EN

ELECTRIC PUMPS UNITS FOR WATER LIFTING AND PRESSURISATION

USE AND MAINTENANCE MANUAL

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Declaration of conformity

of type A (according to Directive 2006/42/EC attachment II)

PENTAX S.p.A.., with office in Viale delll'Industria n. 1

37040 Veronella (VR) - Italy

DECLARES

that the "Booster set" pressurisation units are compliant with the prescriptions of Directives:

- 2006/42/EC and subsequent amendments (Machinery Directive)
- 2014/35/UE and subsequent amendments (Low Voltage Directive)
- 2014/30/UE and subsequent amendments (Electro-magnetic Compatibility Directive)

Veronella (Vr), 03 March 2016

The Legal Representative

Gianluigi Pedrollo

1. General information

1.1. Symbols

Symbol indicating the instructions of the manual relating to safety. The non-compliance with these instructions exposes to health risks.

Symbol indicating the instructions of the manual relating to electrical safety. The non-compliance with these instructions exposes to electrical risks.

ATTENTION

Wording indicating the main warnings for correct system installation, functioning and management. However, for a correct use of the system for its entire life-span, all instructions and indications supplied in this manual must be complied with.

1.2. Generality

Check that the material received corresponds to that in the transport document and that it is not damaged.

To work safely and obtain the best results, before starting the system remember to read all the instructions contained in this manual and in the attached documentation.

The manual and the attached documentation constitute integrating part of the system and must be kept with care and be consulted by those in charge of use and maintenance of the system.

No part of this documentation can be reproduced without the written authorisation by the manufacturer.

Given the quick technical progress, the not strictly standard production and the company continuous improvement policy, the units may be subject to amendments by the manufacturer without prior notice.

The non compliance with all indications supplied in this manual, an improper use of or unauthorised amendments made to the system void any form of responsibility by the manufacturer for eventual damages to persons, animals or things.

1.3. Identification of the units

Every unit is provided with an identification plate similar to that shown in fig. 1, on which the following is reported:

- Trademark, denomination and manufacturer address
- Unit type
- Month/year of manufacture
- Serial (N./Ref.)
- Total power
- Pressure switches calibration

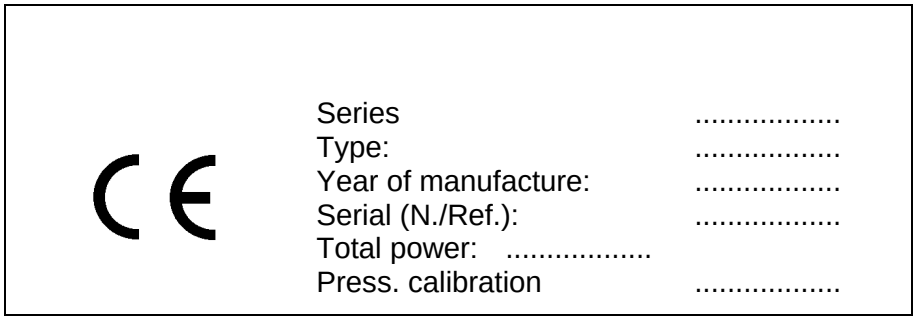


fig. 1

2. Systems description

The pressurisation unit is composed by:

- identical motor-driven pumps connected in parallel, single-phase or three-phase, with horizontal or vertical axis, with sequential start-up with cyclical inversion, in variable number from 1 to 3 and chosen according to the requested features
- steel full port intake and flow collectors, threaded (or flanged) and galvanised
- steel, galvanised unit base and support for electric board
- one check valve for each pump, assembled at intake
- ball valves with inlet for each pump one assembled at intake and one at flow
- a coupling stub pipe for each pump assembled at intake and provided with threaded hole for the connection of eventual air feeder
- rubber anti-vibrating supports with metal core
- manometer with radial connection
- electric board in IP 55 plastic box

– pre-calibrated pressure switches (one per pump) assembled on the flow collector and directly connected to the electric board

– heat protection electric cables of fire-retardant type, connected to the equipment and to the board

– UPON REQUEST: can be supplied separately membrane tanks (20, 24 litres)

ATTENTION For a correct use, at least one autoclave reservoir must be installed in the system.

