



# Model 2400M/4400M

## PNEUMATIC INDICATING RELAY "Space Saver"

### INDICATING RELAY FEATURES

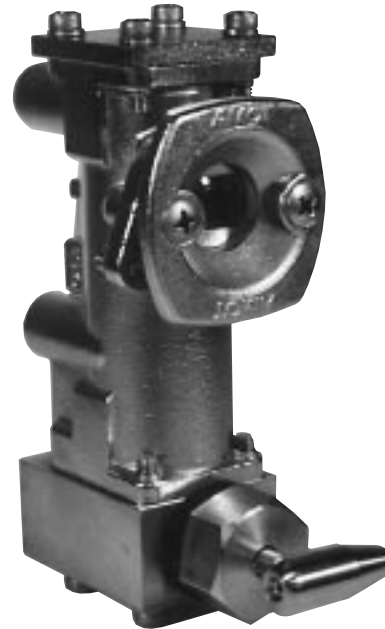
- MEETS NACE MR-01-75  
2400M - Gulfproofed Aluminum  
4400M - 316 Stainless Steel
- COMPACT SIZE
- ONLY ONE MOVING PART
- WIDE VIEWING ANGLE
- EASY MAINTENANCE
- PINPOINTS TROUBLE
- O-RING SEALED BEZEL

### OPTIONS

- TRIP PORT LOCKOUT  
(Patent No. 5,072,748)
- MANUAL BYPASS VALVE

### APPLICATIONS

- PNEUMATIC CONTROL PANELS
  - ~ COMPRESSOR CONTROL PANELS
  - ~ ENGINE CONTROL PANELS
  - ~ WELLHEAD CONTROL PANELS
- FIRST-OUT INDICATION
- FAIL-SAFE SYSTEMS
- SEQUENCING SYSTEMS



**2400M'S PROVEN GULFPROOFED FINISH** is a standard feature that provides excellent value and resistance to corrosive environments such as offshore platforms.

**4400M'S 316 STAINLESS STEEL** body provides superior resistance when needed in extreme or highly corrosive environments.

**COMPACT SIZE** saves up to 50% on panel space while retaining the proven features of the popular 2400D.

**ONLY ONE MOVING PART** for the simplicity and long term reliability you have come to expect from AMOT.

**WIDE VIEWING ANGLE** for quick and easy scanning at a glance even in poor lighting.

**QUICKLY PINPOINTS TROUBLE** in process or machinery systems to reduce troubleshooting time and costs, and holds the first-out-indication indefinitely.

**TRIP PORT LOCKOUT** (Patent No. 5,072,748) is available as an option for circuits where long sensing lines or sensor pressure interfaces require it, such as oil well control systems.

**IN PORT BYPASS VALVE** option allows testing of the indicating relay and sensor required by the Minerals Management Services (MMS).

## TRIP PORT LOCKOUT FEATURES

- **INTERNAL DESIGN**
  - No additional connections
  - No additional space required
  - A non-mechanical latch
- **ONLY TWO MOVING PARTS**
  - Simplicity
  - Long term reliability
- **VITON SEALS**
- **EASY TO SERVICE**

## APPLICATION

- **POSITIVE DETECTION**  
of low or slowly changing pressure signals.
- **ENSURES FIRST-OUT INDICATION**  
in pneumatic control panels signaled through long sensor lines.

## BYPASS VALVE FEATURES

- **INTEGRAL DESIGN**
  - Fewer connections
  - Less space required
- **GULFPROFFED ALUMINUM  
316 STAINLESS STEEL**
  - Meets NACE MR-01-75
  - 1/4 ports
- **VITON, TEFLON & KEL-F SEALS**
  - Long term reliability
- **FRONT PANEL OPERATED**

## APPLICATION

- **INDICATOR BYPASS FOR SENSOR AND  
CIRCUIT TESTING**
- **ALLOWS CIRCUIT TESTING AS REQUIRED  
BY MINERAL MANAGEMENT SERVICES  
(MMS) WITHOUT SYSTEM SHUTDOWN**

