Accumulator Setpoint on the HMI to 1950 psi).

13) Using the HMI put the actuator into Control mode to initiate the accumulator recharge sequence. The motor/pump will run as the accumulator recharges. Verify that Accumulator Pressure readout on the home screen of the HMI rises during recharge process.

14) During the recharge process, observe the hydraulic fluid indicator in the HPS and add fluid as required to move the indicator to the full position.

15) Once the recharge sequence has finished the actuator will be in Control mode and will reposition according to the control signal. Once the actuator moves to the position dictated by the control signal, use the HMI to place the actuator into Manual Mode.

16) Using Manual mode on the HMI move the actuator to the opposite direction of the accumulator failure position (i.e. if the accumulator closes the valve, move the valve to the fully open position).

17) Trip the accumulator. Depending on the actuator configuration, this may be done by losing signal, losing main power, or losing ESD power.

    Note: For this first accumulator failure cycle, the unit will most likely not fully stroke to the accumulator fail position.

18) Return the actuator to the non-failure state, whether that be by restoring control signal, main power, or ESD power.

19) If main power was lost to trip the accumulator it will be necessary to log back in as the Admin user so that the accumulator pressure transmitter readings can be observed on the HMI.

20) Increase the Accumulator Setpoint on the home screen of the HMI by 50 psi above the previous setting.

21) Repeat steps 12 through 20, each time raising the Accumulator Setpoint by 50 psi. Continue this process of triggering an accumulator fail, adding hydraulic fluid, and raising the Accumulator Setpoint until the Accumulator Setpoint is equal to the Accumulator Recharge Pressure listed on the actuator specification sheet.

    This process of multiple recharges purges the accumulator/reservoir system of air. If this purging process is not performed the system may cavitate, fail to achieve desired recharge pressure, or continuously run after an accumulator recharge

5-9 Safe Seat System

With some valve types a plug or gate seats against a hard stop. Applying excessive actuator force while in the seated position can permanently deform the seating surface, which may lead to process fluid leak by. Seating valves with a force/thrust sufficient to properly seat, but also not cause damage, requires the ability to accurately measure and control the actuator output.

With electro-hydraulic actuators, the actuator motor/pump initially continues running as the plug or gate contacts the seat. Since the actuator piston is prevented from moving by the valve seat it is unable to reposition in response to the rapidly increasing pressure in the cylinder caused by the running motor/pump. This spike in actuator cylinder pressure occurs so quickly, within fractions of a second, that it becomes extremely difficult to obtain, and maintain, an accurate seat load based on the valve position only. In addition, thermal expansion and contraction of the valve and actuator assembly will affect the seat load and must be continuously monitored and accounted for while the valve is seated.

To eliminate this problem, the Safe Seat system consisting of a Seat Load Accumulator (SLA) and pressure switch, is employed. The SLA is a small displacement hydraulic accumulator installed in the actuator system. It is preloaded with nitrogen (the exact pressure will vary) which initially keeps the SLA empty of hydraulic fluid. When the plug or gate of the valve makes contact with the seat and the actuator cylinder pressure begins to spike above the nitrogen pressure, the nitrogen is compressed, and the SLA starts to fill with hydraulic fluid from the actuator system. Only as the nitrogen is compressed does the hydraulic fluid pressure rise further. This slowing of the pressure rise allows the pump motor to change system pressure over a greater length of time, thus allowing more accurate actuator pressure control.

A settable pressure switch, installed in the actuator fluid system, is used to provide pressure information to the control electronics. By pumping fluid into and out of the SLA the control electronics have a method to maintain a constant pressure on the valve seat without any direct actuator movement. Only the actuator system pressure changes to maintain a constant seat load.

Safe Seat Operational Steps

1) While the actuator is stroking the valve towards its seat, the position feedback transmitter will control the actuator movement. The SLA pressure switch will indicate open due to the actuator fluid pressure being below the pressure threshold required to cause any compression of the SLA nitrogen.
2) When the valve contacts its seat the position feedback transmitter will no longer indicate any changes in actuator position, but the motor/pump in the HPS will continue to run.
3) With the valve on its seat, the actuator fluid pressure will increase and begin to displace fluid into the SLA. Now the SLA pressure switch controls when the HPS motor/pump shuts off.
4) Control electronics will continue to power the motor/pump until the SLA pressure switch reaches its target value and changes to the closed position.
5) The motor/pump are stopped and locked in position. If the control electronics detect a change in SLA switch state it will react by running the motor/pump in the appropriate direction to achieve a SLA pressure that is within the target deadband.

