WFS1040 and WFS1545 Operation and Maintenance Manual

Version 1.0.0

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2. Who to Contact

For sales, service, and support please contact:

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All systems manufactured by:

HST Spindles
1357 NH-3A
Bow, NH 03222
(603) 483-0333
www.highspeedtechnologies.com

3. Safety Warnings and Precautions

This unit should only be serviced by qualified professionals in accordance with local guidelines and regulations. Any unauthorized use of this equipment will void any warranty expressed or implied. GTS and HST are not liable for any damage or harm that might occur with misuse of the WFS or related systems.

Please use proper safety standards when servicing or operating this equipment. This system contains high voltage, pressurized water, and chemicals that are dangerous or deadly when mishandled. Use all appropriate caution in accordance with local laws and regulations, including the use of PPE and other safety equipment.

4. System Description

The WFS1040 and WFS1545 was designed to provide temperature controlled and filtered water for use in semiconductor equipment. It does so by recirculating through five filter housings in two stages and a chiller, then providing that water to the equipment downstream. The used water is then recovered and processed again for reuse. This provides a drastic reduction in water use and contamination is waste water, as well as a more stable environment for sensitive equipment and processes.

There are two stages of filtration, the first being the “recirculating” or “dirty side” loop. The pump takes water from the dirty side tank and pushes it through 3 filter housings with filters that have been selected for the process. This water then goes through the chiller to be cooled to the set temperature to ± 1°C and stored in the clean side tank. The WFS is not equipped to heat the water in any fashion. When downstream equipment is not in use, the clean side water cascades from the clean side to the dirty side, providing constant scrubbing and temperature regulation. When water is needed by the downstream equipment, the “process” or “clean side” pump takes water from the clean side tank and pushes it through two more filters selected for the process, filtered down as small as 0.1µm. Then through one or more regulators and out to the downstream equipment. Once the water is used, it is collected and returned through a sump to the dirty side tank to be reprocessed.

5. Utilities

5.1. Electrical

US 220VAC 3 Phase 30A 60Hz
EU 230VAC 3 Phase 30A 50Hz
115V 1 phase 7.5A 50/60Hz (Lift station only)

5.2. Water

No greater than 80PSI
City, filtered, or DI water is acceptable

5.3. Environment

Indoor use only, 22°C ±3°C

6. Major Components

This section describes the critical components of the system with detailed information about their operation.

6.1. Chiller

The Chiller on the WFS1040 and WFS1545 is rated at 18000 BTU and will cycle on and off to maintain the temperature set on the Ranco controller attached near the electrical box. Please refer to section 8.4.1 for how to adjust the set point and hysteresis of the Ranco controller.

The chiller is intended to maintain the water temperature to room temperature to ±1°C. Please consult the manuals for downstream equipment to determine a proper operating temperature for the system keeping in mind that the lower the water temperature is in relation to the environment, the harder the chiller will have to work to maintain the set point. This system is not equipped to heat the water or maintain a temperature above room temperature. There are spec sheets section 11.1 for more information.

6.2. Reservoir

The water reservoir is made up of two parts, the clean side tank and dirty side tank. The dirty side has a capacity of 23 gallons and is where the water already used in the process returns to after the sump. This tank is also where fresh water comes in to make up for water lost due to evaporation and processing. The clean side tank has a capacity of 12.5 gallons and is the holding area for water that has been through the first stage of filtration and cooling. The water is held here until it is needed by the downstream equipment or until the tank fills up, at which point the water cascades over the baffle that separates the two chambers back into the dirty side tank. The entire reservoir has a capacity of 42 gallons when brim-full. The reservoir has two lines on the outside, red and blue. The blue line represents the maximum fill line for the dirty side tank. It is at this like that the float valve will turn off from the make-up water line. The red line represent the minimum fill like for pump safety. Below this line pump damage is possible. Please keep in mind that the water level will vary during operation but should always be between these limits, if it is not, add or remove water from the system accordingly. Also note that while the system is off, the water level will stabilize at a level that may be outside these limits. This is fine as long as the dirty water does not cascade into the clean water tank. See section 9.3.8 for remedies to this issue.

6.3. Filter Housings

There are five X100 filter housings on a WFS1040 or WFS1545, each one can contain one bag filter, one 5.5” diameter filter, or three 2.5” diameter filter. This provides great flexibility for filtering a wide range of particle sizes and volume. Housing 1 will contain the largest filter in terms of particle size that has been selected for the process. Each subsequent housing will reduce the filter rating down to as low as 0.1µm. The five housings are separated into two stages, state 1 has three housings in series and stage 2 has two housings in series. There are spec sheets section 11.1 for more information.

6.4. Pumps

The system contains two pumps. The recirculating or dirty side pump moves water from the dirty side tank through the first filtration stage and the chiller to the clean tank. The process or clean side pump takes water from the clean tank and moves it through the second filtration stage and to downstream equipment. Each pump is capable of providing at least 100 psi of pressure in the system. There are spec sheets section 11.1 for more information.

6.5. Electrical Box

The electrical box is mounted to the side of the chiller (refer to section 7.2 for assembly instructions) and contains all of the major electrical components for controlling the WFS. Only qualified electricians should open this box for servicing as it contains high voltage and current components. The outside panel hold the indicator lamps and switches for controlling the pumps and chiller, each of which can be turned on and off individually. Each system also has a control circuit for main power, as well as an EMO circuit for emergencies.

WARNING: The EMO circuit being activated does not mean the electrical box is de-energized. ALWAYS disconnect the power to the unit before servicing.

6.6. Regulating Valve(s)

Depending on the model of WFS, there are one or two pressure control valves. Both the 1040 and 1545 have one back pressure regulator (BPR) and the 1545 has a fluid pressure regulator (FPR). One or both of these valves will work to maintain the line pressure to downstream equipment at a safe level. Refer to section 11.1 for data sheets and installation instructions on these valves.

The BPR is a normally closed valve that opens when the set point is reached in order to relieve line pressure on it's input. It will open only enough to lower pressure to it's set point. As an example, if the set point is 50 PSI the valve will be closed if the line pressure on the BPRs input is 45psi. If the line pressure is 55psi the BPR will open enough to relieve 5psi, returning the line pressure to 50psi. The regulator will maintain the 50psi set point or less regardless of the input pressure, within the regulators specifications. This prevents high pressure from damaging downstream equipment and adjusts for changing demand.

The FPR is a normally open valve that closes to regulate pressure on it's input down to the set point on it's output. As an example, if the input pressure is 60psi and the set point is 45psi, the regulator will adjust to allow only 45psi through to the downstream line. This creates a more stable line pressure on the output while allowing for changes in demand from downstream equipment.

When the FPR and BPR are paired together in the WFS and set properly, they allow no more than about a 10psi swing from high to low pressure for downstream equipment. This swing does depend on actual installation conditions and equipment. The valve(s) are factory set but may need adjusting depending on the specific installation. For minor adjustments to either valve please see sections 8.5.1 and 8.5.2. To reset or fully tune a 1545 please see section 8.5.3.

7. Assembly and Installation

Caution: Following these instructions for the installation of this WFS 1040/1545 will reduce risk of personal injury or damage to this system. Prior to attempting to install this equipment, read these instructions thoroughly. If questions arise regarding installation do NOT proceed. Contact the authorized on-site person(s), equipment distributor, authorized agent, factory, or other qualified person(s).

7.1. Uncrating

Before removing any panels from the crates, inspect it for any signs of shipping damage. Look for tip-n-tell or shock watch indicators on the crates. Any damage should be documented and reported to the carrier and manufacturer before proceeding. The system comes in two crates. The larger of the two contains the base with reservoir, filter housings, pumps, and electrical box. The smaller crate contains the chiller.

1. Remove all packing materials and panels from the crates.
2. Using the proper safety equipment and procedures, remove the chiller and base from their respective crates. The base and chiller are designed to be lifted from the bottom using a forklift or similar device. DO NOT attempt to lift by any piping or support other than the base of each part!
3. Discard the crates and packing materials, ensuring no critical documentation or parts are lost.

7.2. Installing the Chiller and Electrical Box

The Chiller ships in separately from the base to avoid shipping damage. Follow these assembly instructions carefully and read them fully before beginning. Use all appropriate safety precautions and equipment to avoid injury to personnel and equipment. Only qualified individuals should perform this work.

1. The electrical box is strapped to the drip tray above the reservoir during shipment. Remove the box from the tray and set it on the floor nearby without disconnecting the electrical connections. The box is heavy, use a machine or two man lift to accomplish this.
2. Using the proper equipment, such as a forklift, lift the chiller by its base and set it on the drip tray aligning the evaporator connections of the chiller and base. The chiller does not mount to the tray, it just rests on top to allow for some adjustment in the position for alignment.
3. Once aligned, carefully thread the unions together being careful not to overtighten. Leak check these during the initial startup, as per section 8.1.
4. Using the bolts provided, attach the electrical box to the mounting rails on the side of the chiller. Again, use a machine or two man lift to safely mount the box.

7.3. Moving and Clearance

The unit was designed to be lifted and moved from underneath by a forklift, pallet jack, or similar device. With the unit assembled please note that the heavy side is on the side with the chiller and so should be lifted supporting that side. Do not try to move the WFS full of water, drain the system completely before moving it.

When selecting a location for installation, bear in mind that the WFS needs at least two sides open to access the filters, operation panel, and reservoir. The front side, which has the control panel facing out, needs at least 36" of clearance. This is the side that all of the filters can be accessed from. The left side, with the chiller and reservoir also needs 36" of clearance. The back side and right side need at least 6" of clearance. Keep in mind that the right side has all of the water inputs and outputs for water. The top of the unit needs 7" of clearance for the chiller vent. Please see section 10 for a detailed layout.

7.4. Leveling the Base

The base of the unit has four leveling feet, one in each corner, which can be used to adjust the level on the WFS. All four feet should be in contact with the floor to ensure stability. Once the unit is in position, use a spirit level or similar device to check each side of the unit. Do so by placing the level on a flat part of the base. If using a spirit level, the unit should be level on all sides to within 1/4th a bubble on each side. If not, adjust as follows:

1. Place a level on a flat part of the base near the side to be leveled.
2. Using a ¾" or adjustable wrench, loosen the jam nut holding the foot in place and spin it clockwise down out of the way. This is the nut at the top of the foot near the bottom of the base.
3. Next using the wrench, rotate the stationary nut (near the bottom of the foot) to adjust the base up or down for level. Rotating clockwise will move the base up, and counter clockwise will move the base down.
4. Repeat steps 1-3 on all sides of the WFS.
5. Once the system is level, retighten the jam nuts to hold the feet firmly in place.

7.5. Facility Hookup

Warning: Only qualified plumbers or electricians should make the connections described in this section in accordance with local guidelines and regulations. Please follow all appropriate safety procedures and use appropriate PPE and equipment.

7.5.1. Water Connections

There are three water connections for the WFS1040 and WFS1545. From top to bottom they are as follows; Make-up Water, Process Return, and Process Supply. All three are isolated by ball valves for servicing.

Connect the incoming water from the facility to the make-up water line using 1" FNPT threaded schedule 80 pipe. The supply and return lines both use 1.25" FNPT schedule 80 pipe, with the supply line going to the input

of each of the downstream machines. The return line will connect to the output of the sump provided with the WFS. See section 7.5.1.1 for sump installation.

Note: Flush all water lines after installing new piping before connecting to equipment. This will prevent debris from clogging machine lines. This includes the fill line for the WFS, once the piping is installed, remove the float valve and flush the line to prevent the valve leaking. See section 9.3.3 for issues with the float valve.

7.5.1.1. Lift Station

The sump is used to return used water to the WFS for reprocessing. The drain of each piece of equipment using WFS water needs to be attached to the input of the sump using 2" FNPT pipe. The output of the sump goes to the process return line of the WFS, the sump has a 2" FNPT connection and the WFS return uses 1.25" FNPT connectors. See section 10 for detailed schematics.

7.5.2. Electrical Connections

Warning: All electrical connections must be done in accordance with local and national codes by a qualified electrician.

The WFS requires a 230VAC 3 phase 30A connection with ground wire. The electrical connection requires a hole to be punched in the box, usually the bottom near the panel hinge next to the other electrical connections. Install a water tight connector (not included) to fit a 4 wire cable (not included) through. Install the ground wire in the green and yellow bus next to the breakers at the top of the panel. Then install each one of the power wires into the terminals provided on the top of each breaker. Note that while the pumps and chiller phasing have been synchronized at the factory it will be necessary to check the pump rotation on initial start up, please see section 8.1 for details on this.

8. Startup and Operation

8.1. First Time Start Up

Caution: If the power phasing is incorrect coming into the machine, the pumps will run backwards and damage themselves. The chiller will similarly be damaged due to incorrect phasing. The pumps and chillers are synchronized from the factory but it is still necessary to check the pump direction on start up before running the pumps or chiller long term.

Caution: DO NOT run the pumps or chiller dry or with low water, this can cause damage to both and will void the warranty. In particular do not run the chiller without pump #2 running as well as this can cause the coils to freeze.

8.1.1. Checking Pump Phasing

1. Use the make-up water line to fill the dirty side tank, the float should automatically stop the fill at the blue line on the side of the tank. NOTE: If the float valve leaks when closed, see section 9.3.3 for remedies.
2. While watching the recirculating pump fan, located inside the black cover of the pump, have another person quickly cycle on and off pump #2 on the control panel. The recirculating pump is located near the front side of the WFS under the electrical box. Please see section 10 for a diagram. The fan should start rotating in the direction of the arrow on the black cover, or clockwise.
3. If the fan is rotating correctly, move on to priming the pumps (section 8.1.2). If the fan is not rotating correctly, have a qualified electrician swap two of the power wires on the main breakers and check again starting with step 1.

8.1.2. Priming the Pumps and Filling the System

8.1.2.1. Recirculating Pump

1. During this process, check for leaks on the system, pay close attention to valves and threaded joints. Each WFS is fully and thoroughly tested before shipping but shipping can cause joints to loosen in transit. See section 9.3.4 for more information on leaks at threaded joints.
2. The dirty side tank should be filled from the previous section 8.1.1. If it is not, Use the make-up water line to fill the dirty side tank, the float should automatically stop the fill at the blue line on the side of the tank. NOTE: If the float valve leaks when closed, see section 9.3.3 for remedies.
3. Turn on pump #2, the recirculating pump. The water level should start to drop while the float should open to refill the tank. Note: If at any point the water level drops below the red line, turn off the pump and let the dirty tank refill before continuing.
4. Before the water can fill the clean tank, it must fill the three filter vessels and the chiller evaporator. While these are filling you will need to let the air out of the top of each vessel. Starting with Filter #1, open the relief valve attached to the lid, use a container to catch any water that comes out of the valve. *Warning:* The vessels will be under pressure.
5. Once water comes out close the valve. Always keep an eye on the water level during this operation.
6. Move to Filter #2 and repeat steps 3 and 4.
7. Move to Filter #3 and repeat steps 3 and 4.
8. At some point the water will start filling the clean side tank and then start cascading to the dirty side, once this happens and the float turns off, the recirculating pump is operational. At this point it is safe to turn on the chiller, but it is not necessary yet.
9. Check for leaks and fix them before moving any further.

8.1.2.2. Process Pump

Note: Only perform this procedure after the recirculating pump has been primed as per section 8.1.2.1 of this manual. Doing otherwise can cause damage to the pump(s).

1. During this process, check for leaks on the system, pay close attention to valves and threaded joints. Each WFS is fully and thoroughly tested before shipping but shipping can cause joints to loosen in transit. See section 9.3.4 for more information on leaks at threaded joints.
2. Ensure that the process line output and return line are closed on the WFS.
3. With the recirculating pump running (pump 2), turn on the process pump (pump 1). Water will start filling filter vessels 4 and 5, the make up water will compensate for the water loss. You may see the water stop cascading into the dirty tank, this is fine but if the water level in the clean tank reaches the red line stop the process pump and let the water refill before continuing.
4. Let the air out of filter #4 through the relief valve on top. This water is pressurized, be prepared to catch it with a small container. Once water comes out close the valve and repeat for filter #5.
5. You should notice the water start to come back into the clean tank through one of the pipes. This is due to the back pressure regulator, please see section 6.6 for the operation of the regulators and 8.5 for information on adjusting the valves.
6. Open the return and supply line on the WFS in that order. Water will now be flowing to your downstream equipment, but wait for the whole system to fill with water before using.
7. Once the system has stabilized and no new water is coming through the make-up line and there are no leaks, the system is fully operational and ready to use. Fix any leaks that occur before using the system.

8.2. Start up and Shut Down

Warning: Never run the chiller without the recirculating pump on as this can damage the chiller.

Warning: Never allow the pumps to run with low or no water, this can cause the pumps to seize or cavitate and will void the warranty.

8.2.1. Turning the System On

1. With the system full of water and properly connected, turn the control switch to the on position. The red EMO light will come on.
2. Press the the black Reset button, the corresponding blue light should illuminate. If not see section 9.3.5 for help.
3. Press the green “on” button for pump #2.
4. Next, press the green “on” button for pump #1.
5. Finally, turn the chiller on using the corresponding green “on” button.
6. Check that all three green lights are on for the pumps and chiller.
7. The system is now operational.

8.2.2. Turning the System Off

1. Press the red “off” button for the chiller.
2. Press the red “off” button for pump #1.
3. Press the red “off” button for pump #2
4. Turn the control switch to the “off” position.
5. Alternatively, the system can be powered down by turning the control switch first. This will reset all of the circuits for the pump and chiller.
6. The system is now off. *Caution:* There is still power to the electrical box, do not open unless the system is fully disconnected from main power.

8.3. EMO Operation and Error Handling

Each WFS is equipped with an EMO stop button. If pressed, ALL of the mechanical processes will stop immediately. If at any point during operation there is an issue with the machine or personal safety press the red EMO button on the control box. The button will remain depressed until personnel resets it.

Depending on the options installed on the WFS unit, there may be multiple ways to trip the EMO circuit. The EMO is tripped by any error that may occur on the system, if that error handling has been installed. This may include leak detection, low or high pressure sensing, and low or high water level among other things.

8.3.1. EMO and Error Recovery

If for any reason the EMO circuit is tripped, follow these steps to recover after the issue has been corrected.

1. Pull the red EMO button out until it clicks into place.
2. If the control switch is not on, turn it to the “on” position.
3. Press the black reset button.
4. Start the system as per section 8.2.1 of this manual. Refer to section 9.3.5 for issues with starting the WFS.

8.4. Chiller Operation

The Emmerson Chiller is controlled by a Ranco controller unit. Once set, the unit needs no operator input. The Ranco controller is grey in color and located next to the electrical box. Set the controller parameters as per section 8.4.1. Please refer to section 9.3.6 for issues with the chiller.

8.4.1. Ranco Controller Setup

The Ranco Electronic Temperature Control unit has 4 parameters as well as some error handling capabilities. Please see the manufacturer's data sheet in section 11.1 for more information.

1. With the WFS on, the Ranco controller display will be on. By default the display shows the current temperature of the water. Pressing "set" once will cycle to the next setting.
2. Use the " ↑ " or " ↓ " arrows to change the parameters for any setting. "Set" will save the parameter to memory.
3. The first parameter after pressing "set" is the unit of temperature. The display will show either an "F" or "C". Set this to the user's preference.
4. The next parameter is the temperature set point, indicated by a flashing "S1" on the screen. This should be set to room temperature ± 2°C.
5. The third parameter is the temperature differential, or how large a swing the unit will allow before cycling on or off. This is indicated by a flashing "DIF1" on the screen. This should be set to no more than 2°C.
6. The last parameter is heating or cooling mode shown by either "C1" or "H1" of the display. The WFS is not equipped with a heater, this setting should be set to "C1".
7. The Ranco unit is now set and operational.

8.5. Pressure Control

Please see section 11.1 for spec sheets on the Fluid Pressure Regulator and Back Pressure Regulator.

8.5.1. Adjusting the Fluid Pressure Regulator (FPR)

The FPR is located downstream of filter vessel #5. Follow it's output, the pipe coming from the bottom to the 3-way ball valve. The output of that valve to the right (away from the reservoir) leads into the input of the regulator.

1. Loosen the lock nut on the adjustment screw.
2. To lower the pressure, rotate the knob counterclockwise.
3. To raise the pressure, rotate the knob clockwise.
4. Retighten the lock nut.

8.5.2. Adjusting the Back Pressure Regulator (BPR)

The BPR (if equipped) is located downstream of the FPR. Follow its output to a tee, one output will go to the output ball valve, the other leads to the input of the BPR.

1. Loosen the lock nut on the adjustment screw.
2. To lower the pressure, rotate the knob counterclockwise.
3. To raise the pressure, rotate the knob clockwise.

4. Retighten the lock nut.

8.5.3. Balancing the FPR and BPR

Although each WFS regulator is factory set, it may be necessary to balance the regulators based on the specific installation. These instructions are for 1545s which have both the FPR and BPR. This procedure requires a pressure gauge attached to the process supply line outside of the WFS. Balancing the system in this way protects the equipment attached from high pressure while increasing the curve at which the pressure drops below an acceptable level while demand on the supply line changes.

1. With the WFS off, turn off the control valves for each machine attached downstream on the process supply line. This will protect the equipment from high pressure and create a deadhead in the line. The only relief must be through the BPR on the WFS.
2. Turn the system on as per section 8.2.1.
3. Loosen the lock nut on the Fluid Pressure Regulator (FPR) and turn the knob counterclockwise until it reaches its lower limit. This will force the valve all the way open allowing maximum pressure through. The FPR is located after the 3-way ball valve and before the output ball valve.
4. Next loosen the lock nut on the Back Pressure Regulator (BPR) and adjust the knob clockwise or counterclockwise until the pressure gauge on the process supply line reads no more than the maximum allowed pressure for the equipment attached to the WFS. If using equipment with different max pressure ratings, use the lowest max pressure spec available. This way the line pressure will never exceed the safety specifications of the attached equipment.
5. Now open the control valves for each machine attached to the system and turn on any required valves or solenoids at if the machines were operational. This represents the maximum flow demand on the system. The pressure gauge should still read at or near the pressure set it step 4. If it does not, the amount of flow may be too much for the WFS specifications. Consider reducing the amount of demand on the system or otherwise adjusting the settings. Never run the pressure at a higher setpoint than the equipment attached specifies. This can cause damage to downstream equipment.
6. With the system at max flow, turn the FPR knob clockwise to decrease the pressure allowed through the valve. This will increase the backpressure on the filters upstream of the valve. Adjust the knob to lowest acceptable pressure rating of the attached equipment. If using multiple machines, use the highest low pressure setting available. Keep in mind that the tightest “swing” possible between the two valves is about 10psi, in other words if the maximum pressure is 50psi, the highest minimum pressure will be 40psi. Any adjustment to either valve will be counteracted by the other.
7. The system is now balanced and ready to use.

9. Maintenance

9.1. Maintenance Schedule

9.1.1. D-Rings

The D-rings sealing the filter vessel lids will deform and leak with time caused by opening and closing the lids for filter changes. This can be mitigated by only opening the lids when needed and not over tightening the lids, see section 9.2.3 for details.

1. After the lid has been removed as per 9.2.3, use an o-ring hook to remove the D-ring from it's groove.
2. Install the new D-ring by starting at one point in the groove with the flat side of the ring inwards facing the outside diameter of the vessel.
3. Work around the groove until the D-ring is fully seated. Be careful that the ring does not get twisted or overstretched during install as this will cause leaks.
4. Reinstall the lid as per 9.2.3.

9.1.2. Water Change

The water in the system may occasionally need to be changed. The time in between changes will vary based on use, water quality, additives, and contamination. There will always be water lost from evaporation and processing in equipment. This water will be replaced by the make-up fill valve either automatically or manually. This may not be enough to prevent undesirable water quality. Always monitor the water quality to ensure good process control.

1. There is a drain for each side of the reservoir, open both to allow water to drain from the tanks.
2. Next open the valves on top of each of the filter vessels.
3. Once the water has drained from the reservoir and vessels, close the filter and drain valves.
4. If desired, use a wet vac to remove the water at the bottom of the tanks. The filters can also be removed and vessels vacuumed out if needed.
5. Refill the system as per section 8.1.2.

9.1.3. Tank and Filter Vessel Cleaning

While the system is drained as per section 9.1.2 do the following to remove debris build up in the tank and filter vessels. Perform as needed, but it is recommended to do this at least once a year. Do not use any type of cleaning agent that might contaminate downstream equipment. If a cleaning agent is used, flush the system with freshwater before refilling for use.

1. Use a large scrub brush to loosen debris from the sides and bottom of the reservoir.
2. Vacuum out the debris.
3. Remove the filters from their housings. keep track of them if removing more than one set at a time and you intend to keep using them. See section 9.2 for more information.
4. Use a scrub brush to clean the sides of each housing.
5. Vacuum out the debris from the vessels.
6. Reinstall the filters as per sections 9.2.
7. If a cleaning agent was used, fill the system with fresh water as per section 8.1.2 and drain as per 9.1.2 to flush out the cleaner.
8. Refill the system as per 8.1.1.

9.2. Filter Checks and Changes

The filters used in each vessel will need to be changed as part of the normal operation of the WFS. Each filter size has been selected based off water samples from the specific process of the downstream equipment. Filters will load, or clog, at different rates depending on the type, rating, and position. The speed at which they load will depend on how much the system is used and how much debris is generated in the process. For this reason there is no time based schedule to replace each filter, instead each filter manufacturer provides a pressure differential (psid) spec, at which the filters should be replaced. Please refer to the filter manufacturer's spec sheets for this rating. Note that the X100 filter vessels used in the WFS can have bag, one 5.5” OD, or three 2.5” OD filters installed, each housing’s filters should be changed out all at the same time. Please see section 11.1 for the X100 spec sheet.

There are two parallel filtration loops with 3 vessels on one loop and two on the other. The vessels in each loop are tied in series. There are pressure gauges on top of each vessel, because they are tied in series each one of these gauges reads an approximation of it’s vessel plus the other vessels in line, with a tendency towards the last one in line having a higher pressure built up from the previous vessel(s). As such to get a true reading of just one housing it is necessary to remove the other filters in the same series as well as remove any back pressure from the line. Doing this will allow the filters to be used most efficiently. Over time patterns of loading should occur so predictions can be made as to which filters need to be changed the most and least often.

9.2.1. Recirculation Filter Check

The recirculation loop has no backpressure, thus all that is needed is to remove filters from two housings to check the third. When installing new filters, it is generally safe to assume that the “loading” will be less than 10pisd. This will depend on the filter. the process detailed below can be used to check a new filter after installation if desired.

1. With the system off, open the valve on top of filter #3, using a small container to catch any water that comes out.
2. Once the water has stopped coming out of the vessel, repeat step 1 on filter #2.
3. Repeat step 1 and 2 on filter #1.
4. Now open filter #3 using the instructions in section 9.2.3.
5. If this is a bag or 5.5” OD filter, remove it. If there are 2.5” OD filters installed, loosen the caps that hold them down. Complete removal is not necessary.
6. Reinstall the lid as per 9.2.3.
7. Repeat steps 4-6 on filter #2.
8. Now the only filter installed should be be #1. Close all three valves on the filters.
9. Turn on just the recirculation pump (#2).
10. Bleed out the air from each housing. Use a container to catch any water. *Warning:* the vessels will be under pressure.
11. Check filter #1’s pressure gauge and note the psid. If needed, the filters will be changed after checking all three housings.
12. Turn off the recirculating pump.
13. Bleed off the pressure in each housing again.
14. Open filter #1 as per section 9.2.3.
15. If this is a bag or 5.5” OD filter, remove it. If there are 2.5” OD filters installed, loosen the caps that hold them down. Complete removal is not necessary.
16. Reinstall the lid on filter #1.
17. Open filter #2, reinstall the filter or tighten the caps on each filter. Now the only filters installed should be in housing #2.
18. Reinstall the lid on filter #2.
19. Close the relief valves on each lid.
20. Turn on the recirculating pump and bleed off the air from each vessel. Use a container to catch any water. *Warning:* the vessels will be under pressure.
21. Check filter #2’s pressure gauge and note the psid. If needed, the filters will be changed after checking all three housings.
22. Turn off the recirculating pump.
23. Bleed off the pressure in each housing again.
24. Open filter #2 as per section 9.2.3.
25. If this is a bag or 5.5” OD filter, remove it. If there are 2.5” OD filters installed, loosen the caps that hold them down. Complete removal is not necessary.
26. Reinstall the lid on filter #2.
27. Open filter #3, reinstall the filter or tighten the caps on each filter. Now the only filters installed should be in housing #3.
28. Reinstall the lid on filter #3.
29. Close the relief valves on each lid.
30. Turn on the recirculating pump and bleed off the air from each vessel. Use a container to catch any water. *Warning:* the vessels will be under pressure.
31. Check filter #3’s pressure gauge and note the psid. If needed, the filters will be changed after checking all three housings.
32. Turn off the recirculating pump.
33. Bleed off the pressure in each housing again.

34. Change out the filters in each housing as needed. See 9.2.4 for instructions.
35. Be sure to tighten install the filters properly to avoid cross contamination. Also ensure that each lid is properly installed as per 9.2.3 and check for leaks after restarting the system.
36. Start the recirculating pump and bleed off the air from each housing.
37. Turn off the recirculating pump.
38. The system is now ready to use.

9.2.2. Process Filter Check

The process filters build backpressure in two ways. The first is through normal loading, the second source of backpressure is from the output line and restriction from regulators or downstream equipment. For this reason the gauges will always read artificially high and cannot be used during normal operation to check filter loading. The WFS is therefore equipped with a 3-way ball valve to release the back pressure from the output on the filters. This allows an accurate measurement of filter loading.

1. With the system off, rotate the 3-way ball valve handle so that the output faces towards the left (towards the tank). The ball valve is located after the output of filter #5.
2. Close the output ball valve for the process line so that no water goes to downstream equipment.
3. Release the pressure from filter #5 using the valve at the top. Catch any water that spills out with a small container.
4. Repeat step 3 with filter #4.
5. Next, open filter housing #5 as per section 9.2.3.
6. If this is a bag or 5.5” OD filter, remove it. If there are 2.5” OD filters installed, loosen the caps that hold them down. Complete removal is not necessary.
7. Reinstall the lid as per 9.2.3.
8. Close the valves on filters #4 and #5.
9. Turn on the process pump (pump #1).
10. Bleed out the air from filters #4 and #5. Use a container to catch any water. *Warning:* the vessels will be under pressure.
11. Check filter #4’s pressure gauge and note the psid. If needed, the filters will be changed after checking each housing.
12. Turn off the process pump.
13. Release the pressure from filter housings #4 and #5. Note: Starting with #5 will help reduce water loss when opening the lid of each housing.
14. Open filter #5 as per 9.2.3 and tighten the filter caps or reinstall the filters. Reinstall the lid.
15. Open filter housing #4 as per 9.2.3.
16. If this is a bag or 5.5” OD filter, remove it. If there are 2.5” OD filters installed, loosen the caps that hold them down. Complete removal is not necessary.
17. Reinstall the lid as per 9.2.3.
18. Turn on the process pump (pump #1).
19. Bleed out the air from filters #4 and #5. Use a container to catch any water. *Warning:* the vessels will be under pressure.
20. Check filter #5’s pressure gauge and note the psid. If needed, the filters will be changed after checking each housing.

21. Turn off the process pump.
22. Release the pressure from filter housings #4 and #5. Note: Starting with #5 will help reduce water loss when opening the lid of each housing.
23. Change the filters in each housing as needed. Be sure to install the filters properly as per section 9.2.4.
24. Install the lids as per section 9.2.3.
25. Rotate the 3-way ball valve handle so the output is going to the WFS output (to the right).
26. Open the output valve of the process line.
27. Turn the process pump on and bleed the air from filters #4 and #5.
28. Turn off the process pump.
29. The system is now ready to use.

9.2.3. Filter Vessel Lid Removal and Installation

Caution: Filter housings may be under pressure, DO NOT attempt to remove the lids with the system running or when there is pressure present in the lines or vessels.

1. Turn the system off and relieve pressure from the filter housings by opening the valve on top of the vessel. Use a container to catch any water that spills out.
2. Turn the lid counterclockwise to loosen and remove it. Some water may spill out during this process.
3. Reinstall the lid by placing it on the vessel and turning clockwise.
4. Do not overtighten the lid. This can cause the D-ring to deform and leak. Pay attention to the markings on the lid indicating which handle to align with the input pipe for proper tightening. The pressure gauge should face forward, the same direction as the control panel when done properly.
5. Close the release valve on the lid.

9.2.4. Changing the Filters

9.2.4.1. Bag Filter

Bag filters are friction fit and the housing must contain a basket to hold the bag. Simply slide the dirty bag out of the vessel and replace it with a new bag. Ensure that the new bag's rim is seated all the way against the rim of the basket.

9.2.4.2. 5.5" OD Filter

The 5.5" OD filter cartridge is pressure fit into a plate at the bottom of the housing. Pull the old filter out and replace with the new one, pressing it all the way down into the housing.

9.2.4.3. 2.5" OD Filter

Three 2.5" OD filter cartridges fit into one X100 housing. Each one is held in place by a plate on the bottom, a stem in the center and a cap on top. The cap threads onto the stem and the stem threads into the bottom plate. To change, remove the cap and pull up on the filter. Sometimes the stem may loosen instead of the cap, if it does simply remove the cap from the stem and reinstall the stem. Slide the new filter over the stem and reinstall the cap. All three of these filters should be replaced at one time.

9.3. Common issues

9.3.1. Sump Filling the Dirty Tank with the System Off

Some equipment have open loops where even if the machine is off, water can flow through the inlet and out the drain. In these instances it is possible to create a syphon or gravity fed effect where water flows into the machine and then into the sump. The sump returns water to the dirty tank and eventually fills it. At some point the water level in the clean tank will drop low enough to where the water flow will stop. This is not generally an issue except for the sump running when not in use. There can also be an issue if there is enough water in the system to overflow the dirty tank and cascade into the clean tank. This does two things, one it allows this cycle to continue indefinitely. Two, it allows unfiltered water past the recirculation filters directly into the clean tank. This can cause the process filters to load more quickly than needed.

To prevent this from occurring, turn off the control valve(s) at each machine attached to the output when not is use. An alternative is to close the output ball valve for the process line on the WFS when the system is off.

The sump and dirty tank can also suffer from backwards flow from the tank to the sump. This causes a cycle that drains and fills the dirty tank continually and wears out the sump prematurely. Install a check valve inline to prevent this. If a check valve is installed, be sure it is operational and clean.

Check section 11.1 for information on the Liberty 405 sump.

9.3.2. Float Valve Refills to Fast

Depending on the total amount of water in the system, including downstream equipment and facility piping, there is a possibility of the float valve filling the tank in a shorter amount of time than the sump can return water to the reservoir. This leads to the WFS filling enough to raise the water level above the baffle separating the clean and dirty tank or overflowing the reservoir entirely. In these cases it is best to close the control valve supplying the float and manually fill the reservoir as needed. Ensure that the water level stays between the blue and red lines while the system is running to prevent damage to the pumps.

9.3.3. Float Valve Leaks

The float valve used to refill the dirty tank is prone to leaking. This is caused by debris forcing the valve open. Correct this by removing the float and cleaning as per the manufacturer's instructions. See the spec sheet in section 11.1 of this manual.

9.3.4. Leaks at Threaded Joints

All threaded joints on the WFS are sealed with PTFE tape or paste. During shipment or movement these joints can crack loose and leak. Reseal them with new tape or paste after cleaning the threads off. Do not use to much tape as this can cause stress on the joint enough to crack it. Do not over tighten the joints as this can cause similar damage.

9.3.5. Issues on Startup

Depending on the options on the WFS, the system may not start up for a few reasons. Any alarm condition will trip the EMO circuit and prevent start up while the red “Alarm” light is on. Note that not all machines are equipped with error handling. Common errors are:

1. The EMO button is depressed. Pull the button out and press the reset button to clear the error.
2. A leak has been detected. Dry out the leak detector strip and fix the leak. The error will not clear if water is still detected on the strip.
3. Low pressure has been detected. Correct the low pressure state by changing filters. Bad pumps or a clog or leak might be to blame.
4. Low water level. Refill the reservoir.
5. Temperature out of range. Check that the chiller is operating within spec.

After any error is corrected, the black “reset” button must be pressed to turn off the alarm light and turn on the control light.

If the alarm or control lights are not on, there is an issue with the electrical box. Please contact GTS for support.

9.3.6. Chiller Issues

Chiller issues may include not cooling to the set point, cycling on and off too often, cooling below the setpoint, leaks in the evaporator, or a number of other issues. Check section 11.1 for the manufacturer's spec sheet for more information on the chiller. Please contact GTS for support with any chiller issue.

