K20 Series - Smart Positioner
OPERATING MANUAL

IOM: Tech-566		**Revision:** -	
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Revision History

Revision
4/19/2024
Initial Release

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1 Introduction

1.1 Product Certification

Intrinsically Safe Version

K20 Rotary Sensor Version

	C US 154155 Certificate: 70130633	**ATEX** CE 2809 Ex SIRA 17ATEX2181X	**IECEx** IECEx CSA 17.0012X
Resin/ Stainless Steel Enclosure	Class I, Div. 1, Groups A,B,C & D, T4; Class I, Zone 0, AEx/Exia IIC T4 Ga; Class I, Div. 2, Groups A, B, C & D; T4; Type 4X, IP65	II 1G Ex ia IIC T4 Ga	Ex ia IIC T4 Ga
Aluminum Enclosure	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; Class I, Div. 2, Groups A, B, C & D, T4; Class II, Div. 2, Groups F & G; Type 4X, IP65	II 1G/II 2D Ex ia IIC T4 Ga Ex tb IIIC T87 Db	Ex ia IIC T4 Ga Ex tb IIIC T87 Db
Ambient Range:	Ta: -40°C to +85°C	Ta: -40°C to +85°C	Ta: -40°C to +85°C

1.2 Entity Parameters

K20 4-20mA Loop Equipment Version			
4-20 Out (Term. 7 & 8)	**4-20 In (Term. 9 & 10)**	**Switch (Term. 1–3 / 4–6)**	**Inductive Sensor (Term. 1-2 / 3–4)**
Vmax / Ui = 30V Imax /Ii= 100mA Pmax / Pi= 0.75W Ci = 1nF Li = 0µH	Vmax / Ui = 30V Imax /Ii= 100mA Pmax / Pi= 0.75W Ci = 0nF Li = 0µH	Vmax / Ui = 30V Imax /Ii= 25mA Pmax / Pi= 2W Ci = 0 nF Li = 0 µH	Vmax / Ui = 16V Imax /Ii= 25mA Pmax / Pi= 0.034W Ci = 40 nF Li = 50 µH

K20 HART Equipment Version			
4-20 Out (Term. 7 & 8)	**4-20 In (Term. 9 & 10)**	**Switch (Term. 1–3 / 4–6)**	**Inductive Sensor (Term. 1-2 / 3–4)**
Vmax / Ui = 30V Imax /Ii= 100mA Pmax / Pi= 0.75W Ci = 5nF Li = 10µH	Vmax / Ui = 30V Imax /Ii= 100mA Pmax / Pi= 0.75W Ci = 0nF Li = 10µH	Vmax / Ui = 30V Imax /Ii= 25mA Pmax / Pi= 2W Ci = 0 nF Li = 0 µH	Vmax / Ui = 16V Imax /Ii= 25mA Pmax / Pi= 0.034W Ci = 40 nF Li = 50 µH

1.3 Specific Conditions of Use

i Measures shall be taken to avoid ignition due to impact for models utilizing aluminum enclosures.

ii Measures shall be taken to avoid ignition due to electrostatic charges for models utilizing polymeric enclosures.

iii A cable gland suitably rated for the working ambient temperature range maintaining IP65 rating shall be used. The cable gland fitted to the Rotary Sensor Aluminum Enclosure version marked Ex tb IIIC T87 Db shall be an Ex certified type suitably rated for the working ambient temperature range with a minimum upper ambient temperature rating at least 2K above the maximum ambient temperature.

iv Field wiring using multi-conductor cable shall either have each conductor enclosed in grounded metal shield or each conductor have minimum 0.25mm (0.01") insulation thickness.

1.4 Warnings

WARNING: The aluminum housing Model K20 Ex ia is at potential risk of ignition by impact or friction therefore, care must be considered 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 : Danger potentiel de charge électrostatique - Nettoyez 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.

ATTENTION : La pression d'alimentation maximale est de 120 PSI. L'air soufflé doit être propre, sec et exempt d'huile conformément à la norme ANSI / ISA-7.0.01-1996 ou BS ISO 8573-1 :2010.

1.5 Description

The K20 is a 4-20mA smart valve positioner/controller. The position measurements are performed by Hall Effect Sensors inside the electronics that are actuated by magnets mounted to the shaft.

The positioner comes as standard with a 4-20mA feedback transmitter with switch/sensor options for feedback as follows: mechanical, proximity & inductive proximity. This unit may be equipped with either two 3-wire switches or two 2-wire inductive sensors.

The K20 HART upgrade option will allow communication through HART 7 Protocol.

1.6 Principles of Operation

The K20 utilizes two keys for auto-calibration and two keys for setting adjustment. These control both Positioner and Position Transmitter with a local LCD display, 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.

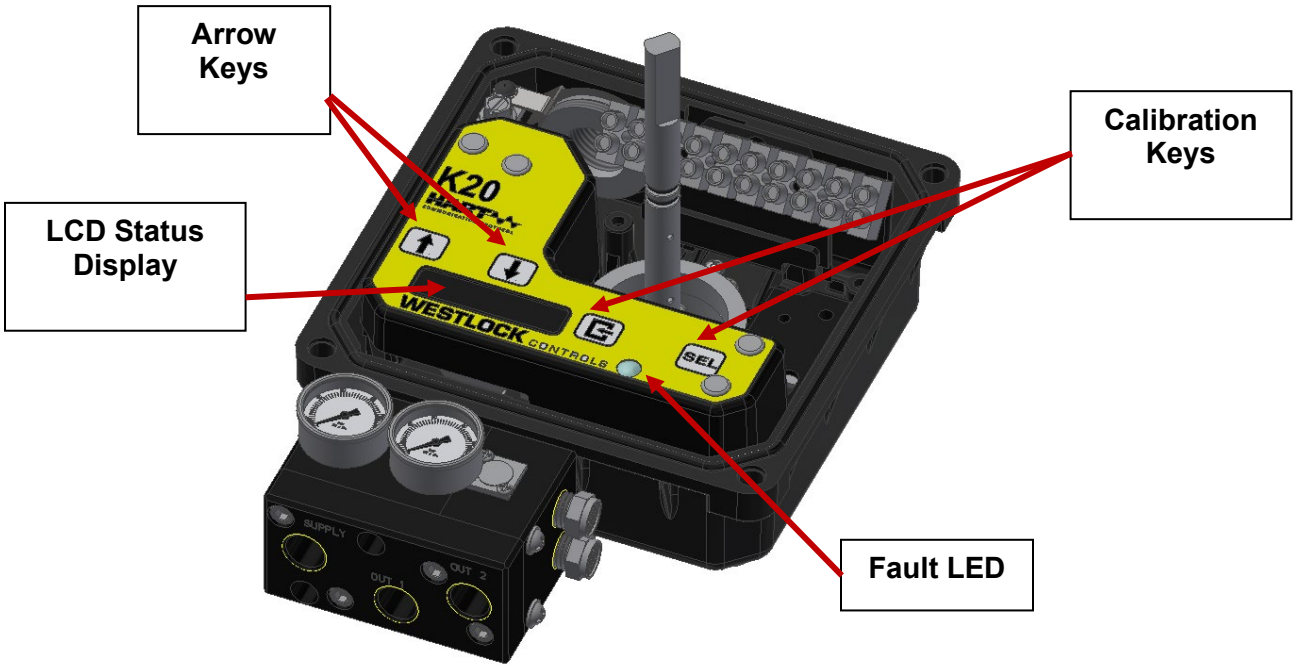


Figure 1: K20 HART Inside View

1.7 Product Features

Standard Features

Front Panel

- LCD display to show alphanumeric characters (8-digit,14 segment display)
- During control operation LCD displays valve position in 0-100% percent of open. (0% = Closed)
- Diagnostic / Fault LED
    - Analog Version: Red (Fault Indication)
    - HART Version: Red (Fault Indication/Squawk Functionality)

- Touch Sensitive Buttons
    - Calibration Keys
        - Select | Toggle Through Menu
        - Enter | Accept Menu Selection
    - Arrow Keys
        - Up, Down | Change Values

Auto-calibration

- Two touch calibration for 4mA and 20mA without need to set loop currents.
- Select from direct acting & reverse acting options.
- Auto tuning automatically selects control parameters for best operation.
- Long CAL (calibration) available for applications with large actuators, enables longer calibration timing window.

Manual Tuning

- Tune for specific customized control (Drop Off, Gain, Span)

Additional Features

Integrated Transmitter

The transmitter operates from the same sensor input as the main unit but is powered by a separate loop (AI card). It shows the position of the valve by 4mA being 0% open and 20mA being 100% open. Transmitter (Analog Output Module) requires minimum 12V and maximum 30V (sinking current).

Open/close Limit Switches

Available switches/sensors as follows: SPDT Mechanical, SPDT Magnum, or NAMUR Inductive proximity sensors.

HART 7 Protocol

Select HART 7 with DD & FDI package for easy device communication and interoperability with other HART field devices (compatible with Trex & 475 handheld devices).

