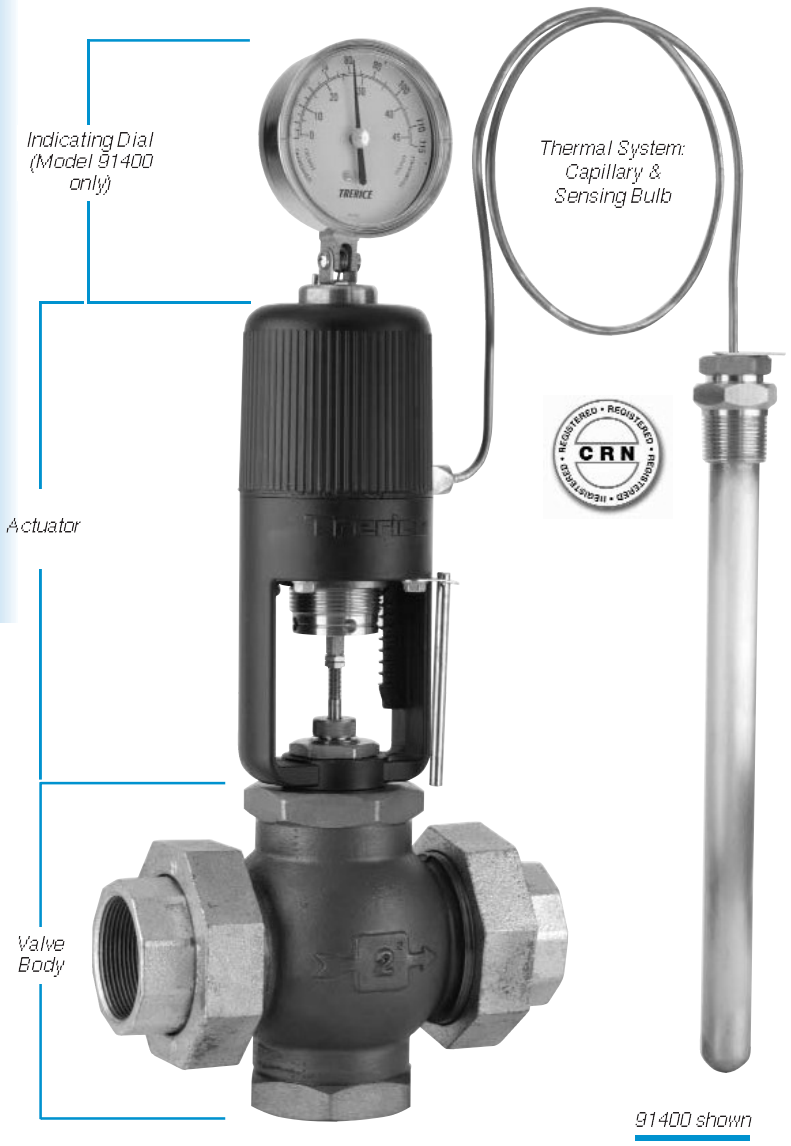
91000 Series Temperature Regulator

The "Self-Op" (Self-Operated Temperature Regulator)



91400 shown

- Self-Operating Design
- Indicating, Non Indicating or Safety Models Available
- Heavy Duty Die Cast Aluminum Housing
- 1/2" thru 6" Valve Sizes
- Fully Enclosed Bellows
- Internal Overrange protection

The **91000 Series** (Models 91000, 91400 & 91600) Self-Operating Temperature Regulator is the preferred choice of original equipment manufacturers, mechanical contractors and specifying engineers. These regulators require no external power source and are ideal for regulating the temperature of tanks, process streams and various types of industrial equipment. The Actutator is noted for its rugged die-cast aluminum housing, fully enclosed bellows assembly and internal over range protection.

Valve bodies for the **91000** are offered in single-seated, double-seated and 3-way designs and are available in Bronze, Cast-Iron, Cast-Steel and Stainless Steel construction.

The Model **91000** (without indicating dial) features a lower profile and should be specified where space constraints may be an issue.

The Model **91400** (with indicating dial) will allow the operator to verify the process temperature and to aid in temperature adjustment.

