

## SM4 and SX4 Servovalves Installation and Troubleshooting Guide



### Introduction

The Vickers SM4 series and SX4 extended frequency response series valves are precision, closed-center, four-way sliding spool servovalves. System performance is enhanced when the Vickers servovalve is applied as part of the control solution. Exact positional accuracy, repeatable velocity profiles, as well as predictable force and torque regulation are realized when including the Vickers servovalve as part of the system control.

Before installing the valve, check that the model designation on the nameplate is correct for the application.

#### NOTE

The operation and performance of each servovalve is factory-tested by Vickers before release for shipment. Warranty on these products may be disallowed by such actions as:

- unauthorized field disassembly of the valve
- incorrect installation
- application of the valve outside of performance or environmental limits
- incorrect electrical connection or control signals

### Valve Installation

The steps below must be followed when installing a servovalve.

1. Do not remove the shipping plate from the valve until immediately prior to installation.
2. Be careful not to lose the O-rings from the valve ports.
3. Be sure the O-rings and both mounting pads are clean, undamaged, and free from burrs.
4. Carefully place the valve on the manifold pad.

#### NOTE

Most servovalves have a locating pin to ensure correct port orientation. Make sure this pin lines up with the mating hole in the manifold pad. If there is no locating pin, make sure the valve P port is lined up with the pressure port on the manifold pad and that the remaining ports are properly aligned.

5. Secure the valve to the manifold with the appropriate bolts torqued to the proper tightness per the following table:

#### Valve Model

	Bolt Size	Torque*
SM4-10/12/15 and SX4-10/12/15	1/4-20 x 2 1/4" (inch) or M6 x 60mm (metric)	7,5 to 9,5 Nm (108 to 132 lb.in.)
SM4-20 and SX4-20	5/16-18 x 2" (inch) or M8 x 50mm (metric)	18,6 to 22,6 Nm (216 to 264 lb.in.)
SM4-30	1/4-20 x 1 1/4" (inch) or M6 x 35mm (metric)	7,5 to 9,5 Nm (108 to 132 lb.in.)
SM4-40	5/16-18 x 3" (inch) or M8 x 80mm (metric)	18,6 to 22,6 Nm (216 to 264 lb.in.)

\* – Torque values are for lubricated threads using Grade 8,8 (metric) or Grade 8 (inch) mounting bolts.

# Electrical Installation

Following the diagram below, wire the female electrical connector (Amphenol No. MS3016A-14S-2S) as required by the system application.

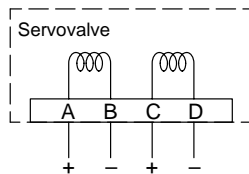
Check the valve model number on the name plate. The single coil resistance (in ohms) and rated maximum current (in milliamps) are part of the valve model code as shown in the following example.

## SM4-20(5)19-80/40-10

Single coil resistance =  $80\Omega$       Maximum rated current = 40 mA

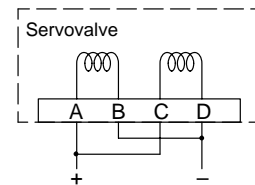
### Single:

A+, B-  
or  
C+, D-



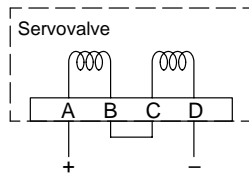
### Parallel:

A+, C+  
B-, D-  
Connect A and C  
Connect B and D



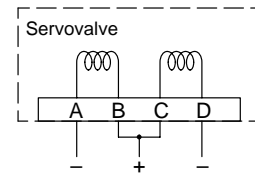
### Series:

A+, D-  
Connect B and C



### Differential:

A-, D-  
B+, C+  
Connect B and C  
BC-, current BA>CD  
BC+, current CD>BA



# Mechanical Null Adjust

All SM4 and SX4 servovalves have a mechanical null adjustment. All valves are shipped with the null adjust set at the center position. In the center position, the A and B control port pressures are equal when no electrical signal is being applied to a blocked port valve.

Occasionally, the servovalve may require a mechanical adjustment to ensure the spool is located at a centered or null position. Normally this adjustment is needed when either

- the actuator experiences significant flow movement at zero input signal/no load conditions, or
- a different maximum flow output from each cylinder port is noted for equal input signals in both directions.

