

READ THIS HANDBOOK CAREFULLY BEFORE INSTALLING OR STARTING THE DEVICE.

The manufacturer guarantees this product for a period of 24 months as of the date of sale; if returned, the device must be accompanied by this handbook, with the installation date entered on the last page.

The guarantee is forfeited in the event of the following: the device is tampered with, disassembled or damaged due to mishandling and/or incorrect installation; the device is put to any other use than the one it was intended for; the device is installed in unsuitable environmental conditions or connected to a non-compliant electrical system.

The manufacturer cannot be held responsible for any kind of damage to people and/or things ensuing from failure to install the necessary electrical safety devices upstream of the device, or as a result of unprofessional installation.

The installation and servicing of this device must be performed by specially trained personnel with the ability to understand the entire contents of this owner's manual.

For all operations required to be carried out with the cover removed, the device must be disconnected from the power supply.

Even though there should not be any reason to remove the board, if you do so, remember that some of its parts remain live for a few minutes after the unit has been disconnected from the mains.

The manufacturer cannot be held responsible for any kind of damage to people and/or things ensuing from the failure of any internal safety devices, with the exception of compensation for the device itself if still under guarantee.

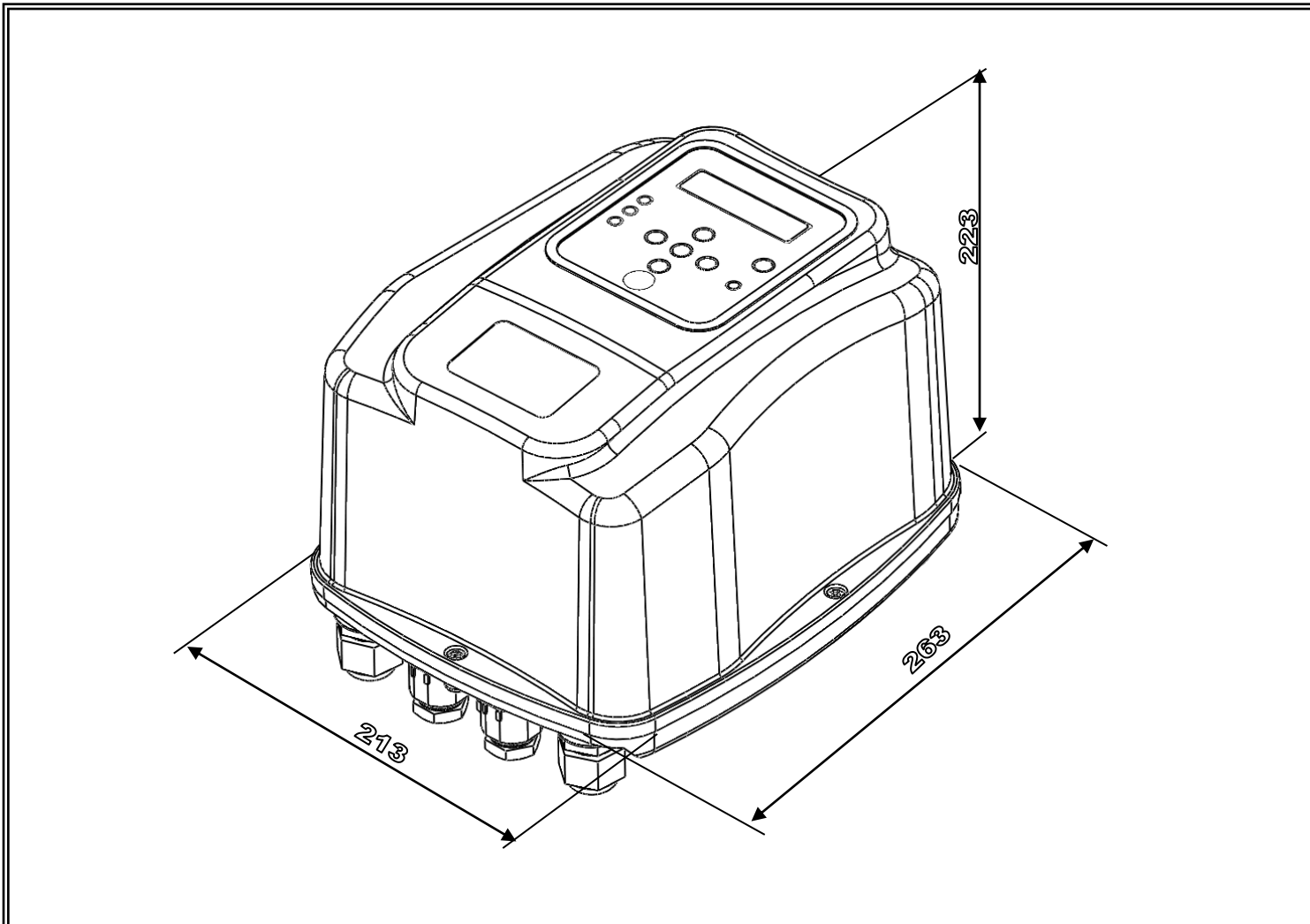


This equipment complies with the ROHS 2011/65/EC directive.

The symbol of the crossed out bin means that to safeguard the environment the equipment cannot be disposed of with other household waste at the end of its lifecycle.

The equipment and packaging must be disposed of according to the local regulations.

↔ OVERALL SIZE - DIMENSIONS – IDENTIFICATION



DESCRIPTION

Nettuno is an electronic device, employing inverter-based technology, which controls electric pump stopping and starting functions. Thanks to the particular type of technology used, it can modulate the frequency (Hz) of the motor's input current to adjust the speed (rpm) according to the water demand by the system. This way, the value of the pressure reaching the user appliances is maintained constant all the time and the motor's absorption is always proportional to the actual system requirements, resulting in notable energy savings over time.

SPECIFICATIONS

	NETTUNO 3P-13A	NETTUNO 3P-9A	NETTUNO 3P-6A
Power mains supply:	three-phase, 400Vac \pm 10% - 50/60Hz		
Motor output	three-phase, 400Vac		
Maximum motor power	7.5 kW – 10 HP	5.5 kW – 7.5 HP	3.7 kW – 5 HP
Maximum motor phase current	13 A (rms)	9 A (rms)	6 A (rms)
Cooling	Forced air ventilation		Air
Analogue inputs	4÷20mA (pressure sensor) + 0÷10V (aux.)		
Digital inputs	3 inputs (enable, error, 2nd set point)		
Digital outputs	2 programmable relays (24V – 2A max.)		
Degree of protection	IP 44		
Weight	6.430 Kg		
Dimensions	213x263x191 mm		
Type of action	1.Y (according to EN 60730-1)		
Operating ambient temperature	+0° C to +40° C	+0° C to +45° C	

FEATURES

- √ Constant pressure due to electric pump speed regulation
- √ Energy savings due to less pump absorption
- √ Gradual pump start and stop reduces hammering
- √ Protection against dry running in the event of water shortage during intake
- √ Automatic reset in the event of dry running, with autonomous clearing of error condition
- √ Efficient leakage monitoring to protect pump in the event of repeated restarts
- √ Anti-seize function
- √ Intelligent overload cut-out management for a longer duration of the inverter
- √ Digital display of pressure, current, voltage and frequency
- √ Operation/error status signalling via LEDs and on-screen alerts
- √ Auxiliary inputs and outputs for remote control and status signalling
- √ Possibility of interfacing more devices as part of the pressurisation units (two to eight)

PROTECTIONS

- √ Dry running
- √ Overpressure
- √ Power supply under-voltage
- √ Power supply over-voltage
- √ Unbalanced load
- √ Output terminal short circuit
- √ Amperometric sensor on motor output
- √ Internal overheating in inverter (ambient temperature and IGBT temperature)
- √ Significant leakage with continuous motor pump restarts

EMC

This product has been tested according to the standards stated in the EC declaration of conformity in one of the typical conditions of use, using shielded cables both on input and output (motor cable 15 metres, without auxiliary connections). However, experience has shown that significant variations in the level of EMC disturbance can occur when the type and length of cable used is changed, as well as their position, type of motor used etc.

If other equipment is subject to disturbance, contact the manufacturer to assess additional solutions to reduce electromagnetic disturbance.

✂ INSTALLATION

⦿ DEVICE FIXTURE:

Nettuno is supplied with a special fixing bracket to enable mounting directly on a wall, or the option of fixture to a horizontal pipe using the optional kit.

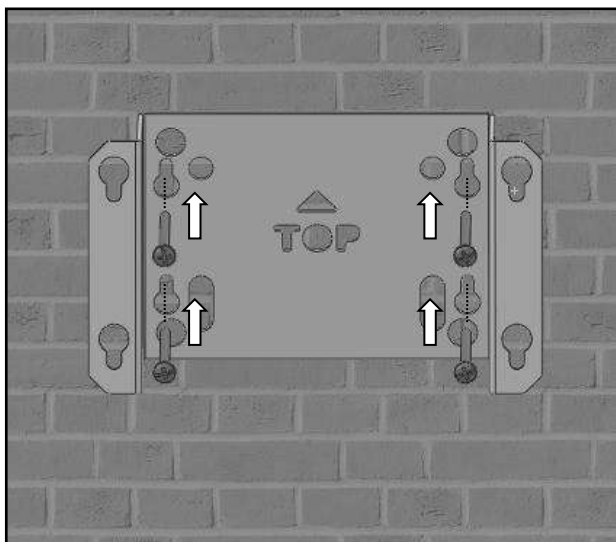
On both wall-mounted and pipe-mounted versions, ensure that fixture is secure and that the pipe or wall is sufficiently strong to withstand the weight of the device.

Always install indoors, in an area protected against dust and water. *Nettuno* must be installed at a higher point than the pump to avoid the risk of immersion in the event of flooding.