2 Ordering Guide

SMART POSITIONER										
K Series Positioner (Intrinsically Safe, Non-Incendive)										
SEE DATASHEET FOR HAZARDOUS AREA RATINGS										
Base Model										
K20	Smart Positioner (4-20 mA Input with Embedded Microprocessor)									
	Shaft Output									
	S	Rotary - Standard (Double-D with 1/4" Flats) *								
	D	Direct mount to Keystone F89 Actuators *								
	N	Rotary - NAMUR VDI/VDE 3845 *								
		Hazardous Area Classification								
		IS	Intrinsically Safe and Cl. I Div. 2 - NEC / ATEX / IECEx Approval							
			Enclosure Material							
			E	Engineered Resin - Clear Cover with Visible LCD Screen						
			S	316/CF8M Stainless Steel						
			A	Aluminum						
				Supply Pressure & Flow Capability						
				H	Standard Flow | Supply 40 - 120 psi | recommended min. actuator swept volume of 12.2 cubic inches					
				L	Standard Flow | Supply 15 - 45 psi | recommended min. actuator swept volume of 12.2 cubic inches					
				V	High Flow | Supply 40 - 120 psi | recommended min. actuator swept volume of 91.5 cubic inches					
					Valve Manifold Material					
					0	Anodized Aluminum				
					1	Stainless Steel ***(Required For: Enclosure Material "S")***				
						Conduit Entry				
						B	(1) M20 x 1.5			
						C	(1) 3/4NPT ***(Recommended with switch options)***			
							Limit Switch & Sensor Options			
							0	None		
							B	(2) SPDT Mechanical with Gold Plated Contacts ***(Not for Cl. I Div. 2)***		
							I	(2) Inductive P+F NJ2-V3-N		
							T	(2) SPDT Magnum Proximity with Tungsten Contacts		
							R	(2) SPDT Magnum Proximity with Rhodium Contacts		
								Communication and Position Feedback		
								B	Analog Only Communication and 4-20mA Position Transmitter	
								H	HART7 Communication and 4-20mA Position Transmitter	
									Pneumatic Connections	
									N	1/4NPT ***(3/8NPT for Supply Pressure "V")***
									B	1/4BSP ***(3/8BSP for Supply Pressure "V")***
									F	1/4NPT w/Aluminum Filter-Regulator ***(3/8BSP for Supply Pressure "V")***
									S	1/4NPT w/ Stainless Steel Filter-Regulator ***(Not available with Supply Pressure "V")***
K20	***N***	***IS***	***E***	***H***	***0***	***C***	***R***	***H***	***F***	***= Model number: K20NISEH0CRHF***

* Rotary options come standard with Black / Yellow Beacon Indicator

Note: Mounting Pattern: 5/16 - 18 Outer ; M6 x 1 Inner

Magnum Proximity Switch Application Note:

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

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

3 Definitions

The symbol warns the user of possible danger. Failure to heed this warning may lead to personal injury or death and/or severe damage to equipment.

The 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.

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

4 Installation

4.1 Rotary Mounting Instructions and Options

4.1.1 Mounting Instructions

Required Tools: Open-end wrenches or adjustable wrenches to fit all sizes of hex head bolts in the mounting kit.

Step 1. Obtain a mounting kit suited for the actuator/valve, commonly available through a local Westlock Controls distributor.

Step 2. Attach the mounting bracket and coupler (if required) to the unit housing with the hardware provided.

Step 3. Attach the unit and mounting system to the actuator.

Step 4. Ensure proper axial alignment between unit shaft, coupler and actuator shaft.

Step 5. Failure to ensure alignment could result in long-term stress-related failure of unit shaft in high cycle or high torque applications.

4.1.2 Mounting Options

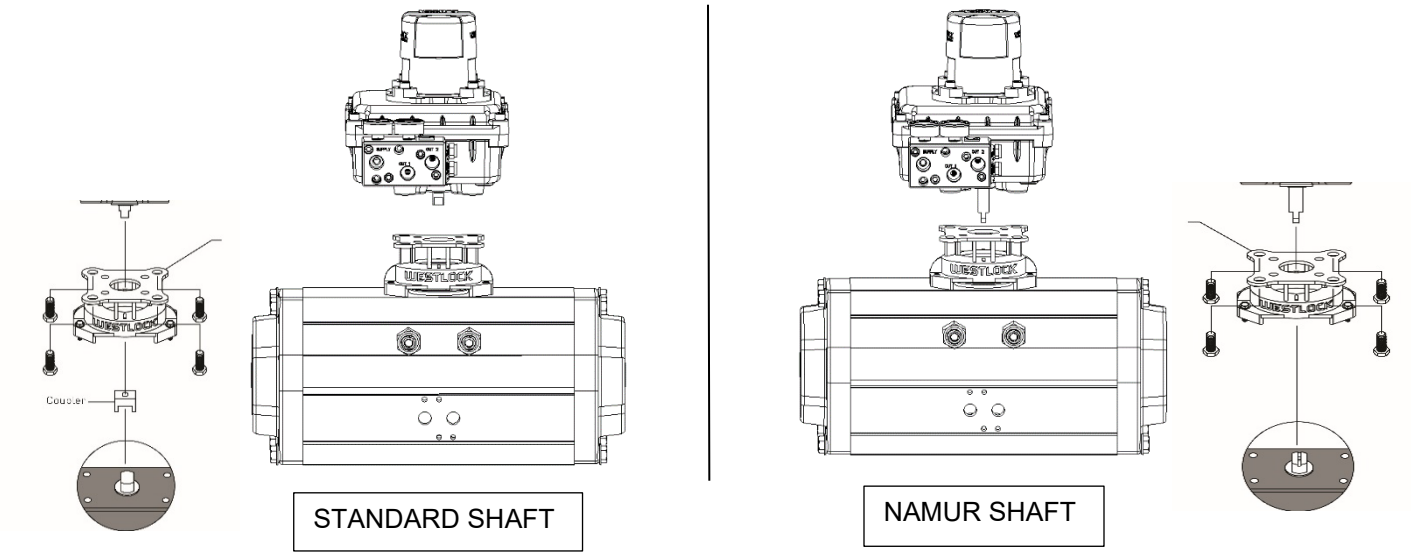


Figure 2: Mounting for Shaft Output Options Standard and Namur

4.2 Pneumatic Piping

4.2.1 Single Acting Actuator (Spring Return):

For single acting actuators Outlet Port 2 (Out 2) is to be plugged. Outlet Port 1 (Out 1) is to be piped to the actuator inlet port that acts against the spring.

4.2.2 Double Acting Actuator:

For double acting actuators, pipe Out 2 to the actuator port that sends the valve to the desired fail position. Pipe Out 1 to the other actuator port (the port that sends the valve away from the fail position, towards span position).

Note: Loss of power will cause an increase in pressure on Out 2 regardless of any configuration.

Standard flow manifold comes with a choice of ¼ NPT, or ¼ BSP port sizes (See Figure 3). High Flow manifold comes with a choice of ⅜ NPT, or ⅜ BSP port sizes (See Figure 4).

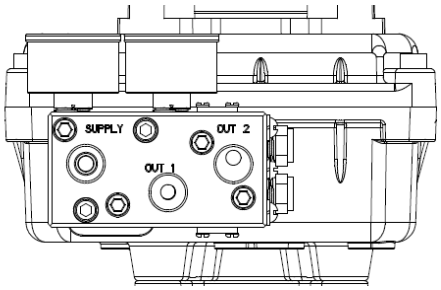


Figure 3: Standard Flow Manifold

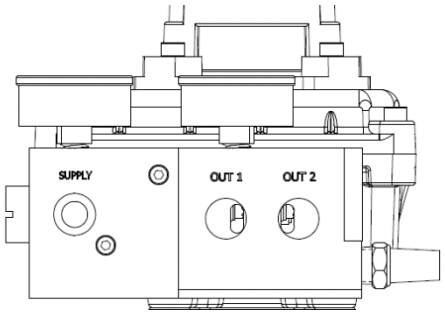


Figure 4: High Flow Manifold

4.3 Keypad Functionality

4.3.1 General Overview

Setting adjustments take immediate effect but must be saved to become permanent.

All options menu steps will timeout after 5 seconds, discarding any changes if no key is pressed during that time.

4.3.2 Memorizing or Discarding Changes

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

Save the changes by pressing and holding .

"HOLD TO SAVE" will display to indicate you must continue holding the key to accept the change.

Releasing after a shorter time (until the message **" SAVED"** has appeared) or not pressing and holding to save will cause the changes to be discarded.
LCD display will show **" DISCRDED"**

You can Exit without saving by quickly pressing and releasing before the **" SAVED"** message is displayed.

" SAVED" Indicates the changes made to this point are saved.

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

4.3.3 Cancelling Calibration

When the LCD displays **"AUTO CAL"** and you do not want to perform this operation, if you take no action within 6 seconds, the function is canceled, and the LCD display reverts to opening percentage "xx%"

If Auto-calibration is started by mistake**,** press again within 5 seconds to cancel auto calibration.

The LCD display will show **"CALIBRATION CANCELED"**. The LCD display will then revert to opening percentage "xx%" after 5 seconds.

4.3.4 Reset to the Factory Default Settings

Press **SEL** until the LCD display scrolls **"Restore Factory Default"**.
Press ⬇ until the LCD display reads "hold ↵ Key".
Press and hold ↵.
LCD display will display **"Factory Default Success"**
Factory default settings are now enabled.

4.3.5 Options Menu Summary

To enter the Menu, press and release the **SEL.** Press **SEL** repeatedly to cycle through the options. To then change setting values, toggle by ⬆ or ⬇. Press ↵ Key to select the desired option. Refer to Appendix E for Menu Tree diagram.

Note: Continuing to press **SEL** repeatedly will return to the start of Options Menu

Press and release the SEL to display the following Calibration and Configuration Menu items:

OPTIONS MENU	DEFINITION
AUTO CAL	Automatic Calibration
MAN MODE	Manual Control Mode (available for K20 HART only)
LOW CAL	Low Calibration (set loop current first)
HIGH CAL	High Calibration
FWGN XX	Forward Motion Gain
RVGN XX	Reverse Motion Gain
DR ENABL or DR DISAB	Drop off Enable or Disabled based upon what is set
ZERO XX	Change the minimum position away from the actuator zero
SPAN XX	Change the maximum position away from actuator span
FL CLOSE or FL OPEN	Based upon setting
DIR ACTG or REV ACTG	Direct or reverse acting based upon setting
TX FT LO or TX FT HI	Based upon setting (transmitter fail 3.5 or 21mA)
REG CAL or LONG CAL	Regular calibration time of 30 seconds or longer time
RESTORE FACTORY DEFAULT	Restore to Factory Default Settings

4.4 Calibration

There are three positioner calibration options (all options will simultaneously calibrate the 4-20mA Transmitter) as below:

4.4.1 Auto-calibration: Determines optimal control parameters for end of travel locations

K20 comes as factory calibrated such that 4mA is the fail position and 20mA is the span position of the valve. An auto-calibration feature is available to tune the positioner to the automated valve package.

The 4-20mA feedback transmitter is automatically calibrated during this procedure. Auto-calibration can be performed at any loop current between 4mA and 20mA, however it is strongly recommend running any calibration at a middle range of loop current (12 mA).

Remark: Auto-calibration consists of many steps requiring valve movement and does not timeout at an arbitrary time interval. Each step will continue if the valve continues to move significantly in the commanded direction, during the specified time window.