ATTENTION ALL UNITS:

– ARE BUILT IN COMPACT EXECUTION TO ENABLE THEIR USE IN REDUCED SPACES ALSO
– ARE REALISED USING HIGH QUALITY COMPONENTS
– ARE COMPLETELY ASSEMBLED AND TESTED IN FACTORY
– TO FUNCTION THEY MUST FIRSTLY BE CONNECTED TO THE HYDRAULIC SYSTEM AND TO THE POWER SUPPLY LINE.

2.1. Functioning principle

In static position with system pressurised, the contacts of the pressure switches result open and the system in stand-by. Upon decreasing of the pressure due to water request, pressure switch number one closes the contact and starts the first motor-driven pump. If the performances supplied by the same are sufficient for maintaining an adequate pressure, the motor-driven pump works until no water flow request and stops. If, on the contrary, other utilities are used and the pressure decreases further, the second pressure switch closes the contact and starts the second motor-driven pump and so on for other eventually available units. Upon stabilising of the pressure, the contacts of the pressure switches open and the motor-driven pumps stop with reverse order to start-up. The electric board changes the starting order of the motor-driven pumps at the beginning of every new cycle, so as to obtain a balanced share of the work times. The protection of the motor-driven pumps against the disconnection and the dry start, is assured by a float on the intake tank, to be connected by the user to the contacts envisioned on the electric board.

2.2.Use and counterindications

The units in standard execution are designed and built for the pressurised maintenance of the water systems using clear water from collection tank.

ATTENTION The standard execution units are not suitable for:

- the dry running
- the pumping of liquids different from clear, clean, chemically and mechanically non aggressive water
- the pumping of liquids with temperature above 40°C
- the pumping of flammable liquids
- the functioning in places classified at risk of explosion
- the functioning in places without ventilation, in that they do not guarantee the ventilation of the motors and facilitate the forming of condensation
- the functioning with too frequent start-ups and switch-offs (approximately from 5 to 30 start-ups every hour, at regular intervals, per individual pump. The greater the power of the pumps, the lower the number of start-ups admitted). For further information please contact the manufacturer.
- the functioning at altimetric level, approximately above 1000 m (can vary depending on the type of motors used). For further information please contact the manufacturer.
- the functioning with ambient temperatures above 40°C

2.3.Use limits

- working pressure depending on the type of pump (see booklet) and use limits of the membrane reservoirs
- minimum intake pressure depending on the NPSH value requested by the pump and load losses (with safety margin of 0.5/1.0 metres)
- the maximum pressure at intake summed to the maximum pressure of the pump must be lower than the working pressure

3. Safety regulations

The "Booster set" units, if correctly installed, function in automatic mode and do not therefore present particular or significant risks linked to their normal use.

The handling, installation, maintenance, eventual repair and dismissal of the units described in this manual must be carried out by qualified staff that has read and understood the content of this manual and the eventual attached documentation. The running of the units can also be carried out by unqualified staff.

Remove voltage by disconnecting from the electric power supply before carrying out any maintenance or repair operations on the units. Place the protection switches upstream of the system in position off or remove the plug from the power supply socket.

In case of fire in the electric equipment, do not use water to put it out.

The units use motor-driven pumps with mechanical parts in motion fully protected against accidental contacts, by means of suitable sumps. Every responsibility is declined in case of damages to persons, animals or things caused by the removal of or tampering with said devices.

The pressurisation unit is an automatic system, therefore the pumps can start without warning. It is therefore necessary to pay maximum attention before any intervention.

4. Information on overhead noise

For information on the power and acoustic pressure level, refer to that reported on the instruction booklet of the pumps.

5.Installation

Do not disperse the packaging materials in the environment, but keep to the regulations in force on the disposal of waste.

5.1. Handling

The units are delivered in cardboard packages on appropriate pallets and can therefore be transported by means of lifting trolley or pallet truck.