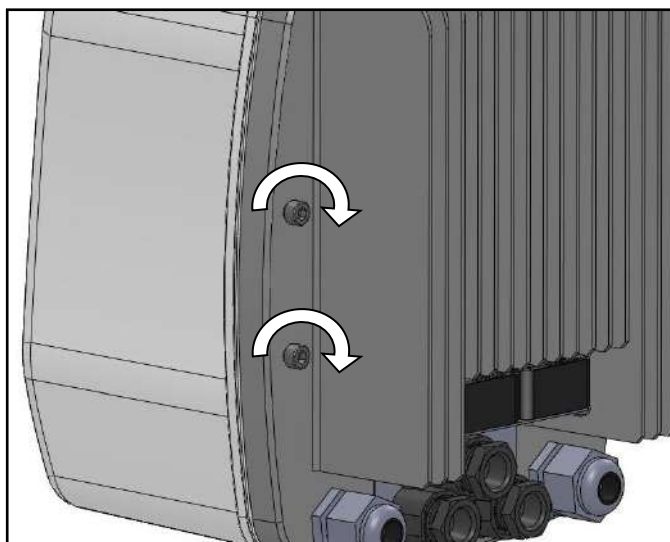
The device must never be installed in confined spaces that can reduce ventilation and therefore cooling of the inverter.

WALL MOUNTING

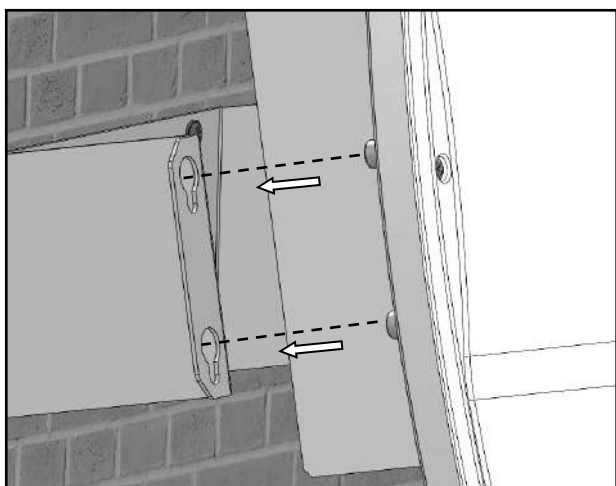
Nettuno can be mounted on a wall or other flat surface by means of the bracket and screws supplied. For simple installation of the product, proceed as described below.



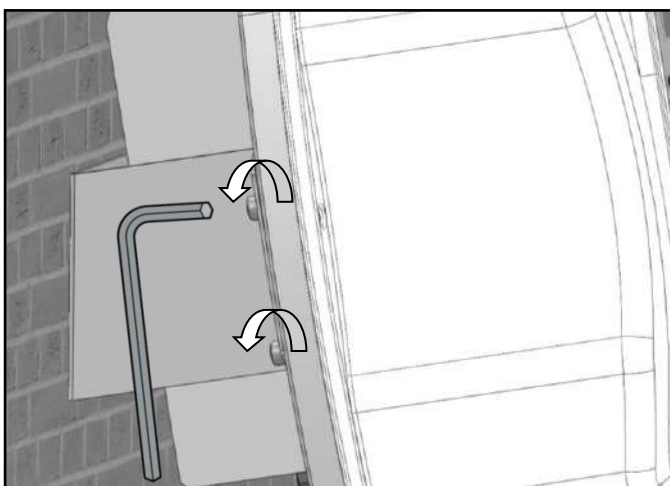
1) Fix the bracket to the wall by means of the 4 screws supplied. Check to ensure correct horizontal alignment.



2) Pre-assemble the fixing screws on the rear side of *Nettuno*, leaving a space of at least 3mm under the screw heads.



3) Fit *Nettuno* onto the bracket, passing the screw heads on the larger holes and then slide downwards.



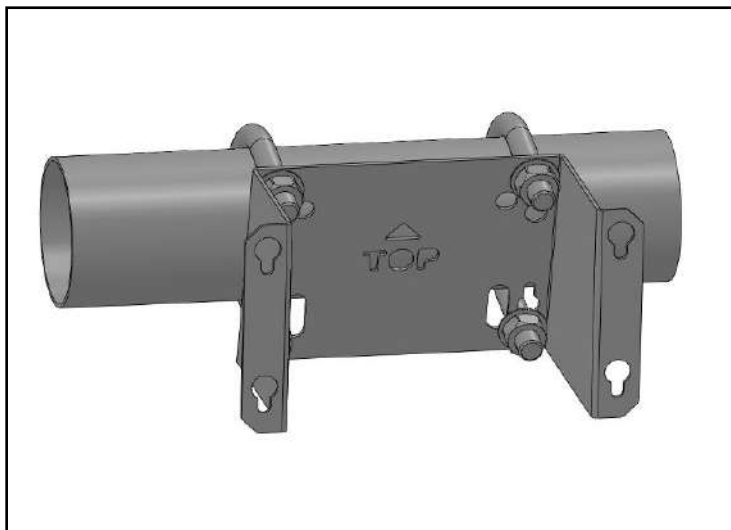
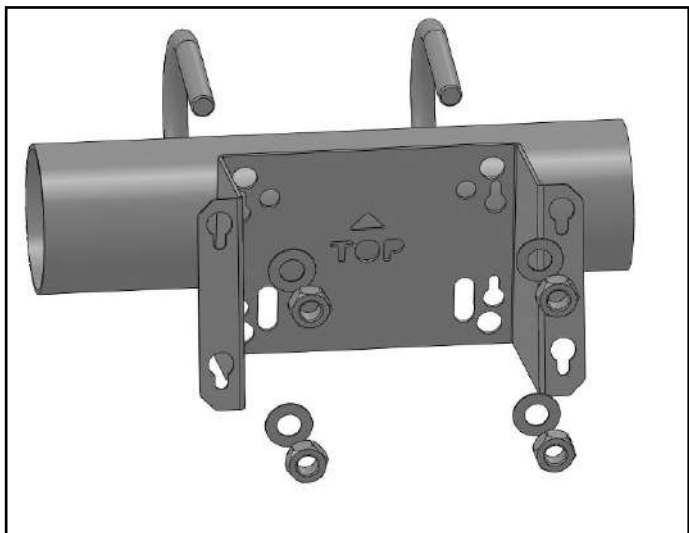
4) Tighten the rear screws fully down on *Nettuno*.

PIPE-MOUNTING

Nettuno can be mounted onto a horizontal pipe by means of a kit of fixing collars (optional, to be ordered separately). 4 different collar sizes are available, as shown in the diagram below.

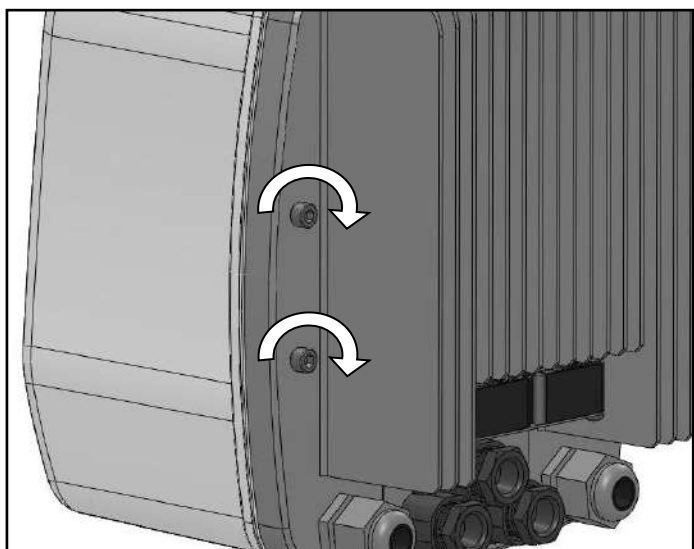
PIPE MOUNTING KIT	
CODE	DESCRIPTION
KIT-TUBO114	Kit for fixture on pipes of 1" 1/4
KIT-TUBO112	Kit for fixture on pipes of 1" 1/2
KIT-TUBO200	Kit for fixture on pipes of 2"
KIT-TUBO212	Kit for fixture on pipes of 2" 1/2

For simple installation of the product, proceed as described below.

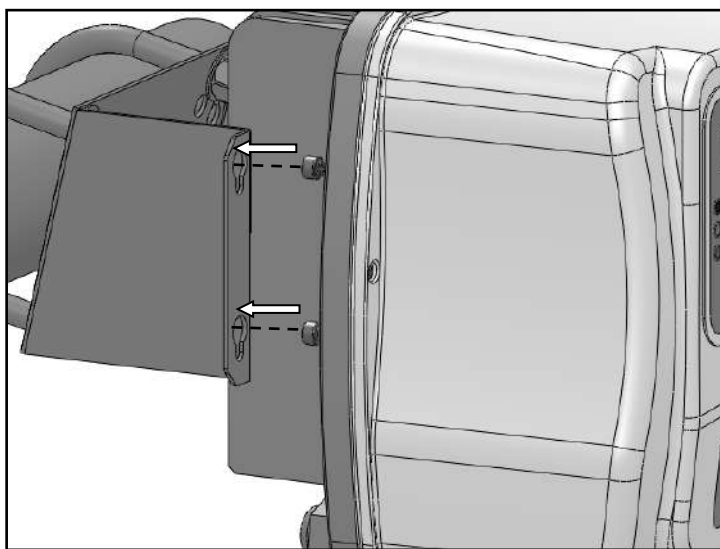


1) Fix the bracket to the pipe by means of the "U-shaped" hooks and 4 bolts supplied. See fig. 6 for selection of the holes.

