

# Service Manual for Multiport Flow Selector™ Valve

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Figure 1. Fisher Multiport Flow Selector Valve



X1398

## Introduction

### Scope of Manual

This instruction manual includes installation, operation, and maintenance information for the Multiport Flow Selector.



Do not install, operate, or maintain a Multiport Flow Selector without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

## Description

The Multiport Flow Selector offers an efficient solution for oil well testing. This valve has eight inlets, one test outlet, and one group outlet. Eight pipe lines can be connected to this valve and allows continuous flow while sampling/testing individual oil wells.

## Educational Services

For information on available courses for the Multiport Flow Selector valve, as well as a variety of other products, contact:

Emerson Automation Solutions  
Educational Services - Registration  
Phone: 1-641-754-3771 or 1-800-338-8158  
E-mail: [education@emerson.com](mailto:education@emerson.com)  
[emerson.com/fishervalvetraining](http://emerson.com/fishervalvetraining)

# Specifications

The Multiport Flow Selector specifications are given in tables 1 through 5.

Table 1. Valve Specifications NPS 2x4 and 3x6

SPECIFICATIONS	VALVE SIZE							
	2 x 4			3 x 6				
ASME Class Rating <sup>(1)</sup>	CL300	CL600	CL900	CL150	CL300	CL600	CL900	CL1500
Weight, kg (lb)	91 (200)	91 (200)	363 (800)	553 (1220)	630 (1390)	658 (1450)	680 (1500)	968 (2135)
Inlet Ports	NPS 2			NPS 3				
Test Outlet Port	NPS 2			NPS 3				
Group Outlet Port	NPS 4			NPS 6				
End Connections	Raised-face flanges (ASME B16.5) or threaded connections for NPS 2x4 constructions only							
Temperature Range <sup>(2)</sup>	-1 to 204°C (30 to 400°F)							
Shutoff	Class IV per ANSI/FCI70-2 and IEC 60534-4							
1. The pressure/temperature limits in this instruction manual and any applicable standard or code limitation should not be exceeded. 2. Standard O-ring material established upper and lower temperature limits.								

Table 2. Valve Specifications NPS 4x8, 4x10, and 6x16

SPECIFICATIONS	VALVE SIZE							
	4 x 8			4x10	6 x 16			
ASME Class Rating	CL300	CL600	CL900	CL1500	CL300	CL600	CL900	CL1500
Weight, kg (lb)	959 (2115)	975 (2150)	1134 (2500)	1742 (3840)	1810 (3990)	2018 (4450)	3590 (7915)	5343 (11780)
Inlet Ports	NPS 4			NPS 4	NPS 6			
Test Outlet Port	NPS 4			NPS 4	NPS 6			
Group Outlet Port	NPS 8			NPS 10	NPS 16			
End Connections	Mates with raised-face flanges per ASME B16.5							
Temperature Range <sup>(1)</sup>	-1 to 204°C (30 to 400°F)							
Shutoff	Class IV per ANSI/FCI70-2 and IEC 60534-4							
1. The pressure/temperature limits in this instruction manual and any applicable standard or code limitation should not be exceeded. 2. Standard O-ring material established upper and lower temperature limits.								

Table 3. Actuator Specifications

SPECIFICATIONS	VALVE SIZE AND ASME CLASS RATING				
	NPS 2 x 4 CL300/600/900	NPS 3 x 6 CL150/300/ 600/900/1500	NPS 4 x 8 CL300/600/900	NPS 4 x 10 CL1500	NPS 6 x 16 CL300/600/ 900/1500
Max Torque Output, N • m (ft • lbf)	203 (150)	881 (650)	1085 (800)	1085 (800)	2034 (1500)
Actuator Speed, RPM	1.0	0.5-1.0	0.5-1.0	0.5-1.0	0.3-0.5
Actuator Weight, kg (lb)	82 (180)				
Plug Position Accuracy	± 1°				

# Installation

## Minimum Tools Required

A torque wrench, socket wrench, and Allen head wrenches are required to install the Multiport Flow Selector Valve and actuator assembly.

Table 4. Socket Size for Multiport Bonnet Studs and Nuts

VALVE SIZE, NPS	ASME CLASS RATING	SOCKET SIZE (in)
2 x 4	CL300	1-5/8
	CL600	
	CL900	
3 x 6	CL150	2
	CL300	
	CL600	
	CL900	
	CL1500	2-3/8
4 x 8	CL300	2-3/16
	CL600	
	CL900	
4 x 10	CL1500	2-3/4
6 x 16	CL300	2-9/16
	CL600	3-1/8
	CL900	
	CL1500	

Other socket sizes (inch) required: 7/16, 1/2, 9/16, 3/4, 7/8, and 1-1/8.

Allen key sizes (inch) required: 5/32, and 1/4

Table 5. Wrench Sizes (Inch) for Multiport Inlet and Outlet Flanges

FLANGE SIZE, NPS	ASME CLASS RATING				
	CL150	CL300	CL600	CL900	CL1500
2	---	1-1/16	1-1/16	1-7/16	---
3	1-1/16	1-1/4	1-1/4	1-7/16	1-13/16
4	---	1-1/4	1-7/16	1-13/16	2
6	1-1/4	1-1/4	1-5/8	1-13/16	2-3/16
8	---	1-7/16	1-13/16	2-3/16	---
10	---	---	---	---	2-15/16
16	---	2	2-3/8	2-9/16	3-7/8

### **⚠ WARNING**

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Avoid personal injury and property damage by keeping hands, tools, and other objects away from the plug while operating the valve.

Observe all WARNING decals and tags.

Key numbers in this procedure are shown in figure 2 and 3 unless otherwise indicated.

Before installing the unit, observe all warning tags and:

1. Check for external physical damage.
2. Check for any visible leakage of gear oil from the Multiport Electric Actuator (MPA).
3. Visually inspect the inside of the Multiport through the group outlet port checking for damage, rust, and/or debris.
4. Verify the voltage requirement of the MPA (AC/DC) and connect power supply and signal circuits to test the operation of the electric actuator and plug. Check for proper plug alignment at each port.
5. Inspect connecting pipelines to be certain they are free of foreign material such as pipe scale or weld slag that could damage the sealing surfaces for the Multiport Flow Selector valve.
6. Provide appropriate flange gaskets and install them between the pipe flanges and valve body flanges. Tighten flange bolting in a star pattern to ensure uniform compression of the gaskets.

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**Note**

To prevent seal damage when hydrotesting external piping, position the plug midway between two inlet ports in order to equalize pressure between the plug and valve body.

The Multiport Flow Selector plug/port alignment is factory adjusted when supplied with an actuator and should not require further adjustment.

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## Field Technician Commissioning Activities

Refer to the Multiport Actuator (MPA) O&M Manual — Supplied by Bettis ([MPA-400-0711](#)). See page 19 for detailed commissioning activities.

### CAUTION

**Replace pipe plug with breather before operating unit. The valve body may be pressurized from hydrostatic testing. Do not remove any bolts or flanges for inspection until after the unit has been depressurized.**

**Circuit boards are susceptible to damage from static discharge when touched. Ensure that you ground yourself before touching the knobs on the electric actuator.**

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### Reinstallation of the Actuator Assembly

1. Using a manual wrench, rotate the plug (key 2) a few revolutions to verify it turns freely. Initial effort required to rotate the plug could be high if the plug has not been rotated for an extended period of time.
2. Secure the actuator mounting bracket (key 43) to the bonnet using two cap screws (key 44), two travel indicator studs (key 54), and four lock washers (key 56). For the NPS 2x4 construction, secure the lower plate to the bonnet using two cap screws, two travel indicator studs and nuts, and four lock washers.

Regardless of size, apply an anti-seize lubricant (key 40) to the threaded portion of the fasteners. The cap screws should be spaced 180 degrees apart from one another and 90 degrees apart from the travel indicator studs.

3. Secure the travel indicator plate to the travel indicator studs by tightening two cap screws (key 55). Proper assembly has occurred if the lock washers have been placed between the travel indicator studs and travel indicator plate and if flat washers (key 57) have been placed between the cap screws and travel indicator plate. For the 2x4 construction, place travel indicator spacers over the travel indicator studs and secure the travel indicator plate

down by tightening the nuts. Proper assembly has occurred if there are flat washers between the travel indicator spacers and travel indicator plate and travel indicator plate and nuts.

Regardless of size, an anti-seize lubricant (key 40) shall be applied to the threaded portion of the fasteners and nuts.

4. To complete the assembly of the mounting kit for the NPS 2x4 construction, thread four spacer studs into the lower plate and secure the upper plate to the spacer studs using four cap screws. Proper assembly has occurred if there are lock washers between the lower plate and spacer studs and spacer studs and upper plate. An anti-seize lubricant (key 40) shall be applied to the threaded portion of the studs and fasteners.
5. Apply grease (key 41) to the surfaces on the key slot(s) found on the shaft coupler (key 47). Insert key(s) (key 48) into the shaft coupler key slot(s). Insert the shaft coupler with key(s) into the bottom of the Multiport Electric Actuator and hold in place by hand.
6. Slowly lower the actuator with shaft coupler (key 47) onto the mounting bracket (key 43). Align the shaft coupler with the square end of the plug (key 2). Position the shaft coupler such that the reference mark on the square end of the plug remains visible between the flats of the shaft coupler. This reference mark indicates the location of the seal assembly relative to the inlet ports of the body.
7. Attach the actuator to the mounting bracket (key 43) using four cap screws (key 45) and four lock washers (key 46). Tighten these fasteners finger tight only.
8. Apply an anti-seize lubricant (key 40) to the travel indicator holder (key 49) and thread on the jam nut (key 51), as well as the travel indicator pointer (key 50) and nut (key 52). Thread this assembly into the shaft coupler (key 47). The travel indicator pointer shall be on the same side as the reference mark found on the square end of the plug and shall be positioned such that it will not contact any parts of the travel indicator assembly while rotating.
9. Using the electric actuator, rotate the plug (key 2) a few revolutions to establish proper alignment between the shaft coupler (key 47) and plug. Visually check for any binding and adjust the position of the actuator as necessary. Once the proper alignment has been established, secure the actuator to the mounting bracket (key 43) by tightening the cap screws (key 46).

## Home Port Calibration

Refer to the Multiport Electric Actuator (MPA) O&M Manual — Supplied by Bettis ([MPA-400-0711](#)) for detailed instructions on how to calibrate the home port position.

## Multiport Electric Actuator Set Up

Refer to the Multiport Electric Actuator (MPA) O&M Manual — Supplied by Bettis ([MPA-400-0711](#)) for detailed instruction on:

1. Disabling port positions
2. Controller address
3. Control room MODBUS RTU operation
4. Installation and use of MPA software on laptop/PC

## Maintenance

Refer to figure 2 and 3, typical Multiport assembly and mounting drawings.

### **⚠ WARNING**

**Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:**

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly rotate the plug.
- Use bypass valves or completely shut off the process to isolate the Multiport from process pressure. Relieve process pressure from all parts of the valve. Drain the process media from all sides of the Multiport.
- Use lockout procedures to be sure the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- The tapered roller bearing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when separating the bonnet from the plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

The Multiport Flow Selector valve is shipped completely greased and lubricated. Routine maintenance of this valve is recommended, especially if it has been stored for an extended amount of time. Maintenance steps include:

1. Keeping the tapered roller bearing (key 3) greased. A high temperature silicone grease (key 39) can be injected into the bearing housing through the lube fitting (key 28).
2. Confirming proper alignment between the plug and inlet ports.
  - Verify the correct placement of the travel indicator pointer (key 50) onto the coupler (key 47).
  - Align the plug (key 2) with one of the inlet ports. Confirm the travel indicator pointer is in alignment with the selected inlet port.
3. Visual inspection of the seal insert (key 12). The sealing surface of this insert should be smooth and completely intact.
  - If the seal insert needs to be replaced, replace all o-rings (key 5, 7, 14, 20, 25, and 26), backup rings (key 6, 8, 15, and 21), rod seal (key 4), plug bushing (key 9), and wiper seals (key 24).
4. Rotate the plug (key 2) one complete revolution using the electric actuator to confirm the assembly is functioning properly. Check the local display unit on the electric actuator for any alarm codes.

## Disassembly

Review warnings found in the Maintenance section of this manual.

Refer to figures 2 and 3 when disassembling the Multiport Flow Selector.

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**Note**

The bonnet can be removed with the Multiport Electric Actuator still attached. If this is done, ensure proper orientation has been maintained between the actuator and valve body once the bonnet has been re-installed onto the valve body. If this orientation has not been maintained, recalibration of the actuator is required. One way to ensure proper orientation has been maintained is to place alignment marks between the plug (key 2) and coupler (key 47) prior to removal of the bonnet (key 19).

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1. Rotate the plug (key 2) to any unused inlet port. Remove the blind flange from this inlet port to gain access to the seal assembly. Once the adjustment tool has been secured to the seal adjuster (key 18), rotate this tool clockwise until it stops. This action unloads the wave springs (key 11, 17) and removes the forces generated between the seal insert (key 12), valve body (key 1) and scraper (key 12)/valve body (key 1).
2. Remove the nuts (key 32) from the bonnet (key 19), lifting lugs (key 33), and the studs (key 31) from the body (key 31). Thread eye bolts into the jack screws holes provided in the bonnet. Raise the bonnet vertically until it clears the plug (key 2) and move it to the side.
3. Remove the plug (key 2) from the valve body (key 1). The seal components should still be installed inside of the plug.
4. Remove the seal assembly from the plug (key 2) using the adjustment tool as follows:
  - Once the adjustment tool has been inserted into the seal adjuster (key 18) and secured, rotate the tool counterclockwise until the seal adjuster disengages from the final thread on the plug.
  - With the adjustment tool still secured to the seal adjuster (key 18), pull it out of the plug. All components that make up the seal assembly are now outside of the plug.
5. Carefully remove the bearing cup (key 3) from the bonnet (key 19).
6. Inspect all components for damage. Replace any damaged parts and reassemble by following the Assembly procedure in this manual.

## Assembly

Refer to figures 2 and 3 when assembling the Multiport Flow Selector.

Ensure all parts are clean and in good condition before assembling the Multiport Flow Selector. Refer to figure 2 to determine which components require lubrication.

### Body (Key 1)

1. Visually inspect all internal and external surfaces and threads.
2. Install the plug bushing (key 9) into the lower section of the body.

### Plug (Key 2)

1. Install the lower plug O-ring (key 8), with the correct number of backup rings (key 7). For ASME rated CL150, 300, 600, and 900 valves, install one backup ring above (on the side nearest to the bonnet) the O-ring. For CL1500 rated Multiports, install two backup rings one on either side of the lower plug O-ring.
2. Lubricate and install the seal adjuster (key 18) by turning it clockwise (i.e. viewing toward the plug centerline) until solid. Follow with the correct number of wave springs (key 17). For NPS 2x4, 3x6, and 6x16 constructions, install three wave springs. For NPS 4x8 and 4x10 constructions, install four wave springs. Ensure the wave springs are properly aligned and seated on the seal adjuster.

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**Note**

If the wave springs are not properly aligned and seated then the seal assembly may not function properly.