It is necessary to verify that the maximum capacity of the hoisting mean is compatible with the weight of the unit.

In case of handling from above (crane, bridge crane, forklift) it is necessary to hook the unit by passing suitable belts from underneath the pumps, in front and behind the fixing points on the base, in order to avoid the possibility of capsizing. Proceed cautiously to avoid accidental impacts.

5.2. Assembly and dismantling

The units are delivered fully assembled and do not therefore require any assembly operation, if not for additional requested accessories.

Verify that the positioning is on a flat and regular surface, act at supporting the weight of the unit and sufficiently spacious to allow the carrying out of use and maintenance operations in safe conditions.

For every dismantling intervention that should be necessary, pre-emptively proceed to the hydraulic and electrical insulation of the components to be dismantled.

ATTENTION Remember that for every dismantling and assembly operation it is a good rule to check and, if necessary, replace, the gaskets and to fasten the flanges proceeding progressively for nuts diametrically opposite.

5.3. Hydraulic connections

The installation of the units described in this manual must be carried out by qualified staff that has read and understood the content of this manual and the eventual attached documentation.

In carrying out the hydraulic connections verify that:

- the sections of the intake and flow piping are equal or greater than those of the collectors or stub pipe or, however, such to avoid a too high speed of the flow (it is preferable to remain below 2 m/sec.).
- the intake and flow piping is perfectly aligned with the collectors of the inserted unit
- the intake piping has the lowest possible number of bends and section variations and is as short as possible

ATTENTION We recommend overlapping anti-vibrating elastic joints to eliminate any misalignment and to reduce the propagation of the vibrations.

ATTENTION We recommend installing a float switch (the electric board is already prepared for the connection) to prevent dry running.

ATTENTION In case of water withdrawal from well or, however, above water level, we recommend mounting a bottom valve with filter on to the intake piping.

In case of withdrawal from reservoir or collection tank, this must be dimensioned according to the maximum water request point and to the supply possibility of the water system.

5.4. Electrical connections

The electric connections must be carried out by qualified staff, following the electric layouts and applying the state-of-the-art rules.

Verify that the electric power supply system is provided with an efficient earthing system. The yellow-green earth conductors must be connected to the electric boards before the other conductors whereas, during the disconnection phase, they must be the last to be removed.

ATTENTION Verify the correspondence between voltage and frequency of the electric power supply network and the plate data of the motor-driven pumps.

6. Start-up, running, checks

6.1. Start-up

Before starting the unit, verify that the motor shafts of the motor-driven pumps rotate freely.

ATTENTION

In case of three-phase motor-driven pumps, verify that the rotation direction corresponds to that indicated by the arrows placed on the pump bodies or on the fan covers; on the contrary, invert the connections of two phases of the electric power supply cable.

Perform the full priming of the pumps by carrying out the following operations:

1. Loosen the cap on the intake collector.
2. Open all collectors motor-driven pumps connection valves.
3. Completely fill with water.
4. Close the cap.
5. Open the motor-driven pumps priming caps and carry out similar operation.
6. Close the caps and the flow valves.
7. Start the pumps from the electric board with manual control.
8. Slowly open the flow valves so as to eliminate the trapped air bubbles (if necessary, stop the pumps and repeat the priming operation, to fill the spaces left empty by the air).
9. Eventually repeat the manual start-up operations a few times for a short time to allow the bleeding of the trapped air.
10. Completely open the flow valves and switch to automatic functioning of the pumps, by acting on the selector switches on the electric board.

6.2. Electric board controls

1 Voltage presence warning light

2 Level alarm warning light

3,4 Motors on warning lights

5,6 Motors in protection warning lights

7,8 Switches and automatic position warning lights

9, 10 Stop buttons

11,12 Manual functioning buttons

ATTENTION All information regarding the electric board, descriptions, regulations, procedures and indications are reported in the specific use and maintenance booklet provided.