9.3.7. Low Water Flow/ Pressure

Low water flow is usually caused by a clog in the system. Most commonly in the filters. Check the filters and any other potential clog points in the system like control valves. Contact GTS for further support.

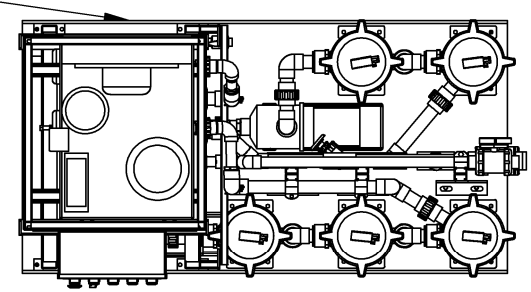
Low pressure may be caused by problems with the pumps or to much demand on the system. Please contact GTS for support.

9.3.8. No Cascade From Clean to Dirty Tank

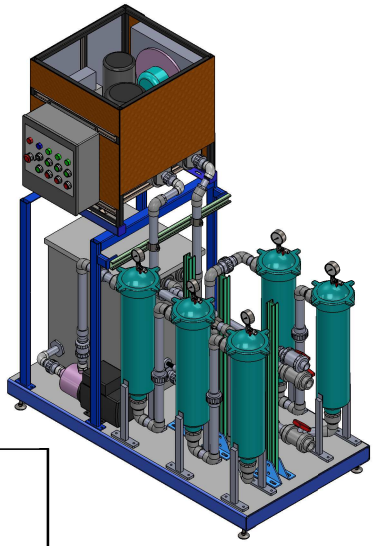
This is not necessarily an issue as the cascade from clean tank to dirty tank may not occur when there is a lot of demand from downstream equipment. If there is so much demand that the clean side water level goes below the level of the dirty side the process pump runs the risk of cavitating or running dry. In this event reduce the demand on the output to prevent issues. The recirculating filters may also be loaded and need to be changed if you see the water stop cascading.

10. Schematics and Diagrams

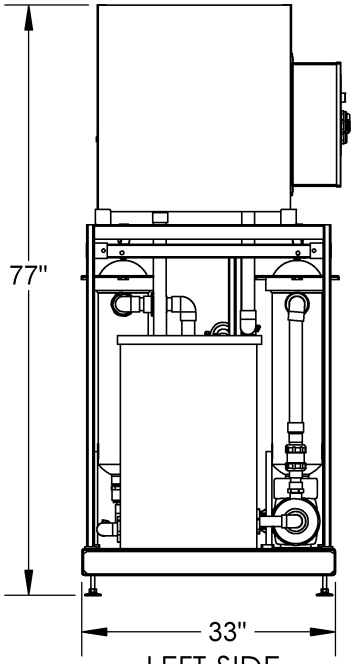
TANK DRAINS



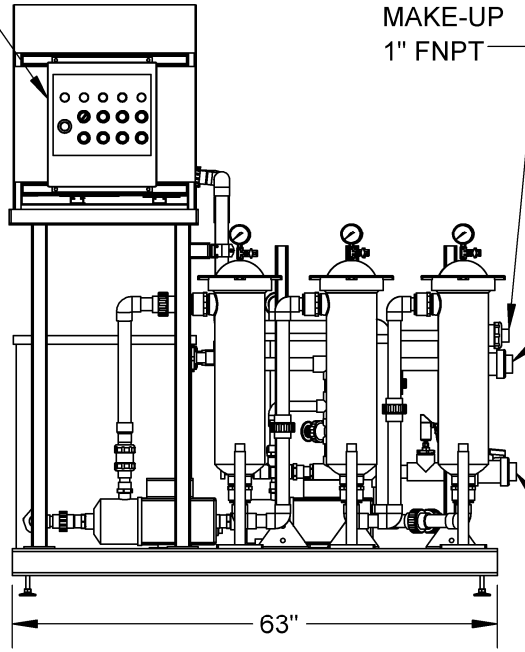
PLAN VIEW



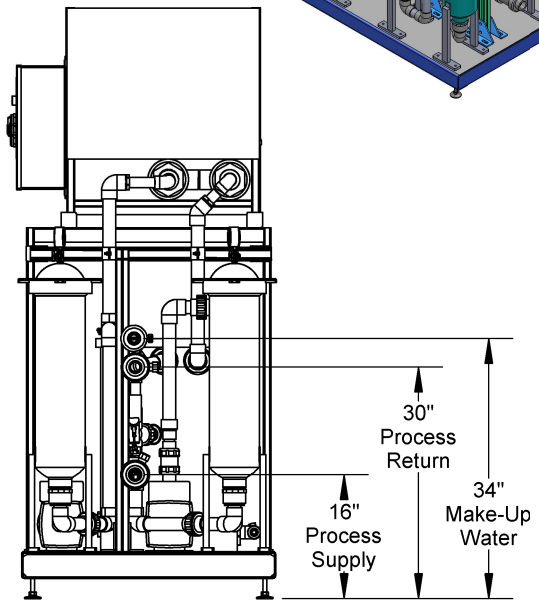
POWER FEED



LEFT SIDE



FRONT ELEVATION



RIGHT SIDE

ELEVATIONS +/- 3"

PROCESS SUPPLY
1-1/4 FNPT

INDOOR USE ONLY
Enviromental Temperature 22C +/- 3
Noise Level Less Than 80dB

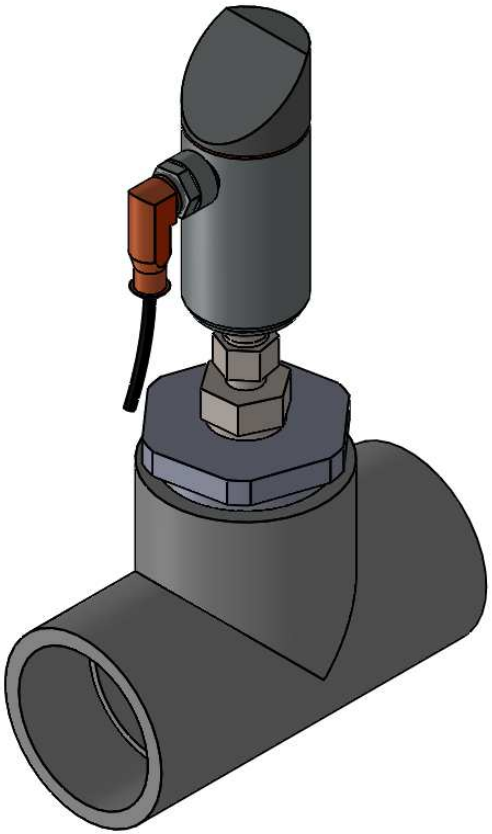
Rating:
Model 1040 = 10 GPM @ 40 PSI
Model 1545 = 15 GPM @ 45 PSI
All Models Chiller 18000 BTU

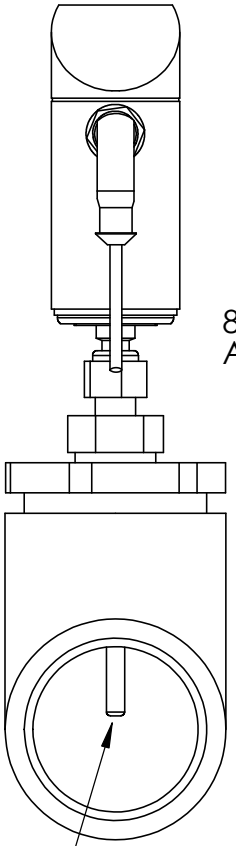
POWER REQUIREMENTS
US 220 VAC 3 PHASE 30 AMP 60 HZ
EU 230 VAC 3 PHASE 30 AMP 50 HZ

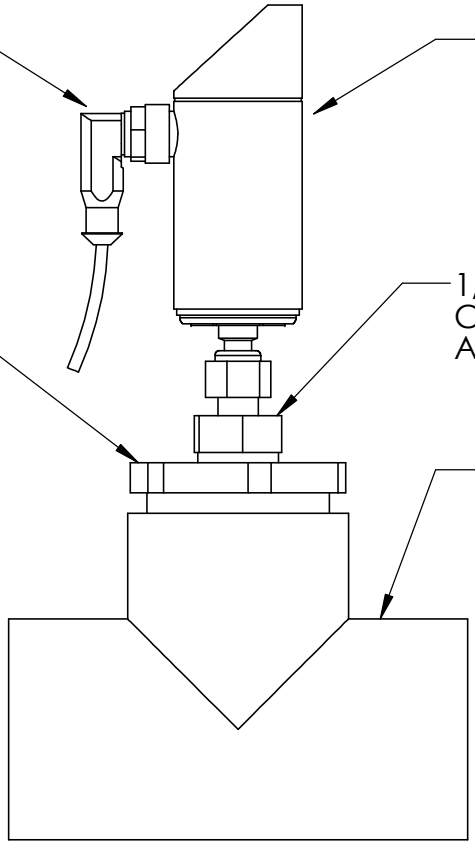
TITLE:
WFS 1040/1545
OVERALLL ASSEMBLY

SIZE	DWG. NO.	REV
A	WFS 10000	D

SCALE: 1:25	WEIGHT:	SHEET 1 OF 1

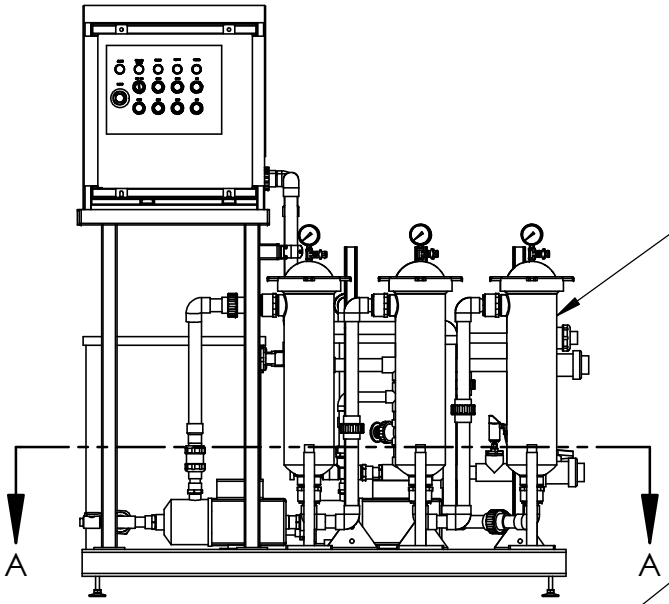


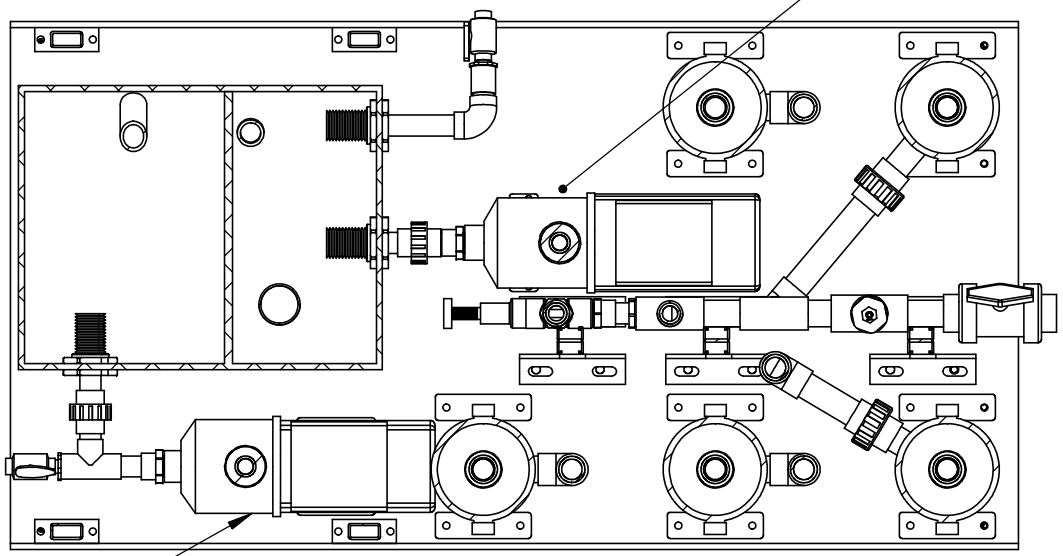




ADJUST SO TIP
OF SENSOR IS IN
CENTER PIPE

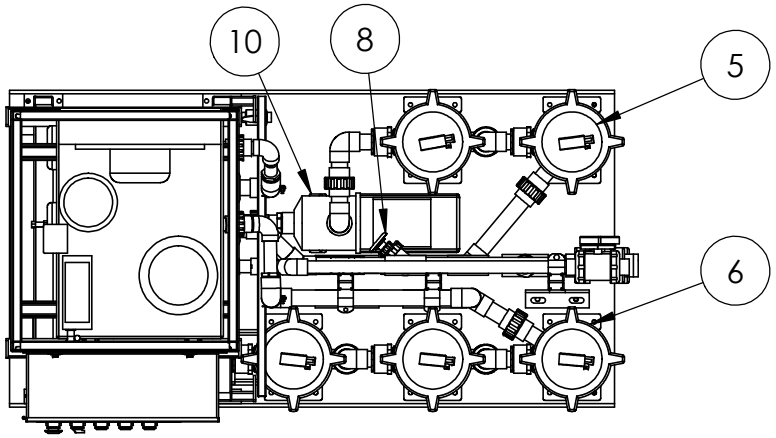
TITLE: FLOW SENSOR DETAIL		
SIZE A	DWG. NO. 24010	REV A
SCALE: 2	WEIGHT:	SHEET 1 OF 1



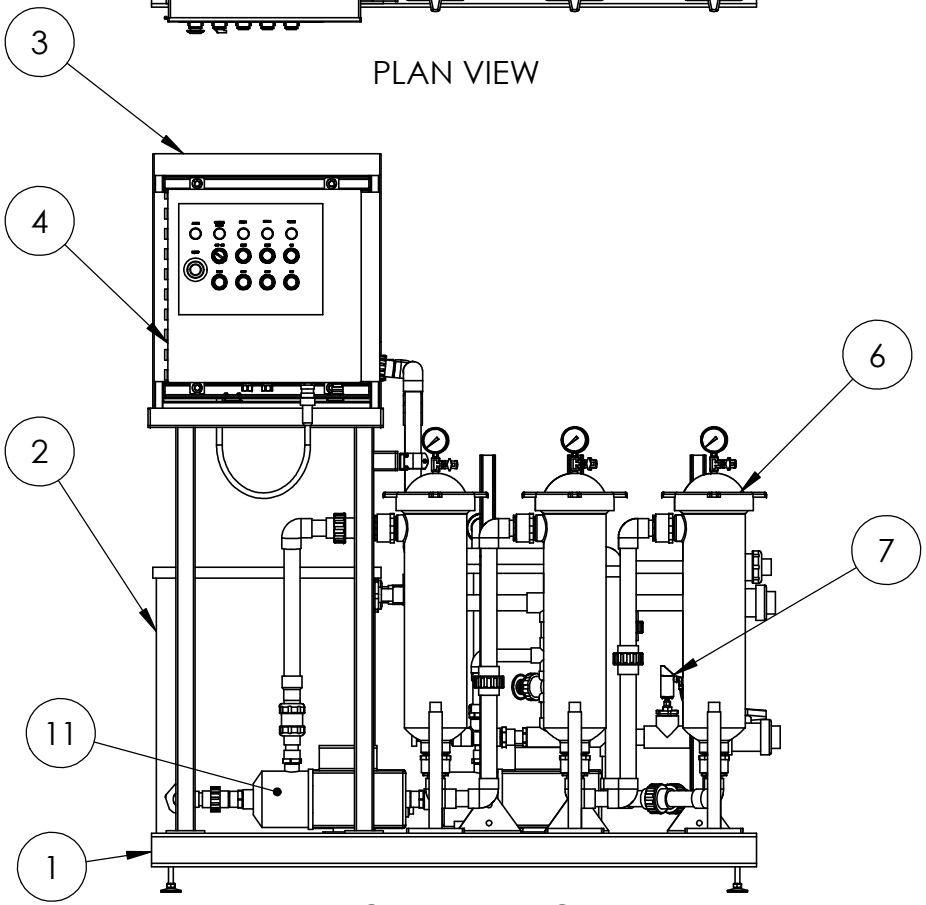


SECTION A-A
SCALE 1 : 12

HIGH SPEED TECHNOLOGIES, INC 16 DEER RUN ROAD, CANDIA, NH 03034		
TITLE: 1545/1040 PUMP CONFIGURATION		
SIZE A	DWG. NO. WFS10010	REV B
SCALE: 1:25	WEIGHT:	SHEET 1 OF 1



PLAN VIEW



FRONT ELEVATION

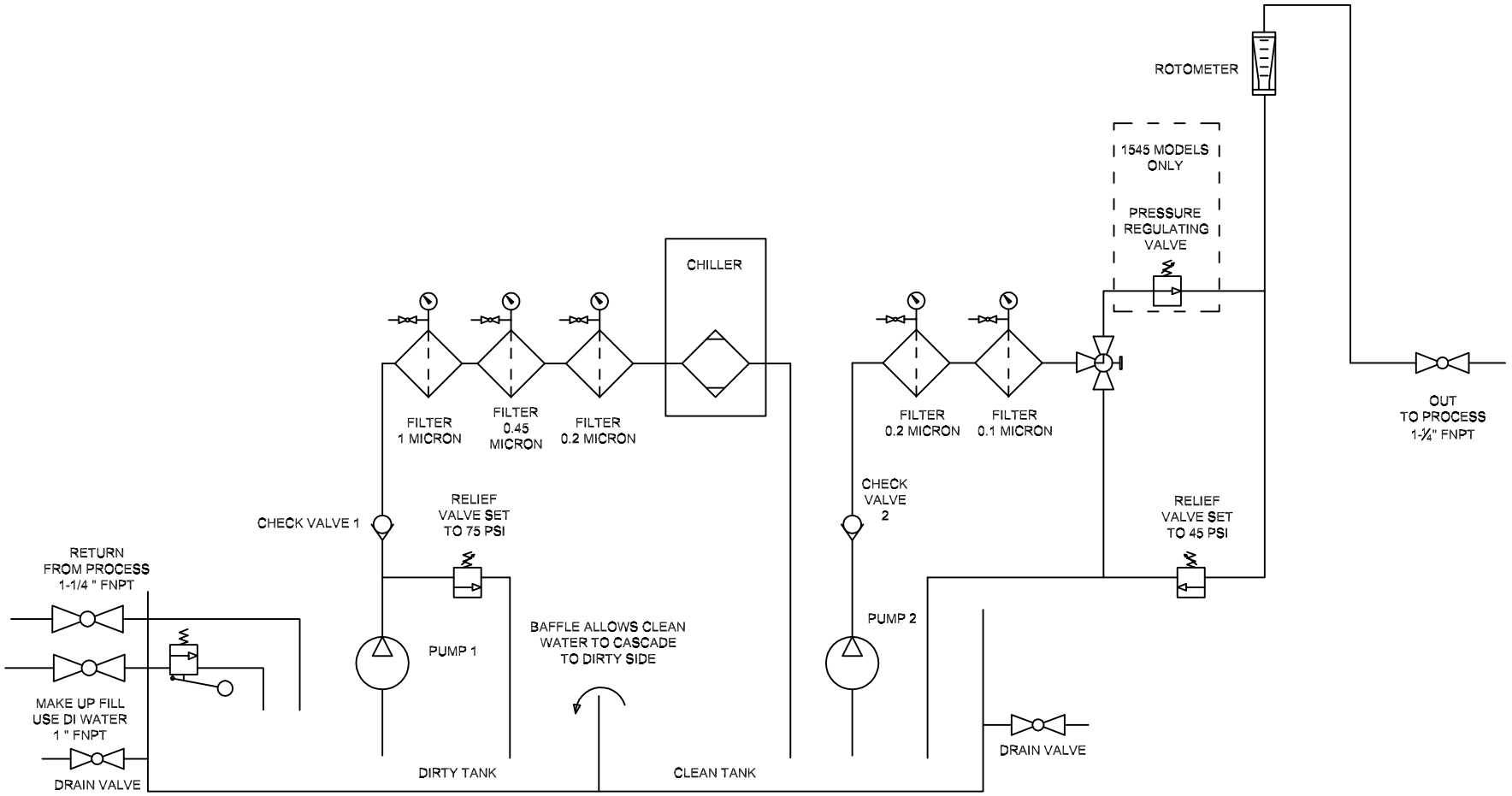
ITEM	DESCRIPTION	HST P/N	QUANT
1	FRAME SUB-ASSEMBLY	WFS 11001	1
2	RESERVOIR	WFS 13000	1
3	CHILLER SUB-ASSEMBLY	WFS 16000	1
4	CONTROL CABINET	WFS 15100	1
5	FILTER ASSEMBLIES (PROCESS)	WFS 14100	2
6	FILTER ASSEMBLIES (RECIRCULATING)	WFS 14100	3
7	FLOW SENSOR ASSMBLY	WFS 14010	1
8	FLOW BALANCE VALVE	P-VG16S	1
9	PRESSURE REGULATING VALVE	P-VP16F	1
10	PUMP (PROCESS US)	3HM07AA	1
10	PUMP (PROCESS EU)	3HM10AA	1
11	PUMP (RECIRCULATING)	3HM04AA	1

PIPING ARRANGEMENT CONFORMS TO PLUMBING SCHEMATIC WFS 14000

TITLE:
WFS 1040/1545
OVERALLL ASSEMBLY

SIZE	DWG. NO.	REV
A	WFS 11000	B

SCALE: 1:25	WEIGHT:	SHEET 1 OF 1



SYMBOL LEGEND

Ball Valve	Flow Direction Indicator
Check Valve	Pressure Gage
Chiller	Pressure Regulating Valve
Filter	Pump
Gate Valve	Sensing Instrument
Float Valve	Rotometer

PUMPS

	US	EU
PUMP 1	GOULD 3HMO7N11T6PBQE	GOULD 3HM10N151T6PBQE
PUMP 2	GOULD 3HMO4N05T6PBQE	GOULD 3HMO4N05T6PBQE

NOTES:
ADDED ROTAMETER
ADDED BY PASS VALVE
ADDED TANK DRAIN VALVES
MOVER SPINDLE COOLANT RELIEF VALVE

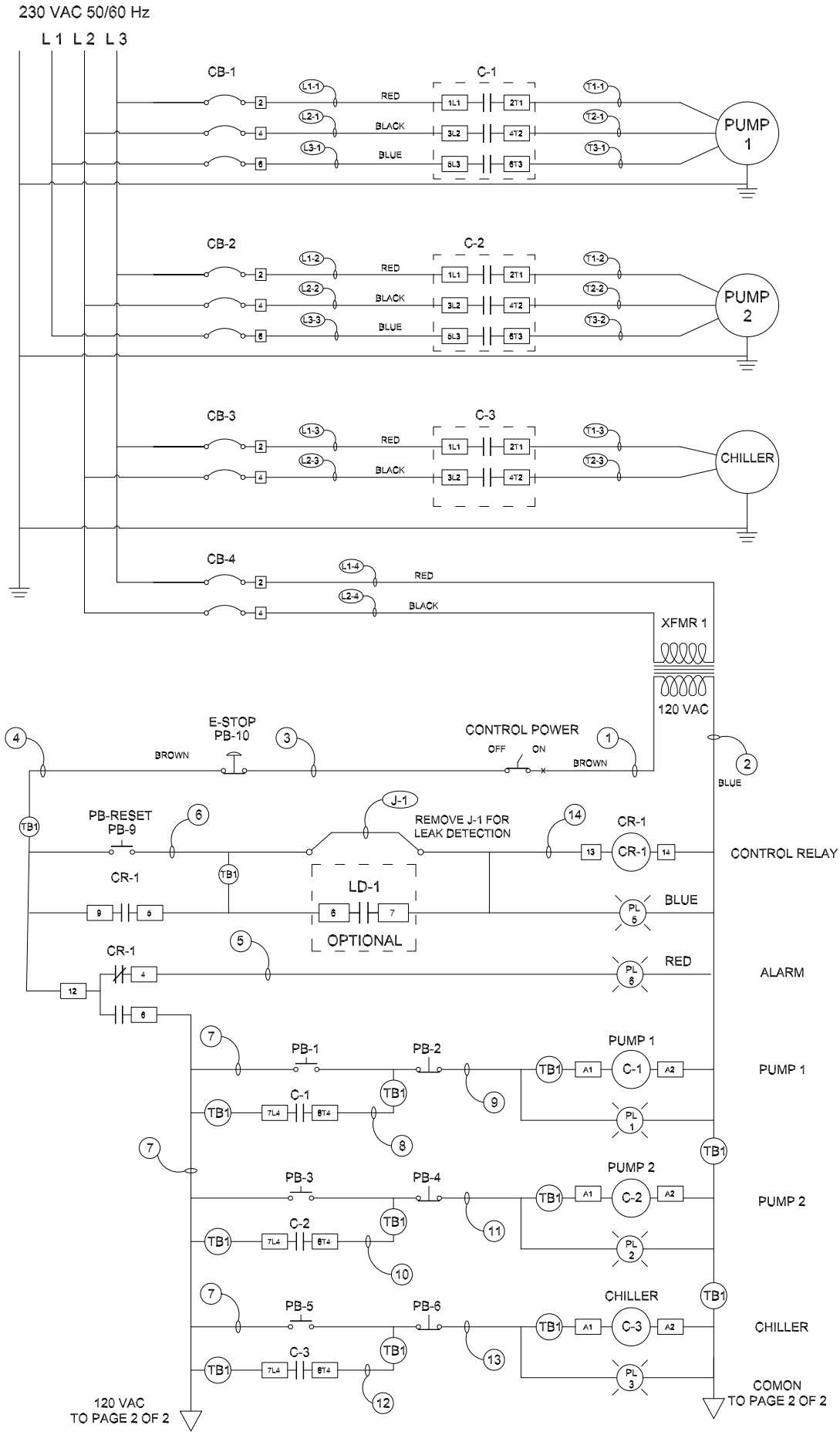
DRAWN C.VALENZE	DATE 10-5-16
REVISED C.VALENZE	DATE 08-03-2019
CHKD	DATE

HST SPINDLES

TITLE
WFS-1040 1545 PLUMBING SCHEMATIC

SIZE	DWG No.	REV
A	WFS 14000	C

SHEET 1 OF 1

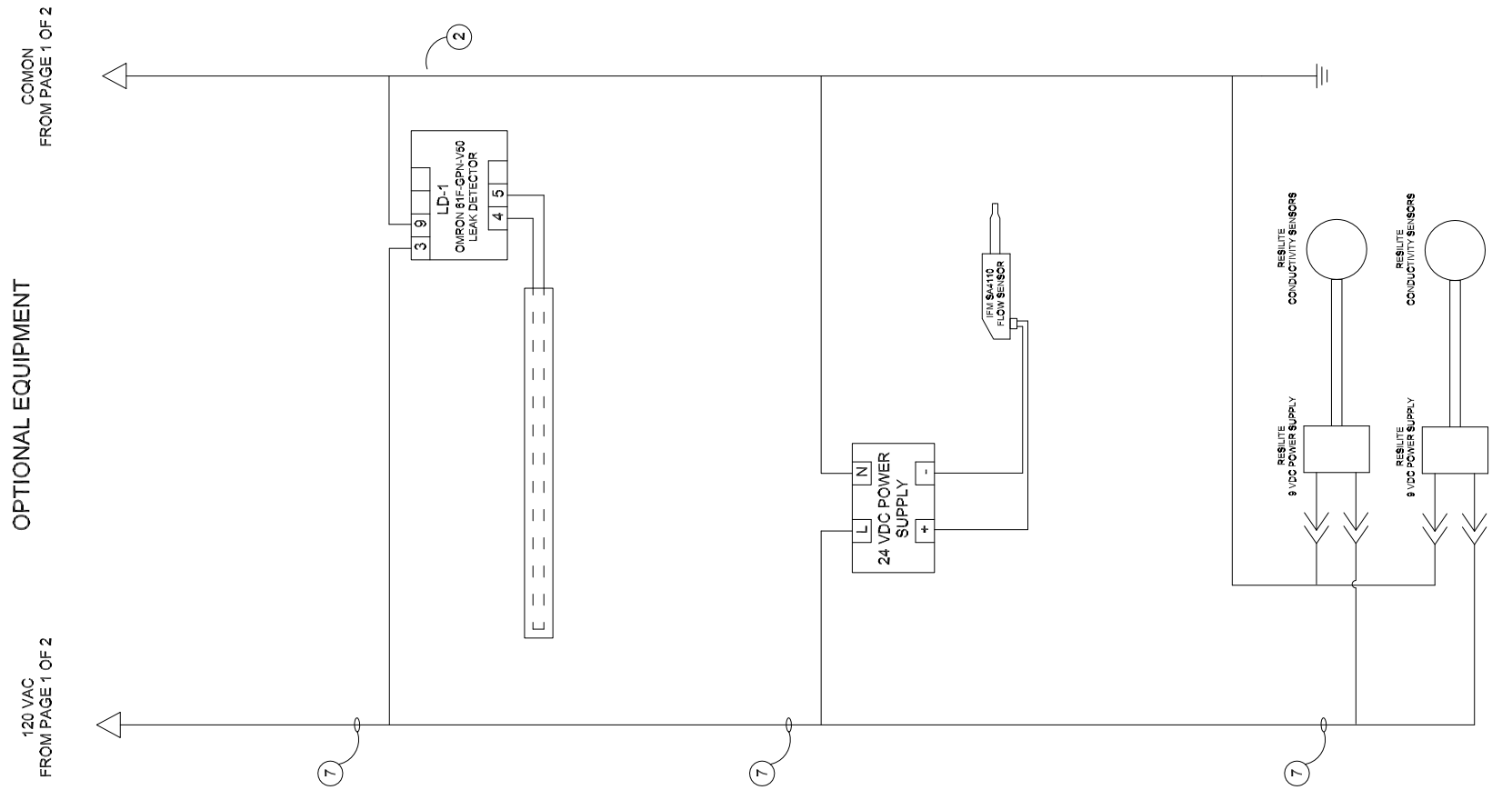


DRAWN	C.VALENZE
CHKD	
DATE	10-5-16
DATE	
SIZE	A
DWG No.	WFS 15000
REV	H
SHEET	1 OF 2

TITLE

WFS-1040 / 1545 ELECTRICAL SCHEMATIC

HIGH SPEED TECHNOLOGIES, INC



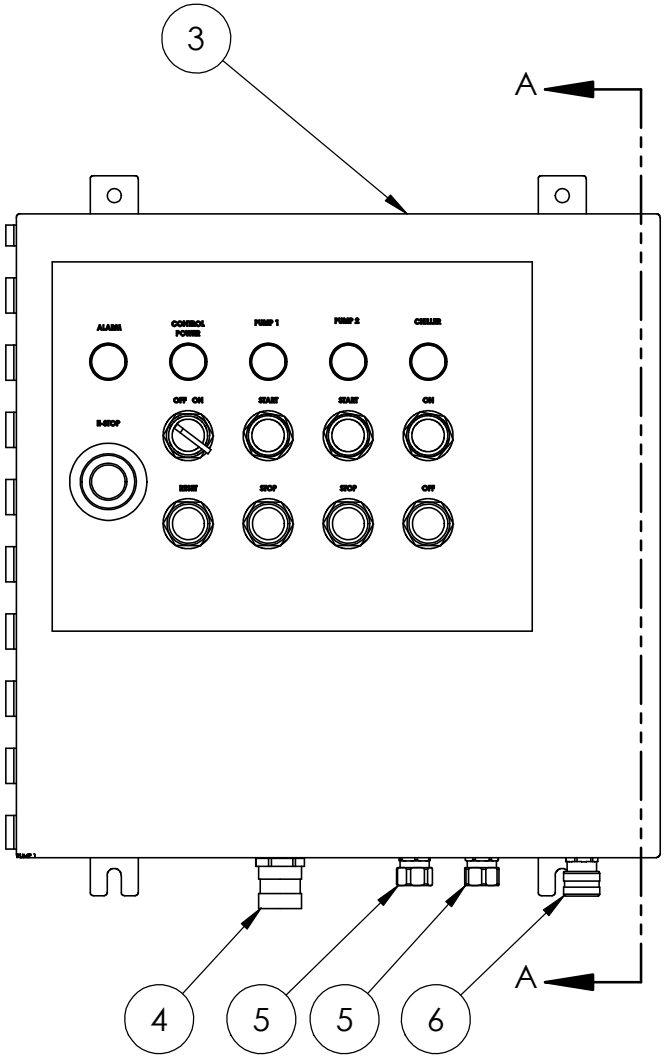
HIGH SPEED TECHNOLOGIES, INC

TITLE

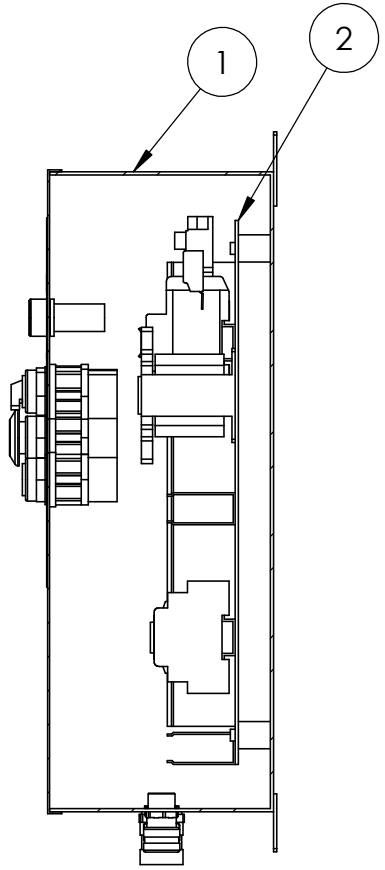
WFS-1040 / 1545 ELECTRICAL SCHEMATIC

DRAWN	DATE	SIZE	DWG No.	REV
C.VALENZE	10-5-16	A	WFS 15000	H
CHKD	DATE		SHEET 2 OF 2	

ITEM	DESCRIPTION	HST P/N	QUANT
1	ENCLOSURE	B2020CH	1
2	CONTROL PANEL SUB-ASSEMBLY	WFS 15113	1
3	FRONT PANEL	WFS 15103	1
4	RECEPTICAL 3 POLE CIRCULAR W/ G	E-CC4W14F	1
5	LIQUID TIGHT CONNECTOR	E-CCLM-11	2
6	CORD CONNECTOR	E-CCSCH1022	1



CHILLER PUMP 1 PUMP 2 FLOW SENSOR



SECTION A-A
SCALE 1 : 6

HIGH SPEED TECHNOLOGIES, INC
16 DEER RUN RD, CANDIA, NH

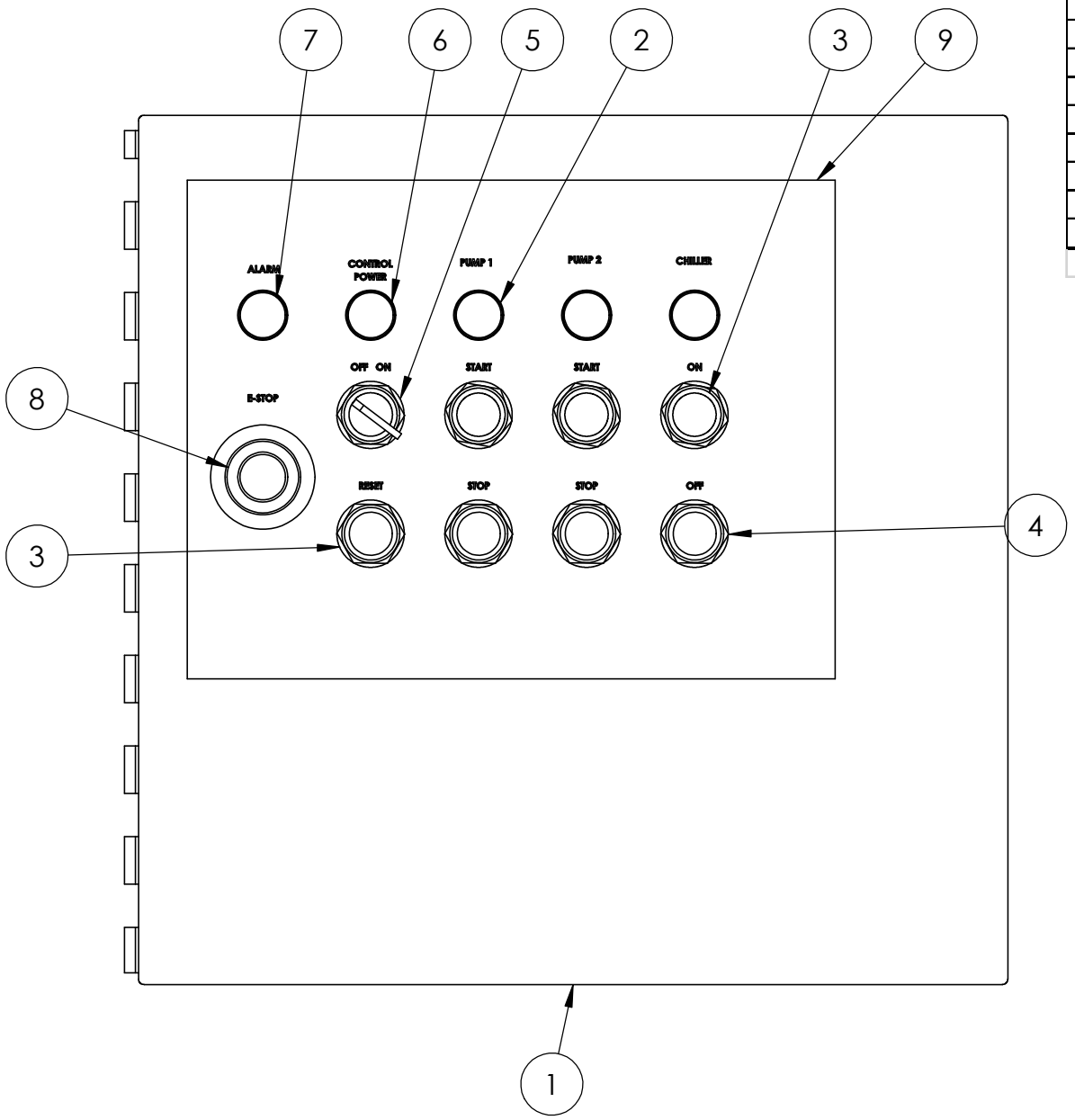
TITLE:

1040 /1545 CONTROL CABINET

SIZE	DWG. NO.	REV
A	WFS 15100	

SCALE: 1:10	WEIGHT:	SHEET 1 OF 1

ITEM	DESCRIPTION	HST P/N	QUANT
1	CABINET DOOR	WFS-15101	1
2	PILOT LIGHT GREEN	E-PLGNA22	3
3	PUSH BUTTON GREEN NO	E-PBHT8AAGA	4
4	PUSH BUTTON RED NC	E-PBHT8AARB	3
5	SELECTOR SWITCH 2 POS MAINTAIN	E-SSLVNOM	1
6	PILOT LIGHT BLUE	E-PLBUA22	1
7	PILOT LIGHT RED	E-PLRDA22	1
8	E-STOP PUSH BUTTON NC MAINT	E-PBHT8CBRB	1
9	DECAL	E-DECB	1



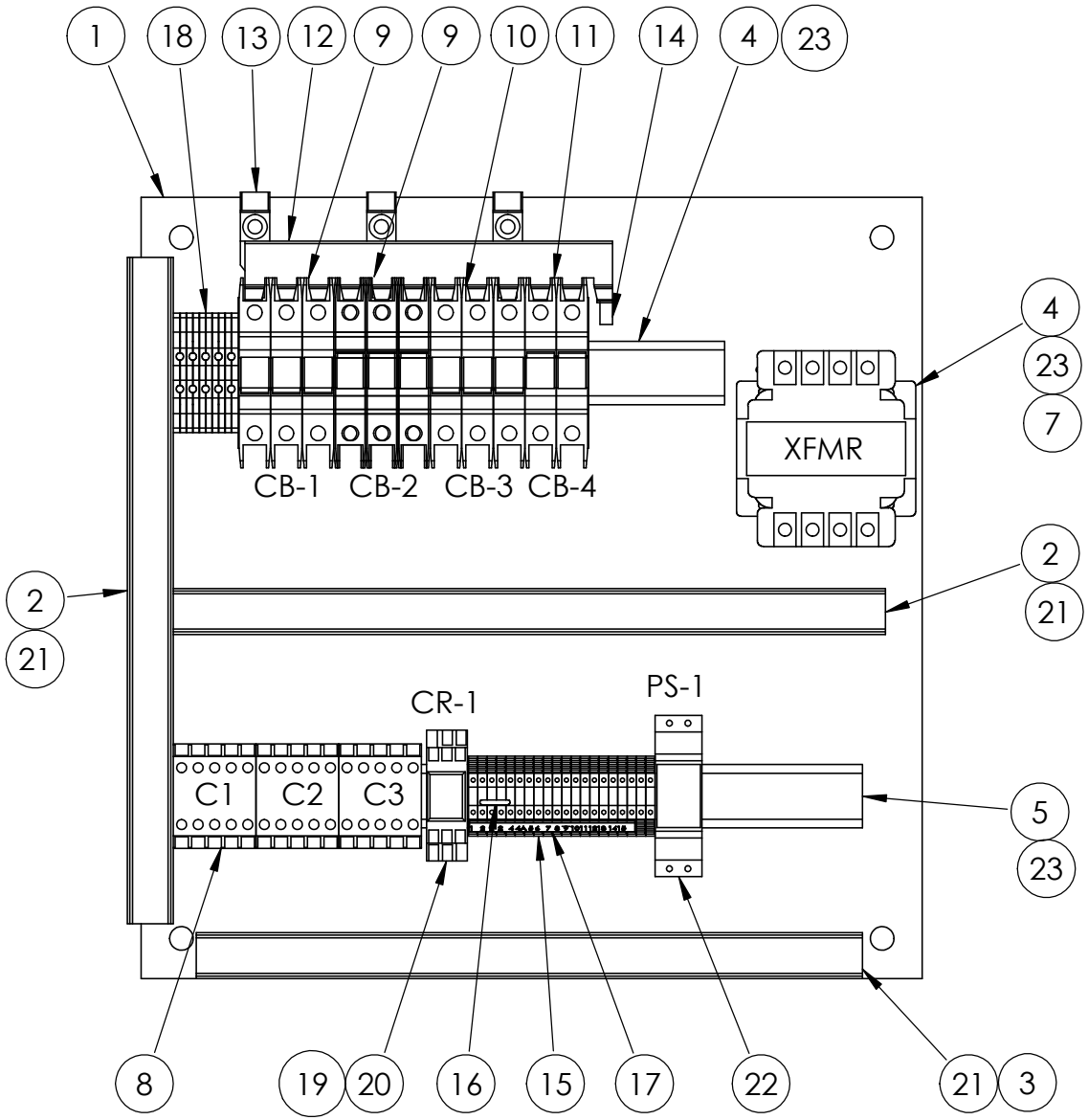
HIGH SPEED TECHNOLOGIES, INC.
16 DEER RUN RD, CANDIA, NH

TITLE:

1545 DOOR ASSEMBLY

SIZE	DWG. NO.	REV
A	WFS 15103	A

SCALE: 1:10	WEIGHT:	SHEET 1 OF 1



ITEM	DESCRIPTION	HST P/N	QUANT
1	SUB-PANEL 17 X 17"	WFS-25110	1
2	WIRE DUCT	E-WDT1-1022G	15.5"
3	WIRE DUCT	E-WDT1-1022G	14.5"
4	DIN RAIL 35MM	E-DRDN-R35S1-2	12"
5	DIN RAIL 35MM	E-DRDN-R35S1-2	16.5"
6	TRANSFORMER	E-XFMRE050TH	1
7	COVERS	E-XFMRIP20	2
8	CONTACTOR 16A 120VAC	E-CO316A	3
9	3 POLE CIRCUIT BREAKER 10 AMP	E-CBNFAZ-D10-3	2
10	3 POLE CIRCUIT BREAKER 15 AMP	E-CBNFAZ-D15-3	1
11	2 POLE CIRCUIT BREAKER 1.5 AMP	E-CBNFAZ-D1P5-2	1
12	BUS BAR 3 POLE X 4	E-BB3PX4	1
13	WIRE LUG FOR BUS BAR	E-BBLUG	3
14	BUS BAR INSULATORS	E-BBSHROUD	1
15	TERMINAL BLOCKS BLUE	E-TBDN-T12B-A	18
16	TERMINAL BLOCK JUMPER	E-TBJPDN-24J2Y	1
17	TERMINAL BLOCK NUMBERS	E-TBDN-L50	1
18	GROUNDING TERMINAL BLOCKS	E-TBGDDN-G10	5
19	RELAY BASE 8 PIN SPADE	E-RBSH2B-05C	1
20	RELAY DPDT 120 VAC COIL	E-RERPM21F7	1
21	RIVET PLASTIC 0.17" DIA HOLE	E-WDR4	1 PACK
22	24 VDC POWER SUPPLY*	E-PSPSC24-015	1
23	SCREWS BUTTON HEAD 8-32 X 1/2"		20

HIGH SPEED ECHNOLOGIES, INC.
16 DEER RUN RD, CANDIA, NH

TITLE:

1040/1545
CONTROL SUB-PANEL

SIZE	DWG. NO.	REV
A	WFS 15113	C

SCALE: 1:10	WEIGHT:	SHEET 1 OF 1

11. Appendix

11.1. Manufacturer Spec Sheets

BPR

DESIGN FEATURES

The R-K BPR series back pressure regulator is designed to protect piping and equipment from pressure changes where a constant regulated pressure on the up stream side of the valve is required. Prevents pumps from dead heading, over pressurization, pressure surge conditions, and maintains back pressure in closed loop systems.

Adjustable screw and lock-nut makes it easy to accurately pre-set desired up-stream pressure.

Teflon (primary) and EPDM (back-up) diaphragms standard.

No metal contact with fluid.

Wide adjustable pressure range (10-125 PSI)

Small pressure differential band from cracking point to fully open, and from fully open to close.

Top entry makes in-line maintenance quick and easy.

Ideally for DI water, harsh chemical, and other high purity applications.

BACK PRESSURE REGULATOR

SPECIFICATIONS

Upstream Pressure		Vacuum to 150 PSIG
Regulated Pressure		1/4" to 3/4" 10-125 PSIG 1" 10-100 PSIG 1-1/2" & 2" 10-60 PSIG
Material	Valve Body	PVC Type 1, Grade 1 Polypropylene PVDF Teflon
	Piston	Teflon
	Diaphragm	Primary TEFLON Back-up EPDM
	Seal	EPDM VITON KALREZ

Pressure differential	Plus or Minus 3 PSIG from any pre-set pressure relief point.
Temperature Range	0 F to 140 F for PVC 0 F to 180 F for POLYPRO 0 F to 280 F for PVDF 0 F to 340 F for Teflon
Valve ports	1/4" to 1" Valve FNPT 1.5" to 2" Valve MPT All valves are fully ported
Mounting method	(4) 1/4" -20 tapped holes for standard machined valve body. (1/4" to 1.00")

ORDER INFORMATION

The chart below will specify R - K standard valves regarding valve size, valve material, and seal material. For special orders, please consult the factory for pricing and delivery information.

BPR - X X X - X

VALVE SIZE

25 = 1/4"
50 = 1/2"
75 = 3/4"
100 = 1.0"
150 = 1.5"
200 = 2.0"

MATERIAL

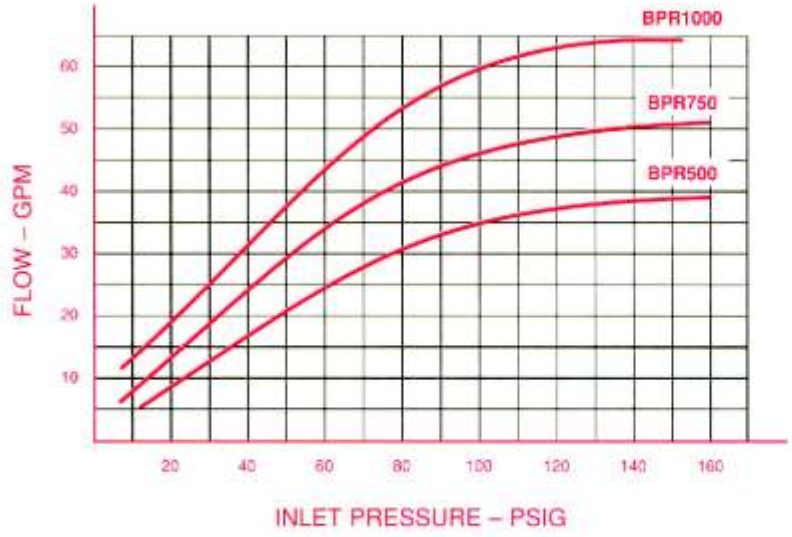
1 = PVC
2 = POLYPRO
3 = PVDF
4 = TEFLON
5 = OTHER (Please specify)

SEALS

E = EPDM
V = VITON
T = TEFLON
O = OTHER (Please specify)

R-K INDUSTRIES
1120 E. LOCUST STREET
ONTARIO, CA 91761
(909) 947-5227 • FAX: (909) 947-3039 • http://www.rkvalve.com

ENGINEERING & PERFORMANCE DATA



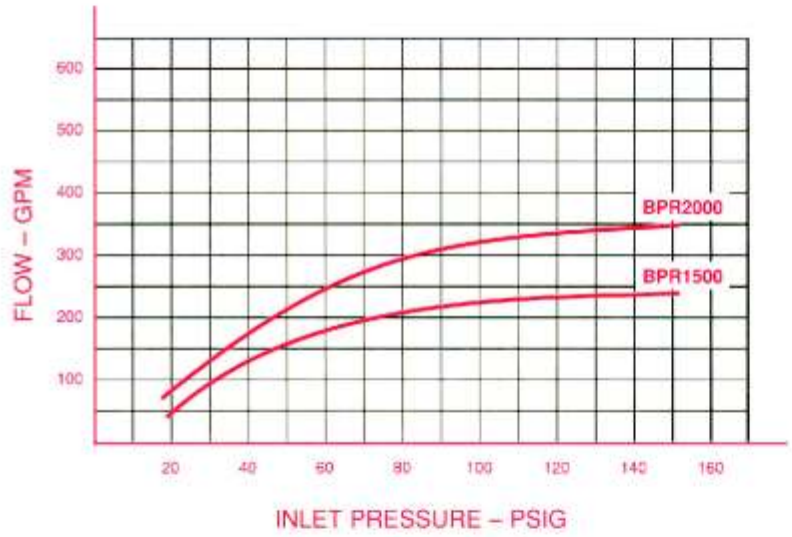
NOTES

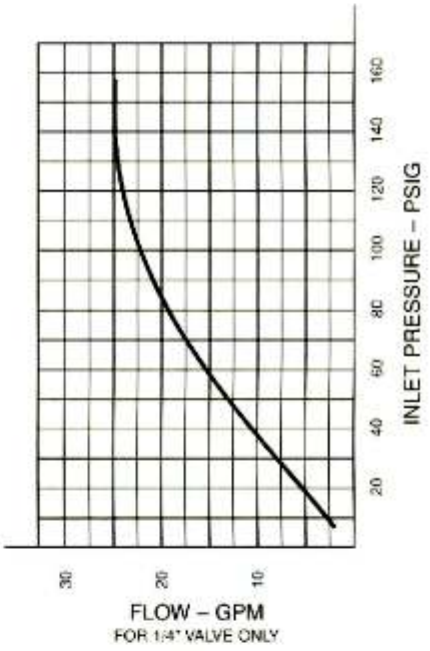
THE PERFORMANCE CURVES SHOW THE FLOW RATE OF BPR VALVES WITH THE VALVE FULLY OPEN AND 100% FLOW THRU THE VALVE. THESE CURVES WILL CHANGE DEPENDING ON THE FLOW THRU THE SYSTEM AT EACH DIFFERENT SET POINT.

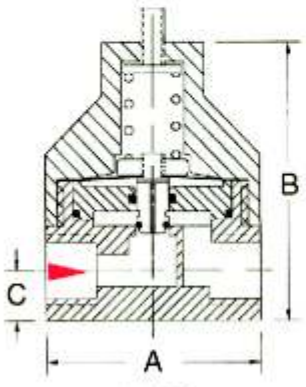
TEST DATA WAS PERFORMED WITH 68 DEGREE F WATER, AND 160 PSIG MAXIMUM PRESSURE.

THESE PERFORMANCE CURVES WILL BE CHANGED WITH HIGHER VISCOSITY LIQUID AND/OR HIGHER TEMPERATURE.

CONSULT YOUR LOCAL SALES REP OR MANUFACTURER DIRECTLY FOR CUSTOM PRODUCTS OR SPECIAL APPLICATIONS.







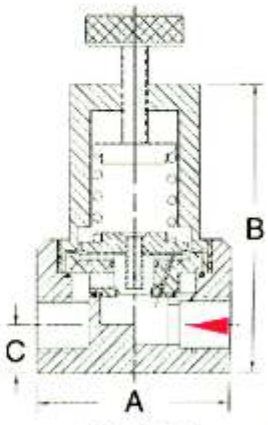
1/4" STYLE

DIMENSIONAL DATA

DIMENSIONS IN INCHES

Valve size	Ports	A	B	C	Cv
1/4"	FNPT	1.60	2.10	.39	.72
1/2"	FNPT	3.00	4.50	.93	3.67
3/4"	FNPT	3.50	4.80	.93	4.28
1.0"	FNPT	4.00	5.09	.93	5.42
1.5"	MPT	5.00	5.70	1.50	17.2*
2.0"	MPT	6.00	6.50	1.70	22.4*

(*) Cv value @ 150 GPM



1/2" TO 2" STYLE

R-K INDUSTRIES
1120 E. LOCUST STREET
ONTARIO, CA 91761
(909) 947-5227 • FAX: (909) 947-3039 • http://www.rkvalve.com

Technical Datasheet

8/26/2019

Model: AWG4520EXNXC

Product Description

Application:	HBP/AC - Air Conditioning
Refrigerant:	R-22
Voltage/Frequency:	208-230V ~ 60Hz
Version:	N/A

Product Specifications

Mechanical

Weight:	122
Weight Unit of Measure:	LB

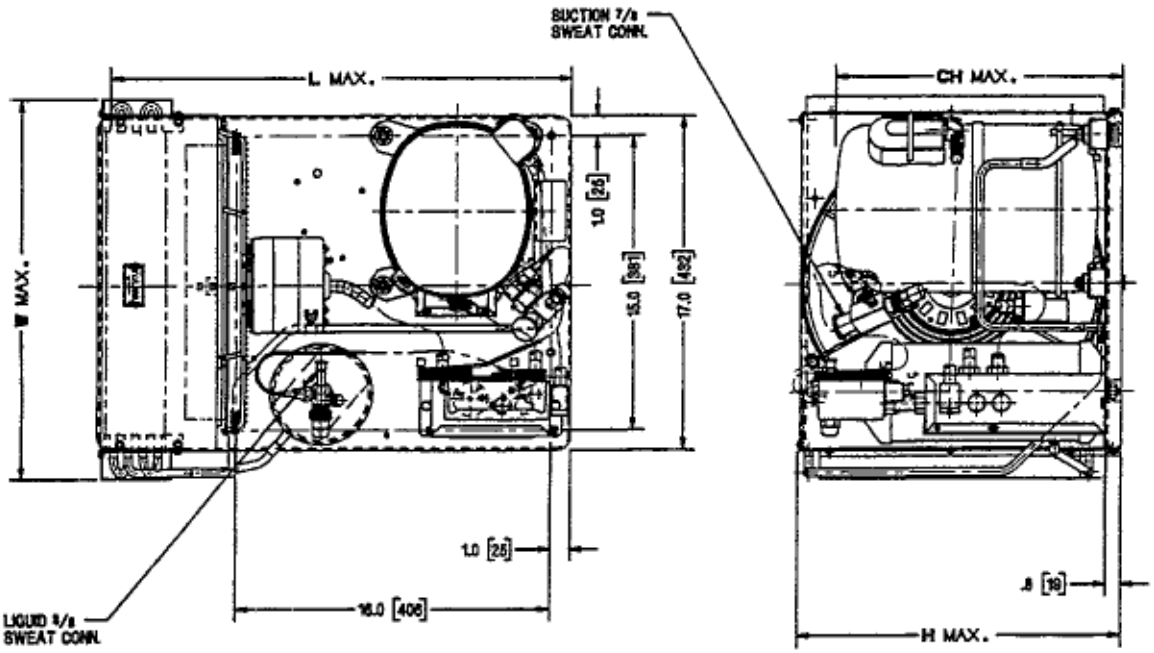
Electrical

Locked Rotor Amps (LRA):	52
Rated Load Amps (RLA 60 Hz):	9.5
Overload Type:	INTERNAL
Relay Type:	Potential Relay

TECUMSEH HERMETIC CONDENSING UNITS

Date: July 15, 1999

MODEL AWG4520EXNXC **R-22** **1 1/2 HP** **AIR COOLED**



NOTE: DIMENSIONING = INCHES [MILLIMETERS]

Model	Dimensions				*Line Connection		Pumpdown 90 ° F 90% Full	Air CFM	Oil Chg oz.	Gr. Wt. Lbs.
	L	W	H	CH	Suct.	Liq.				
AWA4520EXNXC	24.0	19.4	16.2	15.6	7/8RS	3/8F	8.4	772	38	134

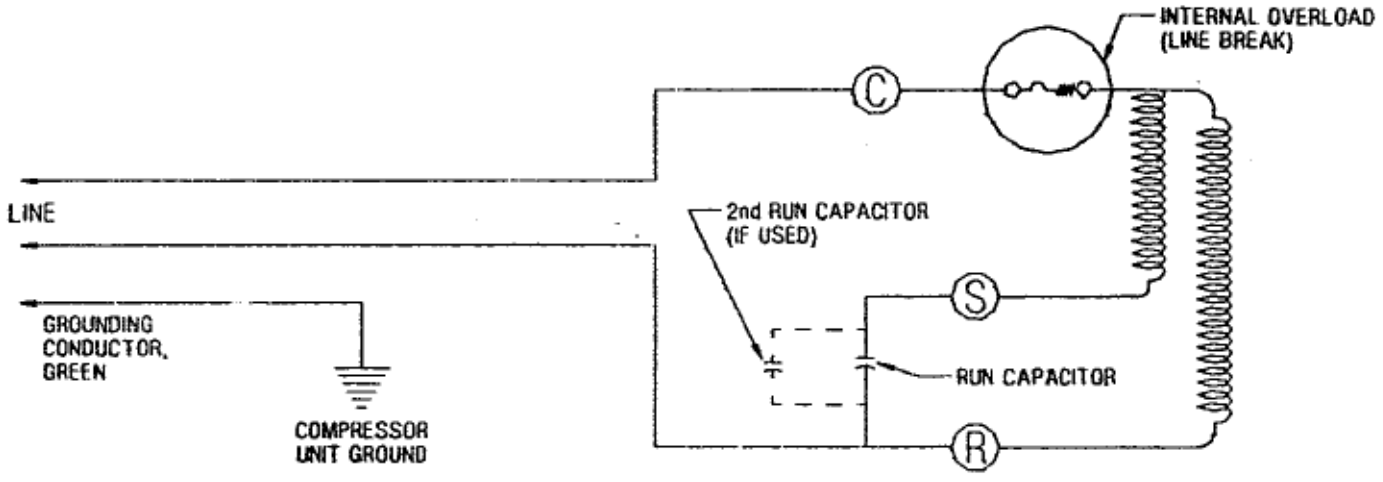
*F=Flare, S=Solder, RF or RS= Rotolock Valve with Flare or Solder Connections
Factory charge: 20 psig nitrogen - **MUST BE EVACUATED** **60 HZ PERFORMANCE**

Approved Evap. Range		Ambient											
		80°F			90° F			100° F			110° F		
°F	PSIG	BTUH	Watts	Head	BTUH	Watts	Head	BTUH	Watts	Head	BTUH	Watts	Head
10	32.8	10218	1480	196	9211	1493	221	8240	1515	249	7241	1534	281
15	37.7	11608	1575	204	10493	1597	230	9397	1625	258	8294	1646	290
20	43.0	13047	1674	213	11819	1706	239	10605	1739	268	9397	1764	300
25	48.7	14533	1776	222	13189	1818	249	11865	1858	279	10551	1888	311
30	54.8	16067	1881	233	14604	1935	260	13177	1982	290	11755	2019	323
35	61.4	17648	1990	244	16063	2055	273	14541	2110	303	13010	2156	336
40	68.5	19278	2102	256	17566	2180	285	15956	2243	316	14315	2299	350
45	76.0	20955	2217	269	19114	2309	299	17424	2381	330	15670	2448	364
50	84.0	22681	2335	283	20707	2441	314	18942	2523	345	17077	2604	380
55	92.6	24454	2457	298	22344	2578	330	20513	2670	361	18533	2766	396

Return gas temp. 65 ° F, 5 ° F subcooling

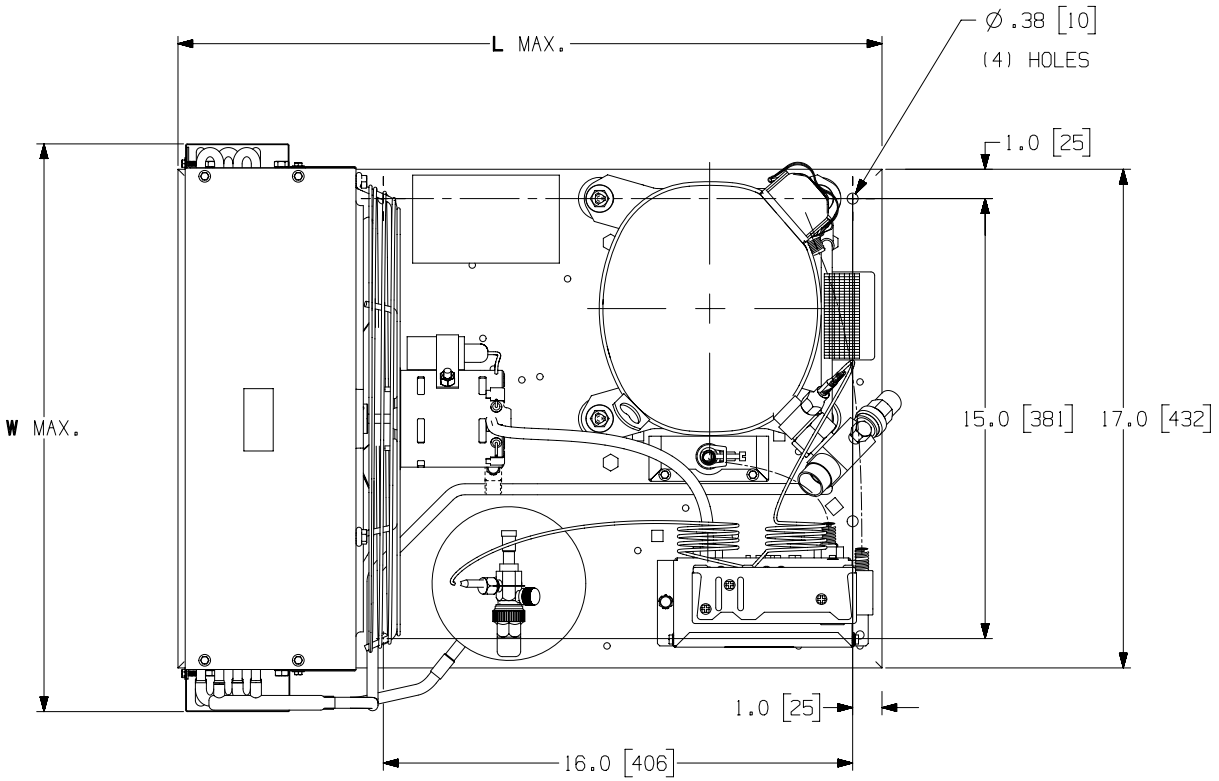
Date: 4-1-98

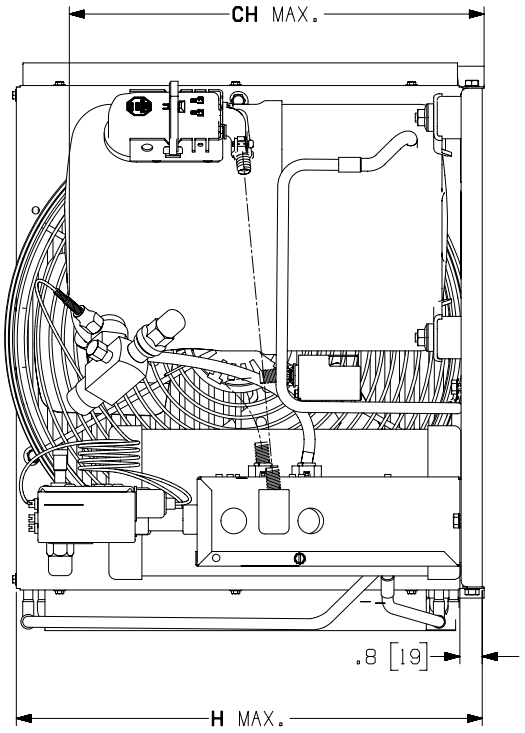
SPECIFICATIONS	AWG4520EXNXC		
Nominal Voltage	230/208-60-1		
Unit B/M	2B3215-1		
Voltage Range	253 to 197		
Min. Circuit Ampacity	13.4		
Max. Fuse Size (Amps)	20		
Compressor Model	AWG5520EXN		
Bill of Material	AW703ET-111		
RLA/LRA	9.5/52.0		
Fan RLA	1.40		
ESP Overload	Internal		
ESP Relay	820ARR3H23		
Cap. Cab. Assy.	AE1397-001		
Start Cap.	85PS330D17	Run Cap.	85PR370F20
Rating	145-175/330V	Rating	25/370V
Fan Motor	810S050A99		
Pressure Controls	Dual 84066	Receiver Tank	51081-1
Crankcase Heater	91022-1	Rec. Tank RL Valve	31581 (3/8"S)
Fan Blade	51556	Suction Rotolock	31529-1 (7/8"S)
Condenser Shroud	70727-1		
Condenser	DCAW-3		
Fan Guard	70831		
Unit Drawing	SU1918		
Schematic or Elect. Dwg.	DEAW-3		



230 VOLT-SCHEMATIC WIRING
DIAGRAM-PSC-INTERNAL OVERLOAD (LINE BREAK)

DWG NO. SU1918





L	W	H	CH
24.0 [610]	19.4 [493]	16.2 [411]	15.6 [396]

NOTE!
DIMENSIONING = INCHES [MILLIMETERS]

ENGLISH

Q.A. SYMBOLS
= CATEGORY I
= CATEGORY II
= CATEGORY III
= CATEGORY IV

AW

SALES UNIT DRAWING

DRN. R.SPENCER 20MAR96 | MODELED R.SPENCE 20MAR96 | CHK & APR ON FILE | SCALE .50 & NOTED

THIS PRINT SUPERSEDES ALL PRINTS PRIOR TO

TECUMSEH PRODUCTS CO.
ANN ARBOR, MICHIGAN

MATERIAL
NOTED

DWG NO. SU1918

RANCO ETC COMMERCIAL TEMPERATURE CONTROLS

The Ranco ETC is a microprocessor-based family of temperature controls designed to provide on/off control for commercial heating, cooling, air conditioning and refrigeration applications. With its wide temperature range, one and two stage capability, selectable heating/cooling modes and multi-voltage input, the ETC is one of the most versatile temperature controls available.

DIGITAL DISPLAY

Unlike many electronic controls, the ETC is simple to install and set up. One finger is all you need to program it. The standard digital display and keypad allow the user to adjust the temperature settings with 1° resolution. Setpoint temperature, differential and mode of operation (heating or cooling) can all be selected using the keypad and display.

When not in the programming mode, the display gives a constant readout of the sensor temperature. Annunciators on the liquid crystal display also indicate when the relay is energized.

CHOICE OF ONE OR TWO STAGE MODELS

The ETC line includes both one and two stage models. On two stage controls, each stage can be set independently thus eliminating the bothersome task of calculating interstage temperatures. And two stage models can be set up with overlapping heating or cooling stages.

REMOTE TEMPERATURE SENSING

The ETC is capable of remote temperature sensing up to 400 feet away from the control when using standard 22 gauge sensor wire.

BUILT-IN SAFETY

Every ETC model is equipped with diagnostic programs that check for hardware, software or system problems and display different error codes to indicate where the trouble is.

The ETC also has a keypad lockout switch to prevent tampering with the control settings by unauthorized personnel. The switch, which is located inside the enclosure, can be used to disable the keypad function.

OPTIONAL ANALOG OUTPUT

ETC models are available with a 0 to 10 volt analog output that can be used for remote temperature indication or as input to a central monitoring system. This signal is a linear representation of the sensor temperature with 0 volt –30°F and 10 volts = 220°F.

ETC-111000

SPECIFICATIONS

Temperature setpoint range	–30° to 220°F
Differential range	1°F to 30°F
Input power requirements	120 or 208/240 VAC (24 VAC optional)
Sensor	Thermistor, 2" long x 1/4" dia. with 8' cable
Control Ambient Temperatures	
Operating	–20°F to 140°F
Storage	–40°F to 176°F
Ambient humidity	0 to 95% RH, non-condensing
Enclosure	NEMA 1, plastic (NEMA 4X optional)
Dimensions	NEMA 1 models, 6.52" high x 2.7" wide x 2.48" deep NEMA 4X models, 7.84" high x 2.7" wide x 2.48" deep
0 to 10 V output impedance	1 K ohms
Agency Approvals	UL listed, file E94419, Guide XAPX CSA certified, file LR68340. class 4813 02
Switch action	SPDT

RELAY OUTPUT RATINGS - NO (NC):	ONE STAGE		TWO STAGE	
	120V	208/240V	120V	208/240V
Full load amps	16 (5.8) A	8 (2.9) A	9.8 (5.8) A	4.0 (2.9) A
Locked rotor amps	96 (34.8) A	48 (17.4) A	58.8 (34.8) A	29.4 (17.4) A
Resistive amps	15 (5.8) A	8 (2.9) A	9.8 (5.8) A	4.9 (2.9) A
Horsepower	1 (1/4) HP	1 (1/4) HP	1/2 (1/4) HP	1/2 (1/4) HP
Pilot duty	125VA at 120/208/240 VAC			

ORDERING DATA

UNI-LINE ORDER NO.	NUMBER OF STAGES	ENCLOSURE	INPUT VOLTAGE	0 TO 10 VOLT OUTPUT
ETC-111000	ONE	NEMA 1	120/208/240 VAC	NO
ETC-111100				YES
ETC-112000			24 VAC	NO
ETC-112100				YES
ETC-141000		NEMA 4	120/208/240 VAC	NO
ETC-211000	TWO	NEMA 1		
ETC-211100				YES
ETC-212000			24 VAC	NO
ETC-212100				YES
ETC-241000		NEMA 4	120/208/240 VAC	NO

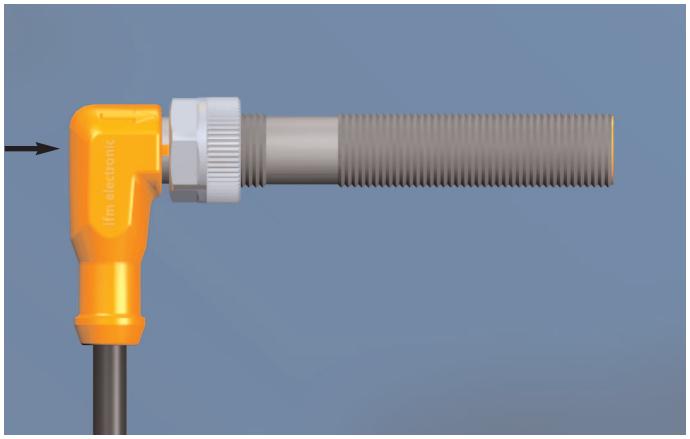
ifm electronic

Montagehinweis / Mounting instruction / Instruction de montage

Verbinden Sie den Steckverbinder mit dem Sensor, der Pfeil zeigt die richtige Lage der Kodierung. Um die angegebene Schutzart zu gewährleisten, muss die Überwurfmutter mit einem Anzugsdrehmoment von 0,6 Nm (handfest) bis 1,5 Nm (Schlüsselmontage) angezogen werden.

Connect the connector to the sensor; the arrow indicates the right position of the coding. To ensure the indicated protection rating, the coupling nut must be tightened with a tightening torque from 0.6 Nm (hand-tight) to 1.5 Nm (using a torque wrench).

