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4HS Submersible Pumps

Installation and Operating Manual



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1. Introduction of the 4HS submersible pumps range

4HS is a 4" high speed centrifugal submersible pump for clean water composed by:

- Three phase permanent magnet synchronous motor with wet rotor and canned type resin filled stator.
- Built-in inverter on board driven by a dedicated control module (CM) positioned outside the well.
- High speed multi stage pump entirely made of AISI 304 stainless steel.

Pump driving made by inverter allows:

- Modify the pump speed to grant constant the desired pressure regardless water request. In this way the pump is operated only and when needed thus avoiding unnecessary waste of energy and granting longer system life.
- Implement the soft start and the soft stop to increase the system life and reducing the current peaks.
- protect the motor from overloading and dry running , overvoltage, undervoltage and possible abnormal conditions

4HS is used on residential and industrial sectors for water pressurized systems, granting:

- Energy saving
- Simplified and quick installation
- Long life reliability

4HS: submersible pump



CM: control module



2. Safety Instructions

The manufacturer strongly suggests to reading carefully this operation manual before using and installing its products. Any operation (installation, maintenance and repair) must be carried out by trained, skilled and qualified personnel. Failure to observe and follow the instruction of this manual may result fatal in dangerous electric shock.

	<p>The unit must be connected to the power supply by a switch granting the complete visual disconnection (separation) from the line before any operation on the 4HS itself and on the connected load.</p> <p>Disconnect the unit from the power supply before any operation.</p> <p>Do not remove for any reason, the cover of the CM and the cable guard without having visually disconnected the unit from the power supply and having waited at least 5 minutes.</p> <p>4HS and pump system must be grounded properly before operation.</p> <p>For the entire period the CM is powered a high voltage is present on the output terminals independently if it is running or not the pump.</p> <p>Do not start the pump for any reason if not completely immersed in water.</p>
	

Avoid any shock or serious impact during transportation.

Check the 4HS immediately upon delivery and check for damage and/or missing parts. In either case, immediately notify the supplier.

Damages due to transportation, incorrect installation, or improper use of the device will null and void the warranty.

The manufacturer cannot be held responsible for any damage to people and/or property due to improper use of its products.

3. Stocking conditions

Store the product on its packaging in a dry and well ventilated environment within a temperature range from -20 ° C and 70 ° C.

If the pump remains in stock for more than a year is recommended to disassemble the rotating parts and test their functionality. It 'also need to power the electric pump (without running the motor) to allow charging of electrolytic capacitors of the inverter module.

If the pump has already been put into operation and is then placed in storage, the minimum storage temperature is 4 ° C. Alternatively you need to add anti-freeze fluid.

4. Packing content

Packing includes:

- 4HS submersible pump with 2 meters flat cable length.
- CM (control module)
- Pressure transducer
- Operating Manual
- Cable junction kit



Check the 4HS packing immediately upon delivery and check for damage and/or missing parts; in either cases immediately notify the supplier

5. General technical features

PUMP	
Max. temperature of pumped liquid	35 °C (92 °F)
Min. speed of water flow on motor case	0.2 m/s
Characteristics of pumped liquid	clean, non-corrosive, non-explosive, free of particles and fibers, with a maximum sand content of 50 g/m ³
Grade of protection	IP68
Used Materials	Impellers and diffusers in AISI 304 stainless steel
Cable	Flat cable ACS – WRAS
CM	
Max. ambient temperature	50 °C (122 °F)
Grade of protection	IP55 (NEMA 4)
Used Materials	Aluminum , LCD membrane with PVC stickers, antipull plug in polyamide
Analog input	2 x analog input 4-20 mA + 2 settable analog input 4-20 mA or 0-10 V .
Digital input	4 inputs, N.O or N.C settable via software
Digital output	2 output relays 5 A , 250 Vac, N.O. or N.C settable
Auxiliary feeding	15 Vdc (300 mA), 10 Vdc (5 mA)
Day and time indication	dater with lithium backup battery (unavailable)
User display	Backlit LCD display with 16 characters x 2 rows , 5 buttons, buzzer for acoustic
Dimensions	180x180x120 mm
Short circuit protection	With fuse

CERTIFICATIONS

CE

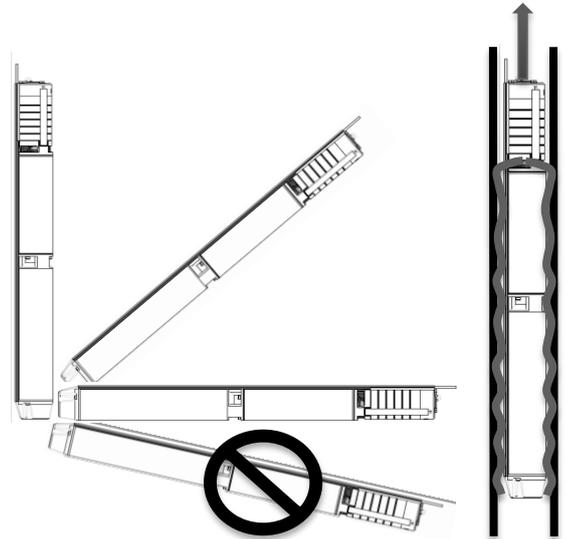
6. Pump installation



Entire installation procedure must be performed verifying that pump is not connected to the mains.

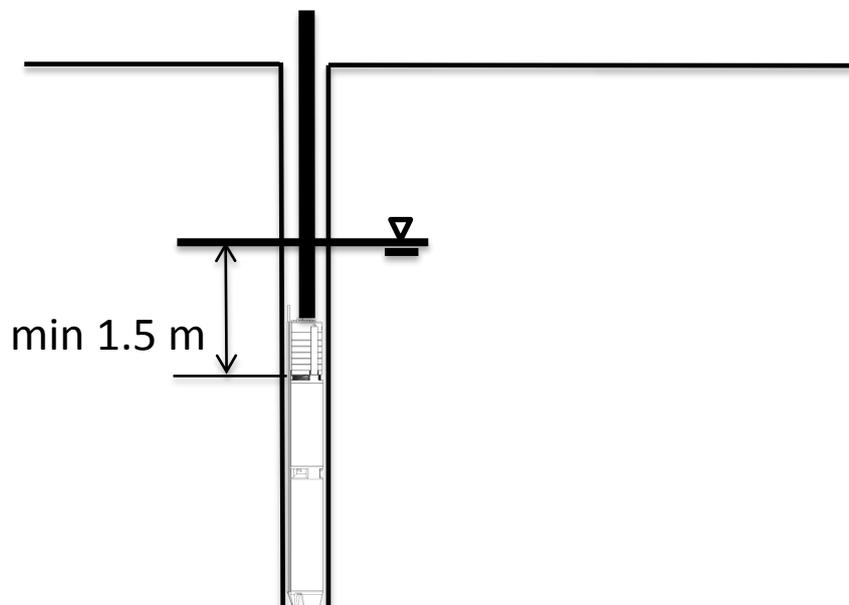
Pump can be installed both vertically and horizontally, but the outlet should never be below the horizontal line. Minimum head of 10% than max pump head must be granted.

If the pump is not installed in a well, to grant a proper cooling, a cooling sleeve must be used; doing so the minimum speed of the pumped liquid has to be granted.



6.1 Installing pump in the well

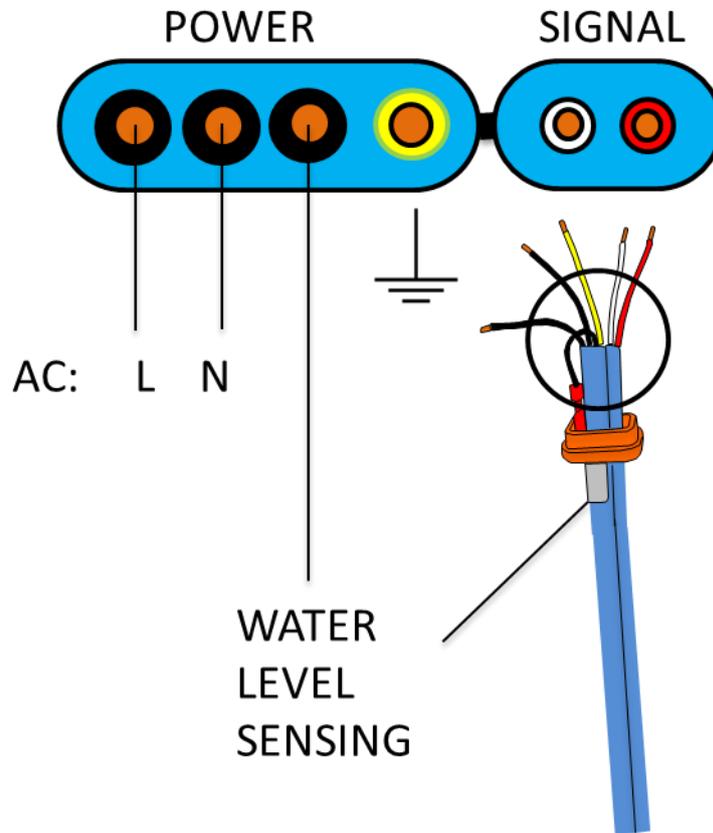
To reduce noise transmission it is advised to use plastic pipes. The pump must always be secured in the well through a special rope attached to loop on the pump head. It is recommended not to drop the pump in the well by using the electric cable, its integrity must be preserved in all operations. In this regard, it is recommended to fix the cable on cable support or on the pipe. During operation, the pump suction must always remains at least 1.5 meters below the dynamic water level.



Do not drop the pump in the well by using the electric cable
Make sure about the electric cable integrity during all the operations.
Ensure the pump in the well with a stainless steel rope to be fixed to the hole in the pump head

6.2 Pump cable

4HS MultiPower are equipped, in their standard configuration, with 2,5 meter flat cable length.



4HS pump communicates with CM (surface control module) by signal wires. If CM is not installed (or failed) it is possible to start the pump (at maximum frequency) or stop it by closing or opening the contact between the signal wires.

If the distance between the pump and the power supply is longer than the supplied cable it is necessary to make a junction performed by the special kit supplied as standard.

The cable section for additional power conductors must be calculated considering the maximum allowed power loss.

$$S = \frac{2 \times \rho \times L \times P1 \times 100}{V^2 \times \Delta P_{[\%]}}$$

- S: wire section [mm²]
- ρ : specific resistance = 0,018 [Ω mm²/m]
- L: cable length [m]
- P1: pump electrical power [W].
- V: voltage at maximum power.
- ΔP : allowed power loss [%]. It is recommended not to exceed 3%.

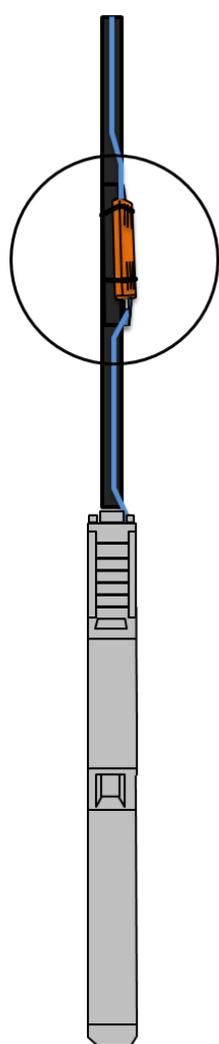


To make the junction is necessary to follow carefully the instructions inside the kit.

At the time of joining and electrical connection is essential to maintain the correspondence between the signal cables.

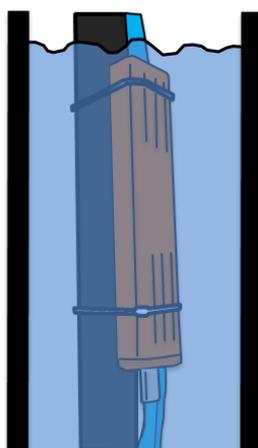
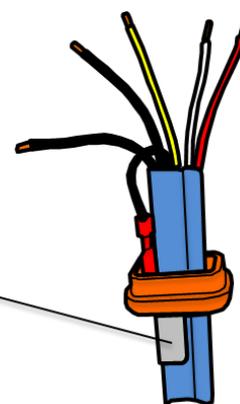
After cable joining and placed the pump in the well you must perform, before connecting to the CM, a test of insulation: join together the two power cables and, applying a voltage of 500V, an insulation resistance from the ground higher than 100 Mohm must be verified. Join together the two signal cables and, applying a voltage of 500V, an insulation resistance from the ground higher than 100 Mohm must be verified.

