Fluid-Pak

Installation, Operation, and Maintenance Manual

COOLTEC REFRIGERATION CORP.

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1. Introduction

The purpose of this manual is to familiarize the end user with the operation of the Fluid-Pak refrigeration system and provide guidelines for the installation, maintenance, and service of the equipment.

The Cooltec Fluid-Pak System is a secondary loop refrigeration system, housed entirely within a stainless-steel cabinet (remote air cooled models). Primary cooling is achieved through the use of multiple compressors piped in a parallel configuration, allowing for maximum energy efficiency and temperature control. The primary refrigerant chills the secondary coolant through through a large heat exchanger. This coolant (a propylene glycol and distilled water mixture) is pumped to the refrigerated fixtures by a pair of variable speed pumps. Section 3 of this manual describes the operation of this system in detail.

Cooltec products are intended to be installed and used according to the guidelines set forth in this manual and other related material, as well as standard electrical and refrigeration practices. Installation, service, and maintenance of this equipment should be performed by a qualified technician only.

Manufacturer

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Nameplate

Refer to the Fluid-Pak nameplate on the equipment control panel for model number, serial number, electrical service requirements and contact information.

Warranty information may be found at the end of this manual.

The Fine Print

The information in this manual is subject to change without notice. Cooltec Refrigeration does not assume any responsibility for any errors that may appear in this document. At no time will Cooltec be held liable for technical or editorial omissions made herein, nor for any direct, indirect, incidental or consequential damages resulting from the use of this manual.

The information presented in this document cannot and is not intended to cover all possible situations and conditions that might occur. The end user must exercise caution and common sense when installing, servicing, and using this equipment.

Any changes made to the equipment during installation, start-up, or at any other time must be submitted in writing to Cooltec for approval, and must be approved and received prior to commissioning.

All personnel working on the installation must read and understand the contents of this manual. Failure to do so can result in serious injury or significant damage to equipment.

2. Safety

General Safety Information

Do not work on or operate the Fluid-Pak System without reading and understanding this section completely. This section contains important information and warnings that must be adhered to, and failure to do so may result in death, serious injury, or damage to the system and equipment.

Lockout

Equipment lockout places the system into a zero energy state and prevents unintentionally energizing electrical circuits and system components during service and maintenance. Always follow the lockout procedure described in this section prior to repairing, maintaining, or cleaning the Fluid-Pak System.

Basic Requirements:

1. All energy sources to equipment shall be locked out or tagged out to protect against accidental or inadvertent operation-when such operation could cause injury to personnel.
2. After all energy sources are locked out, electrical circuits must be tested to verify that they are de-energized.

Procedure:

1. Locate and identify all sources of power to the equipment.
2. Remove power from the equipment at the disconnect or circuit breakers.
3. Lockout and/or tagout the energy-isolating devices with locks or tags. Tags should indicate that the energy-isolated devices cannot be operated until after the removal of the tag.
4. Test for power by attempting to start the equipment that has been locked out.
5. Following repair or maintenance of equipment, verify that it is safe to resume operation, and remove locks or tags.

Doors and Covers

The doors and covers of the Fluid-Pak system are designed to protect against the hazards behind them. Electrical component covers should not be removed before disconnecting power. It is your responsibility to ensure that these safety measures are in place when not in service.

Installation and Startup

These instructions must be followed to prevent death, serious injury, or damage to equipment.

General:

Always wear eye and ear protection.

Only qualified and properly trained technicians should perform installation, maintenance, or repair work.

Use caution and basic common sense when installing and servicing the equipment.

Modifications and alterations to the Fluid-Pak system may not be made without the manufacturer's knowledge and approval.

Fluid-Pak System:

When working with refrigerant, make sure you are in a well ventilated workspace.

Never vent refrigerant to the atmosphere,

Never use an open flame where refrigerant gas is present, as this can produce a poisonous phosgene gas and can cause extreme breathing difficulty and suffocation.

Have a fire extinguisher within reach when welding and/or brazing.

Read and understand the material safety data sheet for the coolant product being used.

Never operate the primary refrigeration system when the secondary coolant system is not running.

Never attempt to maintenance or service equipment without electrical power disconnected.

3. Description

Product Nomenclature

The Cooltec Fluid -Pak uses the product nomenclature described below.

F	A	C	-	1	3	2	H	-	2	3	5
Fluid-	**A** = Air Cooled **W** = Water Cooled	**C** = Stainless Steel Cabinet **R** = Rack Mount		# of Medium Temp Parallel Compressors	# of Low Temp Compressors	# of Coolant Pumps	**H** = Heat Reclaim **X** = Conventional			Maximum Refrigeration Capacity (mbh)	

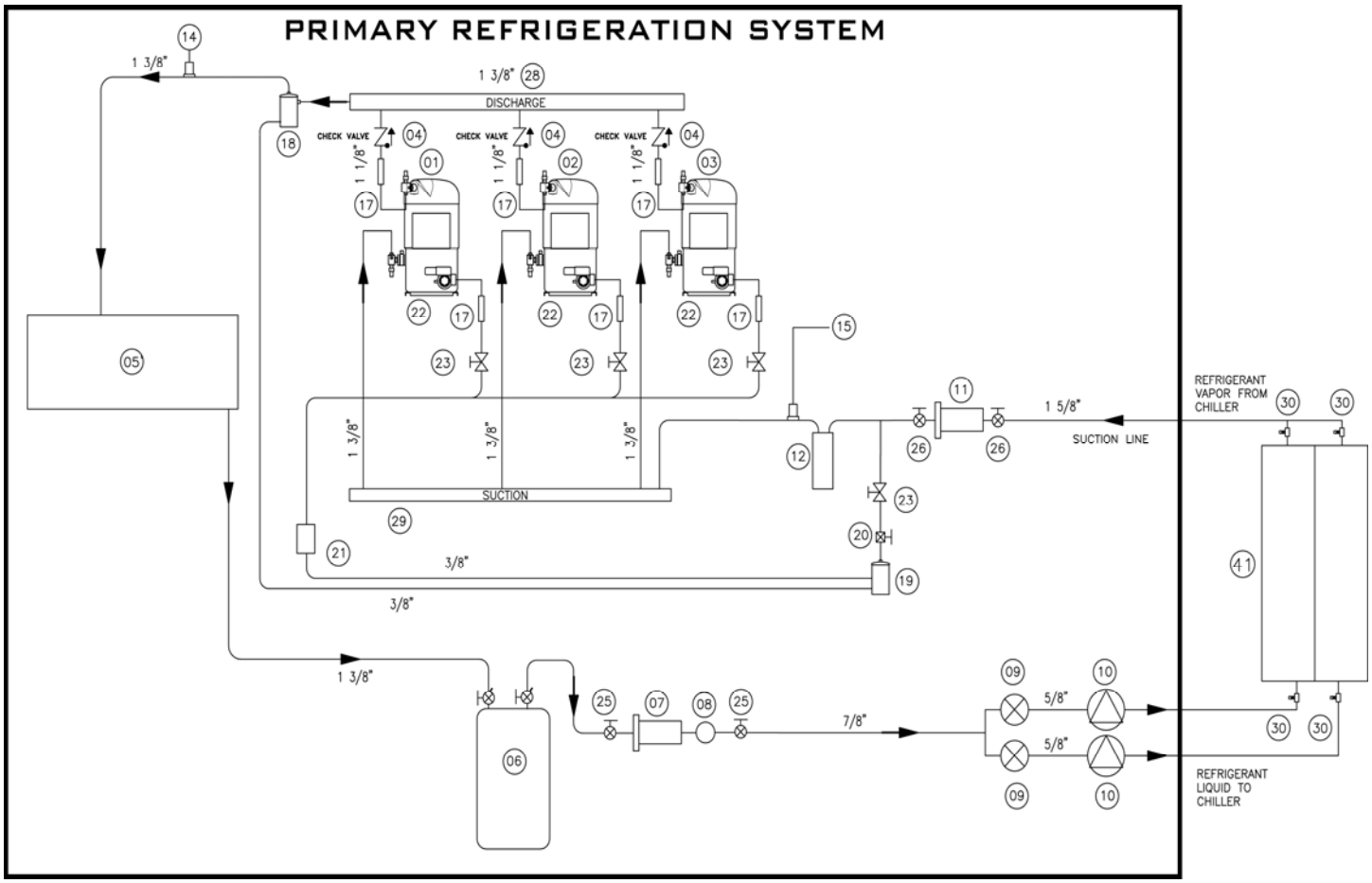
Fluid-Pak System Description

The Cooltec Fluid-Pak System is a high efficiency secondary loop refrigeration system. Figures 1 and 2 show the elements of a typical Fluid-Pak System.

Primary Refrigeration System

Unlike standard refrigeration systems where liquid refrigerant is piped directly to each refrigeration fixture, the Cooltec system uses a secondary refrigerant to chill the refrigeration fixtures.

- The Fluid-Pak cabinet houses the entire refrigeration system (except in remote, air-cooled applications, where a remote condenser is located on the roof).
- The primary refrigeration system components are located on the lower tier of the cabinet. This includes:
    - Compressors
    - Oil Separator and Reservoir
    - Oil Management System
    - Liquid Receiver
    - Suction Accumulator
- Multiple compressors connect to a common suction and discharge manifold within the cabinet. Multiple compressor use allows refrigeration capacity to mirror changing operating conditions and varying refrigeration loads, resulting in better secondary coolant temperature control and lower compressor energy usage during low load conditions.
- Suction line pressure determines how many of these compressors are running at any time. The staging of these compressors is managed by a refrigeration controller designed to maintain a set suction temperature, and thus, a constant secondary coolant supply temperature.
- The primary system compressors pump refrigerant to a heat exchanger, where the refrigerant absorbs the heat from the secondary coolant and releases it through the condenser.

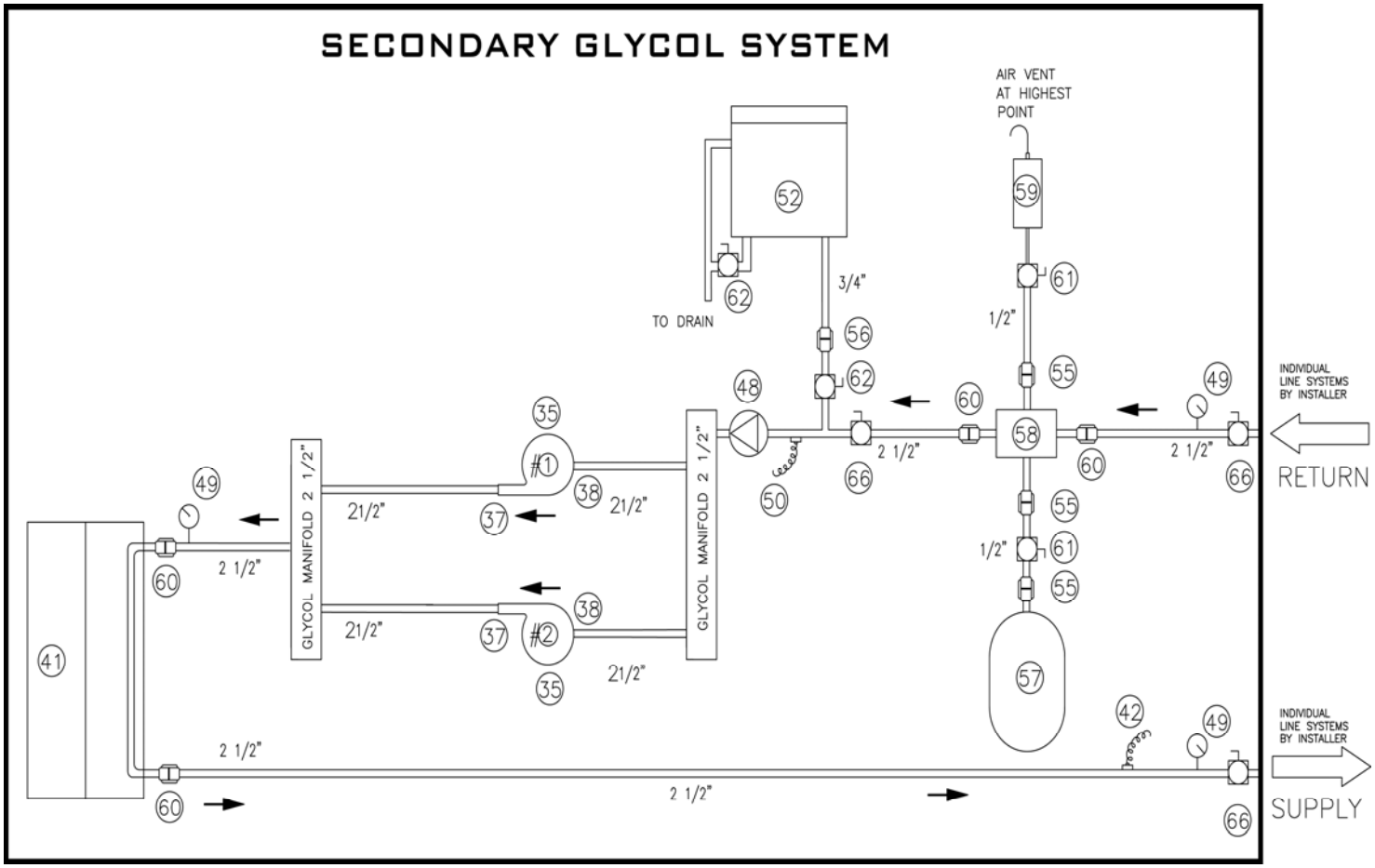


REFRIGERATION PIPING AND PARTS SCHEDULE		
NO.#	QTY.	DESCRIPTION
01	1	# A COPELAND # ZB76KCE-TF5 SCROLL COMPRESSOR (R-404A) *
02	1	# AA COPELAND # ZB76KCE-TF5 SCROLL COMPRESSOR (R-404A) *
03	1	# AAA COPELAND # ZB76KCE-TF5 SCROLL COMPRESSOR (R-404A) *
04	3	DISCHARGE CHECK VALVES (7/8")
05	1	CONDENSER
06	1	RECEIVER
07	1	FILTER / DRIER (5/8")
08	1	SIGHT GLASS (5/8")
09	2	SOLENOID (1/2")
10	2	THERMAL EXPANSION VALVE
11	1	SUCTION LINE FILTER (1 3/8")
12	1	SUCTION ACCUMULATOR (1 3/8")
13		SPARE
14	1	DISCHARGE PRESSURE TRANSDUCER
15	1	SUCTION PRESSURE TRANSDUCER
16		SPARE
17	3	VIBRATION ELIMINATOR

REFRIGERATION PIPING AND PARTS SCHEDULE		
NO.#	QTY.	DESCRIPTION
18	1	OIL SEPERATOR (1 3/8")
19	1	OIL RESERVOIR (3/8") 2 GAL.
20	1	OIL DIFFERENTIAL CHECK VALVE (3/8")
21	1	OIL FILTER (3/8")
22	3	OIL LEVEL CONTROL
23	4	DECK VALVES
24		SPARE
25	1	REFRIGERATION BALL VALVE (7/8")
26	1	REFRIGERATION BALL VALVE (1 5/8")
27		SPARE
28	1	DISCHARGE HEADER (1 1/8")
29	1	SUCTION HEADER (1 3/8")
30	4	ACCESS PORT WITH SCHAEDER VALVE
31		SPARE
32	1	HEAT EXCHANGER (HEAT RECLAIM)
33	2	WATER PRESSURE GAUGE

Secondary Coolant System

- A chilled, secondary fluid (in this case, a propylene glycol and distilled water mixture) is pumped between the primary system heat exchanger and the refrigerated fixtures (walk-in coolers, refrigerated base drawer units, pan chillers, etc.)
- The secondary loop system components are located on the upper tier of the cabinet. This includes:
    - Heat exchanger (Glycol Chiller)
    - Heat exchanger (Heat Reclaim - where applicable)
    - Variable Speed Pumps
    - Expansion Tank
    - Air Separator
    - Secondary Loop System Valves and Controls
- The secondary coolant flows through a closed loop system to the manifold, where separate piping circuits feed chilled fluid to the multiple refrigerated fixtures and then return to the coolant pumps.
- An expansion tank compensates for volume and temperature changes within the closed loop systems due to leaks within the piping circuits and extreme loads. The expansion tank maintains a positive pressure on the suction side of the coolant pumps, preventing a low flow condition and impeller cavitation.
- Air is removed from the closed loop system by the air separator, located on the return coolant line prior to the pumps.
- Balance valves at the manifold provide optimum flow to each coolant circuit.



GLYCOL PIPING AND PARTS SCHEDULE		
NO.	QTY.	DESCRIPTION
34		SPARE
35	3	2.0 HP GLYCOL PUMP
36		SPARE
37	2	DISCHARGE FLANGE W/ SHUT-OFF/CHECK
38	2	SUCTION FLANGE W/ SHUT-OFF
39		SPARE
40		SPARE
41	1	HEAT EXCHANGER (GLYCOL)
42	3	TEMPERATURE SENSOR
43		SPARE
44		SPARE
45		SPARE
46		SPARE
47		SPARE
48	2	STRAINER
49	3	GLYCOL PRESSURE GAUGE
50	1	GLYCOL PRESSURE SWITCH

GLYCOL PIPING AND PARTS SCHEDULE		
NO.	QTY.	DESCRIPTION
51		SPARE
52	1	GLYCOL FILL TANK
53		SPARE
54	1	AIR VENT
55	4	1/2" UNION
56	1	3/4" UNION
57	2	1" UNION
58	2	1-1/4" UNION
59	0	2" UNION
60	0	2 1/2" UNION
61	2	1/2" BALL VALVE
62	2	3/4" BALL VALVE
63	0	1" BALL VALVE
64	2	1 1/4" BALL VALVE
65	0	2" BALL VALVE
66	3	2 1/2" BALL VALVE

Fluid-Pak System Electrical

Circuit voltage and current requirements are listed on the control panel nameplate.

National Electric Code guidelines must always be followed at all times.

Main Power

Main power conductors are to be sized according to the Minimum Circuit Ampacity (MCA).

The sizing of all conductors is the responsibility of the electrical contractor.

Ground Conductors

A path for the electrical current to ground shall be provided by the installing contractor.

Testing

All control wiring is tested for continuity and short circuits.

Electrical components are tested for proper operation at the factory prior to shipment.

Field Wiring

The electrical contractor must pay close attention to the required field wiring as shown on the refrigeration drawings.

The control panel will include terminal blocks for electrical connection to low temperature evaporator coils, the alarm circuit, and heat reclaim pump (where applicable).

Fluid-Pak System Control

Compressor Control

Compressors are controlled by a programmable controller . The I/O board located within the electrical panel receives the system's temperature and pressure inputs, and controls the various loads accordingly. A digital display located on the electrical panel indicates the output status, and allows the user to obtain temperature/pressure readings, access the service menu, and view active alarms. The refrigeration rack controller is covered more in depth in the following section.

Pump Control

Coolant pumps are controlled by a programmable variable frequency drive at each pump. The pumps are set to maintain a constant pressure, by varying their speed based on the flow requirements. Each pump is sized to satisfy the complete system load, thus, only one pump runs a time. The pumps will alternate every 24 hours. The pump drive is covered more in depth in the following section.

Oil Return System

Discharge refrigerant carries small amounts of oil from the compressor outlet. This oil is separated from the refrigerant and stored within a reservoir until it is needed. The oil returns through an oil filter and is the distributed to each compressor by an electronic solenoid valve. This system ensures even distribution of oil between compressors, and eliminates the risk of compressors running without lubrication. Any failure of this system will be monitored and indicated by the refrigeration controller.

Defrost Schedule

Defrost is accomplished through the use of a mechanical time clock. When defrost is initiated, the solenoid valves at the heat exchanger are closed, and the compressors are shut down as a result of the drop in suction pressure. The electrical circuit to the solenoid vales must then be completed through an auxiliary relay on the refrigeration controller. This relay is closed when the coolant supply temperature reaches the defrost termination set point, ending the defrost cycle.

Fluid-Pak Safety Controls

Primary Refrigeration system

Compressors	Each compressor has an internal thermal overload to protect it against overheating.
Refrigeration Controller	The refrigeration controller sends out an alarm signal for the following faults: • Discharge pressure outside of normal range • Suction pressure outside of normal range • Pressure sensor failure • Temperature sensor failure • Low oil level • Oil system failure • Controller failure
High Pressure Switch	A mechanical switch will signal the refrigeration controller to shut down all compressors in the event that the discharge pressure rises above the cut-out set point. Automatic reset occurs unless the switch trips 3 times within 15 minutes, at which time a manual reset must be performed.
Low Pressure Switch	A mechanical switch will signal the refrigeration controller to shut down all compressors in the event that the suction pressure drops below the cut-out set point. Automatic reset occurs unless the switch trips 3 times within 15 minutes, at which time a manual reset must be performed.
Circuit Breakers	Each load on the Fluid-Pak system is protected with a circuit breaker, intended to open the electrical circuit when current draw exceeds its trip point.
Fused Disconnect	Fused disconnect is required to be installed at the equipment location. Fuses here are intended to open the electrical circuit when current draw exceeds its trip point.

Secondary Coolant system

Variable Frequency Drive — The pump controller sends out an alarm signal for the following faults:

- High coolant temperature
- Dry-run detection (loss of coolant)
- Pressure sensor failure
- Temperature sensor failure
- High motor current
- Thermal overload

Low Pressure Switch — A pressure switch located on the return main reads return coolant pressure. If a drop in return pressure occurs, the pressure switch closes a set of contacts, sending an alarm signal to the refrigeration controller and/or a remote alarm panel.

Circuit Breakers — Each load on the Fluid-Pak system is protected with a circuit breaker, intended to open the electrical circuit when current draw exceeds its trip point.

Fused Disconnect — Fused disconnect is required to be installed at the equipment location. Fuses here are intended to open the electrical circuit when current draw exceeds its trip point.

Alarm

The Cooltec Fluid-Pak System may be equipped with a remote alarm panel (optional) to indicate system faults to the user immediately when a failure occurs, allowing for prompt response and less downtime.

Our standard alarm panel consists of LED lights activated when an alarm condition occurs. These conditions are:

- Primary Refrigeration System Alarm

  When this alarm is activated, the refrigeration controller has sent out an alarm signal. The alarm fault can be found on the digital display. A qualified service technician must diagnose the cause of alarm and make the necessary repairs. Alarm signal will reset once normal operation has been restored.

- Secondary Coolant System Alarm

  When this alarm is activated, the pump controller has sent out an alarm signal. On a pump failure, the second coolant pump will start automatically. The alarm fault can be found on the digital display. A qualified service technician must diagnose the cause of alarm and make the necessary repairs. Alarm signal will reset once normal operation has been restored.

- Low Coolant Level Alarm

  This alarm is activated when the coolant pressure at the return line drops below a safe level. Alarm activation shuts down the coolant pumps. This is an indication of a coolant leak or system restriction. A qualified service technician must diagnose the cause of alarm and make the necessary repairs. Alarm signal will reset once normal operation has been restored.

Remote Monitoring

Remote monitoring is available through an optional web-based accessory. This system enables owners and facilities managers complete access to the Fluid-Pak System from a remote location. Compressor and pump status, system pressures, coolant flow rates and temperatures may be monitored and system parameters may be changed if necessary. Additionally, the system controller can be configured to alert specified users to an alarm though an email or mobile phone. This system allows for the immediate notification and reaction to an equipment alarm, resulting in the critical equipment being brought back to operation in as little time as possible.

4. Installation

The installation contractor is responsible for the Fluid-Pak system installation, coolant piping installation, system startup, and making sure that the entire system complies with all operation specifications.

Shipping and Damage

All Cooltec products have been carefully inspected prior to leaving our factory, and the carrier has assumed responsibility for safe arrival. Cooltec is not responsible for any damage that occurs during the shipping of our equipment.

Before accepting delivery from the carrier, all equipment must be thoroughly examined for any visible scratches, dents, or other damage. Receipt of all parts should be verified. Any damage that is evident on delivery should be noted on the freight bill or receipt. If any Cooltec product was delivered with noticeable damage, a claim must be made to the carrier.

Please notify Cooltec of these damages within 10 days of delivery by contacting customer service. This will allow us to work with the carrier to resolve the claim if necessary and provide any replacement parts required.

General Overview

Cooltec's Fluid-Pak installation procedure at a glance:

1. Set the rack into place and secure.
2. Connect electrical service (and water if necessary) to the rack.
3. Install the refrigeration lines to the remote condenser and low temperature fixtures (if present).
4. Install the secondary coolant piping that connects the rack with the refrigerated fixtures.
5. Pressure test and flush the secondary coolant piping system.
6. Pressure test and evacuate primary refrigeration system.

Installation Requirements

The Fluid-Pak System and the secondary coolant system piping installation must comply with the following:

- Safety Standard for Refrigeration Systems (ANSI/ASHRAE Standard 15).
- ASME B31.5 Refrigeration Piping Standard.
- ASME B31.3 Water Piping Standard.
- All Cooltec specifications, drawings, data, and the instructions and safety measures set forth in this manual.
- All applicable nation and local codes.

Electrical diagrams, refrigeration and water line sizes and connections can be found on the job drawings provided with the equipment. These drawings detail all of the electrical and refrigeration requirements concerning the installation and operation of the Fluid-Pak. All installations must comply with the standards discussed above.

Coolant Piping Requirements

All factory piping has been properly braced and all gasketed joints are tight when the equipments leaves the factory. These joints may loosen during shipment and should be checked during startup. All joints, especially threaded and gasketed joints, should be checked again after one to two weeks of operation.

Fluid piping should:

- be kept as short and direct as possible.
- be insulated with a minimum 1" Armaflex insulation or equivalent.
- be a continuous loop with air vents installed at the highest points, and drain valves installed at the lowest points.
- be sized according to ASHRAE standards concerning friction loss and velocity through pipe runs.
- be provided with expansion loops in long straight pipe sections to accommodate the expansion and contraction of piping material.
- be provided with shut-off valves at branch lines and fixtures for isolation and service.
- be provided with drain fittings at system low points.
- be provided with bypass valves at the end of each branch circuit
- be labeled with fluid type (i.e. secondary coolant), purpose (i.e. supply, return), and arrows indicating direction of flow.

All refrigerant and coolant piping must be supported. The distance between supports will vary based on the pipe diameter, wall thickness, and weight of fluid to be carried. This distance must comply with national and local code. While these codes take precedence, the following table may be used as a guide:

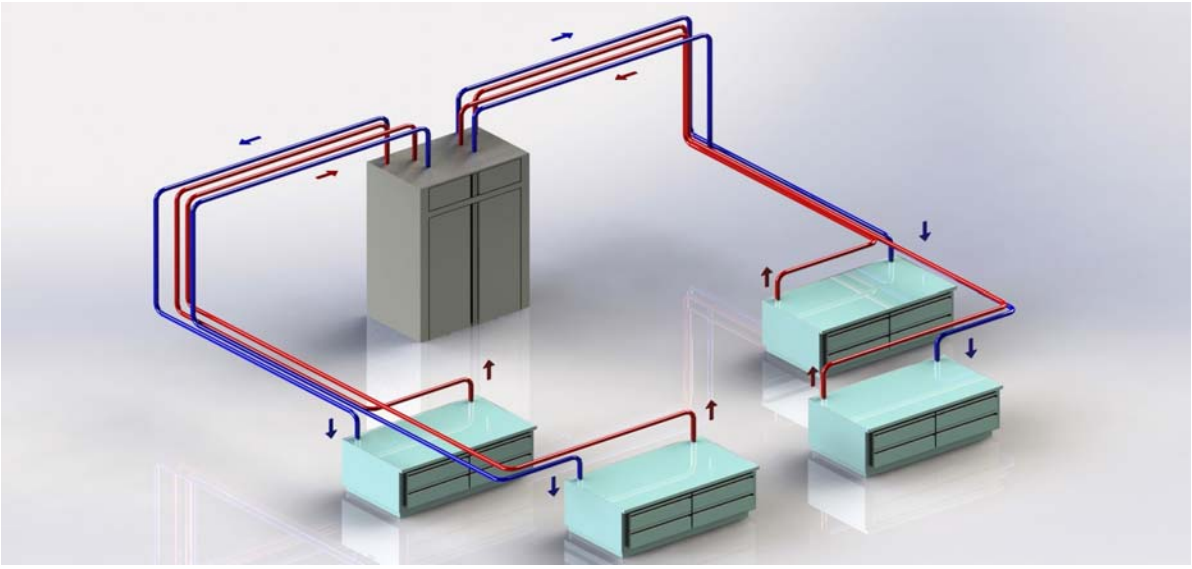
Tube OD (in)	3/8 - 7/8	1 1/8	1 3/8 - 1 5/8	2 1/8	2 5/8	3 1/8
Nominal Pipe Size (in)	1/2	3/4 -1.	1 1/4	1 1/2	2 - 2 1/2	3
Maximum Distance Between Supports (ft)	5	6	7	9	10	12

Fluid piping supports must comply with the following::

- Piping must be supported with a saddle. The saddle must support the weight of the pipe and the liquid contained within.
- Saddle length should be 3 times the diameter of the pipe.
- Saddles should be mounted to a bracket (unistrut or similar) and supported with all thread secured to structural beams.
- Parallel pipes should have minimum 1" distance between each other to prevent condensation from forming on the insulation surface.
- Coolant piping must be installed so that vibration is eliminated. Any amount of vibration can cause damage to insulation and copper and possible fluid leaks.

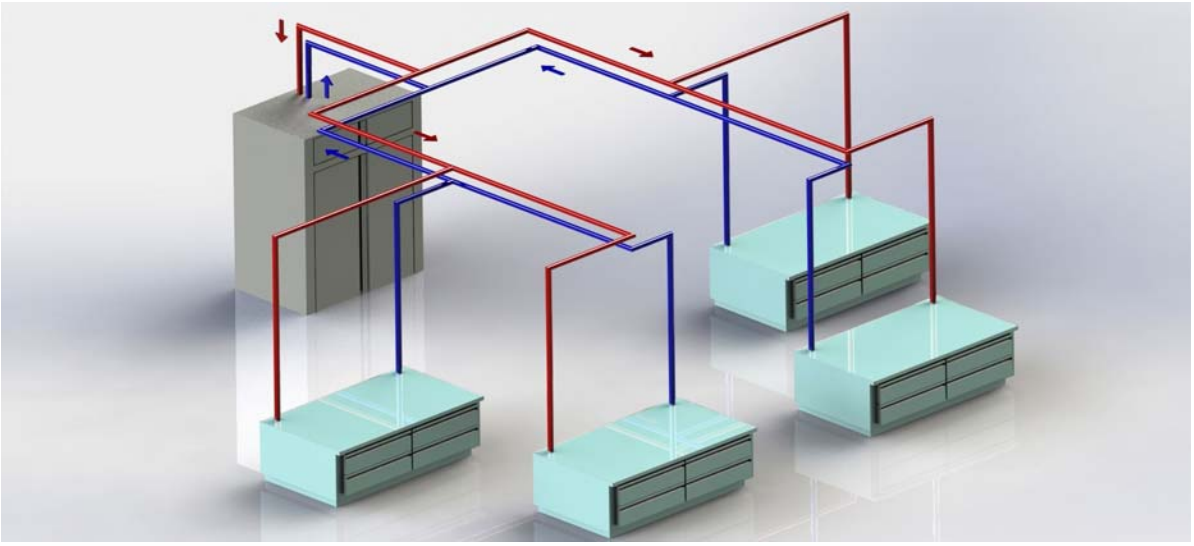
Coolant Piping Configurations

Individual Circuit Piping consists of several pairs of pipes (supply and return) running from the Fluid-Pak system to each individual case, line-up, or walk-in box. This piping configuration allows for all refrigeration valves and controls to be located in one place, such as an equipment room or remote manifold location. In this way, all the servicing, balancing, and adjustment of the piping system is centralized.



Typical Individual Circuit Piping

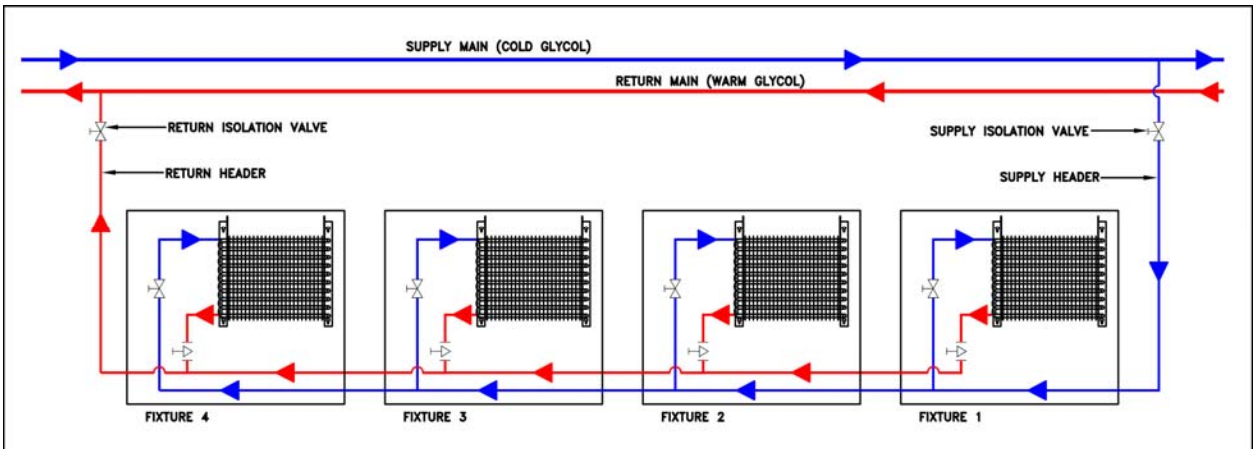
Loop Piping consists of two pipes, a supply and return main, running in a loop throughout the building. Smaller diameter pipes are branched off the supply and return mains to feed coolant to each individual case. In this piping configuration, refrigeration valves and controls are located at or near each refrigerated fixture.



Typical Loop Piping Application

Modified Loop Piping is any combination of the two methods described above. Multiple pipe loops can supply coolant to different areas or departments from a manifold, at which the refrigeration valves for each branch can be serviced and adjusted.

Circuits which contain multiple evaporator coils running in parallel may be piped to avoid unnecessary balancing on startup. This method is called "reverse return piping," and requires that the first coil connected to the supply header is the last coil connected to the return header. This helps to equalize the pressure drop across each coil, and results in a secondary coolant circuit that can be balanced much more easily.



Reverse Return Piping

Coolant Supply and Return Headers

Branch supply lines should tie into the top of the main supply header (the "T" fitting should point up). Never tie into the bottom of the main supply pipe.

Isolation valves are recommended at the supply and return header to allow for the isolation of each branch.

Balance valves may be installed at the return header to facilitate flow control at each branch.

Air Vents and Drains

Always install 1/4" or 3/8" vent valves at the highest point in each pipe section.

Vent valves must have a threaded connection so that a hose or pipe fitting can be attached to bleed air from the coolant system.

Vent valves must have a cap at the threaded connection capable of sealing the valve port before starting the system.

The lowest point in each section must have a 3/8" or 1/2" drain valve to allow for the removal of fluid from the pipe section.

Drain valves must have a threaded connection so that a hose or pipe fitting can be attached to remove fluid from the coolant system.

Drain valves must have a cap at the threaded connection capable of sealing the valve port before starting the system.

Testing

Prior to startup, the entire refrigeration system must be pressure tested.

- Shut off (open) all compressor and pump circuit breakers to prevent the motors from starting during system pressurization. The remaining control circuit breakers may be on (closed).
- Pressurize the system with dry nitrogen in order to verify that all welds and joints are tight and no refrigerant loss will occur following the charging of the system.
- If any leaks are found, locate and repair the source of the leak and restart the pressure test.
- When this has been verified (preferably 24 hours), the system must be placed in a vacuum to remove any moisture or debris from the piping. Triple evacuation to 500 microns or below is recommended.
- Final vacuum gauge readings should be submitted to Cooltec's field service department for warranty purposes.

The secondary coolant piping must be pressure tested to ensure that no coolant leaks will occur following the commissioning of the equipment. This can be done hydraulically (water) or pneumatically (nitrogen).

- If a pneumatic test is performed, be sure that any components rated at a pressure less than the test pressure are isolated from the system. Coolant pumps must always be isolated when testing pneumatically to prevent damage to the pump seals.
- The expansion tank should be isolated.
- All electronic valves must be operational and all valves must be open.
- All vents and drains should be closed completely.
- The system must hold a constant pressure for a minimum of 6 hours.
- All soldered and threaded connections, as well as valves and coils should be checked visually during this time.
- If any leaks are found, locate and repair the source of the leak and restart the pressure test.
- The results of the pressure test should be recorded on the startup checklist (found near the end of this manual) and submitted to Cooltec's field service department for warranty purposes.

After testing and prior to startup, the secondary coolant piping must be flushed with clean water to remove any residue or debris from the system.

- All electronic valves must be operational and all valves must be open during this time to ensure that water can move through all parts of the system.
- Connect a clean water supply to a drain fitting at the lowest point of the system.
- The isolation, filling, and drainage of the supply and return lines in sections may be necessary. All strainers must be opened and cleared of debris.

- The system should not be left open for any length of time after flushing is complete to prevent corrosion due to air and water exposure. Secondary coolants contain corrosion inhibitors and should be charged as soon as possible to eliminate this risk.

Make sure that the Fluid-Pak System is level.

Verify correct wiring and voltage at the disconnect, and that the disconnect was properly sized and grounded.

Check wiring connections at all terminal blocks, contactors, controls, etc. These connections may have come loose during shipping. Tighten as needed.

Make sure the compressor and pump breakers are in the off (open) position before beginning startup.

5. Startup Procedure

Coolant System

Expansion Tank

The expansion tank contains a rubber bladder that holds the glycol and is surrounded by air. The tanks purpose is to:

- provide an air cushion to allow the glycol within the system to expand when the temperature increases.
- provide a pressure ballast that can keep the system from losing pressure if a small amount of glycol is lost during service or in the event of a leak.
- maintain a positive pressure at the suction side of the coolant pumps.
- maintain a positive pressure at the highest point in the system.

The tank pressure must be set before the system is filled. This pressure depends solely on the layout of the restaurant/store. The objective is to ensure a positive pressure throughout the system and make the best use of the tanks surge capacity. If the initial tank pressure is too high or too low, there will be no surge capacity available to the system.

The bladder pressure should be 2-5 psi above the eventual static pressure. Static pressure of the system can be calculated by measuring the difference in height from the expansion tank to the highest pipe in the system and multiplying this measurement be .45 psi/ft of 35% glycol. In any case, the bladder pressure should not be set below 10 psi.

- Example: The expansion tank is at grade level on the floor. The coolant lines rise 30 ft. to the attic and run horizontally 150 ft before dropping to feed the refrigerated bases. (30 ft. x .45 ft/psi) + 5 = 18.5 psi.
- Example: The expansion tank is located on the roof and the highest pipe extends only 5 ft above the tank. (5 ft x .45 ft/psi) + 5 = 7.25 psi. The minimum setting is 10 psi, therefore the expansion take would be charged to 10 psi.

Expansion tank pressure may be checked with a tire gauge. Air may be added to the tank using a standard tire inflator. Again, this must be checked prior to adding coolant to the system. Any pressure reading taken after the system has been filled will match the system pressure if it is above the tank pressure, rendering the reading meaningless.

Coolant Fill

1. The closed loop system may be filled with coolant through a large ball valve at the highest point. Alternatively, a pump and a hose may be used to fill the system from the drain valve at the coolant pumps.
2. A premixed glycol solution is recommended. The concentration of the solution must be checked with a refractometer prior to filling the system in order to verify the glycol freeze point meets operational requirements.
3. Using the vents installed, remove the air from the system completely. Air that remains in the system will cause irregular pump operation, poor heat transfer through the heat exchanger, and will make balancing the system far more difficult.
4. Filling the piping circuit one circuit or branch at a time achieves the best results. Close the return valve and open the vent at each branch. Fill the circuit with coolant from the supply line first. This allows the air to gradually escape from the vent while fluid fills the supply, then the return.

5. All vent valves in the circuit being filled must be open. Close the vent valve at the lowest point in the circuit when liquid appears there. Work your way up to the vent valve at the highest location. If this process is done correctly, the minimum about of air that remains trapped in the system will be removed by the automatic air separator at the main return line during system operation.

6. When the vent valve at the highest point has liquid present and the air has been bled from the system, the system is filled at a pressure of 0 psig. Fill the fill tank with coolant to its maximum level. Additional coolant will be added to pressurize the system during pump startup.

Pump Startup

Bell and Gossett's installation, operation, and maintenance manual, as well at their technical brochure have been included at the conclusion of this manual for reference. These manuals should be read in their entirety and understood completely prior to pump startup.

The first pump is equipped with a wireless module to allow for wireless communication with the pumps through a laptop or smartphone. The pumps also have the ability to be controlled through a BMS (Building Management System) using an RS-485 connection. Section 6.1 of Bell and Gossett's IOM discusses the setting of the communication parameters for programming.

Section 5.1 of Bell and Gossett's IOM includes a diagram of the user interface and descriptions of the control modes that may be used with this pump. Cooltec's Fluid-Pak System is designed to operate in the constant pressure mode. External temperature sensors for use with the pumps are included with the equipment. These sensors allow the installer the option to operate the pumps in a temperature controlled mode. The decision to use this control mode is dependent on the jobsite conditions and must be made and implemented by an experienced refrigeration contractor only.

The system **must be filled** and air **must be purged** from the system prior to pump startup. All isolation and control valves at walk-in coils and refrigerated fixtures must be open completely. All vent and drain valves must be closed com pletely.

1. Turn on the power supply to the pumps.

2. Make the following adjustments to the master pump (left) only. The master pump will communicate these settings to the slave once steps 3 and 4 have been completed.

3. The drive will display **SING** (single head pump). Use the down arrow to change this setting to **TUMA** (dual master pump)

4. The drive will display **BCUP** (backup operation). Use the down arrow to change this to one of the following settings:

   ALTE Alternate Operation - This is the recommended setting. In this configuration, one pumps runs at a time. The pumps alternate every 24 hours for equal runtime. This setting is used when one pump can handle the head and flow requirements of the system. Refer to Bell and Gossett's pump performance curve to decide if this is the case. An accurate calculation of the head and flow requirements of the system is needed.

   PArA Parallel Operation - In this configuration , both pumps run simultaneously at the same set point. The master pumps determines the system behavior and modulates the second slave pump accordingly. This setting is used when both pumps are needed to achieve the head and flow requirements of the system.

5. The drive will display **COMM**. No change to this parameter is needed if programming of the pump is done through the user interface. If communication and the programming of the pump is done through the wireless or RS-485 module, refer to Bell and Gossett's Technical Brochure section 4.3.5.2 for setting this parameter.

6. The drive will display **4DEG** (air purge). During this time, the drive will place the pump into an air purge procedure, counting down from 4 to 1. When the purging of the pumps has finished, they will begin operation in the constant presure mode.

7. Using the control mode button, change the control mode to fixed speed.

8. Use the setting buttons (arrows) to set the master pump for maximum speed.

Pressurizing the System

Pressurization of the system after the initial fill is necessary to provide a positive pressure at the suction side of the pump. On some models, the expansion tank and air removal system are located after the main return valve. In this case, the expansion tank and air removal system must also be isolated from the system any time the main return valve is closed, and vice versa.

1. Close the valve on the main return line.

2. Observe the return coolant pressure. When the return pressure reaches 0 psig, slowly open the fill valve to fill the system from the fill tank.

3. When the fill tank reaches its minimum level, close the fill valve and then open the main return valve. Do not allow the tank level to drop below the minimum level as indicated on the sight glass to prevent adding air to the system.

4. Refill the fill tank with coolant to its maximum level.

5. Steps 1-4 should be repeated until the return coolant pressure reaches 10 psig above expansion tank initial pressure. Do not allow the supply pressure to exceed 75 psig during the fill process.

Refrigeration System

The Fluid-Pak refrigeration system should not be started without the secondary coolant system operational. Failure to do so will cause damage to the refrigeration system heat exchanger.

The primary refrigeration system should be started according to the same standards used when starting a conventional direct expansion system.

1. A suitable refrigerant scale must be used to charge the Fluid-Pak system

2. Begin charging the refrigeration system with r404a with liquid through an access valve at the liquid line. System should be in a deep vacuum and completely evacuated of air and moisture prior to refrigerant charging.

3. An initial charge equal to the capacity of the refrigerant receiver should be weighed into the system.

4. Turn on the power supply to the compressors, refrigeration controller, and oil systems.

5. The refrigeration controller has been programmed at the factory. This controller determines system operation through the monitoring of system pressures and the cycling on/off of compressor stages accordingly. Refer to the Dixell Installation and Operation Manual for additional information regarding the programming and operation of the refrigeration controller.

6. Once the refrigeration system is running add additional refrigerant as needed to achieve a liquid level of 40% within the refrigerant receiver.

7. Monitor system pressures and glycol temperature during pull down. Verify that all solenoid valves and compressors are operational, oil levels are adequate, and compressor amperage is within normal range.

Secondary coolant systems typically operate with a much lower return suction gas temperature than do conventional systems due to the close proximity of the heat exchanger to the compressors. This can cause some ice buildup at the compressor suction service valve and is normal. Compressor flood back is not normal and should be corrected.

System Balance

System balancing is critical for a glycol system. Proper balancing ensures an adequate flow of coolant to each refrigerated fixture and optimum pump performance. Each manufacture has different methods for regulating flow through its balance valve. The following are generic guidelines for balancing a glycol system.

Prior to beginning the balancing procedure:

- Air should be properly vented and removed from the system
- Coolant pumps should be operating at design capacity
- Pump suction pressure should be set
- The system should be at operating temperature
- All isolation valves between Fluid-Pak and refrigerated fixtures must be open

Many Fluid-Pak installations include a glycol manifold (either at the Fluid-Pak or remote), at which the main return and supply lines split into several branch lines. Each branch return line will be equipped with a pressure independent balance valve for regulating flow to each branch circuit. These valves maintain a constant flow rate regardless of system pressure fluctuations. They can be set initially at the design flow rate for each branch circuit prior to balancing the refrigerated fixtures on these circuits. The design flow rate can be found on Cooltec's refrigeration schedule, normally placed within the electrical panel or cabinet upon shipment.

Proportional Flow Method

When using the proportional flow method:

- All solenoid valves must be forced open with the thermostat or other means
- Defrost solenoids (if present) must be closed
- Pump drives should be set to operate at full speed

Begin by setting all balance valves at 90% open. This starting point allows for adjustment in the event that a fixture requires colder temperatures after balancing.

Balance one branch circuit at a time. Using a differential pressure gauge and flow sheet data from the valve manufacturer, record the pressure drops and flow rates of each fixture on a single branch circuit.

Decide which fixture has the lowest flow rate in comparison to the design flow rate. This is almost always the most hydraulically remote fixture. This fixture becomes the control fixture.

Working your way back from the control fixture, close the balance valves until the flow rate on each fixture closely matches the design flow rate. Adjustments made to one balancing valve will have a slight opposite impact on the remaining fixtures on that branch. Thus, as other valves are closed, the fixture with the lowest proportional flow will see an increased flow rate.

Many balance valves have an adjustment lock to prevent inadvertent opening or closing of the valve during service. When final balancing is complete, lock the valves to maintain their setting.

Repeat this process for each branch circuit. Flow rates can be measured and adjusted once more at the manifold following the balancing of all branch circuits if necessary.

Case Temperature Method

This method uses the case temperature and cycle rates to establish which fixtures require more or less flow. It is normally used when the piping configuration requires minimal balancing (reverse parallel piping is used).

Begin by setting all balance valves at 75% open. Run the system under normal operating conditions, monitoring thermostat temperature and solenoid valve cycle rates.

Make adjustments to the balance valves until all fixtures have similar cycle rates. Cases that are too cold or cycle too quickly will require their balance valves to be closed, while cases that cannot meet their design temperature will require their balance valves to be opened.

Pump Set Point

1. Observe the supply and return coolant pressures. The pressure gauge at the pump outlet prior to the heat exchanger is used for this.

2. Calculate the pressure differential between the supply and return by subtracting the pressure at the main return line entering the Fluid-Pak from the supply pressure at the pump outlet. This pressure differential indicates the total pressure loss of the system through all piping and components.

3. Calculate the system head using the following formula:

$$h = \frac{2.31\,p}{SG}$$

h = pump head (ft)
p = pressure (psi)
SG = specific gravity

The specific gravity of 35% glycol to water mixture is **1.05** at 20°F

Example: a pressure difference of 20 psi is observed between the supply and return.

$$h = \frac{2.31\,p}{SG}$$

$$h = \frac{2.31\,(20)}{(1.05)}$$

$$h = \frac{44}{(1.05)}$$

h = 42 ft of head

4. Change the control mode to constant pressure. This configuration maintains a constant differential pressure at any flow demand.

5. Use the setting buttons (arrows) to set the desired head of the pump(s). The set point will be your calculation from step 10. The pump(s) will work to maintain this differential pressure across it.

Final Considerations

At this point, you may set the thermostat and solenoid valves at the remote refrigerated fixtures to operate automatically. As refrigerated fixtures are satisfied and flow requirements are reduced, the drive will throttle down the pump and reduce flow, while keeping supply pressure available at the fixtures constant.

Coolant volume decreases with temperature , therefore additional coolant may need to be added if the coolant suction pressure has dropped below 10 psig above bladder pressure. Refer to the previous section titled "Pressurizing the System" to accomplish this.

The coolant return pressure switch should be set to close on a drop in pressure. The set point must be set at 10 psig below operating return coolant pressure. This will send an alarm to the remote alarm panel (if equipped) in the event of a fluid loss.

Monitor the system cycle rate as needed. Return after 24 hours to verify normal operation.

Proceed to the following section to fill out and submit Cooltec Refrigeration Warranty Checklist upon startup completion.

6. Maintenance Schedule

Quarterly maintenance of the refrigeration equipment is recommended to ensure proper operation and product temperatures. Just like the oil is changed in your car, and you go to the doctor for a routine physical, steps must be taken to protect your investment. A concerted effort by the owner to follow this maintenance schedule will result in far fewer service issues and equipment failures, and a long equipment life.

3 Months	Check refrigeration controller alarm log for any issues and address if needed
	Rinse air cooled condenser coils with water
	Isolate and remove one or more strainer filters to check cleanliness of the system
	Remove, clean, and replace strainer filters if system is determined to be dirty
	Monitor glycol temperature and compressor cycling
	Check compressor and pump amperage and control wiring
	Check refrigerant level
	Check coolant system pressures
	Check air removal system operation
	Check expansion tank pressure with tire gauge
	Set defrost timer to correct time
1 Year	Check refrigeration controller alarm log for any issues and address if needed
	Pressure clean / degrease air cooled condenser coils
	Perform complete oil change and oil filter replacement
	Remove and replace liquid and suction filter cores
	Remove, clean, and replace all strainer filters
	Monitor glycol temperature and compressor cycling
	Check compressor and pump amperage and control wiring
	Check refrigerant level
	Check coolant system pressures
	Check air removal system operation
	Check expansion tank pressure with tire gauge
	Set defrost timer to correct time

7. Warranty Checklist

This checklist allows for the recording of specific pressure/temperature readings and system set points used during the installation, startup, and commissioning of the Fluid-Pak System. Please sign and submit a copy of the completed form to Cooltec Refrigeration Corp. for validation of warranty coverage.

Date_____

Mail to: Cooltec Refrigeration Corp.

1250 E. Franklin Ave. Unit B

Pomona, CA 91766

Contact Information:

Company Name: _____

Startup Technician: _____

Phone: _____ Email: _____

Job Name_____

Start Up Date:_____

Location_____

Serial Number: _____

Pump #1 Nameplate Amps: _____

Running Amps: _____

Pump #2 Nameplate Amps: _____

Running Amps: _____

Compressor A Nameplate Amps: _____

Running Amps: _____

Compressor AA Nameplate Amps: _____

Running Amps: _____

Compressor AAA Nameplate Amps: _____

Running Amps: _____

Compressor B Nameplate Amps: _____

Running Amps: _____

Fluid Freeze Point: _____/_____%Glycol

Expansion Tank Pressure: _____

Coolant Return Pressure: _____

Coolant Supply Pressure at Pump Discharge: _____

Coolant Supply Pressure at Fluid-Pak Outlet: _____

Pump Set Point:_____RPM_____GPM_____

Coolant Return Pressure Switch Set Point: _____

Balance Valves Set and Locked _____

Refrigeration Controller Set Points Verified_____

Fluid Actual Temp. Discharge_____

Fluid Actual Temp. Return_____

Sub Cooling_____

Super Heat _____

Refrigerant_____lbs_____oz / Type_____

Oil, POE Med Temp Only_____Gal

Please list any variations from or modifications to manufacturer's specs:

_____

_____

_____

_____

_____

_____

_____

_____

8. Warranty Information

This warranty is made to the original user at the original installation site and is not transferable.

ALL WARRANTIES ARE VOID IF COOLTEC DOES NOT RECEIVE FULL PAYMENT FOR THE EQUIPMENT AND/OR INSTALLATION PROVIDED.

Cooltec Refrigeration Corp. products are warranted to be free from defect in materials and workmanship under normal use and service for a period of one (1) year from the date of original installation (not to exceed fifteen (15) months from the date of shipment from the factory). Warranty covers DEFECTIVE parts for one (1) year and 90 day labor; unless an extended (1) year labor warranty is purchased with the equipment. Cooltec's obligation under this warranty shall be limited to repairing or exchanging any defective part or parts (defective part needs to be sent to Cooltec for inspection), without charge F.O.B. factory. All service calls must be authorized and approved by Cooltec in advance, in order for service agents to be reimbursed.

Cooltec covers remote refrigeration rack and all its components (except for driers, fuses, refrigerant, refrigeration oil and other maintenance type replacement parts) for the one (1) year defective parts warranty period.

