Process Trainer/Stirred Reactor

User's Manual

Benedictine Senior Design Group Cleanup Crew

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WARNING!

High Voltage on Machine

Use caution when using the Process Trainer and follow all instructions

Use of this machine can cause injury or death if not properly used!

Table of Contents

I. Warnings and Hazards

Warnings

All warnings and hazards should be read through prior to operating the machine. Misuse of the machine can cause injury or death of the user. Follow all the instructions listed in this user's manual.

- At no point should power cord be plugged in if the breaker is switched ON.
- At no point should you remove back cover while the power cord is plugged in.
- At no point should you touch any exposed wire! If a wire is exposed turn system off and inform a professional/Professor.
- At no point should chemical be used outside of the reactant loop.
- No one should lean or rest themselves on the Process Trainer. There should never be any added weight to the top of the reactor.
- Ensure all chemicals going into the system are appropriate for the pipe it is in.
- No electrical component should be removed or altered without the direct supervision of someone who is competent with the machines electrical work.

Hazards

Item	Hazards for Device
Power Supply	The system is a high voltage system. Do not plug system in without ensuring there are no open wires and the breaker is switched to off.
Hot Water Tank	Make sure the water inside the tank goes at least one inch above the heating coil while pump is running. Do not overfill as this can cause the tank to boil over and spill hot water over the entire system.
Hot Water and Reactant Pumps	Do not run the pumps dry. This means, verify a control valve has been switched on for proper flow. Running the pumps dry can cause irreversible damage to them.
Stirrer	Do not continue to power the stirrer if it is stalling or making screeching noises.

Heat Exchanger	The heat exchanger is the only equipment with brass in it. It is also utilized on the reactant side where various chemicals will be pumped in. Please review material warnings for chemicals, and if brass is listed as risk, forgo using that chemical.
PLC Device	Do not add or remove modules unless PLC is unplugged. Ensure PLC is in stop mode before reprogramming it. Do not get wet.
HMI Device	Use only the stylus provided or a finger pad. Do not fold, spindle, mutilate, tear, incinerate, immerse in acid, scratch, smash, cut with a knife, shoot, etc.

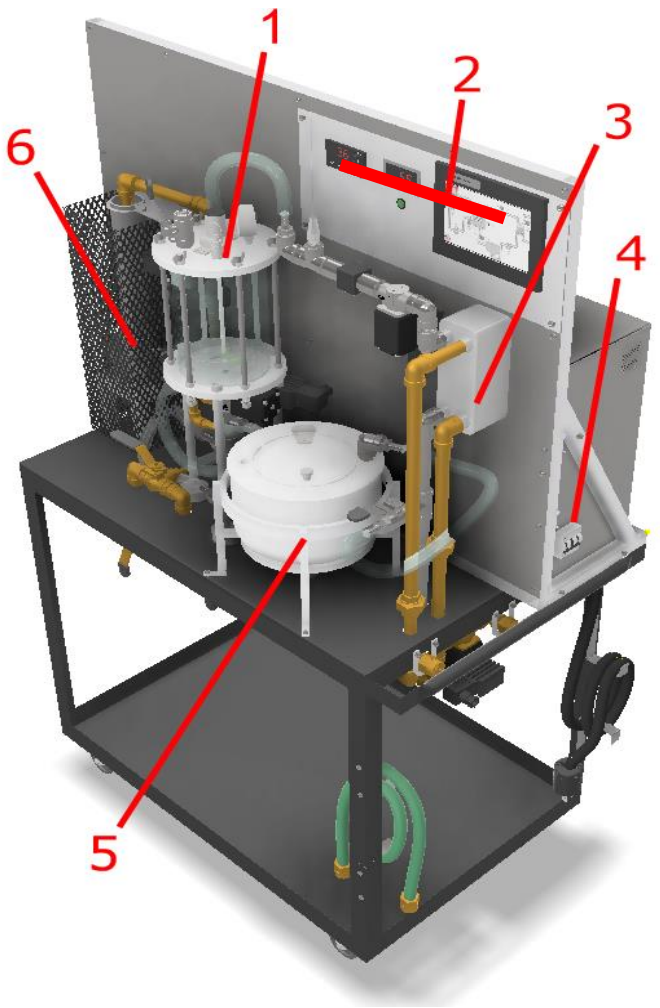
Item	**Hazard To User**
Hot Water Tank	Do not touch the hot water tank after it has been turned on, the tank will be very hot and can burn users.
Valves	Watch for pinch points when operating the valves, do not look away whilst operating the process trainer, even for simple tasks like closing/opening a pressure relief valve.
Electrical Wiring/Back of Process Trainer	DO NOT OPEN BACK HOOD UNLESS THE SYSTEM IS UNPLUGGED! Unless you know what the wires do, do not touch or mess with them. Crossing wires can lead to sparking and potential fires
Process Trainer on a Whole	Please remember to wear proper PPE when using the process trainer. Specifically, utilize safety glasses, pull back hair, and cover toes, arms, and legs. Chemicals or hot water can fall and burn users.
Water/Chemicals	The process trainer utilizes liquid mediums to perform the required tests. Meaning: hot water, steam, or chemicals will be in and around the process trainer. Users need to be aware of the potential risks these mediums cause when dropped, spilled, or ventilated. If valves, ports, pumps, piping, and tanks are not handled responsibly, users can severely damage themselves or others. Please use caution

II. System Overview

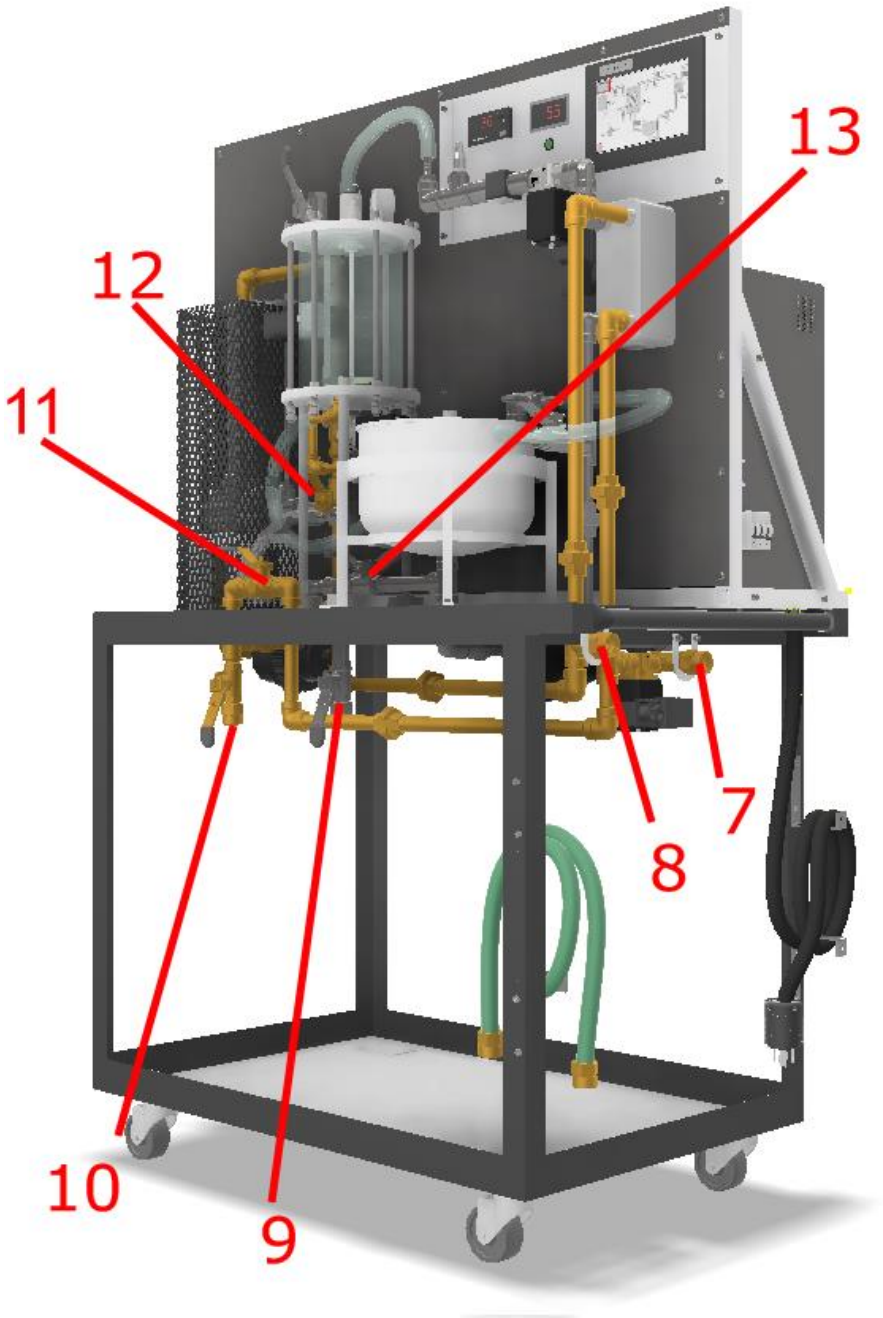
This system is a multipurpose process trainer/stirred-reactor hybrid, consisting of major hardware and software components including a PLC, HMI, two pumps, two tanks, a heat exchanger, a hot water tank, multiple thermocouples, flow meters, and valves. The goal of having such a wide assortment of equipment is to utilize the control-effect aspect of a systems' process in teaching. The trainer can facilitate a wide variety of experimental and educational applications, including exothermic and endothermic reactions, instruction on control systems and disturbances, and batch and continuous operations. Shown below is a figure displaying major components of the system, as well as input and drain valves.

III. General Operation

Control of the system will primarily be done via a connection between an HMI and PLC. Below is a familiarization section that all students should run through prior to starting any experiment. Run through the steps below whether you are utilizing the machine with the HMI or through LabVIEW.



Number	Feature
1	Reactor
2	(From left to right), Thermocouple Readout, Stirrer Controls, HMI
3	Heat Exchanger
4	Power Switch
5	Reactant Tank
6	Hot Water Tank

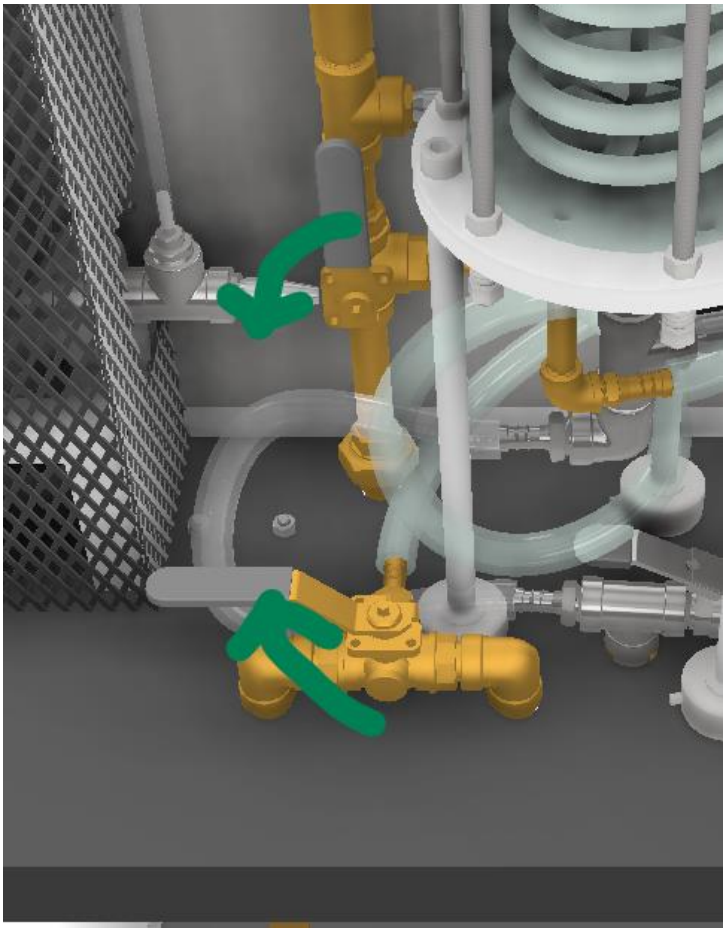


Number	Feature
7	Cold Water Input
8	Cold Water Output
9	Reactant Drain
10	Hot Water Drain
11	Coil Input Valve
12	Coil Output Valve
13	Reactant Recirculation Valve

Familiarization

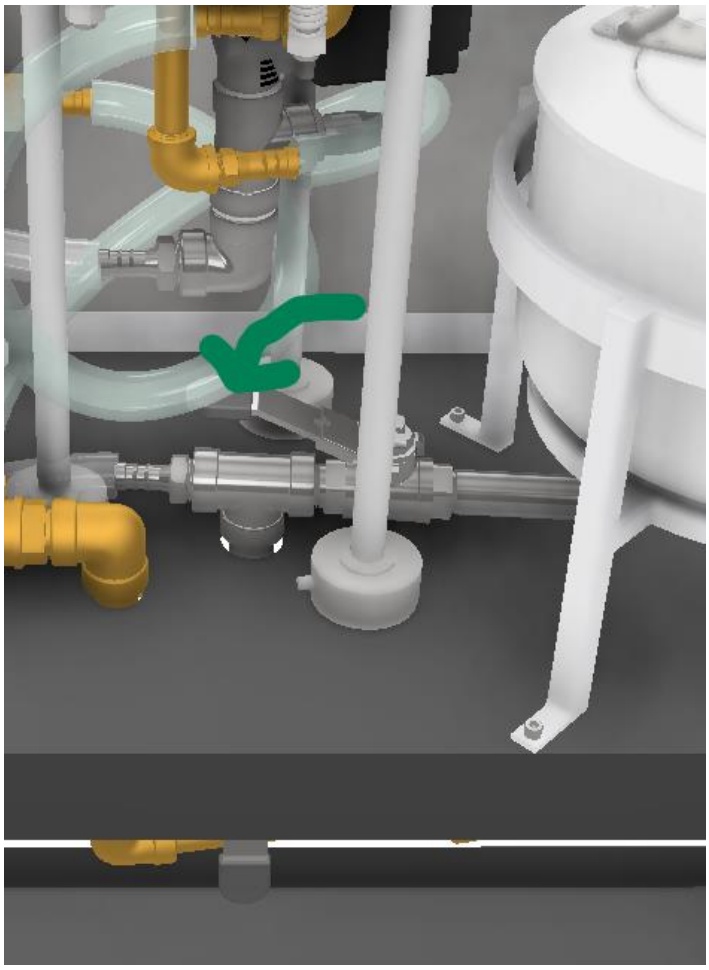
Listed below are steps to familiarize yourself with the Process Trainer and its controls/capabilities.

1. To fill the hot water tank, manually turn Coil Input Valve to Open and turn the Coil Output Valve to Open.

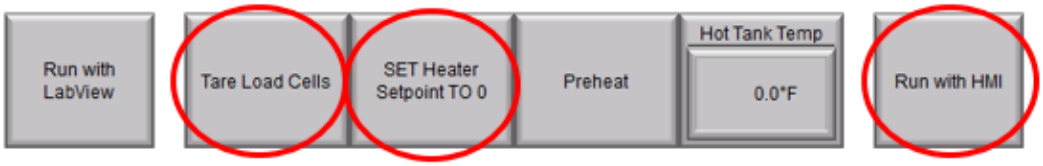


2. Turn reactant drain and hot water drain to Closed.
3. Connect hose to the sink and the Cold-Water Input on the right side of the Process Trainer and manually open FV3 and FV4 on the HMI.

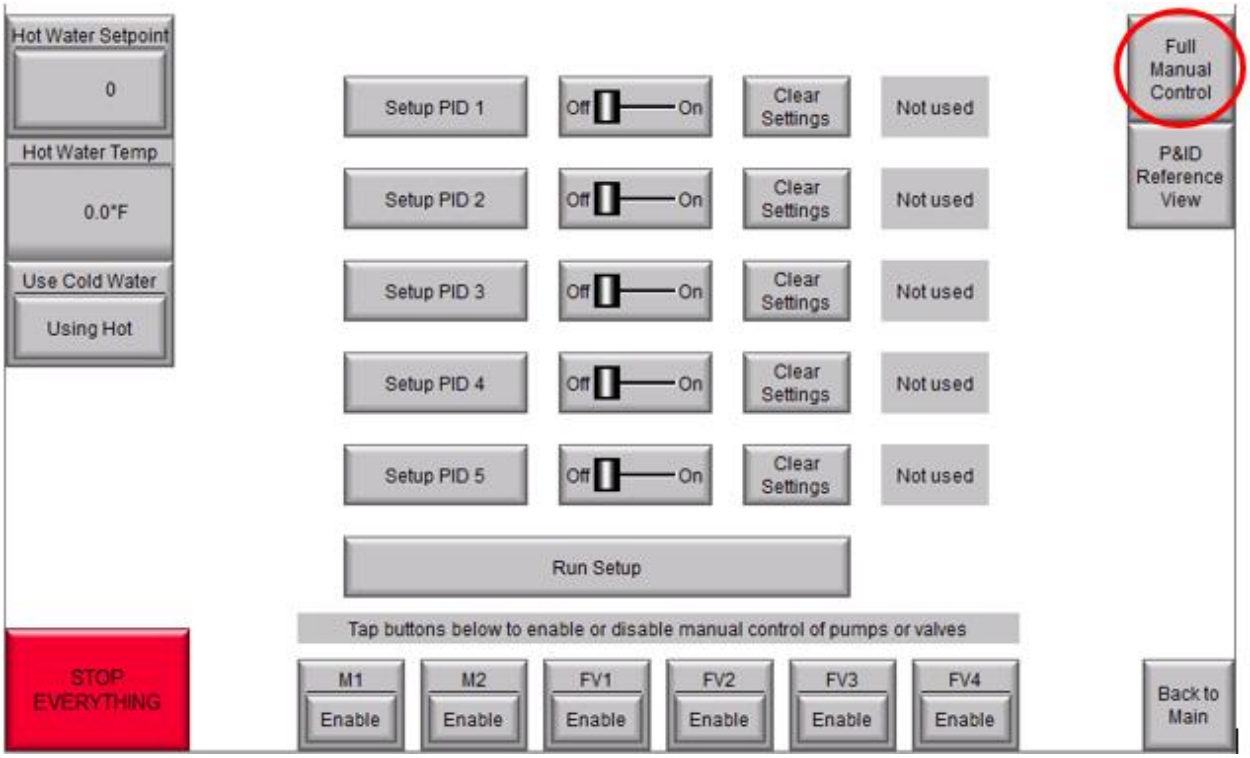
4. Turn on the hose and run water through the system until the Hot Water Tank is full, within an inch of the top of the tank. Note: the level inside of the hot water tank may drop once the pump runs; it is important that the water level remains above the heater so a water jug should be kept on hand to continue to fill the tank if necessary.
5. Turn reactant bypass valve to On and turn reactant recycle valve to On.



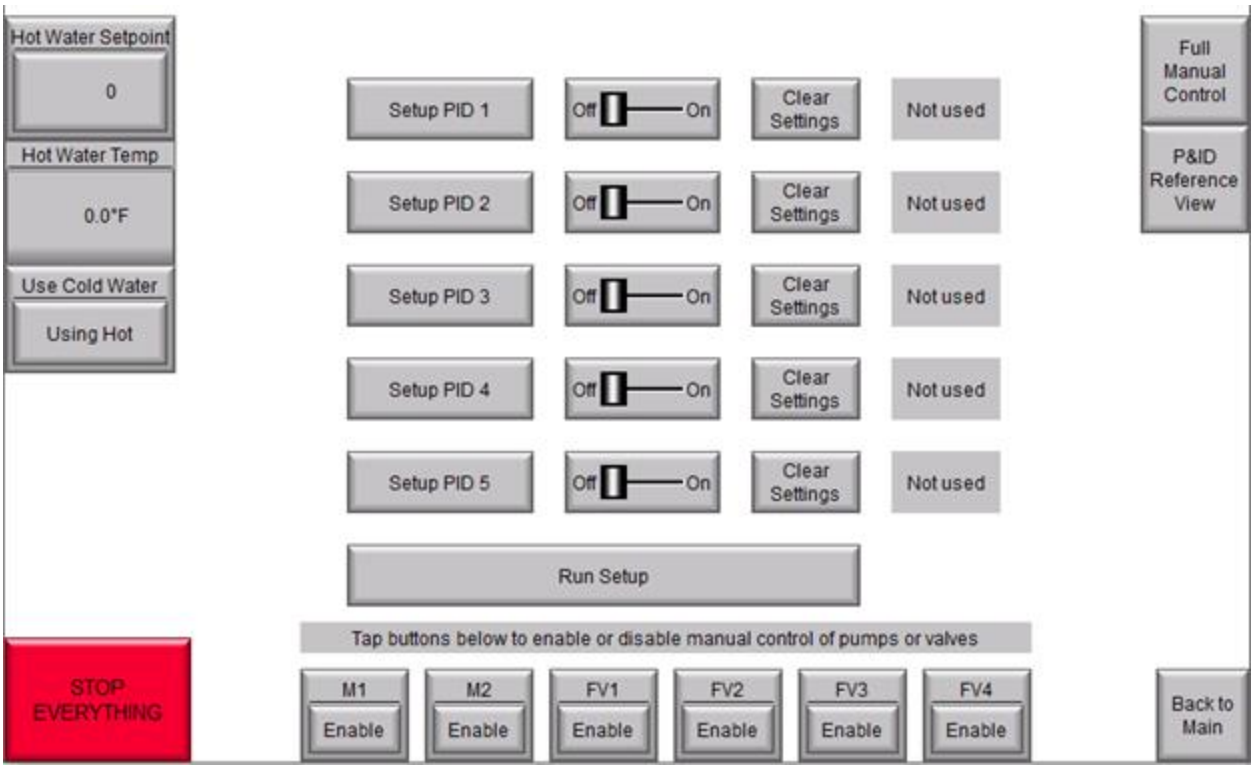
6. Plug power cord in to a three phase 208V supply (ensure breaker, on the right side of the Process Trainer, is switched down or OFF). Once plugged in, switch breaker up to ON to turn system on.
7. Once HMI has finished turning on immediately hit *SET Heater Set Point to 0* and *Tare Load Cells.*



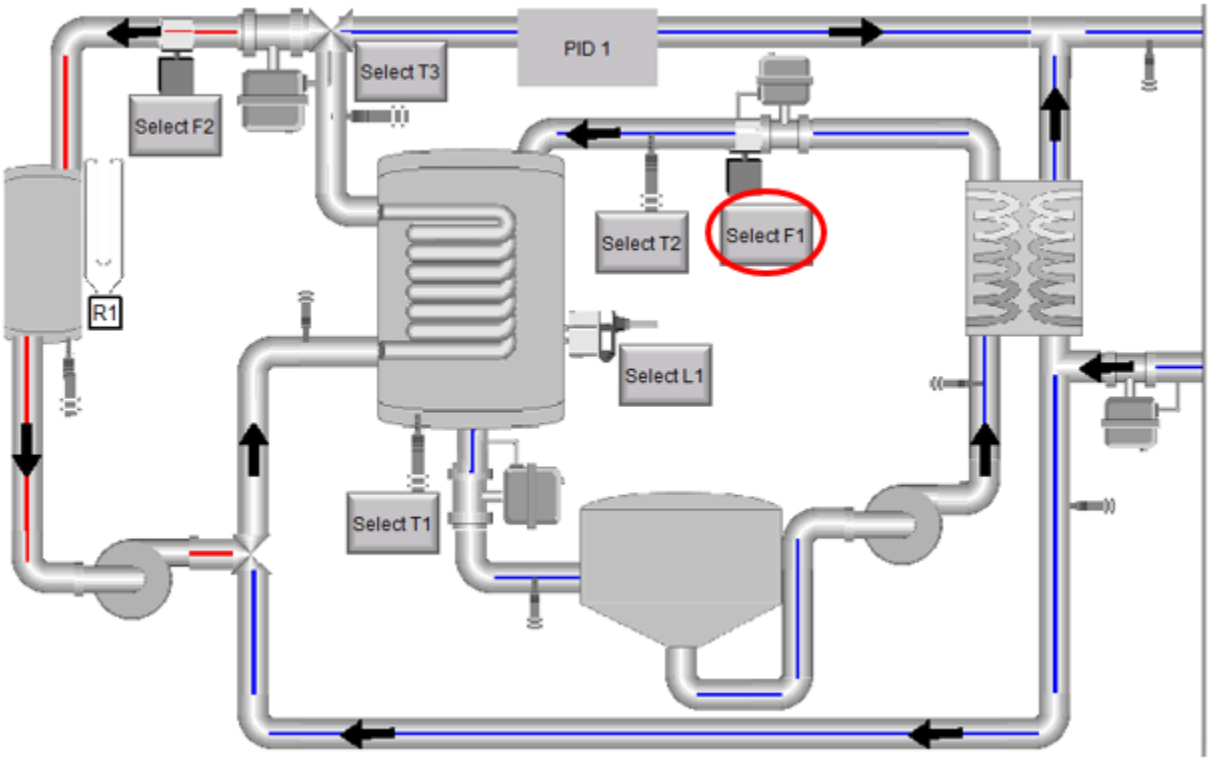
8. Press *Run with HMI* then *Full Manual Control*



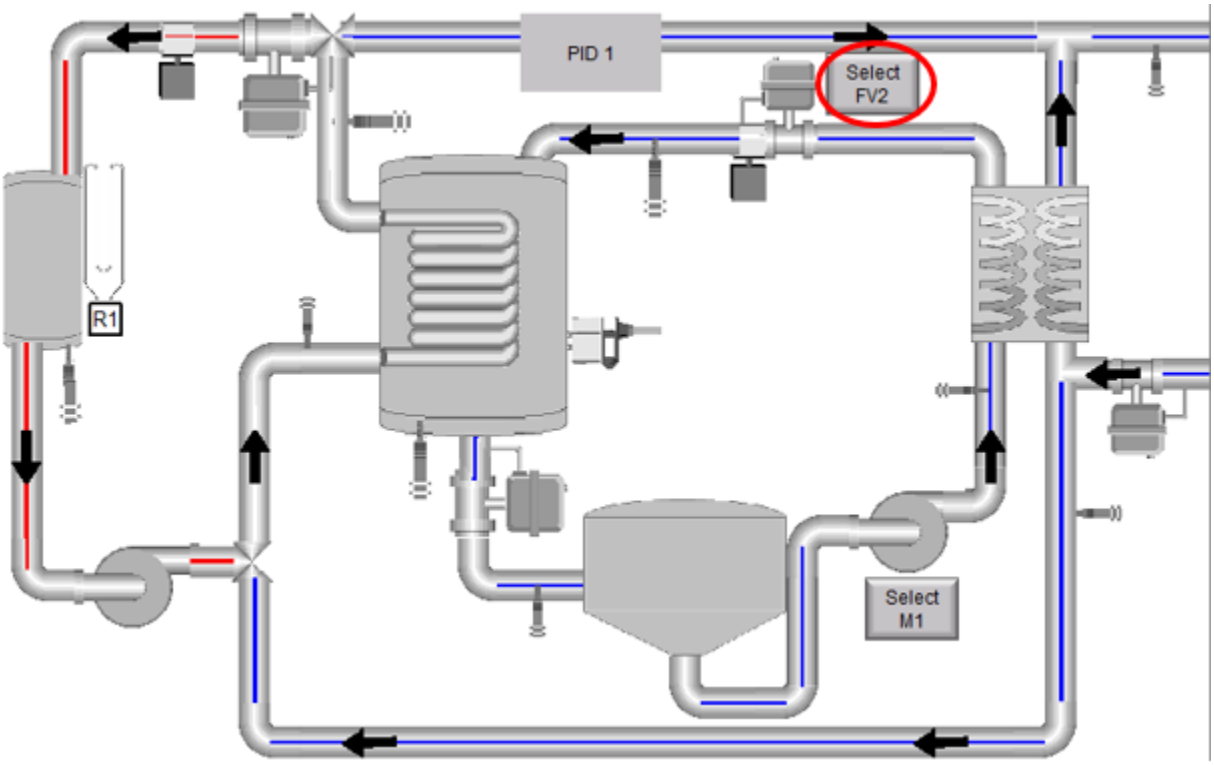
9. First open FV1 and FV2 100% which are two proportionally controlled valves and then slowly begin increase M1 until it reaches 50% power. This sequence will open the appropriate valve to begin running the cold-water loop. Things to notice: the reactor level (L1) should be increasing, reactant flow (F1) should increase, T1 T2 RT3 and RT4 should all stabilize near each other.
10. Shut off M1 then close valves FV1 and FV2.
11. To run the Hot Loop, turn FV4 to 100% open, turn M2 on to 50% power. If the water level in the hot water tank drops continue adding water until the hot water tanks level becomes stable.
12. Hit *Hot Water Setpoint,* set it at 95°F, and turn M2 to 60% of its power. Things to notice: TH T3 and RT5 all increase and eventually all stabilize to 95°F, Hot/Cold water flow (F2) should increase above zero.
13. Hit *Hot Water Setpoint*, set it to 0°F, slide M2 to 0%, close FV4 (You have now utilized the heater and seen the thermocouples and flow sensors react to the change)
14. Open FV1, FV2, and FV4 to 100%, switch M1 and M2 to 50% power, and set hot water setpoint to 95°F. During this process watch the reactant chambers level to ensure it will not overflow. Things to notice: As the hot water runs through the coils and the cold water runs through the reactant chamber T3 is lower than RT5, T1 is going to be hotter than T2, the heater's relay will turn on more frequently in order to keep the system at 95°F.
15. Run system for a few minutes and deviate some of the controllers to see how it changes the system. As you do this watch the level of the heater and reactant chamber, so they do not overflow and watch the reactant tanks level to ensure there is enough water.
16. Turn *Hot Water Setpoint* to 0°F, turn M1 and M2 to 0% power, then close FV1 FV2 and FV4. Wait for all water to stop moving before moving on to step 14.
17. Hit Back located in the top left corner of the screen, this will take you to the following screen.



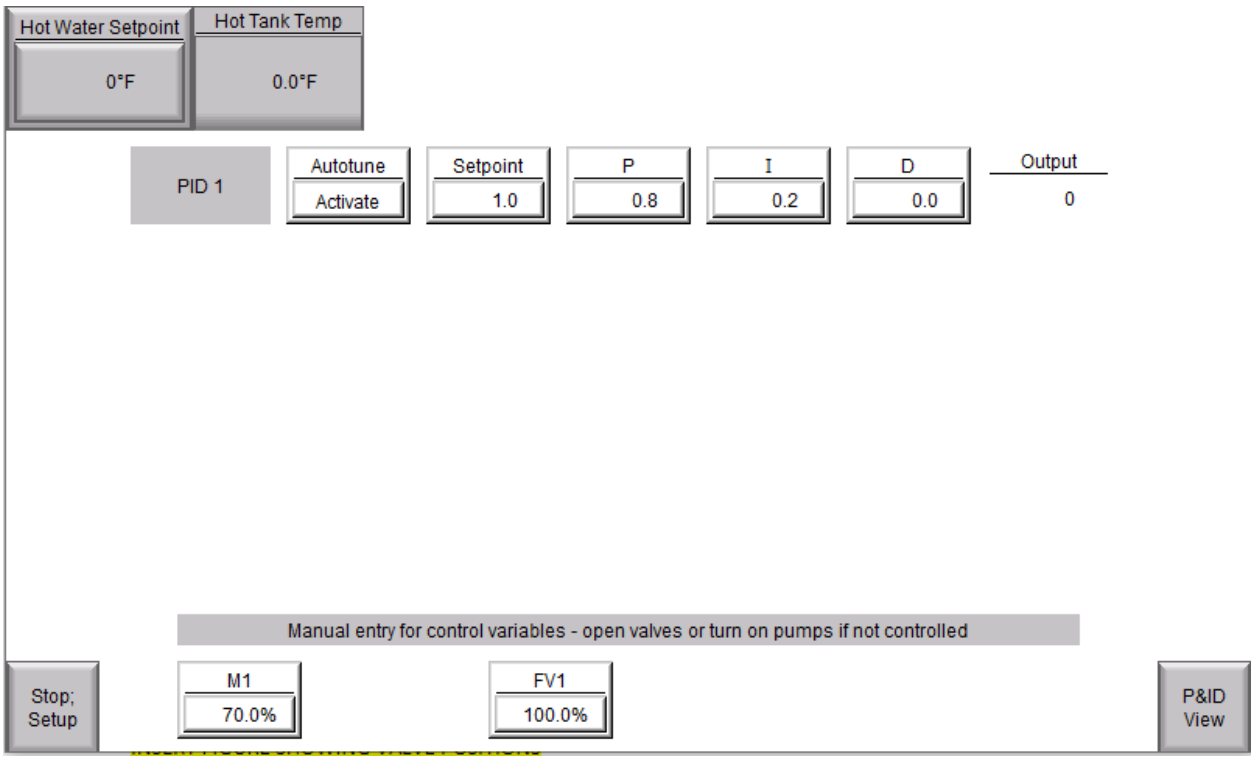
18. Hit *Setup PID 1* then press on *Select F1*. This is to begin the PID controlled process by picking which sensor you want to control.



19. Once the desired sensor is chosen the following image will appear. Click on FV2 which will assign it as the desired controller for the previous sensor. The PID screen will appear, enter 1 to P, 0.2 to I, and 0 to D into the fields then click Confirm and Enable. NOTE: If valve is not opening fast enough, adjust the P value to 10 and the I value to 1.



20. Now enable M1 and FV1 as manual controllers by pressing on the *ENABLE* button on the bottom of the screen, then hit *Run Setup,* and PID View. This takes you to the follow screen.



21. Set the *Setpoint to 0.6,* FV1 to 100% open and then M1 to 60% power, hit *P&ID View.* Things to look at: The main screen will appear once *P&ID View* is hit which shows the whole system and the percent's they are in use. Notice F1 change as the power increases and how FV2 changes to compensate for the power output by either opening or closing more. This same procedure can be followed for any sensor/controller relationship.
22. Push *PID View* to return to the above screen and manually turn of M1 and FV1, Hit *Stop;Setup,* this takes you back to the main PID control screen. Hit *Clear Settings* to zero the system, then push *Enabled* to Disenable M1 and FV1, push *Back to Main.* This returns to the main screen and completes the familiarization of the Process Trainer.

IV. Process Setup

A process can be cooled or heated, bulk process or continuous, stirred or unstirred. These setups can be combined in any way, e.g. process A is cooled, stirred, and bulk process while process B is heated, bulk process, and unstirred. This is summarized in the table below:

Characteristic	**Modes**
Temperature control	Heated or cooled
Reaction type	Continuous or bulk process
Stirring	Stirred or unstirred
Pressure	Pressurized or atmospheric

Stirred/Unstirred

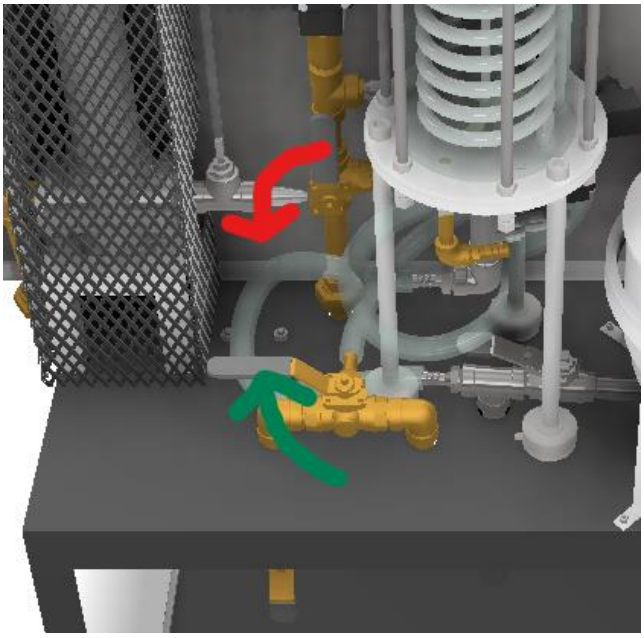
The stirring functionality is controlled by the knob, button, and display to the right of the HMI, as shown in the picture below. Press the button to turn the stirrer on and off and turn the knob to set the speed. The LCD indicates the speed as a percent of the maximum.

Cooled

Connect a hose from a cold water faucet to the female hose connector on the right side of the device (Blue in the picture below). Set the diverting valves to the correct positions as shown in the figure below (Green). Connect a second hose to the male hose connector on the right side of the process trainer (Black in the figure below) and place the other end in a drain.

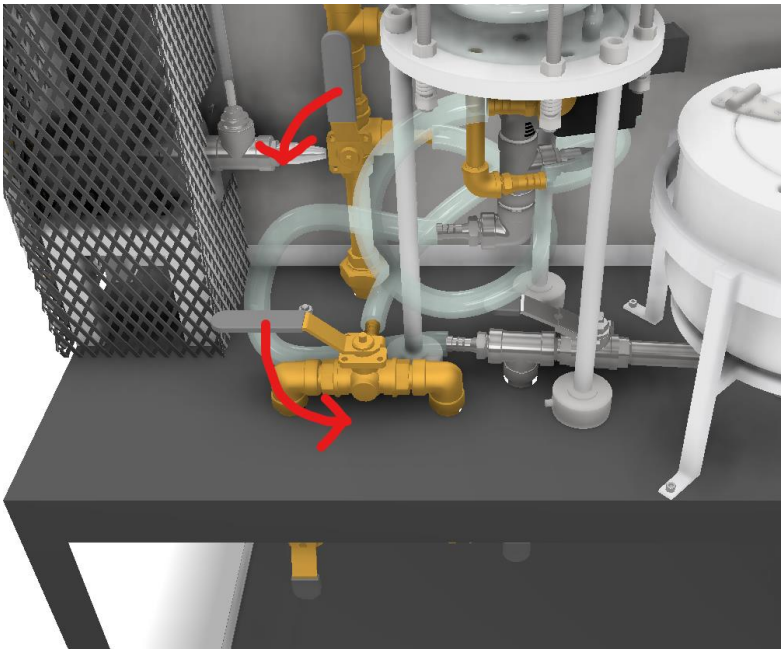
Heated

To fill the hot water tank, connect a hose from a cold water faucet to the female hose connector on the right side of the device, as for cooled. Set the diverting valves to the correct positions as shown in the figure below.

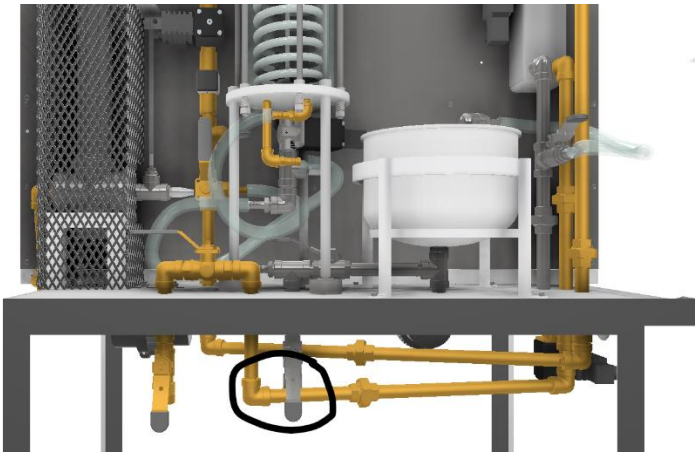


Using the HMI, manually open the heat exchanger valve a small amount, watching the sight valve on the hot water tank, until the hot water tank is full to within an inch of the top.

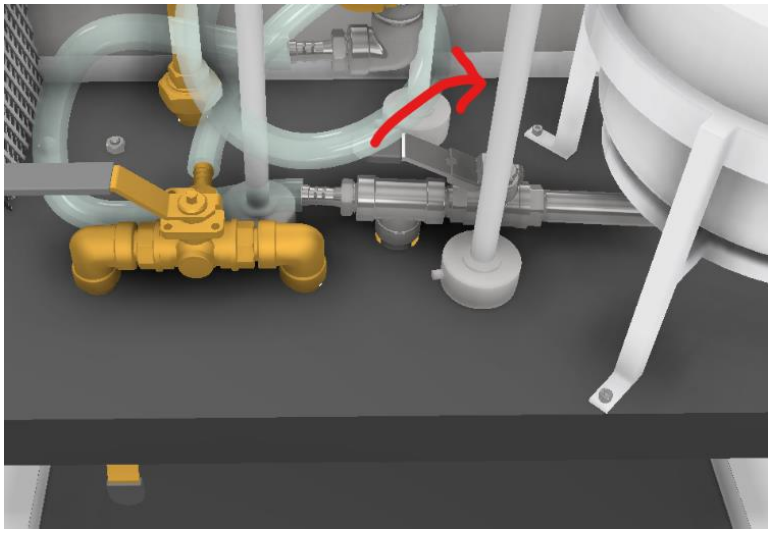
To run the process once the tank is full, set the diverting valves to the correct positions, as shown in the figure below. Note: the level inside of the hot water tank may drop once the pump runs; it is important that the water level remains above the heater so a water jug should be kept on hand to continue to fill the tank if necessary.

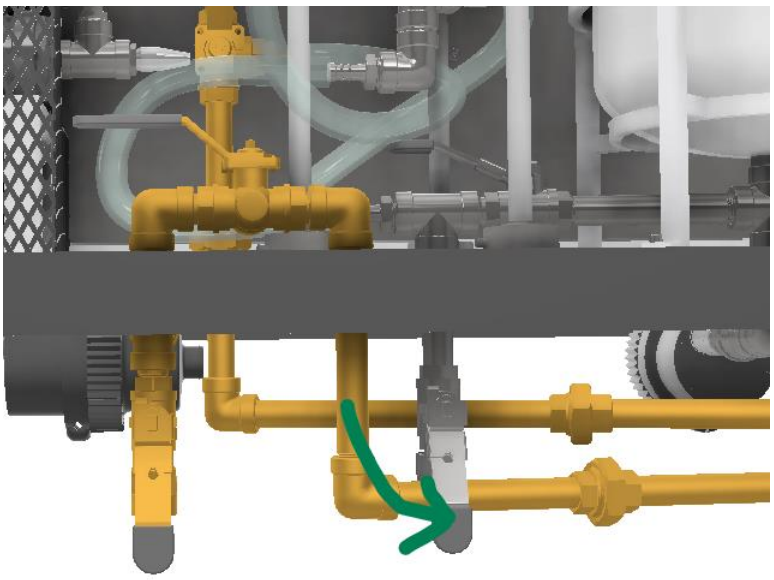


Bulk Process



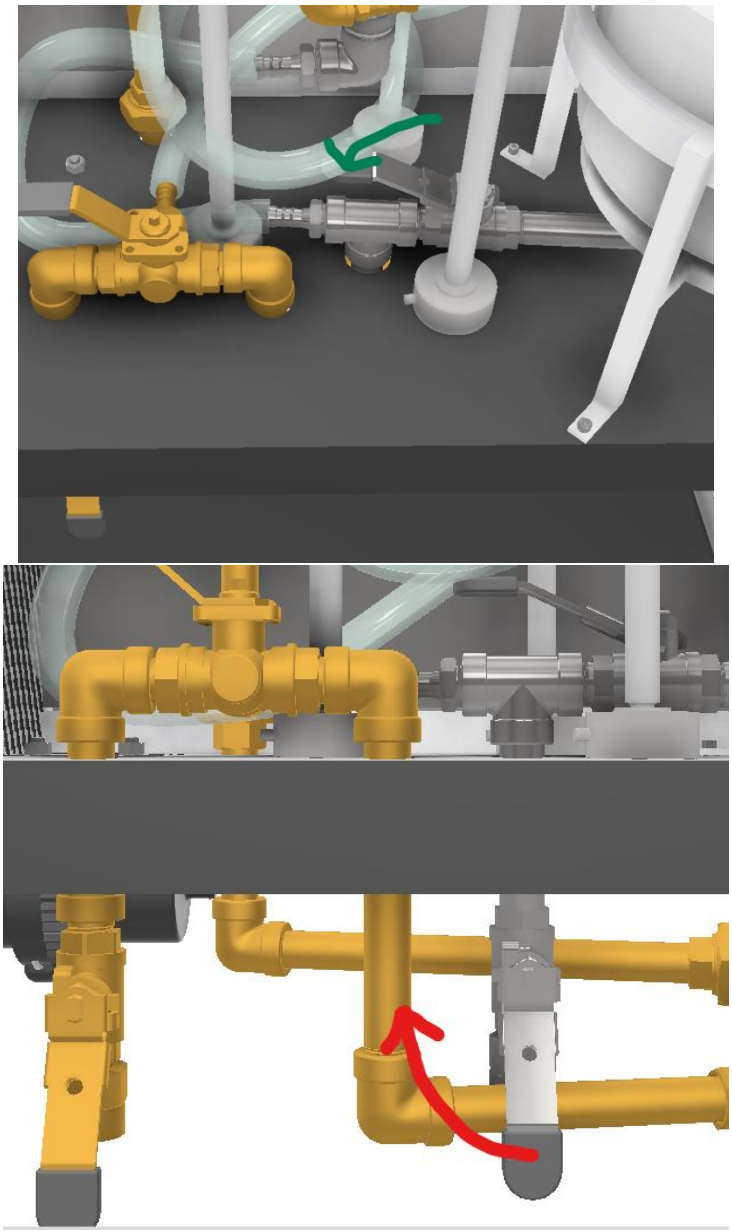
Place the reactant in the reactant tank. Connect a hose from the reactant drain in the center of the process trainer to an appropriate vessel or drain (Circled in the figure above). Close the valve beneath the reactant tank (red) and open the reactant drain valve (green) as shown in the figures below.





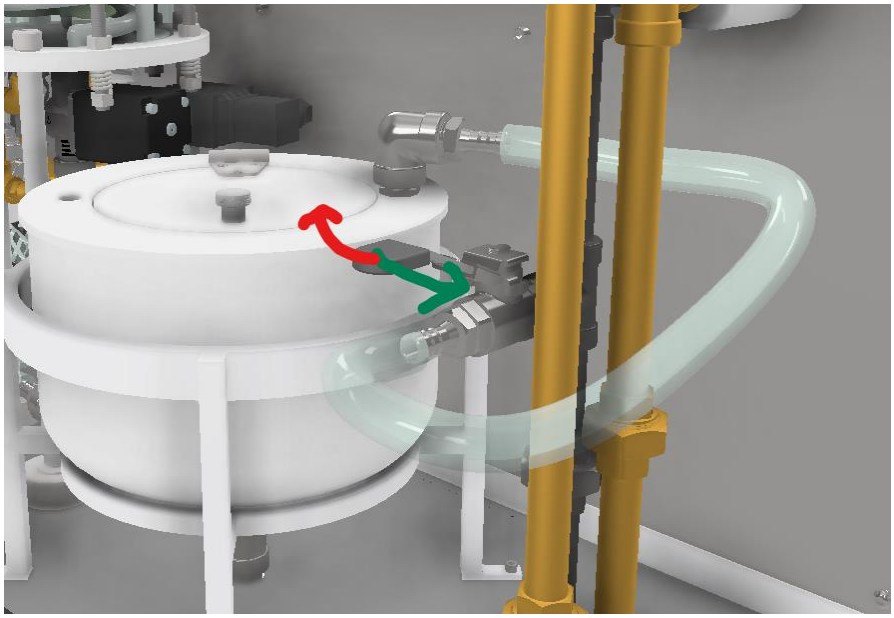
Continuous

Place the reactant in the reactant tank. Open the valve beneath the reactant tank (green) and ensure that the reactant drain valve is closed (red), as shown in the pictures below.



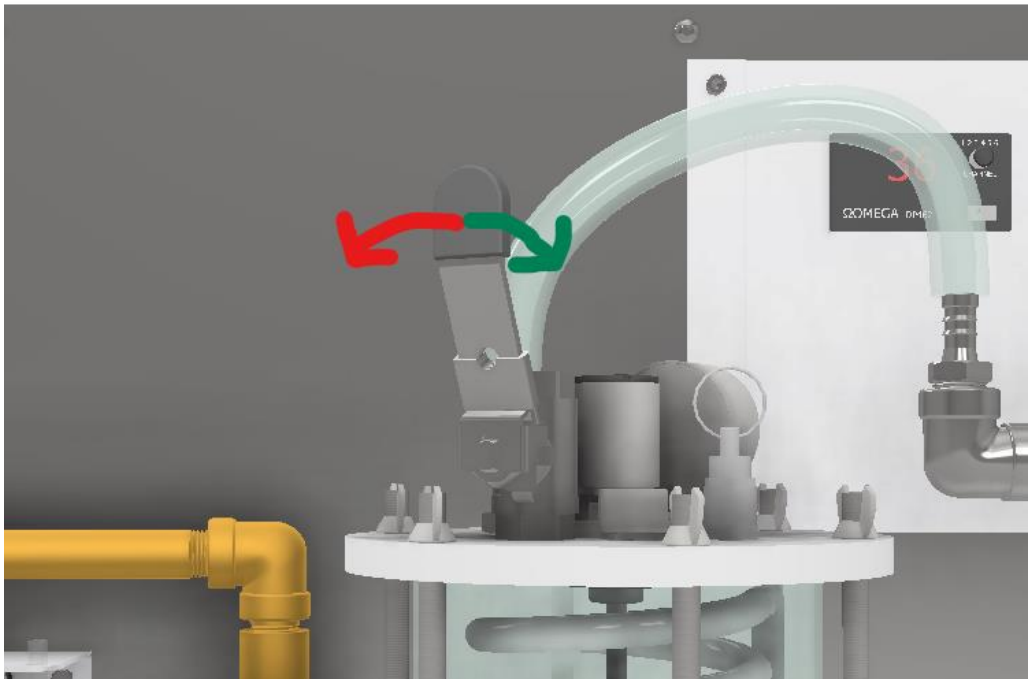
Reactor Bypass

When used as a process trainer, the reactor bypass valve may be opened fully or partially (Green) to introduce a flow disturbance, as shown in the figure below. In other configurations, the bypass valve is closed (Red).



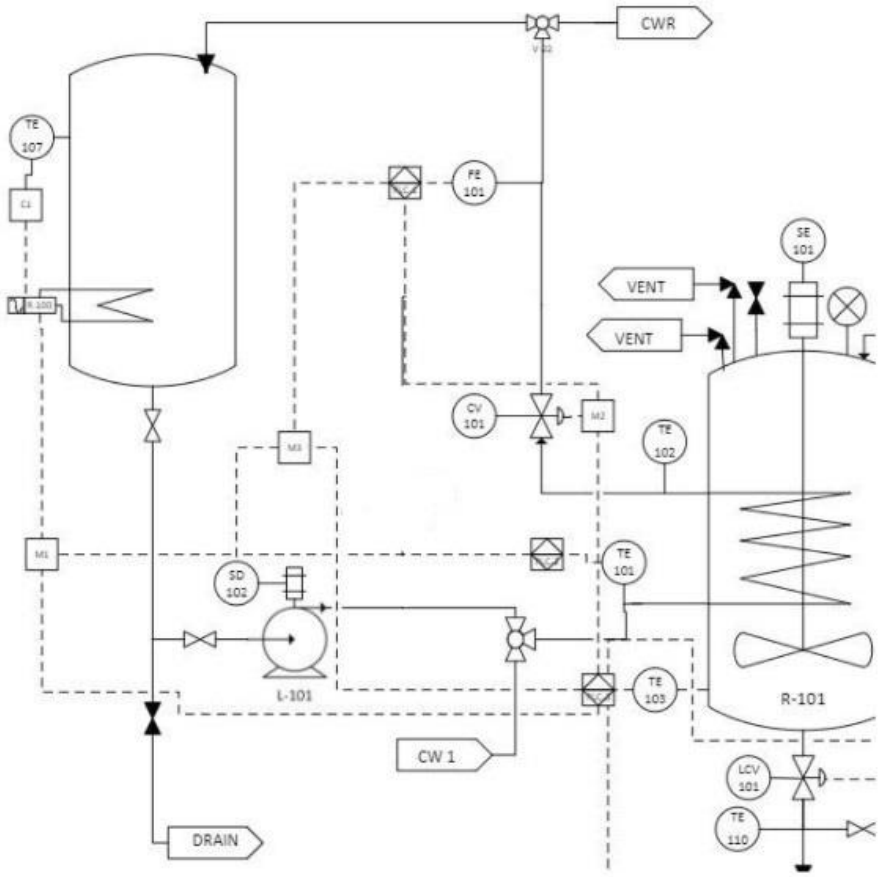
Pressure

The pressure relief valve, located above the reactant tank, is normally operated in the closed position (Red). If atmospheric pressure is necessary, the valve may be opened (Green). The valve also allows for the addition of a second reactant.



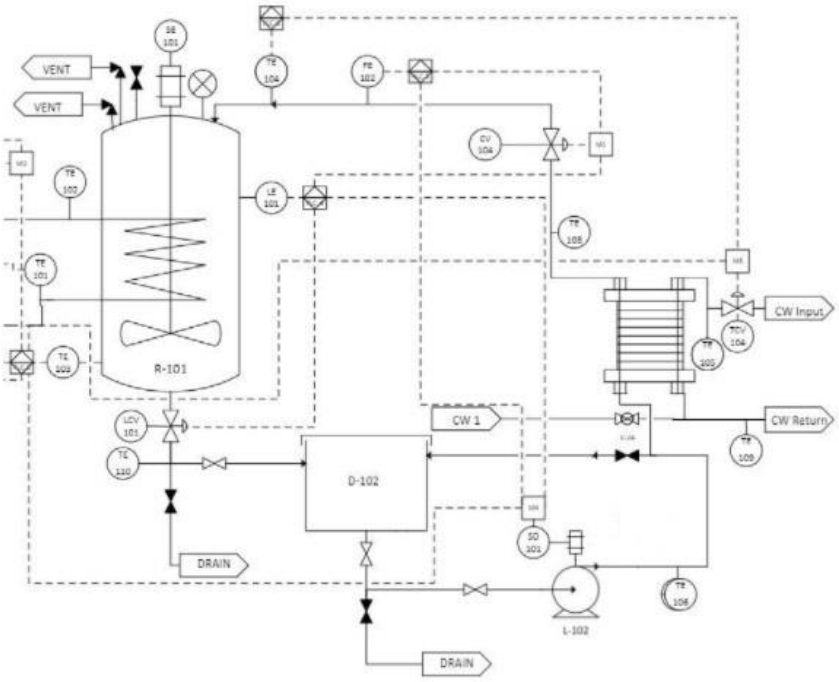
V. Subsystems

Hot Water Loop



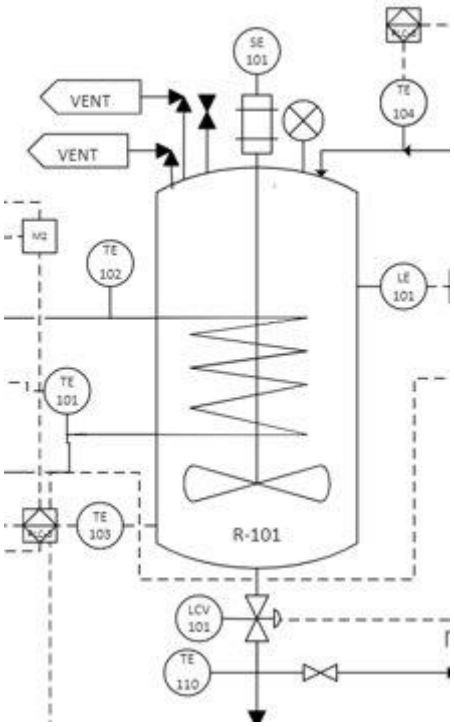
The hot loop works by heating water in a main tank by means of an enclosed electric heating coil, after which the water is circulated by a variable-speed pump through the heating coil within the reactor to add energy and raise the temperature of reactants, with flow rate adjusted either by a control valve or adjustment of pump speed. After exiting the reactor, the water returns to the tank for reheating.

Reactant Loop



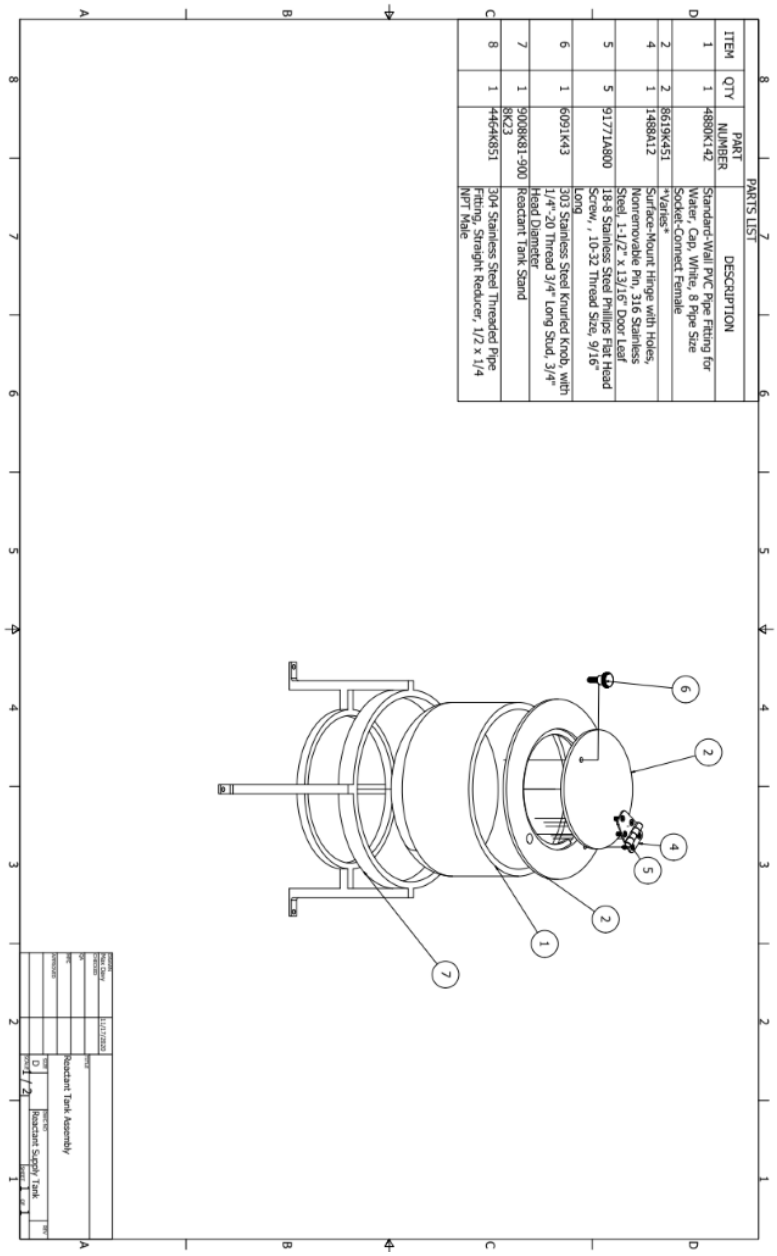
The reactant loop circulates reactant fluid by means of a variable speed pump from a storage tank through a heat exchanger before depositing into the reactor chamber, with flow rates into adjusted either by pump speed adjustment or by control valves, and flow out by a separate control valve to adjust fluid level within the reactor corresponding to readouts from load cells underneath the reactor supports. After exiting the chamber, the reactants may either be recirculated or evacuated to the drain, dependent on user-adjusted ball valve configurations.