## Null Adjustment Procedure

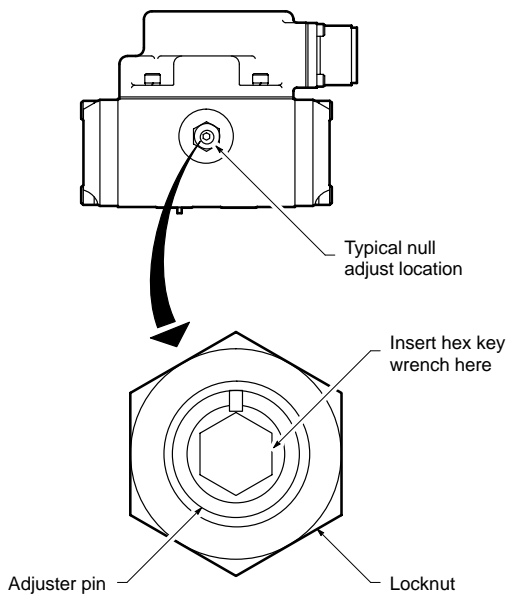
- Turn off the machine.
- Vent pressure to the valve and actuator.
- Make sure the actuator is free to move throughout its range of travel without damage to tooling, fixtures, etc.
- Disconnect the electrical connector from the valve. This causes the valve command signal to be zero.

# Mechanical Null Adjust

## NOTE

Do not loosen the locknut. It is tightened at the factory so that 1,6 to 2,0 Nm (14 to 18 lb.in.) of torque are needed to turn the adjuster pin.

5. For all valves except the SM4-40, insert a 2,38mm ( $3/32$  inch) hex key wrench into the adjuster pin. For an SM4-40 valve, insert a 2,82mm ( $7/64$  inch) hex key wrench into the adjuster pin.



6. While watching the actuator, start up the system and slowly increase system pressure to its normal operating level. There should be little or no actuator movement.

## CAUTION

For all valves except the SM4-40, turning the adjuster pin clockwise increases flow from port A. For the SM4-40, turning the adjuster pin clockwise increases flow from port B.

7. If there was significant actuator movement in step 6, slowly adjust the valve using the hex key wrench until there is little or no actuator movement.
8. Turn off the machine.
9. Vent pressure to the valve and actuator.
10. Connect the electrical connector to the valve.
11. Restart the system according to the system designer's recommendations and procedures.

# Troubleshooting

The following support equipment recommendations and flow chart are to be used as an aid in troubleshooting servocontrol system faults.

A good proactive maintenance program will ensure minimum unscheduled downtime. Fluid cleanliness, periodic maintenance on mechanical parts, and operating within recommended parameters help to maximize system reliability.

## Minimum Recommended Support Equipment

As a minimum, the following items should be available for system startup and any troubleshooting.

- 1 – High pressure gage, 0 to 350 bar (0 to 5000 psi)
- 2 – Pressure gages, 0 to 210 bar (0 to 3000 psi)
- 1 – Low pressure gage, 0 to 70 bar (0 to 1000 psi)
- 1 – Digital multimeter suitable for reading voltage, current, and frequency (Fluke Model 87 or equivalent)

Miscellaneous – Small tools for removing and installing the valve and performing null adjustment procedures.

## Optional Support Equipment

As required – Pressure transducers capable of measuring transient events at up to proof pressures (ideally one transducer per valve port)

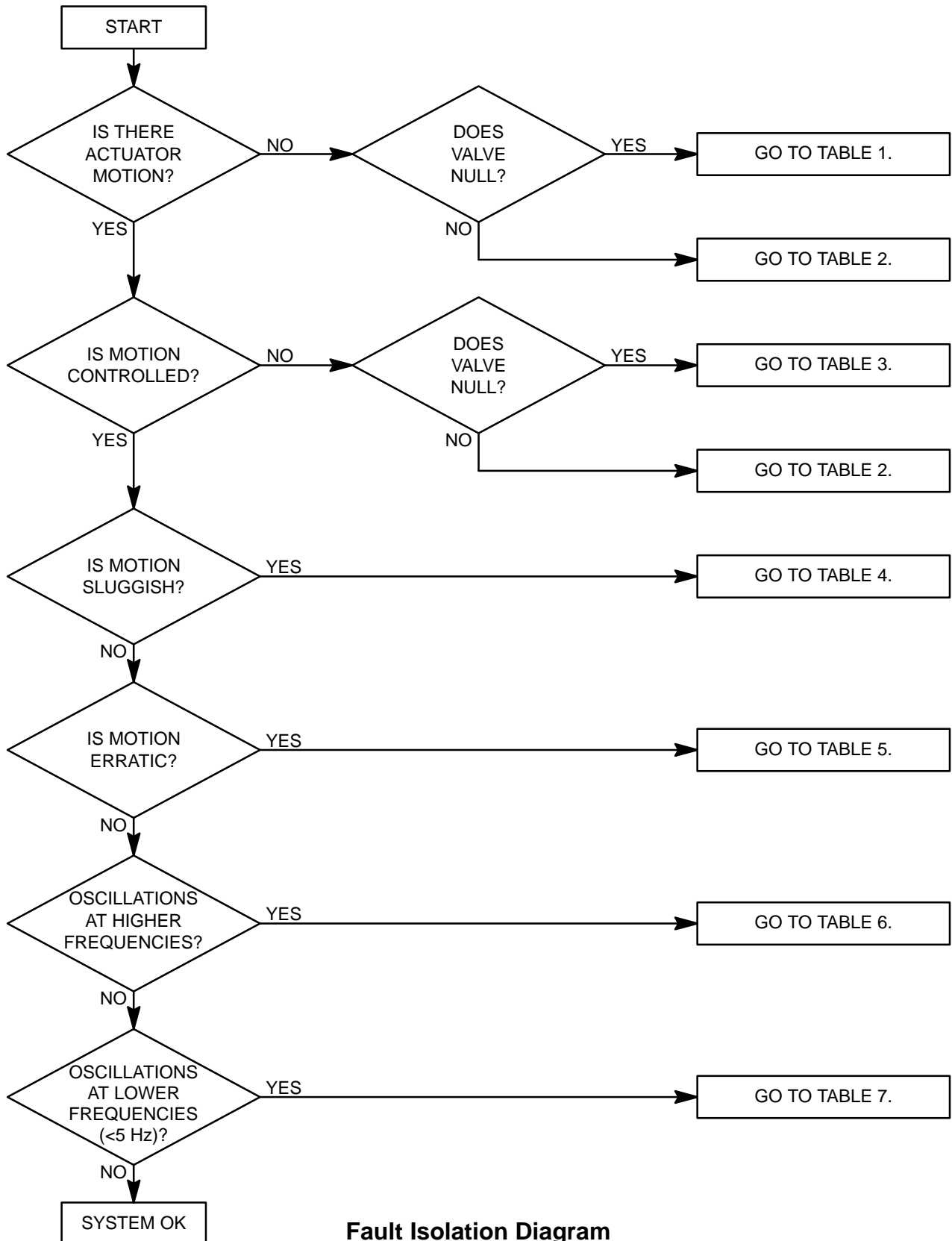
- 1 – Four to six channel portable recorder, DC operated, capable of recording transient events as captured by the pressure transducer(s)