The Model **91600** Fail-Safe Actuator is designed to cause the valve to fail in the safe control position (open in a cooling application, closed in a heating application) should accidental damage to the thermal system occur, resulting in loss of the pressure charge.

For optimal performance, the service conditions (medium, flow, temperature, inlet and outlet pressures) of the application must be considered when selecting a valve. Please refer to the Valve Selection Section of this catalog. For applications where the process media may be corrosive or contained under pressure, the use of a thermowell is required to prevent damage to the regulator bulb and facilitate its removal from the process. Improper application may cause failure of the valve, resulting in possible personal injury or property damage.

For replacement or service parts please see Accessories and Replacement Parts in the Regulators and Control Valves section of the list price sheet.

HOW TO ORDER

Sample Order Number: **91400 R06 08 B01 W01 - A26**

Models	Range	Capillary Length	Thermal System	Thermowell*	Valve Body Selection
91000 Non-Indicating **91400** Indicating Dial **91600** Fail Safe	Refer to Standard Ranges (page 176)	**08** 8 Feet **12** 12 Feet **16** 16 Feet **20** 20 Feet	Refer to Thermal System Selection Chart (pages 178-179)	**W01** - Brass **W02** - Steel **W04** - 316SS *(Omit if not required)*	For 91000/91400 Models (refer to pages 180-187) For 91600 Models (refer to page 188) *(Omit this selection if purchasing Actuator only)*

* Thermowell sized to fit bulb as specified.

Other Capillary Lengths available: Specify in 4 Foot increments (52' maximum)

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91000 Series
Temperature Regulator

Specifications

Actuator Models

91000	(Non-Indicating)
91400	(Indicating Dial)
91600	(Fail-Safe)

Power Requirements
Fully self-contained –
no external power required

Dial Thermometer
3½" dial, stainless steel case, swivel and angle adjustment (Model 91400 only)

Housing Die cast aluminum, epoxy powder coated blue finish

Set Point Scale Integral to housing

Bellows High pressure brass, corrosion resistant, tin plated finish

Adjustment Screw
Brass

Adjustment Screw Bushing
Lubricant impregnated sintered bronze

Range Adjustment Spring
Cadmium Plated

Overrange Protection
Upper range limit +100°F for temporary situations
(not available for Model 91600)

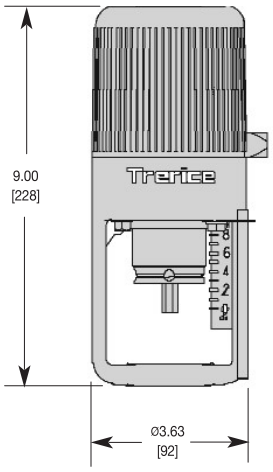
Approximate Shipping Weight

Actuator
91000: 6.0 lbs [2.70 kg]
91400: 6.6 lbs [2.97 kg]
91600: 9.5 lbs [4.32 kg]

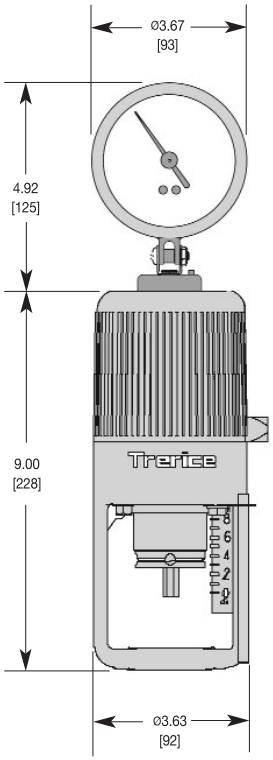
Valve
See Valve Selection tables

All dimensions are nominal. Dimensions in [ ] are in millimeters.

