

Pneumatic Space Saver Indicating Relay

Model 2400M/4400M

Typical applications

- Pneumatic control panels
 - Compressor control panels
 - Engine control panels
 - Wellhead control panels
- First-out indication
- Fail-safe systems
- Sequencing systems



Model 2400M

Key features and benefits

- Pinpoints trouble
- Wide operating pressure range
- Simple maintenance
- One moving part
- Corrosion resistant gulfproofed finish (2400M)
- Corrosion resistant stainless steel (4400M)
- TRIP port lockout and IN port bypass options

Accreditations available

- NACE MR-01-75

Pneumatic Space Saver Indicating Relay - 2400M/4400M

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Pneumatic Space Saver Indicating Relay - 2400M/4400M

Overview

The 2400M and 4400M Space Saving Indicating Relays are used in failsafe pneumatic or hydro mechanical control systems. The indicating relays are used in panel systems and sequencing systems and are used to indicate the status of process operating conditions. Normally, an indicating relay is connected to each condition sensing device in a system.

The condition sensing devices measure process temperature, pressure, speed, vibration, etc. When in a safe condition, the indicator will show a green indicator. The indicating relays can be linked together to provide first out indication in a system.

Operation

Indicating relay *(refer to figures 1 & 2 on page 4)*

AMOT Indicating Relays are differential force operated 3-way spool valves with a side viewing window, a special Red (striped) - Green spool and 4 ports, as shown in figure 1. Usually one 2400M/4400M is connected to each condition-sensing device as shown in figure 2. The sensing devices are normally closed 2-way valves which detect undesirable temperatures, pressures, vibrations, liquid levels, etc. Sensing valves are connected to the "TRIP" port of each indicating relay, and pressure is introduced at the "IN" port. As supply air or gas enters the "IN" port it shifts the spool initially to the tripped position (Red) and continues through an internal orifice out to the sensor. If the sensor is in its satisfied condition (closed), the large end of the piston will be pressurized and the piston will shift into the safe (Green) position. Pressure is also directed through to the "OUT" port which is normally piped to the "IN" port of the next indicating relay, pressuring it.

In the even a sensor trips (opens), it will vent the pressure off the "TRIP" port and the large end of the piston causing the piston to shift to the tripped (Red) position. In addition, the "IN" port is blocked, the "OUT" port connects with the "VENT" port through specially formed vent grooves and all downstream system pressure is released through the vent. This loss of pressure can be used to close fuel valves, actuate audible alarm devices or operate remote signal devices or switches. Any indications existing at that moment will be held indefinitely. The unique Red and White "Trip" tape, selected by optical specialists, can be clearly seen at a distance even in poor light or by those with impaired color vision. An operator can check the 2400M/4400M indicating relay panel at any time and tell immediately what caused the trouble.

When a 2400M/4400M system is reset, most relays will momentarily move to the tripped (Red) position, then back to the safe (Green) position as the lines to the sensing valves are pressurized.

Only when sensor lines are very short will this not occur. This action will be quite pronounced in some systems and is an indication the indicating relays are performing properly. If all sensing valves are healthy or satisfied on start-up all indicating relays will be "Green". Should a condition not be satisfied, its Indicating Relay will stay "Red". Most systems have certain functions that are unsatisfied on start-up. These functions are locked out by pneumatic time delays or other means to allow the rest of the system to function normally.

In most cases, only one indicating relay will show "Red" on a shutdown in a properly designed system. However, if two or more malfunctions should occur within a split second of each other, both indicating relays may go "Red". A correct system will be designed so that an intentional or normal shutdown will leave all the indicating relays "Green".

Offshore platforms, well controls and process applications frequently employ 3-way valve type sensor sending a signal to an AMOT Indicating Relay with a non-orificed piston.

Indicating relays used in these circuits usually require two additional features provided by AMOT Controls. These are:

- **TRIP port lockout**

- Maintains the tripped position of a non-orificed indicating relay in the event the 3-way type sensor resets and pressurizes the tripped (Red) indicating relay. An indicating relay with TRIP port lockout can only return to safe (Green) position after the panel is reset and supplies pressure to the "IN" port.

- **IN port bypass**

- Allow testing of the indicating relay and sensor as required by Minerals Management Service (MMS) without complete system shutdown.

Pneumatic Space Saver Indicating Relay - 2400M/4400M

Operation Continued

TRIP port lockout (refer to figure 3 on page 5)

The TRIP port lockout (TPL) is an internal modification to the indicating relay (without orifice) used as a receiving relay, receiving a signal from a 3-way valve type sensor. The TPL prevents a tripped (Red) indicating relay from resetting to safe (Green), even if the sensor pressurizes the "TRIP" port. Resetting the TPL to safe (Green) requires pressure at both the "TRIP" port and the "IN" port.