## INDICATING RELAY FEATURES

- **HIGH FLOW**
- **BOLTED-ON CONSTRUCTION**
  - Compact size
  - Fewer fittings needed
  - AMOT assembled and tested
- **VERSATILE DESIGN**
  - One moving part
  - Use with clean air or natural gas
- **THREADED VENT PORTS**
  - For capturing vented gas
- **FACTORY TESTED ASSEMBLY**
- **MEETS NACE MR-01-75**
  - 4400M Stainless Steel
  - 2400M Gulfproofed Aluminum
- **VITON SEALS**
- **EASY TO SERVICE**
  - No disconnecting of lines required

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## HOW TO ORDER THE AMOT PNEUMATIC INDICATING RELAY

When ordering please specify the following:

1. AMOT Model 2400M or 4400M
2. Any of the following special features if required:
  - a. Spring return on the Relay Piston.
  - b. If TRIP Port Lockout is required.
  - c. If IN Port Bypass Valve is required.
  - d. Without orifice (instead of with orifice)
  - e. BSP Parallel Port Threads (instead of NPT)
3. Service Tool Kit 10657 if needed.
4. Spacer 10596 for 3/16" thick panels (1/8" thick panel standard) for Model 2400.

This unit may be ordered using the full description as shown or by constructing a Model No. using the Model Code System. The complete Model No. for a gulfproofed aluminum unit with orifice, no spring return, NPT threads and Viton seals is 2400M51J3.

## MODEL CODE SYSTEM

**2400M**  
**Basic**  
**Model**  
**No.**

**51**      **J**      **3**      —      (---)      Special Requirement (MTO) Made to Order

G U L F P R O F E D  A L U M I N U M	TABLE A			TABLE B		TABLE C	
	Code No.	Description	Port Threads	Code No.	Piston	Code No.	Seal Materials
	51	Standard Indicating Relay	NPT	J	With Orifice	3	Viton
	52	Standard Indicating Relay	BSP(PL)	E	Without Orifice		
	53	With Spring Return	NPT	J	With Orifice	3	Viton
	54	With Spring Return	BSP(PL)	E	Without Orifice		
	47	With TRIP Port Lockout, Viton	NPT	G	Without Orifice	7	Viton
	48	With TRIP Port Lockout	BSP(PL)				
	68	With IN Port Bypass Valve (90° Turn)	NPT	J	With Orifice	3	Viton/Teflon
	67	With IN Port Bypass Valve (90° Turn)	BSP(PL)	E	Without Orifice		
	49	With TRIP Port Lockout and IN-Port Bypass Valve (90° Turn)	NPT	G	Without Orifice	8	Viton/Teflon
	50	With TRIP Port Lockout and IN Port Bypass Valve (90° Turn)	BSP(PL)				

**4400M**  
**Basic**  
**Model**  
**No.**

**51**      **H**      **3**      —      (---)      Special Requirement (MTO) Made to Order

3 1 6  S T A I N L E S  S T E E L	TABLE A			TABLE B		TABLE C	
	Code No.	Description	Port Threads	Code No.	Piston	Code No.	Seal Materials
	51	Standard Indicating Relay	NPT	H	With Orifice	3	Viton
	52	Standard Indicating Relay	BSP(PL)	B	Without Orifice		
	53	With Spring Return	NPT	H	With Orifice	3	Viton
	54	With Spring Return	BSP(PL)	B	Without Orifice		
	47	With TRIP Port Lockout	NPT	C	Without Orifice	11	Viton
	48	With TRIP Port Lockout	BSP(PL)				
	81	With IN Port Bypass Valve (90° Turn)	NPT	H	With Orifice	8	Viton/Teflon
	82	With IN Port Bypass Valve (90° Turn)	BSP(PL)	B	Without Orifice		
	83	With TRIP Port Lockout and IN Port Bypass Valve (90° Turn)	NPT	C	Without Orifice	12	Viton/Teflon
	84	With TRIP Port Lockout and IN Port Bypass Valve (90° Turn)	BSP(PL)				

Non Standard Product, extended lead time.