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3. Install the back up plate (key 16) against the shoulder in the plug (key 2).
4. Install the O-ring (key 14) onto the seal carrier (key 13). Install the seal assembly into the plug. Hand force should only be required for proper installation.
5. Install the correct number of wave springs (key 11) followed by the scraper (key 10) into the plug over the seal assembly. For NPS 2x4 constructions, install two wave springs and for NPS 3x6, 4x8, 4x10, and 6x16 constructions, install one wave spring. Ensure the scraper fits freely into the plug. Check by pushing the scraper into the plug using both hands then letting go to see if it returns to its original position.
6. Lower the plug (key 2) into the body ensuring that the seal insert (key 12) and scraper (key 10) clear the bore of the body (key 1). When installed, the plug rests on top of the plug bushing (key 9).
7. Lubricate the tapered bearing cone and rollers (key 3) using a high temperature silicone grease (key 39) and install onto the plug.

## Bonnet (Key 19)

1. Lubricate and press fit the bearing cup (key 3) into the bonnet using a high temperature silicone grease (key 39). Lubricate the bearing cup and press fit it into the bonnet.
2. Install the backup ring (key 6), O-ring (key 5), and rod seal (key 4) into the bonnet bore. Rod seal is not required for NPS 2x4 or 3x6 CL300, 600, and 900 rated valves.
3. Install the bonnet O-ring (key 20) into the groove of the bonnet. For NPS 4x8, 4x10, and 6x16 constructions, install the backup ring above this O-ring.
4. Install the wiper seal (key 24), lube fitting (key 28), and vent plug (key 27). For NPS 4x10 and 6x16 constructions, install the wiper seal on an external wiper retainer (key 24) with two extra O-rings (key 25 and 26).
5. Using two eye bolts threaded into the jack screw holes found on the bonnet, slowly lower the bonnet onto the body. Be careful not to damage any soft parts when feeding the plug through the bonnet. The bonnet has been properly positioned onto the body when the following has been achieved:

- The bolt holes in the bonnet have been aligned with the stud holes in the body.
- The centerline of the bonnet vent port has been aligned with the centerline of the group outlet of the body.

Excessive force should not be required to properly seat the bonnet onto the body. For NPS 2x4, 3x6, and 4x8 constructions, use hoist rings or eye bolts with 1/2 UNC threads. For NPS 3x6 CL1500, 4x10, and 6x16 constructions, use hoist rings or eye bolts with 3/4 UNC threads.

6. Lubricate studs (key 31) with an anti-seize lubricant (key 40) and thread into valve body (key 1). Place the appropriate number of lifting lugs (key 33) over these studs. The placement of these lifting lugs should be equally spaced with one being located directly above the group outlet. The placement of these lifting lugs is as follows:
  - For NPS 2x4, 3x6, 4x8, and 4x10 constructions, place two lifting lugs equally spaced with one being located directly above the group outlet port.
  - For NPS 6x16 CL300, 600, and 900 constructions, place three lifting lugs equally spaced with two of them straddling the group outlet port.
  - For NPS 6x16 CL1500 constructions, place four lifting lugs equally spaced with two of them straddling the group outlet port.
7. Lubricate the threads and the bottom surface of the nuts (key 32) with an anti-seize lubricant (key 40) paste prior to threading them on to the studs (key 31). Once all nuts have been threaded hand tight, tighten two nuts spaced 180-degrees apart to the recommended torque values per table 6. Rotate the plug (key 2) one complete revolution to ensure that it rotates with minimal resistance. If the plug rotates smoothly, then proceed to tighten the remaining nuts using an appropriate tightening pattern.
8. Using the lube fitting (key 28), fill the bearing bore with grease.

**Table 6. Bonnet Bolting Torque**

VALVE SIZE, NPS	ASME CLASS RATING	STUD SIZE		TORQUE	
		mm	Inch	N•m	ft•lbf
2 x 4	300	25.4	1	217	160
	600				
	900				
3 x 6	150	31.8	1-1/4	441	325
	300				
	600				
3 x 6	900	38.1	1-1/2	814	600
	1500				
4 x 8	300	34.9	1-3/8	651	480
	600				
	900				
4 x 10	1500	44.5	1-3/4	1356	1000
6 x 16	300	41.3	1-5/8	1085	800
	600				
	900				
6 x 16	900	50.8	2	2034	1500
	1500				
6 x 16	900	63.5	2-1/2	4203	3100
	1500				

## Plug Seal Adjustment

1. Prior to adjusting the seal assembly (key 12 and 13), align the plug (key 2) with an open inlet port and insert the supplied adjustment tool. Once this tool has been secured to the seal adjuster (key 18), rotate this tool counter clockwise until the scraper (key 10) touches the inside surface of the body (key 1). The resistance to rotate the adjustment tool will increase once the scraper contacts the body. Remove the adjustment tool.
2. Rotate the plug (key 2) a few revolutions to check for binding or excessive turning torque. If the plug rotates smoothly, then insert, secure, and rotate the adjustment tool counter clockwise to tighten the seal adjuster (key 18) to the appropriate torque value listed in table 7.

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### Note

Do not exceed the torque values listed in table 7. Exceeding these values may cause the valve to not function as intended.

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**Table 7. Plug Seal Torque**

VALVE SIZE, NPS	ASME CLASS RATING	TORQUE	
		N•m	ft•lbs
2 x 4	300	41	30
	600		
	900		
3 x 6	150	48	35
	300		
	600		
3 x 6	900	41	30
	1500		
4 x 8	300	54	40
	600		
	900		
4 x 10	1500	54	40
6 x 16	300	95	70
	600		
	900		
6 x 16	900	95	70
	1500		

3. Rotate the plug (key 2) a few revolutions while checking for smooth movement. If the seal assembly is binding during rotation, then the seal assembly or the wave springs (key 17) are not in their proper position(s). See disassembly procedure, if required.
4. Install the appropriate amount of pipe plugs (key 27).
5. Perform any required functionality test(s).

## Troubleshooting

### Actuator Does Not Align Plug to Inlet Port

1. Check the shaft coupler for looseness.
2. Check the motor for stalling or overload.
3. Check the visual leakage or noisy gear.
4. Refer to the Multiport Electric Actuator (MPA) O&M Manual — Supplied by Bettis ([MPA-400-0711](#)) for port calibration procedures and troubleshooting.

### Seal Leakage

1. Check the travel indicator plate (key 53) and travel indicator pin (key 50) to ensure the plug (key 2) is properly aligned with the inlet ports.
2. Check the seal insert (key 12) for damage. To visually inspect the seal insert, the blind flange from an unused inlet port needs to be removed. Prior to removing this flange, verify the Multiport Flow Selector valve has been depressurized to a value of zero. With the blind flange removed, rotate the plug until visual inspection of the seal insert can occur. The sealing surface of the seal insert should be smooth, completely intact, and free of deep groove marks.

#### **⚠ WARNING**

**Ensure that all pressures in the Multiport body, group outlet, and test port are ZERO before visually checking the seal.**

3. If more information is required, please contact your [Emerson sales office](#).

Figure 2. Multiport Drawing Assembly

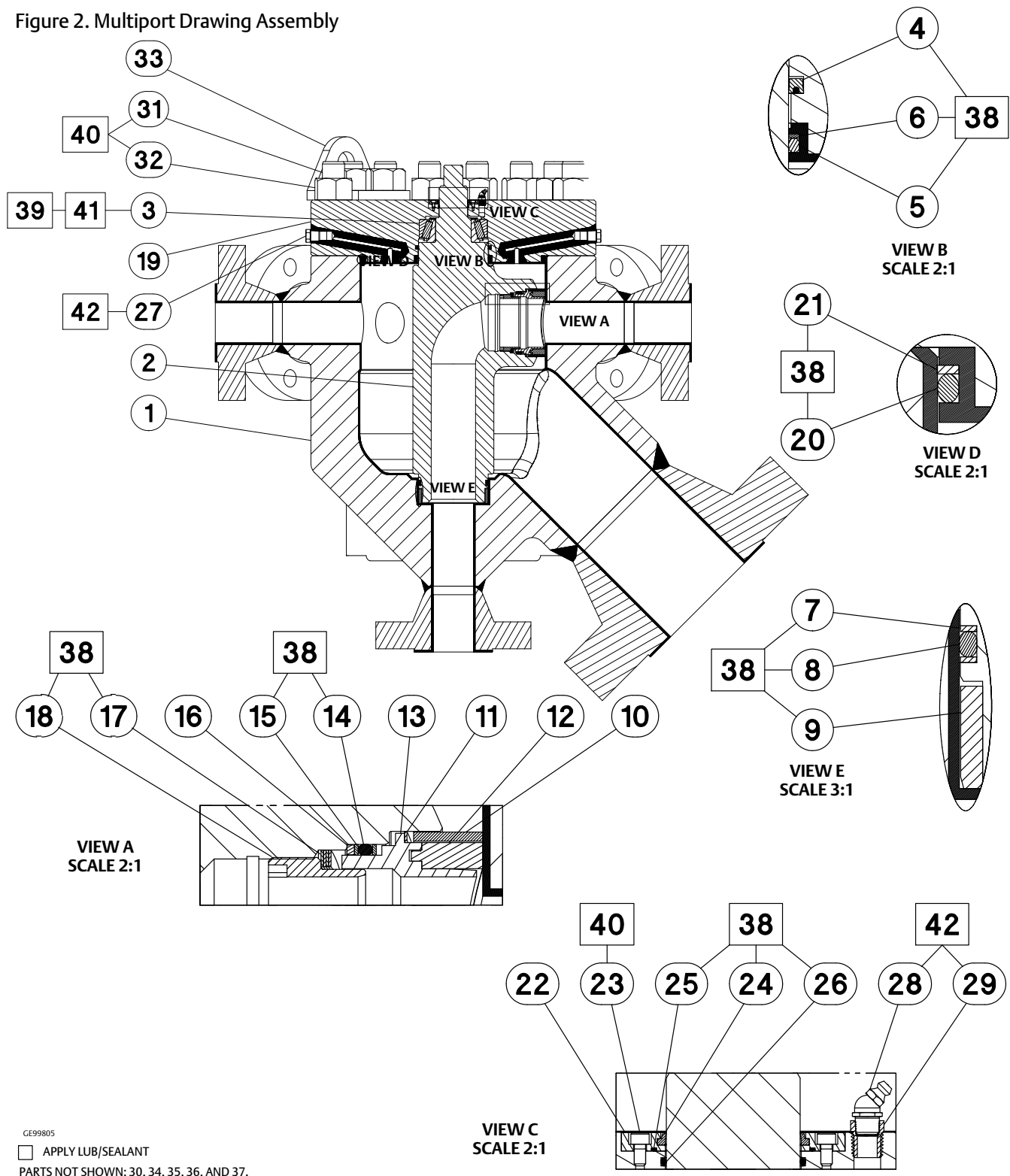
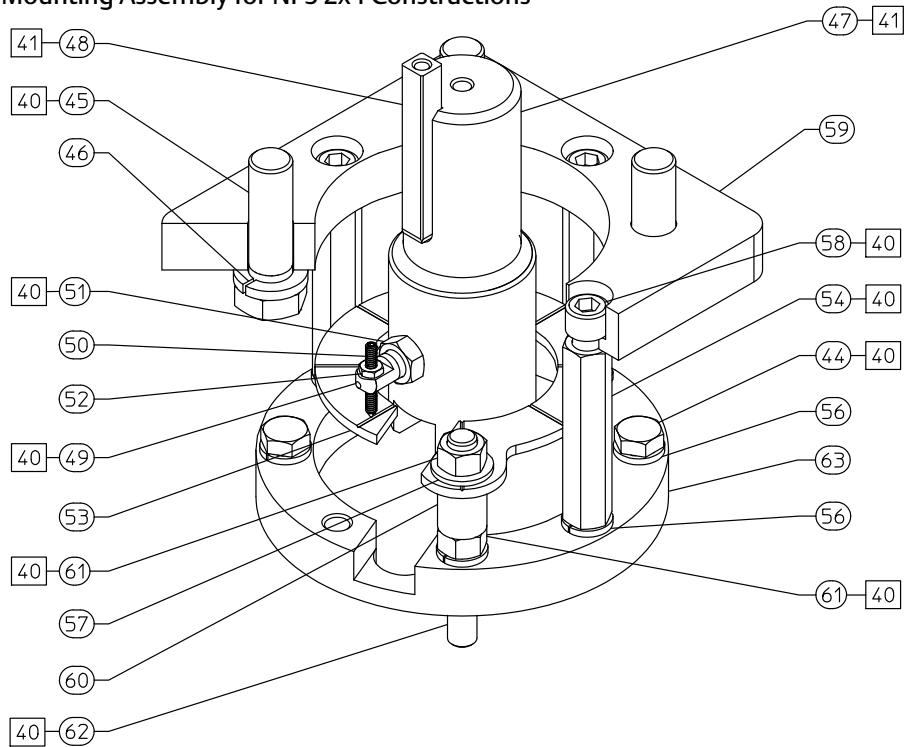
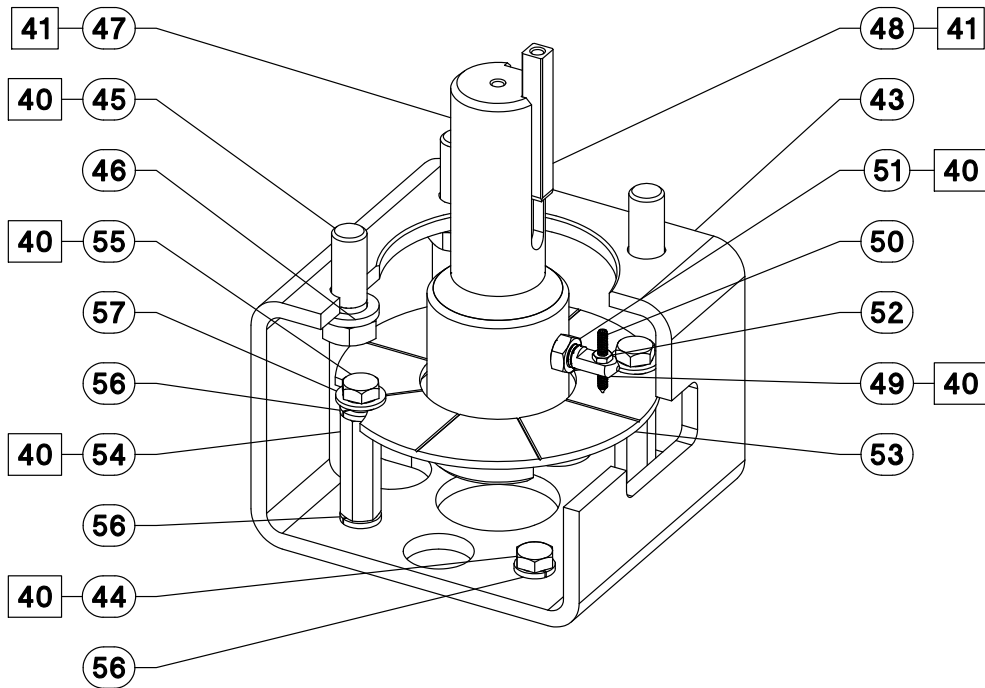