## System Fault Isolation

The diagram and tables on the following pages will aid in system troubleshooting by helping to isolate faults due to the servovalve.

Because systems can vary significantly in type and complexity, these troubleshooting and repair recommendations are not intended to be all inclusive.

# Troubleshooting



Fault Isolation Diagram

## Corrective Action Tables

**Table 1**

<b>Check these items (in sequence):</b>	<b>If item is bad:</b>
Valve coil resistance	Replace valve.
Command signal to valve	Check electronics and cabling. Repair or replace if bad.
Pump flow	Adjust, repair, or replace.
System pressure	
Filters for blockage	Sample for fluid contamination. Replace filters.*

\* If system fluid is contaminated, servovalve may require cleaning and recalibration.

**Table 2**

<b>Check these items (in sequence):</b>	<b>If item is bad:</b>
Valve installation	Adjust, repair, or replace.
Supply pressure	
System plumbing for crossed lines	
Machine mechanical components for binding	
Actuator seals and packings for extreme contamination	
All items above OK	Replace valve.

**Table 3**

<b>Check these items (in sequence):</b>	<b>If item is bad:</b>
Feedback signal	Repair.
Feedback polarity	Change polarity.
Valve coil wiring for crossed wires	Repair.
Command signal to valve	Check electronics and cabling. Repair or replace if bad.

**Table 4**

<b>Check these items (in sequence):</b>	<b>If item is bad:</b>
Command signal to valve	Check electronics and cabling. Repair or replace if bad.
Filters for blockage	Sample for fluid contamination. Replace filters.*
Machine mechanical components for binding	Adjust, repair, or replace.
Pump flow	
System pressure	Adjust.
Electronics for excessively low gain	
All items above OK	Replace valve.

\* If system fluid is contaminated, servovalve may require cleaning and recalibration.

**Table 5**

<b>Check these items (in sequence):</b>	<b>If item is bad:</b>
Hydraulic fluid for cleanliness	Clean fluid. Replace filters.*
System wiring for opens or shorts	
Feedback device for excessive wear or intermittent faults	Repair or replace.
Electronics for intermittent faults	
Machine mechanical components for binding or backlash	Adjust, repair, or replace.

\* If system fluid is contaminated, servovalve may require cleaning and recalibration.

**Table 6**

<b>Check these items (in sequence):</b>	<b>If item is bad:</b>
Electronics for dither (if dither required by system)	Adjust, repair, or replace.
Electronics for excessively high gain	Adjust.
Command signal to valve for excessive noise	Check electronics. Repair or replace if bad.
Feedback signal for excessive noise	Check feedback electronics, cabling, and transducer. Repair or replace if bad.

**Table 7**

<b>Check these items (in sequence):</b>	<b>If item is bad:</b>
Electronics for dither (if dither required by system)	Adjust, repair, or replace.
Electronics for excessively low gain	Adjust (loop gain ratio).
Machine mechanical and feedback components for wear	Repair, or replace.