The TRIP port lockout (TPL) allows operators to correct the condition causing the TPL to trip and to reset the sensor but prevents the TPL control circuit from automatically resetting. The TPL and the control circuit will stay locked out until pressure is applied to the "IN" port of the TPL.

IN port bypass valve (refer to figure 4 on page 5)

With the IN port bypass valve (IPBV) installed, there is no change to the basic function of the indicating relay or the TRIP port lockout as described in either version above. The IPBV provides additional function, the ability to test the sensors and indicators as required by the Materials Management Service (MMS) without causing a panel shutdown.

In the normal operating mode, the arrow on the IPBV handle is pointed at the 2400M/4400M indicator window and all operation will be as described above.

In the "Bypass" mode, the 2400M/4400M supply signal is passed around the 2400M/4400M. The sensors or sensor lines may now be manually vented (or pressurized) to observe that they function and that the resulting signal causes a shift in the 2400M/4400M indicating relay. As shown in figure 4, the operation of a bypassed 2400M/4400M does not send a shutdown signal to other panel devices.

The IN port bypass valve must be factory mounted to incorporate internal passages.

TRIP port lockout and IN port bypass valve (refer to figure 5 on page 5)

The TRIP port relay and IN port bypass valve may be combined as shown in figure 5 and will operate as described above.

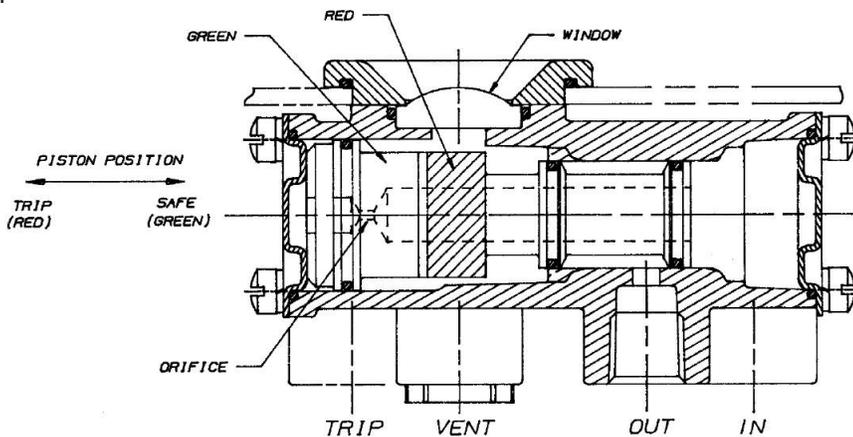


Figure 1:
2400M/4400M indicating relay

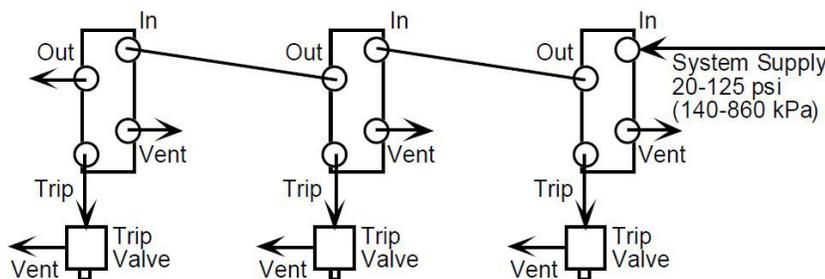


Figure 2:
Typical piping of 2400M/4400M indicating relay

Normally-Closed Valves Sensing Temperature, Pressure, Speed, Fluid Level, Vibration, Etc.

Pneumatic Space Saver Indicating Relay - 2400M/4400M

Operation Continued

TRIP port lockout recommended operating pressures (psi - Nominal)			
Panel supply pressure*	Sensor pressure to panel	Reset** pressure (rising)	Trip pressure (falling)
55-65	60	37	26
50-60	55	34	23
45-55	50	32	20
40-50	45	29	17
40-45	40	27	15
40-45	35	25	13
40-45	30	24	12

* Supply pressure should be determined from available sensor pressure.