Figure 3. Multiport Mounting Assembly for NPS 2x4 Constructions



GE99891

Figure 4. Multiport Mounting Assembly for NPS 3x6, 4x8, and 6x16 Constructions



GE99891

## Parts Kits

### Seal Kits

DESCRIPTION	PART NUMBER
MINOR REPAIR KIT, 316 FOR 2X4 MPFS	RMPFS20409X072
MINOR REPAIR KIT, AFLAS FOR 2X4 MPFS	RMPFS20409X052
MINOR REPAIR KIT, AFLAS/FLEXISEAL FOR 2X4 MPFS	RMPFS20409X062
MAJOR REPAIR KIT, 316 FOR 2X4 MPFS	RMPFS20409X082
MAJOR REPAIR KIT, AFLAS FOR 2X4 MPFS	RMPFS20409X012
HIGH DIFFERENTIAL PLUG UPGRADE, AFLAS/FLEXISEAL FOR 2X4 MPFS	RMPFS20409X042
MINOR REPAIR KIT, 316 FOR 3X6 MPFS	RMPFS30609X102
MINOR REPAIR KIT, AFLAS FOR 3X6 MPFS	RMPFS30609X082
MINOR REPAIR KIT, AFLAS/KALREZ FOR 3X6 MPFS	RMPFS30609X092
MINOR REPAIR KIT, AFLAS/25CFT/DSS FOR 3X6 MPFS	RMPFS30609X022
MINOR REPAIR KIT, AFLAS/25CFT/825 FOR 3X6 MPFS	RMPFS30609X112
MAJOR REPAIR KIT, 316 FOR 3X6 MPFS	RMPFS30609X132
MAJOR REPAIR KIT, AFLAS FOR 3X6 MPFS	RMPFS30609X042
MAJOR REPAIR KIT, AFLAS/25CFT/DSS FOR 3X6 MPFS	RMPFS30609X032
MAJOR REPAIR KIT, AFLAS/25CFT/825 FOR 3X6 MPFS	RMPFS30609X122
HIGH DIFFERENTIAL PLUG UPGRADE, AFLAS FOR 3X6 MPFS	RMPFS30609X062
MINOR REPAIR KIT, 316 FOR 4X8 MPFS	RMPFS40809X112
MINOR REPAIR KIT, AFLAS/VITON FOR 4X8 MPFS	RMPFS40809X102
MINOR REPAIR KIT, 718 FOR 4X8 MPFS	RMPFS40809X022
MINOR REPAIR KIT, AFLAS/25CFT/825 FOR 4X8 MPFS	RMPFS40809X032
MINOR REPAIR KIT, AFLAS/25CFT/SDS FOR 4X8 MPFS	RMPFS40809X132
MAJOR REPAIR KIT, 316 FOR 4X8 MPFS	RMPFS40809X122
MAJOR REPAIR KIT, AFLAS FOR 4X8 MPFS	RMPFS40809X072
MAJOR REPAIR KIT, 4X8 MPFS	RMPFS40809X082
MAJOR REPAIR KIT, AFLAS/25CFT/DSS FOR 4X8 MPFS	RMPFS40809X042
MAJOR REPAIR KIT, AFLAS/25CFT/718 FOR 4X8 MPFS	RMPFS40809X052
MAJOR REPAIR KIT, AFLAS/25CFT/825 FOR 4X8 MPFS	RMPFS40809X062
MAJOR REPAIR KIT, AFLAS/25CFT/SDS FOR 4X8 MPFS	RMPFS40809X142
HIGH DIFFERENTIAL PLUG UPGRADE, AFLAS FOR 4X8 MPFS	RMPFS40809X092

### Adjustment Tool Kits

DESCRIPTION	PART NUMBER
ADJUSTMENT TOOL 2x4 CL 300, 600, and 900	RMP20409X012
ADJUSTMENT TOOL 3x6 CL 150, 300, 600, and 900	RMP30609X012
ADJUSTMENT TOOL 3x6 CL 1500	RMP30615X012
ADJUSTMENT TOOL 4x8 CL 300, 600, and 900	RMP41015X012
ADJUSTMENT TOOL 4x10 CL 1500	RMP41015X012
ADJUSTMENT TOOL 6x16 CL 300, 600, and 900	RMP61609X012
ADJUSTMENT TOOL 6x16 CL 1500	RMP61625X012

# Parts List

## **⚠ WARNING**

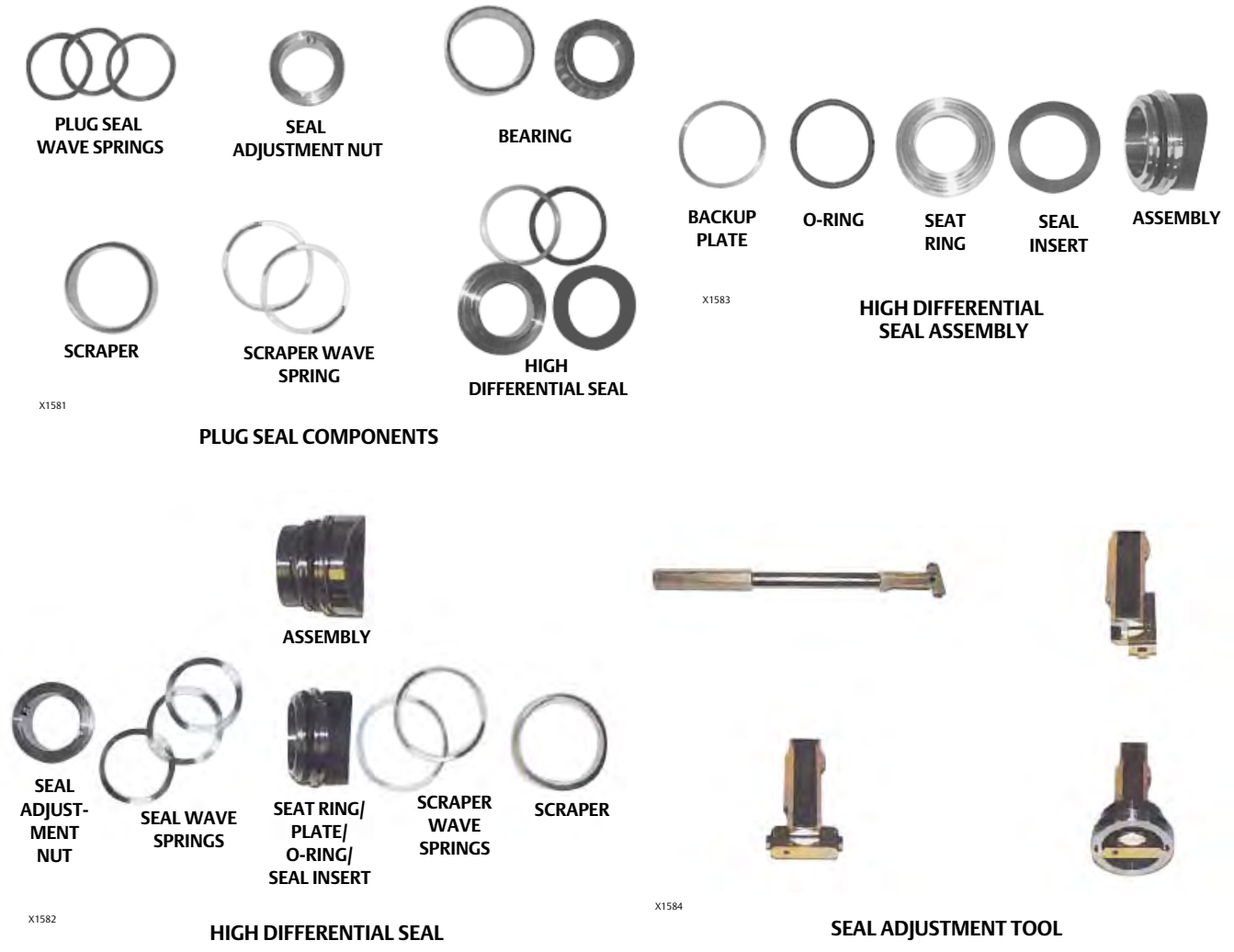
Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

**Note**  
Contact your [Emerson sales office](#) for part ordering information.

## Multiport Assembly (see figure 2 and 3)

Key	Description	Key	Description
1	Valve Body	25	O-Ring, Wiper Retainer
2	Plug	26	O-Ring, Shaft
3	Bearing	27	Pipe Plug
4	Rod Seal	28	Lube Fitting
5	O-Ring, upper plug	29	Pipe Bushing
6	Back up Ring, upper plug	30	Set Screw
7	O-Ring, lower plug	31	Stud
8	Back up Ring, lower plug	32	Nut
9	Plug Bushing	33	Lifting Lug
10	Scraper	38	White Petrolatum
11	Wave Spring Scraper	39	High temperature silicone grease
12	Seal Insert	40	Anti-seize lubricant
13	Seal Carrier	41	Grease
14	O-Ring	42	Thread sealant paste
15	Back up Ring	43	Mounting Bracket
16	Back up Plate	44	Cap Screw
17	Wave Spring	45	Cap Screw
18	Seal Adjuster	46	Lock Washer
19	Bonnet	47	Coupler
20	O-Ring	48	Key
21	Back up Ring	49	Travel Indicator Holder
22	Wiper Retainer	50	Travel Indicator Pointer
23	Cap Screw, Wiper Retainer	51	Jam Nut
24	Wiper Seal	52	Nut
		53	Travel Indicator Plate
		54	Travel Indicator Stud
		55	Cap Screw
		56	Lock Washer
		57	Washer
		58	Cap Screw
		59	Bracket, Upper
		60	Travel Indicator Spacer
		61	Nut
		62	Stud
		63	Bracket, Lower

Figure 5. Typical Multiport Seal Components



**NOTE:**

1 PLUG SEAL ADJUSTMENT TOOL SHOWN WITH BASE PARALLEL TO SHANK FOR INSERTION, BASE PERPENDICULAR TO SHANK, AND ENGAGED IN SEAL ADJUSTMENT NUT.



Figure 6. Typical Multiport Seal Components



E-60681009

**NOTE:**

1 PLUG (INDEX MARK CAN BE FOUND ON THE STEM FLAT THAT FACES THE SAME WAY AS THE PLUG SEAL OPENING.) PLUG SEAL ADJUSTMENT TOOL IN PLUG.

# Recommended Periodic Multiport Maintenance Checklist Procedure

## Half Yearly Check

1. Check the plug port position in the Local Display Module (LDM) and the mechanical indicator respectively and in remote feedback.
2. Check the plug travel sequence for smooth operation with local/remote.
3. Lubricate the bearing through the grease nipple with high temperature silicone grease.
4. Visual Inspection of Multiport Flow Selector (MPFS) valve.

## Annual Check

1. Visual Inspection of MSV.
2. Lubricate the bearing through the grease nipple with high temperature silicone grease.
3. Check the seal torque (refer chart) and seal visual condition.
4. Check the plug position in LDM and the mechanical indicator respectively and in remote feedback.
5. Check the plug travel sequence for smooth operation with local / remote.
6. Check mechanical operation (using manual override).
7. Check electrical connections of Multiport Actuator (MPA) (power and communication port).
8. Check the Torque Encoder and Position Encoder.
9. Visual check of shaft penetrations for lubrication leakage.
10. Inspect stem nut or bushing for wear / damage of Multiport Actuator.
11. Run online seal integrity test.

## Visual Seal Inspection

1. Local Shutdown should be take by end user to isolate the Multiport valve.
2. Check the plug alignment visually at home port (blind flange open condition).
3. If the seal visual inspection and seal torque are deemed acceptable, then assemble the home flange and run on line seal integrity test.

## General

1. It is recommended to operate the Multiport, once in three weeks, at least one full rotation, if there is no well testing. Not recommended to keep Multiport idle for more than 3 to 4 weeks.
2. Recommended to replace the seat ring (complete Seal Kit Assembly) and all the soft seals every 5 years.

# Multiport Actuator

## O&M Manual – Supplied by Bettis

Document No. MPS-400-0711

### **⚠ WARNING**

Use caution when working on, with, or around valves and actuators. High pressures, forces, voltages, and flammable media can be present.

Read this manual in its entirety before installing, operating, or performing maintenance on the MPA valve actuator.

Failure to follow instructions for proper electrical wiring, storage, setup, and maintenance may cause serious injury, damage equipment, or void the warranty. Refer to Manual E796 for instructions on storage, electrical hook-up, and maintenance.

Ensure that the installation is carried out in accordance with EN 60079-14 and IEC 60079-14.

Regulatory information:

II 2 GD



EEx d IIB T4 or EEx d IIB 120° C (T4) Tamb -20° C to +60° C

Revision M

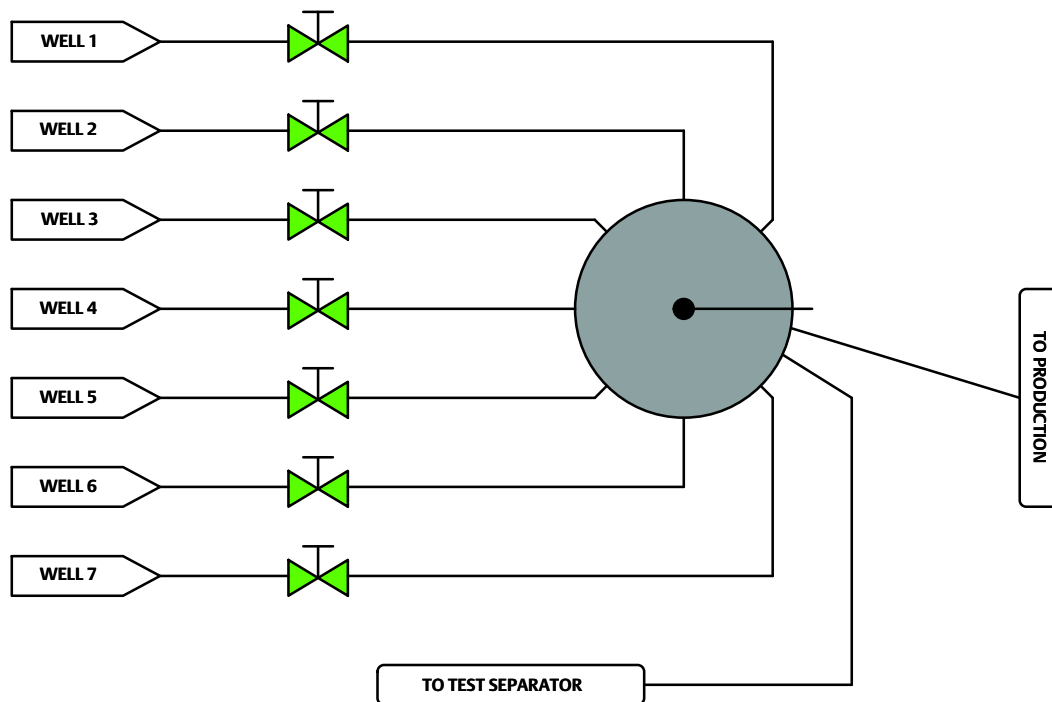
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## Introduction

The Multiport Actuator (MPA) is a Bettis single turn actuator for control of Multiport Flow Selectors (MPFS) with 3 to 8 ports. A typical application is oil or gas well selection for well production testing as shown in figure 1. Typically the MPA is the actuator of a Multiport Flow Selector as shown in figure 2. There are applications in other processes where control of Multiport valves is required.