Reactor Tank



The reactor tank is the focal point of the device. The chemically resistant materials within the chamber provide a safe environment for both process trainer and stirred reactor functions. An additional inlet on the lid of the chamber allows users to deposit fluids different from those in the reactant supply tank. As the medium between the temperature and reactant loops, this chamber offers temperature, level, and flow control. Fluid from the temperature loop, through the tank's coils, controls the temperature of the chamber. LE-101 indicates the level control for the subsystem, a trio of load cells. A summing box combines the outputs of the load cells into a single voltage before relaying the value to the PLC for processing. Reactant pump and control valve settings dictate flow into the vessel, and a valve underneath (CV-102) controls exit flow. Finally, to maintain the pressure of the chamber, the vessel uses an agitator (SE-101) driven by a magnetic coupler. Mounted on thrust bearings, the magnetic coupler offers a leak-proof, near frictionless method of mixing the reactor tank fluid. Pressure relief valves keep the tank from exceeding its pressure limit

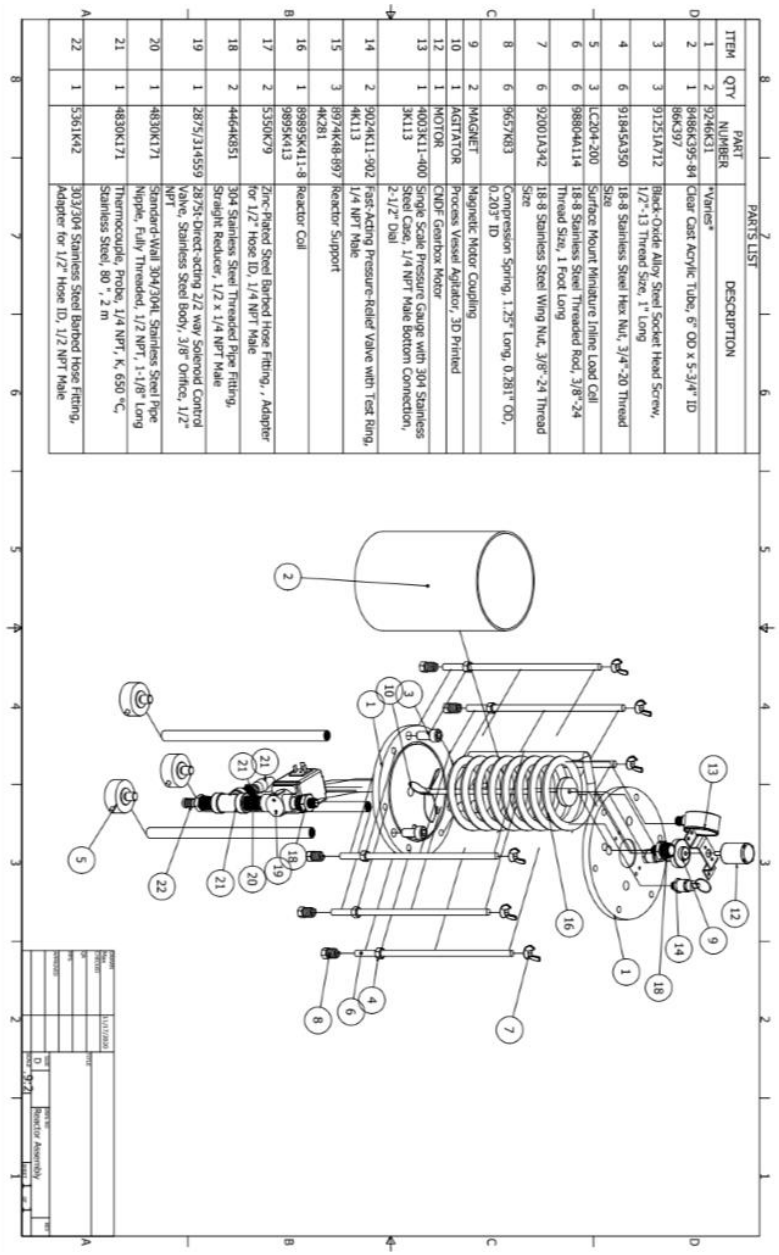
VI. Assembly



PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	4880K142	Standard-Wall PVC Pipe Fitting for Water, Cap, White, 8 Pipe Size
2	2	8615K451	Socket-Connect Female *Varies*
4	1	1488A12	Surface-Mount Hinge with Holes, Nonremovable Pin, 316 Stainless Steel, 1-1/2" x 13/16" Door Leaf
5	5	91771A800	18-8 Stainless Steel Phillips Flat Head Screw, , 10-32 Thread Size, 9/16" Long
6	1	6091K43	303 Stainless Steel Knurled Knob, with 1/4"-20 Thread 3/4" Long Stud, 3/4" Head Diameter
7	1	9008K81-900 8K23	Reactant Tank Stand
8	1	44G4K851	304 Stainless Steel Threaded Pipe Fitting, Straight Reducer, 1/2 x 1/4 NPT Male

Figure: Reactant Tank Assembly



PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	9246K31	*Varies*
2	1	8486K395-84 86K397	Clear Cast Acrylic Tube, 6" OD x 5-3/4" ID
3	3	91251A712	Black-Oxide Alloy Steel Socket Head Screw, 1/2"-13 Thread Size, 1" Long
4	6	91845A350	18-8 Stainless Steel Hex Nut, 3/4"-20 Thread Size
5	3	LC204-200	Surface Mount Miniature Inline Load Cell
6	6	98804A114	18-8 Stainless Steel Threaded Rod, 3/8"-24 Thread Size, 1 Foot Long
7	6	92001A342	18-8 Stainless Steel Wing Nut, 3/8"-24 Thread Size
8	6	9657K83	Compression Spring, 1.25" Long, 0.281" OD, 0.203" ID
9	2	MAGNET	Magnetic Motor Coupling
10	1	AGITATOR	Process Vessel Agitator, 3D Printed
12	1	MOTOR	CNDF Gearbox Motor
13	1	4003K11-400 3K113	Single Scale Pressure Gauge with 304 Stainless Steel Case, 1/4 NPT Male Bottom Connection, 2-1/2" Dial
14	2	5024K11-902 4K113	Fast-Acting Pressure-Relief Valve with Test Ring, 1/4 NPT Male
15	3	8974K48-697 4K281	Reactor Support
16	1	89895K411-8 9895K413	Reactor Coil
17	2	5350K79	Zinc-Plated Steel Barbed Hose Fitting, , Adapter for 1/2" Hose ID, 1/4 NPT Male
18	2	4464K851	304 Stainless Steel Threaded Pipe Fitting, Straight Reducer, 1/2 x 1/4 NPT Male
19	1	2875/3145S9	2875t-Direct-acting 2/2 way Solenoid Control Valve, Stainless Steel Body, 3/8" Orifice, 1/2" NPT
20	1	4830K171	Standard-Wall 304/304L Stainless Steel Pipe Nipple, Fully Threaded, 1/2 NPT, 1-1/8" Long
21	1	4830K171	Thermocouple, Probe, 1/4 NPT, K, 650 °C, Stainless Steel, 80 °, 2 m
22	1	5361K42	303/304 Stainless Steel Barbed Hose Fitting, Adapter for 1/2" Hose ID, 1/2 NPT Male

Figure: Reactor Assembly

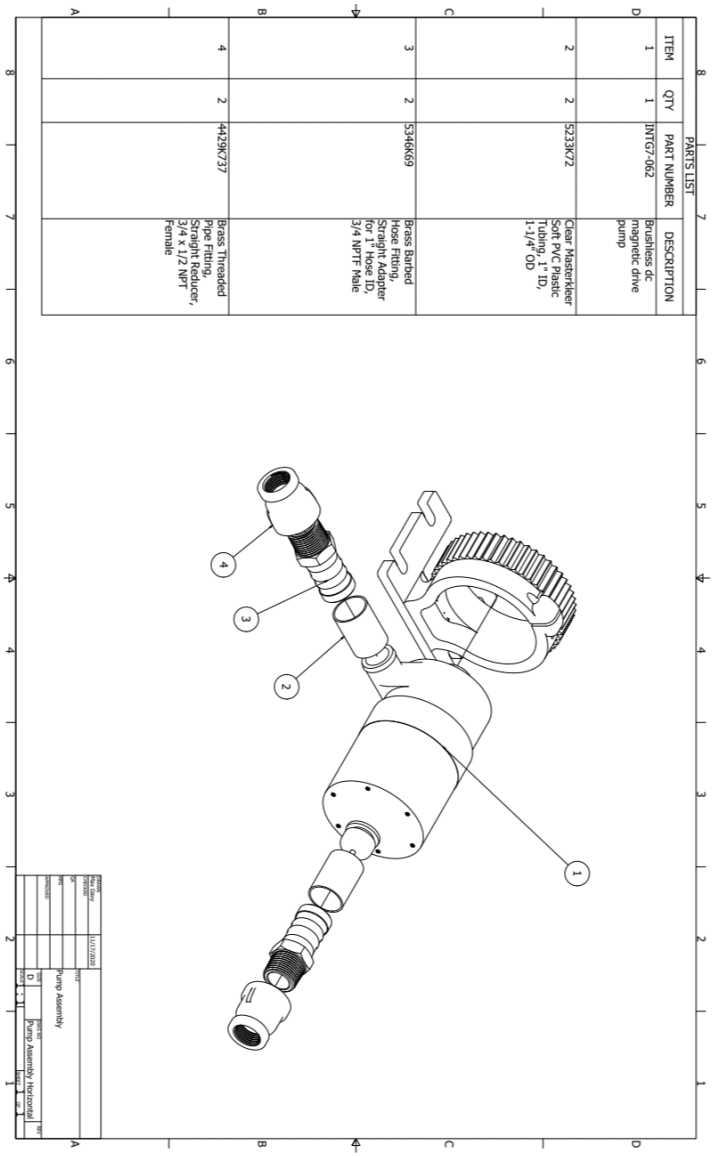


Figure: Pump Assembly

VII. Disassembly

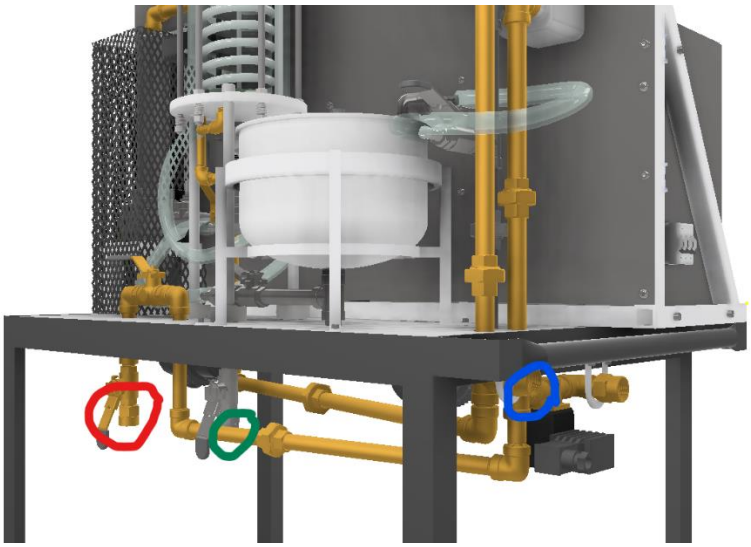
If it is necessary to tear down the machine, please unplug cables, and systematically remove the wires, remembering to label what they are attached to. To remove any of the large components of the system, open drainage valves and ensure the system is empty of fluid on both sides. To remove either of the pumps, loosen the hose clamps on the inlet and outlet ports, then detach the hose from the pump. Unscrew the bolts securing the pump and control box to the frame, then lift both free. To remove the hot water tank, unscrew the nut securing the outlet copper tubing towards the base, then unscrew both fittings on the lid and ensure all tubing is clear of the tank before lifting out. unscrew their connection to piping. The heater may be removed from the base of the tank simply by unscrewing. To remove the reactor, loosen all hose clamps and remove hoses from the underside and lid of the reactor. Detach the coupler between the reactor and

control valve beneath, then unscrew the supports from the load cells at the base and carefully lift out, ensuring none of the hose or other components are snagged. To remove the reactant tank, detach the coupler at the base as well as the bypass lines on the lid before removing. As none of these system components are ruggedized, once removed they should be taken from the deconstruction area and stored safely.

VIII. Maintenance

Short Term

After powering down the system, it is imperative that draining of the system is done before the user leaves. Drain the reactant (green) and hot water (red) or cold water (blue) separately using the drain valves, shown in the figure below.



Closing of all control valves, pressure valves, and drain valves must be completed after system drainage. All data files should be transferred to users' personal devices before powering off the PLC interface. Users should not assume PLC will save data files, even if the capacity is available. PLC interface should be powered off and never removed from home location, unless authorized by faculty. The 208v power supply cord should be unplugged and wrapped on the hooks on the side of the cart. Any additional piping used to transfer chemicals needs to be washed out, dried, and stored in their original locations.

The reactor tank (clear) must be cleaned before any chemicals are put into it. The reactant tank, (white) must be cleaned every time the process trainer is used, regardless of chemicals or water. The exception to this is that if the user is not intending to use the reactant side, then cleaning of the reactant tank does not need to occur. If system is not being used within that weeks' time, empty the system completely.

Long Term

When necessary, the hot water tank should be removed and cleaned to combat the buildup of sediments. If corrosion is to occur on piping, threads, or valves they must be replaced or cleaned,

before any further use. Additionally, the reactant loop should be drained completely using the drain valve located below the cart and fresh water should be run through in a bulk process setup to rinse out any build up that may have occurred. The cold-water inlet hose should be properly drained, rolled back up, and placed on the storage hooks located below the cart. Similarly, the 208v power cord must be properly rolled around its storage hooks on the side of the cart to avoid any damage to the wire insulation. If at any point there is visible damage to any of the wires or piping, testing must be immediately stopped, and the problem taken care of. Testing of the system on a whole, specifically from the point of view of the PLC interface should take place yearly using water as the medium. Attention to how the hardware responds to the software is imperative to whether the tests the users are running can be claimed as accurate. If machine is stored for longer than a month period distilled water should be used to run through the familiarization steps. This is to test every component in the system. If storing the machine for longer than a month it must be drained completely. Leave all drain valves open to ensure the system dries properly.

IX. Troubleshooting

NOTE: If the possible solution does not fix the problem there is most likely something wrong with the mechanism itself. Further examination of the device itself is needed.

Potential Problems	**Confirmation**	**Possible Solutions**
Cold/Hot water is not running through the coils inside of the Reactor	The contents of the Reactor are not being properly heated or cooled	Ensure that the Three-Way valves are in the appropriate orientation for the desired process. See the Process Setup section above to confirm that they are oriented correctly.
Steam is coming out of the Hot Water Tank/there is a loud hissing noise coming from the tank	Large amounts of steam can be seen and a snake like hiss can be heard	The level of the Hot Water Tank has dropped below the coils. Turn the heater off and properly fill the tank.
The Reactor won't drain	The Reactor is filling up beyond the desired level	Ensure that FV1 is open below the Reactor. If the screen says that the valve is open, confirm this by touching the valve; there should be a slight vibration.
Hot water pump won't run	No water is flowing through clear tube; motor is making odd noise	See if the control valve is opened, or if the pump is running dry (no water in the hot water tank), if a drain valve is draining, or if wires have fallen out of the black box attached to the pump.

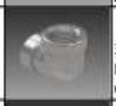
Stirrer won't move	Shaft in the reactor tank isn't rotating; liquid isn't being stirred.	Turn stirrer off and let sit for a while. Since it is a magnetic connection, the stirrer can fall off. Attempt it again; Loosen the head of the stirrer to allow for rotational motion or check if thrust bearings are out of place.
Hot water tank won't heat or takes longer than 10 minutes to heat up.	Allotted time has passed, and the thermocouple isn't reading the required temperature.	See if the coil is plugged into the wall outlet, if there is enough water in the tank, see if thermocouple is damaged, or sediment buildup.
Heat exchanger isn't running	Appropriate temperature is not being met; water and chemicals are not being processed correctly; additional sediments are being collected in liquid passing through.	See if there are any cracks throughout the heat exchanger, if buildup has occurred around threading, or if corrosion and condensation has occurred.
Load cells are not giving correct readings	An overload occurred and readings have been finicky since; readings are obviously false; visible damage has happened; unbalanced leg or cell.	Tare the load cells. If this does not fix the problem than continue to examine if any physical damage has been done to the load cells. If there has, the load cells could have been overloaded requiring a new one.
Reactant pump won't run	No water is flowing through pipes.	See if the control valve is opened, or if the pump is running dry (no water in the hot water tank), if a drain valve is draining, or if wires have fallen out of the black box attached to the pump
Pump is running but there is no flow in the cold-water loop	Ensure, visually, that no water is entering the reactant chamber.	Begin by turning the pump onto 70% power and then closing the reactant chambers control valve (FV1). Once water has filled the bottom of the tank begin closing and opening the bypass valve in long increments to attempt to "burp" the system. This is to remove the air bubbles in the pipes.

Flow Sensor are recording inaccurate numbers	Flow coming out of flow sensors is very different than what it is reading.	The most plausible problem to this is that the signal conditioner's calibration has been altered. To address this issue, remove the back covering, open the specifications manual for the blue signal conditioners, and readjust the signal conditioner following the manuals instructions.
Thermocouple is not reading the correct value	Confirm that the thermal couple is not correct with another thermocouple nearby.	Remove the back cover and check the terminals on the PLC where the thermocouples connect. Ensure that all the wires are still connected.
If all or one sensor/controller stops working	Visually check each item and ensure they are still connected properly.	If all the thermocouples (for example) are not working check the PLC connections. At the bottom of each PLC unit are jumper wires. These wires are required for the block to work/have power.
A read only thermocouple is not displaying a value	Ensure that the system is turned on.	To fix this problem check to see if that specific thermocouple is connected to the display screen. The wires are extremely small which means they can slip out of their ports easily.
The computer won't connect to the PLC to run LabVIEW	The computer won't control the Process Trainer with LabVIEW	Ensure that the ethernet cable is properly connected to the computer. If it is, remove the back cover on the process trainer and check the ethernet connection on the PLC.

Appendix 1: Parts list

Item	Part Number	Description		STOCK (IF MANUFACTURED)	Vendor	Web Link	QTY
2	BC-1		Steel Rolling Cart				1
3	BOLT-1		Hexagon Socket Head Cap Screw, 1/4 - 20 UNC, 1-1/2"				12
4	NUT-1		Hex Nuts (Inch Series) Heavy Hex Nut, 1/4 - 20 UNC				14
5.1	9246K31	"Varies"	"Varies"	Multipurpose 6061 Aluminum, 1/2" Thick, 8" x 8"	McMaster-Carr	https://www.mcmaster.com/9246K31/	2
5.2	8486K395-8486K397		Clear Cast Acrylic Tube, 6" OD x 5-3/4" ID		McMaster-Carr	https://www.mcmaster.com/8486K395-8486K397/	1
5.3	91251A712		Black-Oxide Alloy Steel Socket Head Screw, 1/2"-13 Thread Size, 1" Long		McMaster-Carr	https://www.mcmaster.com/91251A712/	3
5.4	91845A350		18-8 Stainless Steel Hex Nut, 3/4"-20 Thread Size		McMaster-Carr	https://www.mcmaster.com/91845A350/	6
5.5	LC204-200		Surface Mount Miniature Inline Load Cell		Omega	https://www.omega.com/en-us/force-strain-measurement/load-cells/p/LC204	3
5.6	98804A114		18-8 Stainless Steel Threaded Rod, 3/8"-24 Thread Size, 1 Foot Long		McMaster-Carr	https://www.mcmaster.com/98804A114/	6
5.7	92001A342		18-8 Stainless Steel Wing Nut, 3/8"-24 Thread Size		McMaster-Carr	https://www.mcmaster.com/92001A342/	6
5.8	9657K83		Compression Spring, 1.25" Long, 0.281" OD, 0.203" ID		McMaster-Carr	https://www.mcmaster.com/9657K83/	6
5.9	MAGNET		Magnetic Motor Coupling		Salvaged, Unknown		2
5.10	AGITATOR		Process Vessel Agitator, 3D Printed		3D Printed		1
5.12	MOTOR		CNDF Gearbox Motor		Salvaged, Unknown	Unknown	1
5.13	4003K11-4003K113		Single Scale Pressure Gauge with 304 Stainless Steel Case, 1/4 NPT Male Bottom Connection, 2-1/2" Dial		McMaster-Carr	https://www.mcmaster.com/4003K11-4003K113/	1
5.14	9024K11-9024K113		Fast-Acting Pressure-Relief Valve with Test Ring, 1/4 NPT Male		McMaster-Carr	https://www.mcmaster.com/9024K11-9024K113/	1

Item	Part Number	Description		STOCK (IF MANUFACTURED)	Vendor	Web Link	QTY
5.15	8974K48-8974K281		Reactor Support	Multipurpose 6061 Aluminum, 5/8" Diameter	McMaster-Carr	https://www.mcmaster.com/8974K48-8974K281/	3
5.16	89895K411-89895K413		Reactor Coil	Smooth-Bore Seamless 304 Stainless Steel Tubing, 1/4" OD, 0.035" Wall Thickness	McMaster-Carr	https://www.mcmaster.com/89895K411-89895K413/	1
5.18	4464K851		304 Stainless Steel Threaded Pipe Fitting, Straight Reducer, 1/2 x 1/4 NPT Male		McMaster-Carr	https://www.mcmaster.com/4464K851/	1
5.19	2875/314559		2875t-Direct-acting 2/2 way Solenoid Control Valve, Stainless Steel Body, 3/8" Orifice, 1/2" NPT		Burkert	https://www.burkert-usa.com/en/products/solenoid-control-valves/general-purpose-solenoid-control-valves/314559	1
5.20	4830K171		Standard-Wall 304/304L Stainless Steel Pipe Nipple, Fully Threaded, 1/2 NPT, 1-1/8" Long		McMaster-Carr	https://www.mcmaster.com/4830K171/	2
5.21.1	TC-K-NPT-U-72		Thermocouple, Probe, 1/4 NPT, K, 650 °C, Stainless Steel, 80 ", 2 m		Newark	https://www.newark.com/omega/tc-k-npt-u-72/thermocouple-k-type-ss-72/dp/30AC8478	1
5.21.2	4464K51		304 Stainless Steel Threaded Pipe Fitting, Low-Pressure, Tee Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464K51/	1
5.21.3	4464K265		304 Stainless Steel Threaded Pipe Fitting, , Bushing Adapter, 1/2 Male x 1/4 Female		McMaster-Carr	https://www.mcmaster.com/4464K265/	1
5.22	5361K42		303/304 Stainless Steel Barbed Hose Fitting, Adapter for 1/2" Hose ID, 1/2 NPT Male		McMaster-Carr	https://www.mcmaster.com/5361K42/	2
5.17	4464K14		304 Stainless Steel Threaded Pipe Fitting, Low-Pressure, 90 Degree Elbow Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464K14/	1
5.23	4429K161		Low-Pressure Brass Threaded Pipe Fitting, 90 Degree Elbow Connector, 1/4 NPT Female		McMaster-Carr	https://www.mcmaster.com/4429K161/	2
5.24	5346K22		Brass Barbed Hose Fitting for Air and Water, Straight Adapter for 1/2" Hose ID, 1/4 NPTF Male		McMaster-Carr	https://www.mcmaster.com/5346K22/	2
5.25	4568K137		Standard-Wall Brass Pipe Nipple, Threaded on Both Ends, 1/4 NPT, 4" Long		McMaster-Carr	https://www.mcmaster.com/4568K137/	1
5.26	4568K131		Standard-Wall Brass Pipe Nipple, Fully Threaded, 1/4 NPT		McMaster-Carr	https://www.mcmaster.com/4568K131/	1
5.27	46325K28		Standard-Port 316 Stainless Steel Body On/Off Valve, with Lockable Lever Handle, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/46325K28/	1
6.1	4880K142		Standard-Wall PVC Pipe Fitting for Water, Cap, White, 8 Pipe Size Socket-Connect Female		McMaster-Carr	https://www.mcmaster.com/4880K142/	1
6.2	8619K451	*Varies*	*Varies*	HDPE Sheet, 12" x 12" x 3/16"	McMaster-Carr	https://www.mcmaster.com/8619K451/	2

Item	Part Number	Description		STOCK (IF MANUFACTURED)	Vendor	Web Link	QTY
6.4	1488A12		Surface-Mount Hinge with Holes, Nonremovable Pin, 316 Stainless Steel, 1-1/2" x 13/16" Door Leaf		McMaster-Carr	https://www.mcmaster.com/1488A12/	1
6.5	91771A800		18-8 Stainless Steel Phillips Flat Head Screw, , 10-32 Thread Size, 9/16" Long		McMaster-Carr	https://www.mcmaster.com/91771A800/	5
6.6	6091K43		303 Stainless Steel Knurled Knob, with 1/4"-20 Thread 3/4" Long Stud, 3/4" Head Diameter		McMaster-Carr	https://www.mcmaster.com/6091K43/	1
6.7	9008K81-9008K23		Reactant Tank Stand	Multipurpose 6061 Aluminum, 1/2" x 1/2"	McMaster-Carr	https://www.mcmaster.com/9008K81-9008K23/	1
6.8	4464K851		304 Stainless Steel Threaded Pipe Fitting, Straight Reducer, 1/2 x 1/4 NPT Male		McMaster-Carr	https://www.mcmaster.com/4464K851/	1
6.9	4464K14		304 Stainless Steel Threaded Pipe Fitting, Low-Pressure, 90 Degree Elbow Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464K14/	1
6.10	5361K42		303/304 Stainless Steel Barbed Hose Fitting, Adapter for 1/2" Hose ID, 1/2 NPT Male		McMaster-Carr	https://www.mcmaster.com/5361K42/	1
6.11	4464K265		304 Stainless Steel Threaded Pipe Fitting, , Bushing Adapter, 1/2 Male x 1/4 Female		McMaster-Carr	https://www.mcmaster.com/4464K265/	1
7	89015k53		Electronics Shield	Multipurpose 6061 Aluminum Sheet, 0.063" Thick, 48" x 48"	McMaster-Carr	https://www.mcmaster.com/89015k53	1
8.1	9157K785		Standard-Wall 304/304L Stainless Steel Threaded Pipe Nipple, Threaded on One End, 2 NPT, 10" Long		McMaster-Carr	https://www.mcmaster.com/9157K785/	1
8.2	4830K171		Standard-Wall 304/304L Stainless Steel Pipe Nipple, Fully Threaded, 1/2 NPT, 1-1/8" Long		McMaster-Carr	https://www.mcmaster.com/4830K171/	1
8.3	4464K265		304 Stainless Steel Threaded Pipe Fitting, , Bushing Adapter, 1/2 Male x 1/4 Female		McMaster-Carr	https://www.mcmaster.com/4464K265/	2
8.4	TC-K-NPT-U-72		Thermocouple, Probe, 1/4 NPT, K, 650 °C, Stainless Steel, 80 ", 2 m		Newark	https://www.newark.com/omega/tc-k-npt-u-72/thermocouple-k-type-ss-72/dp/30AC8478	1
8.5	5361K84		303/304 Stainless Steel Barbed Hose Fitting, , Adapter, 1/4" Hose ID x 1/2 NPT Male		McMaster-Carr	https://www.mcmaster.com/5361K84/	1
8.6	5233K56		Hot Water Tank Sight Gauge	Clear Masterkleer Soft PVC Plastic Tubing, , 1/4" ID, 3/8" OD	McMaster-Carr	https://www.mcmaster.com/5233K56/	1
8.7	89015K193		Upper Hot Water Tank Bracket	Multipurpose 6061 Aluminum Sheet, 0.08" Thick, 6" x 6"	McMaster-Carr	https://www.mcmaster.com/89015K193/	1

Item	Part Number	Description		STOCK (IF MANUFACTURED)	Vendor	Web Link	QTY
8.8	3656K174		Screw-Plug Immersion Heater, for Water, Adjustable, 304 Stainless Steel Element, 240V AC, 1 Phase, 3000W		McMaster-Carr	https://www.mcmaster.com/3656K174/	1
8.9	4464K319		304 Stainless Steel Threaded Pipe Fitting, Low-Pressure, Cross Connector, 2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464K319/	1
8.10	4464K171		304 Stainless Steel Threaded Pipe Fitting, Low-Pressure, Bushing Adapter, 2 Male x 1/2 Female NPT		McMaster-Carr	https://www.mcmaster.com/4464K171/	2
8.11	4464K51		304 Stainless Steel Threaded Pipe Fitting, Low-Pressure, Tee Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464K51/	1
8.12	6546K53-1		Hot Water Tank Support	Multipurpose 6061 Aluminum Rectangular Tube, 1" High x 1" Wide	McMaster-Carr	https://www.mcmaster.com/6546K53/	1
8.13	9255T935-9255T932		Hot Water Tank Shield	Steel Perforated Sheet, Staggered Holes, 0.075" Thick	McMaster-Carr	https://www.mcmaster.com/9255T935-9255T932/	1
8.14	fls-vm-100		ProSense float liquid level switch		Automation Direct	https://www.automationdirect.com/adc/shopping/catalog/process_control_-a-_measurement/level_sensors_-a-_controllers/float_level_switches/fls-vm-100	1
8.15	BC-6		Float Switch Bracket	Multipurpose 6061 Aluminum Sheet, 0.08" Thick, 6" x 6"	McMaster-Carr	https://www.mcmaster.com/89015K193/	1
8.16	BOLT-2		Hexagon Socket Head Cap Screw, 1/4 - 20 UNC, 1/4"				1
8.17	NUT-2		Hexagon Nut, 1/4 - 20 UNC				1
8.18	BC-5		Hot Water Tank Drip Guard		BC 3D printers		1
9	4568K171		Standard-Wall Brass Pipe Nipple, Fully Threaded, 1/2 NPT		McMaster-Carr	https://www.mcmaster.com/4568K171/	18
11	4429k163		Low-Pressure Brass Threaded Pipe Fitting, 90 Degree Elbow Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4429k163	13
12.1	INTG7-062		Brushless dc magnetic drive pump		GRI	https://burtprocess.com/brand/gri-pumps/integrated-brushless-dc-drives/integrated-brushless-dc-magnetic-drive-pump-intg7-series	1
12.2	5233K72		Clear Masterkleer Soft PVC Plastic Tubing, 1" ID, 1-1/4" OD		McMaster-Carr	https://www.mcmaster.com/5233K72/	2
12.3	5346K69		Brass Barbed Hose Fitting, Straight Adapter for 1" Hose ID, 3/4 NPTF Male			https://www.mcmaster.com/5346K69/	2

Item	Part Number	Description		STOCK (IF MANUFACTURED)	Vendor	Web Link	QTY
12.4	4429K737		Brass Threaded Pipe Fitting, Straight Reducer, 3/4 x 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4429K737/	2
13	4629K13		Brass On/Off Valve with Lockable Lever Handle, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4629K13/	1
14	4429K253		Low-Pressure Brass Threaded Pipe Fitting, Tee Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4429K253/	3
15	70815T43		Brass Garden Hose Fitting, Straight Adapter with Swivel, 3/4 GHT Female x 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/70815T43/	5
16	4568K172		Standard-Wall Brass Pipe Nipple, Threaded on Both Ends, 1/2 NPT, 1-1/2" Long		McMaster-Carr	https://www.mcmaster.com/4568K172/	2
17	4093T23		Threaded Diverting Valve, Brass Body, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4093T23/	2
18	4512K483		Standard-Wall Brass Threaded Pipe, Threaded on Both Ends, 1/2 NPT, 20" Long		McMaster-Carr	https://www.mcmaster.com/4512K483/	1
19	2875/314556		2875t-Direct-acting 2/2 way Solenoid Control Valve, Brassl Body, 3/8" Orifice, 1/2" NPT		Burkert	https://www.burkert-usa.com/en/products/solenoid-control-valves/general-purpose-solenoid-control-valves/314556	2
20	DFC9000100		Dataflow Compact Inline Flow Transmitter		Parker	https://ph.parker.com/us/en/dataflow-flow-transmitters/dfc9000100	2
21	4429K113		Brass Threaded Pipe Fitting, Straight Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4429K113/	3
22.1	TC-K-NPT-U-72		Thermocouple, Probe, 1/4 NPT, K, 650 °C, Stainless Steel, 80 °, 2 m		Newark	https://www.newark.com/omega/tc-k-npt-u-72/thermocouple-k-type-ss-72/dp/30AC8478	1
22.2	4429K253		Low-Pressure Brass Threaded Pipe Fitting, Tee Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4429K253/	1
22.3	4429K422		Brass Threaded Pipe Fitting, Bushing Adapter with Hex Body, 1/2 Male x 1/4 Female NPT		McMaster-Carr	https://www.mcmaster.com/4429K422/	1
25	4568K182		Standard-Wall Brass Pipe Nipple, Threaded on Both Ends, 1/2 NPT, 6" Long		McMaster-Carr	https://www.mcmaster.com/4568K182/	3
26	4512K484		Standard-Wall Brass Threaded Pipe, Threaded on Both Ends, 1/2 NPT, 22" Long		McMaster-Carr	https://www.mcmaster.com/4512K484	1
27	4512K18		Standard-Wall Brass Threaded Pipe, Threaded on Both Ends, 1/2 NPT, 18" Long		McMaster-Carr	https://www.mcmaster.com/4512K18/	2

Item	Part Number	Description		STOCK (IF MANUFACTURED)	Vendor	Web Link	QTY
29	5346K25		Brass Barbed Hose Fitting, Straight Adapter for 1/2" Hose ID, 1/2 NPTF Male		McMaster-Carr	https://www.mcmaster.com/5346K25/	2
31	4830K177		Standard-Wall 304/304L Stainless Steel Pipe Nipple, Threaded on Both Ends, 1/2 NPT, 5" Long		McMaster-Carr	https://www.mcmaster.com/4830K177/	1
32	4464K14		304 Stainless Steel Threaded Pipe Fitting, Low-Pressure, 90 Degree Elbow Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464K14/	7
33	46325K28		Standard-Port 316 Stainless Steel Body On/Off Valve, with Lockable Lever Handle, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/46325K28/	3
34	4464K51		304 Stainless Steel Threaded Pipe Fitting, Low-Pressure, Tee Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464K51/	3
35.1	TC-K-NPT-U-72		Thermocouple, Probe, 1/4 NPT, K, 650 °C, Stainless Steel, 80 ", 2 m		Newark	https://www.newark.com/omega/tc-k-npt-u-72/thermocouple-k-type-ss-72/dp/30AC8478	1
35.2	4464K51		304 Stainless Steel Threaded Pipe Fitting, Low-Pressure, Tee Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464K51/	1
35.3	4464K265		304 Stainless Steel Threaded Pipe Fitting, , Bushing Adapter, 1/2 Male x 1/4 Female		McMaster-Carr	https://www.mcmaster.com/4464K265/	1
36	4830K174		Standard-Wall 304/304L Stainless Steel Pipe Nipple, Threaded on Both Ends, 1/2 NPT, 2-1/2" Long		McMaster-Carr	https://www.mcmaster.com/4830K174/	1
37	5361K42		303/304 Stainless Steel Barbed Hose Fitting, Adapter for 1/2" Hose ID, 1/2 NPT Male		McMaster-Carr	https://www.mcmaster.com/5361K42/	3
38	4830K176		Standard-Wall 304/304L Stainless Steel Pipe Nipple, Threaded on Both Ends, 1/2 NPT, 4" Long		McMaster-Carr	https://www.mcmaster.com/4830K176/	3
39	4830K179		Standard-Wall 304/304L Stainless Steel Pipe Nipple, Threaded on Both Ends, 1/2 NPT, 8" Long		McMaster-Carr	https://www.mcmaster.com/4830K179/	1
40	2875/314559		2875t-Direct-acting 2/2 way Solenoid Control Valve, Stainless Steel Body, 3/8" Orifice, 1/2" NPT		Burkert	https://www.burkert-usa.com/en/products/solenoid-control-valves/general-purpose-solenoid-control-valves/314559	1
41	4830K171		Standard-Wall 304/304L Stainless Steel Pipe Nipple, Fully Threaded, 1/2 NPT, 1-1/8" Long		McMaster-Carr	https://www.mcmaster.com/4830K171/	8
42	7476T51		303 Stainless Steel Barbed Garden Hose Fitting, Straight Adapter with Swivel, 3/4 GHT x 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/7476T51/	1
43.1	INTG7-062		Brushless DC Magnetic Drive Pump		GRI	https://burtprocess.com/brand/gri-pumps/integrated-brushless-dc-drives/integrated-brushless-dc-magnetic-drive-pump-intg7-series	1

Item	Part Number	Description		STOCK (IF MANUFACTURED)	Vendor	Web Link	QTY
43.2	5233K72		Clear Masterkleer Soft PVC Plastic Tubing, 1" ID, 1-1/4" OD		McMaster-Carr	https://www.mcmaster.com/5233K72/	2
43.4	4464k529		304 Stainless Steel Threaded Pipe Fitting, Straight Reducer, 3/4 x 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464k529	2
43.5	5361K42		303/304 Stainless Steel Barbed Hose Fitting, Adapter for 1/2" Hose ID, 1/2 NPT Male		McMaster-Carr	https://www.mcmaster.com/5361K42/	2
44	BOLT-3		Hexagon Socket Head Cap Screw, 1/4 - 20 UNC, 1/2"				6
47	NUT-3		Hex Nuts (Inch Series) Hex Nut, 1/4 - 20 UNC				14
48	4568K174		Standard-Wall Brass Pipe Nipple, Threaded on Both Ends, 1/2 NPT, 2-1/2" Long		McMaster-Carr	https://www.mcmaster.com/4568K174/	1
49	BOLT-4		Hexagon Socket Head Cap Screw, 8-32 UNC, 1/4"				23
52	NUT-4		Hex Nuts (Inch Series) Hex Nut, 8-32 UNC				23
53	89015K191		Drain Bracket	Multipurpose 6061 Aluminum Sheet, 0.08" Thick, 2" x 24"	McMaster-Carr	https://www.mcmaster.com/89015K191/	2
54.1	6546K21		Backboard Frame, Welded Aluminum Tubing	Multipurpose 6061 Aluminum Rectangular Tube, 1/8" Wall Thickness, 1" High x 1" Wide, 6ft, 5X	McMaster-Carr	https://www.mcmaster.com/6546K21/	1
54.2	89015K86		Backboard Panel, Aluminum Sheet	Multipurpose 6061 Aluminum Sheet, 0.08" Thick, 48" x 48"	McMaster-Carr	https://www.mcmaster.com/89015K86/	1
54.3	92949A546		18-8 Stainless Steel Button Head Hex Drive Screw, 1/4"-20 Thread Size, 1-1/2" Long		McMaster-Carr	https://www.mcmaster.com/92949A546/	11
54.4	89015K26		Backboard Cutout	Multipurpose 6061 Aluminum Sheet, 0.08" Thick, 12" x 24"	McMaster-Carr	https://www.mcmaster.com/89015K26/	1
54.5	BOLT-5		Hexagon Socket Head Cap Screw, 1/4 - 20 UNC, 1 1/2"				14
54.6	NUT-5		Hexagon Nut, 1/4 - 20 UNC				14
54.7	8961K15		Steel DIN 3 Rail, 7.5mm Deep, 1m Long		McMaster-Carr	https://www.mcmaster.com/8961K15/	2

Item	Part Number	Description		STOCK (IF MANUFACTURED)	Vendor	Web Link	QTY
54.8	PSN24-120		RHINO 24V Power Supply		Automation Direct	https://cdn.automationdirect.com/static/specs/rhinopsn.pdf	2
54.9.1	C0-00AC		CLICK AC power supply		Automation Direct	https://www.automationdirect.com/adc/shopping/catalog/programmable_controllers/click_series_plcs_(stackable_micro_brick)/power_supplies/c0-00ac	1
54.9.2	C0-10ARE-D		CLICK Ethernet Basic PLC		Automation Direct	https://www.automationdirect.com/adc/shopping/catalog/programmable_controllers/click_series_plcs_(stackable_micro_brick)/plc_units/c0-10are-d	1
54.9.3	C0-04DA-1		CLICK analog output module		Automation Direct	https://www.automationdirect.com/adc/shopping/catalog/programmable_controllers/click_series_plcs_(stackable_micro_brick)/analog_i-z-o/c0-04da-1	2
54.9.4	C0-04AD-2		CLICK analog input module		Automation Direct	https://www.automationdirect.com/adc/shopping/catalog/programmable_controllers/click_series_plcs_(stackable_micro_brick)/analog_i-z-o/c0-04ad-2	2
54.9.5	C0-4AD2DA-2		CLICK analog combo module		Automation Direct	https://www.automationdirect.com/adc/shopping/catalog/programmable_controllers/click_series_plcs_(stackable_micro_brick)/analog_i-z-o/c0-4ad2da-2	1
54.10	7641K83		Modular DIN-Rail Mount Terminal Block, Grounding, 10mm Wide		McMaster-Carr	https://www.mcmaster.com/7641K83/	15
54.11	7641K53-7641K532		Modular DIN-Rail Mount Terminal Block, Red		McMaster-Carr	https://www.mcmaster.com/7641K53-7641K532/	25
54.12	7641K53-7641K531		Modular DIN-Rail Mount Terminal Block, Black		McMaster-Carr	https://www.mcmaster.com/7641K53-7641K531/	21
54.13	EA9-T7CL-R		C-more EA9 series touch screen HMI		Automation Direct	https://www.automationdirect.com/adc/shopping/catalog/hmi_(human_machine_interface)/c-more_touch_panels_ea9_series/c-more_ea9_series_touch_panels/ea9-	1
54.15	CCM5D		DC Motor Speed Controller		Amazon	https://www.amazon.com/uniquegoods-Digital-Display-Controller-Stepless/dp/B00QLYO7XU	1
54.16	B3-12A		20 Plate Heat Exchanger with M5-.08 Mounting Studs		Biodiesel Supply	https://www.dudadiesel.com/choose_item.php?id=HX1220	1
54.17	DP-462		Thermocouple Controller		Omega		1
54.18	89015k53		Electronics Shield	Multipurpose 6061 Aluminum Sheet, 0.063" Thick, 48" x 48"	McMaster-Carr	https://www.mcmaster.com/89015k53	1
54.19	FAZ-C25/3		Eaton circuit breaker, 3 pole, 25 A, 277/480V AC		Grainger	https://www.grainger.com/product/EATON-IEC-Supplementary-Protector-19YF53	1
54.20	SSRL240DC25		Solid State Relay, 240V 25A		Omega	https://www.omega.com/en-us/control-monitoring/relays/solid-state-relays/p/SSRL240DC-25	1

Item	Part Number	Description		STOCK (IF MANUFACTURED)	Vendor	Web Link	QTY
54.21	PSV5-15s		Switching power supply, 5VDC output, 3A, 15W, 120/240 VAC Input		Automation Direct	https://www.automationdirect.com/adc/shopping/catalog/power_products_(electrical)/dc_power_supplies/rhino_(din_rail)/psv_series/psv5-15s	2
54.22	DRF-FR		DIN Rail Frequency Input Signal Conditioner		Omega	https://www.omega.com/en-us/data-acquisition/signal-conditioners/din-rail-signal-conditioners/p/DRF-FR-Series-Sig-Cond	2
54.23	Load Cell Controller						1
54.24	Splash Guard						1
54.25	BOLT-6		Hexagon Socket Head Cap Screw, 10-24 UNC, 1/4"				2
58	8908A001		Electronic Control Unit for Posiflow Control Valves		ASCO	https://www.industrialstores.com/product_detail/asco-8908a001-electronic-module-for-series-sd8202	4
59	4568K172		Standard-Wall Brass Pipe Nipple, Threaded on Both Ends, 1/2 NPT, 1-1/2" Long		McMaster-Carr	https://www.mcmaster.com/4568K172/	3
61	4464k486		304 Stainless Steel Threaded Pipe Fitting, Low-Pressure, Union Straight Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464k486	1
62	4429K214		Low-Pressure Brass Threaded Pipe Fitting, Union Straight Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4429K214/	6
63	4464K354		Low-Pressure, Straight Connector, 1/2 NPT Female		McMaster-Carr	https://www.mcmaster.com/4464K354/	2
66	Hose-1		Reactor Bypass Hose	1/2" ID Flexible PCV Tubing			2
67	Hose-2		Reactor Drain Hose	1/2" ID Flexible PCV Tubing			2
68	Hose-3		Coil Input Hose	1/2" ID Flexible PCV Tubing			2
69	Hose-4		Coil Output Hose	1/2" ID Flexible PCV Tubing			2
70	4568K514		Standard-Wall Brass Pipe Nipple, Threaded on Both Ends, 1/2 NPT, 9" Long		McMaster-Carr	https://www.mcmaster.com/4568K514/	1
71	Hose-5		Reactor Input Hose	1/2" ID Flexible PCV Tubing			2

Item	Part Number	Description		STOCK (IF MANUFACTURED)	Vendor	Web Link	QTY
72	1556A17		Zinc-Plated Steel Corner Bracket, 4" x 4" x 7/8"		McMaster-Carr	https://www.mcmaster.com/1556A17/	4
73	NUT-6		Hex Machine Screw Nut, 8 - 32 UNC				8
74	7082K86		Cable, Black Outer Insulation, 10 Gauge, 4 Wires		McMaster-Carr	https://www.mcmaster.com/7082K86/	1
75	7454T32		Garden Hose, Brass GHT Male x GHT Female, 1/2" ID, 11/16" OD		McMaster-Carr	https://www.mcmaster.com/7454T32/	1
77	7164K49		Grounded Four-Blade Straight Plug, NEMA L15-30		McMaster-Carr	https://www.mcmaster.com/7164K49/	1

Appendix 2: EE User Manual

I. Setup

Under ordinary operation, the Process Trainer is not meant to be taken apart and put back together. For instructions on how to use the Process Trainer, proceed to the Startup section. This section covers how to put the trainer together. Please be aware that putting this together requires skilled personnel, and this document cannot be guaranteed to be perfectly accurate. The person who completes the wiring must be careful to use safe electrical techniques in constructing the device. This Process Trainer has been designed without any current-controlled devices (all grounds are connected), and any future additions should bear this in mind.

As such, nearly everything can be grounded to one common ground -- and in fact, most devices unless noted otherwise need to be connected to this ground to ensure proper operation. This ground must be connected primarily to the two 480W switching power supplies, which provide most of the power to the devices in the Process Trainer. Do not use the PLC or HMI power supplies to power anything except for the signal conditioners, flow meters, the heater relay, and the control signals sent to the voltage-controlled pumps and valves.

Appendix A details all of the PLC connections. Connecting everything as shown to the PLC will enable HMI and LabView control over the Process Trainer (given that the control variables are connected properly to power through the 480W power supplies). The PLC has many unused ports; this is intended so that designers in the future can expand the Process Trainer's functionality with more sensors and control variables. There are 8 unused digital inputs, 5 unused analog voltage inputs, five relay outputs, and 4 analog voltage outputs. The four thermocouple inputs, six analog voltage outputs, one relay output, and three analog voltage inputs are currently used and incorporated into the PLC and HMI.

Appendix B illustrates the wiring for the entire system. It has a detailed wire diagram which shows the connections for each electrical component. Ensure the reader understands electrical symbols to fully understand the diagram.

For reprogramming the PLC, the PLC must be in "Stop" mode and connected via Ethernet to the PC with the CLICK PLC software on it. The PLC's address is 196.254.236.96, and you will have to disconnect the PC from the internet and wait for its own address to become 196.254.236.95. Then, click the "Offline" button just above the main Ladder Logic screen. If all goes well, you will see the PLC on the first row, and then you'll be able to connect to it.

When adding or removing modules from the PLC, ensure that the PLC is disconnected from any and all power. Do not attempt to "hot plug" modules; this will damage them and potentially the CPU module as well.

To reprogram the HMI, connect the HMI via Ethernet to the same local network as the PC with the C-more proprietary software on it. You can choose to connect upon opening the software or later. If

later, click the “Panel” tab in the Navigation sidebar and connect via Ethernet to the panel, which will appear in the list of Ethernet devices. When all reprogramming is finished, reconnect everything.

II. Startup

To begin operation of the process trainer, ensure that the power cable is plugged into a 240V 3-phase outlet. The HMI and all other systems will turn on automatically once the breaker switch is switched to ON. Wait a minimum of eleven (11) seconds for the PLC to startup and prepare the thermocouple module. At startup, your process trainer’s HMI should display the Startup Screen. That is all that you need to do to start up your Process Trainer! If the HMI does not appear with the startup screen (it may take a minute) or you are still facing issues, check the troubleshooting section at the end.

This Process Trainer supports three different methods of control: LabView Control, HMI PID Control, and Full Manual Control. The startup screen provides the selection between these different modes. To begin operating in the desired mode, simply press on the appropriate button.

Startup Screen

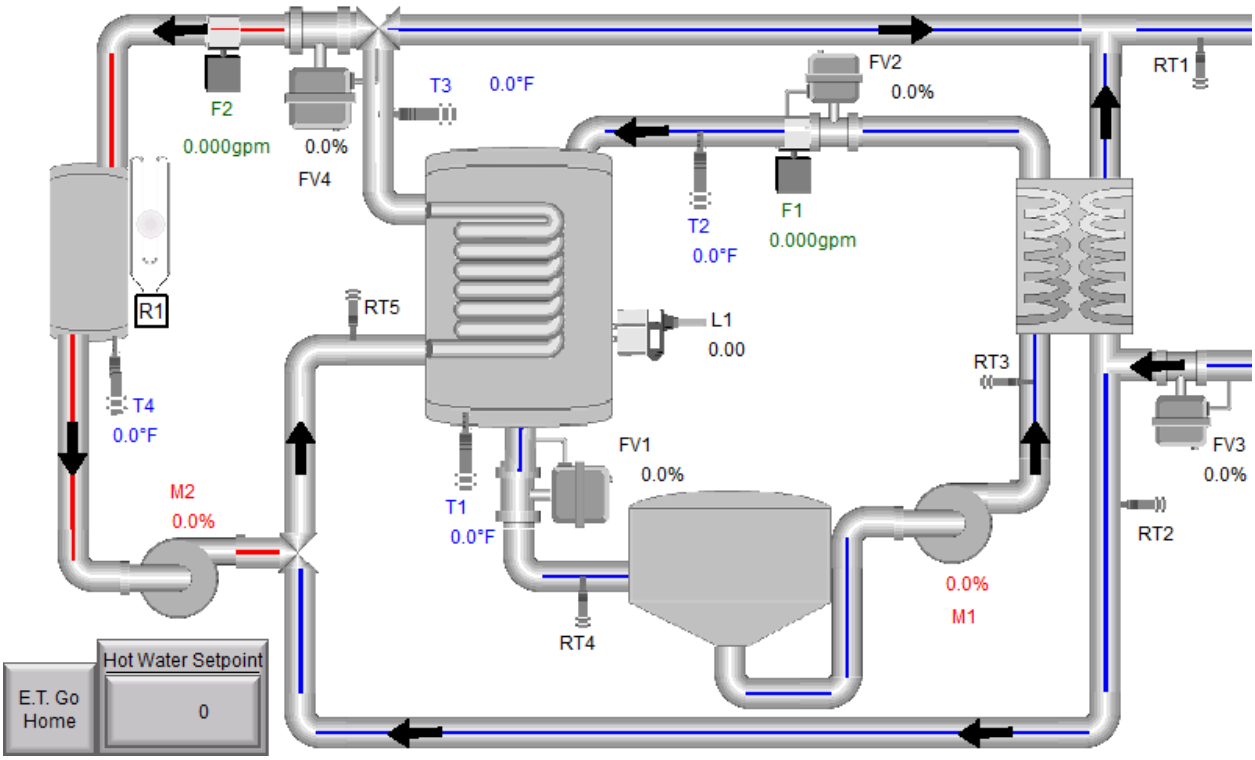
1. **Run with Labview** - This button takes you to the LabView Control screen. Select this button if you intend to operate the Process Trainer with an external LabView program.

2. **Preheat** - This button sets the hot water tank setpoint to 200 degrees Fahrenheit. This enables you to begin the hot water heating immediately to reduce wait time later in operation. The current temperature of the hot water tank is displayed next to the button.
3. **SET Heater Setpoint TO 0** - This button will automatically set the heater's setpoint to 0 so that the heater will not begin heating.
4. **Tare Load Cells** - This button will zero the load cells.
5. **Run with HMI** - This button takes you to the PID Home screen. Select this button if you intend to operate the Process Trainer through PID control or Full Manual Control.

III. Modes of Operation

A. LabVIEW Control

Selecting the 'Run with LabVIEW' button on the Startup Screen brings you to the LabVIEW Control screen. While on this screen, control of the Process Trainer is given to your connected computer running LabVIEW. To control the Process Trainer with LabVIEW it must be connected to the inline ethernet cable. This is the only way to connect to the PLC with a PC. The PLC will communicate with a LabVIEW VI to output the sensor values and read in the given values for the control variables (motors and control valves). A user provided LabVIEW program is required to operate using this mode. The user program should be able to take in the sensor data from the given VI and write out the desired control variable outputs. When running the Process Trainer using LabVIEW, pay careful attention to the levels inside the hot water tank and the reactant tank to ensure that you do not run the pumps dry.

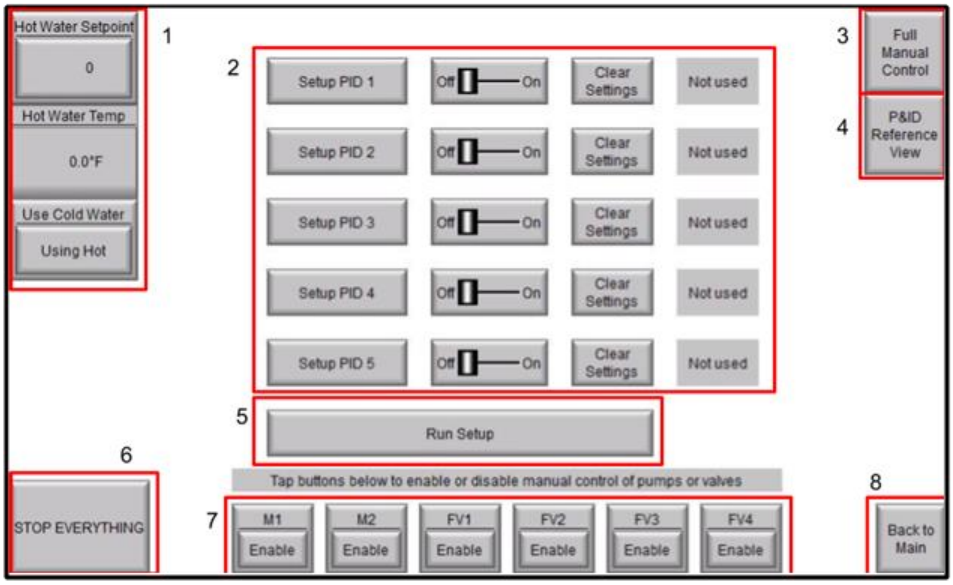


LabVIEW display screen.

1. **Hot Water Setpoint** - This numeric entry allows you to set the setpoint for the hot water when selected. Enter a value in Fahrenheit when prompted and the Process Trainer will heat the water to the desired temperature.
2. **Home** - This button returns to the Startup Screen. NOTE: LabVIEW communication will be halted if you select this button.
3. **Notes:** This screen shows the values for all sensors and control variables. There are few control options on this screen and the values for the variables are determined by a user provided LabVIEW program communicating with the provided VI. The sensors and variables are color-coded to the following system: BLUE - Temperature, GREEN - Flow Meter, RED - Pump, BLACK - Control Valve.

B. PID

Selecting the 'Run with HMI' button on the Startup Screen will bring you to the PID Home screen. This is where setup and enabling of all the PID loops is done.



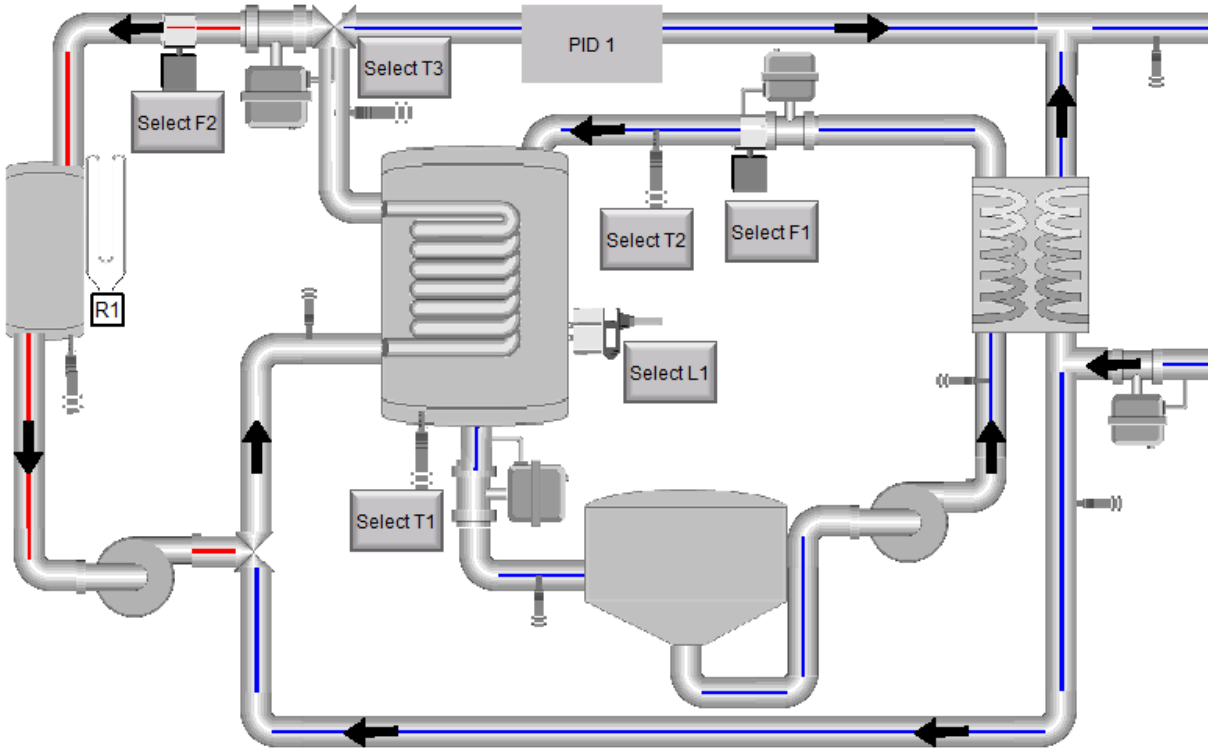
PID Home

1. **Hot / Cold Water** - The Hot Water Setpoint button allows you to set the temperature of the hot water tank. Input a value in Fahrenheit and the Process Trainer will heat the tank to that temperature. The temperature of the hot water tank is displayed immediately below. If you wish to operate the Process Trainer using the Cold Water loop, press the Use Cold Water button. This allows the PLC to properly interpret the temperature and valve assignments.
2. **Setup Panel** - These buttons are used to go to the setup screens and enable each loop. The Process Trainer can support up to 5 simultaneous PID loops. The ON/OFF slider next to each setup button enables or disables that PID loop. This is useful if you want to keep the settings for a particular loop while disabling its functionality temporarily. The Clear Settings button

clears all PID loop assignments previously made for that single loop. Press this for each unused PID loop to ensure that there are no unintended conflicts during operation.

