



WESTLOCK

CONTROLS

K20 Intrinsically Safe Valve Positioner

OPERATING MANUAL



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Revision History

Revision

12/20/2017

Initial release

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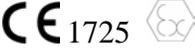
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1 Introduction

1.1 Product Certification

Enclosure Material	 154155 17.70130633	ATEX  17ATEX2181X	IECEx IECEx CSA 17.0012X
Resin/ Stainless Steel	Class I, Div. 1, Groups A,B,C & D, T4; Class I, Zone 0, AEx/Exia IIC T4 Ga; Type 4X, IP65 -40 to +85°C	II 1G Ex ia IIC T4 Ga	Ex ia IIC T4 Ga
Aluminum	Class I, Div. 1, Groups A,B,C & D, T4; Class II, Div. 1, Groups E,F & G; Class III; Class I, Zone 0, AEx/Ex ia IIC T4 Ga; Class II, Zone 21, AEx/Ex tb IIIC T87 Db; Type 4X, IP65 -40 to +85°C	II 1G/II 2D Ex ia IIC T4 Ga Ex tb IIIC T87 Db	Ex ia IIC T4 Ga Ex tb IIIC T87 Db

Model K20 is a 4 – 20 mA Intrinsically Safe Valve Position Controller.

Rated 30 V dc, 100 mA, 0.75 W max. Temperature Code T4, Ambient working temperature range of –40 to +85°C, Type 4X / IP 65.

The unit must be installed as per the control drawing WD-12316 (see appendix A).

This unit may be equipped with either two 3-wire switches or two 2-wire inductive sensors.

1.2 Warnings

WARNING: The aluminum housing Model K20 Ex ia is at potential risk of ignition by impact or friction therefore, care must be taken into account during installation to avoid this problem.

AVERTISSEMENT : *Modèle K20 ia contient en aluminium et est à un risque d'inflammation par choc ou frottement.*

Il faut en compte lors de l'installation pour éviter ce problème.

Wires must be rated at least 105°C with minimum 0.25mm thickness shall be used for external connections.

Fils doivent être évaluées au moins 105°C minimum 0,25 mm d'épaisseur doivent être utilisés pour les connexions externes.

WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD- Clean the equipment only with a damp cloth to prevent static charge build-up on the resin enclosure or beacon.

AVERTISSEMENT : *Potentiel électrostatique de charge dange - Clean l'équipement uniquement avec un chiffon humide pour empêcher statique charger l'accumulation sur l'enveloppe de résine ou la balise.*

ATTENTION: *Maximum supply pressure is 120 PSI. Supply air must be clean, dry, oil free instrument air per ANSI / ISA-7.0.01- 1996 or BS ISO 8573-1:2010.*

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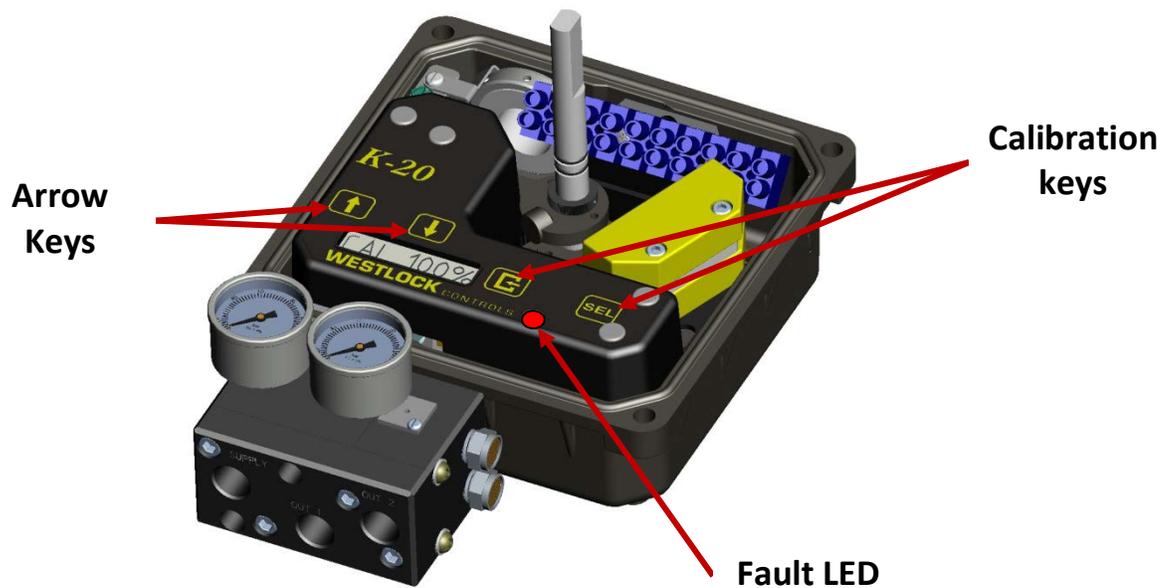
1.3 Description

The K20 is a 4-20mA electro-pneumatic valve positioner/controller. Position measuring is performed by off-set, shaft driven, state of the art Hall Effect Sensor. The positioner comes standard with 4-20mA feedback transmitter. In addition there are options for feedback limit switches, Mechanical, proximity & inductive proximity type.

1.4 Principles of Operation

The K20 utilizes two keys for auto calibration and two keys for settings. This controls both Positioner and Position Transmitter with local LCD in conjunction with the Diagnostic / Fault LED.