5-10 Safe Seat Adjustment

1) Install a temporary pressure gauge on one of the unused actuator SAE-6 manifold ports (1/4" hex Allen wrench required for removal) to measure the actuator system pressure. If the Safe Seat feature is used in the Extend/Clockwise direction of actuator travel install the gauge in one of the unused "B" labeled manifold ports. If the Safe Seat feature is used in the Retract/Counter-Clockwise direction of actuator travel install the gauge in one of the unused "A" labeled manifold ports.
2) Using the HMI put the actuator into Setup Mode and set the Safe Seat Trigger Point and Safe Seat Speed. The Safe Seat Trigger Point is the position at which point the actuator will begin to travel at the Safe Seat Speed while monitoring the Safe Seat pressure switch.
3) Determine the appropriate Safe Seat pressure switch setpoint.

   Note: The Hawk actuator is designed to produce maximum output, torque or thrust, when the actuator fluid pressure is 2000 psi. There is a proportional relationship between pressure and actuator output. For example, if the rated actuator output is 10,000 in-lbs and the maximum allowable seat load is 7,500 lbs, the pressure switch should be set at 75% of 2000 psi or 1500 psi.

4) Locate the Safe Seat pressure switch and slide the adjustment cover back towards the hydraulic connection end of the switch to expose the adjustment ring.
5) While looking at the pressure switch with the electrical connection facing upward and hydraulic connection facing downward use a .095" pin (a 5/64" drill bit also works well) to rotate the adjustment ring completely to the right to lower the setpoint.
6) Using the HMI put the actuator into Manual mode and back the actuator/valve off the seat to unload the SLA.
7) Using the HMI put the actuator into Control Mode and command the unit to stroke to the seated position. Observe the pressure on the temporary gauge as the valve seats. This gauge pressure is equal to the current pressure switch setpoint.
8) Increase the pressure switch setpoint using the adjustment ring to a value closer to, but still below, the setpoint determined in step 3. Rotate the adjustment ring to the left to increase the setpoint or rotate to the right to lower the setpoint.
9) Repeat steps 6-8, each time raising, and fine-tuning, the switch setpoint until it is equal to the value determined in step 3.
10) Slide adjustment cover back into place over pressure switch adjustment ring.

5-11 Safety Precautions

Due to the presence of potentially dangerous electrical and mechanical energy, prior to performing installation and maintenance of any Hawk actuator appropriate safety precautions must be taken. These precautions should include, but not be limited to the following:

- Adherence to site specific permitting and safety guidelines
- Lock out, Tag out procedures where appropriate for the maintenance performed
- Within any electrical work, the Hawk actuator must be de-energized
- If the unit includes an accumulator or Safe Seat all stored energy must be released

5-11.1 Releasing Accumulator/Reservoir Stored Energy

1) Close the shutoff ball valves located upstream of the accumulator and reservoir.

2) For linear Hawk units, use the Manual mode on the HMI to decouple the actuator from the valve/damper.

3) Disconnect the power supply to the actuator.

4) Vent nitrogen from the accumulator and reservoir through the nitrogen fill port.

   Note: The nitrogen stored in the accumulator and reservoir may be at pressures in excess of 2100 psi. Take appropriate action to remain clear of the venting nitrogen.

5) The accumulator/reservoir system is now purged of stored energy and the actuator may be disassembled as appropriate.

5-11.2 Releasing Safe Seat Stored Energy

1) Vent nitrogen from the Safe Seat accumulator through the nitrogen fill port.

   Note: The nitrogen stored in the accumulator may be at pressures in excess of 2000 psi. Take appropriate action to remain clear of the venting nitrogen.

2) The Safe Seat system is now purged of stored energy and the actuator may be disassembled as appropriate.

6. MAINTENANCE

The Hawk actuator is designed to provide robust and precise operation while keeping maintenance to a minimum. However, adequate preventative maintenance procedures are paramount to extending the life of any mechanical device, including the Hawk, and are highly recommended.

