

FORSTA FILTERS

Self Cleaning Water Filters 

EC-2-110/220-UL-ID Controller

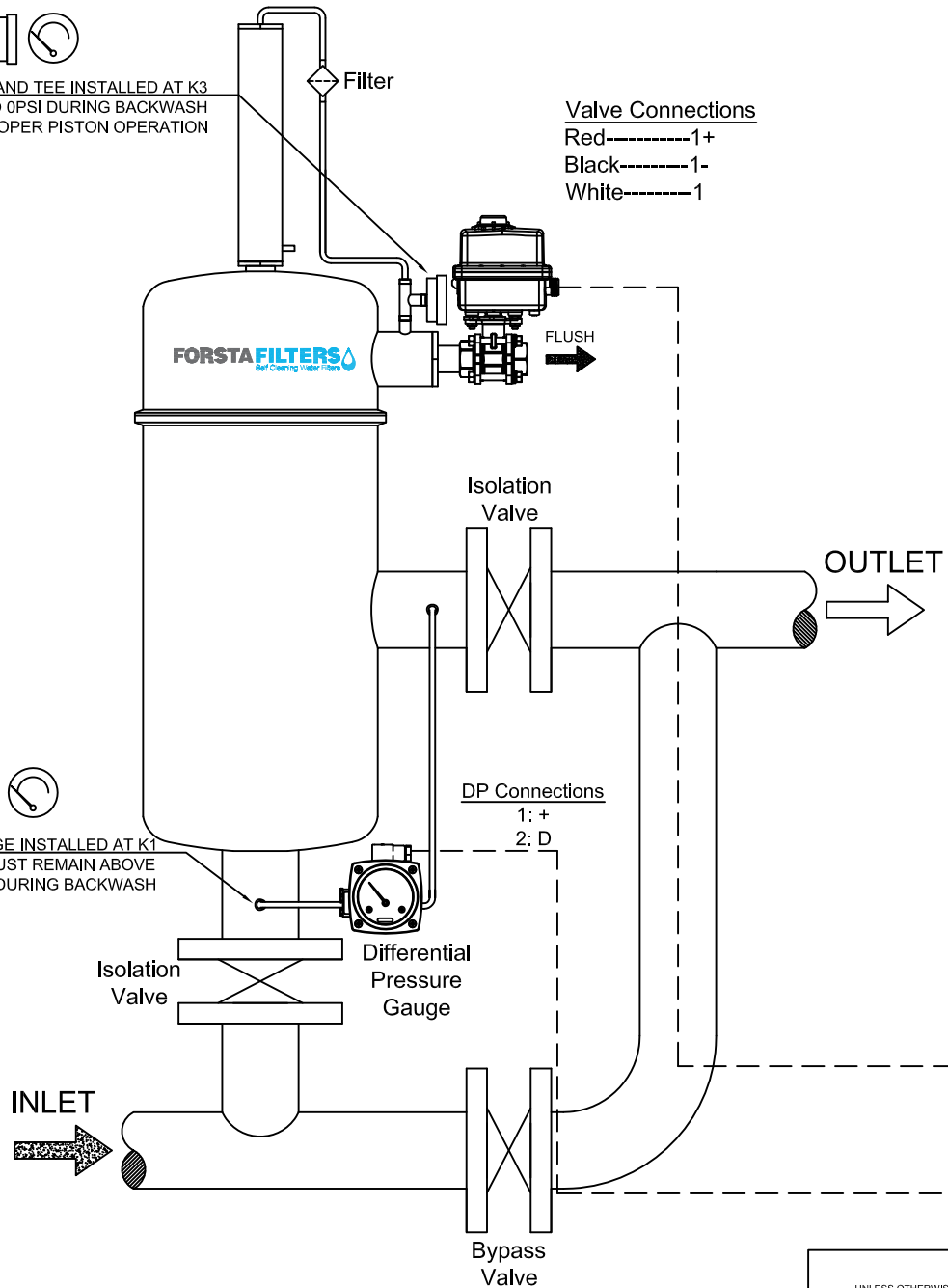
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REVISION	DATE	SIGN	DESCRIPTION

STANDARD	TYPE	CUSTOMER	PROJECT
DRAWN BY: JDS CHECKED BY: WFG ISSUED BY: WFG	DRAWN DATE: 06.10.2021 CHECKED DATE: 06.01.2021 ISSUED DATE: WFG	DRAWING TITLE: COVER SHEET SCALE: NONE	FORSTA FILTERS EC-2-110/220-UL-IDC JOB NO: 2210503 SHEET: 1 OF 1



PRESSURE GAUGE AND TEE INSTALLED AT K3
PRESSURE MUST DROP TO 0PSI DURING BACKWASH
FOR PROPER PISTON OPERATION



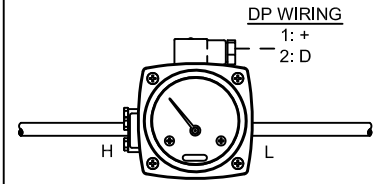
Valve Connections

- Red-----1+
- Black-----1-
- White-----1

DP Connections

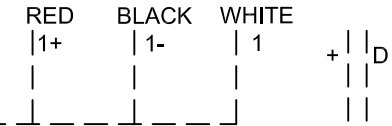
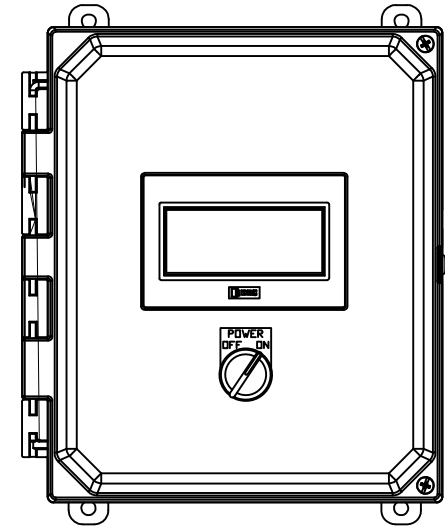
- 1: +
- 2: D

PRESSURE GAUGE INSTALLED AT K1
K1 PRESSURE MUST REMAIN ABOVE
40PSI DURING BACKWASH



DP CONNECTIONS
H - K1 (High Pressure Inlet)
L - K2 (Low Pressure Outlet)