On Cooltec refrigeration system, an additional (4) year extended warranty for the motor/compressor assembly is available, but must be purchased prior to shipment to be in effect. Cooltec reserves the right to inspect the job site, installation and reason for failure of the compressor.

The motor/compressor warranties listed above does not include replacement or repair of controls, relays, capacitors, overload protectors, valve plates, oil pumps, gaskets or any external part on the motor/compressor replaceable in the field, or any other part of the refrigeration system.

THE WARRANTIES TO REPAIR OR REPLACE ABOVE RECITED ARE THE ONLY WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, MADE BY COOLTEC REFRIGERATION CORPORATION WITH RESPECT TO THE ABOVE MENTIONED EQUIPMENT, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS, AND COOLTEC NEITHER ASSUMES NOR AUTHORIZES ANY PERSON TO ASSUME FOR IT, ANY OTHER OBLIGATION OR LIABILITY IN CONNECTION WITH THE SALE OF SAID EQUIPMENT OR ANY PART THEREOF.

THIS WARRANTY SHALL NOT APPLY TO LOSS OF FOOD OR CONTENTS OF THE EQUIPMENT DUE TO FAILURE FOR ANY REASON.

COOLTEC SHALL NOT BE LIABLE:

- For payment of labor for any removal or installation of warranted parts.
- For any repair or replacements made without the written consent of Cooltec or when the equipment is installed or operated in a manner contrary to the printed instructions covering installation and service which accompanied such equipment.
- For any damages, delays, or losses, direct or consequential which may arise in connection with such equipment or part thereof.
- For damages caused by fire, flood, strikes, acts of God or circumstances beyond its control.
- When the equipment is subject to negligence, abuse, misuse or when the serial number of the equipment has been removed, defaced, or altered.
- When equipment is operated on low or improper voltages.
- When equipment is put to a use other than normally recommended by Cooltec.
- When operation of this equipment is impaired due to improper drain installation.
- For payment of refrigerant loss for any reason.
- For cost related to shipping or handling of replacement part.

dixell Installing and operating instructions EMERSON

XC1008D-XC1011D-XC1015D and VGC810

(rel. 1.5A)

INDEX

1. GENERAL WARNING

1.1 ⚠ Please read before using this manual

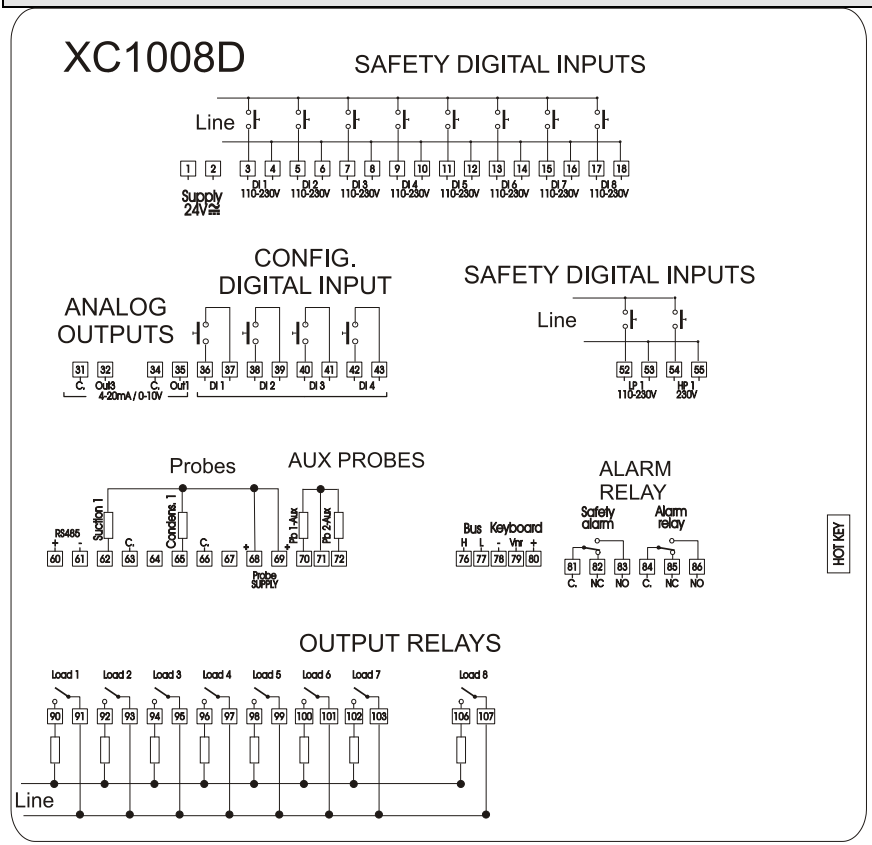
- This manual is part of the product and should be kept near the instrument for easy and quick reference.
- The instrument shall not be used for purposes different from those described hereunder. It cannot be used as a safety device.
- Check the application limits before proceeding.

1.2 ⚠ Safety Precautions

- Check the supply voltage is correct before connecting the instrument.
- Do not expose to water or moisture: use the controller only within the operating limits avoiding sudden temperature changes with high atmospheric humidity to prevent formation of condensation
- Warning: disconnect all electrical connections before any kind of maintenance.
- The instrument must not be opened.
- In case of failure or faulty operation send the instrument back to the distributor or to “DIXELL s.r.l.” (see address) with a detailed description of the fault.
- Consider the maximum current which can be applied to each relay (see Technical Data).
- Ensure that the wires for probes, loads and the power supply are separated and far enough from each other, without crossing or intertwining.
- Fit the probe where it is not accessible by the end user.
- In case of applications in industrial environments, the use of mains filters (our mod. FT1) in parallel with inductive loads could be useful.

2. Wiring connections

2.1 XC1008D

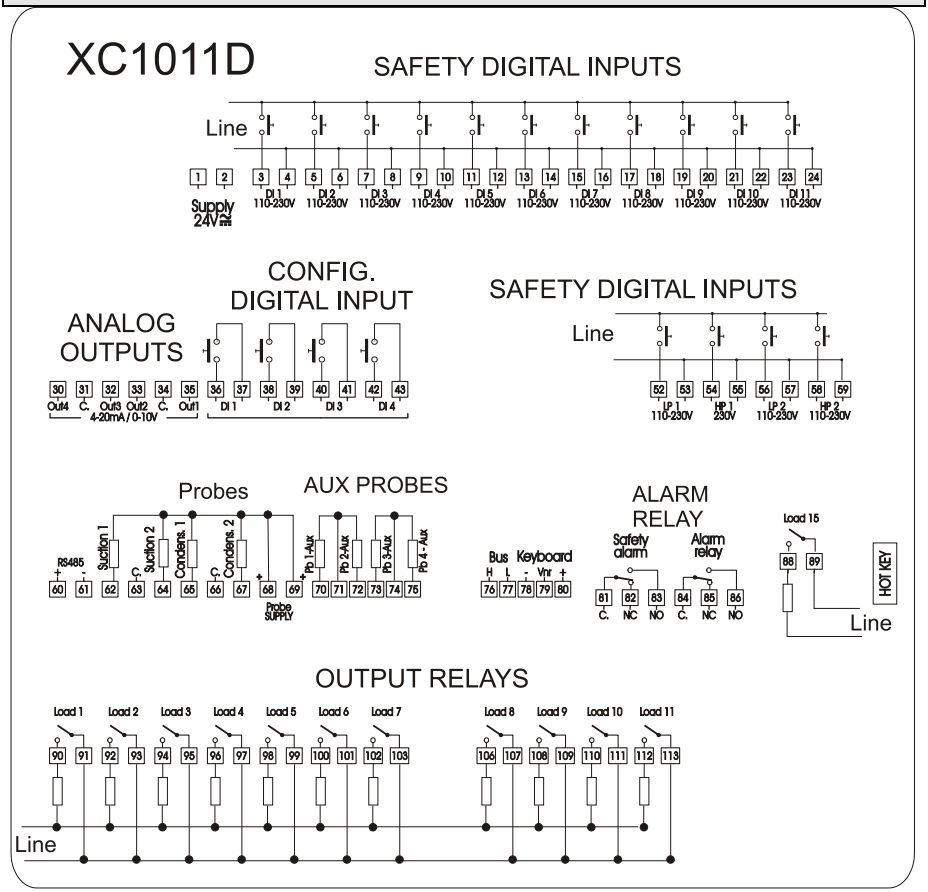


NOTE: according to the models the **digital inputs**: (3-18) and (52-55) can operates at 230V/120V or 24V. Verify on the controller which is the right voltage that can be applied.

ATTENTION

Configurable digital inputs (term. 36-43) are free voltage.

2.2 XC1011D

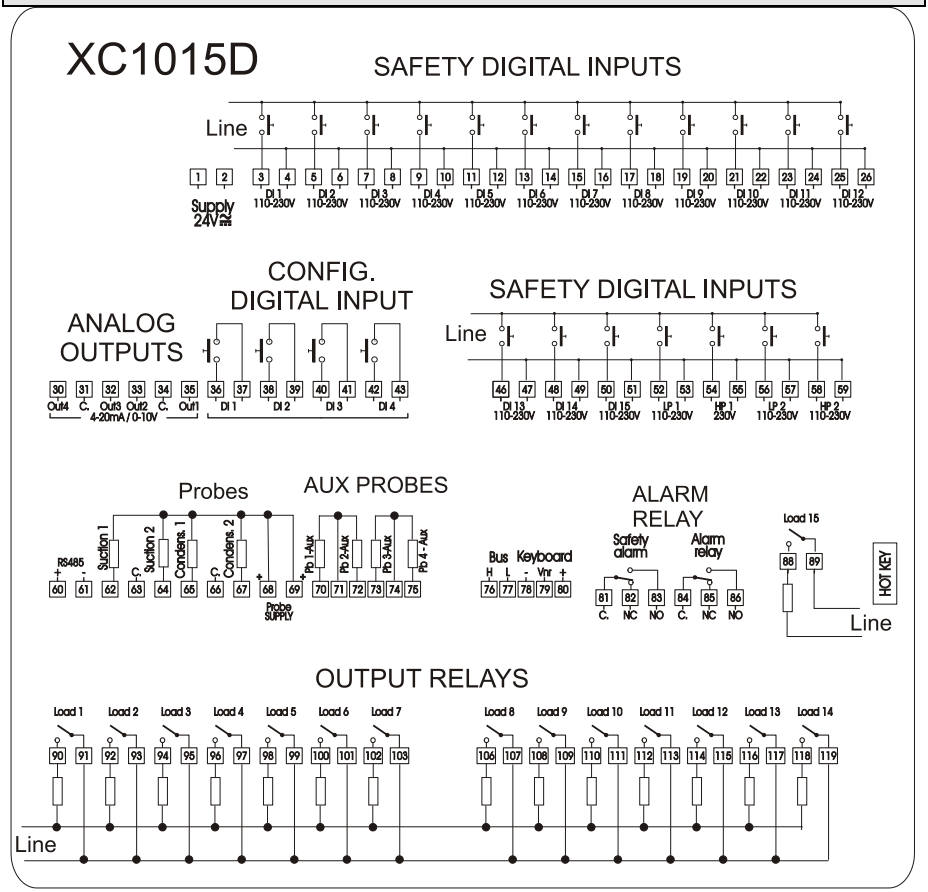


NOTE: according to the models the **digital inputs**: (3-24) and (52-59) can operates at 230V/120V or 24V. Verify on the controller which is the right voltage that can be applied.

ATTENTION

Configurable digital inputs (term. 36-43) are free voltage.

2.3 XC1015D



NOTE: according to the models the **digital inputs**: (3-26) and (46-59) can operates at 230V/120V or 24V. Verify on the controller which is the right voltage that can be applied.

ATTENTION
Configurable digital inputs (term. 36-43) are free voltage.

2.4 Descriptions of the wiring connections

1 - 2 Power supply: ***WARNING:*** THE SUPPLY IS **24Vac/dc**

3 –26 Digital inputs for safeties of compressors and fans – *main voltage*. When an d. i. is activated, the corresponding output is switched OFF. ***Please note: the digital input 1 is linked to the relay 1 (C1); d.i. 2 to relay 2 (C2), etc.***

30-31Analog output 4 (0-10V or 4-20mA depends on the parameter 3Q1)

31-32 Analog output 3 (0-10V or 4-20mA depends on the parameter 3Q1)
34-35 Analog output 1 (0-10V or 4-20mA depends on the parameter 1Q1)
33-34 Analog output 2 (0-10V or 4-20mA depends on the parameter 1Q1)

36-37 Configurable digital input 1 (free voltage)
38-39 Configurable digital input 2 (free voltage)
40-41 Configurable digital input 3 (free voltage)
42-43Configurable digital input 4 (free voltage)

46-51 Digital inputs for safeties of compressors and fans – *main voltage*. When an d. i. is activated, the corresponding output is switched OFF. ***Please note: the digital input 1 is linked to the relay 1 (C1); d.i. 2 to relay 2 (C2), etc.***

52 - 53 Low pressure-switch input for circuit 1: input at the same voltage of loads.

54 - 55 High pressure-switch input for circuit 1: input at the same voltage of loads.

56 - 57 Low pressure-switch input for circuit 2: input at the same voltage of loads.

58 - 59 High pressure-switch input for circuit 2: input at the same voltage of loads.

60-61 RS485 output
62 –(63) or (68): Suction probe input for circuit 1:
with **AI1 = cur** or **rat** use 62 -68
with **AI1 = ntc** or **ptc** use 62 -63

64 –(63) or (68): Suction probe input for circuit 2:
with **AI1 = cur** or **rat** use 64 -68
with **AI1 = ntc** or **ptc** use 64 -63

65 –(66) or (69): Condensing probe input for circuit 1:
with **AI8 = cur** or **rat** use 65 -69
with **AI8 = ntc** or **ptc** use 65 -66

67 –(66) or (69): Condensing probe input for circuit 2:
with **AI8 = cur** or **rat** use 67 -69
with **AI8 = ntc** or **ptc** use 67 -66

70-71 Auxiliary probe 1

71-72 Auxiliary probe 2

73-74 Auxiliary probe 3

74-75 Auxiliary probe 4

78- 79- 80 Keyboard

81-82-83: **Safety relay:** XC1000D off or damaged: 81-82 closed
XC1000D working: 81-83 closed

84-85-86: **Alarm relay**:

88 - 103 and 106 - 119 Relay configurable outputs for compressors, fans, alarms and aux.
The functioning of the relays depends on the setting of the correspondent C(i).

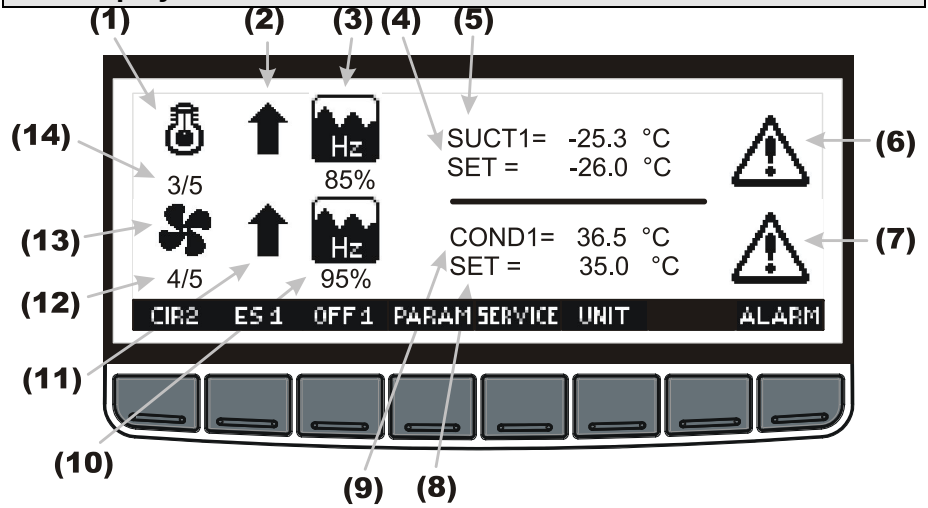
3. User interface

3.1 What is displayed when the keyboard is connected

Where:
release: Rel Firmware XC1000D / release OS Visograph / release Program Visograph

Push the ENTER key to enter the standard visualization

3.2 Display visualization



(1) **Symbol of compressor**: it's present for the following configuration of the parameter C0.
C0 = 1A0D; 1A1D, 2A0D, 2A1D, "2A2D

(2) **Status of the suction section**:

The pressure (temperature) is below the regulation band and the capacity of the plant is decreasing

The pressure (temperature) is above the regulation band and the capacity of the plant is increasing

(3) **Analog output status for frequency compressor:** it's present only if a frequency compressor is used. It displays the percentage of the analog output driving the inverter.
Not present if the "free" analog output is used.

(4) **Suction pressure (temperature) set point:** : it's present for the following configuration of the parameter C0: 1A0D; 1A1D, 2A0D, 2A1D, "2A2D

(5) **Current value of suction pressure (temperature):** it's present for the following configuration of the parameter C0: 1A0D; 1A1D, 2A0D, 2A1D, "2A2D

(6) **Alarm:** it's display when an alarm happens in suction section

(7) **Alarm:** it's display when an alarm happens in delivery section

(8) **Delivery pressure (temperature) set point:** it's present for the following configuration of the parameter C0: 0A1D; 1A1D, 0A2D, 1A2D, "2A2D

(9) **Current value of delivery pressure (temperature):** it's present for the following configuration of the parameter C0: 0A1D; 1A1D, 0A2D, 1A2D, "2A2D

(10) **Analog output status for inverter for fan:** it's present only if an inverter for fan is used. It displays the percentage of the analog output driving the inverter.
Not present if the "free" analog output is used.

(11) **Status of the delivery section**:

↓ The condenser pressure (temperature) is below the regulation band and the number of fans is decreasing

↑ The condenser pressure (temperature) is above the regulation band and the number of fans is increasing

(12) **Number of fans activated / Total number of fans** it's present for the following configuration of the parameter C0.
C0: 0A1D; 1A1D, 0A2D, 1A2D, "2A2D
NOTE: the total number of fans is referred to the number of available fans. Fans that are in "maintenance" or that are stopped by their own digital input aren't included.

(13) **Symbol of fan**: it's present for the following configuration of the parameter C0.
C0: 0A1D; 1A1D, 0A2D, 1A2D, "2A2D

(14) **Number of compressors and steps activated / Total number of compressors and steps.** it's present for the following configuration of the parameter C0.
C0 = 1A0D; 1A1D, 2A0D, 2A1D, 2A2D
NOTE: the total number of compressors is referred to the number of available compressors. Compressors that are in "maintenance" or that are stopped by their own digital input aren't included.

Keys

ALARM **Alarm:** to enter the alarm menu

PARAM **Parameter:** to enter the parameter programming

SERVICE **Service:** to enter the Service menu

UNIT **Measurement unit:** to switch the probe visualization and set point from pressure to temperature and vice versa

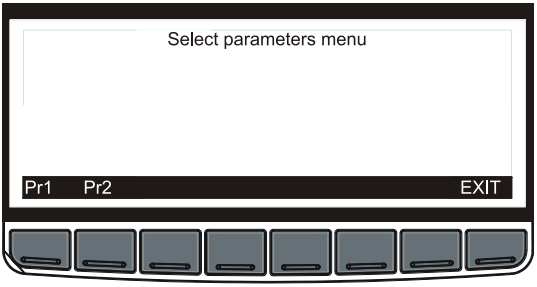
OFF 1 **To switch the controller off:** hold pushed for 10s to switch the controller off (it's enabled only if the parameter OT9 = yES)

ES 1 **Energy saving:** hold pushed for 10s to enable the energy saving cycle (the SET label starts flashing)

CIR2 **Circuit 2:** to pass to visualization of the variables of the second circuit, It's present for the following configuration of the parameter C0: 0A2D; 2A0D, 2A2D.

3.3 Programming

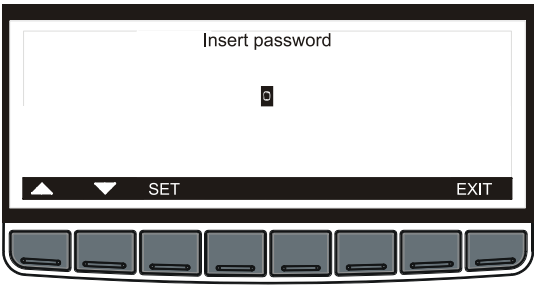
Push the PARAM key and the programming menu is entered.



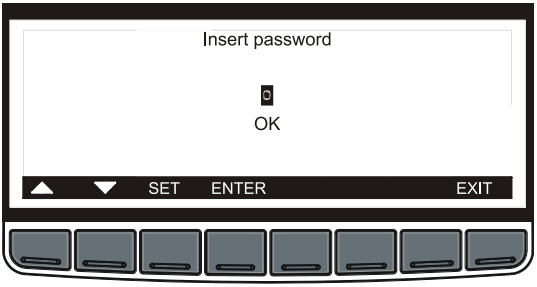
Parameters are collected in two menu:
Pr1: menu of parameters without password. Press the Pr1 key to enter.
Pr2: menu of parameters with password. If the password is enabled, use the following procedure to put it.

3.3.1 Password introduction to enter Pr2

If the password is enabled, by pushing the **Pr2** key the following interface is displayed:



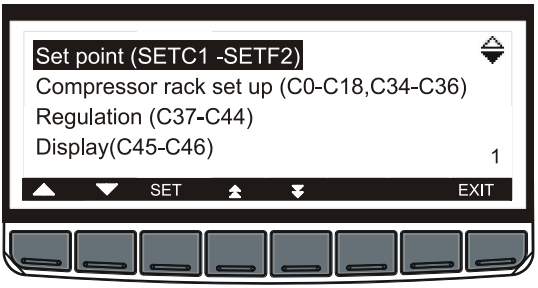
1. Push the SET key.
2. Use the UP and DOWN keys to set the password
3. Push the SET key to confirm it
4. The following message is displayed



5. Push the ENTER key to enter in Pr2 menu

3.3.2 Parameters grouping

The parameters are collected in sub-menu according to the following interface.



The parameters sub menu are the following:

Set Point (SETC1-SETF2)

Compressor Rack setup (C0-C18, C34-C36)
Regulation (C37-C44)
Display (C45-C46)

Analog Inputs of regulation (Ai1-Ai15)

Analog Inputs of auxiliary (Ai16-Ai28)

Safety Digital Inputs (Di2-Di13)

Digital Inputs (Di14-Di27)

Display (C45-C44)

Compressor Action (CP1-CP8)

Safety Compressors (CP9-CP18)

Fan Action (F1-F8)

Safety Fans (F9-F10)

Energy Saving (HS1-HS14)

Compressor Alarms (AC1-AC19)

Fan Alarms (AF1-AF17)

Dynamic Setpoint Suction (o1-o8)

Condenser Set point (O9-O14)

Analog outputs configuration (1Q1, 3Q1)

Analog Outputs 1 (1Q1-1Q26)

Analog Outputs 2 (2Q1-2Q25)

Analog outputs 3 (3Q2-3Q26)

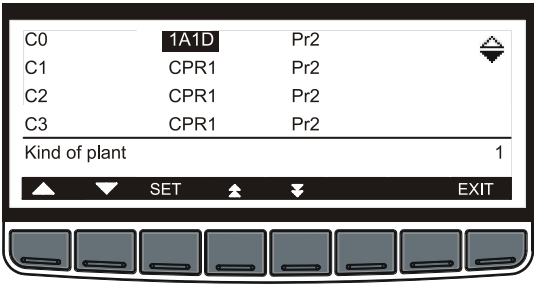
Analog outputs 4 (4Q1-4Q25)

Auxiliary Outputs (AR1-AR12)

Other (oT1-OT9)

NOTE: some sub menu could be absent depending on the model.

Push the SET key to enter a menu and the parameter with their value will be displayed: see below picture.



Push the SET key and use the **UP** and **DOWN** keys to modify the value.
Then push the SET key to store the new value and move to the following parameter.

NOTE: the Pr2 or Pr1 message is present only in Pr2 menu.
It is possible to modify the level of each parameter changing Pr2 → Pr1 or vice versa.

NOTE: Pushing the **EXIT** button the initial screen shot is displayed.

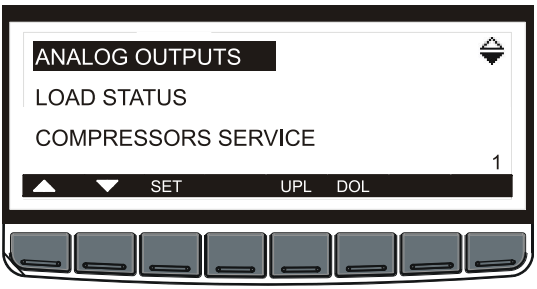
4. SERVICE MENU

The service menu collect the main functions of the controller.
From the Service menu is possible to:

- see the values of analog outputs
- see the status of compressor relay
- operate a maintenance section
- see the status of safety and configurable digital inputs
- see the values of the probes
- set the real time clock
- use the HOT KEY to program the instrument or to program the HOT KEY
- set the password and enable it for some menu
- set the instrument language.

4.1 How to enter the Service menu

From the main display screen push the SERVICE button and the SERVICE menu is entered.
See below picture:



The Service sub-menu are the following:

ANALOG OUTPUTS
RELAY OUTPUTS
COMPRESSOR SERVICE
DIGITAL INPUTS
PROBES
PASSWORD
LANGUAGE

Select one of them with the UP or DOWN keys then push the SET key to enter the sub-menu

4.2 How to program an instrument using a HOT KEY

The XC1000D uses a standard Dixell HOT KEY (cod. DK00000100).

4.2.1 How to program the HOT KEY.

1. Program one controller with the front keypad.
2. When the controller is ON, insert the "**Hot key**". Enter the SERVICE menu and push the **UPL** key. The display will shows the message "**PLEASE WAIT**".
3. The instrument will shows during 10sec:
   "**END**": the programming phase is ended successfully
   the "**ERROR**" message is displayed for failed programming. In this case push again the UPL key if you want to restart the upload again.

4.2.2 How to program an instument using a HOT KEY

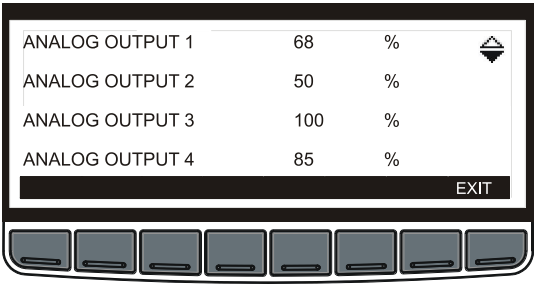
1. Switch off the controller or enter the SERVICE menu.
2. Insert a **programmed "Hot Key" into the 5 PIN receptacle**
3. Turn the controller on, or push the DOL key of the SERVICE menu.
4. Automatically the parameter list of the **"Hot Key"** is downloaded into the Controller memory, the "**doL**" message is blinking. The display will shows the message "**PLEASE WAIT**".
4. The instrument will shows during 10sec:
   "**END**": the programming phase is ended successfully.
   Remove the "Hot Key", the XC1000D will restart working with the new parameters.
   NOTE: until the "Hot Key" is inserted, the instrument doesn't start the regulation.
   the "**ERROR**" message is displayed for failed programming. In this case push again the UPL key if you want to restart the upload again.After 10 seconds the instrument will restart working with the new parameters.

4.3 How to see the values of analog outputs

Procedure:

1. Enter the **SERVICE** menu
2. Select **ANALOG OUTPUTS** sub-menu
3. Push the **SET** key.

The **ANALOG OUTPUTS** sub-menu displays the status of the analog outputs of the controller, with the following layout:



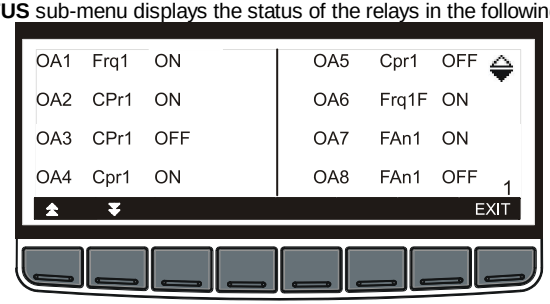
This outputs can be used to drive an external inverter or to repeat a main probe, by means of a signal 4-20mA or 0-10V.

4.4 How to see the status of the relays

Procedure:

1. Enter the **SERVICE** menu
2. Select **LOADS STATUS**
3. Push the **SET** key.

The **LOADS STATUS** sub-menu displays the status of the relays in the following format:



With this meaning:
First column: number of relay; second column: configuration; third column: status.

4.5 COMPRESSOR SERVICE SUB- MENU – For maintenance sections

The COMPRESSOR SERVICE menu could be protected by password. See chapter 3.3.1.

By means of the **COMPRESSOR SERVICE** sub-menu is possible to perform a maintenance section, consisting on:

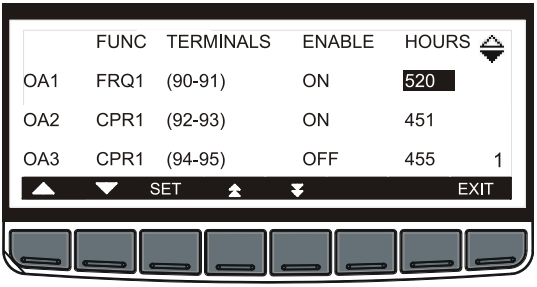
- disabled an output
- check and (eventually) erase the running hour of a load.

4.5.1 How to enter the "COMPRESSOR SERVICE" submenu.

Procedure:

1. Enter the **SERVICE** menu
2. Select **COMPRESSOR SERVICE** sub-menu
3. Push the **SET** key.

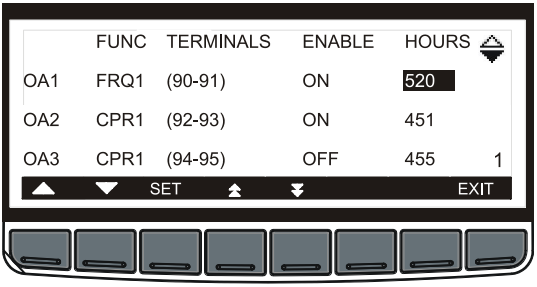
The **COMPRESSOR SERVICE** sub-menu displays the status of the relays with the following layout:



4.5.2 How to disabled/enabled an output during a maintenance section.

To disabled an output during a maintenance session means to exclude the output from the regulation:
To do it act as in the following

1. Enter the **COMPRESSOR SERVICE** sub-menu, as described in the previous paragraph.
2. Select the load by means of the UP and DOWN keys.
3. Push the SET key, then use the UP and DOWN keys to move the status to ON to OFF and vice versa.
4. Confirm the selection by means of the SET key.

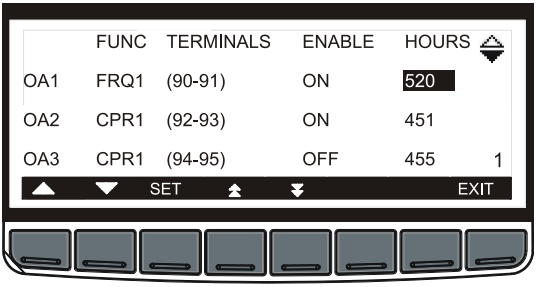


4.5.3 Regulation with some outputs disabled.

If some outputs are disabled they don't take part to the regulation, so the regulation goes on with the other outputs.

4.5.4 How to display the running hours of a load.

The controller memorises the running hours of each load.
To see how long a load has been working enter the **COMPRESSOR SERVICE** sub-menu.
The running hour are displayed with the following layout:



4.5.5 *How to erase the running hours of a load*

After a maintenance session usually is useful to erase the running our of a load.
To do it act as in the following

1. Enter the **COMPRESSOR SERVICE** sub-menu, as described in the paragraph. 4.5.1.
2. Select the load by means of the UP and DOWN keys.
3. Push the SET key, then use the DOWN key to decrease the running hour of the load..
4. Confirm the setting by means of the SET key.

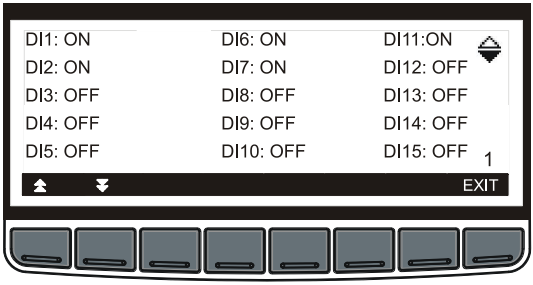
To exit: push the **EXIT** key to come back to the SERVICE menu.

4.6 How to see the status of digital inputs

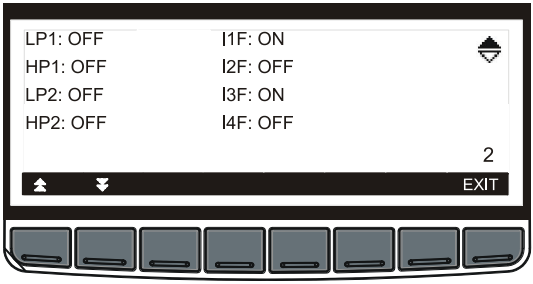
Procedure:

1. Enter the **SERVICE** menu
2. Select **DIGITAL INPUTS** sub-menu
3. Push the **SET** key.

The **DIGITAL INPUTS** sub-menu displays the status of the safety and configurable digital inputs, with the following layout:



Safety digital inputs



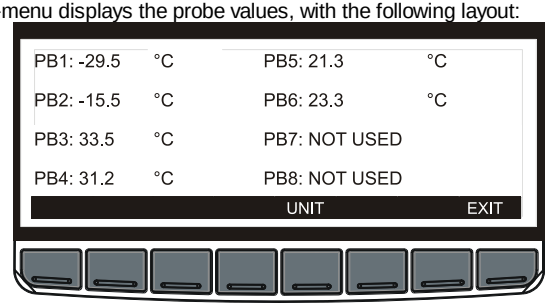
HP, LP and configurable inputs

4.7 How to see the values of the probes

Procedure:

1. Enter the **SERVICE** menu
2. Select **PROBES** sub-menu
3. Push the **SET** key.

The **PROBES** sub-menu displays the probe values, with the following layout:



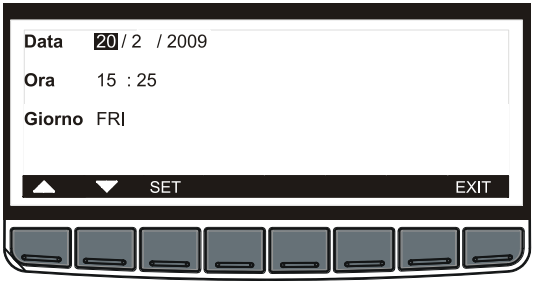
To **change** the measurement unit for the probe PB1, PB2, PB3, PB4, push **UNIT** button.

4.8 How to set time and date

Procedure:

1. Enter the **SERVICE** menu
2. Select **REAL TIME CLOCK** sub-menu
3. Push the **SET** key.

The **REAL TIME CLOCK** sub-menu displays time and date, with the following layout:



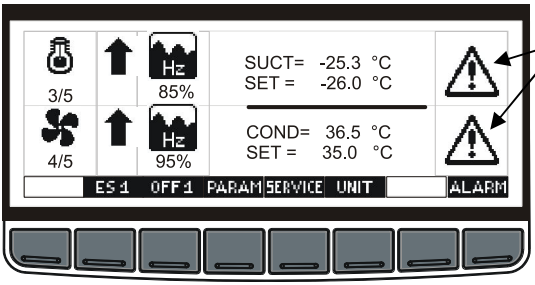
5. Set the day by means of the **UP** and **DOWN** keys.
6. Push the **SET** key, to confirm and pass to the setting of time.
7. Use the same procedure for the date.
8. Then confirm the selection by means of the SET key.

NOTE: to memorise the alarms and to enable the automatic energy saving cycle the real time clock has to be set.

5. Alarms

The controller memorises the last 100 alarms happened, together with their start and finish time. To see the alarms follow the following procedure.

5.1 Menu Active alarms

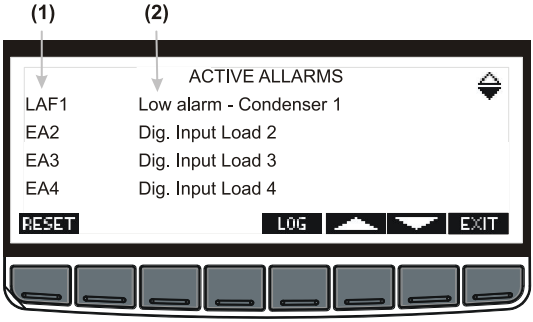


If the alarm icon is flashing on the main display, an alarm is occurring.

Push the **ALARM** key to enter the alarm menu.

1. Push the **ALARM** key to enter the **ALARM MENU,**
2. Select the alarm menu

Premere il tasto **ENTER** per entrare nel menu allarmi

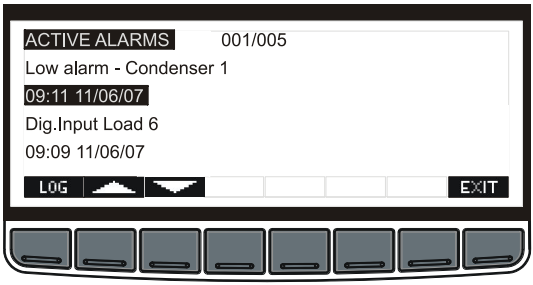


The alarm menu displays the active alarm with the following layout:
(1) = alarm code
(2) = alarm description

Push the **LOG button** to enter the **ALARM ACTIVE** log, as shown in the following picture

5.2 Active alarm log menu

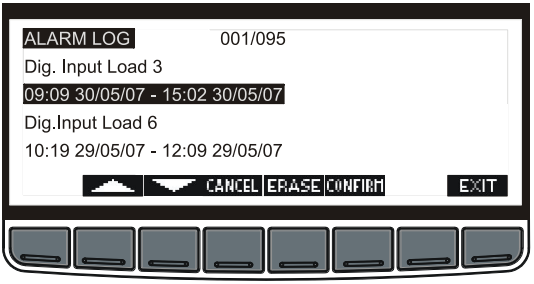
This menu contains all the information concerning the active alarms.
In the first line, it is displayed how many alarms are happening.



It's possible to move through the alarms by the UP and DOWN keys.

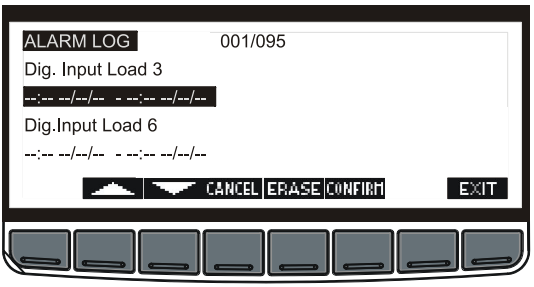
5.3 Active alarm log menu

Push the **LOG button** to enter the **ALARM LOG.**



This menu contains all the memorised alarms. For each alarm the starting time and date and the finish time and date are recorded.

Push the **ERASE button** to delete the whole archive of alarms.
The following display is shown:



Push the **CONFIRM button** to confirm the operation and delete the archive.
Push the **CANCEL button** to cancel the operation and come back to the ALARM LOG menu.

6. Parameters

6.1.1 Compressor Rack setup (C0-C18, C34-C36)

C0 **Kind of plant:** it set the kind of plant.
The following table shows the kind of plant can be set and which probes have to be used

C0	Kind of plant	Pb1	Pb2	Pb3	Pb4
0A1d	Only condenser fan			Delivery 1	
1A0d	Only compressors	Suction 1	-		-
1A1d	Compressors and fans 1 circuit	Suction 1		Delivery 1	
0A2d	Fans of circuit 1 and 2			Delivery 1	Delivery 2
2A0d	Compressors of circuit 1 and 2	Suction 1	Suction 2		
2A1d	Compressors of circuit 1 and 2 – 1 condenser	Suction 1	Suction 2	Delivery 1	-
2A2d	Compressors of circuit 1 and 2 – Fans of circuit 1 and 2	Suction 1	Suction 2	Delivery 1	Delivery 2

C1… C15 Relay 1…15 configuration: by means of parameter **C0 and C1…C15** the plant can be dimensioned according to the number and type of compressors and/or fans and the number of steps for each one.

Each relay according to the configuration of the C(i) parameter can work as

Frq1 = frequency compressor circuit 1;
Frq2 = frequency compressor circuit 2;
CPr1 = compressor circuit 1;
CPr2 = compressor circuit 2,
Screw1 = screw compressor – circuit 1
Screw2 = screw compressor – circuit 2
StP = step of the previous compressor,
FrqF1 = inverter fan circuit 1;
FrqF2 = inverter fan circuit 2;
FAn1 = fan circuit 1,
FAn2 = = fan circuit 2,
ALr = alarm;
ALr1 = alarm 1
ALr2 = alarm 2
AUS1 = auxiliary output 1
AUS2 = auxiliary output 2,
AUS3 = auxiliary output 3,
AUS4 = auxiliary output 4,
onF = on / off relay
nu = relay not used

NOTE 1: CIRCUITS WITH INVERTER FOR COMPRESSORS OR FANS

If in one circuit there are frequency compressors (Frq1 or Frq2) inverter fans, (Frq1F or Frq2F) their relays must be the first of that circuit.

ES: Plant with 1 circuit with 6 compressors (1 with inverter and 5 fans with inverter):

C0 = 1A1d;
C1 = Frq1;
C2 = CPr1**;**
C3 = CPr1**,**
C4 = CPr1**,**
C5 = CPr1;
C6 = CPr1;
C7 = **Frq1F**;

C8 = FAn1;
C9 = FAn1;
C10 = FAn1;
C11 = FAn1;
C12 = nu
C13 = nu
C14 = nu
C15 = nu

PLANT CONFIGURATION EXAMPLE:
Plant with 1 circuit with 6 compressors e 5 fans:
C0 = 1A1d;
C1 = CPr1**;**
C2 = CPr1**;**
C3 = CPr1**,**
C4 = CPr1**,**
C5 = CPr1;
C6 = CPr1;
C7 = FAn1;
C8 = FAn1;
C9 = FAn1;
C10 = FAn1;
C11 = FAn1;
C12 = nu
C13 = nu
C14 = nu
C15 = nu

Plant with 1 circuit with 3 compressors, 2 of them without valves, and 1 compressor with 2 valves e 4 fans:
C0 = 1A1d;
C1 = CPr1**;**
C2 = CPr1**;**
C3 = CPr1**,**
C4 = Stp**,**
C5 = Stp;
C6 = FAn1;
C7 = FAn1;
C8 = FAn1;
C9 = FAn1;
C10 = nu
C11 = nu
C12 = nu
C13 = nu
C14 = nu
C15 = nu

Plant with 2 suctions and 2 deliveries:
Suction 1: 1frequency compressor, 1 compressor without valves and 1 compressors with 2 valves
Delivery 1: 3 fans
Suction 2: 1frequency compressor, 2 compressors
Delivery 2: 1 inverter fan, 2 fans
C0 = 2A2d;

C1 = Frq1**;**
C2 = CPr1**;**
C3 = CPr1**,**
C4 = Stp**,**
C5 = Fan1;
C6 = FAn1;
C7 = FAn1;
C8 = Frq2;
C9 = Cpr2;
C10 = Cpr2;
C11 = Frq2F;
C12 = Fan2;
C13 = Fan2;
C14 = nu
C15 = nu

C16 **Kind of compressors:** to set the kind of compressors.
SPo = compressors with the same capacity.
BtZ = screw compressors like Bitzer, Hanbell, Refcomp etc operation.
Frtz = screw compressors like Frascold operation.

C17 **Valve output polarity - circuit 1: valve polarity:** polarity of the outputs for capacity valves. It determines the state of the relays associated with the capacity valves:
oP=valve enabled with open contact;
cL= valve enabled with closed contact.

C18 **Valve output polarity - circuit 2: valve polarity:** polarity of the outputs for capacity valves. It determines the state of the relays associated with the capacity valves:
oP=valve enabled with open contact;
cL= valve enabled with closed contact.

C34 **Kind of gas: set the kind of freon used in the plant**
r22 = R22; r404= R404A ; 507= R507; 134=134; r717=r717 (ammonia); co2 = CO2; 410 = r410.
Setting the kind of gas, the XC1000D can associate the pressure with the matching temperature.

C35 **Activation time during the switching on of first step (valve of 25%) for Bitzer screw compressors:** (0÷255s): it sets for how long the valve is used during the startup phase.

C36 **First step enabled during the regulation (switching off phase):** it sets if the first step can be used also during normal regulation.
NO = first step used only during the start phase
YES = first step used also during normal regulation

6.1.2 Regulation (C37-C44)

C37 **Type of regulation for compressor circuit 1:db =** neutral zone**,** **Pb =** proportional band**.**
C38 **Type of regulation for compressor circuit 2: db =** neutral zone**,** **Pb =** proportional band**.**

C41 **Compressor rotation circuit 1:**
YES = rotation: the algorithm distributes the working time between loads to ensure even run times.
no = fixed sequence: the compressors are enabled and disabled in fixed sequence: first, second etc.

C42 **Compressor rotation circuit 2:**
YES = rotation: the algorithm distributes the working time between loads to ensure even run times.
no = fixed sequence: the compressors are enabled and disabled in fixed sequence: first, second etc.

C43 **Fan rotation circuit 1:**
YES = rotation: the algorithm distributes the working time between loads to ensure even run times.
no = fixed sequence: the fans are enabled and disabled in fixed sequence: first, second etc.

C44 **Fan rotation circuit 2:**
YES = rotation: the algorithm distributes the working time between loads to ensure even run times.
no = fixed sequence: the fans are enabled and disabled in fixed sequence: first, second etc.

6.1.3 Display (C45-C46)

C45 **Displaying measurement unit:** it sets the measurement unit used for the display and for parameters that are connected to temperature/pressure. In pharentesis other measurement unit.
CDEC: °C with decimal point (bar);

CINT: °C with decimal point (bar);
F: °F (PSI)**;**
BAR: bar (°C)**;**
PSI: PSI (°F)**;**
KPA: KPA (°C)
CKPA: °C (KPA)
NOTE1: changing the measurement unit, the instrument will update parameter values that refer to pressure or temperature.
NOTE2: parameters with probe calibration, are reset during the measurement unit change.

C46 **Pressure display:** it indicates if the range of the probes are related to relative or absolute pressure. **rEL =** relative pressure; **AbS:** absolute pressure
NOTE: the temperature is updated changing this value.

6.1.4 Analog Inputs (Ai1-Ai15)

AI1 **Kind of probe of P1 & P2:** it sets the kind of probes for suction sections: **Cur** = 4 ÷ 20 mA probe; **Ptc** = Ptc probe; **ntc** = NTC probe; **rAt =** rathiometric probe (0÷5V).

AI2 **Adjustment of read out for the probe 1 at 4mA/0V:** (-1.00 ÷ AI3 bar; -15 ÷ AI3 PSI, -100 ÷ AI3 KPA)

AI3 **Adjustment of read out for the probe 1 at 20mA/5V:** (AI2 ÷ 100.00 bar; AI2 ÷ 750 PSI; AI2 ÷ 10000 KPA)

AI4 **Probe 1 calibration:**
with **C45 = CDEC or CINT:** -12.0 ÷ 12.0 °C
with **C45= bar:** -1.20 ÷ 1.20 bar;
with **C45 = F or PSI:** -120 ÷ 120 °F o PSI
with **C45 = KPA:** -1200 ÷ 1200 KPA;

AI5 **Adjustment of read out for the probe 2 at 4mA/0V:** (-1.00 ÷ AI6bar; -15 ÷ AI6 PSI)

AI6 **Adjustment of read out for the probe 2 at 20mA/5V:** (AI5 ÷ 51.00 bar; AI5 ÷ 750 PSI)

AI7 **Probe 2 calibration:**
with **C43 = CEL_DEC or CEL_INT:** -12.0 ÷ 12.0 °C
with **C43 = bar:** -1.20 ÷ 1.20 bar;
with **C43 = FAR or PSI:** -120 ÷ 120 °F or PSI

AI8 **Kind of probe of P3 & P4: :** it sets the kind of probes for delivery sections: **Cur** = 4 ÷ 20 mA probe; **Ptc** = Ptc probe; **ntc** = NTC probe; **rAt =** rathiometric probe (0÷5V).

AI9 **Adjustment of read out for the probe 3 at 4mA/0V:** (-1.00 ÷ AI10bar; -15 ÷ AI10 PSI; -100 ÷ AI10 KPA)

AI10 **Adjustment of read out for the probe 3 at 20mA/5V:** (AI9 ÷ 100.00 bar; AI9 ÷ 750 PSI; AI9 ÷ 10000 KPA)

AI11 **Probe 3 calibration**
with **C45 = CDEC or CINT:** -12.0 ÷ 12.0 °C
with **C45 = bar:** -1.20 ÷ 1.20 bar;
with **C45 = F or PSI:** -120 ÷ 120 °F o PSI
with **C45 = KPA:** -1200 ÷ 1200 KPA;

AI12 **Adjustment of read out for the probe 4 at 4mA/0V:** (-1.00 ÷ AI13bar; -15 ÷ AI13 PSI; -100 ÷ AI13 KPA)

AI13 **Adjustment of read out for the probe 4 at 20mA/5V:** (AI12 ÷ 100.00 bar; AI12 ÷ 750 PSI; AI12 ÷ 10000 KPA)

AI14 **Probe 4 calibration:**
with **C45 = CDEC or CINT:** -12.0 ÷ 12.0 °C
with **C45 = bar:** -1.20 ÷ 1.20 bar;
with **C45 = F or PSI:** -120 ÷ 120 °F o PSI
with **C45 = KPA:** -1200 ÷ 1200 KPA;

AI15 **Alarm activated in case of regulation faulty probe:**
nu = none relay; **Alr:** all the C(i) outputs set as ALr; **ALr1:** all the C(i) outputs set as ALr1, **ALr2:** all the C(i) outputs set as ALr2

6.1.5 Auxiliary analog inputs (Ai1-Ai15)

AI16 **Probe 1 AUX setting:** **ptc** = PTC probe**; ntc**= NTC probe

AI17 **Probe 1 AUX action type:** it sets the function ot the AUX1 probe (term. 70-71)

nu = not used
Au1 = thermostat probe for AUX1 relay**;**
Au2 = thermostat probe for AUX2 relay**;**
Au3 = thermostat probe for AUX3 relay**;**
Au4 = thermostat probe for AUX4 relay**;**
otC1 = for the optimization of the delivery pressure/temperature, circuit 1 (dynamic set of delivery circuit 1)**;**
otC2 = for the optimization of the delivery pressure/temperature, circuit 2 (dynamic set of delivery circuit 2)**;**
otA1 = for the optimization of the suction pressure/temperature, (dynamic set point) circuit 1(dynamic set of suction circuit 1)**;**
otA2 = for the optimization of the suction pressure/temperature, (dynamic set point) circuit 2 (dynamic set of suction circuit 2)

AI18 **Probe 1 AUX calibration:** -12.0 ÷ 12.0 **°**C; -120 ÷ 120 °F

AI19 **Probe 2 AUX setting:** **ptc** = PTC probe**; ntc**= NTC probe

AI20 **Probe 2 AUX action type:** it sets the function ot the AUX1 probe (term. 71-72)
nu = not used
Au1 = thermostat probe for AUX1 relay**;**
Au2 = thermostat probe for AUX2 relay**;**
Au3 = thermostat probe for AUX3 relay**;**
Au4 = thermostat probe for AUX4 relay**;**
otC1 = for the optimization of the delivery pressure/temperature, circuit 1 (dynamic set of delivery circuit 1)**;**
otC2 = for the optimization of the delivery pressure/temperature, circuit 2 (dynamic set of delivery circuit 2)**;**
otA1 = for the optimization of the suction pressure/temperature, (dynamic set point) circuit 1(dynamic set of suction circuit 1)**;**
otA2 = for the optimization of the suction pressure/temperature, (dynamic set point) circuit 2 (dynamic set of suction circuit 2)

AI21 **Probe 2 AUX calibration:** -12.0 ÷ 12.0 **°**C; -120 ÷ 120 °F

AI22 **Probe 3 AUX setting:** **ptc** = PTC probe**; ntc**= NTC probe

AI23 **Probe 3 AUX action type:** it sets the function ot the AUX1 probe (term. 73-74)
nu = not used
Au1 = thermostat probe for AUX1 relay**;**
Au2 = thermostat probe for AUX2 relay**;**
Au3 = thermostat probe for AUX3 relay**;**
Au4 = thermostat probe for AUX4 relay**;**
otC1 = for the optimization of the delivery pressure/temperature, circuit 1 (dynamic set of delivery circuit 1)**;**
otC2 = for the optimization of the delivery pressure/temperature, circuit 2 (dynamic set of delivery circuit 2)**;**
otA1 = for the optimization of the suction pressure/temperature, (dynamic set point) circuit 1 (dynamic set of suction circuit 1)**;**
otA2 = for the optimization of the suction pressure/temperature, (dynamic set point) circuit 2 (dynamic set of suction circuit 2)

AI24 **Probe 3 AUX calibration:** -12.0 ÷ 12.0 **°**C; -120 ÷ 120 °F

AI25 **Probe 4 AUX setting:** **ptc** = PTC probe**; ntc**= NTC probe

AI26 **Probe 4 AUX action type:** it sets the function ot the AUX1 probe (term. 74-75)
nu = not used
Au1 = thermostat probe for AUX1 relay**;**
Au2 = thermostat probe for AUX2 relay**;**
Au3 = thermostat probe for AUX3 relay**;**
Au4 = thermostat probe for AUX4 relay**;**
otC1 = for the optimization of the delivery pressure/temperature, circuit 1 (dynamic set of delivery circuit 1)**;**
otC2 = for the optimization of the delivery pressure/temperature, circuit 2 (dynamic set of delivery circuit 2)**;**
otA1 = for the optimization of the suction pressure/temperature, (dynamic set point) circuit 1 (dynamic set of suction circuit 1)**;**

otA2 = for the optimization of the suction pressure/temperature, (dynamic set point) circuit 2 (dynamic set of suction circuit 2)

AI27 **Probe 4 AUX calibration:** -12.0 ÷ 12.0 °C; -120 ÷ 120 °F

AI28 **Alarm relay on with auxiliary probe fault:**
nu = relay not present; **ALr:** all the C(i) outputs set as ALr; **ALr1:** all C(i) outputs set as ALr1, **ALr2:** all C(i) outputs set as ALr2.