** Pressure required to reset the indicating relay to the Green position.

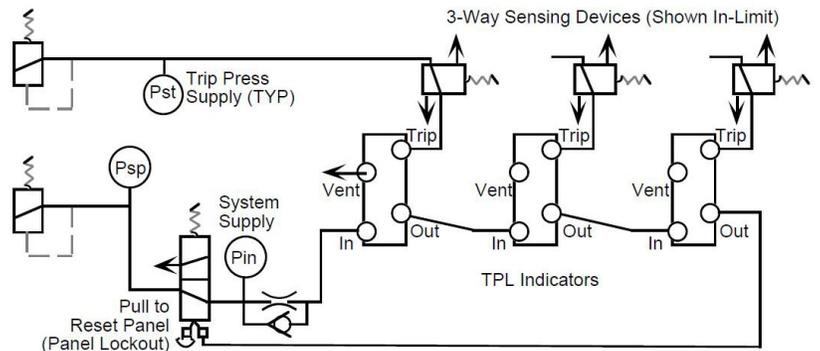


Figure 3:
Indicating relay with TRIP port lockout

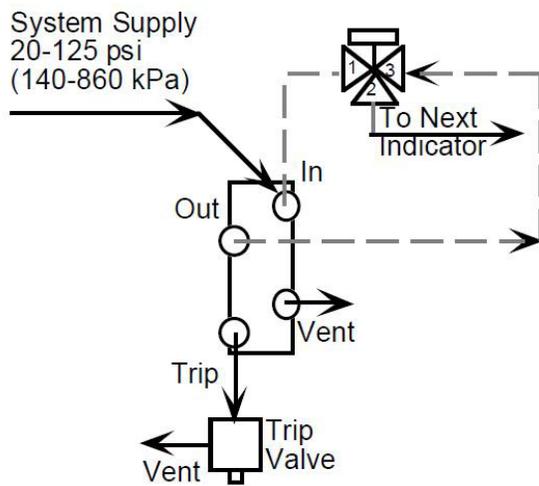
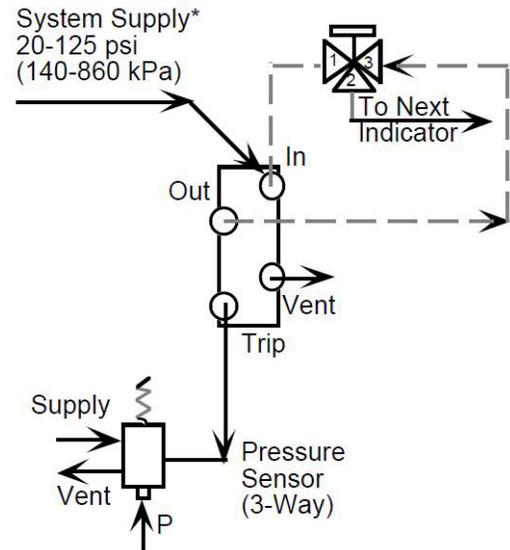


Figure 4:
Indicating relay with IN port bypass



*Supply Pressure Should be Equal

Figure 5:
Indicating relay with TRIP port lockout and IN port bypass

Piping Connections

NOTE: In all cases, a quality thread sealant such as Loctite™ Pipe Sealant or Teflon thread tape should be applied to threaded connections. Take care that shreds of tape, sealant, dirt, scale, tubing chips, etc. are removed from fittings and tubing before being connected to the valves.

A 4125 Vent Closure is installed in the VENT port of the 2400M/4400M when shipped. It may be removed if the vents must be piped to a common vent header.

With the IN port bypass valve option, a pipe plug is factory installed in the "OUT" port of the 2400M/4400M. It should not be removed. The air supply connection should be made to the "IN" port on the indicating relay.

The IN port bypass valve must be factory mounted to an indicating relay that has the required internal passages. DO NOT mount an IN port bypass valve on a standard indicating relay.

Pneumatic Space Saver Indicating Relay - 2400M/4400M

Installation *(refer to diagrams on page 12)*

- Model 2400M Pneumatic Indicating Relays are suitable for mounting in panels up to 1/8" (3.7 mm) thick.
- Model 4400M Pneumatic Indicating Relays are suitable for mounting in panels up to 1/4" (6.4 mm) thick.
- To mount a 2400M/4400M with or without internal TRIP port lockout:
 - Remove both bezel screws ⑨, the front bezel ⑦ with the bezel seal ⑧ and place it through the panel cutout. With setscrews ⑭ backed out all the way and the window ⑩ in place, position the relay on the inside of the panel. Reinstall the bezel seal ⑧, bezel ⑦, and both bezel screws ⑨.
 - When the bezel screws are firmly in place, tighten setscrews ⑭ against the back of the panel until the relay is locked securely in place.
- To mount a 2400M/4400M with integral IN port bypass valve:
 - An additional panel cutout is required for the valve stem.
 - Remove setscrew ⑳, knob (handle) ㉑ and cap ㉒ before mounting the 2400M/4400M as described above. 3 housing seals ㉓ should be installed on the valve shaft before inserting through the panel. After mounting the 2400M/4400M, reinstall the cap ㉒, knob (handle) ㉑ and setscrew ㉓.

How to Order

2400M

Use the table below to select the unique specification of your 2400M Pneumatic Indicating Relay.