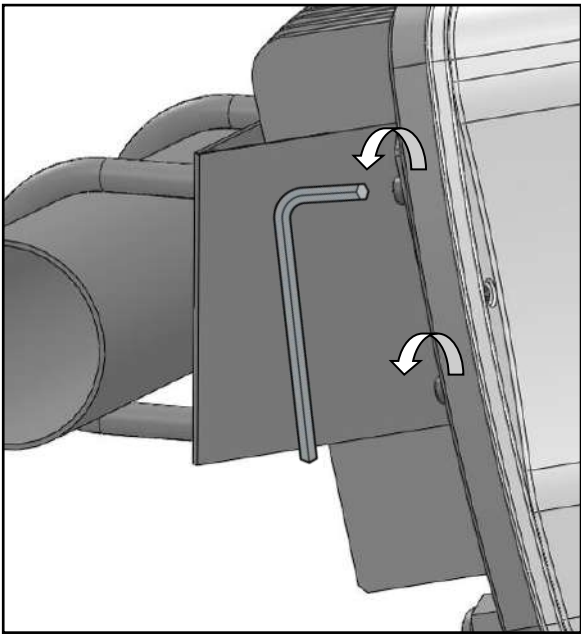
2) Ensure that the bracket is securely fitted on the pipe and cannot rotate.



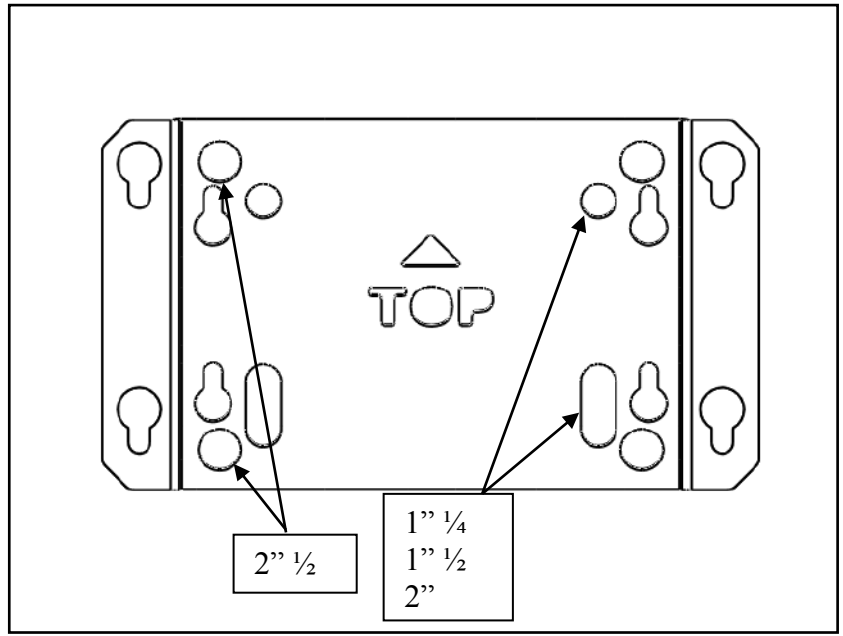
3) Pre-assemble the fixing screws on the rear side of Nettuno, leaving a space of at least 3 mm under the screws.



4) Insert Nettuno onto the bracket, passing the screw heads on the larger holes and then slide downwards.



5) Tighten the rear screws fully down on Nettuno.



6) The bracket is designed for fixture of various sizes of “U-shaped” hooks, refer to the diagram to select the correct version.

◆ HYDRAULIC CONNECTION

The 4÷20mA pressure sensor must be connected to the system delivery, preferably far from areas subject to turbulence (bends, bypasses, branches, etc.) to ensure optimal stability of the measured signal.

It is a compulsory requirement to install an expansion tank with a capacity of at least 2-5 litres to ensure correct shutdown of the pump and limit restarts caused by any small leakages which are common in most systems.

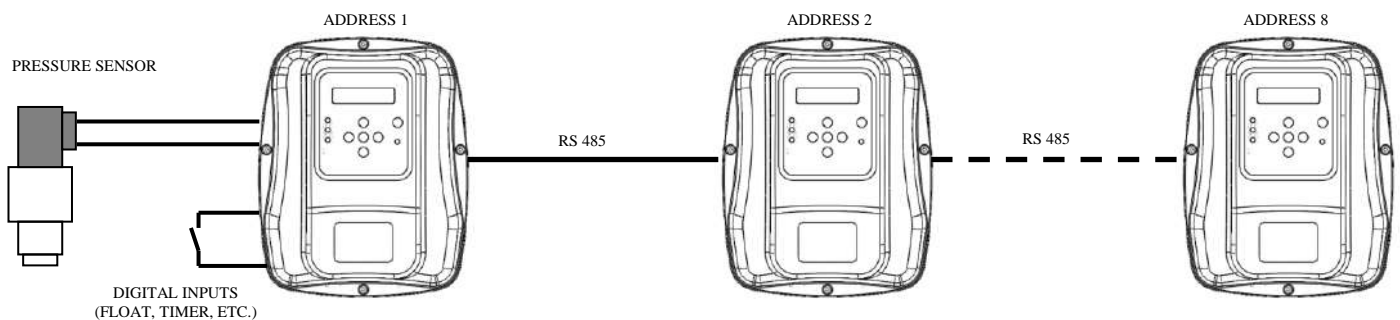
The pre-charge value of the tank must be suitable for the pressure values set. This will also help to keep the operation constant in applications where water requirements are modest (e.g. for washing machines, toilet flushing systems, etc.).

The system must also be equipped with a non-return valve to prevent the return of fluid to suction at the time of pump shutdown. In the case of multiple installations, it is recommended to install a valve on suction for each pump.

⚠ CAUTION: when the pump stops, the conduits are still pressured so a valve must be opened to bleed the system before any work is carried out.

↕ INSTALLATION IN PUMPING UNITS WITH MULTIPLE PUMPS:

Nettuno can be used to create pressurisation units with a maximum of 8 pumps, each controlled by an inverter. The inverters are connected by means of a RS 485 serial connection. Each inverter is assigned an address, from 1 to 8, for identification in the serial bus. To reduce costs, there is no need to install a pressure sensor for each inverter; a single transducer is sufficient, connected to any one of the inverters (the address of the device hosting the pressure sensor must be configured on the software of each inverter). Also any auxiliary 0-10 V control or digital input signal must be connected to a single device. Serial communication deals consists in sharing the data of the pressure sensor and digital inputs among the various connected inverters.



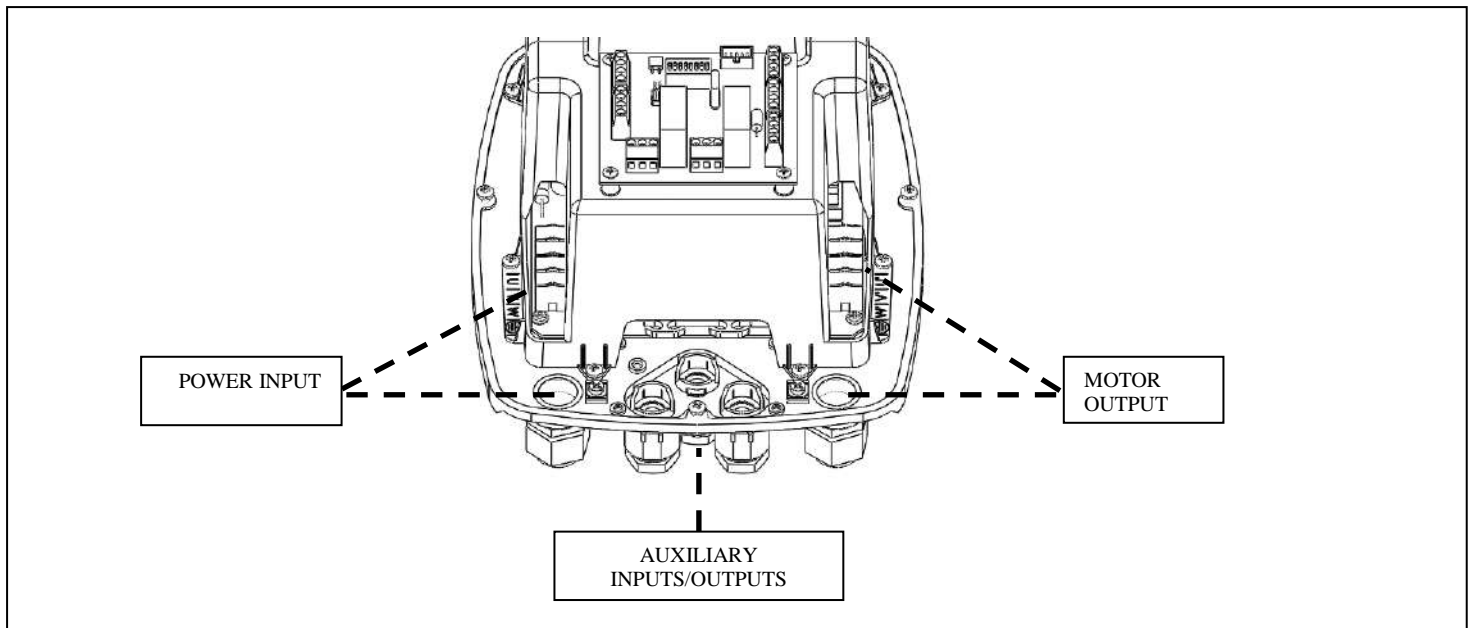
⚡ ELECTRICAL CONNECTION:

⚠ CAUTION:

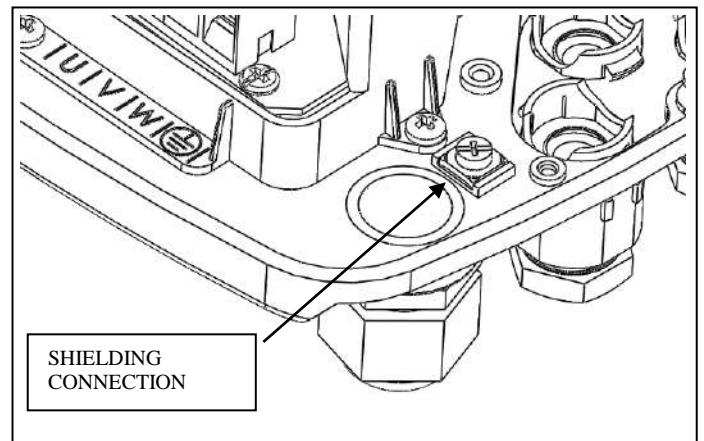
- all wiring up must be carried out by specially trained personnel
- an incorrect motor connection could result in damage to the device or the pump motor.
- failure to comply with what is stated in this paragraph may cause serious damage to things and/or serious injuries to people, and the manufacturer declines all responsibility.
- if the power supply cable or the cable between *Nettuno* and the electric pump is damaged, only the manufacturer of the device, its appointee or equally qualified personnel can replace it; this is to prevent risks to things and people.