6.3. Regulations and calibrations

The units are calibrated and tested before delivery. Should adjustments to regulations of the electric boards or pressure switches be necessary, the same must be carried out by qualified staff. Pressure switches calibration procedure: remove the lid to access the regulating nuts - act on calibration nut "P" to regulate the connection pressure also called minimum pressure (a clockwise rotation increases the value, vice-versa, an anti-clockwise rotation decreases the value) - act on nut "ΔP" to regulate the pressure differential (a clockwise rotation increases the calibration differential and, consequently, fixed the connection pressure, also the stop pressure value also called disconnection or maximum pressure).

6.4. Maintenance

The pressurisation units do not require ***routine*** maintenance, whereas the eventual interventions of ***extraordinary*** maintenance, that should be necessary in case of fault, must only be carried out by experienced staff.

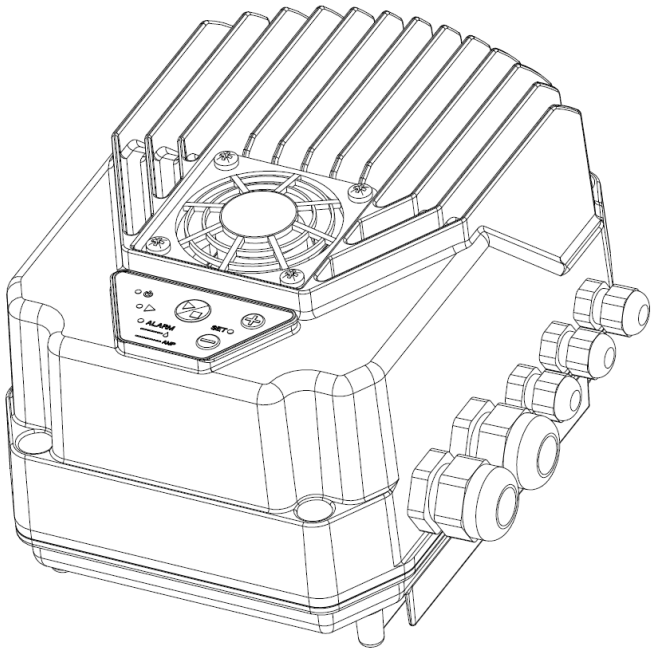
7. Out of service

In case of placing a unit out of service, ensure to hydraulically and electrically insulate the same before proceeding to the dismantling.

Do not disperse materials forming part of the system in the environment; keep to the local legal dispositions with regard to disposal, recovery, re-use, recycling of the materials.

Installation and operation manual

EPIC



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1. EPIC presentation

EPIC is a control and protection device for pumping systems based on the power supply frequency variation of the pump.

EPIC guarantees:

- Energy and cost saving.
- Simplified installation and lower costs of the system.
- Extended durability of the system.
- Increased reliability.

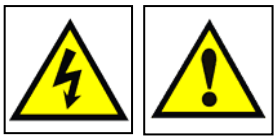
EPIC guarantees pump operation to maintain the pressure constant according to the use conditions variations. This way, the pump, or pump system, is activated only when required, for the time required; as a result, energy waste is avoided and its durability is longer.

At the same time, EPIC can:

- Protect the motor against overload and dry operation and provide a relative alarm indication.
- Activate soft start and soft stop to extend system durability and reduce consumption peaks.
- Connect to another EPIC device for combined operation (COMBO).

2. Safety warnings

The manufacturer recommends reading the instruction manuals of his products carefully before their installation and use.



Any operation must be performed by qualified personnel.

Failure to comply with the recommendations provided in this manual, and in general, with the universal safety standards, may cause severe electric shocks or death.

The device must be connected to the mains via a switch/cut-out switch in order to guarantee disconnection from the power supply (even visual), before acting on the EPIC and on any connected load.

Disconnect the EPIC from the power supply before acting on the device and connected loads.

Never remove the cable gland plate or cover, before having disconnected EPIC from the power supply and waited for at least 5 minutes.

The EPIC system and pump must be accurately earthed before commissioning.

During the period in which EPIC is powered by the mains,

regardless of whether it is activating the load or is in standby mode (digital deactivation of the load), the motor output terminals remain live compared to the earth. This way, the operator is exposed to risks, as by seeing the load stopped, he/she may operate on the device.