NOTE: Letters or numbers in the MTO space, other than nothing, A1 or AA, indicate the unit is built to special requirements and some of the other code numbers may not be valid. Check with the factory for full specifications of such models.

## OPERATIONS

### Indicating Relay (Fig. 1 & 2)

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 2400/4400M is connected to each condition-sensing device as shown in Fig. 2. The sensing devices are normally closed 2-way valves which detect undesirable temperatures, pressures, vibration, 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 event 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 striped trip tape can be clearly seen at a distance. An operator can check the 2400/4400M Indicating Relay panel at any time and tell immediately what caused the trouble.

When a 2400/4400M system is reset, most relays will momentarily move to the "TRIP" position, then back to "Green" 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 sensors 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 valves allow testing of the Indicating Relay and sensor as required by Minerals Management Service (MMS) without complete system shutdown.

### IN Port Bypass Valve (Fig. 3)

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 an 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 2400/4400M indicator window and all operation will be as described above.

In the "Bypass" mode, the 2400/4400M supply signal is passed around the 2400/4400M. The sensors or sensor lines may now be manually vented (or pressured) to observe that they function and that the resulting signal causes a shift in the 2400/4400M Indicating Relay. As shown in Fig 3, the operation of a bypassed 2400/4400M 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 (Fig. 4)

The TRIP Port Relay and IN Port Bypass Valve may be combined as shown in Fig 4. and will operate as described above.

### TRIP Port Lockout (Fig. 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.

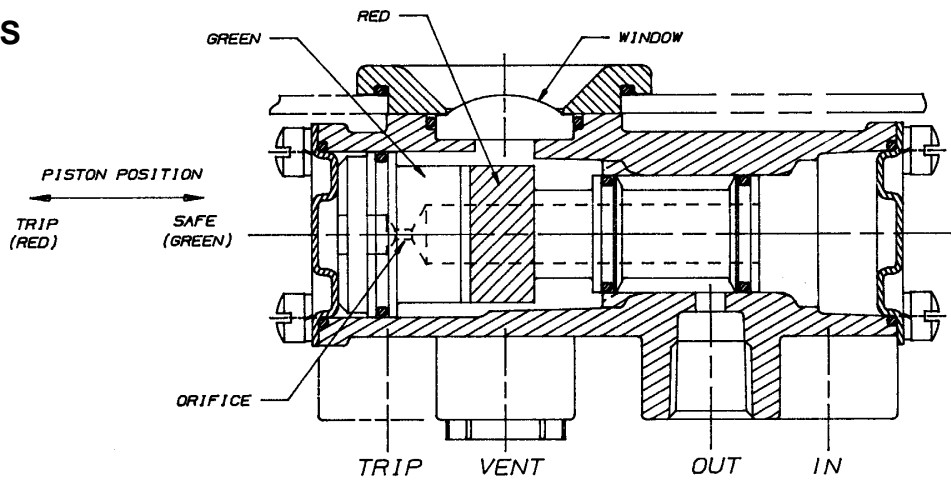
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## PIPING CONNECTIONS

Please 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!

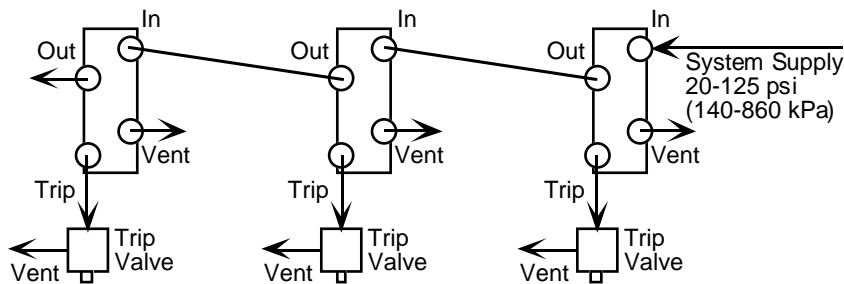
A 4125 Vent Closure is installed in the VENT Port of the 2400/4400M when shipped. It may be removed if the vents must be piped to a common vent header.