EC-2-UL-IDEC

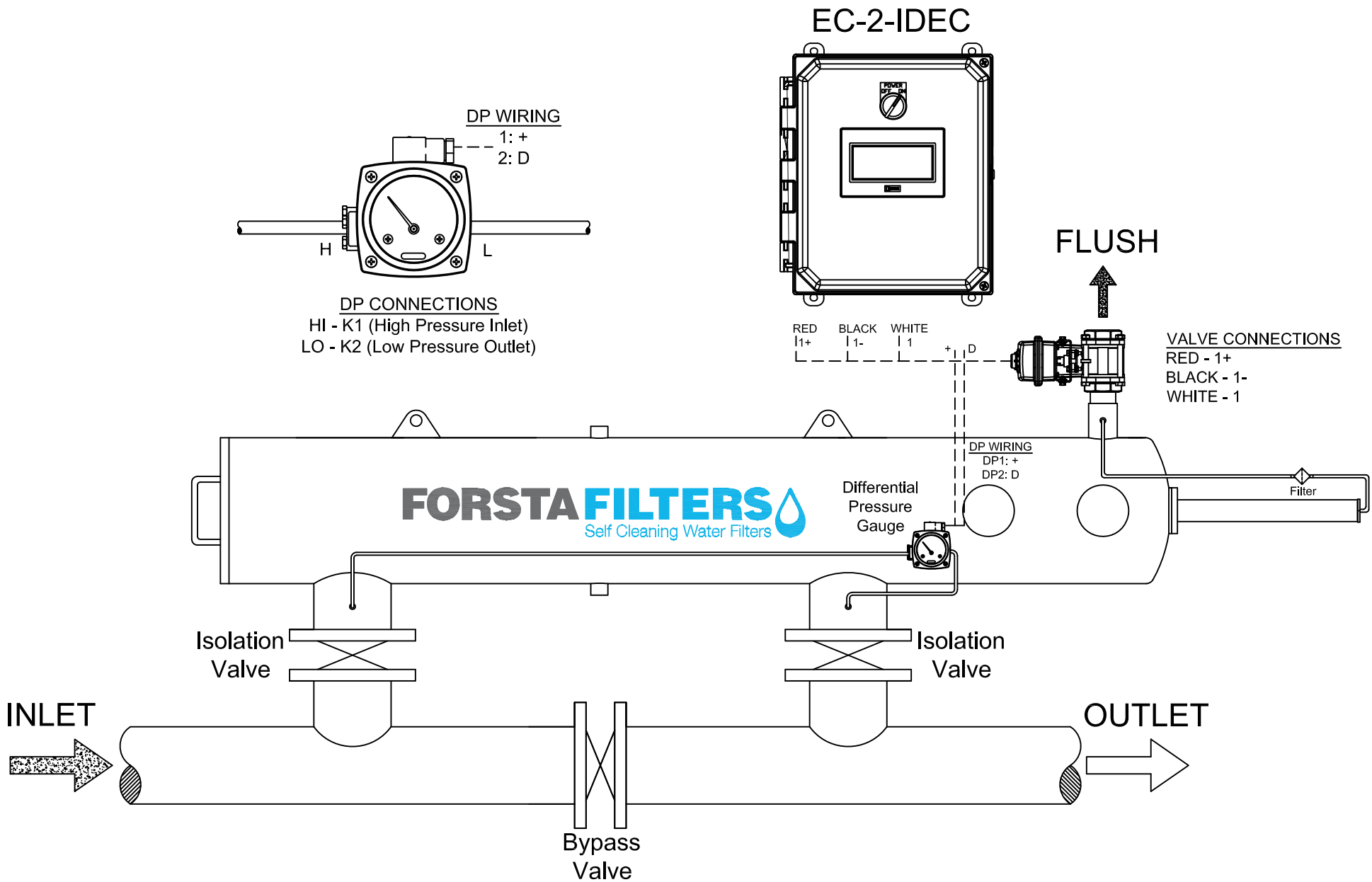


UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.XX +.05 ±0.5 DEG.
.XXX ±.01



90 Series Filters
Installation Layout
MW522 DP Gauge

SIZE	FSCM NO.	DWG NO.	REV
		90 IL	2
SCALE	SHEET		
3.50	1 of 2		



DP WIRING
 1: +
 2: D

DP CONNECTIONS
 HI - K1 (High Pressure Inlet)
 LO - K2 (Low Pressure Outlet)

EC-2-IDEC

RED 1+
 BLACK 1-
 WHITE 1

VALVE CONNECTIONS
 RED - 1+
 BLACK - 1-
 WHITE - 1

DP WIRING
 DP1: +
 DP2: D

UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES
 TOLERANCES
 DECIMALS ANGULAR
 .XX +.05 ±0.5 DEG.
 .XXX ±.01

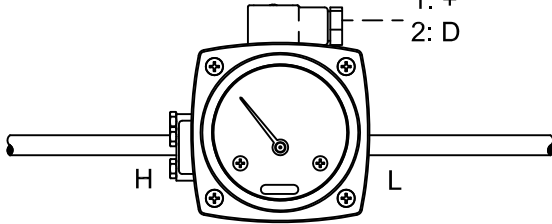
FORSTA FILTERS
 Self Cleaning Water Filters

180 Series Filter
EC-2-IDEC

SIZE	FSCM NO.	DWG NO.	REV
		180-IL	0
SCALE	SHEET		
3.50	1 of 1		

DP WIRING

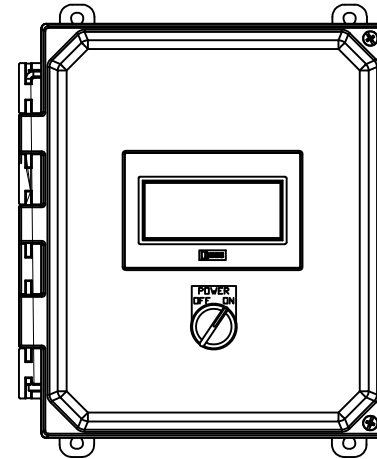
1: +
2: D



DP CONNECTIONS

H - K1 (High Pressure Inlet)
L - K2 (Low Pressure Outlet)

EC-2-UL-IDEC

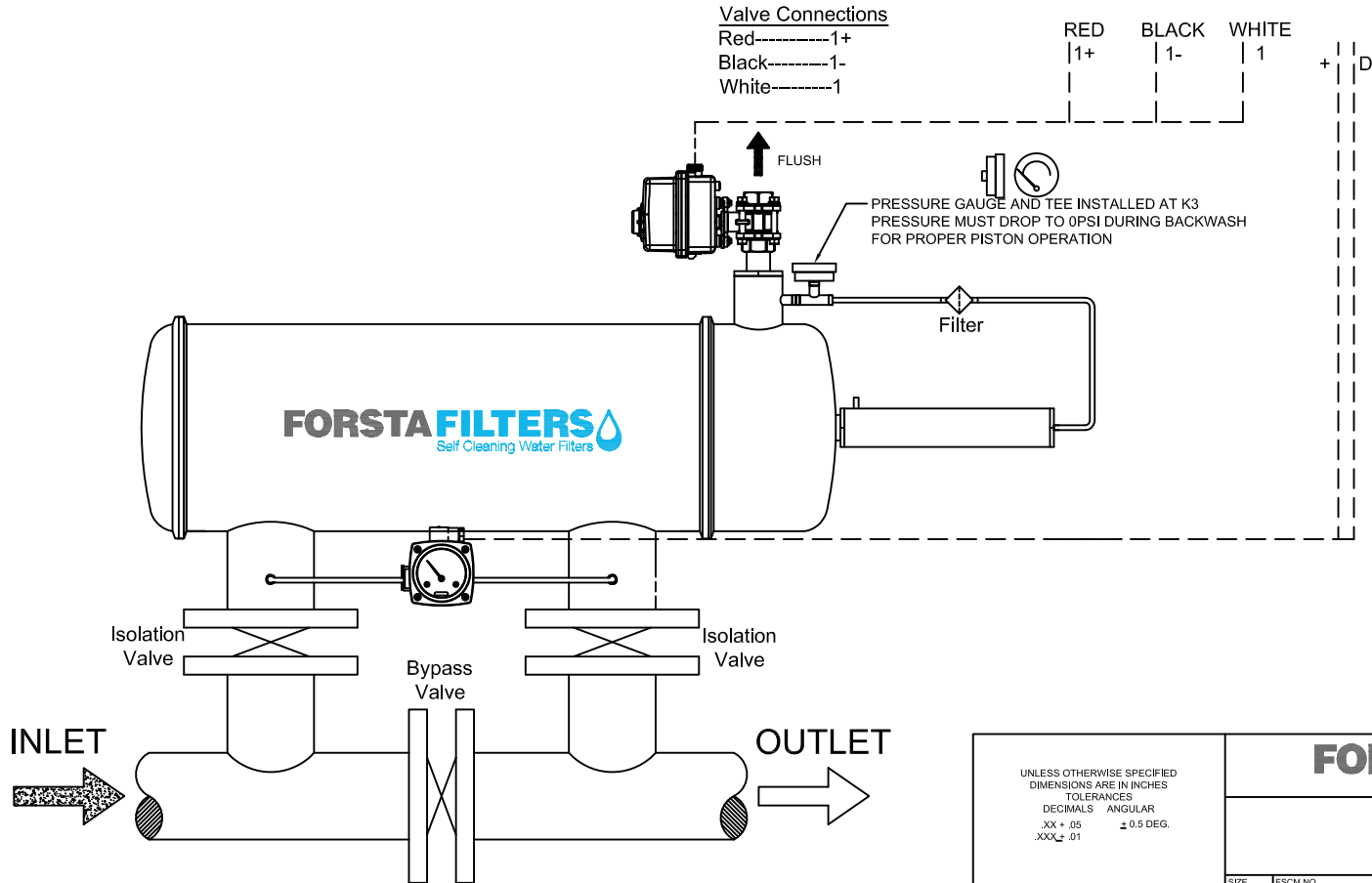


Valve Connections

Red-----1+
Black-----1-
White-----1

RED 1+ BLACK 1- WHITE 1

+ D



INLET

OUTLET

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.XX + .05 ± 0.5 DEG.
.XXX ± .01