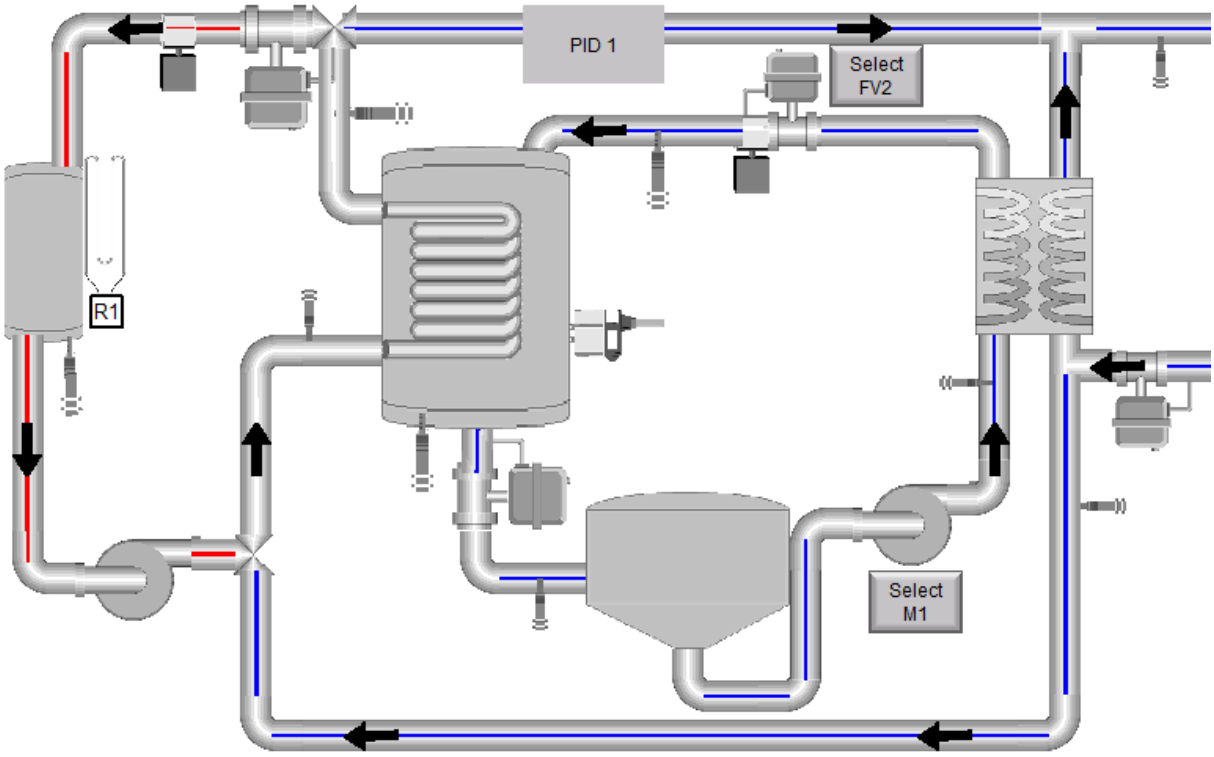
3. **Full Manual Control** - This button leads to the Full Manual Control screen. Select this if you intend to operate the Process Trainer without PID loops by manually assigning each value. See Section II.C Full Manual Control for more information.
4. **P&ID Reference View** - This button leads to the P&ID Reference screen. Select this if you wish to view the P&ID with all current values for variables and sensors.
5. **Run Setup** - This button starts all setup PID loops. This button leads to the PID Run screen and will begin operation of all setup loops. Ensure that PID loops are enabled / disabled as desired before pressing this button.
6. **Stop** - This button halts all motors and opens all control valves. Select this button IMMEDIATELY if there is an issue with the operation of the Process Trainer to avoid any damage to yourself or the machine.
7. **Manual Enables** - These buttons enable / disable manual control of specific control variables. Select the appropriate button if you wish to have a specific setpoint for a variable. These will only work if the variable is not being modified by an enabled PID loop. Setpoints for these variables can be modified once you are in the PID Run screens.
8. **Back** - This button returns you to the Startup screen.

To begin setup of PID control from the HMI, select a PID Setup button. This will start the setup process for the selected loop and bring you to the Select Sensor screen.



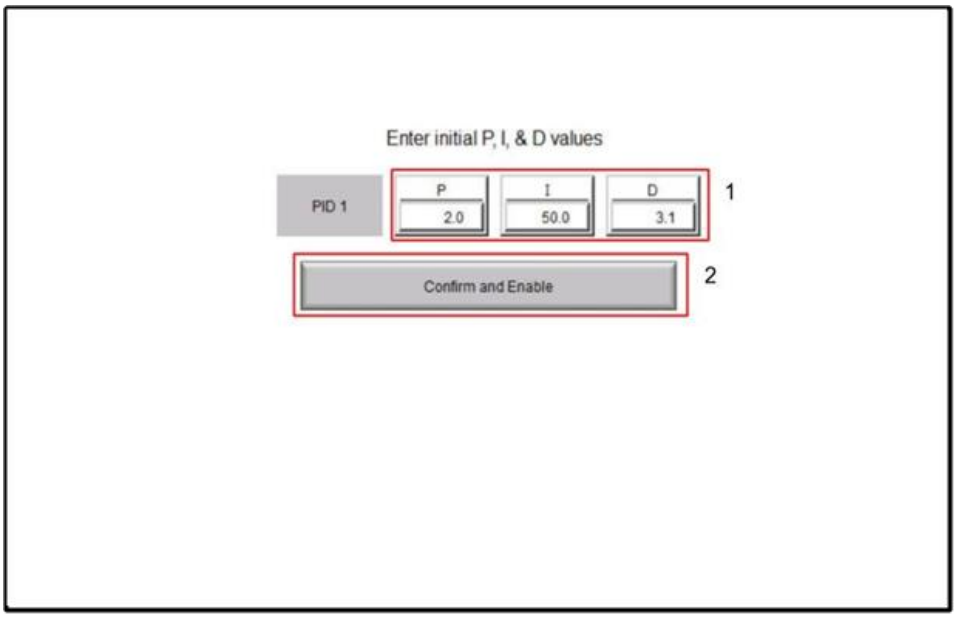
Initial PID screen where a sensor is chosen.

1. **Notes:** This screen is the first part of setting up a PID control loop on the HMI. Select the sensor that you wish to control with this PID loop. Selecting a sensor will bring you to the Select Control Variable screen. You cannot return to this screen unless you restart the setup process.



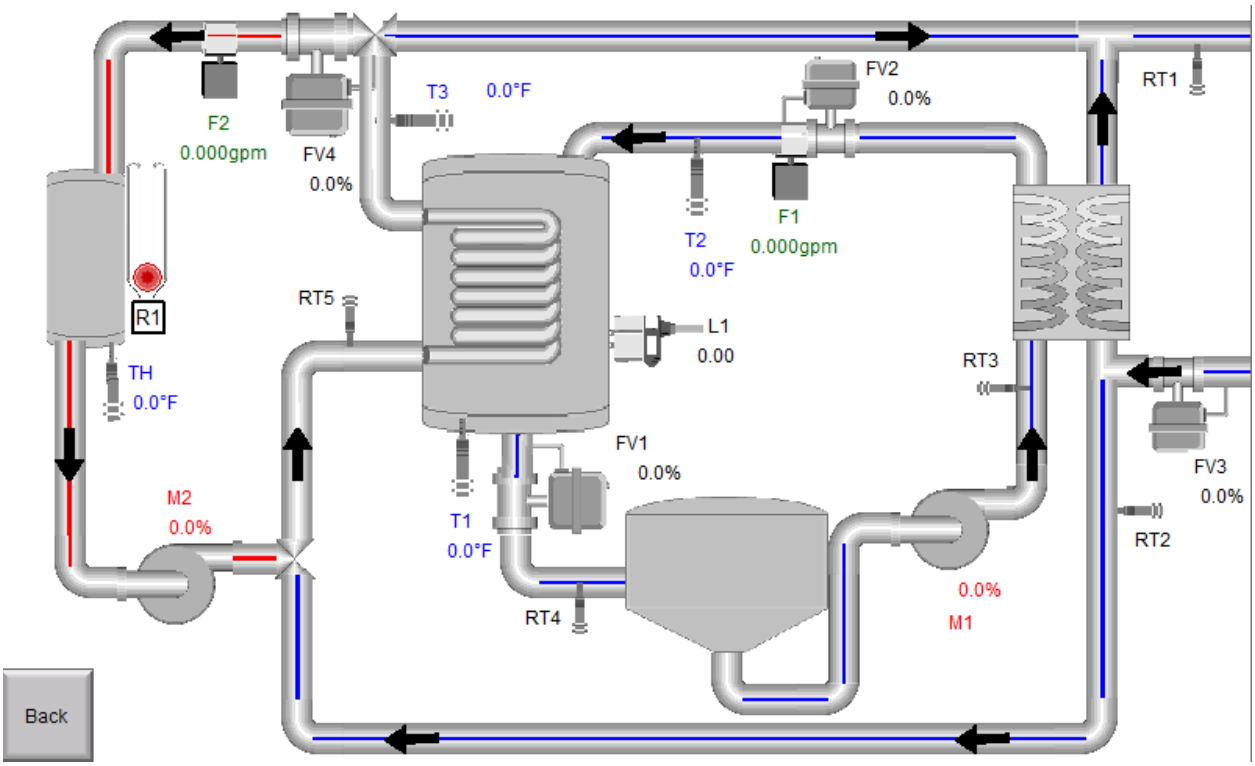
Initial PID screen where the control variable is chosen.

1. **Notes:** This screen allows you to select which pump, control valve, or relay you wish to use to control the sensor selected on the previous screen. All control variables are shown in the figure above, but you will only be able to select variables that are able to control the sensor you selected. (i.e. FV3 will not be available if you select F2). Selecting a control variable will bring you to the PID Values screen.



PID Values Screen

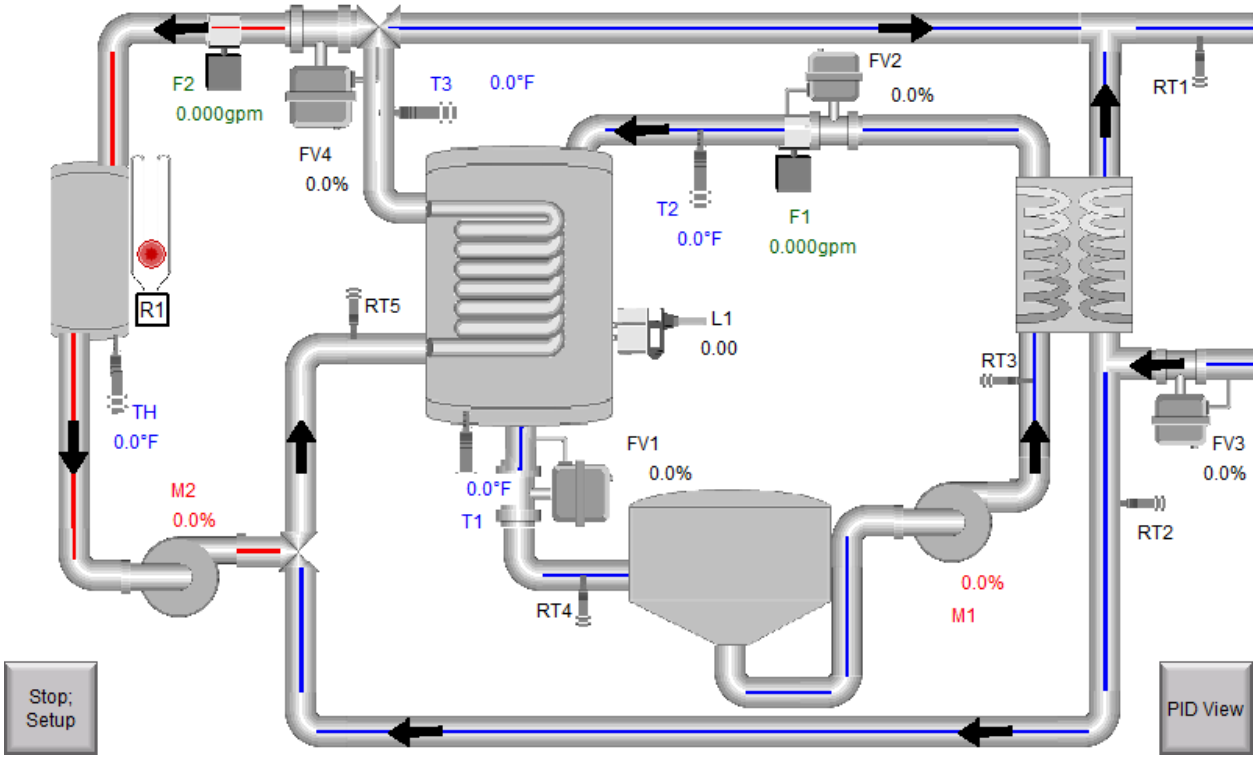
1. **PID Value Entries** - These buttons will allow you to enter initial values for the P, I, and D constants for your PID control loop. Selecting one will bring up a numeric entry keypad.
2. **Confirm** - This button will conclude the setup of the PID loop. It automatically enables the loop and brings you back to the PID Home screen. The setpoint of the loop is automatically set to the current sensor state; run the setup must be completed before the setpoint can be changed.



P&ID Reference Screen

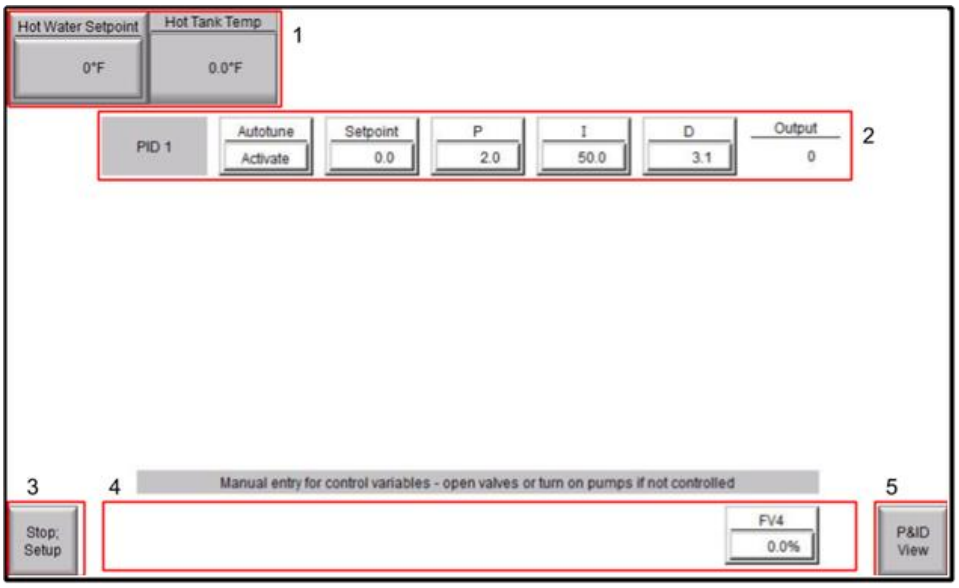
1. **Notes:** This screen is simply available from the PID Home screen to allow the user to view the P&ID and recall labels for each sensor and control variable. The Back button returns you to the PID Home screen.

After you have completed setup for the PID loops you wish to operate, ensure that they and all desired manually controlled variables are enabled. To start the process, select the Run Setup button on PID Home. This will bring you to the PID Run screen.



PID Run Screen

1. **Stop** - This button returns you to the PID Home screen. All PID control is halted. Control variables will keep their last values. To clear all values, select the STOP EVERYTHING on the PID Home screen.
2. **PID View** - This button brings you to the PID View screen. This allows you to modify P, I, and D values for your control loops, as well as set setpoints for all of your manually controlled variables. When beginning operation for the first time, it is necessary to enter this view to set the initial PID setpoints and manual control setpoints.
3. **Notes:** This screen is intended to allow you to view each sensor and control variable's value simultaneously. This is the main screen during PID operation.

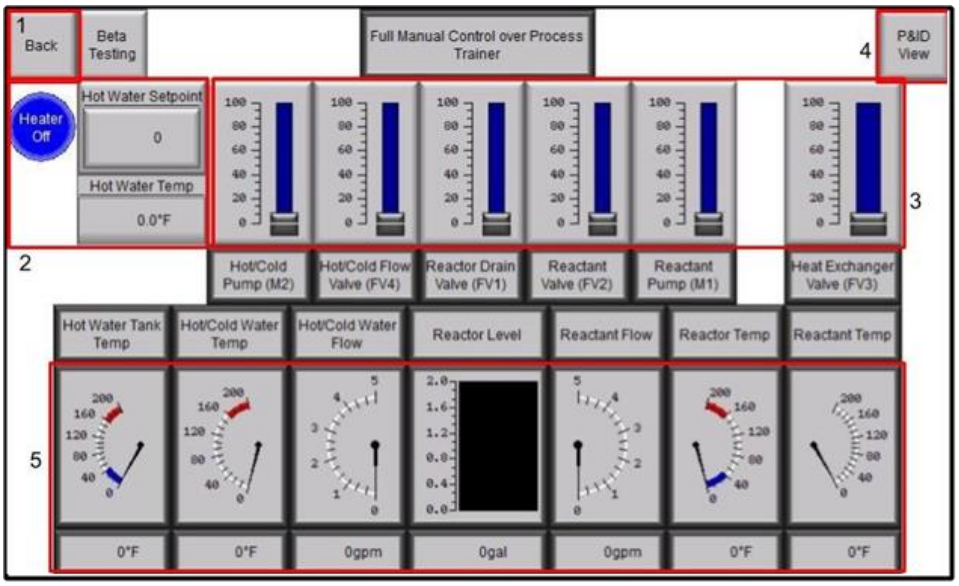


PID View Screen

1. **Hot Water Setpoint** - This button allows you to modify the hot water tank temperature setpoint and view the current temperature of the tank. Select the setpoint button to enter a new value.
2. **PID Values** - This set of buttons allows you to modify PID values and set the setpoint. A row of buttons will be visible for each enabled PID loop. The example above only has PID 1 enabled. The autotune button activates the autotune function of the PLC. This will automatically set PID values after a period of time. NOTE: This function is not very accurate and should only be used if necessary. The control output for the PID loop is also visible in this row.
3. **Stop** - This button halts PID control loop operation and returns you to the PID Home screen.
4. **Manual Control Values** - All enabled manual control variables will be visible in this area. In the example above, only FV4 was enabled on the PID Home screen. Selecting a variable will bring up a numeric entry to manually modify the value of each variable. You will often have to use some of these in order to run your PID loops. For example, you need to open the control valve yourself to run the pump in the same section.
5. **P&ID View** - This button will return you to the PID Run screen.

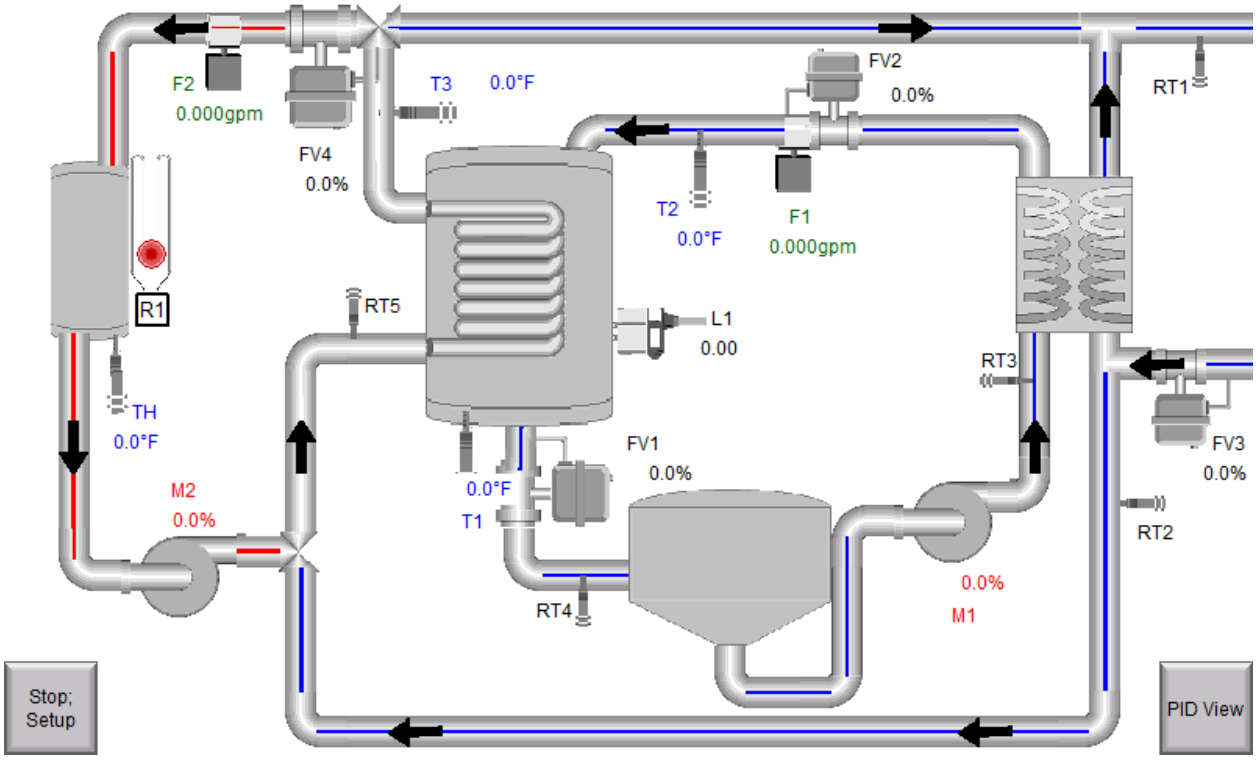
C. Full Manual Control

Selecting the Full Manual Control button on the PID Home screen brings you to the Full Manual Control screen. This is used to manually set all the control variables to specific values and monitor the Process Trainer's behavior. NOTE: This method of control is NOT PID and is just used to manually set all the valve and motor values to watch their effect on the process trainer.



Full Manual Control Screen

1. **Back** - This button will take you back to the PID Home screen. Any control variables you set here will remain in the state to which you set them when you exit this page.
2. **Hot Water Setpoint / Indicator** - Use this to input the desired temperature of water in the hot water tank. The indicator shows whether the tank's heater is currently on or not.
3. **Process Variable Sliders** - These six sliders control the two pumps and the four control valves, in percent of their maximum aperture or speed. These values are retentive.
4. **Reference P&ID View** - This button switches screens to the Full Manual Control P&ID screen below. Tap this to see the flow diagram of the entire system and to determine which element is which.
5. **Process Indicators** - These seven indicators show the current values of F1, F2, L1, T1, T2, T3 and TH. They have been arranged so that the sliders directly above the indicators affect the respective indicators below.



Full Manual Control - P&ID View

1. **Back** - This button takes you back to the Full Manual Control screen.
2. **Notes:** This screen simply gives an overview of the sensors and control variables in the system. No control variables can be changed, but the user can see the current state of the system and see which sensors and control variables correspond to which names (like M2 or FV1).

IV. Troubleshooting

A. Common Issues

1. **Ensure that the device is plugged in.**
   Additionally, look for signs that the devices are all getting power; check the "DC OK" lights on the Rhino 480W Switching Power Supplies, check the PLC PWR light, and see whether the HMI is on (it also has a power light, but the screen should be on if it is getting power).

2. **Ensure the PLC is in Run Mode.**
   The PLC has a small slide switch on it; the Process Trainer will not operate unless this switch is slid to the "Run" position. You can verify the state by looking at the Run LED next to the switch.

3. **LabVIEW communication doesn't work.**

This can be caused by several things. Check items 1 and 2 above. Next, check to see whether LabVIEW is running. Then, check the computer's IP address. Type "ipconfig" into the Command Prompt and see what it is. It must be 169.254.236.95 for the PLC to send to the right address. Our Windows PC always went to this address when it was connected to the PLC and disconnected from any internet connection; the PLC seems to tell the PC that it should be its IP address. Try disconnecting from the internet and connecting the PLC via ethernet to your computer. Wait for about 30s and see what your IP is again using ipconfig. If it is still not working, check to make sure that you have the DSC module installed and the Shared Variable Engine running.

B. Other Problems

1. **Why are temperature readings slow?**

   The thermocouple module attached to the PLC has a latency which increases depending on the number of inputs used. With all four inputs used, the module reads all of them once every 1.6s.

2. **LabVIEW can't install DSC module**

   This can happen. For some reason computers seem to balk at installing Microsoft Server 2008, which is necessary for the DSC module. The DSC module is included with the student license that BC has, but if you can't install it, call National Instruments support. They were able to help us. Or, use the computer which has it already installed and copy your files off of it when you're done.

3. **I changed a setpoint / control variable / sensor on a control loop and it doesn't seem to be responding.**

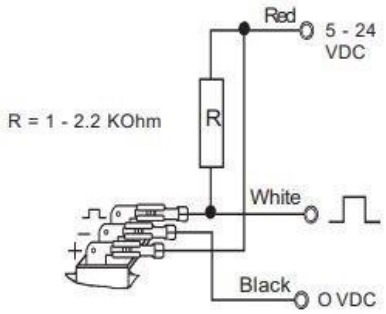
   You are encountering one of the *features* of the PID control loops in the CLICK PLC. There's a thing called "bias" which seems to try to prevent odd changes in the system from affecting the response too badly. However, what can sometimes happen is that an unresponsive or slow-to-respond system (such as the temperature of the hot water tank) will make the PLC think that it needs more bias, sending the bias into the 1000's of percents. Once the bias comes back down to a reasonable value, the loop will behave normally. The simplest solution is to try going back to the PID Home and then tap "Run Setup" again. It's the equivalent of turning it off and on.

V. PLC Connections Diagram

The diagram above illustrates all the devices that are connected to the PLC and shows which ports on the PLC to use. All sensors and control variables included in the PLC program and connected to the PLC are shown above. Additionally, the figure above shows how to wire up the valve controllers and the signal conditioners. The boxes (like FV2 ctrl) are used simply to show which PLC port to connect to which device. Each individual device is connected as shown in the smaller images above, and they are all connected to different PLC port as shown by the boxes. See the image below and the datasheet for the Omega FTB2003 flow meter for more information about that device. Make

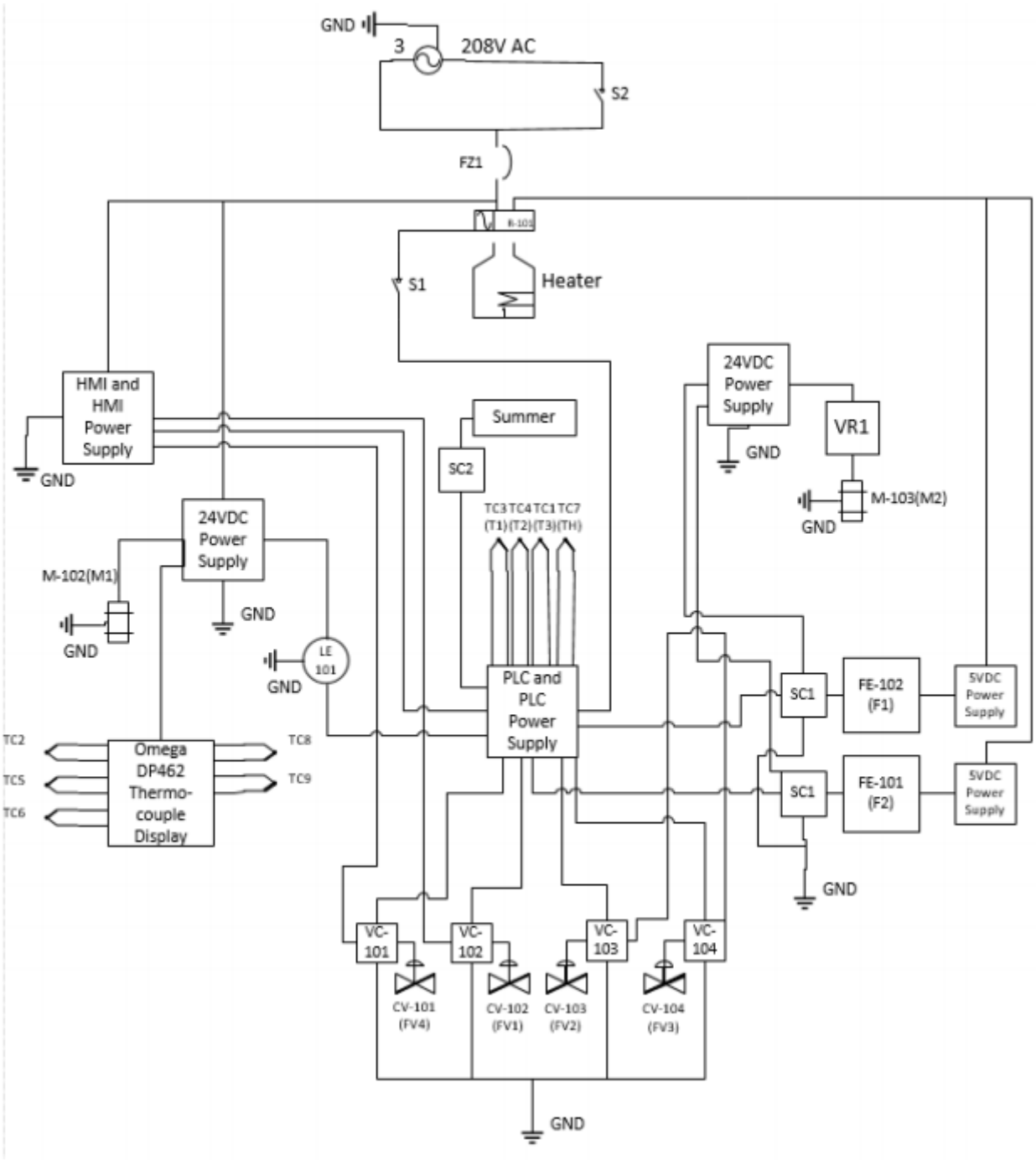
sure that the HMI's serial cable is connected to both the HMI's serial port (the large one with many pins) and the PLC's serial port shown above.

The HMI is quite simple to connect and power up. Simply use the dedicated supply attached to the HMI, and plug (or wire) the input to the power supply to 120VAC. The supply looks suspiciously like a laptop charger, which it should because that is exactly what it is. To power the HMI, the supply must be between about 12 and 24VDC with an output power rating of at least 20W. However, once the PLC and HMI are connected through the serial (and both are powered on) the HMI will control the PLC.



Using this image for reference, connect the 5V to meter wire to the + in the figure above, and connect the Meter Ground wire to the - pin (middle pin), and connect the Meter Output wire to the remaining terminal of the flow meter.

VI. Full Wiring Diagram



Above is the full wiring diagram of the system. This is meant to provide an overview of the entire system, and some caution must be taken when constructing this setup to ensure that it is electrically sound. First, use the diagram in Appendix A, and then use this diagram for the remainder. This schematic shows that the input to the device is a 240V three-phase AC input. This

device uses the three phases to split up the power requirements by attaching high current items to separate phases. However, care is taken to try to balance the loading of the three phases. Note that currently, no level switches alert the PLC that the tanks are empty or full. The user must be aware of such things and control the PLC appropriately. However, the lights on the devices alert the user to potential issues.

VR1 is currently on the process trainer; it is a motor drive from the previous project. This part has not been studied, and the motor must be properly connected to it using its datasheet schematics. Below is a table of each element with an explanation of what it does.

Element	Description
208VAC	208VAC three phase from wall outlet
24VDC Power Supply	Rhino 120-240VAC input 480W, 24VDC Switching Power Supply PSV24-480S
CV-101 (FV4)	Hot/cold water control valve
CV-102 (FV1)	Reactor drain control valve
CV-103 (FV2)	Flow valve for reactant loop
CV-104 (FV3)	Control valve for heat exchanger cold water input from mains
FZ1	15A fast-acting fuse to protect pump
FZ2	15A fast-acting fuse to protect pump
FE-101 (F2)	Hot/cold water loop flow sensor
FE-102 (F3)	Reactant loop flow sensor
HMI and HMI power supply	C-more EA9-T7CL-R; communicates with the PLC using RS-232 and powered with ex-laptop charger
Heater	240AC 3kW heater
LE-101 (L1)	Load cells and summing module (level indicator)

M-101 (M2)	Hot water pump – GRI Pumps DC brushless 24V with 0-5V control
M-102 (M1)	Reactant pump – GRI Pumps DC brushless 24V with 0-5V control
M-103	Stirring motor; simple DC brushed
PLC	Click series PLC with CPU, power supply, and I/O modules from Automation Direct; see the EE specifications and the I/O port diagram
R-101 (R1/H1)	Relay controls the hot water tank's coil
SC1	Flow sensor and signal conditioner for hot/cold water loop
SC2	Flow sensor and signal conditioner for reactant loop
TC1 (T3)	Measures hot/cold water going into the reactor
TC2	Measures temperature of hot/cold water coming out of the reactor
TC3 (T1)	Measures temperature of the reactor
TC4 (T2)	Measures reactant entering reactor
TC5	Read only thermocouple for cold output
TC6	Read only thermocouple for cold input
TC7	Read only thermocouple reactant input
TC8	Read only thermocouple reactor output
TC9	Read only thermocouple reactor coil output
Thermocouple Display	Omega DP462, which supports up to six thermocouples; simply switch between which input source is selected.
VC-101 (FV4)	Valve controller – analog voltage to PWM – for hot/cold flow valve
VC-102 (FV1)	Valve controller – analog voltage to PWM – for reactor drain
VC-103 (FV2)	Valve controller – analog voltage to PWM – for reactant control valve
VC-104 (FV3)	Valve controller – analog voltage to PWM – for heat exchanger cold water from house

VR1	Speed controller (adjustable DC voltage regulator) for stirring rod – currently on process trainer

Appendix 3: Wire Diagrams and Specifications

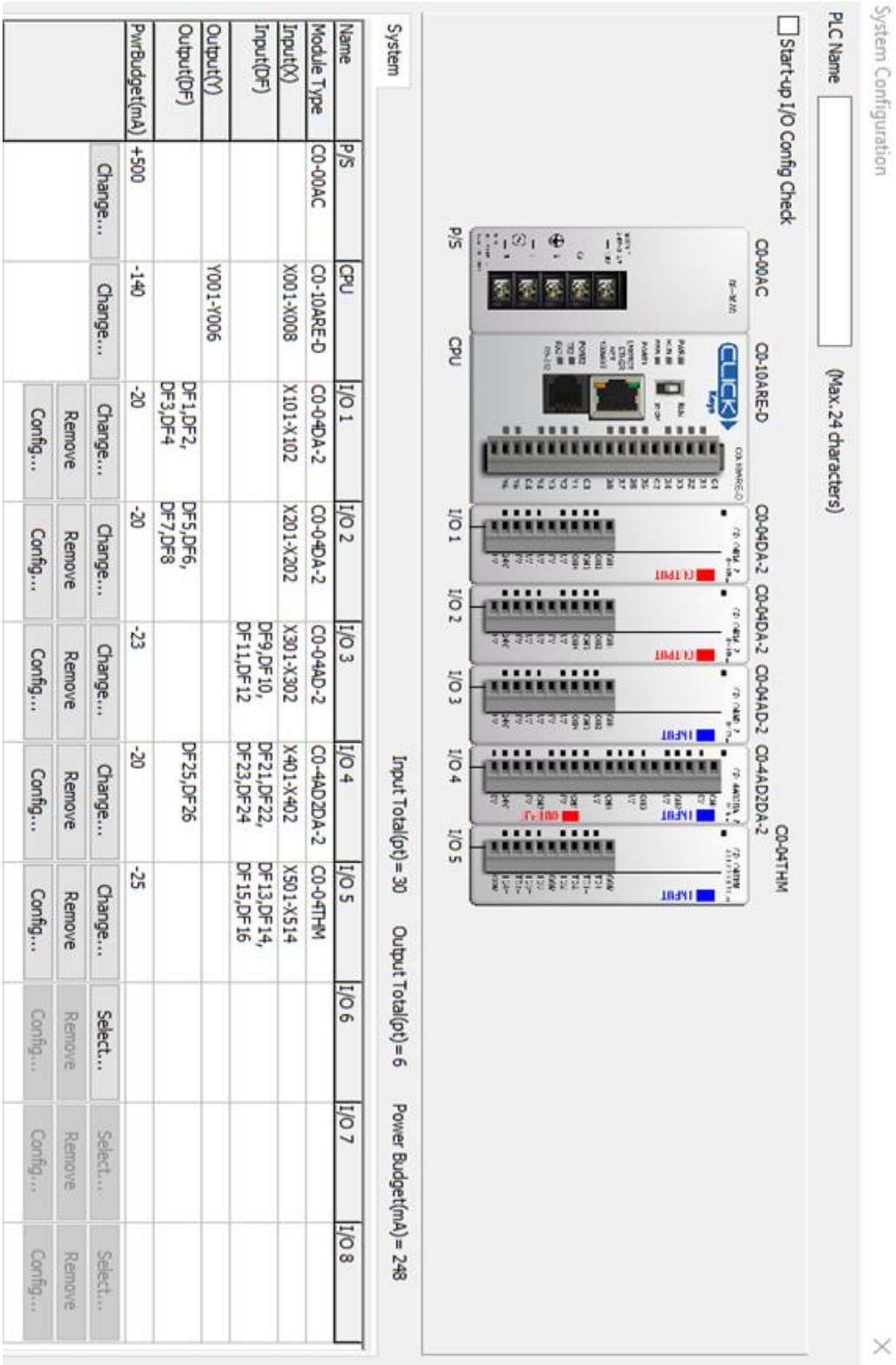


Figure 3-1. Front configuration of input and output blocks with nicknames for each device

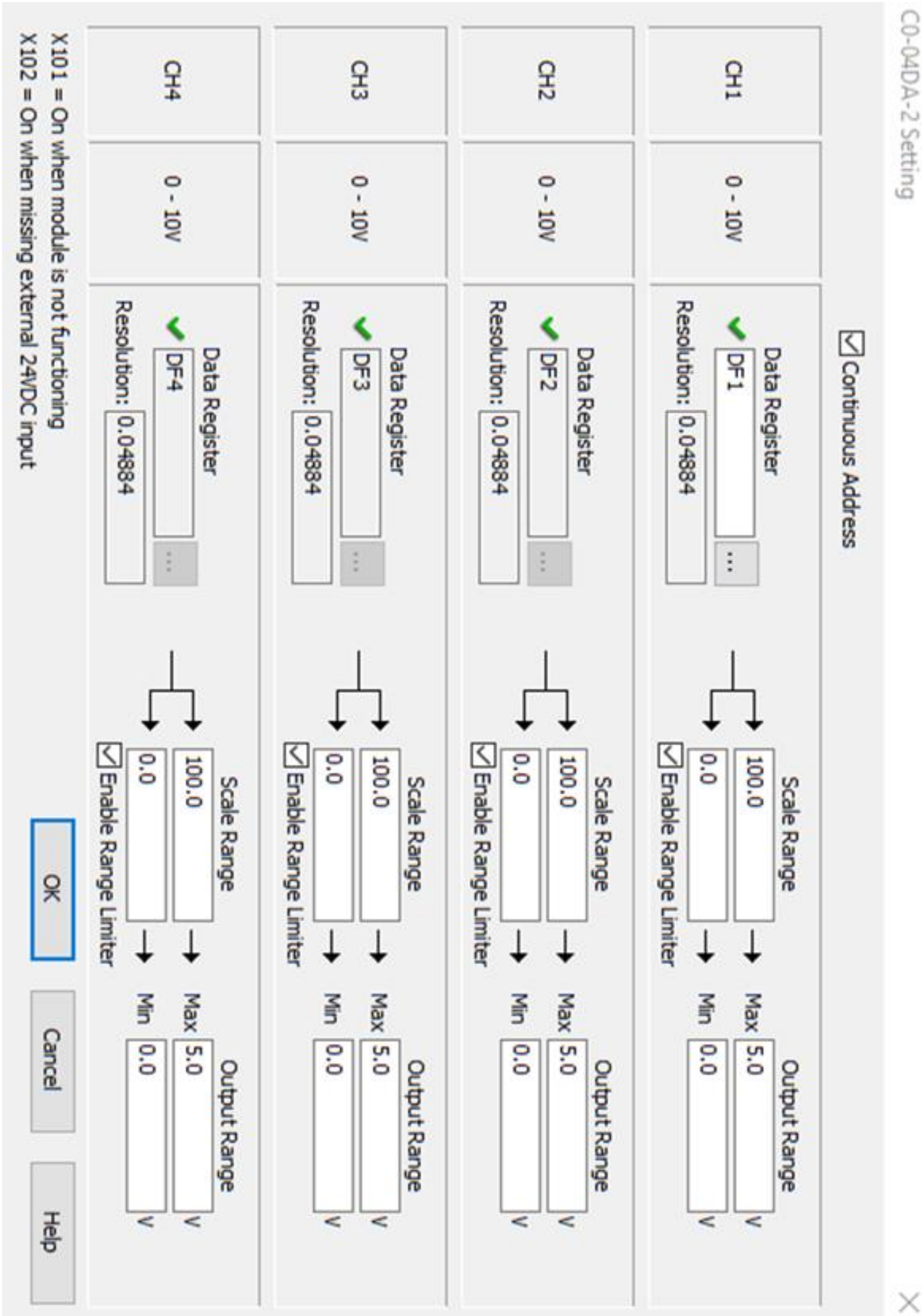


Figure 3-2. I/O1 which displays the outputs for channels 1-4 that controls the two pumps and two of the control valves.

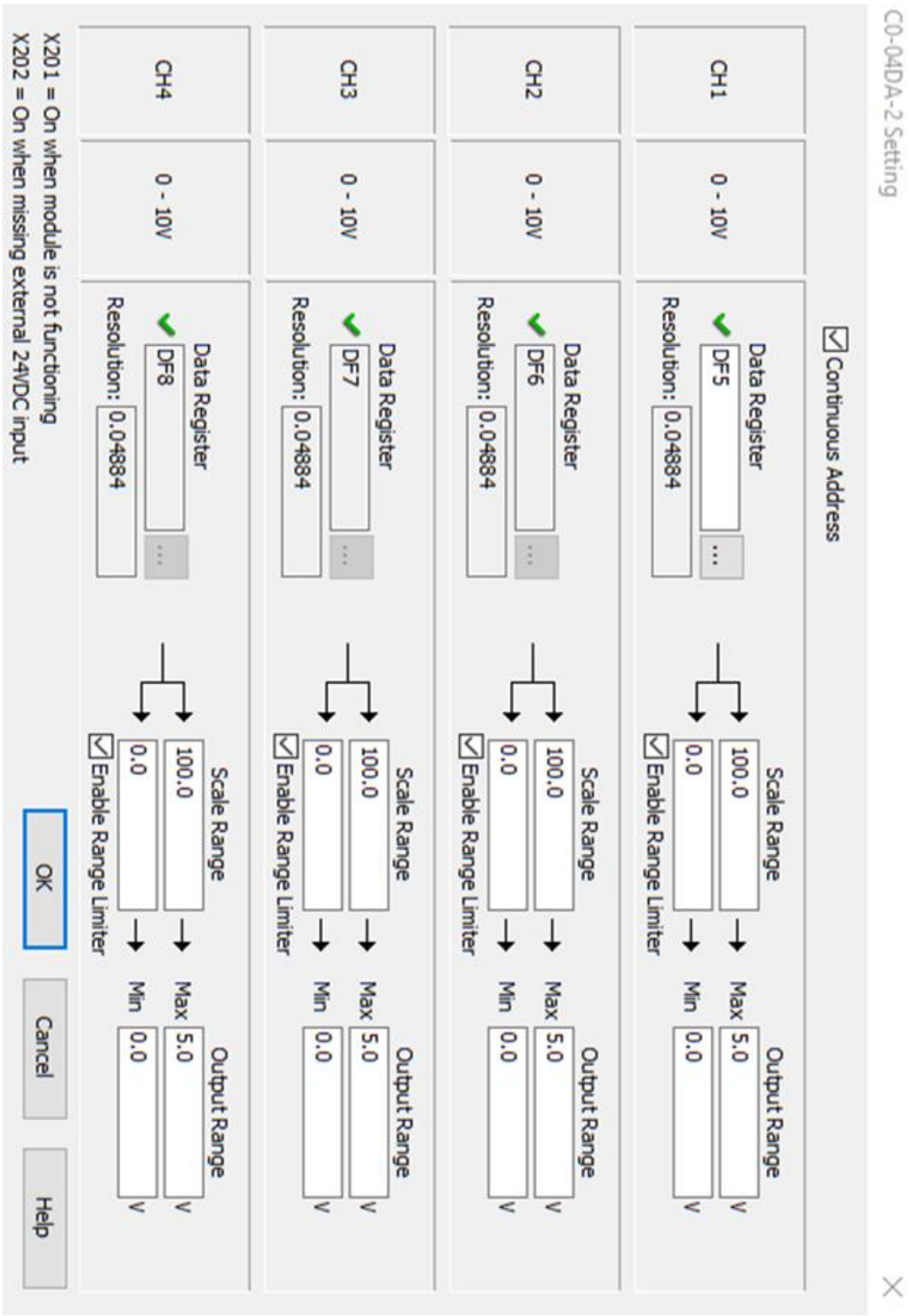


Figure 3-3. I/O 2 which displays the output values for channels 1-4 that controls two of the four control valves.

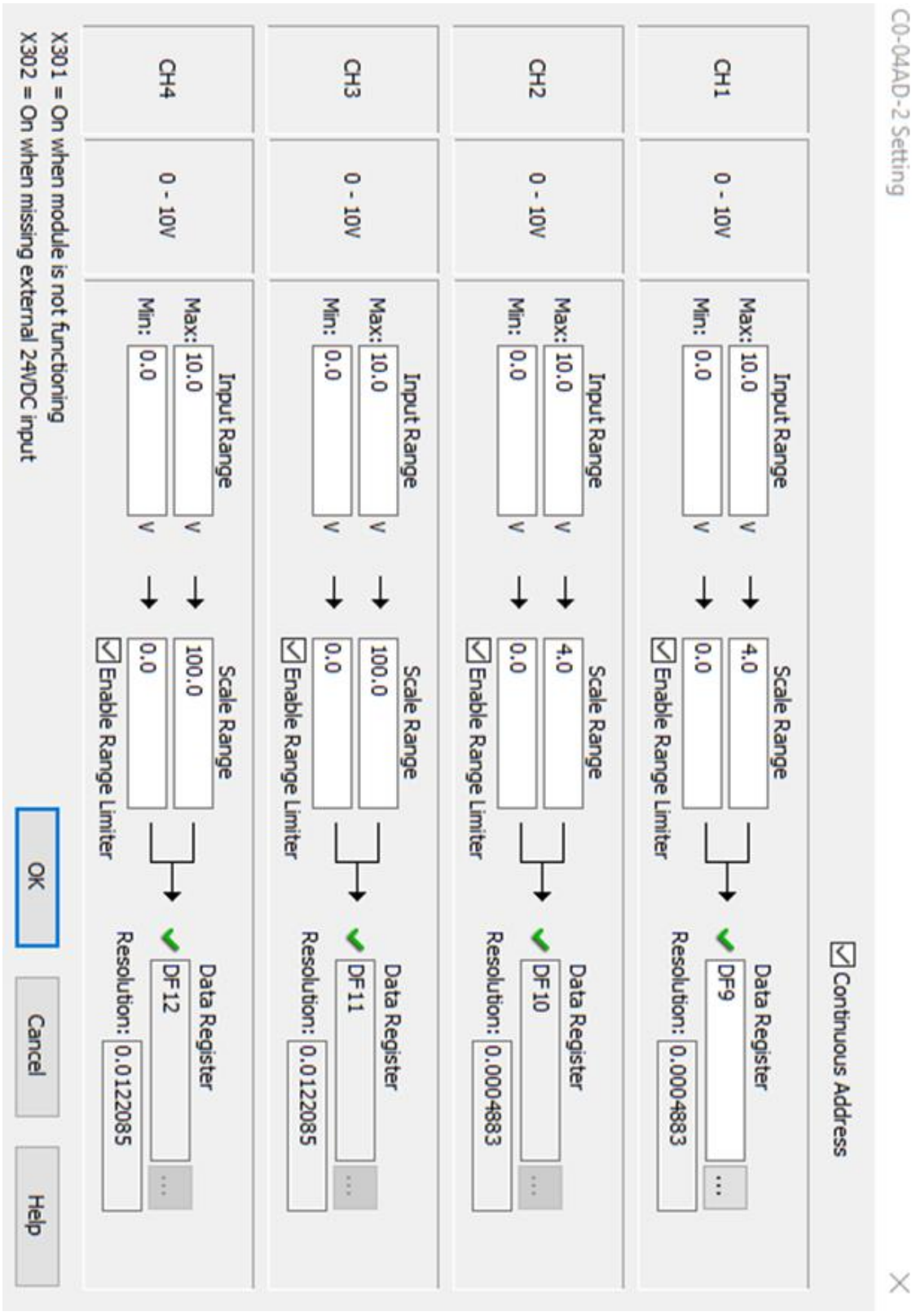


Figure 3-4. I/O 3 which displays the inputs for channels 1-4 and what the PLC is looking for from two flow sensors and one level sensor.

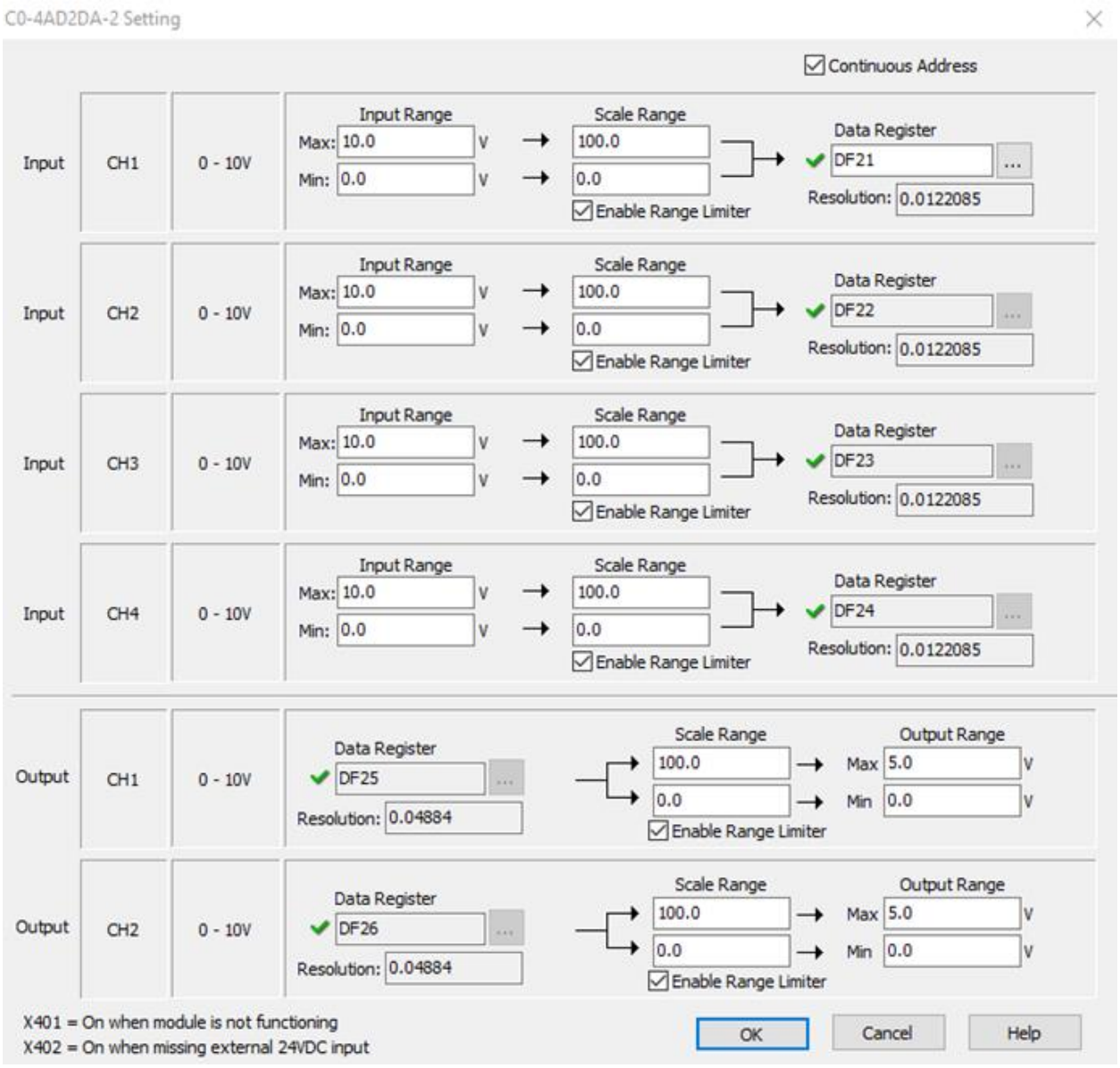


Figure 3-5. I/O 4 which has an input and output ports. This channel is not currently utilized by anything in the system.

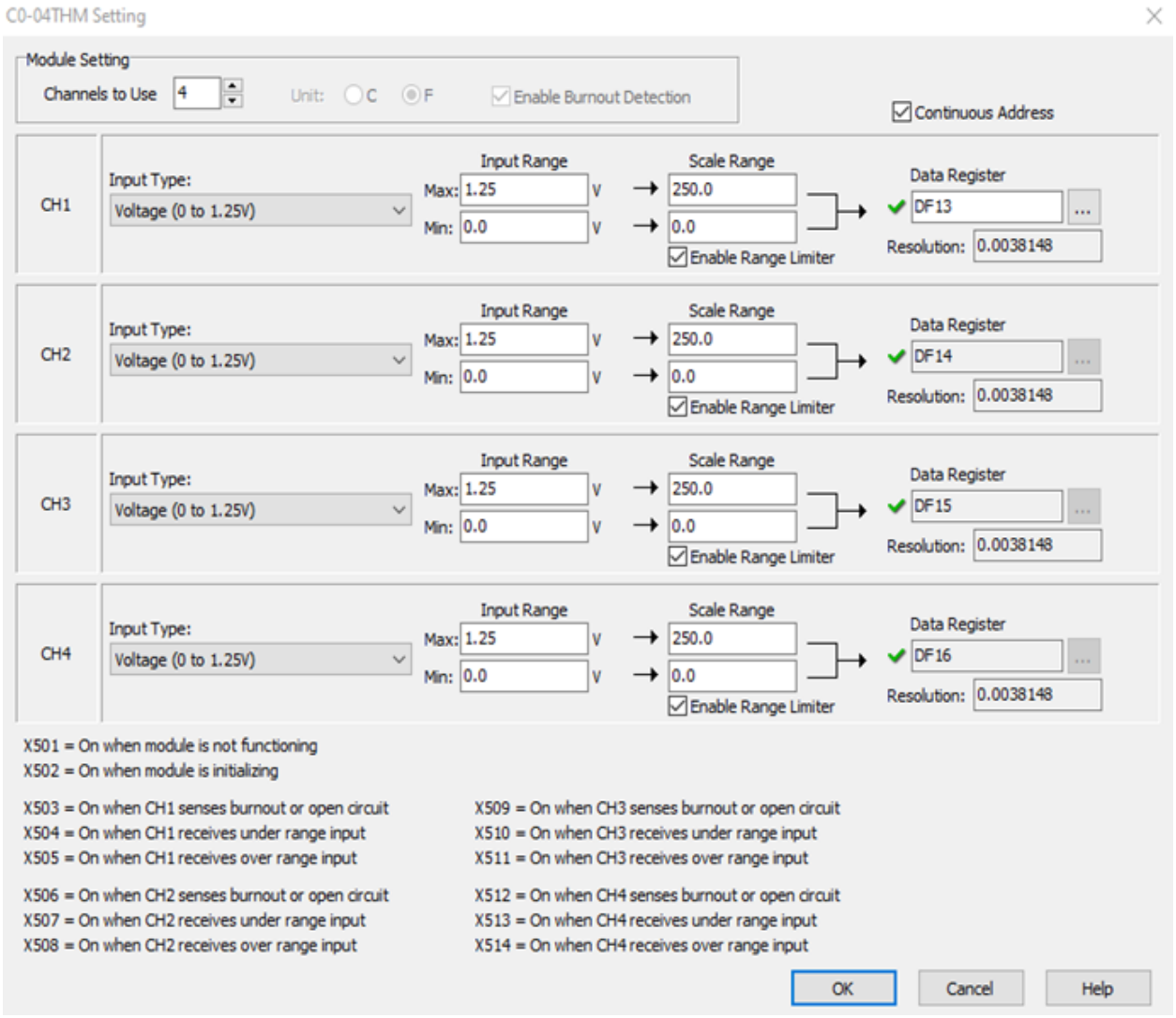


Figure 3-6. I/O 5 which displays the inputs from the four thermocouples

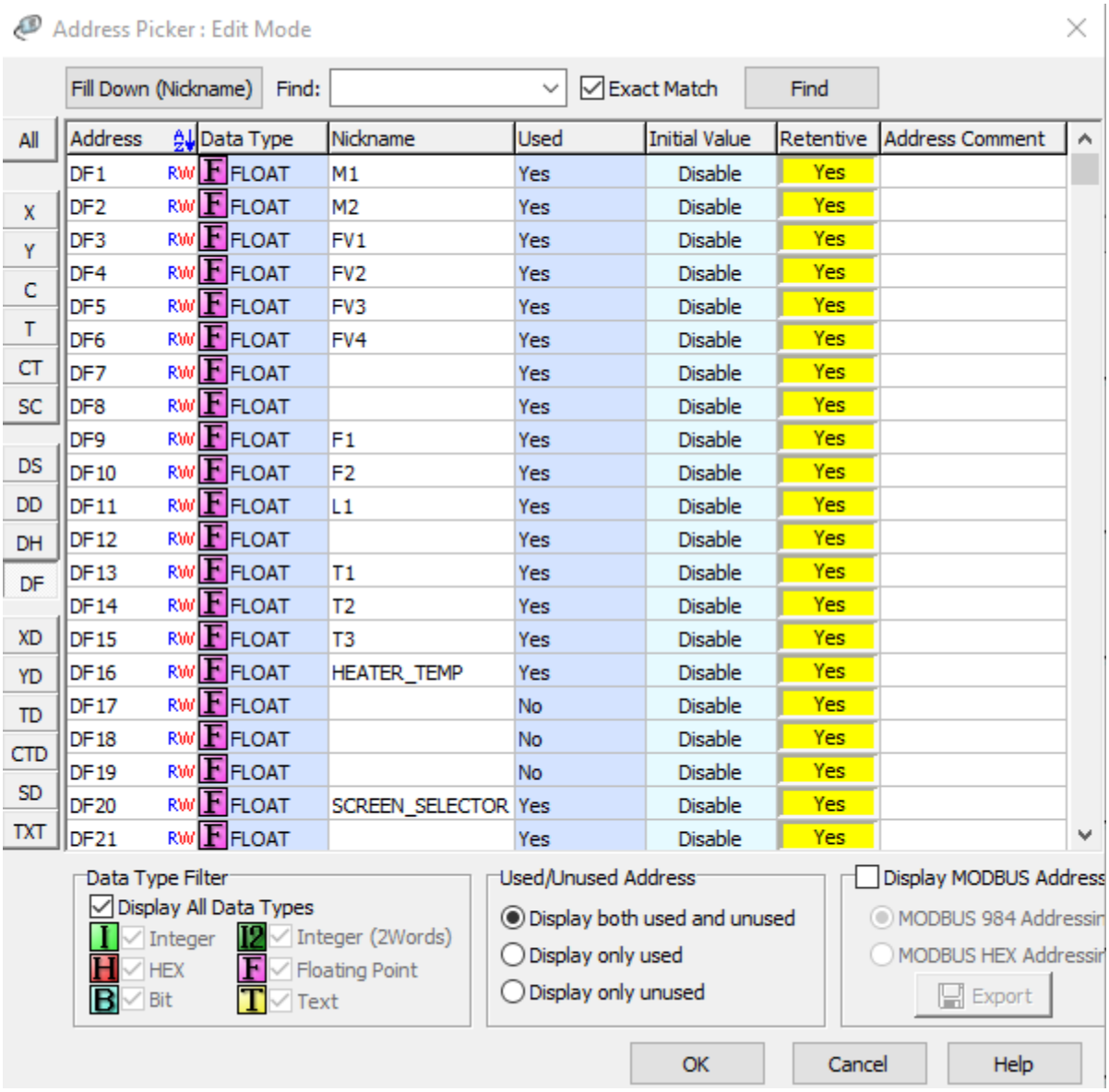


Figure 3-7. Address for all DF variables associated with the nicknames for each device.