Figure 1. Typical Well Test Application

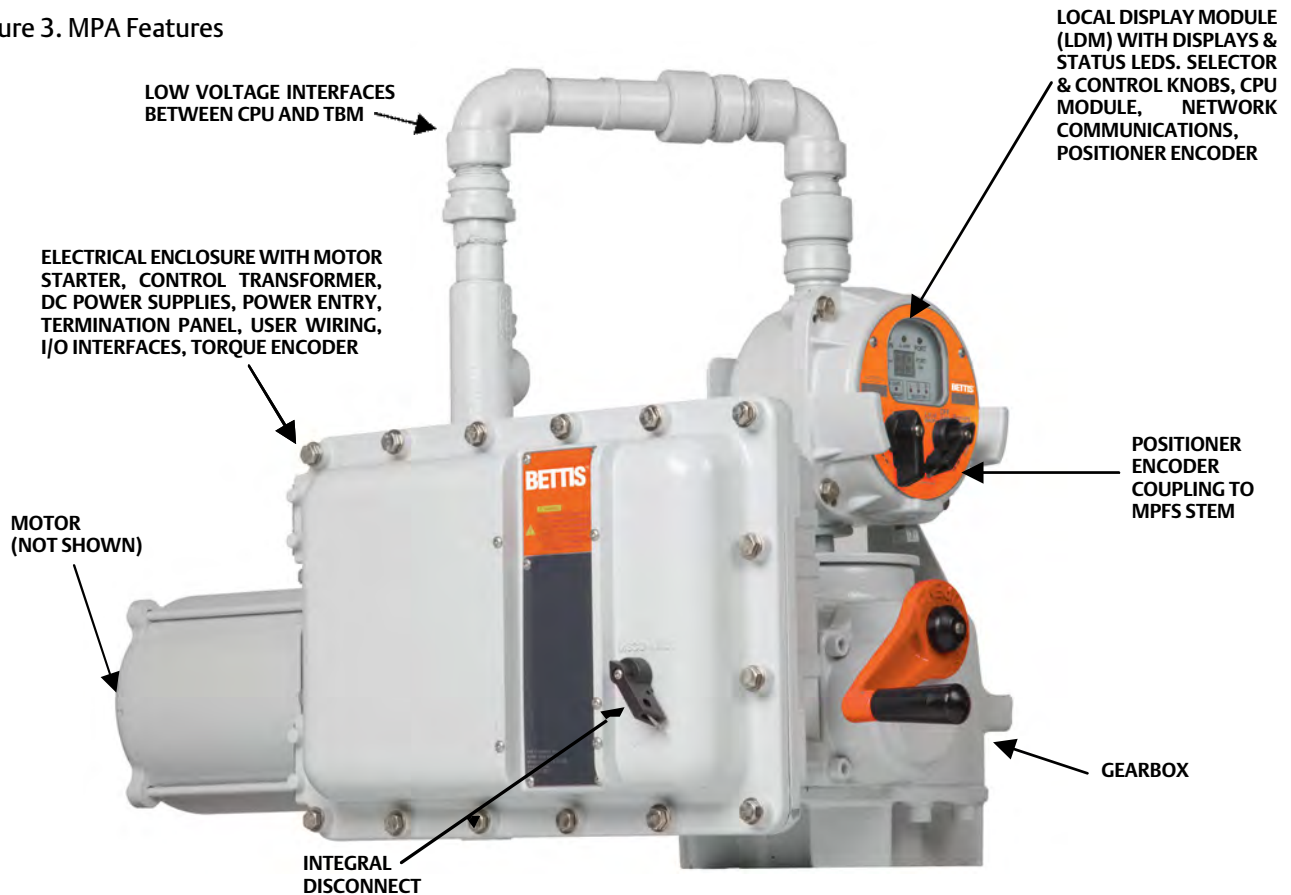




## Features

The actuator features several assemblies as shown in figure 3. Unique features of the actuator are listed below.

Figure 3. MPA Features



1. MPA uses Bettis's heavy duty gearbox with capacity of 3000 ft•lbs
  - a. Wide range of motors available for any voltage and torque
2. Configurable for Multiport flow selectors from 3 to 8 ports
  - a. Any port may be selected as home port and any port(s) may be skipped
  - b. Actuator calibrated at factory for exact match to alignment of flow selector ports
  - c. Calibration parameters stored in nonvolatile memory and available to DCS
3. 12-bit magnetic encoder coupled directly to valve stem for precision position feedback
  - a. Provides position measurement resolution of 0.088 degrees
4. Bettis's exclusive solid-state motor starter and control software provides precise positioning of flow selector within  $\pm 0.26$  degrees of selected port for the largest flow selector, and within  $\pm 0.79$  degrees for smallest flow selector, where accuracy is less of a concern because of reduced radius

5. High performance microcontroller updates motor control output every 4mS for precision motor control
6. 12-bit magnetic encoder coupled directly to torque pinion for torque feedback
  - a. Provides torque measurement resolution of 0.146% of full torque
7. MPA supports all network protocols available with all other Bettis actuators
  - ModbusRS485 Bus or E>Net ring available
  - Profibus Redundancy with Redcom
  - Foundation Fieldbus
  - DeviceNet
  - Ethernet Modbus TCP/IP
8. I/O and alarm monitoring include:
  - Integral circuit breaker/disconnect
  - Motor overload and motor thermal
  - Loss of control voltage
  - Encoder failure
  - Stall detection and alarming (detects mechanical faults)
  - 3-Phase monitoring and phase correction to insure correct motor rotation
  - ESD to send selector to home port (also goes to home port on fault)
  - Monitor relay for hardwired relay contact status on fault
9. Four models support five 8-port MPFS (Also see motor type on page 33)

**Table 1.**

MODEL	MPFS	CAPACITY		RPM			ACCURACY
		lb ft	Nm	1Ph	3Ph	DC	Degrees
MPA 150	2x4	150	203	1.0	1.0	1.0	0.79
MPA 650	3x6	650	881	0.7	1.0	0.5	0.49
MPA 800	4x8 and 4x10	800	1085	0.6	0.9	0.5	0.40
MPA 1500	6x16	1500	2034	0.3	0.4	0.3	0.26

Note: Accuracy based on worse case tests at 38% of maximum torque.

10. MPA includes local display module (LDM) standard
  - Uses rugged, high visibility LED display for port number, torque, and alarms (also displays setup menus and setup parameters)
  - Multiple color LEDs display
    - a. Port position within 1° of port



- b. Port position within 2° of port
  - c. Motor running
  - d. Alarm
  - e. Over torque
  - f. Position within 0.25° of home port
  - g. Local mode    >
  - h. Off mode     > Combined detection logic for two selector switches
  - i. Remote mode  >
- Display blanking user setup option to conserve power in idle mode
  - Includes Local Off Remote selector switch
  - Local control knob for Port selection and Jog control when enabled by User

Figure 4. Local Display Module (LDM)



11. Remote display module (RDM) option available
  - a. RDM displays identical information and performs identical control as LDM
  - b. Bettis's patented combined switch logic allows detection of selector switch position on LDM and RDM
  - c. Allows remote control up to 4,000 feet (1,220 meters) away
  - d. Alarming includes loss of communication with RDM

---

Figure 5. MPA with Remote Display Module (RDM)



---

## Mechanical and Electrical Installation

Do not connect power until you have gone through the following checklist:

1. Does the information given on the nameplate correspond with the application?
2. Have all wire terminations and the equipotential bonding system been connected correctly?
3. EEx d applications: are the cable entries, plugs and adaptors EEx d approved?
4. Are all cable entries of the correct internal diameter providing a good seal around the cable?
5. Do the ambient and process temperatures correspond to the ratings on the nameplate as shown below?

## Wiring

All user wiring terminations are made inside the Electrical Enclosure shown in figure 3. Refer to wiring diagram located at the back of this manual for wiring connections. High voltage power connections are made to the disconnect/circuit breaker located inside the electrical enclosure. All low voltage connections, including network wiring, are made to the Termination Board Module (TBM) located inside the electrical enclosure. Use conduit and seals in accordance with National Electric Code (NEC) and local codes for all wiring entering the electrical enclosure.

## Power Wiring

Connect power voltage leads to the circuit breaker located in the main electrical enclosure. Power wires must enter the electrical enclosure at the conduit entry on the lower right side of the enclosure to prevent water from entering. The controller provides automatic phase correction in case three-phase power is connected in the wrong phase rotation.

## Network Wiring

If a single bus network connection, such as Foundation Fieldbus, is being made, connect to Network Port A at TBM terminals 24 (-) and 25 (+). If the cable is shielded, connect shield to TBM terminal 23. If redundant or repeater network connections such as Bettis E>Net are being made, connect the second network to Network Port B at TBM terminals 23 (+) and 24 (-). Connect cable shield of Port B to TBM terminal 25. Cable shields are isolated from earth in the actuator. Connect shields to only one earth ground point in the network, normally the host location.

## Monitor Relay Wiring

The Monitor Relay is used for hardwiring an indication of availability of the actuator for remote control. When the selector switch is placed in the Remote mode and if there are no alarms present that prevent operation, the Monitor Relay is energized. If an alarm occurs or the selector switch is moved from the Remote position, the relay is deenergized. The Monitor Relay is a Form C relay with both normally open (N.O.) and normally closed (N.C.) contacts. Wire to either TBM terminals 31 and 32 if N.O. contacts are desired. Wire to TBM terminals 32 and 33 if N.C. contacts are desired. The relay is shown on the wiring diagram in the deenergized state, meaning that the actuator is not available for remote control.

## Local ESD Wiring (Emergency Shutdown)

Remove jumper between TBM terminals 27 and 28. Connect Normally Closed (N.C.) dry contacts to terminals 27 and 28. When the contacts open, ESD is activated, causing the actuator to go to Home Port. The actuator will remain at the Home Port until the ESD contacts are closed and a new command is received from either Local or Remote control. The ESD circuit is a closed loop failsafe circuit. If the circuit is opened for any reason, broken wire, bad contact, 24VDC power supply failure, etc., the ESD function is activated. The closed loop circuit is powered by 24VDC from the actuator.

## Optional Remote Display Module (RDM) Wiring

Connect twisted pair RS485 cable from the RDM to TBM terminals 18 (-) and 19 (+). If the RDM is being powered from the actuator 12VDC supply, wire the power wires from the RDM to TBM terminals 16 (-) and 17 (+). The RDM is polarity protected, preventing damage, but will not operate if polarity is reversed.

## Local Display Module

Contains microprocessor controller, position encoder, and network interface. This is the main controller used to setup and operate the actuator.

This module displays operating parameters, port position, torque, and alarms. It also provides a means to configure the actuator by using the local controls.

To use the Local Control and Selector:

---

### Note

Actuator moves in only the counterclockwise position.

---

Figure 6. Local Control and Selector



SELECTOR KNOB (right)	ROTATE	FUNCTION	RESULTS
OFF (Stop)	[return position]	Stop movement	Prevents motor operation
REMOTE (Auto)	Clockwise	Remote control	Allows control from remote location
LOCAL (Hand)	Counter-clockwise	Hand Operation	Allows Control from the local control knob or the control knob of the RDM, if connected.
SELECTOR KNOB (left) (while selector is in LOCAL (hand)mode)	ROTATE	FUNCTION	RESULTS
Spring return	Neutral position	No operation	Releases a local command when Local control is used
PORT (up)	Clockwise	Local command to go to next port	Commands actuator to move to the next port. Momentary knob control
Jog (dn)	Counter-clockwise	Local command to micro-step	Commands actuator to move only while knob is being held , i.e. maintained knob control.

## Operation

Place the “Selector Knob” in the desired operating position –

LOCAL – hands on operation at the actuator by manipulation of Control Knob.

REMOTE – used within the context of plant operation, i.e. Remote Control Panel, PLC, DCS, etc. See wiring diagram for typical user wiring for remote control.

OFF (Stop) – to prevent local or remote operation.

Figure 7.



## Local Operation

Place the “Selector Knob” in the “Local” position. If a remote display is connected, the remote selector switch must not be in the “Off” position. Verify that the selector “L” amber light is on. The actuator may now be operated using the port and jog Control Knobs. Jog control is normally disabled and must be enabled in the setup menu.

To jog or micro-step the actuator toward the next port, rotate the control knob in the counterclockwise direction. Jog to position and release when the desired position is reached. When using jog for calibrating the actuator, always stop short of the desired port and use the hand wheel to complete accurate positioning to center of the port.

To move only to the next port, momentarily rotate the control knob in the clockwise direction to the Port position and release.

To Stop or prevent actuator movement, move Selector knob to the OFF (Stop) position.

## Operational Display

Operational indicators for RUN / ALARM / PORT position use long lasting LED’s. Run torque and port position are shown on the digital readout during normal operation. Torque in percent of maximum is displayed as a 2-digit number only while the motor is running. Port position is displayed as a single digit when the motor stops. If the actuator stops between two ports, the two corresponding port numbers will alternate. Torque less than 10% is displayed as 0%.

RUN LED flashes Green while the actuator is moving to the next port and flashes Red while running within 2° of the selected port position.

PORT LED flashes Green when the actuator is within 2° and outside 1° prior to the setpoint of the selected port. The port LED flashes Red when within 2° and outside 1° beyond the setpoint. The port LED illuminates steady Green while within 1° of the selected port position.

ALARM (Yellow) LED flashes when any alarm is present. The LED is on solid when stopped between ports, otherwise it is off.

OVER TORQUE alarm condition is indicated when a torque alarm occurs in mid-travel. The over torque LED will flash so long as the over torque condition exists.

HOME PORT LED will light when the actuator is within 0.25° of the user selected Home Port position.

Selector switch LEDs are also made available for operational use in the bottom right corner. The selector LEDs are important when using a Remote Display Module (RDM) because these LEDs indicate the combined logic of the two selector switches, i.e. the selected mode of operation of the actuator. All three LOR LEDs flash while the actuator is in setup mode.

## Display Blanking

The user has the option to have the display blank out (turn off) when not in use. This is a very important feature for solar power applications because power consumption is minimized. Option to enable or disable display blanking timeout is available by setup using MPA Config or the control knobs. See the field setup section for selecting the option. When control knobs are used for setup, the parameter is C9 as shown in the table on page 38. The default setting is display blanking timeout enabled for 24VDC versions and disabled for AC versions. If display blanking is enabled, the display will blank out after 60 seconds when left unattended while the selector switch is in Remote mode. The display will blank out after 3 minutes when left unattended while the selector switch is in Local mode. The display will not blank out while in setup mode. When selected, display blanking applies to both local (LDM) and remote (RDM) displays.

## Alarms Display

When an alarm occurs, it is automatically displayed by the two character LED display. The yellow ALARM LED will flash while any alarm is present. The display will alternate between the current port position and the active alarm(s) except when stopped between parts. If more than one alarm is active, the display will cycle through a sequence of Port Position, newest alarm, Port Position, next oldest alarm and so on until all active alarms are displayed. The cycle is continuously repeated until all alarms are cleared. Each alarm is recorded in an Alarm History. The alarm history may be viewed by entering setup mode (see next section).

All possible alarms that may be displayed are listed on the name plate of the Local Display Module (LDM). Following are definitions of the listed alarms.

CE	Communication Error	Lost communication with the Remote Display Module (RDM) when configured.
SA	Stall Alarm	Actuator failed to move within 8 seconds after commanded by either local or remote controls.
LE	Local ESD	Hardwired Local Emergency Shut Down is active.
PH	Phase Alarm	Loss of one phase when configured for 3-Phase.
EF	Encoder Failed	Failure of either the position or torque encoders.
AF	Actuator Failed	A fault is detected by hardware electronics fault monitor. This is a non-recoverable condition that requires actuator service.
OL	Motor Overload	Motor thermals or motor overload relay has tripped.
LC	Lost Control Voltage	Loss of power to the motor control circuits. The control voltage supply has an automatic resetting fuse.

---

### Note

Over torque alarm is displayed by dedicated LED. See Operational Display section above.

---

## Field Setup Using DCMLink Software

DCMLink is an application for configuration, calibration, test, and operation of the MPA DCMLink is a licensed product. It is a Windows-based program. Compatible Windows Operating Systems are listed in the DCMLink IOM, DCM-402-0317.