Fit the electric wires into the relative wire clamps, making sure the correct assembly order is maintained for all the components. Secure the threaded nuts tightly enough to prevent the wires being pulled or turned from the outside.

Use cable clamps in metal for connection of the power line and those in plastic for connection of any I/O (auxiliary inputs and outputs).



The metal plates located in the vicinity of the cable clamps can be used to connect the shielding of the cables and thus ensure correct continuity of the shielding itself with the heat sink.



✓ LINE CONNECTION

Power supply: three-phase 400 Volt 50/60Hz.

The electrical system to which the equipment is connected must comply with the safety regulations in force and must therefore be equipped with:

- an automatic magnetothermic switch with high breaking capacity and with a trigger current proportional to the capacity of the pump installed
- earthing with total resistance in conformity with local standards and in any case never over 100Ω

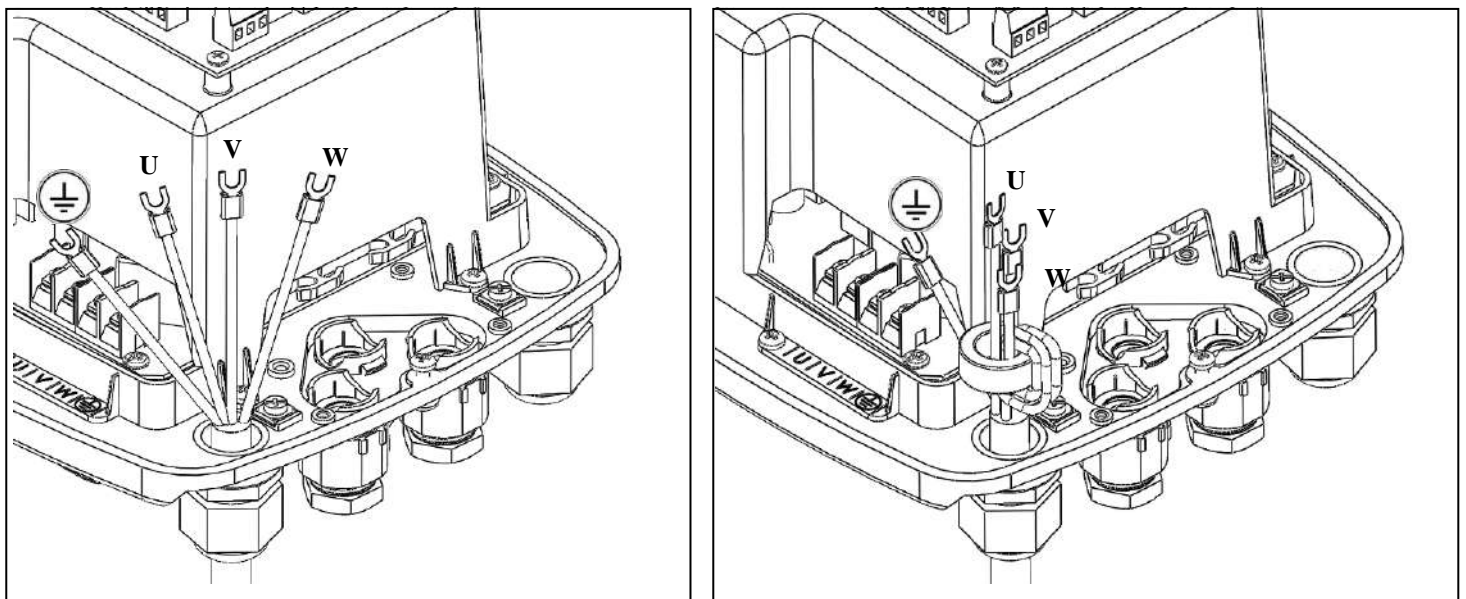
If the device is used in swimming pools, fountains or garden ponds, an automatic differential switch of the “A” type (with $I_{\Delta n}=30\text{mA}$) must always be fitted.

The system comprising *Nettuno* and an electric pump is considered a “fixed system”; it is therefore advisable to make arrangements to prevent the device being disconnected from the power line it was originally connected to and mistakenly reconnected to another source of power not equipped with the electrical protection required.

Always install, upline of the inverter, a device that ensures omnipolar disconnection from the mains with a contact opening gap of at least 3 mm.

Before making the electrical connection, the cables must be prepared with special crimp terminals (fork-type). The terminals must be crimped by specially trained personnel, using proper crimping tools.

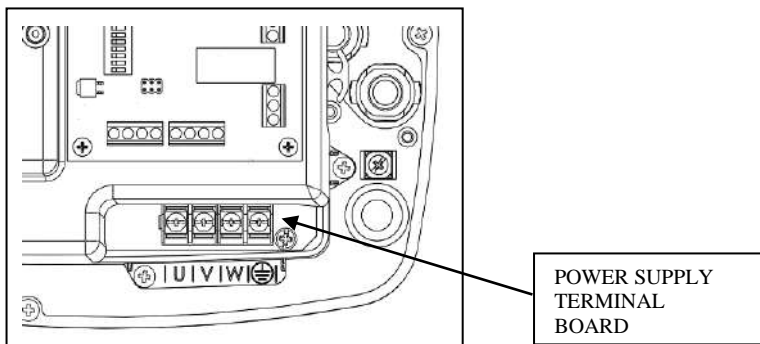
After inserting the cable in the metal cable clamp, coil the three power cables (U,V,W) around the ferrite core supplied, as shown in the images below. This preparation is essential to reduce electromagnetic disturbance. The earthing wire must not be wound around the ferrite core, but connected directly to the terminal board.



Connect the earthing wire to the corresponding terminal. Then proceed with the connection of the device power wires to the terminal board marked with the letters U, V, W as shown in the image below.

The recommended cable section is 2.5mm².

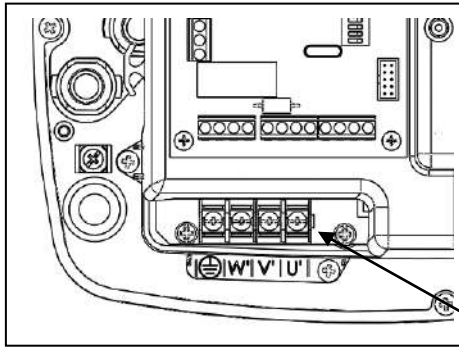
The type of wire must be selected according to the conditions of use (domestic, dry or wet).



✓ ELECTRIC PUMP CONNECTION

Before making the electrical connection, the cables must be prepared with fork-type crimp terminals. The crimp terminals (fork-type) must be crimped by specially trained personnel, using proper crimping tools.

After inserting the cable in the metal cable clamp, connect the motor cables to the terminal board marked with the letters U',V',W' as shown in the image below. Then proceed with connection of the earthing wire to the corresponding terminal. The device is fitted with an output short circuit protection.



The recommended cable section is 2.5mm² for cable lengths from 2 to 30 metres. Longer cables, though admissible, have not been tested according to the EMI/RFI standards and must be evaluated by the manufacturer.

The type of wire must be selected according to the conditions of use (domestic, dry or wet, indoor or outdoor installation).

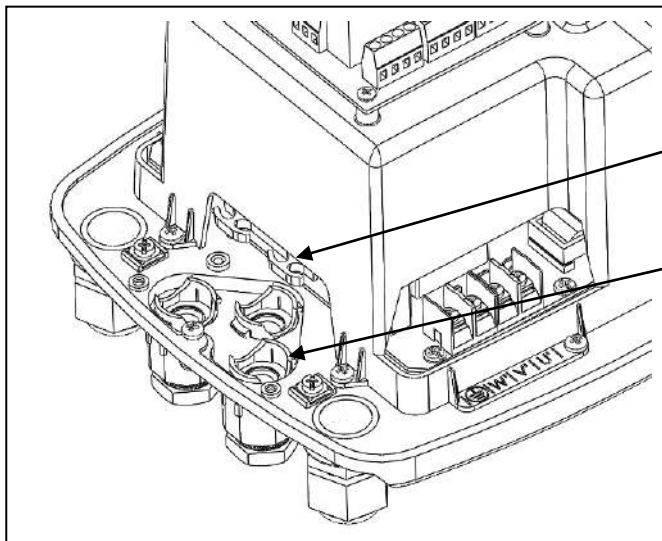
Where an excessive cable length (over 30 metres) is used, it is recommended to insert a dV/dT filter to limit peak current voltage and for motor, especially windings, longevity.

Also observe the installation limits as declared by the manufacturer of the electric pump connected to *Nettuno*.

MOTOR OUTPUT
TERMINAL
BOARD

✓ AUXILIARY INPUT AND OUTPUT CONNECTIONS

⚠ CAUTION: The remote connections are insulated from the network power by a “reinforced” type insulation (reinforced insulation according to EN 60730-1). Therefore it is recommended to make electrical connections with a type of cable that guarantees double or reinforced insulation, using insulated voltage-free contacts for the digital inputs.