Example	2400M	49	G	8	-AA	Code description	Comments
						Basic model (A)	
Basic model (A)	2400M					Anodized aluminum	Gulfproofed finish
						Port thread and finish (B)	
Port thread and finish (B)		47				TRIP port lockout NPT	USA ONLY
		48				TRIP port lockout BSP (PL)	UK ONLY
		49				TRIP port lockout and IN port bypass NPT	USA ONLY
		50				TRIP port lockout and IN port bypass BSP (PL)	UK ONLY
		51				Standard NPT	USA ONLY
		52				Standard BSP (PL)	UK ONLY
		53				Spring return NPT	USA ONLY
		54				Spring return BSP (PL)	UK ONLY
		67				IN port bypass BSP (PL)	UK ONLY
	68				IN port bypass NPT	USA ONLY	
						Piston (C)	
Piston (C)		E				Without orifice	Port thread and finish (B) = 51, 52, 53, 54, 67, 68
		G				Without orifice	Port thread and finish (B) = 47, 48, 49, 50
		J				With orifice	Port thread and finish (B) = 51, 52, 53, 54, 67, 68
						Seal material (D)	
Seal material (D)		3				Viton	Port thread and finish (B) = 51, 52, 53, 54, 67, 68
		7				Viton	Port thread and finish (B) = 47, 48
		8				Viton/Teflon	Port thread and finish (B) = 49, 50
						Customer special requirements (E)	
Customer special requirements (E)		-AA				Standard	May be omitted
		-***				Customer special code	

Pneumatic Space Saver Indicating Relay - 2400M/4400M

How to Order Continued

4400M

Use the table below to select the unique specification of your 4400M Pneumatic Indicating Relay.

Example	4400M	51	H	3	-AA	Code description	Comments
						Basic model (A)	
Basic model (A)	4400M					316 Stainless steel	
						Port thread and finish (B)	
Port thread and finish (B)		47				TRIP port lockout NPT	USA ONLY
		48				TRIP port lockout BSP (PL)	UK ONLY
		51				Standard NPT	USA ONLY
		52				Standard BSP (PL)	UK ONLY
		53				Spring return NPT	USA ONLY
		54				Spring return BSP (PL)	UK ONLY
		81				IN port bypass NPT	USA ONLY
		82				IN port bypass BSP (PL)	UK ONLY
		83				TRIP port lockout and IN port bypass NPT	USA ONLY
		84				TRIP port lockout and IN port bypass BSP (PL)	UK ONLY
						Piston (C)	
Piston (C)		B				Without orifice	Port thread and finish (B) = 51, 52, 53, 54, 81, 82
		C				Without orifice	Port thread and finish (B) = 47, 48, 83, 84
		H				With orifice	Port thread and finish (B) = 51, 52, 53, 54, 81, 82
						Seal material (D)	
Seal material (D)		3				Viton	Port thread and finish (B) = 51, 52, 53, 54
		8				Viton/Teflon	Port thread and finish (B) = 81, 82
		11				Viton	Port thread and finish (B) = 47, 48
		12				Viton/Teflon	Port thread and finish (B) = 83, 84
						Customer special requirements (E)	
Customer special requirements (E)		-AA				Standard	
		-***				Customer special code	

Pneumatic Space Saver Indicating Relay - 2400M/4400M

Specification

Indicating relay

		2400M		4400M	
		Metric units	English units	Metric units	English units
Body material		Anodized aluminum		316 Stainless steel	
Cover and screws		316 Stainless steel		316 Stainless steel	
Piston material		Anodized aluminum		Anodized aluminum	
Standard seals		Viton		Viton	
Window material		Acrylic		Acrylic	
Bezel material		Black nylon		316 Stainless steel	
Pipe threads		¼" NPT and BSP (PL)		⅛" NPT and BSP (PL)	
Operating pressure	W/O TRIP port lockout	140 - 860 kPa	20 - 125 psi	140 - 860 kPa	20 - 125 psi
	W/ TRIP port lockout	205 - 410 kPa	30 - 60 psi	205 - 410 kPa	30 - 60 psi
Flow coefficient	Indicating relay	Kv = 0.43	Cv = 0.50	Kv = 0.43	Cv = 0.50
	Internal orifice	Kv = 0.02	Cv = 0.02	Kv = 0.02	Cv = 0.02
	IN port bypass	Kv = 0.48	Cv = 0.56	Kv = 0.48	Cv = 0.56
Net weight		0.18 kg	0.4 lbs	0.41 kg	0.9 lbs