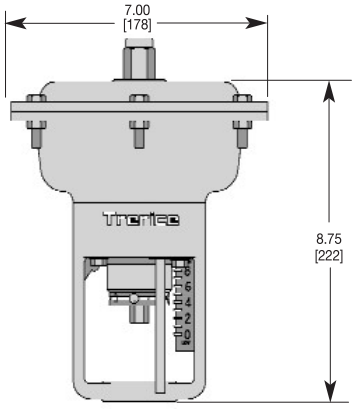
91000
Non-Indicating Actuator



91400
Indicating Actuator



91600
Fail-Safe Actuator



Temperature Ranges

The "Self-Op" Temperature Regulator (91000, 91400, & 91600 Models)

Standard Ranges

91000 & 91400 Actuators

Range Code	Nominal Range	Recommended Working Span: Single Seat, In-To-Close Valves; Double Seat, In-To-Close Valves; Double Seat, In-To-Open Valves; All 3-Way Valves	Recommended Working Span: Single Seat In-To-Open Valves	Dial Thermometer Range (Model 91400 only)
R01*	20° to 70°F & -10° to 20°C	40° to 65°F & 5° to 20°C	N/A	30° to 115°F & C
R02*	40° to 90°F & 5° to 30°C	65° to 85°F & 20° to 30°C	N/A	50° to 140°F & C
R03	30° to 115°F & 0° to 45°C	85° to 110°F & 30° to 45°C	50° to 80°F & 10° to 25°C	30° to 115°F & C
R04	50° to 140°F & 10° to 60°C	110° to 135°F & 45° to 60°C	80° to 105°F & 25° to 45°C	50° to 140°F & C
R05	75° to 165°F & 25° to 70°C	135° to 160°F & 60° to 70°C	105° to 130°F & 40° to 50°C	75° to 165°F & C
R06	105° to 195°F & 40° to 90°C	160° to 190°F & 70° to 90°C	130° to 155°F & 50° to 65°C	105° to 195°F & C
R07	125° to 215°F & 55° to 100°C	190° to 210°F & 90° to 100°C	155° to 180°F & 65° to 80°C	125° to 215°F & C
R09	155° to 250°F & 70° to 120°C	210° to 245°F & 100° to 120°C	180° to 215°F & 80° to 100°C	155° to 250°F & C
R10	200° to 280°F & 95° to 135°C	245° to 275°F & 120° to 135°C	215° to 245°F & 100° to 120°C	200° to 280°F & C
R11	225° to 315°F & 110° to 155°C	275° to 310°F & 135° to 155°C	245° to 280°F & 120° to 140°C	225° to 315°F & C
R12	255° to 370°F & 125° to 185°C	305° to 365°F & 155° to 185°C	275° to 335°F & 135° to 165°C	255° to 370°F & C
R13	295° to 420°F & 145° to 215°C	365° to 415°F & 185° to 215°C	335° to 385°F & 165° to 195°C	295° to 420°F & C
R14	310° to 440°F & 155° to 225°C	415° to 435°F & 215° to 225°C	385° to 405°F & 195° to 205°C	310° to 440°F & C

**Not recommended for single seated valves.*

The recommended working span typically falls within the upper third of the nominal range. Single Seat In-To-Close, all Double Seat, and all 3-Way valves have a recommended working span in this part of the nominal range. However, due to differing thrust requirements, Single Seat In-To-Open valves have a recommended working span in the middle one-third of the nominal range.

Standard Ranges

91600 Fail-Safe Actuators

Range Code	Nominal Range and Recommended Working Span
R81	40° to 65°F & 5° to 20°C
R82	55° to 80°F & 15° to 25°C
R83	65° to 90°F & 20° to 30°C
R84	80° to 110°F & 25° to 40°C
R85	90° to 115°F & 30° to 45°C
R86	110° to 140°F & 40° to 60°C
R89	140° to 175°F & 60° to 80°C
R90	170° to 195°F & 80° to 90°C
R91	190° to 210°F & 85° to 100°C
R92	205° to 225°F & 95° to 105°C
R93	215° to 250°F & 100° to 120°C
R94	230° to 265°F & 110° to 130°C
R95	245° to 280°F & 120° to 135°C
R96	270° to 300°F & 135° to 150°C