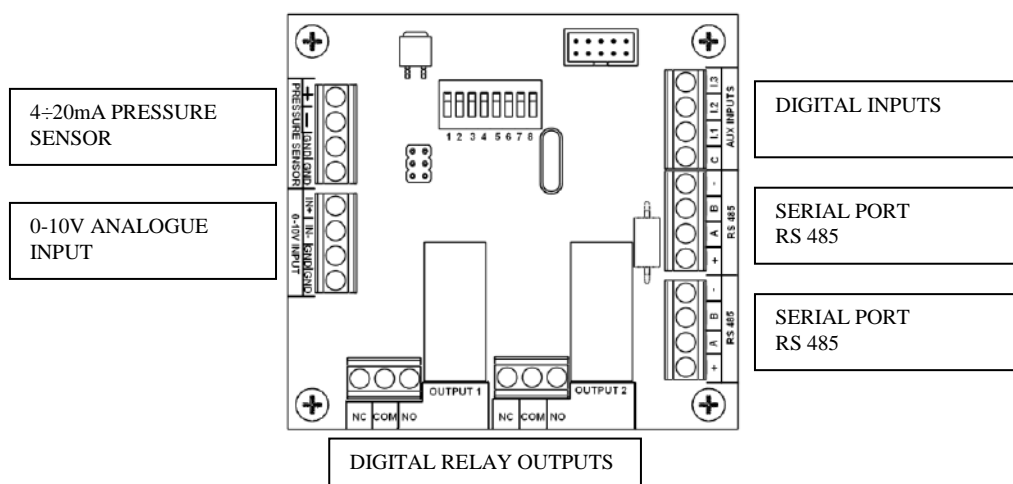


Insert the cables of the auxiliary devices via the central cable clamps in plastic. Use the relative cable guides to keep wiring tidy.

CABLE
GUIDE

CABLE CLAMPS FOR
AUXILIARY INPUTS

Nettuno has various auxiliary connections located on the I/O board. The following diagram identifies the various connections.



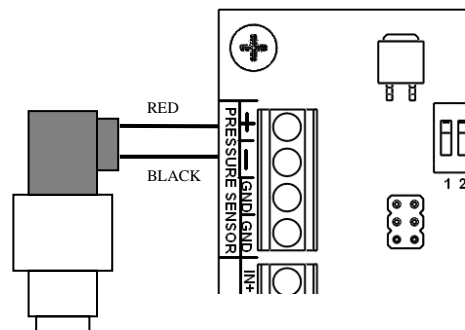
✓ 4÷20mA PRESSURE SENSOR

An external pressure sensor (optional, code no. TRPR-016-420MA) with 4÷20mA signal can be connected to Nettuno to obtain a closed loop pressure control system. The speed of the electric pump is regulated according to the effective demands of the system to maintain constant pressure.

The power supply voltage of the sensor is 10Vdc. The use of 2-wire transducers is recommended, connected as shown in the diagram alongside (red wire +, black wire -).

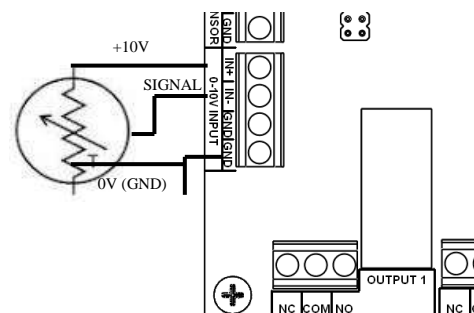
The sensor cable shielding, if present, can be connected to the GND terminal to reduce interference on the sensor signal itself.

The device is compatible with pressure sensors with a scale from 0-6Bar to 0-16Bar, or from 0-100 PSI to 0-250 PSI.



✓ 0-10V ANALOGUE INPUT

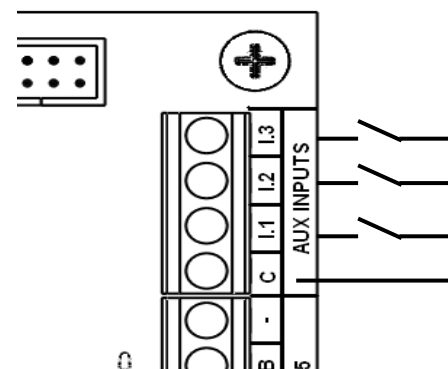
Nettuno operation can also be controlled via a 0-10V analogue signal. The speed of the pump is regulated according to the voltage value on input, considering that 0V corresponds to 0 Hz and 10V corresponds to the set maximum nominal frequency of the pump (50 or 60Hz). The pump is stopped when the control voltage value corresponds to a frequency value below the parameter set as the stop frequency (factory setting 35 Hz).



✓ DIGITAL INPUTS

Nettuno has 3 digital inputs, assigned with the following functions:

- **I.1** = input for **dual set point** ; if the function is activated via the menu, the inverter uses the second pressure set point value as reference for operation at constant pressure, when the contact is switched between terminal C (common) and input I.2. This can be used to control a different operating pressure value during operation.
- **I.2** = input for **external enabling**; if the function is activated via the menu, the inverter only starts up if the contact is switched between terminal C (common) and input I.1. This can be used for connection of a float, timer etc.
- **I.3** = input for **error**; if the function is activated via the menu, the inverter blocks the motor when the contact is switched between terminal C (common) and input I.3. The message "external error" then appears on display. This can be used for an external block signal, for example from a flooding sensor or float.



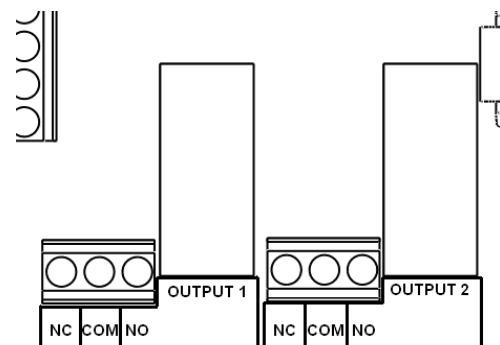
The three digital inputs can all be configured via the software as NO or NC; if the input is set to OFF their functioning is completely ignored.

Refer to the parameter settings section for further details.

✓ DIGITAL OUTPUTS

Two digital relay outputs are available for signalling operation status. The relays can be configured via the software independently, to perform one of the following functions:

- error signalling
- pump running signal
- control of an electric pump at fixed speed, connected directly to the mains via a power relay



Refer to the parameter settings section for further details on configuration of the digital outputs.

✓ RS 485 SERIAL CONNECTION

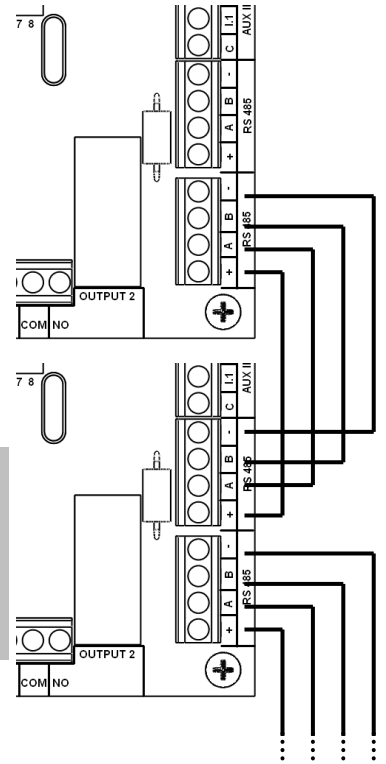
Up to a maximum of 8 inverters can be connected to the RS 485 serial port to create multiple pump pressurisation units.

There are two terminal boards on each device for the serial connection, to enable cascade connections of multiple inverters, as shown in the figure alongside.

A non-shielded cable with a section of $4 \times 0.5 \text{mm}^2$ is recommended for this connection.

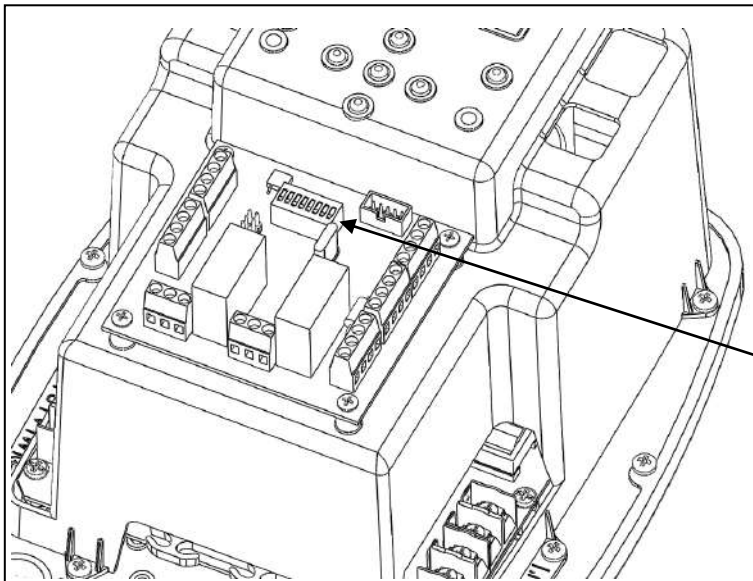
To make the connection, connect the terminals “+”, “-”, “A” and “B” of one device to the same terminals of the next device, and continue in the same way until all inverters are connected in the same communication bus.

No special terminal at the end of the bus is necessary.



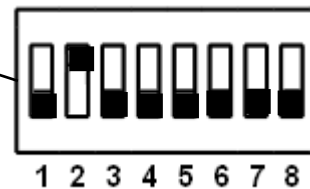
CAUTION: after connecting the devices to one another, they should be assigned an individual number to identify their address in the serial bus. Each device must be assigned a different number; otherwise, if several devices have the same address, the serial communication will overlap with loss of transmitted data.

Therefore, before closing the external cover, use the red dip switch on the I/O board to set the specific serial address of each device.



All devices are supplied with the address set to "1" as a factory setting, and therefore set up for use as a single unit. If used in a serial connection, a different address must be set for each connected inverter.

To set the serial address, lift the white lever of the dip switch corresponding to the number to be assigned, and lower all the other levers. For example, to set address "2", set the dip switch as shown in the figure below:



⚠ The serial address value set via the dip switch on the I/O board must subsequently be entered in the software of each device on initial activation.