Larger and “sticking” valves with stroke time longer than 30 seconds, may require longer time to complete auto-calibration. For the extra-large valves the time window can be expanded by selecting **LONG CAL** option. For additional information see Calibration Timeout Setting in section 5.11 and then proceed to **AUTO CAL**.

To start auto-calibration press **SEL** until the Display shows **“AUTO CAL”**

The display will show:

AUTO CAL	Automatic Calibration is to be performed. Press ↵ to start the calibration process.
STARTED	Automatic Calibration started. The actuator will move the valve into the open position.
ZERO PSI	Zero pressure applied to Out 1. The actuator will move the valve into the fail position (closed position for fail close valves).
FULL PSI	Full pressure applied to Out 1. The actuator will move the valve into the open position.
DYNAMICS	Determine the optimal control parameters.
BALANCE	Determine the transducer parameters.
TESTING	Checking all parameters previously calculated are accurate.
CALIBRATION SUCCESS	This scrolls when calibration is complete

After calibration is completed, it returns to the normal operating mode.

XX %	Percent valve opening will always be shown.

4.4.2 Low Calibration: Set low current values other than 4mA

The low calibration always refers to the input current value corresponding to no pressure on Out 1 (typically the closed valve position).

The 4-20mA feedback transmitter is automatically calibrated during this procedure.

First, follow the procedure for Auto-calibration.
Next, set the loop current to the desired zero value.
Press **SEL** until the display shows **“LO CAL”** then press ↵.

The display will show **"CALIBRATION SUCCESS"** three times and it will adjust to the desired low set-point current.

Note: Factory default low current setting is 4mA

4.4.3 High Calibration: Set high current values other than 20mA

High calibration refers to the input current value that drives the unit to provide full pressure to Out 1, which in turn drives a normally closed valve to the open position.

The 4-20mA feedback transmitter is automatically calibrated during this procedure.

First follow the procedure for the Auto-calibration
Next, set the loop current to the desired Span value. (Span = High Current Value)
Press **SEL** until the display shows **"HI CAL"** then press ↵.
The display will show **"CALIBRATION SUCCESS"** and it will adjust to the desired high set-point current.

Note: Factory default high current setting is 20mA

5 Positioner Options/Setup Menu Overview

5.1 Manual Mode (Function Currently Exclusive to K20 HART)

Manual Mode permits manual override of input signal (via local keypad or HART Interface). To enter Manual Mode, Press **SEL** until the display shows **" MAN MODE ",** then press ↵. The LCD display shows "**MAN XX**" where **XX** is the current position.

- Press ↑ to increase valve position away from 0%.
- Press ↓ to decrease valve position (moving closer to 0%).
- Press **SEL** to scroll through options: MAN xx, OPEN and CLOSE.
- Press ↵ when OPEN or CLOSE are shown to move the valve to fully OPEN or fully CLOSE. When in Manual Mode, (**MAN XX** shown) press ↵ to exit Manual Mode and return to the main screen (percentage open).

Pressing ↑ or ↓ makes a coarse adjustment of 3%, but holding a single direction makes a fine adjustment. If you want to change the position precisely, just hold the key, but for faster adjustment, press and release it repeatedly. **Note:** positioner response may be slightly delayed from keypad input.

Once OPEN or CLOSE options are selected, the positioner returns to manual mode (**MAN XX**). Depending on the actuator size and settings (ie. Drop Off), changing position may take longer, and may require multiple presses of ↑ or ↓.

Note: Figure 5 below displays how to navigate the Manual Mode menu

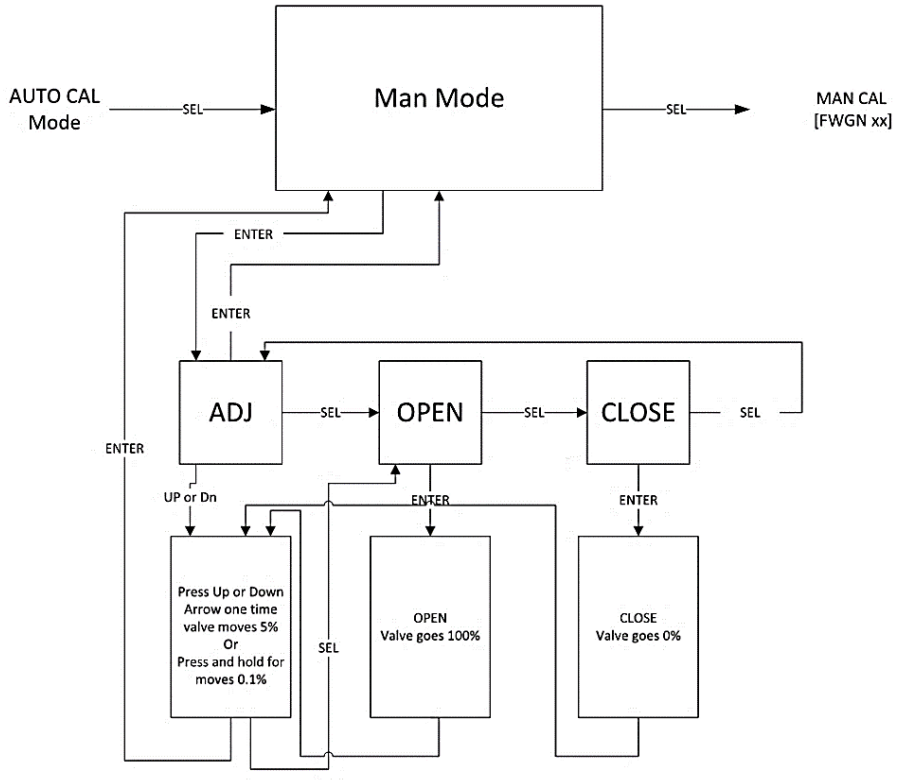


Figure 5: Manual Mode Flowchart

5.2 Forward Gain

Forward Gain increases or decrease the responsiveness of the positioner when pressure is applied to Out 1.

The LCD display shows **"F W G N XX"** where **XX** is the present gain.

- Press ⬇ to decrease the Gain
- Press ⬆ to increase the Gain
- Press and hold ⏎ to save.

Note: Factory Default setting of the forward gain is 10

5.3 Reverse Gain

Reverse Gain increases or decrease the responsiveness of the positioner when pressure is applied to Out 2.

The LCD display shows **"R V G N XX"** where **XX** is the present gain.

- Press ⬇ to decrease the Gain
- Press ⬆ to increase the Gain
- Press and hold ⏎ to save.

Note: Factory Default setting of the reverse gain is 10.

5.4 Drop Off Enable/Disable

Enables or disables drop off at end of travel. When the drop off is enabled, positioner will exhaust actuator air at zero position and will fully pressurize at span.

The LCD display shows: **D R E N A B L** or **D R D I S A B**

- Press the ⬆ or ⬇ to toggle this setting.
- Press and hold ⮌ to save.

Note: Factory default setting of the drop off is disabled.

5.5 Zero Position Adjustment

When drop off is disabled the electronic stop is adjusted away from the physical stop at ZERO or de-energized position (Out 1 = 0 & Out 2 = Supply psi). The adjustment can be made from a count of 0 to 100 (as visible on the LCD) with each count equal to approximately 0.15 degrees (max incremental adjustment possible is approximately 15 degrees from the hard stop).

The LCD display shows: **ZERO** and **X** where X would be a number between 0-100 (0 and 100 including both).

- Press ⬇ to reduce the initial adjustment value X to move closer to the end of the stroke down to a value of 0.
- Press ⬆ to increase the initial adjustment value X to move away from the end of the stroke up to a maximum value of 100.
- Press and hold ⮌ to save.

ⓘ When drop off feature is enabled (LCD displays **D R E N A B L**), the zero-adjustment value will be overridden.

5.6 Span Position Adjustment

When drop off is disabled, the electronic stop is adjusted away from the physical stop at SPAN or energized position (Out 1 = Supply psi & Out 2 = 0 psi). The adjustment can be made from a count of 0 to 100 (as visible on the LCD) with each count approximately equal to 0.15 degrees (max incremental adjustment possible is approximately 15 degrees from the hard stop).

The LCD display shows: **“ SPAN ”** and **X** where X would be a number between 0-100 (0 and 100 including both).

- Press ⬇ to reduce the initial adjustment value X to move closer to the end of the stroke down to a value of 0.
- Press ⬆ to increase the initial adjustment value X to move away from the end of the stroke up to a maximum value of 100.
- Press and hold ⮌ to save.

ⓘ When drop off feature is enabled (LCD displays **“ D R E N A B L ”**), the span-adjustment value will be overridden.

5.7 Fail Open/Fail Close

Fail CLOSE (default mode) means that the LCD display will indicate 0% when a 4mA signal is present, and 100% when a 20mA signal is present. The transmitter will output 4mA at 0% and 20mA at 100%. The actuator will follow the position as given by the piping configuration (see section 4.3). The fail close position of K20 matches the default position of the fail close valve package

Fail OPEN (option) means that the LCD display will indicate 100% when a 4mA signal is present, and 0% when a 20mA signal is present. The transmitter will output 20mA at 100% and 4mA at 0%. The actuator will follow the position as given by the piping configuration (see section 4.3).

The LCD display shows: (**" FL OPEN / FL CLOSE"**)

- Press ↑ or ↓ to toggle this setting.
- Press and hold ↵ to save.

5.8 Direct/Reverse Acting

Direct Acting means that the air pressure increases on Out 1 with increasing loop current; Reverse Acting means that the air pressure decreases on Out 1 with increasing loop current. This function can be selected after the auto-calibration is complete.

The LCD display shows: (**" DIR ACTG / REV ACTG")**

- Press ↑ or ↓ to toggle this setting.
- Press and hold ↵ to save.

The table below summarizes the current-pressure relationships according to the option chosen.

Note: Transmitter output will report the position as shown on the LCD screen.

Options and Loop Signal to K20		**Response of K20**		
Signal Option	**4-20mA Signal**	**Air to actuator (Out 1)**	**K20 LCD Screen**	**K20 Transmitter Output**
Direct Acting (K20 set to Close) Fail CLOSE Actuator (Air to Open)	4mA	0 PSI	0%	4mA
Reverse Acting Fail CLOSE Actuator (Air to Open)	4mA	Full PSI	100%	20mA
Direct Acting Fail OPEN Actuator (Air to Close)	4mA	0 PSI	100%	20mA
Reverse Acting Fail OPEN Actuator (Air to Close)	4mA	Full PSI	0%	4mA

5.9 Transmitter Fault Current

If the transmitter cannot determine the actual valve position or does not receive a signal from the positioner, the transmitter will report a default output of 3.5mA or 21.5mA as per requirements of NAMUR NE 43, selected by customer in Fault Current Setting Menu Option.