We recommend tightening the 4 cover screws with relative washers before powering the device. Otherwise, the cover earth connection may fail causing electric shock or death.

Avoid impacts to the product or extreme climatic conditions during transport.

Make sure the product comes fully equipped with its accessories. In the event components are missing, immediately contact the supplier.

Damage to the product due to transport, installation, or improper use is not covered by the warranty of the manufacturer. Tampering with or disassembling any component will automatically make the warranty void and null.

The manufacturer declines any liability for damage to persons or objects due to improper use of his products.

3. Installation

EPIC can be mounted directly on the motor, replacing the terminal box. Refer to the manufacturer for compatibility and motor-EPIC coupling mode.

The device consists of two essential components.

- Coupling base
- Heat sink with electronic board

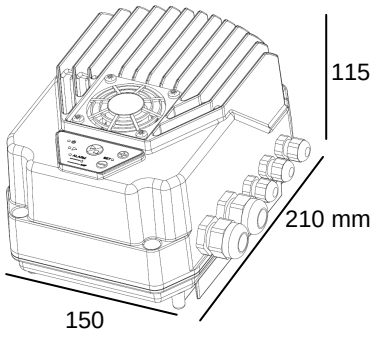
The heat sink part can be rotated by 180° to meet t he application with vertical axes pumps.

4. Technical characteristics

Vin +/- 15%	Max Vout	Max I line	Max I out	P2 typical	Weig ht
[VAC]	[VAC]	[A]	[A]	[KW]	[kg]
1 x 230	3 x 230	11	7.5	1.5	2.5

- P.F. line side: 1 (in compliance with EN61000-3-2).
- Power supply frequency: 48 - 62 Hz .
- Max. operating temperature at nominal load: 40℃ (104 ℉).
- Maximum humidity relative to the installation environment: 50% at 40℃ without condensation.
- Max. altitude at nominal load: 1000 m.
- Protection rate: IP55 (NEMA 4).
- Connectivity: RS 485 serial port for COMBO operation.

- PWM configurable: 2.5, 8 kHz.



5. Electrical connections

Disconnect the EPIC from the power supply before acting on the device and connected loads. Read the chapter relative to electrical safety carefully.

Line power supply:

L1, L2, P.E.

Attention: we recommend using pre-insulated female faston terminals 6.3 x 0.8

Motor output:

- **U, V, W, (P.E.)**

Attention: we recommend using pre-insulated female faston terminals 6.3 x 0.8
Attention: follow the phase sequence to guarantee correct rotation direction of the motor.

Pressure sensor input:

- **AN1**: analogue input 4-20 mA
- **+15V**: sensor power supply 15 VDC

Attention: if the pressure sensor has only two wires, it is not necessary to connect the signal earth.
Attention: connect the shield of the shielded cable directly to the device earth.

External frequency signal input:

- **AN2**: analogue input 0-10 V
- **+10V**: power supply 10 VDC
- **0V**: reference 0V

To switch to the external frequency operation mode via analogue input AN2, connect the pressure sensor upon device activation.

The device will power the motor, which has variable frequency and is proportional to the AN2 analogue input signal.

Digital inputs IN1 and IN2 for motor start/stop:

- **IN1, 0V** : digital input 1
- **IN2, 0V** : digital input 2

Digital inputs 1 and 2 are non-voltage potential free contacts, which allow you to control the motor start/stop.

Both inputs are Normally Closed. Open one of the two contacts to stop the motor (e.g. floater).

Alarm output:

- **N.O. , COM** : the contact is closed in the presence of an alarm or power failure.
- **N.C. , COM**: the contact is open in the presence of an alarm.