✓ KEY DESCRIPTION

- ◀ Left-hand arrow: this scrolls back through the menu pages
- ▶ Right-hand arrow: this scrolls forwards through the menu pages
- ON/OFF RESET On-Off/Reset: this switches the device from stand-by to operation mode and resets the unit in the event of alarms and/or faults.
- + “+” key: this increases the value of the parameter currently shown on the display;
- “-” key: this decreases the value of the parameter currently shown on the display;
- AUTOSET “AUTOSET”: this starts the self-setting procedure for the stop frequency function



✓ INITIAL CONFIGURATION FOR SINGLE DEVICE INSTALLATION

In the case of single installations, power up the device and follow the instructions for initial configuration as described below. On initial activation, a welcome screen is displayed and when any key is pressed, a guided configuration procedure is started up, enabling the entry of the main parameters required for standard operation.

```

Welcome
push any key
    
```

Modify the value of parameters using the keys + and – then confirm the entry by pressing the central key to move to the next parameter. The parameters to be configured are displayed in the following order:

```

2.0 Serial
Address      1
    
```

Parameter 2.0 – Serial address: in the case of single installations with a single pump, leave this value at 1. If a pressurisation unit with multiple pumps is installed, set the number of the device in the serial bus from 1 to 8. The value must correspond to the setting of the dip switch on the I/O board, as explained in the previous paragraph. Each device must have a different serial address number to be distinguished from the others.

```

2.1 Press. sensor
ser. address  1
    
```

Parameter 2.1 – Pressure sensor serial address: in the case of single installations with a single pump, leave this value at 1. If a pressurisation unit with multiple pumps is installed, set the number of the device to which the pressure sensor and any other auxiliary inputs are connected. The value must be the same for all devices as only one pressure sensor transmits the signal to all inverters.

```

1.0 Motor rated
current      0.5A
    
```

Parameter 1.0 – Motor current: set the rated motor current as stated on the pump electrical data plate. In the case of multiple installations with several pumps, the value must be set for each inverter, as the pumps may have different characteristics.

```

0.0 Pressure
setPoint    3.0 BAR
    
```

Parameter 0.0 – Pressure set point : set the constant pressure value that the inverter must maintain in the system. The pump rotation regime is varied according to the flow rate demand of the system, to maintain pressure at the set value.

```

0.1 DeltaP
startPump   1.0
    
```

Parameter 0.1 – Pump start-up DeltaP: set the value of the negative Delta with respect to the set point pressure for pump start-up. For example, if the set point is 2.5 and the DeltaP is 0.3 bar, the pump starts up at values below 2.2 bar.

```

0.2 Dry running
press      0.5 BAR
    
```

Parameter 0.2 – Dry running pressure: set a minimum pressure value, below which the dry running protection device trips due to lack of water. In the case of pump operation at maximum speed, if the pressure in the system falls below this value, the inverter shuts down the motor after a set delay interval.

To ensure correct operation of this protection device, the settable value must never be higher than the set start-up pressure (obtained from the difference between the set point and the DeltaP values described above). Operation of the protection device should be tested after installation. Also take into account the water column on outlet, if present.

```
0.0 BAR    0 Hz
Standby
```

At the end of the configuration procedure the display shows the main operation screen. The device is set to stand-by, and therefore with the motor stopped.

```
2.5 BAR    40Hz
Running
```

Press the central key to exit standby status and start the pump.

✓ CONFIGURATION FOR MULTIPLE INSTALLATIONS

In the case of installation with multiple pumps, great care must be taken on initial start-up, to ensure that the addresses of all devices are set correctly and to avoid serial communication errors.

The initial configuration procedure is shared among devices only for the common parameters (e.g. operating pressures), while the independent parameters (such as the serial address and maximum motor current) are set individually on each device.

On activation, when the welcome screen is displayed; press the central key on all connected devices and then proceed with setting the serial addresses, taking care to ensure that the set value corresponds to the value set via the dip switch on the I/O board (each inverter must have a different address).

Confirm entry of the serial address on all devices by pressing the central key on each inverter.

On each *Nettuno*, set the motor current absorption value and confirm the value by pressing the central key on each device.

WAIT A FEW SECONDS UNTIL ONE OF THE DEVICES IS SET AS MASTER (illumination of blue light) then continue setting the parameters exclusively via the keypad of the MASTER device; the set values will be shared and transmitted automatically to the other connected inverters

✓ REGULATION OF STOP FREQUENCY (AUTOSET FUNCTION)

After setting up the system for normal conditions of use (pump fully primed, no air present, correct direction of rotation), if the pump does not stop automatically on closure of the utilities, the autosest function may be started up to automatically calculate the stop frequency value.

To start the autosest procedure:

```
2.5 BAR    0 Hz
Standby
```

- 1) switch the inverter to stand-by by pressing the central key
- 2) open one of the valves to completely discharge all pressure from the system

```
AUTOSET    Close
delivery
```

- 3) press and hold the "Autosest" key for 5 seconds
- 4) close each valve on delivery and press the central key to start the autosest function

```
AUTOSET    Pending
0.0BAR     30 Hz
```

- 5) wait until the device starts the motor and attempts to calculate the correct value of the stop frequency on the basis of the characteristics of the pump and the set operating pressure

```
AUTOSET    Complete
Correctly!
```

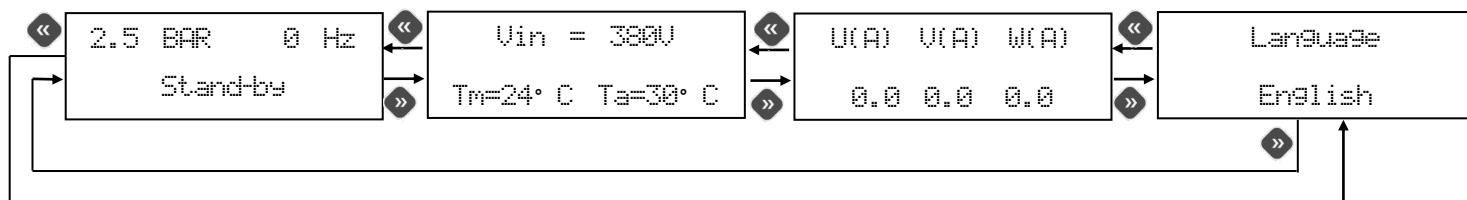
- 6) if the outcome is positive, the confirmation screen is displayed. Press the central key again to return to the main operation screen

```
AUTOSET    not
Completed-Error
```

- 7) if the autosest procedure fails, when the device is unable to determine the correct stop frequency, the relative error screen is displayed. Attempt to repeat the procedure after verifying correct operation of the pump and correct entry of the set point value. If the outcome is still unsuccessful, adjust the parameters "Minimum frequency" and "Stop frequency" manually as explained in the next section.

✓ MAIN MENU STRUCTURE

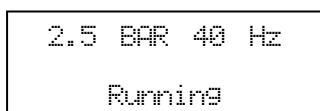
The main menu shows the operational values of the system: pressure, current frequency of the motor, input voltage, output current of the motor and internal temperature of the inverter. It is also possible to select the language.



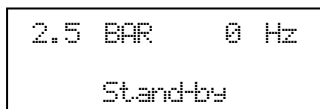
✓ DESCRIPTION OF THE PARAMETERS AND SCREEN PAGES

MAIN MENU:

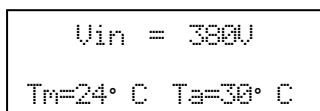
These screen pages are accessible when the device is on. To change pages, press the right and left keys as required.



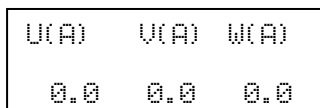
Main screen page: when *Nettuno* is operating correctly, the first line of the display shows the instantaneous pressure detected by the system and the current frequency of the motor. The lower line of the display shows the current status of the inverter (Operation/Stand-by/Slave). From here, it is possible to scroll through the main menu using the arrows, or put the system in "Stand-by" by pressing the central "on-off" key. In the case of multiple installation with several pumps, simply adjust the master device to switch all connected inverters to stand-by status.



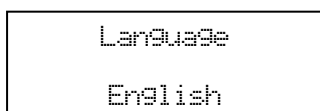
When *Nettuno* is in stand-by, the pump will not start up even if the pressure drops below the value set. To quit stand-by, press the central key again.



Voltage and temperature screen: this menu screen enables the user to view the voltage on inverter input and the internal ambient and IGBT power module temperatures. The values of these temperatures contribute to the intelligent power management, which limits the value of the maximum frequency of the motor when the pre-alarm thresholds are reached.



Currents screen: this screen displays the phase currents of the motor. The value of the output current to the motor may differ from the value of the input current as the inverter modulates both frequency and voltage.



Language: The language used for the menu and the alarm messages can be selected by the user. Use keys + and - to modify the parameter value.

INSTALLER PARAMETERS:

These parameters are present in hidden screens and normally should only be modified during the installation and set-up phases.



To access these pages switch the device to Stand-by and keep the "+" and "-" keys pressed together for 5 seconds. On entry to the hidden menu, use the "<<<" and ">>>" keys to scroll the pages and the "+" and "-" keys to change the parameters. To return to the main page press the central key.