The K20 uses Hall Effect position sensing with 'off axis' detection to allow a through shaft for the top mounted Westlock Beacon.



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1.5 Special Features

- **Front panel**

- LCD to show alphanumeric characters (8 digit 14 segment)
- Diagnostic / Fault - Red LED

- **Auto Calibration**

Direct and reverse acting (set for low or high loop current closes valve)

Transmitter will output 4mA for valve closed, 20mA for valve open with current increasing linearly with opening percentage.

Two switch calibration for 4mA and 20mA without need to set loop currents

Low position calibration

High position calibration

Auto tuning automatically selects loop parameters for best operation

Allowed range of actuators in terms of open/close times

250ms to 2 – 10 minutes, upper limit can be adjusted via Long CAL

- **Manual tuning**

- Set Drop Off on/off
- Set Gain, Zero and Span positions
- LCD displays loop current, valve position.

- **Integrated Transmitter**

The transmitter operates from the same sensor input as the main unit, but is powered by a separate loop. It shows the current position of the valve by sinking between 4mA and 20mA with 4mA being 0% open and 20mA being 100% open.

If the main section of the K20 fails and so ceases to provide position updates to the Transmitter or the position sensor fails on the main section, so that the current valve position is unknown, the Transmitter will put out a current of 3.5mA or 21.5mA (selectable), to indicate this failure. This “fail” current will be put out within 200ms of the actual failure. If the main unit detects an error >10% of position, the transmitter will output fault current and the Fault LED starts blinking.

- **Open/close Limit Switches**

These are optional SPDT Mechanical, SPDT Magnum or NAMUR Inductive proximity sensors.

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2 Order Guide

ELECTRO-PNEUMATIC POSITIONER										
K Series Positioner (Intrinsically Safe and Non-Incendive)										
SEE DATASHEET FOR HAZARDOUS RATINGS OF BASE MODELS										
Base Model										
K20	Electro-Pneumatic Positioner (4-20 mA Input)									
	Shaft Output									
	S	Standard (Double-D with 1/4" Flats)								
	D	Direct mount to Keystone 79U or MRP Actuators								
	N	NAMUR								
		Hazardous Area Certification								
	IS	Intrinsically Safe and Non-Incendive								
		Housing Material								
	E	Engineered Resin Enclosure (Clear Cover w/ Visible LCD)								
	S	316 Stainless Steel CF8M (Adder for 316SS Manifold also required)								
	A	Aluminum Enclosure								
		Supply Pressure								
	H	STD flow High Pressure (40 - 120 psi)								
	L	STD flow Low Pressure (15 - 45 psi)								
	V	High Flow (40 - 120 psi, for larger actuators)								
		Manifold Material								
	0	Anodized Aluminium								
	1	Stainless Steel (Required for 316SS Enclosure)								
		Conduit Entry *								
	B	(1) M20 x 1.5 **								
	C	(1) 3/4-14 NPT *** (Recommended with switch options)								
	D	(1) M25 x 1.5 ** (Recommended with switch options)								
		Limit Switch Options								
	0	None								
	B	2 x SPDT Mechanical Switches with Gold Plated Contacts (Not Suitable for Class I, Div 2)								
	I	2 x Inductive Sensors P&F Model NJ2-V3-N								
	T	2 x SPDT Magnum Proximity switches with Tungsten Contacts								
	R	2 x SPDT Magnum Proximity switches with Rhodium contacts								
		Position Transmitter Output								
	B	4-20mA Transmitter								
		Pneumatic Connections								
	N	1/4" NPT (3/8" NPT with high flow option)								
	B	1/4" BSP (3/8" BSP with high flow option)								
	F	1/4" NPT w/Aluminum Filter-Regulator Assembly (3/8" NPT with High Flow option)								
	S	1/4" NPT w/ Stainless Steel Filter-Regulator Assembly (Not available with High Flow option)								
V	V	V	V	V	V	V	V	V	V	V
K20	N	IS	E	H	0	C	R	B	F	= Model number: K20NISEH0CRBF

Magnum Proximity Switch Application Note:

For 24 VDC service below 1 watt, R (Rhodium Magnum switches) is recommended

For 24 VDC service above 1 watt, T (Tungsten Magnum switches) is recommended

* Consult Sales for multiple conduit offerings.

** Mounting Pattern (M8 x 1.25 Outer Pattern) (M6 x 1 Inner Pattern)

*** Mounting Pattern (5/16 - 18 Outer Pattern) (M6 x 1 Inner Pattern - Metal Housing only)

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3 Definitions



This symbol warns the user of possible danger. Failure to heed this warning may result in personal injury or death and/or severe damage to property.



This symbol identifies information about operating the equipment in a particular manner that may damage it or result in a system failure. Failure to heed this warning can lead to total failure of the equipment or any other connected equipment.



This symbol draws attention to information that is essential for understanding the operation and/or features of the equipment.