6.3 Water level sensing

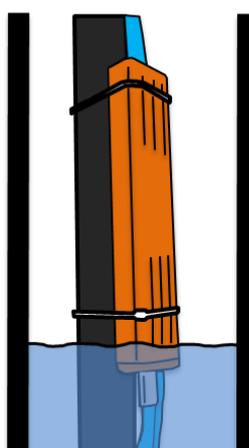


WATER LEVEL SENSOR

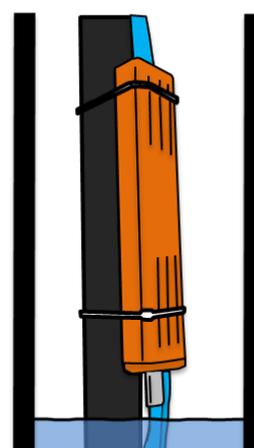
Water level sensing is based on variation of measured impedance. Keep it clean and not in direct contact with pipes in order to grant its function.



WATER



WATER

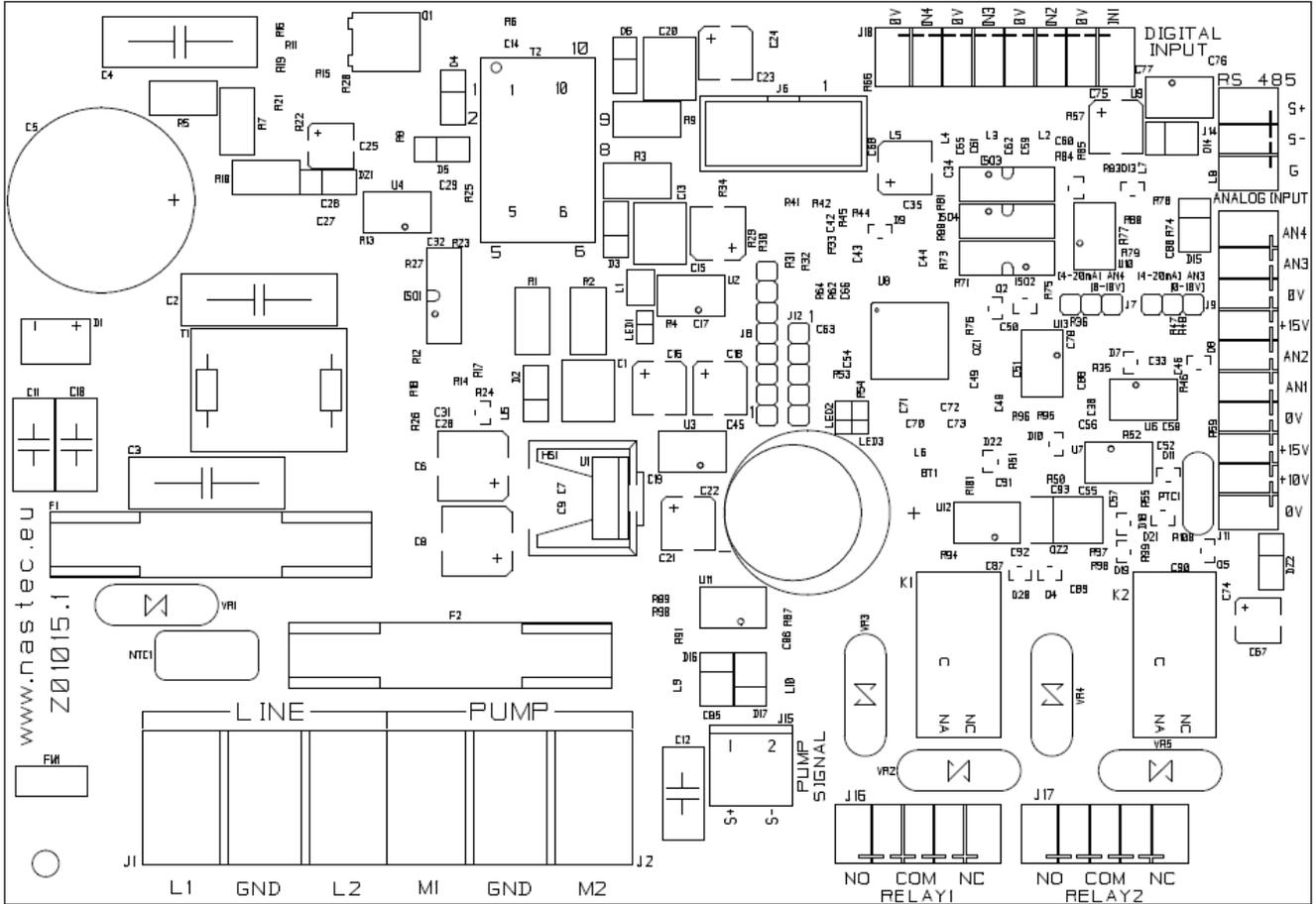


NO WATER

7. CM installation

The CM can be easily fixed to the wall using 2 screws. The IP55 protection degree enables the CM installation even in humid and dusty environments. However, it is recommended to protect the CM from the direct exposure to weather and sunlight.

7.1 Electric wiring



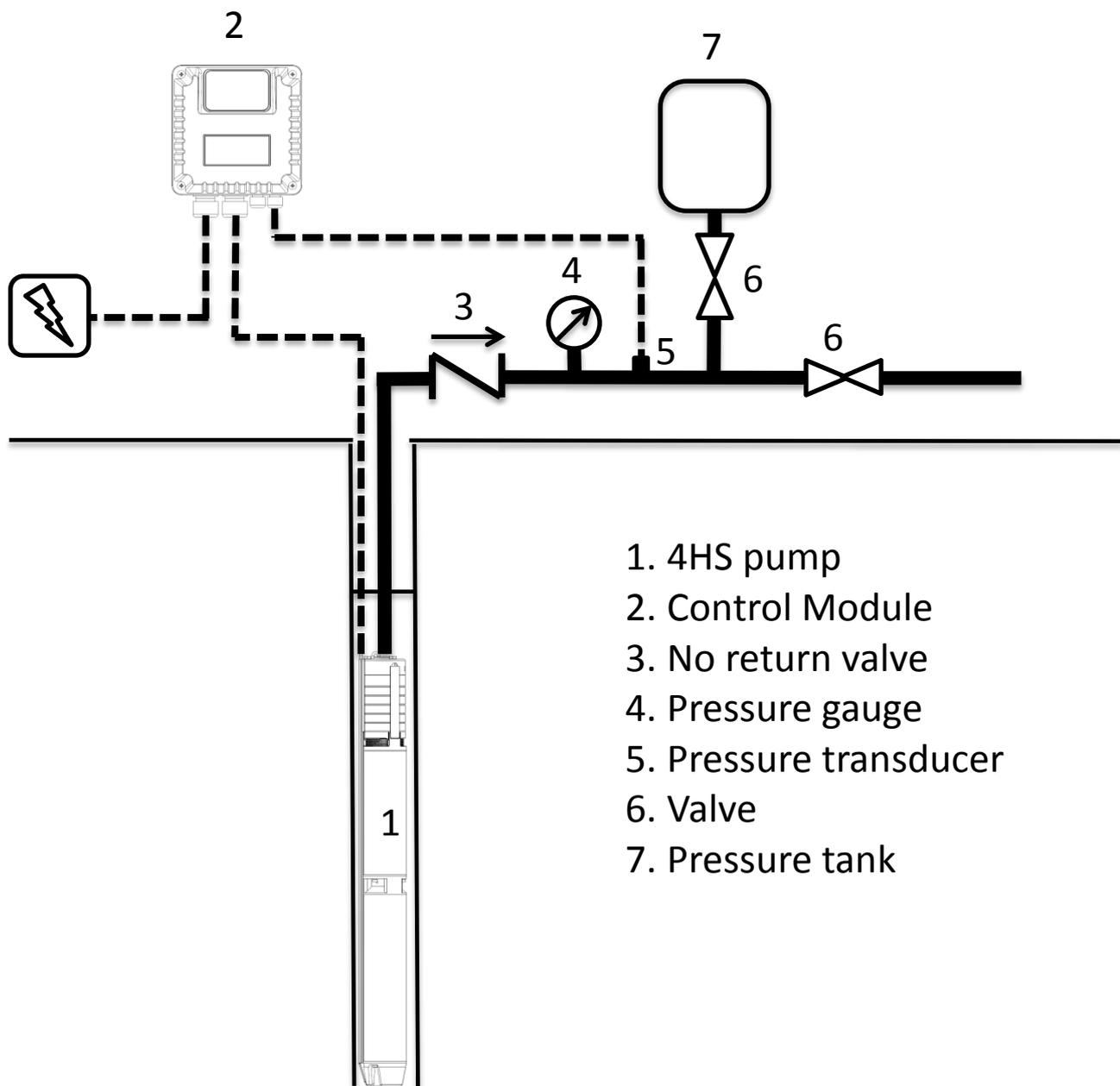
<p>Input power (LINE):</p> <ul style="list-style-type: none"> • L1,L2 • GND ground 	<p>Output power (PUMP):</p> <ul style="list-style-type: none"> • M1,M2 • GND ground 		<p>Pump signal:</p> <ul style="list-style-type: none"> • S+ (red) • S- (white)
<p>Analog inputs:</p> <ul style="list-style-type: none"> • AN1 (4-20 mA) • AN2 (4-20 mA) • 0V • +15V • AN3 (4-20 mA or 0-10V) • AN4 (4-20 mA or 0-10V) • 0V • +15V • 10V • 0V <p>AN3 or AN4 terminals can be set as voltage input (0-10V) or current input (4-20mA).</p>	<p>Digital inputs:</p> <ul style="list-style-type: none"> • IN1 • 0V • IN2 • 0V • IN3 • 0V • IN4 • 0V 	<p>Communication auxiliary (RS485):</p> <ul style="list-style-type: none"> • S+ • S- • G 	<p>Digital outputs (relays):</p> <ul style="list-style-type: none"> • RELAY1: pump run signal NO: normally opened COM: common NC: normally closed • RELAY2: alarm signal NO: normally opened COM: common NC: normally closed <p>Relays of digital outputs are free contacts relays (no voltage) Max voltage is 250 V AC and max current is 5 A.</p>

	<p>Read carefully the Guidelines for safety before installing the device. At the end of the installation check that no other objects are inside the CM or deposited on the electronic board. It is recommended to tighten all 4 screws with washers of the cover before powering the device. Otherwise, you may fail to connect to ground the cover with a risk of electric shock or even death.</p>
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8. 4HS pumps installation for constant pressure mode

CM can manage the rotation speed of pump to maintain constant the pressure in a point of plant regardless the water demand of the user.

The basic scheme of a line of pumping system capable of achieving this operation is as follows:



1. 4HS pump
2. Control Module
3. No return valve
4. Pressure gauge
5. Pressure transducer
6. Valve
7. Pressure tank

8.1 Pressure tank

Installation of a pressure tank in the hydraulic system is recommended to compensate leakage of water in the system (or during minimum water demand) and to avoid continuous start/stop cycling of the pump (check the appendix for more information).

Selecting the proper volume and pre-charge pressure of the tank is very important; smaller tank volumes will not compensate adequately for minimum water usage or leakage, while larger volumes make it more difficult for CM to control the pressure evenly.

Recommended tank volume is equal to the 10% of the maximum water flow of the system (expressed in volume unit/min)

Example: if the max water flow is 50 liters/min, the pressure tank should have a capacity of 5 liters
If the max water flow is 20 gpm, the pressure tank should have a capacity of 2 gallons

Pre-charge pressure of the pressure tank should be at least 1 bar (15 psi) less than the set-pressure of the system.

Example: if the set-pressure of the system is 4 bar, the pre-charge pressure of the tank should be 3 bar
If the set-pressure of the system is 60 psi, the pre-charge pressure of the tank should be 45 psi

8.2 Pressure sensor

It is possible to use pressure sensor with a linear output signal with range 4 – 20 mA.

Pressure transducer will be powered by any range of DC voltage including the value 15 V.

It is necessary to set the pressure sensor characteristics in the initial configuration menu or in the installer menu (please check the relevant chapter on setting parameters).

The connection of the pressure sensor is through the analog input terminals:

- **+15V** (15 V dc power supply)
- **AN1** (4-20 mA signal)

CM accepts the signal of an additional pressure transducer to be activated automatically if the first transducer fails; it is enough to connect the wires of the additional pressure transducer to pin AN2 (signal 4-20 mA) and +15V (power supply 15 V dc).