The parameters are divided into 4 groups:

- group 0 : pressure parameters
- group 1 : motor parameters
- group 2 : multiple operation parameters
- group 3 : input/output parameters
- group 4 : times

GROUP 0 - PRESSURE PARAMETERS

```
0.0 Pressure
setpoint 3.0 BAR
```

0.0 – Pressure set point: this parameter enables entry of the device set point. It is a constant pressure value required by the system (maximum pressure). During its operation, *Nettuno* adjusts the electric pump revs to adapt them to the actual demand from the utilities, therefore maintaining a constant system pressure. The set value must be below the maximum delivery pressure of the pump, to ensure specific modulation of the pump itself and consequent energy savings.

```
0.1 DeltaP start
pump 1.0 BAR
```

0.1 - Pump start-up Delta P: this parameter sets the the negative pressure delta compared to the pump start-up set point. On opening of any type of utility, the pump will not start-up until the system pressure has fallen below the set point by a value equal to the delta set in this parameter. After the motor is started up, the rotation speed is controlled to maintain the pressure value as close as possible to that set in the pressure set point parameter. The minimum differential settable between Pmax and Pmin is 0.3 Bar, with the recommended value being at least 0.5 Bar.

```
0.2 Dry Running
Press. 0.5 BAR
```

0.2 – Dry running pressure: set a minimum pressure value, below which the dry running protection device trips due to lack of water. In the case of pump operation at maximum speed, if the pressure in the system falls below this value, the inverter stops the motor. To ensure correct operation of the protection device, the settable value must never be higher than the set start-up pressure (obtained from the difference between the set point and the deltaP values described above). Operation of the protection device should be tested after installation. Also take into account the water column on outlet, if present.

```
0.3 Over Press.
Limit 16.0 BAR
```

0.3 - Limit pressure: this parameter sets the limit for the over-pressure protection to intervene. Tripping of the over-pressure protection stops operation of the inverter until it is reset by the user.

```
0.4 Pressure set
point2 3.0 BAR
```

0.4 – Pressure 2 set point: this parameter enables entry of the secondary set point of the device. When the I/O board input is closed externally, the pressure value set in this parameter becomes the new set point, according to which *Nettuno* regulates the revs of the electric pump (see also parameter 3.1).

```
0.5 DeltaP stop
immed. 1.5 BAR
```

0.5 - Immediate stop Delta P: this parameter sets the positive pressure delta compared to the set point for immediate shutdown of the pump. During normal operation, when the valves close, the pump stops after a time set in the parameter "stop delay". In any event, if the system pressure exceeds the Pmax value of a delta greater than the value set in this parameter, the pump will stop immediately to avoid overpressure which may damage the system.

```
0.6 Measurement
unit BAR
```

0.6 - Unit of measurement: select the unit of measurement in BAR or PSI

```
0.7 Pres.Sens.
Scale 16.0 BAR
```

0.7 – Sensor full scale: this defines the full scale of the connected pressure sensor. It is compatible with pressure sensors from 0-6 bar up to 0-16 bar or from 0-100 PSI up to 0-250 PSI, with current signal 4÷20mA.

GROUP 1 : MOTOR PARAMETERS

```
1.0 Motor rated
Current 0.5A
```

1.0 – Motor current: this parameter enables entry of the maximum current absorbed by the electric pump in routine conditions, to enable shut-down of the motor in the event of excessive absorption. Shut-down occurs also if the current is unbalanced between phases by more than 25% with respect to the set maximum value.

The trip time of the current overload safety device is inversely proportional to the entity of the overload in progress; therefore, a slight overload will lead to a more delayed trip time while a more significant overload will accelerate the trip time.

```
1.1 Motor rotat.
Direct -->
```

1.1 - Direction of rotation: this screen enables the user to invert the direction of rotation of the electric pump without modification to the electric motor wiring. To modify the direction of rotation of the motor, use keys "+" and "-"; the direction indicated by the arrow has a purely indicative value and does not reflect the actual sense of rotation, which must be verified by the installer.

```
1.2 Minimum
Freq. 25 Hz
```

1.2 - Minimum frequency: this parameter defines the minimum frequency at which the pump is started up and defines the end of the ramp for shutdown. For three-phase pumps a value of 25Hz is advised. Also consult the information supplied by the manufacturer of the electric pump to determine at what minimum frequency value the connected electric motor can operate.

1.3 Stop motor freq.	31 Hz
-------------------------	-------

Stop frequency: this parameter defines the minimum frequency value, below which the motor is stopped. During regulation, if the set point pressure value is reached and the motor frequency is below this value, the inverter attempts to stop the pump (the motor frequency is decreased to the value set in parameter 1.2 Minimum Frequency). If all utilities are closed and the pressure remains constant despite the reduction in rotation speed, the pump is stopped correctly. If the pump does not stop, try to increase this value. Otherwise, in case of continuous pump cycling, try to lower the stop frequency value. To enable correct execution of the shutdown ramp, the stop frequency must be at least 5 Hz above the set minimum frequency in parameter 1.2.

1.4 Motor rated freq.	50 Hz
--------------------------	-------

Nominal motor frequency: depending on which motor is running, it is possible to select the maximum inverter output frequency (50 or 60 Hz). Caution: an incorrect selection of the maximum frequency may cause damage to the pump; consult the manufacturer's technical data carefully.

1.5 Switching freq.	5 kHz
------------------------	-------

Switching frequency: set the frequency of inverter switching. The selectable values are 3, 5 and 10 kHz. Higher switching frequency values may reduce the noise of the inverter and allow a more fluid regulation of the motor but may cause increased temperatures in the electronic board, an increase in electromagnetic disturbances and potential damage to the electric motor (especially with long cables).

Low switching frequency values are recommended for medium-large pumps, where there is a long distance between the inverter and motor or high ambient temperatures.

1.6 Frequency corr.	0 Hz
------------------------	------

Frequency correction: this parameter enables entry of a deviation, positive or negative, of the maximum frequency compared to the set nominal value. It may be useful to set a negative deviation (down to -5Hz) where a limit to the maximum power of the electric pump is wanted and to avoid possible overload. A positive increase (up to +5Hz) may instead be necessary when a slightly higher electric pump performance is required. While no particular precautions exist in lowering the maximum frequency, its increase must be carefully evaluated after having consulted the manufacturer of the electric pump and taking into consideration the maximum current supported by the inverter and the electric motor.

GROUP 2 : MULTIPLE OPERATION PARAMETERS

2.0 Serial Address	1
-----------------------	---

2.0 – Serial address: in the case of single installations with a single pump, leave this value at 1. If a pressurisation unit with multiple pumps is installed, set the number of the device in the serial bus from 1 to 8. The value must correspond to the setting of the dip-switch on the I/O board, as explained in the paragraph on electrical connections. Each device must have a different serial address number to be separate from the others.

2.1 Press. Sensor ser. address	1
-----------------------------------	---

2.1 – Pressure sensor serial address: in the case of single installations with a single pump, leave this value at 1. If a pressurisation unit with multiple pumps is installed, set the number of the device to which the pressure sensor and any other auxiliary inputs are connected.

The value must be the same for all devices to ensure that only one pressure sensor transmits the signal to all inverters.

2.2 Auxiliary PUMP	OFF
-----------------------	-----

2.2 – Auxiliary pump: *Nettuno* can be connected to an auxiliary pump at fixed speed via one of the relays on the I/O board. The auxiliary pump is started up when the maximum frequency is reached and the pressure is below the set point. To enable the auxiliary pump function, proceed as follows:

- deactivate multiple operation by setting parameter 2.5 to OFF
- set parameters 3.4 or 3.5 to “AUX” to associate the auxiliary pump function with one of the output relays.

2.3 Partner act. delay	2.0 sec
---------------------------	---------

2.3 – Partner activation delay: this defines the delay before *Nettuno* activates the auxiliary pump or requests intervention of a partner inverter when the maximum frequency is reached. Increase this delay interval if too many consecutive start-ups occur at close intervals of the auxiliary pump or partner inverters in the case of high speed pressure transients in the system. Reduce the parameter to increase the speed of intervention of the partner device or pilot pump on increase of water demand.

2.4 Timed master Swapping	OFF
------------------------------	-----

2.4 – Timed master changeover: when using pressurisation units with multiple pumps, it is possible to implement timed master changeover, where, together with pump shut-down, the master is also changed over every 60 minutes of continuous operation. In this way, in systems where collection is continuous and the stop condition for all pumps is never reached, the correct changeover of master devices is still guaranteed.

2.5 Booster mode funct.	ON
----------------------------	----

2.5 - Multiple mode activation: set this parameter to OFF to disable *Nettuno* for multiple mode operation with several inverters. In this case the device, though powered, is not involved in multiple mode operation and therefore does not become a master device or intervene as a partner device. However, if no master is present for 15 seconds, the device starts operating as a new master and takes control of the system. This function can be used if, on systems with multiple pumps, the user wishes to

assign one as a reserve pump, activated only in the event of a fault of all other inverters. This parameter should be set to OFF also if the user wishes to use the auxiliary pump function via one of the relays of the I/O board, as this function is not compatible with multiple mode function.

2.6 Reduced
freq. Value 80%

2.6 - Reduced threshold value: when a partner device is set in operation to assist the master device in maintaining the set point pressure, the activation frequency is initially reduced to the set value (as a percentage of the nominal value) in this parameter. In this way, both the partner and master devices can operate in a balanced way, close to the maximum output point of the pump. When intervention of the partner device at the reduced threshold value is not sufficient to guarantee the set pressure value, the partner device is then set to operate at the maximum nominal frequency.

GROUP 3 : INPUT/OUTPUT PARAMETERS

3.0 Command
Source PRES

3.0 - Motor control source: this parameter defines the control source for calculating the motor frequency. These options are available:

PRES (pressure): operation proceeds on the basis of the pressure read by the sensor
4-20mA

MAN (manual): the motor is started up via the keypad of Nettuno and the speed can be adjusted using the keys “+” and “-“.

0-10V (analogue input): regulation is based on the signal from the analogue input of the I/O board. The frequency is calculated considering that 0V corresponds to 0Hz and 10V corresponds to the maximum motor frequency. When the value calculated by the analogue sensor is below the stop frequency (parameter 1.3), the pump is stopped.

3.1 Set-point 2
input OFF

3.1 - Input of set point 2: enables the input for the secondary set point. This contact can be set to NO or NC mode. When this input is switched, the active pressure set point for regulation becomes parameter 0.4.

3.2 Ext.Enable
input OFF

3.2 - Permissive input: sets the input for an external permissive. This contact can be set to NO or NC mode. The pump is only started when the input is in the correct status.

3.3 Ext. error
Input OFF

3.3 - Error input: sets the input for an external error. This contact can be set to NO or NC mode. The pump is stopped and an error message appears on display when the input changes status. This can be used for connection of an external float, or flooding sensor.

3.4 Function
of relay 1 OFF

3.4 - Relay 1 function: defines the function associated with the output relay 1. The admissible settings are:

OFF: relay disabled

AL: alarm output; the relay is switched in the event of an error

P.ON: pump ON, the relay is switched when the pump is running

AUX: auxiliary pump; the relay is used for control of an auxiliary pump

3.5 Function
of relay 2 OFF

3.5 - Relay 2 function: defines the function associated with the output relay 2. The settings are identical to those described for parameter 3.4

GROUP 4 : TIMES

4.0 Pump stop
delay 4.0 sec.

4.0 – Pump stop delay: defines the delay before stopping the pump when the pressure is the same as the set point and the frequency is below the stop frequency.