6.1.6 Safety Digital Inputs (Di2-Di13)

DI2 **Low pressure switch polarity (term. 52 - 53) – circuit 1:**
oP=LP d.i. enabled by voltage absence;
cL= LP d.i. enabled by voltage presence.

DI3 **Low pressure switch polarity (term. 56 - 57) – circuit 2:**
oP=LP d.i. enabled by voltage absence;
cL= LP d.i. enabled by voltage presence.

DI4 **High pressure switch polarity (term. 54 - 55) – circuit 1:**
oP=HP d.i. enabled by voltage absence;
cL= HP d.i. enabled by voltage presence.

DI5 **High pressure switch polarity (term. 58 - 59) – circuit 2:**
oP=HP d.i. enabled by voltage absence;
cL= HP d.i. enabled by voltage presence.

DI6 **Relay activated in case of pressure switch alarm:**
nu = no relay activation, only visual signalling; **Alr:** all the C(i) outputs set as ALr; **ALr1:** all the C(i) outputs set as ALr1, **ALr2:** all the C(i) outputs set as ALr2

DI7 **Compressor alarm inputs polarity - circuit 1**
oP= d.i. enabled by voltage absence;
cL= d.i. enabled by voltage presence.

DI8 **Compressor alarm inputs polarity - circuit 2**
oP= d.i. enabled by voltage absence;
cL= d.i. enabled by voltage presence.

DI9 **Fan alarm inputs polarity - circuit 1**
oP= d.i. enabled by voltage absence;
cL= d.i. enabled by voltage presence.

DI10 **Fan alarm inputs polarity - circuit 2**
oP= d.i. enabled by voltage absence;
cL= d.i. enabled by voltage presence.

DI11 **Manual reset of compressor alarms signalled by d.i.**
no = automatic recover of alarm: regulation restart when the correspondent digital input is disabled
yES = manual recover for the alarms of compressors

DI12 **Manual reset of fan alarms signalled by d.i.**
no = automatic recover of alarm: a fan restarts when the correspondent digital input is disabled
yES = manual recover for the alarms of fan

DI13 **Relay activated in case of compressor or fan alarms:**
nu = no relay activation, only visual signalling; **Alr:** all the C(i) outputs set as ALr; **ALr1:** all the C(i) outputs set as ALr1, **ALr2:** all the C(i) outputs set as ALr2

6.1.7 Digital Inputs (Di14-Di27)

DI14 **Polarity of configurable digital input 1 (term 36-37)**
oP: the digital input is activated by opening the contact;
CL: the digital input is activated by closing the contact.

DI15 **Function of configur. configurable digital input 1 (term. 36-37)**
ES1 = energy saving circuit 1
ES2 = energy saving circuit 2
OFF1 = circuit 1 stand –by
OFF2 = circuit 2 stand –by
LL1 = liquid level alarm for circuit 1
LL2 = liquid level alarm for circuit 2

noCRO = it disables the set point coming from the supervising system, and it restores SETC1 and SETC2 set.
noSTD1 = it disables the dynamic set point on the circuit 1, and it restores SETC1 and SETF1 set.
noSTD2 = it disables the dynamic set point on the circuit 2, and it restores SETC2 and SETF2 set.

DI16 **Delay of configurable d.i. 1** (0 ÷ 255 min)

DI17 **Polarity of configurable digital input 2 (term 38-39)**
oP: the digital input is activated by opening the contact;
CL: the digital input is activated by closing the contact.

DI18 **Function of configur. configurable digital input 2 (term. 38-39)**
ES1 = energy saving circuit 1
ES2 = energy saving circuit 2
OFF1 = circuit 1 stand –by
OFF2 = circuit 2 stand –by
LL1 = liquid level alarm for circuit 1
LL2 = liquid level alarm for circuit 2
noCRO = it disables the set point coming from the supervising system, and it restores SETC1 and SETC2 set.
noSTD1 = it disables the dynamic set point on the circuit 1, and it restores SETC1 and SETF1 set.
noSTD2 = it disables the dynamic set point on the circuit 2, and it restores SETC2 and SETF2 set.

DI19 **Delay of configurable d.i. 2** (0 ÷ 255 min)

DI20 **Polarity of configurable digital input 3 (term 40-41)**
oP: the digital input is activated by opening the contact;
CL: the digital input is activated by closing the contact.

DI21 **Function of configur. configurable digital input 3 (term. 40-41)**
ES1 = energy saving circuit 1
ES2 = energy saving circuit 2
OFF1 = circuit 1 stand –by
OFF2 = circuit 2 stand –by
LL1 = liquid level alarm for circuit 1
LL2 = liquid level alarm for circuit 2
noCRO = it disables the set point coming from the supervising system, and it restores SETC1 and SETC2 set.
noSTD1 = it disables the dynamic set point on the circuit 1, and it restores SETC1 and SETF1 set.
noSTD2 = it disables the dynamic set point on the circuit 2, and it restores SETC2 and SETF2 set.

DI22 **Delay of configurable d.i. 3** (0 ÷ 255 min)

DI23 **Polarity of configurable digital input 4 (term. 42-43)**
oP: the digital input is activated by opening the contact;
CL: the digital input is activated by closing the contact.

DI24 **Function of configur. configurable digital input 4 (term. 42-43)**
ES1 = energy saving circuit 1
ES2 = energy saving circuit 2
OFF1 = circuit 1 stand –by
OFF2 = circuit 2 stand –by
LL1 = liquid level alarm for circuit 1
LL2 = liquid level alarm for circuit 2
noCRO = it disables the set point coming from the supervising system, and it restores SETC1 and SETC2 set.
noSTD1 = it disables the dynamic set point on the circuit 1, and it restores SETC1 and SETF1 set.
noSTD2 = it disables the dynamic set point on the circuit 2, and it restores SETC2 and SETF2 set.

DI25 **Delay of configurable d.i. 4** (0 ÷ 255 min)

DI26 **Relay activated in case of liquid level alarm – circuit 1**
nu = no relay activation, only visual signalling; **Alr:** all the C(i) outputs set as ALr; **ALr1:** all the C(i) outputs set as ALr1, **ALr2:** all the C(i) outputs set as ALr2

DI27 **Relay activated in case of liquid level alarm – circuit 2**
nu = no relay activation, only visual signalling; **Alr:** all the C(i) outputs set as ALr; **ALr1:** all the C(i) outputs set as ALr1, **ALr2:** all the C(i) outputs set as ALr2

6.1.8 Compressor Action (CP1-CP8)

CP1 **Regulation band width for compressors- circuit 1** (0.10÷10.00 bar; 0.1÷25.0°C, 1÷80PSI, 1÷50°F; 10÷1000 KPA) The band is symmetrical compared to the target set point, with extremes: SETC1+(CP1)/2 ... SETC1-(CP1)/2. The measurement unit depends on the C45 par.
NOTE: If the circuit 1 has 1 relay set as a frequency compressor (Frq1), the 1Q19 parameter is used instead of the CP1 parameter: regulation band width that is added to the set point 1.

CP2 **Minimum compressor set point - circuit 1** (AI2 ÷ SETC1 bar, PSI or KPA; -50.0 ÷ SETC1 °C; -58.0 ÷ SETC1 °F). The measurement unit depends on C45 parameter. It sets the minimum value that can be used for the compressor set point, to prevent the end user from setting incorrect values.

CP3 **Maximum compressor set point - circuit 1** (SETC1÷AI3 bar/PSI/KPA; SETC1÷150.0°C; SETC1÷302°F)
The measurement unit depends on C45 parameter. It sets the maximum acceptable value for compressor set point.

CP4 **Compressor energy saving value - circuit 1** (-20.00÷20.00bar; -50.0÷50.0 °C; -300÷300 PSI; -90÷90 °F; -2000÷2000KPA) this value is add to the compressor set point when the energy saving is enabled.

CP5 **Regulation band width for compressors - circuit 2** (0.10÷10.00 bar; 0.1÷25.0°C, 1÷80PSI, 1÷50°F; 10÷1000 KPA). The band is symmetrical compared to the target set point, with extremes: SETC2+(CP5)/2 ... SETC2-(CP1)2. The measurement unit depends on the C43 par.
NOTE: If the circuit 1 has 1 relay set as a frequency compressor (Frq2), the 2Q18 parameter is used instead of the CP5 parameter: regulation band width that is added to the set point 2.

CP6 **Minimum compressor set point - circuit 2** (AI5 ÷ SETC2 bar or PSI o KPA; -50.0 ÷ SETC2 °C; -58.0 ÷ SETC2 °F). The measurement unit depends on C45 parameter. It sets the minimum value that can be used for the compressor set point, to prevent the end user from setting incorrect values.

CP7 **Maximum compressor set point - circuit 2** (SETC2÷AI6 bar/PSI/KPA; SETC2÷150.0°C; SETC2÷302°F)
The measurement unit depends on C45 parameter. It sets the maximum acceptable value for compressor set point.

CP8 **Compressor energy saving value - circuit 2** (-20.00÷20.00bar; -50.0÷50.0 °C; -300÷300 PSI; -90÷90 °F) this value is add to the compressor set point when the energy saving is enabled.

6.1.9 Safety Compressors (CP9-CP19)

CP9 **Minimum time between 2 following switching ON of the same compressor** (0÷255 min).

CP10 **Minimum time between the switching off of a compressor and the following switching on.** (0÷255min).
Note: usually CP9 is greater than CP10

CP11 **Time delay between the insertion of two different compressors** (0 ÷ 99.5 min; res. 1sec)

CP12 **Time delay between switching off of two different compressors (**0 ÷ 99.5 min; res. 1sec)

CP13 **Minimum time load on (**0 ÷ 99.5 min; res. 1sec)

CP14 **Maximum time load on** (0 ÷ 24 h; with 0 this function is disabled.) If a compressor keeps staying on for the CP14 time, it's switched off and it can restart after the CP10 standard time or after the CP15 time with frequency compressor (Frq1 or Frq2).

CP15 **Minimum time a frequency compressor (CP1..CP15 =Frq1 or Frq2) stays off after CP14 time** (0÷255 min)

CP16 **CP11 delay enabled also for the first call**. If enabled, the triggering of the step is delayed for a "CP11" time, respect to the call.
no = "CP11" not enabled;
yES="CP11" enabled

CP17 **CP12 delay enabled also for the first off**. If enabled, the triggering of the step is delayed for a "CP12" time, respect to the call.
no = "CP12" not enabled;
yES="CP12" enabled

CP18 **Output delay at power on** (0 ÷ 255 sec)

CP19 **Booster function enabled:**
no = compressors of 2 circuits work independently
yES = if at least one compressor of the circuit 1 (BT) is ON, also one compressor of the circuit 2 (TN) is enabled, independently from the pressure of the circuit 2. This ensures that the gas coming from the circuit 1 is suct by the compressors of the circuit 2.

6.1.10 Fan Action (F1-F8)

F1 **Regulation band width for fans – circuit 1** (0.10÷10.00 bar; 0.1÷30.0°C, 1÷80PSI, 1÷50°F; 10÷1000 KPA) ***Set the C45 par. and the target set point for fans before setting this parameter***.
The band is symmetrical compared to the fan target set point, with extremes: SETF1-(F1)/2 ... SETF1+(F1)/2. The measurement unit depends on the C45 par.

F2 **Minimum fan set point – circuit 1 BAR: 2** (AI9 ÷ SETF1 bar or PSI o KPA; -50.0 ÷ SETF1 °C; -58.0 ÷ SETF1 °F). The measurement unit depends on C45 parameter. It sets the minimum value that can be used for the fan set point, to prevent the end user from setting incorrect values.

F3 **Maximum fan set point - circuit 1** (SETF1÷AI10 bar/PSI/KPA; SETF1÷150.0°C; SETF1÷302°F)
The measurement unit depends on C45 parameter. It sets the maximum acceptable value for fan set point.

F4 **Fan energy saving value - circuit 1** (-20.00÷20.00bar; -50.0÷50.0 °C; -300÷300 PSI; -90÷90 °F; -2000÷2000KPA) this value is add to the fan set point when the energy saving is enabled.

F5 **Regulation band width for fans – circuit 2** (0.10÷10.00 bar; 0.1÷30.0°C, 1÷80PSI, 1÷50°F; 10÷1000 KPA)
Set the C45 par. and the target set point for fans before setting this parameter.
The band is symmetrical compared to the fan target set point, with extremes: SETF2-(F5)/2 ... SETF2+(F5)/2. The measurement unit depends on the C45 par.

F6 **Minimum fan set point – circuit 2 BAR: 2** (AI12 ÷ SETF2 bar or PSI o KPA; -50.0 ÷ SETF2 °C; -58.0 ÷ SETF2 °F). The measurement unit depends on C45 parameter. It sets the minimum value that can be used for the fan set point, to prevent the end user from setting incorrect values.

F7 **Maximum fan set point - circuit 2** (SETF2÷AI13 bar/PSI/KPA; SETF2÷150.0°C; SETF2÷302°F)
The measurement unit depends on C45 parameter. It sets the maximum acceptable value for fan set point.

F8 **Fan energy saving value - circuit 2** (-20.00÷20.00bar; -50.0÷50.0 °C; -300÷300 PSI; -90÷90 °F; -2000÷2000KPA) this value is add to the fan set point when the energy saving is enabled.

6.1.11 Safety Fans (F9-F10)

F9 **Time delay between the insertion of two different fans** (1 ÷ 255 sec)
F10 **Time delay between switching off of two different fans** (1 ÷ 255 sec)

6.1.12 Energy Saving Management (HS1-HS14)

HS1 **Energy Saving start time on Monday** (0:0÷23.5h; nu)
HS2 **Monday Energy Saving duration** (0:0÷23.5h)
HS3 **Energy Saving start time on Tuesday** (0:0÷23.5h; nu)
HS4 **Tuesday Energy Saving duration** (0:0÷23.5h)
HS5 **Energy Saving start time on Wednesday** (0:0÷23.5h; nu)
HS6 **Wednesday Energy Saving duration** (0:0÷23.5h)
HS7 **Energy Saving start time on Thursday** (0:0÷23.5h; nu)
HS8 **Thursday Energy Saving duration** (0:0÷23.5h)
HS9 **Energy Saving start time on Friday** (0:0÷23.5h; nu)
HS10 **Friday Energy Saving duration** (0:0÷23.5h)
HS11 **Energy Saving start time on Saturday** (0:0÷23.5h; nu)
HS12 **Saturday Energy Saving duration** (0:0÷23.5h)
HS13 **Energy Saving start time on Sunday** (0:0÷23.5h; nu)
HS14 **Sunday Energy Saving duration** (0:0÷23.5h)

6.1.13 Compressor Alarms (AC1-AC19)

AC1 **Probe 1 alarm exclusion at power on** (0 ÷ 255 min) it is the period starting from instrument switch on, before an alarm probe is signalled. During this time if the pressure is out of range all the compressor are switched on.

AC2 **Probe 2 alarm exclusion at power on** (0 ÷ 255 min) it is the period starting from instrument switch on, before an alarm probe is signalled. During this time if the pressure is out of range all the compressor are switched on.

AC3 **Low pressure (temperature) alarm for compressors – circuit 1:** (0.10 ÷ 30.00bar; 0.0 ÷ 100.0°C; 1÷430 PSI; 1÷200.0°F; 10 ÷ 3000KPA)
The measurement unit depends on C45 parameter. AC3 is always subtracted to the set point SETC1. When the value SETC1-AC3 is reached the "Low alarm - Suction 1" is enabled, (possibly after the AC5 delay time)

AC4 **High pressure (temperature) alarm for compressors – circuit 1:** (0.10 ÷ 30.00bar; 0.0 ÷ 100.0°C; 1 ÷ 430 PSI; 1 ÷ 200.0°F; 10 ÷ 3000KPA)
The measurement unit depends on C45 parameter. AC4 is always added to the set point SETC1. When the value SETC1+AC4 is reached the "High alarm - Suction 1" is enabled, (possibly after the AC5 delay time)

AC5 **Low and High compressor pressure (temperature) alarms delay – circuit 1** (0÷255 min) time interval between the detection of a pressure (temperature) alarm condition and alarm signalling.

AC6 **Low pressure (temperature) alarm for compressors – circuit 2:** (0.10 ÷ 30.00bar; 0.0 ÷ 100.0°C; 1÷430 PSI; 1÷200.0°F)
The measurement unit depends on C43 parameter. AC6 is always subtracted to the set point SETC2. When the value SETC2-AC6 is reached the "Low alarm - Suction 2" is enabled, (possibly after the AC8 delay time)

AC7 **High pressure (temperature) alarm for compressors – circuit 2:** (0.10 ÷ 30.00bar; 0.0 ÷ 100.0°C; 1 ÷ 430 PSI; 1 ÷ 200.0°F; 10 ÷ 3000KPA)
The measurement unit depends on C45 parameter. AC7 is always added to the set point SETC2. When the value SETC2+AC7 is reached the "High alarm - Suction 1" is enabled, (possibly after the AC8 delay time)

AC8 **Low and High compressor pressure (temperature) alarms delay – circuit 2** (0÷255 min) time interval between the detection of a pressure (temperature) alarm condition and alarm signalling.

AC9 **Relay activated in case of pressure (temperature) alarm**
nu = no relay activation, only visual signalling; **Alr:** all the C(i) outputs set as ALr; **ALr1:** all the C(i) outputs set as ALr1, **ALr2:** all the C(i) outputs set as ALr2

AC10 **Service request**: (0÷25000h with 0 the function is disabled) number of running hours after that maintenance warning is generated

AC11 **Relay activated in case of service request alarm**
nu = no relay activation, only visual signalling; **Alr:** all the C(i) outputs set as ALr; **ALr1:** all the C(i) outputs set as ALr1, **ALr2:** all the C(i) outputs set as ALr2

AC12 **Low pressure-switch intervention numbers – circuit 1: (0÷15).** Every time the pressure-switch is activated all the compressors of the circuit 1 are turned off. If the low pressure-switch is activated AC12 times in the AC13 interval, the compressors of the first circuit are switched off and only the manually unlocking is possible.

AC13 **Pressure-switch interventions time (0÷255 min) – circuit 1** Interval, linked to the AC12 parameter, for counting interventions of the low pressure-switch.

AC14 **Number of steps engaged with suction probe 1 faulty** (0 ÷ 15)

AC15 **Not used**

AC16 **Low pressure-switch intervention numbers – circuit 2: (0÷15).** Every time the pressure-switch is activated all the compressors of the circuit 2 are turned off. If the low pressure-switch is activated AC16 times in the AC17 interval, the compressors of the second circuit are switched off and only the manually unlocking is possible.

AC17 **Pressure-switch interventions time (0÷255 min) – circuit 2** Interval, linked to the AC16 parameter, for counting interventions of the low pressure-switch.

AC18 **Number of steps engaged with suction probe 2 faulty** (0 ÷ 15)

AC19 **Not used**

6.1.14 Fan Alarms (AF1-AF17)

AF1 **Low pressure (temperature) alarm for fans – circuit 1:** (0.10 ÷ 30.00bar; 0.0 ÷ 100.0°C; 1÷430 PSI; 1÷200.0°F; 10 ÷ 3000KPA)
The measurement unit depends on C45 parameter. AF1 is always subtracted to the set point SETF1. When the value SETF1-AF1 is reached the "Low alarm – Condenser 1" is enabled, (possibly after the AF3 delay time)

AF2 **High pressure (temperature) alarm for fans– circuit 1:** (0.10 ÷ 30.00bar; 0.0 ÷ 100.0°C; 1 ÷ 430 PSI; 1 ÷ 200.0°F; 10 ÷ 3000KPA)

The measurement unit depends on C45 parameter. AF2 is always added to the set point SETF1. When the value SETF1+AF2 is reached the "High alarm – Condenser 1" is enabled, (possibly after the AF3 delay time)

AF3 **Low and High fan pressure (temperature) alarms delay – circuit 1** (0÷255 min) time interval between the detection of a pressure (temperature) alarm condition and alarm signalling.

AF4 **Compressors off with pressure (temperature) alarm for fans– circuit 1**
no = compressors are not influenced by this alarm
yES = compressors are turned off in case of high pressure (temperature) alarm of fans

AF5 **Interval between 2 compressors turning off in case of high pressure (temperature) alarm for fans – circuit 1** (0 ÷ 255 min)

AF6 **High pressure-switch intervention numbers – circuit 1: (0÷15).** Every time the pressure-switch is activated all the compressors of the circuit 1 are turned off and the fan turned on. If the high pressure-switch is activated AF6 times in the AF7 interval, the compressors of the first circuit are switched off and the fans on, only the manually unlocking is possible.

AF7 **High pressure-switch interventions time (0÷255 min) – circuit 1** Interval, linked to the AF6 parameter, for counting interventions of the high pressure-switch.

AF8 **Fans on with delivery probe faulty – circuit 1** (0 ÷ 15)

AF9 **Low pressure (temperature) alarm for fans – circuit 2:** (0.10 ÷ 30.00bar; 0.0 ÷ 100.0°C; 1÷430 PSI; 1÷200.0°F; 10 ÷ 3000KPA)
The measurement unit depends on C45 parameter. AF9 is always subtracted to the set point SETF2. When the value SETF2-AF9 is reached the "Low alarm – Condenser 2" is enabled, (possibly after the AF11 delay time)

AF10 **High pressure (temperature) alarm for fans– circuit 2:** (0.10 ÷ 30.00bar; 0.0 ÷ 100.0°C; 1 ÷ 430 PSI; 1 ÷ 200.0°F; 10 ÷ 3000KPA)
The measurement unit depends on C45 parameter. AF10 is always added to the set point SETF2. When the value SETF2+AF10 is reached the "High alarm – Condenser 2" is enabled, (possibly after the AF11 delay time)

AF11 **Low and High fan pressure (temperature) alarms delay – circuit 2** (0÷255 min) time interval between the detection of a pressure (temperature) alarm condition and alarm signalling.

AF12 **Compressors off with pressure (temperature) alarm for fans– circuit 2**
no = compressors are not influenced by this alarm
yES = compressors are turned off in case of high pressure (temperature) alarm of fans

AF13 **Interval between 2 compressors turning off in case of high pressure (temperature) alarm for fans – circuit 2** (0 ÷ 255 min)

AF14 **High pressure-switch intervention numbers – circuit 2: (0÷15).** Every time the pressure-switch is activated all the compressors of the circuit 2 are turned off and the fans turned on. If the high pressure-switch is activated AF14 times in the AF15 interval, the compressors of the second circuit are switched off and the fans on, only the manually unlocking is possible.

AF15 **High pressure-switch interventions time (0÷255 min) – circuit 2** Interval, linked to the AF14 parameter, for counting interventions of the high pressure-switch.

AF16 **Fans on with delivery probe faulty – circuit 2** (0 ÷ 15)

AF17 **Relay activated in case of pressure (temperature) alarms of fans**
nu = no relay activation, only visual signalling; **Alr:** all the C(i) outputs set as ALr; **ALr1:** all the C(i) outputs set as ALr1, **ALr2:** all the C(i) outputs set as ALr2

6.1.15 Dynamic Setpoint Suction (o1-o8)

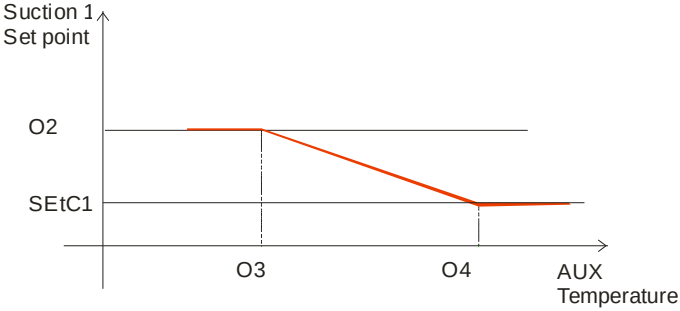
O1 **Dynamic compressor set point function enabled - circuit 1**
no = standard regulation
yES = the SETC1 varies according to the setting of O2, O3, O4.
WARNING the dynamic set point requires a dedicated probe, so it's necessary one of the aux probes is set for this function in other words AI17 or AI20 or AI23 or AI27 has to be set as otA1.
NOTE: if more than one probe is used for the optimization of the suction set point, only the higher temperature is considered.

O2 **Maximum compressor set point - circuit 1** (SETC1÷CP3) It sets the maximum value of compressor set point used in the dynamic set point function. The measurement unit depends on C45 parameter.

O3 **External temperature for maximum set point O2- circuit 1** (-40÷O4 °C /-40÷O4°F) It's the temperature detected by the external AUX probe, at which the maximum set point is reached.

O4 **External temperature for standard set point– circuit 1** (O3÷150°C O3÷302°F)

1. with AUX temper. < O3 ==> “Real SEtC1” = O2
2. with AUX temper. > O4 ==> “Real SEtC1” = SEtC1
3. with O3 < AUX temper < O4 ==> SEtC1 < “Real SEtC1” < O2

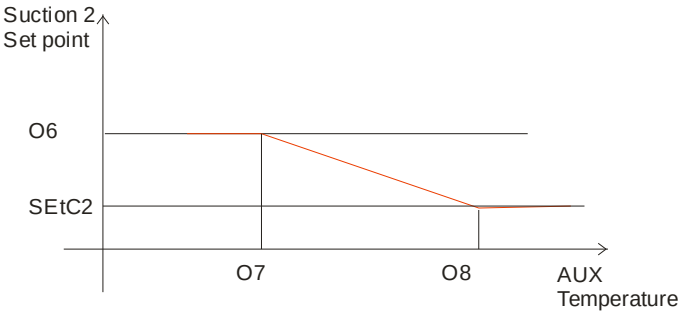


O5 **Dynamic compressor set point function enabled - circuit 2**
no = standard regulation
yES = the SETC2 varies according to the setting of O6, O7, O8.
WARNING the dynamic set point requires a dedicated probe, so it’s necessary one of the aux probes is set for this function in other words AI17 or AI20 or AI23 or AI27 has to be set as otA2.
NOTE: if more than one probe is used for the optimization of the suction set point, only the higher temperature is considered.

O6 **Maximum compressor set point - circuit 2** (SETC2÷CP7) It sets the maximum value of compressor set point used in the dynamic set point function. The measurement unit depends on C45 parameter.

O7 **External temperature for maximum set point O6 - circuit 1** (-40÷O8 °C /-40÷O8°F) It’s the temperature detected by the external AUX probe, at which the maximum set point is reached.

O8 **External temperature for standard set point– circuit 2** (O7÷150°C O7÷302°F)
1. with AUX temper. < O7 ==> “Real SEtC2” = O6
2. with AUX temper. > O8 ==> “Real SEtC2” = SEtC2
3. with O7 < AUX temper < O8 ==> SEtC2 < “Real SEtC2” < O6



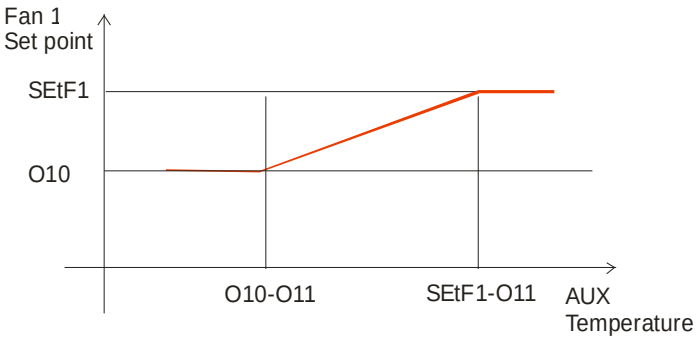
6.1.16 Dynamic Setpoint Condenser (o9-o14)

O9 **Dynamic set enabled for condenser- circuit 1**
no = standard regulation
yES = the SETF1 varies according to the setting of O10, O11.
WARNING the dynamic set point requires a dedicated probe, so it’s necessary one of the aux probes is set for this function in other words AI17 or AI20 or AI23 or AI27 has to be set as otC1

O10 **Minimum condenser set point - circuit 1** (F2÷SETF1)

O11 **Differential for condenser dynamic set point –circuit 1** (-50.0÷50.0°C; -90÷90°F). The way of working of this algorithm is explained in the following exemplum.

Example
With the external temperature (otc1) > SETF1-O11 ==> "real SEtF1" = SETF1
With the external temperature (otc1) < O10-O11 ==> "real SetF1"= O10
With O10-O11 < external temperature (otc1) < SETF1-O11 ==> O10 <"real SEtF1"< SEtF1
where
external temperature (otc1) is the temperature detected by the auxiliary probe set as otC1



NOTE: if C45 = bar or PSI or KPA, O10 is bar or PSI, the XC1000D makes the changes required

O12 **Dynamic set enabled for condenser- circuit 2**
no = standard regulation
yES = the SETF2 varies according to the setting of O13, O14.
WARNING the dynamic set point requires a dedicated probe, so it's necessary one of the aux probes is set for this function in other words AI17 or AI20 or AI23 or AI27 has to be set as otC2.

O13 **Minimum condenser set point - circuit 2** (F6÷SETF2)

O14 **Differential for condenser dynamic set point –circuit 2** (-50.0÷50.0°C; -90÷90°F). The way of working of this algorithm is explained in the following exemplum.
Example
With the external temperature (otc2) > SETF2-O14 ==> "real SetF2" = SETF2
With the external temperature (otc2) < O13-O14 ==> "real SetF1"= O13
With O13-O14 < external temperature (otc1) < SETF2-O14 ==> O13 <"real SetF2"< SetF2
where
external temperature (otc2) is the temperature detected by the auxiliary probe set as otC2

6.1.17 Analog Outputs Configuration (1Q1-3Q1)

1Q1 **Analog outputs 1-2 setting:** (4÷20 mA - 0÷10 V): It set the kind of output for the first 2 analogue outputs (term. 33-34-35).

3Q1 **Analog outputs 3-4 setting:** (4÷20 mA - 0÷10 V): It set the kind of output for the first 2 analogue outputs (term. 30-31-32).

6.1.18 Analog output 1 (1Q2-1Q26)

1Q2 **Analog output 1 function** (term. 34-35)
FREE = pure analogue output
CPR = output for frequency compressor – circuit 1
CPR2 = output for frequency compressor – circuit 2
FAN = output for inverter fans – circuit 1 (only some fans driven by inverter, others enabled by on/off);
FAN2 = output for inverter fans – circuit 2 (only some fans driven by inverter, others enabled by on/off);
INVF1 = not used
INVF2 = not used
nu = not used

1Q3 **Reference probe for analogue output 1,** it's used only when 1Q2 = FREE

Pbc1= Suction Probe, circuit 1 (term. 62-63 or 62 -68)
Pbc2 = Suction Probe, circuit 2 (term. 64-63 or 64 -68)

1Q4 **Adjustment of read out for the analog output 1** (-1.00÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F; -100÷10000 KPA). It's used only when 1Q2 = FREE

1Q5 **Adjustment of read out for the analog output 1 at 20mA/10V** (-1.00÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F; -100÷10000 KPA). It's used only when 1Q2 = FREE

1Q6 **Minimum value for analogue output 1** (0 ÷ 100%)

1Q7 **Analog output 1 value after compressor start** (1Q6 ÷ 100 %) It's the value of the analogue output after a compressor has started, when the pressure/temperature is above the regulation band. – *Used during inverter regulation*

1Q8 **Analog output 1 value after a compressor is switched off** (1Q6 ÷ 100 %) It's the value of the analogue output when a compressor has been switched off and the the pressure/temperature is below the regulation band. – *Used during inverter regulation*

1Q9 **Exclusion band start value for analog output 1** (1Q6 ÷ 100 %): it allows to exclude a range of frequencies that could create problems to the compressor. – *Used during inverter regulation*

1Q10 **Exclusion band end value for analog output 1** (1Q9 ÷ 100 %) – *Used during inverter regulation*

1Q11 **Safety value for analog output 1** (0 ÷ 100 %): it's used in case of probe faulty.

1Q12 **Delay between the entrance in the regulation band and the regulation activation** (0 ÷ 255sec): it's the delay between the entrance in the regulation band of pressure/temperature and the regulation start. Used to avoid false inverter starts dued to pressure variations. – *Used during inverter regulation.*

1Q13 **Analog output 1 rise time** (0 ÷ 255 sec). It's the time necessary to the analog output to pass from the 1Q6 to 100%, when a compressor has started and the pressure/temperature is above the regulation band. – *Used during inverter regulation.*

1Q14 **Analog output 1 permanency at 100% before load activation** (0 ÷ 255 sec): the analog output remains at 100% value for this time before a load is activated. – *Used during inverter regulation*

1Q15 **Delay between pressure (temperature) goes down the set point and start of analog output 1 decreasing** (0÷255sec). – *Used during inverter regulation*

1Q16 **Analog output 1 decreasing time (** 0 ÷ 255sec) It's the time taken from the analog output to pass from the 100% to the 1Q6 value. It's used during the switching off phase, when the pressure is lower than the set point.

1Q17 **Analog output 1 permanency at 1Q6 before a load is switched off** (0 ÷ 255sec) When the pressure (temperature) is below the set point, the analog output remains at 1Q6 value for the 1Q17 before a load is switched off.

1Q18 **Analog output 1 decreasing time when a load is switched on** (0 ÷ 255sec) It's the time necessary to the analog output to pass from 100% to 1Q7 when a load is switched on.

1Q19 **Regulation band** (0.10÷25.00bar; 0.0÷25.0°C; 1÷250 PSI; 1÷250°F;10÷2500 KPA). It is the band with the proportional action. It replaces CP1 for the inverter regulation. It is add to the set point. The proportional action starts when the temperature/pressure value is higher than the set point and it reaches the 100% when the pressure/temperature is equal or higher than set + 1Q19.

1Q20 **Integral time** (0÷999s; with 0 integral action excluded). It sets the pound of the proportional action. The higher is 1Q20, the lower is the integral action support.

1Q21 **Band offset** (-12.0÷12.0°C -12.00 ÷ 12.00BAR, -120÷120°F, -120÷120PSI; -1200÷1200KPA). Used to move the regulation band across to the set point.

1Q22 **Integral action limitation** (0.0÷99.0 °C; 0÷180°F; 0.00÷50,00bar; 0÷725PSI; 0÷5000kPA) to stop the increasing of integral action when the pressure reaches the SET + 1Q22 value.

1Q24 **Minimum inverter capacity with poor lubrication** (0÷99%; with 0 function excluded) If the frequency compressor works for the 1Q25 time with a frequency (in percentage) equal or lower than 1Q24, it is forced to work at 100% for the 1Q26 time in order to make the right lubrication.

1Q25 **Maximum inverter functioning time at a lower frequency than 1Q24, before working at 100%** (1÷255min)

1Q26 **Time of inverter functioning at 100% to restore the right lubrication** (1÷255min)

6.1.19 Analog output 2 (2Q1-2Q25)

2Q1 **Analog output 2 function** (term. 33-34)
FREE = pure analogue output
CPR = output for inverter frequency compressor – circuit 1
CPR2 = output for inverter frequency compressor – circuit 2
FAN = output for inverter fans– circuit 1 (only some fans driven by inverter, others enabled by on/off);

FAN2 = output for inverter fans – circuit 2 (only some fans driven by inverter, others enabled by on/off);
INVF1 = not used
INVF2 = not used
nu = not used

2Q2 **Reference probe for analogue output 2,** it's used only when 2Q1 = FREE
Pbc1= Suction Probe, circuit 1 (term. 62-63 or 62 -68)
Pbc2 = Suction Probe, circuit 2 (term. 64-63 or 64 -68)

2Q3 **Adjustment of read out for the analog output 2 at 4mA/0V** (-1.00÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F; -100÷10000 KPA). It's used only when 2Q1 = FREE

2Q4 **Adjustment of read out for the analog output 2 at 20mA/10V** (-1.00÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F; -100÷10000 KPA). It's used only when 2Q1 = FREE

2Q5 **Minimum value for analogue output 2** (0 ÷ 100%)

2Q6 **Analog output 2 value after compressor start** (2Q5 ÷ 100 %) It's the value of the analogue output after a compressor has started, when the pressure/temperature is above the regulation band. – *Used during inverter regulation*

2Q7 **Analog output 2 value after compressor is switched off** (2Q5 ÷ 100 %) It's the value of the analogue output when a compressor has been switched off and the the pressure/temperature is below the regulation band. – *Used during inverter regulation*

2Q8 **Exclusion band start value for analog output 2** (2Q5 ÷ 100 %): it allows to exclude a range of frequencies that could create problems to the compressor. – *Used during inverter regulation*

2Q9 **Exclusion band end value for analog output 2** (2Q8 ÷ 100 %)– *Used during inverter regulation*

2Q10 **Safety value for analog output 2** (0 ÷ 100 %): it's used in case of probe faulty.

2Q11 **Delay between the entrance in the regulation band and the regulation activation** (0 ÷ 255sec): it's the delay between the entrance in the regulation band of pressure/temperature and the regulation start. Used to avoid false inverter starts dued to pressure variations. – *Used during inverter regulation.*

2Q12 **Analog output 2 rise time** (0 ÷ 255 sec) It's the time necessary to the analog output to pass from the 1Q6 to 100%, when a compressor has started and the pressure/temperature is above the regulation band. – *Used during inverter regulation.*

2Q13 **Analog output 2 permanency before load activation** (0 ÷ 255 sec): the analog output remains at 100% value for this time before a load is activated. - *Used during inverter regulation*

2Q14 **Delay between pressure (temperature) goes down the set point and start of analog output 2 decreasing** (0÷255sec). – *Used during inverter regulation*

2Q15 **Analog output decreasing time** (0 ÷ 255sec) It's the time taken from the analog output to pass from the 100% to the 2Q5 value. It's used during the switching off phase, when the pressure is below the set point.

2Q16 **Analog output 2 permanency at 2Q5 value before a load is switched off** (0 ÷ 255sec) When the pressure (temperature) is below the set point, the analog output 2 remains at 2Q5 value before a load is switched off.

2Q17 **Analog output 2 decreasing time when a load is switched on** (0 ÷ 255sec) It's the time necessary to the analog output to pass from 100% to 2Q6 when a load is switched on.

2Q18 **Regulation band** (0.10÷25.00bar; 0.0÷25.0°C; 1÷250 PSI; 1÷250°F;10÷2500 KPA). It is the band with the proportional action. It replaces CP1 for the inverter regulation. It is add to the set point. The proportional action starts when the temperature/pressure value is higher than the set point and it reaches the 100% when the pressure/temperature is equal or higher than set + 2Q18.

2Q19 **Integral time** (0÷999s; with 0 integral action excluded). It sets the pound of the proportional action. The higher is 1Q20, the lower is the integral action support.

2Q20 **Band offset** (-12.0÷12.0°C -12.00 ÷ 12.00BAR, -120÷120°F, -120÷120PSI; -1200÷1200KPA). Used to move the regulation band across to the set point.

2Q21 **Integral action limitation** (0.0÷99.0 °C; 0÷180°F; 0.00÷50,00bar; 0÷725PSI; 0÷5000kPA) to stop the increasing of integral action when the pressure reaches the SET + 1Q22 value.

2Q23 **Minimum inverter capacity with poor lubrication** (0÷99%; with 0 function excluded) If the frequency compressor works for the 1Q25 time with a frequency (in percentage) equal or lower than 2Q23, it is forsed to work at 100% for the 2Q25 time in order to make the right lubrication.

2Q24 **Maximum inverter functioning time at a lower frequency than 2Q24, before working at 100%** (1÷255min)

2Q25 **Time of Inverter al 100% to restore the right lubrication** (1÷255min)

6.1.20 Analog Output 3 (3Q2-3Q26)

3Q2 **Analog output 3 function** (term. 31-32)
FREE = pure analogue output
CPR = output for inverter frequency compressor – circuit 1
CPR2 = output for inverter frequency compressor – circuit 2
FAN = output for inverter fans – circuit 1 (only some fans driven by inverter, others enabled by on/off);
FAN2 = output for inverter fans – circuit 2 (only some fans driven by inverter, others enabled by on/off);
INVF1 = proportional inverter for fans of circuit 1 (all fans driven by inverter)
INVF2 = proportional inverter for fans of circuit 2 (all fans driven by inverter)
nu = not used

3Q3 **Reference probe for analogue output 3,** it's used only when 3Q2 = FREE, **INVF1 or INVF2**
Pbc1= Suction Probe, circuit 1 (term. 62-63 or 62 -68)
Pbc2 = Suction Probe, circuit 2 (term. 64-63 or 64 -68)

3Q4 **Adjustment of read out for the analog output 3** (-1.00÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F; -100÷10000 KPA). It's used only when 3Q2 = FREE

3Q5 **Adjustment of read out for the analog output 3 at 20mA/10V** (-1.00÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F; -100÷10000 KPA). It's used only when 3Q2 = FREE

3Q6 **Minimum value for analogue output 3** (0 ÷ 100%)

3Q7 **Analog output 3 value after load start** (3Q6 ÷ 100 %) It's the value of the analogue output after a compressor has started, when the pressure/temperature is above the regulation band. – *Used during inverter regulation*

3Q8 **Analog output 3 value after a load is switched off** (3Q6 ÷ 100 %) It's the value of the analogue output when a compressor has been switched off and the the pressure/temperature is below the regulation band. – *Used during inverter regulation*

3Q9 **Exclusion band start value for analog output 3** (3Q6 ÷ 100 %): it allows to exclude a range of frequencies that could create problems to the compressor. – *Used during inverter regulation*

3Q10 **Exclusion band end value for analog output 3** (3Q9 ÷ 100 %) – *Used during inverter regulation*

3Q11 **Safety value for analog output 3** (0 ÷ 100 %): it's used in case of probe faulty.

3Q12 **Delay between the entrance in the regulation band and the regulation activation** (0 ÷ 255sec): it's the delay between the entrance in the regulation band of pressure/temperature and the regulation start. Used to avoid false inverter starts dued to pressure variations. – *Used during inverter regulation.*

3Q13 **Analog output 3 rise time** (0 ÷ 255 sec). It's the time necessary to the analog output to pass from the 3Q6 to 100%, when a compressor has started and the pressure/temperature is above the regulation band. – *Used during inverter regulation.*

3Q14 **Analog output 3 permanency at 100% before load activation** (0 ÷ 255 sec): the analog output remains at 100% value for this time before a load is activated. – *Used during inverter regulation*

3Q15 **Delay between pressure (temperature) goes down the set point and start of analog output 3 decreasing** (0÷255sec). – *Used during inverter regulation*

3Q16 **Analog output decreasing time** (0 ÷ 255sec) It's the time taken from the analog output to pass from 100% to the 3Q8 value. It's used during the switching off phase, when the pressure is below the set point.

3Q17 **Analog output 3 permanency at 3Q6 before a load is switched off** (0 ÷ 255sec) When the pressure (temperature) is belove the set point, the analog output 3 remains at 3Q6 value for the 3Q17 before a load is switched off.

3Q18 **Analog output 3 decreasing time when a load is switched on** (0 ÷ 255sec) It's the time necessary to the analog output to pass from 100% to 3Q7 when a load is switched on.

3Q19 **Regulation band** (0.10÷25.00bar; 0.0÷25.0°C; 1÷250 PSI; 1÷250°F;10÷2500 KPA). It is the band with the proportional action. It replaces CP1 for the inverter regulation. It is add to the set point. The proportional action starts when the temperature/pressure value is higher than the set point and it reaches the 100% when the pressure/temperature is equal or higher than set + 3Q19.

3Q20 **Integral time** (0÷999s; with 0 integral action excluded). It sets the pound of the proportional action. The higher is 3Q20, the lower is the integral action support.

3Q21 **Band offset** (-12.0÷12.0°C -12.00 ÷ 12.00BAR, -120÷120°F, -120÷120PSI; -1200÷1200KPA). Used to move the regulation band across to the set point.

3Q22 **Integral action limitation** (0.0÷99.0 °C; 0÷180°F; 0.00÷50,00bar; 0÷725PSI; 0÷5000kPA) to stop the increasing of integral action when the pressure reaches the SET + 3Q22 value.

3Q24 **Minimum inverter capacity with poor lubrication** (0÷99%; with 0 function excluded) If the frequency compressor works for the 3Q25 time with a frequency (in percentage) equal or lower than 3Q24, it is forsed to work at 100% for the 3Q26 time in order to make the right lubrication.

3Q25 **Time of lower inverter time** (1÷255min)

3Q26 **Time of Inverter at 100% to restore the right lubrication** (1÷255min)

6.1.21 Analog output 4 (4Q1-4Q25)

4Q1 **Analog output 4 function** (term. 30-31)
FREE = pure analogue output
CPR = output for frequency compressor – circuit 1
CPR2 = output for frequency compressor – circuit 2
FAN = output for inverter fans– circuit 1 (only some fans driven by inverter, others enabled by on/off);
FAN2 = output for inverter fans – circuit 2 (only some fans driven by inverter, others enabled by on/off);
INVF1 = proportional inverter for fans of circuit 1 (all the fans driven frequency)
INVF2 = proportional inverter for fans of circuit 2 (all the fans driven frequency)
nu = not used

4Q2 **Reference probe for analogue output 4,** it's used only when 4Q1 = FREE, INVF1 or INVF2.
Pbc3= Suction Probe, circuit 1 (term. 65-66 or 65 -68)
Pbc4 = Suction Probe, circuit 2 (term. 66-67 or 67 -68)

4Q3 **Adjustment of read out for the analog output 4 at 4mA/0V** (-1.00÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F; -100÷10000 KPA). It's used only when 4Q1 = FREE

4Q4 **Adjustment of read out for the analog output 4 at 20mA/10V** (-1.00÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F; -100÷10000 KPA). It's used only when 4Q1 = FREE

4Q5 **Minimum value for analogue output 4** (0 ÷ 100%)

4Q6 **Analog output 4 value after load start** (4Q5 ÷ 100 %) It's the value of the analogue output after a compressor has started, when the pressure/temperature is above the regulation band. – *Used during inverter regulation*

4Q7 **Analog output 4 value after load is switched off** (4Q5 ÷ 100 %) It's the value of the analogue output when a compressor has been switched off and the the pressure/temperature is below the regulation band. – *Used during inverter regulation*

4Q8 **Exclusion band start value for analog output 4** (4Q5 ÷ 100 %): it allows to exclude a range of frequencies that could create problems to the compressor. – *Used during inverter regulation*

4Q9 **Exclusion band end value for analog output 4** (4Q8 ÷ 100 %)– *Used during inverter regulation*

4Q10 **Safety value for analog output 4** (0 ÷ 100 %): it's used in case of probe faulty.

4Q11 **Delay between the entrance in the regulation band and the regulation activation** (0 ÷ 255sec): it's the delay between the entrance in the regulation band of pressure/temperature and the regulation start. Used to avoid false frequency starts dued to pressure variations. – *Used during inverter regulation.*

4Q12 **Analog output 4 rise time** (0 ÷ 255 sec) It's the time necessary to the analog output to pass from the 1Q6 to 100%, when a compressor has started and the pressure/temperature is above the regulation band. – *Used during inverter regulation.*

4Q13 **Analog output 4 permanency before load activation** (0 ÷ 255 sec): the analog output remains at 100% value for this time before a load is activated. - *Used during inverter regulation*

4Q14 **Delay between pressure (temperature) goes down the set point and start of analog output 4 decreasing** (0÷255sec). – *Used during inverter regulation*

4Q15 **Analog output 4 decreasing time (** 0 ÷ 255sec) It's the time taken from the analog output to pass from 100% to the 4Q7 value. It's used during the switching off phase, when the pressure is below the set point.

4Q16 **Analog output 4 permanency at 4Q5 before a load is switched off** (0 ÷ 255sec) The analog output remains at 4Q5 value before a load is switched off.

4Q17 **Analog output 4 decreasing time when a load is switched on** (0 ÷ 255sec) It's the time necessary to the analog output to pass from 100% to 4Q6 when a load is switched on.

4Q18 **Regulation band** (0.10÷25.00bar; 0.0÷25.0°C; 1÷250 PSI; 1÷250°F;10÷2500 KPA). It is the band with the proportional action. It replaces CP1 for the inverter regulation. It is add to the set point. The proportional action starts when the temperature/pressure value is higher than the set point and it reaches the 100% when the pressure/temperature is equal or higher than set + 4Q18.

4Q19 **Integral time** (0÷999s; with 0 integral action excluded). It sets the pound of the proportional action. The higher is 1Q20, the lower is the integral action support.

4Q20 **Band offset** (-12.0÷12.0°C -12.00 ÷ 12.00BAR, -120÷120°F, -120÷120PSI; -1200÷1200KPA). Used to move the regulation band across to the set point.

4Q21 **Integral action limitation** (0.0÷99.0 °C; 0÷180°F; 0.00÷50,00bar; 0÷725PSI; 0÷5000kPA) to stop the increasing of integral action when the pressure reaches the SET + 1Q22 value.

4Q23 **Minimum inverter capacity with poor lubrication** (0÷99%; with 0 function excluded) If the frequency compressor works for the 1Q25 time with a frequency (in percentage) equal or lower than 4Q23, it is forsed to work at 100% for the 4Q25 time in order to make the right lubrication.

4Q24 **Maximum inverter functioning time at a lower frequency than 4Q24, before working at 100%** (1÷255min)

4Q25 **Time of Inverter at 100% to restore the right lubrication** (1÷255min)

6.1.22 Auxiliary Outputs (AR1-AR12)

AR1 **Set point for auxiliary relay 1 (-40÷110°C/-40÷230°F)** it's is used for all the relays configured as AUS1.

AR2 **Differential for aux relay 1 (0,1÷25,0°C/1÷50°F)** Intervention differential for relay AUX1**.**
Cooling (AR3 = CL): Cut IN is AR1+ AR2. Cut OUT is when the temperature reaches the set point AR1.
Heating (AR3=Ht): Cut IN is AR1- AR2. Cut OUT is when the temperature reaches the set point. AR1

AR3 **Kind of action for aux. 1**
CL = cooling
Ht = heating

AR4 **Set point for auxiliary relay 2 (-40÷110°C/-40÷230°F)** it's is used for all the relays configured as AUS2.

AR5 **Differential for aux relay 2 (0,1÷25,0°C/1÷50°F)** Intervention differential for relay AUX2**.**
Cooling (AR6 = CL): Cut IN is AR4+ AR5. Cut OUT is when the temperature reaches the set point AR4.
Heating (AR36 = Ht): Cut IN is AR4- AR5. Cut OUT is when the temperature reaches the set point. AR4

AR6 **Kind of action for aux. 2**
CL = cooling
Ht = heating

AR7 **Set point for auxiliary relay 3 (-40÷110°C/-40÷230°F)** it's is used for all the relays configured as AUS3.

AR8 **Differential for aux relay 1 (0,1÷25,0°C/1÷50°F)** Intervention differential for relay AUX3**.**
Cooling (AR3 = CL): Cut IN is AR7+ AR8. Cut OUT is when the temperature reaches the set point AR7.
Heating (AR8=Ht): Cut IN is AR7- AR8. Cut OUT is when the temperature reaches the set point. AR7-

AR9 **Kind of action for aux. 3**
CL = cooling
Ht = heating

AR10 **Set point for auxiliary relay 4 (-40÷110°C/-40÷230°F)** it's is used for all the relays configured as AUS4.

AR11 **Differential for aux relay 4 (0,1÷25,0°C/1÷50°F)** Intervention differential for relay AUX4**.**
Cooling (AR12 = CL): Cut IN is AR10+ AR11. Cut OUT is when the temperature reaches the set point AR10.
Heating (AR12=Ht): Cut IN is AR10- AR11. Cut OUT is when the temperature reaches the set point. AR10

AR12 **Kind of action for aux. 4**
CL = cooling
Ht = heating

6.1.23 Other (oT1-oT9)

OT1 **Alarm relay off by keyboard** It's referred to the relay with terminals 84-85-86
no = alarm relay remains on for all the duration of the alarm
yES = the alarm relay is switched off by pushing a key

OT2 **Alarm relay polarity**

OP = alarm conditions 84-85 closed
CL = alarm conditions 84-85 open

OT3 **Alarm relay 1 off by keyboard** It's referred to the relays configured as ALr1
no = alarm relay remains on for all the duration of the alarm
yES = the alarm relay is switched off by pushing a key

OT4 **Alarm relay 1 polarity**
OP = the alarm relay terminals are open during an alarm
CL = the alarm relay terminals are closed during an alarm

OT5 **Alarm relay 2 off by keyboard** It's referred to the relays configured as ALr2
no = alarm relay remains on for all the duration of the alarm
yES = the alarm relay is switched off by pushing a key

OT6 **Alarm relay 2 polarity**
OP= the alarm relay terminals are open during an alarm
CL = the alarm relay terminals are closed during an alarm

OT7 **Serial address** **1 ÷ 247**

OT8 **Serial address for keyboard** **not used**

OT9 **Off function enabling**
no = it's not possible to switch the controller off by keyboard
YES = it's possible to switch the controller off by keyboard

7. Regulation

7.1 Neutral zone adjustment – only for compressors

This kind of regulation is available only for compressors. It is used if the parameter C37 = db (C38 = db for circuit 2). The following observations are availables only for adjustment **without inverter**. In this case the neutral zone (CP1) is symmetrical compared to the target set point, with extremes: set+CP1/2 ... set-CP1/2. If the pressure (temperature) is inside this zone the controller maintains the same number of loads switched on and off, without changing anything.
When the pressure (temperature) goes out from the zone, regulation starts. If the pressure is greater than SET+CP1/2, the loads are switching on with timing given by CP11parameter.
A load is turned on only if the his safety times:

CP9 **Minimum time between 2 following switching ON of the same compressor** (0÷255 min).