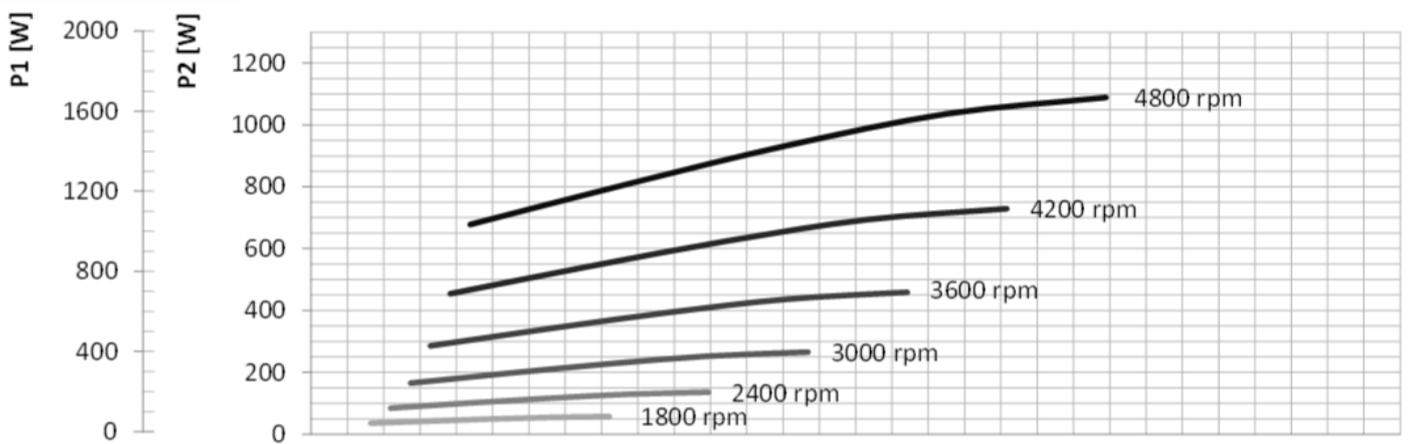
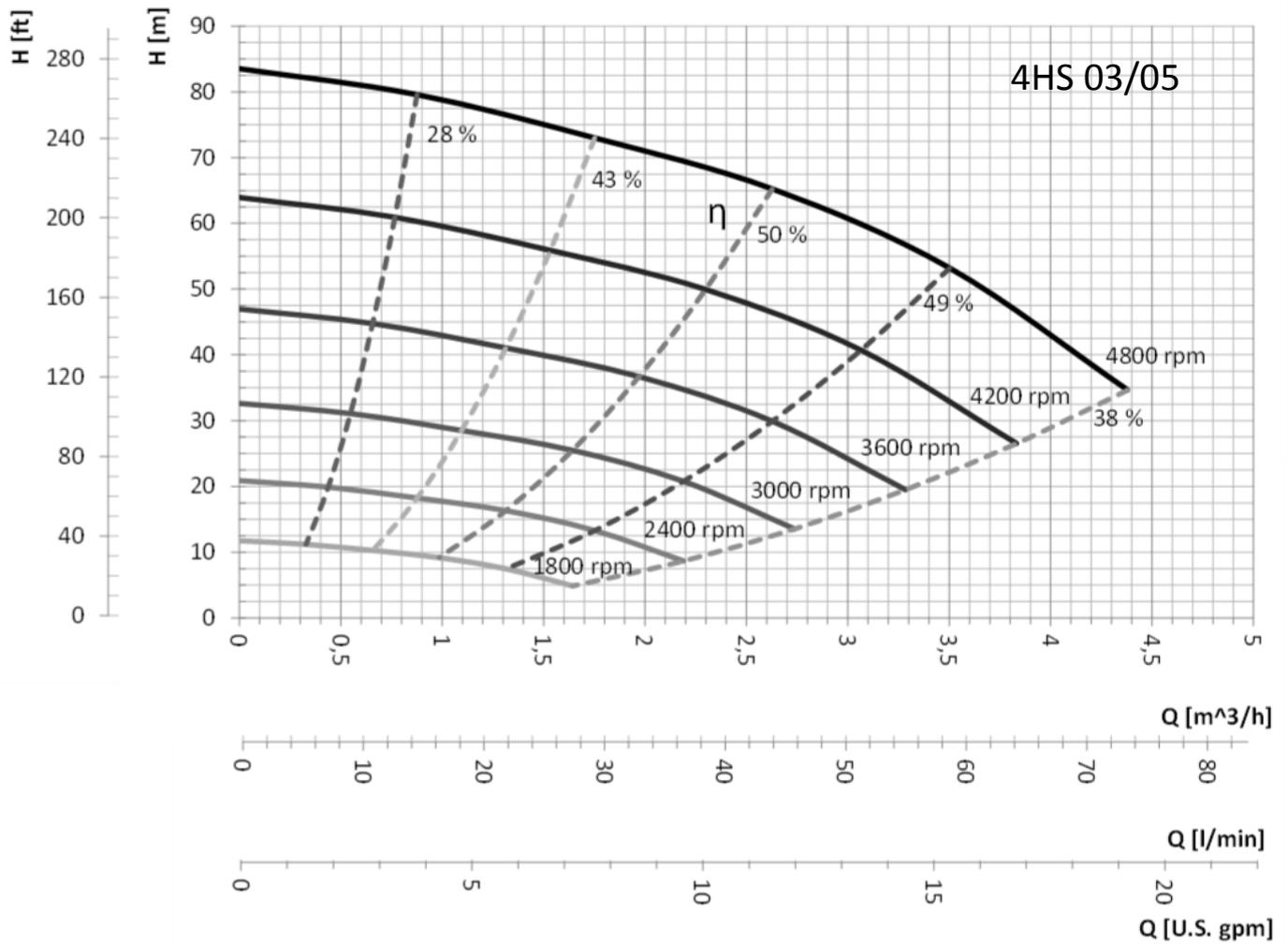


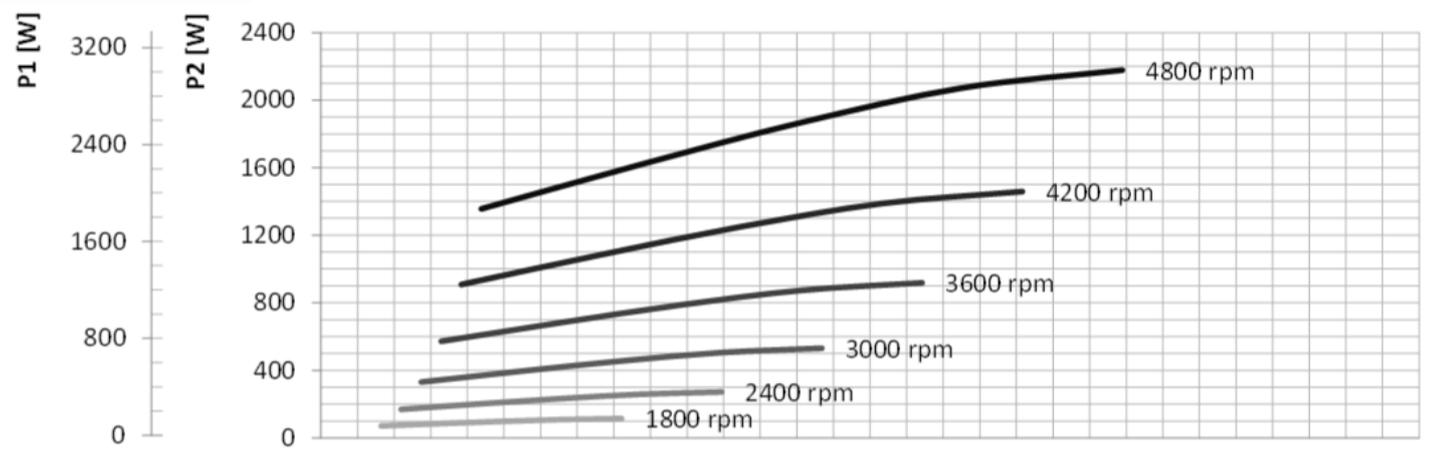
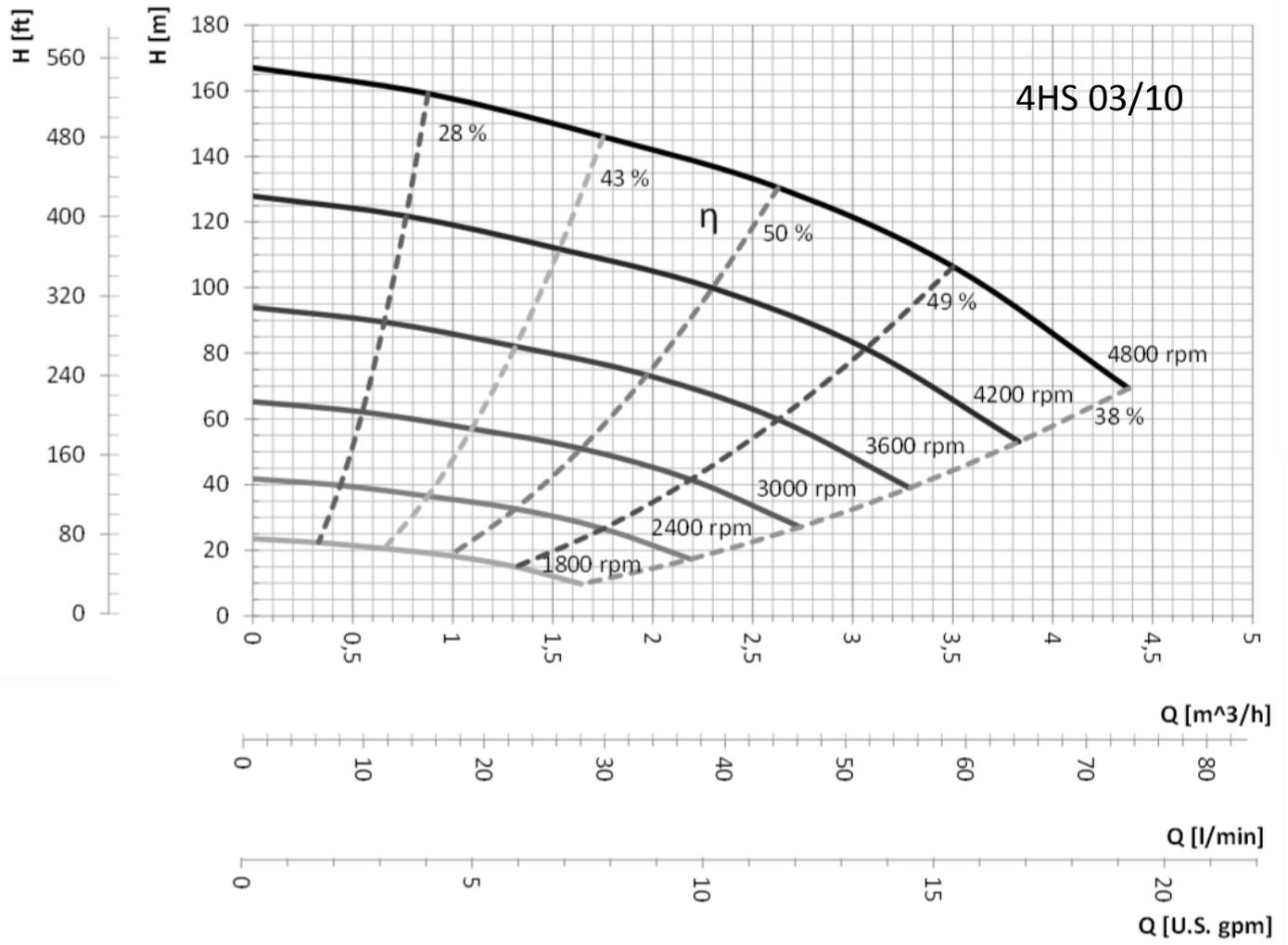
To stabilize the pressure control operated by the CM module, it is suggested to put the pressure sensor near the well exit, after the check valve.