4 Installation

4.1 Mounting

Choice of Mounting:

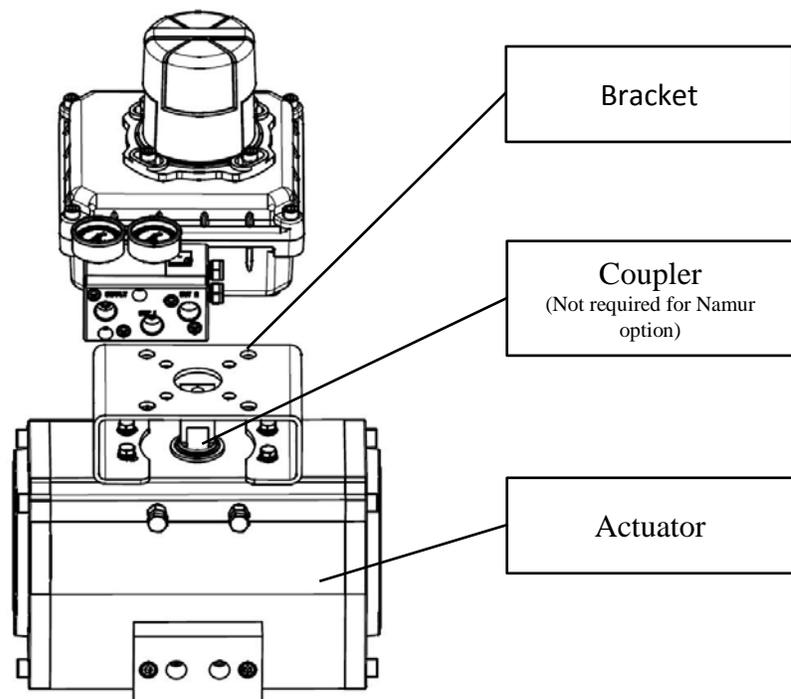


Figure 1

Mounting for Shaft Output Options Standard and Namur

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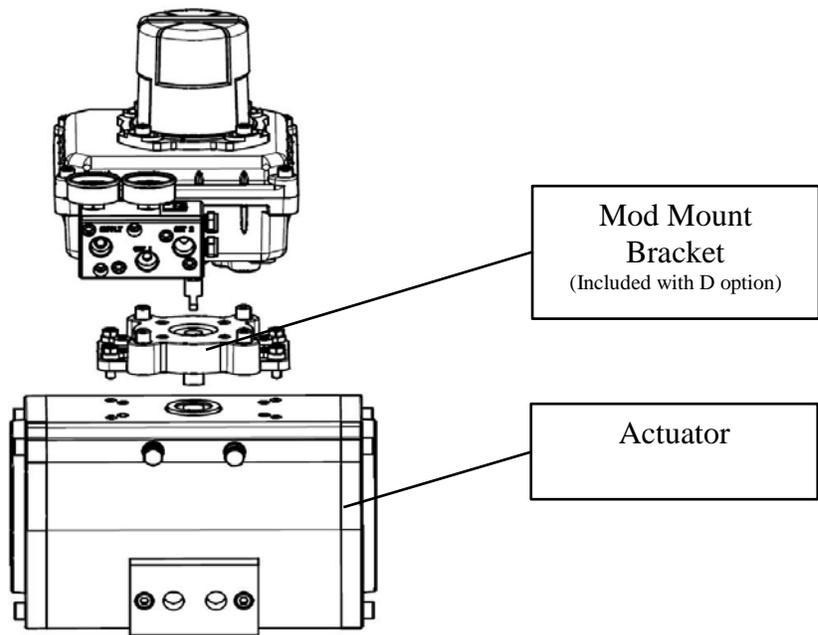


Figure 2

Mounting for Shaft Option Direct Mount to Keystone 79U or MRP Actuators

4.2 Pneumatic piping:

Single Acting Actuator (Spring Return):

For single acting actuators Outlet Port 2 is to be plugged. Outlet Port 1 is to be piped to the actuator inlet port that acts against the spring. (Increasing signal causes pressure to increase in Outlet Port 1 of the positioner).

Double Acting Actuator (Double Return):

For double acting actuators Outlet Port 2 is piped to drive the actuator towards the fail Position. Outlet Port 1 is piped to drive the actuator away from the fail position. (Increasing Signal causes pressure to increase in Outlet Port 1 of the positioner and pressure to Decrease in Outlet Port 2 of the positioner)

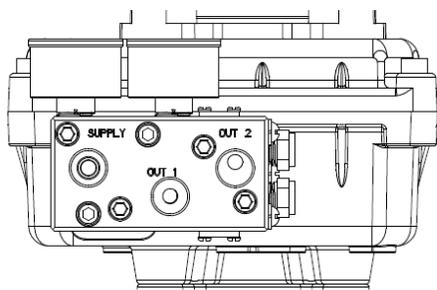


Figure 3 Standard Flow Manifold

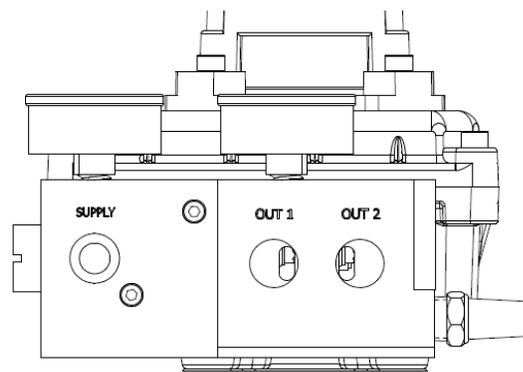


Figure 4 High Flow Manifold

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4.3 Calibration

There are 3 auto calibrate modes (all modes auto calibrate the Transmitter)

- Auto Calibration for 4mA to 20mA.
- Calibration for Low current calibration other than 4mA.
- Calibration for High current calibration other than 20mA.