CP10 **Minimum time between the switching off of a compressor and the following switching on.** (0÷255min).
Note: usually CP9 is greater than CP10

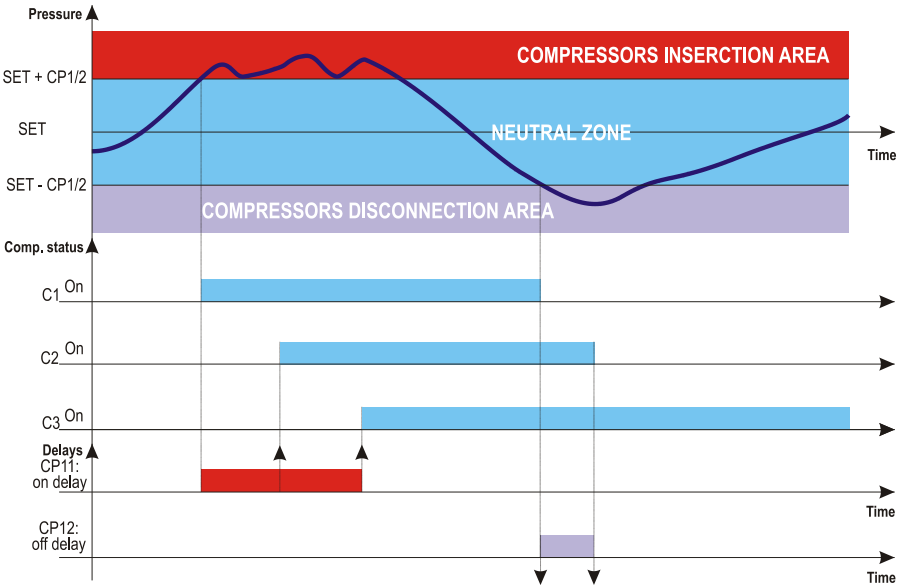
CP13 **Minimum time load on** **(**0 ÷ 99.5 min; res. 1sec)

are over.
Regulation stops when the pressure (temperature) comes back into the neutral zone.

In the following a simplify example that explains the regulation in neutral zone for compressor homogeneous with 1 step for each compressors. The safety times **CP9, CP10, CP13** are not considered. In the real regulation the a load is entered or turned off only if these times are over.

Ex. **Dead band control, compressors with same capacities, 1 step for each compressor.**
In this example:

C1 = cPr1; C2 = cPr1; C3 = cPr1; number of compressors first circuit.
C35 = db dead band regulation
C39 = yES rotation
CP16 = no "CP11" delay not enabled at first calling after an equilibrium condition.
CP17 = no "CP12" delay not enabled at first calling after an equilibrium condition.



7.2 Proportional band adjustment – for compressors and fans

This kind of regulation is available for compressors and fans. It is used by compressors if the parameter C37 = Pb (C38 = Pb for circuit 2). The following observations are availables only for adjustment without inverter. Compressors and fans work in the same way.
Example:
In this case the regulation band (CP1) is divided into as many parts as there are stages according to the following formula:

 # steps = C(i) = CPr1 or Step (number of compr. or steps).

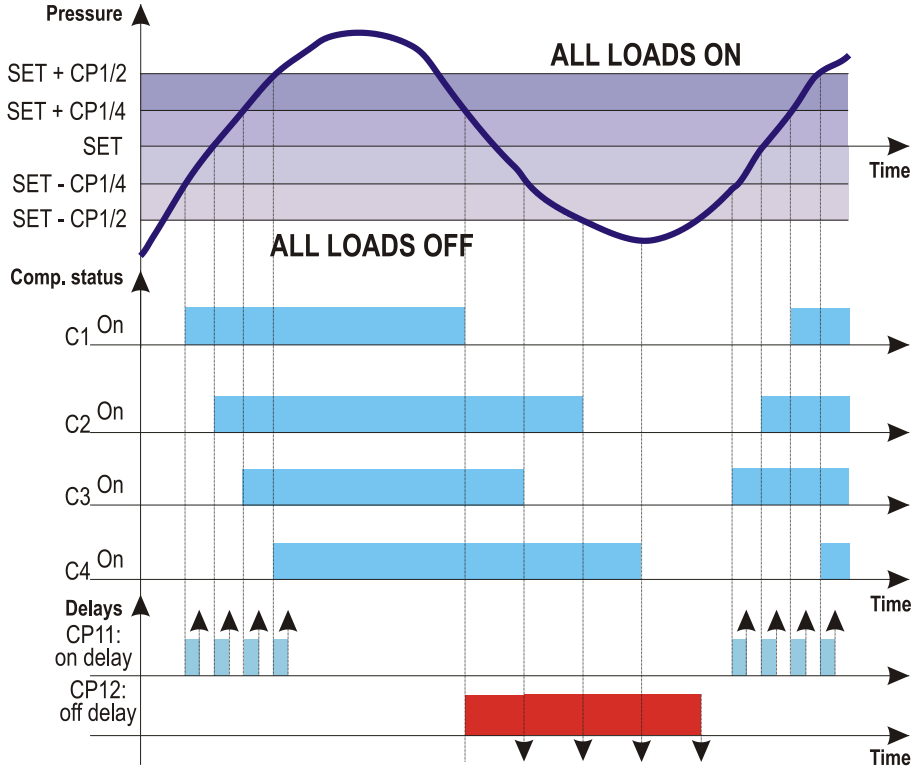
The numbers of stages switched ON is proportional to the value of the input signal: when this distances itself from the target set point and enters the various bands, the compressors are switched ON, to be then turned OFF when the signal brings near the set point.

In this way if the pressure is greater than regulation band, all the compressors are on, if the pressure (temperature) is lower than the regulation band all the compressors are off.
Naturally also for this regulations all the delays (CP11 and CP12) safety times (**CP9, CP10, CP13**) are taken in account.

Regulation according to the running hours
The algorithm switch on and off the loads according to the running hours of each load. In this way the running hours are balanced.

Example

C1 = cPr1; C2 = cPr1; C3 = cPr1; C4 = cPr1: 4 compressors
C37 = Pb proportional band regulation
C39 = yES rotation
CP16 = no “CP11” delay not enabled at first calling after a regulation zone.
CP17 = no “CP12” delay not enabled at first calling after a regulation zone.


Pressure
ALL LOADS ON
SET + CP1/2
SET + CP1/4
SET
SET - CP1/4
SET - CP1/2
Time
ALL LOADS OFF
Comp. status
C1 On
C2 On
C3 On
C4 On
Time
Delays
CP11:
on delay
CP12:
off delay
Time

8. SCREW COMPRESSORS

Loads activation is managed by the neutral zone. They follows general rules of step compressors:
a. C1..C14 = screw1 or screw2 have to be present, following C2..C15 that are set as Stp, are linked to C1..C14 = screw
The relay group is activated depending on the kind of screw compressors that has been selected on the **C16** parameter.

8.1 Regulation with screw compressors like Bitzer/ Hanbell/ Refcomp etc

Screw compressors like Bitzer use up to 4 valves for the power regulation.
The first valve is used during the starting phase for the C35 max time, after this time, the step 2 is automatically activated.
Through the C36 parameter it is possible to decide if the step 1 can be subsequently used during the standard thermoregulation.

8.1.1 Relay activation

ES. Compressor with 4 steps:
C1 = Scrw1; **C2** = Stp; **C3** = Stp; **C4** = Stp; **C16** = Btz

a. Activation with valves ON due to voltage presence (C17=cL).

	C1 = Screw1	**C2 = stp**	**C3 = stp**	**C4 = stp**
Step 1 (25%)	*ON*	*ON*	*OFF*	*OFF*
Step 2 (50%)	*ON*	*OFF*	*ON*	*OFF*
Step 3 (75%)	*ON*	*OFF*	*OFF*	*ON*
Step 4 (100%)	*ON*	*OFF*	*OFF*	*OFF*

b. Activation with valves ON due to voltage absence (C17=oP).

	C1 = Screw1	**C2 = stp**	**C3 = stp**	**C4 = stp**
Step 1 (25%)	*ON*	*OFF*	*ON*	*ON*
Step 2 (50%)	*ON*	*ON*	*OFF*	*ON*
Step 3 (75%)	*ON*	*ON*	*ON*	*OFF*
Step 4 (100%)	*ON*	*ON*	*ON*	*ON*

8.2 Regulation with screw compressors like Frascold

Screw compressors like Frascold use up to 3 valves for the power regulation.
The first valve is used during the starting phase for the C35 max time, after this time, the step 2 is automatically activated.
Through the C36 parameter it is possible to decide if the step 1 can be subsequently used during the standard thermoregulation.

8.2.1 Relay activation

ES. Compressor with 4 steps:
C1 = Scrw1; **C2** = Stp; **C3** = Stp; **C4** = Stp; **C16** = Frtz

a. Activation with valves ON due to voltage presence. (C17=cL)

	C1 = Screw1	**C2 = stp**	**C3 = stp**	**C4 = stp**
C1 = Screw1	*ON*	*OFF*	*OFF*	*OFF*
C1 = Screw1	*ON*	*ON*	*ON*	*OFF*
C1 = Screw1	*ON*	*ON*	*OFF*	*ON*
C1 = Screw1	*ON*	*ON*	*OFF*	*OFF*

b. Activation with valves ON due to voltage absence. (C17=oP)

	oAi = Screw1	**oAi+1 = stp**	**oAi+2 = stp**	**oAi+3 = stp**
Step 1 (25%)	*ON*	*ON*	*ON*	*ON*
Step 2 (50%)	*ON*	*OFF*	*OFF*	*ON*
Step 3 (75%)	*ON*	*OFF*	*ON*	*OFF*
Step 4 (100%)	*ON*	*OFF*	*ON*	*ON*

[redacted]

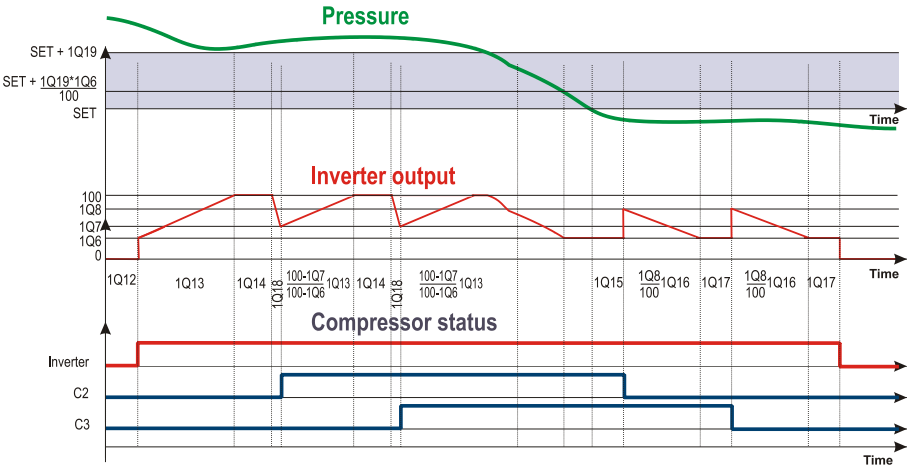
9. ANALOG OUTPUTS FOR INVERTER

9.1 Compressor management

The analog outputs can be used in a rack with frequency compressor, driven by an inverter.
The regulation of the compressors in this case is changed as described in the following graph:
The following examples shows the behaviour of the analog output with proportional regulation.

ES.
3 compressors, 1 frequency compressor

C1 = FRQ1	**C37 = db 1Q8 < 100**
C2 = CPR1	**1Q2 = CPR**
C3 = CPR1	**1Q7 < 100**



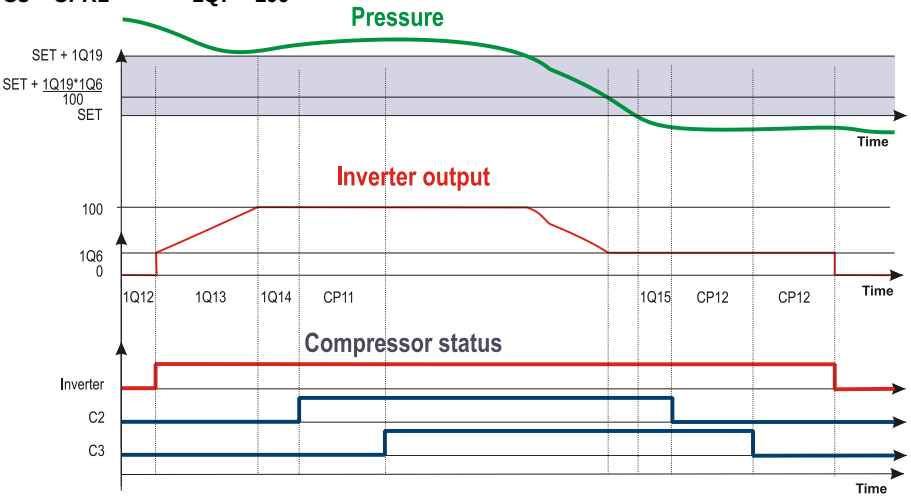
where

1Q6	Minimum value for analog out.1	0 ÷ 100 %
1Q7	Analog output1 value after compressor on	1Q6 ÷ 100 %
1Q8	Analog output1 value after compressor off	1Q6 ÷ 100 %
1Q12	Regulation delay after entering the regulation band	0 ÷ 255 (sec)
1Q13	Analog output 1 rise time from 1Q6 to 100% when the pressure is above the regulation band and a load is switched on.	0 ÷ 255 (sec)
1Q14	Analog output 1 permanency at 100% before load activation	0 ÷ 255 (sec)
1Q15	Delay between pressure (temperature) goes down the set point and start of analog output 1 decreasing	0 ÷ 255 (sec)
1Q16	Analog output 1 decreasing time from 100% to the 1Q6 value	0 ÷ 255 (sec)
1Q17	Analog output1 permanency at 1Q6 before a load is switched off	0 ÷ 255 (sec)
1Q18	Analog output1 decreasing time, from 100% to 1Q7 when a load is switched on	0 ÷ 255 (sec)

EX.

3 compressors, 1 frequency compressor,

C1 = FRQ1 **C37 = db 1Q8 = 100**
C2 = CPR1 **1Q2 = CPR**
C3 = CPR1 **1Q7 = 100**



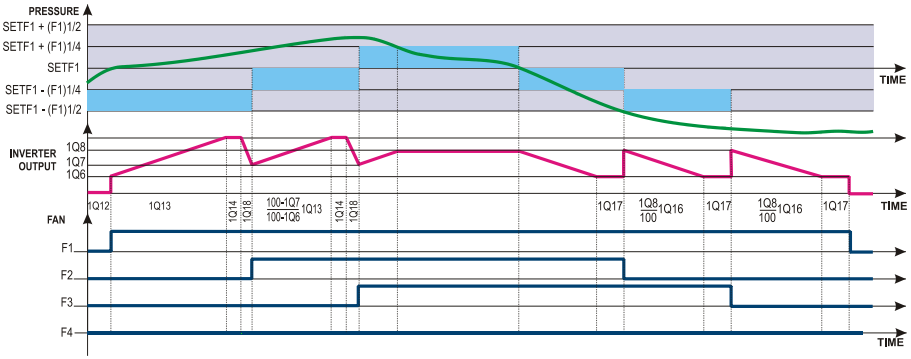
where

1Q6	Minimum value for analog out.1	0 ÷ 100 %
1Q12	Regulation delay after entering the regulation band	0 ÷ 255 (sec)
1Q14	Analog output 1 permanency at 100% before load activation	0 ÷ 255 (sec)
1Q15	Delay between pressure (temperature) goes down the set point and start of analog output 1 decreasing	0 ÷ 255 (sec)
CP11	2 different load start delay	0 ÷ 99.5 (min.1sec)
CP12	2 different load off delay	0 ÷ 99.5 (min.1sec)

9.2 Fans management with inverter– 1 fans group with inverter mode, others ON in on/off mode

With this configuration, one analog output can be used to drive the inverter (1Q2 or 2Q1 or 3Q2 or 4Q1 = FAN or FAN2). Set the first fans relay as inverter (FRQ1F or FRQ2F), and other relays as fans (FAN1 or FAN2).
ES.: 4 fans, 1 with inverter. Analog output 1 drives the inverter

C1 = FRQ1F **1Q2 = FAN**
C2 = FAN1
C3 = FAN1
C4 = FAN1



1Q6	Minimum value for analog output 1	0 ÷ 100 %
1Q7	Analog output 1 value after fan activation	1Q6 ÷ 100 %
1Q8	Analog output 1 value after fan deactivation	1Q6 ÷ 100 %
1Q12	Regulation delay of analog output 1 when the pressure is in the regulation band	0 ÷ 255 (sec)
1Q13	Analog output 1 rise time from 1Q6 to 100% when the pressure is outside the regulation band	0 ÷ 255 (sec)
1Q14	Analog output 1 permanency at 100% before load activation	0 ÷ 255 (sec)
1Q16	Analog output 1 decreasing time from 100% to 1Q6	0 ÷ 255 (sec)
1Q17	Analog output 1 permanency at 1Q6 before a fan is switched off with pressure below the set	0 ÷ 255 (sec)
1Q18	Analog output 1 decreasing time, from 100% to 1Q7 before a load is switched on	0 ÷ 255 (sec)

9.3 Management of all fans with inverter – proportional inverter

In this case all fans of the condensing group are driven by one inverter.
The power used by the inverter is proportional to the delivery pressure value.

Set one relay as inverter (FRQ1F or FRQ2F) and set the analog output 3 or 4 to drive it (3Q2 or 4Q1 = INVF1 or INVF2).
The reference probe is the probe set on parameter 3Q3 or 4Q2 = PBC3 or PBC4, respectively the delivery probe circuit 1 and 2.
The analog output is managed in proportional mode according to the pressure/temperature between the SETF and the SETF1 + 3Q19 (or 4Q18).

Below the SETF the output is OFF, above the SETF the output works at 100%.

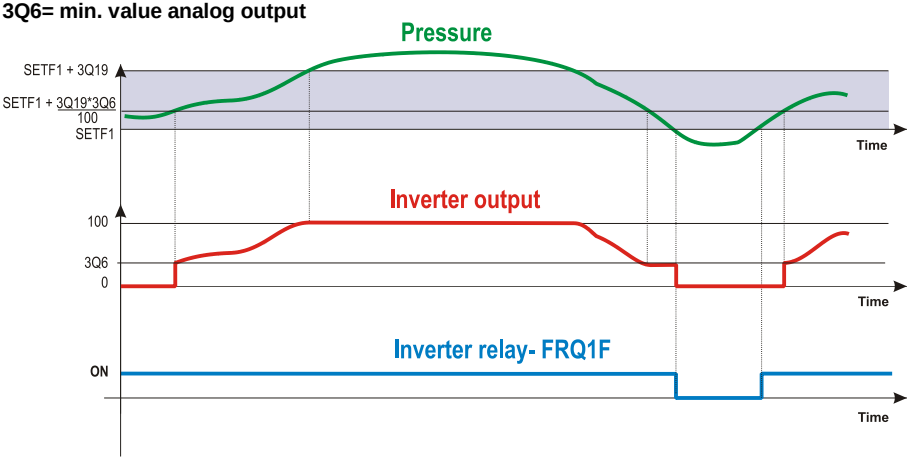
If the delivery pressure/temperature is higher than the SETF1(2) value, the relay set as inverter is ON; if the delivery pressure is lower than the SETF1(2) value the relay is OFF.

9.3.1 Use of fans thermal protection

With this configuration it's possible to use XC1000D digital inputs to monitor the fans functioning. It's necessary to set as much relay as used fans. Connect the thermal protection of every fans to its digital input of the relay set as fan.
DON'T USE relays set as fans.

ES.: 4 fans, driven by one inverter.

C1 = FRQ1F **C2 = FAN1** **C3 = FAN1** **C4 = FAN1** **C5 = FAN1**
3Q2 = INVF1 **3Q3 = PBC3** **3Q19 = Regulation band width**
3Q6= min. value analog output



With this configuration, connect the thermal protection of:
- fan 1 to terminals: 5-6 (i.d. 2)
- fan 2 to terminals: 7-8 (i.d. 3)
- fan 3 to terminals: 9-10 (i.d. 4)
- fan 4 to terminals: 11-12 (i.d. 5)

In this way any fans problem is sent to the controller (even if doesn't affect the regulation)

10. Alarm list

Usually alarm conditions are signalled by means of:
1. Activation of alarm relays
2. Buzzer activation
3. Message on proper display
4. Log of alarms, hour, data and duration

10.1 Alarm conditions – summary table

Code	Description	Cause	Action	Reset
E0L1 (E0L2)	Low pressure-switch alarm for circuit 1 (2)	Low pressure switch input 1 (2) enabled, terminals 52-53 (56-57).	– All compressors of circuit 1 (2) are turned off. Fans unchanged.	**Automatically** if the number of activation are less than Ac12 (Ac16) in the Ac13 (Ac17) time when the input is disable. - The compressors restarts working according to the working algorithm. **Manually**(if Ac12 (Ac16) activation happened in the Ac13 (Ac17) time When the input is disable: a. turn off and on the instrument.. - The compressors restarts working according to the working algorithm.
E0H1 (E0H2)	**High pressure switch fro circuit 1 (2) alarm**	High pressure switch input 1 (2) enabled - terminals 54-55 (58-59)	- All compressors of circuit 1 (2) are turned off. - All fans are of circuit 1 (2) turned on.	**Automatically** if the number of activation are less than AF7 (AF14) in AF8 (AF15) time when the input is disable. - Compressors and fans restart working according to the working algorithm. **Manually** if AF7 (AF14) activation happened in the AF8 (AF15) time When the input is disable: - turn off and on the instrument.. Compressors and fans restarts working according to the working algorithm.
P1 (P2)	**Suction probe circuit 1 (2) failure alarm**	Probe 1 (2) failure or out of range	– The compressors are activated according to the AC14 (AC18) parameters.	**Automatically** as soon as the probe restarts working.
P3 (P4)	**Condensing probe circuit 1 (2) failure alarm**	Probe 3 (4) failure or out of range	– The fans are activated according to the AF8 (AF16) parameters.	**Automatically** as soon as the probe restarts working.
EA1÷ EA15	Compressor safeties alarm	Safeties compressor input activation. NOTE: with step compressors 1 input for each compressor has to be used.	– the corresponding compressor is turned off. (with step compressors all relays referred to the input are disabled).	**Automatically** as soon as the input is disabled.
A02F	**Fan safeties alarm**	Safeties fan input activation.	– The corresponding output is disabled	**Automatically** as soon as the input is disabled.

Code	Description	Cause	Action	Reset
LAC1 (LAC)	**Minimum pressure (temperature) alarm compressors for circuit 1 (2)**	Suction pressure or temperature lower than SETC1-AC3 (SETC2 –AC6) value	– signalling only	**Automatically:** as soon as the pressure or temperature reaches the SETC1-AC3 (SETC2 – AC6) + differential value. (differential = 0.3bar or 1°C)
LAF1 (LAF2	**Minimum pressure (temperature) alarm fans section for circuit 1 (2)**	Condensing pressure or temperature lower than SETF1-AF1 (SETF2 –AF9) value	– signalling only	**Automatically:** as soon as the pressure or temperature reaches the (SETF1-AF1 (SETF2 – AF9) + differential) value. (differential = 0.3bar or 1°C)
HAC1 (HAC2	**Maximum pressure (temperature) alarm compressors for circuit 1 (2)**	Suction pressure or temperature higher than SETC1+AC4 (SETC2 +AC7) value	– signalling only	**Automatically:** as soon as the pressure or temperature reaches the (SETC1-AC4 (SETC2 – AC7) - differential) value. (differential = 0.3bar or 1°C)
HAF1 (HAF2	**Maximum pressure (temperature) alarm fans section for circuit 1 (2)**	Condensing pressure or temperature higher than SETF1+AF2 (SETF2 +AF10) value	– It depends on parameter AF4 (AF12)	**Automatically:** as soon as the pressure or temperature reaches the SETF1+AF2 (SETF2 +AF10) - differential value. (differential = 0.3bar or 1°C)
LL1(LL 2)	**Liquid level alarm for circuit 1 (2)**	Proper digital input enabled	– signalling only	**Automatically** as soon as the input is disabled
Clock failure	**Clock failure alarm**	Problem on RTC board	– signalling only With this alarm the activation by RTC of the reduced set point and the alarm log are not available.	**Manually:** it is necessary to replace the RTC board.
Set clock	**Clock data lost**	The clock back up battery is exhausted	– signalling only – With this alarm the activation by RTC of the reduced set point and the alarm log are not available.	**Manually:** set the data and the time
SEr1÷SEr15	**Compressors maintenance alarm**	A compressor has worked for the time set in the AC10 parameter	- signalling only	**Manually:** reset the running hour of the compressor (see par. 4.5)

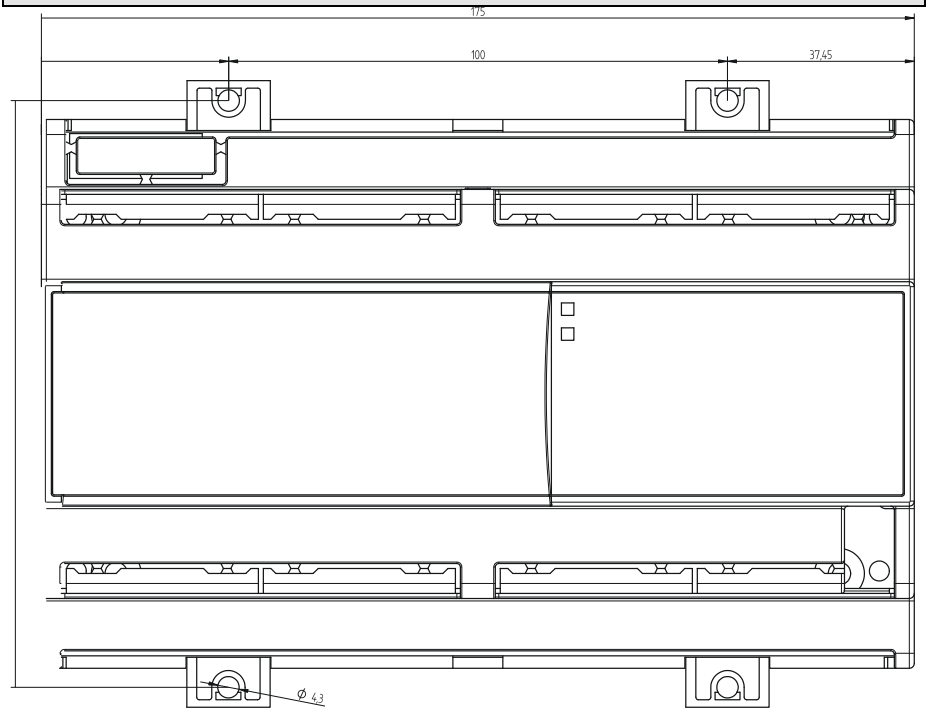
11. Configuration errors

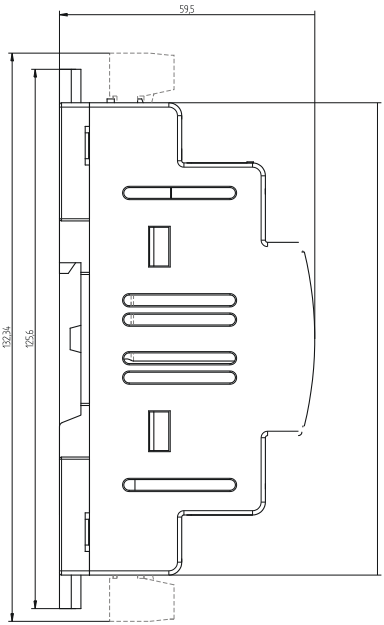
Error N.	Parameters	Alarm description	Action
1	**C1-C15** different from Screw1 or Screw2 **C16 =** Btz or Frsc	Compressors configuration alarm. Set properly par. C16	Machine stop (all relays configured as compr. or fans OFF)
2	One of **C1-C15** parameters= Screw1 or Screw2 **C16 =** SPo	Compressors configuration alarm. Set properly par. C16	Machine stop (all relays configured as compr. or fans OFF)
3	One of **C1-C15** parameters configured as StP. Don't configure any **C1-C15** parameter as compressor.	Presence valve without compressor	Machine stop (all relays configured as compr. or fans OFF)
4	One of **C1-C15** parameters = Frq1 after CPR1; One of **C1-C15** parameters = Frq2 after CPR2	Compressor before inverter: **check *C1-C15* parameters** or More than one relay set as inverter: ***check C1-C15 parameters.*** or One relay set as frequency compressors and none analog output set: ***check C1-C15 parameters and: 1Q2, 2Q1, 3Q2, 4Q1.***	Machine stop (all relays configured as compr. or fans OFF)
5	One of **C1-C15** parameters = Frq1F after FAN1; One of **C1-C15** parameters = Frq2F after FAN2	Fan before inverter: ***check C1-C15 parameters***. or More than one relay set as inverter: ***check C1-C15 parameters.*** or One relay set as fan inverter and no analog output set: ***check C1-C15 parameters and: 1Q2, 2Q1, 3Q2, 4Q1.***	Machine stop (all relays configured as compr. or fans OFF)
6	One of **C1-C15** parameters = Screw1 or Screw2 followed by more than 3 stp **C16 =** Btz or Frsc	Number of wrong compressor steps: ***check C1-C15 parameters***.	Machine stop (all relays configured as compr. or fans OFF)

12. Mounting & installation

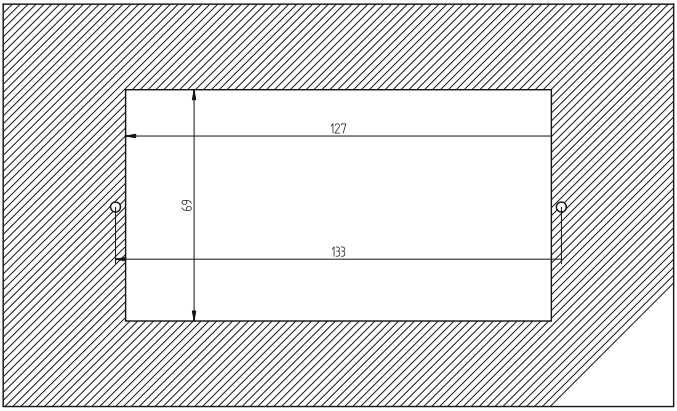
The instruments are suitable only for internal use. They are din rail mounted.
The ambient operating temperature range is between 0÷60°C.
Avoid locations subject to heavy vibration, corrosive gases or excessive dirt. The same applies to the probes. Ensure ventilation around the instrument.

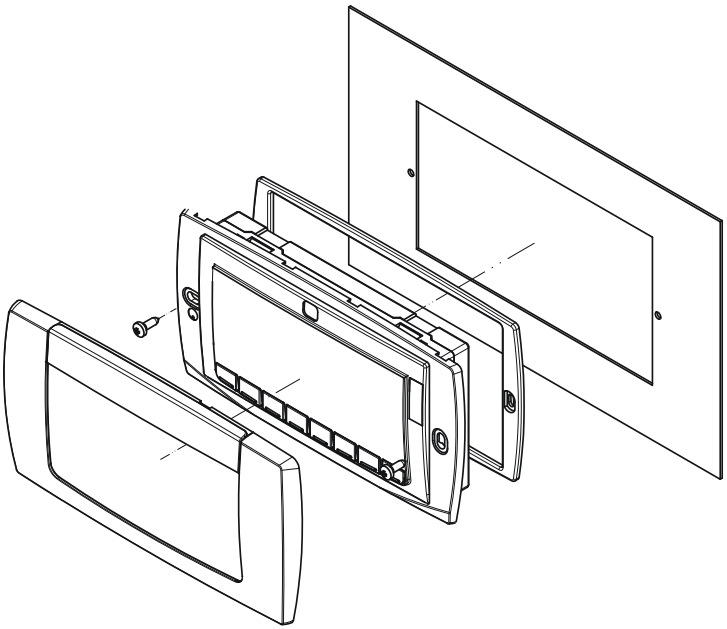
12.1 XC1000D dimensions





12.2 VG810 dimensions and mounting





13. Electrical connections

The instruments are provided with disconnectable screw terminal blocks to connect cables with a cross section up to 2,5 mm^2.
Before connecting cables make sure the power supply complies with the instrument's requirements. Separate the input connection cables from the power supply cables, from the outputs and the power connections. **Do not exceed the maximum current allowed on each relay**, in case of heavier loads use a suitable external relay.

13.1 Probes connection

Pressure probe (4 - 20 mA): respect the polarity. If using terminal ends be sure there are no bear parts which could cause short circuiting or introduce noise disturbance at high frequencies. To minimise the induced disturbances use shielded cables with the shield connected to earth.
Temperature probe: it is recommended to place the temperature probe away from direct air streams to correctly measure the temperature.

14. RS485 serial link

All models can be integrated into the monitoring and alarm system using the RS485 serial port. They use the standard ModBus RTU protocol, so they can be fitted in a system integrator using this protocol.

15. Technical features

Housing: plastic self extinguishing V0.

Case: 175x132 mm; depth 60 mm.
Mounting: DIN rail mounting
Number of configurable relays: XC1015D: 15 (relè 7A 250Vac)
XC1011D: 11 (relè 7A 250Vac)
XC1008D: **8** (relè 7A 250Vac)
Analog inputs:
XC1011D, XC1015D: 4 x 4-20mA o 0÷5V o NTC configurable probe.
XC1008D: 2 x 4-20mA o 0÷5V o NTC configurable probe.
Safety alarm inputs – main voltage:
XC1008D: 8, main voltage, connected to the loads
XC1011D: 11, main voltage, connected to the loads
XC1015D: 15, main voltage, connected to the loads
Configurable digital input:
XC1011D, XC1015D: 4, free voltage.
XC1008D: 2, free voltage.
Safety Pressure switch inputs
XC1011D, XC1015D: 4 main voltage, LP and HP.
XC1008D: 2 main voltage, LP and HP.
Global Alarm output: 1 relay 8A 250Vac
Power supply: 24Vac/dc ± 10%,
Type of refrigerant: R22, R134a, R404a,R507
Alarm logger: the last 100 alarm conditions are stored and displayed
Easy programming: via hot- key
Communication Protocol: Standard ModBus RTU, full documented
Operating temperature: 0÷60°C
Storage temperature: -30÷85 °C
Resolution: 1/100 Bar, 1/10 °C, 1 °F, 1 PSI
Accuracy: better than 1% of F.S.
RTC back up battery: full load battery: tipical: 6 months, minimum: 4 month

16. Default setting

Nome	XC 1008 D	XC 1011 D	XC 1015 D	Level	Description	Range
SETC1	-18.0	-18,0	-18,0	Pr1	Compressor set point circuit 1	
SETF1	35.0	35,0	35,0	Pr1	Fan set point circuit 1	
SETC2	-18.0	-18,0	-18,0	Pr1	Compressor set point circuit 2	
SETF2	35.0	35,0	35,0	Pr1	Fan set point circuit 2	
C0	1A1d	1A1D	1A1D	Pr2	Kind of plant	0A1d(0) - 1A0d(1) - 1A1d(2) - 0A2d(3) - 2A0d(4) - 2A1d(5) - 2A2d(6)
C1	CPr1	CPr1	CPr1	Pr2	Relay 1 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C2	CPr1	CPr1	CPr1	Pr2	Relay 2 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C3	CPr1	CPr1	CPr1	Pr2	Relay 3 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C4	CPr1	CPr1	CPr1	Pr2	Relay 4 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C5	Fan1	CPr1	CPr1	Pr2	Relay 5 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C6	Fan1	Fan1	Fan1	Pr2	Relay 6 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C7	Fan1	Fan1	Fan1	Pr2	Relay 7 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C8	Fan1	Fan1	Fan1	Pr2	Relay 8 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C9	-	Fan1	Fan1	Pr2	Relay 9 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C10	-	Fan1	Fan1	Pr2	Relay 10 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C11	-	FAn1	nu	Pr2	Relay 11 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C12	-	-	nu	Pr2	Relay 12 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C13	-	-	nu	Pr2	Relay 13 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C14	-	-	nu	Pr2	Relay 14 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C15	-	-	nu	Pr2	Relay 15 configuration	Frq1; Frq2; CPr1; CPr2; StP; Frq1F; Frq2F; FAn1; FAn2; Alr; ALr1; ALr2; AUS1; AUS2; AUS3; AUS4; onF; nu
C16	SPo	SPo	SPo	Pr2	Kind of compressors	SPo(0) - dPo(1)
C17	CL	cL	cL	Pr2	Valve polarity circuit 1	OP - CL
C18	-	cL	cL	Pr2	Valve polarity circuit 2	OP - CL

Nome	XC 1008 D	XC 1011 D	XC 1015 D	Level	Description	Range
C34	404	0	0	Pr2	Kind of gas	0 ÷ 255
C35	60	0	0	Pr2	Screw compressors' second step activation delay	0 ÷ 255
C36	NO	0	0	Pr2	Screw compressors' first step used in regulation	0 ÷ 255
C37	db	0	0	Pr2	Regulation for compressor circuit 1	0 ÷ 255
C38	-	0	0	Pr2	Regulation for compressor circuit 2	0 ÷ 255
C41	YES	0	0	Pr2	Compressor rotation circuit 1	0 ÷ 255
C42	-	0	0	Pr2	Compressor rotation circuit 2	0 ÷ 255
C45	YES	0	0	Pr2	Fan rotation circuit 1	0 ÷ 255
C44	-	0	0	Pr2	Fan rotation circuit 2	0 ÷ 255
C45	C / dec	0	0	Pr2	Displaying measurement unit	0 ÷ 255
C46	rEL	0	0	Pr2	Pressure display (rel/abs)	0 ÷ 255
AI1	Cur	Cur	Cur	Pr2	Kind of probe of P1 & P2	Cur(0) - Ptc(1) - ntc(2) - rAt(3)
AI2	-0,5	-0.50	-0.50	Pr2	Probe 1 readout at 4mA/0V	(-1.00 ÷ AI3)^{BAR} (-15 ÷ AI3)^{PSI}
AI3	11,0	11.00	11.00	Pr2	Probe 1 readout at 20mA/5V	(AI2 ÷ 100.00)^{BAR} (AI2 ÷ 750)^{PSI}
AI4	0,0	0.0	0.0	Pr2	Probe 1 calibration	(dEU=bar o °C) -12.0 ÷ 12.0 (dEU=PSI o °F) -120 ÷ 120
AI5	-	-0.50	-0.50	Pr2	Probe 2 readout at 4mA/0V	(-1.00 ÷ AI6)^{BAR} (-15 ÷ AI6)^{PSI}
AI6	-	11.00	11.00	Pr2	Probe 2 readout at 20mA/5V	(AI5 ÷ 100.00)^{BAR} (AI5 ÷ 750)^{PSI}
AI7	-	0.0	0.0	Pr2	Probe 2 calibration	(dEU=bar o °C) -12.0 ÷ 12.0 (dEU=PSI o °F) -120÷120
AI8	Cur	Cur	Cur	Pr2	Kind of probe of P3 & P4	Cur(0) - Ptc(1) - ntc(2) - rAt(3)
AI9	0,0	0.00	0.00	Pr2	Probe 3 readout at 4mA/0V	(-1.00 ÷ AI10)^{BAR} (-15 ÷ AI10)^{PSI}
AI10	30,0	30.00	30.00	Pr2	Probe 3 readout at 20mA/5V	(AI9 ÷ 100.00)^{BAR} (AI9 ÷ 750)^{PSI}
AI11	0,0	0.0	0.0	Pr2	Probe 3 calibration	(dEU=bar o °C) -12.0 ÷ 12.0 (dEU=PSI o °F) -120 ÷ 120
AI12	-	0.00	0.00	Pr2	Probe 4 readout at 4mA/0V	(-1.00 ÷ AI13)^{BAR} (-15 ÷ AI13)^{PSI}
AI13	-	30.00	30.00	Pr2	Probe 4 readout at 20mA/5V	(AI12 ÷ 100.00)^{BAR} (AI12 ÷ 750)^{PSI}
AI14	-	0.0	0.0	Pr2	Probe 4 calibration	(dEU=bar o °C) -12.0 ÷ 12.0 (dEU=PSI o °F) -120 ÷ 120
AI15	ALr	ALr	ALr	Pr2	Alarm relay for regulation faulty probe	nu - ALr - ALr1 - ALr2
AI16	ntc	Ntc	Ntc	Pr1	Probe 5 setting (ntc/ptc)	ptc(0) - ntc(1)
AI17	nu	nu	nu	Pr1	Probe 5 action type	**nu =** not used ; **Au1** = Probe for AUX1 thermostat; **Au2** = Probe for AUX2 thermostat; **Au3** = Probe for AUX3 thermostat; **Au4** = Probe for AUX4 thermostat; **otC1** = dynamic set point for delivery – circuit 1 **otC2** = dynamic set point for delivery – circuit 2 **otA1** = dynamic set point for suction – circuit 1 **otA2** = dynamic set point for suction – circuit 2
AI18	0,0	0.0	0.0	Pr1	Probe 5 calibration	(dEU=bar o °C) -12.0 ÷ 12.0 (dEU=PSI o °F) -120 ÷ 120
AI19	ntc	Ntc	Ntc	Pr1	Probe 6 setting (ntc/ptc)	ptc(0) - ntc(1)
AI20	nu	nu	nu	Pr1	Probe 6 action type	**nu =** not used ; **Au1** = Probe for AUX1 thermostat; **Au2** = Probe for AUX2 thermostat; **Au3** = Probe for AUX3 thermostat; **Au4** = Probe for AUX4 thermostat; **otC1** = dynamic set point for delivery – circuit 1 **otC2** = dynamic set point for delivery – circuit 2 **otA1** = dynamic set point for suction – circuit 1 **otA2** = dynamic set point for suction – circuit 2
AI21	0,0	0.0	0.0	Pr1	Probe 6 calibration	(dEU=bar o °C) -12.0 ÷ 12.0 (dEU=PSI o °F) -120 ÷ 120
AI22	ntc	Ntc	Ntc	Pr1	Probe 7 setting (ntc/ptc)	ptc(0) - ntc(1)

Nome	XC 1008 D	XC 1011 D	XC 1015 D	Level	Description	Range
AI23	nu	nu	nu	Pr1	Probe 7 action type	**nu =** not used ; **Au1** = Probe for AUX1 thermostat; **Au2** = Probe for AUX2 thermostat; **Au3** = Probe for AUX3 thermostat; **Au4** = Probe for AUX4 thermostat; **otC1** = dynamic set point for delivery – circuit 1 **otC2** = dynamic set point for delivery – circuit 2 **otA1** = dynamic set point for suction – circuit 1 **otA2** = dynamic set point for suction – circuit 2
AI24	0,0	0.0	0.0	Pr1	Probe 7 calibration	(dEU=bar o °C) -12.0 ÷ 12.0 (dEU=PSI o °F) -120 ÷ 120
AI25	ntc	Ntc	Ntc	Pr1	Probe 8 setting (ntc/ptc)	ptc(0) - ntc(1)
AI26	nu	nu	nu	Pr1	Probe 8 action type	**nu =** not used ; **Au1** = Probe for AUX1 thermostat; **Au2** = Probe for AUX2 thermostat; **Au3** = Probe for AUX3 thermostat; **Au4** = Probe for AUX4 thermostat; **otC1** = dynamic set point for delivery – circuit 1 **otC2** = dynamic set point for delivery – circuit 2 **otA1** = dynamic set point for suction – circuit 1 **otA2** = dynamic set point for suction – circuit 2
AI27	0,0	0.0	0.0	Pr1	Probe 8 calibration	(dEU=bar o °C) -12.0 ÷ 12.0 (dEU=PSI o °F) -120 ÷ 120
AI28	ALr	ALr	ALr	Pr1	Alarm relay for AUX faulty probe	nu - ALr - ALr1 - ALr2
DI2	cL	CL	CL	Pr2	LP swtich polarity - circuit 1	OP - CL
DI3	-	CL	CL	Pr2	LP swtich polarity - circuit 2	OP - CL
DI4	cL	CL	CL	Pr2	HP swtich polarity - circuit 1	OP - CL
DI5	-	CL	CL	Pr2	HP swtich polarity - circuit 2	OP - CL
DI6	ALr	ALr	ALr	Pr2	Relay for pressure switch alarm	nu - ALr - ALr1 - ALr2
DI7	cL	CL	CL	Pr2	Safe input polarity compressor circuit 1	OP - CL
DI8	-	CL	CL	Pr2	Safe input polarity compressor circuit 2	OP - CL
DI9	cL	CL	CL	Pr2	Safety input polarity fan circuit 1	OP - CL
DI10	-	CL	CL	Pr2	Safety input polarity fan circuit 2	OP - CL
DI11	no	NO	NO	Pr2	Manual restart for compressor alarm	no - YES
DI12	no	NO	NO	Pr2	Manual restart for fan alarm	no - YES
DI13	ALr	ALr	ALr	Pr2	Relay for compressor or fan alarm	nu - ALr - ALr1 - ALr2
DI14	CL	CL	CL	Pr1	Polarity of configurable digital input 1	OP - CL
DI15	LL1	LL1	LL1	Pr1	Function of configurable digital input 1	ES1 - ES2 - OFF1 - OFF2 - LL1 - LL2 -noCRO - noSTD1- noSTD2
DI16	10	20	20	Pr1	Delay of configurable digital input 1	0 ÷ 255 (min)
DI17	CL	CL	CL	Pr1	Polarity of configurable digital input 2	OP - CL
DI18	ES1	ES1	ES1	Pr1	Function of configurable digital input 2	ES1 - ES2 - OFF1 - OFF2 - LL1 - LL2 -noCRO - noSTD1- noSTD2
DI19	0	0	0	Pr1	Delay of configurable digital input 2	0 ÷ 255 (min)
DI20	CL	CL	CL	Pr1	Polarity of configurable digital input 3	OP - CL
DI21	LL2	LL2	LL2	Pr1	Function of configurable digital input 3	ES1 - ES2 - OFF1 - OFF2 - LL1 - LL2 -noCRO - noSTD1- noSTD2
DI22	0	20	20	Pr1	Delay of configurable digital input 3	0 ÷ 255 (min)
DI23	CL	CL	CL	Pr1	Polarity of configurable digital input 4	OP - CL
DI24	ES2	ES2	ES2	Pr1	Function of configurable digital input 4	ES1 - ES2 - OFF1 - OFF2 - LL1 - LL2 -noCRO - noSTD1- noSTD2
DI25	0	0	0	Pr1	Delay of configurable digital input 4	0 ÷ 255 (min)
DI26	ALr	ALr	ALr	Pr1	Relay for LL alarm - circuit 1	nu - ALr - ALr1 - ALr2
DI27	-	ALr	ALr	Pr1	Relay for LL alarm - circuit 2	nu - ALr - ALr1 - ALr2
CP1	4.0	4.0	4.0	Pr1	Regulation band width circuit 1	(BAR) 0.10÷10.00 (°C) 0.0÷25.0 (PSI) 1÷80 (°F) 1÷50

Nome	XC 1008 D	XC 1011 D	XC 1015 D	Level	Description	Range
CP2	-40,0	-40.0	-40.0	Pr1	Minimum set point circuit 1	BAR: (AI2 ÷ SETC1); °C: (-50.0 ÷ SETC1); PSI : (AI2 ÷ SETC1); °F : (-58.0 ÷ SETC1)
CP3	10,0	10.0	10.0	Pr1	Maximum set point circuit 1	BAR: (SETC1÷AI3); °C : (SETC1 ÷ 150.0); PSI : (SETC1 ÷ AI3); °F: (SETC1 ÷ 302)
CP4	0	0.0	0.0	Pr1	Energy saving circuit 1	(BAR) -20.00÷20.00 (°C) -50.0÷50.0 (PSI) -300÷300 (°F) -90÷90
CP5	-	5.0	5.0	Pr1	Regulation band width circuit 2	(BAR) 0.10÷10.00 (°C) 0.0÷25.0 (PSI) 1÷80 (°F) 1÷50
CP6	-	-40.0	-40.0	Pr1	Minimum set point circuit 2	BAR: (AI5 ÷ SETC2); °C: (-50.0 ÷ SETC2); PSI : (AI5 ÷ SETC2); °F : (-58.0 ÷ SETC2)
CP7	-	10.0	10.0	Pr1	Maximum set point circuit 2	BAR: (SETC2÷AI6); °C : (SETC2 ÷ 150.0); PSI : (SETC2 ÷ AI6); °F: (SETC2 ÷ 302)
CP8	-	0.0	0.0	Pr1	Energy saving circuit 2	(BAR) -20.00÷20.00 (°C) -50.0÷50.0 (PSI) -300÷300 (°F) -90÷90
CP9	5	5	5	Pr1	2 start compressor delay	0 ÷ 255 (min)
CP10	2	2	2	Pr1	Minimum time load off	0 ÷ 255 (min)
CP11	15	15	15	Pr1	2 different load start delay	0 ÷ 99.5 (min.1sec)
CP12	5	5	5	Pr1	2 different load off delay	0 ÷ 99.5 (min.1sec)
CP13	15	15	15	Pr1	Minimum time load on	0 ÷ 99.5 (min.1sec)
CP14	0	nu	nu	Pr1	Maximum time load on (0=nu)	0 ÷ 24 (h) – with 0 the function is disabled
CP15	0	0	0	Pr1	Min time Frq1-2 off after CP14	0 ÷ 255 (min)
CP16	no	NO	NO	Pr1	CP11 enabled also at first on	no - YES
CP17	no	NO	NO	Pr1	CP12 enabled also at first off	no - YES
CP18	10	10	10	Pr1	Output delay at power on	0 ÷ 255 (sec)
CP19	-	NO	NO	Pr2	Booster function enabled	no - YES
F1	4,0	4.0	4.0	Pr1	Regulation band width circuit 1	(BAR) 0.10÷10.00 (°C) 0.0÷30.0 (PSI) 1÷80 (°F) 1÷50.0
F2	10,0	10.0	10.0	Pr1	Minimum set point circuit 1	BAR: (AI9 ÷SETF1); °C: (-50.0 ÷ SETF1); PSI : (AI9 ÷ SETF1); °F : (-58.0 ÷ SETF1)
F3	60,0	60.0	60.0	Pr1	Maximum set point circuit 1	BAR: (SETF1÷AI10); °C : (SETF1 ÷ 150.0); PSI : (SETF1 ÷ AI10); °F: (SETF1 ÷ 302)
F4	0,0	0.0	0.0	Pr1	Energy saving circuit 1	(BAR) -20.00÷20.00 (°C) -50.0÷50.0 (PSI) -300÷300 (°F) -90÷90
F5	-	4.0	4.0	Pr1	Regulation band width circuit 2	(BAR) 0.10÷10.00 (°C) 0.0÷30.0 (PSI) 1÷80 (°F) 1÷50.0
F6	-	10.0	10.0	Pr1	Minimum set point circuit 2	BAR: (AI12 ÷ SETF2); °C: (-50.0 ÷ SETF2); PSI : (AI12 ÷ SETF2); °F : (-58.0 ÷ SETF2)
F7	-	60.0	60.0	Pr1	Maximum set point circuit 2	BAR: (SETF2÷AI13); °C : (SETF2 ÷ 150.0); PSI : (SETF2 ÷ AI13); °F: (SETF2 ÷ 302)
F8	-	0.0	0.0	Pr1	Energy saving circuit 2	(BAR) -20.00÷20.00 (°C) -50.0÷50.0 (PSI) -300÷300 (°F) -90÷90
F9	15	15	15	Pr1	2 different fan start delay	1 ÷ 255 (sec)
F10	5	5	5	Pr1	2 different fan off delay	1 ÷ 255 (sec)
HS1	nu	nu	nu	Pr1	Energy Saving start time on Monday	0:0÷23.5h; nu
HS2	00,00	00:00	00:00	Pr1	Monday Energy Saving duration	0:0÷23.5h;
HS3	nu	nu	nu	Pr1	Energy Saving start time on Tuesday	0:0÷23.5h; nu
HS4	00,00	00:00	00:00	Pr1	Tuesday Energy Saving duration	0:0÷23.5h;
HS5	nu	nu	nu	Pr1	Energy Saving start time on Wednesday	0:0÷23.5h; nu
HS6	00,00	00:00	00:00	Pr1	Wednesday Energy Saving duration	0:0÷23.5h;
HS7	nu	nu	nu	Pr1	Energy Saving start time on Thursday	0:0÷23.5h; nu
HS8	00,00	00:00	00:00	Pr1	Thursday Energy Saving duration	0:0÷23.5h;
HS9	nu	nu	nu	Pr1	Energy Saving start time on Friday	0:0÷23.5h; nu
HS10	00,00	00:00	00:00	Pr1	Friday Energy Saving duration	0:0÷23.5h;
HS11	nu	nu	nu	Pr1	Energy Saving start time on Saturday	0:0÷23.5h; nu
HS12	00,00	00:00	00:00	Pr1	Saturday Energy Saving duration	0:0÷23.5h;