FORSTA FILTERS
Self Cleaning Water Filters

180C Series Filters
Installation Layout
EC-2

SIZE	FSCM NO.	DWG NO.	REV
		180C IL	2
SCALE	SHEET		1 of 1
3.50			

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NAMEPLATE

Manufacturer: Pure Automation
 Maximum Voltage: 120 or 240VAC
 Total FLA: 2.5 or 1.3A
 Phase: Single
 Frequency: 50/60Hz
 Field Wiring Diagram: EC-2-110/220-IDEC
 Environmental Rating Type: 4X
 SCCR: N/A Control Circuits Only

 CAUTION: Nonmetallic enclosure does not provide grounding between conduit connections. Use grounding bushings and jumpers.

VOLTAGE TYPE: 120-240VAC 50/60Hz			
ITEM	DEVICE TAG	FLA @ 120VAC	FLA @ 240VAC
1	PS1	2.5	1.3
TOTAL FLA:		2.5	1.3

VOLTAGE TYPE: 24VDC		
ITEM	DEVICE TAG	FLA @ 240VAC
1	CR1	0.009
2	CR2	0.009
3	CR3	0.009
4	+FIELD-EV01	1.2
5	+FIELD-EV02	1.2
6	+FIELD-EV03	1.2
7	+FIELD-EV04	1.2
8	+FIELD-INLET_PRESSURE	0.05
9	+FIELD-OUTLET_PRESSURE	0.05
10	PLC1	0.383
11	PL1	0.018
TOTAL FLA:		5.328

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Bill of Materials & Torque Settings

Tag	Description	Manufacturer Type Number	Quantity
	Electrical Connection Torque		
CP1	12 x 10 x 6 Poly Enclosure Type 4X	Ensto UPCG121006HML	1
CP1	12 x 10 Galvanized Mounting Panel	Ensto UPB1210Z	1
PL1	22mm IEC Unibody Pilot Light, 24V AC/DC, LED Red, Extended Lens, 7 in-lbs	C3 W22UNR-24LR-WLR	1
PL1	22mm "Fault" Legend Plate	C3 22LPAL-101-A	1
SS1	Non-Illuminated, 2-Pos, SS/Maintained, 2 NO 7 in-lbs	C3 W22S2-HW-10/10	1
SS1	22mm "On/Off" Legend Plate	C3 22LPAL-56-A	1
PS1	Input: 120-240VAC; Output 10A, 24VDC 6.5 in-lbs input, 9 in-lbs output	MNW NDR 240-24	1
CB1	BK63HU 1P D10A 10kA 277VAC UL489 35 in-lbs	LSE 0626044463	1
CBL1	Cable, 1 twisted pair, 18 AWG, PVC conductor insulation material, black and red, shielded, PVC jacket, gray	Quabbin Q0170-1	1
PLC1	FT1A 3.8in PLC+HMI 4.5 in-lbs	IDEC FT1A-C12RA-B	1
CR1...CR3	PLC-INTERFACE, 1 changeover contact, input voltage 24 V DC Relay Push In	Phoenix 2900299	1
CR1...CR3	Continuous plug-in bridge, color: blue for Relay	Phoenix FBST 500-PLC BU - 2966692	1
TB1	PT 2,5 PE Feed Through Ground Terminal Push In	Phoenix 3209536	4
TB1	PT 2,5 End Cover	Phoenix 3030417	1
TB1	PT 2,5 3L Triple Level Feed Through Terminal Push In	Phoenix 3210499	12
TB1	PT 2,5 3L End Cover	Phoenix 3211647	2
TB1	Continuous Push In Bridge for PT 2,5 Terminals	Phoenix 3030226	2
TB1	Marker for Terminal Block & Relays	Phoenix 0828734	4
TB1	Marker for PT 2,5 3L Terminals	Phoenix 0828744	72
TB1	End Clamps	Phoenix 3032350	4

Tag	Description	Manufacturer Type Number	Quantity
	Electrical Connection Torque		
	Wire Markers WMCO 2,9 (12x4)	Phoenix 0830780	
	Wide Slotted Wiring Duct 1.5" W x 1.5" H x 6' L	Panduit G1.5X1.5LG6	1
	1.5" W Duct Cover	Panduit C1.5LG6	1
	35mm Din Rail	Phoenix 0801733	1



Pure Automation
2105 Foothill Blvd. Ste. B-147 / La Verne, CA 91750
Phone: (909) 315-4094 / Website: www.PureAutomation.com

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			Modification date: 11/02/22
			Last editor:
			Approved by:

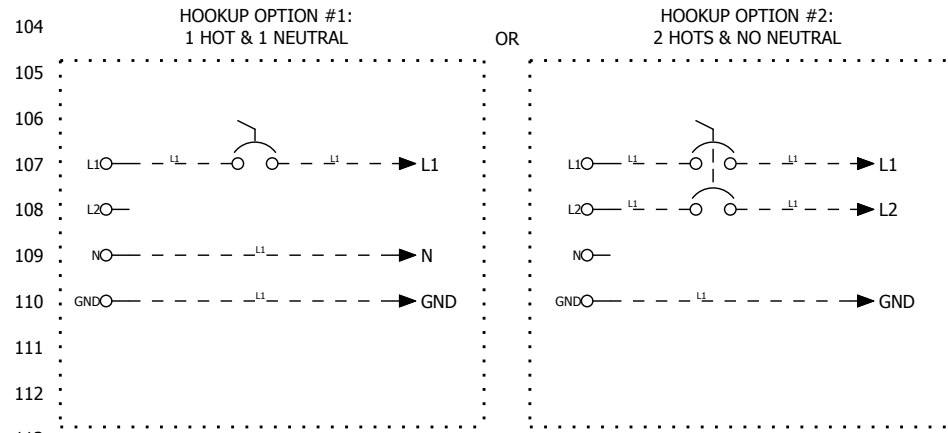
Replacement of:
Replaced by:

Customer: Forsta Filters
Project Description: EC-2-110/220-IDEC

Job #:	File:	Standards:	Higher level:
EC-2-110/220-IDEC	EC-2-110_220-IDEC 1.3 Modbus		Mounting Location: REPORTS
Page description: Bill of Materials and Torques			Page: BOM#1 Pages: 9 of 9