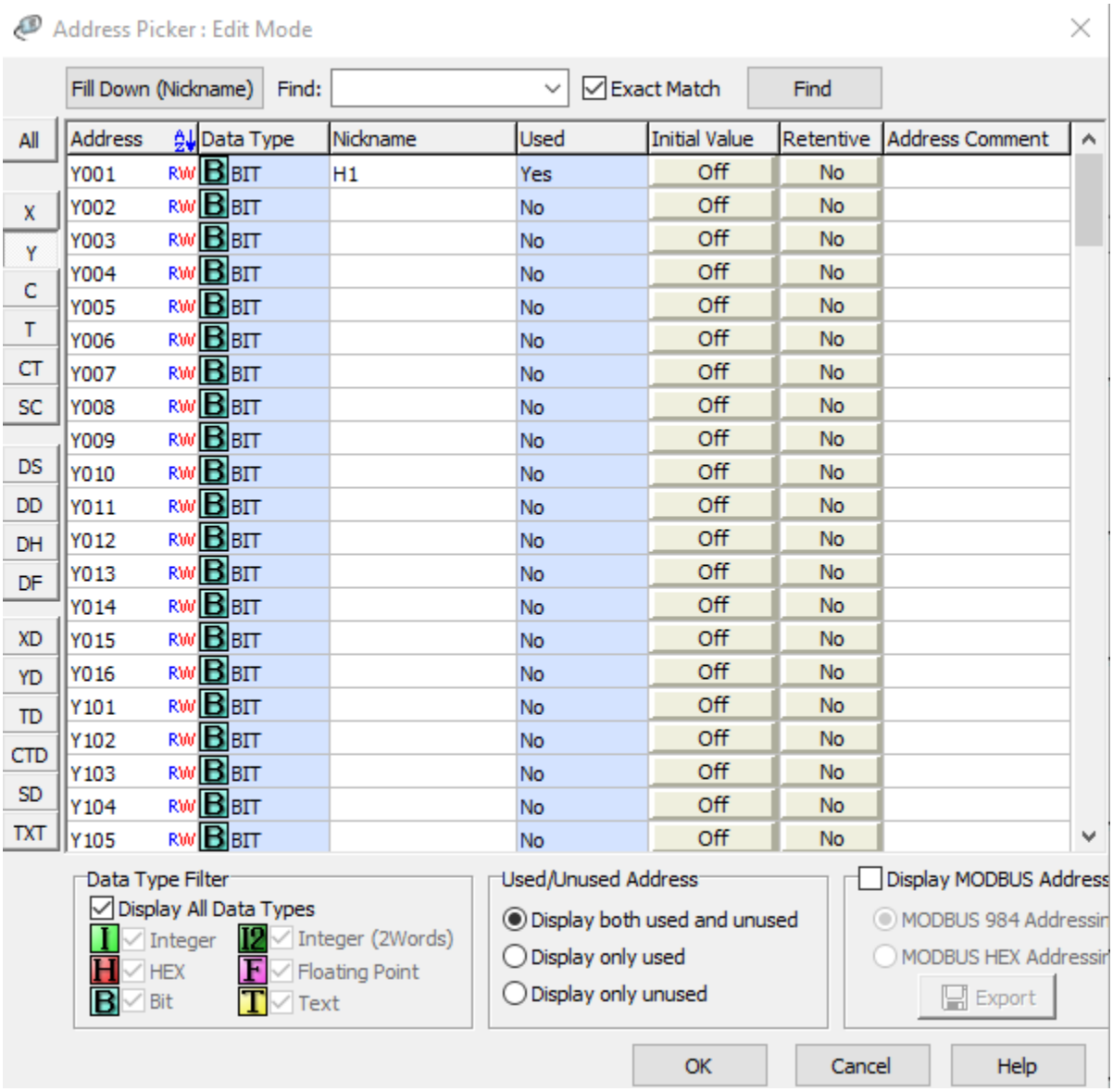


Figure 3-8. Address picker for all Y named variables. This is specific to the main unit which is to control the heater.

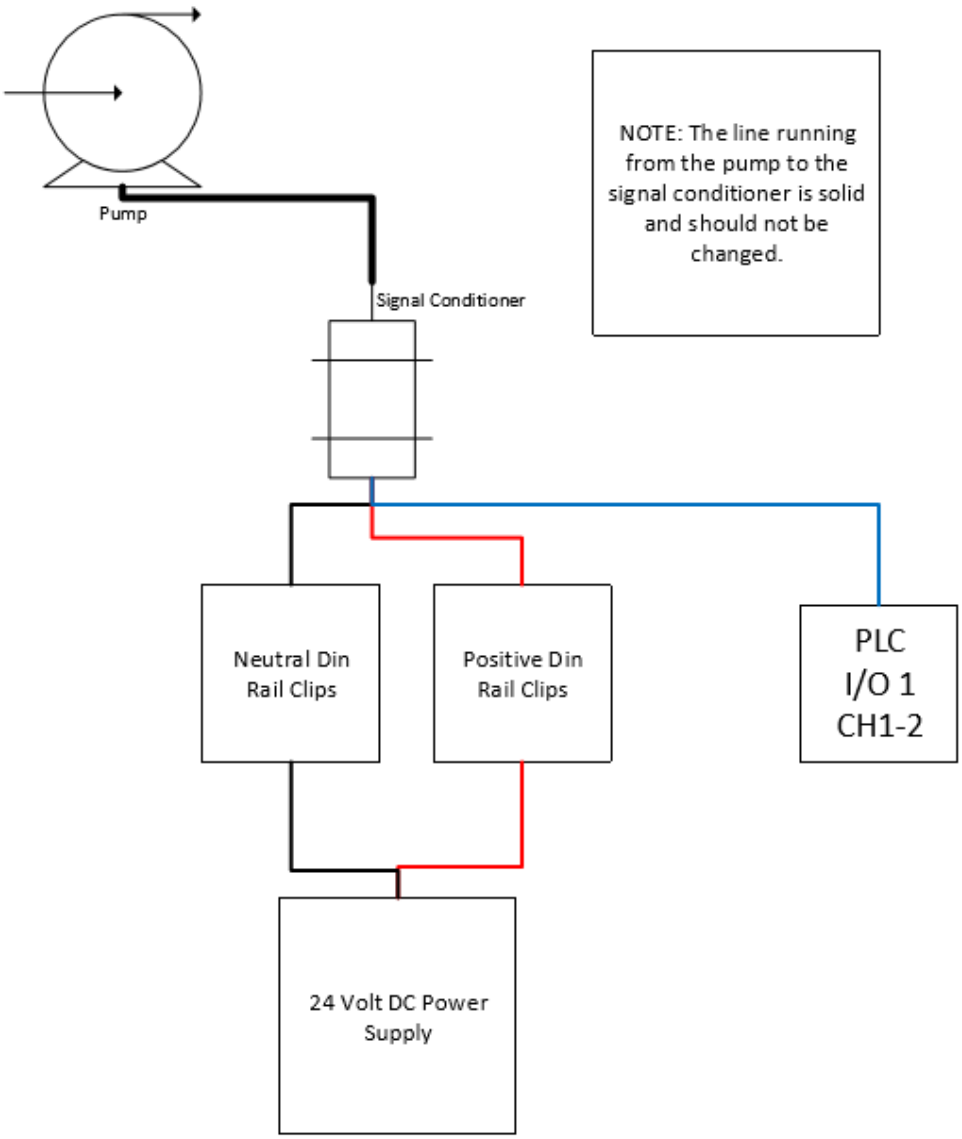


Figure 3-9. Wire diagram for pump connection to power source and PLC.

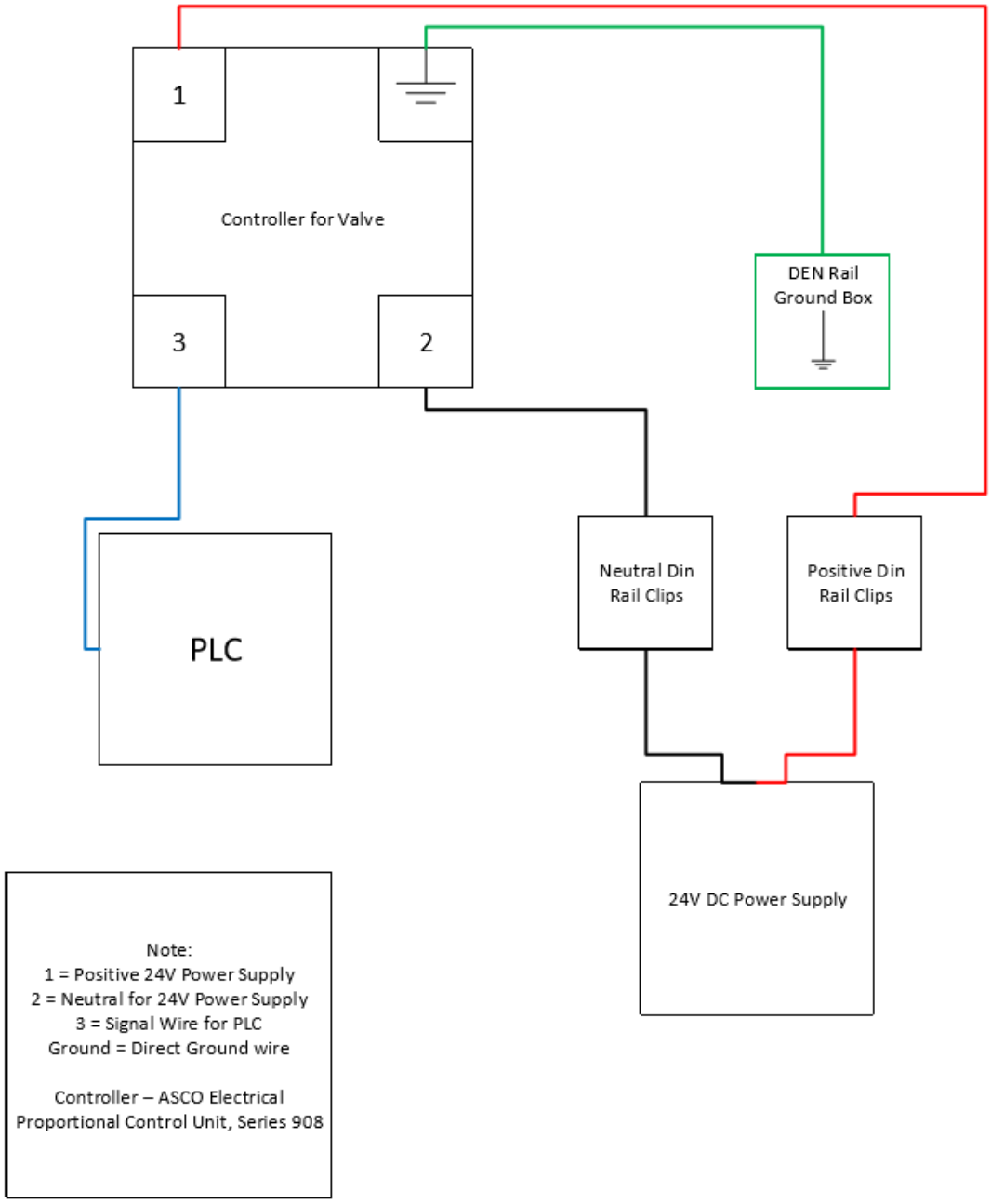


Figure 3-10. Wire diagram showing connection from controller for the control valves to the power source and PLC.

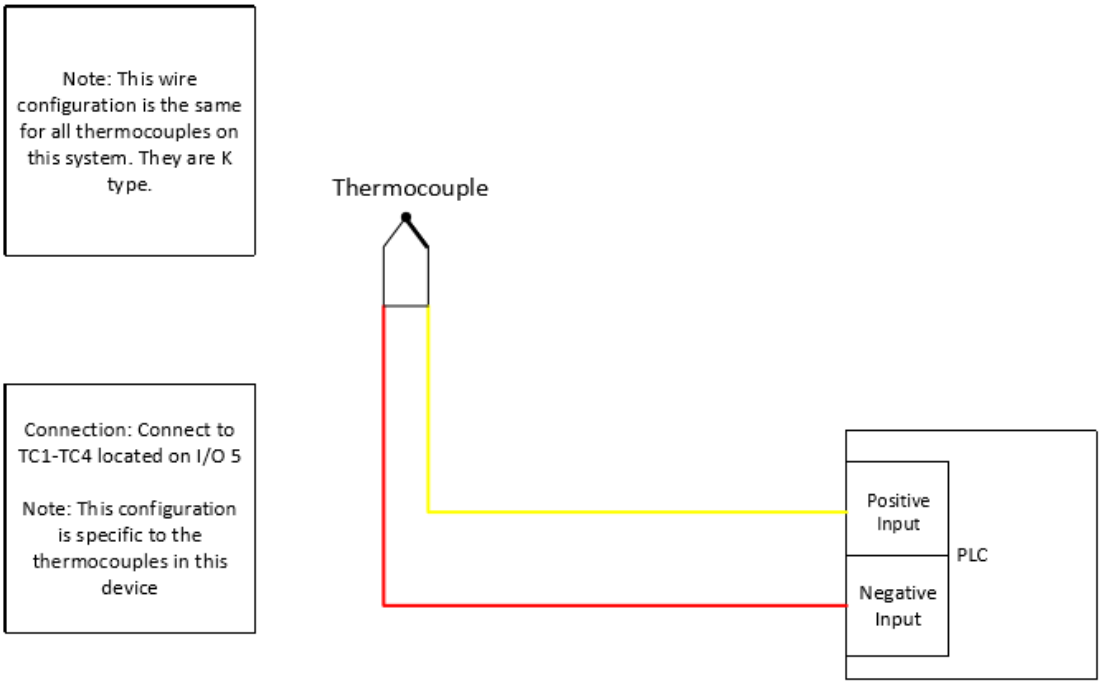


Figure 3-11. Wire diagram showing connections for each K type thermocouple.

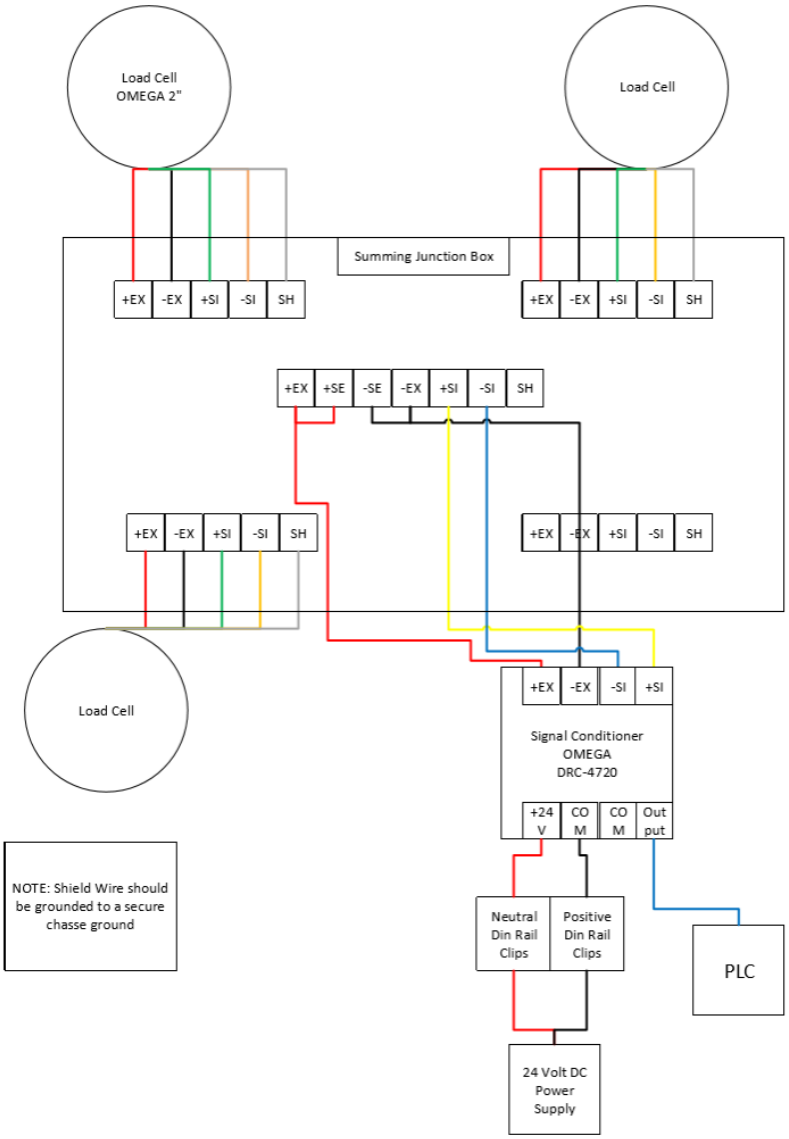


Figure 3-12. Wire diagram showing the connections from each load cell into the summing box, signal conditioner, and then the PLC.

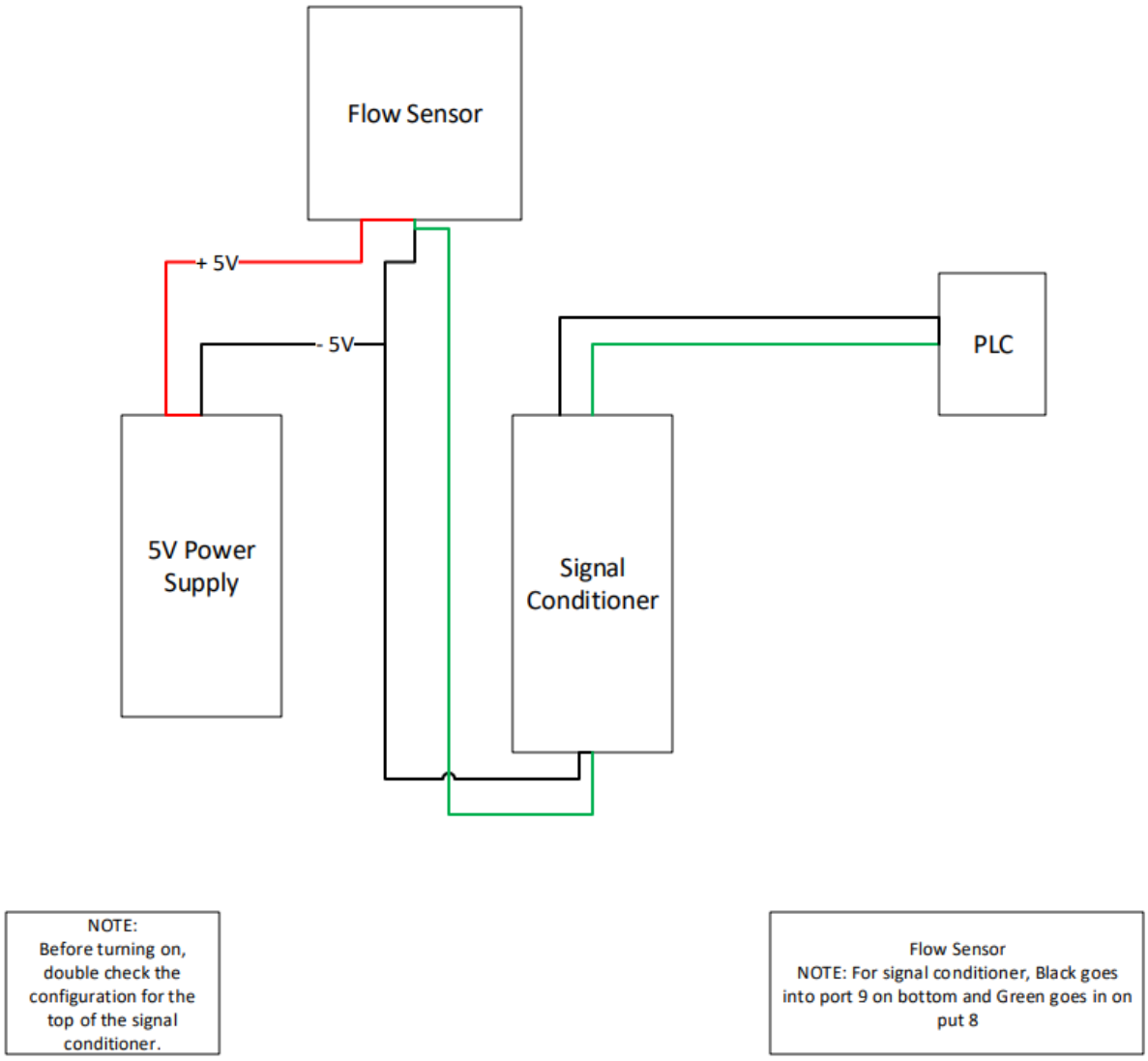


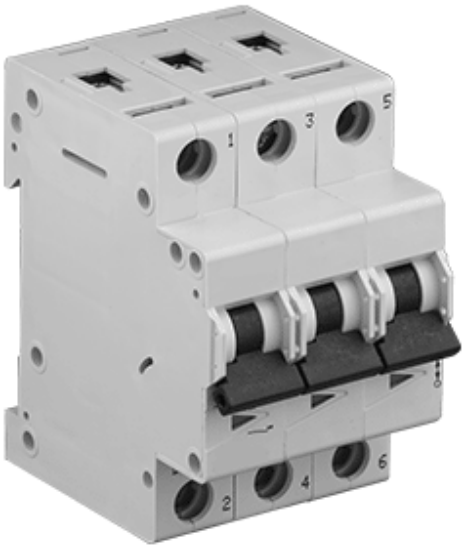
Figure 3-13. Displays the wiring for both flow sensors.

Appendix 4: Unit Specification Sheets

1. AC Branch Circuit Breaker
2. Rhino 24V Power Supplies
3. HMI Screen
4. PLC Power Supplies - Input and Output boxes
5. Ethernet PLC Main Port
6. Digital Agitator Speed Control Screen
7. Heater
8. Solid Sate Relay
9. Heat Exchanger
10. Proportional Pump
11. Proportional Control Valve
12. Proportional Control Unit
13. High Accuracy Load Cells
14. Summing Box (Summer)
15. Omega Signal Conditioner (Load Cells)
16. Inline Flow Transmitter
17. Omega Frequency Input Signal Conditioners (Flow Sensors)
18. Omega Thermocouple

DIN-Rail Mount AC Branch Circuit Breaker

High-Inrush, 3 Poles-Toggle Style



Circuit Breaker Type	Thermal/Magnetic
Number of Poles	3
Voltage	277V AC/480YV AC
Frequency	50/60 Hz
Breakthrough Current	10,000 A @ 277 V AC 10,000 A @ 480 V AC
Reset Type	Manual
Manual Reset Style	Toggle
Mounting Location	DIN Rail
For DIN Rail Size	35 mm
Wire Connection Type	Screw-Clamp Terminals
Height	4.13"
Width	2.09"
Depth	2.36"
Temperature Range	25° to 100° F
Features	Time Delay Trip
Specifications Met	UL 489, CSA Certified, IEC European Standards
RoHS	Not Compliant
REACH	Not Compliant
DFARS	Specialty Metals COTS-Exempt
Country of Origin	Spain
ECCN	EAR99

Able to handle high inrush current caused by equipment startup, use these circuit breakers upstream from motors and larger transformer applications. They meet UL 489 requirements for branch circuit protection. All are thermal/magnetic—breakers trip when heat is generated by sustained, low-level overload current, but will trip quickly when the magnetic field in the coil senses a high-current short circuit. Mount directly to DIN rail.

Breakthrough current is the maximum current that the circuit breaker can safely stop in the event of a short circuit.

Alarm (sold separately) sends an audible signal when the breaker is tripped.

RHINO PSV Series DIN Rail Power Supplies

Economical Power Supplies

Highlights and Features

15–100W Models

- Ultra-compact size
- Up to 89% efficiency and built-in active PFC
- Universal AC input voltage
- Full power from –10°C to +55°C
- Low earth leakage current < 0.5 ma @ 264VAC
- Extreme low temperature cold start at –40°C
- NEC Class 2 / Limited Power Source (LPS) certified
- Plastic housing
- UL/cUL 508
- UL/cUL Recognized 60950-1
- CE
- Three year warranty

120–480W Models

- Universal AC input voltage
- Built-in constant current circuit for reactive loads
- Up to 89% efficiency
- Full power from –10°C to +50°C
- Compliance to SEMI F47 @ 200VAC voltage sag immunity
- Metal housing
- UL/cUL 508
- UL/cUL Recognized 60950-1
- CE
- Three year warranty

UL508 UL60950-1

PSV Series Specifications				
Part No.	*Price*	*Output Voltage*	*Maximum Output Power*	*Efficiency (Typ @ 115VAC)*
PSV5-15S	$34.00	5V	15W	79%
PSV5-25S	$47.50	5V	25W	82%
PSV12-50S	$47.50	12V	48W	88%
PSV24-30S	$34.00	24V	30W	87.5%
PSV24-50S	$44.50	24V	50W	89%
PSV24-100S	$60.00	24V	91.2 W	87%
PSV24-120S	$56.00	24V	120W	85%
PSV24-240S	$81.00	24V	240W	88%
PSV24-480S	$142.00	24V	480W	85%
PSV48-120S	$56.00	48V	120W	89%

RHINO PSV5-15S Power Supply

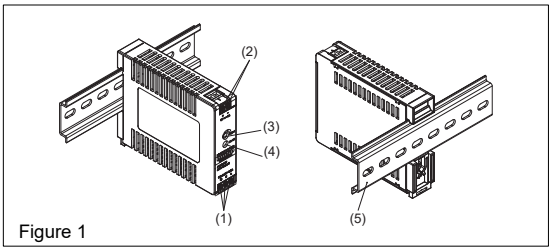


Figure 1

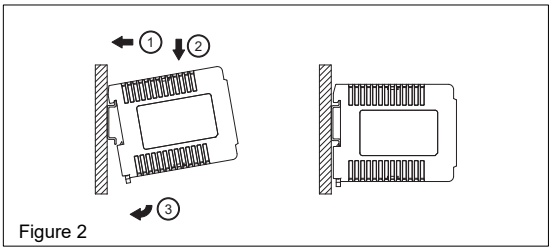


Figure 2

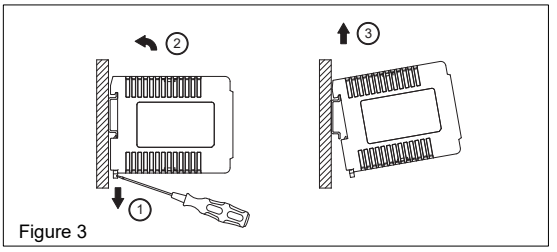


Figure 3

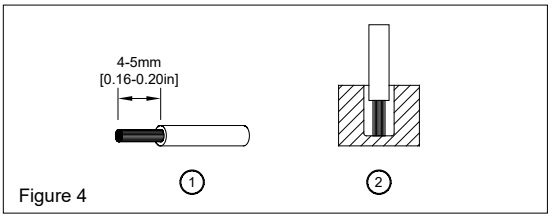


Figure 4

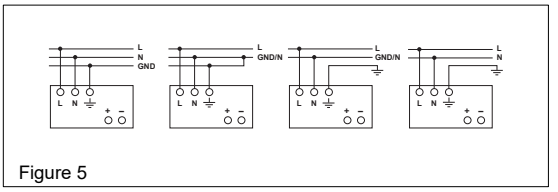


Figure 5

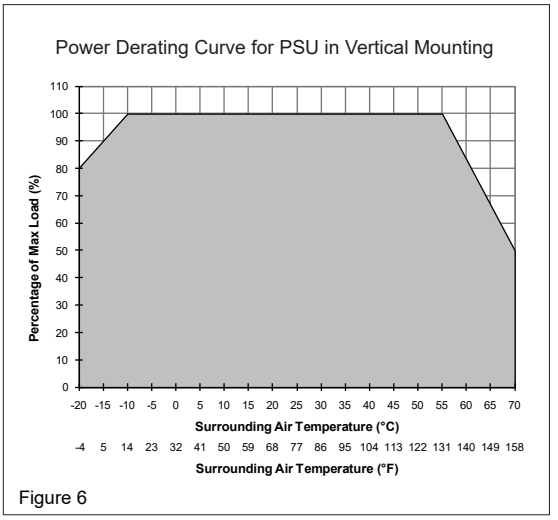


Figure 6

READ INSTRUCTIONS BEFORE INSTALLING OR OPERATING THIS DEVICE. KEEP FOR FUTURE REFERENCE.

1. Safety instructions

- Switch main power off before connecting or disconnecting the device. Risk of explosion!
- To guarantee sufficient convection cooling, please keep a distance of >40mm above and >20mm below the device as well as a lateral distance of >15mm to other cold source or heat source.
- Note that the enclosure of the device can become very hot depending on the ambient temperature and load of the power supply. Risk of burns!
- The main power must be turned off before connecting or disconnecting wires to the terminals!
- Do not introduce any objects into the unit!
- Dangerous voltage present for at least 5 minutes after disconnecting all sources of power.
- The power supplies are built-in units and must be installed in a cabinet or room (condensation free environment and indoor location) that is relatively free of conductive contaminants.
- The unit must be installed in an IP54 enclosure or cabinet in the final installation.
- **CAUTION: FOR USE IN A CONTROLLED ENVIRONMENT.**

2. Device description (Fig. 1)

(1) Input terminal block connector
(2) Output terminal block connector
(3) DC voltage adjustment potentiometer
(4) DC OK LED (green)
(5) Universal mounting rail system

3. Mounting (Fig. 2)

The power supply unit can be mounted on 35mm DIN rails in accordance with EN60715. The device should be installed with input terminal block on the bottom.

Each device is delivered ready to install.

Snap on the DIN rail as shown in Fig. 2:

1. Tilt the unit slightly upwards and put it onto the DIN rail.
2. Push downwards until stopped.
3. Press against the bottom front side for locking.
4. Shake the unit slightly to ensure that it is secured.

4. Dismounting (Fig. 3)

To uninstall, use a flat screwdriver to pull or slide down the latch as shown in Fig. 3. Then slide the PSU in the opposite direction, release the latch and pull out the PSU from the rail.

5. Connection

The terminal block connectors allow easy and fast wiring.

You can use flexible (stranded wire) or solid cables with cross sections:

Electrical Connections and Wire Size				
	Stranded / Solid		*Torque*	
	mm²	*AWG*	*N·m*	*lb·in*
Input	0.32-3.3	22-12	0.51	4.5
Output	0.52-3.3	20-12	0.51	4.5

To secure reliable and shock proof connections, the stripping length should be 4-5mm (see Fig. 4 (1)). Please ensure that wires are fully inserted into the connecting terminals as shown in Fig. 4 (2).

In accordance to EN60950 / UL60950, flexible cables require ferrules.

Use appropriate copper cables that are designed to sustain operating temperature of at least 60°C/75°C for USA or at least 90°C for Canada.

5.1. Input connection (Fig. 1, Fig. 5)

Use L, N and GND connections of input terminal connector (see Fig. 1 (1)) to establish the 100-240 VAC connection. Typical connection methods are shown in Figure 5.

The unit is protected with an internal fuse (not replaceable) at L pin and it has been tested and approved on 20A (UL) and 16A (IEC) branch circuits without additional protection device. An external protection device is only required if the supplying branch has an ampacity greater than above. Thus, if an external protective device is necessary, or utilized, a minimum value of 10A B- or 6A C- characteristic breaker should be used.

The internal fuse must not be replaced by the user.

5.2. Output connection (Fig. 1 (2))

Use the "+" and "-" screw connections to establish the 5VDC connection. The output provides 5VDC. The output voltage can be adjusted from 5 to 5.5 VDC on the potentiometer. The green LED DC OK displays correct function of the output (Fig. 1 (4)). The device has a short circuit and overload protection and an overvoltage protection limited to 6.325-7.425 VDC.

5.3. Output characteristic curve

The device functions normal under operating line and load conditions. In the event of a short circuit or overload the output voltage and current collapses (I_O = 110-150%). The secondary voltage is reduced and bounces until short circuit or overload on the secondary side has been removed.

5.4. Thermal behavior (Fig. 6)

In the case of ambient temperatures:

1. At -10°C to -20°C [14°F to -4°F], the output capacity has to be reduced by 2% per degree Celsius increase in temperature.
2. Above +55°C [131°F], the output capacity has to be reduced by 3.33% per degree Celsius increase in temperature.

If the output capacity is not reduced when T_{Amb} > 55°C [131°F], the device will engage thermal protection by switching off, i.e., the output voltage will go into latch-off mode until the component temperature cools down and the AC power is recycled.

FOR TECHNICAL ASSISTANCE CALL 770-844-4200

RHINO PSV5-15S Power Supply

Technical Specifications	
Input (AC)	
Nominal input voltage / frequency	100-240 VAC / 50-60 Hz
Voltage range	85-264 VAC
Frequency	47-63 Hz
Nominal current	< 0.5 A @ 115VAC, < 0.3 A @ 230VAC
Inrush current limitation (+25°C, cold start)	< 35A @ 115VAC, < 65A @ 230VAC
Mains buffering at nominal load (typ.)	20ms typ. @ 115VAC (100% load) 100ms typ. @ 230VAC (100% load)
Turn-on time	< 3s @ 115VAC, < 1.5 s @ 230VAC (100% load)
Internal fuse	T 3.15 A / 250V (non-replaceable)
Recommended backup protection	10A B- or 6A C- characteristic circuit breaker
Leakage current	< 1mA @ 240VAC
Output (DC)	
Nominal output voltage U_N / tolerance	5VDC ± 2 %
Voltage adjustment range	5-5.5 VDC (maximum power ≤ 15W)
Nominal current	3A
Derating	Refer to Fig. 6 -10°C to -20°C (2%/°C), > 55°C (3.33%/°C) in vertical orientation
Startup with capacitive loads	Max. 3,000µF
Max. power dissipation idling / nominal load approx.	0.3 W / 4 W
Efficiency at 100% load	78.0% typ. @ 115VAC, 79.0% typ. @ 230VAC
PARD (20MHz) at 100% load	< 75 mVpp
General Data	
Type of housing	Plastic (PC), enclosed
LED signals	Green LED DC OK
MTBF	> 350,000 hrs. as per Telcordia
Dimensions (L x W x H)	75mm x 21mm x 89.5 mm [2.95 in x 0.83 in x 3.52 in] (See www.AutomationDirect.com for complete engineering drawings.)
Weight	0.11 kg [3.9 oz]
Connection method	Screw connection
Stripping length	4-5mm [0.16-0.20 in]
Operating temperature (surrounding air temperature)	-20°C to +70°C [-4°F to +158°F] (Refer to Fig. 6)
Storage temperature	-40°C to +85°C [-40°F to +185°F]
Humidity at +25°C, no condensation	5 to 95% RH
Vibration	Operating: IEC60068-2-6, Sine Wave: 10Hz to 500Hz @ 19.6m/s²; displacement of 0.35 mm, 60min per axis for all X, Y, Z directions Non-Operating: IEC60068-2-6, Random: 5Hz to 500Hz (2.09 Grms); 20 min. per axis for all X, Y, Z directions
Shock	Operating: IEC60068-2-27, Half Sine Wave: 10G for a duration of 11ms, shock for 1 direction (X axis) Non-Operating: IEC60068-2-27, Half Sine Wave: 50G for a duration of 11ms, 3 shocks for each 3 directions
Pollution degree	2
Altitude (operating)	2000m
Certification and Standards	
Safety entry low voltage	SELV (EN60950)
Electrical safety (of information technology equipment)	UL/C-UL recognized to UL60950-1 and CSA C22.2 No. 60950-1 (File No. E198298), CB scheme to IEC60950-1, Limited Power Source (LPS)
Industrial control equipment	UL/C-UL listed to UL508 and CSA C22.2 No.107.1-01 (File No. E197592)
Class 2 power supply	UL/C-UL listed to UL508 and CSA C22.2 No.107.1-01 (File No. E197592)
CE	In conformance with EMC directive 2014/30/EU and Low Voltage Directive 2014/35/EU
Component power supply for general use	EN61204-3
Immunity	EN55024, EN61000-6-1, EN61000-6-2 (EN61000-4-2, 3, 4, 5, 6, 8, 11)
Emission	EN55032, EN55011, EN61000-3-3, EN61000-6-3, EN61000-6-4
CE 3PET c UL E197592 US LISTED Ind. Cont. Eq. c US *E198298*	
RoHS Compliant	Yes
Safety and Protection	
Surge voltage protection against internal surge voltages	No
Isolation voltage: Input / output Input / PE Output / PE	 3kVAC 3kVAC 0.5 kVAC
Protection degree	IP20
Safety class	Class I with PE connection

1st Edition, 01/2019

RHINO PSV24-480S Power Supply

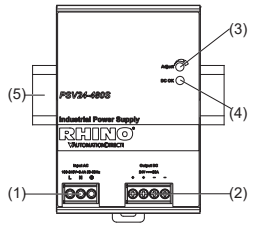


Figure 1

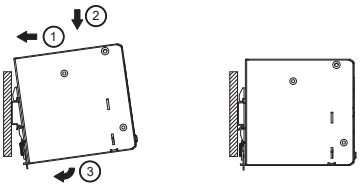


Figure 2

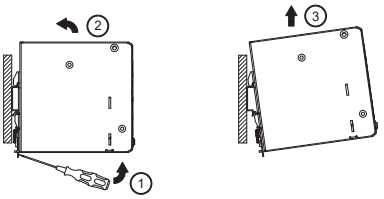


Figure 3

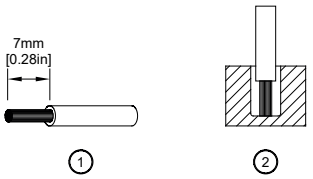


Figure 4

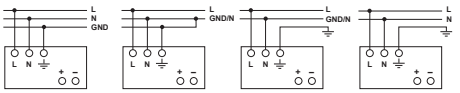


Figure 5

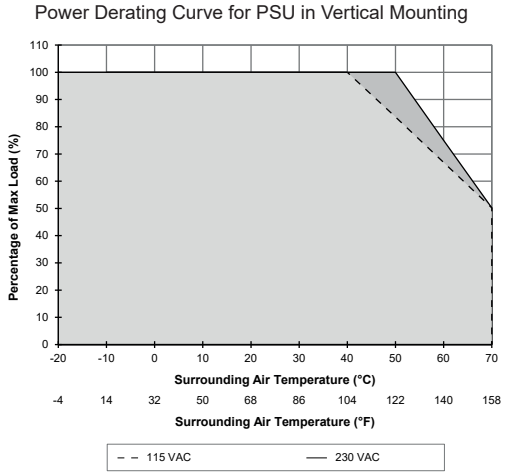


Figure 6

READ INSTRUCTIONS BEFORE INSTALLING OR OPERATING THIS DEVICE. KEEP FOR FUTURE REFERENCE.

1. Safety instructions

- Switch main power off before connecting or disconnecting the device. Risk of explosion!
- If the unit is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- To guarantee sufficient convection cooling, please keep a distance of 50mm above and 18cm below the device as well as a lateral distance of 10mm to other units.
- Note that the enclosure of the device can become very hot depending on the ambient temperature and load of the power supply. Risk of burns!
- The main power must be turned off before connecting or disconnecting wires to the terminals!
- Do not introduce any objects into the unit!
- Dangerous voltage present for at least 5 minutes after disconnecting all sources of power.
- The power supplies are built-in units and must be installed in a cabinet or room (condensation free environment and indoor location) that is relatively free of conductive contaminants.
- The unit must be installed in an IP54 enclosure or cabinet in the final installation.
- **CAUTION: FOR USE IN A CONTROLLED ENVIRONMENT.**

2. Device description (Fig. 1)

(1) Input terminal block connector
(2) Output terminal block connector
(3) DC voltage adjustment potentiometer
(4) DC OK LED (green)
(5) Universal mounting rail system

3. Mounting (Fig. 2)

The power supply unit can be mounted on 35mm DIN rails in accordance with EN60715. For vertical mounting, the device should be installed with input terminal block on the bottom.

Each device is delivered ready to install.

Snap on the DIN rail as shown in Fig. 2:

1. Tilt the unit slightly upwards and put it onto the DIN rail.
2. Push downwards until stopped.
3. Press against the bottom front side for locking.
4. Shake the unit slightly to ensure that it is secured.

4. Dismounting (Fig. 3)

To uninstall, use a flat screwdriver to pull or slide down the latch as shown in Fig. 3. Then slide the PSU in the opposite direction, release the latch and pull out the PSU from the rail.

5. Connection

The terminal block connectors allow easy and fast wiring.

You can use flexible (stranded wire) or solid cables with cross sections:

Electrical Connections and Wire Size				
	Stranded / Solid		*Torque*	
	mm²	*AWG*	*N·m*	*lb·in*
Input	1.3-3.3	16-12	1.01	9
Output	1.3-3.3	16-12	0.68	6

To secure reliable and shock proof connections, the stripping length should be 7mm (see Fig. 4 (1)). Please ensure that wires are fully inserted into the connecting terminals as shown in Fig. 4 (2). All wire strands must be fully inserted into the terminals with the screws securely fastened in order to ensure safety and maximum contact.

In accordance to EN60950 / UL60950, flexible cables require ferrules.

Use appropriate copper cables that are designed to sustain operating temperature of at least 60°C/75°C or more to fulfill UL requirements.

5.1. Input connection (Fig. 1, Fig. 5)

Use L, N and GND connections of input terminal connector (see Fig. 1 (1)) to establish the 100-240 VAC connection. Typical connection methods are shown in Figure 5.

The unit is protected with an internal fuse (not replaceable) at L pin and it has been tested and approved on 20A (UL) and 16A (IEC) branch circuits without additional protection device. An external protection device is only required if the supplying branch has an ampacity greater than above.

The internal fuse must not be replaced by the user.

5.2. Output connection (Fig. 1 (2))

Use the "+" and "-" screw connections to establish the 24VDC connection. The output provides 24VDC. The output voltage can be adjusted from 22 to 28 VDC on the potentiometer. The green LED DC OK displays correct function of the output (Fig. 1 (4)). The device has a short circuit and overload protection and an overvoltage protection limited to 28.8-35.2 VDC.

5.3. Output characteristic curve

The device functions normal under operating line and load conditions. In the event of an overload (I_O = 109-130%) the output voltage will start to droop until overload has been removed.

5.4. Thermal behavior (Fig. 6)

In the case of ambient temperatures:

1. Above +40°C [104°F] (115VAC), the output capacity has to be reduced by 1.67% per degree Celsius increase in temperature.
2. Above +50°C [122°F] (230VAC), the output capacity has to be reduced by 2.5% per degree Celsius increase in temperature.

If the output capacity is not reduced when T_{Amb} > 40°C [104°F] (115VAC) or > 50°C [122°F] (230VAC), the device will engage thermal protection by switching off, i.e., the output voltage will go into latch-off mode until the component temperature cools down and the AC power is recycled.

FOR TECHNICAL ASSISTANCE CALL 770-844-4200

RHINO PSV24-480S Power Supply

Technical Specifications	
Input (AC)	
Nominal input voltage / frequency	100-240 VAC / 50-60 Hz
Voltage range	85-264 VAC
Frequency	47-63 Hz
Nominal current	5.4 A typ. @ 115VAC, 2.7 A typ. @ 230VAC
Inrush current limitation (+25°C, cold start)	40A typ. @ 115VAC, 80A typ. @ 230VAC
Mains buffering at nominal load (typ.)	10ms typ. @ 115VAC (100% load) 16ms typ. @ 230VAC (100% load)
Turn-on time	1000ms typ. @ 115VAC & 230VAC (100% load)
Internal fuse	F 10 A / 250V (non-replaceable)
Leakage current	< 1mA @ 264VAC
Output (DC)	
Nominal output voltage U_N / tolerance	24VDC ± 2 %
Voltage adjustment range	22-28 VDC (maximum power ≤ 480W)
Output current	20A
Derating	Refer to Fig. 6 > 40°C (1.67%/°C) @ 115VAC (90-229 VAC) > 50°C (2.5%/°C) @ 230VAC (230-264 VAC)
Startup with capacitive loads	Max. 8,000µF
Max. power dissipation idling / nominal load approx.	5W @ 115VAC (0% load) 4W @ 230VAC (0% load) 50W @ 115VAC (100% load) 40W @ 230VAC (100% load)
Efficiency at 100% load	85.0% typ. @ 115VAC, 88.0% typ. @ 230VAC
PARD (20MHz) at 100% load	< 120mVpp @ -10°C to +70°C < 240mVpp @ -20°C to -10°C
Parallel operation	PSB60-REM40S or with ORing Diode
General Data	
Type of housing	SGCC (Case Cover) / Aluminum (Case Chassis)
LED signals	Green LED DC OK
MTBF	> 700,000 hrs. as per Telcordia
Dimensions (L x W x H)	123.6 mm x 85.5 mm x 128.5 mm [4.87 in x 3.37 in x 5.06 in] (See www.AutomationDirect.com for complete engineering drawings.)
Weight	1.30 kg [45.9 oz]
Connection method	Screw connection
Stripping length	7mm [0.28 in]
Operating temperature (surrounding air temperature)	-20°C to +70°C [-4°F to +158°F] (Refer to Fig. 6)
Storage temperature	-40°C to +85°C [-40°F to +185°F]
Humidity at +25°C, no condensation	5 to 95% RH
Vibration	Operating: IEC60068-2-6, Sine Wave: 10Hz to 500Hz @ 19.6m/s² (2G peak); 10min per cycle, 60min for X direction Non-Operating: IEC60068-2-6, Random: 5Hz to 500Hz (2.09 Grms); 20 min. per axis for all X, Y, Z directions
Shock	Operating: IEC60068-2-27, Half Sine Wave: 10G for a duration of 11ms, shock for 1 direction (X axis) Non-Operating: IEC60068-2-27, Half Sine Wave: 50G for a duration of 11ms, 3 shocks for each 3 directions
Pollution degree	2
Altitude (operating)	2000m for industrial application 5000m for ITE application
Certification and Standards	
Safety entry low voltage	SELV (EN60950)
Electrical safety (of information technology equipment)	UL/C-UL recognized to UL60950-1 and CSA C22.2 No. 60950-1 (File No. E198298), CB scheme to IEC60950-1
Industrial control equipment	UL/C-UL listed to UL508 and CSA C22.2 No.107.1-01 (File No. E197592)
CE	In conformance with EMC directive 2014/30/EU and Low Voltage Directive 2014/35/EU
Component power supply for general use	EN61204-3
Immunity	EN55024, EN61000-6-1, EN61000-6-2 (EN61000-4-2, 3, 4, 5, 6, 8, 11, 12)
Emission	EN55032, EN55011, EN61000-3-2 Class A, EN61000-3-3, EN61000-6-3, EN61000-6-4
Voltage Sag Immunity	SEMI F47 – 0706 @ 200VAC
	CE 4ZW4 c UL E197592 US LISTED Ind. Cont. Eq. c UL us E198298
RoHS Compliant	Yes
Safety and Protection	
Transient surge voltage protection	Varistor
Current limitation at short-circuits approx.	I_{surge} = 109-130% or Po_{max} typically (continuous current)
Surge voltage protection against internal surge voltages	Yes
Isolation voltage: Input / output Input / PE Output / PE	 3kVAC 2kVAC 0.5 kVAC
Protection degree	IP20
Safety class	Class I with PE connection

1st Edition, 01/2019

C-more Operator Panels Overview

Getting started

Installing the software and configuring the *C-more* panel is simple. You will need the following to successfully connect, configure and send a project to the panel:

- ***C-more*** HMI - 6in, 7in wide, 8in, 10in, 10in wide, 12in, 15in or EA9-RHMI
- ***C-more*** Programming Software, p/n EA9-PGMSW
- ***C-more*** programming cable, USB or Ethernet
- 12-24 VDC switching power supply or the optional ***C-more*** AC Power Adapter, p/n EA-AC
- Personal Computer - to run ***C-more*** programming software
- PLC communications cable (serial or Ethernet) to connect the ***C-more*** HMI to your controller

Part Number	Description	Price
EA9-T6CL-R	*C-more* EA9 series touch screen HMI, 6in color TFT LCD, 320 x 240 pixel, QVGA, LED backlight, supports (1) serial and (2) USB ports and (1) memory card slot.	$534.00
EA9-T6CL	*C-more* EA9 series touch screen HMI, 6in color TFT LCD, 320 x 240 pixel, QVGA, LED backlight, supports (3) serial, (1) Ethernet and (2) USB ports, (1) memory card slot and (1) audio line out.	$748.00
EA9-T7CL-R	*C-more* EA9 series touch screen HMI, 7in color TFT LCD, widescreen, 800 x 480 pixel, WVGA, LED backlight, supports (1) serial, (1) Ethernet and (2) USB ports and (1) memory card slot.	$499.00
EA9-T7CL	*C-more* EA9 series touch screen HMI, 7in color TFT LCD, widescreen, 800 x 480 pixel, WVGA, LED backlight, supports (3) serial, (1) Ethernet and (2) USB ports, (1) memory card slot and (1) audio line out.	$578.00
EA9-T8CL	*C-more* EA9 series touch screen HMI, 8in color TFT LCD, 800 x 600 pixel, SVGA, LED backlight, supports (3) serial, (1) Ethernet and (2) USB ports, (1) memory card slot and (1) audio line out.	$1,069.00
EA9-T10CL	*C-more* EA9 series touch screen HMI, 10in color TFT LCD, 800 x 600 pixel, SVGA, LED backlight, supports (3) serial, (1) Ethernet and (2) USB ports, (1) memory card slot and (1) audio line out.	$1,380.00
EA9-T10WCL	*C-more* EA9 series touch screen HMI, 10in color TFT LCD, wides-creen, 1024 x 600 pixel, WSVGA, LED backlight, supports (3) serial, (1) Ethernet and (2) USB ports, (1) memory card slot and (1) audio line out.	$733.00
EA9-T12CL	*C-more* EA9 series touch screen HMI, 12in color TFT LCD, 800 x 600 pixel, SVGA, LED backlight, supports (3) serial, (1) Ethernet and (2) USB ports, (2) memory card slots, (1) HDMI video out and (1) audio line out.	$1,917.00
EA9-T15CL-R	*C-more* EA9 series touch screen HMI, 15in color TFT LCD, 1024 x 768 pixel, XGA, LED backlight, supports (1) serial, (1) Ethernet and (2) USB ports and (2) memory card slots.	$1,391.00
EA9-T15CL	*C-more* EA9 series touch screen HMI, 15in color TFT LCD, 1024 x 768 pixel, XGA, LED backlight, supports (3) serial, (1) Ethernet and (2) USB ports, (2) memory card slots, (1) HDMI video out and (1) audio line out.	$2,140.00
EA9-RHMI	*C-more* EA9 series headless HMI, supports (2) serial, (1) Ethernet, (2) USB ports and (1) HDMI audio/video out and (1) memory card slot.	$409.00
EA9-PGMSW	*C-more* Windows programming software, CD or free download. For use with *C-more* EA9 series touch panels. Requires USB or Ethernet connection to touch panel.	$11.00 on CD, or FREE download
USB-CBL-AB3	Programming cable, USB A to USB B, 3ft cable length. For use with *C-more* HMIs, Do-more and Productivity series CPUs and most USB devices.	$8.50
USB-CBL-AB6	Programming cable, USB A to USB B, 6ft cable length. For use with *C-more* HMIs, Do-more and Productivity series CPUs and most USB devices.	$11.00
USB-CBL-AB10	Programming cable, USB A to USB B, 10ft cable length. For use with *C-more* HMIs, Do-more and Productivity series CPUs and most USB devices.	$25.50
USB-CBL-AB15	Programming cable, USB A to USB B, 15ft cable length. For use with *C-more* HMIs, Do-more and Productivity series CPUs and most USB devices.	$29.00

C-more Selection Guide & Specifications

Specification \ Model	6" TFT color w/ base features	6" TFT color w/ full features	7" TFT color w/ base features	7" TFT color w/ full features
Part Number	EA9-T6CL-R	EA9-T6CL	EA9-T7CL-R	EA9-T7CL
Price	$534.00	$748.00	$499.00	$578.00
Display Actual Size and Type	5.7" TFT color		7.0" TFT color	
Display Viewing Area	4.54" x 3.40" [115.2 mm x 86.4 mm]		6.00" x 3.60" [152.4 mm x 91.4 mm]	
Weight	1.56 lb [710g]	1.59 lb [720g]	1.46 lb [660g]	1.48 lb [670g]
Screen Pixel	320 x 240 (QVGA)		800 x 480 (WVGA)	
Display Brightness	280 nits (typ)		350 nits (typ)	
LCD Panel Dot Pitch	0.18 mm x 0.18 mm		0.190 mm x 0.190 mm	
Color Scale	65,536 colors			
Backlight Average Lifetime*	50,000 hours @ 25°C			
Touch Panel Type **	Four-wire analog resistive, single touch			
Project Memory	26MB			
Number of Screens	Up to 999 screens – limited by project memory			
Realtime Clock	Realtime clock built into panel, backed up for 30 days at 25°C			
Calendar – Month / Day / Year	Yes - monthly deviation 60sec (Reference)			
Serial Port 1	15-pin D-sub female – RS232C, RS-422/485			
Serial Port 2	N/A	3-wire terminal block – RS-485	N/A	3-wire terminal block – RS-485
Serial Port 3	N/A	RJ-12 modular jack – RS-232C	N/A	RJ-12 modular jack – RS-232C
USB Port – Type B	USB 2.0 High speed (480 Mbps) Type B – Download/Program – Max. cable length 15-feet			
USB Port – Type A	USB 2.0 High speed (480 Mbps) Type A – for USB device options – Max. cable length 15-feet – Bus Power – Less than 200mA at 5VDC			
Ethernet Port	N/A	10/100 Base-T, auto MDI/MDI-X		
Ethernet Port - Expansion Module	N/A	EA-ECOM	N/A	EA-ECOM
Audio Line Out	N/A	3.5 mm mini jack – requires amplifier and speaker(s)	N/A	3.5 mm mini jack – requires amplifier and speaker(s)
Mic In (Future)	N/A	3.5 mm mini jack	N/A	3.5 mm mini jack
SD Card Slot	1 slot supports max 2GB (SD,) max 32GB (SDHC)			
HDMI Video Out	N/A			
HDMI Supported Resolution	N/A			
Supply Power	10.2-26.4 VDC Class 2 or SELV (Safety Extra-Low Voltage) Circuit or Limited Energy Circuit (LEC), or use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz power source. Reverse Polarity Protected			
Power Consumption	16.0 W 1.30 A @ 12VDC 0.66 A @ 24VDC			
Internal Fuse (non-replaceable)	4.0 A			
Altitude	Up to 2000m (6562ft)			
Operating Temperature	0 to 50°C (32 to 122°F) Maximum surrounding air temperature rating: 50°C (122°F) IEC 60068-2-14 (Test Nb, Thermal Shock)			
Storage Temperature	–20 to +60°C (–4 to +140°F) IEC 60068-2-1 (Test Ab, Cold) IEC 60068-2-2 (Test Bb, Dry Heat) IEC 60068-2-14 (Test Na, Thermal Shock)			
Humidity	5-95% RH (non-condensing)			
Environment	For use in Pollution Degree 2 environment, no corrosive gases permitted			
Noise Immunity	(EN61131-2), EN61000-4-2 (ESD), EN61000-4-3 (RFI), EN61000-4-4 (FTB), EN61000-4-5 (Serge), EN61000-4-6 (Conducted) EN61000-4-8 (Power frequency magnetic field immunity) (Local Test) RFI, (145MHz, 440Mhz 10W @ 10cm), Impulse 1000V @ 1µs pulse			
Withstand Voltage	1000VAC, 1min. (FG to Power supply)			
Insulation Resistance	> 10M ohm @ 500VDC (FG to Power supply)			
Vibration	IEC60068-2-6 (Test Fc)			
Shock	IEC60068-2-27 (Test Ea)			
Emission	EN55011 Class A (Radiated RF emission)			
Enclosure	NEMA 250 type 4/4X indoor use only UL50 type 4X indoor use only IP-65 indoor use only (When mounted correctly)		NEMA 250 type 4/4X indoor use only UL50 type 4X indoor use only IP-65 (not tested by UL) (When mounted correctly)	
Agency Approvals	UL508, E157382, Class 1, Div 2, Groups A, B, C CE (EN61131-2), RoHS (2011/65/EU) CUL Canadian C22.2		UL61010, E157382 CE (EN61131-2), RoHS (2011/65/EU) CUL Canadian C22.2	

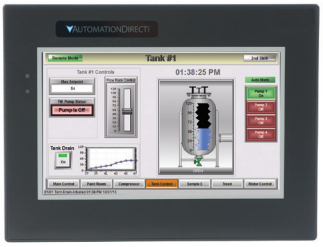
NOTES: ****The backlight average lifetime is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under low or high temperature usage.***

*****The touchscreen is designed to respond to a single touch. If it is touched at multiple points at the same time, an unexpected object may be activated.***

C-more 7" TFT Color Touch Panel - Base Model

EA9-T7CL-R

C-more EA9 series touch screen interface panel, 7-inch color TFT (7.0 inch viewable screen), 64K colors, 800 x 480 pixel WVGA screen resolution, 800MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only)(not tested by UL), non-replaceable LED backlight. Includes (1) serial port, USB 2.0 Type A and B ports and Ethernet port; supports SD memory card. Compatible with EA9-PGMSW programming software version 6.3 or later.