4.3.1 Auto Calibration for 4mA to 20mA operation

This is a two Key auto calibration that defines 4mA for the valve being fully closed and 20mA for valve being fully open. The Transmitter Function is being automatically calibrated during this procedure.

Time for the first move in calibration will be set at a maximum of 30 seconds for **REG CAL** and all subsequent time outs are keyed off the time it takes to go from closed to open, to create much shorter subsequent time outs for smaller valves. The initial 2 minute time out can be lengthened in the Manual Calibration routine **Long CAL**.

Press **SEL** Key until the Display shows "AUTO CAL" then press  Key.

Auto calibration will occur for 4mA low current and 20mA high current.

The display will show:

AUTO CAL

STARTED

LOW CAL The valve is closed and the closed position recorded.

HIGH CAL The valve is opened and the open position recorded.

GAIN The valves best gain setting is found.

CALIBRATION SUCCESS

XX % Percent valve opening for forward acting / closing for reverse acting.

4.3.2 Auto Calibration for Low current Calibration other than 4mA (Split Range)

The Low calibration refers to the input current value that drives the valve into the fail position.

The Transmitter Function is being automatically calibrated during this procedure.

First follow the procedure for the Auto Calibration

Next set loop current to the desired value.

Press the **SEL** Key until the display shows "LO CAL" then press  Key.

The calibration will adjust to the desired low current.

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4.3.3 Auto Calibration for High current Calibration other than 20mA (Split Range)

High calibration refers to the input current value that drives the valve into the Span position.

The Transmitter Function is being automatically calibrated during this procedure.

First follow the procedure for the Auto Calibration

Next set loop current to the desired Span value.

Press the **SEL** Key until the display shows "HI CAL" then press  Key.

The calibration will adjust to the desired high current.

4.4 Manual Calibration

This allows setting of all parameters.

Note - Adjustments take immediate effect.

All Manual Calibration Steps will timeout after 2 minutes, discarding any changes if no key is pressed during that time.

At the end of any procedure, changes can be kept by saving the changes.

To Save the changes press and hold the  Key until the display shows:

HOLD

TO SAVE

SAVED Changes made to this point are saved.

Or you can Exit without saving, this discards the changes that were entered.

To enter Manual Calibration, Press the **SEL** Key until MAN CAL is shown on the the display will show FWGN xx.

Repeatedly pressing the **SEL** switch will cycle through what can be changed.

FWGN xx

RVGN xx

DR ENABL or DR DISAB based upon what is set

ZERO xx

SPAN xx

DIR ACTG or REV ACTG based upon what is set

TX FT LO or TX FT HI based upon what is set

REG CAL

RESTORE FACTORY DEFAULT

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4.4.1 Forward Gain (FWGN XX) is the gain applied when opening the valve.

- The LCD shows “FWGN xx” where xx is the current gain.
- Pressing the DOWN Key decreases the gain
- Pressing the UP Key increases the gain

4.4.1 Reverse Gain (RVGN XX) is the gain applied when closing the valve.

The LCD shows “FWGN XX” press the CAL Key again and the LCD shows “RVGN XX”.
RVGN xx changes can now be made.

Pressing the DOWN Key decreases the gain

Pressing the UP Key increases the gain

4.4.2 Drop off (DR ENABL or DR DISAB) - Enables or Disables Drop off at end of travel

The LCD shows “RVGN XX” press the CAL Key again and the LCD shows either “DR ENABL
or DR DISAB” . DR ENABL or DR DISAB can now be selected.

Pressing the DOWN or UP Key toggles this setting.

4.4.3 Zero Position (ZERO XX) - Adjusts the electronic stop away from (increasing values) or
towards (decreasing values) from the physical closed position. 0 being nominally the
position of the hard stop zero and 100 being about 90 degrees away from it

The LCD shows “DR ENABL or DR DISAB” press the **CAL** Key again and the LCD shows
“ZERO xx”. ZERO XX changes can now be made.

Pressing **UP** Key increases the zero position of the valve away from the hard stop.

Pressing **DOWN** Key moves the zero position closer to the hard stop.

4.4.4 Span Position (SPAN XX) - Adjusts the electronic stop away from (increasing values)
or towards (decreasing values) from the physical open position. 0 being nominally
the position of the hard stop Span Zero and 100 about 15 degrees away from it

Pressing **DOWN** Key reduces the span position of the valve away from the hard stop

Pressing **UP** Key moves the span position closer to the hard stop.

4.4.5 Direct / Reverse Acting (DIR ACTG / REV ACTG) - Direct Acting means that the valve
opens with increasing loop current, Reverse Acting means that it closes with increasing
loop current. This function can be selected after the auto calibration is complete.

Pressing the DOWN or UP Key toggles this setting.

4.4.6 Transmitter Fault Current (TX FT LO or TX FT HI) - This specifies the Monitor Transmitter
Fault current as either LO 3.5mA or HI 21.5mA. This is always available but only effective
if the unit has a Transmitter.

The LCD shows “DIR ACTG or REV ACTG” press the **SEL** Key again and the LCD shows “TX
FT LO or TX FT HI”. TX FT LO or TX FT HI can now be selected.

Pressing the DOWN or UP Key toggles this setting.

