Type 2000

Pneumatic and Electropneumatic Valve Positioner

Installation, Operation and Maintenance Instructions

Ordering Information

Use this coding system to order

Model **CA20 - □ - □ - □ - □ - □**

Type of Motion
R Rotary
L Linear

Cam
C1 90˚/180˚ (Standard Rotary)
C2 45˚/90˚
C3 30˚/60˚ (Standard Linear)

Type of Positioner
00 P/P Pneumatic
10 E/P Electro-pneumatic; FM/CSA Intrinsically Safe
11 E/P Electro-pneumatic; ATEX Intrinsically Safe
20 E/P Electro-pneumatic; FM/CSA Explosion-proof
21 E/P Electro-pneumatic; ATEX Flame-proof

Spindle
0 Namur (Rotary)
1 Standard (Linear)
2 3/8" Square
3 1/2" Square

Indicator
N None (Standard Linear)
A Arrow (Standard Rotary)
D Dome (Option)

Accessories

Gauges 0-30 psi (0-2 bar), 1/8" NPT Back Mount P/N: 446-725-006
0-160 psi (0-11 bar), 1/8" NPT Back Mount P/N: 446-725-008
0-30 psi (0-2 bar), 1/8" NPT Bottom Mount P/N: 446-725-033

Contents

ControlAir

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ISO-9001:2008

DANGER, WARNING, CAUTION and NOTE statements

DANGER **Refers to conditions or hazards which could result in serious personal injury or death.**

WARNING **Refers to conditions or hazards which could result in personal injury.**

CAUTION **Refers to conditions or hazards which could result in equipment or property damage.**

NOTE **Alerts you to facts or special instructions.**

ALL DANGER, WARNING, AND CAUTION NOTICES MUST BE COMPLIED WITH IN FULL

1. INTRODUCTION

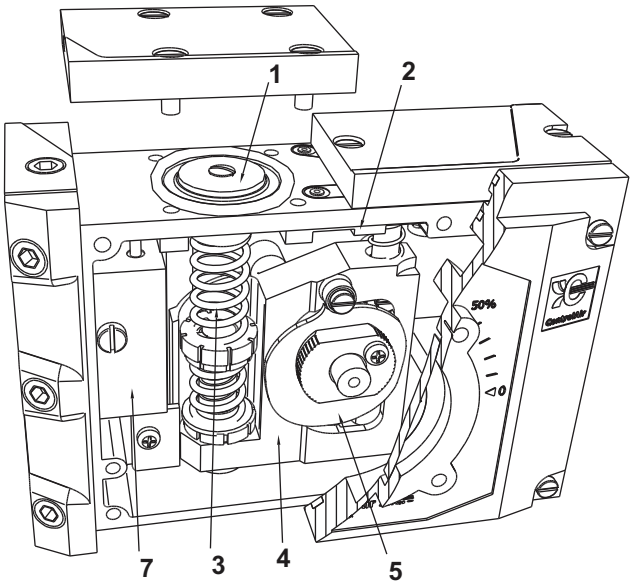
1.1 General

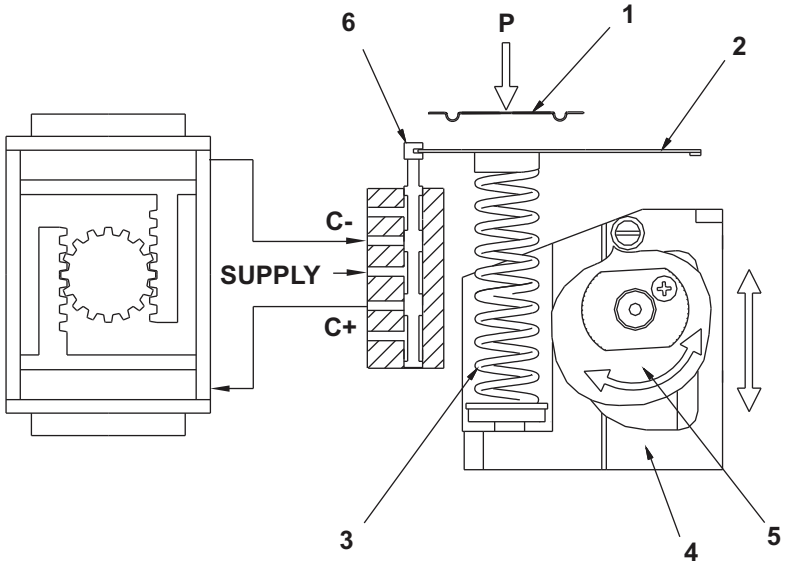
The ControlAir Type-2000 pneumatic and electro-pneumatic positioner provides stable and accurate positioning of rotary and linear valves. The force balanced instrument is simple, reliable and user friendly for calibration, maintenance and field upgrades. The electropneumatic unit is available with worldwide safety approvals in an Intrinsically Safe and Explosion-proof version. The NEMA-4X (IP 66) housing provides rugged resistance to severe industrial environments. The modular design of the Type-2000 allows multiple feature ordering options or easy field conversions.