$499.00

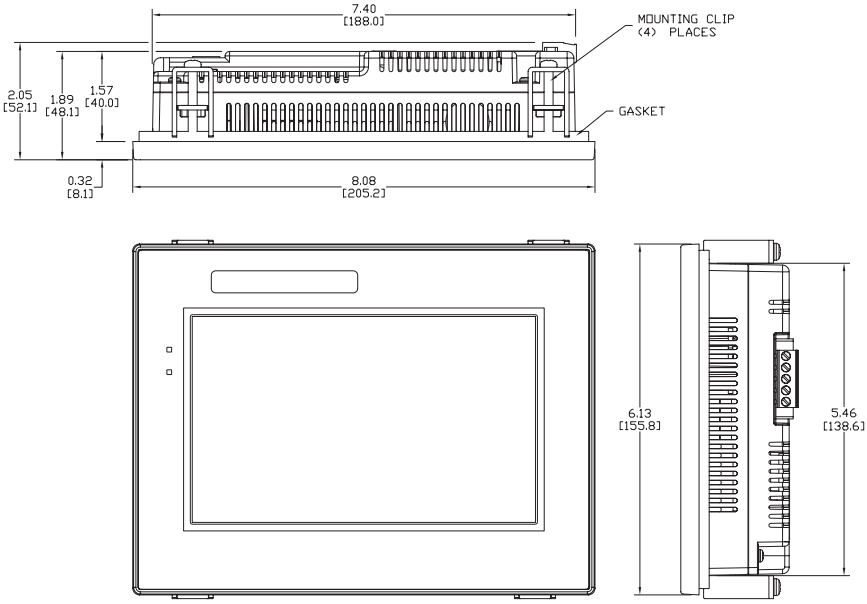
Features

- 7.0" diagonal color TFT (Thin Film Transistor) LCD display with 64K colors
- 800 x 480 pixel resolution
- 350 NITS display brightness
- 50,000 hour average backlight half-life
- Analog resistive (1024 X 1024) touch screen allowing unlimited touch areas
- USB port B (program/download) and USB port A (USB device options)
- Ethernet 10/100 Base-T port (program/download & PLC communication)
- Remote Internet access
- Serial PLC interface (RS-232/422/485)
- One built-in SD memory card slot
- 12–24 VDC powered, 110VAC power adapter (optional)
- 26MB project memory
- Data logging
- 0 to 50°C [32 to 122°F] operating temperature range
- NEMA 4/4X, IP65(not tested by UL) when mounted correctly, indoor use only
- Slim design saves panel space
- UL, cUL & CE agency approvals
- 2-year warranty from date of purchase

Function	Available
Ethernet	Yes
USB	Yes
SD Card	Yes
Audio Out	No
HDMI Video Out	No
Expansion Module	No

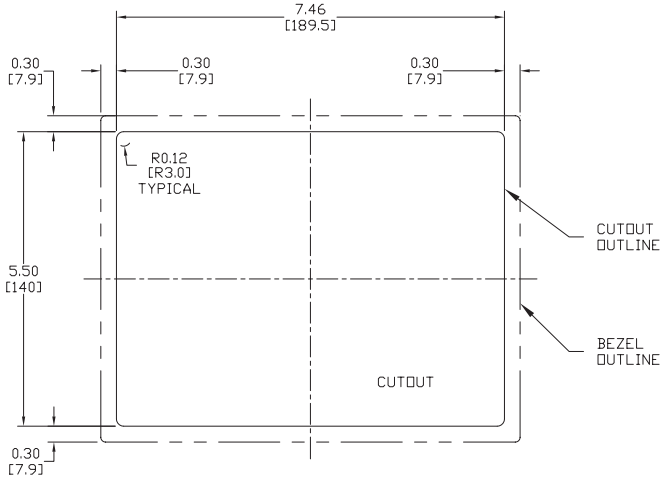
Dimensions

inches [mm]

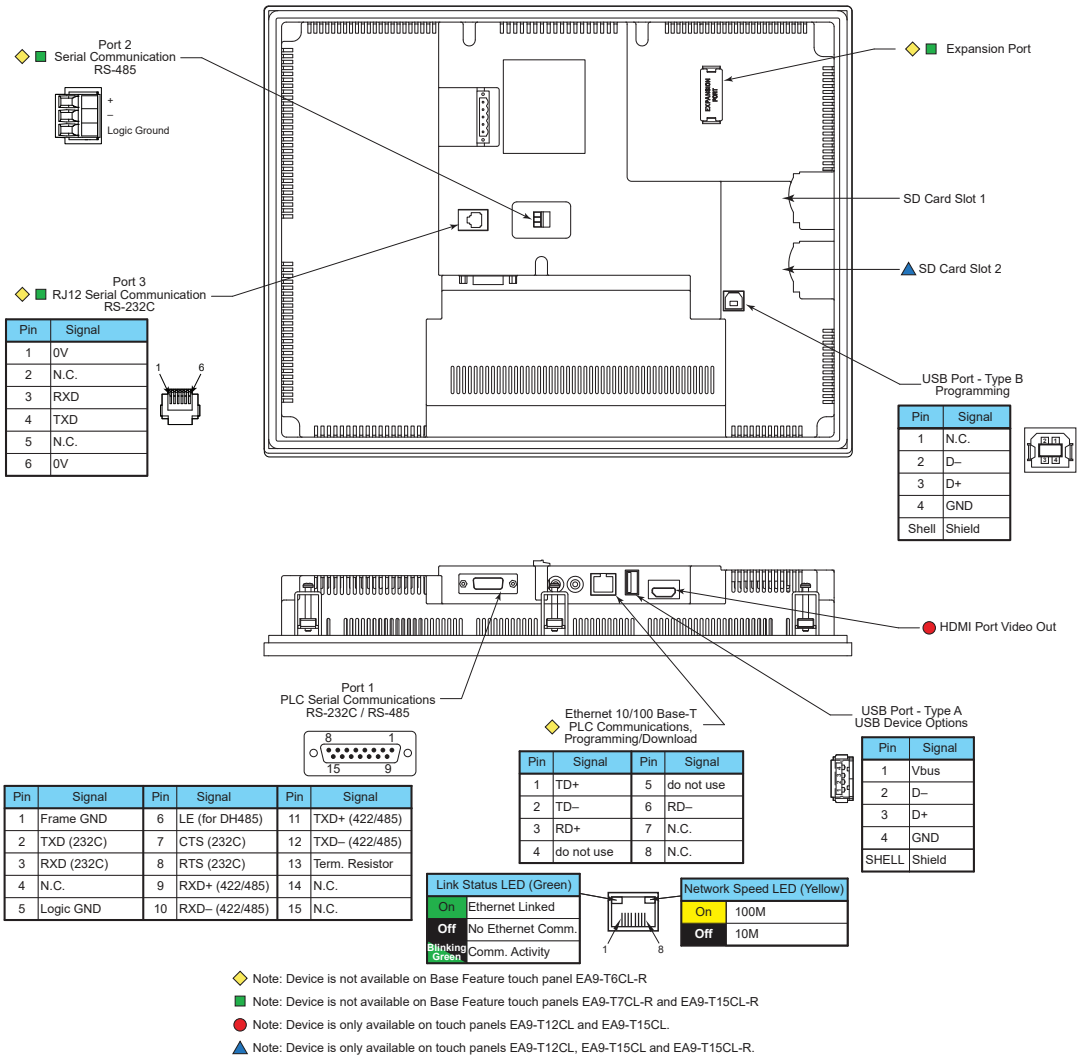


See our website www.AutomationDirect.com for complete engineering drawings.

Mounting Cutout



C-more Communication Ports



Pin	Signal
1	0V
2	N.C.
3	RXD
4	TXD
5	N.C.
6	0V

Pin	Signal
1	N.C.
2	D–
3	D+
4	GND
Shell	Shield

Pin	Signal	Pin	Signal	Pin	Signal
1	Frame GND	6	LE (for DH485)	11	TXD+ (422/485)
2	TXD (232C)	7	CTS (232C)	12	TXD– (422/485)
3	RXD (232C)	8	RTS (232C)	13	Term. Resistor
4	N.C.	9	RXD+ (422/485)	14	N.C.
5	Logic GND	10	RXD– (422/485)	15	N.C.

Pin	Signal	Pin	Signal
1	TD+	5	do not use
2	TD–	6	RD–
3	RD+	7	N.C.
4	do not use	8	N.C.

Pin	Signal
1	Vbus
2	D–
3	D+
4	GND
SHELL	Shield

◇ Note: Device is not available on Base Feature touch panel EA9-T6CL-R

■ Note: Device is not available on Base Feature touch panels EA9-T7CL-R and EA9-T15CL-R

● Note: Device is only available on touch panels EA9-T12CL and EA9-T15CL.

▲ Note: Device is only available on touch panels EA9-T12CL, EA9-T15CL and EA9-T15CL-R.

Ethernet Port

The Ethernet port has several uses:

- Download program to panel
- Communicate to PLCs/PCs
- Send e-mail
- Access FTP server
- Act as a Web server
- Remote Internet access

The Ethernet port has an RJ-45 8-wire modular connector with green and yellow LEDs.

- The yellow LED indicates network speed – off for a 10 Mbps connection and illuminated for a 100 Mbps connection.
- The green LED indicates link status and illuminates when a link is established.

Note: EA6-T6CL-R does not include an Ethernet port, and does not have these capabilities.

Expansion Port

The expansion port supports the EA-ECOM module to provide a second Ethernet Port for all full featured models.

USB Port B

Program *C-more* via the USB programming port. It's fast and easy, with no baud rate settings, parity, or stop bits to worry about. We stock standard USB cables for your convenience. USB Port B can be used to upload or download projects to and from a PC.

USB Port A

The Universal Serial Bus (USB) Port A is a standard feature on all models and can be used to connect various USB HID (Human Input Device) devices to the panel, such as the following:

- USB flash drives (USB-FLASH)
- USB keyboards
- USB barcode scanners
- USB card scanners

C-more can log data to the USB flash drive as well as load projects to the panel from the pen drive. You can also back up project files and panel firmware.

Sound Interface (Audio Line Out)

When attached to an amplifier and speaker(s), *C-more* can play warning sounds or pre-recorded messages such as: "conveyor is jammed". *C-more* supports WAV type files. The output is stereo.

Serial Port

Port 1 - Connect to your serial controller network via Port 1. Port 1 is a 15-pin port that supports RS-232 or RS-422/485.

Port 2 - Connect your RS-485 network via Port 2. Port 2 is provided with a 3-wire removable terminal block.

Port 3 - Connect to your RS-232C device via Port 3. Port 3 is an RJ12 connection.

HDMI Video Out

EA9-T12CL and EA9-T15CL include an HDMI Type A port to provide video output to a projector or remote monitor.

C-more Communication Protocols & Cables

Compatibility Table

PLC Family	Model		Protocols
Allen-Bradley	MicroLogix 1000, 1100, 1200, 1400, 1500, SLC 5-/01/02/03		DH485/AIC/AIC+
	MicroLogix 1000, 1100, 1200, 1400 and 1500		DF1 Half Duplex; DF1 Full Duplex
	SLC 5-/03/04/05		
	ControlLogix™, CompactLogix™, FlexLogix™		
	PLC-5		DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Tag Based		DF1 Half Duplex; DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Generic I/O Messaging		EtherNet/IP Server
	ControlLogix, CompactLogix, FlexLogix - Tag Based		EtherNet/IP Client
	Micrologix 1100, 1400 & SLC5/05, all via native Ethernet port		
	MicroLogix 1000, 1100, 1200, 1400,1500 & SLC 5-03/04/05, all via ENI Adapter		
	Micro 800 series		Modbus RTU
			Modbus TCP
	Micro 800 series - Tag Based		DF1 Full Duplex
			EtherNet/IP Client
Modbus RTU	Modbus RTU devices		Modbus RTU
Modbus TCP/IP	Modbus TCP/IP devices		Modbus TCP/IP
GE	90/30, 90/70, Micro 90, VersaMax Micro		SNPX
	90/30, Rx3i		SRTP Ethernet
Mitsubishi	FX Series		FX Direct
	Q02, Q02H, Q06H, Q12H, Q25H		Q CPU
	Q, QnA Serial		QnA Serial
	Q, QnA Ethernet		QnA Ethernet
Omron	C200 Adapter, C500		Host Link
	CJ1/CS1 Serial, CJ1/CS1 Ethernet		FINS
Modicon	984 CPU, Quantum 113 CPU, AEG Modicon Micro Series 110 CPU: 311-xx, 411-xx, 512-xx, 612-xx		Modbus RTU
Siemens	S7-200 CPU, RS-485 Serial		PPI
	S7-200 CPU, S7-300 CPU, S7-400, S7-1200 CPU, S7-1500; Ethernet		Ethernet ISO over TCP
Productivity Series	all		AutomationDirect P3000 Serial
			AutomationDirect P3000 Ethernet
Do-more	all		Do-more Serial
			Do-more Ethernet
CLICK	all		AutomationDirect Modbus (CLICK)
*Direct*LOGIC	DL05/DL06	all	K-Sequence
			*Direct*NET
			Modbus (Koyo addressing)
		H0-ECOM/H0-ECOM100	*Direct*LOGIC Ethernet
	DL105	all	K-Sequence
	DL205	D2-230	K-Sequence
		D2-240	K-Sequence
			*Direct*NET
		D2-250/D2-250-1/D2-260/ D2-262	K-Sequence
			*Direct*NET
			Modbus (Koyo addressing)
		D2-240/D2-250-1/D2-260 using D2-DCM	*Direct*NET
			Modbus (Koyo addressing)
		H2-ECOM/H2-ECOM100	*Direct*LOGIC Ethernet
	DL305	D3-330/330P (Requires the use of a Data Communications Unit)	*Direct*NET
		D3-340	*Direct*NET
		D3-350	K-Sequence
			*Direct*NET
			Modbus (Koyo addressing)
		D3-350 using D3-DCM	*Direct*NET
			Modbus (Koyo addressing)
	DL405	D4-430	K-Sequence
			*Direct*NET
		D4-440	K-Sequence
			*Direct*NET
		D4-450/D4-454	K-Sequence
			*Direct*NET
			Modbus (Koyo addressing)
		All with D4-DCM	*Direct*NET
			Modbus (Koyo addressing)
		H4-ECOM/H4-ECOM100	*Direct*LOGIC Ethernet
	H2-WinPLC (Think & Do) Live V5.2 or later and Studio any version		Think & Do Modbus RTU (serial port)
	H2-WinPLC (Think & Do) Live V5.5.1 or later and Studio V7.2.1 or later		Think & Do Modbus TCP/IP (Ethernet port)

Cable Description	Cable Part Number	Price
Communication cable, 15-pin male D-sub to 6-pin RJ12, shielded, 9.8ft/3m cable length. For use with *C-more* or *C-more* Micro panel and AutomationDirect PLCs with RJ12 ports.	***EA-2CBL***	$21.50
Communication cable, 15-pin male D-sub to 15-pin D-sub HD15 male, shielded, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and a DL06, D2-250(-1), D2-260 or D2-262 (bottom port) CPU.	***EA-2CBL-1***	$22.00
Communication cable, 15-pin male D-sub to 4-pin RJ11, shielded, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and a D3-340 CPU top or bottom port.	***EA-3CBL***	$21.50
Communication cable, 15-pin male D-sub to 15-pin male D-sub, shielded, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and a DL405 (top port) CPU.	***EA-4CBL-1***	$21.50
Communication cable, 15-pin male D-sub to 25-pin male D-sub, shielded, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and a D2-DCM, D3-232-DCU, D3-350 (bottom port) or DL405 (bottom port) CPU.	***EA-4CBL-2***	$22.50
Communication cable, 15-pin male D-sub to 8-pin male mini DIN, shielded, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and an Allen-Bradley Micrologix CPU.	***EA-MLOGIX-CBL***	$33.00
Communication cable, 15-pin male D-sub to 9-pin female D-sub, shielded, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and an Allen-Bradley SLC 5/03, 5/04 or 5/05 CPU with DF-1 port.	***EA-SLC-232-CBL***	$21.50
Communication cable, 15-pin male D-sub to 25-pin male D-sub, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and an Allen-Bradley PLC-5 CPU with a DF1 port.	***EA-PLC5-232-CBL***	$21.50
Communication cable, 15-pin male D-sub to 6-pin RJ45, shielded, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and an Allen-Bradley SLC 5/01, 5/02 or 5/03 CPU with a DH485 port cable.	***EA-DH485-CBL***	$21.00
Communication cable, 15-pin male D-sub to 15-pin male D-sub, shielded, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro and GE Fanuc Series 90/30 or 90/70 serial port.	***EA-90-30-CBL***	$21.50
Communication cable, 15-pin male D-sub to 25-pin male D-sub, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and a Mitsubishi FX Series CPU.	***EA-MITSU-CBL***	$21.50
Communication cable, 15-pin male D-sub to 8-pin male mini DIN, shielded, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and a Mitsubishi FX Series CPU.	***EA-MITSU-CBL-1***	$21.50
Communication cable, 15-pin male D-sub to 25-pin male D-sub, shielded, 3m/9.8ft cable length. For use with *C-more* or *C-more* Micro panel and an Omron C200 or C500 CPU.	***EA-OMRON-CBL***	$21.50

Example Cables:

EA-2CBL

EA-2CBL-1

C-more Computer Programming Connections

Using the *C-more* Programming Software EA9-PGMSW for project development, the HMI can be connected to a PC (personal computer) in one of several ways:

- Connect a USB Programming Cable such as (USB-CBL-AB15) from a USB port type A on the PC to the USB type B programming port on the C-more HMI. The USB connection is for direct connection only and does not support USB hubs.
- Connect the ***C-more*** HMI to a PC with a Cat5 Ethernet cable via an Ethernet switch. Multiple ***C-more*** HMIs can be programmed in this configuration.

Following are the minimum system requirements for running *C-more* Programming Software, p/n EA9-PGMSW, on a PC:

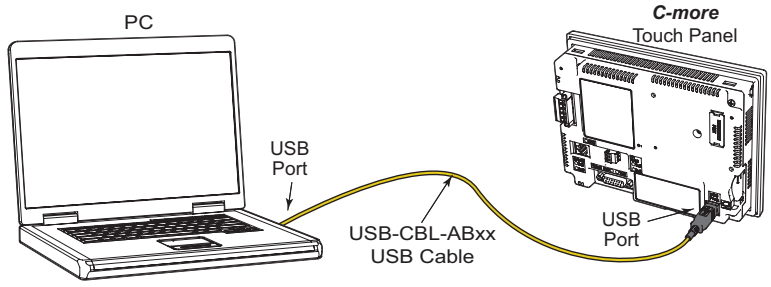
- USB or Ethernet connection to HMI (cables sold separately).
- Windows operating system - see automationdirect.com for specific operating system requirements.

NOTE: Regarding Ethernet access to a C-more HMI.

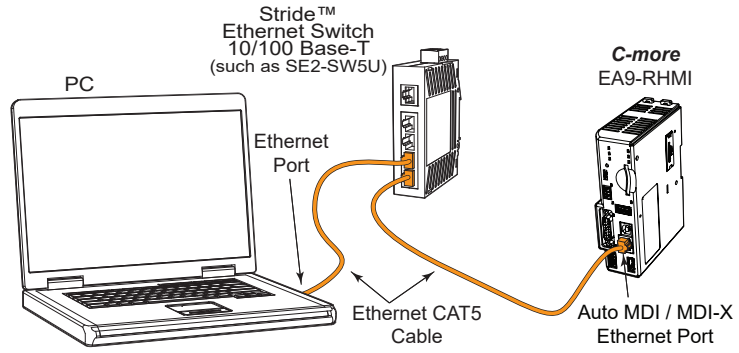
If you intend to take advantage of the methods of remote access to the HMI, including the web server, PC remote access, FTP, iPhone or iPad app, you need to consider the security exposure in order to minimize the risks to your process and your C-more HMI.

Security measures may include password protection, changing the ports exposed on your network, including a VPN in your network, and other methods. Security should always be carefully evaluated for each installation.

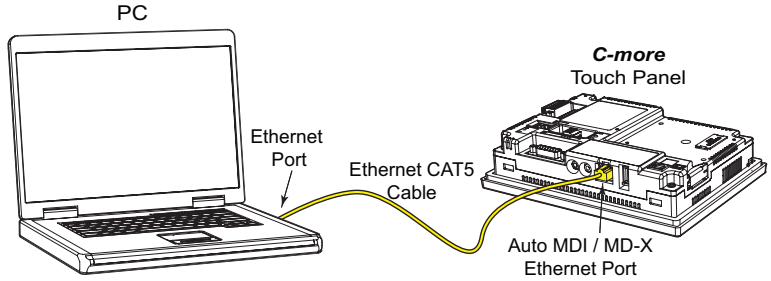
USB Connectivity



Ethernet Connectivity via a Hub or Switch



Ethernet Direct Connection

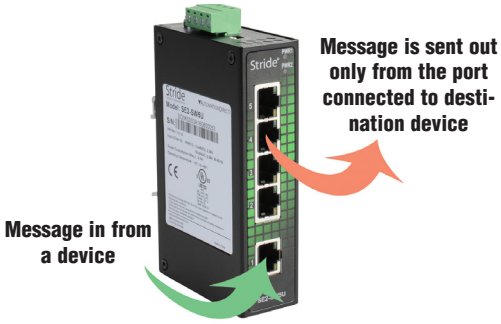


USB Programming Cable

Part No. USB-CBL-ABxx

USB Programming Cables		
Part Number	***Length***	***Price***
USB-CBL-AB3	3 feet	$8.50
USB-CBL-AB6	6 feet	$11.00
USB-CBL-AB10	10 feet	$25.50
USB-CBL-AB15	15 feet	$29.00

Stride® Ethernet Switch



Part No. SE2-SW5U

$78.00

Power Supplies

Power Supplies

The CLICK PLC family offers two 24VDC power supplies. They are identical except for the output current.

It is not mandatory to use one of these CLICK power supplies for the CLICK/CLICK PLUS PLC system. You can use any other 24VDC power supply that Automationdirect.com offers, including the PSP24-DC12-1 12 to 24 VDC converter shown below.

C0-00AC Power Supply

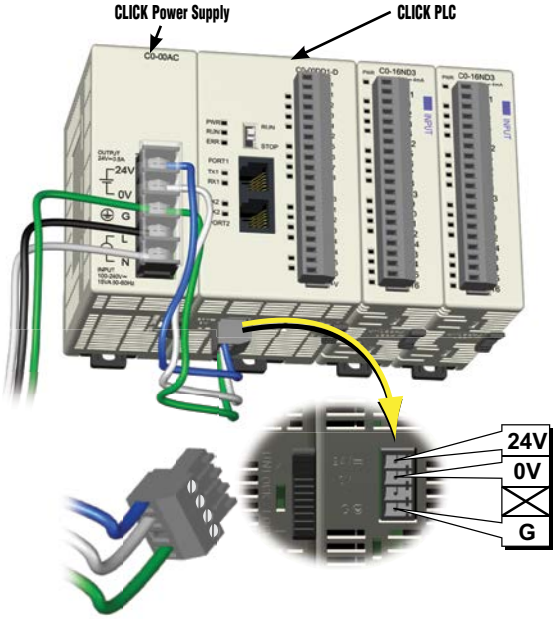
Limited auxiliary AC power supply allows you to power the 24VDC CLICK C0 and C2 series PLCs with 100–240 VAC supply power. The 0.5 A DC power supply is capable of controlling the PLC plus a limited configuration based on the power budget of each I/O module. The C0-00AC is a low-cost solution for applications requiring only minimal I/O and power consumption. This power supply will not support a fully-populated CLICK PLC system with all possible I/O module combinations.

C0-01AC Power Supply

Expanded auxiliary AC power supply allows you to power the 24VDC CLICK C0 and C2 series PLCs with 100–240 VAC supply power. The 1.3 A DC power supply is capable of supporting a fully-populated CLICK PLC system with all possible I/O module combinations, with no concerns for exceeding the power budget.

PSP24-DC12-1 DC-DC Converter

With this DC-DC converter you can operate the CLICK/CLICK PLUS PLC with 12VDC input power.



24VDC power is supplied to the PLC unit through wiring connected from the power supply output to the 4-pin 24VDC input connector located on the bottom of the PLC unit.

C0-00AC

C0-01AC

CLICK 24VDC Power Supply Ratings		
Part Number	Output Current	Price
C0-00AC	0.5 A	$31.00
C0-01AC	1.3 A	$42.50

C0-00AC Power Supply Input Specifications		
Part Number	C0-00AC	C0-01AC
Input Voltage Range	85–264 VAC	
Input Frequency	47–63 Hz	
Input Current (typical)	0.3 A @ 100VAC, 0.2 A @ 200VAC	0.9 A @ 100VAC, 0.6 A @ 200VAC
Inrush Current	30A	
Efficiency	80% typical	

C0-00AC Power Supply Output Specifications		
Part Number	C0-00AC	C0-01AC
Output Voltage Range	23–25 VDC	
Output Current	0.5 A	1.3 A
Ripple	200mV p-p max (0–55°C)	
Ripple Noise	300mV p-p max (0–55°C)	
Over Current Protection	@ 0.65 A (automatic recovery)	@ 1.6 A (automatic recovery)
Over Voltage Protection	@ 27.6 V (clamped by Zener diode)	
Start-up Time	1000ms max at rated input and load	
Hold-up Time	10ms minimum at 85VAC, I=max	

C0-00AC Power Supply General Specifications		
Part Number	C0-00AC	C0-01AC
Ambient Operating Temperature	32–131°F [0–55°C]	
Storage Temperature	-4–158°F [-20–70°C]	
Humidity	30–95%, non-condensing	
Vibration Resistance	JIS C60068-2-6, sine wave vibration	
Shock Resistance	JIS C60068-2-27	
Voltage Withstand		
Input-Output	1500VAC, 5mA cutoff current	
Input-Ground	1500VAC, 5mA cutoff current	
Output-Ground	500VAC, 5mA cutoff current	
Insulation Resistance		
Input-Output	10MΩ minimum, 500VDC	
Input-Ground	10MΩ minimum, 500VDC	
Output-Ground	5MΩ minimum, 500VDC	
Noise Immunity	FCC Class A, EN55022:1998 Class A	
Input/Output Interface	5P terminal block, Fujicon UF2362AX series or equivalent	
Agency Approvals	UL508, UL1604, EN61010-1 (IEC 1010-1), CAN/CSA E60079-15:02, JIS C0025	
Weight	5.3 oz [150g]	6.0 oz [170g]

PSP24-DC12-1

PSP24-DC12-1 DC-DC Converter Specifications	
Input Voltage Range	9.5–18 VDC
Input Power (no load)	1.0 W max.
Startup Voltage	8.4 VDC
Undervoltage Shutdown	7.6 VDC
Output Voltage Range	24–28 VDC (adjustable)
Output Current	1.0 A
Short Circuit Protection	Current limited at 110% typical
Weight	7.5 oz (213g)

Power Budgeting

Power Budgeting

There are two areas to be considered when determining the power required to operate a CLICK PLC system. The first area is the power required by the PLC, along with the internal logic side power that the CPU provides to its own I/O and any connected I/O modules that are powered through the PLC expansion port; plus any device, such as a C-more Micro-Graphic panel, that is powered through one of the communications ports.

The second area is the power required by all externally connected I/O devices. This should be viewed as the field side power required. The field side power is dependent on the voltage used for a particular input or output device as it relates to the wired I/O point, and the calculated load rating of the connected device.

It is strongly recommended that the power source for the logic side be separate from the power source for the field side to help eliminate possible electrical noise.

Power budgeting requires the calculation of the total current the 24VDC power source needs to provide to CLICK's logic side, and also a separate calculation of the total current required for all devices operating from the field side of the PLC system.

Refer to the Power Budgeting example shown on the following page. The table shows required current for a CLICK PLUS PLC, two I/O modules, and a C-more Micro. Use the total amperage values to select the properly sized power supply.

CLICK 24VDC Power Supply
C0-00AC or C0-01AC

Other 24VDC Power Supply
Example: PSP24-060S

Power Consumption for CLICK PLC Units

PLC Current Consumption (mA)		
Part Number	Power Budget 24VDC (logic side)	External 24VDC (field side)
Basic PLC Units		
C0-00DD1-D	120	60
C0-00DD2-D	120	0
C0-00DR-D		
C0-00AR-D		
Standard PLC Units		
C0-01DD1-D	140	60
C0-01DD2-D	140	0
C0-01DR-D		
C0-01AR-D		
Analog PLC Units		
C0-02DD1-D	140	60
C0-02DD2-D	140	0
C0-02DR-D		
Ethernet Basic PLC Units		
C0-10DD1E-D	120	60
C0-10DD2E-D	120	0
C0-10DRE-D		
C0-10ARE-D		
Ethernet Standard PLC Units		
C0-11DD1E-D	140	60
C0-11DD2E-D	140	0
C0-11DRE-D		
C0-11ARE-D		

PLC Current Consumption (mA)		
Part Number	Power Budget 24VDC (logic side)	External 24VDC (field side)
Ethernet Analog PLC Units		
C0-12DD1E-D	140	60
C0-12DD2E-D		0
C0-12DRE-D	160	
C0-12ARE-D		
C0-12DD1E-1-D	140	60
C0-12DD2E-1-D		0
C0-12DRE-1-D	160	
C0-12ARE-1-D		
C0-12DD1E-2-D	140	60
C0-12DD2E-2-D		0
C0-12DRE-2-D	160	
C0-12ARE-2-D	140	

Power Consumption for CLICK PLUS PLC Units

CLICK PLUS PLC and Option Slot Modules Current Consumption (mA)		
Part Number	Power Budget 24VDC (logic side)	External 24VDC (field side)
CLICK PLUS PLCs		
C2-01CPU	110	0
C2-02CPU	105	0
C2-03CPU	130	0
Option Slot I/O Modules		
C2-14D1	50	60
C2-14D2	50	0
C2-14DR	75	0
C2-14AR	75	0
C2-08D1-4VC	80	60
C2-08D2-4VC	80	0
C2-08DR-4VC	100	0
C2-08AR-4VC	100	0
C2-08D1-6C	80	60
C2-08D2-6C	80	0
C2-08DR-6C	100	0
C2-08AR-6C	100	0
C2-08D1-6V	80	60
C2-08D2-6V	80	0
C2-08DR-6V	100	0
C2-08AR-6V	100	0

Power Budgeting

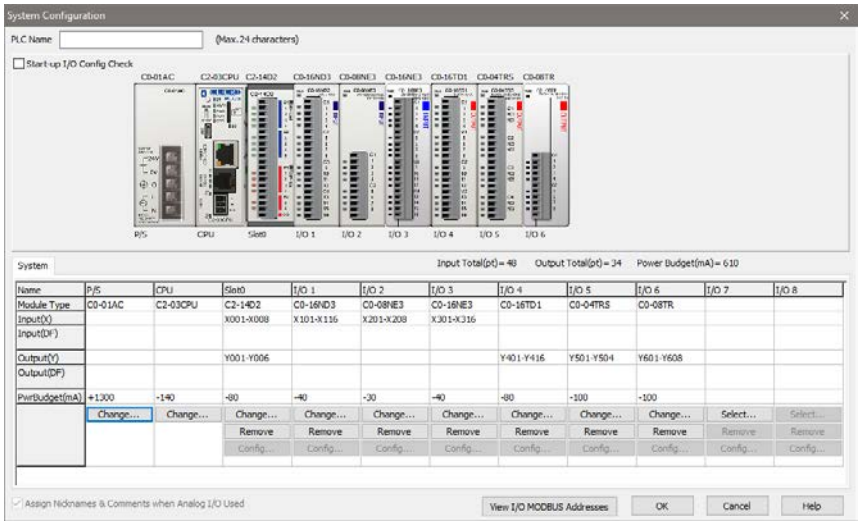
Power Consumption for CLICK Stackable I/O Modules

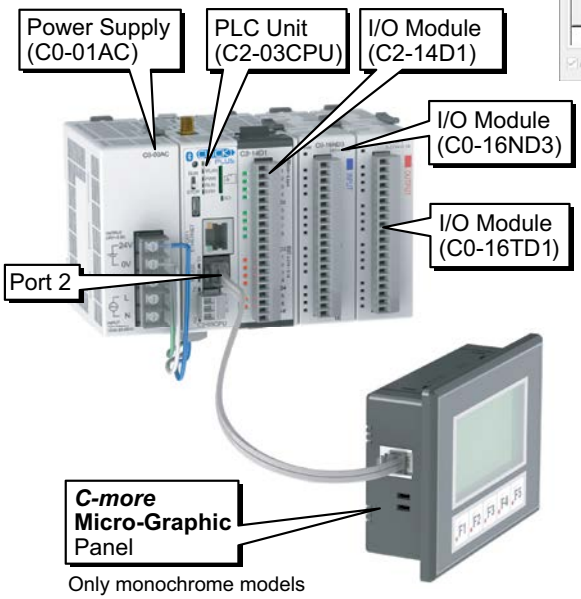
I/O Module Current Consumption (mA)		
Part Number	Power Budget 24VDC (logic side)	External 24VDC (field side)
Discrete Input Modules		
C0-08SIM	50	0
C0-08ND3	30	0
C0-08ND3-1	30	0
C0-16ND3	40	0
C0-08NE3	30	0
C0-16NE3	40	0
C0-08NA	30	0
Discrete Output Modules		
C0-08TD1	50	15
C0-08TD2	50	0
C0-16TD1	80	100
C0-16TD2	80	0
C0-08TA	80	0
C0-04TRS	100	0
C0-04TRS-10	120	0
C0-08TR	100	0
C0-08TR-3	90	0

I/O Module Current Consumption (continued) (mA)		
Part Number	Power Budget 24VDC (logic side)	External 24VDC (field side)
Discrete Combo I/O Modules		
C0-16CDD1	80	50
C0-16CDD2	80	0
C0-08CDR	80	0
Analog Input Modules		
C0-04AD-1	20	65
C0-04AD-2	23	65
C0-04RTD	25	0
C0-04THM	25	0
Analog Output Modules		
C0-04DA-1	20	145
C0-04DA-2	20	85
Analog Combo I/O Modules		
C0-4AD2DA-1	25	75
C0-4AD2DA-2	20	65
C-more Micro-Graphic Panel		
Monochrome only	90	0

Power Budgeting Using the CLICK Programming Software

The CLICK Programming software can also be used for power budgeting. Based on the amperage rating of the power supply selected in the first column, your power budget is calculated by subtracting each consecutive module's power consumption from the total available power budget. If you exceed the maximum allowable power consumption the power budget row is highlighted in red.





Only monochrome models can be powered from port 2.

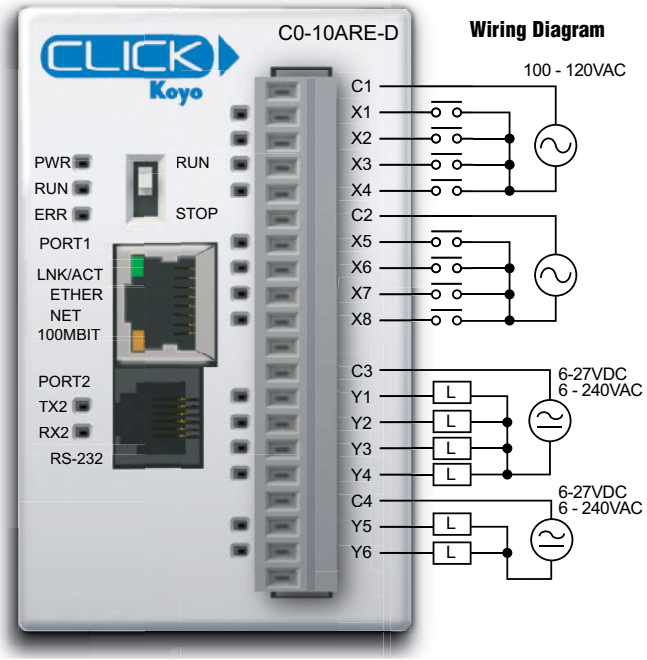
Power Budgeting Example

Current Consumption (mA) Example		
Part Number	Power Budget 24VDC (logic side)	External 24VDC (field side)
C2-03CPU	130	0
C2-14D1	50	60
C0-16ND3	40	0
C0-16TD1	80	100
C-more Micro	90	0
Total:	390	160 *
* Add in calculated load of connected I/O devices.		

Ethernet Basic PLC

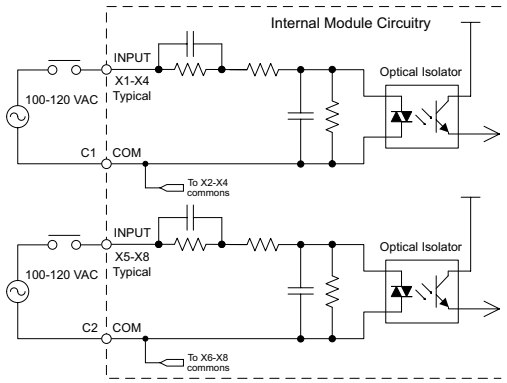
C0-10ARE-D $148.00

8 AC Input/6 Relay Output Micro PLC

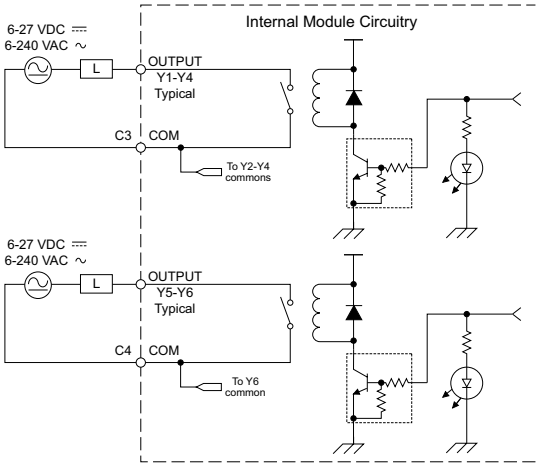


NOTE: *When using Ethernet Basic PLCs, you must use CLICK programming software version V2.00 or later.*

Equivalent Input Circuit



Equivalent Output Circuit

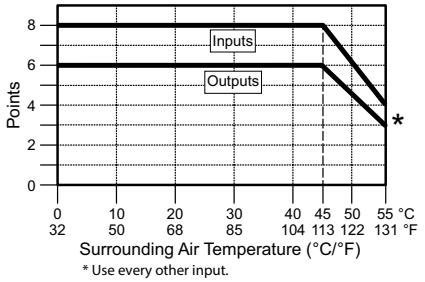


Built-in I/O Specifications - Inputs	
Inputs per Module	8
Operating Voltage Range	100-120 VAC
Input Voltage Range	80-144 VAC
AC Frequency	47-63 Hz
Input Current	8.5 mA @ 100VAC at 50Hz 10mA @ 100VAC at 60Hz
Maximum Input Current	16mA @ 144VAC at 55°C or 131°F
Input Impedance	15kΩ @ 50Hz 12kΩ @ 60Hz
ON Voltage Level	> 60VAC
OFF Voltage Level	< 20VAC
Minimum ON Current	5mA
Maximum OFF Current	2mA
OFF to ON Response	< 40ms
ON to OFF Response	< 40ms
Status Indicators	Logic Side (8 points, green LED)
Commons	2 (4 points/common) Isolated

Built-in I/O Specifications - Outputs	
Outputs per Module	6
Operating Voltage Range	6-240 VAC (47-63 Hz), 6-27 VDC
Output Voltage Range	5-264 VAC (47-63 Hz) 5-30 VDC
Output Type	Relay, form A (SPDT)
Maximum Current	1 A/point; C3: 4 A/common, C4: 2 A/common
Minimum Load Current	5mA @ 5VDC
Maximum Inrush Current	3A for 10ms
OFF to ON Response	< 15ms
ON to OFF Response	< 15ms
Status Indicators	Logic Side (6 points, red LED)
Commons	2 (4 points/com & 2 points/com) Isolated

General Specifications	
Current Consumption at 24VDC	120mA
Terminal Block Replacement Part No.	C0-16TB
Weight	5.6 oz (160g)

C0-10ARE-D Temperature Derating Chart



* Use every other input.

Typical Relay Life (Operations) at Room Temperature	
Voltage & Load Type	**Relay Life**
30VDC, 1A Resistive	300,000 cycles
30VDC, 1A Solenoid	50,000 cycles
250VAC, 1A Resistive	500,000 cycles
250VAC, 1A Solenoid	200,000 cycles
ON to OFF = 1 cycle	

***ZIP*Link Pre-Wired PLC Connection Cables and Modules**

ZL-RTB20 20-pin feed-through connector module

20-pin connector cable
ZL-C0-CBL20 (0.5 m length)
ZL-C0-CBL20-1 (1.0 m length)
ZL-C0-CBL20-2 (2.0 m length)

CLICK PLC Specifications

General Specifications For All CLICK PLC Products

These general specifications apply to all CLICK PLCs and optional power supply products. Please refer to the appropriate I/O temperature derating charts under both the PLC and I/O module specifications to determine best operating conditions based on the ambient temperature of your particular application.

General Specifications	
Operating Temperature	Analog, analog combo I/O modules only: 32°F to 140°F (0°C to 60°C); All other modules: 32°F to 131°F (0°C to 55°C), IEC 60068-2-14 (Test Nb, Thermal Shock)
Storage Temperature	–4°F to 158°F (–20°C to 70°C) IEC 60068-2-1 (Test Ab, Cold) IEC 60068-2-2 (Test Bb, Dry Heat) IEC 60068-2-14 (Test Na, Thermal Shock)
Ambient Humidity	30% to 95% relative humidity (non–condensing)
Environmental Air	No corrosive gases. Environmental pollution level is 2 (UL840)
Vibration	MIL STD 810C, Method 514.2, EC60068-2-27, Category [f], Procedure[VIII] JIS C60068-2-27 (Sine wave vibration test)
Shock	MIL STD 810C, Method 516.2, IEC60068-2-27, JIS C60068-2-27, Category [f], Procedure[VIII]
Noise Immunity	<EN61131-2> EN61000-4-2 (ESD) EN61000-4-3 (RFI) EN61000-4-4 (FTB) EN61000-4-5 (Surge) EN61000-4-6 (Conducted) EN61000-4-8 (Power frequency magnetic field immunity) <Local Test> Impulse noise 1µs, 1000V RFI: No interference measured at 150 and 450 MHz (5w/15cm)
Emissions	EN55011:1998 Class A; EN61000-6-4:2007+A1:2011
Agency Approvals	UL508, UL61010-2-201 (File No. E157382, E316037); CE (EN61131-2); CUL Canadian C22.2
Other	RoHS 2011/65/EU Amendment (EU)2015/863

CLICK PLC Specifications

PLC Unit Specifications

Basic, Standard and Analog PLC Unit Specifications			
	Basic PLC	**Standard PLC**	**Analog PLC**
Control Method	Stored Program/Cyclic execution method	Stored Program/Cyclic execution method	Stored Program/Cyclic execution method
I/O Numbering System	Fixed in Decimal	Fixed in Decimal	Fixed in Decimal
Ladder Memory (steps)	8000	8000	8000
Total Data Memory (words)	8000	8000	8000
Contact Execution (Boolean)	< 0.6 us	< 0.6 us	< 0.6 us
Typical Scan (1K Boolean)	1-2 ms	1-2 ms	1-2 ms
RLL Ladder Style Programming	Yes	Yes	Yes
Run Time Edits	No	No	No
Scan	Variable / fixed	Variable / fixed	Variable / fixed
CLICK Programming Software for Windows	Yes	Yes	Yes
Built-in Communication Ports	Yes (two RS-232 ports)	Yes (two RS-232 ports and one RS-485 port)	Yes (two RS-232 ports and one RS-485 port)
Protocols	Protocols: Modbus RTU (master/slave) and ASCII (in/out)		
FLASH Memory	Standard on PLC	Standard on PLC	Standard on PLC
Built-in Discrete I/O points	8 inputs, 6 outputs	8 inputs, 6 outputs	4 inputs, 4 outputs
Built-in Analog I/O Channels	No	No	2 inputs, 2 outputs
Number of Instructions Available	21	21	21
Control Relays	2000	2000	2000
System Control Relays	1000	1000	1000
Timers	500	500	500
Counters	250	250	250
Interrupts	Yes (external: 8 / timed: 4)	Yes (external: 8 / timed: 4)	Yes (external: 4 / timed: 4)
Subroutines	Yes	Yes	Yes
For/Next Loops	Yes	Yes	Yes
Math (Integer and Hex)	Yes	Yes	Yes
Drum Sequencer Instruction	Yes	Yes	Yes
Internal Diagnostics	Yes	Yes	Yes
Password Security	Yes	Yes	Yes
System Error Log	Yes	Yes	Yes
User Error Log	No	No	No
Memory Backup	Super Capacitor	Super Capacitor + Battery	Super Capacitor + Battery
Battery Backup	No	Yes (battery sold separately; part # D2-BAT-1)	Yes (battery sold separately; part # D2-BAT-1)
Calendar/Clock	No	Yes	Yes
I/O Terminal Block Replacement	AutomationDirect p/n C0-16TB	AutomationDirect p/n C0-16TB	AutomationDirect p/n C0-16TB
Communication Port & Terminal Block Replacement	N/A	AutomationDirect p/n C0-3TB	AutomationDirect p/n C0-3TB
24VDC Power Terminal Block Replacement	AutomationDirect p/n C0-4TB	AutomationDirect p/n C0-4TB	AutomationDirect p/n C0-4TB

CLICK PLC Specifications

PLC Unit Specifications (continued)

Ethernet Basic, Standard and Analog PLC Unit Specifications			
	Ethernet Basic PLC	**Ethernet Standard PLC**	**Ethernet Analog PLC**
Control Method	Stored Program/Cyclic execution method	Stored Program/Cyclic execution method	Stored Program/Cyclic execution method
I/O Numbering System	Fixed in Decimal	Fixed in Decimal	Fixed in Decimal
Ladder Memory (steps)	8000	8000	8000
Total Data Memory (words)	8000	8000	8000
Contact Execution (Boolean)	< 0.2 µs	< 0.2 µs	< 0.2 µs
Typical Scan (1K Boolean)	< 1ms	< 1ms	< 1ms
RLL Ladder Style Programming	Yes	Yes	Yes
Run Time Edits	Yes	Yes	Yes
Scan	Variable / fixed	Variable / fixed	Variable / fixed
CLICK Programming Software for Windows	Yes	Yes	Yes
Built-in Communication Ports	Yes (one Ethernet port and one RS-232 port)	Yes (one Ethernet port, one RS-232 port and one RS-485 port)	Yes (one Ethernet port, one RS-232 port and one RS-485 port)
Protocols	Modbus RTU (master/slave) and ASCII (in/out), Modbus TCP (client/server), EtherNet/IP Implicit and Explicit (adapter server)		
FLASH Memory	Standard on PLC	Standard on PLC	Standard on PLC
Built-in Discrete I/O points	8 inputs, 6 outputs	8 inputs, 6 outputs	4 inputs, 4 outputs
Built-in Analog I/O Channels	No	No	2 or 4 inputs; 2 outputs
Number of High-Speed Input Points	4	8	4
Number of High-Speed Counters	4	6	4
PID Control Loops	8	8	8
Number of Instructions Available	21	21	21
Control Relays	2000	2000	2000
System Control Relays	1000	1000	1000
Timers	500	500	500
Counters	250	250	250
Interrupts	Yes (external: 8 / timed: 4)	Yes (external: 8 / timed: 4)	Yes (external: 4 / timed: 4)
Subroutines	Yes	Yes	Yes
For/Next Loops	Yes	Yes	Yes
Math (Integer and Hex)	Yes	Yes	Yes
Drum Sequencer Instruction	Yes	Yes	Yes
Internal Diagnostics	Yes	Yes	Yes
Password Security	Yes	Yes	Yes
System Error Log	Yes	Yes	Yes
User Error Log	No	No	No
Memory Backup	Super Capacitor + Battery	Super Capacitor + Battery	Super Capacitor + Battery
Battery Backup	Yes (battery part # D2-BAT-1)	Yes (battery part # D2-BAT-1)	Yes (battery part # D2-BAT-1)
Calendar/Clock	Yes	Yes	Yes
I/O Terminal Block Replacement	AutomationDirect p/n C0-16TB	AutomationDirect p/n C0-16TB	AutomationDirect p/n C0-16TB
Communication Port & Terminal Block Replacement	N/A	AutomationDirect p/n C0-3TB	AutomationDirect p/n C0-3TB
24VDC Power Terminal Block Replacement	AutomationDirect p/n C0-4TB	AutomationDirect p/n C0-4TB	AutomationDirect p/n C0-4TB

CLICK Specifications

CLICK PLC Hardware/Software Compatibility

CLICK PLCs require a minimum software version of v2.50 for the PID function. The table below shows the most recent software and hardware versions required for the High-Speed input operation capability to be accessible.

CLICK PLC Features Software Compatibility

CPU Type	Part Number	Minimum CLICK Software Version				
		Hardware	High-Speed Inputs	EtherNet/IP	PID	DHCP
Basic	C0-00DD1-D	v1.00	N/A	N/A	N/A	N/A
	C0-00DD2-D					
	C0-00DR-D					
	C0-00AR-D					
Standard	C0-01DD1-D	v1.20	N/A	N/A	N/A	N/A
	C0-01DD2-D					
	C0-01DR-D					
	C0-01AR-D					
Analog	C0-02DD1-D (before SN 171208001)	v1.12	N/A	N/A	N/A	N/A
	C0-02DD1-D (after SN 171208001)	v2.10				
	C0-02DD2-D (before SN 174018001)	v1.12				
	C0-02DD2-D (after SN 174018001)	v2.10				
	C0-02DR-D (before SN 173158001)	v1.12				
	C0-02DR-D (after SN 173158001)	v2.10				
Ethernet CPUs	Ethernet CPUs require v2.40 for EtherNet/IP communications					
Ethernet Basic	C0-10DD1E-D	v2.00	v2.30	v2.40	v2.50	v3.00
	C0-10DD2E-D					
	C0-10DRE-D					
	C0-10ARE-D		N/A			
Ethernet Standard	C0-11DD1E-D	v2.00	v2.30	v2.40	v2.50	v3.00
	C0-11DD2E-D					
	C0-11DRE-D					
	C0-11ARE-D		N/A			
Ethernet Analog	C0-12DD1E-D	v2.20	v2.30	v2.40	v2.50	v3.00
	C0-12DD2E-D					
	C0-12DRE-D					
	C0-12ARE-D		N/A			
	C0-12DD1E-1-D		v2.30			
	C0-12DD2E-1-D					
	C0-12DRE-1-D					
	C0-12ARE-1-D		N/A			
	C0-12DD1E-2-D		v2.30			
	C0-12DD2E-2-D					
	C0-12DRE-2-D					
	C0-12ARE-2-D		N/A			
I/O Modules	C0-08NE3	v1.20	N/A	N/A	N/A	N/A
	C0-16NE3					
	C0-04AD-1	v1.40				
	C0-04AD-2					
	C0-04DA-1					
	C0-04DA-2					
	C0-4AD2DA-1					
	C0-4AD2DA-2					
	C0-04RTD					
	C0-04THM					
	C0-08CDR					
	C0-16CDD1					
	C0-16CDD2					
	Other modules	v1.00				

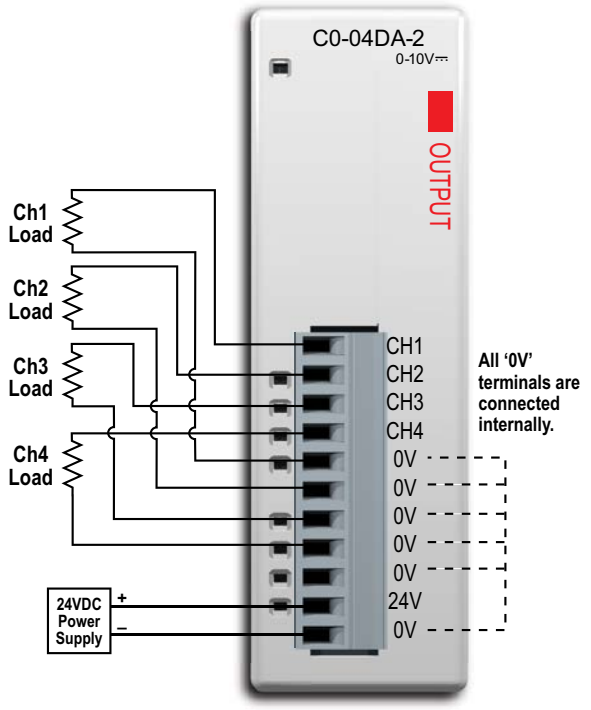
CLICK Stackable I/O Module Specifications

C0-04DA-2 $132.00

4-Channel Analog Voltage Output Module

4-channel analog voltage output module, 12-bit resolution, range: 0-10V. External 24VDC power required, removable terminal block included (replacement AutomationDirect p/n C0-8TB).

Wiring Diagram



NOTE: *When using this module you must also use CLICK programming software and PLC firmware version V1.40 or later.*

Output Specifications	
Outputs per Module	4
Output Range	0-10 V
Resolution	12-bit, 2.44 mV per count
Output Type	Voltage sourcing at 10mA max. (1 common)
Output Value in Program Mode	Determined by CPU
Output Value in Fault Mode	0 V
Output Impedance	0.2 Ω typical
Load Impedance	>1000Ω
Maximum Capacitive Load	0.01 uF maximum
Allowed Load Type	Grounded
Maximum Inaccuracy	0.5% of range
Max. Full Scale Calibration Error (Not including Offset)	±0.2% of range maximum voltage
Max. Offset Calibration Error	±0.2% of range maximum
Accuracy vs. Temperature	±75 PPM/°C maximum full scale calibration change (±0.0025% of range/°C)
Max. Crosstalk at DC, 50/60Hz	-72 dB, 1 LSB
Linearity Error (End to End)	±4 LSB max., (±0.1% of full scale); monotonic with no missing codes
Output Stability and Repeatability	±2% LSB after 10 minute warmup period typical
Output Ripple	0.1% of full scale
Output Settling Time	0.3 ms maximum, 5µs minimum (full scale range)
All Channel Update Rate	10ms
Max. Continuous Overload	Outputs current limited to 40mA typical; continuous overloads on multiple outputs can damage module.
Field to Logic Side Isolation	1800 VAC applied for 1 second (100% tested)
Type of Output Protection	0.1 µF transient suppressor
Output Signal at Power Up and Power Down	0 V
External 24VDC Power Required	85mA
Base Power Required (24VDC)	20mA
Terminal Block Replacement	AutomationDirect p/n C0-8TB
Weight	2.9 oz (82g)

***ZIP*Link Pre-Wired PLC Connection Cables and Modules for CLICK PLC**

11-pin connector cable
ZL-C0-CBL11 (0.5 m length)
ZL-C0-CBL11-1 (1.0 m length)
ZL-C0-CBL11-2 (2.0 m length)

ZL-RTB20 20-pin feed-through connector module

CLICK Stackable I/O Module Specifications

General Specifications For All CLICK Stackable I/O Modules

These general specifications apply to all CLICK Stackable I/O Modules. Please refer to the appropriate I/O temperature derating charts under the PLC (CLICK PLC with built-in I/O), Option Slot module (CLICK PLUS only), and Stackable I/O module specification to determine best operating conditions based on the ambient temperature of your particular application.

NOTE: *These modules are available to use with CLICK or CLICK PLUS systems.*

General Specifications	
Operating Temperature	Analog, analog combo I/O modules only: 32°F to 140°F (0°C to 60°C); All other modules: 32°F to 131°F (0°C to 55°C), IEC 60068-2-14 (Test Nb, Thermal Shock)
Storage Temperature	–4°F to 158°F (–20°C to 70°C) IEC 60068-2-1 (Test Ab, Cold) IEC 60068-2-2 (Test Bb, Dry Heat) IEC 60068-2-14 (Test Na, Thermal Shock)
Ambient Humidity	30% to 95% relative humidity (non–condensing)
Environmental Air	No corrosive gases. Environmental pollution level is 2 (UL840)
Vibration	MIL STD 810C, Method 514.2, EC60068-2-27, Category [f], Procedure[VIII] JIS C60068-2-27 (Sine wave vibration test)
Shock	MIL STD 810C, Method 516.2, IEC60068-2-27, JIS C60068-2-27, Category [f], Procedure[VIII]
Noise Immunity	<EN61131-2> EN61000-4-2 (ESD) EN61000-4-3 (RFI) EN61000-4-4 (FTB) EN61000-4-5 (Surge) EN61000-4-6 (Conducted) EN61000-4-8 (Power frequency magnetic field immunity) <Local Test> Impulse noise 1µs, 1000V RFI: No interference measured at 150 and 450 MHz (5w/15cm)
Emissions	EN55011:1998 Class A; EN61000-6-4:2007+A1:2011
Agency Approvals	UL508, UL61010-2-201 (File No. E157382, E316037); CE (EN61131-2); CUL Canadian C22.2
Other	RoHS 2011/65/EU Amendment (EU)2015/863

Power Supplies

Power Supplies

The CLICK PLC family offers two 24VDC power supplies. They are identical except for the output current.

It is not mandatory to use one of these CLICK power supplies for the CLICK/CLICK PLUS PLC system. You can use any other 24VDC power supply that Automationdirect.com offers, including the PSP24-DC12-1 12 to 24 VDC converter shown below.

C0-00AC Power Supply

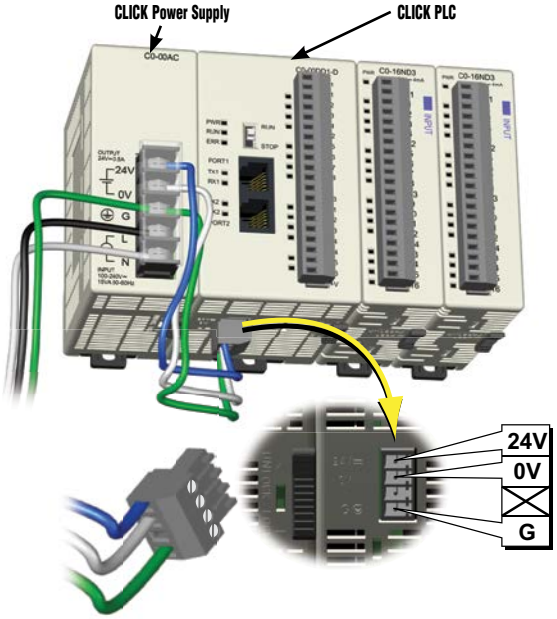
Limited auxiliary AC power supply allows you to power the 24VDC CLICK C0 and C2 series PLCs with 100–240 VAC supply power. The 0.5 A DC power supply is capable of controlling the PLC plus a limited configuration based on the power budget of each I/O module. The C0-00AC is a low-cost solution for applications requiring only minimal I/O and power consumption. This power supply will not support a fully-populated CLICK PLC system with all possible I/O module combinations.

C0-01AC Power Supply

Expanded auxiliary AC power supply allows you to power the 24VDC CLICK C0 and C2 series PLCs with 100–240 VAC supply power. The 1.3 A DC power supply is capable of supporting a fully-populated CLICK PLC system with all possible I/O module combinations, with no concerns for exceeding the power budget.

PSP24-DC12-1 DC-DC Converter

With this DC-DC converter you can operate the CLICK/CLICK PLUS PLC with 12VDC input power.



24VDC power is supplied to the PLC unit through wiring connected from the power supply output to the 4-pin 24VDC input connector located on the bottom of the PLC unit.

C0-00AC

C0-01AC

CLICK 24VDC Power Supply Ratings		
Part Number	Output Current	Price
C0-00AC	0.5 A	$31.00
C0-01AC	1.3 A	$42.50

C0-00AC Power Supply Input Specifications		
Part Number	C0-00AC	C0-01AC
Input Voltage Range	85–264 VAC	
Input Frequency	47–63 Hz	
Input Current (typical)	0.3 A @ 100VAC, 0.2 A @ 200VAC	0.9 A @ 100VAC, 0.6 A @ 200VAC
Inrush Current	30A	
Efficiency	80% typical	

C0-00AC Power Supply Output Specifications		
Part Number	C0-00AC	C0-01AC
Output Voltage Range	23–25 VDC	
Output Current	0.5 A	1.3 A
Ripple	200mV p-p max (0–55°C)	
Ripple Noise	300mV p-p max (0–55°C)	
Over Current Protection	@ 0.65 A (automatic recovery)	@ 1.6 A (automatic recovery)
Over Voltage Protection	@ 27.6 V (clamped by Zener diode)	
Start-up Time	1000ms max at rated input and load	
Hold-up Time	10ms minimum at 85VAC, I=max	

C0-00AC Power Supply General Specifications		
Part Number	C0-00AC	C0-01AC
Ambient Operating Temperature	32–131°F [0–55°C]	
Storage Temperature	-4–158°F [-20–70°C]	
Humidity	30–95%, non-condensing	
Vibration Resistance	JIS C60068-2-6, sine wave vibration	
Shock Resistance	JIS C60068-2-27	
Voltage Withstand		
Input-Output	1500VAC, 5mA cutoff current	
Input-Ground	1500VAC, 5mA cutoff current	
Output-Ground	500VAC, 5mA cutoff current	
Insulation Resistance		
Input-Output	10MΩ minimum, 500VDC	
Input-Ground	10MΩ minimum, 500VDC	
Output-Ground	5MΩ minimum, 500VDC	
Noise Immunity	FCC Class A, EN55022:1998 Class A	
Input/Output Interface	5P terminal block, Fujicon UF2362AX series or equivalent	
Agency Approvals	UL508, UL1604, EN61010-1 (IEC 1010-1), CAN/CSA E60079-15:02, JIS C0025	
Weight	5.3 oz [150g]	6.0 oz [170g]

PSP24-DC12-1

PSP24-DC12-1 DC-DC Converter Specifications	
Input Voltage Range	9.5–18 VDC
Input Power (no load)	1.0 W max.
Startup Voltage	8.4 VDC
Undervoltage Shutdown	7.6 VDC
Output Voltage Range	24–28 VDC (adjustable)
Output Current	1.0 A
Short Circuit Protection	Current limited at 110% typical
Weight	7.5 oz (213g)

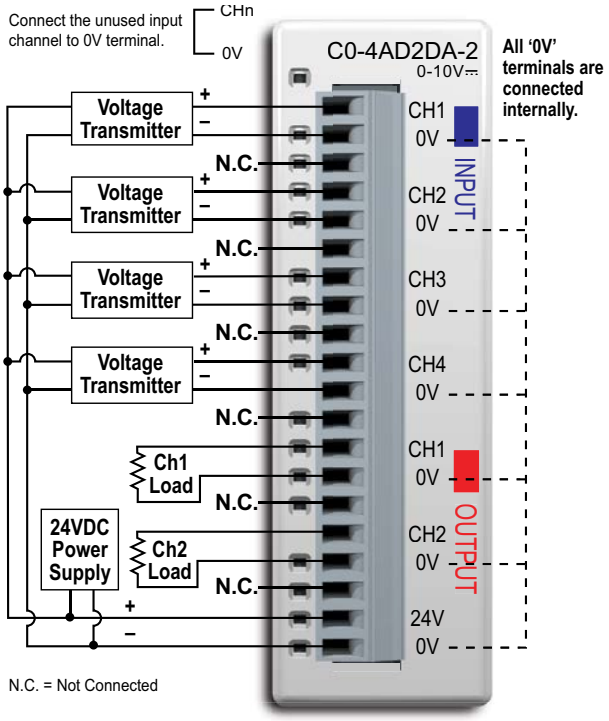
CLICK Stackable I/O Module Specifications

C0-4AD2DA-2 $165.00

4-Channel Analog Voltage Input and 2-Channel Analog Voltage Output Module

4-channel analog voltage input (13-bit resolution) and 2-channel analog voltage output (12-bit resolution) module, range: 0–10V. External 24VDC power required, removable terminal block included (replacement AutomationDirect p/n C0-16TB).