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4.4.7 Calibration Timeout (REG CAL or LONG CAL): Time for the first move in calibration will be set at a maximum of 30 seconds for REG CAL and all subsequent time outs are keyed off the time it takes to go from closed to open, to create much shorter subsequent time outs for smaller valves. The initial 2 minute time out can be lengthened in the Manual Calibration routine Long CAL.

This should normally be left at REG CAL. If however the valve is likely to take more than 30 seconds to open or close, switching to LONG CAL allows 100 seconds.

The LCD shows "TX FT LO or TX FT HI" press the **SEL** Key again and the LCD shows "REG CAL or LONG CAL". REG CAL or LONG CAL can now be selected.

Pressing the DOWN or UP Key toggles this setting.

4.4.8 Saving or discarding changes:

At the end of any procedure, changes can be kept by saving the changes. To Save the changes by pressing and holding the  Key until the LCD shows:

HOLD

TO SAVE

SAVED Changes made to this point are saved.

Releasing after a shorter time will cause the changes to be discarded.

LCD will show "DISCRDED"

Or you can Exit without saving, this discards the changes that were entered.

All Manual Calibration Steps will timeout after 2 minutes, discarding any changes if no Key is pressed during that time.

4.4.9 Cancelling Calibration

When the LCD displays "AUTO CAL" and you do not want to perform this operation. Do nothing. Within 15 seconds the function displayed is canceled and the LCD display reverts back to opening percentage "xx %"

If starting an Auto Calibration by mistake. Wait 5 seconds and press  again. LCD shows "CALIBRATION CANCELED". The LCD display will revert to opening percentage "xx %" after 20 seconds.

4.4.10 To reset to the Factory Default Settings

Press **SEL** Key until the LCD scrolls "Restore Factory Default" .

Press Down arrow until LCD reads "Hold  Key".

Press and hold  Key.

LCD will scroll "Factory Default Success"

Factory default settings are now enabled.

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4.5 Setting the Cams.

To release the cover, loosen the cover retaining screws using a 4mm A/F Allen Key. Lift the cover and twist approx. 45° and remove. See Figure 2 below.

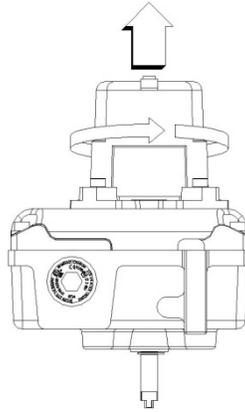


Figure 5

To set switches, lift the bottom Touch Set cam and turn until the switch has activated and then release. The spring will push the Touch Set cam back onto the splined shaft. See figure X.

To set switches, lift the bottom Touch Set cam and turn until the switch has activated and then release. The spring will push the Touch Set cam back onto the splined shaft. See figure X.



Before stroking the actuator, please ensure that the process is safe to do so and that all hands are kept away from the moving shaft / cams.

Stroke the actuator to the opposite end of travel. Set the top Touch Set cam by pushing down and turning the Touch Set cam until the switch is activated. See figure X.



Before stroking the actuator, please ensure that the process is safe to do so and that all hands are kept away from the moving shaft / cams.

Stroke the actuator from one end of travel to the other several times to check the switch operation. If the switches require adjustment, repeat as required.

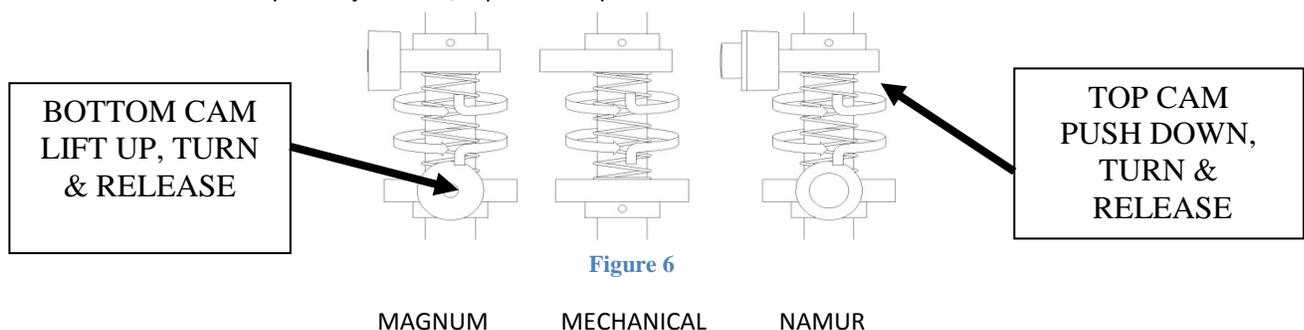


Figure 6

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5 Field Wiring

Field Wiring Terminal Strip:

- 10) Blue wire Input (-) 4-20mA
- 9) Brown wire Input (+) 4-20mA
- 8) Yellow transmitter (no polarity)
- 7) Yellow transmitter (no polarity)

Terminal screw torque: 2 – 3 in. lb. (0.22 - 0.3 Nm)

Wires must be rated at least 105°C with minimum 0.25mm thickness shall be used for external connections.