1.2 Principles of Operation

The Type 2000 operates on a force balance principal of operation. Force is created by the input signal pressure acting on the diaphragm (1) which transmits to the balance arm (2). An opposing force is created by the feedback spring (3) and works in the opposite direction on the balance arm (2). The feedback spring, resting on the guide arm (4) is positioned by the shape and response of the cam (5). The cam (5) is connected to the spindle and actuator shaft which provides feedback from the valve/actuator. The spool (6) in the pilot valve (7) is connected to the balance arm and follows the balance arm's movement.

The system is stable when these opposing forces that affect the balance arm are neutral. When there is a signal change or a change in the position of the actuator occurs, the force balance is also changed and the spool moves. Supply air immediately begins to flow through the pilot valve into the actuator (C+ or C-) which allows the feedback mechanism to return the spool to the neutral position. At this point the two forces are equal and the unit is in balanced equilibrium.





1.3 Air Requirements

1.3.1 Supply air should be clean, dry, oil-free instrument air filtered to 40 micron. A filter regulator is recommended to be installed as close to the Type-2000 as possible.

1.3.2 Maximum supply pressure is 150 psig (10 bar).

CAUTION Water, Oil and Particulate in the air line will cause blockage and malfunction of the spool valve and/or the I/P Transducer.

2. SPECIFICATIONS

2.1 Functional Specifications

Type-2000	**Pneumatic** (CA2000)		**Electro-Pneumatic Intrinsically Safe** (CA2010/CA2011)	**Electro-Pneumatic Explosion-proof** (CA2020/CA2011)
Input Signal	3-15 PSI (0.2-1.0 Bar)		4-20 mA	
Supply Pressure	145 PSI (10 Bar) maximum		21.8-145 PSI (1.5-10 Bar)	
Linearity Error	0.7 % full span		<1.0% full span	
Hysteresis	0.4% full span		<0.6% full span	
Repeatability	0.3% full span		<0.5% full span	
Pressure Gain	750 P out/P in		750 P out/P in	
Flow Capacity	**SCFM**	**Nl/min**	**SCFM**	**Nl/min**
@29 PSI (2.0 Bar)	9.5	268.9	9.5	268.9
@87 PSI (6.0 Bar)	28.3	800.1	28.3	800.1
@145 PSI (10 Bar)	47.1	1333	47.1	1333
Air Consumption	**SCFM**	**Nl/min**	**SCFM**	**Nl/min**
@29 PSI (2.0 Bar)	0.18	5.09	0.2	5.7
@87 PSI (6.0 Bar)	0.53	424.5	0.6	17.0
@145 PSI (10 Bar)	0.88	707.5	1.0	28.3
Impedance			260 Ohms at 70 degrees F	
Loop Load			5.2 Volts at 70 degrees F	

2.2 Physical Specifications

Temperature Range	-40˚ to 185˚ F (-40˚ to 85˚ C)		
Port Sizes	Pneumatic: 1/4" NPT; Gauge Ports - 1/8" NPT Electric: 1/2" NPT; M20-1.5 (ATEX)		
Media	Clean, dry, oil-free instrument air, filtered to 40 micron		
Enclosure	Nema 4X / IP66		
Finish	Polyester Epoxy		
Weight	3.5 lbs (1.6 kg)	3.8 lbs (1.7 kg)	4.8 lbs (2.2 kg)

2.3 Hazardous Area Approvals

Model **Factory Mutual (FM) & Canadian Standards (CSA) Approvals**

2010 **Intrinsically Safe**
Class I, Division 1, Groups A, B, C, D

Nonincendive
Class I, Division 2, Groups A, B, C, D

Entity Parameters
Ui (Vmax) = 40 VDC
Li (Imax) = 125 mA
Ci = 0
Li = 0
Pi = 0.7 watts max.

2020 **Intrinsically Safe**
Class I, II & III, Division 1, Groups A, B, C, D, E, F, G

Explosion-Proof
Class I, Division 1, Goups B, C, D

Dust Ignition-Proof
Class II, III, Division 1, Groups E, F, G

Model **ATEX Approvals**

2011 **Intrinsically Safe**
II 1 G Ex ia IIC T4/T5/T6

Entity Parameters
Ui (Vmax) = 40 VDC
Li (Imax) = 125 mA
Ci = 0
Li = 0
Pi = 0.7 watts max.

2021 **Intrinsically Safe**
II 1 G Ex ia IIC T4/T5/T6

Flame-Proof – ATEX
II 2 G Ex d IIB + H2 T6
II 2 D Ex tD A21 T850C

3. INSTALLATION

3.1 Safety Instructions

WARNING Beware of moving parts when positioner is operated!

WARNING Beware of parts with live voltage! A voltage, which is normally not dangerous, is supplied to the positioner. Avoid touching live parts and bare wires as well as short circuting live parts and the housing.

WARNING Do not dismantle a pressurized positioner! Dismantling a pressurized positioner will result in uncontrolled pressure release. Always isolate the relevant part of the pipeline. Release the pressure from the positioner and the piping. Failure to do this may result in damage or personal injury.

DANGER Do not exceed the positioner performance limitations! Exceeding the limitations marked on the positioner may cause damage to the positioner, actuator and valve. Damage or personal injury may result.