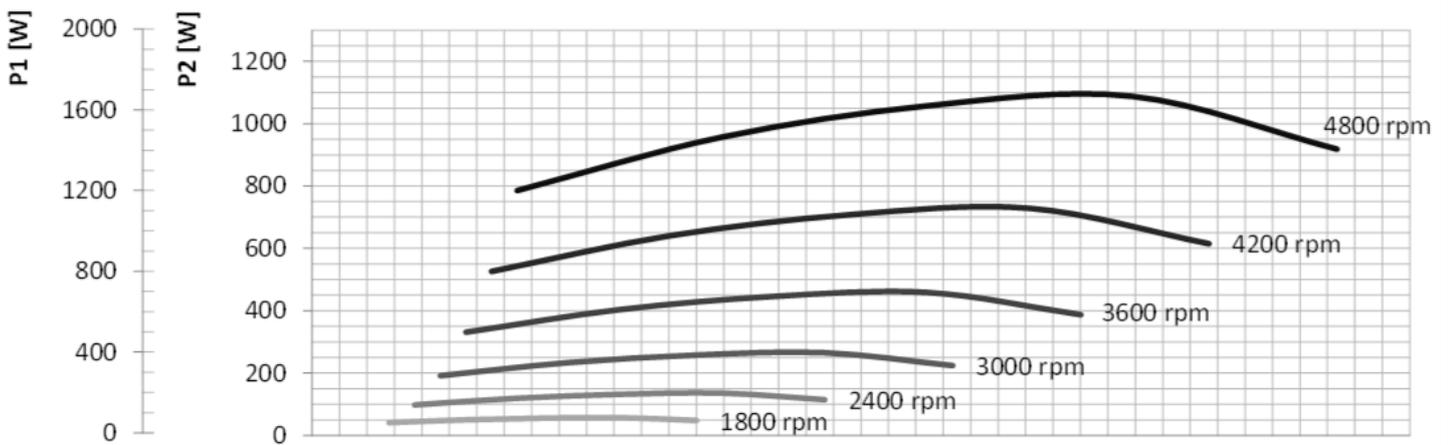
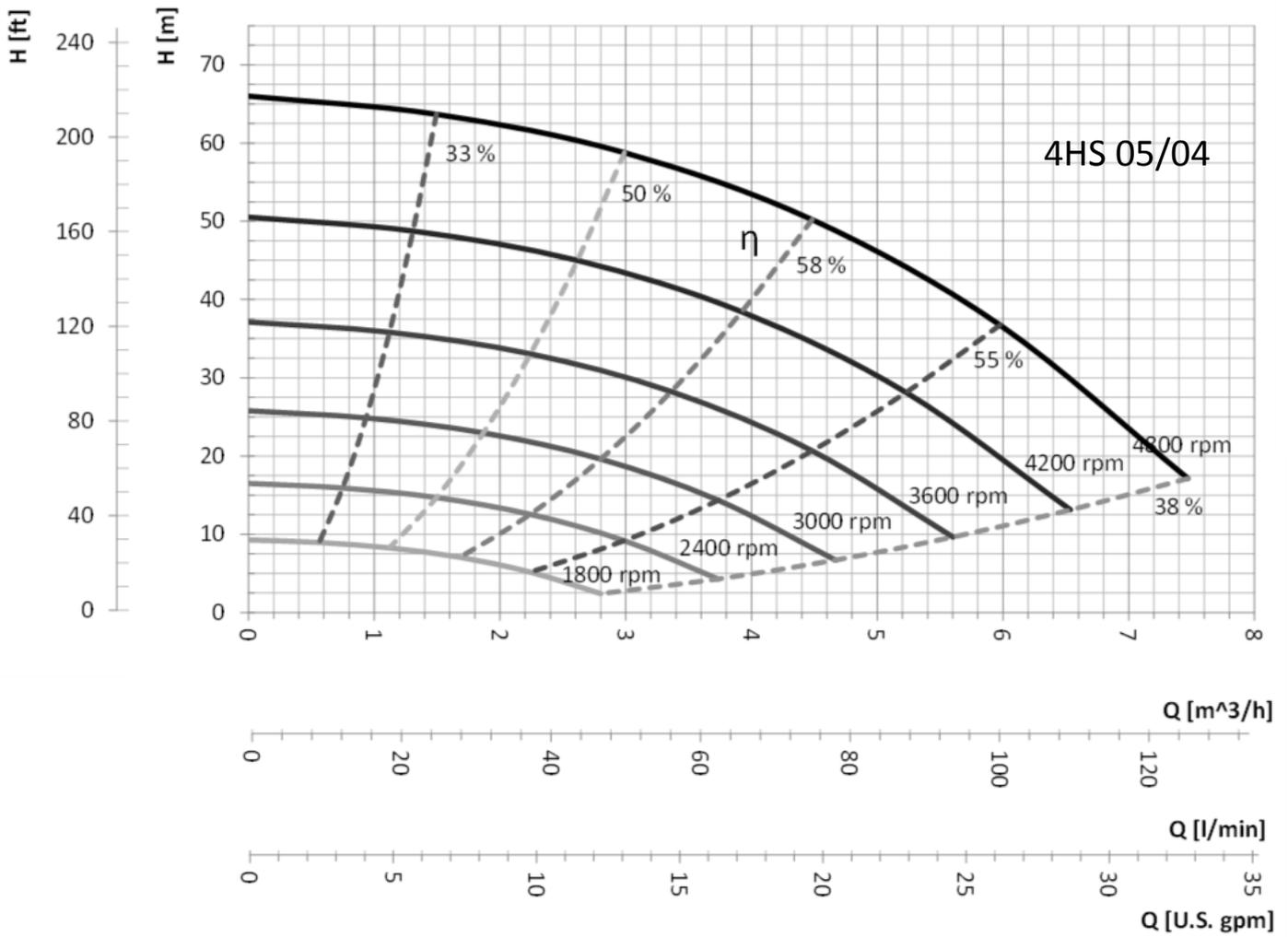
9. Performance

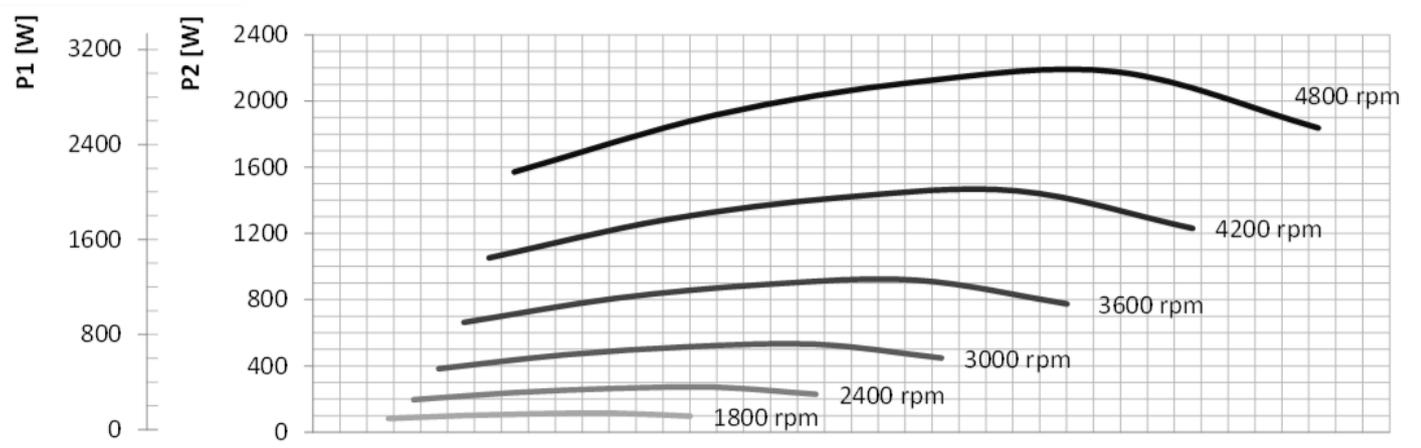
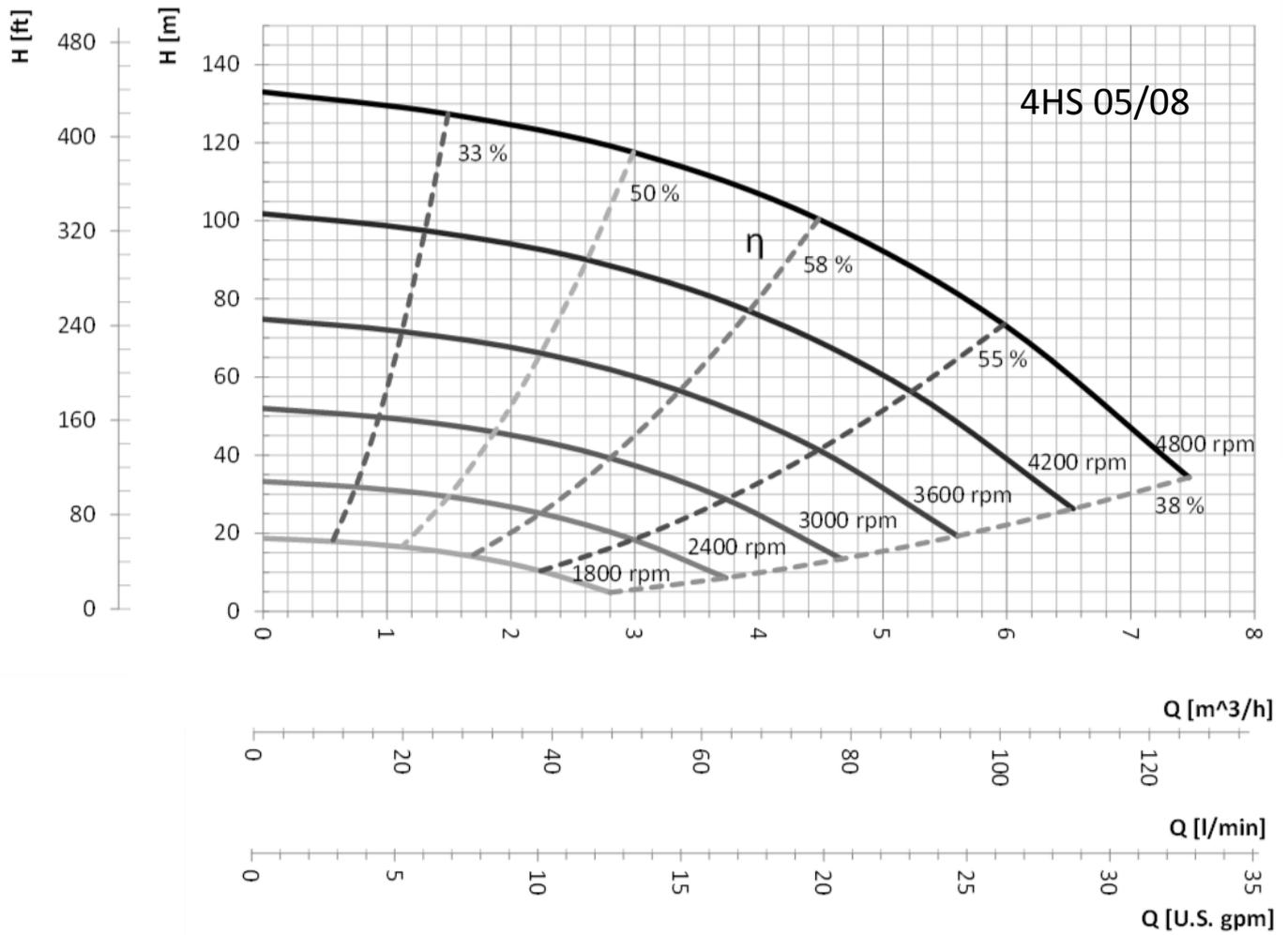
Model	Voltage supply	Max input current	P.F.	Max input power	Length	Discharge	Weight	Max diameter*	Packaging dimensions	Packaging weight
4HS	[VAC]	[A]		P1 [W]	[mm]		[kg]	[mm]	[cm]	[Kg]
03/05 M	1 x 190 - 265	9,5	1	1800	900	1 1/4 "	19,7	101	120x20x29	21,2
03/10 M	1 x 190 - 265	16	1	3200	1055	1 1/4 "	22,2	101	120x20x29	23,2
05/04 M	1 x 190 - 265	9,5	1	1800	879	1 1/2 "	19,5	101	120x20x29	21
05/08 M	1 x 190 - 265	16	1	3200	1013	1 1/2 "	22	101	120x20x29	23
08/03 M	1 x 190 - 265	9,5	1	1800	858	1 1/2 " 2"	19,4	101	120x20x29	21
08/05 M	1 x 190 - 265	16	1	3200	950	1 1/2 " 2"	21	101	120x20x29	22