Attention: Max. 250 VAC, 2A

RS485 serial for COMBO operation:

S+ , S-

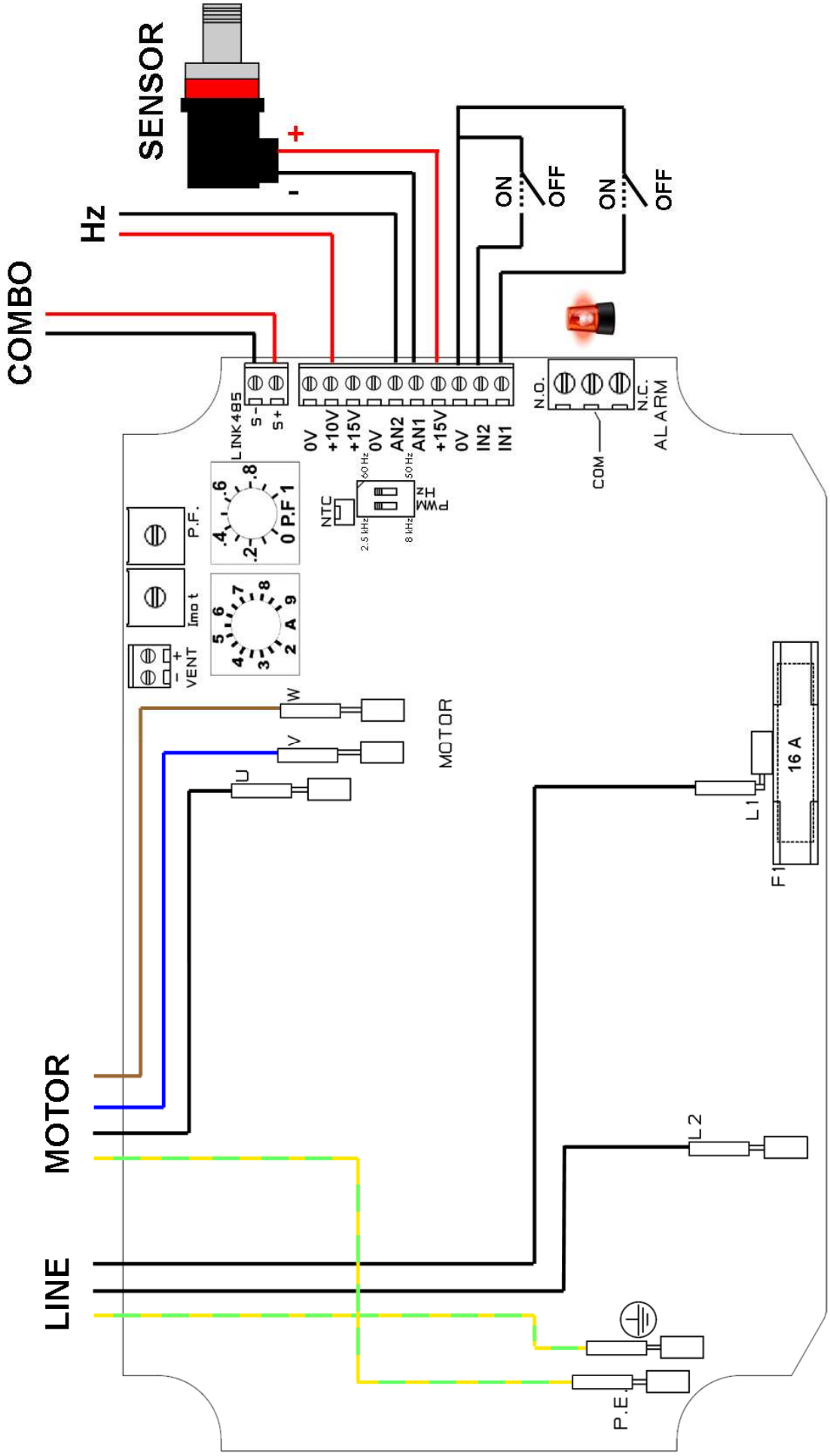
Thanks to the RS485 serial connection, two devices can communicate with each other to allow the COMBO operation in a pressure unit.

We recommend using bipolar cables with minimum 0.35 mm section2.

Fan power supply (12 VDC):

- **VENT: + , -**

Attention: the fan start and stop depend on the temperature of the device.
Attention: Failure to comply with the polarities may damage the fan.