# OPERATIONS



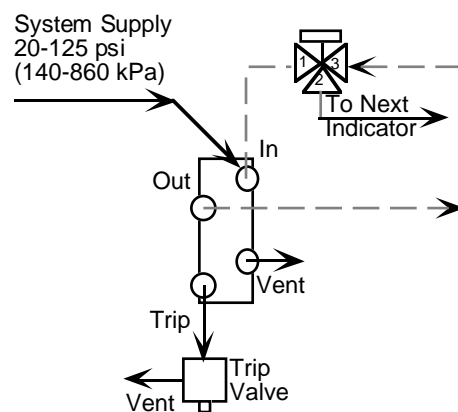
**Figure 1**  
2400M/4400M Indicating Relay

## TYPICAL PIPING

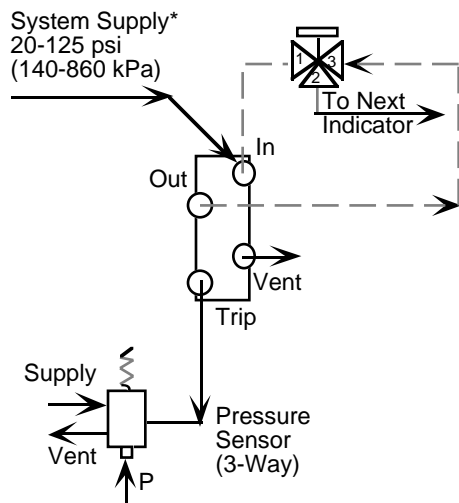


Normally-Closed Valves Sensing Temperature, Pressure, Speed, Fluid Level, Vibration, Etc.

**Figure 2**  
Indicating Relay

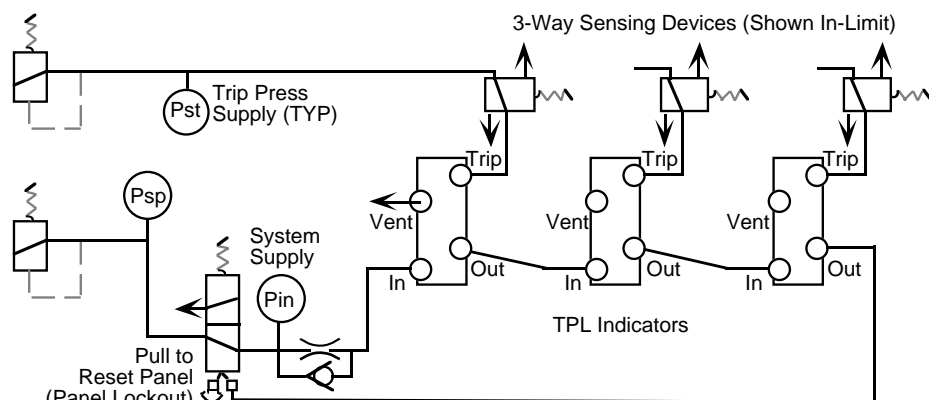


**Figure 3**  
With In-Port Bypass



\*Supply Pressure Should be Equal

**Figure 4**  
With Trip-Port Lockout  
and In-Port Bypass



**Figure 5**  
With Trip-Port Lockout

## PIPING NOTES

With the IN Port Bypass Valve option, a pipe plug is factory installed in the OUT Port of the 2400/4400M. It should not be removed. The air supply connection should be made to the "IN" port on the Indicating Relay.

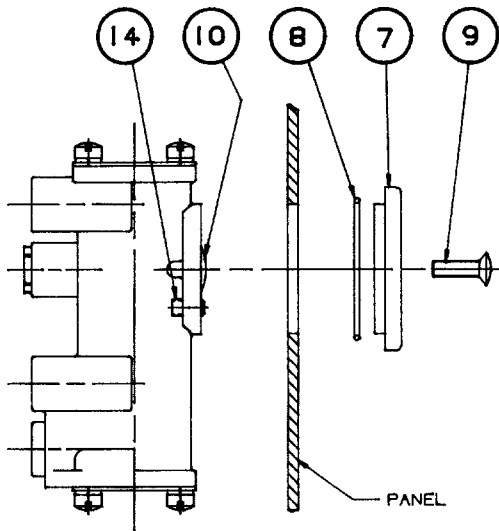
INPort Bypass Valve must be factory mounted to an Indicating Relay that has the required internal passages. **Do not mount an IN Port Bypass Valve on a standard Indicating Relay.**

# INSTALLATION

Model 2400 Pneumatic Indicating Relays are suitable for mounting in panels up to 1/8" (3.7mm) thick.