IN port bypass valve

		2400M		4400M	
		Metric units	English units	Metric units	English units
Body material		Anodized aluminum		316 Stainless steel	
Cover and screws		316 Stainless steel		316 Stainless steel	
Piston material		Anodized aluminum		Anodized aluminum	
Shaft		316 Stainless steel		316 Stainless steel	
Window material		Acrylic		Acrylic	
Standard seals		Viton and Teflon		Viton and Teflon	
Handle material		Polycarbonate		Polycarbonate	
Bezel material		Black nylon		316 Stainless steel	
Pipe threads		¼" NPT and BSP (PL)		¼" NPT and BSP (PL)	
Operating pressure	W/O TRIP port lockout	140 - 860 kPa	20 - 125 psi	140 - 860 kPa	20 - 125 psi
	W/ TRIP port lockout	205 - 410 kPa	30 - 60 psi	205 - 410 kPa	30 - 60 psi
Flow coefficient	Indicating relay	Kv = 0.43	Cv = 0.50	Kv = 0.43	Cv = 0.50
	Internal orifice	Kv = 0.02	Cv = 0.02	Kv = 0.02	Cv = 0.02
	IN port bypass	Kv = 0.48	Cv = 0.56	Kv = 0.48	Cv = 0.56
Net weight		0.3 kg	0.63 lbs	0.6 kg	1.3 lbs

Pneumatic Space Saver Indicating Relay - 2400M/4400M

Dimensions

2400M/4400M Pneumatic indicating relay with and without TRIP port lockout

Dimensions - inches (mm)

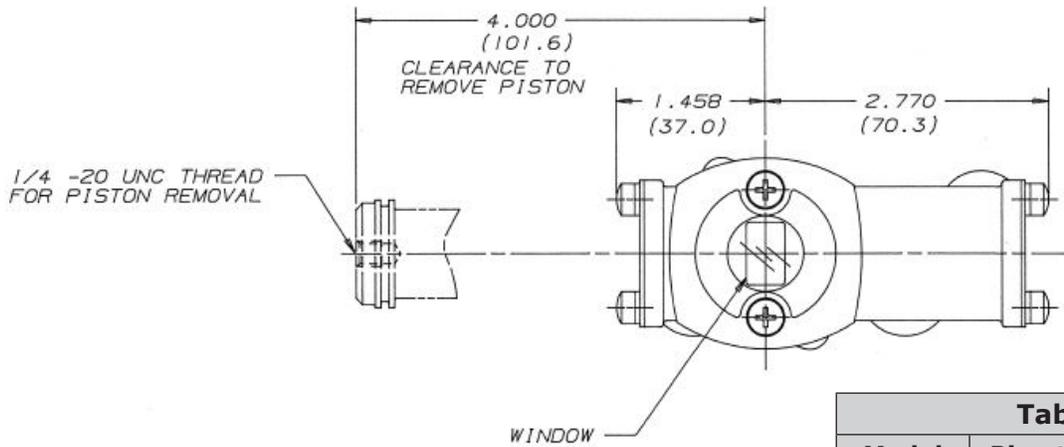
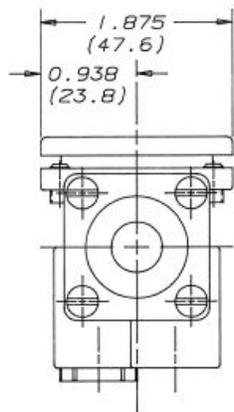
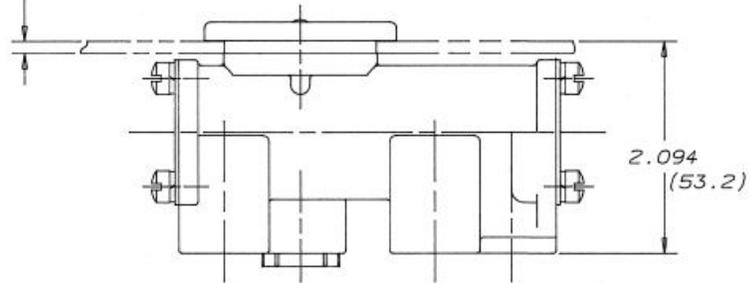


Table A		
Model	Pipe threads available	
2400M	1/4" NPT	1/4" BSP(PL)
4400M	1/8" NPT	1/8" BSP(PL)
IPBV	1/4" NPT	1/4" BSP(PL)