If the main unit detects an error >10% of position, the transmitter will show current valve position and the Fault LED starts blinking.

This “fail” current will be put out within 200ms of the actual failure.

5.10 Fault Current Setting

The position transmitter fault current is defined as either:

TX FT LO: 3.5mA or **TX FT HI**: 21.5mA.

The LCD display shows: **“TX FT LO”** or **“TX FT HI ”**.

- Press ⬆ or ⬇ to toggle this setting.
- Press and hold ↵ to save.

5.11 Calibration Timeout Setting

There are two types of calibration timeout settings in K20 Series – Regular Calibration (REG CAL) and Long Calibration (LONG CAL). The default is REG CAL with optional LONG CAL required if the valve takes longer time (approx. > 30 seconds) to open, close, or shows friction during movement. Switching to LONG CAL in such cases will help to pass auto-calibration.

For K20 HART, auto-calibration consists of many steps requiring valve movement and does not timeout at the arbitrary time interval. Each step will continue if the valve continues to move significantly in the commanded direction during the specified time window.

The LCD display shows: **“REG CAL”** or **“LONG CAL”**.

- Press ⬆ or ⬇ to toggle this setting.
- Press and hold ↵ to save.

5.12 Restore Factory Default Settings

Display scrolls message: “Restore Factory Default”.

Press ⬇ until the LCD display reads “Hold ↵ Key”.
Press and hold ↵.
The LCD display will scroll **“Factory Default Success”**

Factory default settings are now restored to the following values:

LOW CAL	4mA
HIGH CAL	20mA
CALIBRATION TIME	REG CAL
ACTING	DIRECT ACTING
Fail Close/Fail Open	FL CLOSE
Dropoff	DR DISABLE
ZERO	0
SPAN	0
FWGN	10
RVGN	10
TX FT	LO

5.13 Switch Adjustment (Two Switches)

Note 1: Switch actuation can be confirmed using a signal detection device such as a multimeter or ohmmeter, set for “continuity”.

Note 2: For NAMUR inductive proximity sensors, use appropriate test meter, or equivalent to check sensor actuation and calibration. If the proper meter is not available, contact the factory for additional assistance with the test procedure.

Note 3: Adjust TouchSet cams by hand by pushing/pulling the TouchSet cam against the shaft spring to disengage from the mating spline, rotating to adjust and re-engaging firmly onto spline.

Required Tools: Signal detection device (see note 1); slotted screw drivers or 4mm A/F Allen Key (M5 socket head cap screws) for cover screws.

Warning: 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.

Step 1: Remove unit cover as follows: loosen (but do not remove) captive screws using the Allen Key (suggested above), rotate cover slightly (twist approx. 45°) to grip corners, pull firmly.

DO NOT PRY COVER WITH TOOLS.

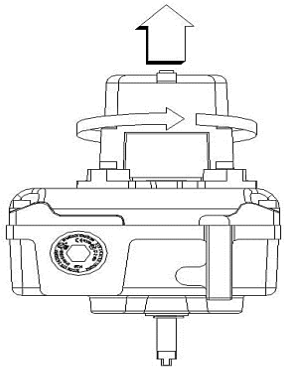


Figure 6: Switch Adjustment

Step 2: With valve in the closed position (no air at Out 1) adjust TouchSet cam corresponding to selected closed position switch until the switch actuates (Refer to Figure 7).

Step 3: Stroke valve to the open position (air at Out 1) adjust TouchSet cam corresponding to selected open position switch until the switch actuates.

Step 4: Cycle actuator several times to confirm proper switch indication at each end of stroke. Finely adjust TouchSet cams if necessary.

Step 5: Skip to Field Wiring section or replace unit cover, applying approximately 20 in-lbs of torque to cover screws.

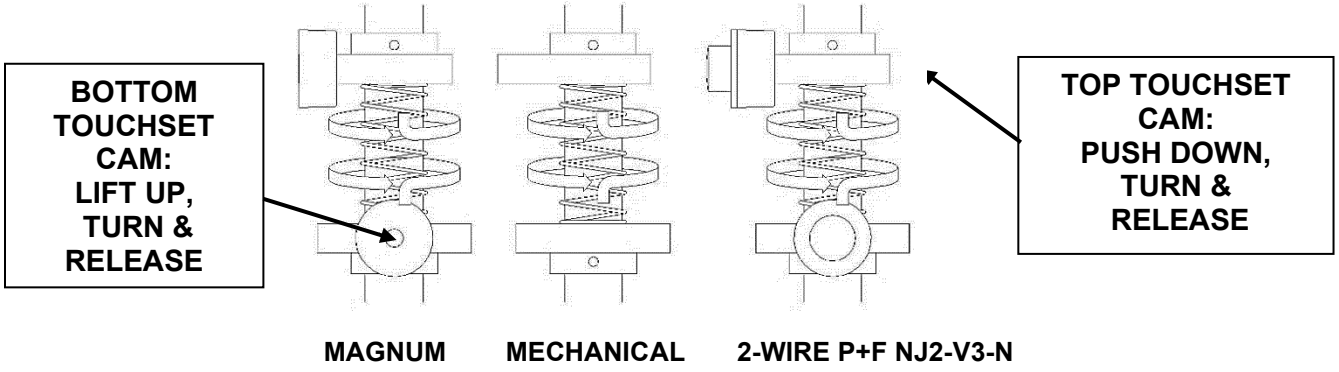


Figure 7: TouchSet Cams

5.14 Beacon Adjustment

For two-way OPEN/CLOSED: remove, rotate, and re-fasten outer beacon to ensure correct displayed flow path with valve/actuator flow path as shown in the figure below.

Note: Skip this step if cover is flat or Beacon already displays the correct valve status.
Required Tools: 4mm A/F Allen Key (M5 socket head cap screws)

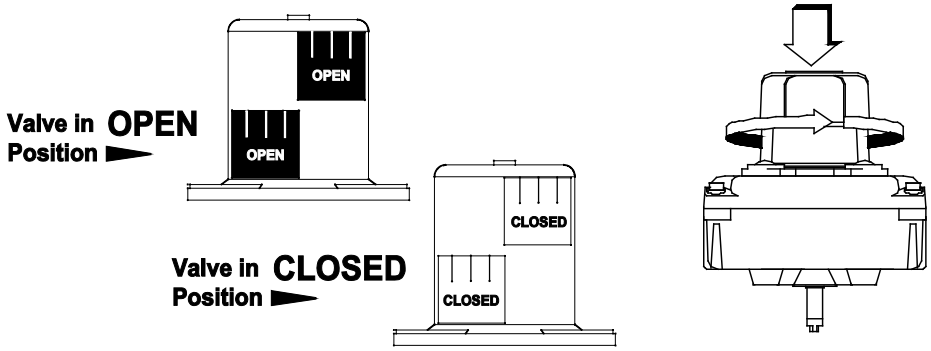


Figure 8: Beacon Adjustment

6 Field Wiring

6.1 Field Wiring Terminal Strip

Wires must be rated at least 105˚C with minimum 0.25mm thickness shall be used for external connections. The unit must be installed as per the control drawing WD-12316 (see appendix A).

Refer to the below wiring diagrams

Terminal Point 10: Blue wire Input (-) 4-20mA

Terminal Point 9: Brown wire Input (+) 4-20mA

Terminal Point 8: Yellow transmitter (no polarity)

Terminal Point 7: Yellow transmitter (no polarity)

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

Warning: Do not pinch wires when putting the cover back on

6.2 Wiring Diagrams

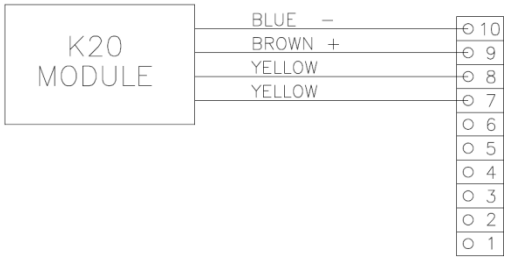


Figure 9: No Switch Option

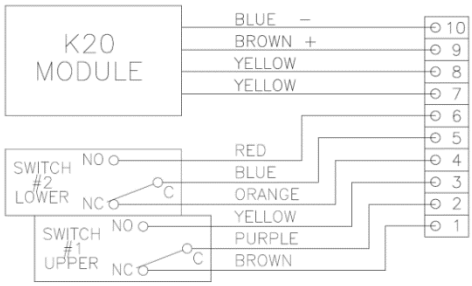


Figure 10: SPDT Mechanical Switches

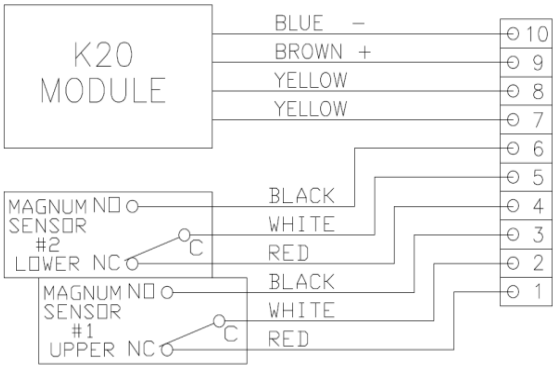


Figure 11: SPDT Magnum Proximity Switch

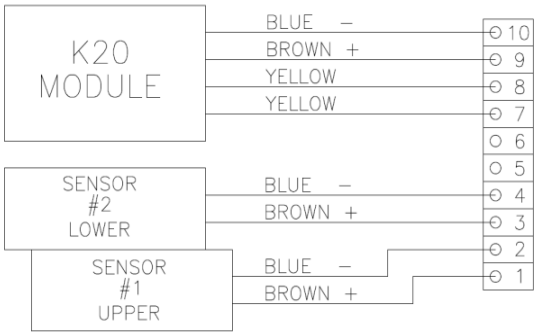


Figure 12: Inductive Proximity Sensors

7 Maintenance and Repair

The positioner's onboard filter should be replaced during regular maintenance or when the filter gets clogged. See Figure 13 below for location of the filter.