Model 4400M Pneumatic Indicating Relays are suitable for mounting in panels up to 1/4" (6.4mm) thick.

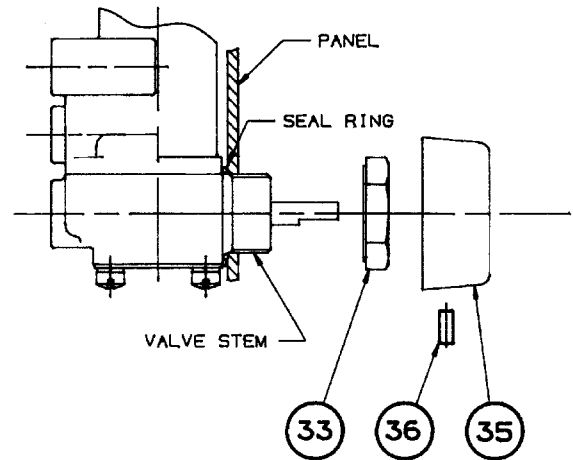
To Mount a Model 2400/4400M, remove the front Bezel (7) with O-ring (8) and place it through the panel cutout. With Setscrews (14) backed out all the way and Window (10) in place, position the relay on the inside of the panel. Reinstall O-ring (8), Bezel (7), and both Bezel Screws (9). When the Bezel screws are firmly in place, tighten Setscrews (14) against the back of the panel until the Relay is locked securely in place.



Mounting the Indicating Relay

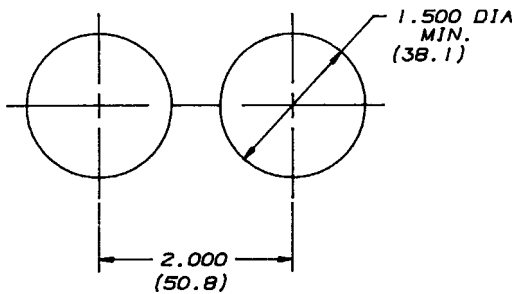
To Mount a Model 2400/4400M with internal TRIP Port Lockout, the procedure is the same as the mounting of the Model 2400/4400M, there are no additional steps.

To Mount a Model 2400/4400M with integral IN Port Bypass valve, an additional panel cutout is required for the valve stem. Remove Setscrew (36), Handle (35) and Panel Nut (33) before mounting the 2400/4400M as described at left. One or two seal rings (included) should be installed on the Valve Stem before inserting through the panel. After mounting the 2400/4400M, tighten Panel Nut (33) and reinstall its Handle (35).

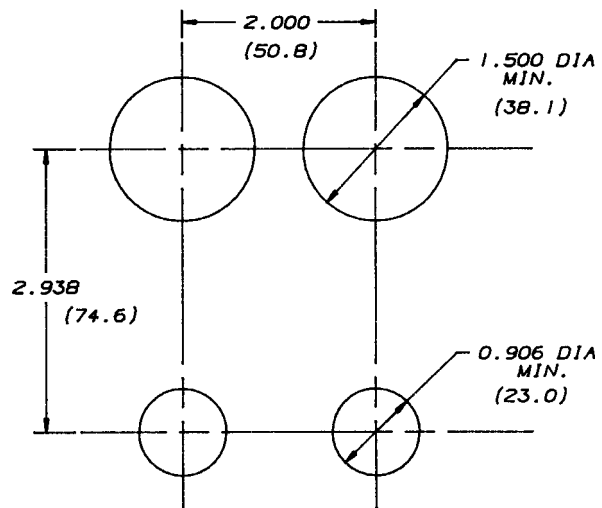


Integral IN Port Bypass Valve

## PANEL MOUNTING DIMENSIONS



2400M/4400M Indicating Relay



2400M/4400M with In-Port Bypass

Mounting Note: 2400M/4400M with Trip Port Lockout does not require any additional cutouts.