Connection to the MPA to utilize DCMLink requires a RS485 link. The MPA supports several network protocols so it may be necessary to use a USB to RS485 converter for connection of a PC to the RDM port of the actuator. RDM port is at TBM terminals 18 (-) and 19 (+). DCMLink Software loaded to a laptop or other compatible PC device can connect the RS485 link to the TBM in the electrical enclosure. If opening the enclosure is undesirable, configuration may be performed using the local control knobs of the actuator as described in the next section of this manual. If the system is configured for Modbus networking, the PC may be connected to the local area network at any location in the network after disconnecting the Host system communication. The MPFS factory uses this software to configure and calibrate the MPA and saves the configuration to a “.mpa” file by MPFS serial number. Should loss of factory configuration or port calibration occur due to failure of a CPU module or user error, a copy of the file may be obtained from the MPFS factory and loaded to the actuator using DCMLink program.

## DCMLink SetUp

HELP: Clicking the Menu Bar Help Tab button at the top of the screen will open linked documents or information. Passing the cursor across the Icons or Navigation Pane tabs will cause a description of that item to be displayed.

To setup communication and DCMLink Display Preferences, select the DCMLink Setup Tab in the Menu Bar as shown in figures 8b and 8c. To configure the network communication link select the Communication Tab in Preferences per figure 9.

Figure 8a.

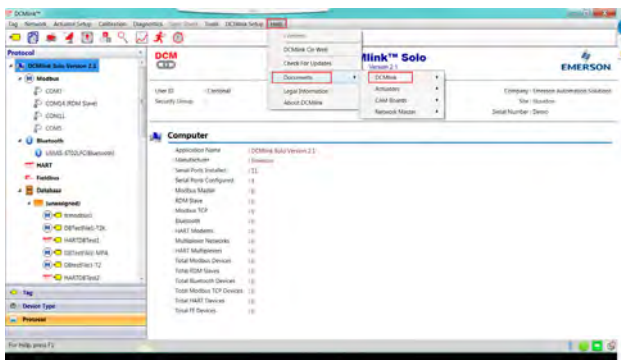


Figure 8c.

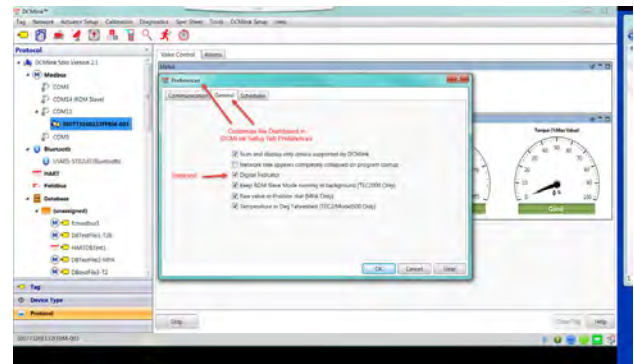
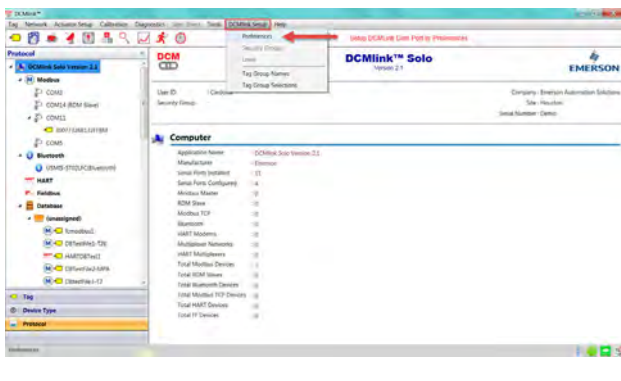


Figure 8b.



## Communications Setup

If connected to the RDM port, set the computer Baud Rate to 9600, Parity None and Stop Bits to 1. Set the Slave Address to 99. The RDM port configuration of the MPA is fixed at 9600,N,8,1 and may not be changed by the user.

If connected to a Modbus local area network, the baud rate and slave address configured for the actuator must be known in order to setup the computer communication port. Default configuration for the MPA network port is 19,200 baud and default address is 99.

Select the configured Com Port in Navigation Pane and Right Click to Scan for Devices. Set address and Start Scan. When device is detected stop scan and close the window .

Figure 9.

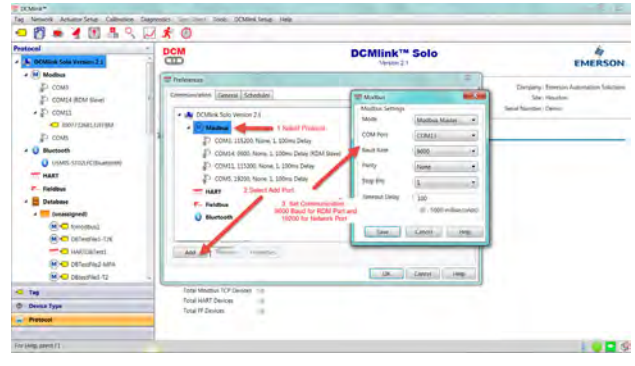


Figure 10.

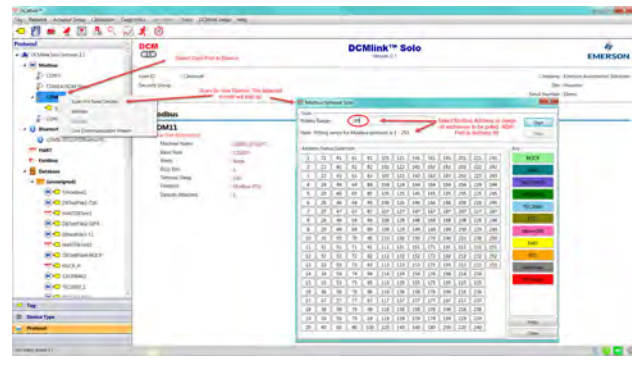
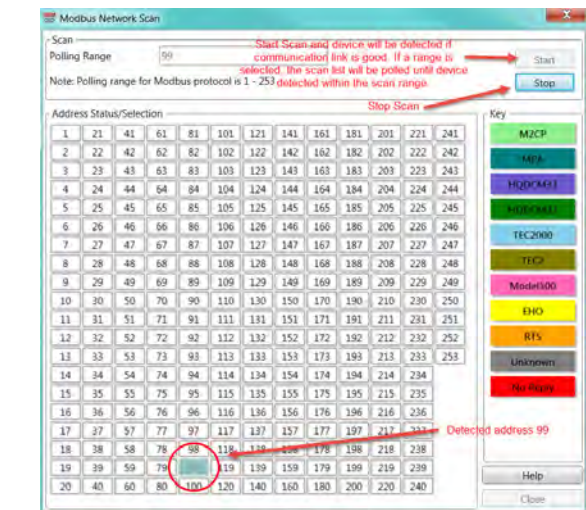


Figure 11.





## User Setup Menus

To configure the actuator, select (highlight) the Device Tag in the Navigation Pane per figure 12. Then Right Click or use the Icon in the Menu Bar to select Detailed Setup as shown in figure 13. The current Actuator configuration and the default MPA settings or opened Dataset settings are displayed. A Dataset is a file on DCMLink based on the Device type and Displayed Device Tag. A yellow Tab indicates there are differences between the displayed Actuator configuration and the displayed Dataset. Configuration can be changed between the Actuator and the Dataset and the actuator Configuration File and Dataset can be saved to the PC. No passcode is required to change User Configuration Settings (Detailed Setup & Home Port Calibration) when using DCMLink.

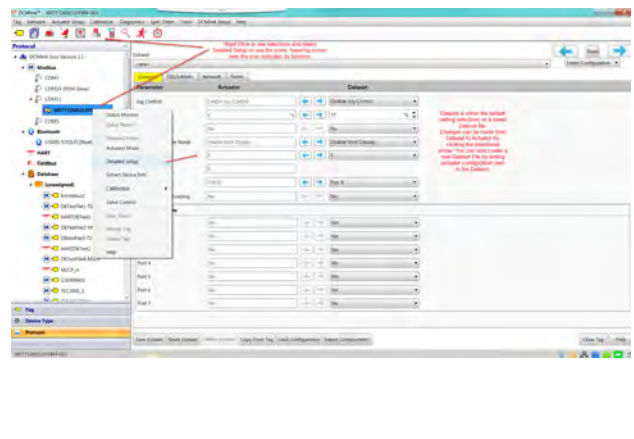
The Network Tab allows changes in configuration only for the network ports. It does not affect the RDM port. The Control Tab allows unused/unconnected Ports of the MPFS to be bypassed. If a pipeline is not connected to any one or more ports, or if it is desirable to skip any one or more ports, click on the “Delete Port” number. The deleted ports will be skipped when a next port command is issued in either local or remote control modes.

Notice: When configuration changes are made, clicking the Blue arrows “Writes” the configuration to the Actuator or Dataset. If there are no differences between the Actuator and Dataset, the arrows will be grey. Using the dropdown box arrow of the Dataset allows for parameter change selections to be made. The “Read” button may be used to refresh the screen to verify the parameters have been properly written for storage in the actuator. You can read or write entire configuration or just the opened page using the Arrows or tab in upper right hand of the page. Values are written to EEPROM when the Setup page or Device Tag is closed. On the MPA LDM, within several seconds of writing the configuration, the 3 LOR LEDs will simultaneously flash slowly. This slow flash is a signal that all new values were successfully written to EEPROM.

Figure 12.



Figure 13.



## Selecting New Home Port

The user may select any port as the new “Home Port” in the field. When a new home port is selected, the new home port is identified as Port 0 or 8 and the MPA reassigns all other port numbers (1-7) in a counterclockwise sequence around the MPFS. The MPA recalculates the exact calibrated port position based on factory calibration values so no accuracy is lost.

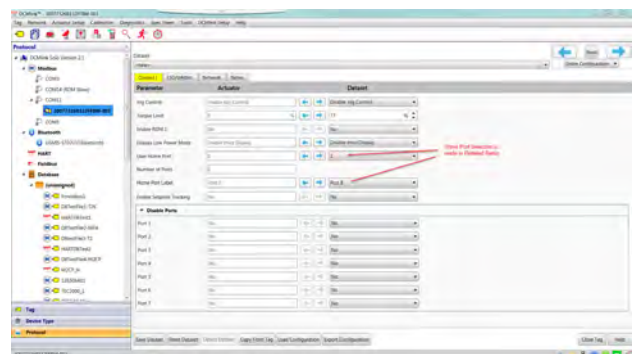
To select a new home port, click on the desired selection in Detailed Setup for User Home Port and Label (0 or 8) as shown in figure 14.

**Note**

When a new home port is selected, it must be a port without piping connected and must be fitted with a blind cover to allow for future seal inspection and visual port alignment. Selecting a new home port will cause the MPA to recalculate all calibration parameters based on the factory calibration and store the new values to EEPROM.

Home port may be identified as either Port 0 or Port 8. The desired designation may be selected by the CA configuration parameter as shown on page 38.

Figure 14.



## Home Port LED Function

The home port LED on the LDM will now identify the newly selected home port position. This LED is on when the actuator is within 0.25 degrees of the selected home port. When the blind cover of the home port is removed in the field to inspect the seals, the home zero may be verified and corrected if an error is detected.

## Home Port Calibration

If maintenance is performed on the actuator that can cause loss of calibration, the home port must be recalibrated. Examples of maintenance that affect calibration are removal of the actuator from the MPFS and replacement of the position encoder. If a MPA is removed from one MPFS and installed on another or if a CPU module is replaced, the factory configuration (.mpa) file for the MPFS must be loaded to the new actuator and the selected home port calibrated.

To calibrate the home port position, remove the blind cover from the selected home port. Use the hand wheel of the MPA to position the plug seal over the port as precisely as possible. Open DCMLink and connect to Device. Right click Device Tag or select Calibration button on the Menu Bar. Select the “Home Port Calibration” as shown in Figure 15. To avoid accidental setting of a new home port, the user is required to enter a passcode of 43 to gain access. A Pop-Up will appear as shown in figure 16 providing a warning and allow entry of the passcode. The Port Raw Value should be displayed in the Home Port Calibration Box. Select Calibrate Home Port and review the value before closing. The Home Port should be indicated on the MPA LDM as the MPA is aligned with the Home Port.

## Factory Settings

Factory Settings are only accessible by Factory Authorized Technicians with DCMLink License authorization. Factory Setup contains protected configuration items defining the application and motor control as well as the User Password and Port Calibration. These items are in the “.mpa” configuration file saved by the Factory and can be loaded to or saved from a PC during any service or CPU Replacement. See figure 17.

Factory Settings Items are displayed in figure 18.

Figure 15.

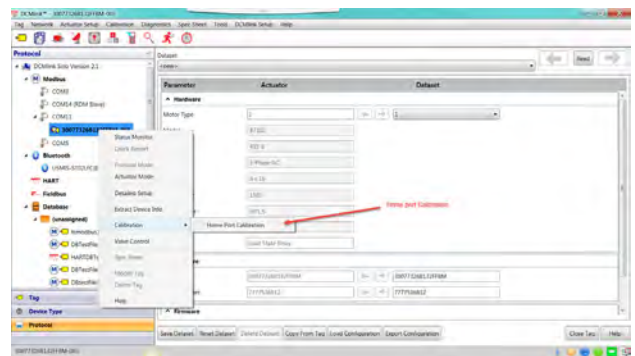


Figure 16.

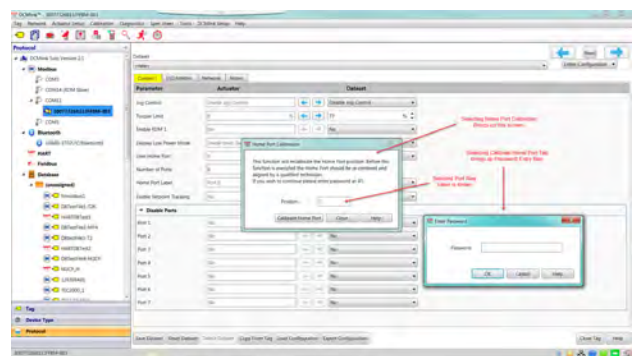
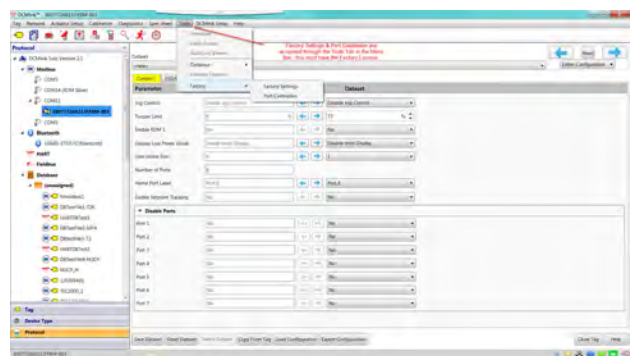


Figure 17.



# Factory Settings - Port Calibration

Port Calibrations are made by Factory Authorized Technicians through the Factory Menu only accessible by Factory Authorized Technicians with DCMLink License authorization.

Select Port Calibration from the Factory Menu Options. See figure 19.

For precise MPFS port alignment, the factory calibrates each actuator to each of the ports of the mated MPFS. These items are in the ".mpa" configuration file saved by the Factory and can be loaded to or saved from a PC during any service or CPU replacement.

The calibrated values are displayed on the Port Calibration screen and may be compared to the current position (Encoder Feedback) to determine accuracy. When a new home port is selected by the user, these calibration values are recalculated and stored to EEPROM. See figure 20.

Figure 18.