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Thermowells

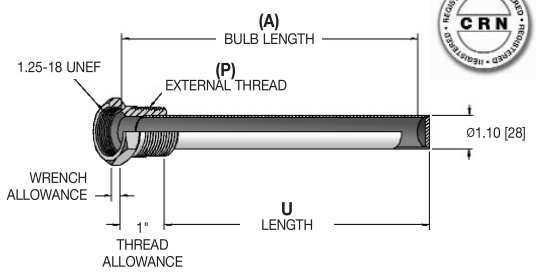
for **Temperature Regulator** (91000, 91400, & 91600 Models)

If Thermowells are to be purchased as a separate item, or if a Special Thermowell is required, please refer to this page. If a complete Temperature Regulator is purchased, the proper Thermowell to match the sensing bulb ordered will be supplied. Please note sensing bulb size is affected by capillary length. Indicate W01 for Brass, W02 for Steel or W04 for 316SS.

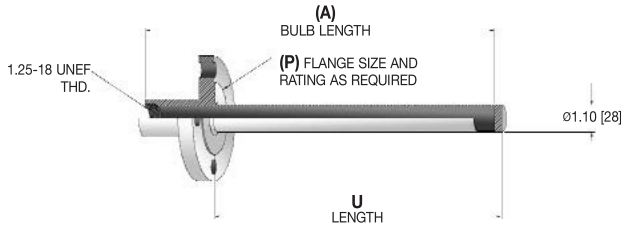
Thermowell to fit Standard Bulb

All dimensions are nominal. Dimensions in [ ] are in millimeters.

Threaded



Flanged



Pressure Rating (psi)

	Operating Temperature		
Material	70°F	300°F	500°F
Carbon Steel	850	850	680
316 Stainless Steel	850	780	730
Brass	480 psi @ 150°F, 400 @ 350°F		

Lengths

(A) BULB LENGTH	U Length
13"	12.25 [311]
16"	15.25 [387]
20"	19.25 [489]
24"	23.25 [591]

Maximum pressure and temperature ratings are limited by the choice of flange. Please see ANSI/ASME B16.5-2003 for more information.

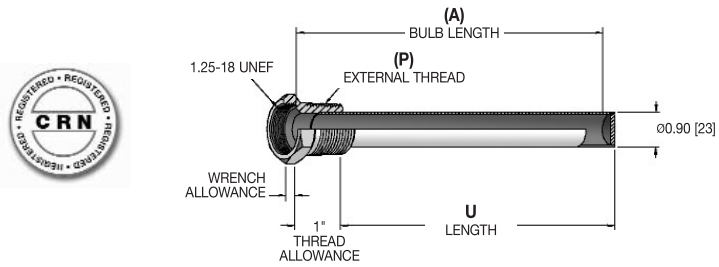
HOW TO ORDER

Sample Order Number: **53-6S6**

Thermowell Style	(P) External Connection	(A) Bulb Length	Material
53 - Temperature Regulator	**6** 1¼ NPT	**S** 13" Bulb	**2** Brass (500 psi max.)
	71 1½" 150# RFF *	**Se** 16" Bulb	**3** Steel (500 psi max.)
	81 2" 150# RFF *	**We** 20" Bulb	**6** 316SS (1000 psi max.)
	181 3" 150# RFF *	**Wk** 24" Bulb	

* Not available in Brass.
Other connections and lengths may be available, consult factory.

Thermowell to fit Special "Small" Bulb



Lengths

(A) Bulb Length	Thermowell U Length
9"	8.25 [210]
12"	11.25 [286]

Pressure Rating (psi)

	Operating Temperature		
Material	70°F	300°F	500°F
Carbon Steel	850	850	680
316 Stainless Steel	850	780	730
Brass	480 psi @ 150°F, 400 @ 350°F		

HOW TO ORDER

Sample Order Number: **53-5M2**

Thermowell Style	(P) External Thread	(A) Bulb Length	Material
53 - Temperature Regulator	**5** 1 NPT	**M** 9" Bulb	**2** Brass (500 psi max.)
		R 12" Bulb	**3** Steel (500 psi max.)
			6 316SS (1000 psi max.)

Selection of the proper thermowell is the sole responsibility of the user. Pressure limitations must be considered. Improper application may cause failure of the thermowell, resulting in possible personal injury or property damage.