Note: the following instructions are for Standard Flow. For High Flow, please contact the factory.

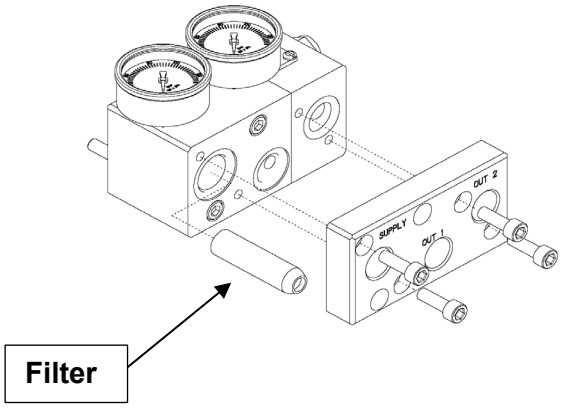


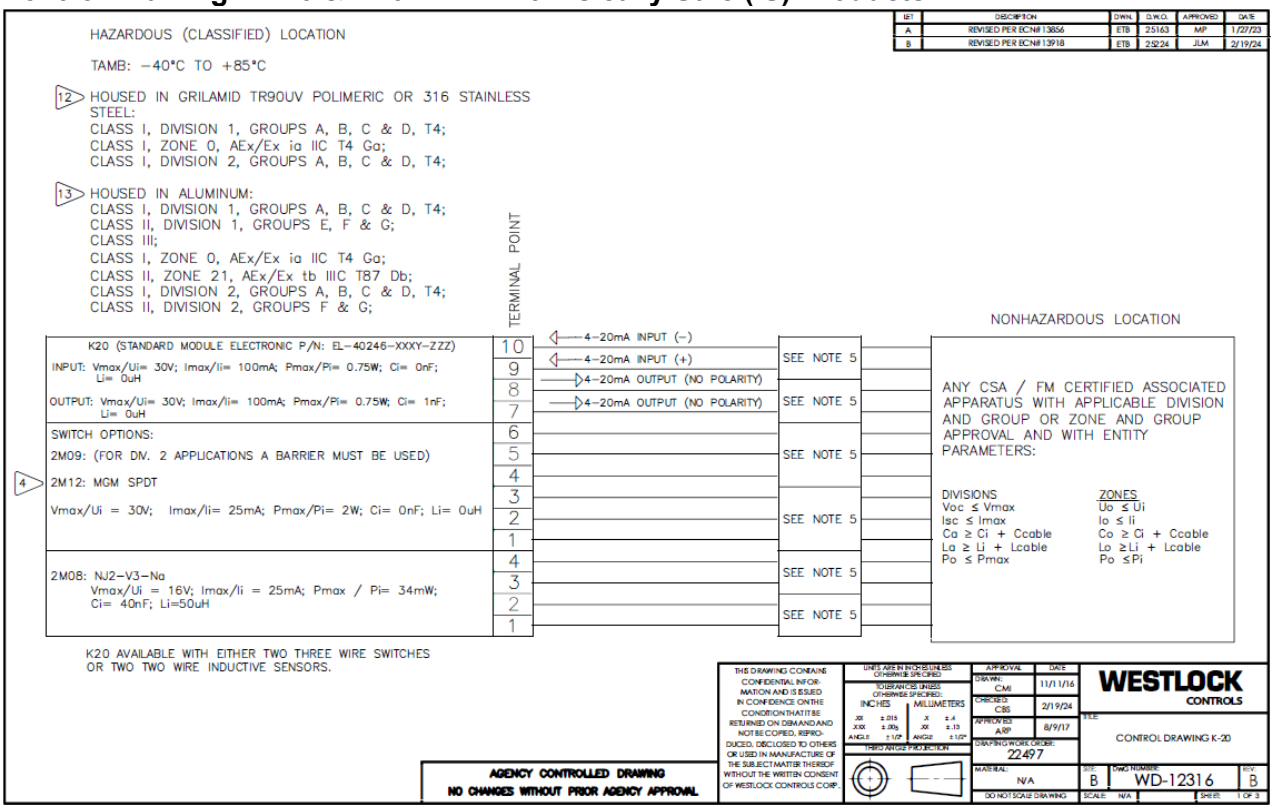
Figure 13: Filter Location

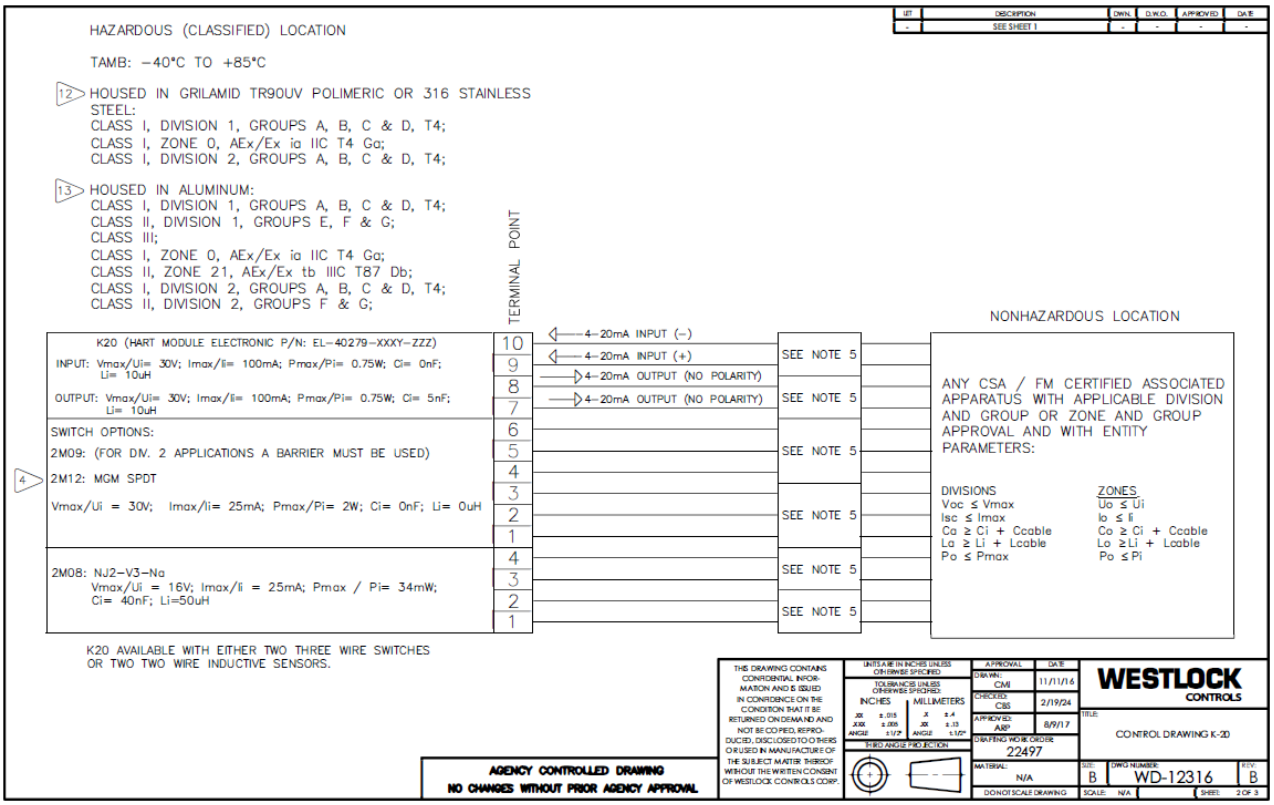
The positioner's onboard filter is not a substitute for normal instrument air preparation. Supply air to the positioner should be clean, dry, oil free instrument air per ISA-S7.3.

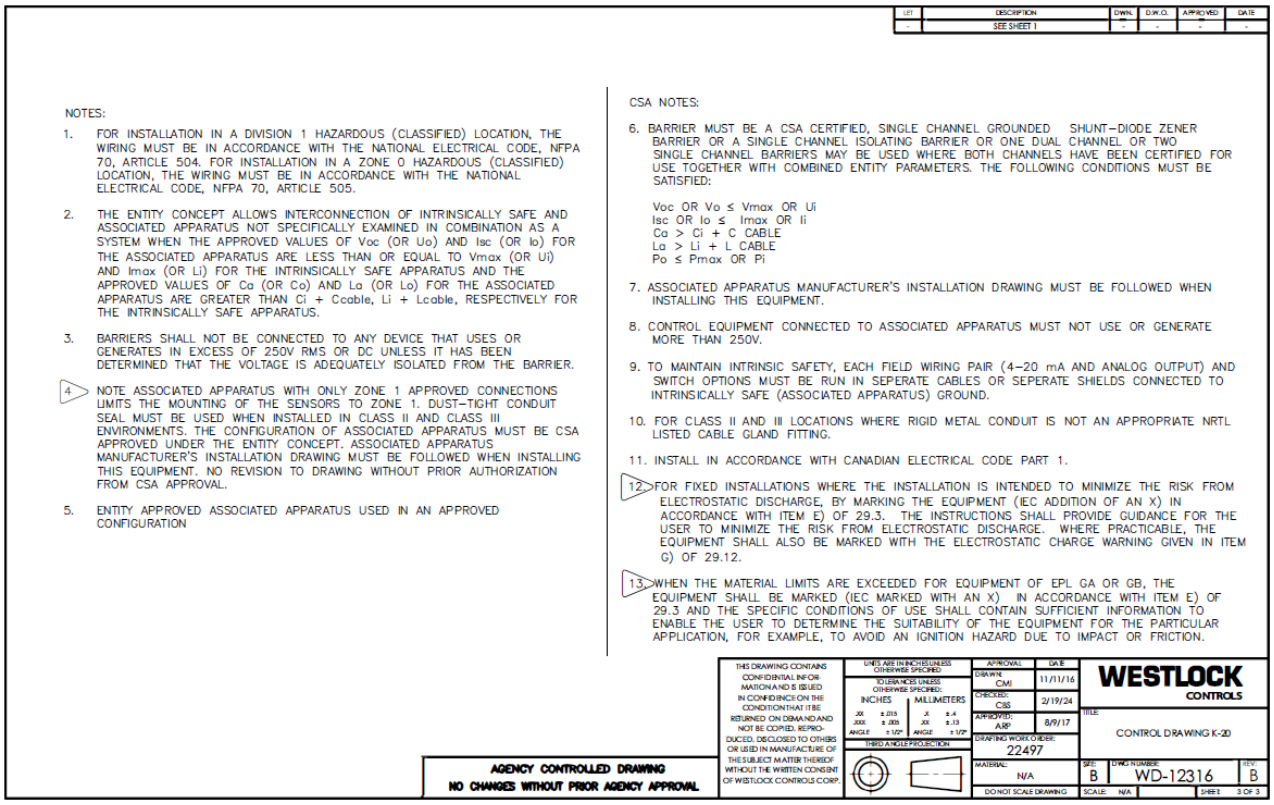
The filter's original color is chalk white. If the filter is discolored, its replacement should be performed more often. A discolored filter may also indicate the need for an evaluation of the air-supply quality. A filter/regulator with a 5 micron or better element, just prior to the positioner, is therefore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