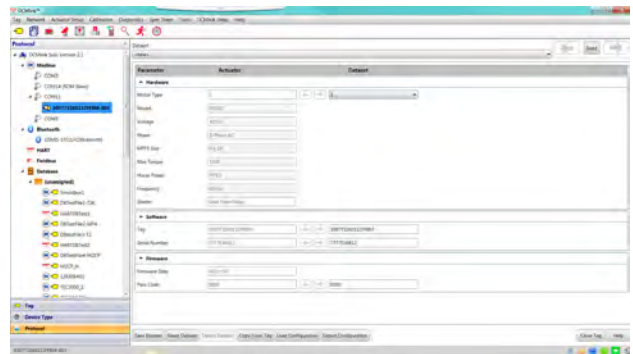


Figure 19.

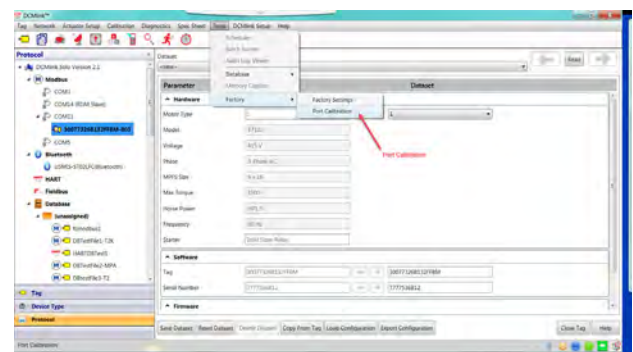
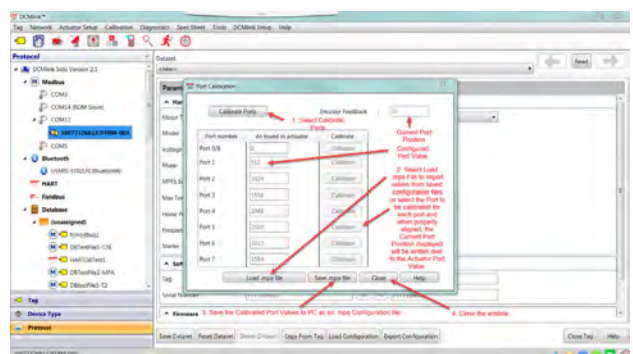


Figure 20.



## Motor Type

Motor Type is entered at the factory for the type of MPFS, power supply and motor horse power rating as shown in the table below. Motor type is displayed on the MPA Config Factory Setup Menu. If the motor type is changed, it is necessary to cycle power to the actuator after existing factory setup to ensure proper initialization.

Table 2. Motor Type

MPFS	Motor HP	1 Ph 115 VAC	1 Ph 230 VAC	3 Ph 220/230 VAC	3 Ph 380 VAC	3 Ph 415 VAC	3 Ph 460 VAC	3 Ph 575 VAC	24 VDC
2 x 4	1/12	2	6	10	14	18	22	26	---
2 x 4	1/6	---	---	---	---	---	---	---	30
3 x 6	1/6	3	7	11	15	19	23	27	31
4 x 8/ 4 x 10	1/6	4	8	12	16	20	24	28	32
6 x 16	1/6	5	9	13	17	21	25	29	33

### Note

The user is not required to select motor type unless qualified to download firmware upgrade to the MPA. If a new HEX file for firmware upgrade is loaded to the MPA in the field, the motor type must be configured before the actuator will operate. When power is first applied to the MPA after a firmware upgrade, in order to know how to initialize the electronics, the Motor Type stored in the EEPROM will be examined. If a new HEX file was just downloaded, it will not yet have a Motor Type (it will be ZERO).

When firmware sees that the Motor Type is ZERO, firmware will immediately go to the display entry in the Factory Setup Menu for Motor Type. The user will NOT have to move the left control knob back and forth to go to Setup Mode or enter a passcode. The user will see alternate display of "F1" and "0". The "F1" is the abbreviation for Motor Type in the factory setup menu, and the current value is 0. Then the user (who just now completed the hex file download) will have to use the left hand control knob to increment the display number to the correct Motor Type (from 1 to 33 shown in the table above). Then a move of the right hand selector knob either left or right will force an exit out of the Setup Menu in this unusual one-time circumstance after a HEX file download.

Now the firmware will examine the Motor Type and know how to initialize the electronics. Normally when power is applied to the MPA, if it is NOT after a new download of the HEX file, the Motor Type will already be non-ZERO so the firmware will know how to initialize the electronics without forcing the user to use the knobs.

Table 3. MPA Model Selections and Capacities

Valve Size and Max Torque	Power Supply	Model Size	MOTOR DATA							
			Nominal Size (HP)	Start Current (amps)	Run Current		Speed (rpm)	Motor Torque		
					15 min (amps)	5 min (amps)		Start (ft•lb)	15 min (ft•lb)	15 min (ft•lb)
2 x 4 150 ft•lb	24 VDC	37RK-FJ	1/6	50	6.5	11.7	2000	2.58	0.42	0.76
	115/1/60	35RK-6J	1/12	4.4	2	3.6	1725	0.74	0.37	0.67
	230/3/60	35RK-2J	1/12	2.32	0.64	1.2	1725	1.07	0.35	0.63
	415/3/50	35RK-9J	1/12	0.94	0.32	0.6	1400	1.41	0.34	0.61
	460/3/60	35RK-3J	1/12	1.16	0.32	0.6	1725	1.4	0.33	0.59
3 x 6 650 ft•lb	24 VDC	37LK-FJ	1/6	50	6.5	11.7	2000	2.58	0.42	0.76
	115/1/60	37OK-6J	1/6	6.8	3.9	7.0	1725	1.43	0.53	0.95
	230/3/60	37RK-2J	1/6	3.8	1.1	2.0	1725	2.57	0.52	0.94
	415/3/50	37RK-9J	1/6	1.54	0.54	1.0	1400	2.61	0.64	1.15
	460/3/60	37RK-3J	1/6	1.9	0.55	1.0	1725	2.48	0.53	0.95
4 x 8 / 4 x 10 800 ft•lb	24 VDC	37MK-FJ	1/6	50	6.5	11.7	2000	2.58	0.42	0.76
	115/1/60	37MK-6J	1/6	6.8	3.9	7.0	1725	1.43	0.53	0.95
	230/3/60	37QK-2J	1/6	3.8	1.1	2.0	1400	2.57	0.52	0.94
	415/3/50	37QK-9J	1/6	1.54	0.54	1.0	1400	2.61	0.64	1.15
	460/3/60	37QK-3J	1/6	1.9	0.55	1.0	1725	2.48	0.53	0.95
6 x 16 1500 ft•lb	24 VDC	37DK-FJ	1/6	50	6.5	11.7	2000	2.58	0.42	0.76
	115/1/60	37DK-6J	1/6	6.8	3.9	7.0	1725	1.43	0.53	0.95
	230/3/60	37JK-2J	1/6	3.8	1.1	2.0	1725	2.57	0.52	0.94
	415/3/50	37DK-9J	1/6	1.54	0.54	1.0	1400	2.61	0.64	1.15
	460/3/60	37JK-3J	1/6	1.9	0.55	1.0	1725	2.48	0.53	0.95

Note: All valve torques are run torques.

## Valve Status Monitor

The Status Monitor is a valuable tool for monitoring and commissioning the system. It provides a Dashboard for quick visual indication of status and provides tab for review of Alarm and ESD Status, as well as Device Info. This screen may be used to determine command and position status troubleshoot any problems should they occur. Red Tabs indicate an active alarm or event exists. Field diagnostic code or Alarms are displayed in the Monitor Tab. All active alarms may be viewed at a glance in the Alarms tab. See figures 21 through 23.

Mode displays the mode selected by the selector switch of the LDM or combined logic of both LDM and RDM selector switches.

Monitor provides a snapshot of the active conditions and and Logs displays the last 9 Alarms.

At Port displays the port number position of the actuator and whether the MPA is at the port within 1 degree or within 2 degrees.

Torque is displayed as percentage of the full torque rating of the actuator. Torque is displayed from 10% to 99% in 1% increments. Torque less than 10% is displayed as zero because torque between 0% and 10% cannot be accurately measured.

Tracking and trend graphics display Setpoint, Position, and Torque over travel time.

Encoder Value is the 12-bit raw data from the position encoder in the range of 0 to 4095. This value is the same as the value displayed during Port Calibration in the Factory on the Factory Setup screen so it can be compared to port calibration value of each port.

Figure 21.



Figure 22.

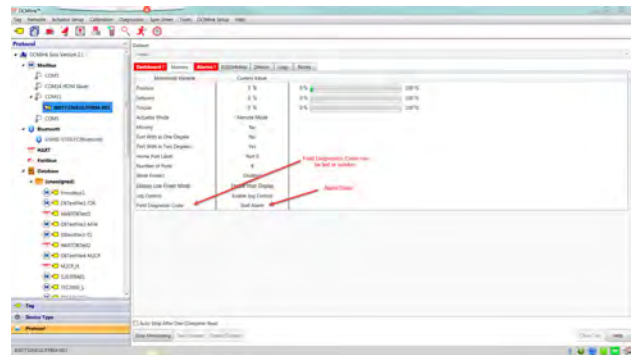
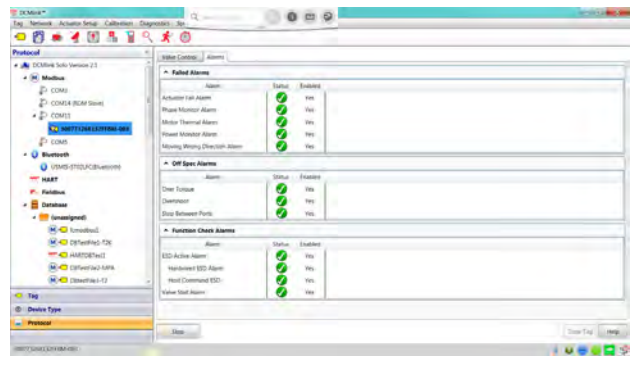


Figure 23.



## Valve Control

Valve Control allows all functions of the system to be tested prior to commissioning with the DCS. It provides for a Dashboard for Controlling the MPA and providing Host ESD. It also includes a tab for Alarm Status.

Valve Control can be used to command the actuator to go to the next port or go to a desired port number. “Go to Port” is the new setpoint in the range of 0 to 8 for the 8 ports (including the Home Port).

Based on selections for general display preferences in DCMLink™ Setup, the Dashboard can display Digital indication of Setpoint, Port Position, and Torque.

Figure 24.

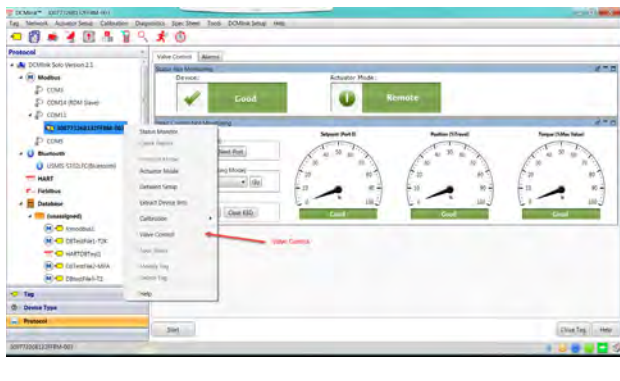


Figure 25.

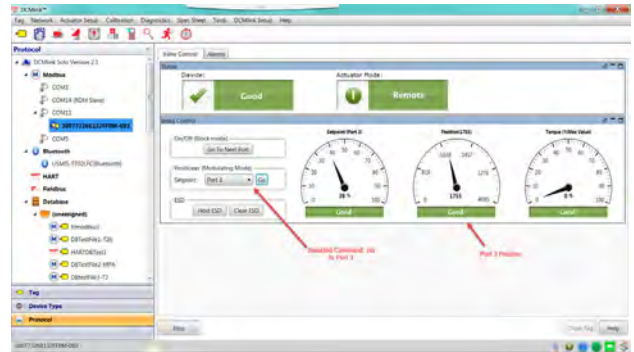


Figure 26.

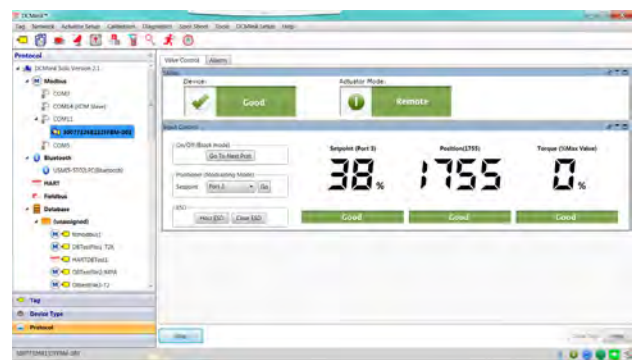


Figure 27.



## Field Setup Using Local Controls

Use the Local Control (left) knob and Selector (right) knob to enter setup mode and to execute Setup functions. The table below outlines the knob functions for Setup mode.

To access the Field SETUP mode of operation ensure the Selector Knob is placed in the OFF (Stop) position. Once set, rotate the Control Knob to the “UP” and then to the “DOWN” position in right to left succession three times. Keep the knob in each position for at least ½ second but not more than 3 seconds. The display module will flash the (3) amber LOR selector LED’s when the SETUP mode is enabled.

Figure 28.



SELECTOR KNOB (right)	SETUP FUNCTION	RESULTS
OFF (Stop) [return position]	Neutral position	Allows entry to SETUP mode. Completes NEXT, or BACK entry cycle, except when knob is held for scrolling through various menus
Clockwise (REMOTE) (Auto)	NEXT	Advances to the next menu item. Displayed data is accepted
Counter-clockwise (LOCAL) (Hand)	BACK	Backs up to the last menu item
CONTROL KNOB (left)	SETUP FUNCTION	SETUP RESULTS
Spring return to Center	Neutral position	Completes UP or Down entry Cycle except when knob is held for continuous data entry update
Clockwise (CLOSE)	UP	Increments displayed data
Counter-clockwise (OPEN)	DOWN	Decrements displayed data



When the actuator LDM is placed in SETUP mode of operation it first displays the Field Diagnostics (Fd) menu item. The second menu item Alarm History (AH) menu. The field diagnostics and alarm history may be viewed without entering a passcode (See Field Diagnostics and Alarm History Display section).

---

**Note**

On any setup menu, use up/down to change a parameter and back/next to accept the displayed parameter. All menus and all parameters are wrap around, meaning they will advance from the highest or last value to the lowest or first value.

---

To view or change setup parameters of the actuator, Rotate the Selector Knob to the right or NEXT position to cycle through the alarm history display A1 through A8 until P1 is displayed. Alarm history (A1-A8) may be skipped by changing AH(1) to AH(0) and go directly to passcode menu. Passcode menu is displayed as two, 2-digit entries, P1 and P2. The actuator is shipped from the factory with the passcode disabled, meaning that the passcode is 00 00. Until the passcode is changed by the user, the passcode of 00 00 may be accepted by using the NEXT selector knob sequence to accept the passcode and continue to the setup menus. You will now be able to display and/or edit setup data. If you forget your configured passcode, factory trained technicians can reset the passcode back to 00 00.

---

**Note**

While in the SETUP mode the actuator will not turn on the motor control circuits and disables all control of discrete outputs until exiting the Setup Mode.