Nome	XC 1008 D	XC 1011 D	XC 1015 D	Level	Description	Range
HS13	nu	nu	nu	Pr1	Energy Saving start time on Sunday	0:0÷23.5h; nu
HS14	00,00	00:00	00:00	Pr1	Sunday Energy Saving duration	0:0÷23.5h;
AC1	30	30	30	Pr1	Probe 1 alarm delay at power on	0 ÷ 255 (min)
AC2	-	30	30	Pr1	Probe 2 alarm delay at power on	0 ÷ 255 (min)
AC3	15,0	15.0	15.0	Pr1	Minimum temp/press alarm circuit 1	(0.10 ÷ 30.00)BAR (0.0 ÷ 100.0)°C (1 ÷ 430)PSI (1 ÷ 200.0)°F
AC4	20,0	20.0	20.0	Pr1	Maximum temp/press alarm circuit 1	(0.10 ÷ 30.00)BAR (0.0 ÷ 100.0)°C (1 ÷ 430)PSI (1 ÷ 200.0)°F
AC5	20	20	20	Pr1	Temp/press alarm delay circuit 1	0 ÷ 255 (min)
AC6	-	15.0	15.0	Pr1	Minimum temp/press alarm circuit 2	(0.10 ÷ 30.00)BAR (0.0 ÷ 100.0)°C (1 ÷ 430)PSI (1 ÷ 200.0)°F
AC7	-	20.0	20.0	Pr1	Maximum temp/press alarm circuit 2	(0.10 ÷ 30.00)BAR (0.0 ÷ 100.0)°C (1 ÷ 430)PSI (1 ÷ 200.0)°F
AC8	-	20	20	Pr1	Temp/press alarm delay circuit 2	0 ÷ 255 (min)
AC9	ALr	ALr	ALr	Pr1	Relay for temp/press alarm	nu - ALr - ALr1 - ALr2
AC10	20000	20000	20000	Pr1	Running hours for maintenance	0 ÷ 25000 – with 0 the function is disabled
AC11	ALr	ALr	ALr	Pr1	Relay for maintenance alarm	nu - ALr - ALr1 - ALr2
AC12	15	15	15	Pr1	LP switch 1 activation number	0 ÷ 15
AC13	15	15	15	Pr1	LP switch 1 activation time	0 ÷ 255 (min)
AC14	2	2	2	Pr1	Compressure on-faulty probe1	0 ÷ 15
AC16	-	15	15	Pr1	LP switch 2 activation number	0 ÷ 15
AC17	-	15	15	Pr1	LP switch 2 activation time	0 ÷ 255 (min)
AC18	-	2	2	Pr1	Compressure on-faulty probe2	0 ÷ 15
AF1	20,0	20.0	20.0	Pr1	Minimum temp/press alarm circuit 1	(0.10 ÷ 30.00)BAR (0.0 ÷ 100.0)°C (1 ÷ 430)PSI (1 ÷ 200.0)°F
AF2	20,0	20.0	20.0	Pr1	Maximum temp/press alarm circuit 1	(0.10 ÷ 30.00)BAR (0.0 ÷ 100.0)°C (1 ÷ 430)PSI (1 ÷ 200.0)°F
AF3	20	20	20	Pr1	Temp/press alarm delay circuit 1	0 ÷ 255 (min)
AF4	no	NO	NO	Pr1	Compressor off with max alarm 1	no - YES
AF5	2	2	2	Pr1	Off delay with max alarm 1	0 ÷ 255 (min)
AF6	15	15	15	Pr1	HP switch 1 activation number	0 ÷15
AF7	15	15	15	Pr1	HP switch 1 activation time	0 ÷ 255 (min)
AF8	2	2	2	Pr1	Fans on with faulty probe 3	0 ÷ 15
AF9	-	20.0	20.0	Pr1	Minimum temp/press alarm circuit 2	(0.10 ÷ 30.00)BAR (0.0 ÷ 100.0)°C (1 ÷ 430)PSI (1 ÷ 200.0)°F
AF10	-	20.0	20.0	Pr1	Maximum temp/press alarm circuit 2	(0.10 ÷ 30.00)BAR (0.0 ÷ 100.0)°C (1 ÷ 430)PSI (1 ÷ 200.0)°F
AF11	-	20	20	Pr1	Temp/press alarm delay circuit 2	0 ÷ 255 (min)
AF12	-	NO	NO	Pr1	Compressor off with max alarm 2	no - YES
AF13	-	2	2	Pr1	Off delay with max alarm 2	0 ÷ 255 (min)
AF14	-	15	15	Pr1	HP switch 2 activation number	0 ÷15
AF15	-	15	15	Pr1	HP switch 2 activation time	0 ÷ 255 (min)
AF16	-	2	2	Pr1	Fans on with faulty probe 3	0 ÷ 15
AF17	ALr	ALr	ALr	Pr1	Relay for temp/press alarm	nu - ALr - ALr1 - ALr2
O1	no	NO	NO	Pr2	Dynamic set enabled - circuit 1	no - YES
O2	-18,0	-18.0	-18.0	Pr2	Maximum set for circuit 1	SETC1÷CP3
O3	15,0	15.0	15.0	Pr2	Dynamic set start temperature circuit 1	-40÷O4 °C /-40÷O4°F
O4	15,0	15.0	15.0	Pr2	Dynamic set stop temperature circuit 1	O3÷150°C /O3÷302°F
O5	-	NO	NO	Pr2	Dynamic set enabled - circuit 2	no - YES
O6	-	-18.0	-18.0	Pr2	Maximum set for circuit 2	SETC2÷CP7
O7	-	15.0	15.0	Pr2	Dynamic set start temperature circuit 2	-40÷O8°C /-40÷O8°F
O8	-	15.0	15.0	Pr2	Dynamic set stop temperature circuit 2	O7÷150°C /O7÷302°F
O9	no	NO	NO	Pr2	Dynamic set enabled - circuit 1	no - YES
O10	25,0	25.0	25.0	Pr2	Minimum condens. set - circuit 1	F2÷SETF1
O11	15	15.0	15.0	Pr2	Differential dynamic set-circuit 1	(BAR) -20.00÷20.00 (°C) -50.0÷50.0 (PSI) -

Nome	XC 1008 D	XC 1011 D	XC 1015 D	Level	Description	Range
						300÷300 (°F) -90÷90
O12	-	NO	NO	Pr2	Dynamic set enabled - circuit 2	no - YES
O13	-	25.0	25.0	Pr2	Minimum condens. set - circuit 2	F6÷SETF2
O14	-	15.0	15.0	Pr2	Differential dynamic set-circuit 2	(BAR) -20.00÷20.00 (°C) -50.0÷50.0 (PSI) -300÷300 (°F) -90÷90
1Q1	4.20mA	4.20mA	4.20mA	Pr1	Analog outputs 1-2 setting	4.20 mA (0) - 0.10 V (1)
1Q2	nu	nu	nu	Pr1	Analog output 1 function	FREE – CPR - CPR2 - FAN - FAN2 - INVF1 - INVF2 - nu
1Q3	Pbc1	Pbc1	Pbc1	Pr1	Probe for analog output 1	Pbc1(0) - Pbc2(1) ; used only with 1Q2 = 0
1Q4	0.0	0.0	0.0	Pr1	Lower limit for analog output 1	-1÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F;
1Q5	100.0	100.0	100.0	Pr1	Upper limit for analog output 1	-1÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F;
1Q6	30	50	50	Pr1	Minimum value for analog output 1	0 ÷ 100 %
1Q7	40	50	50	Pr1	Analog output 1 value after compressor start	1Q6 ÷ 100 %
1Q8	40	60	60	Pr1	Analog output 1 value after compressor off	1Q6 ÷ 100 %
1Q9	40	50	50	Pr1	Exclusion band start value 1	1Q7 ÷ 100 %
1Q10	40	50	50	Pr1	Exclusion band end value 1	1Q9 ÷ 100 %
1Q11	50	50	50	Pr1	Safety value for Analog output 1	0 ÷ 100 (%)
1Q12	0	0	0	Pr1	Regulation delay after exit from neutral zone	0 ÷ 255 (sec)
1Q13	60	60	60	Pr1	Analog output 1 rise time	0 ÷ 255 (sec)
1Q14	10	10	10	Pr1	Analog output 1 permanency before load activation	0 ÷ 255 (sec)
1Q15	0	2	2	Pr1	Analog output 1 decreasing delay	0 ÷ 255 (sec)
1Q16	150	5	5	Pr1	Analog output 1 decreasing time	0 ÷ 255 (sec)
1Q17	10	5	5	Pr1	Analog output 1 permanency before load off	0 ÷ 255 (sec)
1Q18	5	5	5	Pr1	Analog output 1 decreasing time after load off	0 ÷ 255 (sec)
1Q19	4.0	4.0	4.0	Pr1	Regulation band width 1	0.10÷25.00bar; 0.0÷25.0°C; 1÷250 PSI; 1÷250°F;10÷2500 KPA
1Q20	350	350	350	Pr1	Integral time 1	0÷999s; with 0 integral action excluded
1Q21	0.0	0.0	0.0	Pr1	Band offset 1	(-12.0÷12.0°C -12.00 ÷ 12.00BAR, -120÷120°F, -120÷120PSI; -1200÷1200KPA
1Q22	4.0	4.0	4.0	Pr1	Anti reset wind-up 1	0.0÷99.0 °C; 0÷180°F; 0.00÷50,00bar; 0÷725PSI; 0÷5000kPA
1Q24	0	0	0	Pr1	Minimum capacity of inverter 1	0÷99%; with 0 function excluded
1Q25	255	255	255	Pr1	Maximum time at minimum capacity of inverter 1	1÷255min
1Q26	2	2	2	Pr1	Time at maximum capacity of inverter 1	1÷255min
2Q1	-	nu	nu	Pr1	Analog output 2 function	FREE – CPR - CPR2 - FAN - FAN2 - INVF1 - INVF2 - nu
2Q2	-	Pbc2	Pbc2	Pr1	Probe for analog output 2	Pbc1(0) - Pbc2(1) ; usata solo quando 2Q2 = 0
2Q3	-	0.0	0.0	Pr1	Lower limit for analog output 2	-1÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F;
2Q4	-	100.0	100.0	Pr1	Upper limit for analog output 2	-1÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F;
2Q5	-	50	50	Pr1	Minimum value for analog output 2	0 ÷ 100 (%)
2Q6	-	50	50	Pr1	Analog output 2 value after compressor start	2Q5 ÷ 100 %
2Q7	-	60	60	Pr1	Analog output 2 value after compressor off	2Q5 ÷ 100 %
2Q8	-	50	50	Pr1	Exclusion band start value 2	2Q6 ÷ 100 %
2Q9	-	50	50	Pr1	Exclusion band end value 2	2Q8 ÷ 100 %

Nome	XC 1008 D	XC 1011 D	XC 1015 D	Level	Description	Range
2Q10	-	50	50	Pr1	Safety value for Analog output 2	0 ÷ 100 (%)
2Q11	-	0	0	Pr1	Regulation delay after exit from neutral zone	0 ÷ 255 (sec)
2Q12	-	60	60	Pr1	Analog output 2 rise time	0 ÷ 255 (sec)
2Q13	-	10	10	Pr1	Analog output 2 permanency before load activation	0 ÷ 255 (sec)
2Q14	-	2	2	Pr1	Analog output 2 decreasing delay	0 ÷ 255 (sec)
2Q15	-	5	5	Pr1	Analog output 2 decreasing time	0 ÷ 255 (sec)
2Q16	-	5	5	Pr1	Analog output 2 permanency before load off	0 ÷ 255 (sec)
2Q17	-	5	5	Pr1	Analog output 2 decreasing time after load off	0 ÷ 255 (sec)
2Q18	-	4.0	4.0	Pr1	Regulation band width 2	0.10÷25.00bar; 0.0÷25.0°C; 1÷250 PSI; 1÷250°F;10÷2500 KPA
2Q19	-	350	350	Pr1	Integral time 2	0÷999s; with 0 integral action excluded
2Q20	-	0.0	0.0	Pr1	Band offset 2	-12.0÷12.0°C -12.00 ÷ 12.00BAR, -120÷120°F, -120÷120PSI; -1200÷1200KPA
2Q21	-	4.0	4.0	Pr1	Anti reset wind-up 2	0.0÷99.0 °C; 0÷180°F; 0.00÷50,00bar; 0÷725PSI; 0÷5000kPA
2Q23	-	0	0	Pr1	Minimum capacity of inverter 2	0÷99%; with 0 function excluded
2Q24	-	255	255	Pr1	Maximum time at minimum capacity of inverter 2	1÷255min
2Q25	-	2	2	Pr1	Time at maximum capacity of inverter 2	1÷255min
3Q1	4.20mA	4.20mA	4.20mA	Pr1	Analog outputs 3-4 setting	4.20 mA (0) - 0.10 V (1)
3Q2	nu	nu	nu	Pr1	Analog output 3 function	FREE – CPR - CPR2 - FAN - FAN2 - INVF1 - INVF2 - nu
3Q3	Pbc3	Pbc3	Pbc3	Pr1	Probe for analog output 3	Pbc3(0); Pbc4(1); used with 3Q2 = 0
3Q4	0.0	0.0	0.0	Pr1	Lower limit for analog output 3	-1÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F;
3Q5	100.0	100.0	100.0	Pr1	Upper limit for analog output 3	-1÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F;
3Q6	30	50	50	Pr1	Minimum value for analog output 3	0 ÷ 100 (%)
3Q7	40	50	50	Pr1	Analog output 3 value after fan start	3Q6 ÷ 100 %
3Q8	40	70	70	Pr1	Analog output 3 value after fan off	3Q6 ÷ 100 %
3Q9	40	50	50	Pr1	Exclusion band start value 3	3Q7 ÷ 100 %
3Q10	40	50	50	Pr1	Exclusion band end value 3	3Q9 ÷ 100 %
3Q11	50	50	50	Pr1	Safety value for Analog output 3	0 ÷ 100 (%)
3Q12	0	0	0	Pr1	Regulation delay after exit from neutral zone	0 ÷ 255 (sec)
3Q13	60	60	60	Pr1	Analog output 3 rise time	0 ÷ 255 (sec)
3Q14	10	10	10	Pr1	Analog output 3 permanency before load activation	0 ÷ 255 (sec)
3Q15	0	0	0	Pr1	Analog output 3 decreasing delay	0 ÷ 255 (sec)
3Q16	150	15	15	Pr1	Analog output 3 decreasing time	0 ÷ 255 (sec)
3Q17	10	5	5	Pr1	Analog output 3 permanency before load off	0 ÷ 255 (sec)
3Q18	5	5	5	Pr1	Analog output 3 decreasing time after load off	0 ÷ 255 (sec)
3Q19	4.0	4.0	4.0	Pr1	Regulation band width 3	0.10÷25.00bar; 0.0÷25.0°C; 1÷250 PSI; 1÷250°F;10÷2500 KPA
3Q20	500	500	500	Pr1	Integral time 3	0÷999s; with 0 integral action excluded
3Q21	0.0	0.0	0.0	Pr1	Band offset 3	(-12.0÷12.0°C -12.00 ÷ 12.00BAR, -120÷120°F, -120÷120PSI; -1200÷1200KPA
3Q22	4.0	4.0	4.0	Pr1	Anti reset wind-up 3	0.0÷99.0 °C; 0÷180°F; 0.00÷50,00bar; 0÷725PSI; 0÷5000kPA
3Q24	0	0	0	Pr1	Minimum capacity of inverter 3	0÷99%; with 0 function excluded

Nome	XC 1008 D	XC 1011 D	XC 1015 D	Level	Description	Range
3Q25	255	255	255	Pr1	Maximum time at minimum capacity of inverter 3	1÷255min
3Q26	2	2	2	Pr1	Time at maximum capacity of inverter 3	1÷255min
4Q1	-	nu	nu	Pr1	Analog output 4 function	FREE – CPR - CPR2 - FAN - FAN2 - INVF1 - INVF2 - nu
4Q2	-	Pbc4	Pbc4	Pr1	Probe for analog output 4	Pbc3(0); Pbc4(1); used with 4Q1 = 0
4Q3	-	0.0	0.0	Pr1	Lower limit for analog output 4	-1÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F;
4Q4	-	100.0	100.0	Pr1	Upper limit for analog output 4	-1÷100.00 bar; -15÷750PSI; -50÷150°C; -58÷302°F;
4Q5	-	50	50	Pr1	Minimum value for analog output 4	0 ÷ 100 (%)
4Q6	-	50	50	Pr1	Analog output 4 value after fan start	4Q5÷ 100 %
4Q7	-	70	70	Pr1	Analog output 4 value after fan off	4Q5÷ 100 %
4Q8	-	50	50	Pr1	Exclusion band start value 4	4Q6 ÷ 100 %
4Q9	-	50	50	Pr1	Exclusion band end value 4	4Q8 ÷ 100 %
4Q10	-	50	50	Pr1	Safety value for Analog output 4	0 ÷ 100 (%)
4Q11	-	0	0	Pr1	Regulation delay after neutral zone exit	0 ÷ 255 (sec)
4Q12	-	60	60	Pr1	Analog output 4 rise time	0 ÷ 255 (sec)
4Q13	-	10	10	Pr1	Analog output 4 permanency before load activation	0 ÷ 255 (sec)
4Q14	-	0	0	Pr1	Analog output 4 decreasing delay	0 ÷ 255 (sec)
4Q15	-	15	15	Pr1	Analog output 4 decreasing time	0 ÷ 255 (sec)
4Q16	-	5	5	Pr1	Analog output 4 perm before load off	0 ÷ 255 (sec)
4Q17	-	5	5	Pr1	Analog output 4 decreasing time after load off	0 ÷ 255 (sec)
4Q18	-	4.0	4.0	Pr1	Regulation band width 4	0.10÷25.00bar; 0.0÷25.0°C; 1÷250 PSI; 1÷250°F;10÷2500 KPA
4Q19	-	500	500	Pr1	Integral time 4	0÷999s; with 0 integral action excluded
4Q20	-	0.0	0.0	Pr1	Band offset 4	(-12.0÷12.0°C -12.00 ÷ 12.00BAR, -120÷120°F, -120÷120PSI; -1200÷1200KPA
4Q21	-	4.0	4.0	Pr1	Anti reset wind-up 4	0.0÷99.0 °C; 0÷180°F; 0.00÷50,00bar; 0÷725PSI; 0÷5000kPA
4Q23	-	0	0	Pr1	Minimum capacity of inverter 4	0÷99%; with 0 function excluded
4Q24	-	255	255	Pr1	Maximum time at minimum capacity of inverter 4	1÷255min
4Q25		2	2	Pr1	Time at maximum capacity of inverter 4	1÷255min
AR1	0,0	0,0	0,0	0,0	Set point aux relay 1	-40÷110°C/-40÷230°F
AR2	1,0	1,0	1,0	1,0	Differential for aux relay 1	0,1÷25,0°C/1÷50°F
AR3	CL	CL	CL	CL	Kind of aciton for aux 1	CL = cooling; Ht = heating
AR4	0,0	0,0	0,0	0,0	Set point aux relay 2	-40÷110°C/-40÷230°F
AR5	1,0	1,0	1,0	1,0	Differential for aux relay 2	0,1÷25,0°C/1÷50°F
AR6	CL	CL	CL	CL	Kind of aciton for aux 2	CL = cooling; Ht = heating
AR7	0,0	0,0	0,0	0,0	Set point aux relay 3	-40÷110°C/-40÷230°F
AR8	1,0	1,0	1,0	1,0	Differential for aux relay 3	0,1÷25,0°C/1÷50°F
AR9	CL	CL	CL	CL	Kind of aciton for aux 3	CL = cooling; Ht = heating
AR10	0,0	0,0	0,0	0,0	Set point aux relay 4	-40÷110°C/-40÷230°F
AR11	1,0	1,0	1,0	1,0	Differential for aux relay 4	0,1÷25,0°C/1÷50°F
AR12	CL	CL	CL	CL	Kind of aciton for aux 4	CL = cooling; Ht = heating
OT1	yES	yES	yES	yES	Alarm relay off by keyboard	no - YES
OT2	CL	CL	CL	CL	Alarm relay polarity	OP - CL
OT3	yES	yES	yES	yES	Alarm relay 1 off by keyboard	no - YES
OT4	OP	OP	OP	OP	Alarm relay 1 polarity	OP - CL
OT5	yES	yES	yES	yES	Alarm relay 2 off by keyboard	no - YES
OT6	OP	OP	OP	OP	Alarm relay 2 polarity	OP - CL
OT7	1	1	1	1	Serial address	1 ÷ 247

Nome	XC 1008 D	XC 1011 D	XC 1015 D	Level	Description	Range
OT9	NO	NO	NO	NO	Off function enabling	no - YES

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TECHNICAL BROCHURE

P0002554

ecocirc® XL Electronic Drive Manual

Bell & Gossett

a xylem brand

Table of Contents

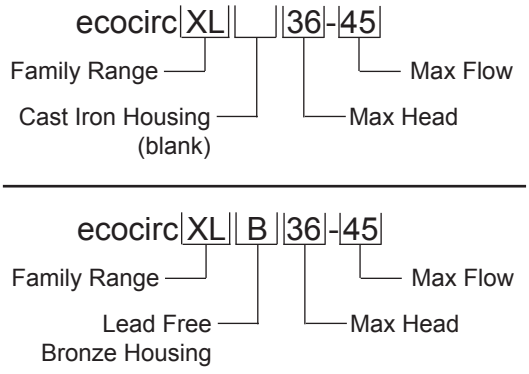
1. Introduction

The electronic drive described in this manual controls ecocirc XL circulators; the drive's main features are:

- sensorless motor control
- sine wave modulated PWM
- 2 micro-controllers:
  one dedicated to motor control
  one implementing the following features:
  - pressure sensorless control modes
  - night setback mode operation
  - 0-10V analog input signal control
  - 4-20mA pressure sensor control
  - external temperature sensor control - external start/stop signal control
  - fault signal control
  - connection to Modbus control systems
  - connection to BACnet control systems
- multiple alarms and errors detection and control
- multiple pump status indication
- optional Wireless module control
- optional RS485 module control

In the next chapters, a detailed description of ecocirc XL family drives' features will follow.

1.1 Product nomenclature



2. Electrical Installation

Power Supply: 1 x 115V ±10%, 50/60Hz and
1 x 208-230V ±10%, 50/60Hz

The NEC and local codes must be followed at all times. The branch circuit supplying power to the pump must be fitted with a suitably sized circuit breaker. If a ground fault CB is used, ensure that the CB is suitable for use with inverter driven appliances.

2.1 Power supply connection

1. Open the terminal box cover removing the screws, fig. 4.
2. Tighten the ½" NPT electrical fitting into the conduit connection of the pump.
3. Route power wiring through conduit to the terminal block.
4. Connect the electrical conduit to the 1/2" NPT fitting.
   a. Connect the ground (earth) wire; be sure that the ground (earth) wire is sized at least as large as the phase wires.
   b. Connect the phase wires.
5. Close the terminal box cover

CAUTION:
If stranded wire is used to connect power to the pump make sure that all individual strands enter the terminal block as the wire is inserted. Peeled back strands can cause a short circuit hazard at the pump terminal block connections.

2.2 I/O connection

1. Open the terminal block removing the screws.
2. Connect the control wiring according to the terminal block diagram. See Figure 6 on page 16, Appendix 1 and the requirements of sec. 2.3 and 2.4.

2.3 Wiring

Power and control signal types	½" NPT for power wiring	M16 cable gland (1) for control wire	M16 cable gland (2) for control wire
Power supply and ground wires	3x14 AWG Min. wire size		
Fault relay	2x20 (AWG) (high volt)	2x20 AWG (low volt)	
Analog 0-10V		(Do not run high volt wiring for fault signal relay through these glands) Run multiple control wires according to number of control circuits. Use shielded wires as necessary.	
External pressure sensor			
External temperature sensor			
External start/ stop			
Communication bus			Bus cable

Note: If power wiring is used for the fault relay terminals, the power wiring must be routed through the ½" NPT conduit (dedicated for power wiring). However if low voltage power is used for the fault relay control, it must be routed through one of the M16 cable glands.

For all electrical connections use heat resistant wires or cable rated for at least 194°F (90°C). The cables should not touch the motor housing, the pump or the piping.

Power and control wires must be run in separate channels.

2.4 Connection diagram

With reference to Figure 6 on page 16, Appendix 1:

Function	Terminal pair	Contact rating	See section
External start/stop	(11) (12)	The drive provides 5VDC through these terminals: no external voltage must be provided.	2.5.1
External analog input 0-10V	(7) (8)		2.5.2
Fault signal	(4) (5)	Max 250V at 2A (inductive load)	2.5.3
External pressure sensor input 4-20mA	(9) (10)	15VDC sourcing for 2-wire DP sensor	2.5.4
External temperature sensor input	(13) (14)	The drive works with a KTY83 temperature sensor (1kΩ at 24°C)	2.5.5
Communication bus (standard)	(15) (16) (17)	TIA/EIA RS485	2.5.6
Communication bus (optional)	(18) (19) (20)	TIA/EIA RS485	2.5.7
Optional wireless or RS485 module	(21)		

2.5 I/O description

2.5.1 External start/stop [(11) (12)]

The circulator can be started or stopped via an external potential-free contact or a relay connected to terminals (11) and (12). If no external start/stop switch is connected, the terminals (11) and (12) should stay jumpered, per factory default.

NOTE:
The drive provides 5VDC through these terminals: no external voltage must be provided to these terminals!

2.5.2 External analog input 0-10V [(7) (8)]

An external analog signal 0-10V, applied to terminals (7) and (8), controls the circulator speed ranging from 0 to 100%, following a linear function as depicted in Figure 1.

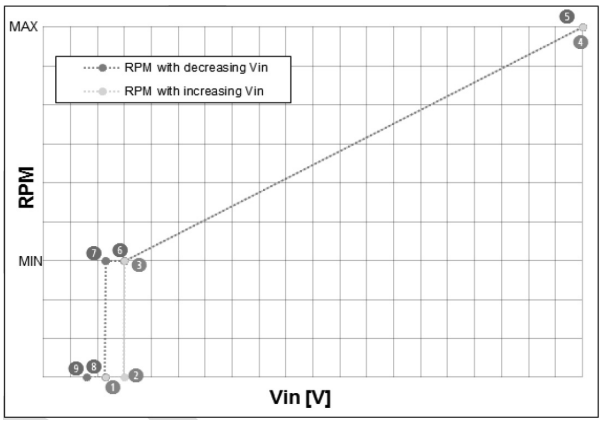


Figure 1

The table below is a description of the points shown in Figure 1.

V_{in} thresholds [V]	Speed setpoint [rpm] when $V_{in}\Uparrow$	Pump status when $V_{in}\Uparrow$	Point	Speed setpoint [rpm] when $V_{in}\Downarrow$	Pump status when $V_{in}\Downarrow$	Point
0	-	Input disabled	-	0	Input disabled	-
0.8	-	Input disabled	-	0	OFF	(9)
1.19	-	Input disabled	-	0	OFF	(8)
1.20	0	OFF	(1)	MIN	RUN	(7)
1.49	0	OFF	(2)	MIN	RUN	
1.50	MIN	RUN	(3)	MIN	RUN	(6)
10.0	MAX	RUN	(4)	MAX	RUN	(5)

2.5.3 Fault signal [(4) (5)]

The drive controls a dry contact relay for fault signal detection. If an error causes the pump to stop operating, the relay contact closes and terminals (4) and (5) are short circuited.

RATINGS

V_{max} < 250VAC

I_{max} < 5A (if resistive load)

I_{max} < 2A (if inductive load)

2.5.4 External analog input 4-20mA [(9) (10)]

The circulator can be equipped with a 4-20mA external differential pressure sensor, connected to terminals (9) and (10), with the purpose of increasing the precision in operating modes involved with pressure regulation.

For setting the correct pressure sensor model in the drive, see sec. 4.3.5.3.

2.5.5 External temperature sensor [(13) (14)]

The circulator can be equipped with an external KTY83 temperature probe (1KΩ at 25°C), connected to terminals (13) and (14), with the purpose of measuring an absolute or a differential water temperature, in temperature dependent / influenced operating modes.

2.5.6 Communication bus (standard) [(15) (16) (17)]

The circulator can communicate remotely through a built-in RS485 port, whose characteristics are:

Interface	RS485 (TIA/EIA) optically isolated
Baud rate	4800 / 9600 (factory setting) / 14400 / 19200 / 138400 / 56000 / 57600 baud
Data format	8 data bits, no parity, 1 stop bit
Protocol	Modbus RTU (factory setting) BACnet MSTP
Address	1-247 Modbus RTU 0-127 Bacnet MSTP ID #1 factory setting

For setting the correct communication parameters in the drive, see sec. 4.3.5.2.

NOTE:
This communication bus, implemented on terminals (15), (16) and (17), is the only one which can be used for connecting 2 pumps in dual pump operations (see sec. 4.3.5.1).

2.5.7 Communication bus (optional) [(18) (19) (20)]

The circulator can communicate remotely through the RS485 port, if the optional Wireless module or the optional RS485 module is installed; main characteristics of this port are:

Interface	RS485 (TIA/EIA) not isolated
Baud rate	4800 / 9600 (factory setting) / 14400 / 19200 / 138400 / 56000 / 57600 baud
Data format	8 data bits, no parity, 1 stop bit
Protocol	Modbus RTU (factory setting) and BACnet MSTP
Address	1-247 Modbus RTU 1-127 BACnet MSTP ID #1 factory setting

The aim of this additional communication bus is to offer a connection to an external BMS, or to a generic external device, when the standard communication bus (described in 2.5.6) is used for dual pump operations (2x single-head pumps)

NOTE:
Do not use this communication bus, implemented on terminals (18), (19) and (20), for connecting 2 pumps in dual pump operations.

2.5.8 Optional wireless and RS485 module [(21)]

The drive can be equipped with
• an optional Wireless module or
• an optional RS485 module

Both modules can be plugged inside the drive (see Figure 8 on page 17) by the provided clips and with the cable connected to the connector (21).

2.6 Settings priority

All the I/O signals, described in 2.5, can interact together changing the behavior of the circulators they are connected to. If two or more signals are enabled and active at the same time, the circulator will operate according to the setting with the highest priority.

Refer to the table below for the settings priority:

Priority	Possible settings			
	User Interface	External Start/Stop	External 0-10V	Bus Signal
1		Stop		
2			Speed Regulation	
3			Stop	
4				Speed Regulation
5				Stop
6	Speed Regulation			
7	Stop			

Example 1
In case the external start/stop switch is open or unconnected (External Start/Stop = Stop), the drive will not accept any speed regulation.

Example 2
The circulator can be operated through the User Interface only if no external signals are applied (to the provided terminals) and no communication bus is connected.

3. Initial Start-up

Before operating the circulator, verify that wires are correctly and firmly terminated into the terminal blocks.

1. Switch on the power supply to the pump
   The drive lights on all the LEDs of the User Interface, to allow a quick detection of any display malfunction.
2. After few seconds, the drive will display the message **“SING”**.
   While this message (**“SING”**) is displayed, the drive allows the possibility to set the dual pump operations' parameters: if the user does not change this setting, the device will default to the factory setting (single-head pump) and proceed to the next step.

   For setting up the correct dual pump operations' parameters in the drive, see sec. 4.3.5.1.
3. After a few seconds, the drive will display the message **“COMM”**.

   While this message (**“COMM”**) is displayed, the drive allows the possibility to set the communication parameters: if the user does not change this setting, the device will default to the factory settings (9600baud, address = 1, no optional module, Modbus RTU protocol) and proceed to the next step.

   For setting up the correct communication parameters in the drive, see sec. 4.3.5.2.
4. If a pressure sensor is connected to terminals P+ and P-, the drive will display the message **“PRES”**.*

   While this message (**“PRES”**) is displayed, the drive allows the possibility to set the optional external differential pressure sensor's parameter. If the user does not change this setting, the device will default to the factory setting (differential pressure sensor 15 PSID (1.0bar) and proceed to the next step.

   For setting the correct differential pressure sensor's parameter in the drive, see sec. 4.3.5.3.
5. After a few seconds, the drive will display the message **“4DEG”**.

   While this message (**“4DEG”**) is displayed, the drive is performing the first (out of 4) cycles of the *Air Purge* procedure: if the user does not stop this procedure, the device will complete the 4 cycles (decrementing in each sub-phase the countdown “4DEG”- “3DEG”- “2DEG”-“1DEG”) and then proceed to the next step.

   To stop or start the Air Purge procedure, see sec. 4.3.4.2.
6. At the end of the *Air Purge* procedure, the pump starts pumping in Constant Pressure control mode (factory default)

   For more information about Control Modes and relative default value, see sec. 4.3.3

NOTE:
All 5 steps (1-5) stated under “Initial Start-up” will repeat in the same manner for any subsequent start-up.

In step 6, the start-up control mode will always be the last control mode used before the previous power off.

* Only *if an external differential pressure sensor is connected to the provided terminals* (see 2.5.4)

4. Control Panel

For a description of buttons, indicators and display given on the user interface, see the table below with reference to Figure 7.

(1)	Control Mode button	See sec. 4.3.3
(2)	Control Mode indicators (LEDs)	See sec. 4.3.3
(3)	Parameter button	See sec. 4.2
(4)	Parameter indicators (LEDs)	See sec. 4.2
(5)	Setting buttons	See sec. 4.3.1
(6)	Numeric display	
(7)	Power indicator (LED)	See sec. 4.1.1
(8)	Status indicator (LED)	See sec. 4.1.2
(9)	Remote control indicator (LED)	See sec. 4.1.3

4.1 LEDs description

4.1.1 Power indicator [(7)]

When the Power (green) LED is lit, the circulator is supplied with power and the electronic devices are operative.

4.1.2 Status indicator [(8)]

- If the “Status” LED is not lit, then the pump is stopped or disabled and the pump motor is not running.
- If the Status (orange) LED is lit, then the pump is stopped and the pump motor is not operating due to a non-blocking alarm
- If the Status (red) LED is lit, then the pump is stopped or disabled and the pump motor is not running due to a blocking error
- If the Status (green) LED is lit, then the pump is operating

4.1.3 Remote control indicator [(9)]

The way the Remote LED is lit (permanently) or blinks, depends on various settings and conditions as below

4.1.3.1 Condition 1

If no optional wireless or RS485 module is used (referring to sec. 4.3.5.2, parameter **“Module”** is set to value “None”) and the protocol for the communication bus is Modbus RTU (parameter **“Protocol”** is set to value “Modbus”)

- If the Remote LED is not lit, then the drive does not detect any valid Modbus message on the terminals provided for the communication bus
- If the Remote (green) LED is permanently lit, then the drive both:
  - detected a communication bus on the provided terminals
  - acknowledged the correct addressing
- If the Remote (green) LED is blinking with 50% duty cycle, then the drive:
  - detected a communication bus on the provided terminals but has not been correctly addressed

Reasons for this condition are the following:

- If the Remote (green) LED switches from being permanently lit to being not lit, then the drive did not detect any valid Modbus RTU message (at least) for the last 5 seconds
- If the Remote (green) LED switches from being permanently lit to blinking with 50% duty cycle, then the drive has not been correctly addressed (at least) for the last 5 seconds

4.1.3.2 Condition 2

If no optional wireless / RS485 module is used (referring to sec. 4.3.5.2, parameter **“Module”** is set to value “None”) and the protocol for the communication bus is BACnet MSTP (parameter **“Protocol”** is set to value “BACnet”)

- If the Remote LED is not lit, then the drive did not receive any valid request, coming from any BACnet MSTP device, (at least) for the last 5 seconds
- If the Remote (green) LED is permanently lit, then the drive is exchanging information with BACnet MSTP device

4.1.3.3 Condition 3

If the optional wireless module is used (referring to sec. 4.3.5.2, parameter **“Module”** is set to value “Wireless”)

- If the Remote LED is not lit, then the connection with the wireless module is damaged or absent.
- If the Remote (green) LED is blinking with 10% duty cycle, then the drive is exchanging information with the wireless module.

4.1.3.4 Condition 4

If the optional RS485 module is used (referring to sec. 4.3.5.2, parameter **“Module”** is set to value “RS485”)

- If the Remote LED is not lit, then either:
  - the connection with the RS485 module is damaged or absent
  - the drive didn’t receive any valid request, coming from any other external device, (at least) for the last 5 seconds
- If the Remote (green) LED is blinking with 90% duty cycle, then both:
  - the RS485 module is correctly connected
  - the drive is exchanging information with an external device

4.2 Parameter LEDs description [(4)]

Referring to Figure 7 on page 16, use the Parameter button (3) to change the displayed unit of measurements during normal operation, following these logical flows:

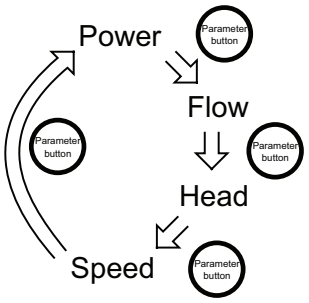


Figure 2

4.2.1 Power

When Power input (active electric power) is the measurement selected:

- The current power absorbed from the power line [watts] is displayed on the numeric display (6)
- The **W** indicator is permanently lit

4.2.2 Flow

When Flow (hydraulic water flow) is the measurement selected:

- The current water flow estimation **gpm** (**m³/h**) is displayed on the numeric display (6).
- The **gpm (m³/h)** indicator is permanently lit.

4.2.3 Head

When *Head* (hydraulic water head) is the measurement selected:

- The current water head estimation [feet or meters of water head] is displayed on the numeric display (6).
- The **ft** (**m**) indicator is permanently lit.

4.2.4 Speed

When *Speed* (pump impeller speed) is the measurement selected:

- The current rotational speed [revolutions per minute] is displayed on the numeric display (6)
- The **rpm** indicator is permanently lit

NOTICE
Each hydraulic measure (Flow or Head) can be singularly switched, between ISO and US units of measure, by pressing the Parameter button (3) continuously for at least 2 seconds

4.3 Settings

4.3.1 Set points editing

Referring to Figure 7 on page 16, use the Setting buttons (5) to change the set point corresponding to the currently selected Control Mode (see sec. 4.3.3)

1. Press shortly one of the Setting buttons (5)
   The actual set point is shown (blinking) for 4 seconds on the Numeric display (6), while the relative unit of measurement is displayed on the Parameter LEDs (4).
2. Change the value with the Setting buttons (5)
   A short button pressure will vary the set point by one single step, but if the button is kept pressed, the change will progress automatically in the selected direction, with an acceleration factor proportional to the pressed time.
3. Wait 4 seconds to store and activate the new set point
   When the change is confirmed, the Numeric display (6) stops blinking and gets back to the active measurement which was before entering the setpoint editing.

NOTE:
During the Set points editing (while the Numeric display (6) is blinking), pressing the Parameter button (3) remains ineffective, until the edit operation has been acknowledged.

4.3.2 Operating modes

Referring to Figure 7, use the Setting buttons (5) to change the Operating mode from *On* (factory default) to *Off* or vice versa.

4.3.2.1 On ⇒ Off

1. Press shortly one of the Setting buttons (5)
   The actual set point is shown (blinking) for 4 seconds on the Numeric display (6), while the relative unit of measurement is displayed on the Parameter LEDs (4).
2. Change the value with the Down arrow button (5), till reaching the minimum set point
   The minimum set point can be easily reached keeping the Down arrow button (5) continuously pressed.
3. A further short press of the Down arrow button (5) sets the Off operating mode
   When the operating mode is set to Off, on the Numeric display (6) the message OFF appears
4. Wait 4 seconds to store and activate the new operating mode

When the change is confirmed, the message OFF disappears. The Numeric display (6), the Parameters LEDs (4) and the Control mode LEDs (2) become unlit. Only the Power, Status and Remote LEDs ((8), (7) and (9)) remain active according to the description in sec. 4.1.

4.3.2.2 Off ⇒ On

1. Press shortly the Up arrow button (5)

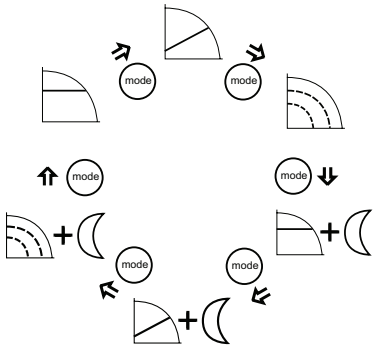
   The Numeric display (6), the Parameters LEDs (4) and the Control mode LEDs (2) returns to show the information according to the last settings before the Off operating mode selection.

2. Change the set point value with the Setting buttons (5)

   After the transition from Off to On operating mode, the set point (related to the actual control mode) is equal to the minimum value: change it if necessary.

4.3.3 Control modes

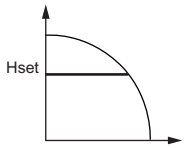
Referring to Figure 7 on page 16, short press the Control mode button (1) to select the desired control mode, following this logical flow:



NOTE:
All control modes can be combined with the *Night Mode* function (see sec. 4.3.4.1)

4.3.3.1 Constant Pressure (Head)

The circulator maintains a constant differential pressure at any flow demand;



for setting up the desired head of the pump (H_{set}), see sec. 4.3.1.

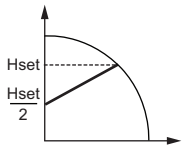
When *Constant Pressure* (which is the factory setting) is the selected control mode, the indicator is permanently lit.

If the hydraulic working point allows the circulator to be operated by regulating the head within the electric power limits, then the target head will coincide with the desired (set) head.

If the hydraulic working point requires the circulator to be operated at a working point that exceeds the electric power limits, then the target head will be de-rated to remain within the maximum power limitation curve.

4.3.3.2 Proportional pressure (head)

The circulator pressure is continuously increased/decreased depending on the increased/decreased flow demand;



for setting up the desired maximum head of the pump (H_{set}), see sec. 4.3.1.

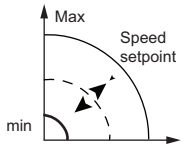
When *Proportional Pressure* is the selected control mode, the indicator is permanently lit.

If the hydraulic working point allows the circulator to be operated by regulating the head within the electric power limits, then the target head will coincide with the desired (set) head.

If the hydraulic working point requires the circulator to be operated at a working point that exceeds the electric power limits, then the target head will be de-rated to remain within the maximum power limitation curve.

4.3.3.3 Fixed speed

The circulator maintains a fixed speed at any flow demand;



for setting up the desired speed of the pump, see sec. 4.3.1.

When Fixed Speed is the selected control mode, the indicator is permanently lit

If the hydraulic working point allows the circulator to be operated by regulating the speed within the electric power limits, then the target speed will coincide with the desired (set) speed.

If the hydraulic working point requires the circulator to be operated at a working point that exceeds the electric power limits, then the target speed will be de-rated to remain within the maximum power limitation curve.

4.3.4 Special functions

4.3.4.1 Night setback mode

The *Night Setback Mode* function cannot be used in cooling systems.

Prerequisites:

- The circulator is installed in the supply line
- The “night condition” can be detected with good confidence if a higher-level control system is set to change the supply temperature

When *Night Setback Mode* is activated, by short pressing the Control mode button (1) as described in sec. 4.3.3, the indicator is permanently lit

The Night Setback Mode can be active in combination with each one of the Control Modes described in sec. 4.3.3.

This function reduces the power consumption of the circulator to the minimum when the heating system is not running; an algorithm detects the proper working conditions and automatically adjusts the speed of the pump.

The pump returns to the original set point as soon as the heating system restarts.

4.3.4.2 Air purge (Degassing)

At each power-on, the drive performs (factory default) an automatic *Air Purge* procedure, with the aim of flushing out air pockets from the circulator housing.

The *Air Purge* cycle will run the pump at a fixed speed for a predetermined length of time, followed by a shorter period of minimum speed; this cycle will be repeated 4 times (in total approximately 60 seconds), with the message **4DEG** reporting the corresponding decrementing counter (as described in sec. 3).

Referring to Figure 7, page 16:

- the Air Purge can be skipped or started up (at any time) by short pressing (for about 2 seconds) both the Setting buttons (5) (Up and Down arrow) together
- the Air Purge can be permanently enabled or disabled (at any time) by long pressing (for at least 10seconds) both the Setting buttons (5) (Up and Down arrow) together: by this operation, in case of Air Purge initially enabled (factory default), after 10 seconds the drive will display the message **dGOF**. On the other hand, if the Air Purge is initially disabled, then keeping the button pressed for 10 seconds, will enable the Air Purge and the drive will display the message **dGOn**.

4.3.4.3 Keypad lock

Keypad Lock is a function with which the drive disables all the buttons of the Control Panel, but maintains running all the indicators and the numeric display.

The Control Panel can be locked/unlocked by pressing simultaneously, and for two seconds, the Parameter button (3) and the Up arrow button (5).

In any case, the drive will automatically lock the user interface after 10 minutes from the last button pressure.

Once the lock is active, by pressing any button the drive displays the symbol; unlocking the Control Panel, the drive will display the symbol .

4.3.5 Sub-menus (parameters)

4.3.5.1 Dual pump operations settings

Each electronic drive can be configured to couple with another drive, so that they start working in concert in dual pump operation.

Prerequisites:

- Dual pump operation is available only when identical pumps are used.
- Wire both pumps to terminals (15), (16) and (17) as described in sec. 2.4 and sec. 2.5.6, connecting the 2x single-head pumps.

For a correct automatic configuration, follow the subsequent procedure, by first setting the pump selected to be the *master* of the couple

1. **Switch on the power supply to both the pumps**
2. After few seconds, the drive will display the message **SING**.
3. While this message (“SING”) is displayed, press shortly one of the Setting buttons (5), in order to configure the circulator as:
   - **Single Head Pump** (factory default): the message **SING** is flashing onto the Numeric Display (7).
   - **Dual Slave Pump**: the message **TUSL** is flashing onto the Numeric Display (7).
   - **Dual Master Pump**: the message **TUMA** is flashing onto the Numeric Display (6).
4. Press shortly the Parameter button (3) to confirm and store the value selected.

   The Numeric Display (7) stops flashing.

   - When the **Single Head Pump** or **Dual Slave Pump** configuration is finalized, the drive will proceed to the next step as described in sec. 3, step 2.
   - Only in case of **Dual Master Pump**, a new sub-menu is made available (as described in the next steps) for setting the dual pump operation
5. After few seconds, the drive will display the message **“BCUP”**.
6. While this message (**“BCUP”**) is displayed, press shortly one of the Setting buttons (5), in order to configure the dual pump operation as:

- **Backup operation** (factory default): the message **bCUP** is flashing onto the Numeric Display (6).

  In this configuration, only the master pump runs, while the second pump starts in case of failure of the master pump.
- **Alternate operation**: the message **ALTE** is flashing onto the Numeric Display (6).

  In this configuration, only one pump runs at a time. The working time is switched every 24 hours so that workload is balanced between both pumps. The second pump starts immediately in case of failure of the running pump. The 24 hour alternating time is non-adjustable.
- **Parallel operation**: the message **PArA** is flashing onto the Numeric Display (6).

  In this configuration, both pumps run simultaneously with the same set point. The master pump determines the behavior of the full system and is able to optimize the performance. To satisfy the required performance, the master pump starts or stop the second pump depending on the required head and flow.
- **Forced parallel operation**: the message **FOrC** is flashing onto the Numeric Display (6).

  In this configuration, both pumps always run simultaneously at the same set point.

7. Press shortly the Parameter button (3) to confirm the value selected.

   The Numeric Display (6) stops flashing: the configuration is finalized and the drive will proceed to the next step as described in sec. 3, step 2.

Once the *master* pump is configured, the second pump (slave) is then automatically configured by the *master* pump. To verify this, the **Remote** (green) LED is permanently lit.

In case the automatic configuration of the second pump (slave) did not take effect (**Remote** LED not lit), repeat the above procedure, from step 1 to step 4, configuring the second pump to be a **Dual Slave Pump**.

NOTE:
Whenever two pumps, connected in Dual Pump Operations, are required to communicate remotely with a BMS or a generic external device, then the Optional Communication Bus, described in sec. 2.5.7, must be activated through the **installation of an optional module** (see sec. 2.5.8) **exclusively into the Master pump of the couple**.

4.3.5.2 Communication settings

Each electronic drive can communicate remotely through a built-in RS485 port, as briefly described in sec. 2.5.6.

Referring to Figure 7 on page 16, the communications settings are accessible following the subsequent procedure.

1. Switch on the power supply to the pump
2. After few seconds, the drive will display the message **COMM**.
3. While this message (**"COMM"**) is displayed, press shortly the Parameter button (3) in order to configure the subsequent parameters:

- **Baud Rate**: the message **bAUd "BAUD"** is displayed onto the Numeric Display (7), allowing the communication port baud rate to be set to a specific value.

Available values for this parameter are:
- 4.8 kbps
- 9.6 kbps (factory default)
- 14.4 kbps
- 19.2 kbps
- 38.4 kbps
- 56.0 kbps
- 57.6 kbps.

- **Protocol**: the message **PrOT "PROT"** is displayed onto the Numeric Display (6), allowing the user to select a specific protocol on the communication port.

Available values for this parameter are:
- Modbus **MOd "MOD"** (factory default)
- BACnet **bAC "BAC"**.

- **Address:** the message **Addr** is displayed onto the Numeric Display (6): by mean of it, the circulator address is set to a specific value (1 is the factory default).

Available values for this parameter are:
- [1-247] (in case of Modbus protocol)
- [0-127] (in case of BACnet protocol)

- **Module:** the message **MOdU "MODU"** is displayed onto the Numeric Display (6), allowing the user to select one optional module in the drive.

Available values for this parameter are:
- None **NONE** (factory default)
- Wireless **"WIFI"**
- RS485 **485**

4. Press the Parameter button (3) to enter each sub-menu, thus accessing to the next level.
5. Use the Setting buttons (5), in order to select the desired value for every parameter
6. Press the Parameter button (3) to confirm and store the value selected
7. Press the Control mode button (1) to exit each

sub-menu, thus returning to the previous level

If no buttons are pressed for 10 seconds, then the pump exits the current menu and continues start-up procedure. All the parameters changed without confirmation are restored to former state.

5. Diagnostic codes

4.3.5.3 Differential pressure sensor

When an optional external differential pressure sensor is connected to the circulator, as described in sec. 2.5.4, a submenu is made available for setting the differential pressure sensor's parameters, as described in sec. 3.

Referring to Figure 7 on page 16, the differential pressure sensor's settings are accessible by following the procedure below.

1. Switch on the power supply to the pump.
2. After few seconds, the drive will display the message **PrES "PRES"**.
3. While this message **"PRES"** is displayed, press shortly the Parameter button (3) in order to configure the subsequent parameter:

   • **Type**: the message **tYPE "TYPE"** is displayed onto the Numeric Display (7), allowing the user to select a specific differential pressure range.

   Available values for this parameter are:
   - 0-15 PSID (0-1 bar) **d01** (factory default)
   - 0-30 PSID (0-2 bar) **d02**
4. Press the Parameter button (3) to enter each sub-menu, thus accessing to the next level.
5. Use the Setting buttons (5), in order to select the desired value for the parameter
6. Press the Parameter button (3) to confirm and store the value selected
7. Press the Control mode button (1) to exit each sub-menu, thus returning to the previous level

If no buttons are pressed for 10 seconds, the pump exits the current menu and continues start-up procedure. All the parameters changed without confirmation are restored to former state.

Referring to Figure 7, as briefly described in sec. 4.1:

- In case of any alarm that allows the pump to continue running, the display shows an alarm code as given below and the status indicator becomes orange (see sec. 5.1).
- In case of a failure that stops the pump, the display shows the error code (see sec. 5.2) permanently and the status indicator becomes red.

5.1 Alarm codes

Alarm code	Description	Cause
A01	Water probe alarm	Fluid sensor anomaly
A02	Water over-temperature alarm	High temperature on the fluid
A05	Data memory alarm	Data memory corrupted
A06	External water temperature probe alarm	External temperature probe anomaly
A07	Pressure sensor alarm	External pressure sensor anomaly
A12	Twin pump communication alarm	Twin pump communication lost
A20	Internal alarm	

5.2 Error codes

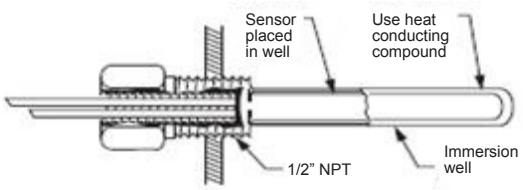
Error code	Description	Cause
E01	Internal communication error	Internal communication lost
E02	Motor overload error	High motor current
E03	DC-bus overvoltage error	DC-bus overvoltage
E04	Trip control error	Motor stall
E05	EEPROM Data memory error	EEPROM Data memory corrupted
E06	Grid voltage error	Voltage supply out of operating range
E07	Motor winding temperature error	Motor thermal protection trip
E08	Power module temperature error	Inverter thermal protection trip
E09	Generic Hardware error	Hardware error
E10	Dry-run error	Dry run detection

6. Accessories

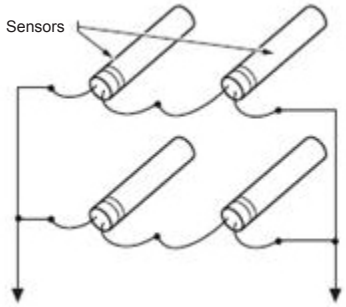
6.1 External temperature sensor

As briefly described in sec. 2.5.5, the circulator can be equipped with an external KTY83 temperature probe (1KΩ at 77F) for the purpose of measuring an absolute or a differential fluid temperature, in temperature dependent or temperature influenced control modes.

The sensor may be strapped to the pipe or inserted in an immersion well for sensing hot or cold water. The sensor may also be used to sense air temperature in an air duct.



Multiple sensors may be connected in parallel-series configuration for averaging temperature measurements.