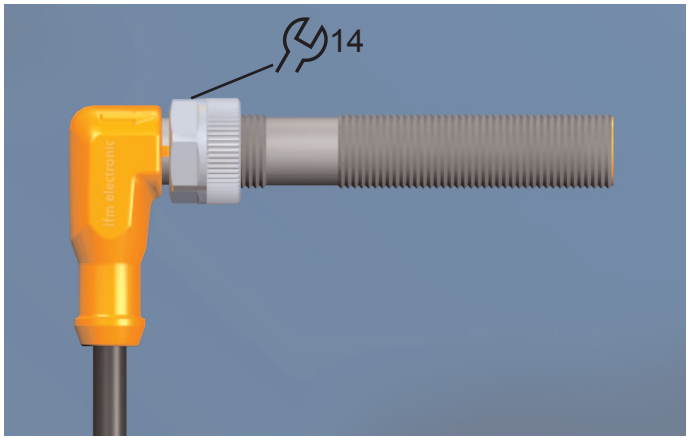
Raccorder le connecteur au capteur, la flèche indique la bonne direction du codage. Afin d'assurer le degré de protection indiqué, il faut serrer l'écrou avec un couple de serrage de 0,6 Nm (à la main) à 1,5 Nm (avec une clé).



Zur Demontage lösen Sie die Überwurfmutter und drücken gleichzeitig den Steckverbinder gegen den Sensor.

For removal loosen the coupling nut and at the same time press the connector against the sensor.

Pour le démontage desserrer l'écrou et presser simultanément le connecteur contre le capteur.

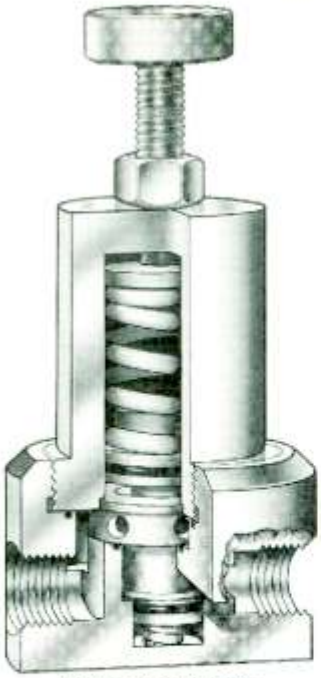


Beim Einsatz in rauen Umgebungen ziehen Sie die Überwurfmutter mit einem Schlüssel (SW14) eine Raste weiter fest, um Schock- und Vibrationsfestigkeit zu erhöhen. Zur Demontage verwenden Sie ebenfalls einen Schlüssel (SW14).

For applications in harsh environments tighten the coupling nut by turning it one notch further with a key (width across flats 14) to increase shock and vibration resistance.
For removal also use a key (width across flats 14).

Pour les applications en environnement agressif serrer l'écrou en le tournant d'un cran d'arrêt supplémentaire, avec une clé (cote sur plat 14), afin d'augmenter la tenue aux chocs et vibrations. Utiliser également une clé (cote sur plat 14) pour le démontage.

Sachnr. 704149/01 12/2007



PATENT NO. 4,276,902

FPR

DESIGN FEATURES

The R-K FPR series fluid pressure regulator is designed to protect piping systems and equipment from pressure changes.

The adjustable screw and lock nut makes it easy to convert varying upstream pressure into accurate pre-set downstream pressure.

Outlet pressure should be adjusted in a closed loop system within a range of 15-100 PSI.

Top entry and parallel inlet and outlet ports to facilitate installation and avoid piping problems.

This patented pressure reducing valve is designed to keep the stainless steel spring totally isolated from the fluid chamber insuring no metal contact with the fluid.

It is ideally suited for systems that require additional pressure protection.

FLUID PRESSURE REGULATOR

SPECIFICATIONS

Upstream Pressure		Vacuum to 150 PSIG
Regulated Pressure		15 to 100 PSIG (1/4" to 1-1/2") 15 to 80 PSIG (2" to 3") Consult factory for higher regulated pressure requirements
Material	Valve Body	PVC Type 1, Grade 1
		Polypropylene
		PVDF
		Teflon
	Seal	EPDM
		VITON
		KALREZ

Temperature Range	0 F to 140 F for PVC
	0 F to 180 F for POLYPRO
	0 F to 280 F for PVDF
	0 F to 340 F for TEFLON
Valve ports	1/4" to 1" Valve FNPT
	1.5" to 3" Valve MPT
	All valves are fully ported
Mounting method	(4) 1/4" -20 tapped holes for standard machined valve body. (1/4" to 1.00")
	(2) cut-out slots on molded valve body (1/2" to 1.00")

ORDER INFORMATION

The chart below will specify R - K standard valves regarding valve size, valve material, and seal material. For special orders, please consult the factory for pricing and delivery information.

FPR - X X X - X X

VALVE SIZE

25 = 1/4"
50 = 1/2"
75 = 3/4"
100 = 1.0"
150 = 1.5"
200 = 2.0"
300 = 3.0"

MATERIAL

1 = PVC
2 = POLYPRO
3 = PVDF
4 = TEFLON
5 = OTHER (Please specify)

SEALS

E = EPDM
V = VITON
K = KALREZ
O = OTHER (Please specify)

X = MOLDED BODY

(1/2"-3/4"-1" only)

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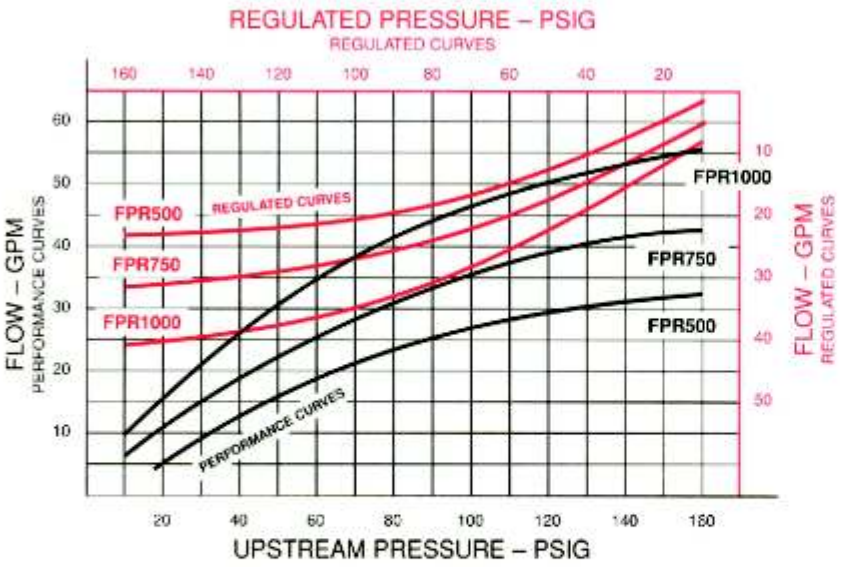
ENGINEERING & PERFORMANCE DATA



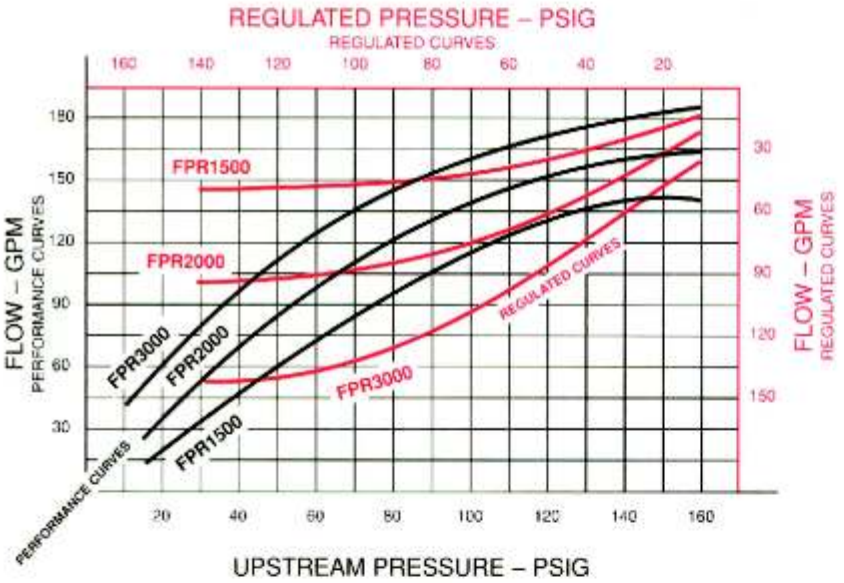
NOTES

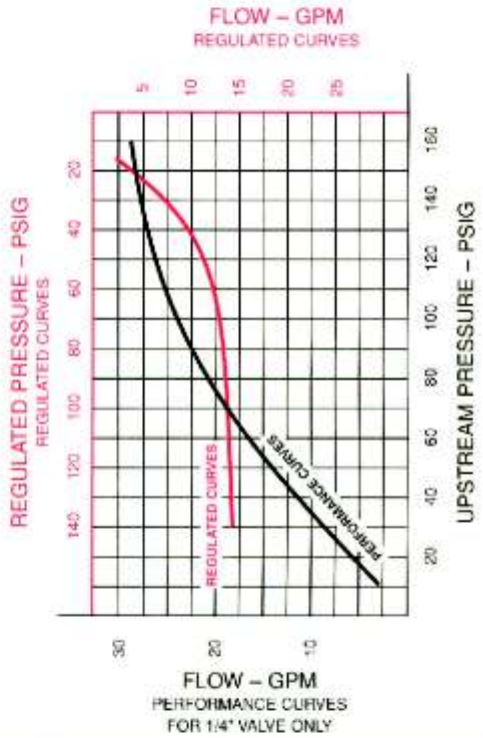
TEST DATA WAS PERFORMED WITH 68 DEGREE F WATER AND 160 PSIG MAXIMUM PRESSURE.

THESE PERFORMANCE CURVES WILL BE CHANGED WITH HIGHER VISCOSITY LIQUID AND/OR HIGHER TEMPERATURE.

CONSULT YOUR LOCAL SALES REP OR MANUFACTURER DIRECTLY FOR CUSTOM PRODUCTS OR SPECIAL APPLICATIONS.

The performance curves show the flow rate of FPR valves when piston seal is fully open.
The regulated curves show the flow rate of FPR valves at the points of pre-set downstream pressure.



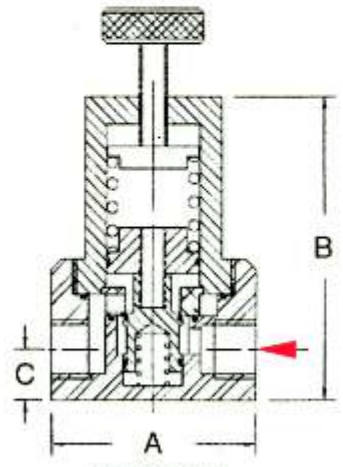


DIMENSIONAL DATA

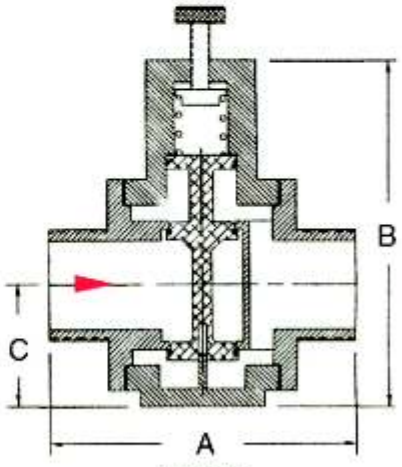
DIMENSIONS IN INCHES ( ) MOLDED BODY DIM

Valve size	Ports	A	B	C	Cv
1/4"	FNPT	2.00	3.12	.5	.58
1/2"	FNPT	3 (2.9)	4.2 (4.1)	.7 (.7)	2.35
3/4"	FNPT	3.5 (3.3)	4.9 (4.9)	.9 (.8)	2.72
1.0"	FNPT	4 (3.9)	5.4 (5.6)	1.1 (.9)	3.48
1.5"	MPT	5.0	8.0	1.5	15.8*
2.0"	MPT	6.0	9.0	1.7	21.1*
3.0"	MPT	9.7	10.9	3.8	31.7*

(*) Cv value @ 150 GPM



1/4" TO 2.0" STYLE



3.00" STYLE

R-K INDUSTRIES
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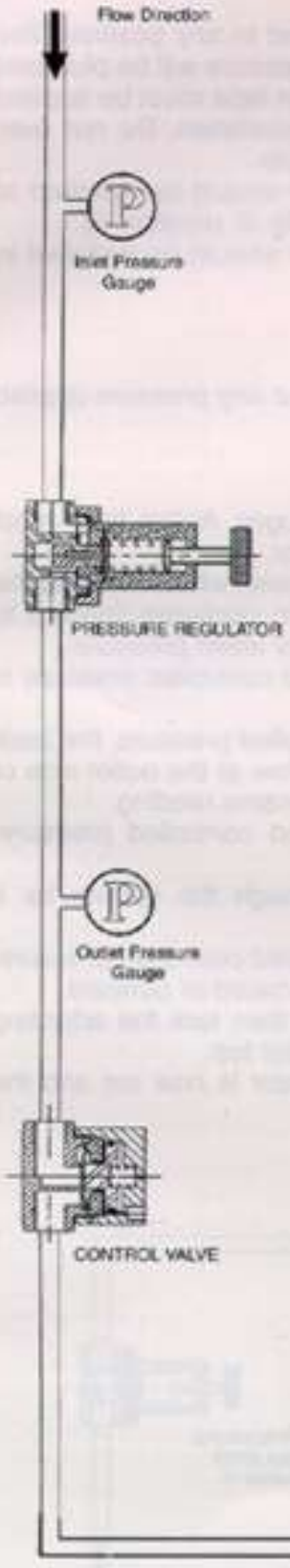
PRESSURE REGULATORS

INSTALLATION AND SET-UP INSTRUCTIONS



INSTALLATION

All R-K pressure regulators can be installed in any position. The "IN" label indicates where the high end (or upstream) pressure will be plumbed into the regulator. To prevent leakage, sufficient teflon tape must be applied to the threaded area of the male fittings prior to installation. Do not over tighten, hand tighten snug plus half turn if it is possible.

It is recommended that a pressure gauge should be installed in front of and after the pressure regulator, as shown, so the upstream (inlet) and the downstream (outlet) pressure can be read clearly during the set-up steps listed below.

SET-UP

Start with the adjusting screw in place and without any pressure applied to the internal spring:

1. Set the control valve to the closed position.
2. Turn on the pump or supply line.
3. Read the inlet pressure.
4. Start to turn the adjusting screw inward (clockwise), while checking the outlet pressure gauge. NOTE: turn clockwise (inward) to obtain higher pressure; counter clockwise (outward) for lower pressure.
5. Stop turning the adjusting screw when the outlet pressure gauge indicates the desired pressure. (continue with step 6). If the outlet pressure can not be increased, stop set up and see note below.
6. Open the control valve to relieve air trapped inside of the regulator. Let the fluid flow for a couple of minutes.
7. Close the control valve and recheck the outlet pressure gauge.
8. Make any adjustment to the outlet pressure by turning the adjusting screw inward (increasing pressure) or outward (decreasing pressure).
9. Open and close the control valve several times.
10. If the outlet pressure is the same as step 8, lock the adjusting screw by tightening the locking nut against the regulator top.
11. Now, the system is ready to be operated - Open the control valve and let the fluid flow to its destination.

NOTE:

During this process, always check both inlet and outlet pressure gauges. The outlet pressure CAN NOT be higher than the inlet pressure due to the pressure differential of the regulator. If you can not get the desired outlet pressure, please STOP this set-up and check your supply line or system for adequate inlet pressure before repeating this set-up.

Installation, Operation, and
Maintenance Manual

Model e-HM

GOULDS
WATER TECHNOLOGY
a xylem brand

Table of Contents

1 Introduction and Safety

1.1 Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance

CAUTION:
Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:
Save this manual for future reference, and keep it readily available at the location of the unit.

1.2 Inexperienced users

WARNING:
This product is intended to be operated by qualified personnel only.

Be aware of the following precautions:

- Persons with diminished capacities should not operate the product unless they are supervised or have been properly trained by a professional.
- Children must be supervised to ensure that they do not play on or around the product.

1.3 Safety terminology and symbols

Hazard levels

Hazard level	Indication
DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	• A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:

Electrical Hazard:

Hot surface hazard

Hot surface hazards are indicated by a specific symbol that replaces the typical hazard level symbols:

CAUTION:

Description of user and installer symbols

	Specific information for personnel in charge of installing the product in the system (plumbing and/or electrical aspects) or in charge of maintenance.
	Specific information for users of the product.

1.4 Warranty

For information about warranty, see the sales contract.

1.5 Spare parts

WARNING:
Only use original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the guarantee.

For more information about the product's spare parts, refer to the Sales and Service department.

1.6 Declaration of Conformity

We at,

Xylem Inc./Goulds Water Technology

1 Goulds Drive

Auburn, NY 13021

Declare that the following products: NPE, MCS, MCC, 3642/3752, 3656, 3656 SP, GB, e-SV, SVI, NPO, Prime Line SP, HB, e-HM, HMS, LC, NPV, LB, LBS comply with Machine Directive 06/42/EC. This equipment is intended to be incorporated with machinery covered by this directive, but must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the actual provisions of the directive.

Nick Daddabbo

Industrial Product Engineer

2 Transportation and Storage

2.1 Inspect the delivery

1. Check the outside of the package.
2. Notify our distributor within eight days of the delivery date, if the product bears visible signs of damage.
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4. Remove the securing screws or the straps from the wooden base (if any).
5. Remove packing materials from the product. Dispose of all packing materials in accordance with local regulations.
6. Inspect the product to determine if any parts have been damaged or are missing.
7. Contact the seller if anything is out of order.

2.2 Transportation guidelines

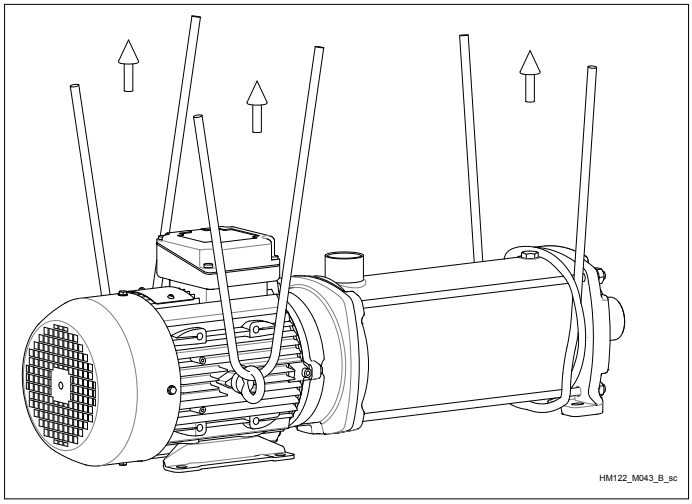
Precautions

WARNING:
- Observe accident prevention regulations in force.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.

Check the gross weight that is indicated on the package in order to select proper lifting equipment.

Position and fastening

The unit can be transported either horizontally or vertically. Make sure that the unit is securely fastened during transportation, and cannot roll or fall over.



2.3 Storage guidelines

Storage location

NOTICE:
- Protect the product against humidity, dirt, heat sources, and mechanical damage.
- The product must be stored at an ambient temperature from -40°C to +60°C (-40°F to 140°F).

3 Product Description

3.1 Pump design

The pump is a multistage, non-self priming pump. The pump can be used to pump:
- Cold water
- Warm water

Intended use

The pump is suitable for:
- Civil and industrial water distribution systems
- Irrigation (for example, agriculture and sporting facilities)

Improper use

DANGER:
Do not use this pump to handle flammable and/or explosive liquids.

WARNING:
Improper use of the pump may create dangerous conditions and cause personal injury and damage to property.

NOTICE:
Do not use this pump to handle liquids containing abrasive, solid, or fibrous substances, toxic or corrosive liquids, potable liquids other than water, or liquids not compatible with the pump construction material.

An improper use of the product leads to the loss of the warranty.

3.2 Application limits

Table 1: Pressure and temperature limits

Seal Code	1HM, 3HM		5HM		10HM, 15HM, 22HM
	2-6 Stages	7+ Stages	2-5 Stages	6+ Stages	All Stages
BQE	147PSI at 248F	235PSI at 248F	147PSI at 248F	235PSI at 248F	235PSI at 248F
BQV	147PSI at 248F	235PSI at 248F	147PSI at 248F	235PSI at 248F	235PSI at 248F
QQE	147PSI at 248F	235PSI at 194F	147PSI at 248F	235PSI at 194F	235PSI at 194F
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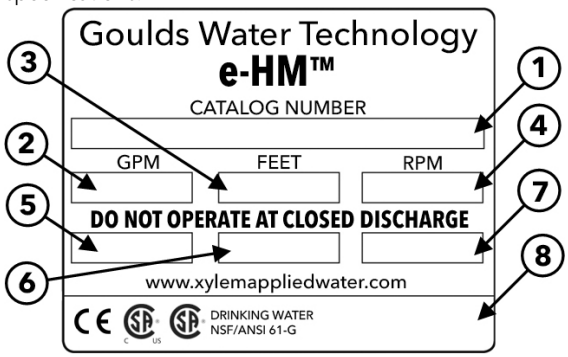
BVE	147PSI at 194F	Not Available	147PSI at 194F	Not Available	Not Available

3.3 The data plate

The data plate is a label on the pump. The data plate lists key product specifications.



1. Goulds Water Technology Catalog Number
2. Capacity range
3. TDH range
4. Rated speed
5. Rated horsepower
6. Maximum operating pressure
7. Maximum fluid temperature
8. Pump serial number

IMQ or other marks (for electric pump only)

Unless otherwise specified, for products with a mark of electrical-related safety approval, the approval refers exclusively to the electrical pump.

4 Installation

Precautions

WARNING:
- Observe accident prevention regulations in force.
- Use suitable equipment and protection.
- Always refer to the local and/or national regulations, legislation, and codes in force regarding the selection of the installation site, plumbing, and power connections.

4.1 Facility requirements

4.1.1 Pump location

DANGER:
Do not use this unit in environments that may contain flammable/explosive or chemically aggressive gases or powders.

Guidelines

Observe the following guidelines regarding the location of the product:
- Make sure that no obstructions hinder the normal flow of the cooling air that is delivered by the motor fan.
- Make sure that the installation area is protected from any fluid leaks, or flooding.
- If possible, place the pump slightly higher than the floor level.
- The ambient temperature must be between -30°C (-22°F) and +40°C (+104°F) unless otherwise specified in the data plate.
- The relative humidity of the ambient air must be less than 50% at +40°C (+104°F).

Installation above liquid source (suction lift)

The theoretical maximum suction height of any pump is 34 ft. In practice, this is not achieved due to the following conditions affecting the suction capability of the pump:
- Temperature of the liquid
- Elevation above the sea level (in an open system)
- System pressure (in a closed system)
- Resistance of the pipes
- Own intrinsic flow resistance of the pump
- Height differences

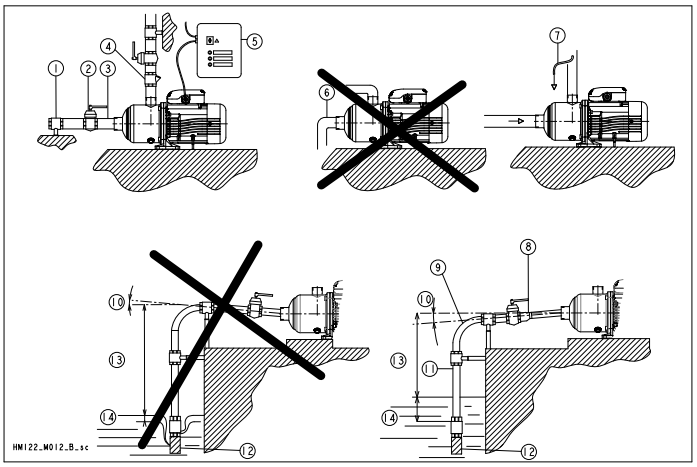
NOTICE:
Do not exceed the pumps suction capacity as this could cause cavitation and damage the pump.

4.1.2 Piping requirements

Precautions

WARNING:
- Use pipes suited to the maximum working pressure of the pump. Failure to do so can cause the system to rupture, with the risk of injury.
- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.
- Do not use the on-off valve on the discharge side in the closed position for more than a few seconds. If the pump must operate with the discharge side closed for more than a few seconds, a bypass circuit must be installed to prevent overheating of the water inside the pump.

Piping checklist
- Pipes and valves must be correctly sized.
- Pipe work must not transmit any load or torque to pump flanges.



4.2 Electrical requirements
- The local regulations in force overrule these specified requirements. In the case of fire fighting systems (hydrants and/or sprinklers), check the local regulations.

Electrical connection checklist

Check that the following requirements are met:
- The electrical leads are protected from high temperature, vibrations, and collisions.
- The power supply line is provided with:
  - A short-circuit protection device
  - A main disconnect switch.

The electrical control panel checklist

NOTICE:
The control panel must match the ratings of the electric pump. Improper combinations could fail to guarantee the protection of the motor.

Check that the following requirements are met:
- The control panel must protect the motor against overload and short-circuit.
- Install the correct overload protection (thermal relay or motor protector).

Pump Type	Protection
Single phase standard electric pump up to 3 HP	• Built-in automatic reset thermal-overload protection • Short circuit protection (must be supplied by the installer)
Three-phase electric pump	• Thermal protection (must be supplied by the installer) • Short circuit protection (must be supplied by the installer)

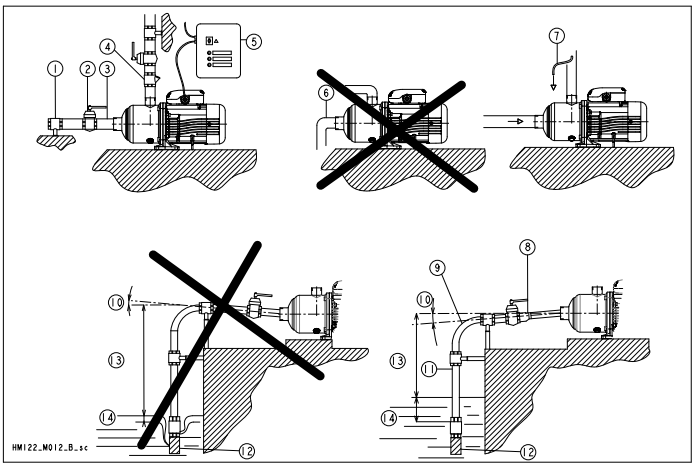
- The control panel must be equipped with a dry-running protection system to which a pressure switch, float switch, sensors, or other suitable device is connected.
- The following devices are recommended for use on the suction side of the pump:
  - When the liquid is pumped from a water system, use a pressure switch.
  - When the liquid is pumped from a storage tank or reservoir, use a float switch or sensors.
- When thermal relays are used, relays that are sensitive to phase failure are recommended.

The motor checklist

Use cable according to rules with 3 leads (2+earth/ground) for single phase versions and with 4 leads (3+earth/ground) for three-phase version.

4.3 Install the pump

4.3.1 Install the pump on a concrete foundation



1. Piping support
2. On-off valve
3. Flexible pipe or joint
4. Check valve
5. Control panel
6. Do not install elbows close to the pump
7. Bypass circuit
8. Eccentric reducer
9. Use wide bends
10. Positive gradient
11. Piping with equal or greater diameter than the suction port
12. Use foot valve
13. Do not exceed maximum height difference
14. Ensure adequate submersion depth

1. Anchor the pump onto the concrete or equivalent metal structure.
   - If the liquid temperature exceeds 50°C, the unit must be anchored only by the motor bracket side and not also by the side of the inlet supporting bracket
   - If the transmission of vibrations can be disturbing, then provide vibration-damping supports between the pump and the foundation.
2. Remove the plugs covering the ports.
3. Assemble the pipe to the pump threaded connections.

   Do not force the piping into place.

4.3.2 Electrical installation

Precautions

Electrical Hazard:

- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.
- Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized.

Grounding (earthing)

Electrical Hazard:

- Always connect the external protection conductor to ground (earth) terminal before making other electrical connections.

Connect the cable

1. Connect and fasten the power cables according to the wiring diagram under the terminal box cover.
   a) Connect the ground (earth) lead.

   Make sure that the ground (earth) lead is longer than the phase leads.
   b) Connect the phase leads.

NOTICE:

Tighten the cable glands carefully to ensure the protection against the cable slipping and humidity entering the terminal box.

2. If the motor is not equipped with automatic reset thermal protection, then adjust the overload protection according to the nominal current value of electric pump (data plate).

5 Commissioning, Startup, Operation, and Shutdown

Precautions

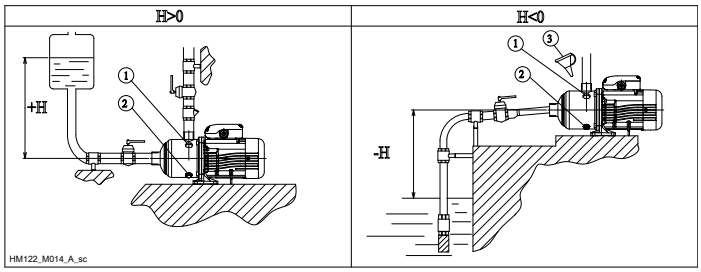
WARNING:

Make sure that the drained liquid does not cause damage or injuries.

NOTICE:

- Never operate the pump below the minimum rated flow.
- Never operate the pump with the delivery ON-OFF valve closed for longer than a few seconds.
- Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump. Failure to do so can cause liquid to freeze and damage the pump.
- The sum of the pressure on the suction side (water mains, gravity tank) and the maximum pressure that is delivered by the pump must not exceed the maximum working pressure that is allowed (nominal pressure PN) for the pump.
- Do not use the pump if cavitation occurs. Cavitation can damage the internal components.

5.1 Prime the pump



1. Fill plug
2. Drain plug
3. Funnel

Installations with liquid level above the pump (suction head)

Close the on-off valve located downstream from the pump.

Installations with liquid level below the pump (suction lift)

Open the on-off valve that is located upstream from the pump and close the on-off valve downstream.

5.2 Check the rotation direction (three-phase motor)

Follow this procedure before start-up.

1. Start the motor.
2. Stop the motor.
3. If the rotation direction is incorrect, then do as follows:
   a) Disconnect the power supply.
   b) In the terminal board of the motor or in the electric control panel, exchange the position of two of the three wires of the supply cable.
   c) Check the direction of rotation again.

5.3 Start the pump

1. Start the motor.
2. Gradually open the on-off valve on the discharge side of the pump.

   At the expected operating conditions, the pump must run smoothly and quietly. If not, refer to *Troubleshooting* (page 6).
3. If the pump does not start in correctly in 30 seconds, then do the following:

   a) Switch off the pump.
   b) Reprime the pump.
   c) Start the pump again.
4. Switch off and on the pump (for about 30 seconds of continuos running) and make sure that all the trapped air is bled out by repeating this 2–3 times.

NOTICE:

Make sure that the pump has bled away all the trapped air. Failure to do so can harm the product.

6 Maintenance

Precautions

Electrical Hazard:

Disconnect and lock out electrical power before installing or servicing the unit.

WARNING:

- Maintenance and service must be performed by skilled and qualified personnel only.
- Observe accident prevention regulations in force.
- Use suitable equipment and protection.

6.1 Service

The pump does not require any scheduled routine maintenance. If the user wishes to schedule regular maintenance deadlines, they are dependent on the type of pumped liquid and on the operating conditions of the pump.

Contact the local sales and service representative for any requests or information regarding routine maintenance or service.

7 Troubleshooting

Introduction

Always specify the exact pump type and identification code when requesting information or spare parts from the Sales and Service department.

For other situation not mentioned in the table, refer to the Sales and Service department.

7.1 Troubleshooting table

Problem	Cause and solution
The pump does not start.	• The thermo-overload protection in the single-phase motor has tripped; it will automatically reset when the motor cools down. • Check the power supply wiring to see that the connections are all tight • Check to see that the circuit breaker or ground-fault protection device has tripped. Or replace any fuses that may have blown. • Check to see if any protection device installed for dry running protection has tripped or hung up.
The pump starts up but the thermal protector is triggered after a short time or the fuses blow.	• The power supply cable is damaged, the motor short circuits or thermal protector or fuses are not suited for the motor current. Check and replace the components as necessary. • The thermo-overload protection (single phase) or of the protection device (three-phase) trips due to excessive current input. Check the pump working conditions. • A phase in the power supply is missing. Check the power supply. • The pump is clogged with solids and the impeller becomes bound. Clean the pump.
The pump starts but does not deliver any liquid.	• Air is entering the suction piping, check the liquid level, the tightness of the suction pipes and the operation of the foot valve. • The pump is not correctly primed. Repeat the instructions in *Prime the pump* (page 5).
The pump's delivery is reduced.	• Check for restrictions in the piping system. • Wrong rotation of the impeller (three-phase). Check the direction of rotation. • The pump is not correctly primed. Repeat the instructions in *Prime the pump* (page 5).

Xylem |’zīləm|

1) The tissue in plants that brings water upward from the roots
2) A leading global water technology company

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to xyleminc.com

xylem
Let’s Solve Water

Xylem Inc.
2881 East Bayard Street, Suite A
Seneca Falls, NY 13148
USA
Tel: (866) 325-4210
Fax: (888) 322-5877

Visit our Web site for the latest version of this document and more information

The original instruction is in English. All non-English instructions are translations of the original instruction.

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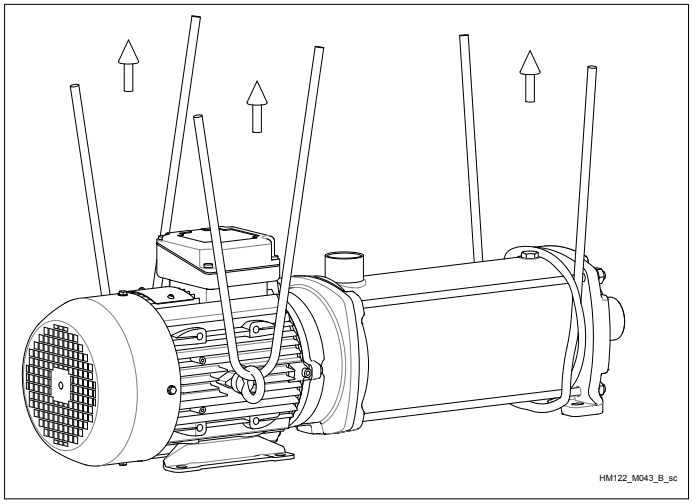

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The pump is a multistage, non-self priming pump. The pump can be used to pump:
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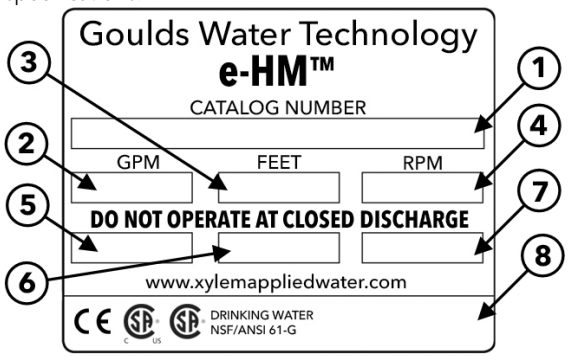

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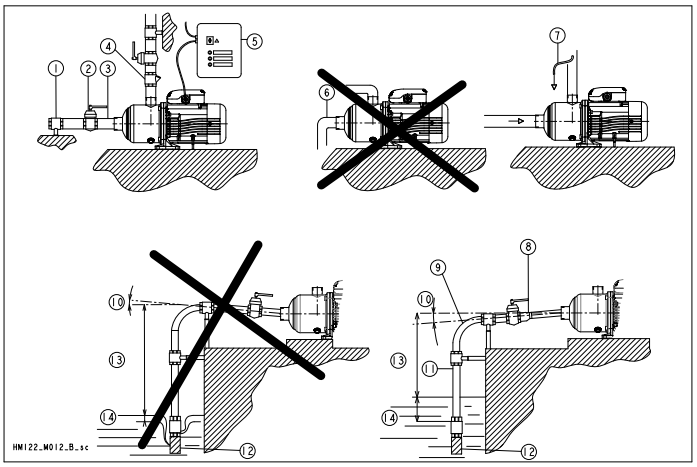

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Pump Type	Protection
Single phase standard electric pump up to 3 HP	• Built-in automatic reset thermal-overload protection • Short circuit protection (must be supplied by the installer)
Three-phase electric pump	• Thermal protection (must be supplied by the installer) • Short circuit protection (must be supplied by the installer)

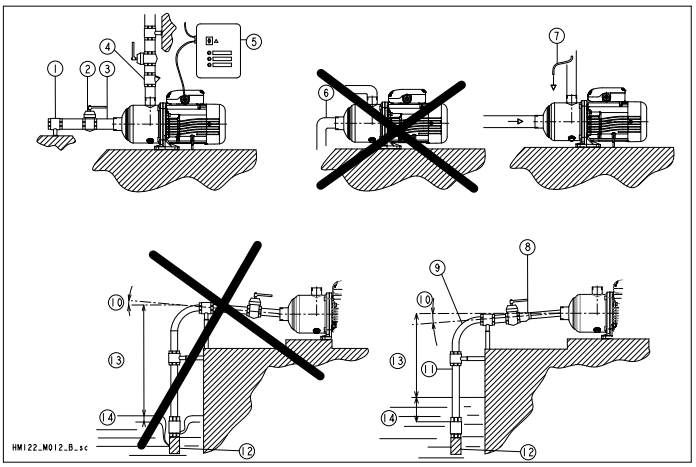
- The control panel must be equipped with a dry-running protection system to which a pressure switch, float switch, sensors, or other suitable device is connected.
- The following devices are recommended for use on the suction side of the pump:
  - When the liquid is pumped from a water system, use a pressure switch.
  - When the liquid is pumped from a storage tank or reservoir, use a float switch or sensors.
- When thermal relays are used, relays that are sensitive to phase failure are recommended.