3.2 Connections

S – Supply Air
CA2000: max 150 PSI / 10 BAR
CA2010, CA2011, CA2020, CA2021: min. 21 PSI / 1.5 BAR

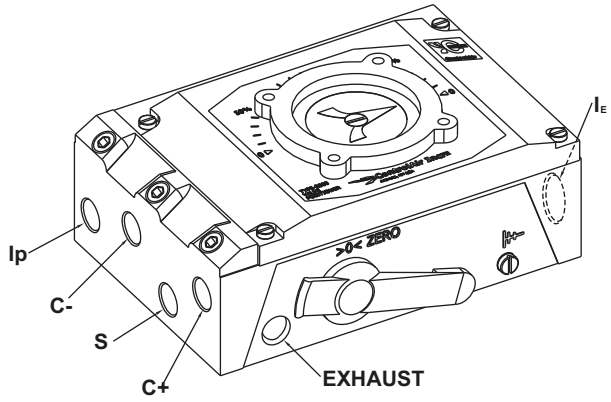
I_P – Input, pressure signal
CA2000: 3-15 PSI / 0.2-10 BAR

CA2010, CA2011, CA2020, CA2021 plugged

I_E Input, Current signal
CA2010, CA2011 – 4-20mA

C+ - Actuator connection + stroke
C- - Actuator connection – stroke

EXHAUST – All air from the actuator, IP and positioner is vented through this port. Do not block!



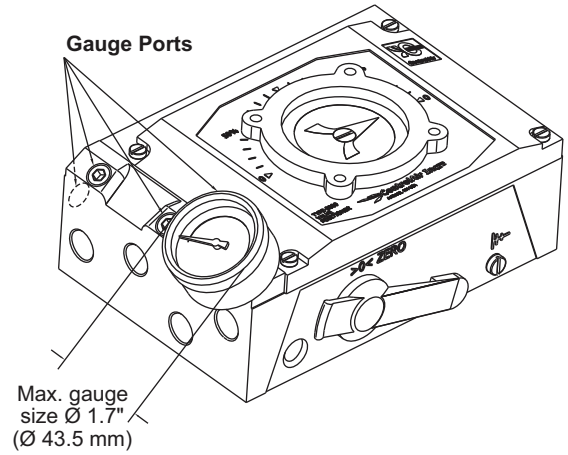
Air connections for male 1/4" NPT

Gauge connections for male 1/8" NPT

Cable entry for conduit male 1/2" NPT

The appropriate threads are clearly indicated by the markings on the housing.

Gauge ports I , C+ , C- and S are factory plugged. Remove the plugs and replace with gauges.

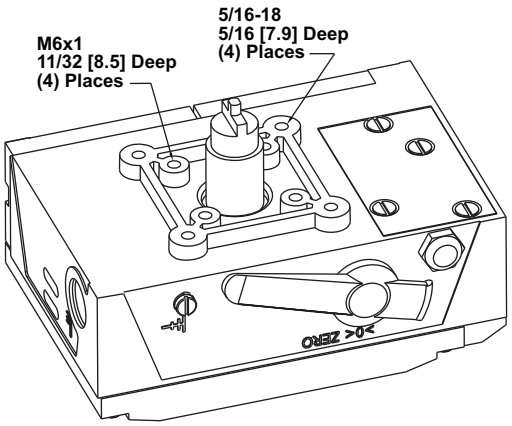


NOTE Liquid sealant for threads, Loctite or similar, is recommended for all air connections.

NOTE The I_P connection must be plugged in CA2010, CA2011, CA2020, CA2021.
The I_E connection should be plugged in CA2000, CA2020, CA2021.

3.3 General Mounting Instructions

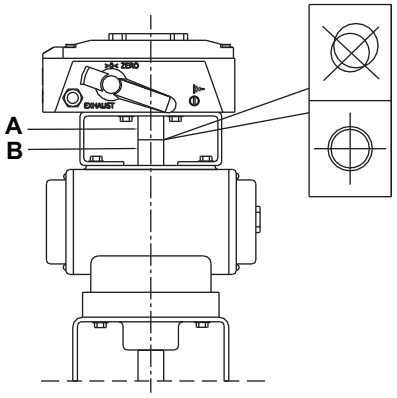
The ControlAir Type-2000 has the ISO F05 hole pattern for mounting kits.



3.3.1 Rotary Actuator

The ControlAir Type-2000 has a very stable and properly sized drive shaft bearing. However, the positioner drive (A) should be aligned properly to the rotary actuator spindle (B).

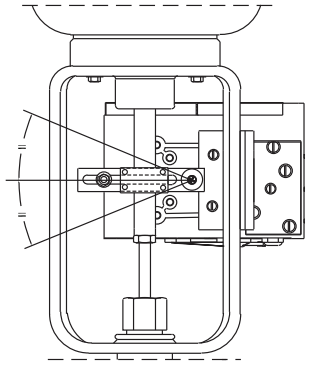
A relatively small error combined with a rigid coupling can create very powerful radial forces, which can in turn overload and in short time wear out even the very best drive shaft bearing.