6.1.1 Fluid temperature dependent control modes – setting parameters

The subset of parameters given in Parameters Table 2, Appendix 2 (described in sec. 8.2.1.2) is devoted to set the Water Temperature dependent Control Modes; in particular:

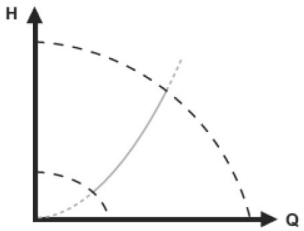
- 0x0030 - Temperature control mode
  Defines if there's a dependency of the control modes on the temperature, as stated below: and which kind of dependency
  - o [= 0] ⇒ None of the standard control modes (described in sec. 4.3.3) are affected or influenced by the fluid temperature
  - o [= 1] ⇒ The differential pressure control modes; Constant Pressure [ConstΔP] (see sec. 4.3.3.1) and Proportional Pressure [PropΔP] (see sec. 4.3.3.2), are influenced by water temperature (**[ConstΔP]/T** and **[PropΔP]/T**)
  - o [= 2] ⇒ The active control mode is Constant Absolute Temperature [**ConstT**] or Constant Differential Temperature [**ConstΔT**], depending on the value of Parameter "0x0033 – Temperature Probe"
- 0x0031 – Absolute temperature setpoint
  The single temperature set-point is maintained by the system when operating in Constant Absolute Temperature [**ConstT**]
- 0x0032 – Differential temperature setpoint
  The differential temperature set-point is maintained by the system when operating in Constant Differential Temperature **[ConstΔT]**
- 0x0033 – Temperature probe
  Defines which temperature probe must be considered as input for the temperature- dependent control mode selected
  - o [= 0] ⇒ The control mode uses the internal temperature probe's input signal
  - o [= 1] ⇒ The control mode uses the auxiliary (external) temperature sensor's input signal (the external temperature sensor must be connected)
  - o [= 2] ⇒ The control mode calculates the differential temperature between the internal and the external sensor, and uses the differential temperature as input signal (the external temperature sensor must be connected)
- 0x0034 – Temperature slope
  Defines how the speed (when ConstT control mode is active) or the Head set-point (when ConstantΔP/T or PropΔP/T control modes are active) reacts to the water temperature's increase/decrease
  - o [= 0] ⇒ The speed or the Head set-point increases when the temperature increases
  - o [= 1] ⇒ The speed or the Head set-point decreases when the temperature increases
- 0x0035 – Kp for temperature Control
  Is the proportional constant used in the PI-regulator which drives the temperature control
- 0x0036 – Ki for temperature Control
  Is the integral constant used in the PI-regulator which drives the temperature control
- 0x0037 – temperature control sampling time
  Sampling time used in the temperature control

6.1.2 Fluid temperature dependent control modes

Using the setting parameters described in sec. 6.1.1, the Fluid Temperature dependent Control Modes are the folllowing:

6.1.2.1 Constant Absolute Temperature [ConstT]

This control mode ensures a constant water temperature. Constant temperature is a comfort control mode that can be used in heating/cooling hot-water systems to control the flow and to maintain a fixed temperature in the system



In this control mode, the basic assumption is that the circulator regulates (following the feedback of the internal or external temperature sensor) the water temperature at a point, on the return pipe of the system, as close as possible to the heating/cooling terminal unit.

It is then clear that the **ConstT** control mode can be deployed in the subsequent possible application

o *ConstT for heating applications, using internal temp. sensor*
In this application the pump is installed in the return pipe, and utilizes the internal temp. sensor
As described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 2
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 0
- 0x0034 – Temperature Slope = 1

o *ConstT, for heating applications, using external temp. sensor*
In this application the pump is installed in the supply flow pipe, and utilizes the external temp. sensor as described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 2
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 1
- 0x0034 – Temperature Slope = 1

o *ConstT, in cooling applications, using internal temp. sensor*

In this application the pump is installed in the return pipe, and utilizes the internal temp. sensor as described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 2
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 1
- 0x0034 – Temperature Slope = 1

o *ConstT, in cooling applications, using external temp. sensor*

In this application the pump is installed in the supply pipe, and utilizes the external temp. sensor as described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 2
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 1
- 0x0034 – Temperature Slope = 1

6.1.2.2 Constant differential temperature [ConstΔT]

This control mode keeps the differential temperature of the pumped liquid constant, changing the flow rate to maintain the user-selectable set-point.

In this case, it's unnecessary to discriminate between heating and cooling applications, because the differential temperature is considered as absolute value.

According to what is described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 2
- 0x0032 – Differential Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 2

6.1.2.3 Constant differential pressure depending on water temperature [ConstΔP/T]

In this control mode the drive alters the differential pressure set-point that the pump maintains, depending on the measured fluid temperature, as depicted in Figure 3

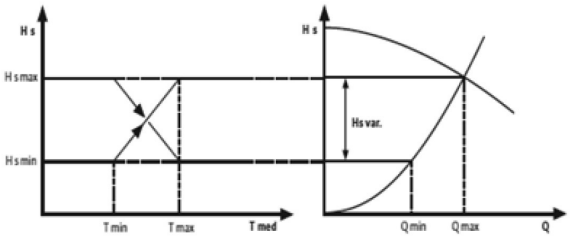


Figure 3

Referring to Figure 3

- Tmin = 20°C
- Tmax = Absolute Temperature Setpoint (sec. 0x0031)
- Hsmin = 30% of Hsmax
- Hsmax = Constant pressure set-point (settable via User Interface, see sec. 4.3.3.1)

The ConstΔP/T control mode can be deployed in the following applications:

o *ConstΔP/T, positive relation P/T, using internal temp. sensor*

As described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 1
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 0

- 0x0034 – Temperature Slope = 0
- Control Mode = Constant Pressure (settable via User Interface)
- Constant Pressure Setpoint = desired value

o *ConstΔP/T, negative relation P/T, using internal temp. sensor*

As described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 1
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 0
- 0x0034 – Temperature Slope = 1
- Control Mode = Constant Pressure (settable via User Interface)
- Constant Pressure Setpoint = desired value

o *ConstΔP/T, positive relation P/T, using external temp. sensor*

As described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 1
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 1
- 0x0034 – Temperature Slope = 0
- Control Mode = Constant Pressure (settable via User Interface)
- Constant Pressure Setpoint = desired value

o *ConstΔP/T, negative relation P/T, using external temp. sensor*

As described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 1
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 1
- 0x0034 – Temperature Slope = 1
- Control Mode = Constant Pressure (settable via User Interface)
- Constant Pressure Setpoint = desired value

6.1.2.4 *Proportional pressure depending on water temperature [PropΔP/T]*

In this control mode the drive alters the proportional pressure set-point the pump maintains, depending on the measured fluid temperature

Referring to Figure 3

• Tmin = 20°C

• Tmax = Absolute Temperature Setpoint (sec. 0x0031)

• Hsmin = 30% of Hsmax

• Hsmax = Proportional pressure set-point (settable via User Interface, see sec. 4.3.3.2)

As already described in sec. 6.1.2.3, even the PropΔP/T control mode can be deployed in the subsequent applications:

o *PropΔP/T, positive relation P/T, using internal temp. sensor*

As described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 1
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 0
- 0x0034 – Temperature Slope = 0
- Control Mode = Proportional Pressure (settable via User Interface)
- Proportional Pressure Setpoint = desired value

o *PropΔP/T, negative relation P/T, using internal temp. sensor*

As described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 1
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 0
- 0x0034 – Temperature Slope = 1
- Control Mode = Proportional Pressure (settable via User Interface)
- Proportional Pressure Setpoint = desired value

o *PropΔP/T, positive relation P/T, using external temp. sensor*

As described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 1
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 1
- 0x0034 – Temperature Slope = 0
- Control Mode = Proportional Pressure (settable via User Interface)
- Proportional Pressure Setpoint = desired value

o *PropΔP/T, negative relation P/T, using external temp. sensor*

As described in sec. 6.1.1, the necessary settings are:

- 0x0030 - Temperature Control Mode = 1
- 0x0031 – Absolute Temperature Setpoint = desired value
- 0x0033 – Temperature Probe = 1
- 0x0034 – Temperature Slope = 1
- Control Mode = Proportional Pressure (settable via User Interface)
- Proportional Pressure Setpoint = desired value

6.1.3 Fluid temperature dependent Control modes – Circulator Control Panel

The PC based software application “Circulator Control Panel” may be used to configure temperature dependent control modes. Refer to Advanced Tab to access temperature based control parameters.

A suitable USB-RS485 cable must be used for a wired connection from a PC to the pump terminals 15-16-17.

The USB-RS485 cable may be sourced at http://www.ftdichip.com or through any other source meeting those requirements.

6.1.3.1 Advanced tab

Collects two subset of parameters:

- The subset used for advanced settings, as described in this technical sheet at sec. 8.2.1.2
- The subset used for twin pump settings, as described in this technical sheet at sec. 8.2.1.3

6.2 Wireless Module

Referring to Figure 8 on page 17, after the module has been connected, configure it by setting the parameter “Module” to the value “Wireless”, as described in sec. 4.3.5.2.

6.2.1 Wireless module use

When the wireless module is assembled into ecocirc XL, and correctly configured, it generates a (type 902.11n) wireless network accessible (by a mobile phone, tablet or a PC) using data (S/N and PWD) printed on the label at the side of the circulator’s drive

In particular,

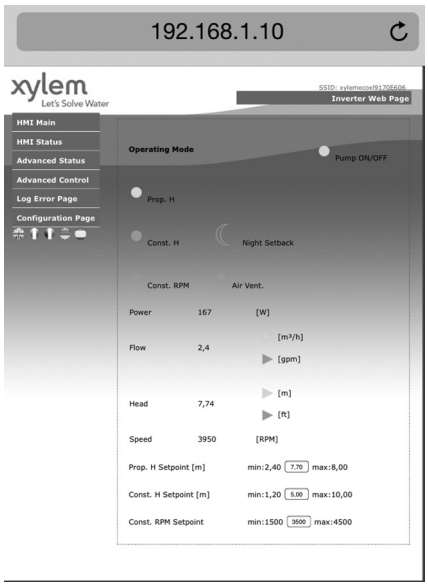
• Network name: “xylemecoxl"_____S/N_____” where S/N is an 8 character word

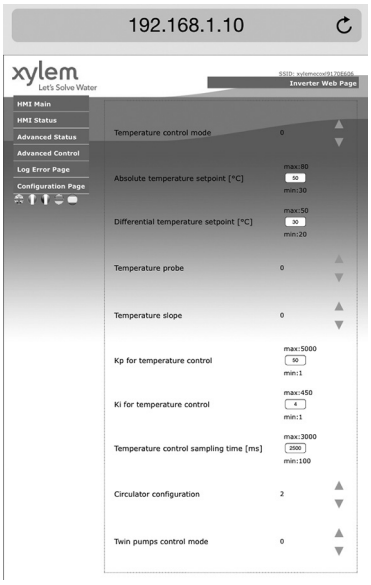
• Password: “xylem_____PWD_____” where PWD is an 8 character word

To access the circulator’s web pages using a browser (on the connected external device), use the web address “https://xylemecoxl” or type directly “192.168.1.10”

6.3 RS485 Module

Referring to Figure 12, after the module is connected, configure it by setting the parameter “Module” to the value “RS485”, as described in sec. 4.3.5.2





7. Appendix 1

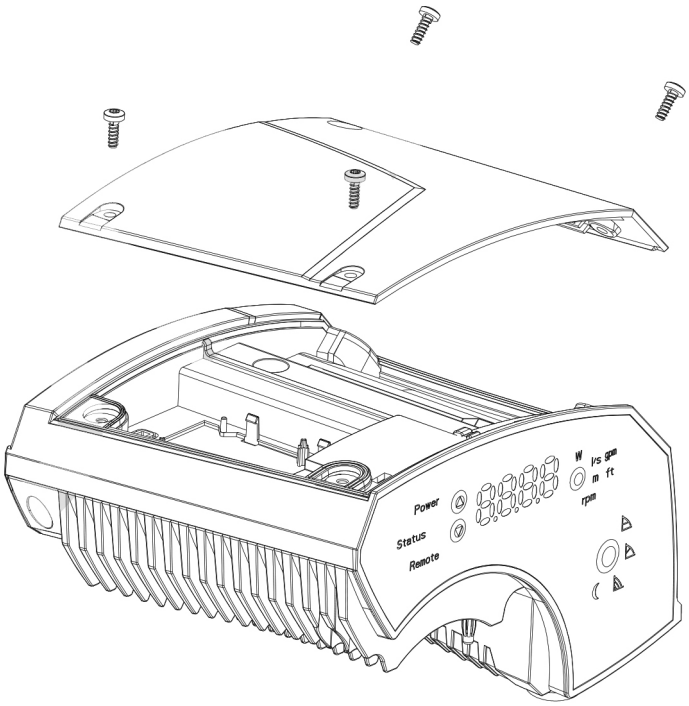


Figure 4

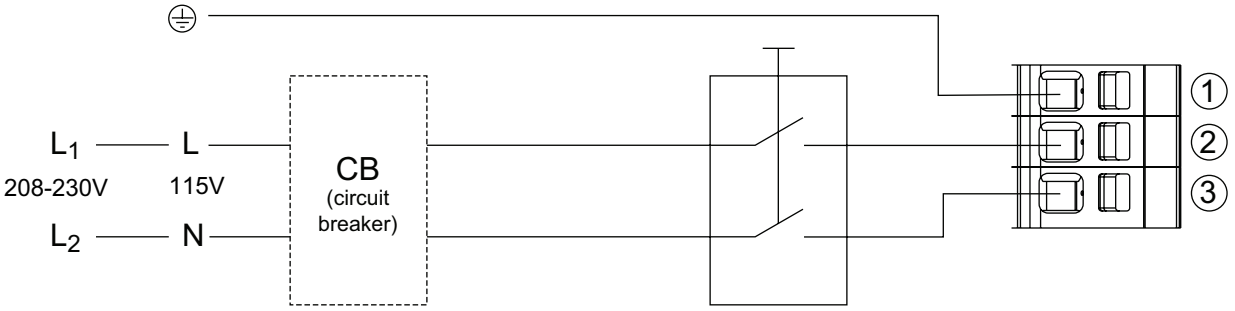


Figure 5

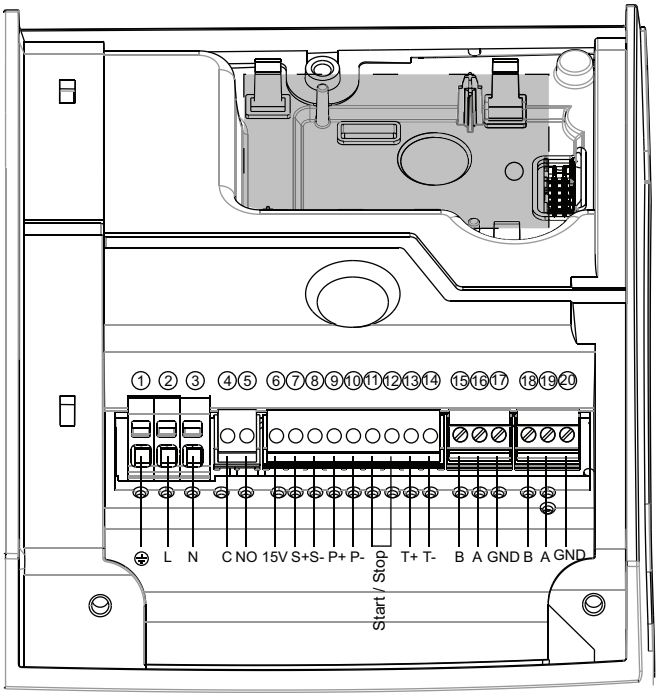


Figure 6

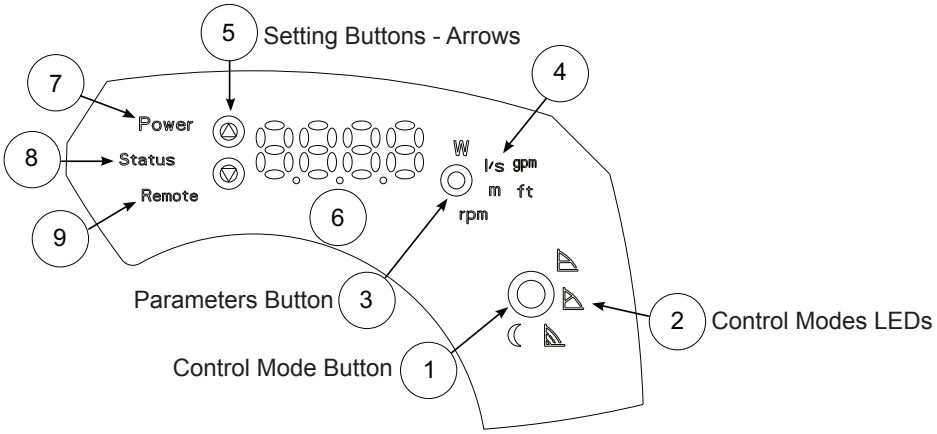


Figure 7

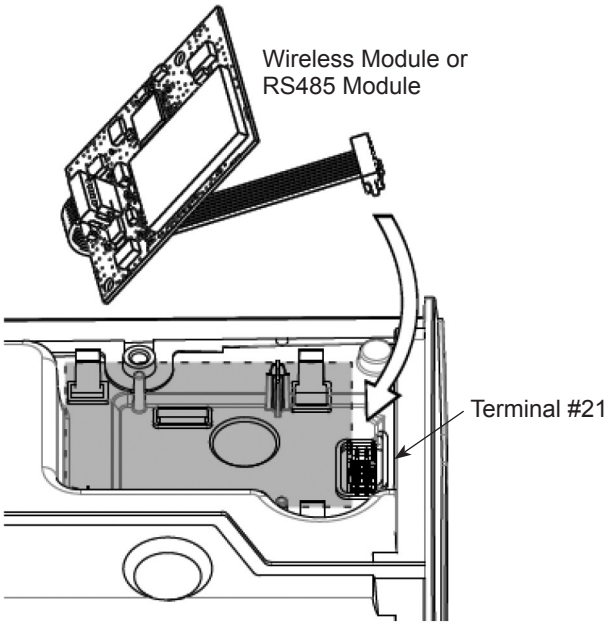


Figure 8

8. Appendix 2

8.1 Data organization

The drive offers below Modbus Virtual Memory (see sec. 8.2), based on a data set that can be divided into 2 main subsets:

- Parameters are “Readable and Writable” data [R/W] used for setting a specific behaviour, activating a function, writing data, etc. inside the drive.
- Information is “Readable” data [R], used for acquiring values or feedback from the drive

8.2 Modbus virtual memory

The complete data-set managed by the ecocirc XL is accessible via Modbus Virtual Memory made exclusively of Holding Registers, representing both Parameters and Information: readable and writeable are the Parameters, and readable only is the Information.

For a detailed description of the Modbus Virtual Memory organization, refer to the related document “ecocirc XL - Modbus Parameters Table”.

8.2.1 Parameters tables

8.2.1.1 Parameters table 1

A set of parameters [R/W] used for *standard settings*: generally the same operations or functions a user can perform/activate through the user interface.

MB. ADDRESS (HEX)	PARAMETER DESCRIPTION
0x0000	**OPERATING MODE** 0 = OFF 1 = ON
0x0001	**CONTROL MODE** 1 = CONSTANT PRESSURE 2 = PROPORTIONAL PRESSURE 3 = CONSTANT CURVE
0x0002	**NIGHT-MODE ACTIVATION** 0 = NOT ACTIVE 1 = ACTIVE
0x0003	**AIR VENTING PROCEDURE** 0 = NOT ACTIVE 1 = ACTIVE
0x0004	**PROPORTIONAL PRESSURE SETPOINT** (for CONTROL MODE = 2)
0x0005	**CONSTANT PRESSURE SETPOINT** (for CONTROL MODE = 1)
0x0006	**CONSTANT CURVE SETPOINT** (for CONTROL MODE = 3)
0x0007	**AIR VENTING POWER ON** 0 = NOT ACTIVE 1 = ACTIVE

8.2.1.2 Parameters table 2

A set of parameters [R/W] used for advanced settings: these operations or functions cannot be performed/ activated through the user interface

MB. ADDRESS (HEX)	PARAMETER DESCRIPTION
0x0030	**TEMPERATURE CONTROL MODE** 0 = NOT ACTIVE 1 = PROP. TEMPERATURE TO HEAD 2 = CONSTANT TEMPERATURE
0x0031	**ABSOLUTE TEMPERATURE SETPOINT**
0x0032	**DIFFERENTIAL TEMPERATURE SETPOINT**
0x0033	**TEMPERATURE PROBE** 0 = INTERNAL 1 = EXTERNAL 2 = DIFFERENTIAL
0x0034	**TEMPERATURE SLOPE** 0 = INCREASING 1 = DECREASING
0x0035	**K_P FOR TEMPERATURE CONTROL**
0x0036	**K_I FOR TEMPERATURE CONTROL**
0x0037	**TEMPERATURE CONTROL SAMPLING TIME**

8.2.1.3 Parameters table 3

It is a set of parameters [R/W] used for *twin pump* settings.

MB. ADDRESS (HEX)	PARAMETER DESCRIPTION
0x0060	**CIRCULATOR CONFIGURATION** 0 = TWIN MASTER 1 = TWIN SLAVE 2 = SINGLE
0x0061	**TWIN PUMPS CONTROL MODE** 0 = BACKUP 1 = ALTERNATE 2 = PARALLEL 3 = FORCED PARALLEL

8.2.2 Information tables

8.2.2.1 Information table 1

It is a set of information [R] used for standard use: some of the data can be acquired through the user interface

MB. ADDRESS (HEX)	INFORMATION DESCRIPTION
0x0200	**INPUT POWER**
0x0201	**HEAD [H]**
0x0202	**FLOW [Q]**
0x0203	**SPEED**
0x0204	**WATER TEMPERATURE**
0x0205	**EXTERNAL WATER TEMPERATURE**
0x0206	**WINDING 1 TEMPERATURE**
0x0207	**WINDING 2 TEMPERATURE**
0x0208	**WINDING 3 TEMPERATURE**
0x020A	**QUADRATURE CURRENT**
0x020B	**BIT FIELDS I/O**
0x020C	**BIT FIELDS ALARM 1**
0x020D	**BIT FIELDS ALARM 2**
0x020E	**BIT FIELDS ERRORS**
0x020F	**ACTIVE ERROR CODE**

8.2.2.2 Information table 2

It is a set of information [R] used for advanced use: generally this data cannot be accessed through the user interface.

MB. ADDRESS (HEX)	INFORMATION DESCRIPTION
0x0230	**MODBUS SLAVE ADDRESS**
0x0231	**WI-FI CLIENT/SERVER CONFIGURATION** 0 = SERVER 1 = CLIENT
0x0232	**PRESSURE SENSOR MODEL** 0 = DIFF. PRESSURE SENSOR / Range 0 ÷ 1.0bar 1 = DIFF. PRESSURE SENSOR / Range 0 ÷ 2.0bar
0x0233	**PROPORTIONAL PRESSURE MIN SETPOINT**
0x0234	**PROPORTIONAL PRESSURE MAX SETPOINT**
0x0235	**CONSTANT PRESSURE MIN SETPOINT**
0x0236	**CONSTANT PRESSURE MAX SETPOINT**
0x0237	**CONSTANT CURVE MIN SETPOINT**
0x0238	**CONSTANT CURVE MAX SETPOINT**
0x0239	**COMMUNICATION PROTOCOL** 0 = MODBUS 1 = BACNET
0x023A	**BAUD RATE**

8.2.2.3 Information table 3

It is a set of information [R] used for twin pump use: generally this data cannot be accessed through the user interface, and are available to the Twin Master for managing the pump: in fact this table is visible only in case the drive is configured as a Twin Pump Master (see sec. 4.3.5.1)

MB. ADDRESS (HEX)	INFORMATION DESCRIPTION
0x0260	**TWIN SLAVE DRIVEN CURVE**
0x0261	**TWIN SLAVE START/STOP** 0 = STOP 1 = START
0x0262	**TWIN SLAVE INPUT POWER**
0x0263	**TWIN SLAVE HEAD [H]**
0x0264	**TWIN SLAVE FLOW [Q]**
0x0265	**TWIN SLAVE SPEED**
0x0266	**TWIN SLAVE WINDING 1 TEMPERATURE**
0x0267	**TWIN SLAVE WINDING 2 TEMPERATURE**
0x0268	**TWIN SLAVE WINDING 3 TEMPERATURE**
0x0269	**TWIN SLAVE POWER MODULE TEMPERATURE**
0x026A	**TWIN SLAVE QUADRATURE CURRENT**
0x026B	**TWIN SLAVE BIT FIELDS ALARM 1**
0x026C	**TWIN SLAVE BIT FIELDS ALARM 2**
0x026D	**TWIN SLAVE BIT FIELDS ERRORS**

Xylem |ˈzīləm|

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

We’re 12,500 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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Morton Grove, IL 60053
Tel (847) 966-3700
Fax (847) 965-8379
www.bellgossett.com

Installation, Operation, and
Maintenance manual

ecocirc XL

Bell & Gossett
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 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:

Qualified personnel

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

1.3 Environmental safety

The work area

Always keep the station clean.

Waste and emissions regulations

Observe these safety regulations regarding waste and emissions:

- Appropriately dispose of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.

CAUTION: Radiation Hazard
Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

Recycling guidelines

Always follow local laws and regulations regarding recycling.

FCC Statement — USA only (Federal Communications Commission)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference and
2. this device must accept any interference received, including interference that may cause undesirable operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the manufacturer responsible for compliance could void the user's authority to operate the equipment.

1.4 Product warranty

Coverage

Xylem undertakes to remedy defects in products from Xylem under these conditions:

- The faults are due to defects in design, materials, or workmanship.
- The faults are reported to a local sales and service representative within the warranty period.
- The product is used only under the conditions that are described in this manual.
- The monitoring equipment that is incorporated in the product is correctly connected and in use.
- All service and repair work that is done by Xylem authorized personnel.
- Genuine Xylem parts are used.
- Only Ex-approved spare parts and accessories that are authorized by an Ex-approved Xylem representative are used in Ex-approved products.

Limitations

The warranty does not cover defects that are caused by these situations:

- Deficient maintenance
- Improper installation
- Modifications or changes to the product and installation that are made without consulting a Xylem authorized representative
- Incorrectly executed repair work
- Normal wear and tear

Xylem assumes no liability for these situations:

- Bodily injuries
- Material damages
- Economic losses

Warranty claim

Xylem products are high-quality products with expected reliable operation and long life. However, should the need for a warranty claim arise, contact your local sales and service representative.

1.5 Spare parts

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

2 Transportation and Storage

2.1 Inspect the delivery

1. Inspect the package for damage or missing items upon delivery.
2. If applicable, unfasten the product by removing any screws, bolts, or straps. For your personal safety, be careful when you handle nails and straps.
3. Remove packing material from the product.
4. Dispose of all packing material in accordance with local regulations.
5. Inspect the product to determine if any parts have been damaged or are missing.

Contact your local sales representative if there are any issues.

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 should be transported in an upright position as indicated on the package. Make sure that the unit is securely fastened during transportation and cannot roll or fall over. The product can be safely transported at ambient temperature from -40°F to +158°F (-40°C to +70°C) with humidity <95% (non-condensing) and protected against dirt, heat source, and mechanical damage.

2.3 Storage guidelines

2.3.1 Storage location

NOTICE:
- Protect the product against humidity, dirt, heat sources, and mechanical damage.
- The product must be stored at an ambient temperature from -13°F to +131°F (-25°C to +55°C) and humidity < 95% (non-condensing).

3 Product Description

3.1 Pump design

- The ecocirc XL is a large wet rotor pump with energy efficient, electronically commutated permanent magnet motor.
- The pump is designed for systems with variable flow rates to optimize pump operation thus reducing energy consumption. The pump can be set to any one of the multiple operating modes available, with each designed for a specific application to achieve high performance and maximum energy savings.
- A single pump can handle heating, cooling, and plumbing applications with a choice for cast iron or bronze lead-free body pumps to handle HVAC and potable water applications. The pumps are also suitable for a 50/50 percent water/glycol circulating fluid. The built-in electrical overload and dry run protection provide safety and protection to pump from damage.

Intended use

WARNING:
California Proposition 65 warning! This product contains chemicals known to the state of California to cause cancer and birth defects or other reproductive harm.

The pump is suitable for:
- Potable hot water (only with bronze pump body models)
- Hot water heating systems
- Cooling and cold water systems

The pump can also be used for:
- Solar systems
- Geothermal applications

Improper use

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

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

WARNING:
Do NOT install this pump in swimming pools or marine areas. Failure to follow these instructions could result in serious personal injury, death and/or property damage.
THIS IS A NON-SUBMERSIBLE PUMP

WARNING:
Do NOT exceed the maximum working pressure of the pump. This information is listed on the nameplate of the pump.

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. Water pH must be maintained between 7-9 and water hardness must not exceed 14 grains/ gallon.

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

3.2 Product nomenclature

Example: ecocirc XL B 15–75	
ecocirc XL	high efficiency pump series
B	Pump type: Blank = Cast iron B = bronze pump body for potable hot water pumping

Example: ecocirc XL B 15–75	
-15	Maximum pump head (FT)
-75	Maximum pump flow rate (GPM)

3.3 Technical data

Feature	Description
Motor model	Electronically commutated motor with permanent magnet rotor
Series	ecocirc XL
Rated voltage	1 x 115 V ±10% 1 x 208–230 V ±10%
Frequency	50/60 Hz
Power consumption	100–1700 W
IP protection	IP 44
Insulation class	Class 155 (F)
Maximum working pressure	The maximum pressure is indicated on pump nameplate 175 PSI (12 bars)
Liquid temperature range	14°F (-10°C) to 230°F (110°C)
Ambient temperature range	32°F (0°C) to 104°F (40°C)
Ambient humidity	95% non-condensing
Pumping media	Water and water/glycol mixtures[1] up to 50%.
Sound pressure	≤ 43 dB (A)
EMC (electromagnetic compatibility)	EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-2:1997 + A1:2001 + A2:2008, EN 61000-3-2:2006 + A1:2009 + A2:2009, EN 61000-3-3:2008, 61800-3:2004+A1:2012.
Leakage current	< 3.5 mA
I/O auxiliary +15 VDC power supply	Imax < 40 mA
Fault signal relay	Vmax < 250 VAC Imax < 2 A
CSA certification	NSF/ANSI-372 compliant (bronze body parts)

3.4 Scope of delivery

Inside the package you will find:

- Pump unit
- Insulating shells for pump body – for heating applications
- O-ring to be used as replacement between motor housing and pump body
- Two (2) gaskets for flanged connection
- 20 mm x ½" NPT electrical fitting
- IOM and Quick Start guide

3.5 Accessories

- Companion flanges
- Fastener Packs consisting of 4 bolts and 4 nuts (for 2–bolt models)
- Fastener Packs consisting of 8 bolts and 8 nuts (for 4–bolt models)
- Pressure sensor (for details see section 5.2.10 of this manual)
- Temperature sensor (for details see section 5.2.10 of this manual)
- Wireless module
- RS–485 module

4 Installation

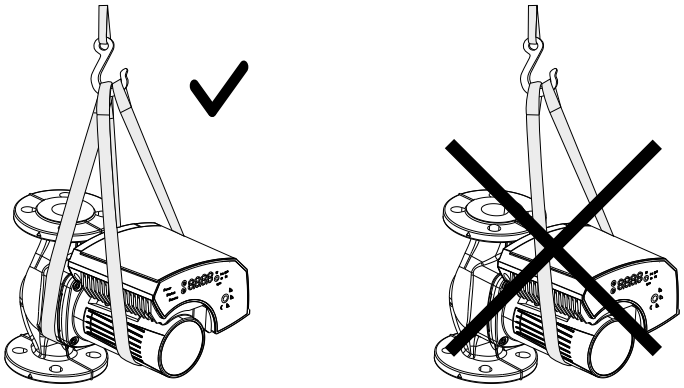
Precautions

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 Pump handling

WARNING:
Observe local codes and regulations setting the limits for manual lifting or handling.

Always lift the pump by the motor housing or pump body. If the pump weight exceeds the manual handling limits, use lifting equipment with lifting straps.



4.2 Tools required for pump installation

- T-Handle with allen screw
- Control screw driver – with 2 mm blade size

Model number	Allen screw size (mm)	T-handle length (in)
20–35	5	8
36–45	5	8
15–75	5	8
55–45	6	10
20–140	6	10
65–130	8	12
40–200	8	12

4.3 Facility requirements

4.3.1 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:

[1] The pump can be used with water/propylene glycol mixtures up to 50% with a maximum viscosity of 50cST at 14°F (-10°C). The pump has built-in overload and thermal protection to protect the pump from overload due to increased fluid viscosity. Pump performance is based on 77°F (25°C). Therefore pumping of glycol mixtures will affect max performance, depending on mixture concentration and temperature.

- 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.
- Provide shut-off valves on the suction and discharge sides of the pump.
- The relative humidity of the ambient air must be less than 95% non-condensing.
- This pump is suitable for indoor use only.

CAUTION:

CAUTION: PROPERTY DAMAGE HAZARD. It is not advisable to install circulators in an attic or upper floor over finished living space. If the circulator must be installed over head, or over expensive equipment, provide adequate drainage in the event of leakage. Failure to follow these instructions could result in property damage.

4.3.2 Minimum inlet pressure at the suction port

The values in the table below are the inlet pressures above the atmospheric pressure.

Nominal Suction Diameter	Fluid temperature 77°F (25°C)	Fluid temperature 203°F (95°C)	Fluid temperature 230°F (110°C)
1½″	4.5 PSI	16 PSI	25 PSI
2″	4.5 PSI	16 PSI	25 PSI
3″	7.5 PSI	19 PSI	28 PSI

NOTICE:

- Ensure that the suction pressure is never below the values specified above, as this could cause cavitation and damage the pump.
- The inlet pressure plus the pump pressure against a closed valve must be lower than maximum admissible system pressure.

4.3.3 De-rating table

The following table indicates percent decrease in input power draw, with the increase in temperature of circulating water and the ambient.

Ambient temperature	Fluid Temperature (°C)			
	-10	60	95	110
32°F–77°F (0°C–25°C)	100%	100%	100%	100%
86°F (30°C)	100%	100%	80%	70%
104°F (40°C)	100%	100%	70%	55%

4.3.4 Piping requirements

Precautions

CAUTION:

- 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 a shut-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.
- Be sure to minimize any pipe-strain on the pump:
  - Support suction and discharge piping by the use of pipe hangers near the pump.
  - Line up the vertical and horizontal piping so that the bolt-holes in the pump flanges match the bolt-holes in the pipe flanges.
  - Do not attempt to spring the suction or discharge lines in position. This may result in unwanted stress in the pump body, flange connections and piping.
  - The code for pressure piping (ANSI B31.1) lists many types of supports available for various applications.

4.4 Electrical requirements

- The NEC and local codes must be followed at all times. If a branch circuit is fitted with ground fault circuit breaker, ensure that the circuit breaker is suitable for use with inverter-driven appliances.

Electrical connection checklist

Check that the following requirements are met:

- The electrical wires are protected from high temperature and vibrations.
- The current type and power supply voltage connection must correspond to the specifications on the name plate on the pump.
- Use wires at least 14 AWG to supply power to the pump. Follow all local and NEC wiring codes and practices.

The electrical control panel checklist

NOTICE:

The electrical supply must match the electrical rating of the pump. Improper combination could fail to guarantee protection of the unit.

Check that the following requirements are met:

- The control panel circuit breaker be sized properly to protect the pump against short-circuit.
- The pump has built in overload and thermal protection, no additional overload protection is required.

The motor checklist

Electrical supply and grounding wires must be suitable for at least 194°F (90°C).

4.5 Pump installation

1. Install the pump according to the liquid flow direction.
   - The arrow on the pump housing shows the flow direction through the pump body.
   - The pump must be installed with the motor in a horizontal position. For more information about allowed positions, refer to the following image:

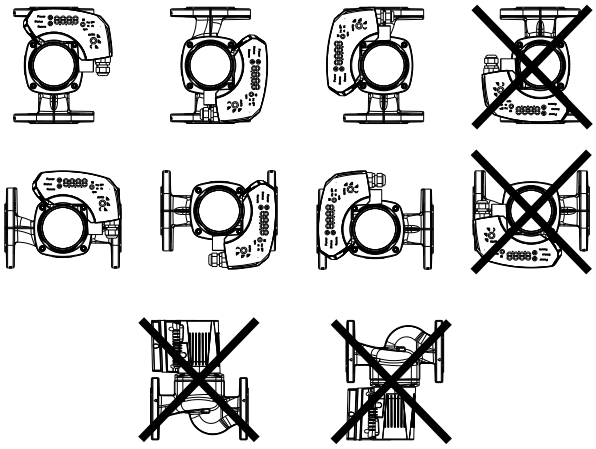


Figure 1: Allowed pump installation

2. If necessary, rotate the position of the motor for better visibility of the user interface.

   Section 4.6 below describes the procedure of changing of motor orientation.
3. If applicable, install the thermal insulation shells.

- Only use the pump thermal shells that are included in the delivery. Do not insulate the motor housing, the electronics can overheat and cause the pump to thermally overload.
- The thermal shells that are included with the pump must only be used in hot water circulation applications with fluid temperature above 68°F (20°C). The thermal shells are permeable to water vapor.
- If the customer installs the vapor barrier insulation shells for cold water application, then the pump housing must not be insulated above the motor flange. The drain opening must be kept unobstructed in order that the accumulated condensation can run out.

4.6 Change the position of the motor housing

WARNING:
- Drain the system if possible or close the service valves on both sides of the pump before disassembling the pump. The pumped fluid can be pressurized and may be scalding hot.
- There is the risk of escaping vapor when the motor is separated from the pump housing.

Electrical Hazard:
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.

CAUTION:
Burn hazard. During operation various surfaces on the unit will become hot. To avoid burn injury, use heat protective gloves.

WARNING:
- A strong magnetic field is created when the rotor is removed from or inserted into the motor housing. This magnetic field can be harmful to pacemaker wearers and others with medical implants. In addition, the magnetic field may attract metal parts to the rotor which can cause injuries and/or damage the bearing of the pump.

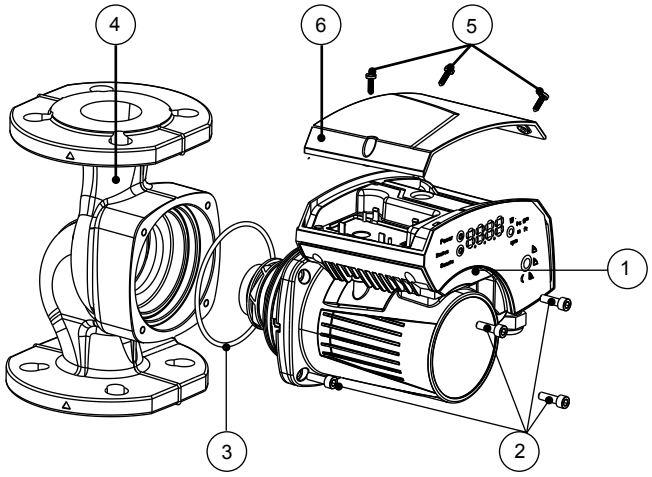


Figure 2: Change the position of the pump head

1. Loosen the four hex-head screws (2) that fix the motor to the pump housing (4) using the T-handle allen wrench described.
2. Rotate the motor (1) in 90° steps to the desired position.
3. In case of separation of the motor housing from the pump body (4):

   a) avoid removing the rotating assembly from motor housing;
   b) pay attention to the magnetic hazard listed before.

   A defective O-ring must be replaced. An O-ring is already available inside the package as spare part.
4. Properly align and tighten the four hex-head screws (2) that affix the motor to the pump body (4) according to the torque table given below in a criss cross pattern.

M6	90 in-lb
M8	170 in-lb
M10	340 in-lb

CAUTION:
Check for the presence of leaks after reassembling the pump.

4.7 Electrical installation

Precautions

WARNING:
- Make sure that all connections are performed by a qualified electrician in accordance with all applicable codes, ordinances and good practices. Failure to follow these instructions could result in serious injury, death and/or property damage.
- 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)

WARNING:
Reduced risk of electric shock during operation of this pump requires the provision of acceptable grounding.

Be sure the following are adhered to. Failure to follow these instructions could result in serious personal injury, death, and/or property damage.
- If means of connection to the supply connection box (wiring compartment) is other than grounded metal conduit, ground the pump back to service using a copper conductor at least the size of the circuit conductors supplying the pump.
- Connect the ground wire to the green grounding terminal in the wiring compartment.

4.7.1 Power supply connection

WARNING:
Do not make any connection in the pump control box unless the power supply has been switched off for at least 2 minutes.

For models with standard terminal block connection:
1. Open the terminal box cover removing the screws (5).
2. Thread the ½" NPT electrical fitting into the conduit connection of the pump.
3. Connect the cable according to the wiring diagram.
   a. Connect the ground wire, if used.
   b. Connect the wires.
4. Close the terminal box cover.

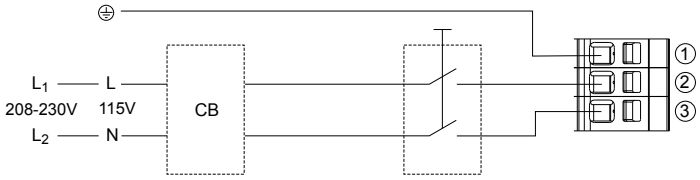


Figure 3: Wiring diagram

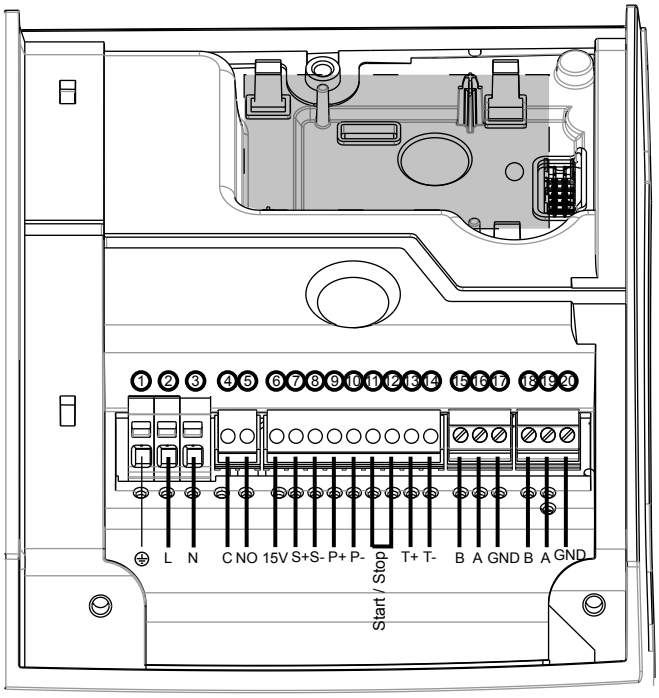


Figure 4: Connection diagram

For cable terminations, see above connection diagram.

4.7.2 I/O connections

1. Open the terminal box cover removing the screws (5). Refer to figure 2 on page 7. Use control screwdriver described under section 4.2 to access terminal blocks.
2. Connect the appropriate wires according to the terminal block diagram and the requirements of section *Connection assignment* (page 8) given below in section 4.7.3.
3. Close the terminal box cover.

- For a two-pump connection, wire them through a communication cable connecting the 2 RS-485 ports at the pumps to terminals 15, 16 & 17.

4.7.3 Connection assignment

- For all electrical connections use heat resistant wires or cable rated for at least 194°F (90°C). The cables should not touch the motor housing, the pump or the piping.
- Power and control wires must be run in separate channels.
- Metal conduit for power wiring must only be attached to 1/2" NPT conduit fitting.

NOTICE:

Cable glands are only available for low voltage wiring to protect against cable slippage and vapor ingress into the terminal box.

5 System Description

5.1 User interface

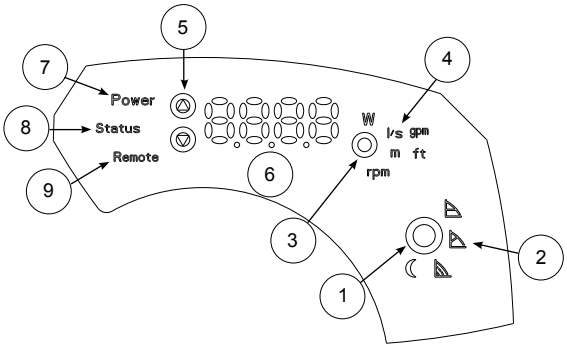


Figure 5: User interface diagram

1. Control mode button
2. Control mode indicators
3. Parameter button
4. Parameter indicators
5. Setting buttons
6. Numeric display
7. Power indicator
8. Status / Fault indicator
9. Remote control indicator

Hot Surface:

Burn hazard. During the normal operation, the pump surfaces may be so hot that only the buttons should be touched to avoid burns.

5.1.1 User interface locking/unlocking

The user interface will automatically lock if no button is pressed for ten minutes, or if the upper setting button (5) and the parameter button (3) are pressed for two seconds. See *User interface* (page 8).

If a button is pressed when the user interface is locked, the display (6) shows:

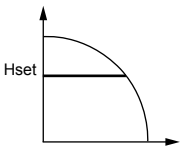
To unlock the user interface, press the upper setting button (5) and the parameter button (3) for two seconds. The display (6) will show:

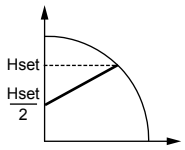
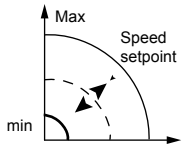
Now it is possible to change the pump setting as preferred.

5.2 Functions

The main functions of the pump and control modes are selectable through the pump user interface and the embedded I/O. Advanced functions or communication features, can only be set via bus protocol or the optional Wireless module. See the advanced functions manual at www.bellgossett.com.

5.2.1 Control mode

Mode	Description
Constant pressure 	The pump maintains a constant pressure at any flow demand. The desired head of the pump can be set via user interface. See section 6.1.2 Change set point.

Mode	Description
Proportional pressure 	The pump pressure is continuously increased/decreased depending on the increased/decreased flow demand. The maximum head of the pump can be set via user interface. See section 6.1.2 Change set point.
Fixed speed control 	The pump maintains a fixed speed at any flow demand. The speed of the pump can be set via user interface. See section 6.1.2 Change set point.

All the above control modes can be combined with the night mode function.

5.2.2 Night set back mode

The night set back mode cannot be used in cooling systems.

Prerequisite

- The pump is installed between boiler outlet and system supply.
- The night set back feature is initiated when the pump recognizes a water temperature change brought about by the boiler or high level control system.

The night set back mode is active only in combination with:

- Proportional pressure
- Constant pressure
- Constant speed

This function reduces power consumption of the pump to the minimum when heating system is not running. An algorithm detects the water temperature change and automatically adjusts the speed of the pump.

The pump returns to the original set point as soon as the system restarts.

5.2.3 Δp-T control

This function adjusts the nominal differential pressure set point according to the temperature of the pumped media.

For details refer to advanced functions manual on www.bellgossett.com

5.2.4 T-Constant temperature control

This functional mode changes the speed of the pump in order to maintain a constant temperature of the pumped media. It is suitable for heating systems with fixed system characteristics, for example Domestic Hot Water Systems.

For details, refer to the advanced functions manual on www.bellgossett.com

5.2.5 Δp-ΔT control

This function requires the external temperature probe type KTY83 (see section 5.2.10 of this manual).

This function adjusts the nominal differential pressure set point depending on the differential temperature of the pumped media. An external temperature sensor Type: KTY83 is required for this functionality (see section 5.2.10 of this manual for details).

For details, refer to the advanced functions manual on www.bellgossett.com

5.2.6 ΔT constant

This function alters the speed of the pump in order to maintain a constant differential temperature of the pumped media.

For details, refer to the advanced functions manual on www.bellgossett.com

5.2.7 External start/stop

The pump can be started or stopped via an external dry contact or a relay that is connected to terminals 11 and 12. The pump unit is provided by default, with the terminals 11 and 12 jumpered. See Figure 4 on page 8.

NOTICE:

- The pump provides 5 VDC through the start / stop terminals.
- No external voltage must be provided to start / stop terminals.
- The cables connected to terminals 11 and 12 shall not exceed 65 feet in length.

5.2.8 Analog Input

The pump integrates a 0-10 V analog input at terminals 7 and 8. See terminal diagram figures for changing the setpoint. See Figure 4 on page 8.

When a voltage input is detected, the pump switches to fixed speed control mode automatically and starts to run according to the following diagram:

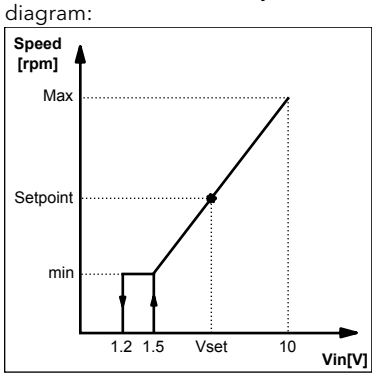


Figure 6: Voltage input detected

Pump stops at 1.2 V

Pump restarts at 1.5 V

5.2.9 Signal relay

A dry contact relay is provided at terminals 4 and 5. See connection diagram, figure 4 on page 8, for location. If there is a fault, the relay contact closes to display a red status light and the error code on the user interface display. See *User interface* (page 8). The relay contact closure can also be used to energize a remote fault display.

Ratings

- Voltage: 115/208 – 230/1
- Imax < 2 A

5.2.10 External sensors (optional)

The pump can be equipped with a differential pressure sensor and a temperature sensor according to the following table:

Sensor description	Type	Terminals
Differential pressure sensor 4-20mA	15 PSI 30 PSI	9 - 10
Temperature sensor	KTY83/121	13 - 14

Pressure sensor setup

1. Install pressure sensor on the pipe
2. Connect wires at terminals 9 and 10. See Figure 4 on page 8.
3. Power the pump on.
4. Upon startup, the pump detects the sensor and displays the setup menu.
5. Select the right sensor model and confirm the selection using the parameter button (3). See *User interface* (page 8).
6. The pump will run through the startup sequence and automatically start working in constant pressure mode.
7. The setpoint can be changed using the settings button (5). See *User interface* (page 8).

External temperature sensor setup

The external temperature sensor setup and related control modes are available only through RS-485 or wireless module connection.

For details refer to advanced functions manual on www.bellgossett.com

Wireless module

The wireless module is an optional module, to be coupled with the ecocircXL circulators. When correctly configured, it generates a wireless network accessible by a mobile device, tablet or a personal computer. See wireless module instructions manual for details.

5.2.11 Communication bus

The pump has a built-in RS-485 communication channel (terminals 15-16-17). See Figure 4 on page 8.

The pump can communicate with external BMS systems via Modbus or BACnet protocol. For a complete description of the protocols, refer to the advanced functions manual at www.bellgossett.com.

NOTICE:

When remote control is active, the set points and control modes are managed only through communication channels and cannot be changed via the user interface. The displayed quantity and unit of measurement remain active on the user interface.

5.2.12 Automatic two-pump operation

Backup operation

Only the lead pump runs. The second pump starts in case of failure of the lead pump.

Alternate operation

Only one pump runs at the time. The working time is switched every 24 hours so that workload is balanced between both pumps. The second pump is started immediately in case of failure of the lead pump.

Parallel operation

Both pumps run simultaneously at the same set point. The lead pump determines the behavior of the full system and is able to optimize the performance. To guarantee the required performance with the minimum power consumption, the lead pump starts or stops the lag (second) pump to satisfy system requirement of flow and head.

6 System Setup and Operation

Precaution

CAUTION:

Always wear protective gloves when handling the pumps and motor. When pumping hot liquids, the pump and its parts may exceed 40°C (104°F).

NOTICE:

The pump must not run dry as this can result in the destruction of the bearings. Fill the system correctly with liquid and vent the air before first start-up.

NOTICE:

- Never operate the pump with discharge 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 suction plus shut-off discharge pressure must not exceed the pump pressure rating.
- Do not use the pump if cavitation occurs. Cavitation can damage the internal components.

6.1 Configure the pump settings

Change the pump settings using one of the following methods:

- User interface
- Bus communication
- Wireless communication

6.1.1 Change the communication parameters

Change pump communication parameters. See *User interface* (page 8).

1. Switch off the pump.
   Wait until the power indicator light turns off.
2. Switch on the pump.
3. When the display shows **COMM (COM)**, press the parameter button (3) to access the communication menu.
4. Select one of the below parameters using the settings button (5).
   - **BAUD (BDR)** = baud rate setup (available values 4.8 - 9.6 - 14.4 - 19.2 - 38.4 - 56.0 - 57.6 kbps)
   - **ADDR (ADD)** = address setup (available address 1-255 for Modbus 0÷127 for BACnet)
   - **MODU (MDL)** = optional module setup (0 = no module; 1 = Wireless module; 2 = RS-485 module)
5. Press the parameter button to enter the submenu
6. Edit the values using setting buttons.
7. Press the parameter button to confirm and store the new values.
8. Press mode button to exit the submenu.
9. Repeat above procedure for each of the three parameters.

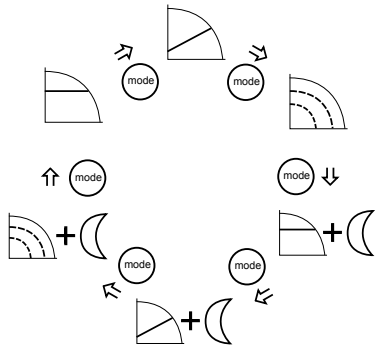
If no buttons are pressed for 10 seconds, then the pump exits the current menu and continues start-up procedure. All the parameters that are changed but not confirmed restore back to previous state.

6.1.2 Change the control mode

The pump can be controlled by a BMS (Building management system) or other devices through the RS-485 communication port via Modbus or BACnet protocol.

The following instructions are used when making the change on the user interface. See *User interface* (page 8).

- Press the operating mode button (1).
- The operating modes are cyclically changed by the pressed button.



6.1.3 Change the set point

See *User interface* (page 8).

1. Press one of the arrow setting buttons (5).
   The display starts to blink.
2. Change the value using the buttons (5).
3. Wait 3 seconds to store and activate the new set point.
   The display will stop blinking to confirm the change.