Wiring Diagram



***NOTE:** When using this module you must also use CLICK programming software and CPU firmware version V1.40 or later.*

General Specifications	
Field to Logic Side Isolation	1800VAC
External 24VDC Power Required	65mA
Base Power Required (24VDC)	15mA
Terminal Block Replacement	AutomationDirect p/n C0-16TB
Weight	3.1 oz (86g)

ZL-RTB20 20-pin feed-through connector module

***ZIP*Link Pre-Wired PLC Connection Cables and Modules for CLICK PLC**

20-pin connector cable
ZL-C0-CBL20 (0.5 m length)
ZL-C0-CBL20-1 (1.0 m length)
ZL-C0-CBL20-2 (2.0 m length)

Input Specifications	
Inputs per Module	4
Input Range	0-10 V
Resolution	13-bit, 1.22 mV per count
Input Type	Single ended (1 common)
Maximum Continuous Overload	±100VDC
Input Impedance	>150kΩ
Filter Characteristics	Low pass, -3 dB at 500Hz
Sample Duration Time	5ms
All Channel Update Rate	20ms
Open Circuit Detection Time	Zero reading within 100ms
Conversion Method	Successive approximation
Accuracy vs. Temperature	±75 PPM/°C maximum
Maximum Inaccuracy	0.5% of range (including temperature changes)
Linearity Error (End to End)	±3 count maximum, monotonic with no missing codes
Input Stability and Repeatability	±2 count maximum
Full Scale Calibration Error (including Offset)	±8 count maximum
Offset Calibration Error	±8 count maximum
Maximum Crosstalk at DC, 50/60Hz	±2 count maximum

Output Specifications	
Outputs per Module	2
Output Range	0-10 V
Resolution	12-bit, 2.44 mV per count
Output Type	Voltage sourcing at 10mA max. (1 common)
Output Value in Program Mode	Determined by CPU
Output Value in Fault Mode	0 V
Output Impedance	0.2 Ω typical
Load Impedance	>1000Ω
Maximum Capacitive Load	0.01 uF maximum
Allowed Load Type	Grounded
Maximum Inaccuracy	1% of range
Max. Full Scale Calibration Error (Not including Offset)	±0.2% of range maximum voltage
Max. Offset Calibration Error	±0.2% of range maximum
Accuracy vs. Temperature	±75 PPM/°C maximum full scale calibration change (±0.0025% of range/°C)
Max. Crosstalk at DC, 50/60Hz	-72 dB, 1 LSB
Linearity Error (End to End)	±4 LSB maximum, (±0.1% of full scale); monotonic with no missing codes
Output Stability and Repeatability	±2% LSB after 10 minute warmup period typical
Output Ripple	0.5% of full scale
Output Settling Time	0.3 ms maximum, 5µs minimum (full scale range)
All Channel Update Rate	20ms
Max. Continuous Overload	Outputs current limited to 40mA typical; continuous overloads on multiple outputs can damage module.
Type of Output Protection	0.1 µF transient suppressor
Output Signal at Power Up or Power Down	0 V

CLICK Stackable I/O Module Specifications

General Specifications For All CLICK Stackable I/O Modules

These general specifications apply to all CLICK Stackable I/O Modules. Please refer to the appropriate I/O temperature derating charts under the PLC (CLICK PLC with built-in I/O), Option Slot module (CLICK PLUS only), and Stackable I/O module specification to determine best operating conditions based on the ambient temperature of your particular application.

NOTE: *These modules are available to use with CLICK or CLICK PLUS systems.*

General Specifications	
Operating Temperature	Analog, analog combo I/O modules only: 32°F to 140°F (0°C to 60°C); All other modules: 32°F to 131°F (0°C to 55°C), IEC 60068-2-14 (Test Nb, Thermal Shock)
Storage Temperature	–4°F to 158°F (–20°C to 70°C) IEC 60068-2-1 (Test Ab, Cold) IEC 60068-2-2 (Test Bb, Dry Heat) IEC 60068-2-14 (Test Na, Thermal Shock)
Ambient Humidity	30% to 95% relative humidity (non–condensing)
Environmental Air	No corrosive gases. Environmental pollution level is 2 (UL840)
Vibration	MIL STD 810C, Method 514.2, EC60068-2-27, Category [f], Procedure[VIII] JIS C60068-2-27 (Sine wave vibration test)
Shock	MIL STD 810C, Method 516.2, IEC60068-2-27, JIS C60068-2-27, Category [f], Procedure[VIII]
Noise Immunity	<EN61131-2> EN61000-4-2 (ESD) EN61000-4-3 (RFI) EN61000-4-4 (FTB) EN61000-4-5 (Surge) EN61000-4-6 (Conducted) EN61000-4-8 (Power frequency magnetic field immunity) <Local Test> Impulse noise 1µs, 1000V RFI: No interference measured at 150 and 450 MHz (5w/15cm)
Emissions	EN55011:1998 Class A; EN61000-6-4:2007+A1:2011
Agency Approvals	UL508, UL61010-2-201 (File No. E157382, E316037); CE (EN61131-2); CUL Canadian C22.2
Other	RoHS 2011/65/EU Amendment (EU)2015/863

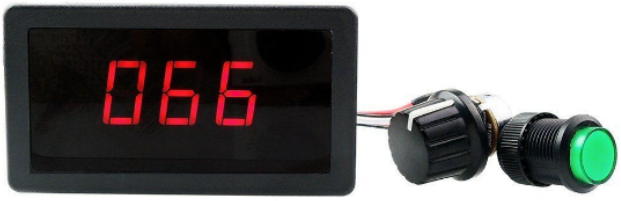
Digital Display PWM DC Motor Speed Control

Model: CCM5D

Features:

- CCM5D DC motor speed regulator controls the speed of a DC motor by adjusting Pulse-Width-Modulation (PWM).
- Large 0.56inch 3-digit LED display numbers allow viewing under the most adverse conditions.
- The display range of 3-digit LED display is “000”-“100”. (For example, the display “066” means that the PWM output duty cycle is 66%).
- Adjustable speed range is 0%-100%.
- Suitable for the DC motor (or DC load) within 5A, peak current 8A.
- Standard industrial-grade touch of a button, push the button that goes to sleep, press again to start working again.

Specifications:

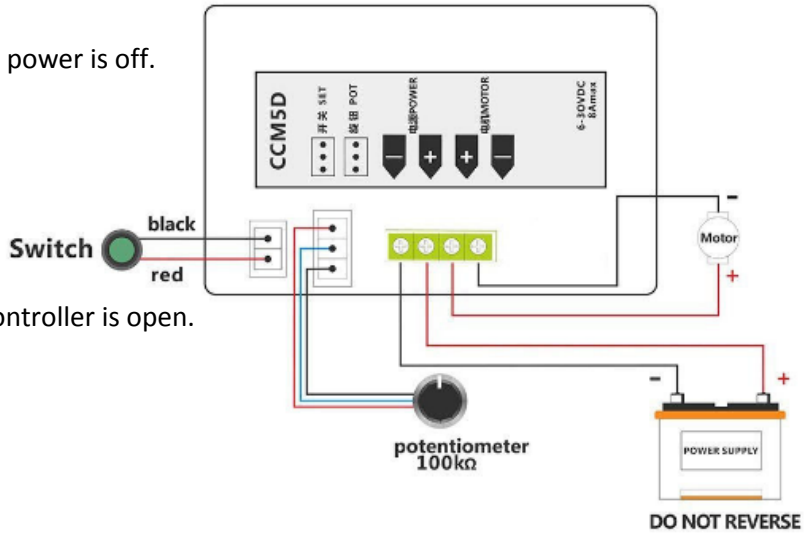


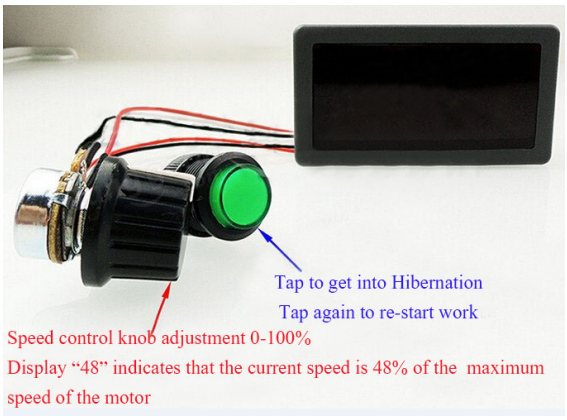
-Applicable voltage: DC 6V-30V
-Controlled power: 6V*6A=36W, 12V*6A=72W,....30V*6A=180W
-Applicable current: -rated current: 6A
-maximum current: 8A
-Speed control range: 0-100%
-Product frequency: 16 KHz
-Dimensions:79mm(L)*42mm(W)*24mm(H)

Operating Instructions:

1. Before you attempt to wire the controller, make sure the power is off.
2. Do not reverse positive and negative power loads, this will damage the controller. To change the motor directic interchange the positive and negative wires of the motor.
3. Connect the wires by referring to the wiring diagram.
4. Turn on the power, and adjust the potentiometer.
5. The LED display displays the PWM output duty cycle.
6. Push the key, the controller is closed, push it again, the controller is open.

Wiring Diagram



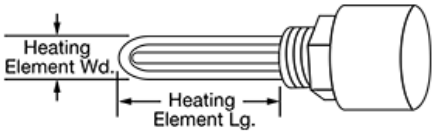


Made in China

Electronics Katrangi Trading

Screw-Plug Immersion Heater

for Water, Adjustable, 304 Stainless Steel Element, 240V AC, 1 Phase, 3000W



Each

In stock
$375.12 Each
3656K174

ADD TO ORDER

3-D Solidworks

Download

Heater Type	Immersion
Wattage	3,000 W
Watt Density	54 W/sq. in.
Voltage	240V AC
Electrical Phase	Single
Current	12.5 A
Heating Element	
Length	8"
Width	1 7/8"
Material	304 Stainless Steel
Unheated Length	1"
Heated Length	7"
Number of Heating Elements	3
Minimum Heating Element Coverage	Fully Covered
Temperature Control Type	Adjustable Thermostat
Temperature Control Method	Dial
Temperature Control Range	60° to 250° F
Temperature Accuracy	Not Rated
Pipe Connection Type	Threaded
Pipe Size	2
Thread Type	NPT
Thread Length	1"
Gender	Male
Power Source	Electric
Electrical Connection Type	Hardwire
Wire Connection Type	Screw Terminals

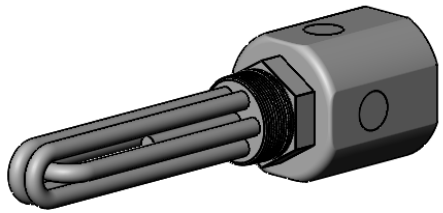
Body	
Diameter	4"
Length	4"
Material	304 Stainless Steel
Overall Length	13 5/16"
Hex Shoulder	
Length	11/16"
Width	2 1/2"
Maximum Pressure	185 psi
Environmental Rating	NEMA 1
Conduit Connection Type	Knockout
Conduit Trade Size	3/4
Mount Type	Screw Plug
Mounting Orientation	Horizontal, Vertical
For Use With	Water
Specifications Met	CE Marked; CSA Certified; UL Recognized Component
RoHS	Not Compliant
REACH	Not Compliant
DFARS	Specialty Metals COTS-Exempt
Country of Origin	United States
USMCA Qualifying	Yes
Schedule B	851610.0080
ECCN	EAR99

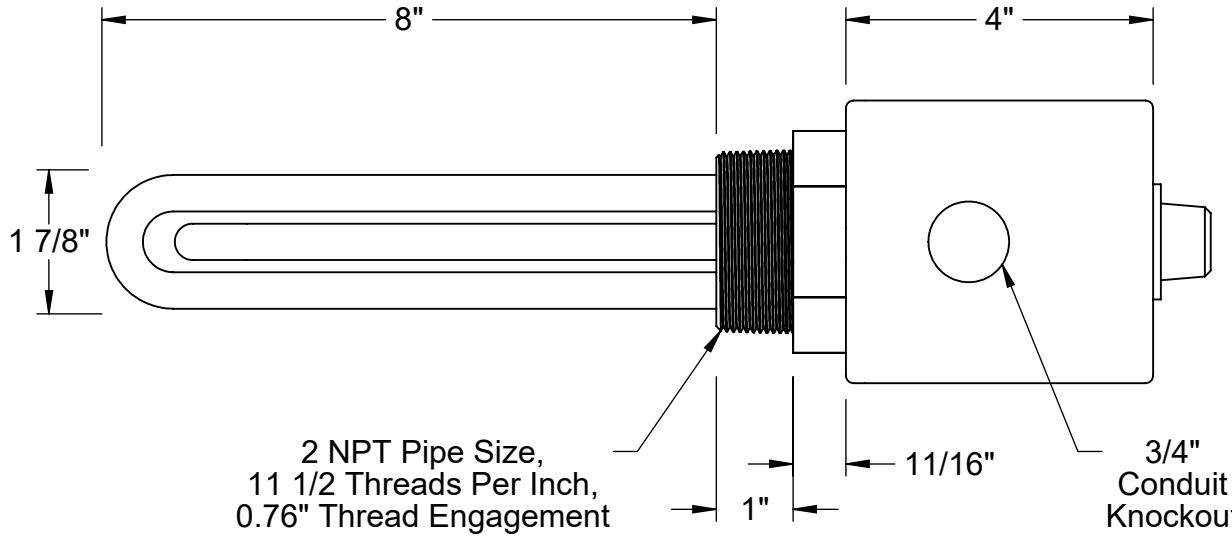
Install these heaters into threaded container openings or pipe couplings to quickly and efficiently heat liquid through direct contact.

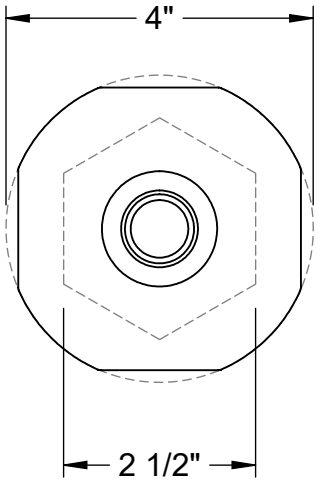
Heaters with an adjustable thermostat automatically turn on when the temperature drops below the set temperature and off when it rises above the set temperature. Adjust the set temperature with the dial.

304 stainless steel heating elements are more corrosion resistant than copper heating elements.

Note: Fully immerse the heating element in liquid to prevent heater failure. Install these heaters into threaded container openings or pipe couplings to quickly and efficiently heat liquid through direct contact.







McMASTER-CARR® CAD	PART NUMBER 3656K174
http://www.mcmaster.com	Screw-Plug Immersion Heater for Water

Solid State Relays

High Reliability, Vdc Input/Vac Output, Vac Input/Vac Output

SSRL Series Starts at

$21

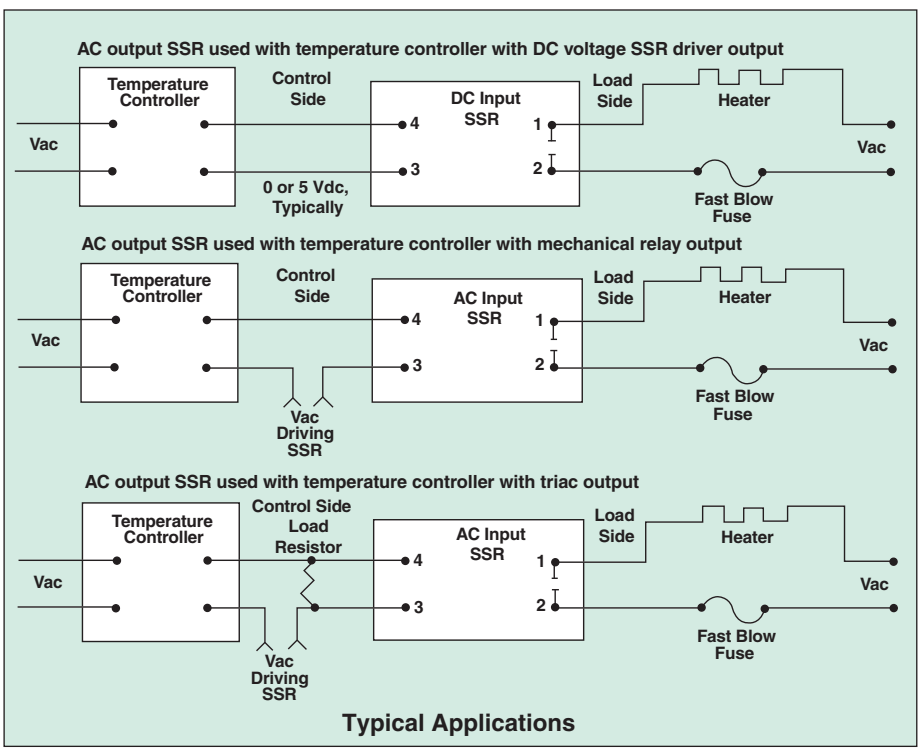
1 YEAR WARRANTY

SSRL240AC10, $25, shown actual size.

- **Current Ratings to 100 A**
- **Multi-Million Cycle Life**
- **Compatible with Temperature Controllers**
- **Solid-State, SCR Design**
- **Zero Voltage Switching**
- **Control AC Lines to 660 Vac**
- **AC and DC Control Signal Models**
- **LED Input Status Indicator**
- **Thermal Conductive Pad Included**

The SSRL Series solid state relays are used to control large resistance heaters in conjunction with temperature controllers. Solid state relays are SPST, normally open switching devices with no moving parts, capable of millions of cycles of operation. By applying a control signal, an SSR switches "on" the AC load current, just as the moving contacts do on a mechanical contactor. Three-phase loads can be controlled using 2 or 3 SSR's. Use 3 SSR's for "Y" or "star" 3-phase loads using a neutral line. Two SSR's will control "delta" loads with no neutral line. Three solid state relays are also used when there is no neutral load to provide redundancy and extra assurance of control.

"Switching" takes place at the 0 voltage crossover point of the alternating current cycle. Because of this, no appreciable electrical noise is generated, making SSR's ideal for environments where there are apparatuses susceptible to RFI.



Typical Applications

Common Specifications

Operating Temperature: -20 to 80°C (-5 to 175°F)

Storage Temperature: -40 to 80°C (-40 to 175°F)

Isolation: 4000 Vrms, input to output; 2500 Vrms input/output to ground

Capacitance: 8 pF, input to output (max)

Line Frequency Range: 47 to 63 Hz

Turn-On Time: 20 ms, AC; 05 cycle, DC

Turn-Off Time: 30 ms, AC; 05 cycle, DC

Output Specifications for Vac and Vdc Input Models

Specifications	10 Amp	25 Amp	50 Amp	75 Amp	100 Amp
Max On-State Current	10 A	25 A	50 A	75 A	100 A
Min On-State Current	100 mA				
Max 1-Cycle Surge	150 A	300 A	750 A	1000 A	1200 A
Max 1 sec Surge	30 A	75 A	150 A	225 A	300 A
1^2T (60 Hz), A^2sec	416	937	2458	5000	6000

These SSR's are of the twin SCR type, inherently more reliable and capable of higher overloads before failure than triacs. Heat is developed in a solid state relay due to the nominal voltage drop across the switching device. To dissipate the heat, an SSR must be mounted on a finned heat sink or aluminum plate. An SSR should be located where the ambient temperature is relatively low, since the current switching rating is lowered as the temperature increases. Another SSR characteristic is a small leakage current across the output when the relay is open. Because of this, a voltage will always exist on the load side of the device.

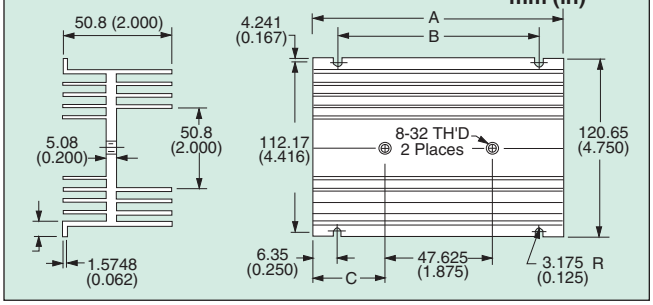
In comparing SSR's with mechanical contactors, the SSR has a cycle life many times that of a comparably priced contactor. However, SSR's are more prone to failure due to overload and improper initial wiring. Solid state relays can fail, contact closed, on overload circuits. It is essential that a properly rated, fast blowing I^2T fuse be installed to protect the load circuit.

Finned heat sinks are anodized fabrications that come complete with tapped mounting holes and screws. See thermal rating curves and ordering instructions for proper selection.

All SSRL series relays come with a thermally conductive pad mounted on the baseplate. This will significantly improve the thermal conductivity between the heat sink and SSR baseplate. It is also suggested that 10"/lb of torque be used on the SSR mounting screws.

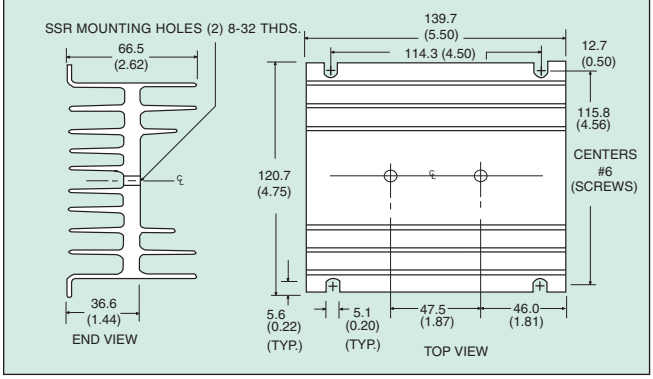
SSRL240DC50 solid state relay, $37, shown smaller than actual size with FHS-2 heat sink, $19. See P-114 for more information.

FHS-1 and FHS-2 Heat Sink — **Dimensions: mm (in)**



FHS Heat Sink Dimensions and Specifications

FHS-6 Heat Sink — **Dimensions: mm (in)**

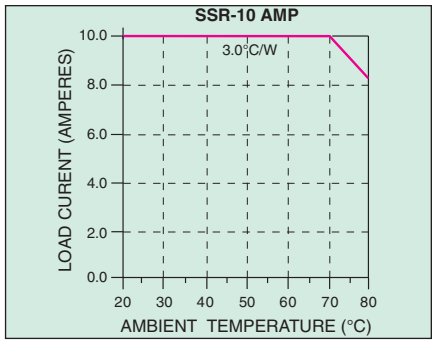


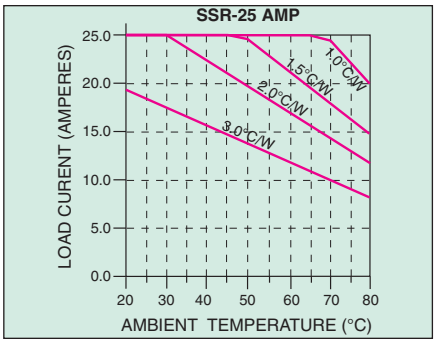
Model No.	A	B	C	Thermal Rating
FHS-1	3.00"	2.50"	0.56"	2°C/W
FHS-2	5.50"	5.00"	1.81"	1.2°C/W

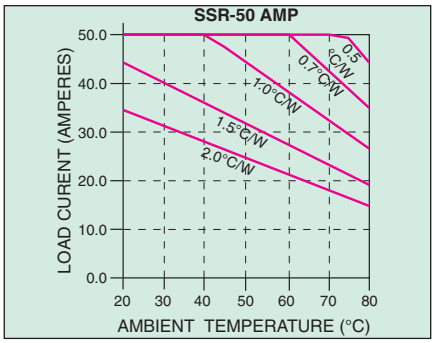
SSR240 Series Electrical Specifications

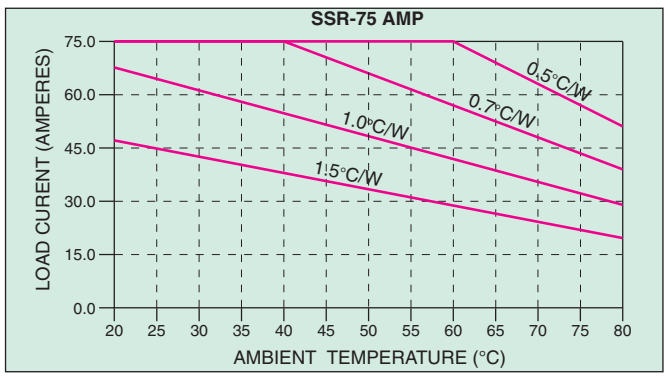
Model No.	Type	Control Signal Voltage	Input-Control Signal			Output
			Control Signal Turn-On	Control Signal Turn-Off	Max Input Current	Peak Voltage* (60 s Max)
SSRL240AC10 SSRL240AC25 SSRL240AC50 SSRL240AC75 SSRL240AC100	AC control signal	90 to 280 Vac	90 Vac	10 Vac	10 mA	800V
SSRL240DC10 SSRL240DC25 SSRL240DC50 SSRL240DC75 SSRL240DC100	DC control signal	3 to 32 Vdc	3 Vdc	1 Vdc	14 mA	800V
SSRL660AC50 SSRL660AC75 SSRL660AC100	AC control signal	90 to 280 Vac	90 Vac	10 Vac	10 mA	1200V
SSRL660DC50 SSRL660DC75 SSRL660DC100	DC control signal	4 to 32 Vdc	4 Vdc	1 Vdc	14 mA	1200V

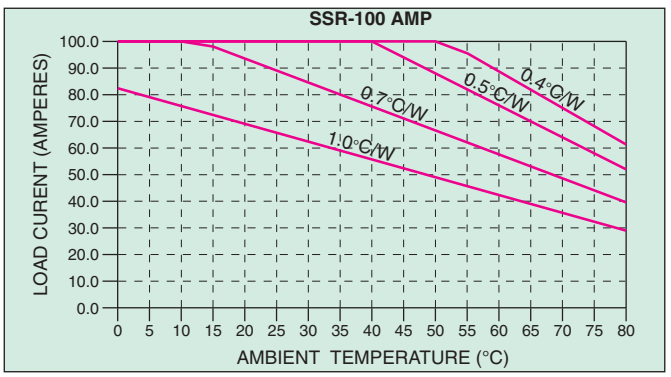
** Transients above table value should be suppressed.*

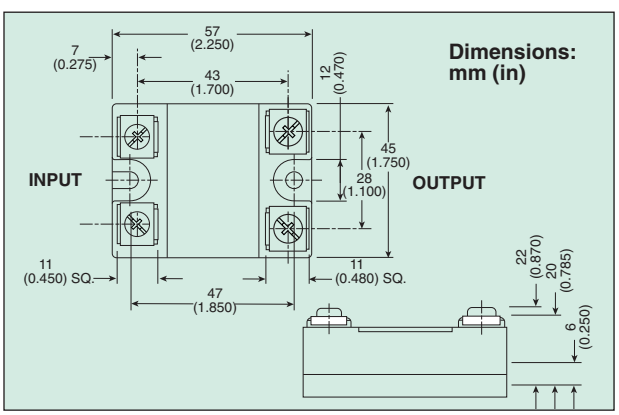


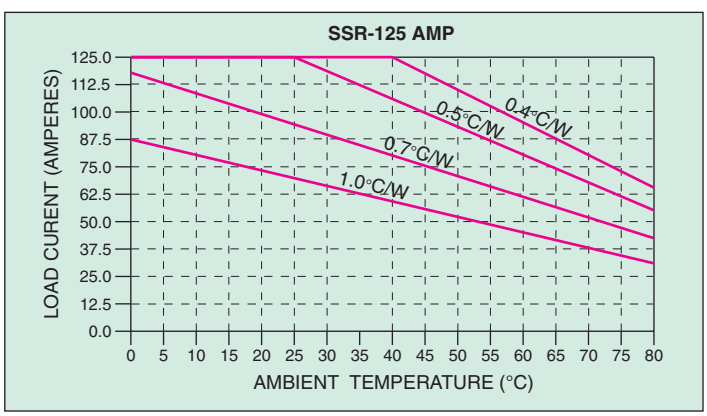






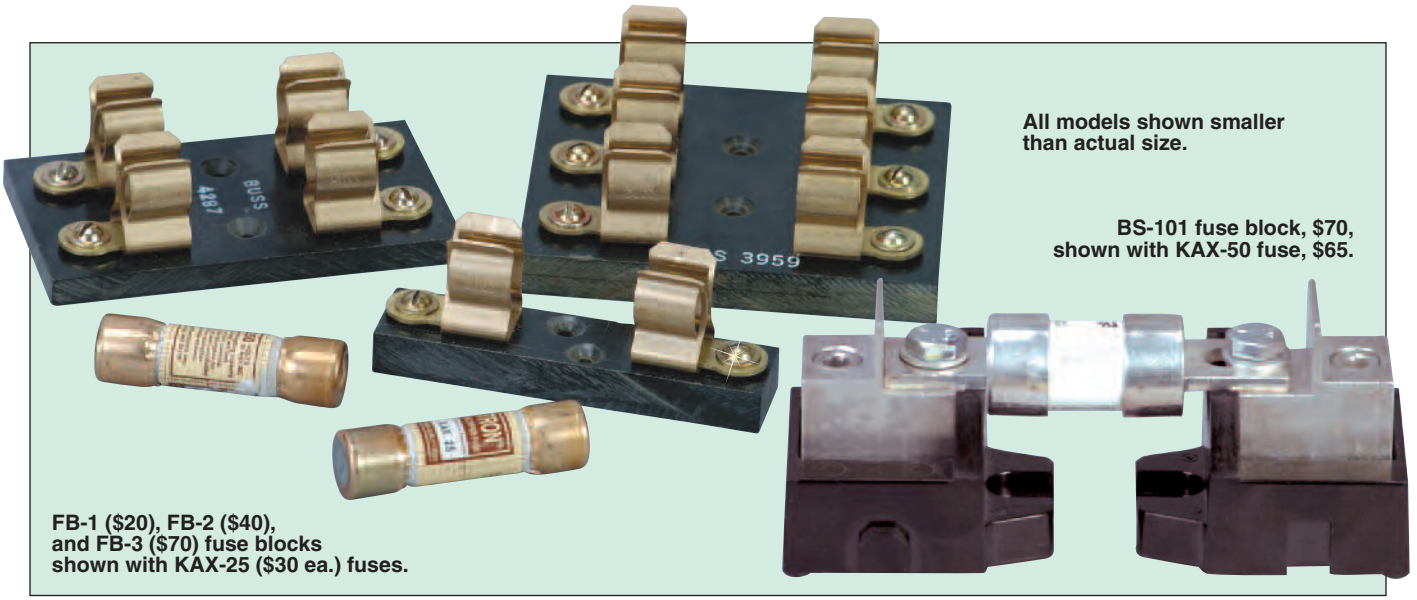






SSR240 Series Output-Vac Load Specifications

Model Number	Nominal AC Line Voltage	Nominal Load Current	Maximum Contact Voltage Drop	Maximum Off-State Leakage (25°C Maximum Ambient)		
				120 Vac	240 Vac	440 Vac
SSRL240AC10 **SSRL240AC25** **SSRL240AC50** **SSRL240AC75** **SSRL240AC100**	24 to 280 Vac	10 A 25 A 50 A 75 A 100 A	1.6V	0.1 mA	0.1 mA	N/A
SSRL240DC10 **SSRL240DC25** **SSRL240DC50** **SSRL240DC75** **SSRL240DC100**	24 to 280 Vac	10 A 25 A 50 A 75 A 100 A	1.6V	0.1 mA	0.1 mA	N/A
SSRL660AC50 **SSRL660AC75** **SSRL660AC100**	48 to 660 Vac	50 A 75 A 100A	1.6V	0.25 mA	0.25 mA	0.25 mA
SSRL660DC50 **SSRL660DC75** **SSRL660DC100**	48 to 660 Vac	50 A 75 A 100 A	1.6V	0.25 mA	0.25 mA	0.25 mA



Fuses

To Order *(Specify Model Number)*			
Model No.	**Price**	**Capacity**	**Dimensions (Dia. x L)**
KAX-10	**$30**	10 A	14 x 51 mm (0.6 x 2")
KAX-25	**30**	25 A	14 x 51 mm (0.6 x 2")
KAX-30	**50**	30 A	14 x 51 mm (0.6 x 2")
KAX-50	**65**	50 A	21 x 81 mm (0.8 x 3.2")
KAX-70	**75**	70 A	31 x 92 mm (1.2 x 3.6")
KBH-50	**45**	50 A	18 x 81 mm (0.7 x 3.2")
KBH-70	**55**	70 A	19 x 92 mm (0.7 x 3.6")

Fuse Blocks

To Order *(Specify Model Number)*			
Model Number.	**No. of Fuses**	**Price**	**Compatible Fuses**
FB-1	1	**$20**	KAX-10, KAX-25, KAX-30
FB-2	2	**40**	KAX-10, KAX-25, KAX-30
FB-3	3	**70**	KAX-10, KAX-25, KAX-30
BS-101	1	**70**	KAX-50, KAX-70, KAX-100, KBH (all models)

Shunt Resistors for Controllers with AC SSR (Triac) Output

To Order *(Specify Model Number)*		
Model No.*	**Price**	**Value**
SSRR20-12	**$8**	2000 Ω, 12 watts
SSRR20-50	**10**	2000 Ω, 50 watts
SSRR15-12	**6**	1500 Ω, 12 watts
SSRR15-50	**9**	1500 Ω, 50 watts

***** *12 W versions for 120 V circuits; 50 W for 240 V.*

How to Order:

1) Select solid state relay based on type of control signal (AC or DC) and current switching requirements for resistive load.
2) Select fast blow (I^2T) fuse and fuse block. It is essential that a fuse be installed to protect the load circuit.
3) Select required finned heat sink based on max ambient temperature and thermal rating curve on previous page.

MOST POPULAR MODELS HIGHLIGHTED!

To Order *(Specify Model Number)*			
Model No.	**Price**	**Description**	**Nominal Rating**
SSRL240AC10	**$25**	AC control signal (280 Vac line)	10 A
SSRL240AC25	**30**		25 A
SSRL240AC50	**43**		50 A
SSRL240AC75	**65**		75 A
SSRL240AC100	**80**		100 A
SSRL240DC10	**21**	DC control signal (280 Vac line)	10 A
SSRL240DC25	**26**		25 A
SSRL240DC50	**37**		50 A
SSRL240DC75	**61**		75 A
SSRL240DC100	**76**		100 A
SSRL660AC50	**48**	AC control signal (660 Vac line)	50 A
SSRL660AC75	**99**		75 A
SSRL660AC100	**84**		100 A
SSRL660DC50	**45**	DC control signal (660 Vac line)	50 A
SSRL660DC75	**99**		75 A
SSRL660DC100	**85**		100 A
FHS-1	**19**	Finned heat sink	2°C/W
FHS-2	**19**		1.2°C/W
FHS-6	**23**		0.7°C/W

Accessory

Model No.	Price	Description
SSRL-DINRAIL-ADAPT	**$16**	DIN rail adaptor for 10 A models only

Comes complete with operator's manual.

Note: *All SSRL Series come with thermally conducting pad. Reference SSR330 Series for additional heat sinks.*

Ordering Examples: SSRL240DC25*, solid state relay,* ***FHS-2,*** *finned heat sink,* ***KAX-25,*** *fuse, and* ***FB-1,*** *fuse block, $30 + 19 + 30 + 20 =* ***$99.***

SSRL240AC10, *solid state relay,* ***FHS-1,*** *finned heat sink,* ***KAX-10,*** *fuse, and* ***FB-1,*** *fuse block, $25 + 19 + 30 + 20 =* ***$94.***

P

1/2" Female

Item Description

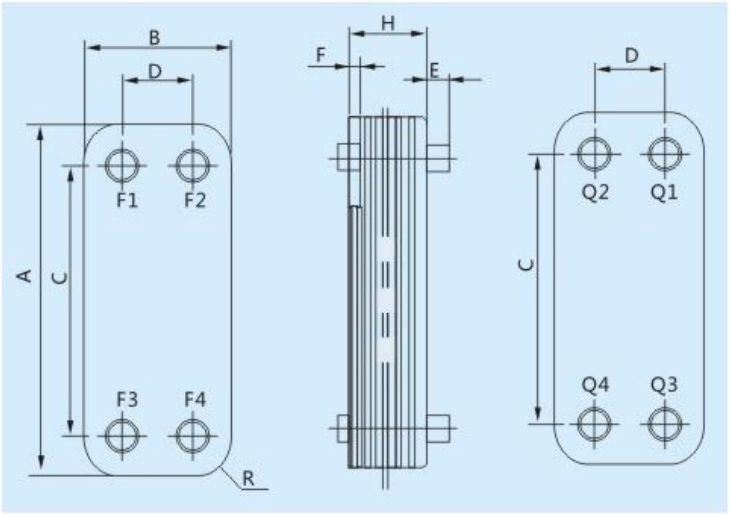


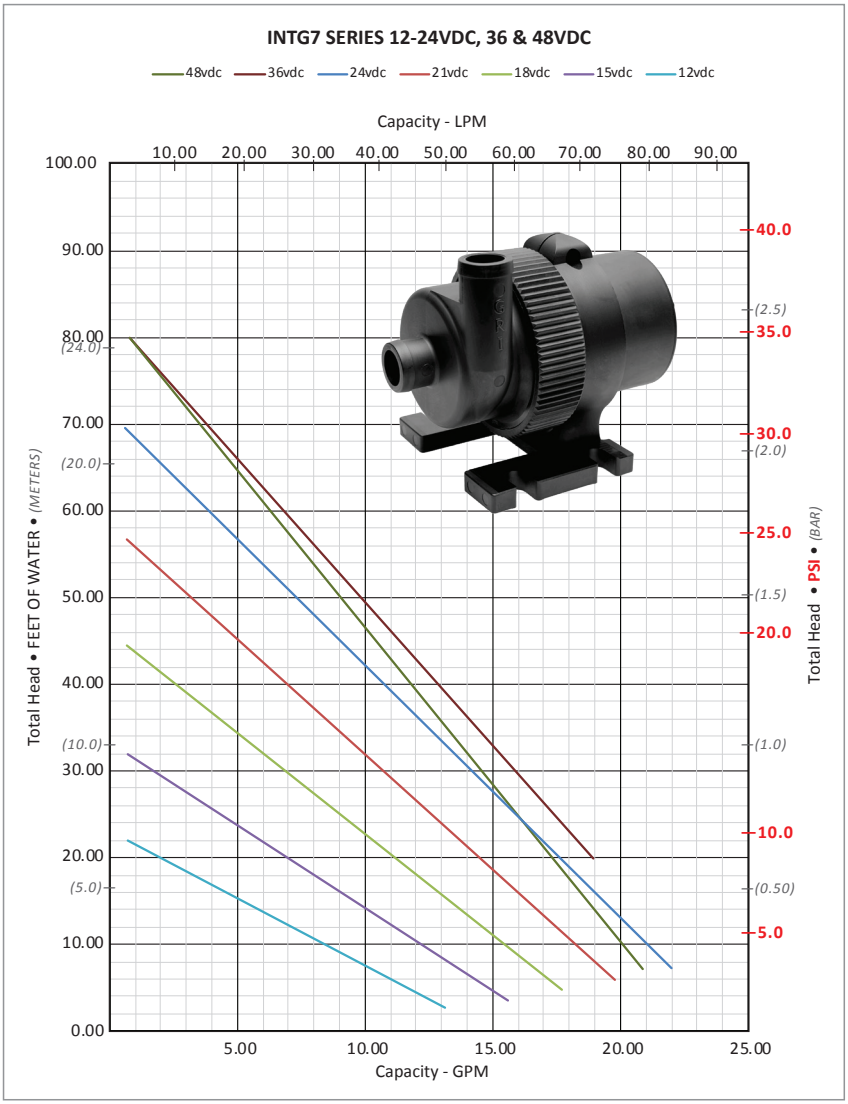
Plate Heat Exchanger Specifications by Model

Model	A	B	C	D	F	H	Weight	Volume per Channel	Unit Heat Exchanger Area	Design Pressure	Refrigeration Capacity	Max Number of Plates	Max Connection Size
	mm						kg	Liters	m^2	Mpa	KW		
B3-5A	135	40	104	18	5	4.7+1.8xNP	0.04+0.0021xNP	0.006	0.005	3.0	1-5	30	1/4" NPT
B3-12A	199	85	154	40		13+2.34xNP	0.4+0.044xNP	0.018	0.012		1-6		
B3-14DW	196	86	156	46		7+2.35xNP	0.4+0.096xNP	0.022	0.014	1.0		60	3/4" NPT 7/8" Welded
B3-16A	220	90	180	52		7+2.24xNP	1.1+0.06xNP	0.029	0.016		2-8		
B3-23A	315	73	278	40			1.2+0.07xNP	0.040	0.023		3-10		
B3-27A	286	116	234	63		7+2.4xNP	1.3+0.125xNP	0.050	0.027	3.0	5-20	120	1-1/4" NPT
B3-32A			243	72			1.3+0.126xNP		0.032				1" NPT 1-1/8" Welded
B3-32DW						10+2.42xNP	1.3+1.52xNP						
B3-36A	466	73	432	40		7+2.24xNP	1.3+0.106xNP	0.063	0.036		4-15		3/4" NPT 7/8" Welded
B3-52A	523	107	466	50	7	15+2.4xNP	1.5+0.23xNP	0.094	0.052		10-70		1" NPT 1-1/8" Welded
B3-60A	529	124	478	73		7+2.4xNP	2.7+0.26xNP	0.111	0.060			160	
B3-63A	390	200	298	120		7+2.55xNP	5.5+0.27xNP	0.128	0.063				
B3-95A	616	191	519	92		7+2.4xNP	7.8+0.42xNP	0.250	0.095		30-200	200	2" Threaded 2-1/8" Welded
B3-105A	528	246	430	148			9.5+0.46xNP	0.290	0.105	2.0		280	3" Threaded
B3-115A	535	253	456	174		15+2.4xNP	14+0.424xNP	0.250	0.115	3.0			2" Threaded 2-1/8" Welded
Conversion	1" = 25.4mm						1 kg = 2.2 lb	1 Liter = 0.264 Gallons	$1m^2 = 10.76ft^2$	1 Mpa = 145 psi	1 KW = 3412 Btu/h		

General Specifications of Duda Energy Plate Heat Exchangers

Plate Material	SUS304, SUS316 for Double Wall Units & Nickel Brazed
Welding Material	B3=99.9% Copper, B4=99.9% Nickel
Mounting Studs	B3-5A & B3-12A use M5-0.8, Larger units use M8-1.25
Flow Direction	A Type: F1-F3, F2-F4
UL Listing	TUVReinland ISO9001:2000

INTG7 Series • Maximum flow per voltage						
Voltage	Flow (GPM)	Flow (L)	Ttl. Hd. (Ft)	Ttl. Hd. (PSI)	Ttl. Hd. (BAR)	Ttl. Hd. (M)
48vdc	21.99	83.25	7.52	3.26	0.22	2.29
36vdc	18.98	71.85	19.80	8.58	0.59	6.04
24vdc	22.08	83.59	7.25	3.14	2.21	5.50
21vdc	19.81	75.00	5.76	2.50	1.76	4.14
18vdc	17.73	67.13	4.73	2.05	1.44	2.94
15vdc	15.58	58.96	3.55	1.54	1.08	7.01
12vdc	13.16	49.83	2.49	1.08	0.76	1.24



Note: Testing performed in a controlled laboratory environment. Actual performance may vary (+) or (-) 10% from the information shown.

Do Not Run Pumps Dry. Pumps must be in a continuous flooded suction environment.

Specifications

Maximum System Pressure: 75 psi

Approximate Weight (w/ external box)**:** 4.3 lbs (1950.45 grams)

Ports: 1" MHB

Materials In Contact With Solution

Body: PPS	**Housing:** PPS	**Static O-Ring:** EPDM, FKM
Impeller: PPS	**Pump Shaft:** Ceramic	

Motor Specifications

Motor: Integrated, Brushless DC

Supply Voltage: 12-48 VDC

Electronics Maximum Power: 300 Watts

To protect the control board, each Integrity Series pump will be issued with a Maximum Power limit (Watts). To stay within this limit, the recommended fuse size (Amps) will be based on the voltage supplied. (Watts = Voltage X Amps)

Control Options

- **Direct Supply Voltage:** Speed of the pump determined by the voltage supplied
- **Analog:** 0-5v DC Signal
- **Digital:** PWM
- **CAN-Bus:** Option available
- **Tachometer:** Feedback option available

Maximum Fluid Rating Chart

Controller Position	Maximum Fluid Temp Rating
Separate from pump	225°F (107°C)
Within pump's housing	Not Applicable

Various factors influence the recommended maximum temperature rating. These factors play a role in determining the pump's life and applied warranties. In some applications, a higher maximum fluid temperature rating may be warranted.

Factors influencing maximum temperature rating include, but are not limited to:

- Starting temperature of fluid in system
- Ambient temperature
- Required performance, application's specifications
- Run time

Optional Agency Approvals

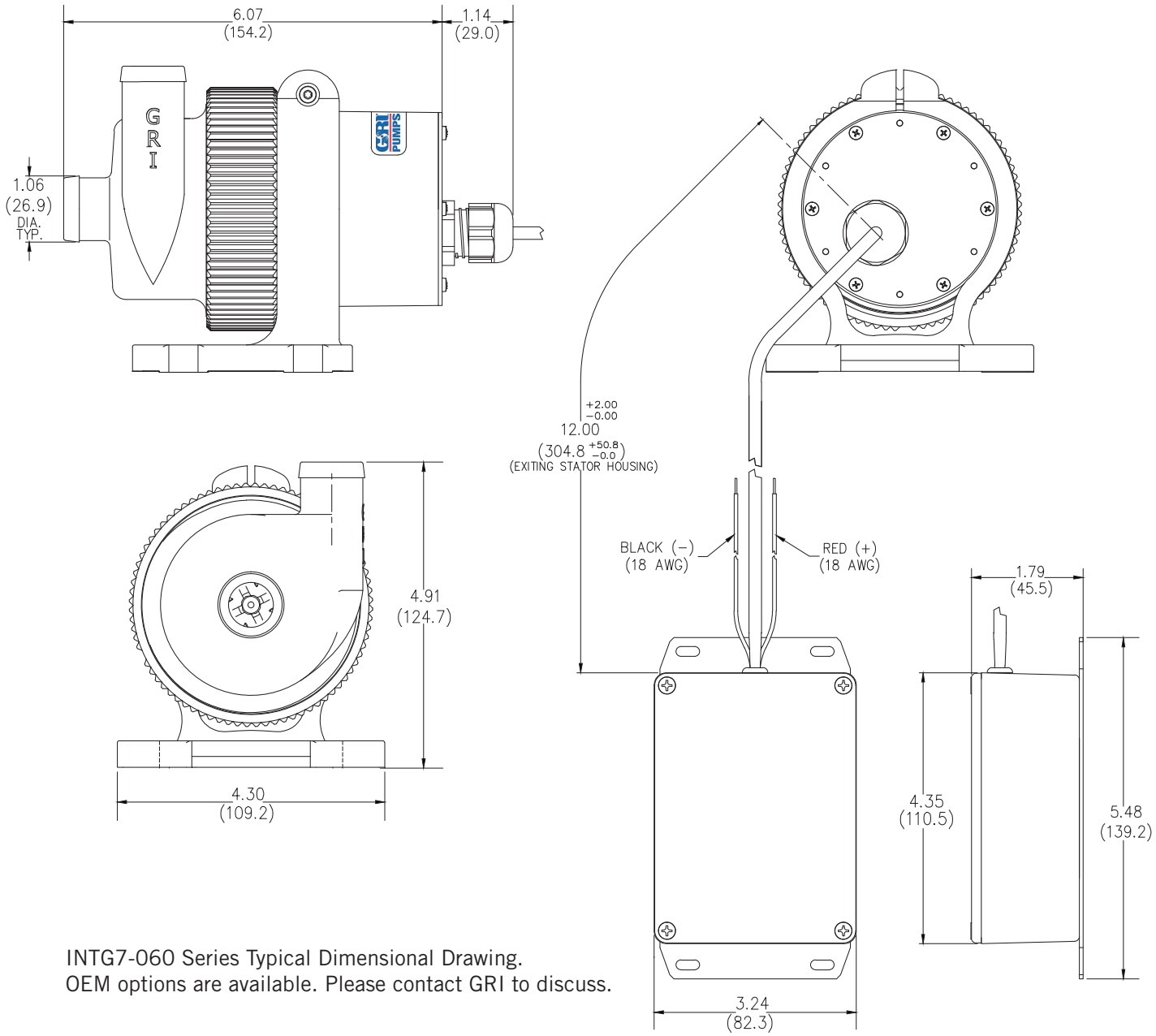
UL778: Motor-Operated Water Pumps
NSF61: Potable Water
NSF372: Lead Content

RoHS/REACH

Many GRI pumps are RoHS & REACH compliant. For declarations by specific model numbers, please contact GRI.

IP (Ingress Protection)

IP66: No ingress of dust, protection against powerful water jets.
IP67: No ingress of dust, protection against temporary water immersion.
IP68: No ingress of dust, protection against continuous water immersion.



INTG7-060 Series Typical Dimensional Drawing.
OEM options are available. Please contact GRI to discuss.

Integrity Series Pumps are designed and manufactured specifically for OEM customization. If you don't immediately find a pump that meets your exact requirements, our dedicated Pump Team is ready to work with you in developing a solution specific to your application.

INTG7 SERIES MODELS				Ports Inches	Max Flow GPM (LPM)	Max Head Ft. (PSI) (m)	Voltage
EPDM O-Ring		FKM O-Ring					
2 wire: (+), (-)	**3 wire:**(+), (-), Speed Control	**2 wire:** (+), (-)	**3 wire:** (+), (-), Speed Control				
INTG7-060	INTG7-062	INTG7-061	INTG7-063	1" MHB	22.0 (83.3)	70.0 (30.3) (21.3)	**12-24**
Connectors: MHB = Male Hose Barb; I **O-Ring Material:** EPDM = Ethylene Propylene Diene Monomer, FKM = Fluoroelastomer.							

bürkert
FLUID CONTROL SYSTEMS

Direct-acting 2 way standard solenoid control valve

- Excellent range
- Very good response
- Compact valve design
- Orifice sizes 2…9.5 mm
- Optional: Explosion-protected coil

Product variants described in the data sheet may differ from the product presentation and description.

Can be combined with

Type 8605 ▸
PWM Control Electronics for Solenoid Control Valves

Type 2518 ▸
Cable Plug DIN EN 175301-803 - Form A

Type 8611 ▸
eCONTROL - Universal controller

Type description

The direct-acting solenoid control valve Type 2875 is used as the regulating unit in control loops. Due to an elastomeric seat seal the valve closes tight (integrated shut-off function), up to the DN specific nominal pressure. The plunger of the valve is assembled frictionless, which leads to an extraordinary adjustment characteristic. This valve is particularly suitable for demanding control tasks (high control range, dry gases, etc.).

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Visit product website ▸

Table of contents

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1. General Technical Data

Product properties	
Dimensions	Detailed information can be found in chapter "5. Dimensions" on page 5.
Material	
Body	Brass, stainless steel
Seal	FKM, EPDM
Performance data	
Typical values of positioning behaviour[1.]	
Hysteresis	< 5 %
Reproducibility	< 0.5 % of end value[2.]
Response sensitivity	< 0.25 % of end value[2.]
Setting range	1:200
Actuating time (10…90 %)	< 25 ms
Pressure range[3.]	0…25 bar
Nominal operating mode	100 % continuous operation
Electrical data	
Operating voltage	24 V DC (12 V on request)
Power consumption	16 W
Maximum coil current[4.]	750 mA (at 16 W and 24 V coil)
PWM frequency[5.]	900 Hz
Medium data	
Operating medium	Neutral gases, liquids on request
Medium temperature	-10 °C…+90 °C (with FKM) -30 °C…+90 °C (with EPDM)
Viscosity	Maximum 21 mm²/s (21 cSt)
Process/Port connection & communication	
Port connection size	Sub-base, G ⅜, G ½, NPT ⅜, NPT ½
Electrical connection	Cable plug Type 2518 acc. to DIN EN 175301-803 form A Detailed information can be found in chapter "Cable plug Type 2518, Form A according to DIN EN 175301-803" on page 13.
Approvals and certificates	
Degree of protection	IP65
Environment and installation	
Installation position	Any, preferably actuator face up
Ambient temperature	Maximum +55 °C

1.) Characteristic data of control behaviour depends on process conditions

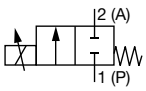
2.) By flow measurement

3.) Pressure data: Overpressure with respect to atmospheric pressure, depending on nominal diameter, tightness seal or nominal pressure

4.) Maximum value: value depends on operating pressure

5.) PWM: pulse width modulation

2. Circuit functions

Circuit functions	Description
	**Type: A, proportional control valve** 2/2 way Direct-acting Normally closed

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3. Approvals

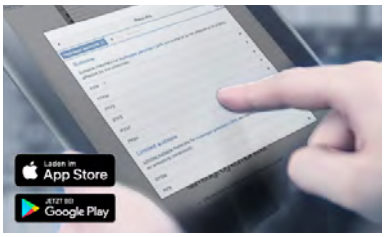
Note:

- The following approvals or conformity certificates must be mentioned in all enquiries. This is the only way to ensure that the product fulfils all the required specifications.
- Not all available device versions can be delivered with the below-mentioned approvals or conformities.

Approvals	Description
	UL recognized
	Conformity of all materials in contact with the medium USP Class VI chapter „87 in vitro“ and „88 in vivo, Implantation“
	Conformity of all materials in contact with the medium FDA – Code of Federal Regulations Title 21 Paragraph 177 (CFR 21 177.2600)
	Conformity of all materials in contact with the medium Regulation (EC) No. 1935/2004 on materials and articles intended to come into contact with food
	Explosion protection ATEX: II 2 G Ex mb IIC T4 Gb II 2 D Ex mb IIIC T130 °C Db IECEx: Ex mb IIC T4 Gb Ex mb IIIC T130 °C Db

4. Materials

4.1. Chemical Resistance Chart – Bürkert resistApp



Bürkert resistApp – Chemical Resistance Chart

You want to ensure the reliability and durability of the materials in your individual application case? Verify your combination of media and materials on our website or in our resistApp.