3.3.2 Linear Actuator

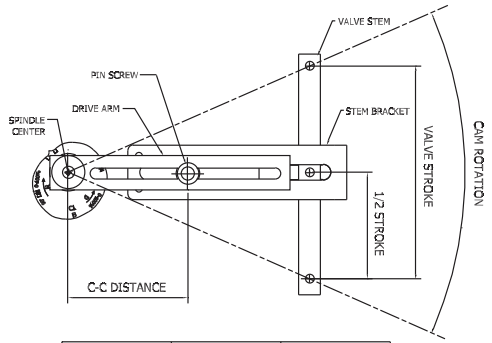
Mounting Procedure

1. Mount bracket(s) on Valve Positioner. Bracket(s) must be ordered separately.
2. Install drive arm using Phillips screw and washer. Parts included with Valve Positioner.
3. Attach stem bracket to valve actuator.
4. Stroke and hold valve actuator at 50 % travel. Hold the positioner with the bracket(s) on the valve actuator so that the pin screw is guided within slot in the stem bracket and the drive arm is horizontal.
5. Secure brackets and set C-C distance. See 3.3.3 C-C drawing.



NOTE Set the height of the positioner so that the horizontal position of the drive arm is reached as close as possible to mid-point of the valve stroke. (If symmetrical mounting is not possible, the drive arm must pass the horizontal position within the stroke range.)

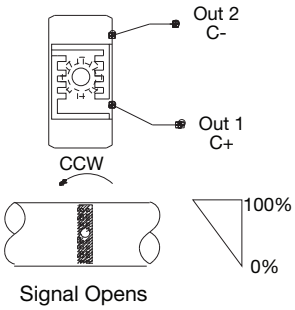
3.3.3 C-C Drawing

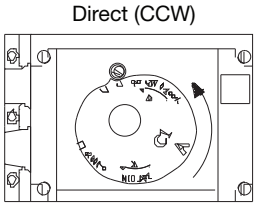


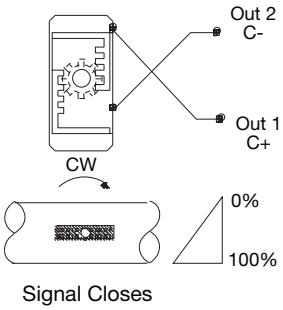
CAM Rotation	C-C Distance (in) +.25"/-.00"	Max. Stroke (in)
90°	.70 x Valve Stroke	6.36
60°	1.00 x Valve Stroke	4.50
45°	1.30 x Valve Stroke	3.44
30°	1.94 x Valve Stroke	2.32

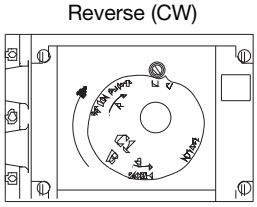
3.4 Installation Instructions for Rotary Actuators