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Pressure Regulators

DESIGN & OPERATION

One-Piece Design

Two-Piece Design

Description

A Pressure Regulator is a mechanical device designed to regulate system flow pressure in response to upstream or downstream pressure changes.

Principles of Operation

Trerice Pressure Regulators are available in two basic configurations: a one-piece design with an integrated actuation system, or a two-piece design comprised of individual components (actuator and globe valve), which are factory assembled into a complete regulator.

One-Piece Pressure Regulators (Series 988, 1002) have an internal diaphragm that is attached to a valve plug. The diaphragm is balanced between the downward force of an adjustment spring and the upward force of the reduced downstream pressure within the regulator. As the downstream pressure decreases, the adjustment spring pushes down on the diaphragm, which in turn opens the valve. Conversely, as downstream pressure increases, the diaphragm is forced upward, overcoming the force of the spring and closing the valve.

Two-Piece Pressure Regulators (921 Series) employ a user-supplied pressure line connecting the actuator to the point of regulation within the pipeline or process. The process pressure will depress a diaphragm within the actuator housing and the subsequent movement of the diaphragm will push an attached valve stem to the “in” position. Choice of a stem In-To-Close or stem In-To-Open globe valve will determine if the assembled pressure regulator is for reducing downstream pressure (ITC or normally open) or relieving upstream pressure (ITO or normally closed). This unit features spring-opposed actuation: when the controlled pressure decreases, the adjustment spring will push the diaphragm upward, which will in turn move the valve stem back to the “out” position.

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921 Series Pressure Regulator

Pressure Reducing or Back Pressure Relief Valve

PRESSURE REGULATORS

921 shown

- Self-Contained Design
- Spring-loaded Diaphragm Actuated
- Cast Ductile Iron Housing & Yoke
- 1/2" – 6" Valve Sizes

The Trerice **921Series** Pressure Regulator is fully self-contained and requires no external power source. This regulator requires that a user- supplied pressure sensing line be connected from the controlled point to the diaphragm actuator. Pressure in this line acts upon the diaphragm to develop the necessary thrust to stroke the valve, thereby maintaining the system at the desired condition.

- For pressure reducing applications, the pressure sensing line is mounted downstream, and the valve closes as this sensed pressure increases.

Reduced outlet pressure not to be less than 10% of inlet pressure.

- For back pressure relief applications, the sensing line is mounted upstream, and the valve opens as the sensed pressure increases.

For optimal performance, the service conditions (medium, flow, temperature, inlet and outlet pressures) of the application must be considered when selecting a valve. Please refer to the Valve Selection Section of this catalog. Improper application may cause failure of the valve, resulting in possible personal injury or property damage.

For replacement or service parts please see Accessories and Replacement Parts in the Regulators and Control Valves section of the list price sheet.

Specifications

Actuator Models

921PRV (Pressure Reducing Valve)
921BPR (Back Pressure Relief)

Housing Cast ductile iron, black finish

Pressure Plate Cast iron

Diaphragm Material Nylon reinforced Neoprene

Regulated Pressures
2–100 psi

Maximum PRV Inlet Pressure
1/2" - 2": 200 psi
2 1/2" - 6": 125 psi*

Maximum BPR Set Pressure
100 psi

Pressure Connection
1/4 NPT

Adjustment Nut
Steel

Adjustment Screw
Brass

Adjustment Spring
Cadmium plated steel

Body Material
1/2"–2": Bronze
2 1/2"–6": Cast iron

Trim Material Stainless steel

Trim Style Quick-opening

Connection
1/2"-2": Threaded, malleable Iron union ends
2 1/2"–6": Class 125 Flanged

Pressure & Temperature Rating
1/2"-2": 250 psi @ 410° F (210° C)
2 1/2"–6": 125 psi @ 350° F (175° C)

HOW TO ORDER

Sample Order Number: **921PRV-A55-075060**

Model	Valve	Inlet Pressure	Outlet Pressure
921PRV- (Pressure Reducing Valve) **921BPR-** (Back Pressure Relief)	See Available Valves	Specify Upstream Pressure in psig (i.e., 75 psig = 075)	Specify Downstream Pressure in psig (i.e., 60 psig = 060) Omit if 921BPR

*200 psi inlet available with Class 250 flanged valve body. Consult Factory.