# DIMENSIONS

## 2400/4400M Indicating Relay ( with/without TRIP Port Lockout)

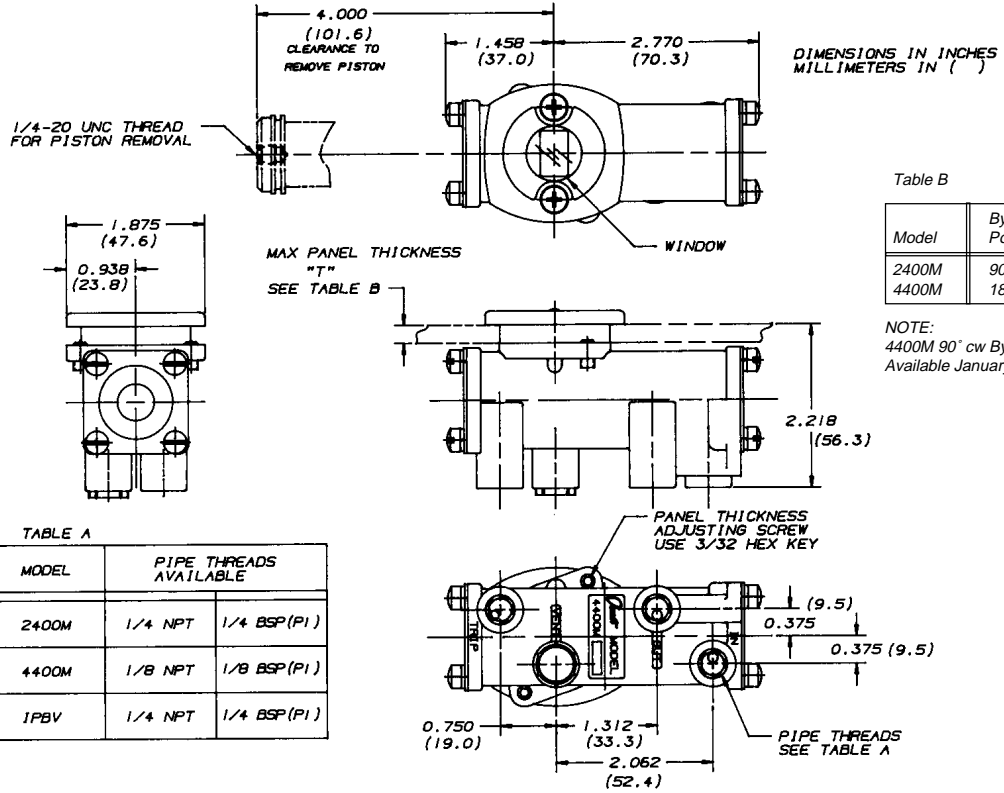
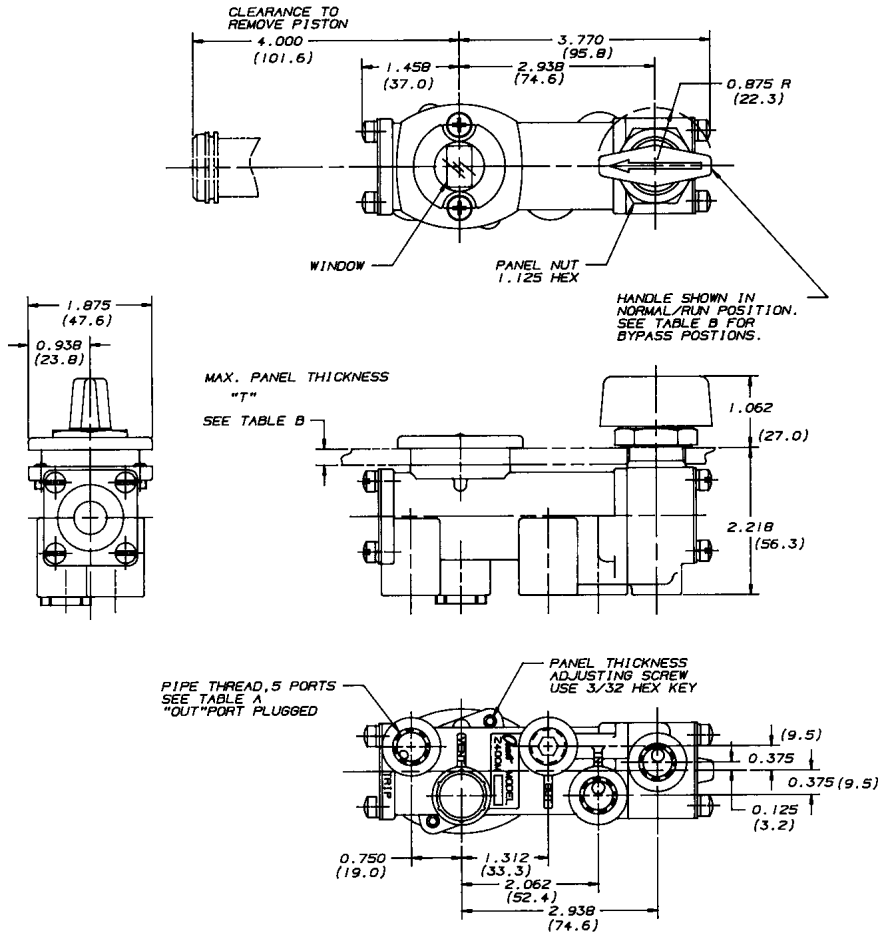