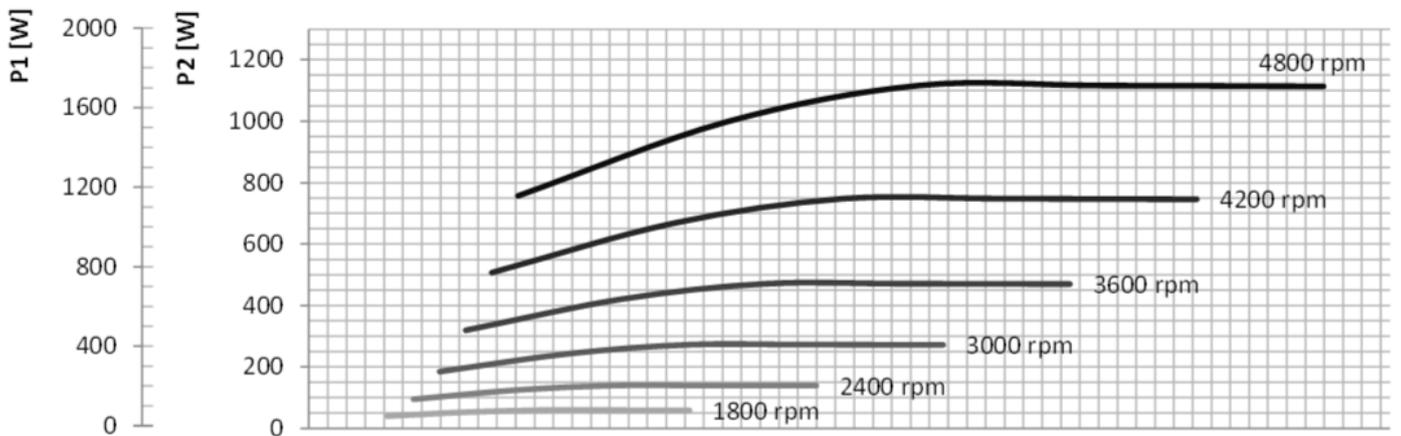
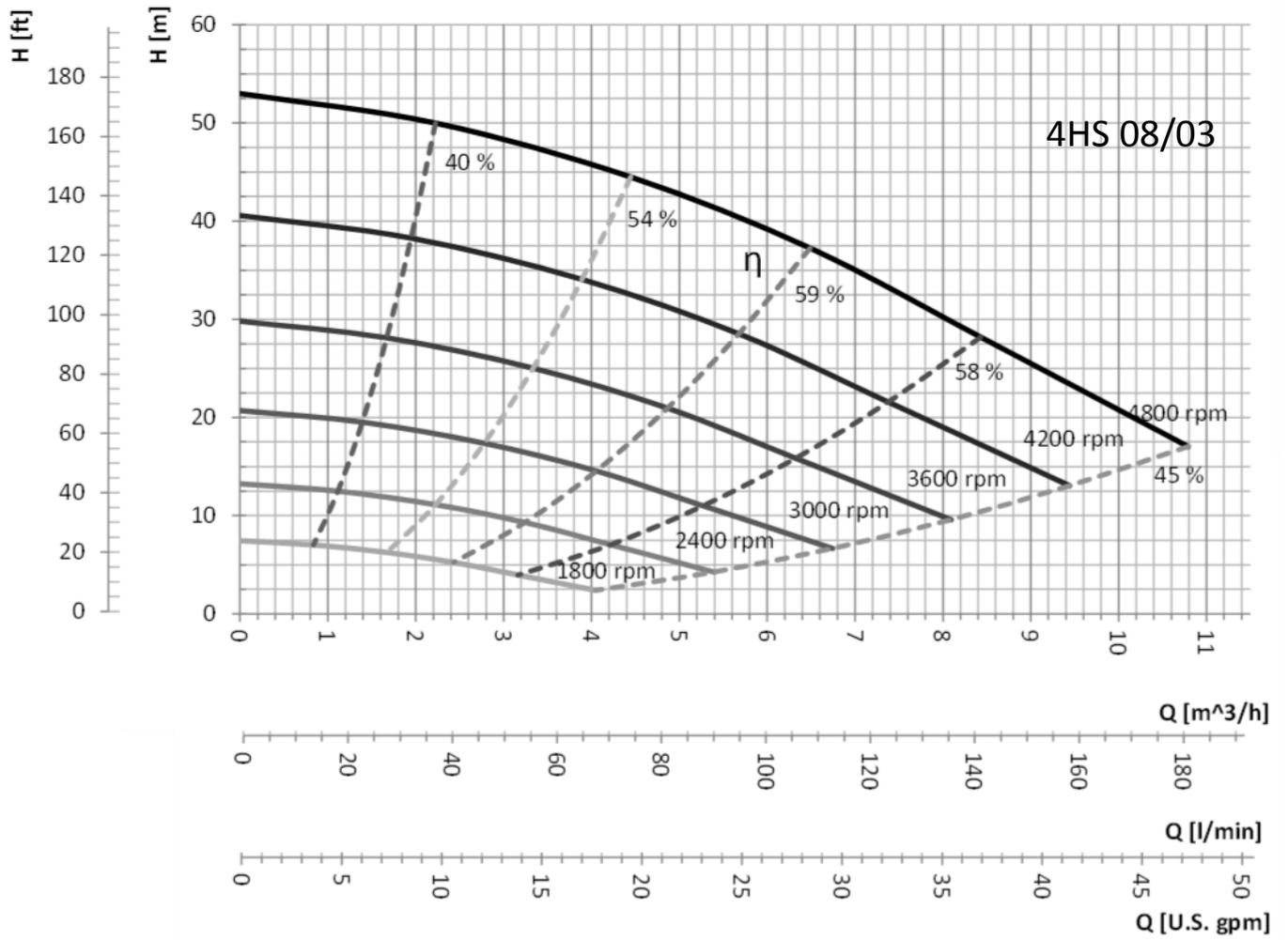
* including cable guard.



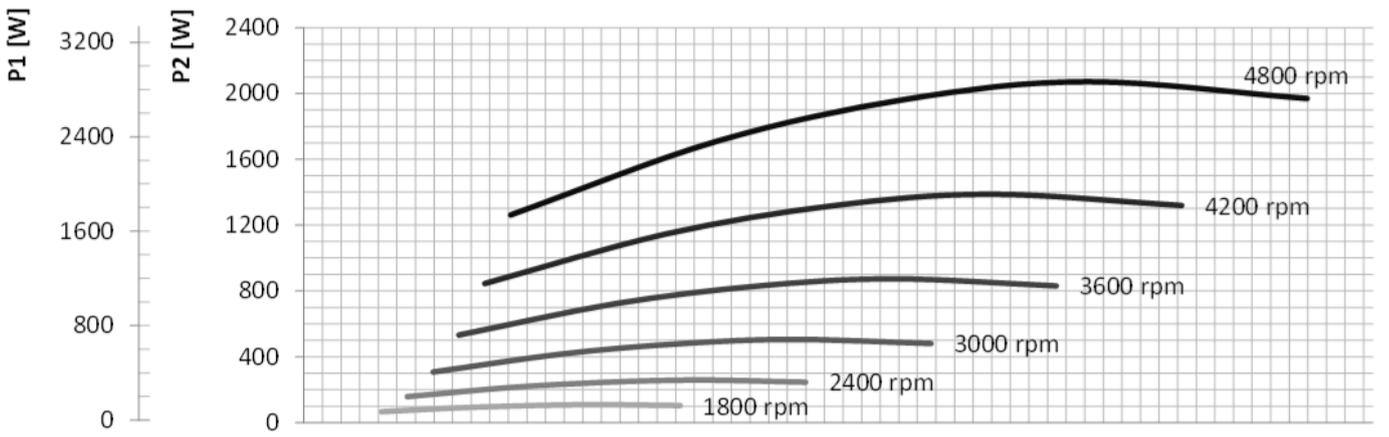
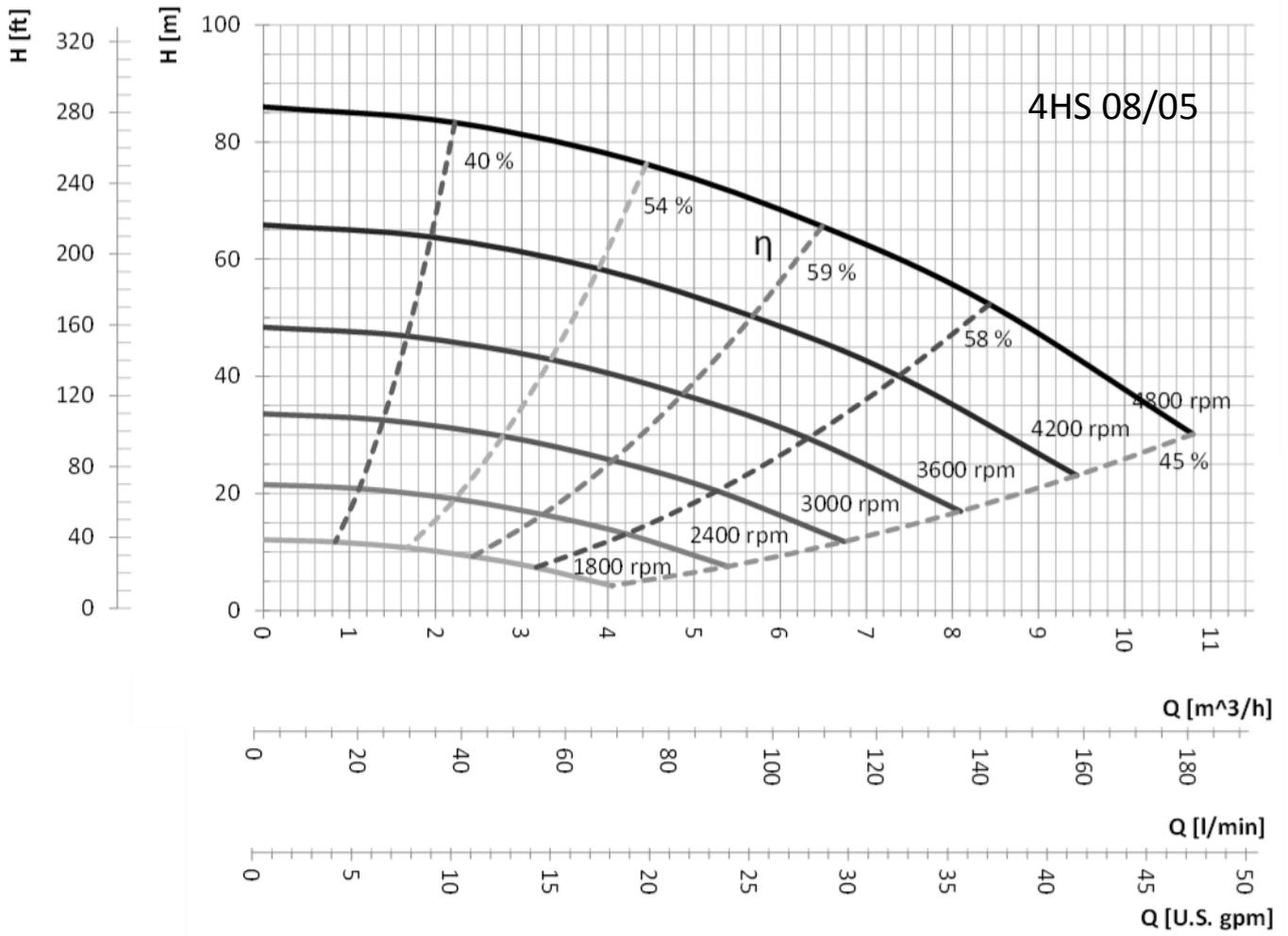








4HS 08/05



10. 4HS use and programming

CM software is extremely simple to use, but allows a wide variety of parameters to be set for ideal system calibration.

Setting Parameters are organized in 2 levels:

1: Installer level

A password is required for this level; these parameters are adjustable by trained professionals

Default password: **001**

From the menu a different password can be set up.

2. Advanced level

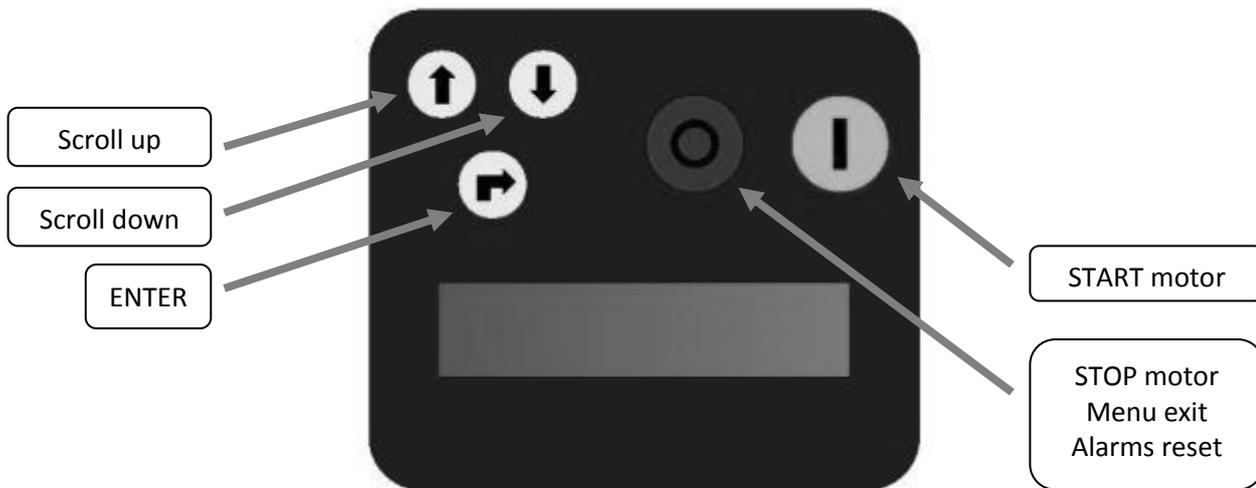
A second and different password is required; improper setting of these advanced parameters could compromise the integrity and the life of CM and pump;

Default password **002**

It is possible to set up a different password.