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988 Series Pressure Regulator

for Steam Service

988 shown

- Cast-Iron Construction
- Stainless Steel Seat & Disc
- 1/2" – 2" Sizes
- Sensitivity Adjuster

Specifications

Model	**988**
Body	Cast-Iron
Diaphragm	Laminated bronze
Trim	Valve Disc: Stainless steel Seat: Stainless steel
Strainer	Stainless steel
Maximum Inlet Pressure	200 psi
Operating Temperature	Maximum: 387˚F (197˚C)

The Trerice **988 Series** Pressure Regulator, designed for steam service, provides a sensitive response to reduced pressure changes and delivers the fullest possible volume without an appreciable reduced pressure drop. The 988 includes a spring-loaded diaphragm that can be externally adjusted by the operator to provide a uniform outlet pressure. This regulator is intended for use in testing fixtures, autoclaves, steam tables, vulcanizers, sterilizers and other process applications. It features a "sensitivity adjuster," which can be used to eliminate any vibrating or chattering caused by critical flow requirements.

For optimal performance, the service conditions (medium, flow, temperature, inlet and outlet pressures) of the application must be considered when selecting a valve. Please refer to the Valve Selection Section of this catalog. Improper application may cause failure of the valve, resulting in possible personal injury or property damage.

HOW TO ORDER

Sample Order Number: **988 O8 B**

Model	Connection Size (NPT)			Reduced Pressure Range		
988	04	1/2	NPT	A	3 to 15 psi	1/2 - 1 1/4 NPT Connection Size only.
	06	3/4	NPT	B	10 to 30 psi	
	08	1	NPT	C	30 to 140 psi	
	10	1 1/4	NPT			
	12	1 1/2	NPT	D	5 to 40 psi	1 1/2 & 2 NPT Connection Size only.
	16	2	NPT	E	30 to 100 psi	

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1002 Series Pressure Regulator

for Water Service

1002 shown

- Bronze or Cast-Iron Construction
- Stainless Steel Seat
- 1/2" – 2 1/2" Sizes

Specifications

Model		
1002		
Body	1/2" to 2":	Bronze
	2 1/2":	Cast-Iron
Diaphragm	Nitril	
Trim	Valve Disc:	Nitril
	Seat:	Stainless steel
Maximum Inlet Pressure	300 psi	
Operating Temperature	Maximum: 160° F (71°C)	

The Trerice **1002 Series** Pressure Regulator is a high capacity pressure reducing valve for water service. The 1002 has a broad seat opening and is capable of supplying large volumes at reduced pressures. This regulator is intended for use in a variety of commercial, institutional and industrial applications. It features a bronze or cast-iron body and a stainless steel seat.

For optimal performance, the service conditions (medium, flow, temperature, inlet and outlet pressures) of the application must be considered when selecting a valve. Please refer to the Valve Selection Section of this catalog. Improper application may cause failure of the valve, resulting in possible personal injury or property damage.

HOW TO ORDER

Sample Order Number: **1002 12 B**

Model	Connection Size (NPT)	Reduced Pressure Range
1002	**04** 1/2	**A** 10 to 35 psi
	06 3/4	**B** 25 to 75 psi
	08 1	**C** High Pressure Range
	10 1 1/4	*50 to 145 psi (1/2, 3/4, 1 NPT only)*
	12 1 1/2	*50 to 120 psi (1 1/4 NPT only)*
	16 2	*50 to 95 psi (1 1/2, 2, 2 1/2 NPT only)*
	20 2 1/2	