Start Chemical Resistance Check

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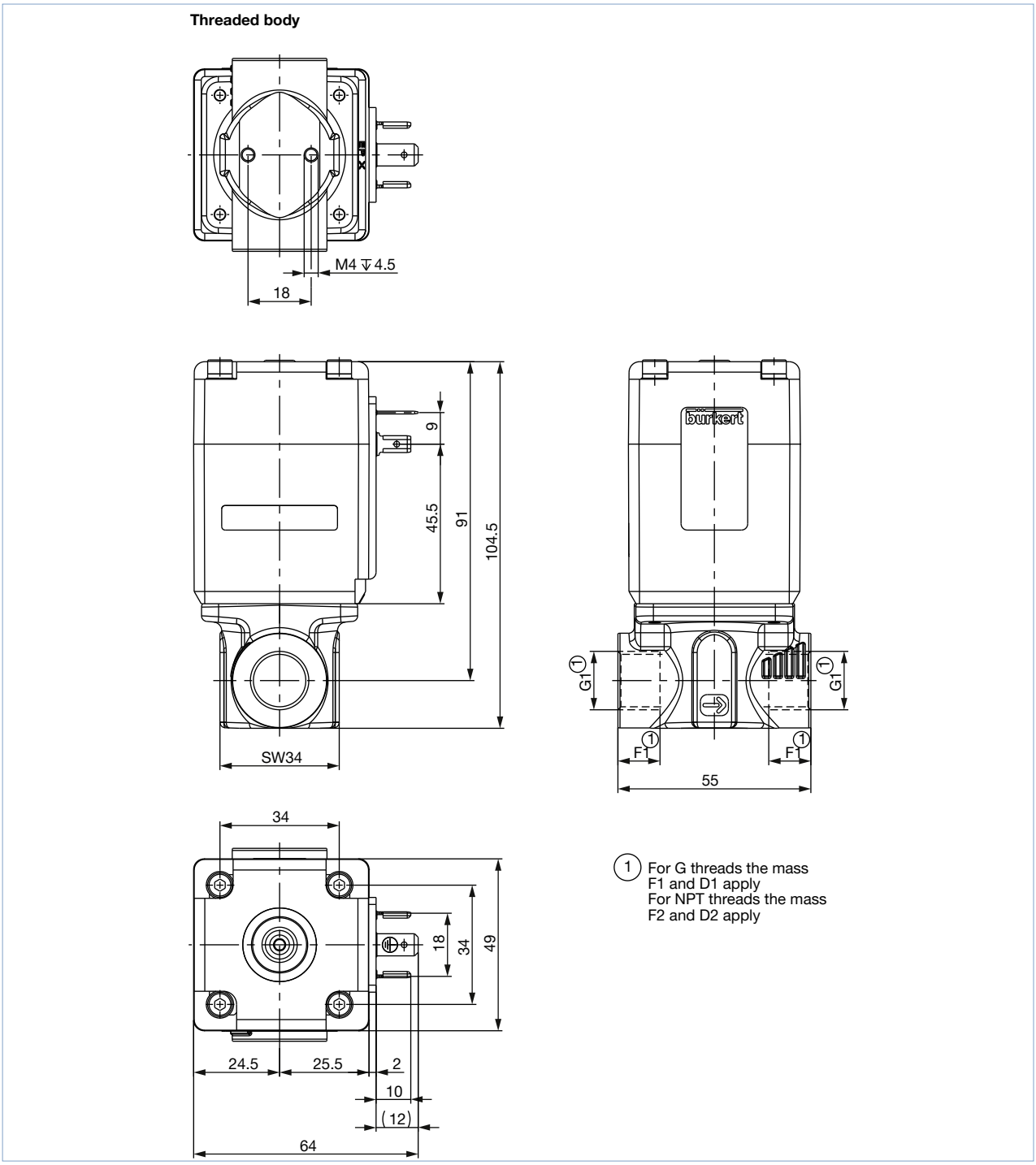
5. Dimensions

5.1. Standard version

Threaded body

Note:
Dimensions in mm



Body version	F1	G1	F2	G2
Threaded body	12	G ⅜	10.3	NPT ⅜
	14	G ½	13.7	NPT ½

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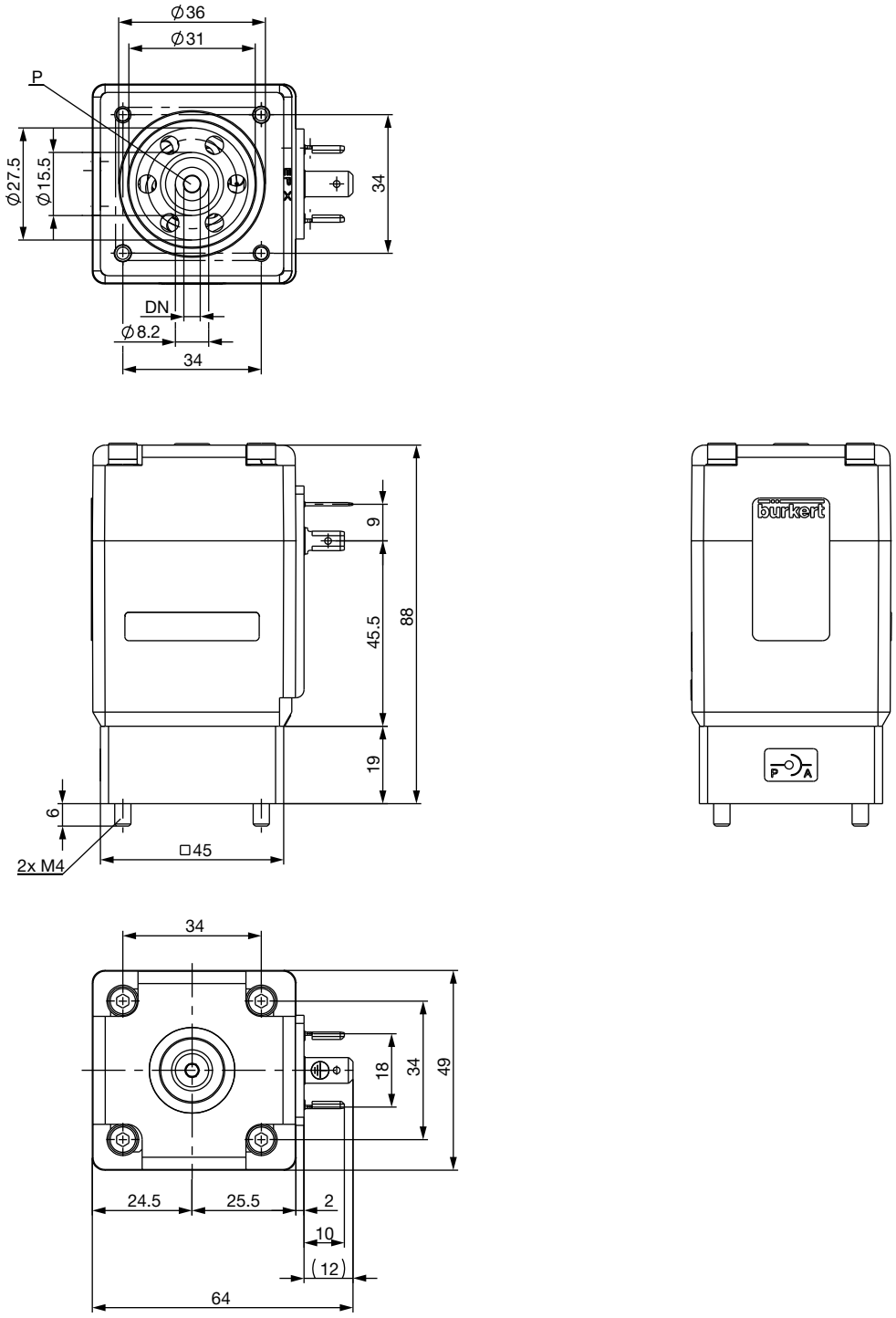
Sub-base body

Note:
Dimensions in mm

Sub-base body



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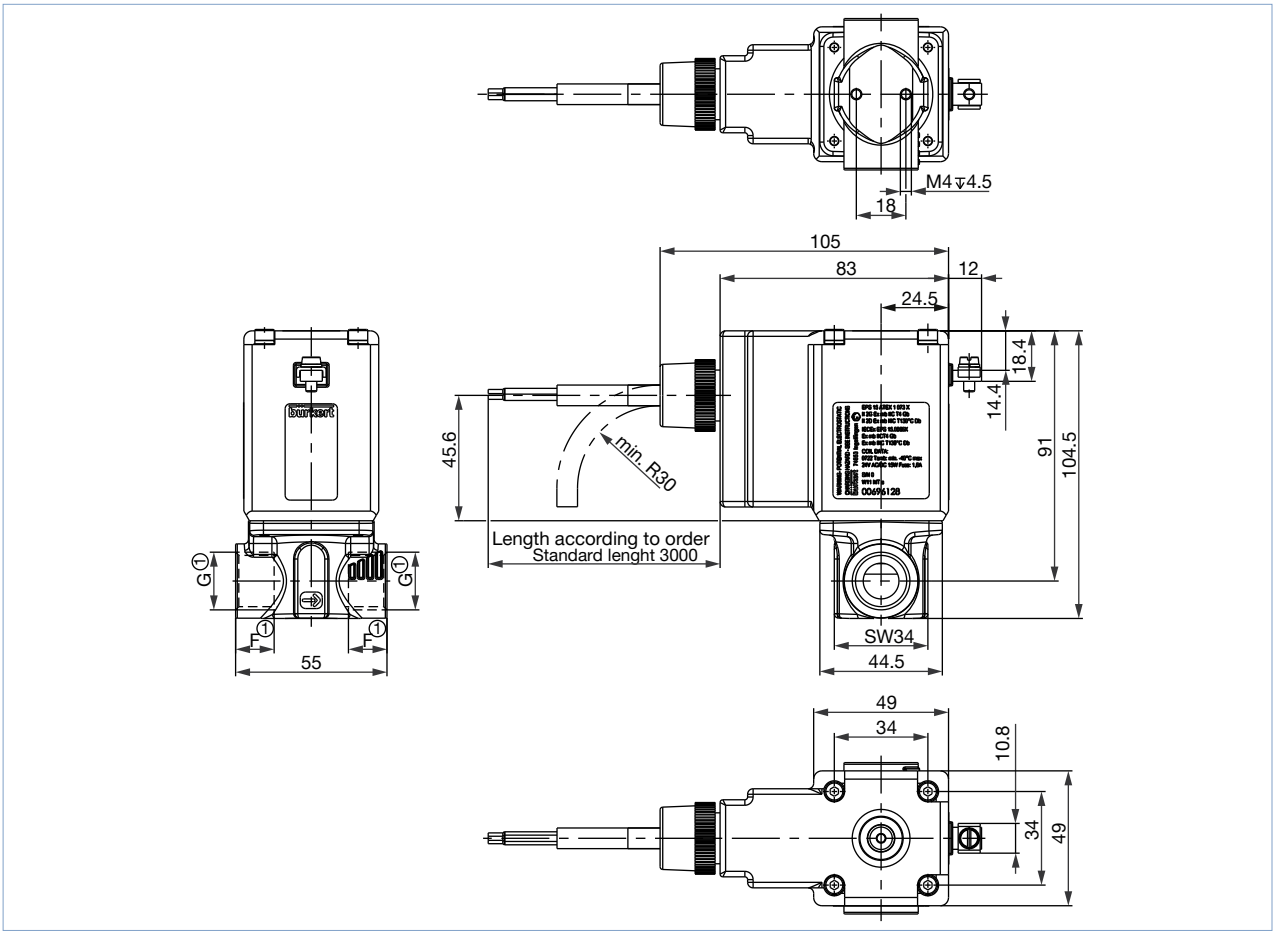
5.2. ATEX version

Threaded body

Note:
Dimensions in mm



Body version	F1	G1	F2	G2
Threaded body	12	G ⅜	10.3	NPT ⅜
	14	G ½	13.7	NPT ½

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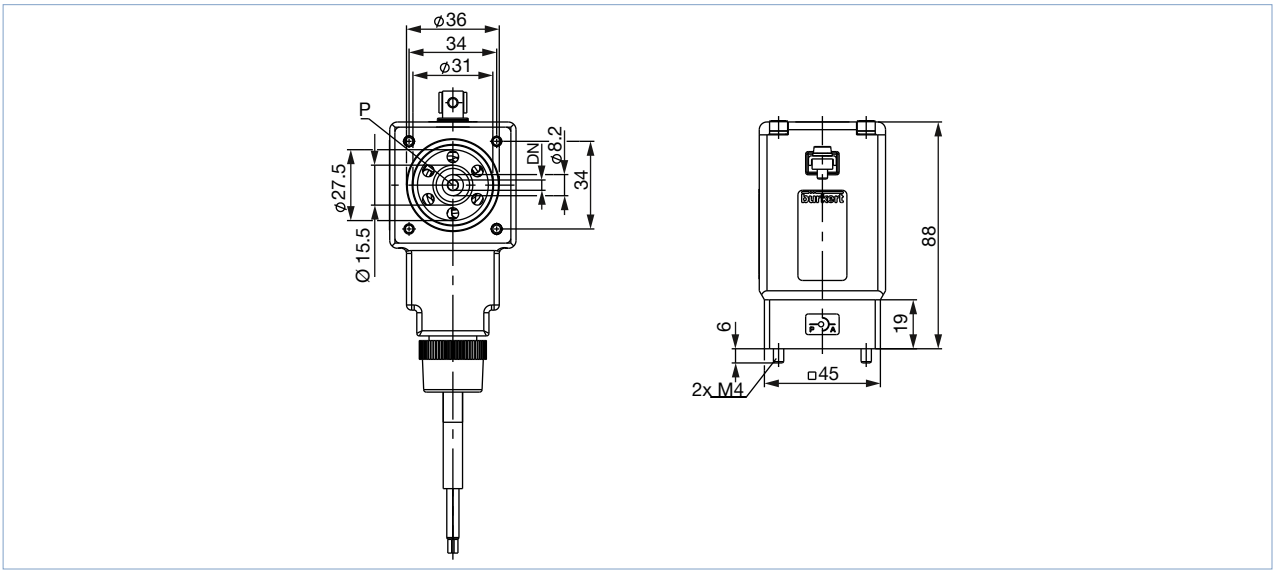
Sub-base body

Note:
Dimensions in mm



6. Performance specifications

6.1. Flow characteristic

Determination of the K_V value

Pressure drop	K_V value for liquids [m³/h]	K_V value for gases [m³/h]
Sub-critical $p_2 > \frac{p_1}{2}$	$= Q\sqrt{\frac{\rho}{1000\,\Delta p}}$	$= \frac{Q_N}{514}\sqrt{\frac{T_1\,\rho_N}{p_2\,\Delta p}}$
Supercritical $p_2 < \frac{p_1}{2}$	$= Q\sqrt{\frac{\rho}{1000\,\Delta p}}$	$= \frac{Q_N}{257\,p_1}\sqrt{T_1\,\rho_N}$

K_V	Flow coefficient	[m³/h][1.)]
Q_N	Standard flow rate	[m_N^3/h][2.)]
p_1	Inlet pressure	[bar][3.)]
p_2	Outlet pressure	[bar][3.)]
Δp	Differential pressure p_1...p_2	[bar]
ρ	Density	[kg/m³]
ρ_N	Standard density	[kg/m³]
T_1	Medium temperature	[(273+t)K]

1.) Measured for water, Δp = 1 bar, over the value
2.) At reference conditions 1.013 bar and 0 °C (273 K)
3.) Absolute pressure

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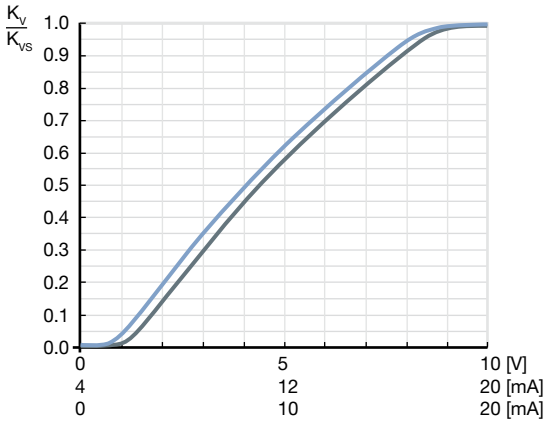
6.2. Exemplary characteristic curve of a proportional valve

Note:
In continuous flow applications, the choice of an appropriate valve size is much more important than with on/off valves. The optimum size should be selected such that the resulting flow in the system is not unnecessarily reduced by the valve. However, a sufficient part of the pressure drop should be taken across the valve even when it is fully opened.

Recommended value: $\Delta p_{valve} > 25\,\%$ of total pressure drop within the system

Otherwise, the ideal, linear valve curve characteristic is changed.

If the differential pressure (difference between inlet and outlet pressure) exceeds half the value of the nominal pressure discontinuities may occur.
For that reason take advantage of Bürkert competent engineering services during the planning phase!



7. Product operation

7.1. Control unit

Valve control takes place through a PWM signal (pulse-width modulation). The duty cycle of the PWM signal determines the coil current and hence the position of the plunger.

The Bürkert control electronics Type 8605 (see relevant data sheet **Type 8605** ▸) converts an analogue signal to a reference value corresponding to the valve type PWM signal and provides additional functions such as temperature compensation (coil heating), ramp function and the adjustment of min. and max. duty cycle/coil current for the control range.

Please note the sizing comments for such a control valve in chapter **"6.2. Exemplary characteristic curve of a proportional valve" on page 9**.

8. Ordering information

8.1. Bürkert eShop – Easy ordering and quick delivery

8.2. Recommendation regarding product selection

Note:

- Please use the "Product Inquiry Form" at the end of this data sheet for the specifications of the device configuration and send us a copy of the inquiry with information about the application.
- Please note the chapter "6.2. Exemplary characteristic curve of a proportional valve" on page 9 on product selection.

8.3. Bürkert product filter

Bürkert product filter – Get quickly to the right product

You want to select products comfortably based on your technical requirements? Use the Bürkert product filter and find suitable articles for your application quickly and easily.

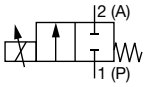
Try out our product filter

8.4. Ordering chart

Standard version

Note:

- All valves with FKM seal
- Please note that the cable plug must be ordered separately, see "Cable plug Type 2518, Form A according to DIN EN 175301-803" on page 13 or separate data sheet for **Type 2518** ▶.

Circuit function	Orifice	Port connection	K_{VS} value water[1.]	Nominal pressure[2.]	Maximum differential pressure	Article no. brass body	Article no. stainless steel body
	[mm]		[m³/h]	[bar]	[bar]		
A, proportional control valve 2/2 way Direct-acting Normally closed  	2	G ⅜	0.12	25	12.5	236897	236899
		NPT ⅜	0.12	25	12.5	236898	236900
	3	G ⅜	0.25	10	5	236901	236903
		NPT ⅜	0.25	10	5	236902	236904
	4	G ⅜	0.45	8	4	236905	236910
		NPT ⅜	0.45	8	4	236908	236912
		G ½	0.45	8	4	236906	236911
		NPT ½	0.45	8	4	236909	236913
	6	G ½	0.80	4	2	236915	236919
		NPT ½	0.80	4	2	236917	236921
	8	G ½	1.10	2	1	236922	236924
		NPT ½	1.10	2	1	236923	236925
	9.5	G ½	1.40	0.7	0.35	273004	314557
		NPT ½	1.40	0.7	0.35	314555	314559

1.) Flow rate value for water, measured at +20 °C and 1 bar pressure differential over a fully opened valve.

2.) Pressure data: Overpressure with respect to atmospheric pressure, with a differential pressure (difference between inlet and outlet pressure) above half of the nominal pressure there are discontinuities in the valve's characteristics possible."

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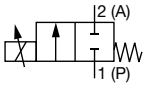
Version with approvals

Note:

- All valves with FKM seal and ATEX version with 3 m connection cable.
- Please note that the cable plug must be ordered separately, see "Cable plug Type 2518, Form A according to DIN EN 175301-803" on page 13 or separate data sheet for **Type 2518** ▶.
- For detailed information regarding the approvals see "3. Approvals" on page 4.

Circuit function	Orifice	Approvals	Port connection[1.]	K_{VS}-value water[2.]	Nominal pressure	Maximum differential pressure	Article no. brass body	Article no. stainless steel body
	[mm]			[m³/h]	[bar]	[bar]		
A, proportional control valve 2/2 way Direct-acting Normally closed  	2	UR	G ⅜	0.12	25	12.5	274976	274988
			NPT ⅜	0.12	25	12.5	274977	274989
		ATEX / IECEx	G ⅜	0.12	20	10	291483	On request
	3	UR	G ⅜	0.25	10	5	274978	274990
			NPT ⅜	0.25	10	5	274979	274991
		ATEX / IECEx	G ⅜	0.25	9	4.5	291485	On request
	4	UR	G ⅜	0.45	8	4	274980	274992
			NPT ⅜	0.45	8	4	274981	274993
		ATEX / IECEx	G ⅜	0.45	7	3.5	291486	On request
		UR	G ½	0.45	8	4	274982	274994
			NPT ½	0.45	8	4	274983	274995
	6	UR	G ½	0.80	4	2	274984	274996
			NPT ½	0.80	4	2	274985	274997
		ATEX / IECEx	G ½	0.80	3.5	1.75	291487	On request
	8	UR	G ½	1.10	2	1	274986	274998
			NPT ½	1.10	2	1	274987	274999
		ATEX / IECEx	G ½	1.10	1.5	0.75	291488	On request

1.) Port connection: others on request

2.) Flow rate value for water, measured at +20 °C and 1 bar pressure differential over a fully opened valve.

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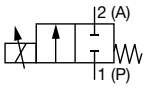
Version for higher differential pressures

Note:

- All valves with FKM seal
- Please note that the cable plug must be ordered separately, see "Cable plug Type 2518, Form A according to DIN EN 175301-803" on page 13 or separate data sheet for **Type 2518** ▶.
- PWM frequency 500 Hz, Span 1:100
- Other connection variations (Sub-base, NPT) on request
- For Δp > 10 bar it is possible to get inconsistencies in the characteristic curve because of flow conditions in the application.
- For detailed information regarding the approvals see "3. Approvals" on page 4.

Circuit function	Orifice [mm]	Approvals	Port connection[1.]	K_{VS}-value water[2.] [m³/h]	Nominal pressure [bar]	Article no. brass body	Article no. stainless steel body
A, proportional control valve 2/2 way Direct-acting Normally closed  	2.0	–	G ⅜	0.12	25	239040	239085
		UR	G ⅜	0.12	25	275000	275005
		ATEX / IECEx	G ⅜	0.12	20	291468	On request
	3.0	–	G ⅜	0.25	10	239086	239087
		UR	G ⅜	0.25	10	275001	275006
		ATEX / IECEx	G ⅜	0.25	9	291470	On request
	4.0	–	G ⅜	0.45	8	239088	239089
		UR	G ⅜	0.45	8	274090	274091
		ATEX / IECEx	G ⅜	0.45	7	291474	On request
	6.0	–	G ½	0.80	4	239090	239091
		UR	G ½	0.80	4	275002	275007
		ATEX / IECEx	G ½	0.80	3.5	291476	On request
	8.0	–	G ½	1.10	2	239092	239093
		UR	G ½	1.10	2	275004	275008
		ATEX / IECEx	G ½	1.10	1.5	291477	On request
	9.5	–	G ½	1.40	0.7	291586	314558

1.) Port connection: others on request

2.) Flow rate value for water, measured at +20 °C and 1 bar pressure differential over a fully opened valve.

Further versions on request

Material EPDM	**Analytical** Oxygen version, Parts oil-, fat- and silicon free
Approval UR (UL recognized) ATEX / IECEx	**Process connection** Sub-base version

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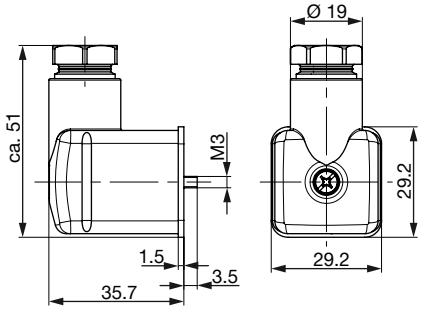
8.5. Ordering chart accessories

Cable plug Type 2518, Form A according to DIN EN 175301-803

Note:
Further versions see data sheet **Type 2518** ▶.

Cable plug	Dimensions	Version	Voltage	Article no.
		Without circuitry (AC/DC)	0…250 V AC/DC	314802

Control unit Type 8605

Note:
Further versions see data sheet **Type 8605** ▶.

	Version	Max. coil current range	2875	2875	Article no.
		[mA]	24 V DC	12 V DC	
	Cable plug with PG cable gland	200…1000	x	–	316530
	Cable plug with M12 connection	200…1000	x	–	316528
	Cable plug with PG cable gland	500…2000	x	x	316529
	Cable plug with M12 connection	500…2000	x	x	316526
	Cable plug with PG cable gland without operating element	200…1000	x	–	316521
	Cable plug with M12 connection without operating element	200…1000	x	–	316522
	Cable plug with PG cable gland without operating element	500…2000	x	x	316523
	Cable plug with M12 connection without operating element	500…2000	x	x	316525
	Standard rail	200…1000	x	–	316532
	Standard rail	500…2000	x	x	316533

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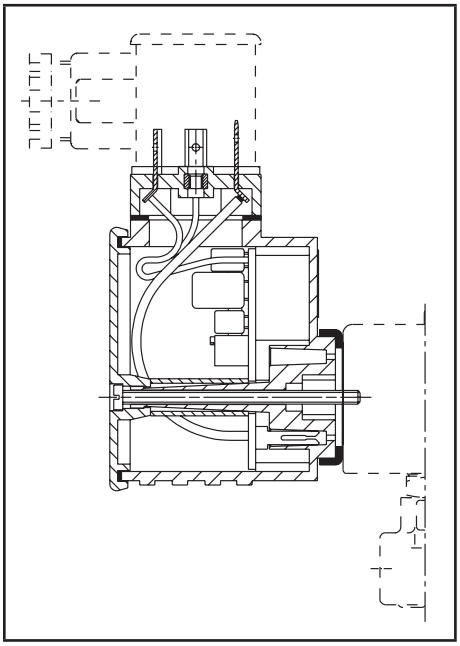
ELECTRONIC PROPORTIONAL CONTROL UNIT

for proportional POSIFLOW solenoid valves

Series **908**

FEATURES

- *Converts analog input control signals to coil current of a proportional solenoid valve by means of pulse width modulatiion*
- *Switch-off function at less then 2% of the maximum control signal*
- *Adjustable ramp control*
- *Output coil current independent of coil resistance (temperature) and supply voltage variations*
- *Min. and max. output coil current adjustable to required input control signal*
- *The electronic circuit is integrated in a housing connectable to a 3-terminal spade plug coil connector according to ISO 4400/ EN 175301-803, form A, DIN 43650, 11 mm, industry standard B or DIN 43650, 9,4 mm, industry standard B*



GENERAL

Nominal voltage	24 V DC
Maximum current	1100 mA

CONSTRUCTION

Housing	PA
Cover	PA
Screw	Zinc plated steel
Seals	NBR

ELECTRICAL CHARACTERISTICS

Connector	Spade plug (cable Ø 6-10 mm)
Connector specification	ISO 4400 / EN 175301-803, form A [2]
Valve connection	With 3 terminal plug connection
Control unit: E908A001	ISO 4400 / EN 175301-803, form A
Control unit: E908A003	DIN 43650, 11 mm, industry standard B
Control unit: E908A004	DIN 43650, 9,4 mm, industry standard B (assembled to 200 mm cable)
Electrical safety	IEC 335
Electrical enclosure protection	IP65 (EN 60529)
Supply voltage	DC (=) : 24V ±10 % (U_N), max. ripple 10%

prefix option	max. full load current (I_{FL})	input control signal (selectable) U_c =	I_{cx}	I_c	power consumption (electronics)	unit ambient temperature range [2]	type [1]
	(mA)	(V)	(mA)	(mA)	(W)	(C°)	
-	1100	0 - 10	0 - 20	4 - 20	0,8	-10 to +75	01 - 02

Switch-off current	< 2 % of max. input control signal
Adjustable offset	Upwm 15 - 50 % E.D.
Adjustable full load	Upwm 30 - 100 % E.D.
Ramp time	Selectable on/off, adjustable 0,1 - 3 sec.
Adjustable switch frequency	40 - 700 Hz

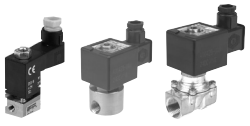
SPECIFICATIONS

recommended for proportional valve types	type	catalogue number
202A001V to 202A087V 203B001V and 203B002V	**01**	**E908A001**
202A201V to 202A208V	**02**	**E908A003**
202A101V to 202A104V 202A105V to 202B108V	**01**	**E908A004**

(1) Refer to the dimensional drawings on the following page.

(2) The connector is supplied with each control unit. **Do not use the standard connector mounted on the POSIFLOW solenoid valves.**

PROPORTIONAL VALVES SUITABLE FOR CONTROL APPLICATIONS

description	series	illustration	catalogue page
3-port proportional valve for pressure control	602		see "Proportional Technology" on: **www.asco.com**
Posiflow proportional solenoid valves	202 203		See "Proportional Technology" on: **www.asco.com**

OPTIONS

- ASCO can offer any adaption or modification to the control unit to meet special requests from the users' field

INSTALLATION

- The control unit can be mounted in any position without affecting operation
- The connector to ISO 4400 / EN 175301-803, form A, is supplied with each unit
- Catalogue number E908A004: The 4-terminal connector to ISO 4400 / EN 175301-803, form A, is supplied with each unit. The outlet to the solenoid valve is fitted with a 200 mm long cable with a connector to DIN 43650, 9,4 mm, industry standard B
- Installation and maintenance istructions are included with each control unit

ORDERING EXAMPLES:

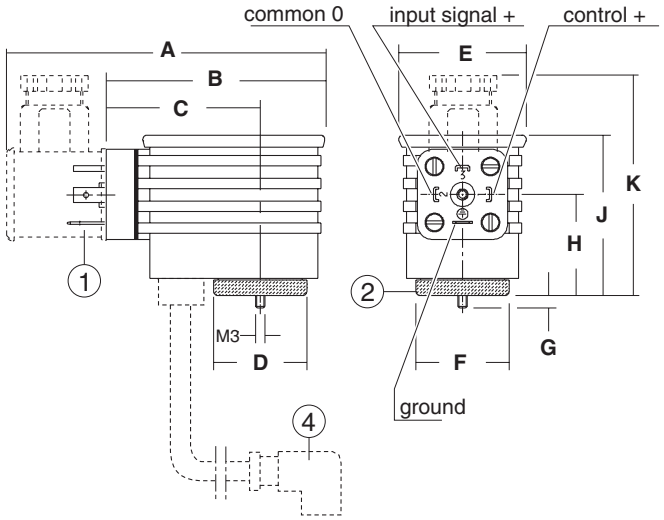
E 908 **A** 001
E 908 **A** 003

pipe thread
basic number

DIMENSIONS (mm), WEIGHT (kg)

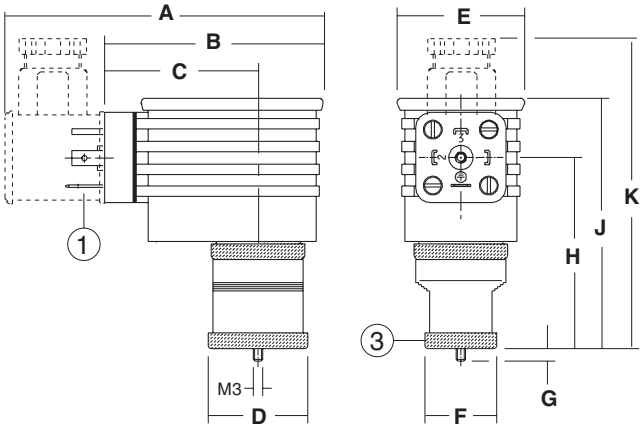
TYPE 01
POSIFLOW control unit
IEC 335 / ISO 4400
IP65

E908A001 - E908A004



TYPE 02
POSIFLOW control unit
IEC 335 / ISO 4400
IP65

E908A003

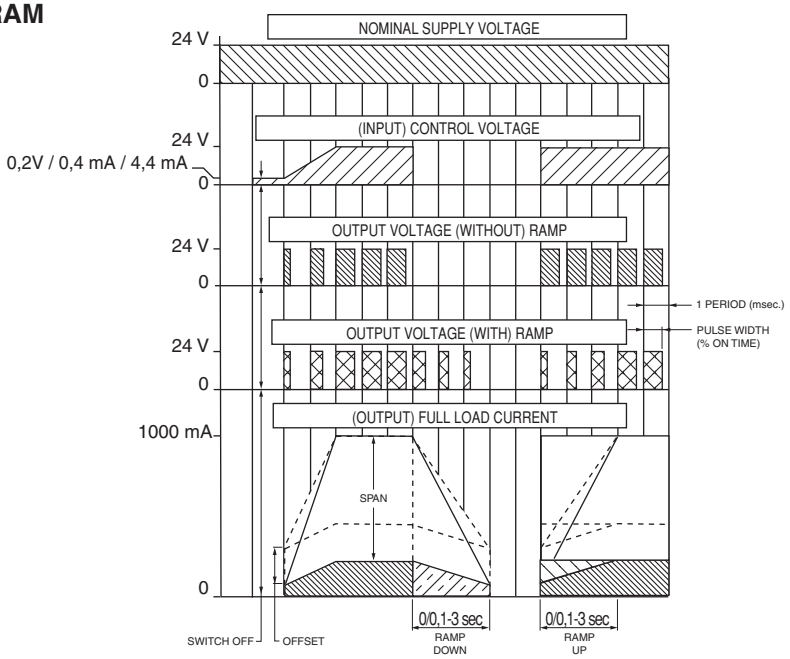


type	catalogue number	A	B	C	D	E	F	G	H	J	K	weight (1)
01	E908A001/004	98	70	48	30	41	30	4	32	51,5	70	0,1
02	E908A003	98	70	48	32	41	23	4	61	80	98	0,1

(1) Weight without connector.

① Supply, 4 terminals, ISO 4400/EN 175301-803, form A
Solenoid valve connection:
② 3 terminals, ISO 4400/EN 175301-803, form A
③ 3 terminals, DIN 43650, 11 mm, industry standard B
④ 3 terminals, DIN 43650, 9,4 mm, industry standard B

VOLTAGE-CURRENT / TIME DIAGRAM



INSTALLATION AND MAINTENANCE INSTRUCTIONS
Pulse width modulating proportional control unit

GB

DESCRIPTION

Series 908 are IP-65 spade plug connectors to ISO 4400 containing an electronic amplifier to modify and amplify an input control signal (setpoint) to a modulating output voltage to provide stepless control for ASCO proportional solenoid valves as series 202 and 203.

IMPORTANT

This I&M sheet must be used in conjunction with the I&M sheet of the main proportional valve.

OPERATION

- Input control signal 0-10 V DC, 0-20 mA or 4-20 mA to be selected by dipswitches.
- Flow rate at required input control signal adjustable by means of two potentiometers.
- Switch-off function, at less than 2% of the maximum control signal.
- Ramp control function (up and down) can be activated by a dipswitch and is adjustable by means of a potentiometer.
- Switch frequency, adjustable by means of a potentiometer.

INSTALLATION/ADJUSTMENT

Check nameplate for correct catalogue number and voltage.

1. Install valve and apply line pressure.
2. Remove centre screw and cover with gasket from plug connector.
3. Position connector gasket between coil and connector and install plug connector.

Control signal selection

4. Select required input control signal (Uc/Ic/Icx) by adjusting dipswitches S1, S3 and S4. The factory default is 0 - 10V DC.

S1	S2	S3	S4	Control signal
off		on	off	0 - 10 V DC
on		off	on	4 - 20 mA
on		on	off	0 - 20 mA

Supply Voltage

5. Apply 24V DC ±10% supply voltage to pin 1 (+) and 2 (0), common.

Control signal

6. Apply control signal (Uc/Ic/Icx) to pin 3 (+).

Minimum flow

7. Increase control signal to value where minimum flow is required and adjust potentiometer P1 until the required minimum flow is reached.

Maximum flow

8. Increase control signal now to value where maximum flow is required and adjust potentiometer P3 until the required maximum flow is reached.
   Notes:
   a. Adjusting the maximum flow will slightly influence the minimum flow. For accurate adjustment, repeat steps 7 and 8 until the required values are reached.
   b. Minimum and maximum flow at the chosen settings are dependent on the pressure differential (ΔP) over the valve. If valve has to operate at several ΔP's. adjust minimum flow (step 7) at the highest ΔP and the maximum flow (step 8) at the lowest ΔP.

Switch-off

9. To ensure that the valve will close at minimum control signal, the coil current will switch-off at less than 2% of the maximum selected input control signal.

Ramp function

10. To temporize the flow at fast up and down input control signal changes, a ramp control function can be activated by dipswitch S2. The factory default is “no ramp”. The ramptime can be adjusted between 0,1 and 3 seconds by means of potentiometer P2.

S1	S2	S3	S4	Ramp function
	off			yes
	on			no

Switching frequency

11. The electronic amplifier is equipped with a device switching the voltage rapidly “on” and “off”. The switching frequency (number of “on/off” times per second) will influence the flow regulation characteristics like hysteresis, sensitivity etc. In addition it influences core vibration. The frequency is factory set to 300 Hz (E908A001 and A002) and 400 Hz (E908A003) for optimal operation. Depending on operation requirements the frequency can be adjusted between 40 and 700 Hz by means of potentiometer P4.

12. Under certain installation circumstances, undesirable vibration might occur. In that case, increase frequency and/or ramptime.

Control unit assembly/disassembly

13. Push printed circuit in place. Align cover with gasket and torque the central screw according to torque chart to ensure proper gasket compression. Disassemble in reverse order.

INSTRUCTIONS D’INSTALLATION ET D’ENTRETIEN
Boîtier de régulation proportionnelle par modulation de la largeur d’impulsion

FR

DESCRIPTION

Les electrovannes de la série 908 sont des connecteurs ISO 4400 équipés d’un amplificateur électronique pour modifier et amplifier un signal de régulation entrée (valeur de consigne) en une tension sortie par modulation afin de fournir une régulation sans étape pour les électrovannes proportionnelles ASCO telles que les séries 202 et 203.

IMPORTANT

Cette feuille I&M doit être utilisée conjointement avec la feuille I&M de la vanne proportionnelle principale.

FONCTIONNEMENT

- Signal de régulation entrée 0-10 V CC, 0-20 mA ou 4-20 mA sélectionné par commutateurs en boîtier DIP.
- Vitesse d’écoulement au signal de régulation entrée réglable à l’aide de deux potentiomètres.
- Fonction de fermeture de la vanne dès retombée à 2% du signal maximum de régulation.
- La fonction de régulation de rampe (vers le haut et le bas) peut être activée via un commutateur en boîtier DIP et elle est réglable à l’aide d’un potentiomètre.
- Fréquence de commutation, réglable au moyen d’u potentiomètre.

INSTALLATION/REGLAGE

Vérifiez la plaque signalétique pour obtenir le numéro correct du catalogue ainsi que la tension.

1. Installez la vanne et la pression linéaire.
2. Ôtez la vis centrale et le bouchon avec le joint d’étanchéité du connecteur.
3. Placez le joint d’étanchéité du connecteur entre la bobine et le connecteur, puis installez le connecteur.

Sélection du signal de régulation

4. Sélectionnez le signal de régulation entrée (Uc/Ic/Icx) en réglant les commutateurs en boîtier DIP S1, S3 et S4. La valeur usine par défaut est O-10 V CC.

S1	S2	S3	S4	Signal de régulation
arrêt		marche	arrêt	0 - 10 V CC
marche		arrêt	marche	420 mA
marche		marche	arrêt	0 - 20 mA

Tension d’alimentation

5. Appliquez une tension d’alimentation de 24V CC avec 10% ± à la broche 1 (+) et 2, ligne commune.

Signal de régulation

6. Appliquez un signal de régulation (Uc/Ic/Icx) à la broche 3 (+).

Fluide minimal

7. Augmentez le signal de régulation afin d’atteindre la valeur correspondant au fluide minimal requis et réglez le potentiomètre P1 jusqu’à ce que le fluide minimal requis soit atteint.

Fluide maximal

8. Augmentez le signal de régulation maintenant afin d’atteindre la valeur correspondant au fluide maximal requis et réglez le potentiomètre P3 jusqu’à ce que le fluide maximal requis soit atteint.
   Remarques:
   a. Le réglage du fluide maximal influencera légèrement le fluide minimal. Pour un réglage précis, répétez les étapes 7 et 8 jusqu’au moment où les valeurs requises sont atteintes.
   b. Le fluide minimal et maximal fixé lors du réglage dépendent du différentiel de pression (ΔP) sur la vanne. Si la vanne doit fonctionner sur plusieurs ΔP, réglez le fluide minimal (étape 7) sur le ΔP le plus élevé et le fluide maximal (étape 8) sur le ΔP le plus faible.

Fermeture

9. Pour être certain que la vanne ferme au signal minimum de régulation, le courant de la bobine se ferme dès retombée à 2% du signal maximum de régulation sélectionné.

Fonction de rampe

10. Afin de temporiser le fluide lors des changements rapides du signal de régulation vers le haut ou vers le bas, il est possible d’activer la fonction de régulation de rampe au moyen du commutateur en boîtier DIP S2. Par défaut, la valeur usine est « aucune rampe ». Il est possible de régler la durée de rampe entre 0,1 et 3 secondes à l’aide du potentiomètre P2.

S1	S2	S3	S4	Fonction de rampe
	arrêt			oui
	marche			non

Fréquence de commutation

11. L’amplificateur électronique est équipé d’un appareil qui commute rapidement la tension sur « marche » et « arrêt ».La fréquence de commutation (nombre de mouvements de « marche/arrêt » par seconde) influence les caractéristiques de la régulation du fluide telles que l’hystérésis, la sensibilité, etc. De plus, il y a une influence sur la vibration du noyau mobile. La fréquence fixée à l’usine est de 300 Hz (E908A001 et A002) et 400 Hz (E908A003) afin d’obtenir un fonctionnement optimal. En fonction des exigences de fonctionnement, vous pouvez régler la fréquence entre 40 et 700 Hz à l’aide du potentiomètre P4.

12. Dans certains cas d’installations, une vibration indésirable peut se produire. Dans ce cas, augmentez la fréquence et ou la durée de rampe.

Montage/démontage du boîtier de régulation

13. Poussez le circuit imprimé en place. Alignez le bouchon avec le joint d’étanchéité et raccordez la vis centrale selon le schéma de couple afin d’assurer une parfaite compression du joint d’étanchéité. Démontez en sens inverse.

BETRIEBSANLEITUNG
Proportionalregler mit Pulsbreitenmodulation

DE

BESCHREIBUNG

Bei der Baureihe 908 handelt es sich um Gerätesteckdosen nach ISO 4400 sowie Schutzart IP65, in denen ein elektronischer Verstärker zur Modifikation und Verstärkung eines Eingangs-regelsignals (Sollwert) auf eine modulierende Ausgangsspannung integriert ist. Diese werden eingesetzt, um bei ASCO Proportionalventilen der Baureihe 202 und 203 eine stetige Regelung zu erreichen.

WICHTIG

Diese Betriebsanleitung muß in Verbindung mit der Betriebsanleitung des Hauptproportionalventils verwendet werden.

MANUELLE RÜCKSTELLUNG

- Das Eingangsregelsignal 0 - 10 V=, 0 - 20 mA oder 4 - 20 mA ist per Dip-Schalter wählbar.
- Die Durchflußrate bei dem erforderlichen Eingangsregelsignal ist mittels zweier Potentiometer einstellbar.
- Das Ventil wird bei weniger als 2% des maximalen Regelsignals abgeschaltet.
- Die Rampenregelfunktion (nach oben und unten) kann über einen Dip-Schalter aktiviert werden und ist mittels Potentiometer einstellbar.
- Die Schaltfrequenz ist mittels Potentiometer einstellbar.

INSTALLATION/EINSTELLUNG

Die korrekte Katalognummer und Spannung sind auf dem Typenschild angegeben.

1. Ventil einbauen und mit Leitungsdruck beaufschlagen.
2. Mittlere Schraube und Deckel mit Dichtung von Gerätesteckdose entfernen.
3. Dichtung zwischen Spule und Gerätesteckdose einsetzen und Gerätesteckdose installieren.

Auswahl des Regelsignals

4. Erforderliches Eingangsregelsignal (Uc/Ic/Icx) durch Einstellung der Dip-Schalter S1, S3 und S4 wählen. Werkseitig sind 0 - 10V= eingestellt.

S1	S2	S3	S4
Aus		Ein	Aus
Ein		Aus	Ein
Ein		Ein	Aus

Regelsignal
0 - 10 V=
4 - 20 mA
0 - 20 mA

Versorgungsspannung

5. Versorgungsspannung von 24V= ±10% an Stift 1 (+) und 2 (0) anlegen.

Regelsignal

6. Regelsignal (Uc/Ic/Icx) an Stift 3 (+) anlegen.

Minimaler Durchfluß

7. Regelsignal auf den Wert erhöhen, bei dem minimaler Durchfluß erforderlich ist, und Potentiometer P1 einstellen, bis der geforderte minimale Durchfluß erreicht wird.

Maximaler Durchfluß

8. Regelsignal nun auf den Wert erhöhen, bei dem maximaler Durchfluß erforderlich ist, und Potentiometer P3 einstellen, bis der geforderte maximale Durchfluß erreicht wird.
   Hinweise:
   a. Die Einstellung des maximalen Durchflusses wirkt sich geringfügig auf den minimalen Durchfluß aus. Für eine genaue Einstellung sind Schritt 7 und 8 zu wiederholen, bis die geforderten Werte erreicht werden.
   b. Die ausgewählten Einstellungen für minimalen und maximalen Durchfluß sind von der Druckdifferenz (ΔP) am Ventil abhängig. Sofern das Ventil mit verschiedenen Druckdifferenzen ΔP betrieben werden muß, sind der minimale Durchfluß (Schritt 7) auf die größte Druckdifferenz (ΔP und der maximale Durchfluß (Schritt 8) auf die geringste Druckdifferenz ΔP einzustellen.

Abschaltung

9. Um sicherzustellen, daß das Ventil bei Erreichen des minimalen Regelsignals schließt, wird der Spulenstrom bei einem Wert kleiner als 2% des ausgewählten maximalen Eingangsregelsignals abgeschaltet.

Zeitrampenfunktion

10. Um den Durchfluß bei schnellen Änderungen des Eingangsregelsignals (nach oben oder unten) zu verzögern, kann eine Zeitrampenfunktion über Dip Schalter S2 aktiviert werden. Werkseitig ist „Keine Zeitrampe“ eingestellt. Die Zeitrampe ist mittels Potentiometer P2 auf 0,1 bis 3 Sekunden einstellbar.

S1	S2	S3	S4
	Aus		
	Ein		

Zeitrampenfunktion
Ja
Nein

Schaltfrequenz

11. Der elektronische Verstärker ist mit einer Vorrichtung zum schnellen Ein- und Ausschalten der Spannung ausgerüstet. Die Schaltfrequenz (Anzahl der Schaltvorgänge (Ein/Aus) pro Sekunde) wirkt sich auf die Durchflußregeleigenschaften wie Hysterese, Empfindlichkeit usw. aus. Zusätzlich beeinflußt dies die Schwingung des Magnetankers. Für einen optimalen Betrieb ist die Frequenz werkseitig auf 300 Hz (E908A001 und A002) sowie auf 400 Hz (E908A003) eingestellt. Je nach Betriebsanforderungen kann die Frequenz mittels Potentiometer P4 zwischen 40 und 700 Hz eingestellt werden.

12. Unter bestimmten Installationsbedingungen können unerwünschte Schwingungen auftreten. In diesem Fall Frequenz erhöhen und/oder Zeitrampe verlängern.

Montage/Demontage des Reglers

13. Leiterplatte in die korrekte Position schieben. Deckel mit Dichtung ausrichten, und mittlere Schrauben entsprechend den Angaben im Drehmomentdiagramm anziehen, um die korrekte Pressung an der Dichtung zu erreichen. In umgekehrter Reihenfolge demontieren.

INSTRUCCIONES DE INSTALACION Y MANTENIMIENTO
Unidad de control proporcional de modulación por anchura de pulso

ES

DESCRIPCION

La Serie 908 está formada por conectores desenchufables IP-65 a ISO 4400 que contienen un amplificador electrónico para modificar y amplificar una señal de control de entrada (punto de ajuste) a una tensión de salida modulante que proporciona un control continuo para las válvulas de solenoide profesional de ASCO, como las series 202 y 203.

IMPORTANTE

Esta hoja I&M debe utilizarse conjuntamente con la hoja I&M de la válvula principal proporcional.

FUNCIONAMIENTO

- Señal de control de entrada de 0 a 10 VCC, 0 a 20 mA ó 4 a 20 mA a seleccionar mediante los microinterruptores.
- La velocidad de flujo en la señal de control de entrada requerida se ajusta mediante dos potenciómetros.
- Función de desconexión, a menos del 2% de la señal de control máxima.
- La función de control de rampa (subida y bajada) puede activarse mediante un microinterruptor y es ajustable por medio de un potenciómetro.
- La frecuencia de conmutación es ajustable por medio de un potenciómetro.

INSTALACIÓN/AJUSTE

Compruebe la placa de características para obtener el número de catálogo y tensión correctos.

1. Instalar válvula y aplicar presión en la línea.
2. Retirar el tornillo central y cubrir con la guarnición del conector macho.
3. Colocar la guarnición del conector entre la bobina y el conector e instalar el conector macho.

Controlar la selección de la señal

4. Seleccionar la señal de control de entrada requerida (Uclc/Icx) ajustando los microinterruptores S1, S3 y S4.
   El valor pre-ajustado en fábrica es de 0 a 10 VCC.

S1	S2	S3	S4
apagado		encendido	apagado
encendido		apagado	encendido
encendido		encendido	apagado

Señal de control
0 a 10 VCC
4 a 20 mA
0 a 20 mA

Tensión de alimentación

5. Aplique 24VCC ±10% de tensión de alimentación a la patilla 1 (+) y 2 (0), común.

Señal de control

6. Aplique la señal de control (Uc(Ic/Icx) a la patilla 3 (+).

Flujo mínimo

7. Aumente la señal de control a la válvula donde se requiera un flujo mínimo y ajuste el potenciómetro P1 hasta que se alcance el flujo mínimo requerido.

Flujo máximo

8. Aumente ahora la señal de control de la válvula donde se requiera un flujo máximo y ajuste el potenciómetro P3 hasta que se alcance el flujo máximo requerido.
   Notas:
   a. El ajuste del flujo máximo tendrá una ligera influencia en el flujo mínimo. Para realizar un ajuste preciso repita los pasos 7 y 8 hasta obtener los valores requeridos.
   b. Los flujos mínimo y máximo en los ajustes elegidos dependen del diferencial de presión (ΔP) en la válvula.Si la válvula tiene que funcionar en varios ΔP's, ajuste el flujo mínimo (paso 7) al máximo ΔP y el flujo mínimo (paso 8) al mínimo ΔP.

Desconexión

9. Para asegurar que la válvula se cierre con la señal de control mínima, la corriente de la bobina se desconectará a menos del 2% de la señal de control de entrada máxima seleccionada.

Función rampa

10. Para temporizar el flujo en los cambios rápidos de señal de control de entrada hacia arriba y abajo, puede activarse una función de control de rampa mediante el microinterruptor S2. El valor pre-ajustado en fábrica es «sin rampa». El tiempo de rampa puede ajustarse entre 0,1 y 3 segundos por medio del potenciómetro P2.

S1	S2	S3	S4
	apagado		
	encendido		

Función rampa
sí
no

Frecuencia de conmutación

11. El amplificador electrónico cuenta con un dispositivo de conmutación rápida de la tensión «encendido» y «apagado». La frecuencia de conmutación (el número de veces que se produce el «encendido/apagado» por segundo) tendrá influencia en las características de regulación del flujo, como por ejemplo la histéresis, sensibilidad, etc. Además, tiene influencia en la vibración del núcleo. La frecuencia está fijada en fábrica en 300 Hz (E908A001 y A002) y 400 Hz (E908A003) para un funcionamiento óptimo.
    Dependiendo de los requisitos de funcionamiento, la frecuencia puede ajustarse entre 40 y 700 Hz por medio del potenciómetro P4.

12. En ciertas circunstancias de instalación podrían ocurrir vibraciones no deseadas. En ese caso, aumente la frecuencia y/o el tiempo de rampa.

Montaje/desmontaje de la unidad de control.

13. Coloque el circuito impreso en su lugar a presión. Ponga en línea la cubierta con la guarnición y apriete el tornillo central según el cuadro de apriete para asegurar una buena compresión de la junta. Desmonte en el orden inverso.

ISTRUZIONI DI INSTALLAZIONE E MANUTENZIONE
Unité elettronica di controllo per valvole proporzionali

IT

DESCRIZIONE

La Serie 908 comprende connettori a spada IP65 s ISO 4400 contenenti un amplificatore elettronico per la modifica e l'amplificazione di un segnale di controllo d'ingresso (valore di riferimento) in tensione d'uscita di modulazione per fornire il controllo infinitamente variabile delle elettrovalvole proporzionali ASCO della serie 202 e 203.

IMPORTANTE

Questa scheda I&M deve essere usata unitamente alla scheda I&M della valvola proporzionale principale.

FUNZIONAMENTO

- Segnale di controllo d'ingresso 0-10 V DC, 0-20 mA o 4 20 mA selezionabile mediante dip switch.
- Portata al segnale di controllo d'ingresso richiesto regolabile per mezzo di due potenziometri.
- Funzione di interruzione a meno del 2% del segnale di controllo massimo.
- La funzione di controllo della rampa (in più e in meno) può essere attivata da dip switch ed è regolabile mediante potenziometro.
- Frequenza di commutazione regolabile mediante potenziometro.

INSTALLAZIONE/REGOLAZIONE

Il numero di catalogo e la tensione sono rilevabili dalla targhetta.

1. Installare valvola e applicare pressione di linea.
2. Togliere la vite centrale e il coperchio con la guarnizione dal connettore a spada.
3. Posizionare la guarnizione del connettore tra la bobina e il connettore e installare il connettore a spada.

Selezione del segnale di controllo

4. Selezionare il segnale di controllo d'ingresso richiesto (Uc/Ic/Icx) regolando i dip switch S1, S3 e S4. L'impostazione di fabbrica è 0-10 V c.c.

S1	S2	S3	S4	Segnale di comando
off		on	off	0 - 10 V c.c.
on		off	on	4 - 20 mA
on		on	off	0 - 20 mA

Tensione di Alimentazione

5. Applicare una tensione di alimentazione di 24 V c.c. ±10% ai piedini 1 (+) e 2 (0), comuni.

Segnale di comando

6. Applicare il segnale di controllo (Uc/Ic/Icx) al piedino 3 (+).

Portata minima

7. Aumentare il segnale di controllo fino al valore corrispondente alla portata minima e regolare il potenziometro P1 fino ad ottenere tale portata minima.

Portata massima

8. Aumentare il segnale di controllo fino al valore corrispondente alla portata massima e regolare il potenziometro P3 fino ad ottenere tale portata massima.
   Note:
   a. La regolazione della portata massima avrà effetto limitato sulla portata minima. Per una regolazione di precisione, ripetere i passi 7 e 8 fino a ottenere i valori richiesti.
   b. La portata minima e la massima ai valori scelti dipendono dalla differenza di pressione (DP) nella valvola. Se il funzionamento dell'elettrovalvola deve avvenire a diversi DP, regolare la portata minima (passo 7) al valore massimo DP e la portata massima (step 8) al valore minimo DP.

Disinserimento

9. Per avere la certezza che l'elettrovalvola chiuda al segnale di controllo minimo, la corrente della bobina verrà interrotta a meno del 2% del segnale di controllo d'ingressomassimo selezionato.

Funzione di rampa

10. Una funzione di controllo della rampa può essere attivata dal dip switch S2 all scopo di temporizzare la portata alle rapide variazioni in più o in meno del segnale di controllo dell'ingresso. Il valore impostato in fabbrica è "rampa assente". Il tempo di rampa è regolabile tra 0,1 e 3 secondi per mezzo del poten-ziometro P2.

S1	S2	S3	S4	Funzione di rampa
	off			sì
	on			no

Frequenza di commutazione

11. L'amplificatore elettronico è munito di un dispositivo per l'insierimento e il disinserimento rapido. La frequenza delle manovre (numero di volte in cui viene data/tolta tensione) avrà effetto sulle caratteristiche di regolazione della portata, come l'isteresi, la sensibilità, ecc. Agisce anche sulle vibrazioni del nucleo. La frequenza è regolata in fabbrica su 300 Hz (E908A001 e A002) e 400 Hz (E908A003) per un funzionamento ottimale. A seconda delle esigenze operative, la frequenza è regolabile da 40 a 700 Hz per mezzo del potenziometro P4.

12. In certe condizioni d'installazione si potrebbero verificare vibrazioni indesiderate. In questo caso aumentare la frequenza e/o il tempo di rampa.

Montaggio/smontaggio dell'unità di controllo

13. Inserire il circuito stampato. Allineare il coperchio con la guarnizione e serrare la vite centrale in conformità con il diagramma delle coppie per garantire la giusta compressione della guarnizione. Smontare procedendo in ordine inverso.

ALGEMENE INSTALLATIE- EN ONDERHOUDSINSTRUCTIES
Pulsbreedtemodulerende proportionele stuurunit

NL

BESCHRIJVING

Serie 908 zijn IP-65 stekeraansluitingen naar ISO 4400 die een elektronische versterker bevatten om een ingangssignaal (instelpunt) zodanig te bewerken en te versterken dat er een modulerend uitgangssignaal ontstaat voor de traploze regeling van proportionele ASCO magneetafsluiters, bijv. de series 202 en 203.

BELANGRIJK

Raadpleeg dit I&M-blad altijd in combinatie met het I&M-blad van de gebruikte proportionele afsluiter.

WERKING

- Via DIP-schakelaars kunt u kiezen tussen ingangssignalen van 0-10 V DC, 0-20 mA en 4-20 mA.
- Via twee potentiometers kunt u het debiet instellen bij het gewenste ingangssignaal.
- De versterker sluit de afsluiter als het ingangssignaal minder dan 2% wordt van het ingestelde maximum.
- Via een DIP-schakelaar kunt u een helling-functie inschakelen (zowel voor toename als voor afname), en via een potentiometer kunt u de helling bepalen.
- Schakelfrequentie, instelbaar via potentiometer.

INSTALLATIE/AFSTELLEN

Controleer op het typeplaatje het catalogusnummer en of de correcte spanning is aangesloten.

1. Installeer de afsluiter en sluit de drukleidingen aan.
2. Verwijder de centrale schroef en het deksel met de afdichting van het stekerhuis.
3. Plaats de stekerafdichting tussen de spoel en de steker en monteer de steker.

Selectie regelsignaal

4. Selecteer het gewenste ingangssignaal (Uc/Ic/Icx) met behulp van de DIP-schakelaars S1, S3 and S4. De standaardinstelling is 0-10V DC.

S1	S2	S3	S4	Regelsignaal
uit		aan	uit	0 - 10 V DC
aan		uit	aan	4 - 20 mA
aan		aan	uit	0 - 20 mA

Voedingsspanning

5. Sluit een voedingsspanning van 24V DC ±10% aan op pen 1 (+) en pen 2 (0), massa.

Regelsignaal

6. Sluit het regelsignaal (Uc/Ic/Icx) aan op pen 3 (+).

Minimumdebiet

7. Verhoog het regelsignaal tot de gewenste signaalwaarde voor het minimumdebiet, en regel vervolgens de grootte van het debiet met potentiometer P1 tot de door u gewenste minimum-waarde is bereikt.

Maximumdebiet

8. Verhoog nu het regelsignaal tot de gewenste signaalwaarde voor het maximumdebiet, en regel daarna de grootte van het debiet met potentiometer P3 tot de door u gewenste maximumwaarde is bereikt.
   Opmerkingen:
   a. Bij het instellen van het maximumdebiet ontstaat een kleine afwijking aan het ingestelde minimumdebiet. Als een nauwkeurige instelling is vereist, herhaal dan de stappen 7 en 8 tot de door u gewenste waarden zijn bereikt.
   b. Het minimale en maximale debiet bij de gekozen instellingen is afhankelijk van het drukverschil (DP) over de afsluiter. Als de afsluiter moet werken bij verschillende DP's, kies dan het minimale debiet (stap 7) afhankelijk van de grootste DP en het maximale debiet afhankelijk van de laagste DP.

Uitschakelpunt

9. Om zeker te zijn dat de afsluiter wordt gesloten als het regelsignaal de minimumwaarde bereikt, wordt de stroom door de spoel uitgeschakeld als het regelsignaal nog maar 2% is van het gekozen maximale ingangssignaal.

Helling-functie

10. Met behulp van DIP-schakelaar S2 kunt u voor de regeling een helling-functie inschakelen om de debietveranderingen geleidelijker te laten verlopen bij snel wisselende ingangssignalen. Standaard is "geen helling" ingesteld.
    Via potentiometer P2 kunt u de hellingperiode instellen tussen 0,1 en 3 seconden.

S1	S2	S3	S4	Helling-functie
	uit			ja
	aan			nee

Schakelfrequentie

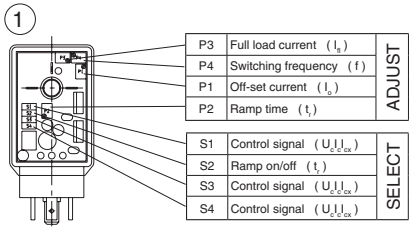
11. De elektronische versterker is voorzien van een schakeling die de spanning achtereenvolgens snel "aan" en "uit" schakelt. De schakelfrequentie (aantal "aan/uit" perioden per seconde) is van invloed op de karakteristieken van de debietregeling, bijv. de hysterese, de gevoeligheid, enz. Bovendien heeft het een effect op trillingen van de plunjer. Voor een optimale werking is de frequentie standaard ingesteld op 300 Hz (E908A001 en A002) of op 400 Hz (E908A003).
    Via de potentiometer P4 kunt u, afhankelijk van de toepassing, de frequentie instellen tussen 40 en 700 Hz.

12. Onder bepaalde omstandigheden kunnen ongewenste trillingen optreden. Verhoog in dat geval de frequentie en of kies een langere helling-periode.

Montage/demontage van de regelaar

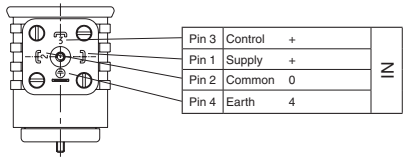
13. Druk de printplaat op zijn plaats. Druk het deksel recht op de afdichting en draai de centrale schroef met het juiste aandraaimoment vast zodat de afdichting voldoende onder druk staat. Demontage in omgekeerde volgorde.

ASCO™	DRAWING	DESSIN	ZEICHNUNG
	DISEGNO	DIBUJO	TEKENING

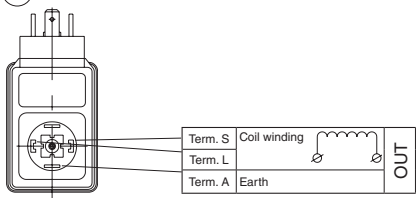


Régler
Einstellen
Ajuste
Regolare
Instellen

Sélectionner
Auswählen
Seleccionar
Selezionare
Selectie



Entrée
Eingang
Dentro
Ingresso
In



Sortie
Ausgang
Afuera
Uscita
Uit

FR

1 P3 courant à pleine charge
P4 fréquence de commutation
P1 courant de décalage
P2 durée de rampe

S1 signal de régulation
S2 marche/arrêt de la rampe
S3 signal de régulation
S4 signal de régulation

2 Pin3 régulation
Pin1 alimentation
Pin2 ligne commune
Pin4 terre

3 enroulement de la bobine terre

A Courbe du fluide
Signal de régulation / amplificateur de fluide 8908A001
Potentiomètre P1 de réglage signal de régulation min. / fluide min.