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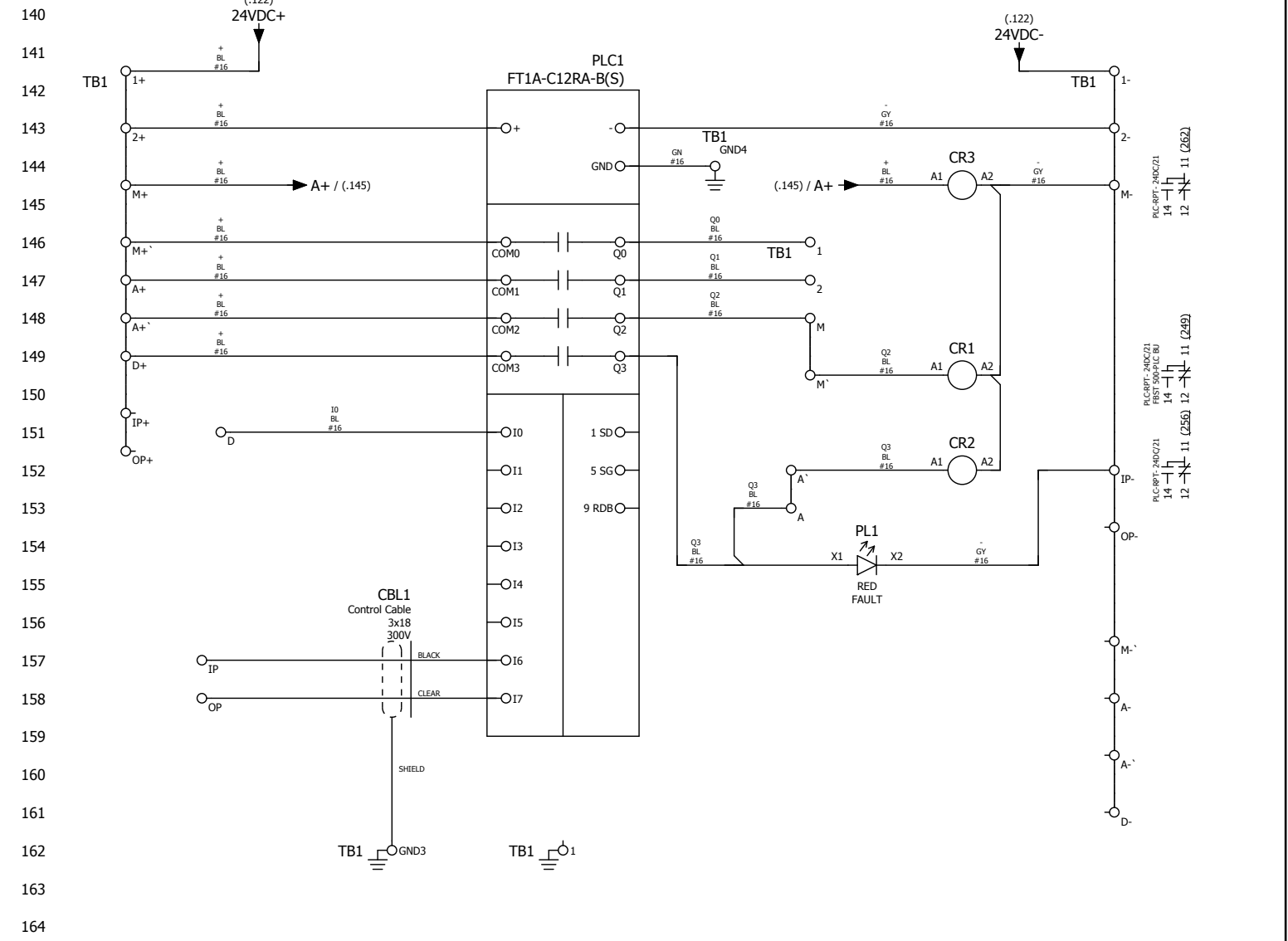
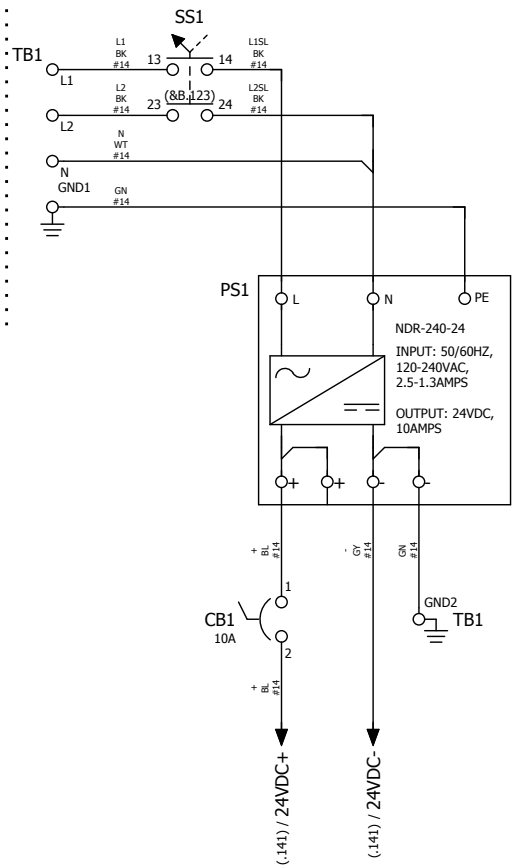
100 MAINS
 101 110-240VAC/1PH/50 OR 60HZ
 102 AN OVERCURRENT PROTECTION DEVICE (A CIRCUIT BREAKER, MAXIMUM 16A)
 103 AND A DISCONNECT SWITCH (MINIMUM 4A)
 104 SHALL BE PROVIDED BY THE INSTALLER IN THE FIELD



115 **WARNING: ONLY WIRE HOOKUP OPTION #1 OR**
 116 **HOOKUP OPTION #2. DO NOT HOOKUP OPTIONS**
 117 **#1 & #2 AT THE SAME TIME.**

118 **CAUTION: NONMETALLIC ENCLOSURE DOES NOT**
 119 **PROVIDE GROUNDING BETWEEN CONDUIT CONNECTIONS.**
 120 **USE GROUNDING BUSHING AND JUMPER WIRES.**

121 **FIELD WIRING: USE COPPER CONDUCTORS ONLY,**
 122 **RATED AT A MINIMUM OF 60°C. TORQUE SETTINGS**
 123 **ARE LISTED ON SUMMERIZED PARTS LIST.**