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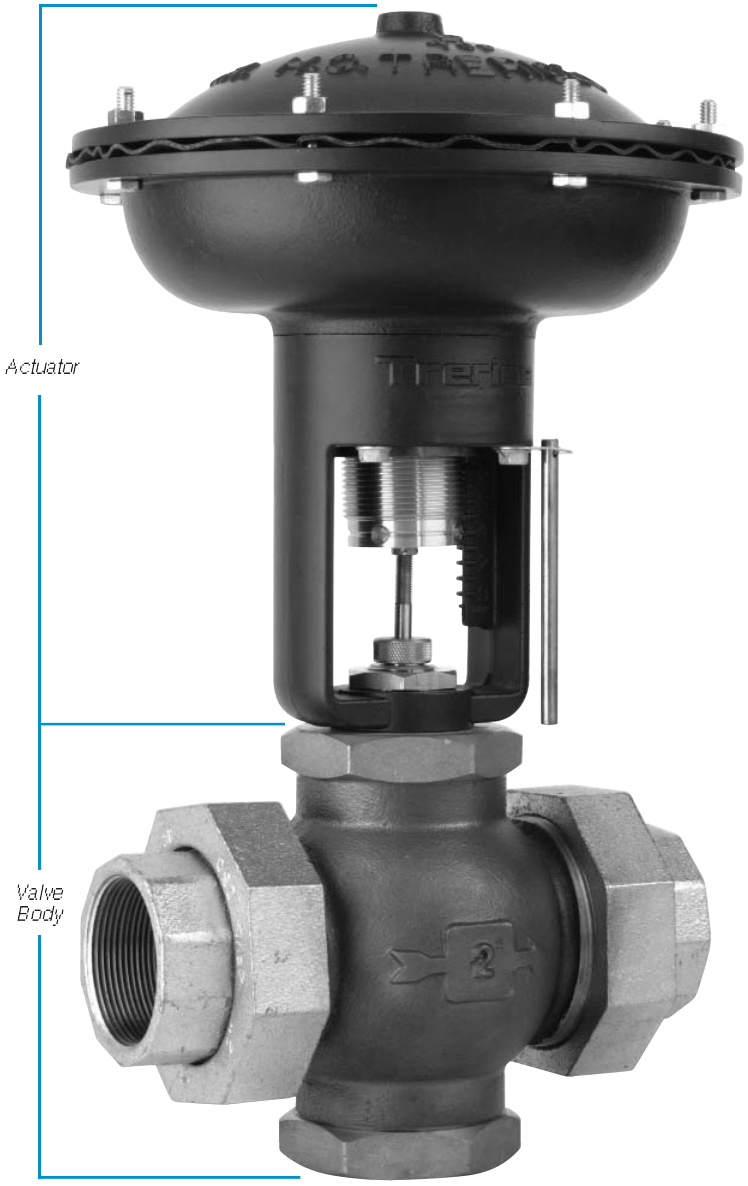
910 Series Compact Control Valve



910B shown

- Diaphragm Actuated
- 7", 9", & 12" Actuator Sizes
- Heavy Duty Die CastHousing
- 1/2" – 6" Valve Sizes

The Trerice **910 Series Pneumatic Control Valve** offers high quality at an economical price, incorporating many features found only on more expensive units. Models are available to provide the proper flow response required by the application.

The **910A, 910B & 910C** are used for On/Off control applications, providing a quick-opening flow response when used with single or double seated valves.

The **910TB** is used for proportional or PID control applications, providing a throttling flow response when used with double seated or 3-way valves.

The **910EPA & 910EPC** is used for proportional or PID control applications, providing an equal percentage flow response when used with single seated valves.

For optimal performance, the service conditions (medium, flow, temperature, inlet and outlet pressures) of the application must be considered when selecting a valve. Please refer to the Valve Selection Section of this catalog. Consult the Valve Selection tables for the capabilities of a particular valve/actuator assembly. Improper application may cause failure of the valve, resulting in possible personal injury or property damage.

For replacement or service parts please see Accessories and Replacement Parts in the Regulators and Control Valves section of the list price sheet.

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940 Series Heavy Duty Control Valve

940B shown

- Diaphragm Actuated
- 14" & 17" Actuator Sizes
- Heavy Duty Die Cast Housing and Yoke
- 1/2" – 8" Valve Sizes

The Trerice **940 Series** Pneumatic Control Valve offers extreme quality and maximum valve performance. The Series 940 is available in a variety of 2-way and 3-way valve styles for industrial, demanding HVAC and commercial process applications. The 940 Actuator can be furnished with a 14" or 17" diaphragm and includes a rugged, die cast aluminum diaphragm chamber.