3.4.1 Double Acting

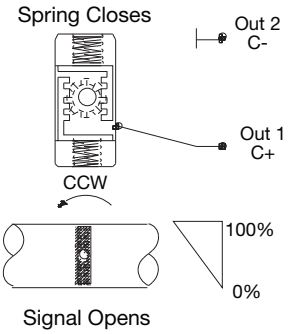


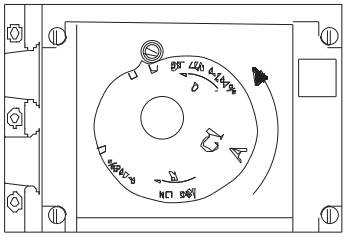


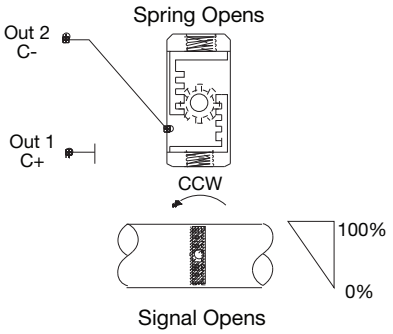


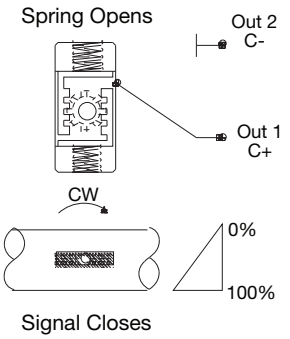


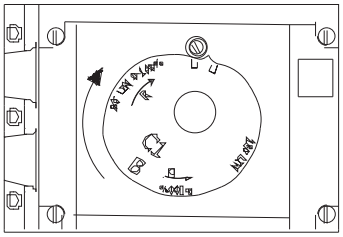
3.4.2 Single Acting

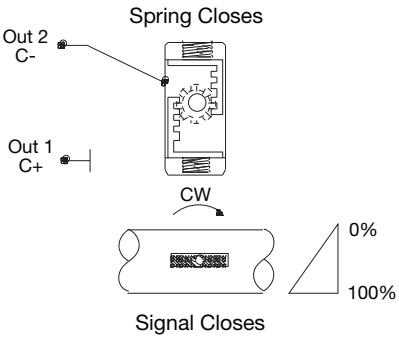






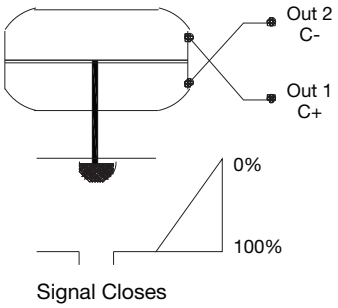


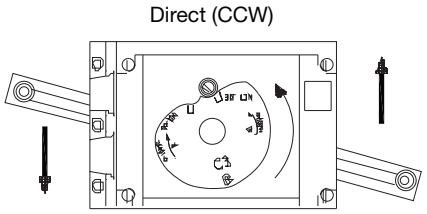


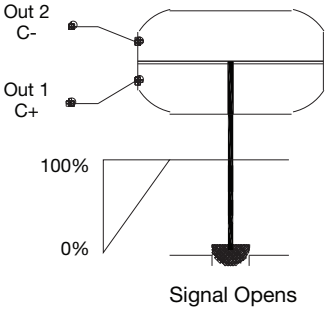


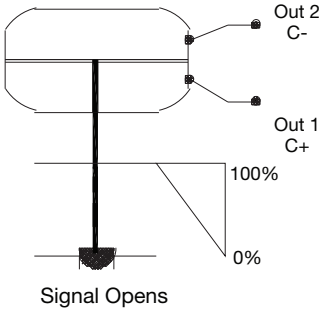
3.5 Installation Instructions for Linear Actuators

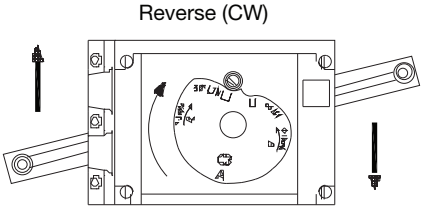
3.5.1 Double Acting

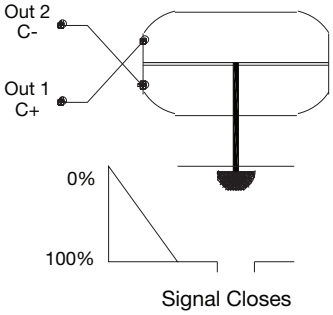




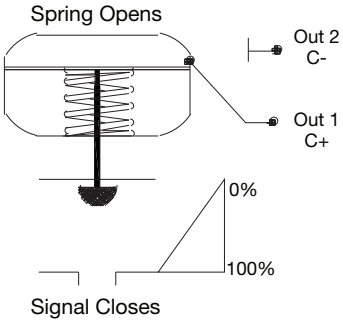


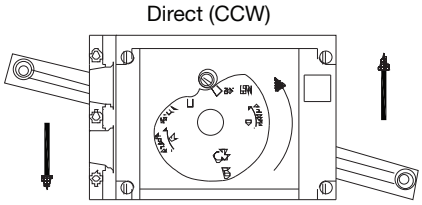


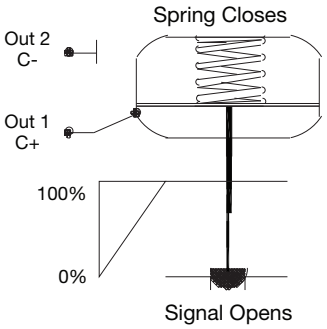


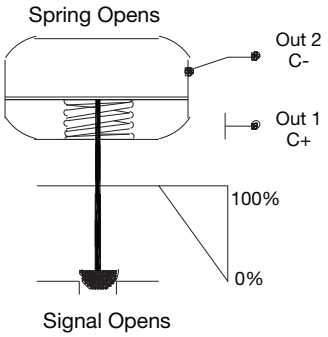


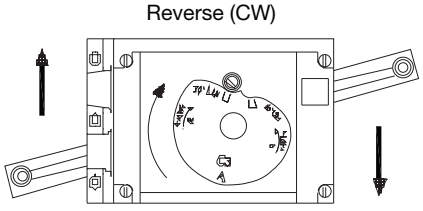
3.5.2 Single Acting

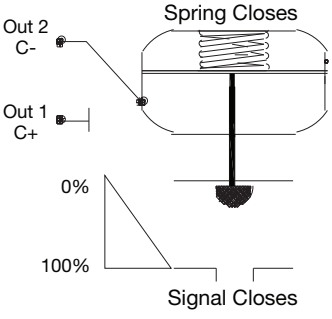












3.6 Cam Adjustment

NOTE The ControlAir CA-20R is standard shipped with the C1-cam, factory set for 90 +/-1, direct (CCW) turning. The CA-20L is standard shipped with the C3-cam, factroy set for direct (CCW) movement.

3.6.1 Adjustments

Loosen and remove the front cover and indicator.

1 Loosen the screw (1) and the cam lock nut (2) by turning counter clockwise.

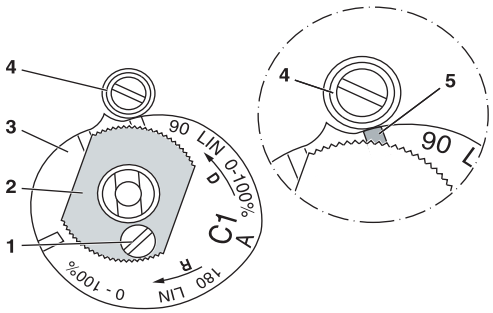
2 Run the valve/actuator to the stop/endposition at 0% input.

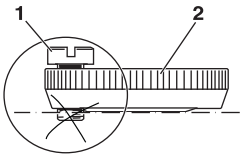
3 Turn the cam (3) so that the index mark (5) for the selected curve aligns with and is riding on the ball bearing (4).