Installer and Advanced levels can be entered only with the correct password; otherwise, it is impossible to set up and/or modify any parameters (they can be only displayed).

10.1 Display



Screen is a back-lit LCD displaying 2 rows of 16 digits each. Alarms are indicated by an audible signal.

10.2 Initial setting

When the 4HS is switched on for the first time, the initial setting menu is displayed for the initial setting of parameters to configure pumps and plant characteristics. If the initial setting procedure is not ended properly, it is impossible to run the pump. Initial setting procedure can be repeated. The CM software suggests default values for each parameter. If you wish to change the suggested value, press ENTER button, wait for the value blinks and act on the scroll keys. Press ENTER again to set the new value that will end to flash. A detailed description of parameters of initial setting will follow:

parameter	default	description
Language XXXXXX	XXXX	End user communication language
Unit XXXXX	bar	Unit
Control mode: Constant pressure		
F. scale sensor p = XX.X [bar]	16	Sensor full scale.
Sensor test Press ENT		If the transducer is not connected or connected improperly, the signal SENSOR OFF is activated when pressing ENTER.
Max alarm value p = XX.X [bar]	10	Maximum pressure allowed in the system. If the pressure goes over this value, an alarm occurs and the pump is stopped. Pump is automatically restarted if the pressure goes below the maximum value for a period of at least 5 seconds.
Set value p = XX.X [bar]	3	The pressure value to be kept constant.
Autorestart ON/OFF	OFF	If ON is selected, after a lack of voltage, CM returns to its normal status; if CM was powering the pump before the voltage drop, it resumes powering the pump automatically. <u>Warning</u> , review the advice in chapter 1
INITIAL SETUP COMPLETED		Once the Setting procedure is completed you will get this indication on the display; setting parameters are recorded by CM; these parameters can be set up individually in the INSTALLER Parameters menu or ADVANCED Parameters menu.

10.3 Initial view

When powering the CM LCD display shows: model, release of digit display software (LCD =X.XX) and the release of inverter software (INV = X.XX) as shown below:

www.nastec.eu
4HS

www.nastec.eu
LCD = X.XX

www.nastec.eu
INV = X.XX

The following End User messages are displayed by pushing the scroll buttons:

<p>Inv: ON/OFF Mot: ON/OFF</p> <p>p = XX.X [bar]</p>	<p><i>p is the pressure value read by the pressure transducer.</i></p> <p><i>By pressing ENTER the pressure set value is displayed <XXX.X></i></p>
------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------

<p>Inv: ON/OFF Mot: ON/OFF</p> <p>f = XXX [Hz]</p>	<p>f value is the supply frequency to the motor; On fix frequency control mode, by pressing ENTER you can change the f value manually (word "set" is displayed) , press ENTER again to exit parameter setting (word "set" disappeared).</p>
<p>Inv: ON/OFF Mot: ON/OFF</p> <p>V_in = X.XX [V] I= XX.X</p>	<p>V_in is the line voltage. This value is displayed only if motor is OFF; if motor is ON, A value equal to the absorbed motor current.</p>
<p>Inv: ON/OFF Mot: ON/OFF</p> <p>cosphi = XXX</p>	<p>cosphi index means the angle phi between the voltage and current absorbed by the motor</p>
<p>Inv: ON/OFF Mot: ON/OFF</p> <p>P = XXXXX [W]</p>	<p>P is the power in Watts supplied to the pump.</p>
<p>Inv: ON/OFF Mot: ON/OFF</p> <p>STATUS: NORMAL</p> <hr/> <p>Inverter Life</p> <p>xxxxx h : xx m</p> <hr/> <p>Motor Life</p> <p>xxxxx h : xx m</p> <hr/> <p>%f 25 50 75 100</p> <p>%h XX XX XX XX</p> <hr/> <p>XXXXXXXXXXXXXXXXXXXX</p> <p>XXXXXXXX h : XX m</p>	<p>NORMAL status means no alarms. If an alarm occurs, a message blinks on the display and an audible signal is activated. Pressing ENTER accesses: Inverter lifetime, motor lifetime, consumption statistic, alarm list. To return to previous views, press ENTER.</p>
<p>Menu</p> <p>ENT to enter</p>	<p>Return to MENU list by pressing ENTER.</p>

First row gives the 4HS status:

- **Inv:ON XXX.X Hz** CM is powered and feeding the 4HS showing its frequency.
- **Inv:ON Mot: OFF** CM is powered but 4HS is not running (i.e. motor/pump was stopped due to minimum frequency being reached).
- **Inv:OFF Mot: OFF** 4HS is not controlled.

If COMBO function is activated, the CM address is placed close to indication "**Inv**".

10.4 Menu display

Pressing ENTER where you are in [MENU' / ENT to access] in initial display, the following MENUs are displayed:

MENU Instal. param.	Password required to enter (default 001)
MENU Advanced param.	Password required to enter (default 002)
MENU Retrieve Init. Set.	Installer password required to enter (default 001) It is possible to return to original default set parameters (Change Init. Set.)
MENU' Change Init. Set.	Password required to enter (default 002)

To exit the Menu level and return to INITIAL DISPLAY is enough to press STOP button

10.5 Installer parameters

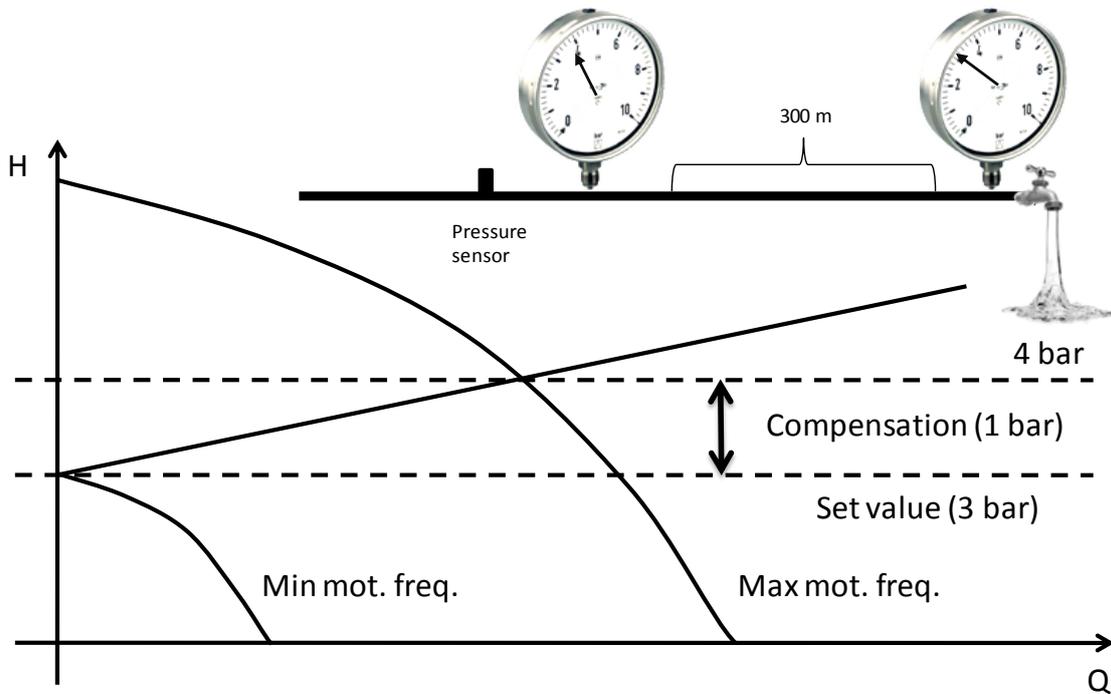
Most of the installer parameters are already set up during the initial configuration. Through this menu is possible to change again the previous parameters or enable further parameters allowing a perfect calibration of the pumping system in relation to the plant.

parameter	default	description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Control mode</p> <ul style="list-style-type: none"> • Constant value • Fix speed • Const.value 2set • Fix speed 2 val. • External speed </div>	Constant value	<p>Mode of control:</p> <ul style="list-style-type: none"> • Constant value: CM changes the speed of pump to keep the set value constant, independent of water demand. • Fix speed: CM feeds the pump a set frequency, so the speed of motor is kept constant. • Const. value 2 set: the two values are selected by opening or closing the digital input IN2. • Fix speed 2 val: to be selected by opening or closing the digital input IN2. • External speed: control motor frequency by using analogical input AN4. 					
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Unit XXXXX</p> </div>	bar	Unit	✓	✓	✓	✓	✓

parameter		default	description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
F. scale sensor p = XX.X [bar]		16	Sensor full scale.	✓	✓	✓	✓	✓
Min value sensor p = XX.X [bar]		0	Sensor minimum value.	✓	✓	✓	✓	✓
Max alarm value p = XX.X [bar]		10	Maximum value allowed in the system. If the readen value goes over this value, an alarm occurs and the pump is stopped. Pump is automatically restarted if the readen value goes below the maximum value for a period of at least 5 seconds.	✓	✓	✓	✓	✓
Min alarm value p = XX.X [bar]		0	Minimum value allowed in the system. If the readen value goes lower than this value, an alarm occurs and the pump is stopped. Pump is automatically restarted if the readen value goes higher than the minimum value for a period of at least 5 seconds.	✓	✓	✓	✓	✓
Ext.set enabling ON/OFF		OFF	Enabling of set value changing by analog input AN3.	✓		✓		
Set value p = XX.X [bar]		3	The set value to be kept constant.	✓				
Compensation p = XX.X [bar]		0	Value compensation at the maximum frequency for each pump. Acting on the green button you can reverse the sign.	✓				
Set value 2 p = XX.X [bar]		3	The set value to be kept constant.			✓		
Compensation 2 p = XX.X [bar]		0	Value compensation at the maximum frequency for each pump. Acting on the green button you can reverse the sign.			✓		
Set value update t = XX [s]		5	Time to update set value for compensation.	✓		✓		

parameter	default	description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
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To ensure proper operation of pressure control is recommended to place the sensor near the pump.
 To compensate the pressure loss in the pipes (proportional to flow) it is possible to vary the pressure set in a linear relation with respect to frequency.



It can perform the following test to verify the correct value of compensation:

1. install a pressure gauge away from the pressure sensor
2. open completely the valve
3. check the pressure gauge

--> Set the value of *compensation*. equal to the difference of the values from the two gauges.

When using a group of pumps, the pressure compensation to be applied to each pump is equal to the total pressure compensation (when all the pumps are running at full speed) divided by the number of pumps in the group.