See Controlled Diagram (Appendix A - page 18)

Wiring Diagrams:

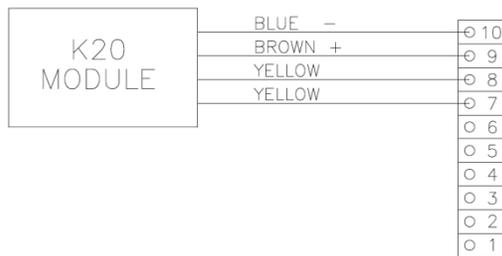


Figure 7 No Switch option

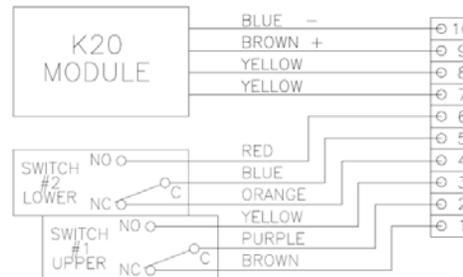


Figure 8 SPDT mechanical switches

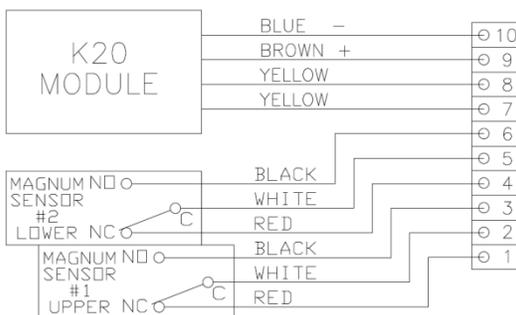


Figure 9 SPDT Magnum proximity switch

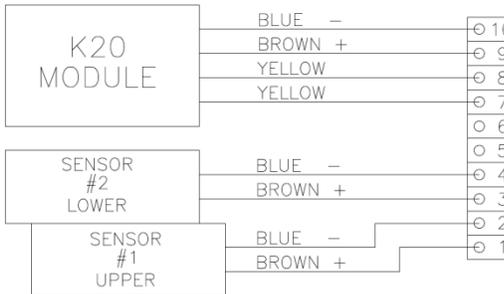


Figure 10 Inductive proximity sensors

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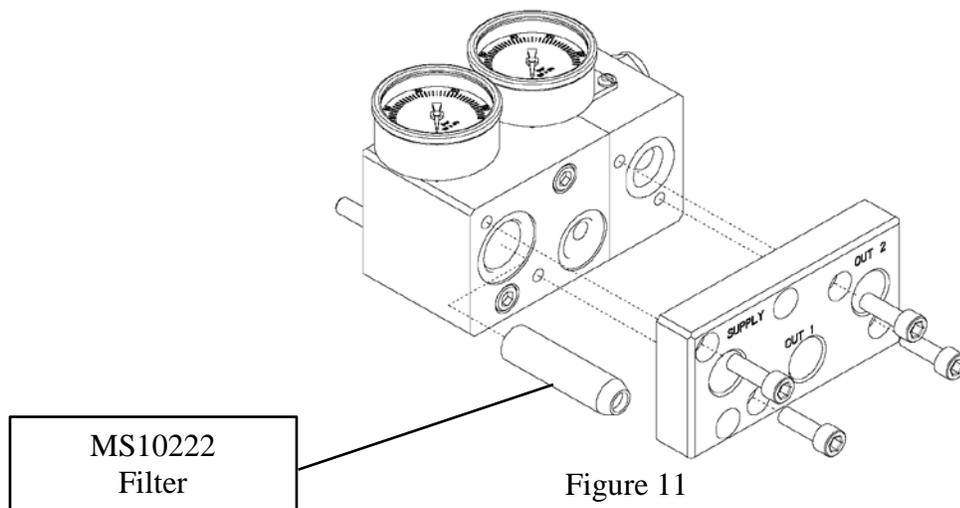
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6 Maintenance and Repair

The positioner's onboard filter should be replaced regularly or whenever it gets clogged. See diagram below for location of the filter. Note: the following instructions are for Standard Flow. For High Flow please contact the factory.

Important: The positioner's onboard filter is not a substitute for normal instrument air preparation. Supply air to the positioner should conform to ISA Standard S7.3 - Quality for Instrument Air.

Important: The filter's original color is chalk white. If the filter is discolored, its replacement should be performed more often. A discolored filter may also indicate the need for an evaluation of the air-supply quality. A filter/regulator with a 5 micron or better element, just prior to the positioner, is therefore recommended.