6-1 Quarterly Inspection/Maintenance

It is recommended that visual inspections are performed on a quarterly basis to help identify easily correctable mechanical issues. Quarterly inspection checks should include, but not be limited to, the following:

- Verify that the hydraulic fluid level is correct
- Are tubing and fitting connections tight
- Are mounting bolts and screws fastened correctly
- Is there hydraulic fluid pooling on or below the actuator
- Are cable connections secure at both the HPS and Control Enclosure
- Are there cuts or excess wear in cables
- Is there moisture or dirt in the HPS or Control Enclosure
- Is the HMI responding accurately to user input
- Is the actuator hunting or unable to hold a position
- Is the actuator responding accurately to control signals
- Is the position feedback signal accurate and stable

6-2 Five Year Inspection/Maintenance

In addition to the quarterly visual inspection it is recommended that the following maintenance is performed at five (5) year intervals:

- Quarterly visual inspection
- Install soft goods repair kit (includes cylinder, manifold, and HPS soft goods)
- Install accumulator/reservoir soft goods repair kit, if applicable
- Replace HPS solenoids
- Purge and replace hydraulic fluid

6-3 Ten Year Inspection/Maintenance

It is recommended that the following, more extensive, maintenance is performed at ten (10) year intervals to ensure the proper, long term, working condition of the Hawk actuator:

- Quarterly visual inspection
- Install soft goods repair kit (includes cylinder, manifold, and HPS soft goods)
- Install accumulator/reservoir soft goods repair kit, if applicable
- Replace HPS solenoids
- Replace servo motor(s)
- Replace pump
- Purge and replace hydraulic fluid

7. TROUBLESHOOTING

Symptom	Cause	Remedy
Drive Diagnostic is displaying F8022 error code	Interference between motor and encoder	A F8022 error typically indicates interference between the motor power and motor encoder wiring. This may be caused by unshielded motor power and encoder wires being in close proximity to each other, exposed shielding making contact with the metal Control Enclosure housing, or improperly wired motor and encoder wiring. In some instances, F8022 errors may also be caused by improper motor encoder wiring (similar to C0285 errors) or power supply wiring (similar to E8260 errors). In these cases review the C0285 and E8260 troubleshooting entries for possible remedies.
Drive Diagnostic is displaying C0285 error code	Motor encoder wiring is incorrect	A C0285 error indicates improper motor encoder wiring. This could be due to improperly landed field wiring or physical damage to wiring. After wiring errors are corrected, power to the actuator must be cut and then restored to reset and remove the error.
Drive Diagnostic is displaying E8260 error code	Power supply wiring is incorrect	A E8260 error indicates the phases of the power supply wiring are incorrect. Be sure to depower the actuator before making any changes to power wiring.
Actuator movement is "jerky" or rough	Excessive air is in the hydraulic fluid system and must be purged	Follow the Hydraulic Power Source (HPS) & Actuator Fluid Fill Procedure to properly purge the hydraulic fluid system of air.
Actuator movement is delayed after command signal is changed	Excessive air is in the hydraulic fluid system and must be purged	Follow the Hydraulic Power Source (HPS) & Actuator Fluid Fill Procedure to properly purge the hydraulic fluid system of air.
Actuator cycles or is unable to hold a position	There is internal leak-by somewhere in the hydraulic fluid system	Leak-by in the hydraulic fluid system will cause the actuator to constantly cycle as it drifts and then repositions itself back to the correct position. Leak-by may occur in the solenoid seals or in the