B Courbe du fluide
Signal de régulation / amplificateur de fluide 8908A001
Potentiomètre P3 de réglage signal de régulation max. / fluide max.

DE

1 P3 Vollaststrom
P4 Schaltfrequenz
P1 Offset-Strom
P2 Zeitrampe

S1 Regelsignal
S2 Zeitrampe ein/aus
S3 Regelsignal
S4 Regelsignal

2 Pin3 Regelung
Pin1 Versorgung
Pin2 Gemeinsam
Pin4 Erde

3 Spulenwicklung
Erde

A Durchflußkurve
Regelsignal/Durchflußverstärker 8908A001
Einstellpotentiometer P1
Min. Regelsignal / Min. Durchfluß

B Durchflußkurve
Regelsignal/Durchflußverstärker 8908A001
Einstellpotentiometer P3
Max. Regelsignal / Max. Durchfluß

ES

1 P3 corriente de carga completa
P4 frecuencia de conmutación
P1 corriente de desplazamiento
P2 tiempo de rampa

S1 señal de control
S2 activación/desactivación de la rampa
S3 señal de control
S4 señal de control

2 Pin3 control
Pin1 suministrar
Pin2 común
Pin4 tierra

3 arrollamiento de la bobina tierra

A Curva de flujo
Señal de control / amplificador de flujo 8908A001
Potenciómetro de ajuste P1
señal mínima de control/ flujo mínimo

B Curva de flujo
Señal de control / amplificador de flujo 8908A001
Potenciómetro de ajuste P3
señal máxima de control/ flujo máximo

IT

1 P3 corrente a pieno carico
P4 frequenza di commutazione
P1 corrente offset
P2 tempo di rampa

S1 segnale di controllo
S2 rampa inserita/disinserita
S3 segnale di controllo
S4 segnale di controllo

2 Pin3 controllo
Pin1 alimentazione
Pin2 comune
Pin4 terra

3 avvolgimento bobina terra

A Curva della portata
Segnale di controllo / amplificatore del flusso 8908A001
Potenziometro di regolazione P1.
segnale di controllo min / portata min

B Curva della portata
Segnale di controllo / amplificatore del flusso 8908A001
Potenziometro di regolazione P3.
segnale di controllo max / portata max

NL

1 P3 vollast-stroom
P4 schakelfrequentie
P1 offset-stroom
P2 helling-periode

S1 regelsignaal
S2 helling-functie aan/uit
S3 regelsignaal
S4 regelsignaal

2 Pin3 regeling
Pin1 voeding
Pin2 massa
Pin4 aarde

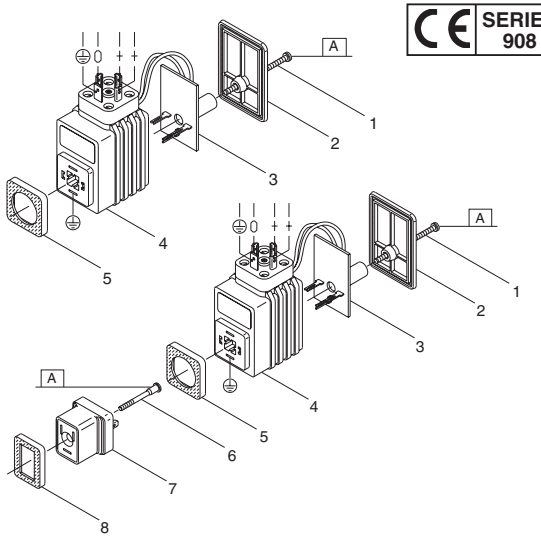
3 spoelwikkeling aarde

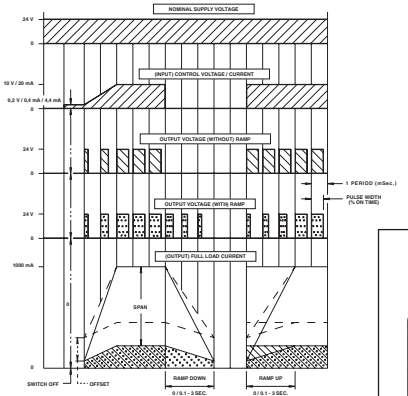
A Debiet-kromme
Regelsignaal / debiet versterker 8908A001
Instelpotmeter P1
min. regelsignaal / min. debiet

B Debiet-kromme
Regelsignaal / debiet versterker 8908A001
Instelpotmeter P3
max. signaal / max. debiet

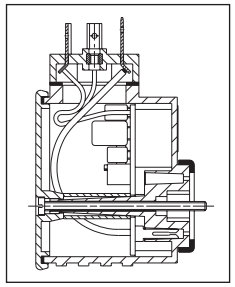
ASCO™	DRAWING	DESSIN	ZEICHNUNG
	DISEGNO	DIBUJO	TEKENING

SERIES 908





VOLTAGE-CURRENT / TIME DIAGRAM



GB DESCRIPTION

1. Screw, connector II
2. Cover + gasket
3. Printed circuit
4. Connector II
5. Gasket, connector II
6. Screw, connector I
7. Connector I
8. Gasket, connector I

FR DESCRIPTION

1. Vis, connecteur II
2. Bouchon + joint d'étanchéité
3. Circuit imprimé
4. Connecteur II
5. Joint d'étanchéité connecteur II
6. Vis, connecteur I
7. Connecteur I
8. Joint d'étanchéité, connecteur I

DE BESCHREIBUNG

1. Schraube, Gerätesteckdose II
2. Deckel & Dichtung
3. Leiterplatte
4. Gerätesteckdose II
5. Dichtung,
6. Schraube, Gerätesteckdose I
7. Gerätesteckdose I
8. Dichtung, Gerätesteckdose I

ES DESCRIPCION

1. Tornillo, conector II
2. Cubierta + guarnición
3. Circuito impreso
4. Conector II
5. Guarnición, conector II
6. Tornillo, conector I
7. Conector I
8. Guarnición, conector I

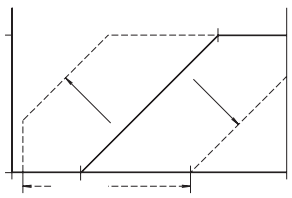
IT DESCRIZIONE

1. Vite, connettore II
2. Coperchio + guarnizione
3. Circuito stampato
4. Connettore II
5. Guarnizione, connettore II
6. Vite, connettore I
7. Connettore I
8. Guarnizione, connettore I

NL BESCHRIJVING

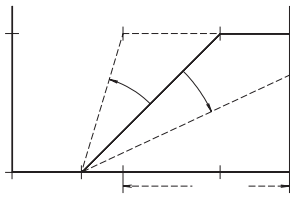
1. Schroef, steker II
2. Deksel + afdichting
3. Printplaat
4. Steker II
5. Afdichting, steker II
6. Schroef, steker I
7. Steker I
8. Afdichting, steker I

TORQUE CHART		
A	0,6 ± 0,2	5 ± 2
ITEMS	NEWTON.METRES	INCH.POUNDS



A
FLOW CURVE
CONTROL SIGNAL/FLOW AMPLIFIER 8908.001

ADJUSTMENT POTENTIOMETER P_1 MIN. CONTROL SIGNAL / MIN. FLOW



B
FLOW CURVE
CONTROL SIGNAL/FLOW AMPLIFIER 8008.001

ADJUSTMENT POTENTIOMETER P_3 MAX. CONTROL SIGNAL / MIN. FLOW

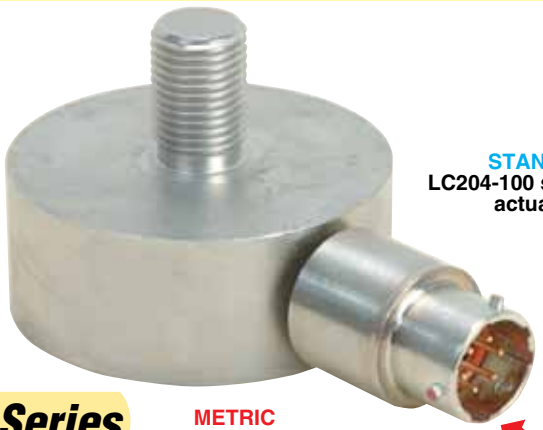
HIGH-ACCURACY MINIATURE UNIVERSAL LOAD CELLS SURFACE MOUNT STYLE

51 mm (2") DIAMETER STANDARD AND METRIC MODELS

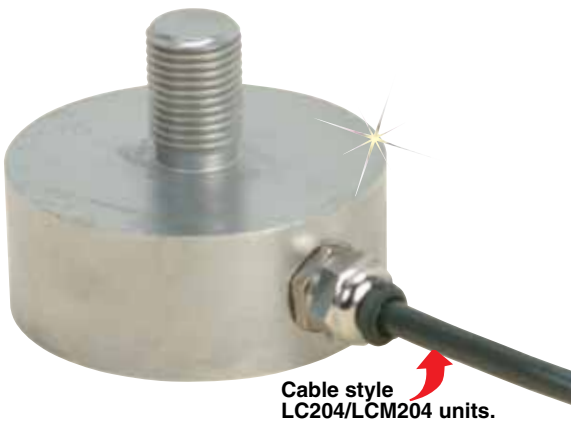
OMEGA®

Tension/Compression
Calibrated in Tension
0-25 lb to 0-10,000 lb
0-100 to 0-50,000 N

1 Newton = 0.2248 lb
1 daNewton = 10 Newtons
1 lb = 454 g
1 t = 1000 kgf = 2204 lb



METRIC
LCM214-100N shown actual size.



STANDARD
LC204-100 shown actual size.

Cable style LC204/LCM204 units.

Twist-lock connector LC214/LCM214 units.

Bottom view of all units, Shown smaller than actual size.

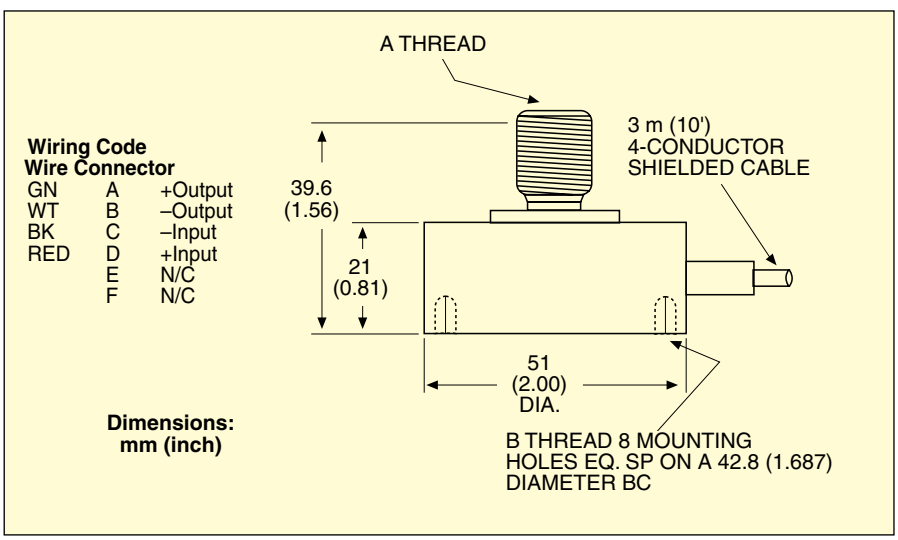
LC204/LCM204 Series
LC214/LCM214 Series

NIST FM APPROVED RoHS

Standard

- **FM Intrinsically Safe**
- **1.0% Interchangeability for Scale Applications**
- **Miniature Package for Test Stands and Difficult Locations**
- **Designed to be Mounted on a Flat Surface**
- **5-Point Calibration**

OMEGA's LC204/LCM204 Series load cells are designed to be surface mounted with the load applied through the mounting stud. The high linearity (0.15%) and all stainless steel construction make them ideal for industrial and commercial weighing and for force measuring applications.



Wiring Code
Wire Connector

GN	A	+Output
WT	B	–Output
BK	C	–Input
RED	D	+Input
	E	N/C
	F	N/C

Dimensions: mm (inch)

Dimensions: mm (inch)

MODEL	A THREAD	B THREAD
LC204/LC214	½-20 UNF-2A 19 (0.75) L	10-32 UNF 6.3 (0.25) DP min
LCM204/LCM214	M12 x 1.75 19 (0.75) L	M5 x 0.8 6.3 (0.25) DP min

SPECIFICATIONS

Excitation: 10 Vdc, 15 Vdc maximum
Output: 2 mV/V ±1.0%
5-Point Calibration (in Tension): 0%, 50%, 100%, 50%, 0%
Linearity: ±0.15% FSO
Hysteresis: ±0.1% FSO
Repeatability: ±0.05% FSO
Zero Balance: ±2% FSO
Operating Temp Range: -46 to 107°C (-50 to 225°F)
Compensated Temp Range: 16 to 71°C (60 to 160°F)
Protection Class: IP65
Thermal Effects:
Zero: 0.0045% FSO/°F
Span: 0.009% FSO/°F
Safe Overload: 150% of capacity
Ultimate Overload: 300% of capacity
Input Resistance: 350 Ω minimum
Output Resistance: 350 ±10 Ω
Construction: Stainless steel
Electrical: 3 m (10') 4-conductor shielded cable
LC214/LCM214 Mating Connector: PT06F10-6S (sold separately)
LC214/LCM214 Cable Assembly with Twist Lock Connector: CA-4PC24-2-015 (sold separately)

STANDARD
LC204-100 shown actual size.

STANDARD MODELS

To Order

CAPACITY		MODEL NO.		COMPATIBLE METERS**
lb	N	CABLE	CONNECTOR	
25	111	LC204-25	LC214-25	DPiS, DP41-S, DP25B-S
50	222	LC204-50	LC214-50	DPiS, DP41-S, DP25B-S
100	445	LC204-100	LC214-100	DPiS, DP41-S, DP25B-S
200	890	LC204-200	LC214-200	DPiS, DP41-S, DP25B-S
300	1334	LC204-300	LC214-300	DPiS, DP41-S, DP25B-S
500	2224	LC204-500	LC214-500	DPiS, DP41-S, DP25B-S
1000	4448	LC204-1K	LC214-1K	DPiS, DP41-S, DP25B-S
2000	8897	LC204-2K	LC214-2K	DPiS, DP41-S, DP25B-S
2500	11,121	LC204-2.5K	LC214-2.5K	DPiS, DP41-S, DP25B-S
5000	22,242	LC204-5K	LC214-5K	DPiS, DP41-S, DP25B-S
8000	35,587	LC204-8K	LC214-8K	DPiS, DP41-S, DP25B-S
10,000	44,484	LC204-10K	LC214-10K	DPiS, DP41-S, DP25B-S

Comes complete with 5-point NIST-traceable calibration and 59 kΩ shunt data.
******* Visit us online for compatible meters. DPiS meter suitable for one direction measurement only.*
***Ordering Examples: LC204-25,** 25 lb capacity surface mount load cell.*
***LC204-1K,** 1000 lb capacity surface mount load cell.*

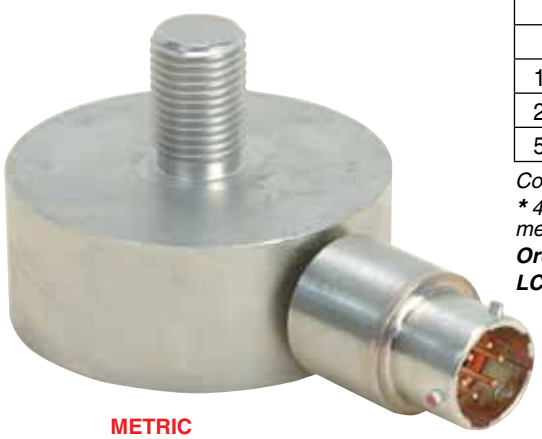
Bottom view of all units, shown smaller than actual size.

METRIC MODELS

To Order

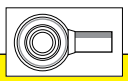
CAPACITY		MODEL NO.		
N	lb	CABLE	CONNECTOR	COMPATIBLE METERS**
100	22	LCM204-100N	LCM214-100N	DPiS, DP41-S, DP25B-S
200	45	LCM204-200N	LCM214-200N	DPiS, DP41-S, DP25B-S
500	112	LCM204-500N	LCM214-500N	DPiS, DP41-S, DP25B-S
1000	225	LCM204-1KN	LCM214-1KN	DPiS, DP41-S, DP25B-S
2000	450	LCM204-2KN	LCM214-2KN	DPiS, DP41-S, DP25B-S
5000	1124	LCM204-5KN	LCM214-5KN	DPiS, DP41-S, DP25B-S
10,000	2248	LCM204-10KN	LCM214-10KN	DPiS, DP41-S, DP25B-S
20,000	4496	LCM204-20KN	LCM214-20KN	DPiS, DP41-S, DP25B-S*
50,000	11,241	LCM204-50KN	LCM214-50KN	DPiS, DP41-S, DP25B-S*

Comes complete with 5-point NIST-traceable calibration and 59 kΩ shunt data.
****** 4-digit meter. ****** Visit us online for compatible meters. DPiS meter suitable for one direction measurement only.*
***Ordering Examples: LCM204-100,** 100 N capacity surface-mount load cell.*
***LCM204-5KN,** 5000 N capacity surface-mount load cell.*



METRIC
LCM214-100N shown actual size.

ACCESSORIES

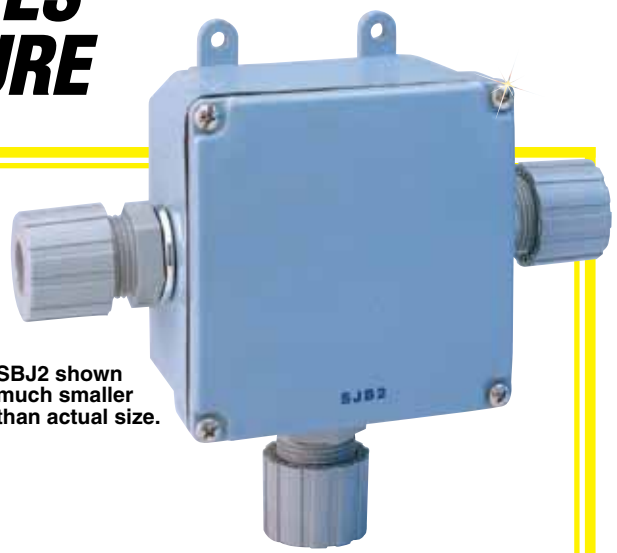


MODEL NO.	DESCRIPTION
REC-012F	Rod end for LC204/LC214 Series
MREC-M12F	Rod end for LCM204/LCM214 Series
PT06F10-6S	Mating connector for LC214/LCM214 series load cells

SUMMING JUNCTION BOXES NEMA 4X (IP66) ENCLOSURE

Summing Junction Boxes for 2, 3, or 4 Load Cells

1 Newton = 0.2248 lb
1 daNewton = 10 Newtons
1 lb = 454 g
1 t = 1000 kg = 2204 lb



SBJ2 shown much smaller than actual size.

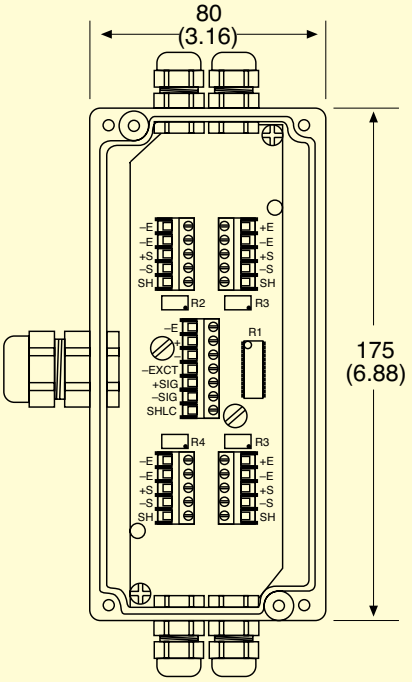
SBJ Series

MADE IN USA

- **NEMA 4X (IP66) Enclosure**
- **Heavy-Duty Case for Industrial Applications**
- **Models for 2, 3, or 4 Load Cell Installations**

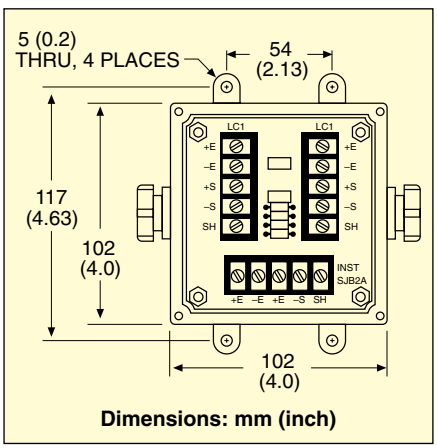
SBJ4 shown much smaller than actual size.

The SBJ Series summing junction box electronically sums the outputs of bridge-type load cells to form a single output equal to the sum of the loads on each load cell.



Dimensions: mm (inch)

Potentiometers in series with the bridge excitation are provided to match the outputs of the load cell. It is commonly used in industrial scale, bin, tank, hopper, and platform applications. The load cell should be the same capacity as the summing junction box and have output interchangeability of better than 3%.



Dimensions: mm (inch)

SPECIFICATIONS

Case: NEMA 4X (IP66)
Feedthroughs: Compression type for wire up to 6.35 mm (0.25") diameter
Span: ±3% adjustment

To Order ***Visit omega.com/sbj2 for Pricing and Details***

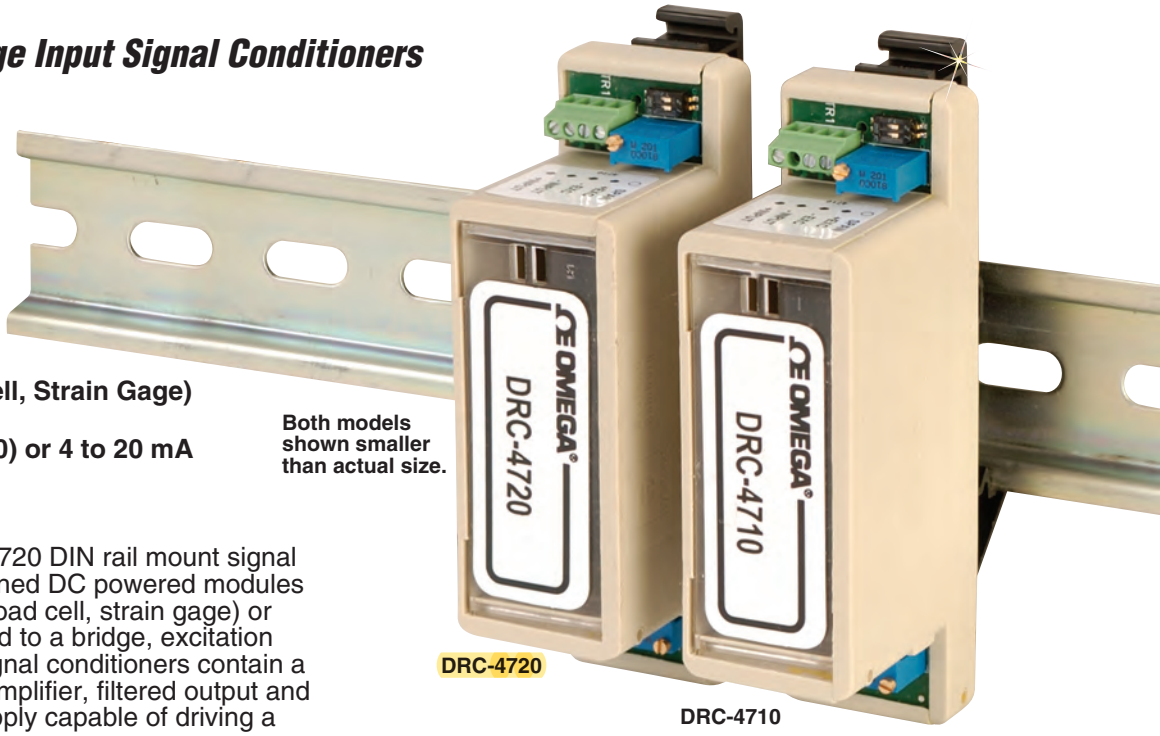
CAPACITY	MODEL NO.	DESCRIPTION
2	**SBJ2**	Sums 2 load cells
3 or 4	**SBJ4**	Sums up to 4 load cells

Ordering Examples: SBJ2, *NEMA 4X (IP66) summing junction box for 2 load cells.*
SBJ4, *NEMA 4X (IP66) summing junction box for up to 4 load cells.*

DIN Rail Mount Bridge Input Signal Conditioners

DRC-4710/4720

1 YEAR WARRANTY — MADE IN USA



DRC-4720

DRC-4710

Both models shown smaller than actual size.

- **DIN Rail Mount**
- **Bridge Input (Load Cell, Strain Gage) or Voltage Input**
- **0 to 10 Vdc (DRC-4710) or 4 to 20 mA (DRC-4720) Output**
- **Economical**

The DRC-4710 and DRC-4720 DIN rail mount signal conditioners are self-contained DC powered modules designed for bridge input (load cell, strain gage) or voltage input (not connected to a bridge, excitation supply not used). These signal conditioners contain a precision instrumentation amplifier, filtered output and a built-in 10V excitation supply capable of driving a 350 Ω bridge. The 0 to 30 mV input range makes the DRC-4710 and DRC-4720 compatible with most strain gage based load cell or pressure transducer outputs. Two models are available, one with 0 to 10 Vdc output (DRC-4710), and the other with 4 to 20 mA output (DRC-4720). Connections are made via easily accessible screw terminal blocks. Zero and Span adjustment potentiometers are located externally as well for easy access.

Specifications

INPUT

Input Range: 0 to 10 mV, 0 to 20 mV, 0 to 30 mV (dip switch selectable)
Power: 18 to 26 Vdc (350 Ω Bridge)
Linearity: ±0.01%
Zero Adjust: 20% max output
Temperature Coefficient: 0.05%/°C
Input Offset Voltage: ±70 µV
Input Offset Voltage Temperature Coefficient: 0.7 µV/°C
Common Mode Voltage: 0 to 5V
Common Mode Rejection (DC): 100 dB
Input Noise: 0.3 µV pp typ (0.1 to 10 Hz)

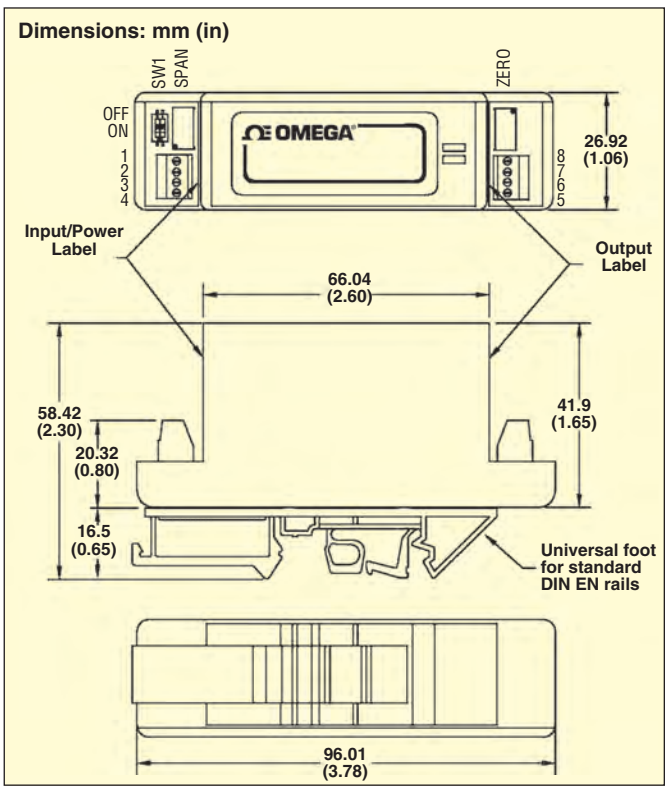
OUTPUT

Output Range:
DRC-4710: 0 to 10 Vdc
DRC-4720: 4 to 20 mA
Load Current (DRC-4710): 5 mA max
Compliance Voltage (DRC-4720): 5.5V max
Loop Resistance (DRC-4720): 250 Ω max **Frequency Response (2-Pole Filter):** DC to 10 Hz **Total RMS Gain Temperature Coefficient:** 0.007%/°C

BRIDGE EXCITATION SUPPLY

Fixed Output: 10V ±1.0%
Temperature Coefficient: 0.05%/°C
Load Current: 30 mA max

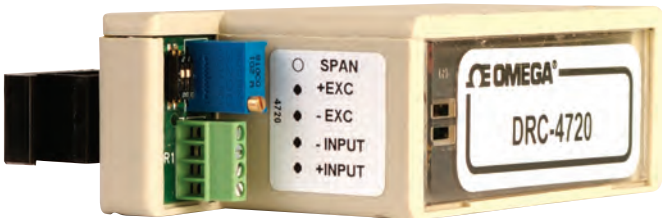
Dimensions: mm (in)

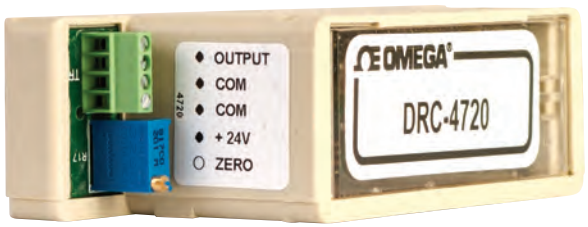


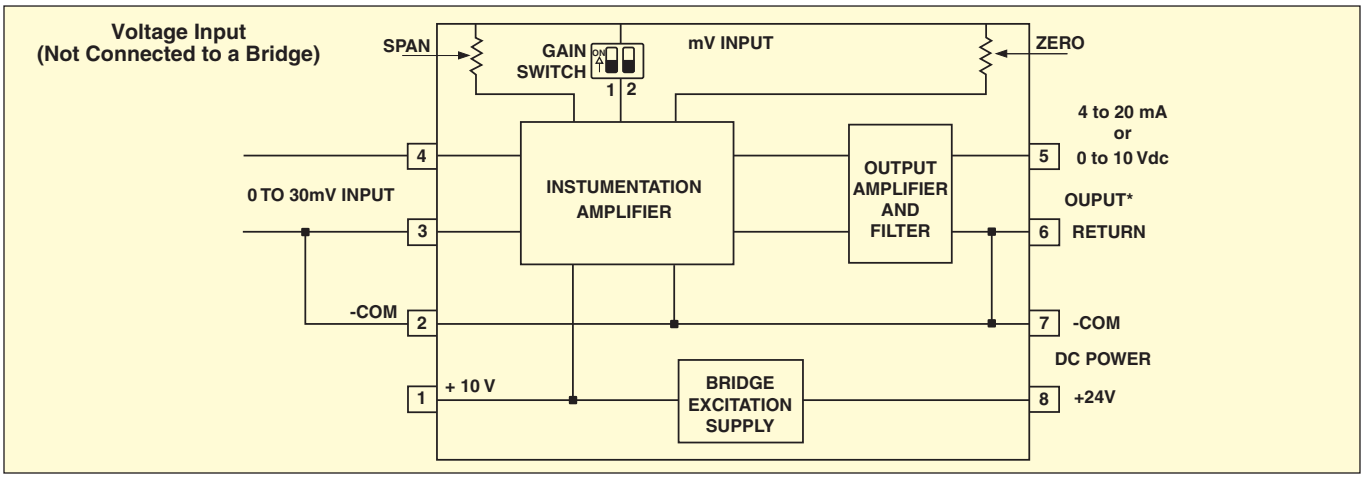
GENERAL

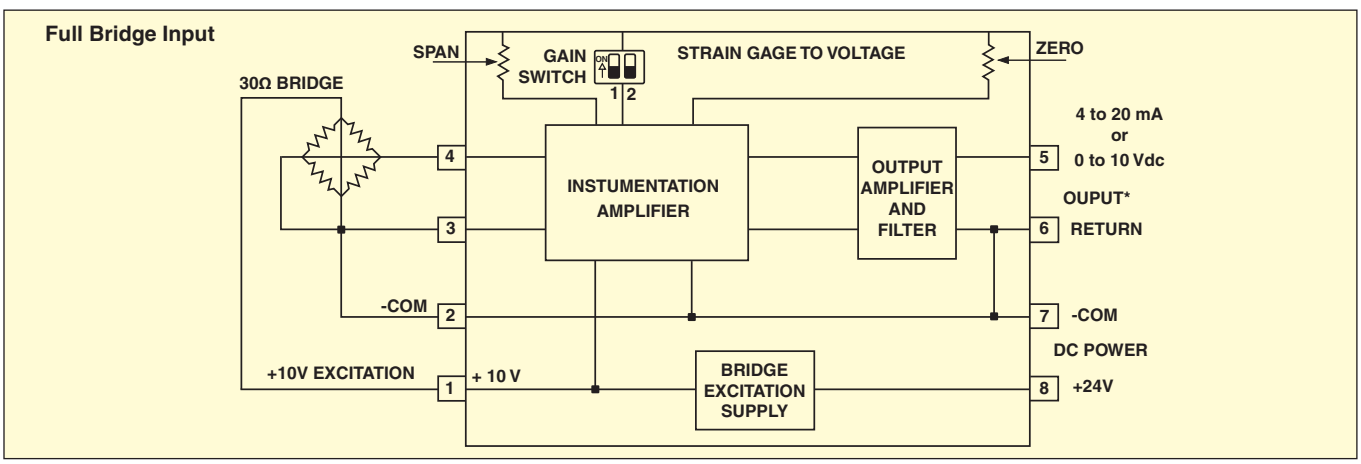
Power: 18 to 26 Vdc
Input Current (One 350 Ω Bridge):
DRC-4710: 40 mA
DRC-4720: 55 mA
Operating Ambient: 0 to 55°C (32 to 131°F)
Storage Temperature: -40 to 80°C (-40 to 176°F)
Dimensions: 96 H x 27 W x 42 mm D (3.78 x 1.06 x 1.65")
Weight: 85 g (3 oz)

Detail of input/output connections for DRC-4720 shown actual size.









**DRC-4710 (0 to 10 Vdc output)*
DRC-4720 (4 to 20 mA output)

IN STOCK FOR FAST DELIVERY!

To Order *Visit omega.com/drc4710_4720 for Pricing and Details*

Model No.	Description
DRC-4710	Bridge input signal conditioner with 0 to 10 Vdc output
DRC-4720	Bridge input signal conditioner with 4 to 20 mA

OMEGACARE℠ Extended Warranty Program

OMEGACARE℠ extended warranty program is available for models shown on this page. Ask your sales representative for full details when placing an order.

Accessories

Model No.	Description
iDRN-PS-1000	Power supply (switching), 95 to 240 Vac Input, 24 Vdc output @ 850 mA
RAIL-35-2	35 mm (1.4") DIN rail, 2 m (6.6') length
RAIL-35-1	35 mm (1.4") DIN rail, 1 m (3.3') length

Comes complete with operator's manual.
Ordering Example: DRC-4710,** bridge input signal conditioner with 0 to 10 Vdc output, **iDRN-PS-1000** power supply, **RAIL-35-2** mounting rail, and **OMEGACARE** 1-year extended warranty for **DRC-4710.

Dataflow Compact - Inline Flow Transmitter

Features & Benefits

- Pulse output signal for flows up to 25 l/min.
- Lightweight and robust.
- Operates in any plane. Simple to install.
- Low cost flow measurement.
- Negligible pressure drop.
- Accepts reverse flow.
- 3/8 BSP male connection.
- Water or compatible clear fluids only.
- Ideal for washing machines, showers and vending machines.

Specification

Construction:
Body Grilamid – TR55.
Rotor 18% PTFE filled nylon.
Shaft Stainless steel.
Shaft Retainers Grilamid TR55.

Operation:
Infra-red.

Maximum working pressure:
20 bar.

Pressure drop:
Max 0.1 bar at 15 l/min.

Flow range:
1 to 25 l/min.
(Accepts reverse flow).

Calibration:
'K' Factor 752 pulses per litre, typical.
Subject to application.

Accuracy:
±2% typical.

Repeatability:
±1%.

Temperature range:
+5°C to +70°C.

Overall dimensions:
52mm x 29mm x 27mm.

Weight:
16 grams.

Connections:
3/8 BSP

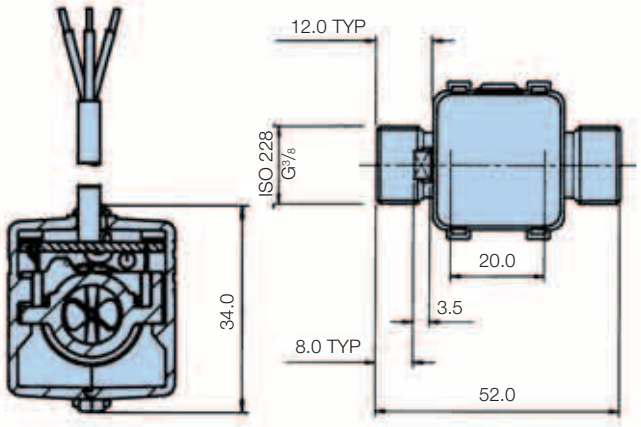
Cable length:
300mm.

Power supply:
5 Vdc.

Output signal:
5 Vdc - square wave

Installation Details

Red wire +5V supply
Green wire Output signal
Blue wire 0V supply



Dataflow Compact – The Low Cost Transmitter

The Dataflow Compact Transmitter was designed to offer OEM's and end users alike a means of monitoring low flows on liquids with an electronic output signal – but at LOW COST. Fluid passes through the one piece sensor body impacting on the twin vaned turbine rotor, causing it to rotate at a speed proportional to the flow rate. Two opposing photo-transistors are mounted either side of the rotor and externally of the clear sensor body, these generate a continuous signal.

As the rotor spins each blade obscures the infra red signal. This is then converted into an industry standard pulse output signal – compatible with inexpensive display units for flow rate, totalising, batch control and large, central control systems. The lightweight Grilamid body with its virtually unrestricted flow path, offers negligible pressure drop for flows up to 25 l/min and withstanding pressures up to 20 bar.

Flow Rate • Totalising • Batch Control and applications in many industries

Dataflow Compact Transmitters are small and very robust having been developed and tested extensively in industry applications where space is a restriction. Dataflow Compact with its Grilamid body and BSP connections can be installed almost anywhere and once installed will give accurate and reliable output signalling.

Ordering Information

Standard products table

Product number	Supercedes	Description
DFC9000100	DFC.9000100	Dataflow compact transmitter

Note 1: Part numbers featured with bold highlighted codes will ensure a 'standard' product selection.
Note 2: Alternate displayed part number selection will require you to contact Parker Filtration for availability.

1 YEAR WARRANTY

OMEGA CARE Extended Warranty Program

CE

User's Guide

Shop online at

omega.com®

OMEGA®

omega.com
e-mail: info@omega.com
For latest product manuals:
omegamanual.info

ISO 9001 CERTIFIED CORPORATE QUALITY — STAMFORD, CT

ISO 9002 CERTIFIED CORPORATE QUALITY — MANCHESTER, UK

DRF-FR
FOR FREQUENCY INPUT
DRF Series Signal Conditioners

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ΩOMEGA®

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Tel: (203) 359-1660
FAX: (203) 359-7700
e-mail: info@omega.com

Canada:
976 Bergar
Laval (Quebec) H7L 5A1, Canada
Tel: (514) 856-6928
FAX: (514) 856-6886
e-mail: info@omega.ca

For immediate technical or application assistance:

U.S.A. and Canada:
Sales Service: 1-800-826-6342 / 1-800-TC-OMEGA®
Customer Service: 1-800-622-2378 / 1-800-622-BEST®
Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN®
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Toll Free in Germany: 0800 639 7678
e-mail: info@omega.de

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Manchester M44 5BD
United Kingdom
Tel: +44 (0)161 777 6611
FAX: +44 (0)161 777 6622

Toll Free in United Kingdom:
0800-488-488
e-mail: sales@omega.co.uk

INDEX

SAFETY CONSIDERATIONS

PRESCRIPTION.- Before starting any operation of adjustment, replacement, maintenance or repair, the unit must be disconnected from any kind of power supply. Keep the unit clean, to assure good functioning and performance. To prevent electrical or fire hazard, do not expose the unit to excessive moisture. Do not operate the unit in the presence of flammable gases or fumes, such an environment definetely constitutes a safety hazard. The unit is designed to be mounted on a metal panel.

If the unit shows signs of damage, is not able to show the expected measures, has been stored in a bad conditions or a protection failure happened, then do not attempt to operate, keep the unit out of service and send for repair.

IN CASE OF FIRE

1.- Disconnect the unit from the power supply
2.- Give the alarm according to the local rules
3.- Switch off all air conditioning devices
4.- Attack the fire with carbonic snow, do not use water in any case

WARNING: In closed areas do not use systems with vaporized liquids.

GENERAL INFORMATION

The DRF series of Isolated Signal Converters, allow to convert process signals, temperatures, electrical signals, etc, to current loops or voltage signals for further retransmision, while introducing into the system galvanic isolation barriers between the input, the output and the power supply circuits.

The DRF series of Isolated Signal Converters, offer an excellent relation between signal conversion speed and measurement accuracy. Offering up to a 0.2% accuracy and down to 70ms response time, these units can process information coming from probes or transducers, in such a way that can be quickly retransmitted in a fast and accurate form to remote data acquisition systems or PLC's. The isolated signal converters of the DRF series are ideal to integrate into 12 bit data acquisition systems.

Its powerful galvanic isolation of 3500 V introduces high security to the measuring systems, preventing the propagation of those phenomenon which usually cause damage, such as transient peaks or energy shocks in any of the circuits of the system. The galvanic isolation also acts as a strong CE barrier. The decoupling created between the circuits avoids pernicious effects on the output, such as ground loops or signal leaks, which distort the acquired data and are extremely difficult to isolate once introduced into the signal.

The isolation offered by the DRF series of Isolated Signal Converters is a 3 way isolation. Thus, all the benefits exposed above are applicable to any of the three circuits composing the instrument : input, output and power.

Recalibration of the instruments is realized in a fast and easy way. Opening the front cover grants access to the configuration jumpers. Additional Span and Offset potentiometers are directly accessible from the frontal part. These potentiometers are highly decoupled, minimizing the iterations needed to obtain a correct adjustment.

In order to obtain a higher and quickest benefit of the DRF units, we recommend you to read carefully the information provided in this manual before proceeding to the installation of the instrument. In this manual you will find all technical data, both electrical and mechanical, needed for a correct instalation and utilization.

Note : The DRF Series Isolated Signal Converters have a characteristics label attached on the side of the instrument. Check that this information matches with your requirements for the specific application, and especially check the value and type of the Power Supply.

QUICK GUIDE

The DRF units have a front cover which can be opened down. This cover gives access to the Span and Offset potentiometers, and to the selection jumpers for input and output signal ranges.

To open the front cover, press slightly the sides of the cover at the upper side, close to the OUTPUT terminals, as indicated on Figure1.

The cover is free to open down, as shown on Figure2.

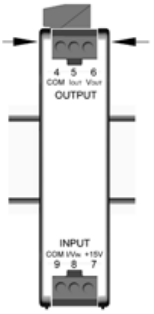


FIGURE1
FRONT VIEW WITH COVER

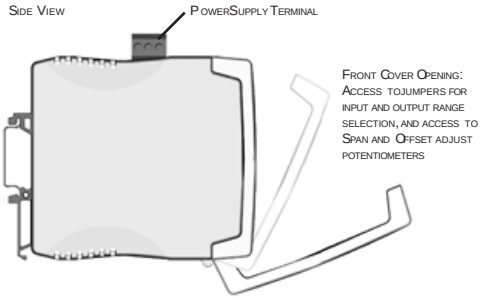
POWER SUPPLY CONNECTIONS

DRF units are powered through the plug-in terminal positioned on the upper side of the instrument. This terminal is placed in a transverse axis, different from the other terminals. Close to the power supply terminal there is a small yellow label with indications on the connections for AC and DC

IMPORTANT !! Check that the power supply indicated on the white label attached to the side of the instrument, matches with the power supply you want to connect.

For more accurate information on the power supply connections, please see page 6 of this manual.

FIGURE 2
SIDE VIEW



SIGNAL ADJUSTMENT

To proceed to adjust a range of input and output signals, first select with the appropriate jumpers, the signal ranges which include your desired adjustment. Then proceed to the adjustment.

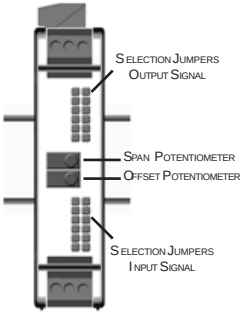
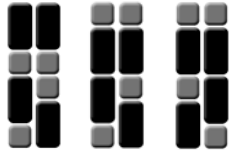


FIGURE 3
Front View
without Cover

Selection Jumpers : Output Signal Range



0/20mA (4/20mA) | 0/10Vdc | 0/1Vdc

Selection Jumpers : Input Signal Range
Selection Jumpers: Input Signal Type
(See next page)

For your safety select input and output jumpers BEFORE generating signal for the adjustment.

Adjustment

1.- Connect input signal to terminals *(8 «signal» and 9 «common»)*.

2.- Connect a multimeter to the output signal terminals *(4 and 5 for mA or 4 and 6 for Vdc)*.

(Values in brackets are examples for a calibration 0/1 KHz = 0/10Vdc)

3.- Input a zero signal *(0Hz)* .
Operate offset potentiometer until getting a zero output *(0Vdc)*.

4.- Input the difference between the high and low input levels *(1000-0=1000Hz)*.
Operate span potentiometer until getting an output which is the difference between the high and low output levels *(10-0=10Vdc)*.

5.- Input low input level *(0Hz)*.
Operate offset potentiometer until getting the low level output *(0Vdc)*.

6.- Input high input level and check that that the output also matches the desired level *(1000 Hz=10Vdc)*.

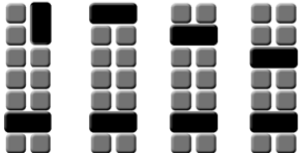
If more accurate measurement is needed, repeat steps 5 and 6.

Most of the input / output combinations will be properly adjusted within the instrument accuracy after these steps. Close front cover once calibration is finished.

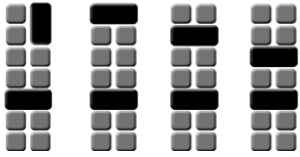
Selection Jumpers :
Input Signal Ranges

0/50 KHz 0/30 KHz 0/20 KHz 0/10 KHz

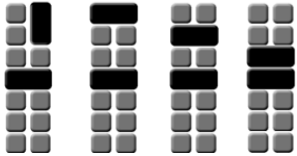
0/5 KHz 0/3 KHz 0/2 KHz 0/1 KHz



0/500 Hz 0/300 Hz 0/200 Hz 0/100 Hz

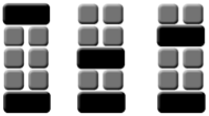


0/100 Hz 0/60 Hz 0/40 Hz 0/20 Hz

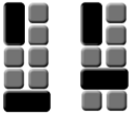


Selection Jumpers :
Input Signal Type

NPN PNP NAMUR



<24 VAC <200 VAC



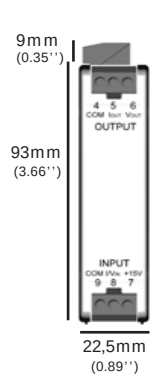
Selection : Excitation Voltage

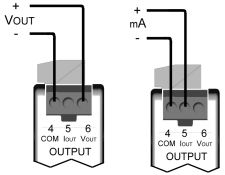
Within the set of jumpers for Input Signal Range, the last jumper allows selection of the level of Excitation Voltage Ouput generated by the DRF.

Vexc .- +15V
(20mA)

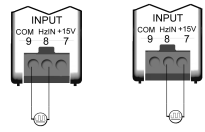
Vexc .- 9V2
NAMUR

DIMENSIONS AND CONNECTIONS





Output Connections

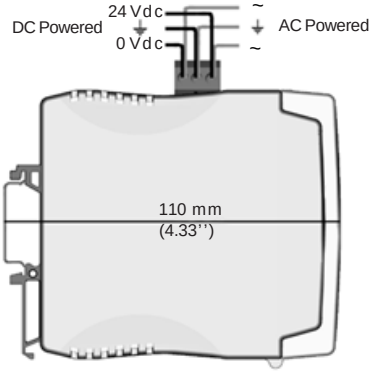


Input Connections

SENSOR POWERED EXTERNALLY

NAMUR OR PNP SENSOR POWERED FROM DRF

Special Width for AC Power models



TECHNICAL DATA : DRF-FR

INPUT SIGNAL in FREQUENCY

RANGES 50KHz,30KHz,20KHz,10KHz
5KHz, 3KHz, 2KHz, 1KHz
500Hz, 300Hz, 200Hz, 100Hz
60Hz, 40Hz, 20Hz
(minimum 10Hz)

SIGNAL NPN, PNP
NAMUR
PICK-UP Voltage Impulse
SINUSOIDAL up to 200Vac

Vexc 15 Vdc @ 20mA
9V2 for NAMUR

OUTPUT SIGNAL in VDC

RANGES	0/10 Vdc 0/1 Vdc
Max Output	11Vdc approx.
Min Output	-1Vdc approx.
Min Load R	≥1KOhm

OUTPUT SIGNAL in mA

RANGES	0/20mA (4/20mA)
Max Output	22mA approx.
Min Output	-1.5mA approx.
Max Load R	≤400 Ohms

POWER SUPPLY

DC Power	24Vdc ±10%
AC Power	230Vac ±10%50/60 Hz 115Vac ±10%50/60 Hz
Consumption	<3.8VA

MECHANICAL DIMENSIONS

DC Units	22.5 x 93 x 110 mm
AC Units	37.0 x 93 x 110 mm
Weight DC	120 gr.
Weight AC	200 gr.

Standard DIN rail mounting, as specified on DIN46277 and DIN EN 50022
37.5 x 7.5 mm (1.38 x 0.3 ´´)

GALVANIC ISOLATION LEVELS

DC Units

Input - Output	3,5 KV *(60 seconds)*
Power-Input	3,5 KV *(60 seconds)*
Power- Output	1 KV *(60 seconds)*

AC Units

Input - Output	3,5 KV *(60 seconds)*
Power- Input	3,5 KV *(60 seconds)*
Power - Output	3,5 KV *(60 seconds)*

All isolation levels are tested during a time of 60 seconds, with current leaks <1mA

Note : Indicated isolation levels are also sometimes named as STRENGTHENED ISOLATION levels, for systems with Polution Level 2

GENERAL SPECIFICATIONS

Accuracy	<0.2% F.S.
Optimized for	12 bit systems
Linearity	<0.1% F.S.
Thermal Drift	<250 ppm/ºC Tipical
Warm-Up Time	5 minutes

Response Time for signal ranges of
0/100 Hz <300mS (90% of signal)
0/500 Hz <250mS (90% of signal)
0/5 KHz <200mS (90% of signal)
0/50 KHz <150mS (90% of signal)

Plug-In Screw Terminals
Maximum Wire Section 2.5 mm²
Protection IP-30

Temp. Operation from 0 to 60ºC
Temp. Storage from -20 to +70ºC

MATERIALS

Box and Cover in Poliamide PA6 UL94 V-2 blue color
Terminals in Poliamide UL94 V-0

CAUTIONS, WARNINGS AND NOTES

INSTALATION

PRECAUTIONS.- The installation and the future use of this unit must be done by qualified personnel. The unit has not AC (mains) switch, neither internal protection fuse. It will be in operation as soon as power is connected. The installation must incorporate an external mains switch with a protection fuse and also the necessary devices to protect the operator and the process when using the unit to a control machine or process where injury to personnel or damage to equipment or process may occur as a result of failure of the unit.

RECOMMENDED FUSES

24 Vdc 230 Vac 115 Vac
250mA 70 mA 100 mA
All fuses .-Time Lag Fuse

SAFETY PRESCRIPTIONS.- The unit has been designed and tested under EN-61010-1 rules and is delivered in good conditions. This User's Manual contains useful information the user has to respect in order to warrant a proper function of the unit, and good security conditions. The unit is designed for internal applications, with good ventilation to avoid excessive heating. It can ***occasionally*** be applied to temperatures down to 10ºC or up to 70ºC without security degradation. Do all connections before applying power to the unit. Do not make wiring changes until power is disconnected from the unit.

Install the unit far from elements generating electric noise, or magnetic fields, such as power relays, electrical engines, speed regulators, etc. Do not use until installation is completed.

POWER SUPPLY.- The power supply must be connected to the adequate terminals 1, 2 and 3. The characteristics of the power supply are shown on the side label. Please make sure that the unit is correctly connected to a power supply of the correct voltage and frequency. Do not connect the unit to lines which are overloaded or which provide power to systems working on ON-OFF cycles or inductive loads.

ATTENTION : If the power supply is DC voltage, be careful with the polarity indicated for each terminal.

SIGNAL WIRING .- Certain considerations must be given when installing the signal input wires. If the wires are long, they can act as an antenna introducing electrical noise into the unit. Therefore :

Do not install the signal input wires in the same conduit with power lines, heaters, solenoids, SCR controls, etc ... and always far from these elements.

When shielded wires are used, leave unconnected the shield on the transmitter side and conect the other end of the shield to the ground terminal of the machine.

EXCITATION VOLTAGE.- Model DRF-PR incorporates an internal power supply for transducers. The output of this power supply is connected to terminals 7 and 9. Do not connect these terminals to an external power supply, beacuse both units will be permantently damaged.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/ DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence. The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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TEMPERATURE

- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

M4136/0305

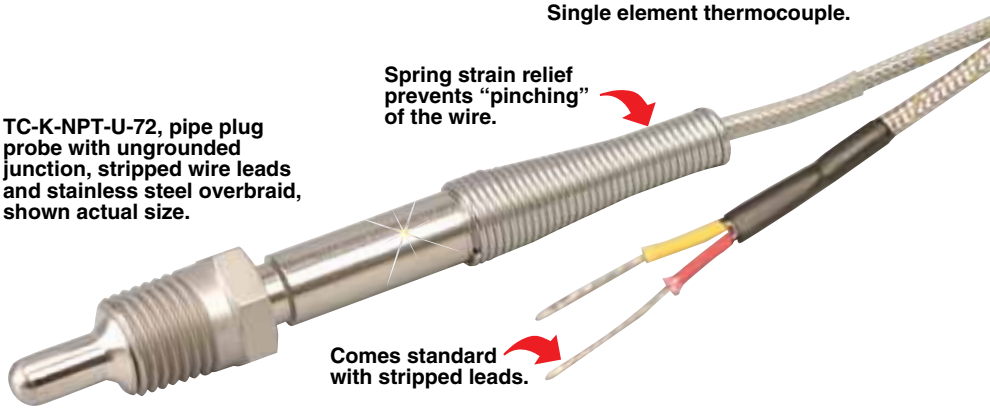
Rugged Pipe Plug Thermocouple Probe

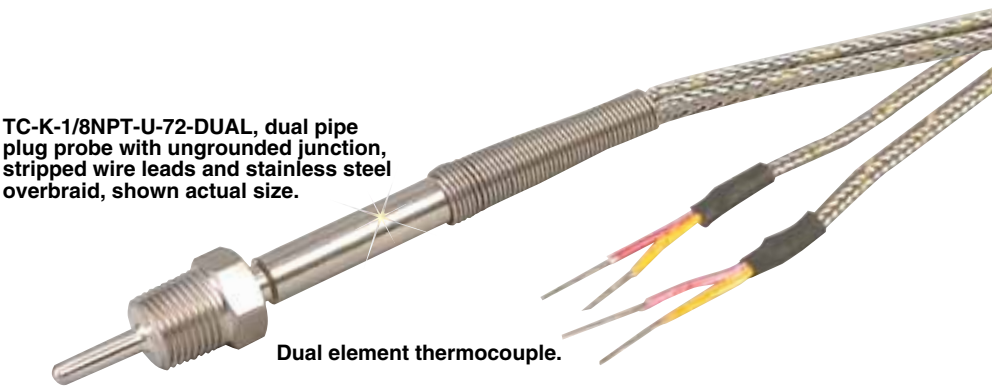
TC-(*)-NPT Series

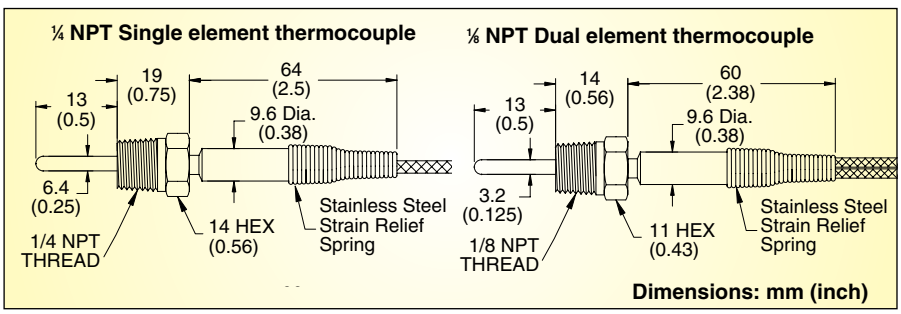
MEETS OR EXCEEDS SPECIAL LIMITS OF ERROR (SLE) AND EN 60584-2: Tolerance Class 1

- Rugged 304 SS Design with Strain Relief Spring
- Single and Dual Elements
- ¼ or ⅛ NPT Mounting Thread
- 2 m (80") Stainless Steel Braid Over Fiberglass Lead Wire
- 20 AWG, Stranded for ¼ NPT 24 AWG, Stranded for ⅛ NPT Stainless Steel Overbraid–Resists Abrasions and Cuts, Yet Remains Flexible
- Withstands Pressures to 2500 psi at Ambient Temperatures
- Grounded and Ungrounded Junction Is Ideal For Vessel Application, Pressurized Chambers and Pipelines
- Exposed Junction Designed For Air Temperature Measurement and Monitoring of Gas Streams
- Stripped Leads Standard SMPW Connectors, Optional
- Choice J, K, T or E Thermocouple Types
- Grounded, Ungrounded or Exposed Junctions
- Special Custom Designs Having Different NPT Threads, Tip Diameters or Tip Lengths are Also Available
- Flush Tip Available, Consult Custom Engineering
- Probe Temperature Range to 650°C (1200°F)
- Transition Joint/Cable Temperature Range to 480°C (900°F)

Single element thermocouple.







To Order

Mounting Thread	Model No.
¼	TC-(*)-NPT-(**)-72
	TC-(*)-1/4 NPT-(**)-72-DUAL
	TC-(*)-1/4 NPT-(**)-72-SMP-DUAL
	TC-(*)-1/4 NPT-(**)-72-SMP-DUAL
⅛	TC-(*)-1/8 NPT-(**)-72
	TC-(*)-1/8 NPT-(**)-72-DUAL
	TC-(*)-1/8 NPT-(**)-72-SMP
	TC-(*)-1/8 NPT-(**)-72-SMP-DUAL

** Specify calibration: **J, K, T** or **E**.*
*** Specify junction type: **G** (Grounded), **E** (Exposed), **U** (Ungrounded).*

For lead wire length over 2 m (80"), use additional price per 300 mm (12") increments and modify model number.

***Ordering Example: TC-K-NPT-G-72,** pipe plug style, Type K grounded junction thermocouple with ¼ NPT thread and 72" long extension leads.*