Operating freq. f = XXX [Hz]	50	Set the frequency value to feed the pump.		✓			
Operating freq. 2 f = XXX [Hz]	50	Set the frequency value to feed the pump.				✓	
Freq.min.control fmin = XXX [Hz]	50	Minimum frequency below which the pump tries to stop.	✓		✓		✓
Stop delay t = XX [s]	5	Delay for which the pump tries to stop below freq.min. control.	✓		✓		✓

parameter	default	description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Start delay AUX t = XX [s] </div>	1	delay time with which the auxiliary pumps start after the variable speed pump has reached the maximum frequency and the readen value has fallen below set value – delta control.	✓		✓		
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> COMBO ON/OFF </div>	OFF	Function to enable multiple CM's to work in parallel as described in the technical appendix (see the relevant chapter). Up to 8 CM units can be connected in parallel. CM's communication through RS 485 gates is granted by a private protocol.	✓		✓		
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> PI control Direct/Reverse </div>	Direct	Direct: increasing misured value, CM decreases motor frequency. Reverse: increasing misured value, CM increase motor frequency.	✓		✓		
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Dry run cosphi cosphi = X.XX </div>	0.65	If the pump goes into dry-running, the cosphi reaches its lowest level. To set this value, contact the pump manufacturer or test by closing the suction and checking the value on the CM display;	✓	✓	✓	✓	✓
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Restarts delay t = XX [min] </div>	10	Restart delay after a dry running alarm. At each tentative (max 5) restart delay will be doubled.	✓	✓	✓	✓	✓
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Digital input 1 N.O. / N.C. </div>	N.O.	By selecting N.A. (normally open) CM runs the motor if the digital input 1 is open; motor will be stopped if the digital input 1 is closed. By selecting N.C. (normally closed) CM runs the motor if the digital input 1 is closed; motor will be stopped if the digital input 1 is opened.	✓	✓	✓	✓	✓
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Digital input 2 N.O. / N.C. </div>	N.O.	By selecting N.A. (normally open) CM runs the motor if the digital input 2 is open; motor will be stopped if the digital input 2 is closed. By selecting N.C. (normally closed) CM runs the motor if the digital input 2 is closed; motor will be stopped if the digital input 2 is opened.	✓	✓	✓	✓	✓

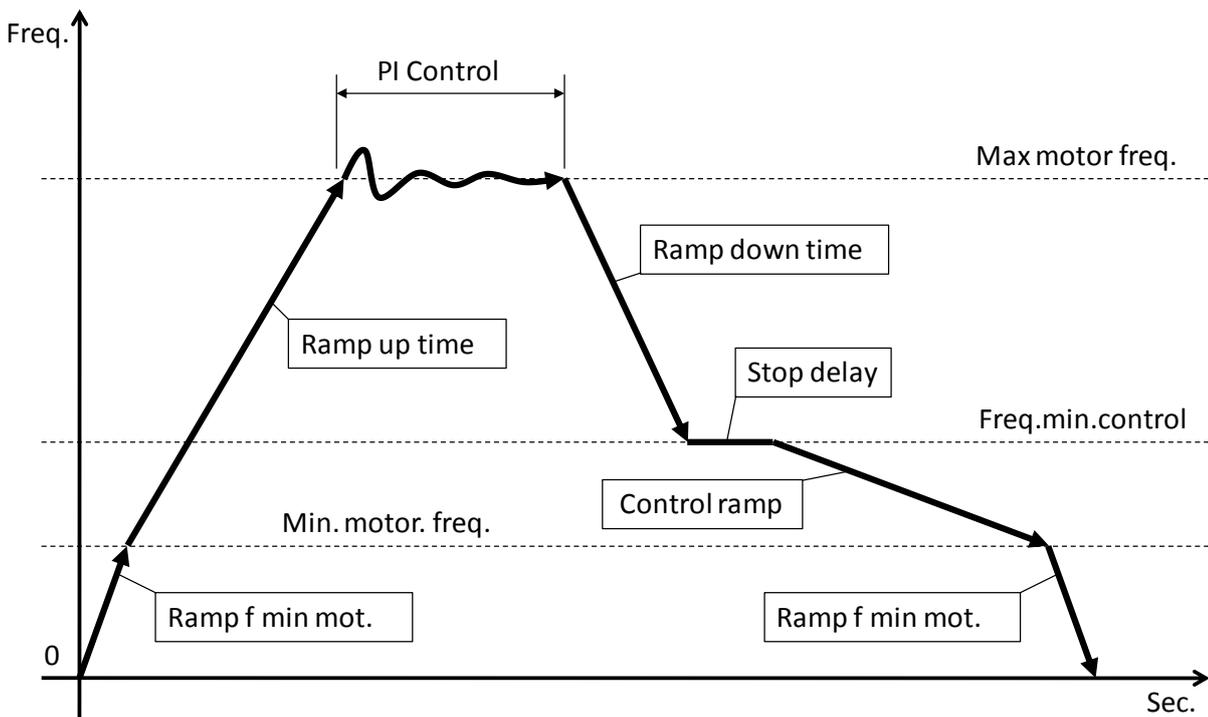
parameter	default	description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Digital input 3 N.O. / N.C. </div>	N.O.	By selecting N.A. (normally open) CM runs the motor if the digital input 3 is open; motor will be stopped if the digital input 3 is closed. By selecting N.C. (normally closed) CM runs the motor if the digital input 3 is closed; motor will be stopped if the digital input 3 is opened.	✓	✓	✓	✓	✓
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Digital input 4 N.O. / N.C. </div>	N.O.	By selecting N.A. (normally open) CM runs the motor if the digital input 4 is open; motor will be stopped if the digital input 4 is closed. By selecting N.C. (normally closed) CM runs the motor if the digital input 4 is closed; motor will be stopped if the digital input 4 is opened.	✓	✓	✓	✓	✓
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Dig.In.2/3 delay t= XX [s] </div>	3	Digital input IN2 and IN3 delay. Digital input IN1 and IN4 have 1 second fix delay.	✓	✓	✓	✓	✓
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Change PASSWORD1 ENT </div>		Pressing ENT allows the installer level password (1st level) (default 001) to be changed.	✓	✓	✓	✓	✓

10.6 Advanced parameters

All the advanced parameters, due to their importance, are automatically set during initial setup. However, it is always possible to modify individual parameters or modify the password 2:

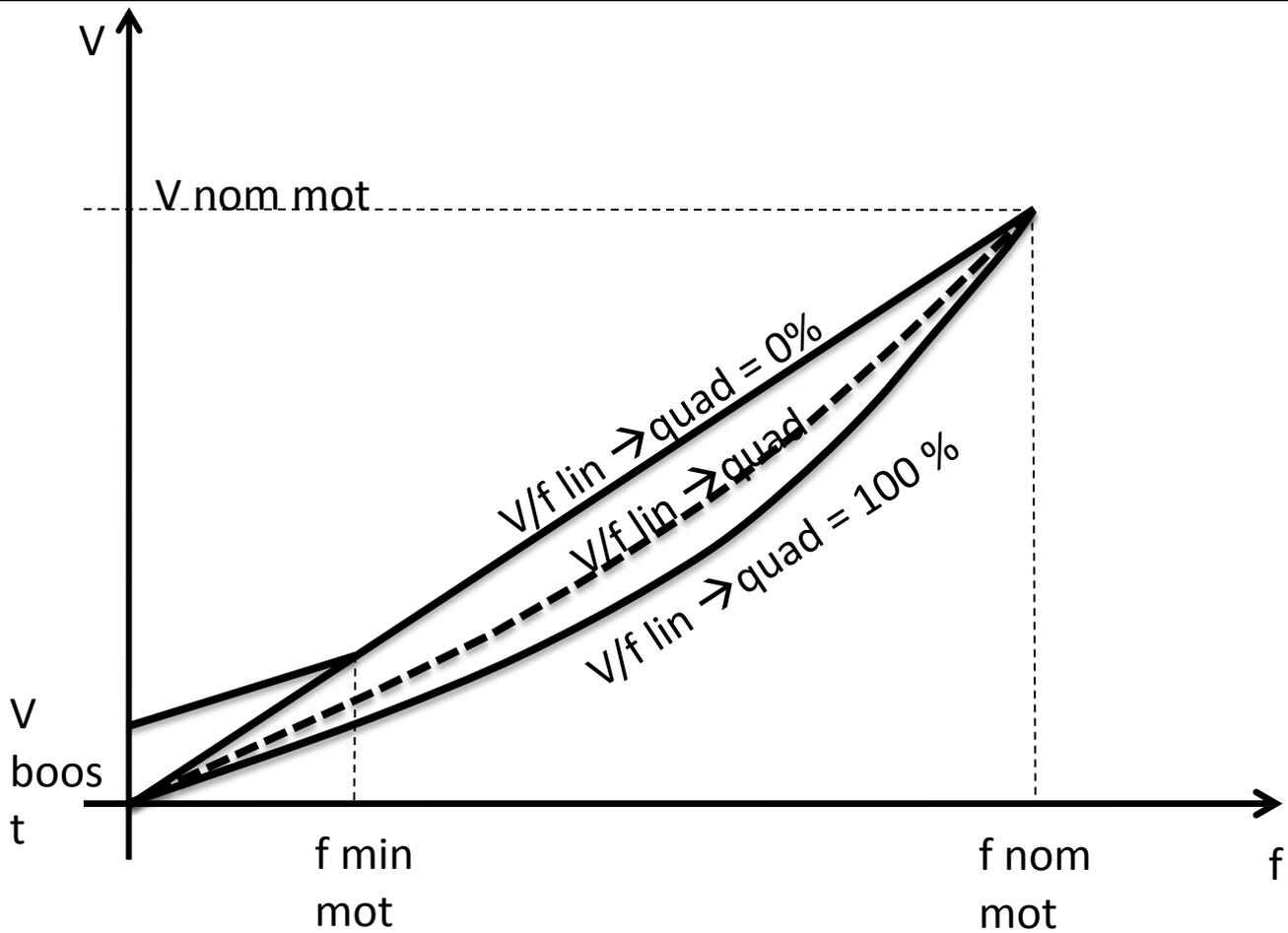
parameter	default	description
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Rated motor Volt. V = XXX [V] </div>	230	Motor rated voltage.
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Voltage boost V = XX [%] </div>	1	Refers to the voltage increase during the start up of the motor.
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Max motor Amp. I = XX.X [A] </div>	12	Max current absorbed by the motor. This parameters allows the possibility to limit the current to the motor limiting as well the hydraulic performances.

parameter	default	description
Max motor freq. f = XXX [Hz]	110	Maximum frequency of the motor. Note: by reducing the maximum frequency of the motor, maximum current will be reduced as well.
Min motor freq. f = XXX [Hz]	40	Minimum frequency of the motor. Note: for 4HS pump is not advisable to set minimum frequency lower than 40 Hz in order to protect the integrity of the thrust bearings.
Ramp up time t = XX [sec]	5	Ramp-up time to reach the speed required to achieve the set pressure (or frequency value). Longer times delay the system reaching the pre set value but better protect system components. Excessively long ramp-up times can create difficulties in CM setup, and can also cause false overload alarms.
Ramp down time t = XX [sec]	5	Ramp-down time to reach zero speed. Longer times keep the system pressurized, while protecting the system components. Excessively long ramp-down times can create difficulties in CM setup. Excessively short ramp-down times can cause false overload alarms.
Ramp f min mot. t = XX [sec]	0.5	Time to reach the minimum frequency of the motor and vice versa. Note: it's important to keep this time less than one second.



Dry run cosphi cosphi = X.XX	0.50	If the pump goes into dry-running, the cosphi reaches its lowest level. Typically the value 0.50 is sufficient to detect dry running pump 4HS.
PWM f = XX [kHz]	10	Carrier frequency (switching frequency). It is possible to chose PWM in the range of 2.5 ,4, 6, 8, 10 kHz .
V/f lin. --> quad. XXX %	50	This parameter allows you to change the V / f characteristic with which MINT feeds the engine. The linear characteristic corresponds to constant torque with variable speed. The quadratic characteristic is normally used with centrifugal pumps. The selection of torque characteristic should be done ensuring a smooth operation, a

parameter	default	description
		reduction of energy consumption and a lower level of heat and acoustic noise.



Autorestart ON/OFF	OFF	If ON is selected, after a lack of voltage, CM returns to its normal status; if CM was powering the pump before the voltage drop, it resumes powering the pump automatically. <u>Warning</u> , review the advice in chapter 1.
Periodic autorun t = XX [h]	0	Pump periodic autorun after XX hours of inactivity. Value 0 makes function disabled. <u>Warning</u> , review the advice in chapter 1.
AN1,AN2 function XXXXXX	Independent	Function logic for analog input AN1,AN2.
Offset input 1 x = XX.X [%]	20%	Zero correction for analog input 1 (20 mA x 20% = 4 mA).
Offset input 2 x = XX.X [%]	20%	Zero correction for analog input 2 (20 mA x 20% = 4 mA).
Offset input 3 x = XX.X [%]	20%	Zero correction for analog input 3 (20 mA x 20% = 4 mA).

parameter	default	description
Offset input 4 x = XX.X [%]	00%	Zero correction for analog input 4 (default 0-10V) (10V x 00% = 0 V).
Change PASSWORD2 ENT		Pressing ENT allows the advanced level password (2st level) (default 002) to be changed.