---

## Alarm History Display

Setup always enters the main menu at the Field Diagnostics (Fd) and the next menu item is Alarm History (AH). The user may view the alarm history without having to enter a passcode. The AH menu will alternately display a value of 0 or 1. Use the Control Knob up or down to change the selection from 0 to 1 or 1 to 0. If display of the alarm history is desired, then the value must be 1. When AH with a value of 1 is displayed, use the Selector Knob REMOTE (NEXT) to advance through the alarms. If it is desirable to skip the alarm history and advance to the setup menus, use the control knob to select a value of 0 and then the Selector Knob Remote (Next) to advance directly to the P1 passcode entry. Alarms are displayed by a sequence number A1 through A8. The display alternates between the alarm sequence number (A1-A8) and the recorded alarm. A1 is the newest alarm and A8 is the oldest alarm. Use the NEXT and BACK selector positions to cycle through the alarms. Blanks are displayed for fewer than 8 alarms. The alarm history is cleared by cycling power to the actuator. If it is desirable to only display alarm history and not go into setup, use the LOCAL (BACK) selection repeatedly to back out of the alarm history and return to normal operating mode.

## Setup Mode Display Sequence

The three (3) amber LED's for the LOR section flash to indicate Setup Mode. When in setup mode, the user must enter the REMOTE (NEXT) or LOCAL (BACK) within 120 seconds or the display will revert back to the normal display mode.

Setup data may be changed by using the Up and Down entries of the Control Knob. The Up and Down entries are active only after a valid pass-code is entered and the Selector Switch is in the STOP position. The default pass-code is P1 00 and P2 00. Once the correct passcode is entered and accepted at the actuator controls, the user will then be able to advance thru the displays shown in the Main Menu table on the following page.

The table on the following page shows the sequence of the setup menus. It also shows the selections, units, and defaults. Each time the REMOTE (NEXT) selector knob is selected, the display advances to the next menu item. Each time the LOCAL (BACK) selector knob is selected, the display backs up to the previous menu item. The Up and Down control knob is used to increment or decrement the value shown in the table.

Following is an example for changing the Torque Limit. In this example the current torque value is the default value of 60%.

1. Enter setup mode – Selector knob Off – Rock control knob back and forth until 3 selector LEDs begin to flash and Fd is displayed. When using the selector knob to advance to the next menu or back to the previous menu, always return the selector to the Off position to complete the cycle.
2. Use control knob to change the value of AH to 0 – Rotate selector knob clockwise to Remote (Next) to display P1 (1<sup>st</sup> passcode). The display will alternate between P1 and the value (default is 00). If the passcode has been changed, rotate the control knob clockwise to advance the display to the correct first passcode. Rotate the selector knob clockwise to advance to the next display, P2. The display will alternate between P2 and value of the second passcode (default is 00). If the passcode has been changed, rotate the control knob clockwise to increment the display to the correct second passcode.
3. Repeatedly cycle the selector knob clockwise to advance to the next menu item until C2 is displayed. This is the torque limit setting as shown in the following table. The display will alternate between C2 and the value of C2 which we have assumed to be 60.
4. Rotate the control knob clockwise to the “up” position to increase the torque limit setting. Rotate the control knob counterclockwise to the “dn” position to decrease the torque limit setting.
5. Repeatedly cycle the selector knob to the Remote (Next) position and the Off position to advance through the remaining menu items until the EP (Exit Program) is displayed.
6. If it is desirable to exit, use the control knob “up” to display a 1 value. Use the selector knob Remote (Next) to select exit. The system and display will return to normal operating mode.

---

**Note**

Use Selector Knob to select Menu and Use Control Knob to select Units.

---

Menu	Parameter	Value	Units	Default
Fd	Field diagnostics	0-27	Fault code	0
AH	Display Alarm History?	0-1	0=No, Skip to 1 <sup>st</sup> Passcode 1=Yes, Display History	
A1	1 <sup>st</sup> latest alarm	Alarm	None	
A2	2 <sup>nd</sup> older alarm	Alarm	None	
A3	3 <sup>rd</sup> older alarm	Alarm	None	
A4	4 <sup>th</sup> older alarm	Alarm	None	
A5	5 <sup>th</sup> older alarm	Alarm	None	
A6	6 <sup>th</sup> older alarm	Alarm	None	
A7	7 <sup>th</sup> older alarm	Alarm	None	
A8	8 <sup>th</sup> older alarm	Alarm	None	
P1	1 <sup>st</sup> Passcode	00-99	None	00
P2	2 <sup>nd</sup> Passcode	00-99	None	00
C0	Control Mode	0-1	0=Discrete 1=Network	1
C1	ESD Action	0-1	0=Stop/Stayput 1=Go to Home Port	1
C2	Torque Limit	15-99	Torque in %	77
C3	Network Node Address	1-99	99 = selection of default address 254 for other protocol CAM modules.	99
C4	Network Baudrate	0-3	0=4800 1=9600 2=19200 3=38400	2
C5	Network Parity	0-2	0=None 1=Odd 2=Even	0
C6	Network Stop Bits	1-2	1=1 Stop bit 2= 2 Stop bits	1
C7	Torque Spring Factor	0-81	None	81
C8	Disable Jog Control	0-1	0=No, 1=Yes	1
C9	Disable Display Timeout	0-1	0=No, 1=Yes	1
CA	Home Port Number (0 or 8)	0-1	0=0, 1=8	0
HP	Home Port (User selected)	0-7	Port No. 1-7	0
HC	Accept Home Port Calibration	0 or 43	0=No, 43=Yes	0
d1	Delete port 1	0-1	0=No, 1=Yes	0
d2	Delete port 2	0-1	0=No, 1=Yes	0
d3	Delete port 3	0-1	0=No, 1=Yes	0
d4	Delete port 4	0-1	0=No, 1=Yes	0
d5	Delete port 5	0-1	0=No, 1=Yes	0
d6	Delete port 6	0-1	0=No, 1=Yes	0
d7	Delete port 7	0-1	0=No, 1=Yes	0
E1	Edit 1 <sup>st</sup> Passcode	00-99	None	00
E2	Edit 2 <sup>nd</sup> Passcode	00-99	None	00
EP	Exit Program?	0-1	0=No, Return to last menu 1=Yes, Exit	

Note: RDM port configuration is fixed at 9600,N,8,1 address 254 and may not be changed by the user. Only the network port configuration may be changed. The address programmed for the network port will be accepted by the RDM port in addition to address 254.

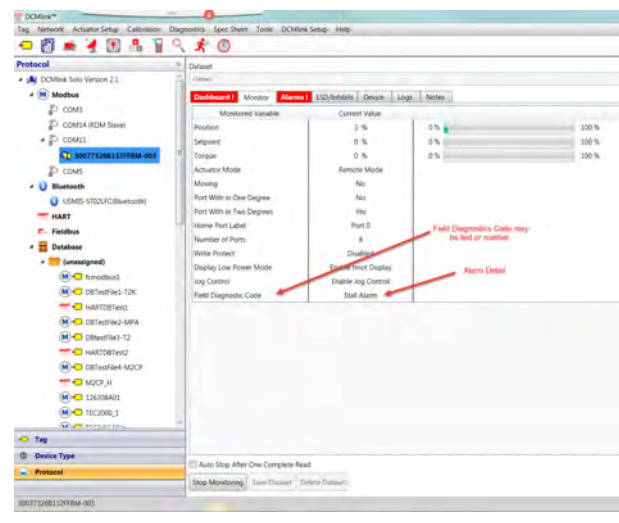
## Field Diagnostics

Should trouble occur, the Field Diagnostics feature may be used to help diagnose the problem. Field diagnostics provides more detailed and definitive feedback than the alarms, i.e. possible root cause(s) for the alarm. For example, there may be many causes for an Actuator Fail alarm. Field diagnostics may be displayed by MPA Config as shown here.

Field diagnostic may be displayed by the local display by entering setup mode. In Setup Mode, the first entry is Field Diagnostics having visible code "Fd". Its value is 0 if there is no fault. If there is a fault, its code is from 1 to 28. If there are multiple faults, only the first of those faults in the following list will be seen. When that fault is corrected, the next fault will display if present.

In DCMLink the Field Diagnostics Code is indicated in the Status Monitor.

Figure 29.



## Fd Fault Codes

1. MCP23 Chip will not initialize (pertains to a three phase AC motor type)
2. Motor is wired to turn in the wrong direction
3. Self-detected wiring fault (Emergency Shut Down - LE)
4. Host transmitted ESD command (Emergency Shut Down - LE)
5. Lost Phase, pertains to a three phase AC motor type - PH
6. Motor has over-heated or overload relay trip (Motor overload - OL)
7. Stall Alarm. No motor movement after excess time of power applied - SA
8. Lost Control Voltage (Loss of power for motor control - LC)
9. Contactor is engaged, but there is no AUX feedback (= Control Failure)
10. SPI communication failure for GPA chip
11. AUX feed-back alarm (= Incorrect AUX feedback from contactor)
12. Three consecutive overshoots of the port
13. RDM is not communicating and is required (Communication Error - CE)
14. No input from Torque Encoder. Check for cable connection problems or encoder failure
15. Torque OCF bit is low. Power supply to the Torque Encoder is likely at fault
16. Encoder reports that Torque Encoder value is invalid
17. Torque Encoder Parity error
18. Torque Encoder Magnet is out of range
19. Over-Torque. Torque value is greater than the Torque Limit
20. Value from the Torque Encoder is out of range (invalid instead of over-torque)
21. No input from Position Encoder. Check for cable connection problems or encoder failure

- 22. Position OCF bit is low. Power supply to the Position Encoder is likely at fault
- 23. Encoder reports that Position Encoder value is invalid
- 24. Position Encoder Parity error
- 25. Position Encoder Magnet is out of range
- 26. Encoder Position inconsistent consecutive times. Expect Position Encoder problem
- 27. Stopped between ports (non-critical)
- 28. Home Port is the last port reached (stopped at Home Port, non-critical and may be normal operation)

## Remote Control Network

### Modbus RTU

The native language of the MPA is Modbus RTU. If other network protocols such as Foundation Fieldbus are used, a Communication Adapter Module (CAM) module is installed to translate between the selected protocol and Modbus. The controller supports Modbus function codes 01,02,03,04,05,06,15,16. Following are the memory maps for discrete I/O and unsigned 16-bit Holding registers used in this application. All memory maps shown are zero based, i.e. register 1 = holding register 40002. reading Input Bit 0 using FC02 = 10001.

### Discrete Input Map (Valve Status and Alarms)

Bit	Input	
0	16	At commanded port within 1 degree
1	17	At commanded port within 2 degrees
2	18	Flow selector moving
3	19	Wrong direction alarm
4	20	Selector switch Local/Manual Mode
5	21	Selector switch Remote/Auto Mode
6	22	Over torque alarm
7	23	Stop between ports alarm
8	24	Flow selector stall alarm
9	25	Power monitor alarm
A	26	Motor thermal overload alarm
B	27	Phase monitor alarm
C	28	Local ESD alarm
D	29	Actuator fail alarm
E	30	No input (always zero)
F	31	Unit alarm (above alarms are OR'ed)

These same status and alarm bits are duplicated in Modbus Registers 01, 06, 09 (40002, 40007, 40010) in the same bit sequence shown above.

### Coil Map (Discrete Network Control)

There are only two coils used for discrete network control as follows. When Coil 10 is set by the host, the actuator resets the coil automatically when the command is executed. When Coil 11 is set, the host must reset the coil before the actuator will respond to any other command.

## Coil

10 Go to next port

11 Host ESD command, Go to Home Port

## Holding Register Map

These are the recommended registers to use. Other registers are active but the user is cautioned not to use the data or write to any other registers.

### Monitor and Control Registers

#### Register

01 Actuator status and alarms in the bit sequence shown for the input map

06 Actuator status and alarms in the bit sequence shown for the input map

07 Last Port position reached (0-7 or 1-8) (See CA Home port number on page 38)

09 Actuator status and alarms in the bit sequence shown for the input map

11 Port position Setpoint (0-7 or 1-8) (Data must be a single digit between 0 and 7 or 1 and 8 depending on Home configuration) (See CA Home port number on page 38) (MPA returns 255 (0xFF) in register 11 when the commanded port is reached)

12 Field diagnostic code 0-28 (See Fd Fault Codes on page 22)

13 Raw 12-bit position encoder value (0-4095)

14 Port position (0-4095)

15 Torque (0-4095)

### Configuration and Calibration Registers

#### Register

211 Port 0 calibration value (0-4095)

212 Port 1 calibration value (0-4095)

213 Port 2 calibration value (0-4095)

214 Port 3 calibration value (0-4095)

215 Port 4 calibration value (0-4095)

216 Port 5 calibration value (0-4095)

217 Port 6 calibration value (0-4095)

218 Port 7 calibration value (0-4095)

---

### Note

After the HC command is executed, Register 211 will be zero and remain zero.

---

**⚠ WARNING**

Extreme caution must be used when writing port calibration values to registers 211 through 218 (40212 thru 40219). Only values read from these registers shall be written to them. The purpose of these registers is to allow the network host to store the port calibration values and then write them back to the actuator in case of replacement of the CPU module.

## Foundation Fieldbus (FF)

The MPA uses a CAM18 to convert between Modbus and Foundation Fieldbus. Refer to Bettis M2CP CAM18 & TEC2000 CAM218 Installation, Operation and Instruction Manual for installation and setup of the FF link. Relations between the Modbus and FF maps are identified as follows.

### Foundation Fieldbus

#### Modbus Discrete Input Map

Input	
16	At port within 1 degree
17	At port within 2 degrees
18	Flow selector moving
19	Wrong direction alarm

#### Actuator Readback (Channel 2)

Note: Channel 2 has only 1 value

DI	PV / Out_D
1	
2	
4	
5	

#### Modbus Discrete Input Map

Input	
20	SS Local/Manual Selector Switch Off
21	SS Remote/Auto
22	Over torque alarm
23	Stop between ports alarm
24	Flow selector stall alarm
25	Power monitor alarm
26	Motor thermal overload alarm
27	Phase monitor alarm
28	Local ESD alarm
29	Actuator fail alarm

#### Actuator Status (Channel 5)

Note: Channel 5 has only 1 discrete value and depends upon Selector Switch position.

	AUTO	DI	PV / Out_D	OFF	LOCAL
					3
	0			2	
	56		58		59
	52		54		55
	9		11		12
	12		14		15
	20		22		23
	76		78		79
	40		42		43
	44		46		47

#### Coil Map (Discrete Network Control)

##### Coil

10 Go to Next Port

#### Actuator Command (Channel 1)

##### DO SP / Out\_D

1

#### Coil Map (Discrete Network Control)

##### Coil

11 Host ESD Command

#### ESD Command (Channel 10)

##### DO SP / Out\_D

1

#### Monitor and Control Registers

##### Register

11	Port Position Setpoint (0-7 or 1-8)
14	Port position (0-4095)
15	Torque (0-99%)

Setpoint AO (Channel 3)
Position AI (Channel 4)
Torque AI (Channel 18)

SP / OUT
SP / OUT
SP / OUT

Modbus

## Configuration and Calibration Registers

Foundation Fieldbus

## MAO (Channel 19)

## MAI (Channel 20)

Register		Parameter	Parameter
211	Port 0 calibration	IN_1	OUT_1
212	Port 1 calibration	IN_2	OUT_2
213	Port 2 calibration	IN_3	OUT_3
214	Port 3 calibration	IN_4	OUT_4
215	Port 4 calibration	IN_5	OUT_5
216	Port 5 calibration	IN_6	OUT_6
217	Port 6 calibration	IN_7	OUT_7
218	Port 7 calibration	IN_8	OUT_8

**Note**

Input and Output parameters are the number of hardware registers that are connected to the I/O block. They define the transducers to be used going to or from the physical world.