The motor checklist

Use cable according to rules with 3 leads (2+earth/ground) for single phase versions and with 4 leads (3+earth/ground) for three-phase version.

4.3 Install the pump

4.3.1 Install the pump on a concrete foundation



1. Piping support
2. On-off valve
3. Flexible pipe or joint
4. Check valve
5. Control panel
6. Do not install elbows close to the pump
7. Bypass circuit
8. Eccentric reducer
9. Use wide bends
10. Positive gradient
11. Piping with equal or greater diameter than the suction port
12. Use foot valve
13. Do not exceed maximum height difference
14. Ensure adequate submersion depth

1. Anchor the pump onto the concrete or equivalent metal structure.
   - If the liquid temperature exceeds 50°C, the unit must be anchored only by the motor bracket side and not also by the side of the inlet supporting bracket
   - If the transmission of vibrations can be disturbing, then provide vibration-damping supports between the pump and the foundation.
2. Remove the plugs covering the ports.
3. Assemble the pipe to the pump threaded connections.

   Do not force the piping into place.

4.3.2 Electrical installation

Precautions

Electrical Hazard:

- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.
- Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized.

Grounding (earthing)

Electrical Hazard:

- Always connect the external protection conductor to ground (earth) terminal before making other electrical connections.

Connect the cable

1. Connect and fasten the power cables according to the wiring diagram under the terminal box cover.
   a) Connect the ground (earth) lead.

   Make sure that the ground (earth) lead is longer than the phase leads.
   b) Connect the phase leads.

NOTICE:

Tighten the cable glands carefully to ensure the protection against the cable slipping and humidity entering the terminal box.

2. If the motor is not equipped with automatic reset thermal protection, then adjust the overload protection according to the nominal current value of electric pump (data plate).

5 Commissioning, Startup, Operation, and Shutdown

Precautions

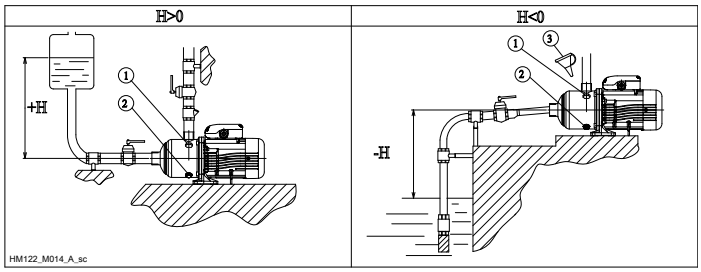
WARNING:

Make sure that the drained liquid does not cause damage or injuries.

NOTICE:

- Never operate the pump below the minimum rated flow.
- Never operate the pump with the delivery ON-OFF valve closed for longer than a few seconds.
- Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump. Failure to do so can cause liquid to freeze and damage the pump.
- The sum of the pressure on the suction side (water mains, gravity tank) and the maximum pressure that is delivered by the pump must not exceed the maximum working pressure that is allowed (nominal pressure PN) for the pump.
- Do not use the pump if cavitation occurs. Cavitation can damage the internal components.

5.1 Prime the pump



1. Fill plug
2. Drain plug
3. Funnel

Installations with liquid level above the pump (suction head)

Close the on-off valve located downstream from the pump.

Installations with liquid level below the pump (suction lift)

Open the on-off valve that is located upstream from the pump and close the on-off valve downstream.

5.2 Check the rotation direction (three-phase motor)

Follow this procedure before start-up.

1. Start the motor.
2. Stop the motor.
3. If the rotation direction is incorrect, then do as follows:
   a) Disconnect the power supply.
   b) In the terminal board of the motor or in the electric control panel, exchange the position of two of the three wires of the supply cable.
   c) Check the direction of rotation again.

5.3 Start the pump

1. Start the motor.
2. Gradually open the on-off valve on the discharge side of the pump.

   At the expected operating conditions, the pump must run smoothly and quietly. If not, refer to *Troubleshooting* (page 6).
3. If the pump does not start in correctly in 30 seconds, then do the following:

   a) Switch off the pump.
   b) Reprime the pump.
   c) Start the pump again.
4. Switch off and on the pump (for about 30 seconds of continuos running) and make sure that all the trapped air is bled out by repeating this 2–3 times.

NOTICE:

Make sure that the pump has bled away all the trapped air. Failure to do so can harm the product.

6 Maintenance

Precautions

Electrical Hazard:

Disconnect and lock out electrical power before installing or servicing the unit.

WARNING:

- Maintenance and service must be performed by skilled and qualified personnel only.
- Observe accident prevention regulations in force.
- Use suitable equipment and protection.

6.1 Service

The pump does not require any scheduled routine maintenance. If the user wishes to schedule regular maintenance deadlines, they are dependent on the type of pumped liquid and on the operating conditions of the pump.

Contact the local sales and service representative for any requests or information regarding routine maintenance or service.

7 Troubleshooting

Introduction

Always specify the exact pump type and identification code when requesting information or spare parts from the Sales and Service department.

For other situation not mentioned in the table, refer to the Sales and Service department.

7.1 Troubleshooting table

Problem	Cause and solution
The pump does not start.	• The thermo-overload protection in the single-phase motor has tripped; it will automatically reset when the motor cools down. • Check the power supply wiring to see that the connections are all tight • Check to see that the circuit breaker or ground-fault protection device has tripped. Or replace any fuses that may have blown. • Check to see if any protection device installed for dry running protection has tripped or hung up.
The pump starts up but the thermal protector is triggered after a short time or the fuses blow.	• The power supply cable is damaged, the motor short circuits or thermal protector or fuses are not suited for the motor current. Check and replace the components as necessary. • The thermo-overload protection (single phase) or of the protection device (three-phase) trips due to excessive current input. Check the pump working conditions. • A phase in the power supply is missing. Check the power supply. • The pump is clogged with solids and the impeller becomes bound. Clean the pump.
The pump starts but does not deliver any liquid.	• Air is entering the suction piping, check the liquid level, the tightness of the suction pipes and the operation of the foot valve. • The pump is not correctly primed. Repeat the instructions in *Prime the pump* (page 5).
The pump's delivery is reduced.	• Check for restrictions in the piping system. • Wrong rotation of the impeller (three-phase). Check the direction of rotation. • The pump is not correctly primed. Repeat the instructions in *Prime the pump* (page 5).

Xylem |’zīləm|

1) The tissue in plants that brings water upward from the roots
2) A leading global water technology company

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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Xylem Inc.
2881 East Bayard Street, Suite A
Seneca Falls, NY 13148
USA
Tel: (866) 325-4210
Fax: (888) 322-5877

Visit our Web site for the latest version of this document and more information

The original instruction is in English. All non-English instructions are translations of the original instruction.

1/2" VALVE INSTALLATION INSTRUCTIONS

1/2" VALVE

INSTALLING THE VALVE

1. See diagram A below
2. The 1/2" Hudson Valve has 1/2" female threading. To connect the valve, you will need a 1/2" water line coming in with male threads. You can also use the Hudson Mounting Bracket and hook the valve up directly to a standard hose.
3. Use plumber's tape on threads of water supply pipe or Hudson mounting bracket, then screw on Hudson Valve. Hand tighten only. DO NOT use pipe compound.
4. Turn water source on FULL volume
5. Valve will shut off 1 1/2" - 2" up from the bottom of the valve depending on pressure. Note: there will be a short delay in shut-off the first time the valve is used.

Diagram A

* Please contact Hudson Valve for Anti-Siphon installation instructions.

Optimal operating pressure 4-100 psi

The valve can work at lower and higher presures than what is optimal, depending on various factors. Please contact Hudson Valve.

MAINTENANCE INSTRUCTIONS

The Hudson Valve should be routinely cleaned to prevent any buildup of debris inside of the valve. To clean, remove valve from water line and take completely apart. Wash all parts with mild, soapy water. Re-assemble and return to water line. For further maintenance instructions, please visit **www.hudsonvalve.com**.

Hudson Valve Company, Inc.

5301 Office Park Drive, Suite 330
Bakersfield, CA 93309
800-748-6218 • Fax 800-607-8731
www.hudsonvalve.com

RHINO PSC Series Power Supplies Specifications

PSC-05-012, PSC-12-015, PSC-24-015

NEC Class 2 Compliant Supplies

The RHINO PSC series power supplies are plastic low-profile housed switching supplies available in 5, 12 and 24 VDC adjustable output models. There are 8 models with power ratings from 12W to 90W. They have an integral DIN rail mounting adapter and feature universal 120/240 VAC input voltage, adjustable DC output, DC-OK LED indication, and output current limitation.

PSC-12-030, PSC-24-030

The RHINO PSC series of switching power supplies provide tightly regulated output voltage for sensitive loads in industrial, commercial and residential environments. The plastic housing is lightweight and low-profile, designed to fit in shallow depth control panels often used in the building automation industry. Screw terminals are provided for simple and speedy wiring terminations.

The RHINO PSC series is both UL508 listed for demanding industrial applications and UL1310 recognized for NEC Class 2 compliance in industrial, commercial and residential applications.

Features

- Low-profile housing - only 2.15 inches (55mm) deep (MCB form factor)
- 5, 12, 24VDC adjustable outputs
- Output power ratings from 12 to 90W
- Integral DIN rail mouting adapter
- Universal input voltage range 120/240 VAC
- Tight output voltage regulation
- DC-OK LED indication
- UL508 Listed
- UL1310 Recognized for NEC Class 2 compliance
- CE compliant
- RoHS compliant

PSC-12-060, PSC-24-060

PSC-24-090

Input Specifications						
Part Number	Input Voltage Range	Input Frequency Range	Input Current (Typical) at full load		Efficiency (Typ.)	C-Curve Circuit Breaker or Slow-blow Fuse
			115 VAC	230 VAC		
PSC-05-012	100-240VAC - Nominal 85 to 264VAC - Universal (output power derating 5% / V for operation below 90 VAC)	47-63 Hz	0.25A typ.	0.17A typ.	73%	6.0 A
PSC-12-015			0.29A typ.	0.20A typ.	79%	
PSC-24-015					81%	
PSC-12-030			0.57A typ.	0.39A typ.	81%	
PSC-24-030					83%	
PSC-12-060			1.00A typ.	0.68A typ	83%	
PSC-24-060			1.10A typ.	0.70A typ.	85%	
PSC-24-090			1.60A typ.	1.07A typ.	86%	

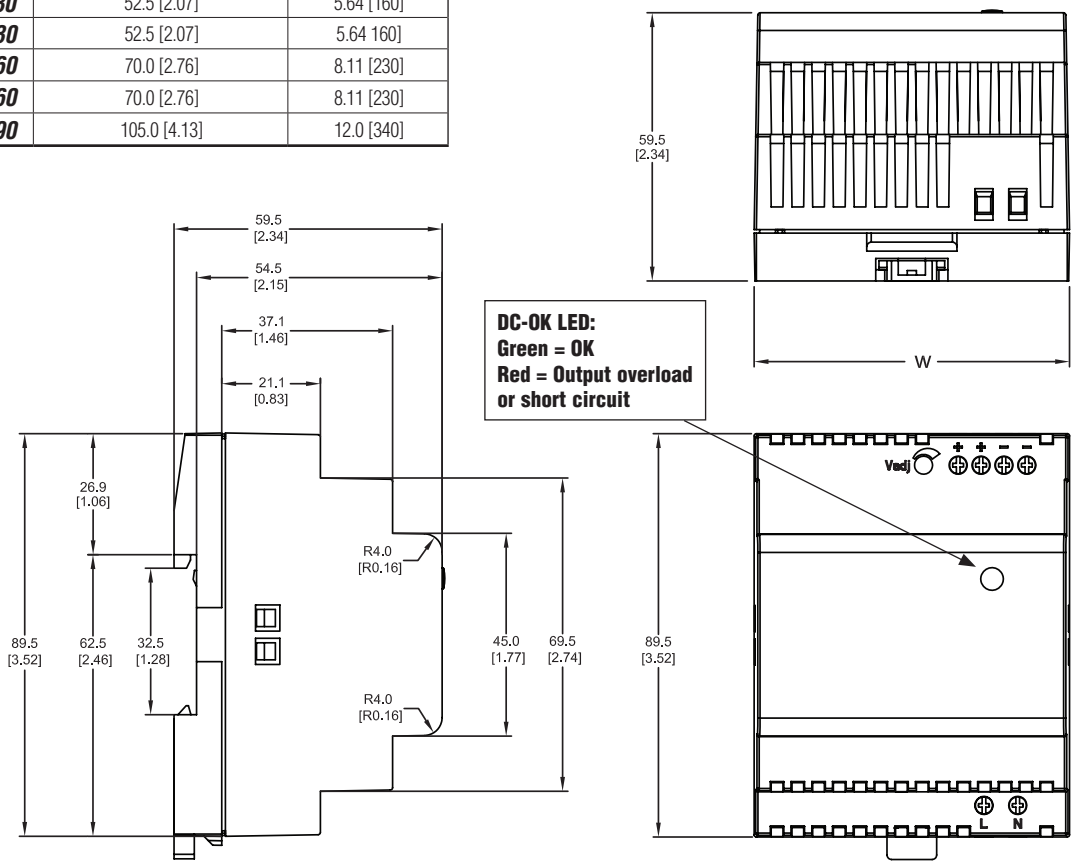
Output Specifications							
Part Number	Price	Output Voltage	Output Volt. Adjust. Range	Output Current (Max.)	Output Power (Max.)	Hold-Up Time	MTBF (IEC 1709 @ 25°C)
						115 VAC / 230 VAC	
PSC-05-012	$46.50	5.0VDC	5.0 to 5.2VDC	2.4A	12 Watt	minimum 10 ms / minimum 20 ms	1,600,000 hours
PSC-12-015	$46.50	12.0VDC	12.0 to 16.0VDC	1.25A	15 Watt		
PSC-24-015	$46.50	24.0VDC	24.0 to 28.0VDC	0.63A			
PSC-12-030	$59.00	12.0VDC	12.0 to 16.0VDC	2.5A	30 Watt		1,300,000 hours
PSC-24-030	$59.00	24.0VDC	24.0 to 28.0VDC	1.25A			
PSC-12-060	$72.00	12.0VDC	12.0 to 16.0VDC	4.5A	54 Watt		2,100,000 hours
PSC-24-060	$72.00	24.0VDC	24.0 to 28.0VDC	2.5A	60 Watt		
PSC-24-090	$90.00	24.0VDC		3.75A	90 Watt		1,300,000 hours

RHINO PSC Series Power Supplies Specifications and Dimensions

General Specifications		
Temperature	**Operating**: -25°C (-13°F) to +60°C (+140°F) max at nominal load, above +60°C (+140°F) 2.5% / °C derating up to +70°C (+185°F) **Storage**: -25°C (-13°F) to +85°C (+185°F) max	
Humidity	95% (non-condensing) relative humidity max.	
Output Regulation	1%	
Protection Class II	to IEC/EN 60536	
Safety Standards	UL508, UL1310, Class 2 IEC/EN 60950-1, UL60950-1, EN50178 EN60204, EN61558-2-8	
Output Voltage Ripple	<100 mV peak-to-peak	
Output Protection	Current limitation at 100 - 150% typ. (automatic recovery)	
Electromagnetic Compatibility (EMC)	Emissions - EN61000-6-3 Conducted RI suppression on input - EN55032 class B Radiated RI suppression - EN55032 class B FCC Class B	Immunity - EN61000-6-2 EN61000-4-X
Enclosure Rating	IP 20 (IEC 60529)	
Enclosure Material	Plastic FR2010-110C (UL 94V- 0 rated)	
Mounting	DIN-rails as per EN50022-35x15/735 (snap-on with self-locking springs)	
Connection	Screw terminals with combi-type screw heads for wire size 24 to 12 AWG (0.20 to 3.30mm²)	
Agency Approvals	UL508 Listed, file #E197592 UL1310 Class 2 Recognized, file #E198298	

Dimensions		
Part No.	***Width (W) - mm [inches]***	***Weight oz [g]***
PSC-05-012	26.3 [1.04]	3.53 [100]
PSC-12-015	26.3 [1.04]	3.53 [100]
PSC-24-015	26.3 [1.04]	3.53 [100]
PSC-12-030	52.5 [2.07]	5.64 [160]
PSC-24-030	52.5 [2.07]	5.64 160]
PSC-12-060	70.0 [2.76]	8.11 [230]
PSC-24-060	70.0 [2.76]	8.11 [230]
PSC-24-090	105.0 [4.13]	12.0 [340]

Wiring		
Input/Output	***Description***	***Wire size***
AC Input	all models: L, N only (2 pin terminal)	24 -12 AWG / 3.30mm² max
DC Output	15 -30 Watt models: single + and - terminals	24 -12 AWG / 3.30mm² max
DC Output	60 - 90 Watt models: double + and - terminals	24 -12 AWG / 3.30mm² max



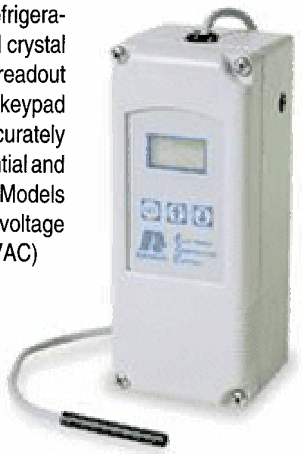
TOLERANCE +/- 0.5mm [0.02"]

Form No. 7515003-001 Rev. C

ETC SINGLE STAGE ELECTRONIC TEMPERATURE CONTROL

PRODUCT DESCRIPTION

The Ranco ETC is a microprocessor-based family of electronic temperature controls, designed to provide on/off control for commercial heating, cooling, air conditioning and refrigeration. The ETC is equipped with a liquid crystal display (LCD) that provides a constant readout of the sensed temperature, and a touch keypad that allows the user to easily and accurately select the set point temperature, differential and heating/cooling mode of the operation. Models are available that operate on either line voltage (120/208/240 VAC) or low voltage (24VAC)



APPLICATIONS

With its wide temperature setpoint range and selectable heating or cooling modes, the ETC can be used for a wide variety of applications including refrigerated display cases, walk-in and reach-in refrigerators, milk coolers, refrigerated warehouses, chillers, beer and beverage coolers, tank heating, space and return air temperature control and condenser fan cycling.

FEATURES

- Wide setpoint temperature range (-30°F to 220°F) and differential adjustment (1°F to 30°F).
- Simple keypad programming of setpoint temperature, differential and cooling/heating modes.
- LCD readout of sensor temperature, control settings, relay status and onboard diagnostics.
- Remote temperature sensing up to 400 feet.
- SPDT output relay.
- User-selectable Fahrenheit/Celsius scales.
- Lockout switch to prevent tampering by unauthorized personnel.
- Choice of line voltage and low voltage models available.
- Optional 0 to 10 volt analog output available for remote temperature indication.

SPECIFICATIONS

Input Voltage	120 or 208/240 VAC (24 VAC optional), 50/60 Hz
Temperature Range	-30°F to 220°F
Differential Range	1°F to 30°F
Switch Action	SPDT
Sensor	Thermistor, 1.94 in. long x 0.25 in. diameter with 8 ft. cable
Power Consumption	120/208/240 VAC: 100 Milliamps 24 VAC: 2 - 6 VA

Relay Electrical Ratings

	120V	208/240V
NO Contact		
Full-load amps	16 A	8 A
Locked rotor amps	96 A	48 A
Resistive amps	15 A	8 A
Horsepower	1 hp	1 hp
NC Contact		
Full-load amps	5.8 A	2.9 A
Locked rotor amps	34.8 A	17.4 A
Resistive amps	5.8 A	2.9 A
Horsepower	1/4 hp	1/4 hp

Pilot Duty: 125 VA at 120/208/240 VAC

Control Ambient Temperature	
Operating	-20°F to 140°F (-29°C to 60°C)
Storage	-40°F to 176°F (-40°C to 80°C)
Ambient Humidity	0 to 95%, RH, Non-condensing
0 to 10 V Output Impedance	1K
Enclosure	NEMA 1, Plastic
Agency Approvals	UL Listed, File E94419, Guide XAPX CSA Certified, File LR68340, Class 4813 02

ETC ORDERING INFORMATION

Code Number	Input Voltage	No. of Stages	0 - 10 V Output
ETC-111000-000	120/240	1	No
ETC-111100-000	120/240	1	Yes
ETC-112000-000	24	1	No
ETC-112100-000	24	1	Yes

OPERATION

Liquid Crystal Display (LCD)

The LCD display provides a constant readout of the sensor temperature and indicates if the output relay is energized. When the **S1** annunciator is constantly illuminated during operation, the relay is energized. The display is also used in conjunction with the keypad to allow the user to adjust the setpoint temperature, differential and heating/cooling modes.

Control Setup

The temperature setpoint refers to the temperature at which the normally open (NO) contacts of the output relay will open. Determine the load (s) to be controlled and the operating mode required, cooling or heating. Refer to Figure 1 for a visual representation.

- When the cooling mode is chosen, the differential is above the setpoint. The relay will de-energize as the temperature falls to the setpoint.
- When the heating mode is chosen, the differential is below the setpoint. The relay will de-energize as the temperature rises to the setpoint.

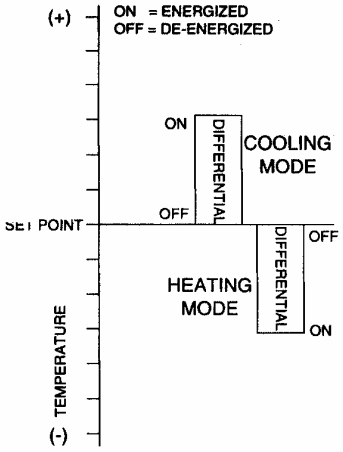


Figure 1: Setpoint and Differential Settings. Diagram indicates relay on and off points in either the heating or cooling modes.

Programming Steps and Display

The ETC can be programmed in four simple steps using the LCD display and the three keys on the face of the control.

Step 1- To start programming, press the **SET** key once to access the Fahrenheit/Celsius mode. The display will show the current status, either **F** for degrees Fahrenheit or **C** for degrees Celsius. Then press either the up⬆ or down⬇ arrow key to toggle between the **F** or **C** designation.

Step 2- Press the **SET** key again to access the setpoint. The LCD will display the current setpoint and the **S1** annunciator will be blinking on and off to indicate that the control is in the setpoint mode. Then press either the up⬆ key to increase or the down⬇ key to decrease the setpoint to the desired temperature.

Step 3- Press the **SET** key again to access the differential. The LCD will display the current differential and the **DIF 1** annunciator will be blinking on and off to indicate that the control is in the differential mode. Then press either the up⬆ key to increase or the down⬇ key to decrease the differential to the desired setting.

Step 4- Press the **SET** key again to access the cooling or heating mode. The LCD will display the current mode, either **C1** for cooling or **H1** for heating. Then press either the up⬆ or down⬇ key to toggle between the **C1** or **H1** designation. Press the **SET** key once more and programming is complete.

Step	Annunciator	Description	Display
1	**F** or **C**	Fahrenheit or Celsius Scale	F
2	**S1** (blinking)	Setpoint Temperature	S1 70
3	**DIF 1** (blinking)	Differential Temperature	DIF 1 5
4	**C1/H1**	Cooling or Heating Mode	C1

NOTE: The ETC will automatically end programming if no keys are depressed for a period of thirty seconds. Any settings that have been input to the control will be accepted at that point.

All control settings are retained in non-volatile memory if power to ETC is interrupted for any reason. Re-programming is not necessary after power outages or disconnects unless different control settings are required.

Lockout Switch

The ETC is provided with a lockout switch to prevent tampering by unauthorized personnel. When placed in the **LOCK** position, the keypad is disabled and no changes to the settings can be made. When placed in the **UNLOCK** position, the keypad will function normally.

To access the lockout switch, disconnect the power supply and open the control. The switch is located on the inside cover about 2 inches above the bottom. (see Figure 2). To disable the keypad, slide the switch to the left **LOCK** position. To enable the keypad, slide the switch to the right **UNLOCK** position. All ETC controls are shipped with this switch in the **UNLOCK** position.

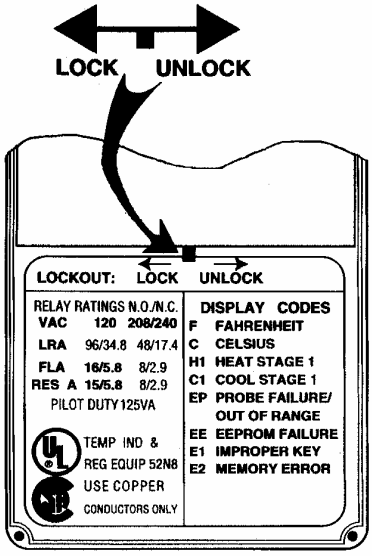


Figure 2: Lockout Switch

TROUBLESHOOTING ERROR MESSAGES

Display Messages

E1 - Appears when either the up⬆ or down⬇ key is pressed when not in the programming mode.

To correct: If the E1 message appears even when no keys are being pressed, replace the control.

E2 - Appears if the control settings are not properly stored in memory.

To correct: Check all settings and correct if necessary.

EP - Appears when the probe is open, shorted or sensing a temperature that is out of range.

To correct: Check to see if the sensed temperature is out of range. If not, check for probe damage by comparing it to a known ambient temperature between -30°F and 220°F. Replace the probe if necessary.

EE - Appears if the EEPROM data has been corrupted.

To correct: This condition cannot be field repaired. Replace the control.

CL - Appears if calibration mode has been entered.

To correct: Remove power to the control for at least five seconds. Reapply power. If the **CL** message still appears, replace the control.

INSTALLATION INSTRUCTIONS

IMPORTANT

1. All ETC series controls are designed as operating controls only. If an operating control failure could result in personal injury or loss of property, a separate safety control and /or alarm should be installed.

2. The schematic drawings and other information included in these installation instructions are for the purpose of illustration and general reference only.

3. These instructions do not expand, reduce, modify or alter the Ranco Terms in any way; and no warranty or remedy in favor of the customer or any other person arises out of these instructions.

4. Ranco ETC controls have been approved by Underwriter's Laboratories as UL listed; however, approval does not extend to their use for any other purpose. Ranco assumes no responsibility for any unconventional application of its control unless such application has been approved in writing by Ranco.

5. It is the responsibility of the installer and the user to assure that his or its application and use of all Ranco products are in compliance with all federal, state and local requirements, including, without any limitation, all requirements imposed under the National Electric Code and any applicable building codes.

CAUTION

To prevent possible electrical shock or equipment damage, disconnect electrical power to the unit before and during installation. DO NOT restore electrical power to unit until the control is properly installed and the cover is assembled. DO NOT locate the control in an explosive atmosphere as a safety hazard can result due to possible spark generation in the control. Controls are not to be located in areas of significant moisture, dirt or dust, or in a corrosive explosive atmosphere. Use of control in such environments may result in injury or damage to the persons or property (or both) and are likely to shorten the control life;
Ranco assumes no responsibility for any such use.

CONTROL MOUNTING

Mount the ETC to a wall or any flat surface using a combination of any two or more of the slotted holes located on the back of the control case. The control's components are not position sensitive,but should be mounted so that they can be easily wired and adjusted. Avoid excessive conditions of moisture, dirt, and corrosive atmosphere.

The ETC has provisions for 1/2 inch conduit connections. The conduit hub should be secured to the conduit before securing the hub to the plastic housing of the control. When using the conduit entry in the rear of the case, a standard plug should be inserted into the conduit hole in the bottom. Caution should be exercised not to damage the control circuit board or wiring when installing a conduit connector.

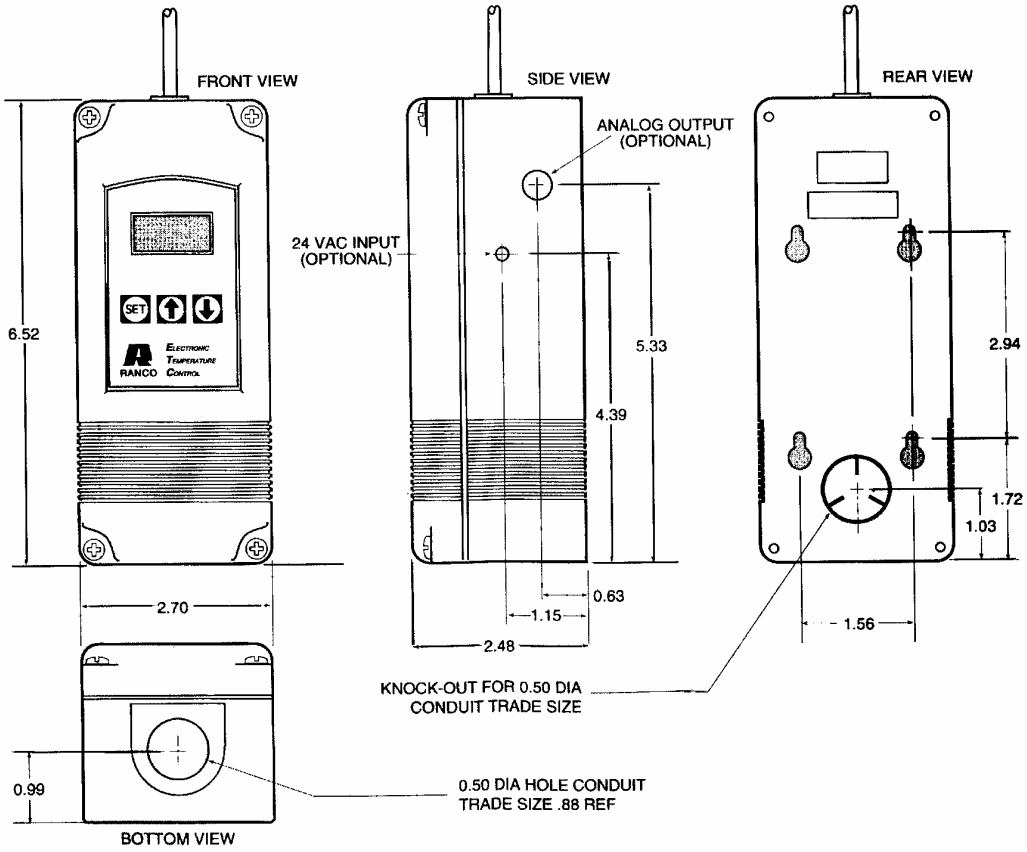


Figure 3: Dimensions (Inches)

CONTROL WIRING

General

- All wiring should conform to the National Electric Code and local regulations.
- The total electrical load must not exceed the maximum rating of the control (see Specifications).
- Use copper conductors only.
- Electrical leads should not be taut; allow slack for temperature change and vibration.

Input and Output Wiring

For typical wiring diagrams, refer to Figures 4, 5 and 6. All connections are made to the power (lower) circuit board. When using the 24 VAC powered models, the 24 VAC input lines must enter through the sidewall of the case. Refer to figure 3 for location of the entry hole.
Figure 7 for wiring.

Analog Output

ETC models are available with an optional 0 to 10 volt analog output. This signal is a linear representation of the sensor temperature with 0 volts = -30°F and 10 volts = 220°F. See figure 8 for wiring information and figure 3 for location of the entry hole. The reference for this output is designated by the "-" symbol on the wiring diagram. The output signal is designated by the "+" symbol.

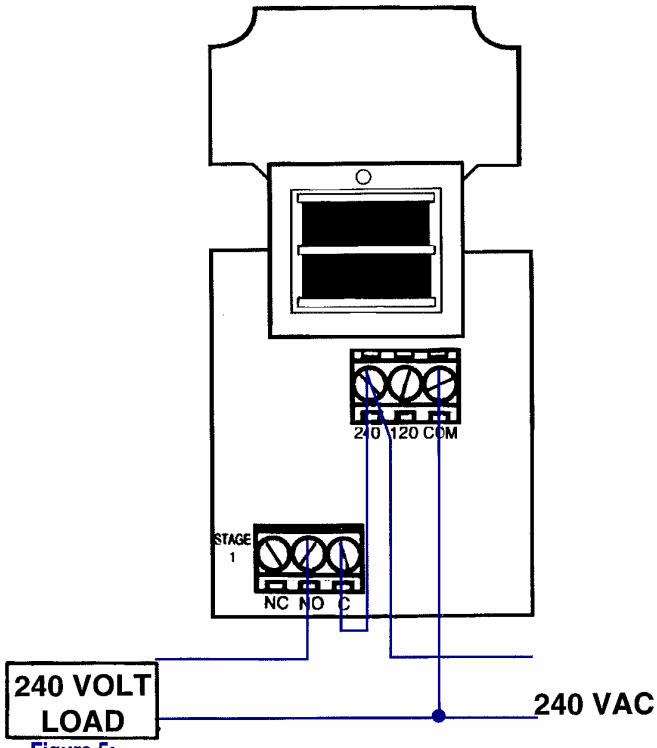


Figure 5: Typical Wiring Diagram for 240 VAC Power Input and Line Voltage Switching.

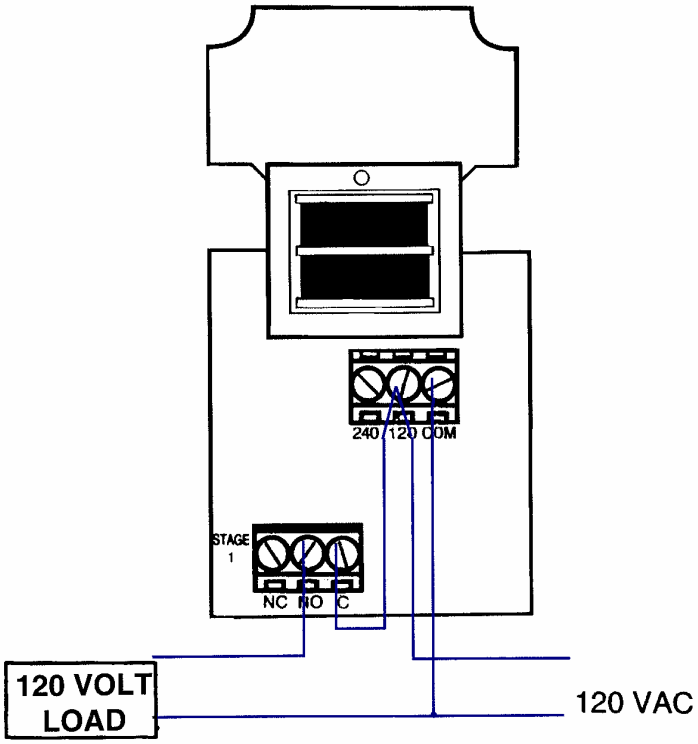


Figure 4: Typical Line Voltage Wiring Diagram.

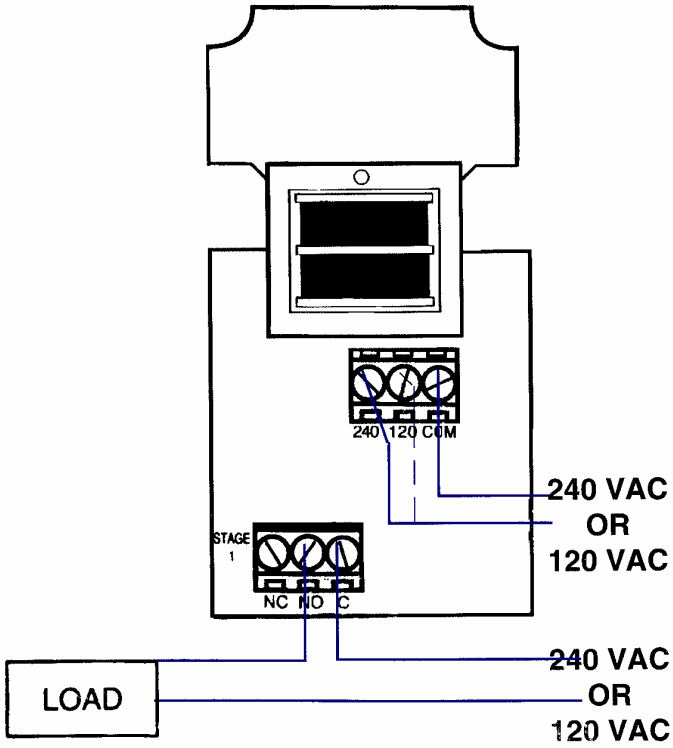


Figure 6: Different Voltage to Control and Different Voltage Load.