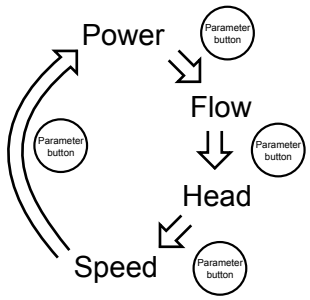
NOTICE:

If a check valve is installed on the system, ensure that the pump head is sufficient to allow flow through the system.

6.1.4 Change the displayed unit of measurement

Power, Flow, Head and Speed parameters cyclically change by pressing the parameter button (3). In order to change the unit of measurement, follow these steps:

1. Press the button (3) to change the unit of measurement. See *User interface* (page 8).



2. When flow and head are displayed, by pressing the button (3) for more than one second at each of these parameters, the unit of measurement automatically changes as below:
   - Flow: m3/h ↔ gpm (US)
   - Head: m ↔ ft

6.2 Start or stop the pump

CAUTION:
- The pump must not run dry as this can result in premature failure of the bearings in a very short time. Fill and vent the system correctly before first start-up. The pump rotor chamber will be vented after the pump is powered on with an automatic air venting procedure. "deg" will be displayed indicating degassing process.

NOTICE:
The system cannot be vented through the pump.

- Start the pump in one of the following ways:
  - Switch on power to supply the pump.
  - Close the start/stop contact by jumpering terminals 11 and 12 or through a remote dry contact..
  - Send start command through the communication bus.

  The pump starts pumping in constant pressure mode with the following default set points:

7.5 ft	15–XX (Max head 15 ft)
10 ft	20–XX (Max head 20 ft)
18 ft	36–XX (Max head 36 ft)
20 ft	40–XX (Max head 40 ft)
27.5 ft	55–XX (Max head 55 ft)
32.5 ft	65–XX (Max head 65 ft)

  For more information about how to change setting, see *Configure the pump settings* (page 10).
- Stop the pump in one of the following ways:
  - Switch off power supply to the pump.
  - Open the start/stop contact.
  - Send stop command through the communication bus.

6.2.1 Automatic air venting procedure

At each power-on of the pump unit, an automatic air venting procedure is executed. During this phase, the user interface displays "deg" (degassing) and a count-down begins until the completion of the procedure.

The procedure can be recalled or skipped:

- Manually by pressing simultaneously the two buttons (5). See *User interface* (page 8). The feature will remain disabled until power to pump is disconnected.

The procedure can be permanently enabled or disabled by:

- Manually by pressing simultaneously the two buttons (5) for at least 10 seconds. See *User interface* (page 8). Or
- Via communication bus. See the advanced functions manual on www.bellgossett.com.

6.2.2 Activate automatic two-pump operation

Once the communication cable is connected, configure only the “lead” pump. The twin pump submenu for this configuration is available at each power-on, when the drive is displaying **SING** (which stands for “Single Pump).

The following procedure must be executed during the start-up phase of the pump.

1. Enter the two-pump sub menu when the display is showing **TWMA (two-pump master)** or **TWSL (two-pump slave)**.
2. Select the applicable two-pump operation.
   - **bcup** = backup operation
   - **alte** = alternative operation
   - **para** = parallel operation
3. Push the parameter button to activate the new setting.

The second pump is configured by the lead pump.

7 Maintenance

Precaution

Electrical Hazard:
Disconnect and lock out electrical power before installing or servicing the unit.
Wait 2 minutes before opening the conduit box.

WARNING:
- Always wear protective gloves when handling the pumps and motor. When pumping hot liquids, the pump and its parts may exceed 40°C (104°F).
- Maintenance and service must be performed by skilled and qualified personnel only.
- Observe accident prevention regulations in force.
- Use suitable equipment and apply personal protection.
- Risk of property damage, serious personal injury or death. You must repair or replace the pump if corrosion or leakage is found.

8 Troubleshooting

Introduction

See *User interface* (page 8).

- In case of any alarm that allows the pump to continue running, the display shows a blinking alarm code and the last quantity selected, while the status indicator (8) becomes orange.
- In case of a failure that stops the pump, the display shows the error code permanently and the status indicator (8) becomes red

8.1 Periodic inspection

Bell & Gossett ecocircXL circulators are designed to provide years of trouble-free service. It is recommended that periodic inspections be made to check for potential problems with the pump. If any leakage or evidence of leakage is present, repair or replace the unit.

8.2 Display messages

Table 1: Default

Operating LEDs / Display	Cause
Power On	Pump powered
All LEDs and display On	Start-up of the pump
Status Green light	Pump is working properly
Remote On	Remote communication is activated

Table 2: Fault messages

Operating LEDs / Display	Cause	Solution
Power Off	Pump is not connected or is incorrectly connected	Check connection
	Power failure	Check power supply and circuit breaker
Status light Orange	Alarm for system problem	Check the displayed alarm code and find cause from table 8.3.
Status light Red	Pump failure	Check the displayed error code and find the cause from table 8.2.
Remote Off	Remote communication is deactivated	If the communication does not work, check the connection and the configuration parameters for communication on the external controller.

8.3 Fault and error codes

Error code	Cause	Solution
E01	Internal communication lost	Restart the pump[2]
E02	High motor current	Restart the pump[2]
E03	DC Bus overvoltage	Indicates excessive power through the pump. Confirm system setup, verify correct position and operation of check valves.
E04	Motor stall	Restart the pump[2]
E05	Data memory corrupted	Restart the pump[2]
E06	Voltage supply out of operating range	Check the electrical system voltage and wiring connection.
E07	Motor thermal protection trip	Check the presence of foreign material around impeller and rotor that cause overload. Check installation conditions and temperature of the water and ambient air. Wait until the motor is cooled. If the error persists try to restart the pump[2].
E08	Inverter thermal protection trip	Check installation conditions and ambient air temperature.
E09	Hardware error	Restart the pump.
E10	Dry run	Check for system leakage or fill the system.

8.4 Alarm codes

Alarm code	Cause	Solution
A01	Fluid sensor malfunction	Switch off the pump for 5 minutes and then power on. If the problem persists, contact local B&G representative.
A02	High temperature of the fluid	Check water temperature value
A03	Automatic speed reduction to prevent inverter overheating	Check installation conditions and rectify status of the system
A05	Data memory corrupted	Switch off the pump for 5 minutes and then power on. If the problem persists, contact local B&G representative.
A06	External temperature probe malfunction	Check the probe and the connection to the pump
A07	External pressure sensor malfunction	Check the sensor and the connection to the pump
A12	2-pump communication lost	If both pumps show the A12 alarm, check the connection between the pumps. If one of the pump is switched off or shows another error code, check the section 8.1 and 8.2 to find the problem
A20	Internal alarm	Switch off the pump for 5 minutes and then power on. If the problem persists, contact local B&G representative.

8.5 Faults, causes, and remedies

The pump does not start

Cause	Remedy
No power.	Check the power supply and ensure that it is properly terminated to the pump power.
Tripped circuit breaker or ground-fault protection device or the circuit breaker.	Reset power supply circuit breaker and determine cause for overload.

The pump starts but the thermal protection is triggered after a short time

Cause	Remedy
Incorrect wiring size or circuit breaker rating not suitable for motor current.	Check and replace the components as necessary.
Thermal overload protection due to excessive input.	Check the pump working conditions.
Missing a phase in the power supply.	Verify continuity and ensure proper wiring connections.

[2] Switch off the pump for 5 minutes and then power on. If the problem persists, contact service.

The pump is noisy

Cause	Remedy
Not thoroughly vented.	Switch off the pump and after 30 seconds switch on again to restart the automatic air-venting procedure.
Cavitation due to insufficient suction pressure.	Increase the system suction pressure within the admissible range.
Foreign objects in pump.	Clean the system.
Worn out bearing	Contact local B&G representative.

9 Other Relevant Documentation or Manuals

9.1 Embedded Software and Driver Software License Agreement

With the purchase of the product, the terms and conditions of the license for the software embedded on the product are considered accepted. For more information see license condition on www.bellgossett.com

Xylem |'zīləm|

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

We're 12,500 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

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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.

P2002548_Rev. B

CURVES
A-165

ecocirc® XL

HIGH EFFICIENCY LARGE WET ROTOR PUMP PERFORMANCE 50/60HZ CURVES

Bell & Gossett
a xylem brand

Table of Contents

Useful Pump Formulas

$$\text{Pressure (PSI)} = \frac{\text{Head (Feet)} \times \text{Specific Gravity}}{2.31}$$

$$\text{Head (Feet)} = \frac{\text{Pressure (PSI)} \times 2.31}{\text{Specific Gravity}}$$

$$\text{Vacuum (Inches of Mercury)} = \text{Dynamic Suction Lift (Feet)} \times .883 \times \text{Specific Gravity}$$

$$\text{Horsepower (Brake)} = \frac{\text{GPM} \times \text{Head (Feet)} \times \text{Specific Gravity}}{3960 \times \text{Pump Efficiency}}$$

$$\text{Horsepower (Water)} = \frac{\text{GPM} \times \text{Head (Feet)} \times \text{Specific Gravity}}{3960}$$

$$\text{Efficiency (Pump)} = \frac{\text{Horsepower (Water)}}{\text{Horsepower (Brake)}} \times 100$$

$$\text{NPSH (Available)} = \text{Positive Factors} - \text{Negative Factors}$$

Affinity Laws: Effect of change of speed or impeller diameter on centrifugal pumps.

	GPM Capacity	Ft. Head	BHP
Impeller Diameter Change	$Q_2 = \frac{D_2}{D_1} Q_1$	$H_2 = \left(\frac{D_2}{D_1}\right)^2 H_1$	$P_2 = \left(\frac{D_2}{D_1}\right)^3 P_1$
Speed Change	$Q_2 = \frac{RPM_2}{RPM_1} Q_1$	$H_2 = \left(\frac{RPM_2}{RPM_1}\right)^2 H_1$	$P_2 = \left(\frac{RPM_2}{RPM_1}\right)^3 P_1$

Where Q = GPM, H = Head, P = BHP, D = Impeller Dia., RPM = Pump Speed

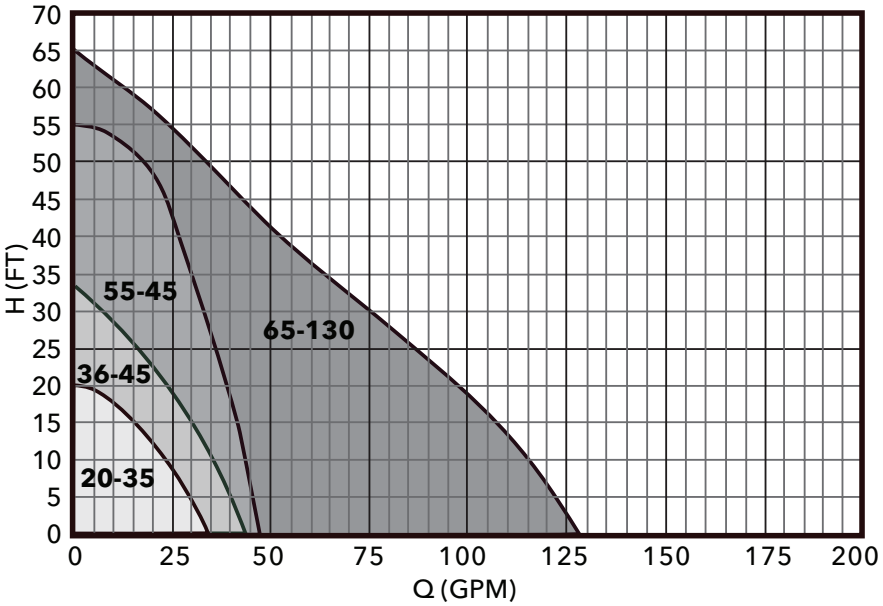
ecocirc XL

Model Part Numbers & Motor Data

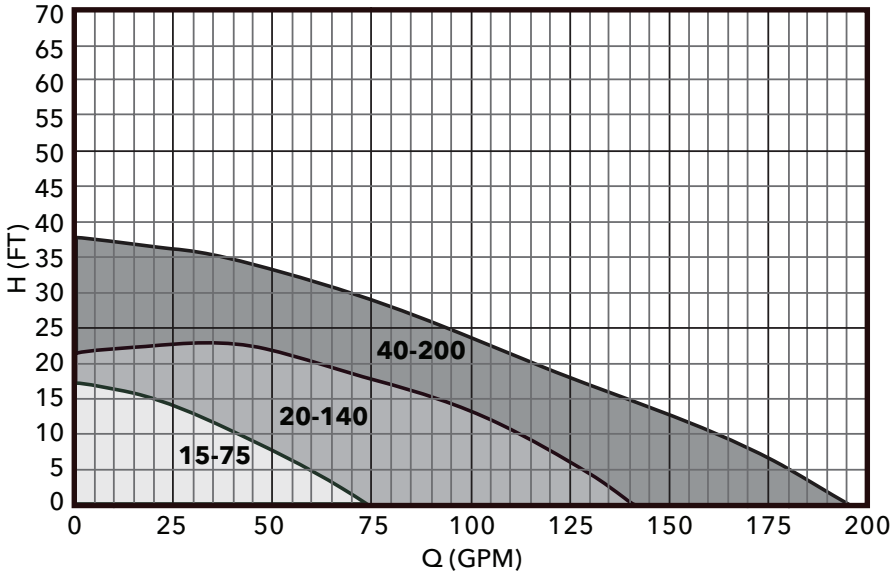
Cast Iron Body		Lead-Free Bronze Body*		Rated Motor Characteristics						
Model Number	Part Number	Model Number	Part Number	HP**	Voltage	Phase	Hz	Watts Range	AMP Range	Speed Range
ecocirc XL 20-35	104300	ecocirc XL B 20-35	104400LF	1/12	115	1	50/60	6-85	0.1 – 1.3	1500-3500
ecocirc XL 36-45	104301	ecocirc XL B 36-45	104401LF	1/6	115	1	50/60	20-200	0.1 – 3.0	1500-4450
ecocirc XL 36-45	104302	ecocirc XL B 36-45	104402LF	1/6	208-230	1	50/60	20-200	0.1 – 1.5	1500-4450
ecocirc XL 15-75	104303	ecocirc XL B 15-75	104403LF	1/6	115	1	50/60	30-150	0.1 – 2.3	1500-3000
ecocirc XL 15-75	104304	ecocirc XL B 15-75	104404LF	1/6	208-230	1	50/60	30-150	0.1 – 1.1	1500-3000
ecocirc XL 55-45	104306	ecocirc XL B 55-45	104406LF	1/2	208-230	1	50/60	30-500	0.2 – 2.0	1500-4500
ecocirc XL 20-140	104308	ecocirc XL B 20-140	104408LF	1/2	208-230	1	50/60	35-470	0.2 – 2.0	1500-3550
ecocirc XL 65-130	104309	ecocirc XL B 65-130	104409LF	1	208-230	1	50/60	45-825	0.5 – 3.5	1100-3550
ecocirc XL 40-200	104312	ecocirc XL B 40-200	104412LF	1	208-230	1	50/60	50-825	0.5 – 3.5	1100-3550

Note: Where potable water is pumped, use a lead-free bronze booster. ecocirc XL pumps are recommended for indoor use only.
*CSA certified to NSF/ANSI 372 that product contains less than 0.25% lead content by weight on wetted surface.
** Nominal HP

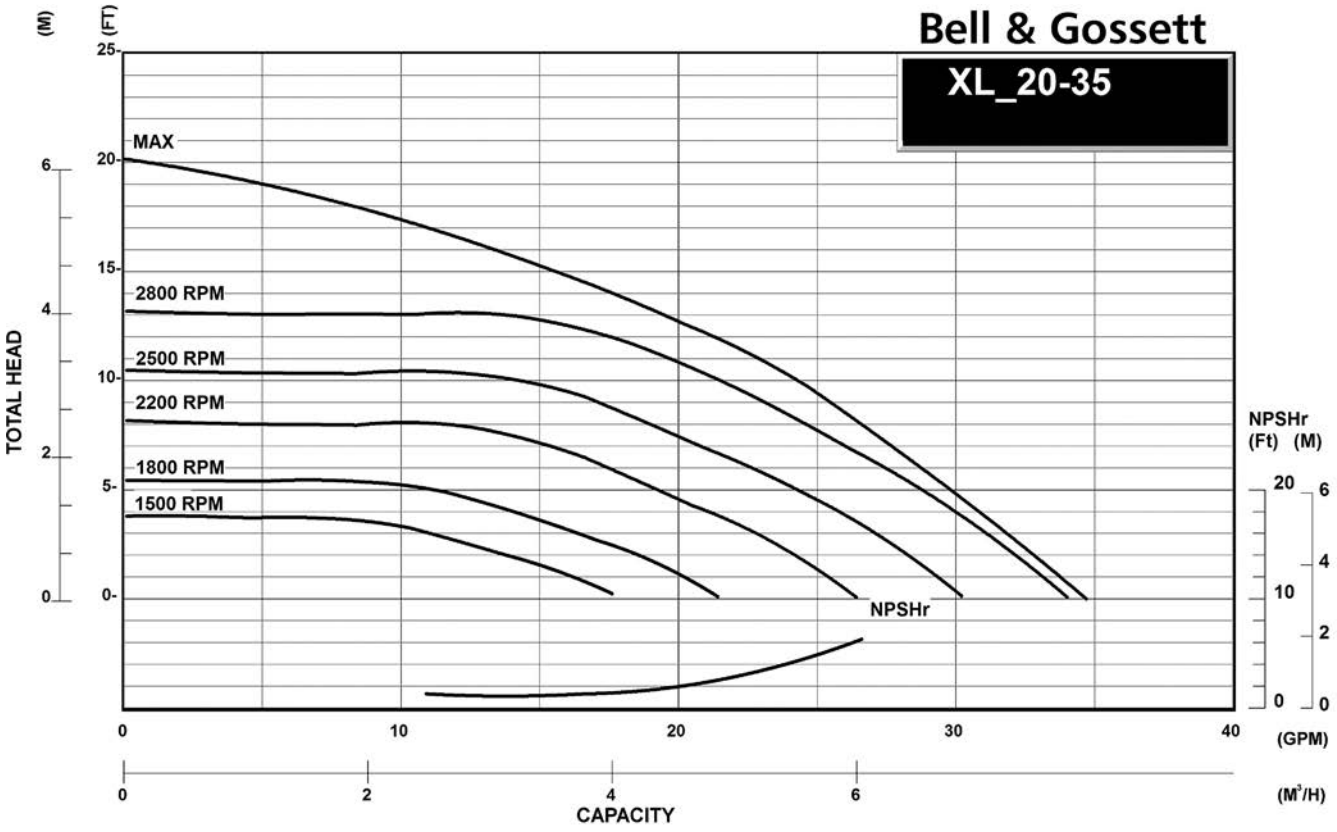
ecocirc XL High Head Performance Range

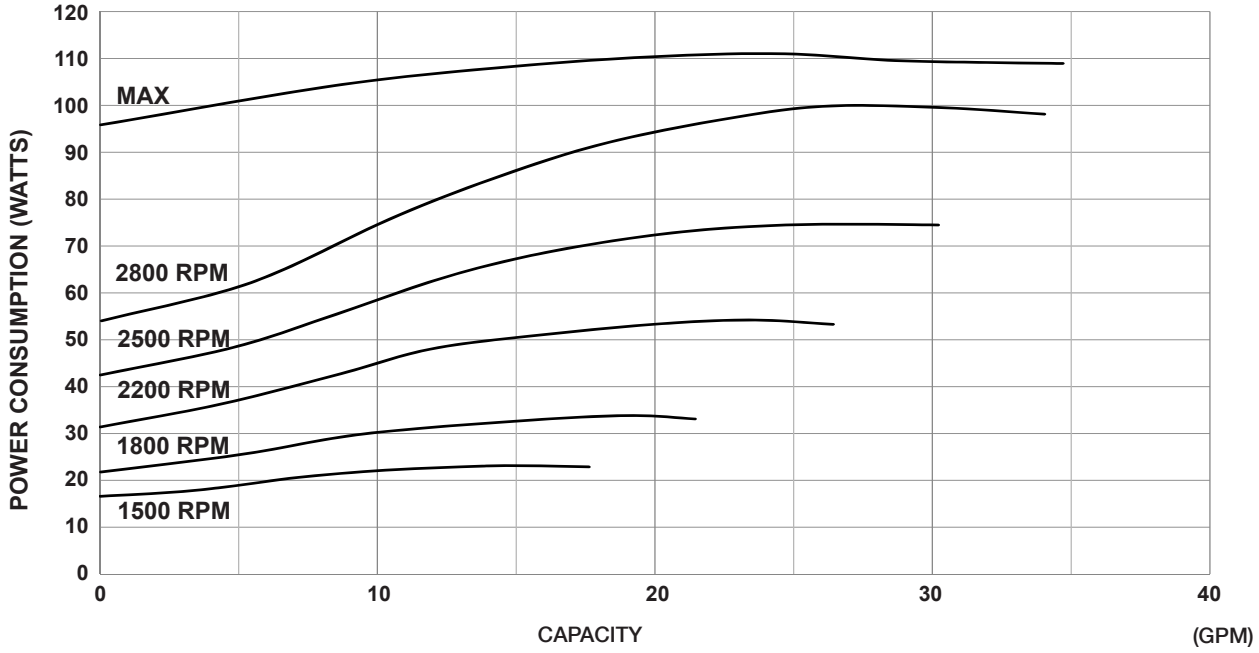


ecocirc XL High Flow Performance Range



ecocirc XL 20-35 Curves





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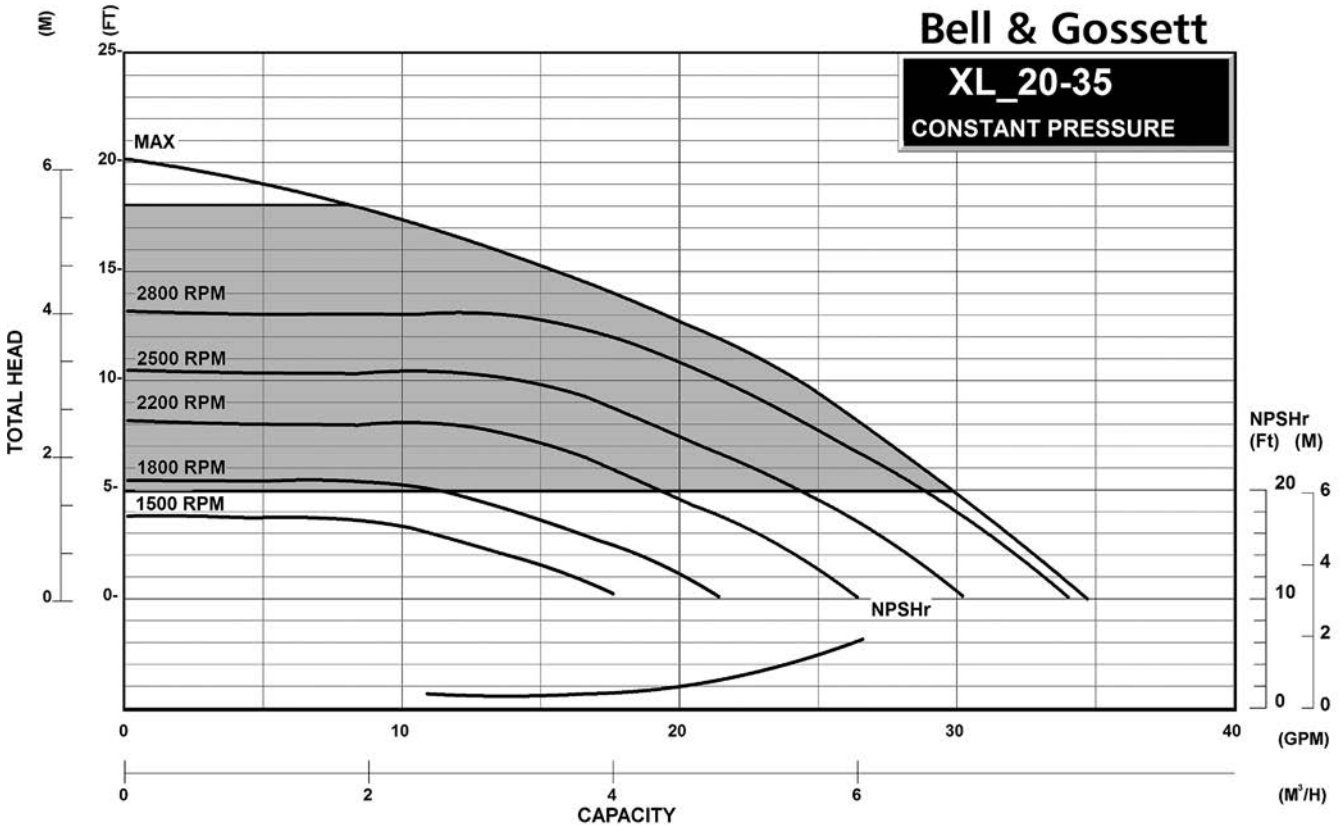
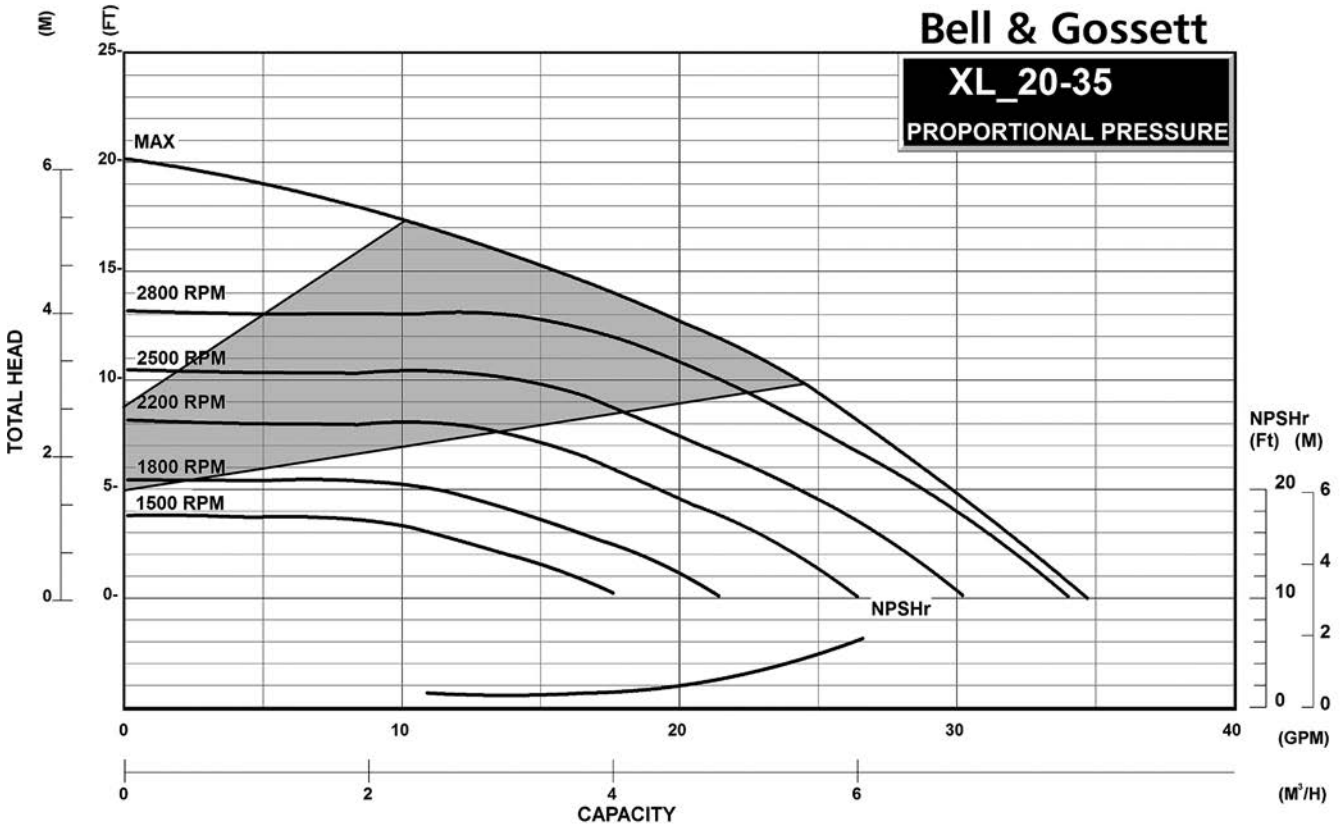
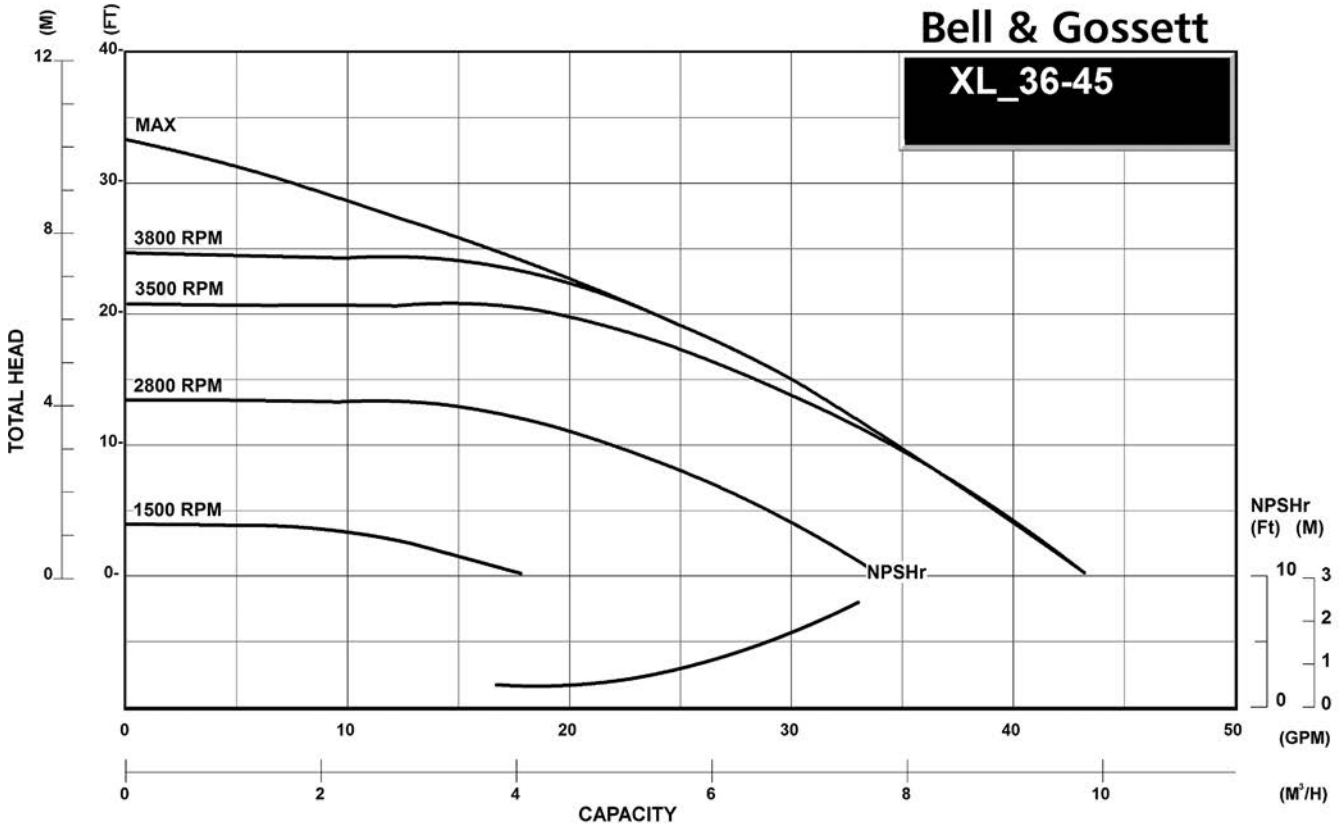
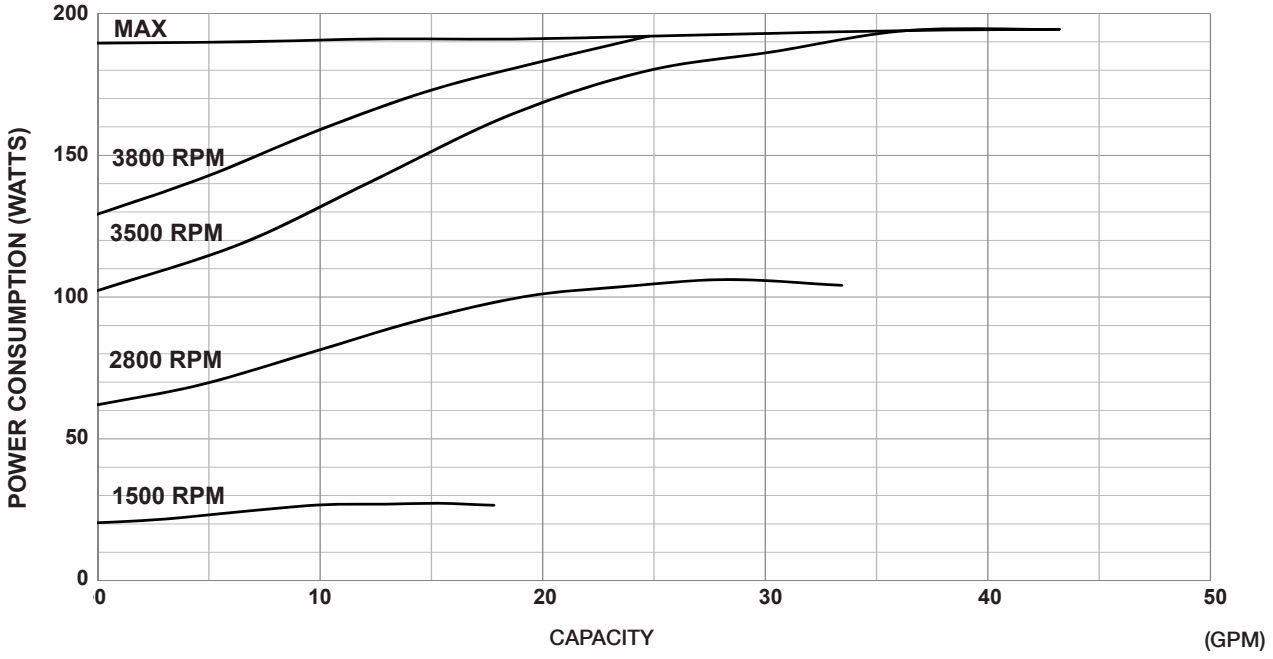




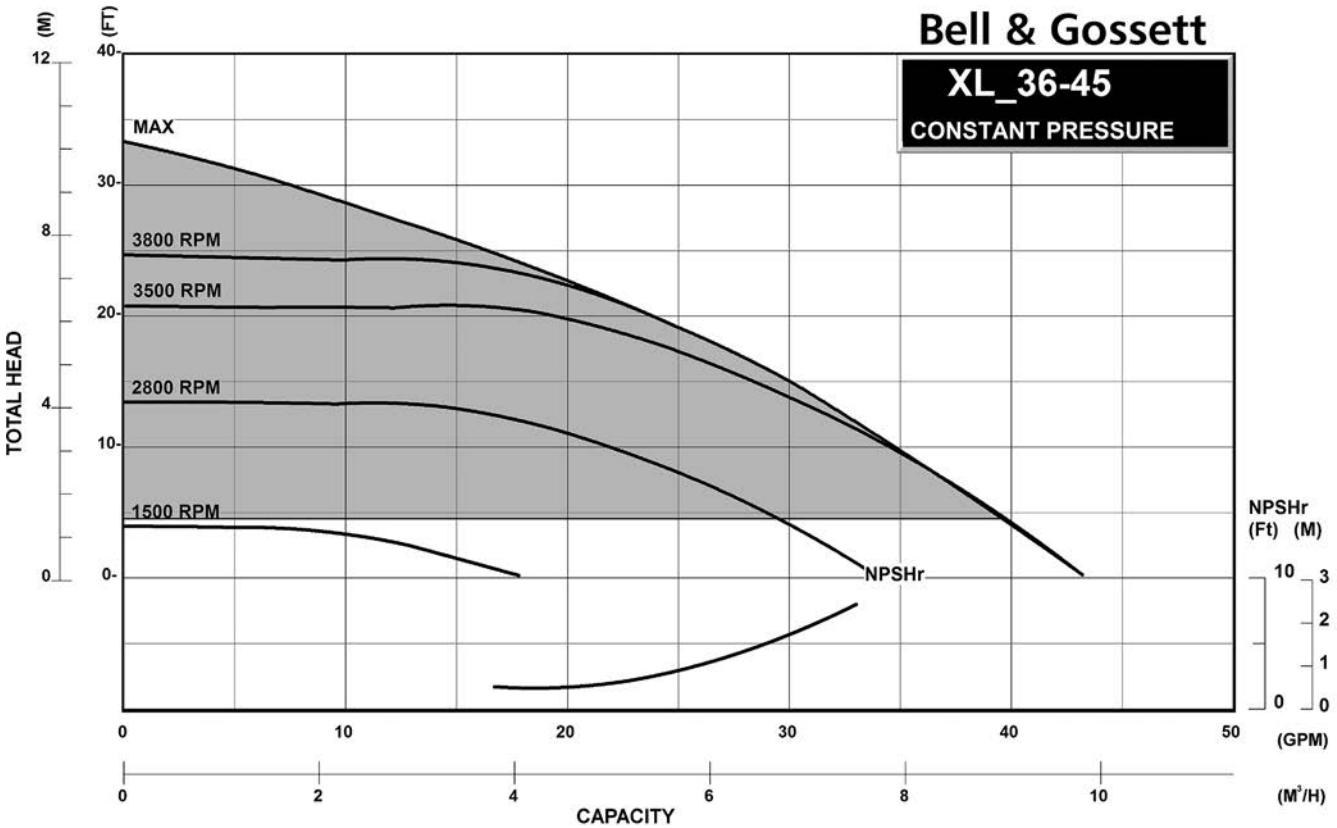
Note: The shaded area represents the operating range for the control mode. Each control mode will operate along a single control curve set by the max differential pressure set point.

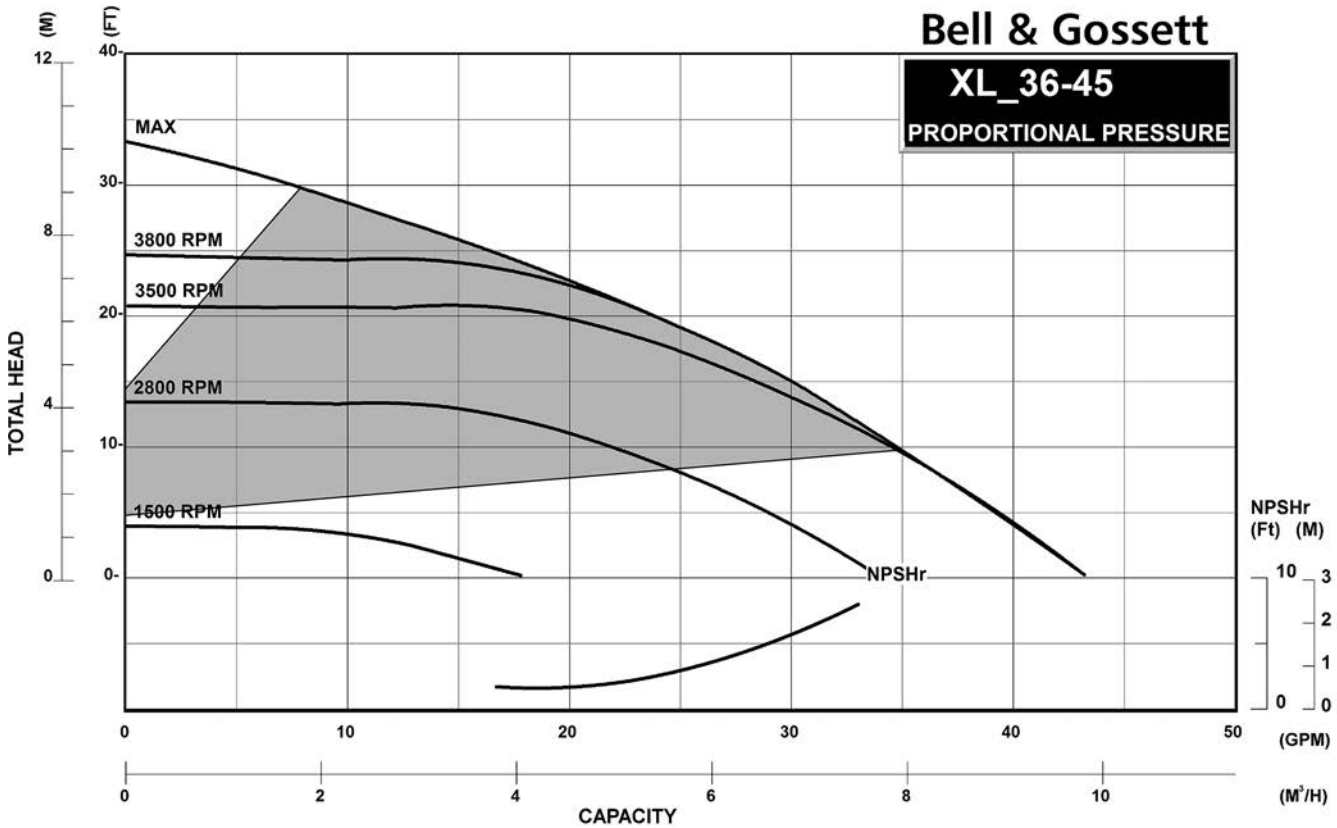
ecocirc XL 36-45 Curves





ecocirc XL 36-45 Curves





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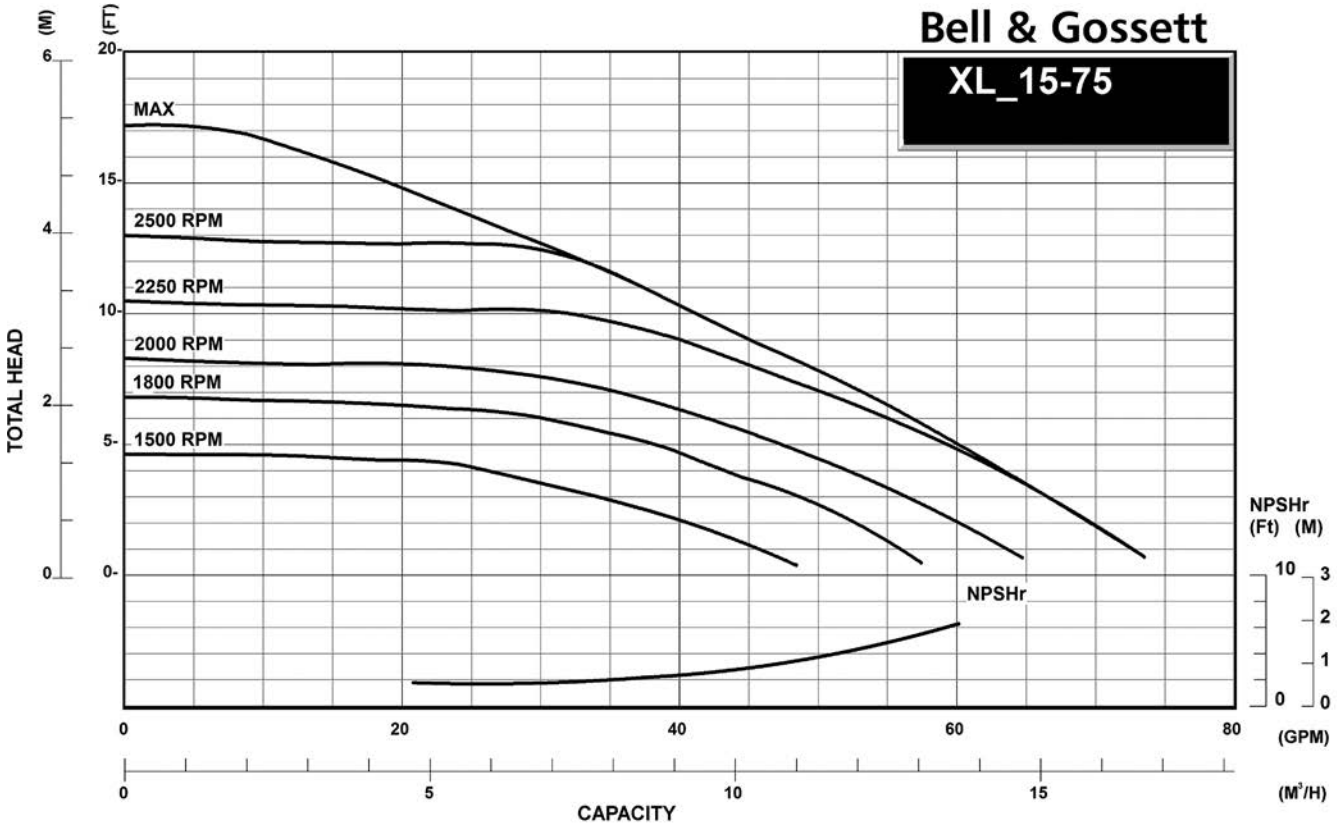
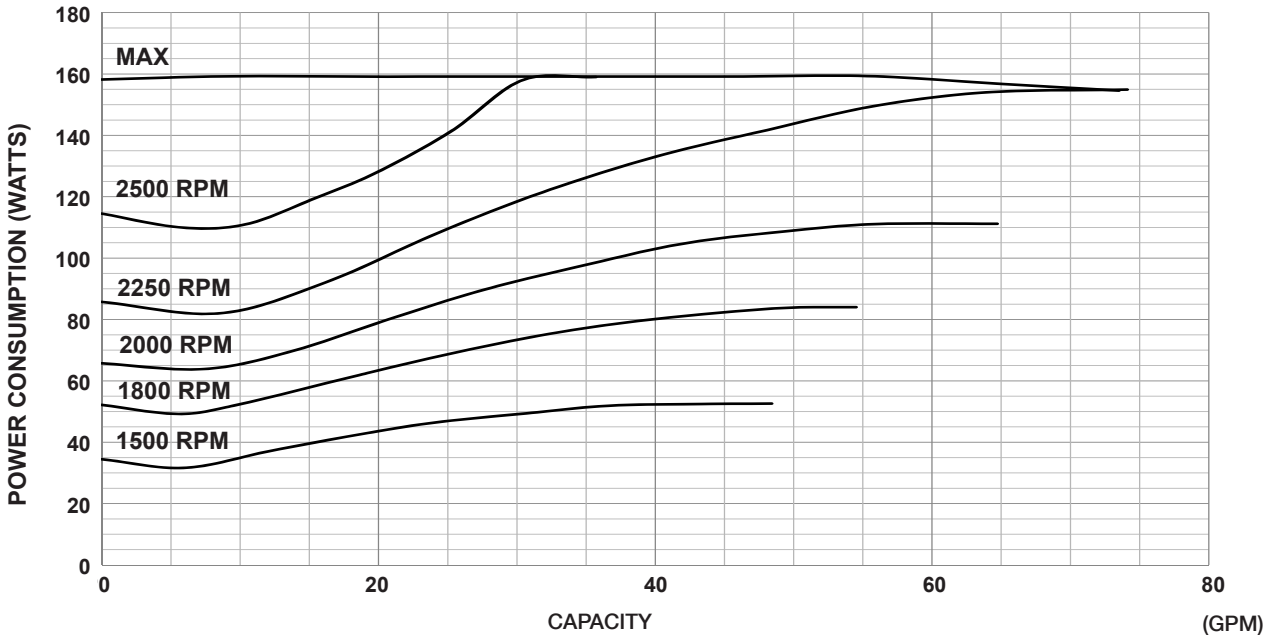
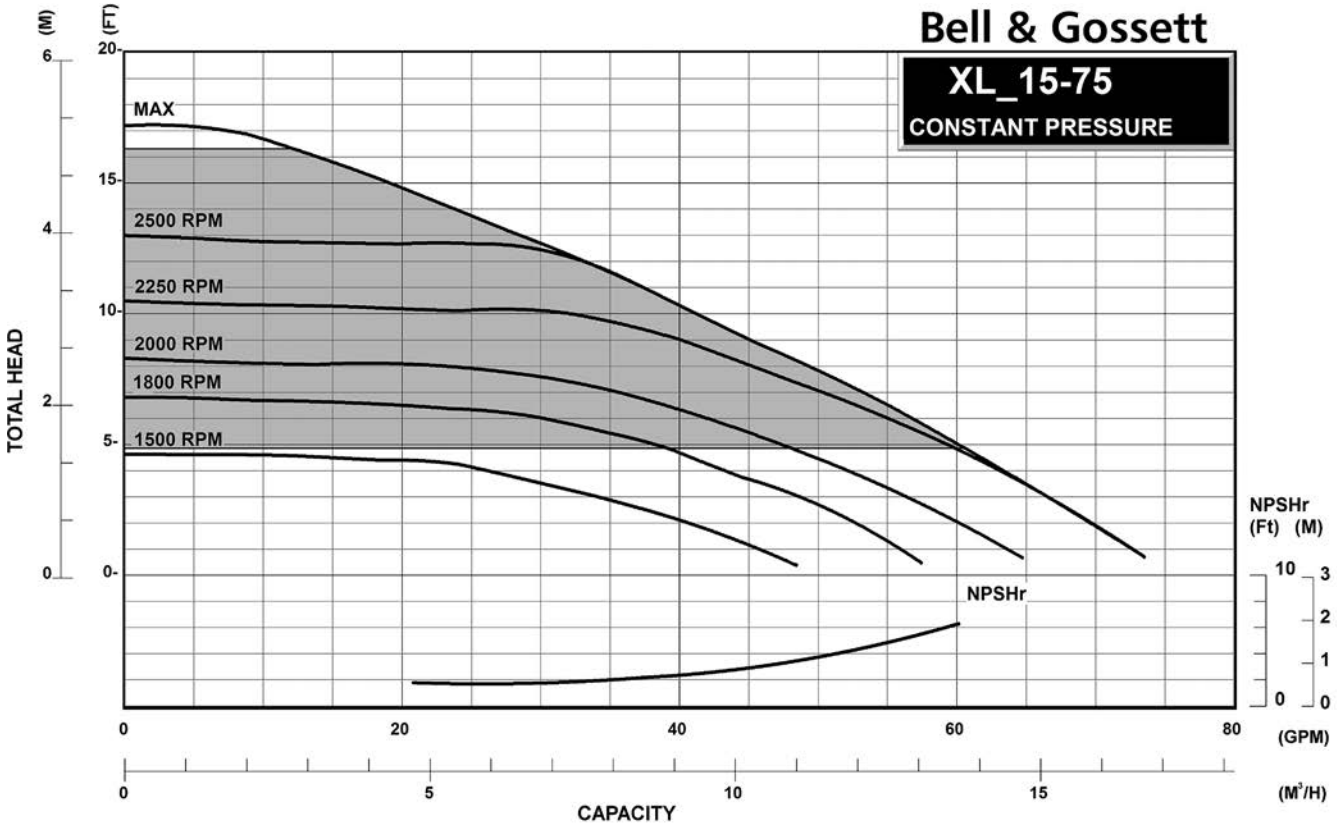
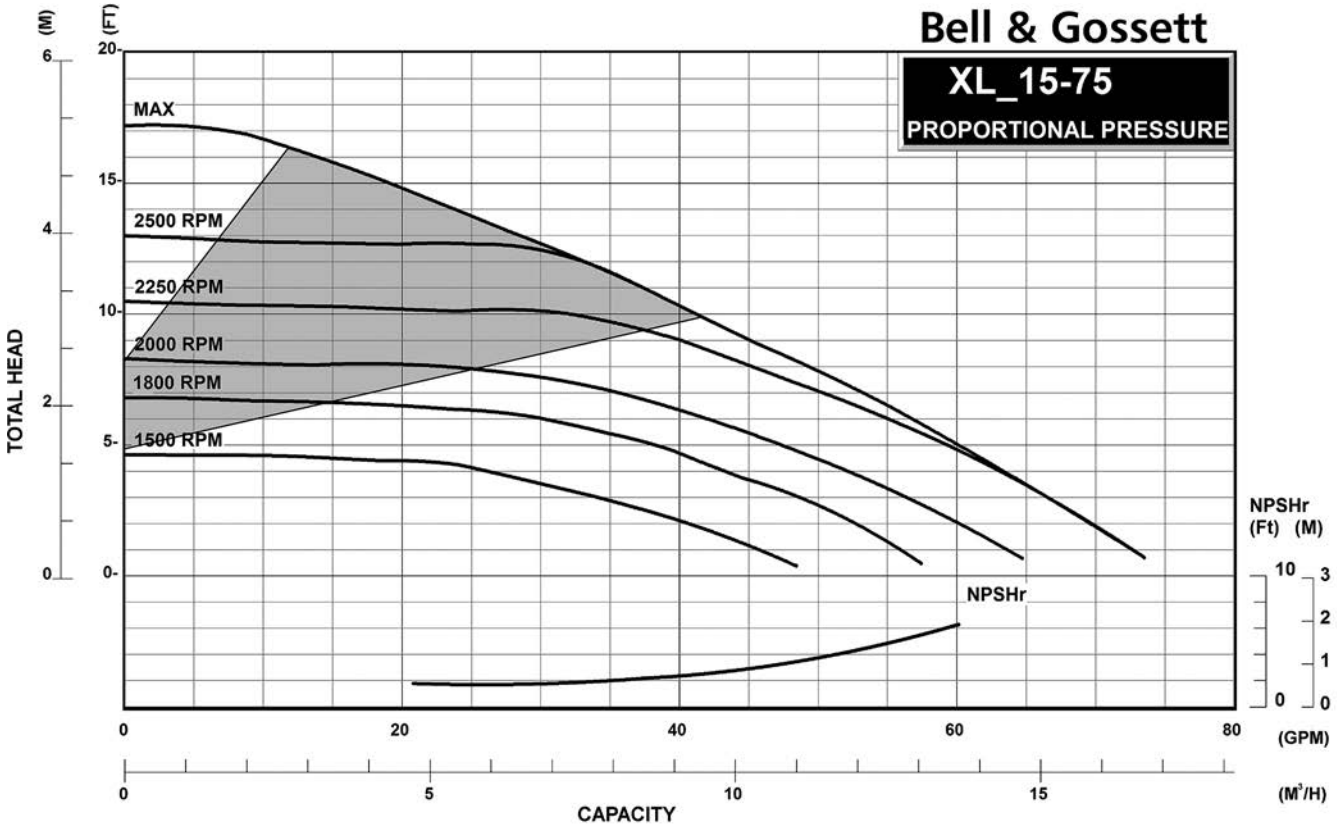
ecocirc XL 15-75 Curves