		actuator cylinder seals. To determine the location of the leak, it is recommended that first the solenoids are replaced, one by one, and then if the leak-by still persists install an actuator soft goods repair kit.
Solenoids are hot while actuator is at rest	Solenoids are hot to the touch when they are powered. The center solenoid will typically be hot during normal operation. The top and bottom solenoids would be hot during frequent actuator movement.	The center solenoid will typically be hot during normal operation and is not a cause for alarm. The top and bottom solenoids may become hot due to frequent actuator movement, but should cool as the actuator is at rest. If the top and bottom solenoids continue to be hot while the control signal is constant it may indicate that the actuator is unable to hold a position due to internal leak-by somewhere in the hydraulic fluid system. In this case review the "Actuator cycles or is unable to hold a position" troubleshooting entry for possible remedies.
HPS relief valve is venting hydraulic fluid	The hydraulic fluid system is overfilled, the pump is cavitating, or there has been a solenoid failure	If the hydraulic fluid emitted from the HPS relief valve appears clear in color it often indicates that the hydraulic fluid system is overfilled with fluid. Fully stroke the actuator several times to purge the excess fluid. If the hydraulic fluid emitted from the HPS relief valve appears "foamy" or white in color it often indicates that cavitation is occuring in the actuator pump. Cavitation is most often caused by a hydraulic fluid system that is underfilled with fluid. Follow the Hydraulic Power Source (HPS) & Actuator Fluid Fill Procedure to properly purge the hydraulic fluid system of air. If a solenoid is improperly wired or otherwise not functioning it could prevent the pump from moving fluid through the actuator as intended. "Dead heading" the pump in this manner may also cause cavitation which could cause hydraulic fluid that appears "foamy" or white in color to be emitted from the HPS relief valve.
Motor is running, but the actuator is not moving	Solenoids are not functioning or the pump suction check valve is damaged	If a manual override is installed, use the override to stroke the valve and confirm that the actuator isn't physically prevented from moving by debris in or damage to the valve/damper. After valve/damper movement is verified, confirm that the power supply wiring to the solenoids is correct and that they are energized. Solenoids will be warm, or even hot, to the touch when energized. If the solenoids are working properly, the problem may lie with the pump suction check valve. It is possible that dirt, debris, or a seal from elsewhere in the hydraulic fluid system is preventing the check valve from closing properly. Problems with pump suction check valves often occur after dirt or debris was introduced to the hydraulic fluid system after a rebuild.
Actuator stroke speeds have become slower	The pump is slipping	Over time general wear and tear may cause pump slip to increase. This can lead to lost pump efficiency and actuator speeds will become slower as a result.

Actuator can not completely close the valve	The pump is slipping	Over time general wear and tear may cause pump slip to increase. This can lead to lost pump efficiency and in the worst cases the pump is unable to generate sufficient pressure in the actuator to close the valve/damper against a load.
Actuator with accumulator does not complete a full stroke upon failure	The Accumulator/Reservoir system is either filled with too much or too little hydraulic fluid	Log in as the Admin user to enable viewing of the Accumulator Pressure on the HMI Home screen and determinine if the Accumulator/Reservoir system is filled with too much or too little hydraulic fluid: Too Much Fluid - After the actuator strokes to the fail position observe the Accumulator Pressure on HMI Home screen. If the pressure remains close to the Accumulator Setpoint pressure, the Accumulator/Reservoir system is overfilled. Too Little Fluid - After the actuator strokes to the fail position observe the Accumulator Pressure on HMI Home screen. If the pressure is less than 100 psi, the Accumulator/Reservoir system is underfilled. If overfilled, follow the Accumulator/Reservoir Fluid and Nitrogen Drain Procedure to completely drain the Accumulator/Reservoir system and then follow the Accumulator/Reservoir Fluid and Nitrogen Fill Procedure to refill the system with hydraulic fluid and nitrogen. If underfilled, follow the Accumulator/Reservoir Fluid and Nitrogen Fill Procedure to refill the system with hydraulic fluid and nitrogen.
Input Command (DCS) Missing or below 2mA alarm	The control signal has been lost or fallen below 2 mA	A low control signal may be due to improperly landed field wiring, physical damage to wiring, or an inadequate signal from the DCS.
Loss of feedback signal below 2mA alarm	The feedback signal has been lost or fallen below 2 mA	A low feedback signal may be due to improperly landed field wiring, physical damage to wiring, or a malfunction in the actuator's position transmitter.
Valve not in position within time alarm	The actuator has failed to reach the desired position within time	The total time the actuator is permitted to move from the current position to the desired position is settable in the HMI Setup screens. Several possible causes of this alarm are: 1. The Not In Position Alarm Time is set too low. Verify the setting in the HMI Setup screens. 2. The running speed of the actuator is set too low. Verify the setting in the HMI Setup screens. 3. The hydraulic fluid level is low and preventing the actuator from moving properly. Check the hydraulic fluid level indicator and verify that the actuator is properly filled. 4. The valve/damper is physically prevented from moving due to debris or damage.
ESD is active alarm	24 VDC ESD power has been lost	An ESD condition may be triggered by improperly landed field wiring, physical damage to wiring, or a loss of 24 VDC ESD power.