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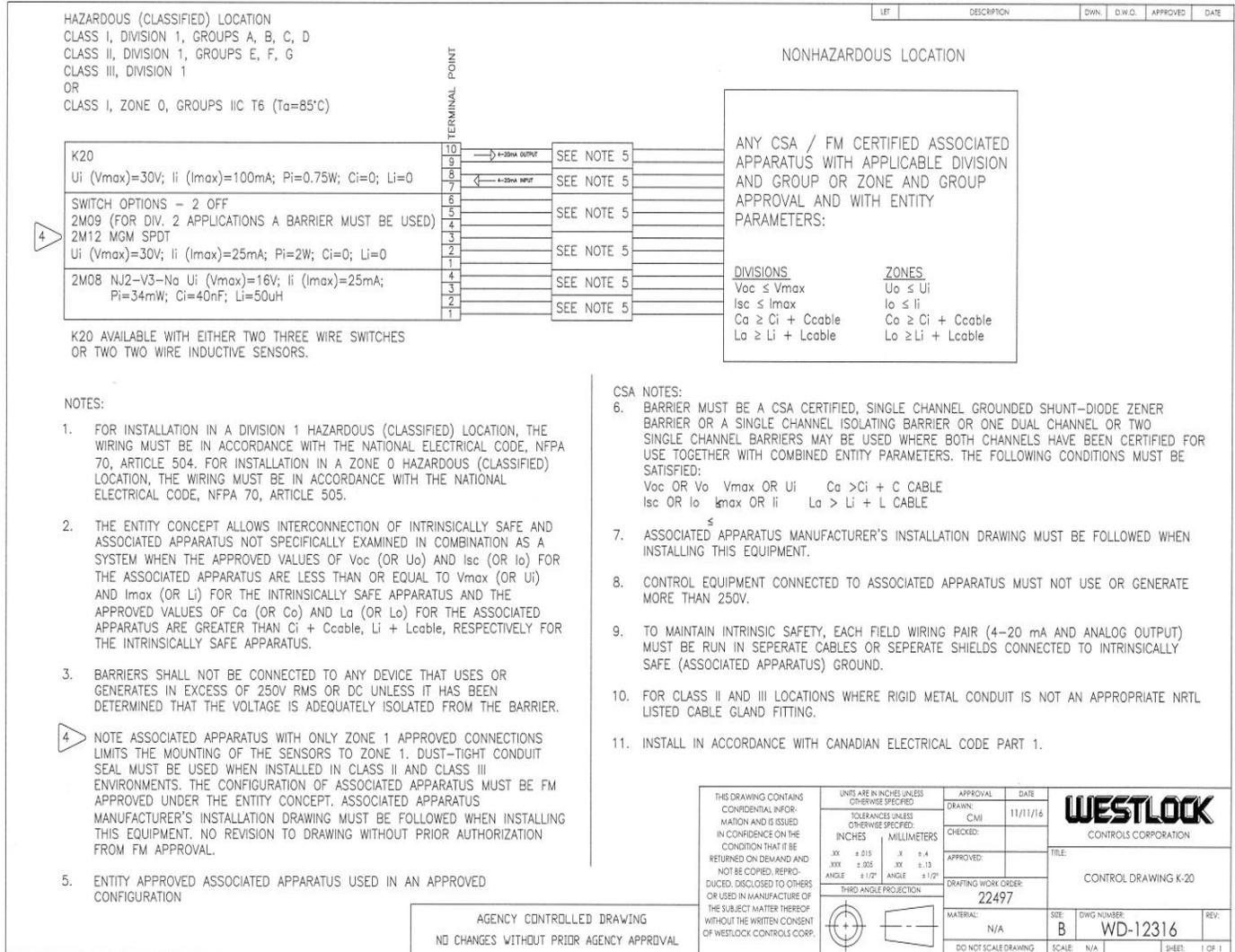
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7 Appendix

Appendix: A

Intrinsically Safe wiring:

Controlled Diagram



Appendix: B

Trouble shooting guide for Calibration Error Messages

TRANSDUCER ERROR

When performing an **Auto Calibration** if the LCD shows “TRANSDUCER ERROR” within 2 minutes. The transducer is not connected to the K20.

UNABLE TO CLOSE

When performing an **Auto Calibration** and within 2 minutes the LCD displays “UNABLE TO CLOSE”. The air supply is not connected or turned on.

CURRENT OUT OF RANGE

Input current set too high for Low current Calibration.

When performing an **Auto Calibration for Low Current** and within a few seconds the LCD displays “CURRENTS OUT OF RANGE”. Set the loop current to the desired Low Current value.

Input current set too low for High current Calibration.