11. Protections and alarms

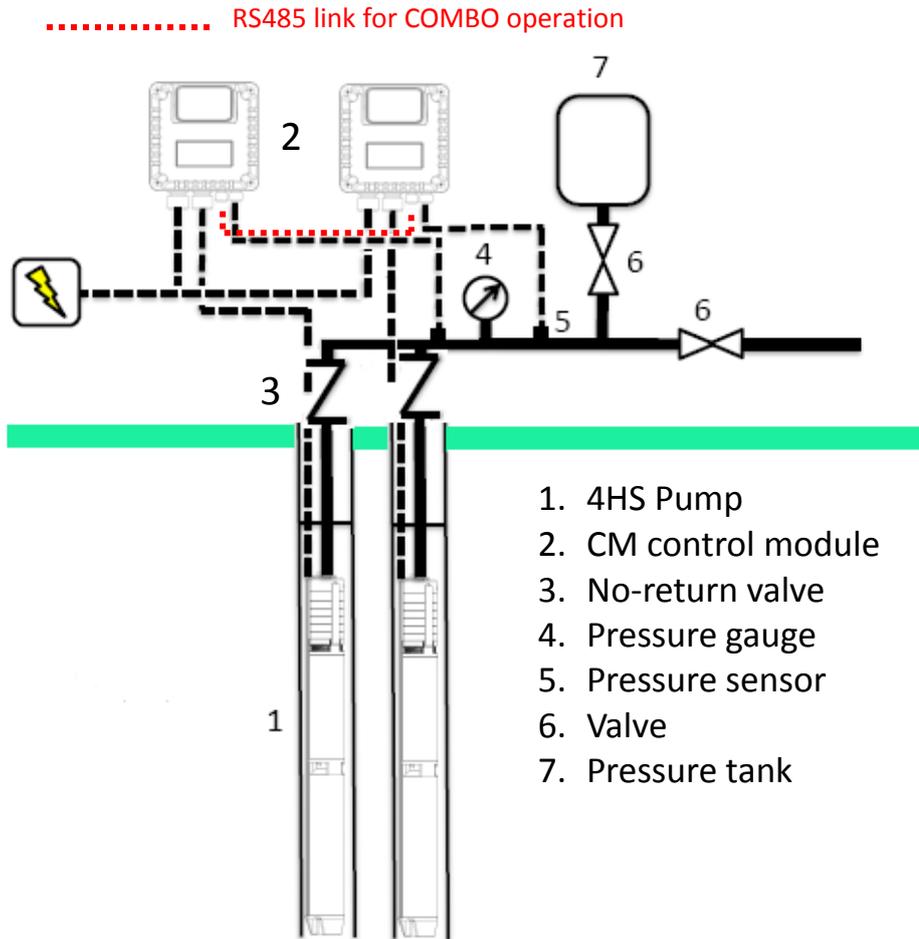
Anytime a protection occurs a blinking message is displayed together an acoustic alarm; on STATUS on INITIAL VIEW the protection is displayed; by pressing STOP button (only and exclusively from the this position of STATUS on INITIAL VIEW) is possible to try to reset the alarm; if CM does not reset the alarm it is displayed again together an acoustic sound.

ALARM MESSAGE	ALARM DESCRIPTION	POSSIBLE SOLUTIONS
OVERCURRENT MOT.	Motor overload: input current of the motor is higher than the rated motor current setting parameter.	<ul style="list-style-type: none"> Check possible causes of over current
UNDER VOLTAGE	Supply voltage too low	Check possible causes of undervoltage
OVER VOLTAGE	Supply voltage too high	Check possible causes of overvoltage
OVER TEMP. INV.	Inverter over temperature	<ul style="list-style-type: none"> Make sure that water temperature is less than 35°C .
NO WATER (DRY RUN COSPHI)	Motor cosphi is lower than the set value of dry running cosphi	<ul style="list-style-type: none"> Check water level. Check the set value of dry running cosphi. <p>If pump's cosphi is lower than the set dry-running cosphi for at least 2 seconds, CM stops the pump. CM tries to run the pump every 10, 20, 40, 80, 160 minutes and then the pump is stopped.</p> <p>WARNING: if dry running protection occurs, CM will try to start the pump automatically. Be sure to cut power supply to CM before performing any maintenance.</p>
SENSOR FAULT	Sensor error	<ul style="list-style-type: none"> Check the transducer Check the wiring of transducer
MAX. VALUE ALARM	Measured value has reached the maximum value accepted by the system.	<ul style="list-style-type: none"> Check possible causes of reaching max value Check the max alarm value setting

MIN. VALUE ALARM	Measured value has reached the lowest value accepted by the system.	<ul style="list-style-type: none"> • Check possible causes reaching min value (i.e. broken pipe, open pressure relief valve, etc.) • Check the min alarm value setting.
IGBT TRIP ALARM	The current exceeds IGBT module capacity.	<ul style="list-style-type: none"> • Increase the ramp-up time
ALL COM. INV.	No communication between CM and 4HS pump	<ul style="list-style-type: none"> • Check signal wires connection.
NO COMMUNICATION	Communication between Master and slave(s) has been interrupted	<ul style="list-style-type: none"> • Check the wiring connections • Make sure the Master is not in the Menu level; if so, exit from the level. • In the STATUS of the slave (where the alarm is displayed) try to reset the alarm by pushing STOP button.
ADDRESS ERROR	Same address as other CMs in the group	<ul style="list-style-type: none"> • The address of each CM needs to be different
KEYBOARD FAULT	A Button on the keyboard has been pressed for more than 150 seconds	<ul style="list-style-type: none"> • Make sure buttons are not depressed • Call service assistance
ACTIVE DIG.IN.X	Digital input X opened /closed	<ul style="list-style-type: none"> • Check the input digital configuration (Installer Parameters menu)
ALARM SLAVE XX	slave XX error detected by master	<ul style="list-style-type: none"> • check the status of the slave
	<p>If pumps cosphi is lower than the dry-running cosphi for at least 2 seconds, CM will stop the pump. CM will try to run the pump every 10, 20, 40, 80, 160 minutes and then the pump is stopped.</p> <p>ATTENTION: if dry-running protection occurs, CM will try to start the pump automatically. Be sure to cut power supply before attempting maintenance</p> <p>CM will stop the pump if the input motor current is higher than the set motor current for an extended time. By pressing the START button it is possible to run the pump again.</p> <p>CM will stop the pump if the input voltage is higher than the set voltage for an extended time. By pressing the START button it is possible to run the pump again. CM will stop the pump if the input voltage is lower than the set voltage for an extended time. By pressing the START button it is possible to run the pump again.</p>	

12. Auxiliary pumps during constant pressure control

When the water needs vary considerably, it is advisable to share the water request between several pumps ensuring better efficiency and reliability.



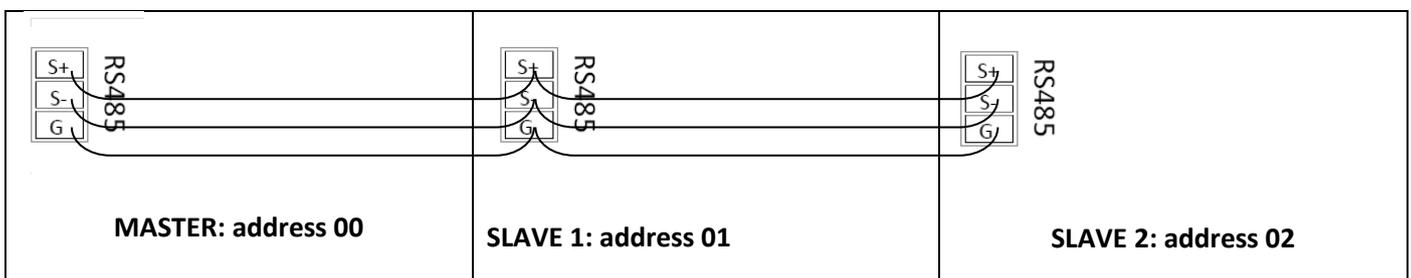
12.1 COMBO function

In the “Installer parameters” menu it is possible to enable the COMBO function that allows serial communication between up to 8 CM.

To achieve the COMBO function in a system consisting of several interconnected CMs, use a pressure sensor connected to each CM. The value of the *set pressure* is communicated to the slaves via the serial port. To prevent the shutdown of the system due to pressure sensor failure, connecting a 2nd pressure sensor to the CM; make sure that the two pressure sensors are identical. Remember to perform the offset operation of the sensors in each CM (Installer Parameters menu) .

RS485 serial connection

CM’s communication is made through a private protocol using the RS485 port. Each CM must be connected to each other by using a tripolar cable (0,5 mm²) wired on S+,S-,G pins on control board.



Master setup

1. Supply power to the CM master.
2. If not yet completed, perform the initial configuration.
3. Initial view is shown:

<p>Inv: ON/OFF Mot: ON/OFF</p> <p>p_mis=XX.X [bar]</p>

4. Scroll until:

<p>Menù</p> <p>ENT to access</p>

5. Press ENT

<p>MENU'</p> <p>Param. install.</p>

6. Press ENT
7. Insert password (default 001).

8. Scroll until:

<p>Combo</p> <p>ON/OFF</p>

9. Set ON
10. Set:

<table border="1"> <tr> <td>Address</td> <td>XX</td> </tr> </table>	Address	XX	00	<p>CM's address in parallel operation.</p> <ul style="list-style-type: none"> • 00 : CM master
Address	XX			
<table border="1"> <tr> <td>Alternance</td> <td>ON/OFF</td> </tr> </table>	Alternance	ON/OFF	OFF	<p>Function to allow alternating between the CMs connected in parallel in order to allow equal use of each pump in the group; in this way Master will reorganize the starting priority of the pumps by checking the life of each of them.</p>
Alternance	ON/OFF			
<table border="1"> <tr> <td>Start delay AUX</td> <td>t = XX [s]</td> </tr> </table>	Start delay AUX	t = XX [s]	0	<p>Delay time with which the slaves start after the variable speed pump has reached the maximum frequency and the pressure value has fallen below set value – delta control</p>
Start delay AUX	t = XX [s]			

11. Press STOP (red button)
12. Press STOP again

Slave setup

Follow Master setup until point 11.

In case of failure of master in a Combo system, will be replaced by slave. As a consequence, all parameters must be setup independently on each inverter, master mode.

1. Set:

Address XX	CM's address in parallel operation. <ul style="list-style-type: none">• 01 --> 07: CM slaves
-------------------	---------------------------------------------------------------------------------------------------------------

2. Press STOP (red button).
3. In the *advanced parameters* verify that *Autorestart* is set *ON*.
4. Press STOP (red button).
5. Press STOP again.

Whenever the user accesses the Menu screen of the CM master, the communication between CMs is automatically interrupted.

In case of alarm or failure of a pump in a Combo system, this pump's operation will be replaced (temporary or permanently) by another pump.

In case of failure of master in a Combo system, it will be replaced by the next slave after about 1 minute. In order to enable master replacement Autorestart must be set ON in each slaves.

13. Trouble-shooting chart

<p>LCD does not switch on after powering the CM</p>	<ul style="list-style-type: none"> • Check the connecting flat cable between the LCD board (fixed to the cover) and the control board. • Check the fuses. • Check the feeding cable are properly connected .
<p>Power line of CM is interrupted by the differential protecting contactor</p>	<ul style="list-style-type: none"> • Check the leakage current to ground of EMC filter. • following a rapid off/on operation the power supply differential contactor can interrupt again the power . After turning off the 4HS is therefore recommended to wait at least 1 minute before start the system.
<p>When performing the Offset operation of the pressure device, SENS. PRESS. OFF alarm occurs</p>	<ul style="list-style-type: none"> • check that the sensor cable is properly connected to the sensor device and CM. • Make sure that the sensor and its cable are no damaged. • Check that the range of pressure sensor is of 4 -20 mA type and the value of 15 V will be within its voltage feeding range.
<p>Frequency and pressure oscillation on constant pressure control mode</p>	<ul style="list-style-type: none"> • Check if the water tank and its air pressure are correct. In addition, it is suggested to increase the tank volume or reduce the pre-charge pressure. • Check the ki e kp parameters (<i>Installer Parameters menu</i>). At first, it is advisable to increase the Ki value. If it not enough, reduce of one unit the Kp value.
<p>During constant pressure control, pump stops and starts continuously.</p>	<ul style="list-style-type: none"> • Make sure that the value f min control(<i>Installer Parameters menu</i>) is properly set up. • Increase the value of parameter stop delay (<i>Installer Parameter menu</i>). • Increase the value of Ramp control parameter (<i>Installer Parameters menu</i>).
<p>Measured pressure p_m drops too much before 4HS turning on the pump.</p>	<ul style="list-style-type: none"> • Decrease the delta start pressure (<i>Installer Parameters menu</i>). • Check if the water tank and its air pressure are correct. In addition it is suggested to increase the tank volume or reduce the pre-charge pressure. • Modify the value of ki e kp parameters (<i>Installer Parameters menu</i>). At first, it is advisable to reduce the Ki value. If it is not enough, increase of one unit the Kp value.

DECLARATION OF CONFORMITY

In according with:

Machine Directive 2006/42/EC

EMC Directive 2004/108/CE

Low Voltage Directive 2006/95/EC

4HS pumps conform to the following regulations:

EN 55011 Class A

EN 60335-1, EN60335-2-41

Ing. Marco Nassuato
Operation Manager