TABLE A

MODEL	PIPE THREADS AVAILABLE	
2400M	1/4 NPT	1/4 BSP (P1)
4400M	1/8 NPT	1/8 BSP (P1)
IPBV	1/4 NPT	1/4 BSP (P1)

## 2400/4400M WITH TRIP Port Relay and IN Port Bypass Valve



## SPECIFICATIONS

**Operating Temperature** ..... 15° to 200°F (-26° to 93°C)

**Flow Coefficient**

Indicating Relay ..... Cv = 0.50  
 Internal Orifice ..... Cv = 0.02  
 IN Port Bypass Valve ..... Cv = 0.56

**Net Shipping Weights**

2400M ..... 3/4 lb  
 4400M ..... 1-1/2 lbs  
 In Port Bypass ..... 1/2 lb

**Operating Pressure**

Indicating Relay w/o Trip Port Lockout ... 20-125 psi (140 to 860 kPa)  
 Indicating Relay with Trip Port Lockout .... 30 to 60 psi (205-410 kPa)

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 indicating relay to the green position.

## MATERIALS

**INDICATING RELAY**

	2400M	4400M
Body	Anodized Aluminum	316 Stainless Steel
Cover & Screws	316 Stainless Steel	316 Stainless Steel
Bezel	Black Nylon	316 Stainless Steel
Piston	Anodized Aluminum	Anodized Aluminum
Window	Acrylic	Acrylic
Seals	Viton	Viton
Net Weight	0.4 lbs (0.18 kg)	0.9 lbs (0.41 kg)

**IN PORT BY PASS VALVE**

	2400M	4400M
Body	Anodized Aluminum	316 Stainless Steel
Shaft	316 Stainless Steel	316 Stainless Steel
Seals	Viton and Teflon	Viton and Teflon
Handle	Polycarbonate	Polycarbonate
Net Weight	0.63 lbs (0.3 kg)	1.3 lbs (0.6 kg)

## SERVICE KITS

Service Kits consist of all the seals required for normal maintenance. For complete maintenance and service parts information, see Form 1272.

MODEL	SERVICE KIT PART NO.
2400M / 4400M	10403X002
2400M / 4400M and IN Port Bypass (IPBV)	10403X003
2400M / 4400M and TRIP Port Lockout (TPL)	10403X004
2400M / 4400M and IPBV and TPL	10403X005

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