8 Appendix A: Intrinsically Safe Wiring

Control Drawing – K20 & K20 HART Intrinsically Safe (IS) Products







LET	DESCRIPTION	DWN.	D.W.O.	APPROVED	DATE
-	SEE SHEET 1	-	-	-	-

NOTES:

1. FOR INSTALLATION IN A DIVISION 1 HAZARDOUS (CLASSIFIED) LOCATION, THE WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NFPA 70, ARTICLE 504. FOR INSTALLATION IN A ZONE 0 HAZARDOUS (CLASSIFIED) LOCATION, THE WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NFPA 70, ARTICLE 505.
2. THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE AND ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM WHEN THE APPROVED VALUES OF Voc (OR Uo) AND Isc (OR Io) FOR THE ASSOCIATED APPARATUS ARE LESS THAN OR EQUAL TO Vmax (OR Ui) AND Imax (OR Li) FOR THE INTRINSICALLY SAFE APPARATUS AND THE APPROVED VALUES OF Ca (OR Co) AND La (OR Lo) FOR THE ASSOCIATED APPARATUS ARE GREATER THAN Ci + Ccable, Li + Lcable, RESPECTIVELY FOR THE INTRINSICALLY SAFE APPARATUS.
3. BARRIERS SHALL NOT BE CONNECTED TO ANY DEVICE THAT USES OR GENERATES IN EXCESS OF 250V RMS OR DC UNLESS IT HAS BEEN DETERMINED THAT THE VOLTAGE IS ADEQUATELY ISOLATED FROM THE BARRIER.
4. NOTE ASSOCIATED APPARATUS WITH ONLY ZONE 1 APPROVED CONNECTIONS LIMITS THE MOUNTING OF THE SENSORS TO ZONE 1. DUST-TIGHT CONDUIT SEAL MUST BE USED WHEN INSTALLED IN CLASS II AND CLASS III ENVIRONMENTS. THE CONFIGURATION OF ASSOCIATED APPARATUS MUST BE CSA APPROVED UNDER THE ENTITY CONCEPT. ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT. NO REVISION TO DRAWING WITHOUT PRIOR AUTHORIZATION FROM CSA APPROVAL.
5. ENTITY APPROVED ASSOCIATED APPARATUS USED IN AN APPROVED CONFIGURATION

CSA NOTES:

6. BARRIER MUST BE A CSA CERTIFIED, SINGLE CHANNEL GROUNDED SHUNT-DIODE ZENER BARRIER OR A SINGLE CHANNEL ISOLATING BARRIER OR ONE DUAL CHANNEL OR TWO SINGLE CHANNEL BARRIERS MAY BE USED WHERE BOTH CHANNELS HAVE BEEN CERTIFIED FOR USE TOGETHER WITH COMBINED ENTITY PARAMETERS. THE FOLLOWING CONDITIONS MUST BE SATISFIED:

   Voc OR Vo ≤ Vmax OR Ui
   Isc OR Io ≤ Imax OR Ii
   Ca > Ci + C CABLE
   La > Li + L CABLE
   Po ≤ Pmax OR Pi

7. ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.
8. CONTROL EQUIPMENT CONNECTED TO ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250V.
9. TO MAINTAIN INTRINSIC SAFETY, EACH FIELD WIRING PAIR (4-20 mA AND ANALOG OUTPUT) AND SWITCH OPTIONS MUST BE RUN IN SEPERATE CABLES OR SEPERATE SHIELDS CONNECTED TO INTRINSICALLY SAFE (ASSOCIATED APPARATUS) GROUND.
10. FOR CLASS II AND III LOCATIONS WHERE RIGID METAL CONDUIT IS NOT AN APPROPRIATE NRTL LISTED CABLE GLAND FITTING.
11. INSTALL IN ACCORDANCE WITH CANADIAN ELECTRICAL CODE PART 1.
12. FOR FIXED INSTALLATIONS WHERE THE INSTALLATION IS INTENDED TO MINIMIZE THE RISK FROM ELECTROSTATIC DISCHARGE, BY MARKING THE EQUIPMENT (IEC ADDITION OF AN X) IN ACCORDANCE WITH ITEM E) OF 29.3. THE INSTRUCTIONS SHALL PROVIDE GUIDANCE FOR THE USER TO MINIMIZE THE RISK FROM ELECTROSTATIC DISCHARGE. WHERE PRACTICABLE, THE EQUIPMENT SHALL ALSO BE MARKED WITH THE ELECTROSTATIC CHARGE WARNING GIVEN IN ITEM G) OF 29.12.
13. WHEN THE MATERIAL LIMITS ARE EXCEEDED FOR EQUIPMENT OF EPL GA OR GB, THE EQUIPMENT SHALL BE MARKED (IEC MARKED WITH AN X) IN ACCORDANCE WITH ITEM E) OF 29.3 AND THE SPECIFIC CONDITIONS OF USE SHALL CONTAIN SUFFICIENT INFORMATION TO ENABLE THE USER TO DETERMINE THE SUITABILITY OF THE EQUIPMENT FOR THE PARTICULAR APPLICATION, FOR EXAMPLE, TO AVOID AN IGNITION HAZARD DUE TO IMPACT OR FRICTION.

AGENCY CONTROLLED DRAWING
NO CHANGES WITHOUT PRIOR AGENCY APPROVAL

THIS DRAWING CONTAINS CONFIDENTIAL INFORMATION AND IS ISSUED IN CONFIDENCE ON THE CONDITION THAT IT BE RETURNED ON DEMAND AND NOT BE COPIED, REPRODUCED, DISCLOSED TO OTHERS OR USED IN MANUFACTURE OF THIS SUBJECT MATTER THEREOF WITHOUT THE WRITTEN CONSENT OF WESTLOCK CONTROLS CORP.

UNLESS OTHERWISE SPECIFIED: TOLERANCES UNLESS OTHERWISE SPECIFIED: INCHES / MILLIMETERS; THIRD ANGLE PROJECTION

APPROVAL	DATE
DRAWN: CMI	11/11/16
CHECKED: CSS	2/19/24
APPROVED: AJB	8/9/17

DRAFTING WORK ORDER: 22497
MATERIAL: N/A
DO NOT SCALE DRAWING

WESTLOCK CONTROLS
TITLE: CONTROL DRAWING K-20
SIZE: B | DWG NUMBER: WD-12316 | REV: B
SCALE: N/A | SHEET 3 OF 3

9 Appendix B: Troubleshooting Guide for Calibration Error Messages

Note: the following errors will appear as shown on the LCD Display

TRANSDUCER ERROR

Error occurs within two minutes when performing an **Auto-calibration** indicating that the transducer is not connected to the K20 or if the wire connections are damaged.

UNABLE TO CLOSE

Error occurs within two minutes when performing an **Auto-calibration** indicating that the air supply is not connected or turned on.

CURRENT OUT OF RANGE

Input current set too high for Low Current Calibration.

Error occurs within two minutes when performing an Auto-calibration for Low Current when the current is outside of the input current calibration range indicating that the loop current needs to be set to the desired Low Current value.

INPUT CURRENT SET TOO LOW FOR HIGH CURRENT CALIBRATION

Error occurs within two minutes when performing an Auto-calibration for High Current when the current is outside of the input current calibration range indicating that the loop current needs to be set to the desired High Current value.

SENSOR DETECT FAULT

Error occurs when there is no response from any sensor.

For rotary units – this may indicate that change of electronics is required.