ecocirc XL 15-75 Curves





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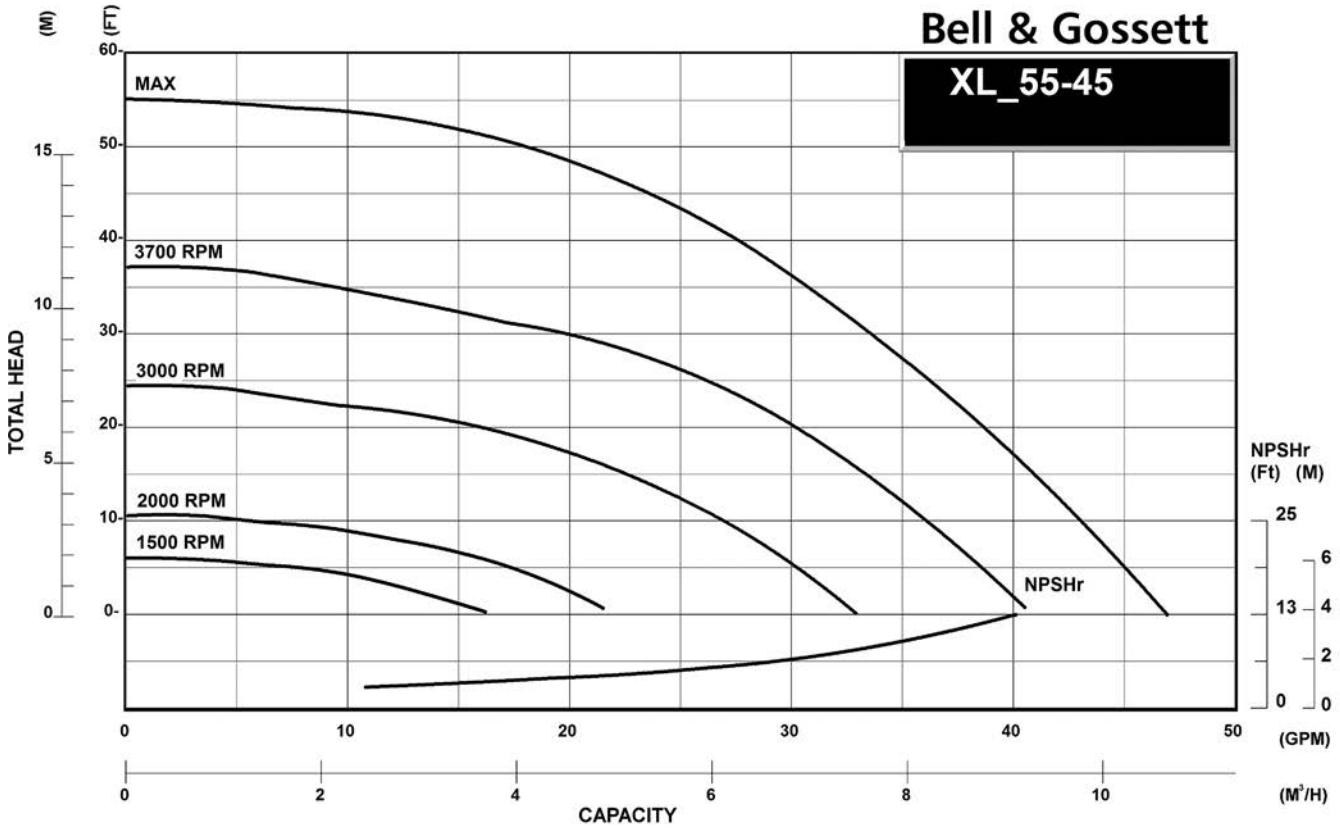
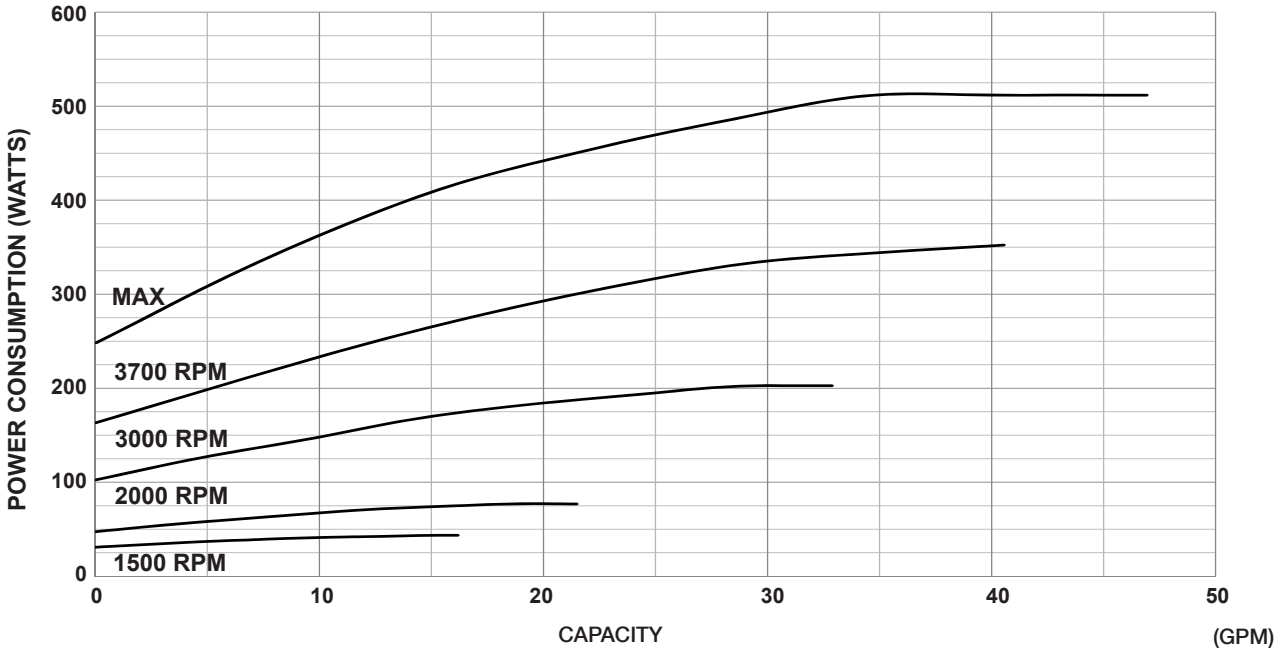
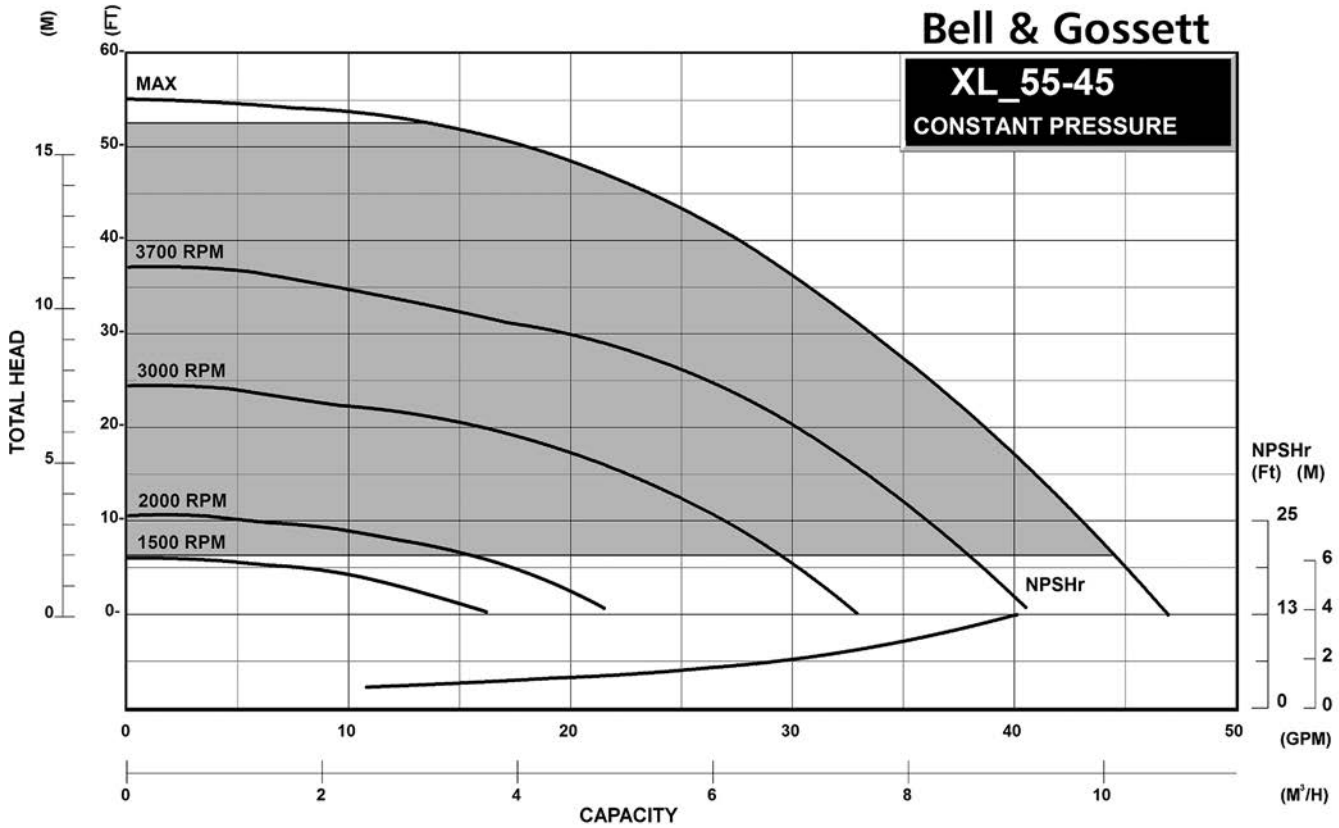
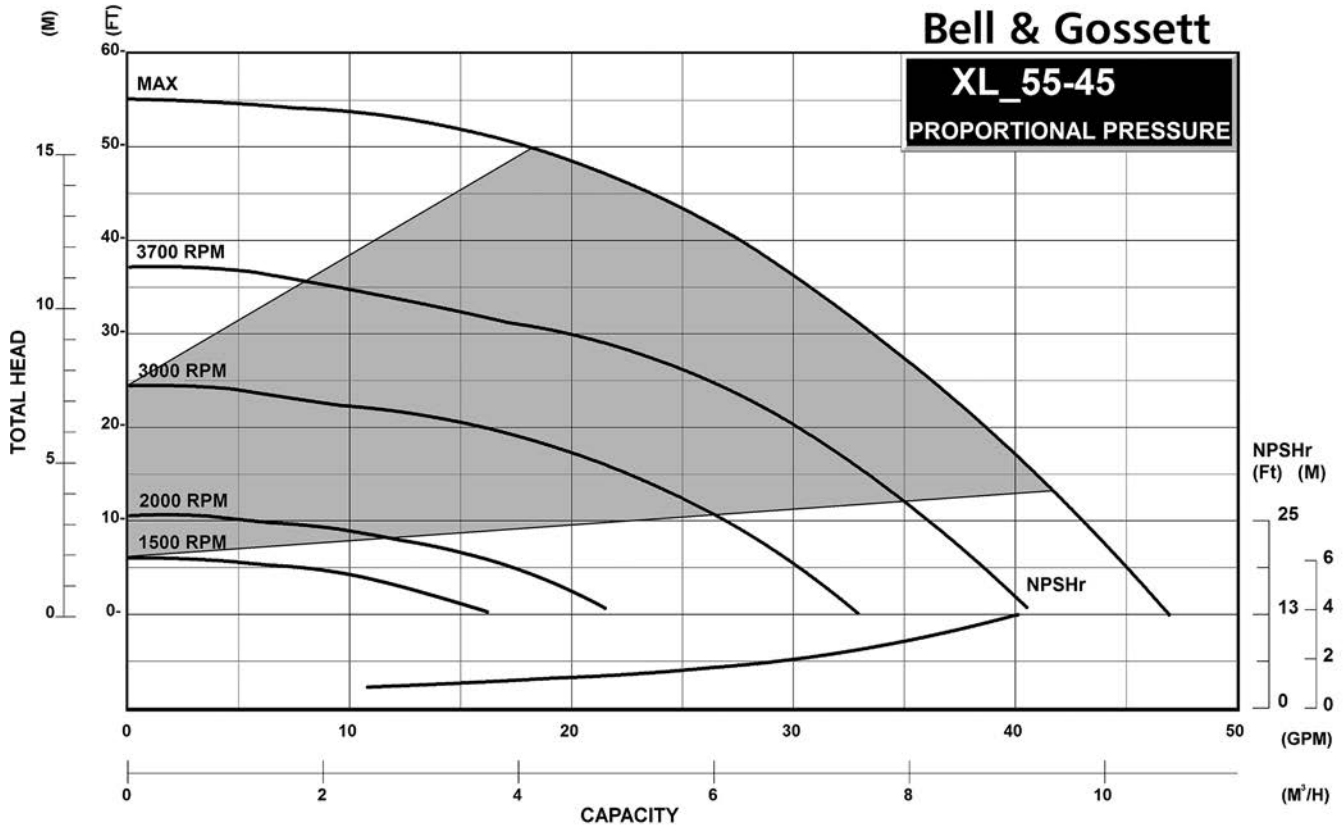
ecocirc XL 55-45 Curves





ecocirc XL 55-45 Curves





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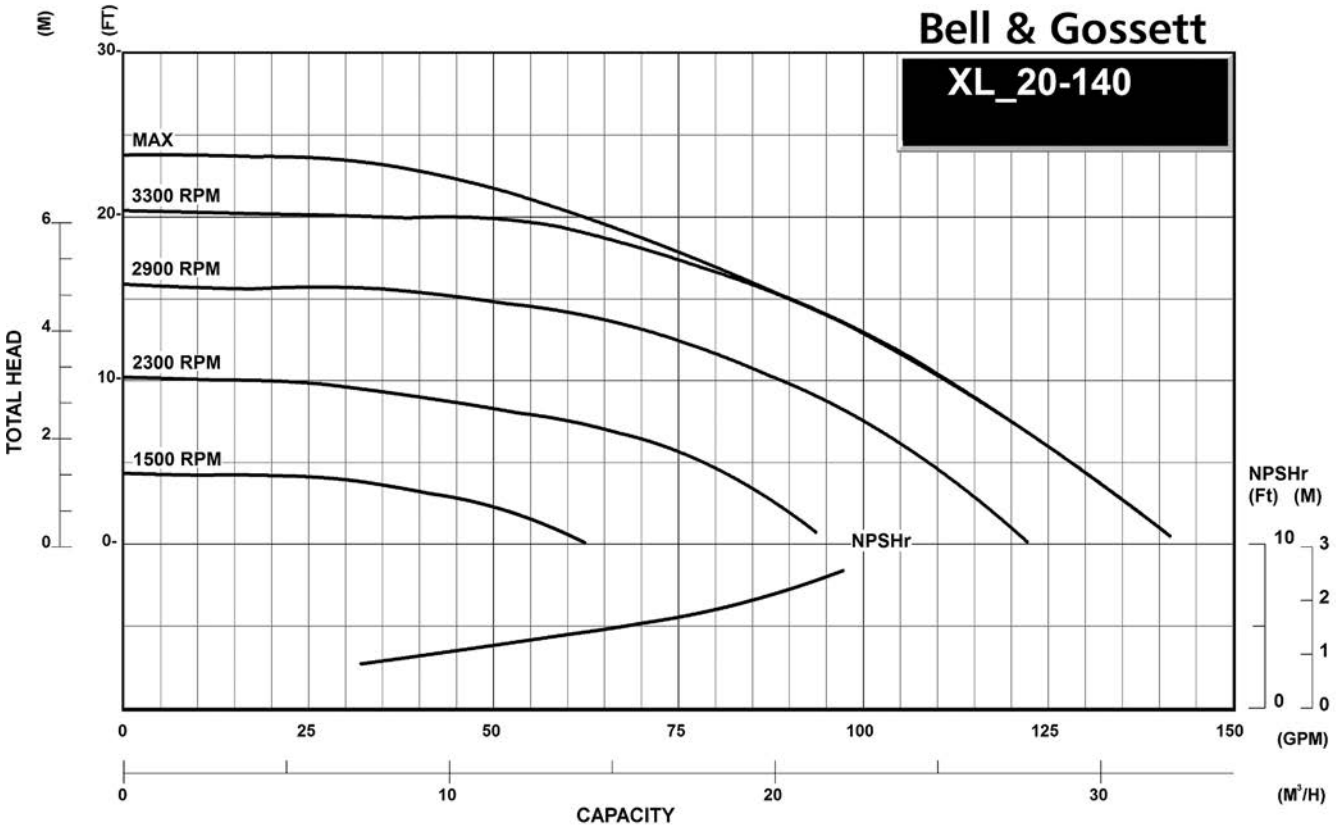
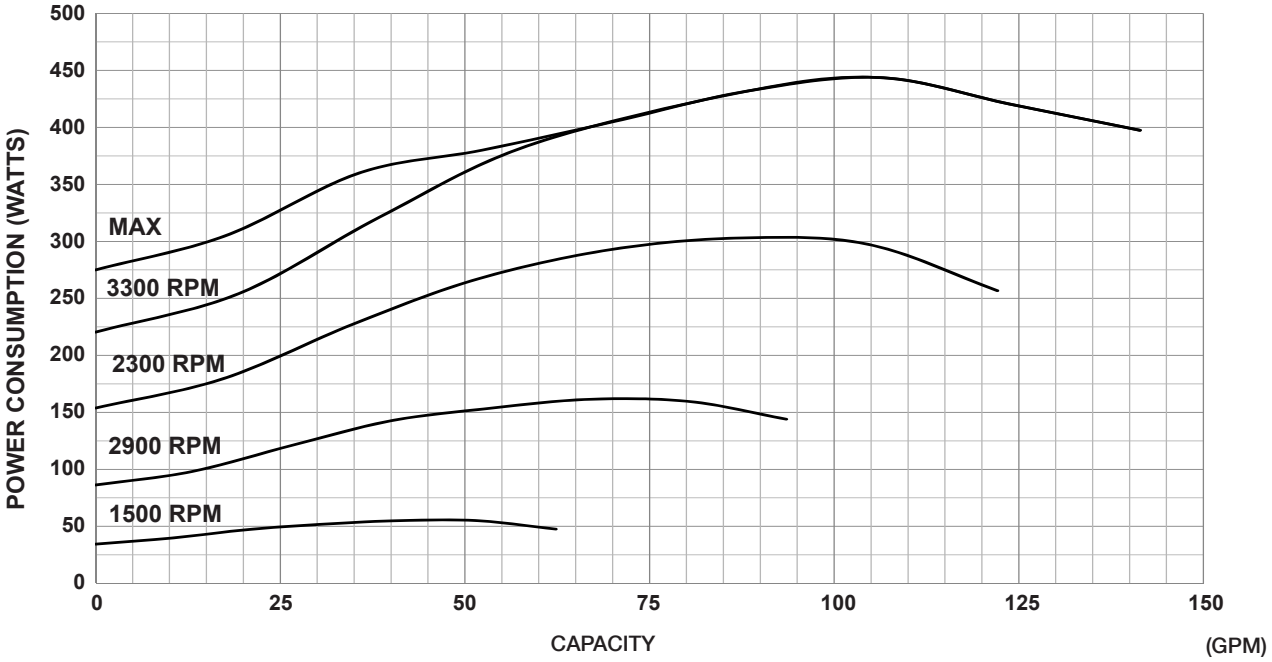
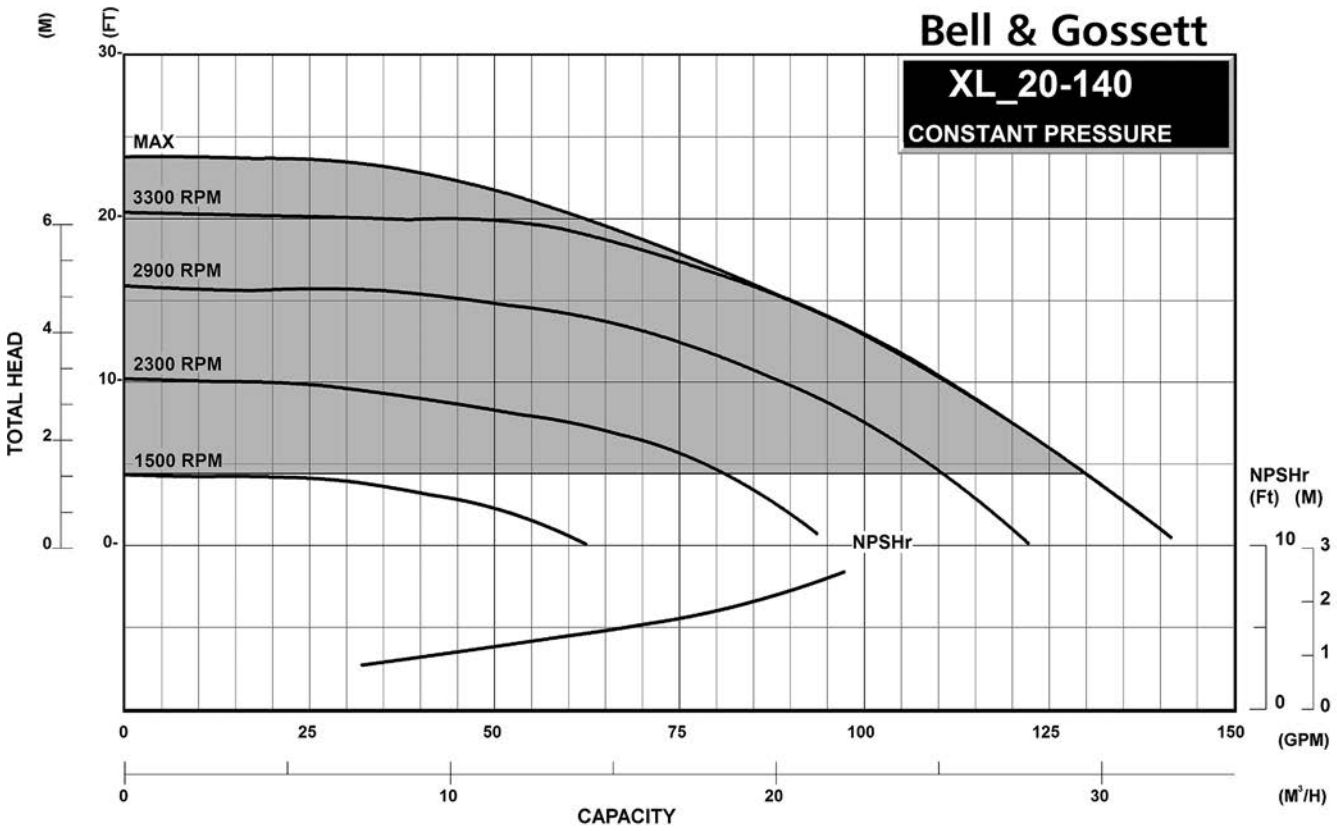
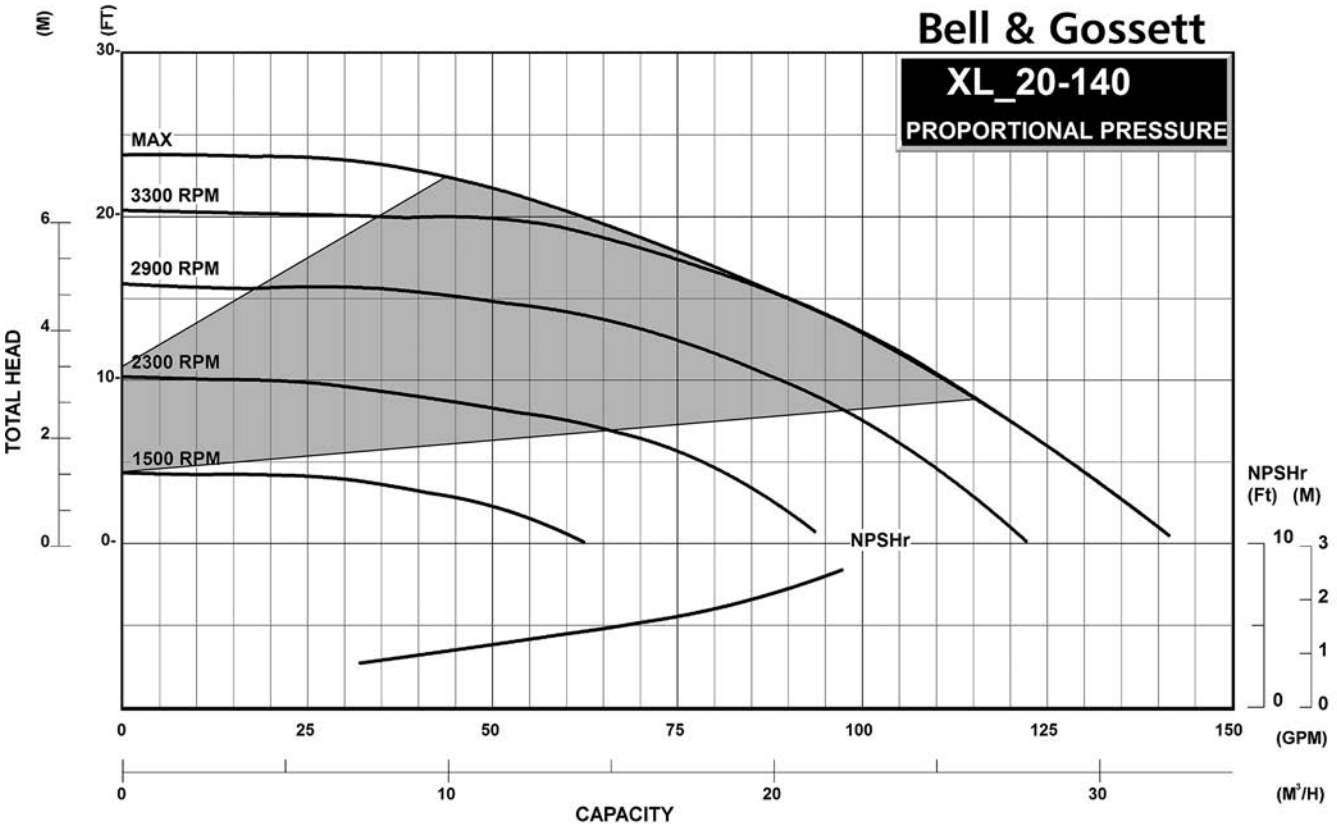
ecocirc XL 20-140 Curves





ecocirc XL 20-140 Curves





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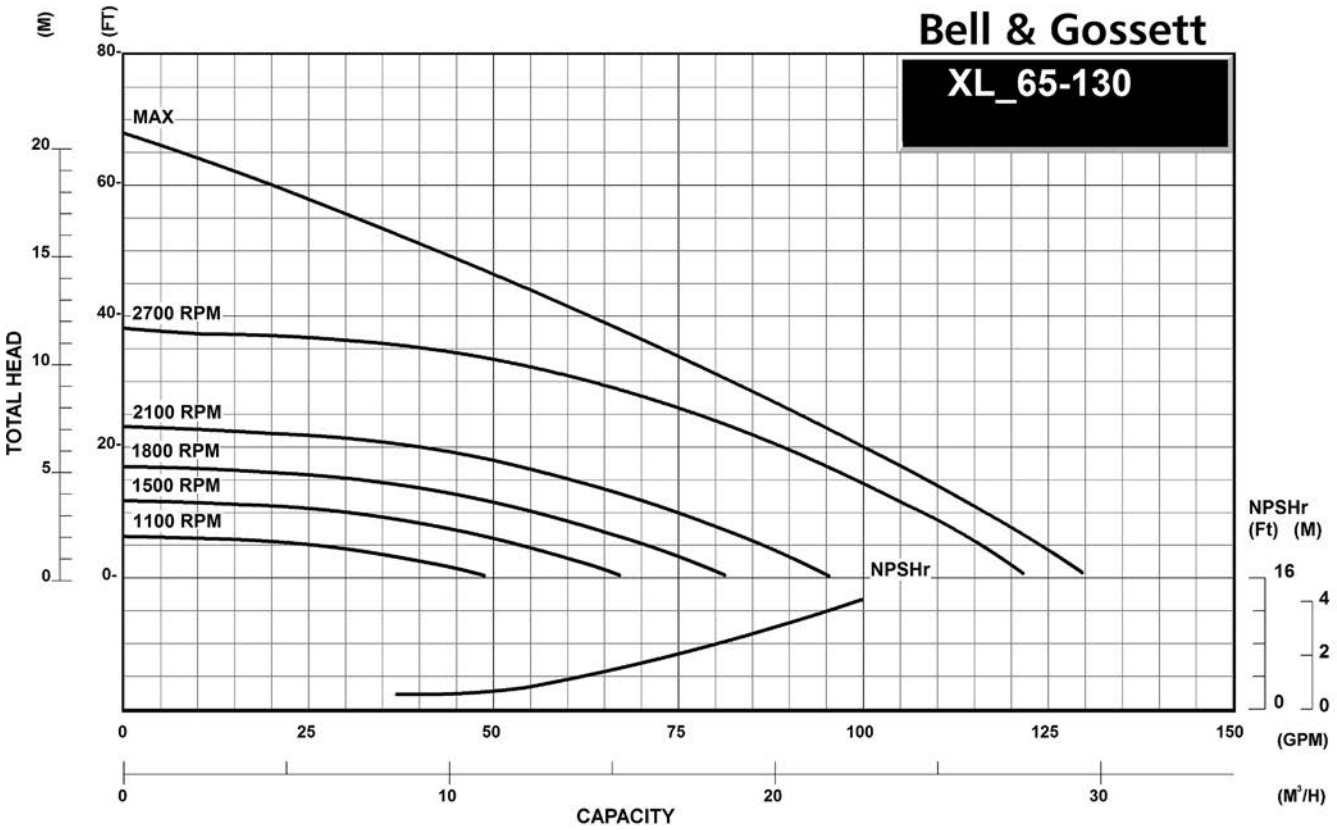
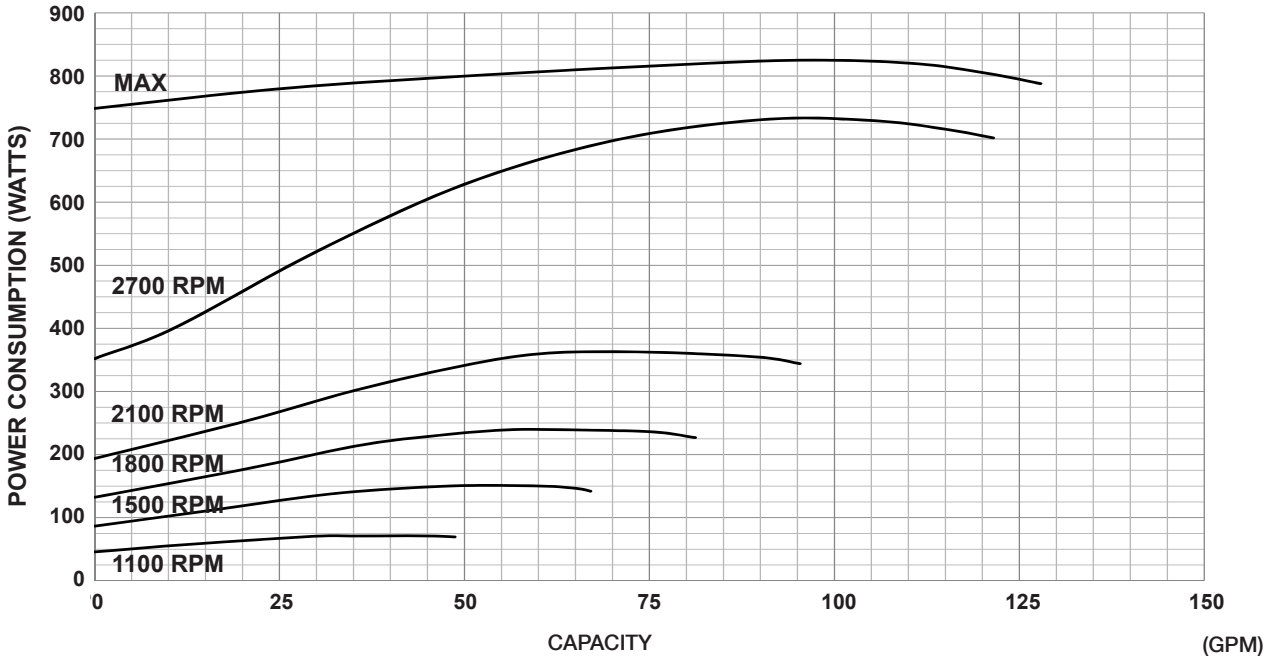
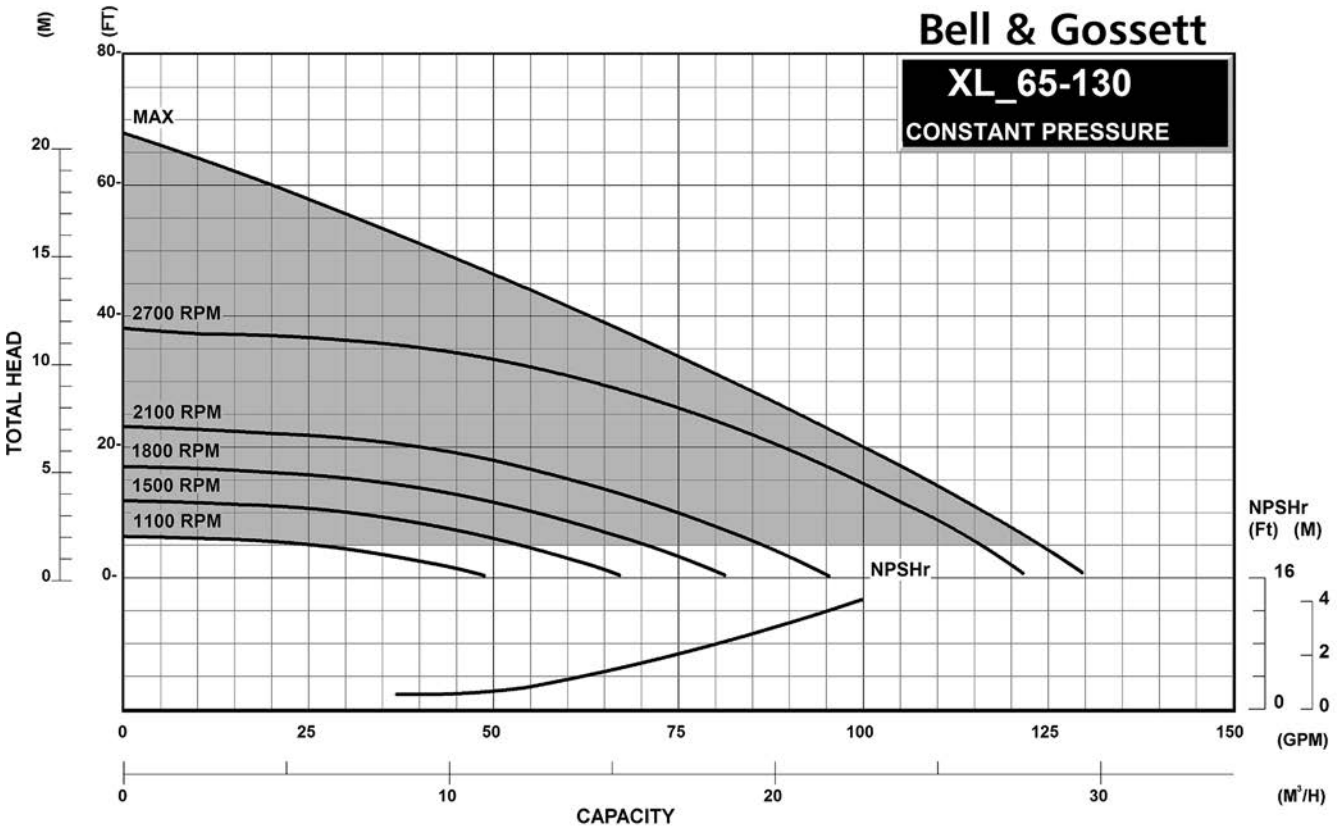
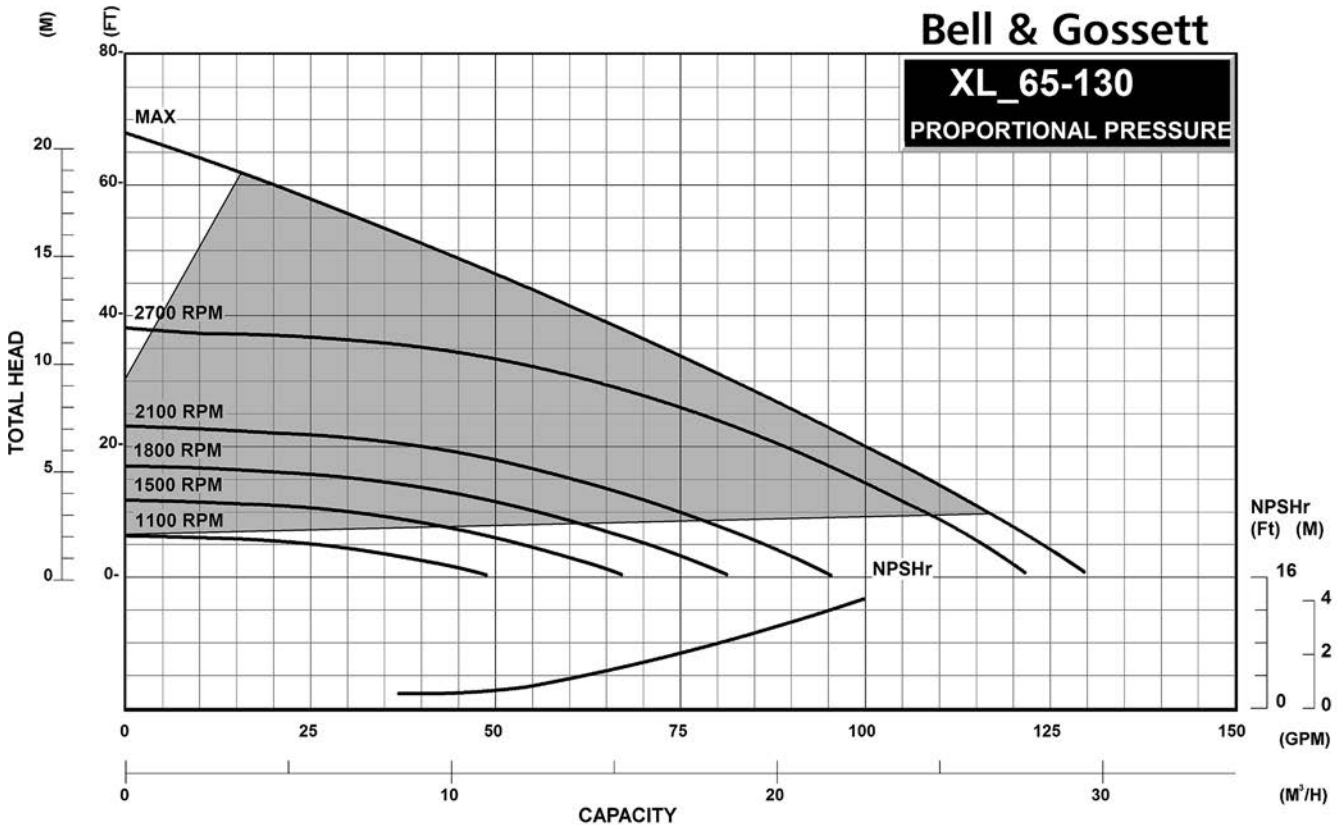
ecocirc XL 65-130 Curves





ecocirc XL 65-130 Curves





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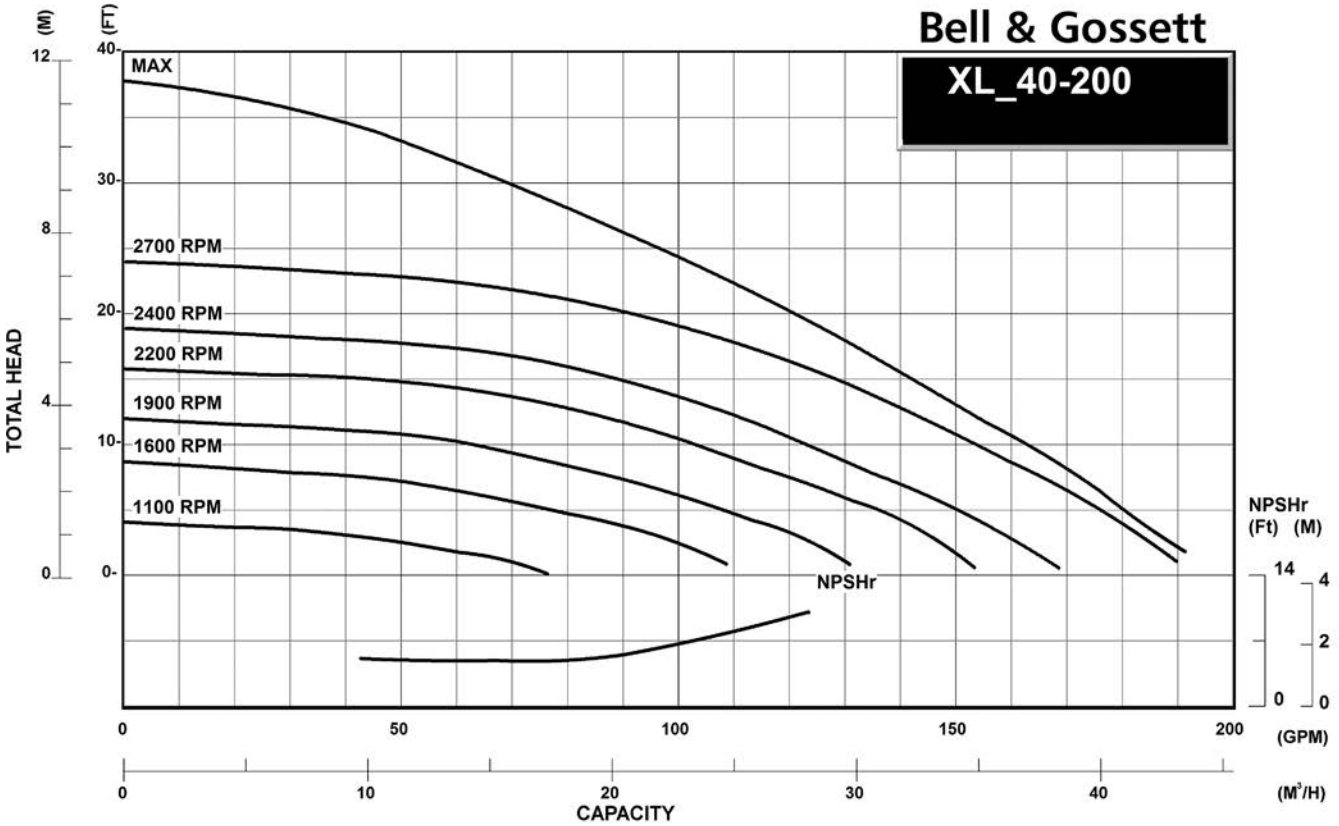
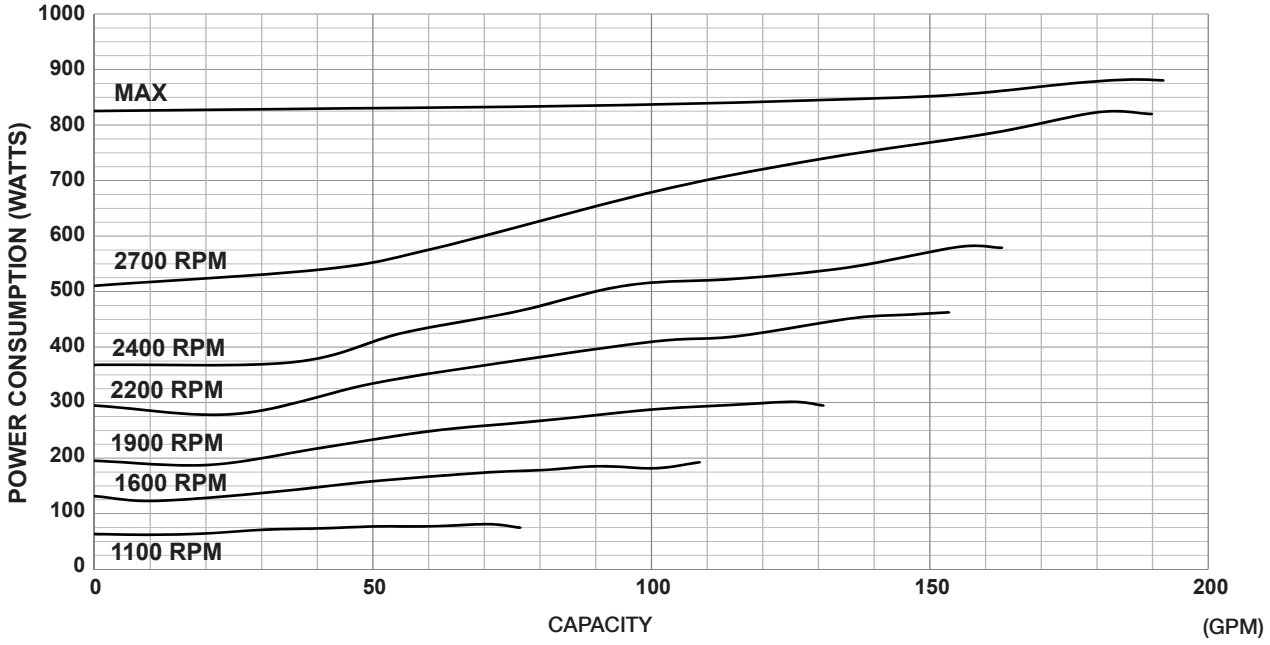
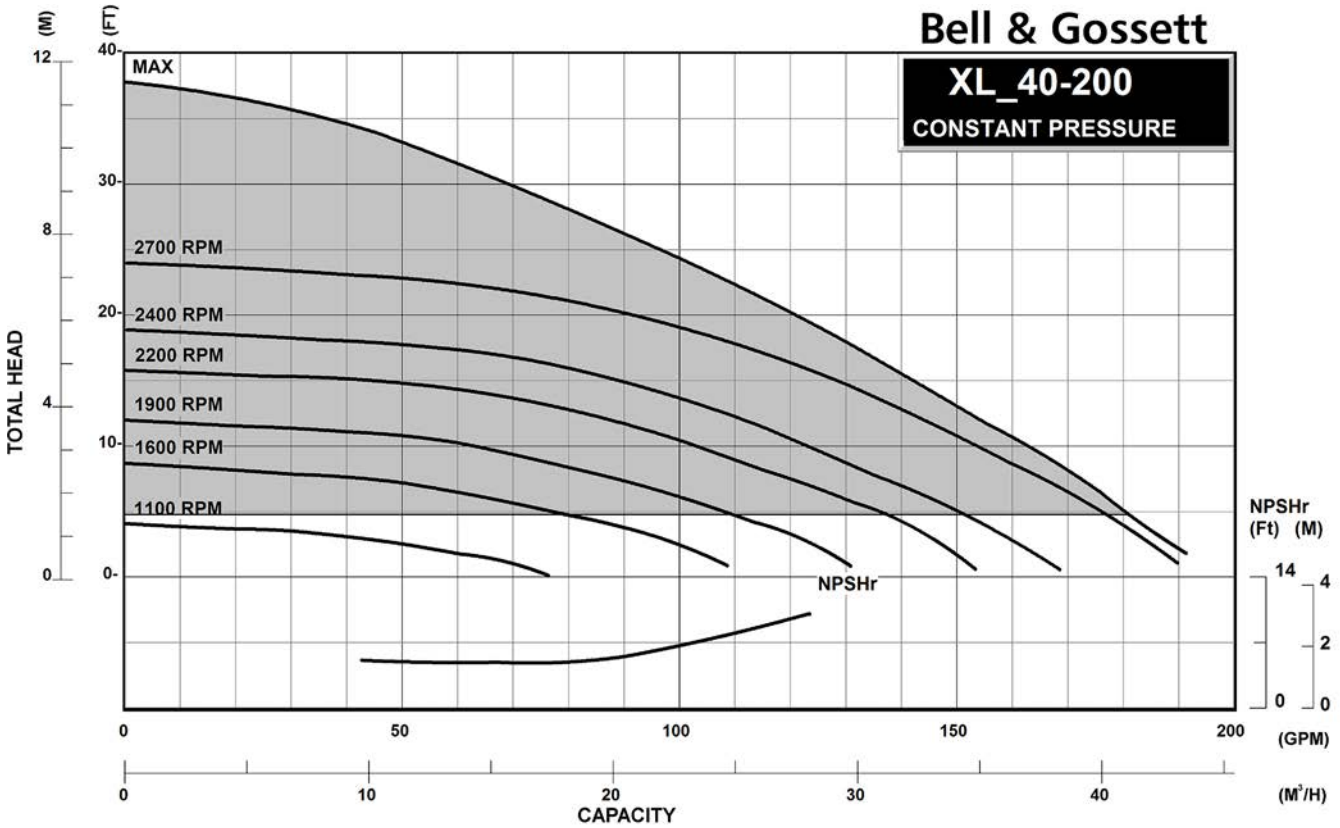
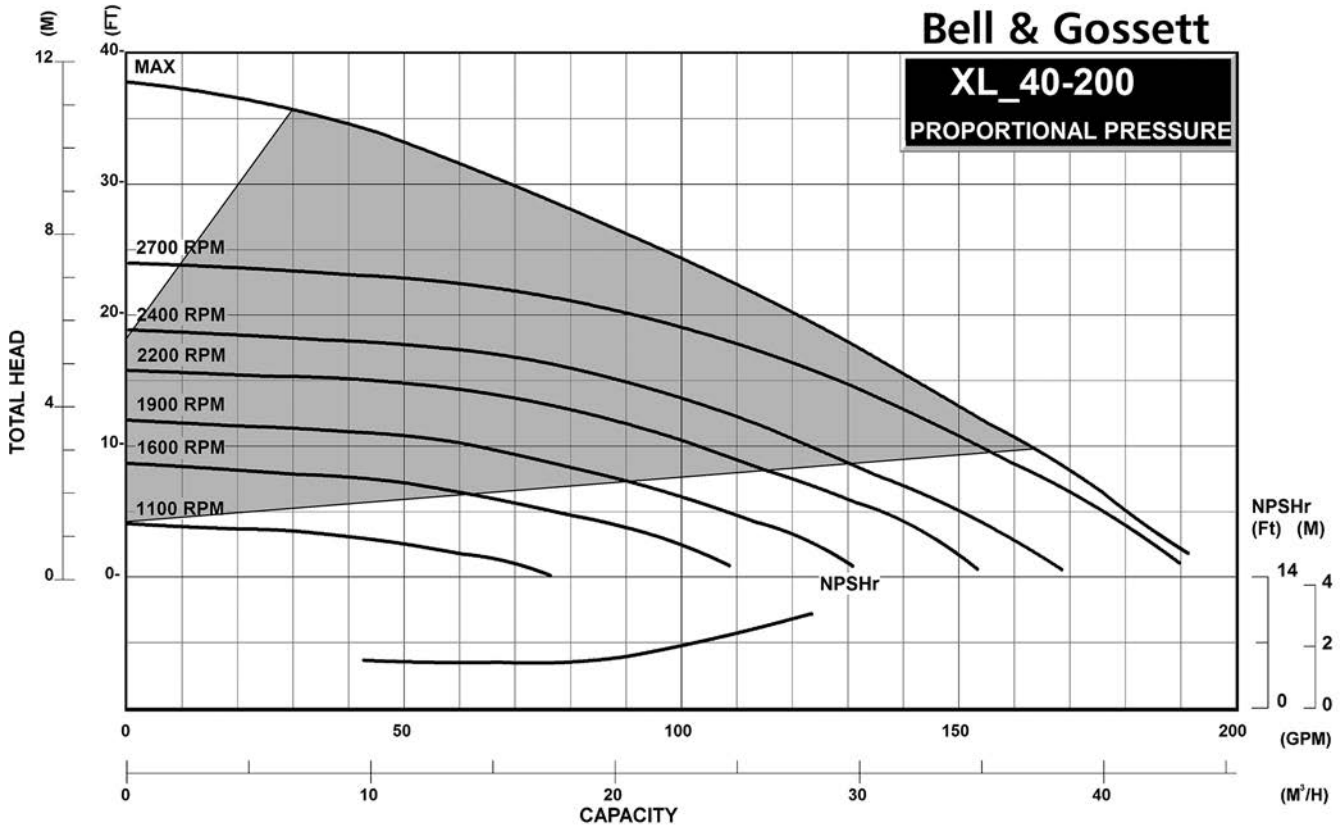
ecocirc XL 40-200 Curves





ecocirc XL 40-200 Curves





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

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