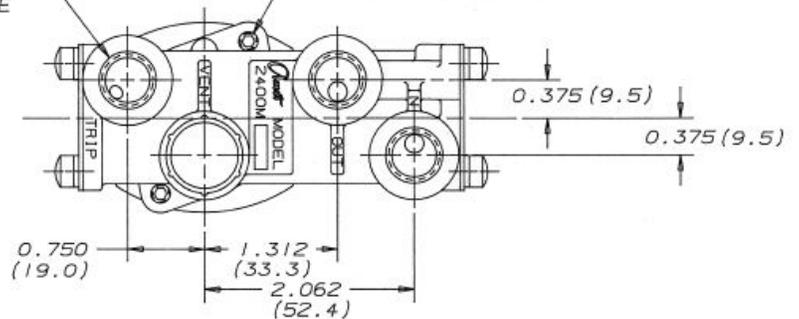


MAX. PANEL THICKNESS
0.125 (3.2)



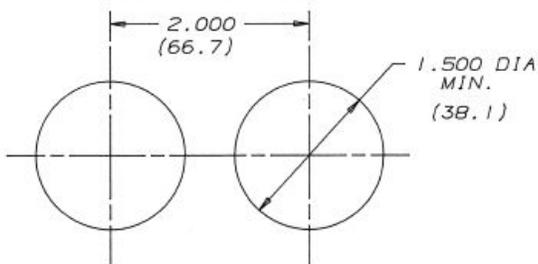
1/4 PIPE THREAD
4 PORTS - SEE TABLE

PANEL THICKNESS
ADJUSTING SCREW
USE 3/32 HEX KEY



Panel mounting dimensions

MINIMUM CENTER DISTANCE

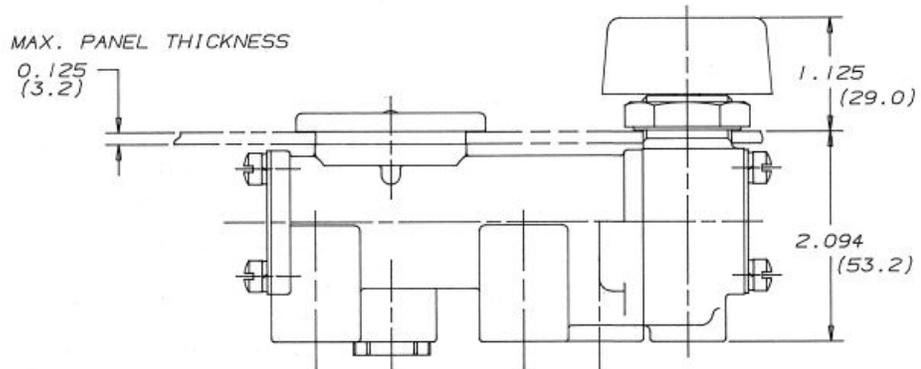
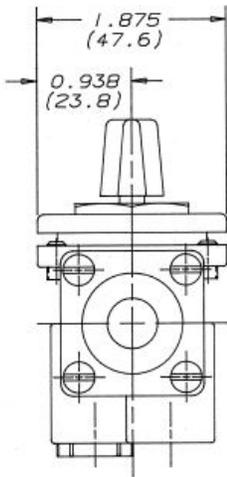
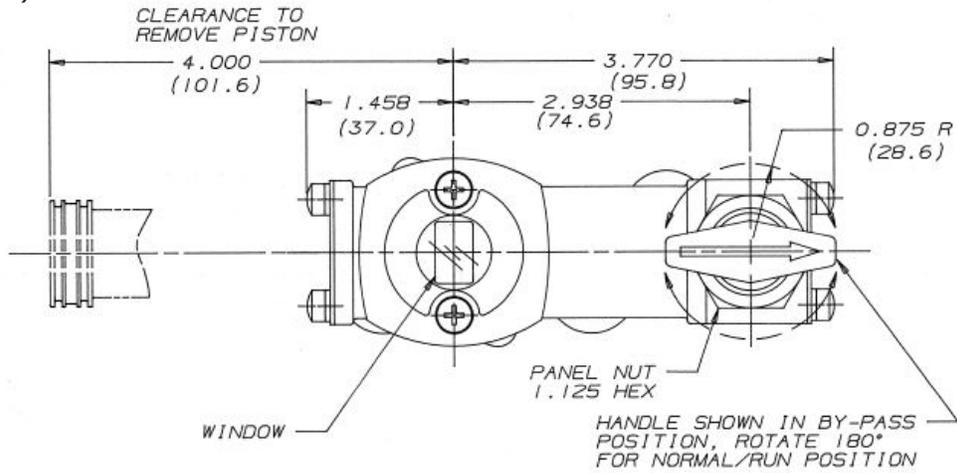