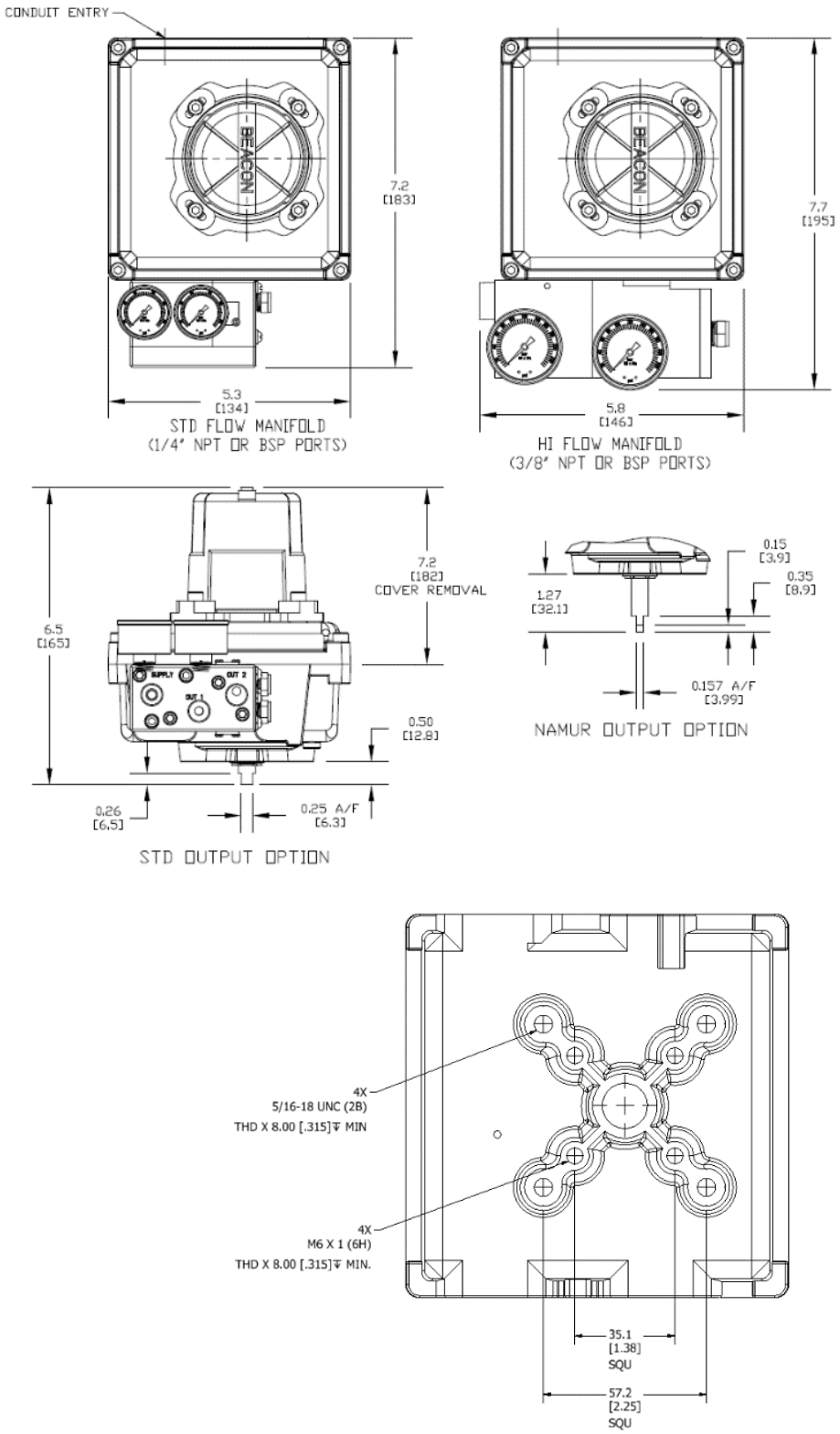
"SENS ERR"

Error occurs if we do not have communication with the detected sensor.

"ERROR MAGNET PRESENT?"

Error occurs when sensor's values do not change.

10 Appendix C: Dimensions



11 Appendix D: K20 Quick Start Guide

AUTO-CALIBRATION INSTRUCTIONS

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

MANUAL MODE

PRESS **SEL** UNTIL THE DISPLAY SHOWS '**MAN MODE',** THEN PRESS ↵. THE LCD DISPLAY SHOWS "**MAN XX**" WHERE **XX** IS THE CURRENT POSITION. ADJUST VALUE USING ↑ OR ↓. PRESS **SEL** ONCE FOR FULLY OPEN OR TWICE FOR FULLY CLOSE, THEN PRESS ↵.

SETTING LOW AND HIGH LOOP CURRENT

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

HIGH CURRENT

SET LOOP CURRENT TO OPEN VALUE. PRESS AND RELEASE **SEL** UNTIL 'HIGH CAL' SHOWS IN DISPLAY.PRESS ↵ AND 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.

FAIL OPEN OR FAIL CLOSE

PRESS AND RELEASE **SEL** UNTIL **'FL CLOSE'** OR **'FL OPEN**' SHOWS IN THE DISPLAY. PRESS ↑ OR ↓ TO SELECT ACTUATOR DIRECTION ON AIR AND DISPLAY 0-100 or 100-0 READING.

DIRECT OR REVERSE ACTING

PRESS AND RELEASE **SEL** UNTIL **'DIR ACTG'** OR **'REV ACTG**' SHOWS IN THE DISPLAY. ↑ 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.

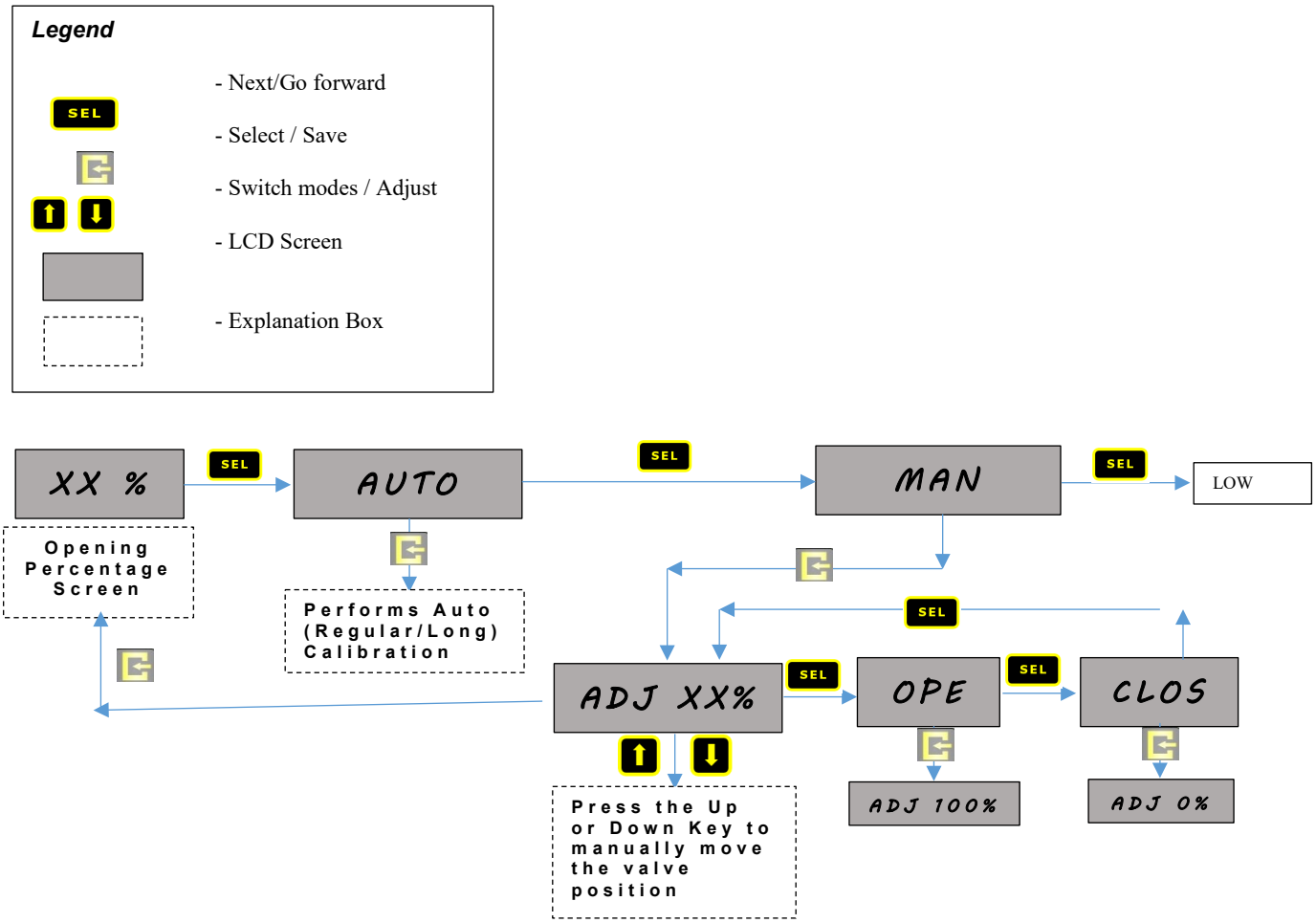
PRESS AND RELEASE **SEL** UNTIL **'REG CAL'** OR **'LONG CAL'** SHOWS IN DISPLAY. PRESS ↑ OR ↓ TO SELECT CALIBRATION TIME.

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**'.

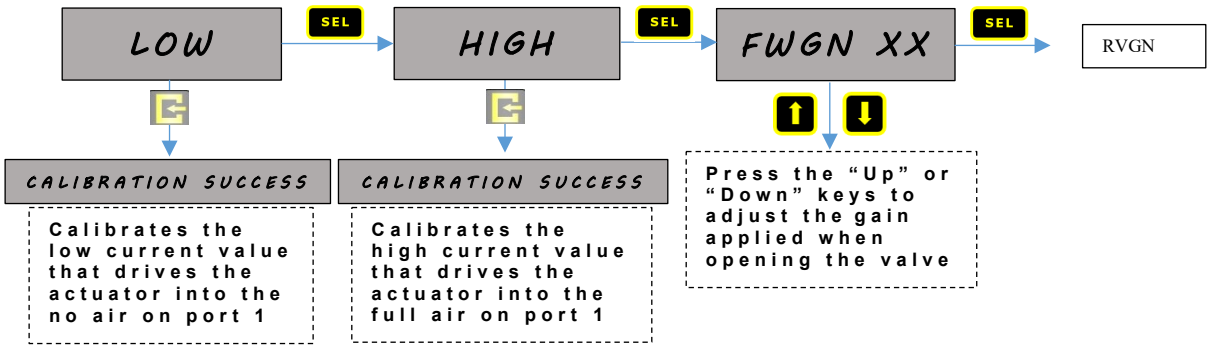
12 Appendix E: Menu Trees

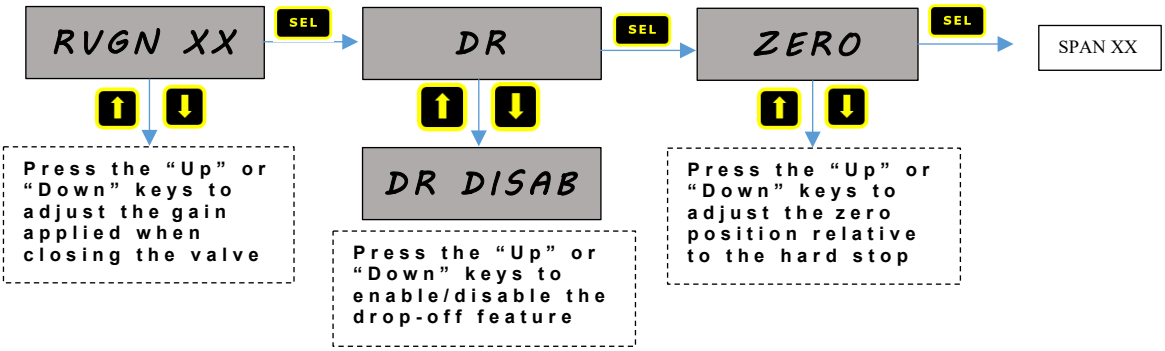
Note: The menu for K20 Electro-Pneumatic Positioner is linear. There is not a back option available. The menu returns to the opening percentage screen after the last option or after 15 seconds if no key is pressed during this time.