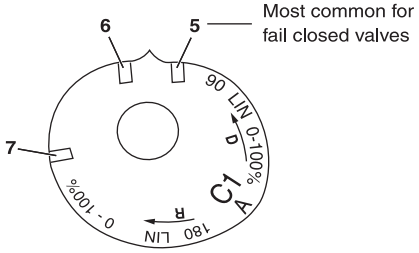
4 To secure the cam, tighten the cam lock nut by hand (2).Check that the screw (1) is still loose. (if not, loosen the screw slightly and tighten the lock nut again)

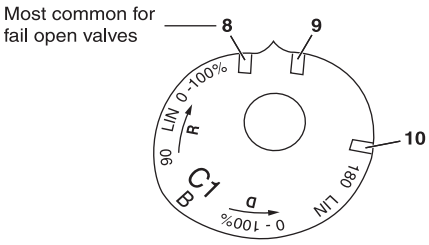
5 Tighten the lock screw (1).

6. Install and adjust the indicator. Reinstall the front cover.









3.6.2 Cam Specifications C1

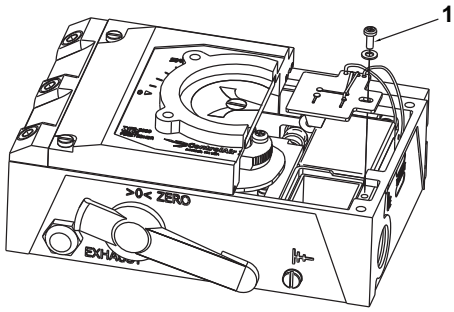
Index mark		Starting point of rotation	
*5	90°	Linear 0-100%	CCW
6	180°	Linear 0-100%	CW
6	90°	Linear 0-50%	CW split range
7	90°	Linear 50-100%	CW split range
8	90°	Linear 0-100%	CW
9	180°	Linear 0-100%	CCW
9	90°	Linear 0-50%	CCW split range
10	90°	Linear 50-100%	CCW split range

*Increasing signal rotation.

NOTE Most valves rotate CW to close / CCW to open.

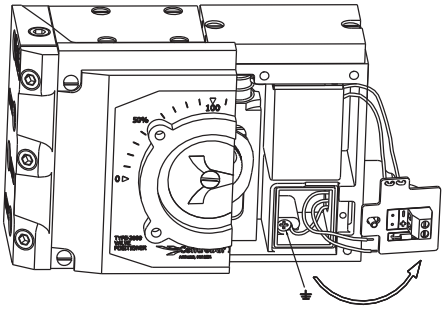
CAUTION When field reversing action of positioner, tubing must be reversed as well.

3.7 4-20 mA Connection & Calibration



3.7.1 Connecting the control signal

Loosen and remove the front cover and indicator. Loosen the screw (1) enough so that the terminal connector board can be lifted. Terminal block screws are now easily accessible. Connect the cables providing the input signal from the controller to its respective pole. Max cable area 2.5mm^2, ~AWG 13



NOTE The I/P transducer is factory-adjusted. No extra range or zeroing adjustments are necessary.

NOTE The ControlAir Type-2000 is delivered factory calibrated 0 -100% for 90 + 1.0 degree rotation.

Calibration procedure

Zero

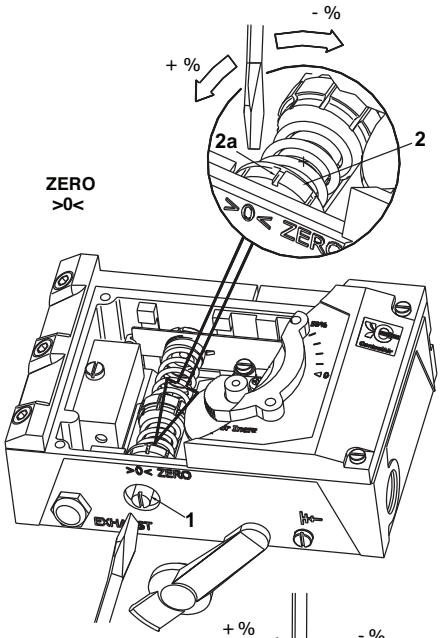
1 Set 0% input signal (3 psi/0.2 bar or 4 mA).
2 Wait until the valve has settled.
3 Adjust the zero position by turning the zeroing screw (1), with a screw-driver from the outside or by using the slot (2a) on the bottom wheel (2).

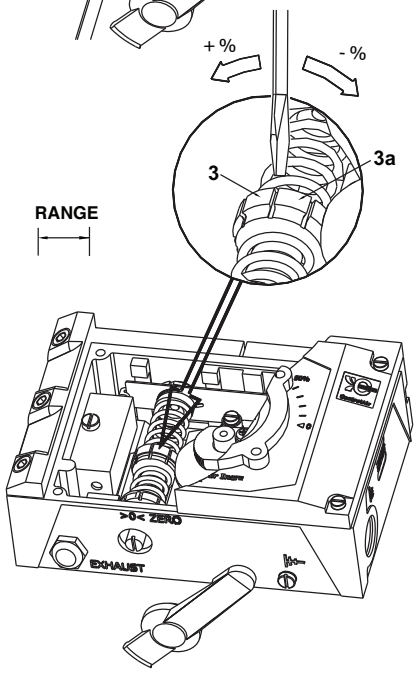
Range

4 Increase to 100% input signal (15 psi/1.0 bar or 20 mA).
5 Wait until the valve has settled.
6 Adjust the range by using the slot (3a) on the top wheel (3).