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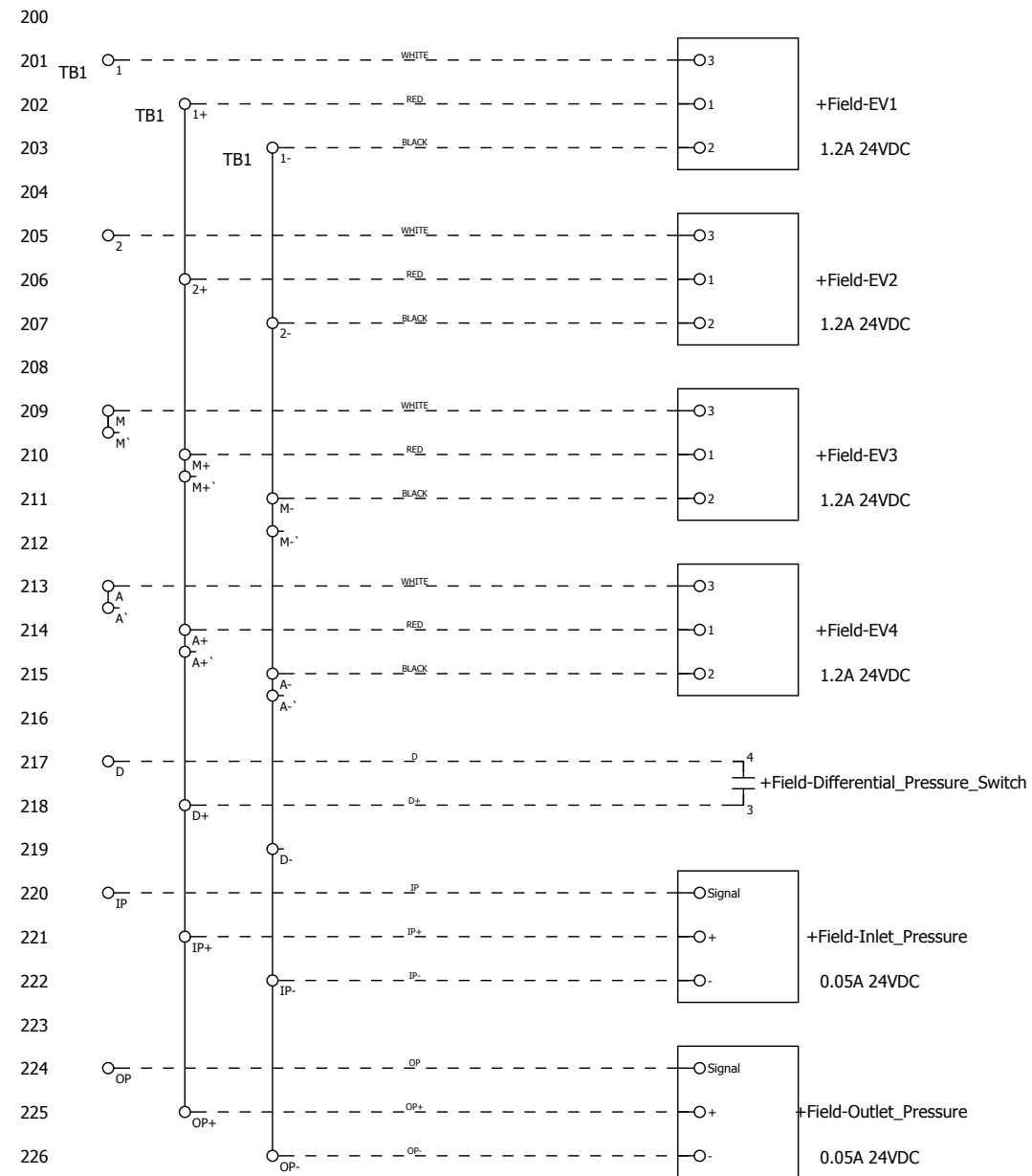
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			Modification date: 11/02/22	
			Last editor:	Replaced by:
			Approved by:	

Customer: Forsta Filters
 Project Description: EC-2-110/220-IDEC

Job #: EC-2-110/220-IDEC
 File: EC-2-110_220-IDEC 1.3 Modbus
 Standards: CP1
 Higher level: CP1
 Mounting Location: CP1

Page description: Schematic: 120VAC or 240VAC Feed, 24VDC Power Supply, and PLC
 Page: 5 of 9
 Pages: 5 of 9

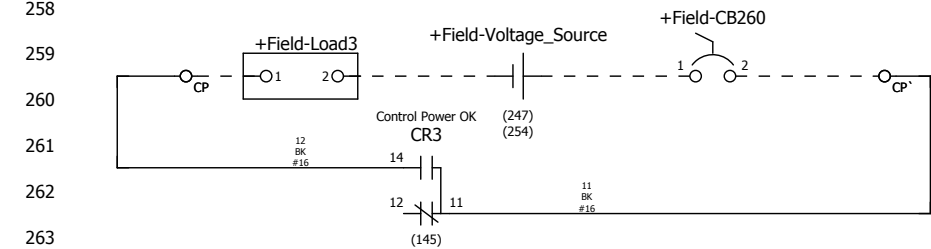
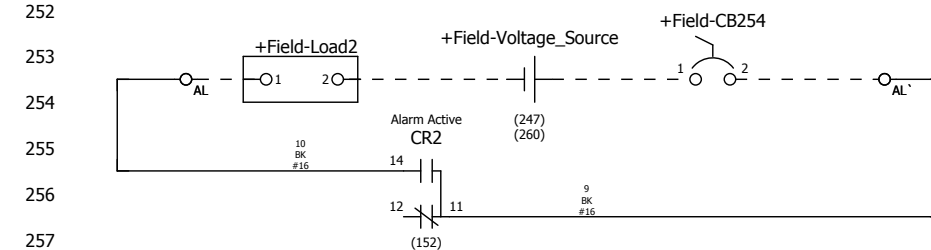
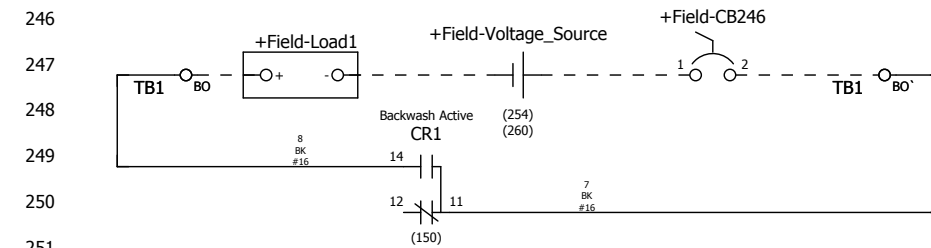
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240 DRY CONTACTS FOR MONITORING SYSTEM STATUS:

- 241 CR1 = BACKWASH ACTIVE
- 242 CR2 = ALARM ACTIVE
- 243 CR3 = 24VDC POWER PRESENT

244 CONTACTS RATED FOR CONTROL CIRCUIT LOADS OF 0.5A @ 24VDC/120VAC
245 AN OVERCURRENT PROTECTION DEVICE (A CIRCUIT BREAKER, MAXIMUM 5A)
246 AND A DISCONNECT SWITCH (MINIMUM 4A)
247 SHALL BE PROVIDED BY THE INSTALLER IN THE FIELD
248 FOR EACH VOLTAGE SOURCE



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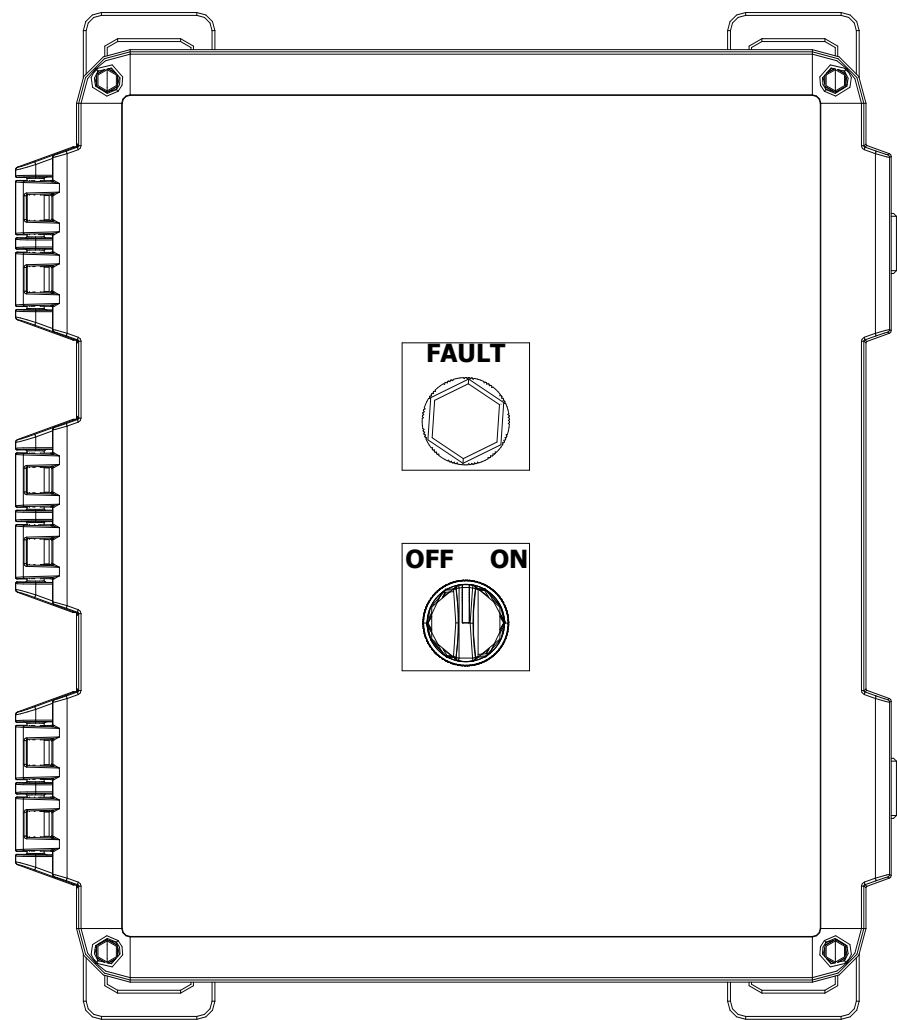
Modification	Date	Name	Original project:
			EC-2-110/220-IDEC
			Modification date: 11/17/22
			Last editor:
			Approved by:

Replacement of:	Customer:
Replaced by:	Project Description:

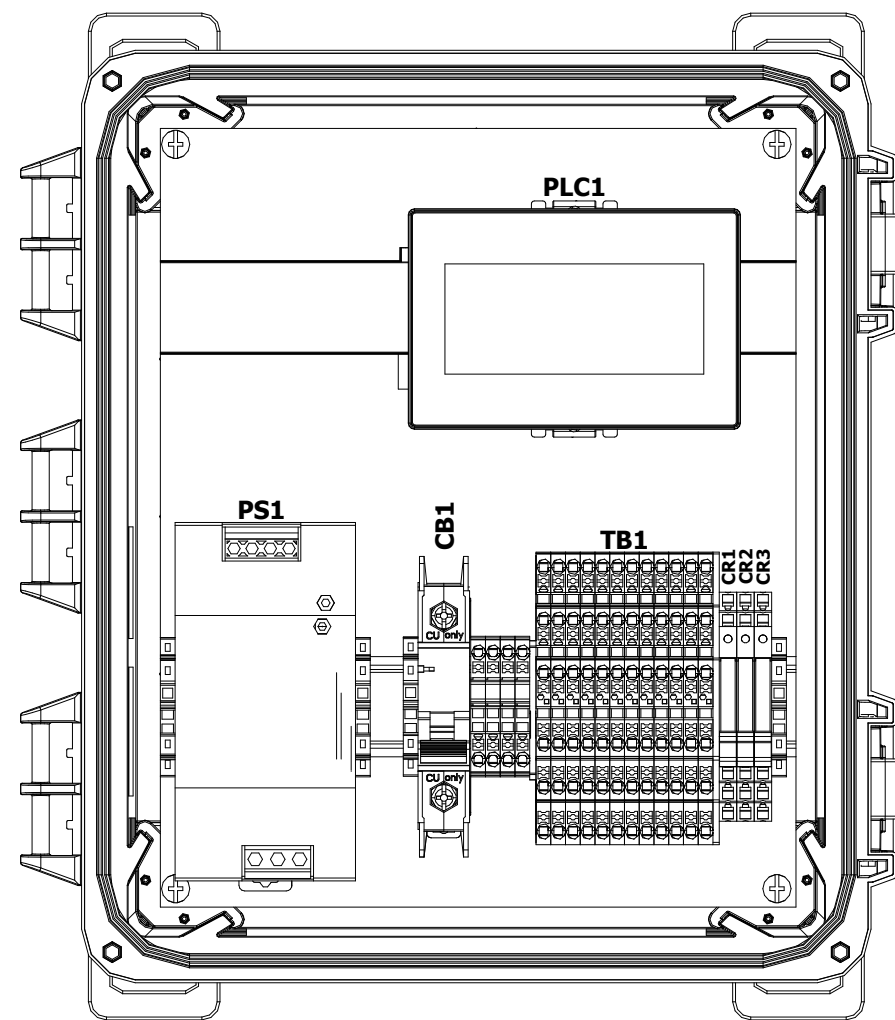
Job #:	File:	Standards:	Higher level:
EC-2-110/220-IDEC	EC-2-110_220-IDEC 1.3 Modbus		Mounting Location: CP1
Page description:		Page: C2	
Schematic: Control Signals and Loads		Pages: 6 of 9	

Customer:	Job #:	File:	Standards:	Higher level:
Forsta Filters	EC-2-110/220-IDEC	EC-2-110_220-IDEC 1.3 Modbus		Mounting Location: CP1
Project Description:	Page description:		Page: C2	
EC-2-110/220-IDEC	Schematic: Control Signals and Loads		Pages: 6 of 9	

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Front



MOUNTING PANEL



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			Modification date: 11/17/22
			Last editor:
			Approved by:

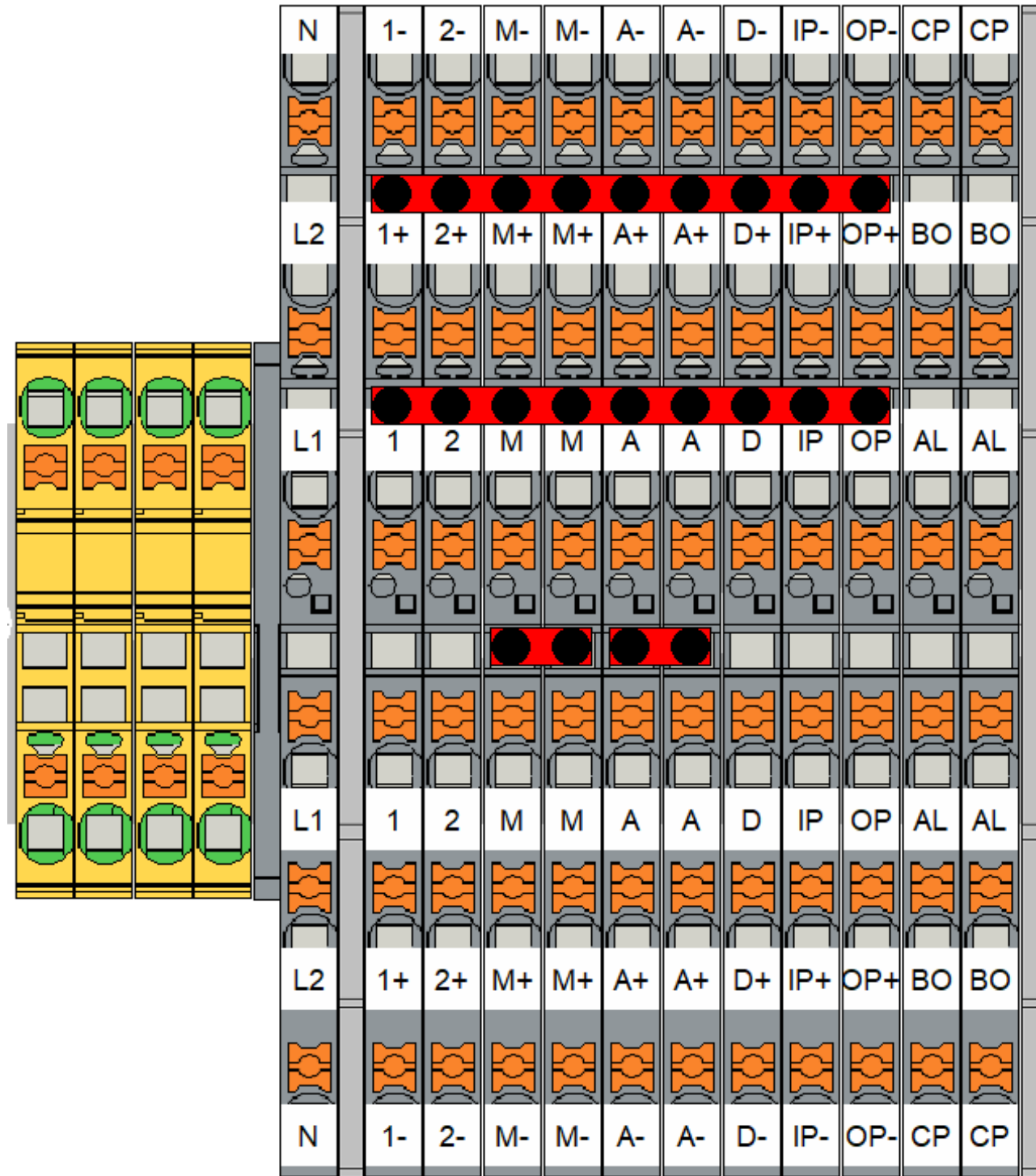
Replacement of:	Customer:
Replaced by:	Project Description:

Customer:	Job #:	File:	Standards:	Higher level:
Forsta Filters	EC-2-110/220-IDEC	EC-2-110_220-IDEC 1.3 Modbus		CP1
Project Description:	Page description:			Mounting Location:
EC-2-110/220-IDEC				CP1

Model View	Pages: 7 of 9
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TERMINAL LAYOUT: TB1

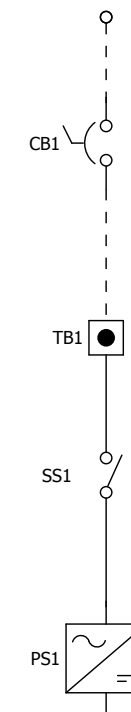


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PLC IO DESIGNATION: PLC1			
MODULE TYPE	SIGNAL TYPE	SIGNAL DESIGNATION	DEVICE TAG
DI	24VDC	I0	DP SWITCH
DI	24VDC	I1	SPARE
DI	24VDC	I2	SPARE
DI	24VDC	I3	SPARE
DI	24VDC	I4	SPARE
DI	24VDC	I5	SPARE
AI	0-10V	I6	INLET PRESSURE
AI	0-10V	I7	OUTLET PRESSUE
DO	24VDC	Q0	EV01
DO	24VDC	Q1	EV02
DO	24VDC	Q2	EV03
DO	24VDC	Q3	EV04

MAINS
 110-240VAC/1PH/50 OR 60HZ
 AN OVERCURRENT PROTECTION DEVICE (A CIRCUIT BREAKER, MAXIMUM 16A)
 AND A DISCONNECT SWITCH (MINIMUM 4A)
 SHALL BE PROVIDED BY THE INSTALLER IN THE FIELD



1.0 System Outline

The system is designed to monitor and activate a cleaning cycle for two (2) filters in parallel. The controller allows the user to adjust the flush duration and the specified periodic backwash. Other features include force a backwash cycle, counter reset and alarm reset.

The system will operate in two modes. These modes will be user selected. The selections are DIGITAL or ANALOG. If digital is selected, the system will monitor the differential input from the remote mounted gage. If analog is selected, the system will monitor the two transducer inputs, for a high differential pressure set point, set by the user to initiate a backflush cycle.

1.1 Sequence of Operation:

The following section describes the sequence the controller will utilize to perform a system backwash. If the system is enabled and differential pressure monitored by the differential pressure switch, or transducer pressure in - transducer pressure out, depending on the control type selection. If the differential pressure has risen to be greater than the set point the controller will initiate a backwash cycle.

- A. The controller will start the Start delay. When this delay expires, the controller will change state from STANDBY to BACKWASH 1. The following steps will occur:
 - a. The controller will signal the main valve and flush to open.
 - b. The Backwash timer will start timing.
 - c. When the backwash timer is complete, the controller will signal the valve for filter #1 to close.
 - d. The state will change to DWELL and start the DWELL timer.
- B. When the DWELL timer is complete, the state will change to BACKWASH 2.
 - a. The controller will signal the valve for filter #2 to open. The Backwash delay will start timing.
 - b. When the backwash delay is complete, the controller will signal the valve for filter #2 and main valve to close. The state will change to STANDBY.

2.0 Special Features

2.1 Adjustable Delays

The controller will have field adjustable delays, using a password to gain access to the set points. There are a total of three (3) delays. These are:

1. Periodic: The delay between flush cycles. Adjustable from 0:01 to 24:00 hours.
2. Flush: The delay that the valve is signaled to be open. Adjustable from 0 to 59 seconds.
3. Dwell: The delay between valve being signaled to close and the next valve signaled to open. Adjustable from 0 to 59 seconds.
4. Start Delay: This delay will cause the system to ignore a start signal for the delay period. This delay is adjustable from 0 to 59 seconds.

2.2 Backwash Cycle Counter

The system will keep a count of all the backflush operations. There is the capability to reset this counter.

2.3 Manual Backwash Cycle Start

The controller will allow for the user to force a manual operation of the valves.

2.4 Alarm Operation and Contacts

There is a field adjustable set point for a backwash failure. If the system backwashes a total amount of the configured set point, then it will display an alarm condition on the display and turn on an output. The output is normally open and closes for indication. The contact is rated for 3 amps maximum.

2.5 Control Power Okay Contacts

If the system is okay, contact closes to indicate. The contact is normally open and closes for indication. The contact is rated for 3 amps maximum.

2.6 System Backwashing Contacts

If the system is backwashing, in manual or automatic, a contact will close to indicate the operation. The contact is normally open and closes for indication. The contact is rated for 3 amps maximum.

2.7 HMI Screen Automatic off

If the HMI has not been touched for 5 minutes the screen will automatically turn off. Just touch the screen for the display to turn back on.

2.8 Settings Security

To access the set points on the main screen and the settings screen you must login. On the main screen is the login button. Refer to the main display section to view this operation. Once logged in, the operator has 5 minutes before the controller will automatically log out.

3.0 Main HMI Screen

The following section describes the screens of the controller. The following screens are the main screens. Depending on the configuration of the system, all the options may not be displayed as shown below.



Figure 1: Main Screen, Digital and Periodic delay

Notes:

1. Status display will show the state of system.
2. Settings button will allow access to the set points of the system. This will request a password to allow access.
3. XXXXX CYCLES shows the current completed cycles where XXXX represents the value.
4. Login button when touched will pop up a password screen. On this screen select User. Then enter the proper password. Once entered, the pop up screen goes away then the user will have access to all the password protected items.
5. PERIODIC IN HH:MM:SS shows the time remaining till the next periodic cycle. Note this display will not be present if the periodic function is disabled.
6. MAN BACKWASH Button will force a complete flush cycle.
7. COUNTER RST will reset the cycle counter.
8. ALARM RST button will reset the alarm indication.
9. PERIODIC (HRS). Adjustable from 0 to 24.0. If set to 0, then the periodic timer is disabled. This is password protected.
10. FLUSH (SEC). Adjustable from 1 to 60 seconds. This is password protected.
11. DWELL (SEC). Adjustable from 0-90 seconds. If set to 0, then no dwell is performed.
12. XXX IN shows the inlet pressure. This display is only visible if the Analog operation is selected.
13. XXX OUT shows the outlet pressure. This display is only visible if the Analog operation is selected.
14. XX DP shows the calculated differential pressure. This display is only visible if the Analog operation is selected.
15. LED PD will switch from grey to green to show that the start was generated by the differential pressure switch.
16. LED D will switch from grey to green to show that the dwell is active.
17. LED 1 will switch from grey to green to show that the first valve is in backwash.
18. LED 2 will switch from grey to green to show that the second valve is in backwash.
19. LED A will switch from grey to red to show that the alarm is in active.