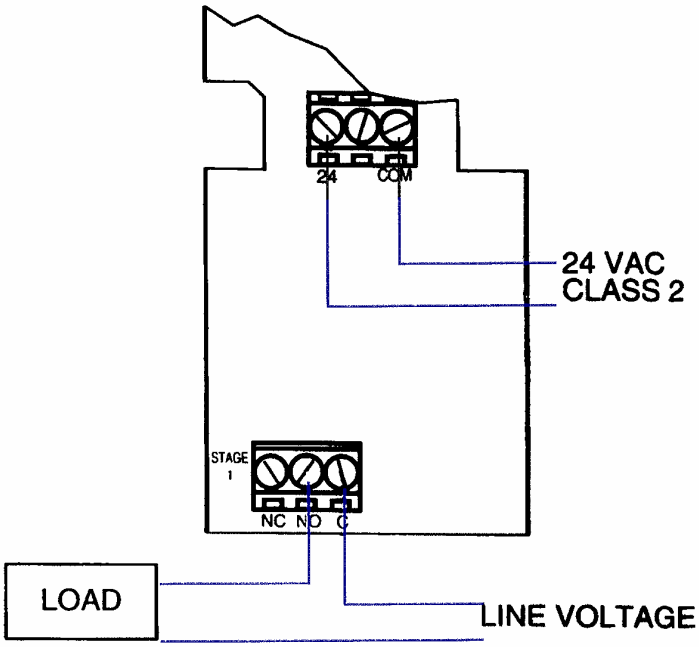


Figure 7: **Typical Wiring Diagram for 24 VAC Power Input and Line Voltage Switching.**

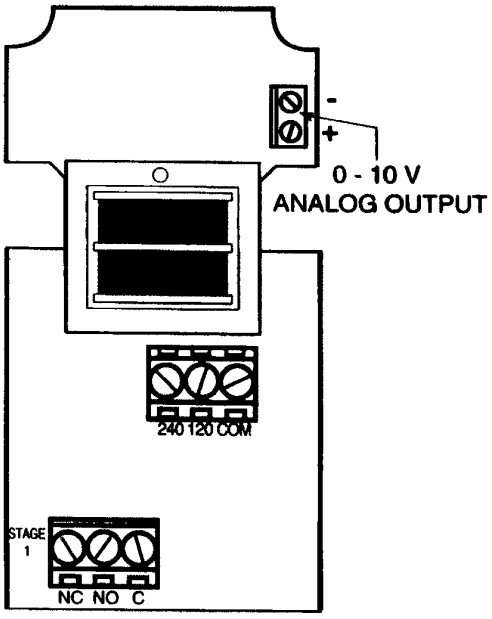


Figure 8: **0-10 V Analog Output Located on Power (Lower) Circuit Board.**

FIELD REPAIRS

Field calibrating or repairs to the ETC control must not be attempted. Sensors and replacement controls are available through Ranco wholesalers.

SENSOR MOUNTING

For space sensing, mount the sensor where it will be unaffected by heat/cool discharge or radiated heat sources. Spot sensing requires the sensor to be in good contact with the surface being sensed. The sensor can be inserted in a bulb well for immersion sensing.

EXTENDING SENSOR

CAUTION: Sensor wiring splices may be made external from the control. **DO NOT** attempt to unsolder the sensor at the control circuit board!

CAUTION: Disconnect power to control before wiring to avoid possible electrical shock or damage to the controller.

Additional cable can be spliced to the sensor cable to increase the length beyond the standard 8 feet. It can be extended up to 400 feet. The cable should be at least 22 AWG or larger to keep additional resistance to a minimum.

All splices and wire lengths added to the sensor cable should be made according to acceptable wiring practices and should conform to the National Electrical Code and local regulations. Use copper conductors only. Shielded cable is not required.

Checkout Procedure

1. Before applying power, make sure installation and wiring connections are correct.
2. Apply power to the control and observe one or more cycles of operation.
3. If performance indicates a problem, check sensor resistance to determine if sensor or control is at fault.
4. To check sensor resistance, disconnect sensor and measure the resistance across the leads while measuring temperature at the sensor.

TEMPERATURE AVERAGING

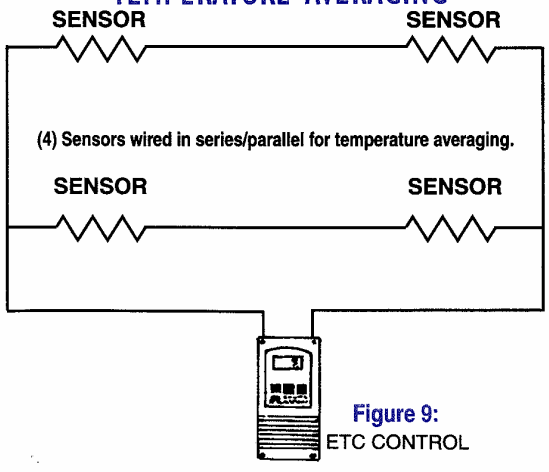


Figure 9:
ETC CONTROL

Replacement Sensor - Order Part No. 1309007-044

SPECIFICATIONS

The 1309007-044 sensor is a negative temperature coefficient (NTC) thermistor sensor. The sensor resistance decreases with temperature increase. It is .25 x 1.94 long with 8 feet #22 AWG cable. The thermistor has a reference resistance of 30,000 ohms at 77°F (25°C).

IMPORTANT

The schematic drawings and other information included in these instructions are for the purpose of illustration and general reference only. Ranco assumes no responsibility for any unconventional application of this control, unless such application has been approved in writing by Ranco.

Deg. C.	Deg. F.	RES. Nom.
-40	-40	1,010,000
-30	-22	531,000
-20	-4	291,200
-10	14	166,000
0	32	97,960
10	50	59,700
20	68	37,470
25	77	30,000
30	86	24,170
40	104	15,980
50	122	10,810
60	140	7,464
70	158	5,200
80	176	3,774
90	194	2,753
100	212	2,036
110	230	1,531

Figure 10 :

Resistance vs Temperature of 1309007-044. Sensor including 8 foot cable.

RANCO

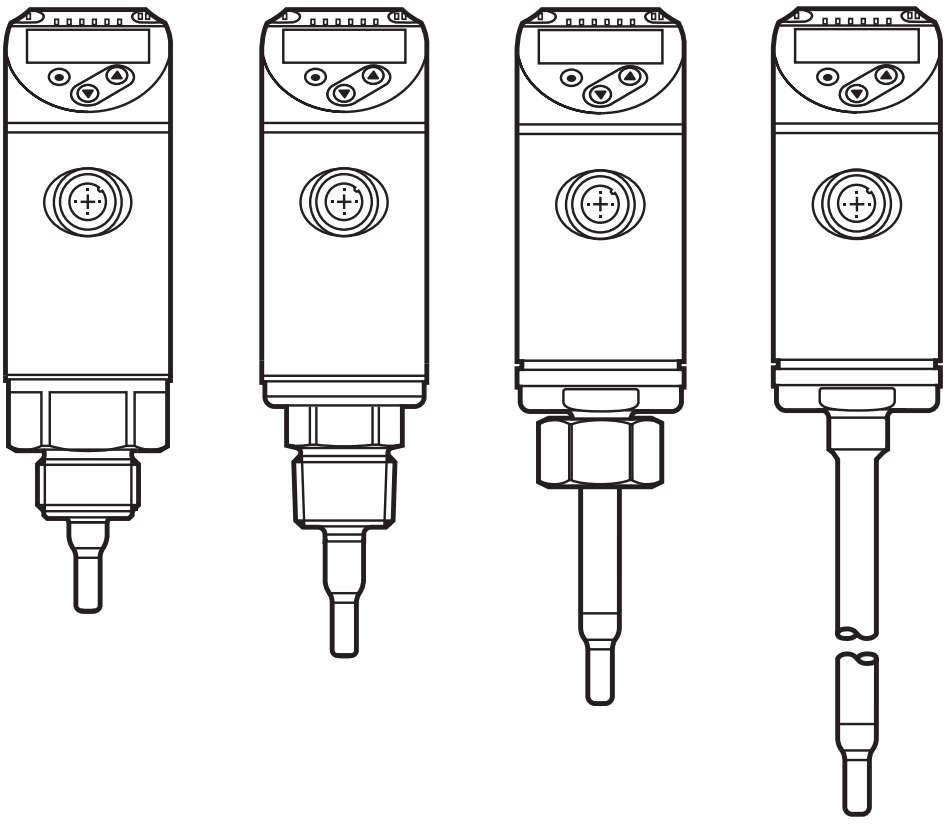
Ranco North America
8115 U.S. Rt. 42 North
Plain City, Ohio 43064

Invensys
An Invensys Company

UK

Operating instructions
Flow sensor

SAxx00
SAxx10
SAxx30
SAxx40



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Contents

1 Preliminary note

Technical data, approvals, accessories and further information at www.ifm.com.

▶ Instructions

> Reaction, result

[…] Designation of keys, buttons or indications

→ Cross-reference

Important note
Non-compliance may result in malfunction or interference.

Information
Supplementary note.

⚠ CAUTION

Warning of personal injury.
Slight reversible injuries may result.

2 Safety instructions

- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ 3 Functions and features).
- Only use the product for permissible media (→ 12 Technical data).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the unit must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

3 Functions and features

The unit monitors liquids and gases.
It detects the process categories flow and medium temperature.

Application area

- Air
- Water
- Glycol solutions (reference medium: 35 % ethylene glycol solution)
- Low-viscosity oils (viscosity: ≤ 40 mm²/s at 40 °C / ≤ 40 cSt at 104 °F)
- High-viscosity oils (viscosity: ≥ 40 mm²/s at 40 °C / ≥ 40 cSt at 104 °F)

Selection of the medium to be monitored → 10.4.3.

This is a class A product.
The unit may cause radio interference in domestic areas.

▶ If required, take appropriate EMC screening measures.

4 Function

- The unit detects flow based on the calorimetric measuring principle.
- The unit also detects the medium temperature.
- It features an IO-Link interface.
- The unit displays the current process value.
  It generates 2 output signals according to the parameter setting:

OUT1/IO-Link: 2 selection options	Parameter setting
- Switching signal for flow limit values	→ 10.2.3
- Frequency signal for flow	→ 10.2.5

OUT2: 7 selection options	Parameter setting
- Switching signal for flow limit values	→ 10.2.4
- Switching signal for temperature limit values	→ 10.3.1
- Analogue signal for flow	→ 10.2.7
- Analogue signal for temperature	→ 10.3.3
- Frequency signal for flow	→ 10.2.6
- Frequency signal for temperature	→ 10.3.2
- Input for external teach signal	→ 10.2.9

4.1 Operating modes (ModE)

The unit provides three selectable operating modes for flow measurement:

Operating mode	Medium	Display unit
REL	Liquids, air	% (of the taught range) → 10.2.8
LIQU	Liquids	m/s, l/min, m3/h (fps, gpm, cfm)
GAS	Air	m/s, l/min, m3/h (fps, gpm, cfm)

The selected operating mode has no effect on the temperature measurement, only absolute values in °C or °F are indicated.

The parameter settings are saved in the respective operating mode, i.e. when the operating mode is changed, the settings are not lost.

If the operating modes LIQU and GAS are selected:

- ▶ Define the medium and the internal pipe diameter (→ 10.2.1).
- ▶ If required, calibrate curve of measured values (→ 10.4.9).

4.2 Select the medium (MEdI)

The unit has characteristic curves for different media. Depending on the operating mode, the following media can be selected in the menu (→ 10.4.3):

Medium	Operating mode		
	REL	LIQU	GAS
H2O	x	x	
OIL1*	x	x	
OIL2**	x	x	
GLYC	x	x	
AIR	x		x

*OIL1:
viscosity ≥ 40 mm²/s at 40 °C / ≥ 40 cSt at 104 °F

**OIL2:
viscosity ≤ 40 mm²/s at 40 °C / ≤ 40 cSt at 104 °F

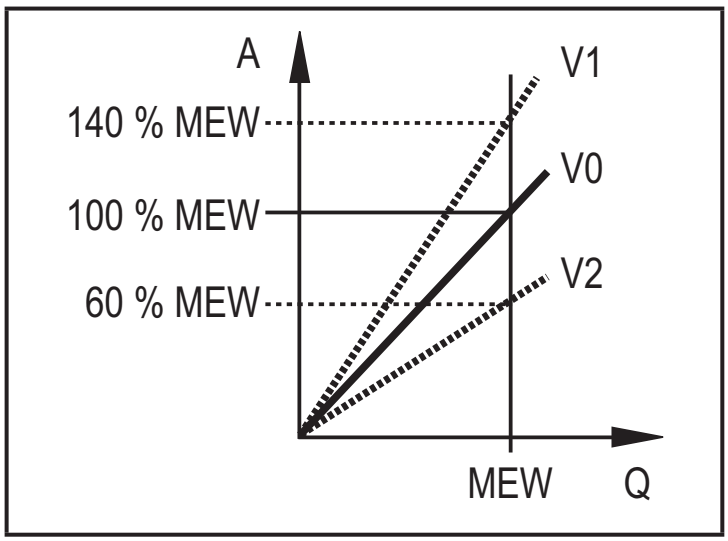
4.3 Define the internal pipe diameter (diA)

In the operating modes LIQU and GAS the internal pipe diameter has to be entered to define the volumetric flow (→ 10.2.2).

4.4 Customer-specific calibration (CGA)

Via the calibration factor CGA the sensor can be adjusted to a reference flow in the application.

The customer-specific calibration allows changing the gradient of the curve of measured values. It influences the display and the outputs.



A = Operating value for display and output signals
Q = Flow
MEW = Final value of the measuring range
V0 = Curve of measured values at factory setting
V1, V2 = Curve of measured values after calibration

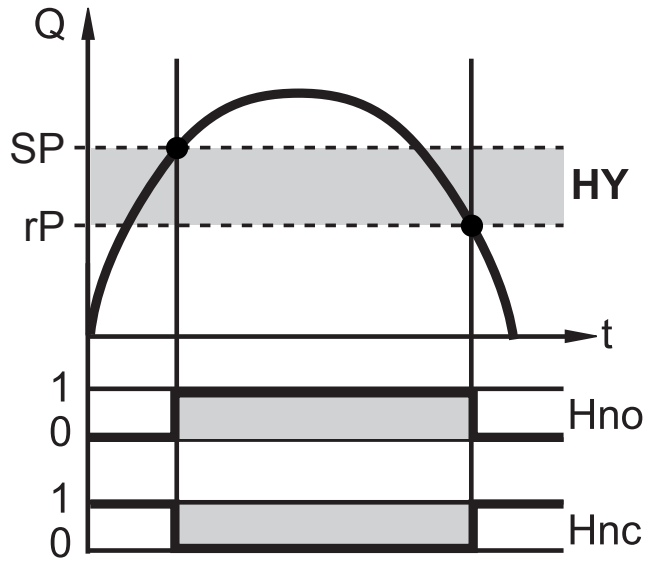
The change in the gradient is indicated in percentage.
Factory setting: CGA = 100 %.
After a change the calibration can be reset to factory setting (→ 10.5.2).

Depending on the set CGA factor, it may not be possible to use the complete measuring range.

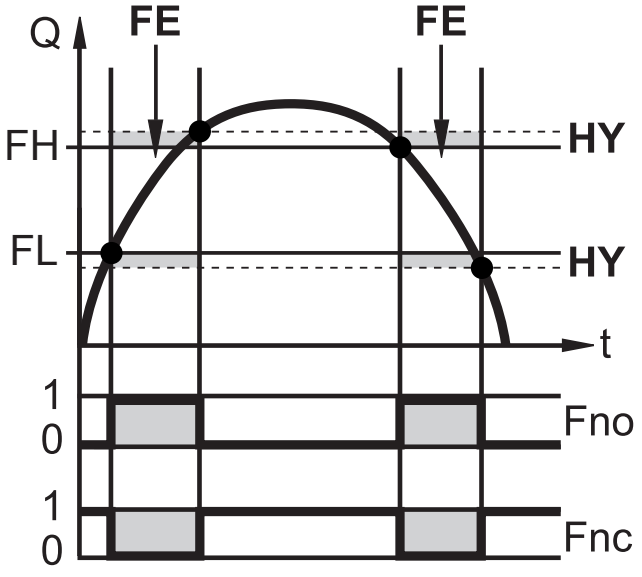
4.5 Switching function

OUTx changes its switching status if it is above or below the set switching limits (flow or temperature). Hysteresis or window function can be selected. Example of flow monitoring:

Hysteresis function



Window function



SP = set point
rP = reset point
HY = hysteresis
Hno = hysteresis NO (normally open)
Hnc = hysteresis NC (normally closed)

FH = upper limit value
FL = lower limit value
FE = window
Fno = window NO (normally open)
Fnc = window NC (normally closed)

When the hysteresis function is set, the set point SP and the reset point rP are defined. The rP value must be lower than the SP value. The distance between SP and rP is at least 4 % of the final value of the measuring range (= hysteresis).
If only the set point is changed, the reset point is changed automatically; the difference remains constant.

When set to the window function the upper limit value FH and the lower limit value FL are defined. The distance between FH and FL is at least 4 % of the final value of the measuring range.FH and FL have a fixed hysteresis of 0.25 % of the final value of the measuring range. This keeps the switching status of the output stable if the flow rate varies slightly.

4.6 Analogue function

The unit provides an analogue signal that is proportional to the flow quantity or the medium temperature.

Within the measuring range the analogue signal is 4...20 mA.

The measuring range is scalable:

- [ASP2] determines at which measured value the output signal is 4 mA.
- [AEP2] determines at which measured value the output signal is 20 mA.

Minimum distance between [ASP2] and [AEP2] = 20 % of the final value of the measuring range.

For flow measurement in the operating mode [ModE] = REL, [ASP2] and [AEP2] are not available. In this operating mode, the characteristic curve of the analogue output is defined by the flow adjustment:
high flow = 20 mA; low flow = 4 mA.

If the measured value is outside the measuring range or in the event of an internal error, the current signals indicated in figure 1 are provided.

For measured values outside the display range or in case of a fault, messages are displayed (UL, OL, Err; → 13).

The analogue signal in case of a fault is adjustable (→ 10.4.8):

- [FOU] = On determines that the analogue signal goes to the upper final value (22 mA) in case of an error.
- [FOU] = OFF determines that the analogue signal goes to the lower final value (3.5 mA) in case of an error.

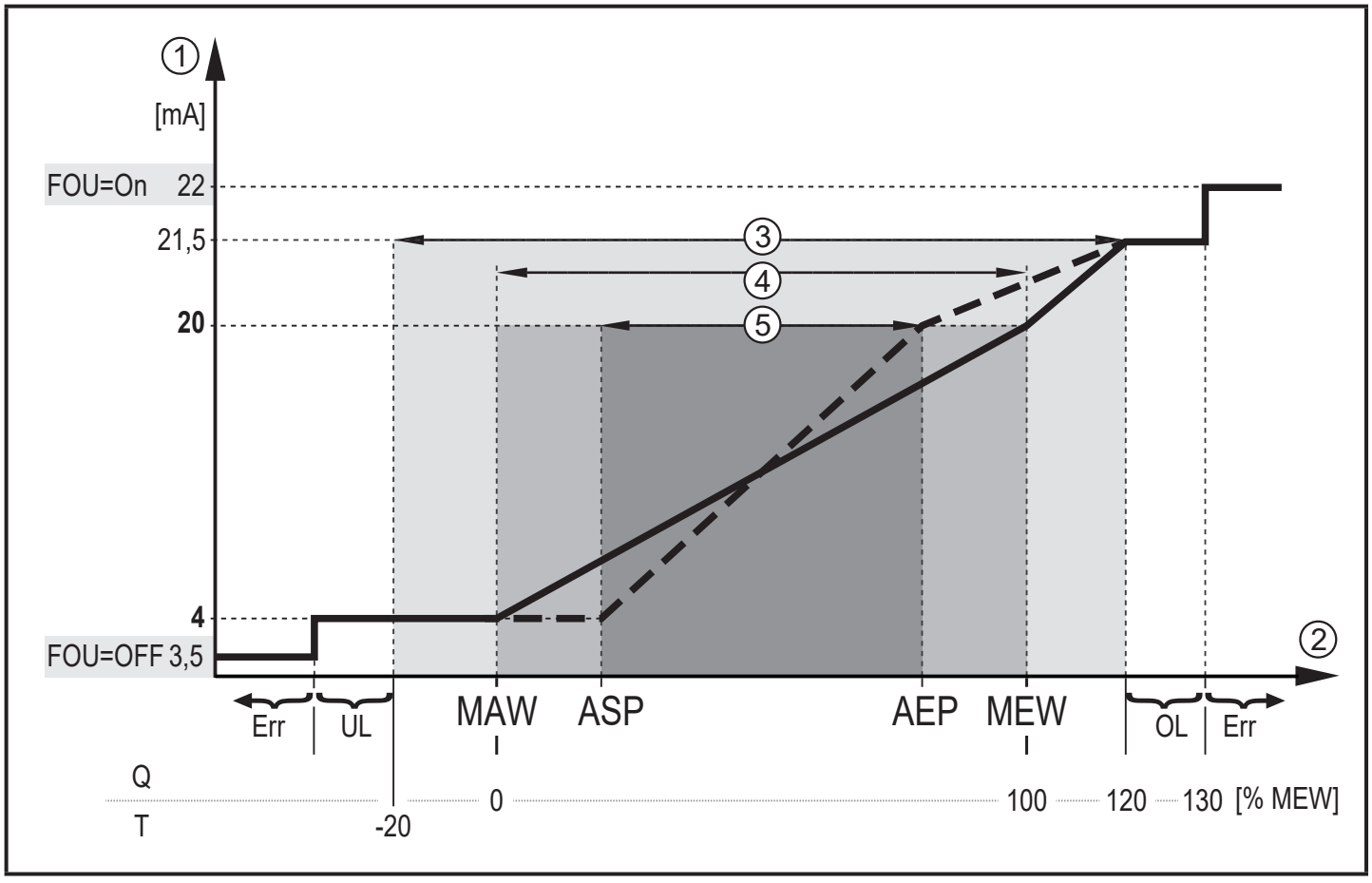


Figure 1: Characteristics of the analogue output according to the standard IEC 60947-5-7.

Q: Volumetric flow
T: Medium temperature
MAW: Initial value of the measuring range for non-scaled measuring range
MEW: Final value of the measuring range for non-scaled measuring range
ASP: Analogue start point with scaled measuring range
AEP: Analogue end point with scaled measuring range
UL: Below the display range
OL: Above the display range
Err: The unit is in the error state

① Analogue signal
② Measured value (flow or temperature)
③ Display range
④ Measuring range
⑤ Scaled measuring range

4.7 Frequency output

The unit provides a frequency signal that is proportional to the volumetric flow and the medium temperature.

Within the measuring range the frequency signal is between 0 and 100 Hz for the factory setting.

The frequency signal is scalable:

- [FrPx] determines the frequency signal in Hz provided when the upper measured value (MEW or FEPx) is reached.

The measuring range is scalable:

- [FSP2] determines the lower temperature value from which a frequency signal is provided.

  FSP2 is not adjustable for flow measurement.

- [FEPx] determines at which measured value the frequency signal is FrPx.

  FEPx is not available for flow measurement in the operating mode [ModE] = REL.

Minimum distance between [FSP2] and [FEP2] = 20 % MEW.

If the measured value is outside the measuring range or in the event of an internal error, the frequency signals indicated in figure 2 are provided.

For measured values outside the display range or in case of a fault, messages are displayed (UL, OL, Err; → 13).

The frequency signal in case of a fault is adjustable (→ 10.4.8):

- [FOU] = On determines that the frequency signal goes to the upper final value (130 % FrPx) in case of an error.
- [FOU] = OFF determines that the frequency signal is 0 Hz in case of an error.

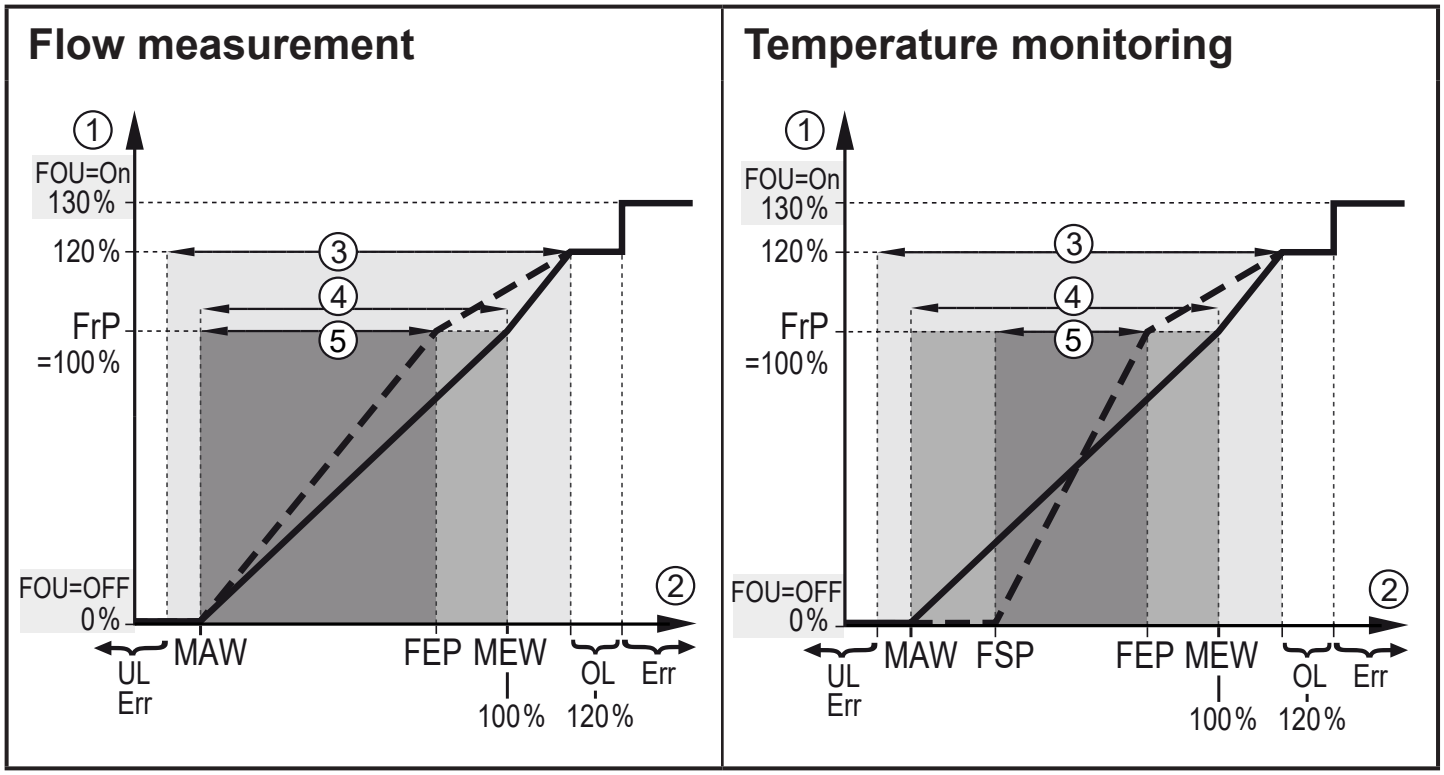


Figure 2: Output curve frequency output

MAW: Initial value of the measuring range for non-scaled measuring range
MEW: Final value of the measuring range for non-scaled measuring range
FSP: Frequency start point with scaled measuring range (only temperature)
FEP: Frequency end point with scaled measuring range
FrP: Frequency signal for upper measured value
OL: Above the display range
Err: The unit is in the error state

① Frequency signal (FrP at factory setting = 100 Hz)
② Measured value (flow or temperature in % MEW)
③ Display range
④ Measuring range
⑤ Scaled measuring range

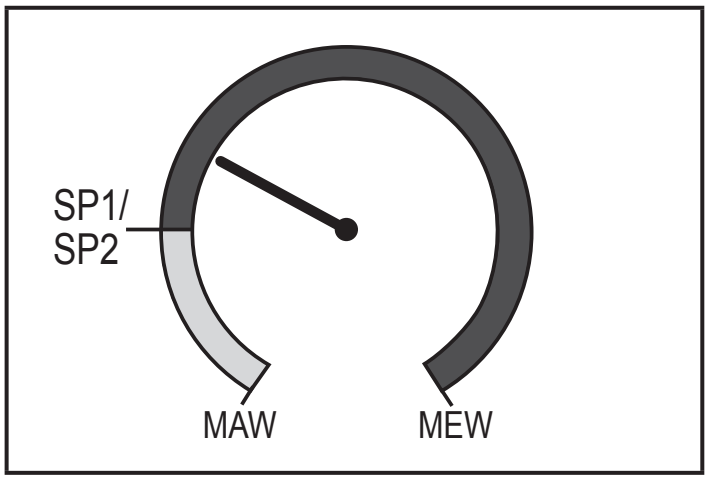
4.8 Measured value damping (dAP)

The damping time enables setting how many seconds after the output signal has reached 63 % of the final value if the flow value changes suddenly. The set damping time stabilises the outputs, the display and the process value transfer via the IO-Link interface. The signals [UL] and [OL] (→ 13 Troubleshooting) are defined under consideration of the damping time.

4.9 Colour change display (coLr)

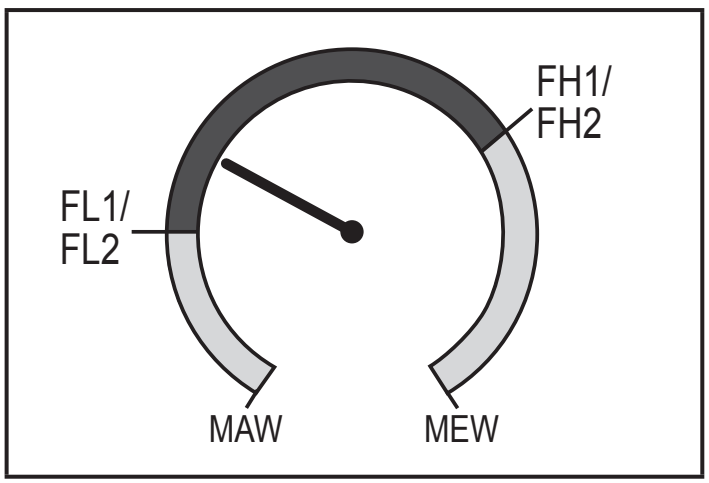
The colour of the characters in the display can be set via the parameter [coLr] (→ 10.4.4). With the set parameters rED (red) and GrEn (green), the display is permanently set to one colour. If the parameters rxou and Gxou are set, the colour of the characters changes depending on the process value:

	OUT1	OUT2	Colour change to ...
Parameter settings	r1ou	r2ou	red
	G1ou	G2ou	green



Hysteresis function:

Colour change if process value is above the set point



Window function:

Colour change if process value is within the window range

MAW = initial value of the measuring range, MEW = final value of the measuring range

4.10 IO-Link

This unit has an IO-Link communication interface which enables direct access to process and diagnostic data. In addition it is possible to set the parameters of the unit during operation. Operation of the unit via IO-Link interface requires an IO-Link capable module (IO-Link master).

With a PC, suitable IO-Link software and an IO-Link adapter cable communication is possible when the system is not in operation.

The IODDs necessary for the configuration of the unit, detailed information about process data structure, diagnostic information, parameter addresses and the necessary information about the required IO-Link hardware and software can be found at www.ifm.com.

4.10.1 IO-Link process values

The process values for flow and temperature are transmitted via IO-Link in the following units of measurement:

Operating mode	Unit of the transmitted process values			
	SAxx00, SAxx30, SAxx40		SAxx10	
REL	%	°C	%	°F
LIQU	m/s	°C	fps	°F
GAS	m/s	°C	fps	°F

A change of [uni] does not affect the IO-Link process values.

More information → IO Device Description at www.ifm.com.

5 Mounting

⚠ CAUTION

For medium temperatures above 50 °C (122 °F) some parts of the housing can heat up to over 65 °C (149 °F).

> Risk of burns.

▶ Protect the housing against contact with flammable substances and unintentional contact.

▶ Ensure that the system is free of pressure during installation.
▶ Ensure that no media can leak at the mounting location during installation.

Using process adapters the unit can be adapted to different process connections. Adapters have to be ordered separately as accessories.

- Information about the available mounting accessories at www.ifm.com.

- A correct fit of the unit and ingress resistance of the connection are only ensured using ifm adapters.

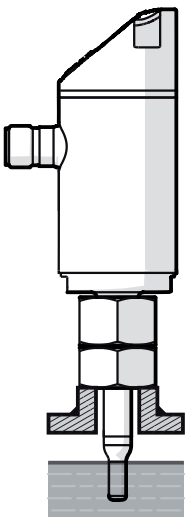
▶ Observe the instructions of the mounting accessories.

▶ Use a lubricating paste which is suitable and approved for the application. Grease the threads of the process connection, adapter and sensor. Ensure no grease is applied to the sensor tip.

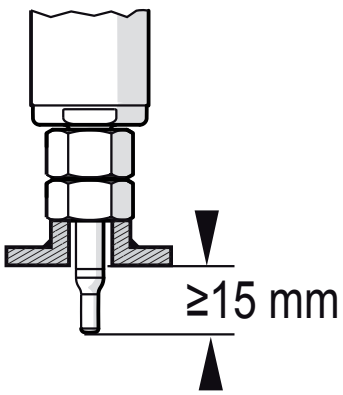
▶ Take the tightening torques of sensor and fixing elements into account. The following tightening torques apply to ifm sensors:
Types M18 x 1.5 and G1/2: 25 Nm
Types 1/2" NPT: 100 Nm

5.1 Installation position

General



The sensor tip must be completely surrounded by the medium.



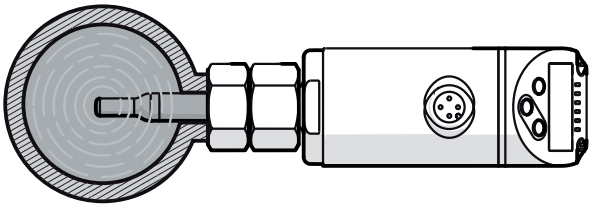
Internal pipe diameter (diA)	Immersion depth
< 120 mm	~ 15 mm
≥ 120 mm	~ ⅛ diA

Table 1: Immersion depth of the probe

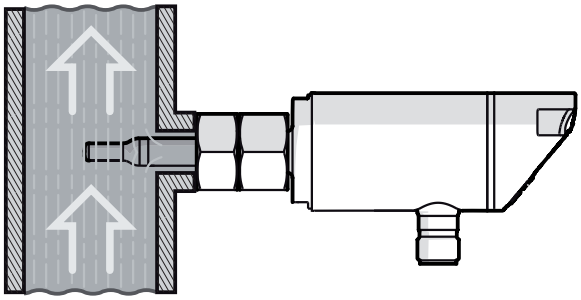
For strong leverage on the measuring probe, e.g. due to high-viscosity or strongly flowing media:

▶ Do not exceed the immersion depth indicated in table 1.

Recommended

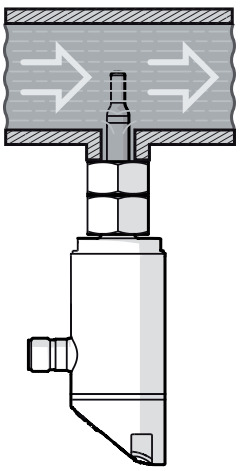


For horizontal pipes: mounting from the side.

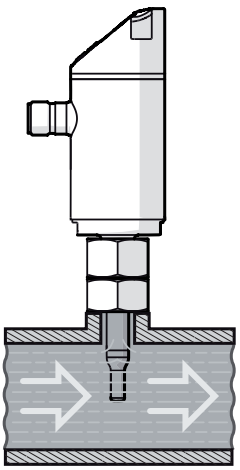


For vertical pipes:
mounting in the rising pipe.