Check the zero position. Make fine adjustments if necessary.*

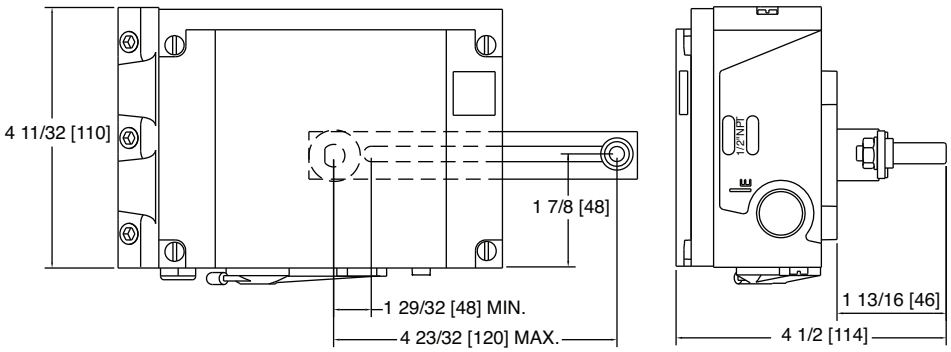
*With Split Range, where zeroing can bedone by a signal other than 0%, the steps 1-6 must be repeated until the desiredsetting has been reached.