**⚠ WARNING**

**Extreme caution must be used when writing port calibration values to registers 211 through 218. Only values read from these registers shall be written to them. The purpose of these registers is to allow the network host to store the port calibration values and then write them back to the actuator in case of replacement of the CPU module.**

Note: The network host may write a Port Position Setpoint to Channel 3 (SP/OUT) as a 12-bit unsigned integer analog value corresponding to 0% to 8% where the percentage relates to the port number 0 to 8. The analog value is calculated as absolute value of Port Number / 100 \* 4095. Example: Analog value for Port 6 =  $6/100 * 4095 = 245.7 = 245$ . The actuator will accept the percentage analog value within a tolerance as shown below:

Port 0 = 0  
 Port 1 = 39 – 42  
 Port 2 = 79 – 82  
 Port 3 = 120 – 123  
 Port 4 = 162 – 165  
 Port 5 = 203 – 206  
 Port 6 = 244 – 247  
 Port 7 = 284 – 288

If CA is configured as 1 for Home Port = 8, the MPA will accept either 0 or 327 for setpoint of Home Port. The acceptable range for Port 8 is 325 to 329. (see page 21 for CA configuration)



## Profibus DP Redundant Networks with Redcom

The MPA uses CAM20 to convert between Modbus RTU and Profibus DP. This section describes the data mapping between the Profibus DP host and MPA Modbus map. The mapping allows the Profibus DP host to control the Flow Selector and monitor the actuator status. The control information is mapped directly to words in the Profibus Output data and status information is mapped directly to words in the Profibus Input data.

### Output Data

Location		Bit							
Word	Byte	7	6	5	4	3	2	1	0
1	1	Not used		Not used					
1	2	Not used	Not used	Not used	Not used	Host ESD Command	Go to Next Port	Not used	Not used
2	3	Flow Selector Port Position Setpoint (0-7) or (1-8) Single Byte							
2	4								
3	5	Not used							
3	6								

### Input Data

Location		Bit							
Word	Byte	7	6	5	4	3	2	1	0
1	1	Not used	Not used	Not used	Not used	Not used			Actuator Fail Alarm
1	2	Not used		Not used	Not used	Host ESD Monitor	Not used		
2	3	Unit Alarm	Not used		Local ESD Alarm	Phase Monitor Alarm	Motor Thermal Alarm	Power Monitor Alarm	Flow Selector Stall Alarm
2	4	Stopped Between Ports	Over Torque Alarm	Selector Remote / Auto	Selector Local / Manual	Wrong Direction Alarm	Flow Selector Moving	Within 2 degrees of port	Within 1 degree of port
3	5	Flow Selector Position (0-7) or (1-8) Single Byte							
3	6								
4	7	Torque (0-99%)							
4	8								
5	9	Not used							
5	10								
6	11	Not used							
6	12								

## DeviceNet

The MPA uses CAM09 to convert between Modbus and DeviceNet. This section describes the data mapping between the DeviceNet host and MPA Modbus map. The mapping allows the DeviceNet host to control the Flow Selector and monitor actuator status. The control information is mapped directly to words in the DeviceNet Output data and status information are mapped directly to words in the DeviceNet Input data.

### Output Data

Location		Bit								
Word	Byte	7	6	5	4	3	2	1	0	
1	1	Not used				Host ESD Command	Go to Next Port	Not used		
	2	Not used								
2	3	Flow Selector Port Position Setpoint (0-7) or (1-8) Single Byte								
	4									
3	5	Not used								
	6									

### Input Data

Location		Bit							
Word	Byte	7	6	5	4	3	2	1	0
1	0	Not used		Not used	Not used	Not used	Not used	Not used	Not used
	1	Not used	Not used	Not used	Not used	Not used			
2	2	Stopped Between Ports	Over Torque Alarm	Selector Remote / Auto	Selector Local / Manual	Wrong Direction Alarm	Flow Selector Moving	Within 2 Degrees of Port	Within 1 Degree of Port
	3	Unit Alarm	Not used	Actuator Fail Alarm	Local ESD Alarm	Phase Monitor Alarm	Motor Thermal Alarm	Power Monitor Alarm	Flow Selector Stall Alarm
3	4	Flow Selector Position (0-7) or (1-8) Single Byte							
	5								
4	6	Torque (0-99%)							
	7								
5	8	Not used							
	9								
6	10	Not used							
	11								

Figure 30.



Figure 31. Wiring Diagram — Three Phase Power

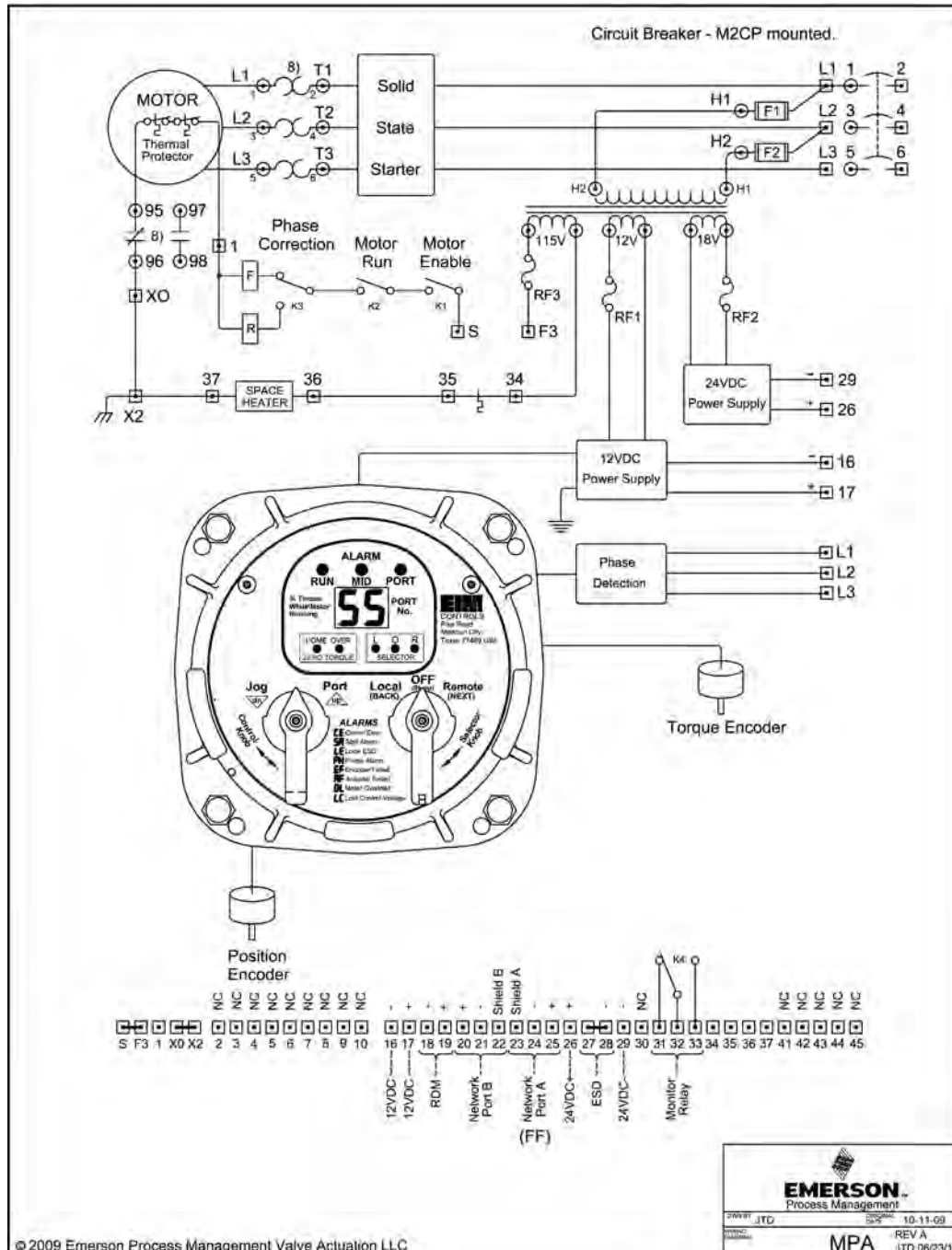


Figure 32. Wiring Diagram — Single Phase Power

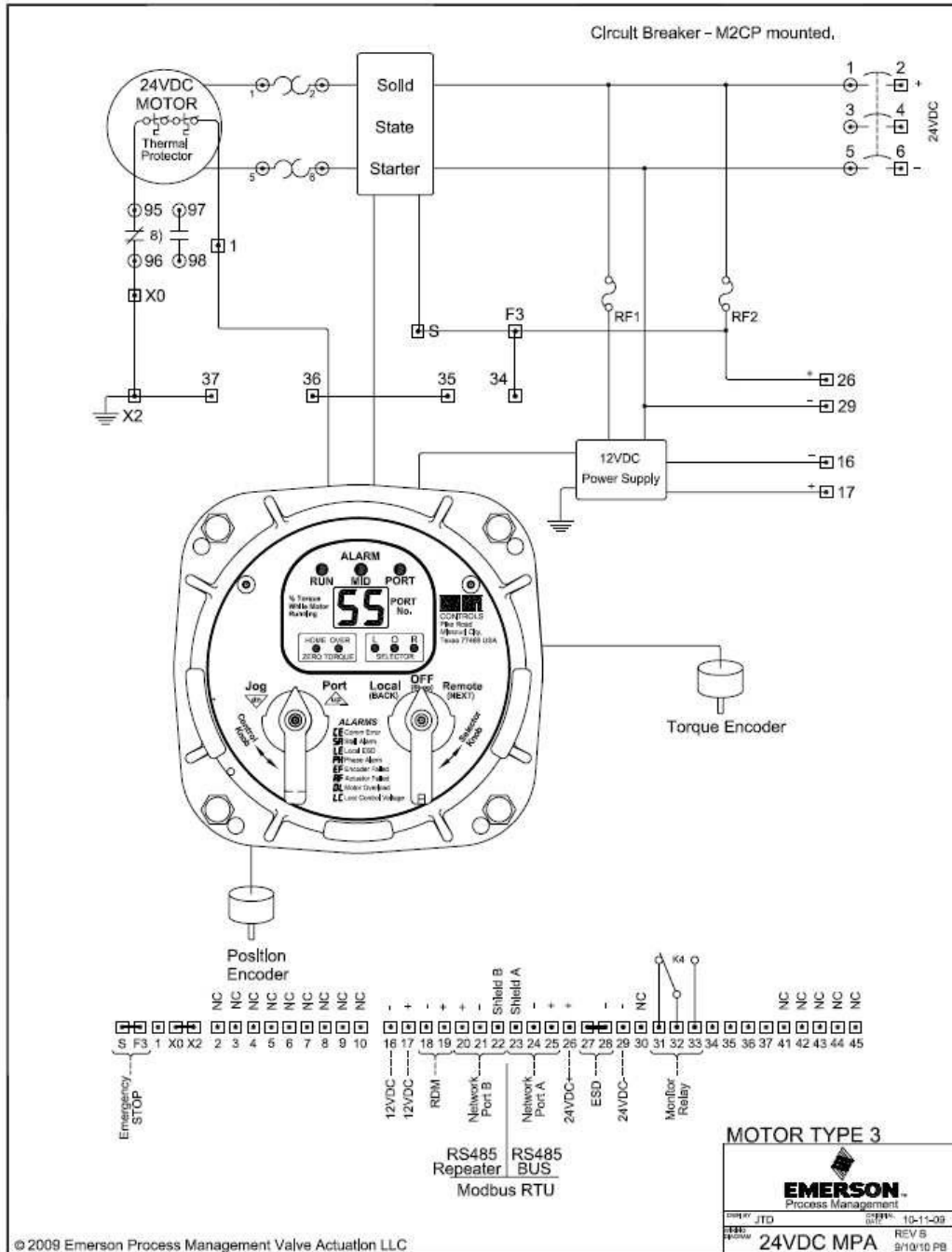
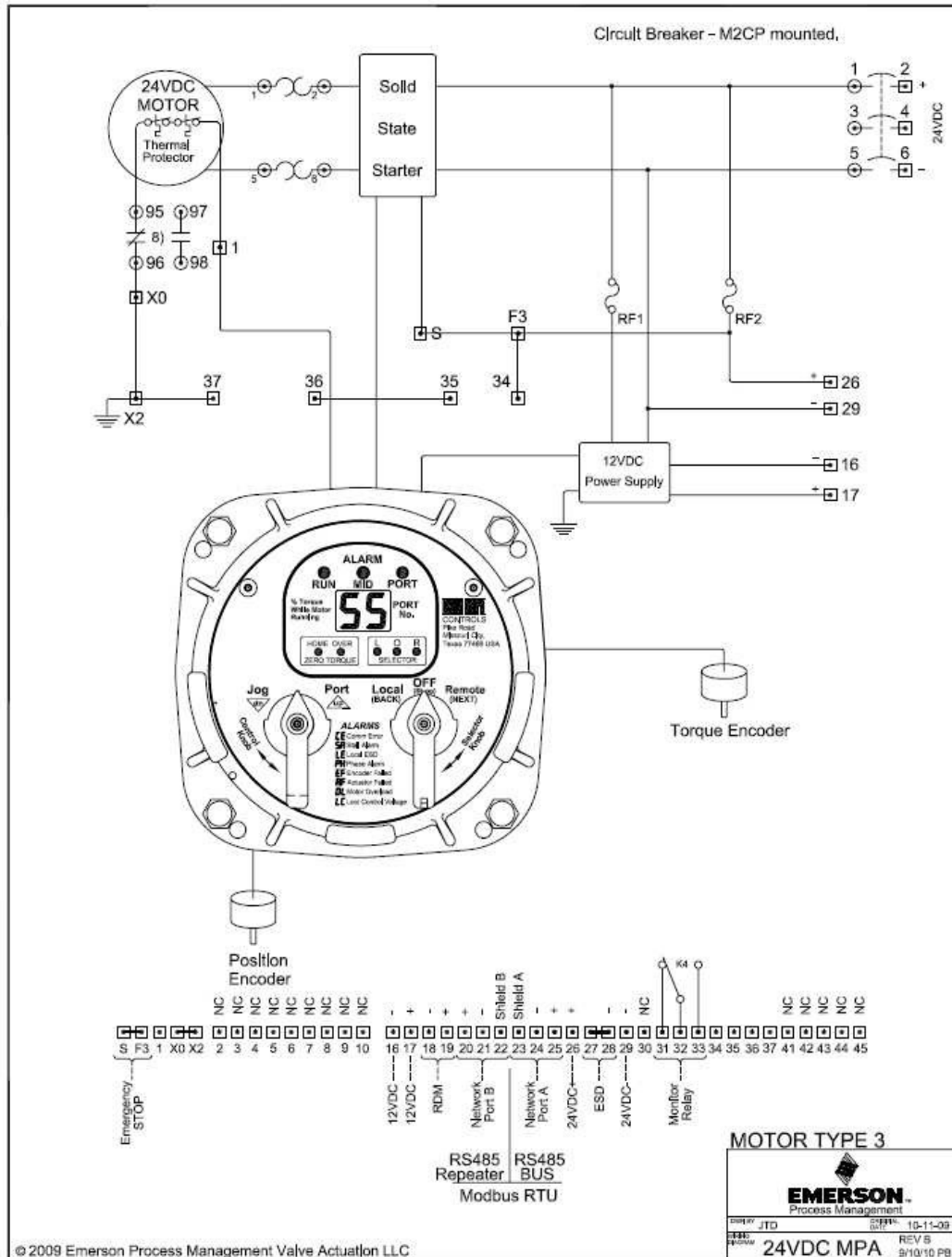


Figure 33. Wiring Diagram – 24VDC Power





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