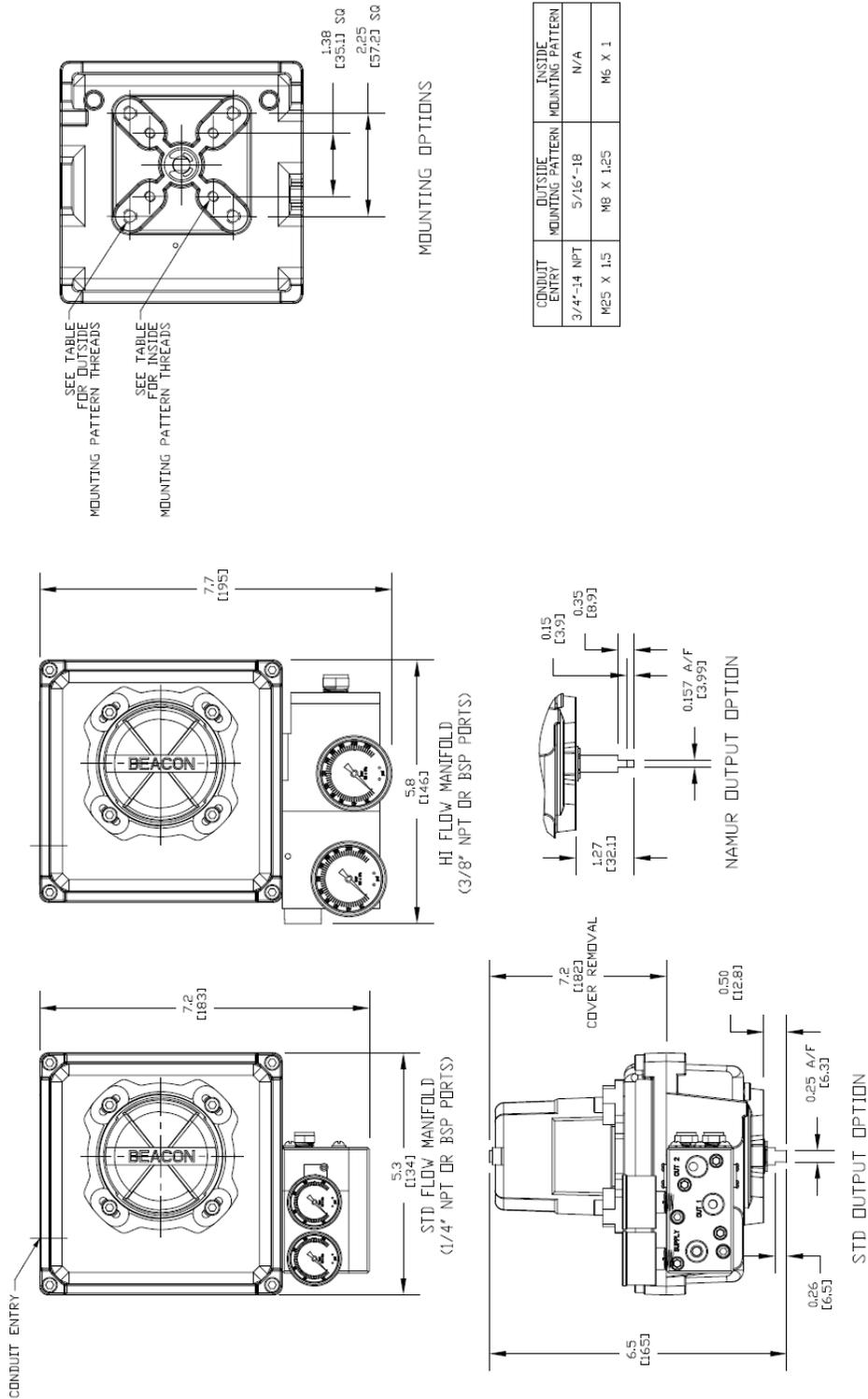
When performing an **Auto Calibration for High Current** and within a few seconds the LCD displays “CURRENTS OUT OF RANGE”. Set the loop current to the desired High Current value.

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Appendix: C
Dimensions:



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Appendix D: Westlock K20 Quick Start Guide

-AUTO CALIBRATION INSTRUCTIONS-

PRESS AND RELEASE [SEL]. DISPLAY WILL SHOW 'AUTO CAL'. PRESS  AUTO CAL WILL BEGIN WITH 4MA AS LOW CURRENT AND 20MA AS HIGH CURRENT.

-SETTING LOW AND HIGH LOOP CURRENT-

-LOW CURRENT-

SET LOOP CURRENT TO IDLE VALUE. PRESS AND RELEASE [SEL] UNTIL 'LOW' SHOWS IN DISPLAY.
PRESS  CALIBRATION WILL BEGIN.

-HIGH CURRENT-

SET LOOP CURRENT TO OPEN VALUE. PRESS AND RELEASE [SEL] UNTIL 'HIGH' SHOWS IN DISPLAY.
PRESS  CALIBRATION WILL BEGIN.

-FORWARD GAIN-

PRESS AND RELEASE [SEL] UNTIL 'FWGN' SHOWS IN DISPLAY. ADJUST VALUE USING  OR .

-REVERSE GAIN-

PRESS AND RELEASE [SEL] UNTIL 'RVGN' SHOWS IN DISPLAY. ADJUST VALUE USING  OR .

-DROP OFF-

PRESS AND RELEASE [SEL] UNTIL 'DR ENABL' OR 'DR DISAB' SHOWS IN DISPLAY. PRESS  OR  TO ENABLE/DISABLE DROP OFF.

-ZERO ADJUST-

PRESS AND RELEASE [SEL] UNTIL 'ZERO' SHOWS IN DISPLAY. PRESS  OR  TO ADJUST THESE VALUES.

-SPAN ADJUST-

PRESS AND RELEASE [SEL] UNTIL 'SPAN' SHOWS IN DISPLAY. PRESS  OR  TO ADJUST THESE VALUES.

-DIRECT OR REVERSE ACTING-

PRESS AND RELEASE [SEL] UNTIL 'DIR ACTG' OR 'REV ACTG' SHOWS IN THE DISPLAY. PRESS  OR  TO SELECT ACTUATOR OPERATION.

-MONITOR TRANSMITTER FAULT CURRENT-

PRESS AND RELEASE [SEL] UNTIL 'TX FLT LO' OR 'TX FLT HI' SHOWS IN DISPLAY. PRESS  OR  TO SELECT 'LO' (3.5mA) OR 'HI' (21.5mA).

-REGULAR OR LONG CALIBRATION TIME-

ACTUATORS WITH SLEW RATES BELOW 20 SEC. TO BE SET TO REGULAR CALIBRATION TIME.
ACTUATORS WITH SLEW RATES ABOVE 20 SEC TO BE SET TO LONG CALIBRATION TIME.

PRESS AND RELEASE [SEL] UNTIL 'REG CAL' OR 'LONG CAL' SHOWS IN DISPLAY. PRESS  OR  TO SELECT CALIBRATION TIME.

-SAVING OR DISCARDING CHANGES-

PRESS AND HOLD  UNTIL DISPLAY SHOWS 'SAVED'. RELEASING LESS THAN 5 SECONDS DISCARD THE CHANGES AND THE DISPLAY WILL SHOW 'DISCRDED'.

WESTLOCK CONTROLS

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