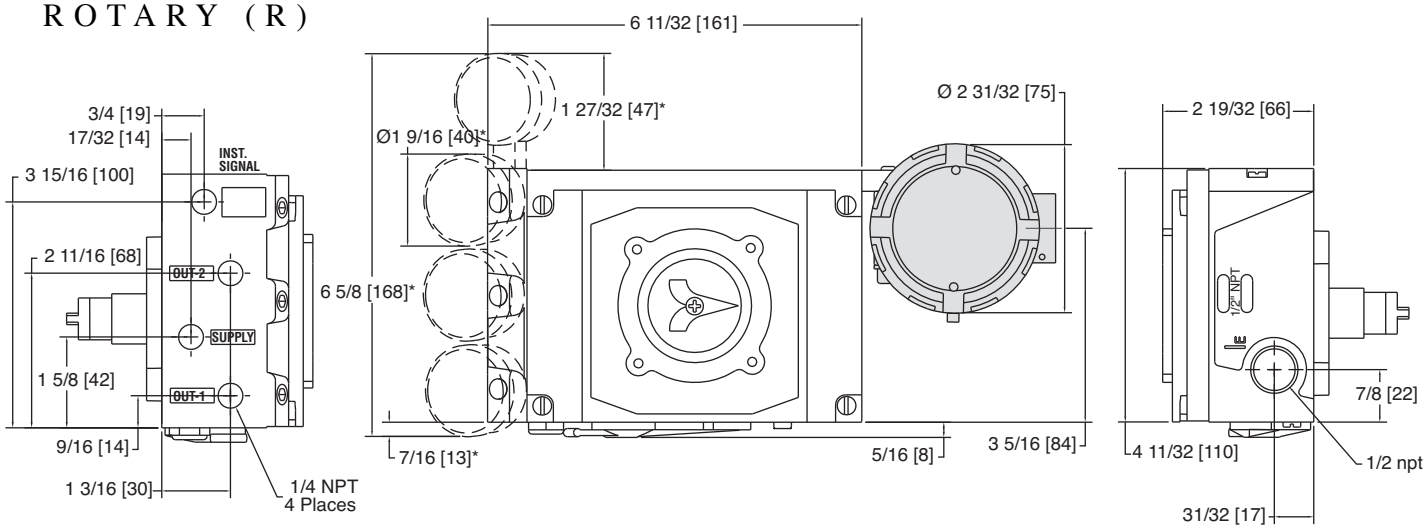


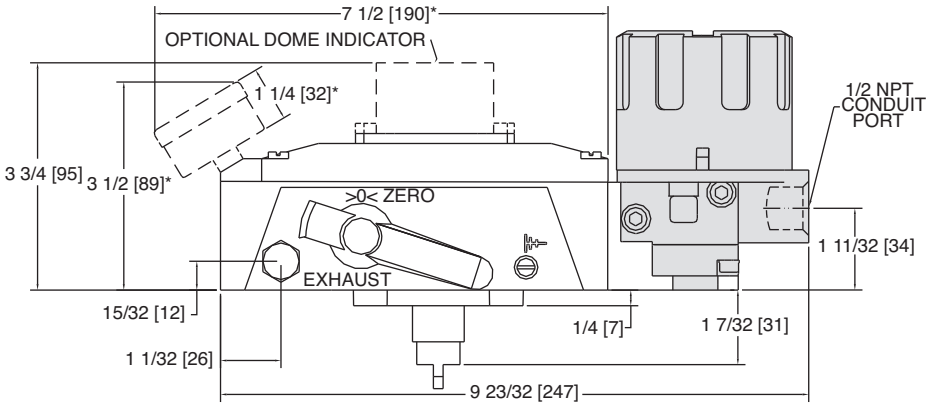
4. DIMENSIONS

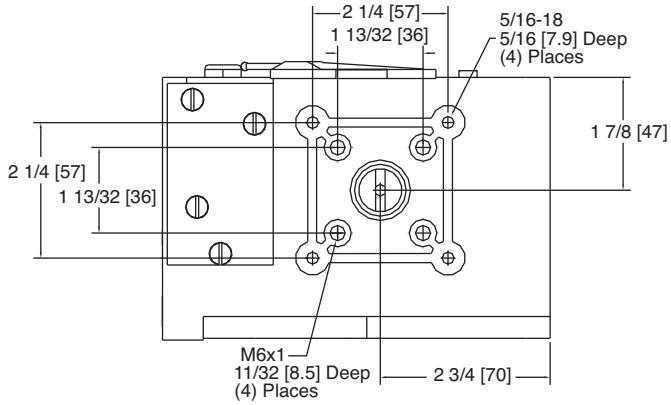
LINEAR (L)



ROTARY (R)



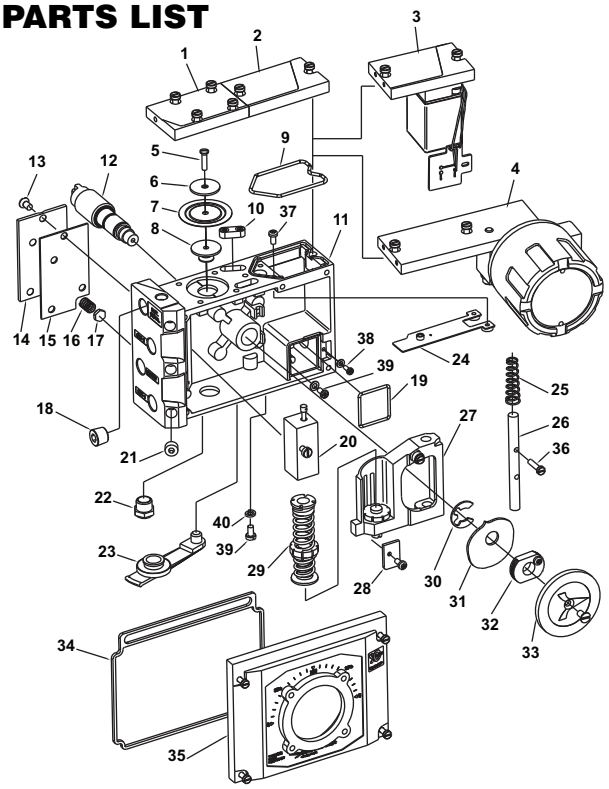




Optional Explosion-proof

5. SPARE PARTS

5.1 PARTS LIST



Item	Description	Qty
1	Diaphragm Cover (includes)	1
	-Screw	4
	-O-ring	1
2	Cover Plate	1
	-Screw	2
3	I/P Transducer Plate	1
	-590-AC Transducer	1
	-Screw	2
4	XP I/P Transducer Plate	1
	-595-AC Transducer	1
	-Screw	2
5	Screw, Diaphragm	1
6	Washer, Diaphragm	1

Item	Description	Qty
7	Diaphragm	1
8	Piston, Diaphragm	1
9	O-ring Seal	1
10	Filter Cap	2
	-Rubber Channel	1
	-Filter	1
11	Housing	1
12	Drive Shaft	1
	-O-ring	1
	-O-ring	1
13	Screw, Back Plate	4
14	Back Plate	1

Item	Description	Qty
15	Nitrile Gasket	1
16	Spring, Safety Valve	1
17	Safety Valve	1
18	Pipe Plug ¼ NPT	1
19	O-ring Seal	1
20	Pilot Valve	1
	-Screw	1
	- Gasket	1
21	Pipe Plug, 1/8 NPT	4
22	Exhaust Filter	1
23	Zero Plug	1
24	Balance Arm	1
25	Spring, Guide Arm	1
26	Guide Pin	1
27	Guide Arm	1
	-Roller Bearing	1
	-Zero Screw	1
	-Screw	1
	-Bearing	1
28	Holding Washer	1
	-Screw	1
29	Feedback Spring Assembly	1
30	E-clip	1
31	Cam (C1 Shown)	1
32	Cam Nut	1
	-Screw	1
33	Indicator with Label	1
	-Screw	1
34	Front Cover Seal	1
35	Front Cover	1
	- Label	1
	-Screw	4
36	Screw, Pin Retain	2
37	Screw, Balance Arm	2
38	Screw, Terminal Block	1
39	Screw, Ground	2
40	Lock Washer, Ground	2

6. WARRANTY & DISCLAIMER

ControlAir LLC products are warranted to be free from defects in materials and workmanship for a period of eighteen months from the date of sale, provided said products are used according to ControlAir LLC recommended usages. ControlAir, LLC's liability is limited to the repair, purchase price refund, or replacement in kind, at ControlAir LLC's sole option, of any products proved defective. ControlAir LLC reserves the right to discontinue manufacture of any products or change products materials, designs or specifications without notice.

WARNING **These products are intended for use in industrial compressed-air systems only. Do not use these products where pressures and temperatures can exceed those listed under Specifications.**

Before using these products with fluids other than air, for non-industrial application, life-support systems, or other applications not within published specifications, consult ControlAir LLC.