Conditionally possible

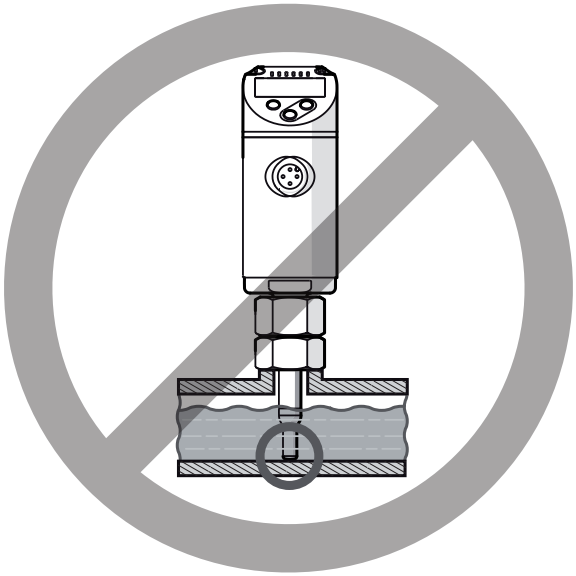


Horizontal pipe /mounting from the bottom: if the pipe is free from build-up.

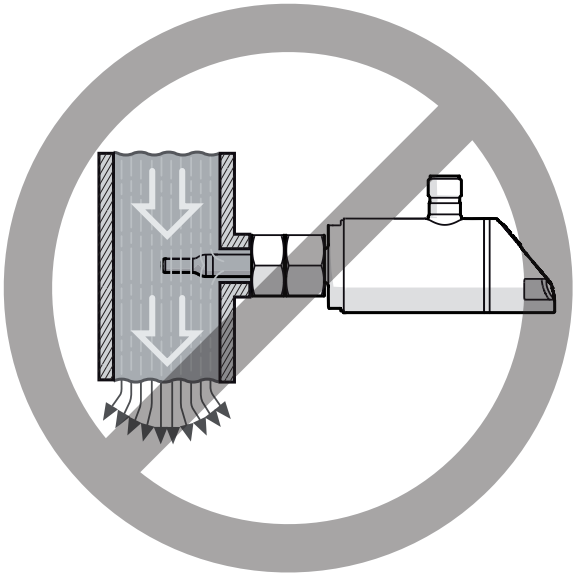


Horizontal pipe /mounting from the top: if the pipe is completely filled with medium.

Not allowed



The sensor tip must not be in contact with the pipe wall.

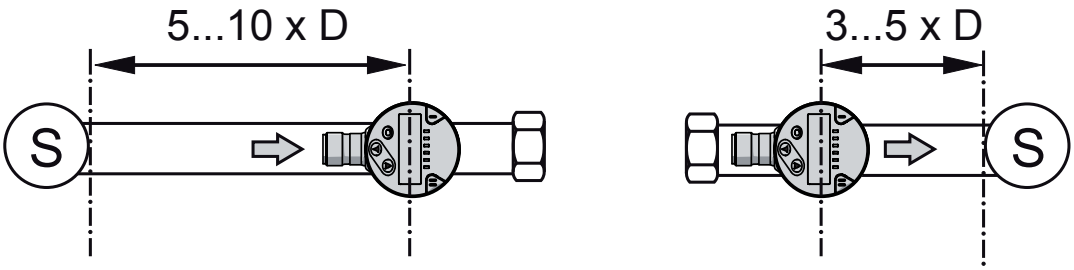


Do not mount in downpipes that are open at the bottom.

5.2 Interference in the pipe system

Components integrated in the pipes, bends, valves, reductions, etc. lead to turbulence of the medium. This affects the function of the unit.

► Adhere to the distances between sensor and sources of interference:

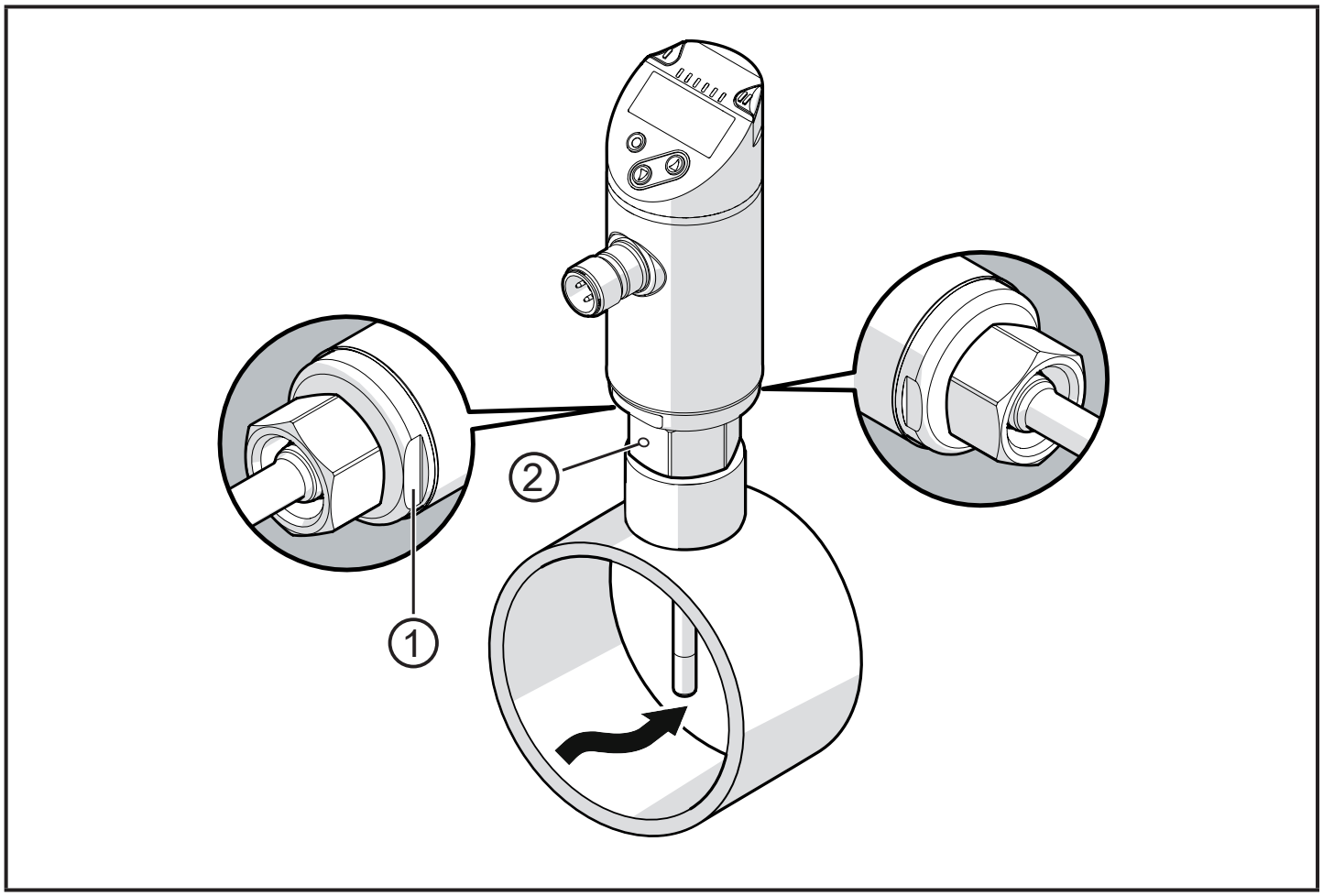


D = pipe diameter; S = sources of interference

5.3 Alignment

▶ To achieve the optimum measuring accuracy: mount the sensor in a way that the flow goes to the larger of the two key surfaces (1).

On units with an external thread, a bore hole in the key surface (2) indicates the flow direction.



For easier readability of the display the sensor housing can be rotated by 345° with regard to the process connection.

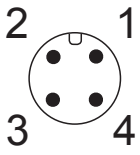
Do not go beyond the end stop.

6 Electrical connection

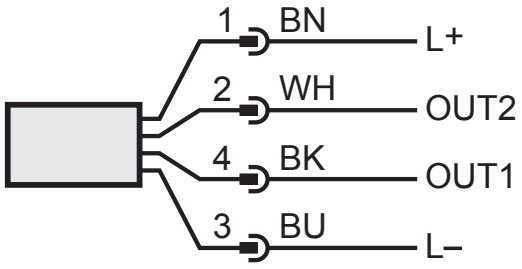
The unit must be connected by a qualified electrician.
The national and international regulations for the installation of electrical equipment must be adhered to.
Voltage supply according to EN 50178, SELV, PELV.

▶ Disconnect power.

▶ Connect the unit as follows:



BK: black
BN: brown
BU: blue
WH: white

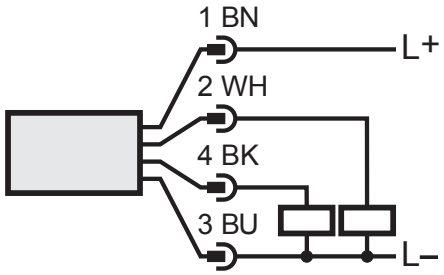


Colours to DIN EN 60947-5-2

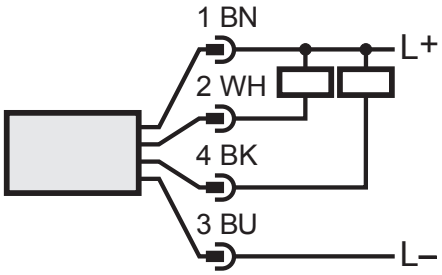
UK

Sample circuits:

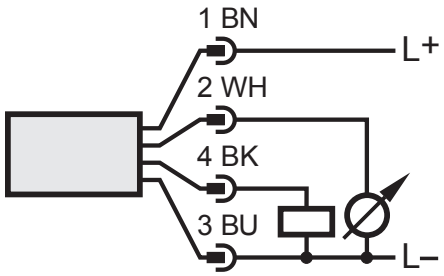
2 x positive switching



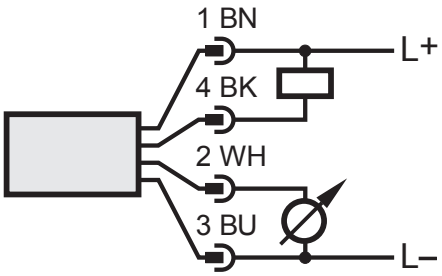
2 x negative switching



1 x positive switching / 1 x analogue

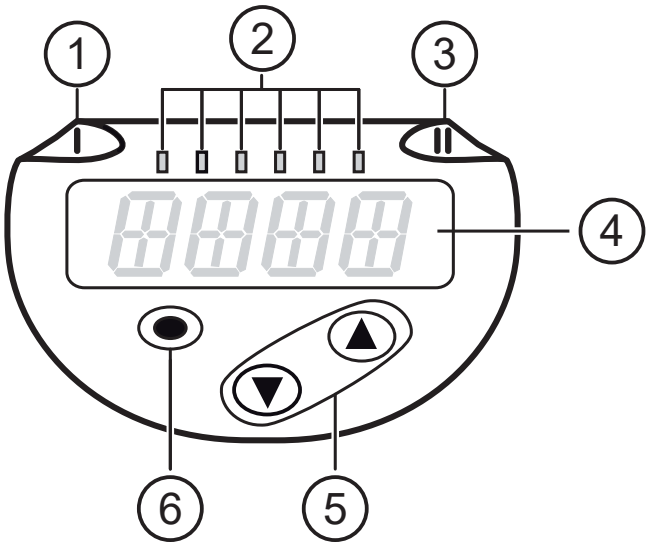


1 x negative switching / 1 x analogue



Pin 1	L+
Pin 3	L-
Pin 4 (OUT1)	• Switching signal: limit flow value • Frequency signal for flow • IO-Link
Pin 2 (OUT2)	• Switching signal: limit flow value • Switching signal: limits for temperature • Analogue signal for flow • Analogue signal for temperature • Frequency signal for flow • Frequency signal for temperature • Input for external teach signal (remote calibration)

7 Operating and display elements



1, 2, 3: Indicator LEDs

- LED 1 = switching status OUT1 (lights if output 1 is switched)
- LED 2 = process value in the indicated unit of measurement:

SAxx00 SAxx30 SAxx40	%, m/s, l/min, m3/h, °C, 10^3
SAxx10	%, fps, gpm, cfm, °F, 10^3

- LED 3 = switching status OUT2 (lights if output 2 is switched)

4: Alphanumeric display, 4 digits

- Indication of the current process values in red or green characters → 4.9.
- Display of the parameters and parameter values

5: Buttons up [▲] and down [▼]

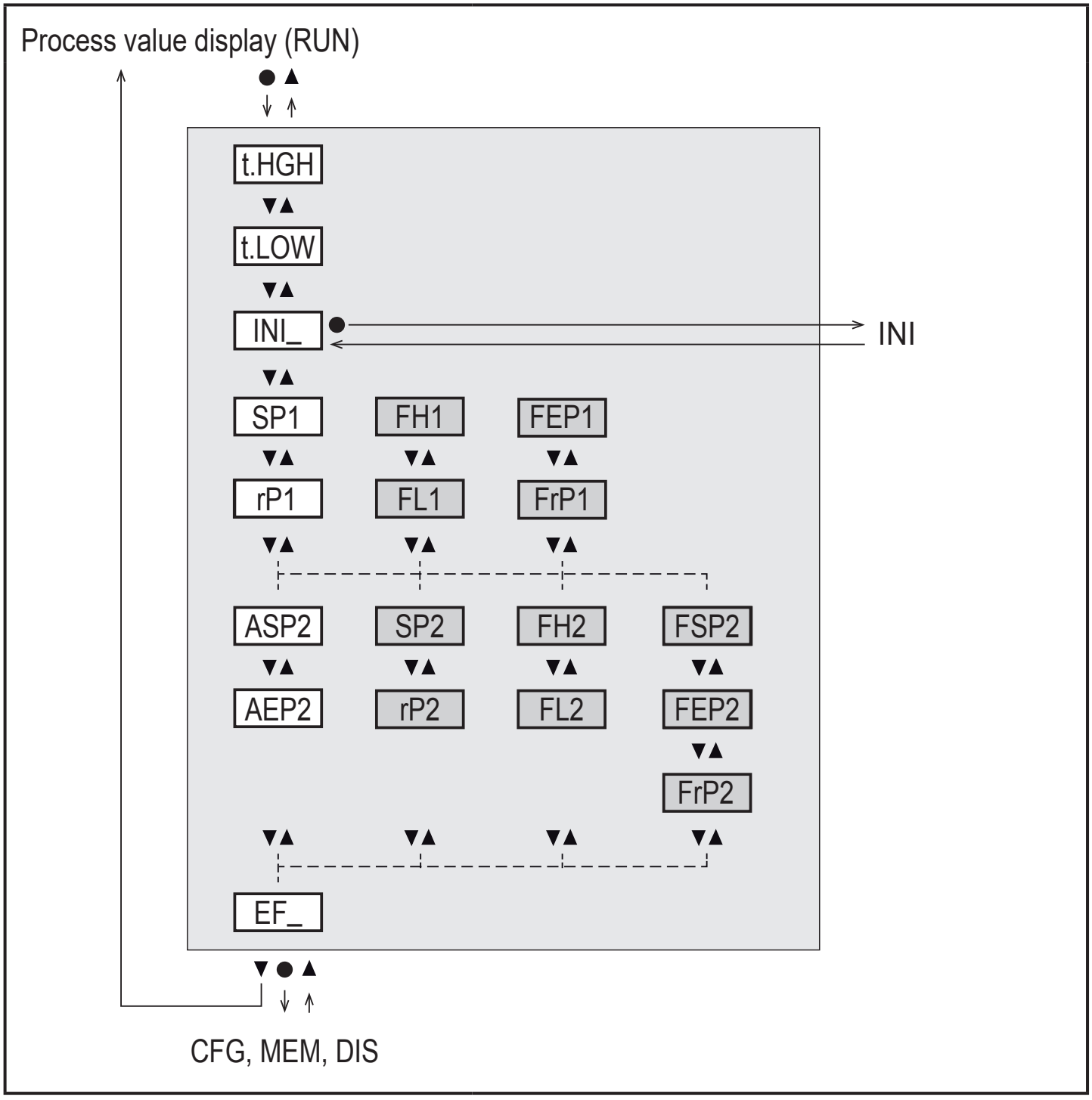
- Select parameter
- Change parameter value (hold button pressed)
- Change of the display unit in the normal operating mode (Run mode)
- Lock / Unlock (buttons pressed simultaneously > 10 seconds)

6: Button [●] = Enter

- Change from the RUN mode to the main menu
- Change to the setting mode
- Acknowledge the set parameter value

8 Menu

8.1 Main menu



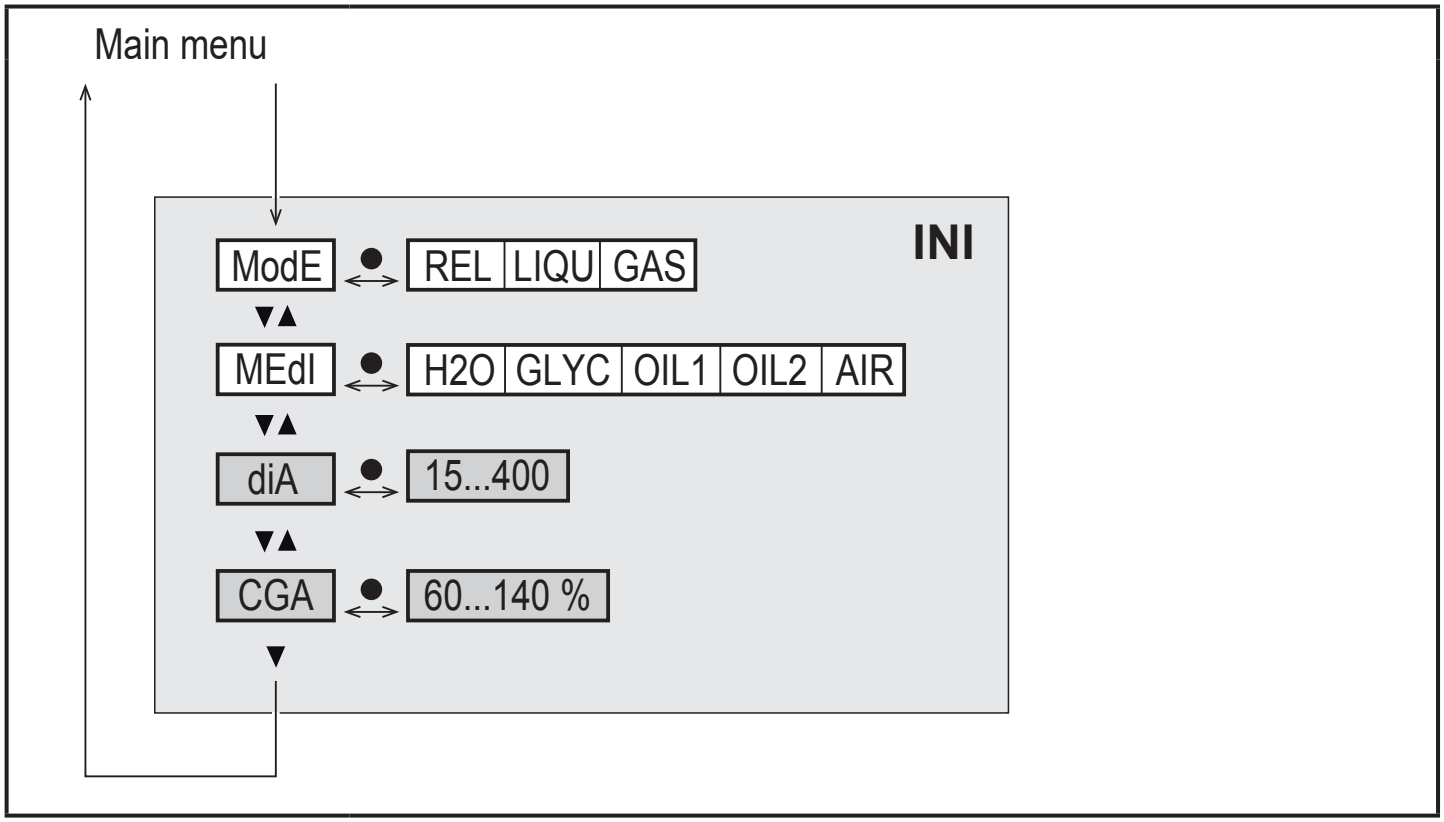
Parameters with white background are indicated in case of factory setting (→ 15).

Parameters with grey background are indicated depending on the operating mode [ModE] and output functions [ou1] and [ou2].

Explanation main menu

t.HGH	Flow adjustment to maximum value (high teach) = 100 % flow with the operating mode REL.
t.LOW	Flow adjustment to minimum value (low teach) = 0 % flow with the operating mode REL.
INI	Opening of the initialisation menu.
EF	Extended functions. Opening of the lower menu level.
Switching output with hysteresis function:	
SP1	Set point OUT1.
rP1	Reset point OUT1.
SP2	Set point OUT2.
rP2	Reset point OUT2.
Switching output with window function:	
FH1	Upper limit for window OUT1.
FL1	Lower limit for window OUT1.
FH2	Upper limit for window OUT2.
FL2	Lower limit for window OUT2.
Frequency output:	
FEP1	End point for flow OUT1.
FrP1	Frequency at the end point (FEP1) OUT1.
FEP2	End point for flow or temperature OUT2.
FrP2	Frequency at the end point (FEP2) OUT2.
FSP2	Start point for temperature OUT2, only for SEL2 = TEMP.
Analogue output:	
ASP2	Analogue start point at OUT2 = flow or temperature value at which the output signal is 4 mA.
AEP2	Analogue end point at OUT2 = flow or temperature value at which the output signal is 20 mA.

8.2 Initialisation menu (INI)



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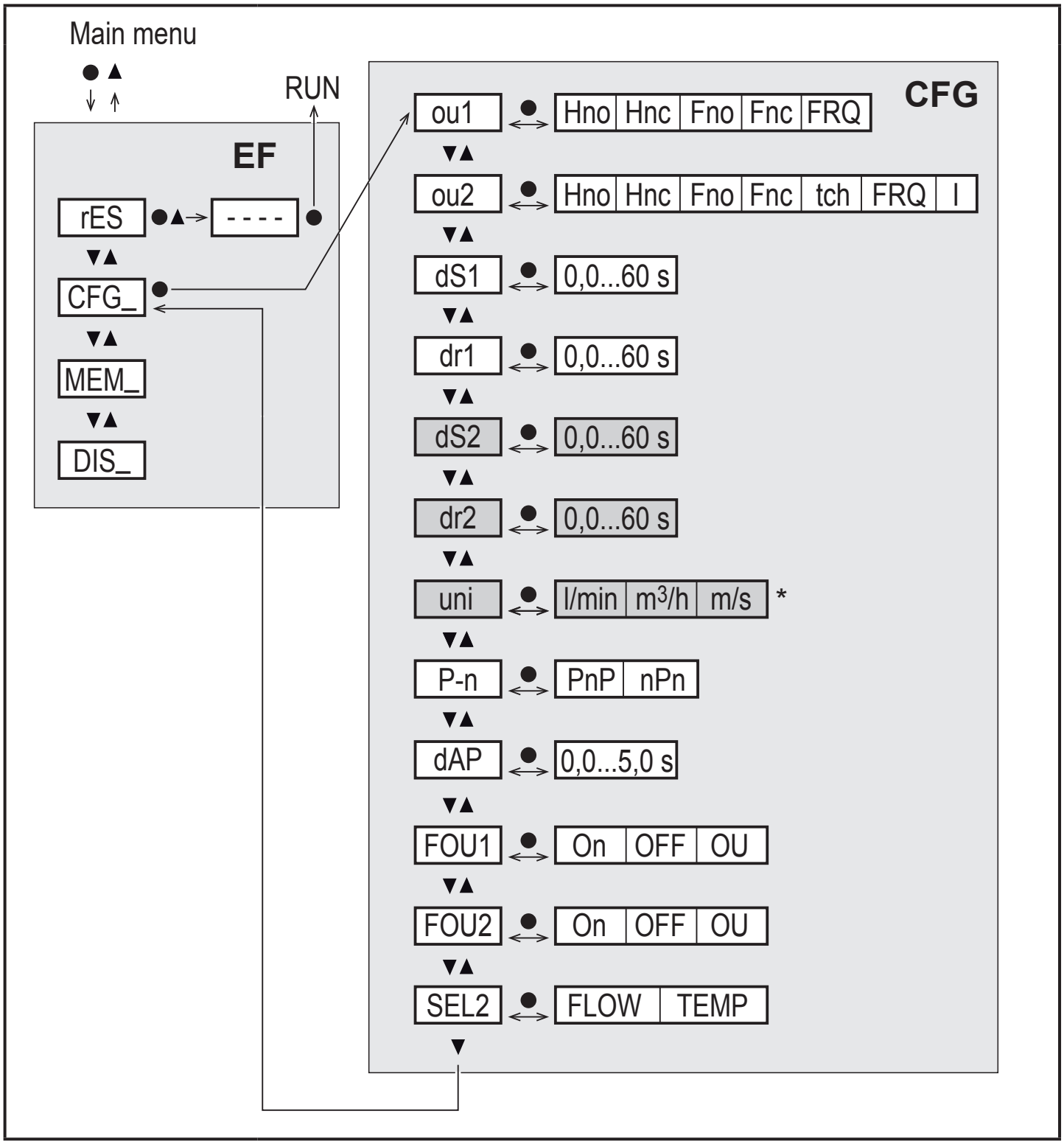
Parameters with white background are indicated in case of factory setting (→ 15).

Parameters with grey background are displayed depending on the operating mode [ModE].

Explanation initialisation menu (INI)

ModE	Selection of the operating mode for flow measurement: REL = Display of relative process values (liquids or air) LIQU = Display of absolute process values (liquids) GAS = Display of absolute process values (air)
MEdI	Medium selection
diA	Setting the internal pipe diameter in mm or inch.
CGA	Calibration of the measurement graph (pitch)

8.3 Extended functions (EF) – Basic settings (CFG)



* for SAxx10 units: cfm / gpm / fps

Parameters with white background are indicated in case of factory setting (→ 15).

Parameters with grey background are indicated depending on the operating mode [ModE] and output functions [ou1] and [ou2].

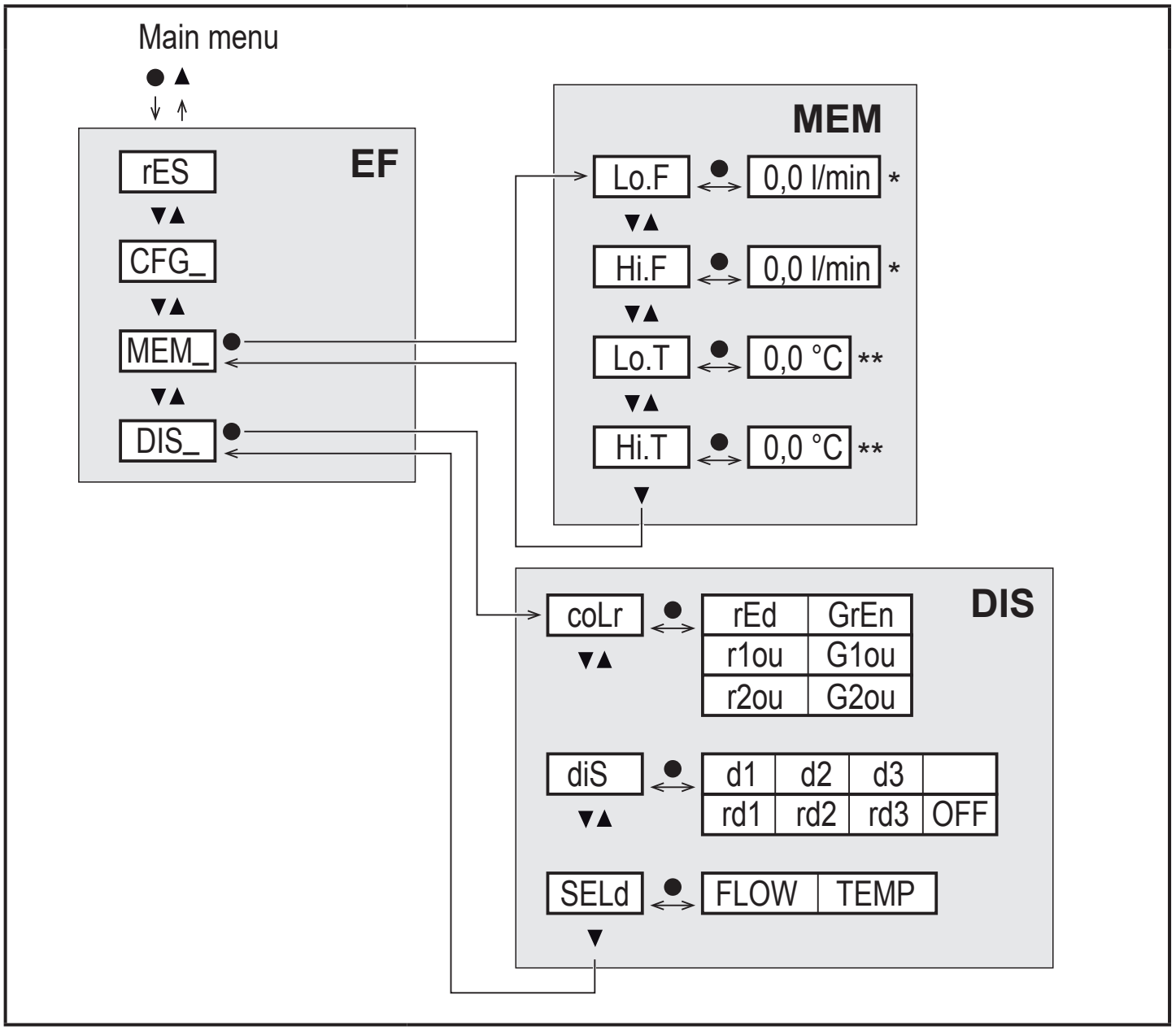
Explanation extended functions (EF)

rES	Restore factory setting
CFG	Submenu basic settings
MEM	Submenu min/max memory
DIS	Submenu display settings

Explanation basic settings (CFG)

ou1 / ou2	Output functions OUT1 / OUT2 Hno = Hysteresis function normally open Hnc = Hysteresis function normally closed Fno = Window function normally open Fnc = Window function normally closed FRQ = Frequency output I = Analogue signal 4...20 mA. tch = Input for external teach signal
dS1 / dS2	Switch-on delay on OUT1 / OUT2
dr1 / dr2	Switch-off delay on OUT1 / OUT2
uni	Standard unit of measurement for flow
P-n	Output logic: pnp / npn
dAP	Measured value damping (only for flow)
FOU1 / FOU2	Behaviour of output OUT1 / OUT2 in case of an error
SEL2	Standard unit of measurement for evaluation via OUT2

8.4 Min/Max memory (MEM) – Display (DIS)



* measured value in the standard unit of measurement for SAxx10 units: cfm / gpm / fps
** for SAxx10 units: °F

Explanation min/max memory (MEM)

Lo.F	Min. value of the flow measured in the process
Hi.F	Max. value of the flow measured in the process
Lo.T	Min. value of the temperature measured in the process
Hi.T	Max. value of the temperature measured in the process

Explanation display settings (DIS)

coLr	Colour configuration of the display rEd = Display always red GrEn = Display always green r1ou = Display red in case of switched output OUT1 G1ou = Display green in case of switched output OUT1 r2ou = Display red in case of switched output OUT2 G2ou = Display green in case of switched output OUT2
diS	Update rate and orientation of the display d1 = update of the measured values every 50 ms. d2 = update of the measured values every 200 ms. d3 = update of the measured values every 600 ms. rd1, rd2, rd3 = display as for d1, d2, d3; rotated by 180°. OFF = the measured value display is deactivated in the Run mode.
SELd	Standard display: flow or medium temperature

9 Set-up

After power on and expiry of the power-on delay time, the unit is in the normal operating mode. It carries out its measurement and evaluation functions and generates output signals according to the set parameters.

During the start up delay time the outputs are switched as programmed:

- ON with normally open function (Hno / Fno)
- OFF with normally closed function (Hnc / Fnc)
- OFF for frequency output (FRQ)
- 20 mA for current output (I)

10 Parameter setting

⚠ CAUTION

For medium temperatures above 50 °C (122 °F) some parts of the housing can heat up to over 65 °C (149 °F).

> Risk of burns.

▶ Do not touch the device with your hands.

▶ Use another object (e.g. a ballpoint pen) to carry out settings on the unit.

Parameters can be set before installation or during operation.

If you change parameters during operation, this will influence the function of the plant.

▶ Ensure that there will be no malfunctions in your plant.

During parameter setting the unit remains in the operating mode. It continues to monitor with the existing parameter until the parameter setting has been completed.

The parameters can also be set via the IO-Link interface (→ 4.10).

10.1 Parameter setting in general

1. Change from the RUN mode to the main menu	[●]
2. Select the requested parameter	[▲] or [▼]
3. Change to the setting mode	[●]
4. Change the parameter value	[▲] or [▼] > 1 s
5. Acknowledge the set parameter value	[●]
6. Return to the RUN mode	> 30 seconds (timeout) or press [▲] + [▼] simultaneously until the RUN mode is reached.

By pressing [▲] + [▼] simultaneously you exit the setting mode without saving the changed parameter.

10.1.1 Switch between the menus

1. Change from the RUN mode to the main menu	[●]
2. Select the parameter EF	[▼]
3. Change to sub-menu EF	[●]
4. Select the parameters CFG, MEM, DIS	[▼]
5. Change to the sub-menus CFG, MEM, DIS	[●]
6. Return to the next higher menu level	Press [▲] + [▼] simultaneously

10.1.2 Change to the process value display (RUN mode)

There are 3 possibilities:

I.	Wait for 30 seconds (→ 10.1.4 Timeout).
II.	Press [▲] until the RUN mode is reached.
III.	Press [▲] + [▼] simultaneously until the RUN mode is reached.

10.1.3 Locking / Unlocking

The unit can be locked electronically to prevent unintentional settings.
On delivery: not locked.

Locking	▶ Make sure that the unit is in the normal operating mode. ▶ Press [▲] and [▼] simultaneously for 10 s until [Loc] is displayed.
Unlocking	▶ Make sure that the unit is in the normal operating mode. ▶ Press [▲] and [▼] simultaneously for 10 s until [uLoc] is displayed.

10.1.4 Timeout

If no button is pressed for 30 s during parameter setting, the unit returns to the operating mode with unchanged values.

10.2 Settings for volumetric flow monitoring

▶ Select the operating mode [ModE] first before doing all the other settings (→ 10.2.1).

For the operating modes GAS and LIQU, the flow values are set in the unit defined in [uni].

▶ If necessary, change the unit before setting the flow values.

For the operating mode REL the unit % is always used.

10.2.1 Define the operating mode

▶ Select [ModE] and define the operating mode: REL, GAS, LIQU.

A medium and an internal pipe diameter must be entered for the operating modes LIQU and GAS.
When the factory setting is changed (ModE = REL), the unit displays [≡≡≡≡] to force these entries:

▶ Press [●].
> [MEdI] is displayed.
▶ Define the medium.
> [diA] is displayed.
▶ Define the internal pipe diameter in mm or inch.

The operating mode REL requires a flow adjustment → 10.2.8.

A change of the operating mode leads to a restart of the unit.
The settings are saved in the respective operating mode, i.e. after a change of the operating mode the settings are not lost.

Menu INI: [ModE]

10.2.2 Define the internal pipe diameter

▶ Select [diA] and define the internal pipe diameter:

SAxx00 SAxx30 SAxx40	15...400 mm
SAxx10	0.6...16 inch

[diA] is only available if the operating mode GAS or LIQU is selected.