Pneumatic Space Saver Indicating Relay - 2400M/4400M

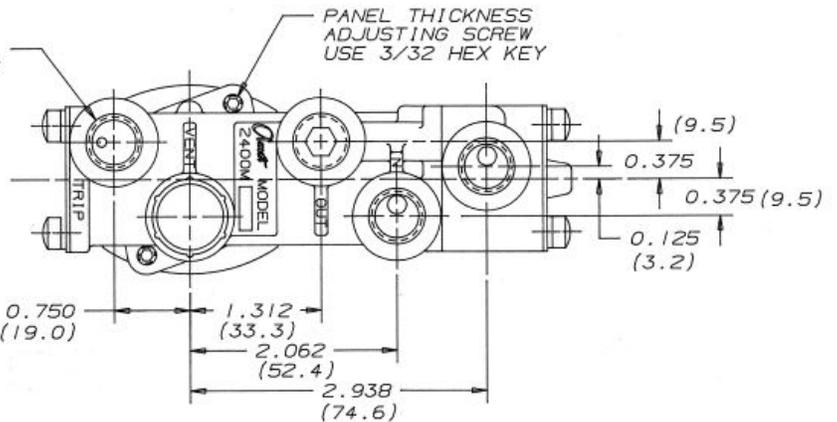
Dimensions Continued

2400M/4400M Pneumatic indicating relay with IN port bypass valve

Dimensions - inches (mm)



1/4 PIPE THREAD
5 PORTS - SEE TABLE
"OUT" PORT PLUGGED



Panel mounting dimensions

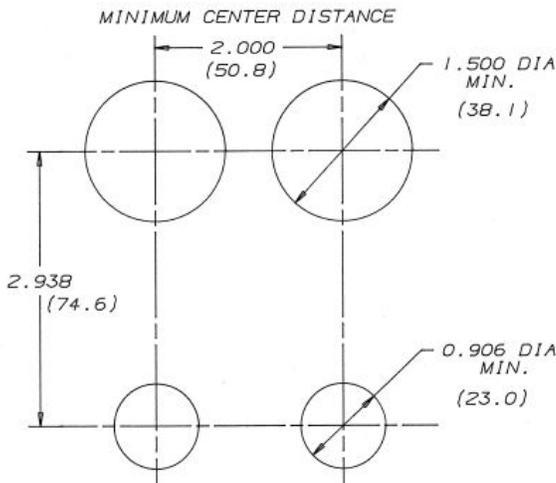


Table A

Model	Pipe threads available	
2400M	1/4" NPT	1/4" BSP(PL)
4400M	1/8" NPT	1/8" BSP(PL)
IPBV	1/4" NPT	1/4" BSP(PL)

Pneumatic Space Saver Indicating Relay - 2400M/4400M

Maintenance and Service Parts

Over time, exposure to foreign chemicals, particulate matter and prolonged operation at extreme conditions may reduce the effectiveness of the indicating relay. At such time, AMOT Pneumatic Indicating Relays can be restored to original performance by installing an AMOT pneumatic indicating relay service kit. Service kits include all new seals and seal components required for normal maintenance.

Periodic inspection, cleaning, o-ring replacement and lubrication is the only maintenance that these units should require.

How to order service kits

Service kits are available with seals required to service the valve. Order service kits by service kit model number which is identified by the Basic model (A) and Port thread and finish code (B) found in the AMOT valve part number.

Service kit model number structure

- 1) Identify the basic valve model, located in the Basic model (A) section of the AMOT valve part number.
- 2) Identify the port thread and finish code, located in the Port thread and finish (B) section of the AMOT valve part number.

AMOT 2400M/4400M Relays have a snap-action initiated by loss of pressure on the TRIP port end of the piston. If the unit is sluggish or fails to respond, check for foreign material, piston deformation, lack of o-ring lubrication, lack of sufficient air pressure etc. Also check the sensing device to assure proper operation.

AMOT designs and tests all its products to ensure that high quality standards are met. For good product life, carefully follow the installation and maintenance instructions; failure to do so could result in damage to the equipment being protected or controlled.

Refer to the AMOT valve part number that is printed on the valve nameplate and the AMOT valve part number structure on pages 6 and 7.

- 3) Use those 2 values in the service kit identification table below to identify the proper service kit to service the valve.

Service kit identification				
Basic model (A)	Port thread and finish (B)			Service kit model no.
2400M	51, 52*, 53, 54*			10403X002
4400M				
2400M	47, 48*			10403X004
4400M				
2400M	67*, 68			10403X008
4400M				
2400M	49, 50*			10403X009
4400M				
Examples				
Valve part number				Service kit model no.
2400M	49	G	8	10403X009
4400M	81	H	8	10403X008