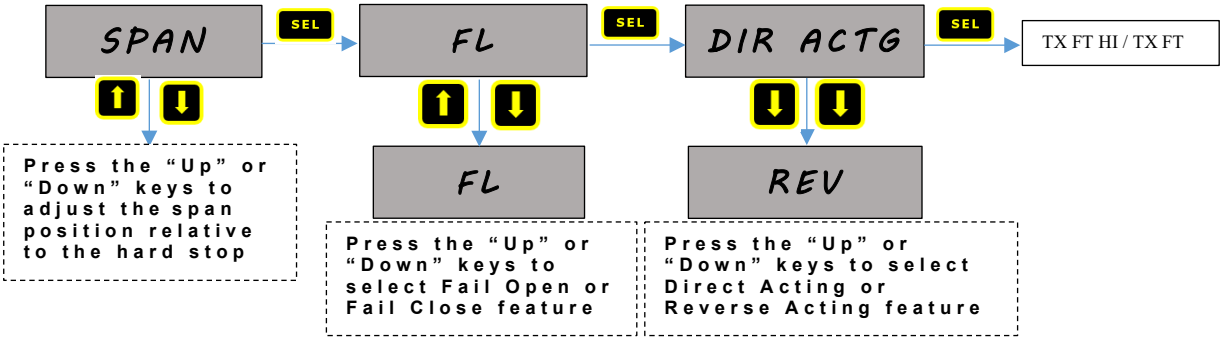


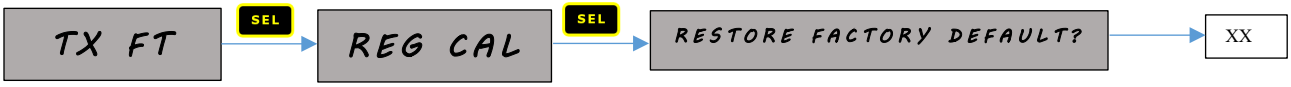
Valve goes to 100% (Open). This overrides the 4-20mA input. Pressing again sets the position back to its original value and returns to the opening screen.

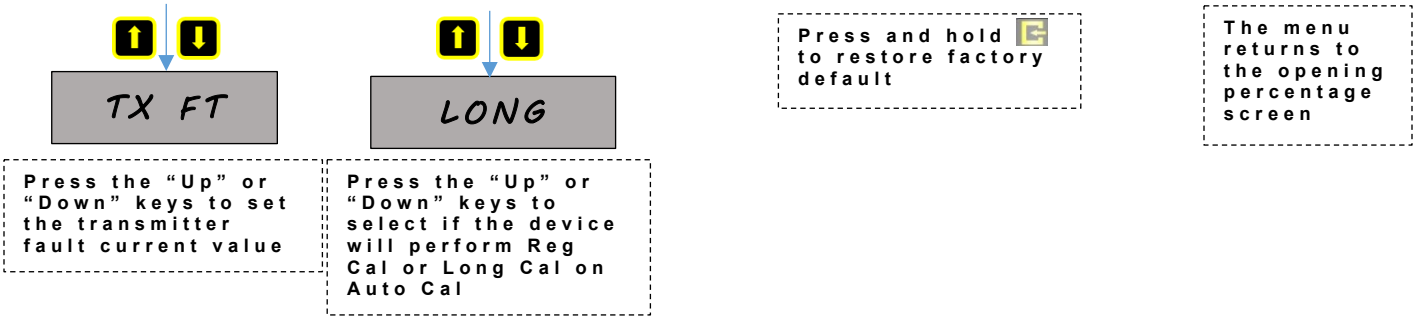
Valve goes to 0% (Closed). This overrides the 4-20mA input. Pressing again sets the position back to its original value and returns to the opening screen.



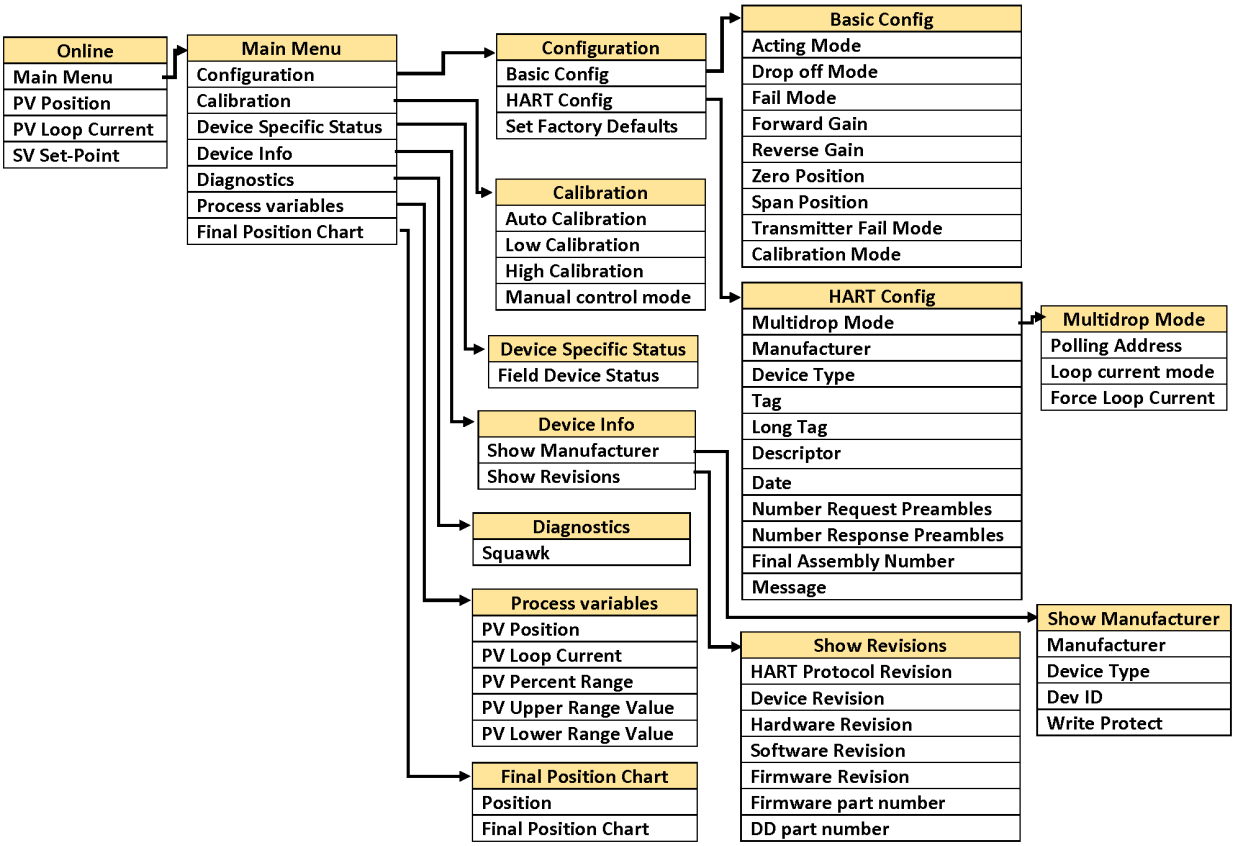








K20 HART DD Menu Structure



13 Appendix F: Fieldcomm Registration

EDD for configuration and control system integration.

The K20 HART® positioner can be fully integrated into most of the configuration tools, control systems and asset management systems in the market. Westlock Controls provides EDD files and FDI for this integration.

EDD files can be downloaded from:

https://www.fieldcommgroup.org/registered-products?protocol=hart&manufacturer=Westlock%20Controls

Certified EDD. FDI contact Westlock Controls:

http://www.westlockcontrols.com

14 APPENDIX G: Supported Commands

The following universal commands are implemented:

0	Read Unique Identifier
1	Read Primary Variable
2	Read Loop Current and Percentage of Range
3	Read Dynamic Variables and Loop Current - returns PV, SV, TV, and QV.
6	Write Polling Address
7	Read Loop Configuration
8	Read Dynamic Variable Classification
9	Read Device Variables with Status
11	Read Unique Identifier Associated with Tag
12	Read Message
13	Read Tag, Descriptor, Date
14	Read Primary Variable Transducer Information
15	Read Device Information
16	Read Final Assembly Number
17	Write Message
18	Write Tag, Descriptor, Date
19	Write Final Assembly Number
20	Read Long Tag
21	Read Unique Identifier Associated with Long Tag
22	Write Long Tag
38	Reset "Configuration Changed" Flag
48	Read Additional Device Status

15 APPENDIX H: Common-Practice Commands

Supported Commands

The following common-practice commands are implemented:

35	Write PV Range Values
40	Enter/Exit Fixed Current Mode
45	Trim Loop Current Zero
46	Trim Loop Current Gain
50	Read Dynamic Variable Assignments
59	Write Number of Response Preambles
72	Squawk
73	Find Device
89	Set Real-Time Clock – **Note**: this implementation only has accuracy of 1 second.
90	Read Real-Time Clock – **Note:** this implementation only has accuracy of 1 second.

Burst Mode

This Field Device does not support Burst Mode.

Catch Device Variable

This Field Device does not support Catch Device Variable.

16 APPENDIX I: Device-Specific Commands

The following lists the device-specific commands that are implemented:

128 Read Factory Options

129 Write Factory Options

130 Read Basic Configuration

131 Write Basic Configuration

132 Read Hysteresis Configuration

133 Write Hysteresis Configuration

134 Read PST Configuration

135 Write PST Configuration

136 Read Cycle Counts

137 Write Cycle Counts

139 Reload Factory Defaults

140 Start Calibration

141 Read Calibration Progress Status

142 Read Last Calibration Info

149 Send Abort Calibration

200 Set Device ID – Unpublished command, Manufacturer use only to set Device ID. Used by device, not DD.