Menu INI: [diA]

10.2.3 Configure the limit value monitoring for flow for OUT1

▶ Select [ou1] and set the switching function: Hno, Hnc, Fno or Fnc 1. When the hysteresis function is selected: ▶ Select [SP1] and set the value at which the output is set. ▶ Select [rP1] and set the value at which the output is reset. 2. When the window function is selected: ▶ Select [FH1] and set the upper limit value of the window. ▶ Select [FL1] and set the lower limit value of the window.	Menu CFG: [ou1] Main menu: [SP1] [rP1] [FH1] [FL1]

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10.2.4 Configure the limit value monitoring for flow for OUT2

▶ Select [SEL2] and set FLOW. ▶ Select [ou2] and set the switching function: Hno, Hnc, Fno or Fnc 1. When the hysteresis function is selected: ▶ Select [SP2] and set the value at which the output switches. ▶ Select [rP2] and set the value at which the output is reset. 2. When the window function is selected: ▶ Select [FH2] and set the upper limit value of the window. ▶ Select [FL2] and set the lower limit value of the window.	Menu CFG: [SEL2] [ou2] Main menu: [SP2] [rP2] [FH2] [FL2]

10.2.5 Configure the frequency signal for flow for OUT1

▶ Select [ou1] and set FRQ. ▶ Select [FEP1] and set the flow value at which the frequency set in FrP1 is provided. ▶ Select [FrP1] and set the frequency: 100 Hz...1000 Hz. [FEP1] is only available if the operating mode GAS or LIQU is selected.	Menu CFG: [ou1] Main menu: [FEP1] [FrP1]

10.2.6 Configure the frequency signal for flow for OUT2

▶ Select [SEL2] and set FLOW. ▶ Select [ou2] and set FRQ. ▶ Select [FEP2] and set the upper flow value at which the frequency set in FrP2 is provided. ▶ Select [FrP2] and set the frequency: 100 Hz...1000 Hz. [FEP2] is only available if the operating mode GAS or LIQU is selected.	Menu CFG: [SEL2] [ou2] Main menu: [FEP2] [FrP2]

10.2.7 Configure the analogue output for flow for OUT2

▶ Select [SEL2] and set FLOW. ▶ Select [ou2] and set the function: I = flow-proportional current signal 4…20 mA ▶ Select [ASP2] and set the flow value at which the output signal is 4 mA. ▶ Select [AEP2] and set the flow value at which the output signal is 20 mA. [ASP2] and [AEP2] are only available if the operating mode GAS or LIQU is selected.	Menu CFG: [SEL2] [ou2] Main menu: [ASP2] [AEP2]

10.2.8 Carry out the flow adjustment

1. High-flow adjustment: ▶ Switch on the supply voltage. ▶ Activate the maximum flow in the installation. ▶ Select [t.HGH] and press [●]. > [tch] is displayed. ▶ Keep [▲] or [▼] pressed. > [----] is displayed. ▶ Briefly press [●]. > Display [donE]: adjustment successful. Display [FAIL]: Repeat the adjustment. > The unit defines the existing flow as maximum flow (final value of the measuring range = 100 %). ▶ Briefly press [●]. 2. Low-flow adjustment: ▶ Switch on the supply voltage. ▶ Activate the minimum flow in the installation. ▶ Select [t.LOW] and press [●]. > [tch] is displayed. ▶ Keep [▲] or [▼] pressed. > [----] is displayed. ▶ Briefly press [●]. > Display [donE]: adjustment successful. Display [FAIL]: Repeat the adjustment. > The unit defines the existing flow as minimum flow (0 %). ▶ Briefly press [●]. [t.HGH] and [t.LOW] are only available if the operating mode REL is selected.	Main menu: [t.HGH] [t.LOW]

10.2.9 Carry out the remote calibration

▶ Select [ou2] and set [tch]. 1. High-flow adjustment: ▶ Apply the operating voltage to pin 2 for 5 to 10 s. 2. Low-flow adjustment: ▶ Apply the operating voltage to pin 2 for 10 to 15 s. > OUT2 high for 2 s: adjustment successful. > OUT2 high for 1 s: adjustment failed. ▶ Repeat the adjustment.	Menu CFG: [ou2]

10.3 Settings for temperature monitoring

10.3.1 Configure the limit value monitoring for temperature for OUT2

▶ Select [SEL2] and set TEMP. ▶ Select [ou2] and set the switching function: Hno, Hnc, Fno or Fnc 1. When the hysteresis function is selected: ▶ Select [SP2] and set the value at which the output switches. ▶ Select [rP2] and set the value at which the output is reset. 2. When the window function is selected: ▶ Select [FH2] and set the upper limit value of the window. ▶ Select [FL2] and set the lower limit value of the window.	Menu CFG: [SEL2] [ou2] Main menu: [SP2] [rP2] [FH2] [FL2]

10.3.2 Configure the frequency signal for temperature for OUT2

▶ Select [SEL2] and set TEMP. ▶ Select [ou2] and set FRQ. ▶ Select [FSP2] and set the lower temperature value at which 0 Hz is provided. ▶ Select [FEP2] and set the upper temperature value at which the frequency set in FrP2 is provided. ▶ Select [FrP2] and set the frequency: 100 Hz...1000 Hz.	Menu CFG: [SEL2] [ou2] Main menu: [FSP2] [FEP2] [FrP2]

10.3.3 Configure the analogue output for temperature for OUT2

▶ Select [SEL2] and set TEMP. ▶ Select [ou2] and set the function: I = temperature-proportional current signal 4…20 mA ▶ Select [ASP2] and set the temperature value at which the output signal is 4 mA. ▶ Select [AEP2] and set the temperature value at which the output signal is 20 mA.	Menu CFG: [SEL2] [ou2] Main menu: [ASP2] [AEP2]

10.4 User settings (optional)

10.4.1 Configuration of the standard display

▶ Select [SELd] and determine the standard unit of measurement: - FLOW = the current flow in the standard measuring unit is displayed. - TEMP = the current medium temperature in °C (SAxx10: °F) is displayed. ▶ Select [diS] and set the update rate and orientation of the display: - d1, d2, d3: update of the measured values every 50, 200, 600 ms. - rd1, rd2, rd3: display as for d1, d2, d3; rotated by 180°. - OFF = the measured value display is deactivated in the Run mode. The LEDs remain active even if the display is deactivated. Error messages are displayed even if the display is deactivated.	Menu DIS: [SELd] [diS]

10.4.2 Set the standard unit of measurement for flow

▶ Select [uni] and set the unit of measurement: SAxx00 SAxx30 SAxx40 — l/min, m3/h, m/s SAxx10 — cfm, gpm, fps [uni] is only available if the operating mode GAS or LIQU is selected. For the operating mode REL the flow value is always displayed in % of the measuring range.	Menu CFG: [uni]

10.4.3 Select the medium

▶ Select [MEdI] and define the medium to be monitored: H2O, OIL1*, OIL2**, GLYC, AIR. Depending on the operating mode different media are available (→ 4.2). *OIL1 = high-viscosity oil (≥ 40 mm²/s at 40 °C / ≥ 40 cSt at 104 °F) **OIL2 = low-viscosity oil (≤ 40 mm²/s at 40 °C / ≤ 40 cSt at 104 °F)	Menu INI: [MEdI]

10.4.4 Configure colour change display

▶ Select [coLr] and define the colour of the process value display: rEd, GrEn, r1ou, r2ou, G1ou, G2ou (→ 4.9).	Menu DIS: [coLr]

10.4.5 Setting the output logic

▶ Select [P-n] and set PnP or nPn.	Menu CFG: [P-n]

10.4.6 Set the measured value damping

▶ Select [dAP] and set the damping constant in seconds (Tvalue 63 %): 0...5 s (→ 4.8).	Menu CFG: [dAP]

10.4.7 Setting the switching delays

▶ Select [dSx] and set the delay for switching OUTx in seconds: 0...60 s. ▶ Select [drx] and set the delay for resetting OUTx in seconds: 0...60 s.	Menu DIS: [dS1] [dS2] [dr1] [dr2]

10.4.8 Set output status in fault condition

▶ Select [FOU1] or [FOU2] and set the value: 1. Switching output: - On = output 1 / output 2 switches ON in case of an error. - OFF = output 1 / output 2 switches OFF in case of an error. - OU = output 1 / output 2 switches irrespective of the fault as defined with the parameters. 2. Frequency output: - On = frequency signal: 130 % of FrP1 / FrP2 (→ 4.7). - OFF = frequency signal: 0 Hz (→ 4.7). - OU = frequency signal output continues to run without changes. 3. Analogue output: - On = the analogue signal goes to the upper fault value (→ 4.6). - OFF = the analogue value goes to the lower fault value (→ 4.6). - OU = the analogue signal corresponds to the measured value.	Menu CFG: [FOU1] [FOU2]

10.4.9 Calibration of the curve of measured values

▶ Select [CGA] and set a percentage between 60 and 140 → 4.4. (100 % = factory calibration) [CGA] is only available if the operating mode GAS or LIQU is selected.	Menu INI: [CGA]

10.5 Service functions

10.5.1 Read min/max values

▶ Select [Lo.x] or [Hi.x]. [Lo.F] = minimum flow value , [Hi.F] = maximum flow value [Lo.T] = minimum temperature value , [Hi.T] = maximum temperature value Delete memory: ▶ Select [Lo.x] or [Hi.x]. ▶ Keep [▲] or [▼] pressed. > [----] is displayed. ▶ Briefly press [●]. It is recommended to delete the memories as soon as the unit operates under normal operating conditions for the first time. In the operating mode REL a new teaching process deletes the memory.	Menu MEM: [Lo.F] [Hi.F]

10.5.2 Reset all parameters to factory setting

▶ Select [rES] and press [●]. ▶ Keep [▲] or [▼] pressed. > [----] is displayed. ▶ Briefly press [●]. We recommend noting down your own settings before carrying out a reset .	Menu EF: [rES]

11 Operation

After power on, the unit is in the RUN mode (= normal operating mode). It carries out its measurement and evaluation functions and provides output signals according to the set parameters.

11.1 Read the process value

It can be preset whether flow or temperature is indicated as default (→ 10.4.1 Configuration of the standard display).
A standard unit of measurement can be defined for the flow measurement (l/min or m3/h or m/s; for SAxx10: gpm, cfm or fps → 10.4.2). For the operating mode REL flow is always displayed in %.

The display can be changed to another display unit in addition to the preset standard display:

▶ Press [▲] or [▼].

> The display changes, the indicator LEDs indicate the current display unit.

> After 30 seconds the display changes to the standard display.

11.2 Read the set parameters

▶ Briefly press [●]

▶ Press [▼] to select the parameter.

▶ Briefly press [●]

> The currently set value is displayed for 30 s. Then the unit returns to the process value display.

12 Technical data

Technical data and scale drawing at www.ifm.com.

13 Troubleshooting

The unit has many self-diagnostic options. It monitors itself automatically during operation.

Warnings and error states are displayed, even when the display is switched off. Error indications are also available via IO-Link.

Display	Type	Description	Troubleshooting
Err	Error	• Unit faulty / malfunction.	▶ Replace the unit.
No display	Error	• Supply voltage too low. • Setting [diS] = OFF.	▶ Check the supply voltage. ▶ Change the setting [diS] → 10.4.1.
PArA	Error	Parameter setting outside the valid range.	▶ Check parameter setting.
Loc	Warning	Setting pushbuttons on the unit locked, parameter change rejected.	▶ Unlock the unit → 10.1.3.
C.Loc	Warning	Setting buttons on the unit temporarily locked, parameter setting via IO-Link communication active.	▶ Finish parameter setting via IO-Link communication.

Display	Type	Description	Troubleshooting
S.Loc	Warning	Setting buttons locked via parameter software, parameter change rejected.	▶ Unlock the unit via IO-Link interface using the parameter setting software.
UL	Warning	Below the display range. Temperature value < - 20 % MEW (→ 4.6).	▶ Check temperature range. ▶ Repeat low-flow adjustment.
OL	Warning	Above the display range: measured value > 120 % of MEW (→ 4.6).	▶ Check flow range / temperature range. ▶ Repeat high-flow adjustment.
SC1	Warning	Switching status LED for OUT1 flashing: short circuit OUT1.	▶ Check switching output OUT1 for short-circuit or excessive current.
SC2	Warning	Switching status LED for OUT2 flashing: short circuit OUT2.	▶ Check switching output OUT2 for short-circuit or excessive current.
SC	Warning	Switching status LEDs for OUT1 and OUT2 flashing: short circuit OUT1 and OUT2.	▶ Check switching outputs OU1 and OUT2 for short-circuit or excessive current.
FAIL	Warning	Faulty low-flow or high-flow adjustment (e.g. the distance between maximum and minimum flow is too small)	▶ Repeat flow adjustment.

MEW = final value of the measuring range

14 Servicing

▶ From time to time check the sensor tip visually for build-up.

▶ Clean with soft cloth. Stubborn build-up, for example lime can be removed using a common vinegar cleaning agent.

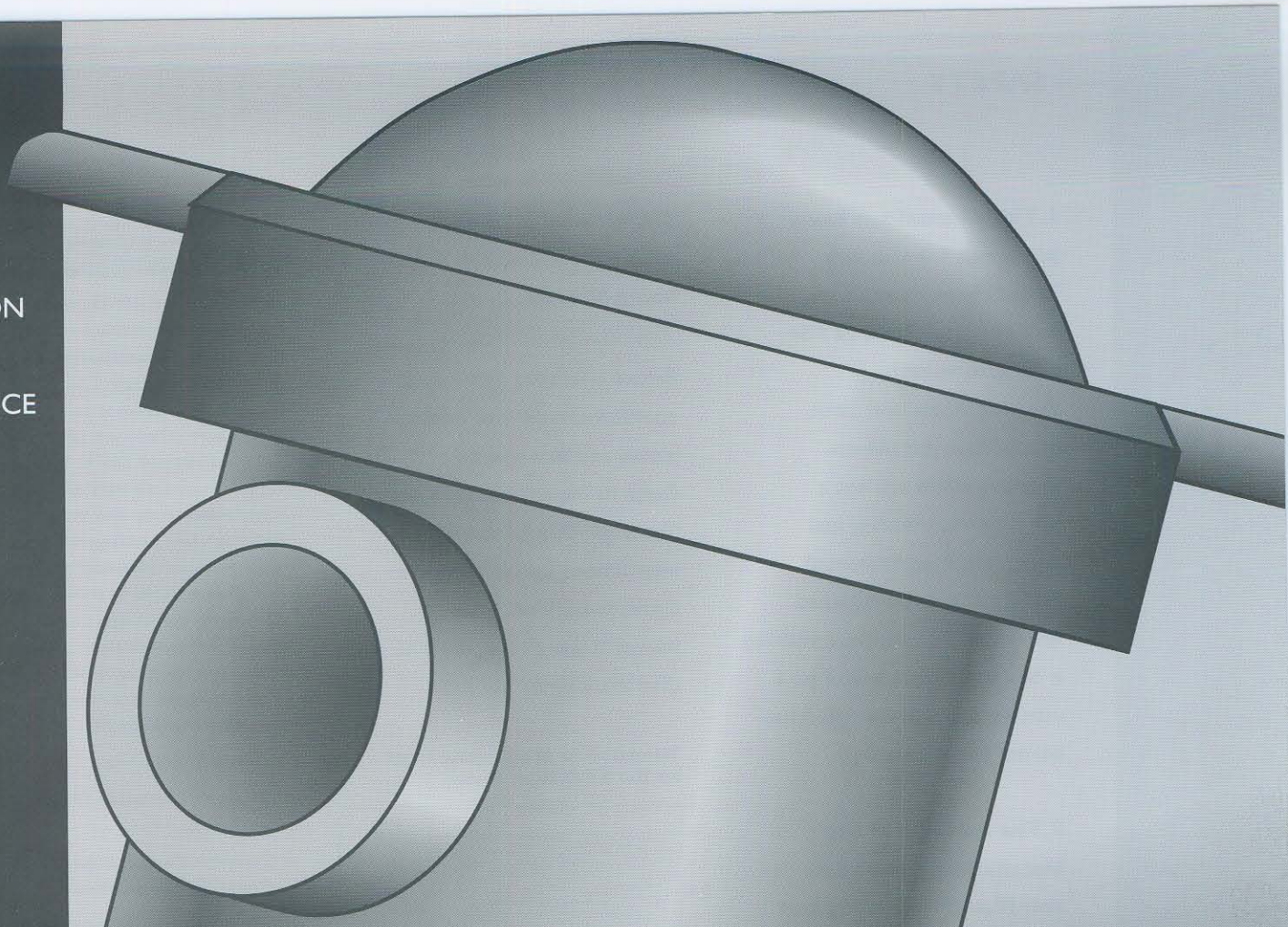
15 Factory setting

Parameter	Factory setting	User setting
SP1	20 %	
rP1	15 %	
FH1	20 %	
FL1	15 %	
FEP1	100 %	
FrP1	100 Hz	
SP2	40 %	
rP2 (FLOW)	35 %	
rP2 (TEMP)	38 %	
FH2	40 %	
FL2 (FLOW)	35 %	
FL2 (TEMP)	38 %	
FSP2	0 %	
FEP2	100 %	
FrP2	100 Hz	
ASP2	0 %	
AEP2	100 %	
diA	----	
ou1	Hno	
ou2	I	
dS1	0 s	
dr1	0 s	
dS2	0 s	
dr2	0 s	

Parameter	Factory setting	User setting
uni	SAxx00 / SAxx30 / SAxx40: l/min SAxx10: gpm	
P-n	PnP	
dAP	0.6 s	
MEdI	H2O	
FOU1	OFF	
FOU2	OFF	
SEL2	FLOW	
CGA	100 %	
ModE	REL	
coLr	rEd	
diS	d2	
SELd	FLOW	

The percentage values refer to the final value of the measuring range (MEW).

INSTALLATION
OPERATION
MAINTENANCE



X100™

CONVERTIBLE FILTER HOUSING

OPERATOR
STUDY
GUIDE

READ AND UNDERSTAND
ENTIRE MANUAL BEFORE
OPERATING THIS VESSEL

FSI®

1. This manual has been prepared for the safe installation, operation, and maintenance of FSI pressure vessels.

Warning labels have been reprinted in this manual. Warning labels are not a substitute for reading and understanding this manual. All labels must be replaced when legibility is lost or visibility is blocked. Labels have a part number in the lower left-hand corner for reordering.

2. The location of the Installation, Operation and Maintenance Manual for the filter vessel.

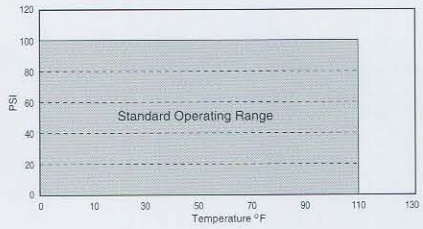
The end user is to place the Installation, Operation, and Maintenance Manual on each vessel upon final installation. The manual must be visible and accessible to the operator.

3. Chemical Compatibility of the filter and the fluid being filtered.

PROTECTIVE CLOTHING

Before operating this vessel, operator should wear protective gloves and face shield. Refer to Material Safety Data Sheet (MSDS), for specific instructions for handling the liquid, as supplied by the manufacturer of the material. (See Warnings)

Temperature of operating range for the X100 Filter Vessel.



WARNINGS

Before use, consult chemical compatibility guidelines.
This vessel is manufactured from talc filled polypropylene. The maximum operating pressure is rated at 100 PSI with water where the temperature does not exceed 110°F. The operating pressure may vary when using other substances and temperatures. Although this housing material has a wide range of chemical resistance, there are several factors that affect or restrict the usage, i.e., temperature and concentration of solutions. Therefore the user should refer to published reference materials for chemical compatibility.

A partial list follows:

- **Compass Corrosion Guide—Section B.**
- **Compass Chemical Resistance Guide for Elastomers.**
- **Dow Chemical Resistance Guide.**
- **DuPont Chemical Resistance and Fluid Compatibility.**

Failure to comply with the chemical compatibility guidelines may result in extensive vessel structural integrity failure.
Such failure could result in severe injury to the user.

Hot and/or chemically active liquids can cause serious injury.

Wear protective face shield and clothing.

4. Mounting Location.
Locate the filter away from direct sunlight and all heat sources that could elevate its temperature beyond the maximum allowable. See lid for maximum temperature rating.

MOUNTING

Hard pipe the filter housing in place with 2 inch sch. 80 plastic piping. Secure the inlet and outlet pipe to provide filter support. If it is desirable to support the filter and its contents, polypropylene legs and floor mounting pads are a standard option. The legs can be shortened by saw cutting. Note: The plastic legs are used in conjunction with hard piping to provide rigid filter support. For filters requiring solid floor mounting, stainless steel or carbon steel support legs are a standard option.

The height of the support legs can be adjusted by moving the belly bands of the leg assembly up or down the filter housing. Maximum floor to filter outlet is 13 1/4 inches.
Use commercially available 3/8 inch diameter floor anchors.

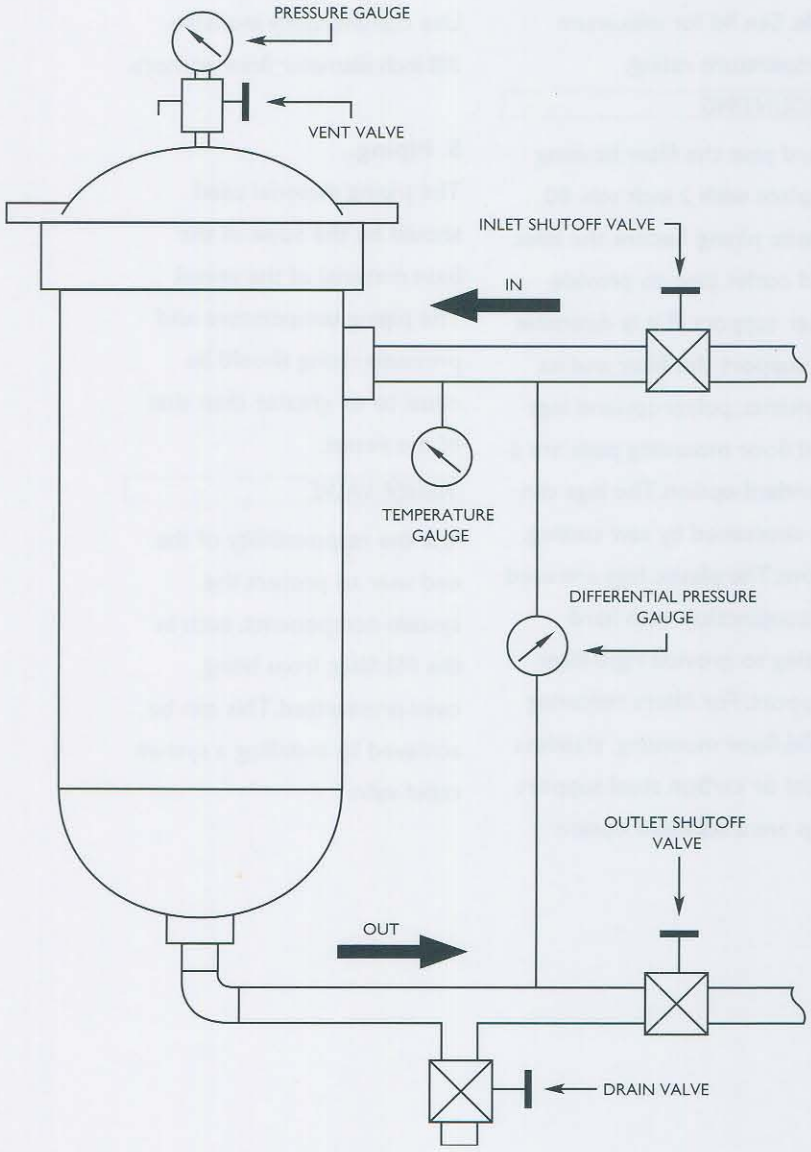
5. Piping.
The piping material used should be the same as the base material of the vessel. The piping temperature and pressure rating should be equal to or greater than that of the vessel.

RELIEF VALVE

It is the responsibility of the end user to protect the system components, such as the FSI filter, from being over-pressurized. This can be achieved by installing a system relief valve.

PRESSURE GAUGE, TEMPERATURE GAUGE, AND VENT VALVE

FSI does not supply the vessel pressure gauge, temperature gauge, or the vent valve. It is the responsibility of the end user to obtain, install, and maintain the proper components. Refer to Figure 1 (See Warnings)

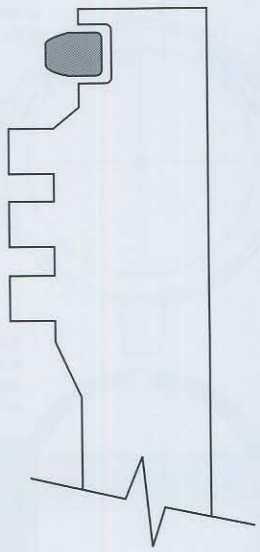


(Figure 1)

6. Gasket.

GASKET INSTALLATION

Clean the gasket groove.
Slip the gasket over the filter and into the groove.
Make sure the gasket is not twisted and the bevelled edges are facing out.
Apply a small amount of sanitary O-ring lubricant to the outside of the gasket.
Use only FSI replacement gaskets.
Refer to Figure 2
(See Warnings)



(Figure 2)

7. Opening and Closing the Filter.

OPENING

To isolate the filter:

1. Turn off and lock out pump.
2. Turn off inlet shutoff valve.
3. Turn off outlet shutoff valve.
4. Drain filter (vent valve may have to be cracked open).
5. Filter should have no internal pressure.
6. Check pressure gauge for zero PSI.
7. Remove lid manually by turning counterclockwise.
   A gentle tap against the handle may be necessary, if the lid was over tightened.

Refer to Figure 1

8. Remove filter bag or cartridge with caution. Insert new filter bag, or cartridge.
   Note: The recommended differential pressure across a filter element before changing is: 10-15 PSI for bag filters, 10-15 PSI for cartridges.

WARNINGS

Vent valve exhaust can be dangerous — direct exhaust to a safe place.

Do not open vessel under pressure; escaping fluid under pressure can cause serious injury.

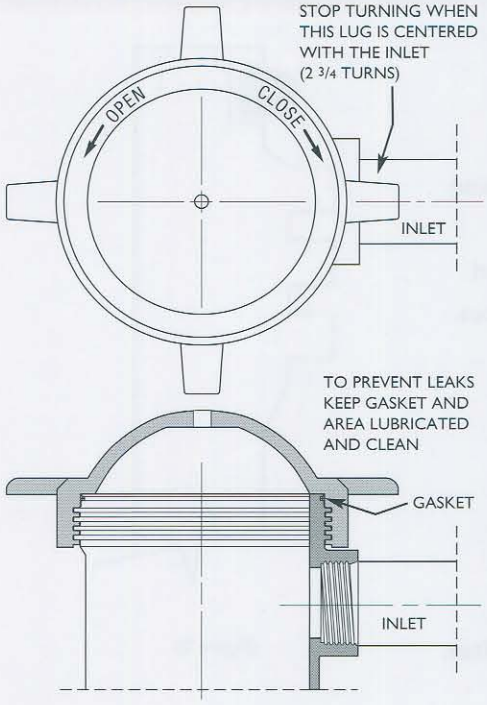
Gasket can fail, causing serious injury. Gasket material must be chemically and temperature compatible with fluid being filtered.

CLOSING

1. Lubricate the gasket with a small amount of sanitary O-ring lubricant.
2. Turn the lid clockwise until it bottoms out.
   STOP. Additional force will not enhance the seal; it may cause the threads to stick.

Refer to Figure 3

3. Before opening the inlet valve, close the drain valve and vent valve.



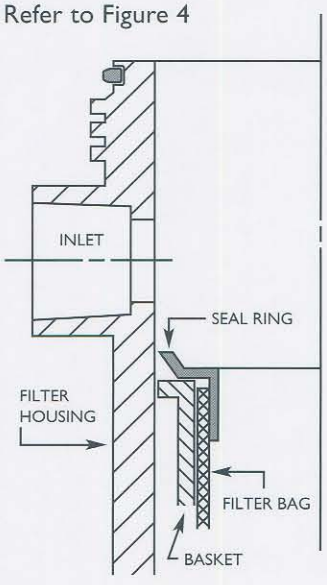
(Figure 3)

Gasket seals on the sides. Tightening beyond the inlet center line WILL NOT increase sealability.

8. Converting from a cartridge filter to a bag filter.

1. Clean the inside of the filter housing. Do not scratch the molded interior surface.
2. Pull out the cartridge conversion plate.
3. Drop the basket in.

Refer to Figure 4



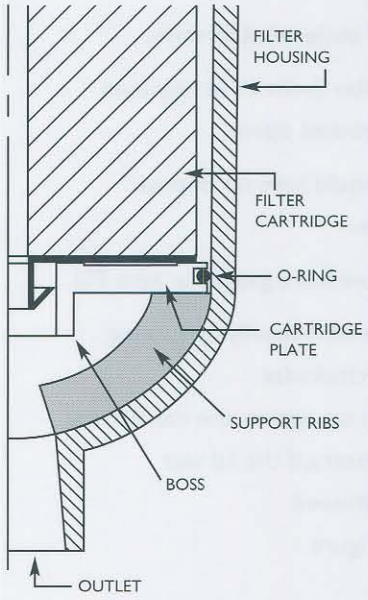
(Figure 4)

Insert filter bag into the basket.
Make sure the bag seal ring bottoms out against the basket shoulder.
The ring seals against the filter wall.

9. Converting from a bag filter to a cartridge filter.

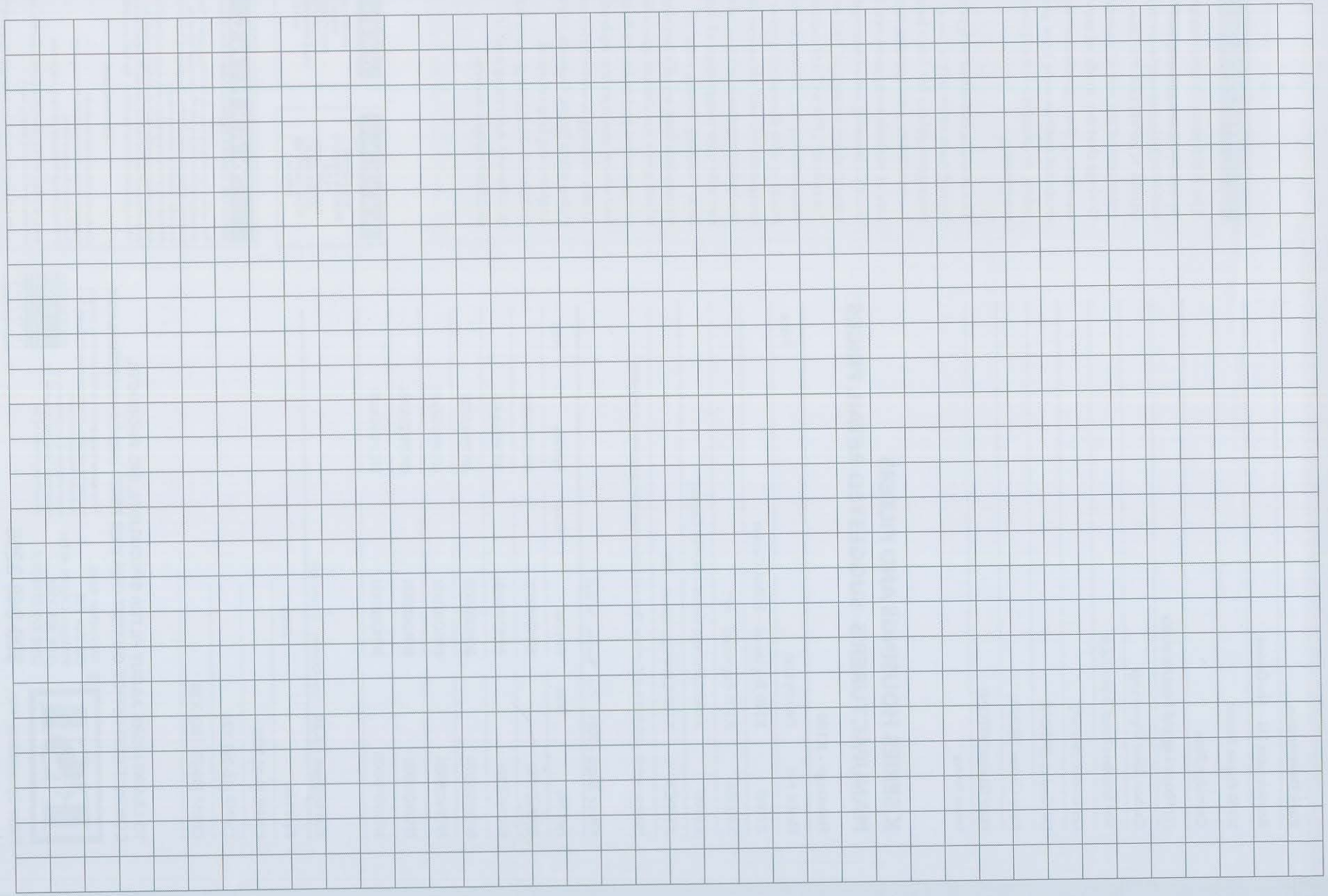
1. Remove the basket.
2. Clean the inside of the filter housing.
   Do not scratch the molded interior surface.
3. Lubricate the cartridge conversion plate with a small amount of sanitary O-ring lubricant.
4. Slide the plate into the housing with the boss facing down. Push the plate firmly against the support ribs.

Refer to Figure 5



(Figure 5)

Insert the self-centering filter cartridge.
Stop when it bottoms out on the cartridge plate.



OPTIONS & REPLACEMENT PARTS

Part Description
Replacement Lid - No Gasket
X100 Plastic Basket
Cartridge Plate
(2) Plastic Leg and Foot Assembly
Carbon Steel Tripod Legs
304 Stainless Steel Tripod Legs
Lid Gasket (BUNA)
Lid Gasket (VITON)
Plate Gasket (BUNA)
Plate Gasket (VITON)

Patents Pending

X SERIES HOUSINGS AND FILTERS MANUFACTURER'S SUGGESTED RETAIL PRICES

Housings - X100

Model No.	Description	Price
X100B	X100 Bag Vessel - BUNA Gasket	
X100BA	X100 Bag Vessel - API	
X100C	X100 Cartridge Vessel - BUNA Gasket	
X100CA	X100 Cartridge Vessel - API	

Housings include - Lid, Basket or Cartridge Plate and Gaskets (Leg-Foot assemblies not included)

Filter Bags - X01 Case Quantity - 50 Bags

Part No.	Price	Part No.	Price	Part No.	Price
BPONG1X01		BPMO100X01		BPOMF0AX01	
BPONG5X01		BPMO150X01		BPOMF1AX01	
BPONG10X01		BPMO200X01		BPOMF2AX01	
BPONG25X01		BPMO300X01		BPOMF10AX01	
BPONG50X01		BPMO600X01		BPOMF25AX01	
BPONG100X01		BPMO800X01		BPOMF90AX01	

Cartridges - X20 Case Quantity - 6 Cartridges

Part No.	Price
CMMF [1-5] X20	
CMMF [10-25] X20	
CMMF [50-75-100] X20	

WARNINGS

The X100 vessel is only designed to use lathe cut gaskets made of self-energizing material such as BUNA N or VITON. FSI does not recommend the use of gaskets or O-rings that are made of non-self energizing (i.e. non-elastomeric) material such as rope type gaskets, teflon, or graphite-impregnated materials.

The X100 is talc-filled polypropylene. Please refer to chemical resistance guides for filter housing compatibility with specific chemicals at various temperatures. Only use this housing with chemical vs. temperature ratings of "+" or "excellent". FSI will not assume responsibility for the use of this housing with chemicals and/or at temperatures and pressures that are not compatible with or within the safe operating range of this filter housing. Please refer to nameplate data on this housing which gives maximum operating temperature and pressure limits, and which assumes the operation of this housing is with chemically compatible fluids. Consult the FSI Engineering Department (1-800-348-3205) for pressure limits at different operating and/or ambient temperatures.

WARNING
BEFORE USE
REMOVE RED CAP
PLUG
REPLACE WITH
COMPATIBLE
PLUG VALVE OR
GAUGE

WARNING
WITH WATER
SERVICE
MAX PRESSURE
100 PSI
MAX TEMPERATURE
110 F

WARNING

BEFORE USE, CONSULT CHEMICAL COMPATIBILITY GUIDELINES.

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DuPont Chemical Resistance and Fluid Compatibility.

Failure to comply with the chemical compatibility guidelines may result in extensive vessel structural integrity failure

SUCH FAILURE COULD RESULT IN SEVERE INJURY TO THE USER.

TO LEARN MORE ABOUT FILTER SPECIALISTS, INC. PRODUCTS, CONTACT OUR OFFICE OR VISIT OUR WEB PAGE: http://www.fsifilters.com.

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MANUFACTURED IN THE USA
PRINTED IN USA

X100OPMAN-005-902
Part No. RMLX100OPMAN

11.2. Change Log

The version number is defined as follows. The first digit is based on the machine type represented, it will only change between machine models. The second digit represents major revisions, i.e. whole sections being added or changed. The third digit represents minor revisions or changes, i.e. small corrections to spelling or wording.

Version Number	*Release Date*	*Notes*
1.0.0	2019-09-09	Initial Release