4.0 Set Points Access

To access the set points, on the main display, depress the Settings button.



Figure 2: Settings Screen

Notes:

1. ANALOG DISABLED button enables / disables the analog control.
2. Selects if the alarm operation is ALARM Only or ALARM LOCKOUT.
3. SET DEFAULTS button will force the factory values to the set points.
4. Alarm Cycles allows for setting the alarm condition count. This is field adjustable from 0-20.
5. PSI Differential allows for the setting of the differential start pressure in analog operation. This is adjustable from 0 to 10.
6. Start Delay is adjustable from 0 to 10 seconds.
7. REV: X.X Shows the current revision of the program.
8. INLET PSI will display the Inlet PSI configuration screen.
9. OUTLET PSI will display the outlet PSI configuration screen.
10. COMMS button will bring up the communication setting display
11. MAIN returns to the main screen.

4.1 Analog Settings Screen

To access the analog set points, press the Analog Settings button on the Settings screen. This screen shows the Inlet PSI, but the description is the same for

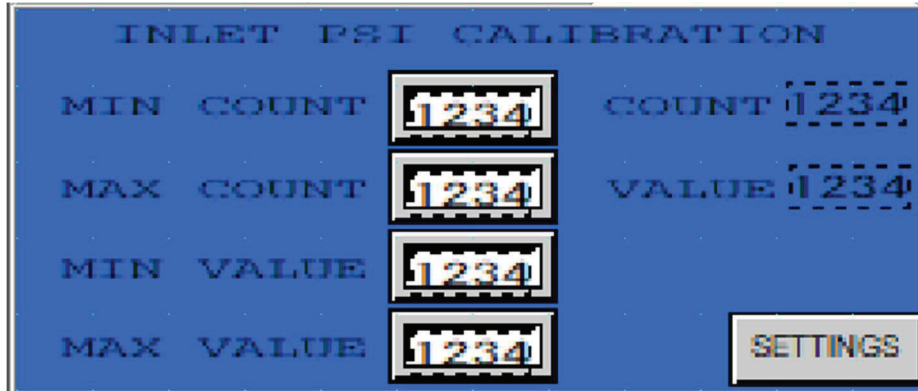


Figure 3: Analog Configuration screen.

Notes:

1. Minimum Count: With the transducer input at 4 ma, set the value to the raw count value.
2. Maximum Count: With the transducer input at 20 ma, set this value to the raw count value.
3. Minimum Value is set to the minimum value of the transducer. If it is rated for 0 to 150, then a 0 is entered here.
4. Maximum Value is set to the maximum value of the transducer. If it is rated for 0 to 150, then a 150.0 is entered here.
5. Count is the actual raw value of the actual signal from the transducer. The value will vary between 0 and 1023.
6. Value shows the configured engineered value.
7. Settings button returns to the Settings screen.

5.0 Controller Set Points

The following section has the set point listing and the factory set point values.

5.1 Time delay Set Points

Delay	Adjustment	Factory Set Value	User Value
Periodic	Adjustable from 0.0 to 59:59 hrs.	24:00	
Backwash Delay	Adjustable from 1 to 59 seconds.	5	
Dwell Delay	Adjustable from 0 to 59 seconds.	1	
Start Delay	Adjustable from 0 to 59 seconds.	2	

5.2 Alarm Set Point

Set Point	Adjustment	Factory Setting	User Settings
Backwash Alarm	Adjustable from 1 to 20.	3	

5.3 Mode Select Set Points

Set Point	Adjustment	Factory Setting	User Settings
Mode Analog or Digital	Selections are ANALOG or DIGITAL	DIGITAL	

5.4 Analog Configuration Set Points

Set Point	Adjustment	Factory Setting	User Settings
Filter in PSI MAX Value	Adjustable from 0 to 500.0 PSI	150.0	
Filter in Minimum Value	Adjustable from 0 to 500.0 PSI	0.0	
Filter in Minimum Count	Adjustable from 0 to 32767	249	
Filter in Maximum Count	Adjustable from 0 to 32767	1023	
Filter out PSI Max Value	Adjustable from 0 to 500.0 PSI	150.0	
Filter out Minimum Value	Adjustable from 0 to 500 PSI	0.0	
Filter out Minimum Count	Adjustable from 0 to 32767	249	
Filter out Maximum Count	Adjustable from 0 to 32767	1023	

6.0 Controller Connections

The following section describes the connections to the controller in the system. The controller has a total of 8 digital inputs, 2 of which are configured for 0-10 VDC analog inputs and 4 relay outputs.

6.1 Analog / Digital Inputs

Input	Nomenclature	Description
In_00	Differential input	Differential pressure input from differential pressure gauge.
In_01	Spare	Not used in this application
In_02	Spare	Not used in this application
In_03	Spare	Not used in this application
In_04	Spare	Not used in this application
In_05	Spare	Not used in this application
In_06	Analog 0	Inlet Pressure
In_07	Analog 1	Outlet Pressure

6.2 Digital Outputs

Output	Nomenclature	Description
Out_00	Valve #1	Controls Valve #1 operation
Out_01	Valve #2	Controls Valve #2 operation
Out_02	Master Valve	Controls Master Valve operation
Out_03	Alarm	Controls the alarm contacts.

Modbus TCP Connection Instructions

Steps to change the IP address on the unit:

Press and hold the top left corner of the screen for 3-5 seconds (there is no button, so just press and hold as if there were)

The maintenance screen will pop up, press "System Mode"

You will be prompted for a password. Use the arrows and ENT key to enter "3261", then navigate to "OK" using the arrows and press ENT.

Press "Main Menu"

Press "Initial Setting"

Press "Comm. I/F"

Press "IP Address"

Use "<--" and "-->" to change between octets (decimal points) on the IP address and subnet. When an octet is highlighted, enter the number you'd like, then press "ENT".

Use the arrows to move to the next octet. Once all done press "SAVE"

Press "Main Menu"

Press "Top Page"

Press "Run"

EC-2 1.3 Modbus Table

Port: 502, Data Type: U16, Modbus Point Type: 03, Holding Registers

Register	Name	Description	Register Type
400001	Differential Pressure Switch	0 = DP switch off 1 = DP switch on	Read Only
400002	Inlet Pressure PSI	Range will be 0 to 150 PSI	Read Only
400003	Outlet Pressure PSI	Range will be 0 to 150 PSI	Read Only
400004	Differential Pressure PSI	Range will be 0 to 150 PSI	Read Only
400005	System Status	Below are the values representing the system state: 0 = Standby 1 = Master Valve On 2 = Valve 1 On 3 = Dwell 1 4 = Valve 2 On 5 = Dwell 2 6 = Remote System Lockout	Read Only
400006	Alarm	0 = Alarm off 1 = Alarm on	Read Only
400007	Cycle Count	The number of cycles the system has completed	Read Only
400008	Periodic Time Remaining (Hours)	Hours remaining to the next periodic backwash cycle.	Read Only
400009	Periodic Time Remaining (Minutes)	Minutes remaining to the next periodic backwash cycle.	Read Only
400010	Periodic Time Remaining (Seconds)	Seconds remaining to the next periodic backwash cycle.	Read Only
400011	Remote System Lockout	0 = Remote system lockout off 1 = Remote system lockout on *a cycle will complete itself before entering into lockout mode if lockout is initiated mid-cycle	Read/Write
400012	Manual Backwash Remote Start	0 = Remote start not engaged 1 = Remote start engaged *the EC-2 will automatically set the value back to 0 after the manual backwash has started	Read/Write