* UK ONLY

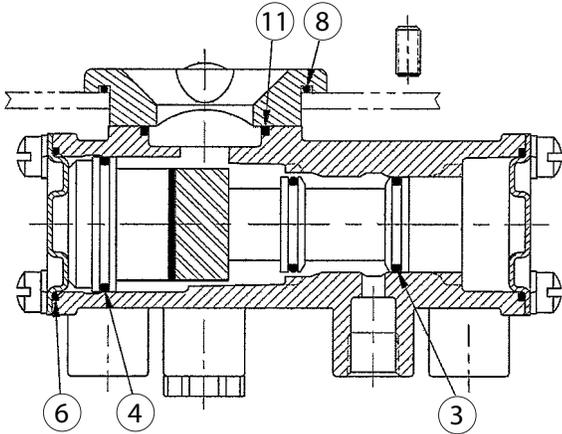
Pneumatic Space Saver Indicating Relay - 2400M/4400M

Maintenance and Service Parts Continued

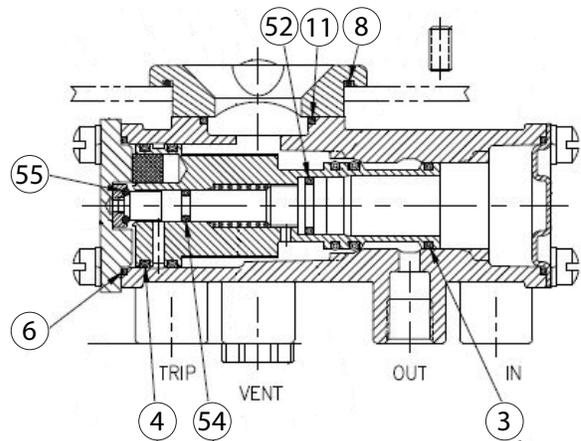
Service parts

Ref no.	Service kit parts				Description
	Qty.				
	10403X002	10403X004	10403X008	10403X009	
3	2	3	2	3	Lower piston seal
4	2	2	2	2	Upper piston seal
6	2	2	3	3	Cover seal
8	1	1	1	1	Bezel seal
11	1	1	1	1	Window seal
28	-	-	3	3	Packing seal
30	-	-	2	2	Shaft seal
43	-	-	3	3	Housing seal
52	-	1	-	1	Upper spool seal
54	-	1	-	1	Middle spool seal
55	-	1	-	1	Spool cap seal

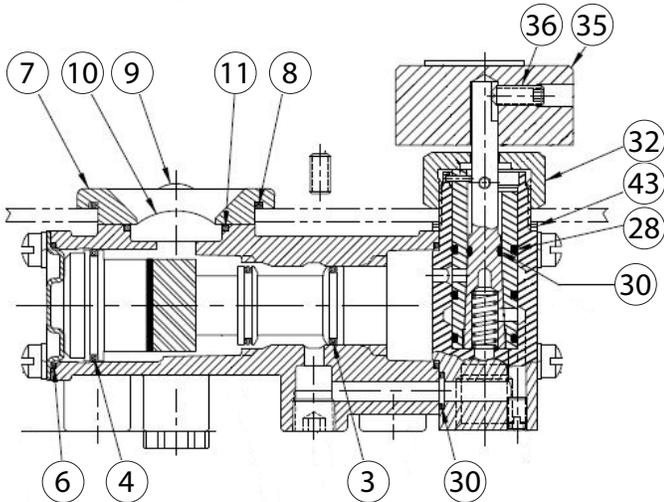
Indicating relay



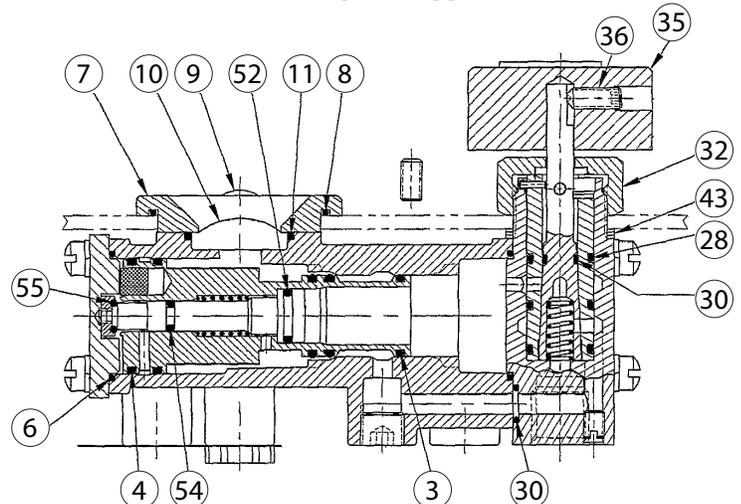
Indicating relay with TRIP port lockout



Indicating relay with IN port bypass



Indicating relay with TRIP port lockout and IN port bypass



Pneumatic Space Saver Indicating Relay - 2400M/4400M

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WARNING

This product can expose you to chemicals including Lead, which is known to the state of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.