4.1 Auton. Reset
Time 30 min

4.1 – Automatic reset time: if a temporary absence of water on intake is detected during operation of the electric pump, *Nettuno* will shut off power to the motor to avoid it being damaged. On this screen it is possible to set how many minutes the device will remain stopped before carrying out an automatic restart to check for the availability of water on intake. If the attempt is successful, *Nettuno* will automatically exit from the error condition and the system resumes normal operation; if this is not the case, another attempt will be carried out after the same time interval. The maximum settable interval is 240 minutes (recommended value is 30 min).

4.2 Auton.
reset tests 5

Automatic reset test no.: this parameter sets the number of attempts that *Nettuno* will perform to resolve a stop condition due to dry running. Once this limit has been exceeded, the system shuts down and the user's intervention is required. If this value is set to zero, the auto-reset function is switched off. The maximum number of attempts allowed is 20.

4.3 Reset all
Errors OFF

Total automatic reset: when set to ON, the automatic reset function is active for any error, in addition to dry-running, detected by the system. Caution: the automatic and uncontrolled reset of some errors (for example, overload) could over time cause damage to the system and to *Nettuno*. Always take great care when using this function.

ADVANCED PARAMETERS:

The advanced parameters are accessible only to the technical assistance service. For access to these parameters, it is necessary to contact the re-seller, a technical assistance centre or the manufacturer.

The following table lists the advanced parameters for reference when technical assistance is required.

REF.	PARAMETER	DESCRIPTION	DEFAULT SETTING
7.0	Vboost	Voltage boost at 0Hz	5%
7.1	Dry run delay	Time delay before activation of the protection due to lack of water	30
7.2	Max. start-ups per hour	Activation or deactivation of the control on the number of start-ups per hour (leak checks)	OFF
7.3	Anti-seizure protection	Activation or deactivation of the control that enables start-up of the pump after 24 hours of downtime.	OFF
7.4	Dead time	Dead time PWM setting	20*125ns
7.5	Int. constant (Ki)	PID controller integrative constant	10
7.6	Prop. constant (Kp)	PID controller proportional constant	15
8.0	Last error recorded	Last error occurred log	0
8.1	Power supply timer	Inverter power supply time	0
8.2	Motor timer	Electric pump operation time	0
8.3	Motor start-ups	Pump start-up counter	0
8.4	Rel. Software	Release of software	/
9.0	Max. amb. temp.	Maximum ambient temperature	80
9.1	Max. mod. temp.	IGBT module maximum temperature	85
9.2	Reduction index on At	Frequency reduction index on ambient temperature	1
9.3	Reduction index on Mt	Frequency reduction index on module temperature	1
9.4	Fan stop delay	Fan shutdown delay after pump stop	10
9.6	Vin min.	Minimum power supply voltage threshold	
9.7	Vin max	Maximum power supply voltage threshold	
9.9	Variable debug	Debug variable selection for process value display	0

✓ ALARMS

In the event of system anomalies or malfunctions, one of the following screens will appear on Nettuno display. Each error is coded with the letter "E" followed by a number from 0 to 13. The number which appears in brackets represents the number of recurrences of each error. To reset an alarm, after having resolved the cause, it usually sufficient to press the central "reset" key or interrupt the electrical power supply for a few seconds.

```
E0 Input voltage
Low      ( 0)
```

E0 – Low voltage: indicates that the power supply voltage is too low. Check the input voltage value

```
E1 Input voltage
high     ( 0)
```

E1 – High voltage: indicates that the power supply voltage is too high. Check the input voltage value

```
E2 Output Short
circuit  ( 0)
```

E2 - Short Circuit: This message will appear on the screen when a short circuit is detected on inverter output; this may occur following incorrect connections of the electric motor, damage to the electrical insulation in the wires connecting the electric pump to the device or a fault in the pump's electric motor.

When this error appears, the electrical system should be checked as soon as possible by skilled personnel. The error may only be removed by disconnecting the equipment from the electrical power source and resolving the cause of the fault. Attempting to restart the inverter in the presence of a short-circuit in output may cause serious damage to the equipment and be a source of danger to the user.

```
E3 Pump dry
Running  ( 0)
```

E3 - Dry running: this message appears when the system is stopped following a pump intake water shortage. If the auto-reset function has been enabled, *Nettuno* will carry out automatic attempts to check for the availability of water. To clear the error status, press the central "reset" key.

```
E4 Ambient over
temp.    ( 0)
```

E4 – Ambient temperature: the error appears if the maximum internal ambient temperature of the inverter is exceeded. Check the conditions of operation of the inverter.

```
E5 Module over
Temp     ( 0)
```

E5-IGBT module over temperature: the error appears if the maximum temperature of the IGBT module of the inverter is exceeded. Check operating conditions of the inverter, and in particular the cleanliness of the forced air ventilation system, the current absorption of the pump and the ambient temperature. If necessary, attempt to reduce the switching frequency.

```
E6 Motor over
Load     ( 0)
```

E6-Overload: this alarm is displayed when electric pump absorption exceeds the maximum set current as entered in the *I_{max}* value: this may occur following intensive use of the electric pump, continuous restarts at close intervals, problems with the motor windings, or following problems with the electrical connection between the motor and *Nettuno*. If this alarm trips frequently, arrange for the system to be checked by the installer.

```
E7 Unbalanced
Load     ( 0)
```

E7 –Load not balanced: this alarm may occur if the phase currents of the motor are unbalanced by more than 25 % of the nominal value.

```
E8 Internal ser.
Error    ( 0)
```

E8-serial error: this alarm may occur where there is an internal serial communication on *Nettuno*. Contact the technical assistance.

```
E9 Over Pressure
Error    ( 0)
```

E9-Pressure limit: the alarm intervenes when the maximum set pressure threshold has been exceeded. If the error appears repeatedly, check the setting of the "P limit" parameter. Also check other conditions which may have caused an overpressure (for example, partial freezing of the fluid).

```
E10 External
error    ( 0)
```

E10-External error: this alarm will be displayed if, after setting the external error function on the auxiliary I/O board, the I/O input contact is closed.

```
E11 Max.starting
hour     ( 0)
```

E11-Number of maximum starts/hour: this error appears if the maximum number of admissible start-ups per hour has been exceeded. Check for the presence of any leaks in the system. Check pre-loading of the expansion tank.

```
E12 12V SUPPLY
Error ( 0)
```

E12- Error 12V: an anomaly has been detected in the internal low voltage power supply circuit. Have the manufacturer check the device.

```
E13 Press. sensor
error ( 0)
```

E13-Pressure sensor error: the pressure sensor has detected an incorrect value. Check or replace the pressure sensor.

? POSSIBLE MALFUNCTIONS:

✓ The pump does not stop

The stop frequency is too low; increase this value or run the self adjusting procedure.
The expansion tank does not have the correct pre-load value; check.

✓ When one of the cocks in the system is opened, the pump does not start, or there is a few seconds delay before it starts

The set “pump start-up DeltaP” is too high. Try to reduce the DeltaP value.
Ensure that the system is not set to stand-by; press the central key if necessary.
Check correct operation of the external permissive contact (if configured).

✓ When the water flow is extremely low, the pump does not operate normally

The stop frequency is too high; try to lower the value to ensure more uniform operation also at low flow rates.

✓ When the cocks are closed, the pump stops but restarts a few seconds later and there is no leakage from the system

The “pump start-up DeltaP” value is too low; increase.
The expansion tank does not have the correct pre-load value; check.

✓ The device often signals 'dry running'

The pump intake pipe drains when the system is not used for some time, thereby preventing it priming the next time it is started. If there is a foot valve fitted, check its seal.
The dry running protection pressure value has not been set correctly; correct the value.

✓ The device often signals 'high or low voltage'

The power supply voltage may not comply with the device specifications; have it checked by qualified personnel.

✓ The device overheats and the over-temperature protection intervenes

The forced air cooling system on the heatsink fins may be blocked; check correct operation and condition (cleanliness).
The switching frequency is too high for the power of the pump used; reduce the value.
The ambient temperature is too high for use of this device.

✓ The pump turns at maximum speed but with poor performance

The connection of the pump is incorrect; check the electrical wiring.
The pump turns in the opposite direction; check the direction of rotation.

✓ When more water is required by the system, the pressure drops

This is a normal condition which is due to the fact that the device is unable to force the pump beyond its capacity curve. As a result, once a certain flow rate is exceeded, the pressure is no longer offset as the pump is already running at the highest number of revolutions allowed. In these cases, a pump with higher performance levels should be installed.

✓ The pressure signal is not correct or the devices are not communicating correctly, or multiple masters are present at the same time.

Some inverters connected on the serial bus may have the same address; check settings of the parameter "serial address" and settings of the dip switch on the I/O board for each device.
Check the serial connection between the devices.

✂ MAINTENANCE:

Nettuno is designed to keep maintenance requirements at a minimum. To guarantee the device a long working life and perfect functionality, always follow the instructions below:

- every 12 months, clean the cooling fans and ensure their correct operation. In particularly dusty environments, reduce the frequency to 6 months
- if the pump is equipped with intake filters, carry out regular checks to ensure they are clean;
- always ensure that the cover is closed properly and the cable clamps are tight to prevent dust from penetrating from outside;
- switch off the power supply and drain the water from the system when it is going to be left unused for a long time;
- do not carry out any operations when the device is open
- wait 10 minutes before removing the cover from the device so the capacitors can discharge.



WARNING: this device does not contain any parts that can be repaired or replaced by the end user. You are therefore advised not to remove the electronic card's protective cover electronic board protective cover as this would render the warranty null and void!

Installation date/..../.....	Stamp Installer	
Pump make/model			
Nettuno serial n.			