For optimal performance, the service conditions (medium, flow, temperature, inlet and outlet pressures) of the application must be considered when selecting a valve. Please refer to the Valve Selection Section of this catalog. Consult the Valve Selection tables for the capabilities of a particular valve/actuator assembly. A positioner may be required to maximize the shut-off capability of the valve. Improper application may cause failure of the valve, resulting in possible personal injury or property damage.

For replacement or service parts please see Accessories and Replacement Parts in the Regulators and Control Valves section of the list price sheet.

HOW TO ORDER

Sample Order Number: **940B-K84-760P**

Actuator Models	Valve Body Number	Positioner Model
940B 940C	Refer to pages 242–249	760P Pneumatic 760E Electropneumatic Omit if None

1. ***Determine*** *the valve size, style and material required by the application.*
2. ***Consult*** *the Valve Selection table to determine the required Valve Model.*
3. ***Refer*** *to the maximum close-off pressure columns to determine the Actuator (with or without positioner) needed to provide the close-off pressure required by your application.*
4. ***Specify*** *the Actuator Model.*
5. ***Specify*** *the Valve Body Number.*
6. ***Specify*** *the Positioner Model (if required).*

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940E Series Electric Motor Control Valve

940E shown

- Fail Open or Closed
- Cast Aluminum or Iron Linkages
- 1/2" – 8" Valve Sizes

The Trerice **940E Series** Control Valve uses an AC power supply to stroke the valve via an actuator drive, electric motor, and valve linkage unit. The actuator drive causes the motor to drive the valve stem up or down in relation to an input signal (factory set at 4-20 mA, field switchable to 0-10 VDC) from a controller. Electric motors are available to accept a power supply of 24 or 120 VAC and can be specified for failure in an open, closed, or last position upon loss of power. Linkages are available in two sizes (30 and 52), the larger of which uses leverage to provide increased shut-off capabilities on smaller valves and is required for use on larger sized valves.

For optimal performance, the service conditions (medium, flow, temperature, inlet and outlet pressures) of the application must be considered when selecting a valve. Please refer to the Valve Selection Section of this catalog. Consult the Valve Selection tables for the capabilities of a particular valve/actuator assembly. Improper application may cause failure of the valve, resulting in possible personal injury or property damage.

For replacement or service parts please see Accessories and Replacement Parts in the Regulators and Control Valves section of the list price sheet.

Specifications

Model
940E

Linkages
30, 52

Motor Case
Aluminum

Yoke
Linkage 30: Aluminum
Linkage 52: Cast-iron

Power Supply
24 VAC, 60 Hz, 2.5 A or
120 VAC, 60 Hz, 0.5 A

Input Signal
4-20 mA or
0-10 VDC

Fail Position
Stem-Out (open),
Stem-In (closed), or Last Position

No-Load Timing
Fail Stem-In or Stem-Out: 90 seconds
Fail Last Position: 120 seconds

Protection
NEMA 1 (indoor only)

Maximum Temperature
Ambient: 130°F (54°C)
Process Flow: 400°F (204°C)

Humidity
Maximum: 95% RH

Approximate Shipping Weight
Actuator:
Linkage 30: 15 lbs [6.8 kg]
Linkage 52: 30 lbs [13 kg]

Valve Body:
see Valve Selection tables

HOW TO ORDER

Sample Order Number: **940E-30-J36-27**

Model	Linkage Size	Valve Body Number	Power Supply	Fail Position
940E	30 52	Refer to pages 252-260	1 120 VAC, 60 Hz, 0.5 A 2 24 VAC, 60 Hz, 2.5 A	6 Stem-Out (open) 7 Stem-In (closed) 8 Last Position

1. ***Determine*** *the valve size, style and material required by the application.*
2. ***Consult*** *the Valve Selection table to determine the required Valve Body.*
3. ***Refer*** *to the maximum close-off pressure columns to determine the Linkage Size needed to provide the close-off pressure required by your application.*
4. ***Specify*** *the Model and Linkage Size.*
5. ***Specify*** *the Valve Body Number.*
6. ***Specify*** *the Power Supply and Fail Position codes.*

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