SENSOR
+
-
Hz
COMBO
ON
OFF
ON
OFF
LINK485
S-
S+
0V
+10V
+15V
0V
AN2
AN1
+15V
0V
IN2
IN1
N.O.
N.C.
ALARM
COM
NTC
60 Hz
50 Hz
2.5 kHz
8 kHz
TIME
P.F.
0 P.F 1
Imot
VENT
W
V
U
MOTOR
L1
16 A
F1
L2
LINE
MOTOR
P.E.

6. Mains protection and electromagnetic compatibility

The device is equipped with a 16 A delayed fuse (6.3 x 32 mm), as per standard.

The mains protection devices required upstream the device depend on the type of installation and local standards. We recommend using a circuit breaker protection with characteristic curve of type C and differential switch of type A.

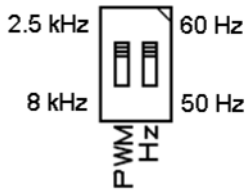
Comply with the following provisions to guarantee electromagnetic compatibility (EMC) of the system:

- always connect the device to earth.
- if required, use shielded signal cables earthing the shield to one end only.
- install signal cables, motor cables and power supply separately.
- use motor cables as short as possible (< 1 m).

We recommend installing an additional inlet filter for particularly sensitive installation environments. (Available upon request).

7. Settings

PWM regulation and nominal Hz of the motor via dip-switch.



The dip-switch allows you to vary:

- Modulation frequency (PWM):
  - 8 kHz : suitable for device application on board the motor.
  - 2.5 kHz: suitable for wall-mounted application of the device and motor cables longer than 10 m.

Nominal frequency of the applied motor (50 Hz or 60 Hz). Attention: the 50 Hz setting with 60 Hz nominal frequency motor may reduce the provided performance. The 60 Hz setting with 50 Hz nominal frequency motor may produce motor overload and trigger an overload alarm.

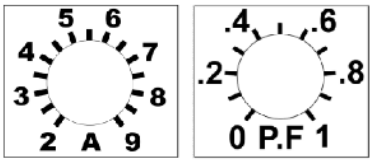
Regulation of the maximum motor current threshold and P.F. (power factor or cosØ) threshold of dry operation.

The Imot trimmers and P.F. allow you to adjust the two alarm thresholds:

- **maximum motor current threshold:** when this value is exceeded, the device stops the load and triggers an over-current alarm. We recommend setting a maximum motor current threshold equal to the nominal current of the motor increased by 10%.

- **P.F. threshold of dry operation**: under this value, the device stops the load and triggers the dry operation alarm.

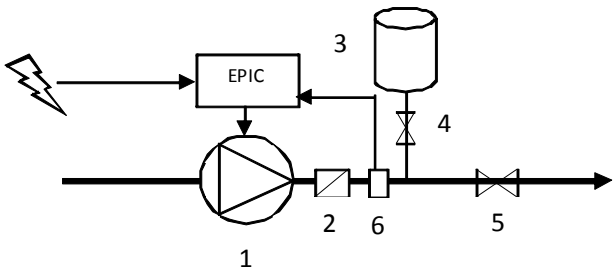
After 5 minutes from the stop, the device will attempt an automatic restart. In the event the attempt triggers an additional dry operation alarm, the pump stops for another 10 minutes before another attempt is carried out. Similarly, the attempts will be repeated automatically after 20, 40, 80 minutes. In the event all 5 attempts fail to restore the alarm, the device will stop the pump definitely. Therefore, to restore the operation, you must deactivate and activate the device manually.
To adjust the trimmer position correctly, we recommend referring to the indication below.
Generally, the P.F. value of the dry operation may vary be-



tween 60% and 70% compared to the nominal P.F. value of the pump.

8. Installation for constant pressure operation

The EPIC can manage the rotation speed of the pump in order to maintain pressure constant in a point of the system according to the water request variation of the utility.
The basic diagram of a pumping line that performs this operation is the following:



1. pump
2. check valve
3. expansion tank

4. valve

5. valve

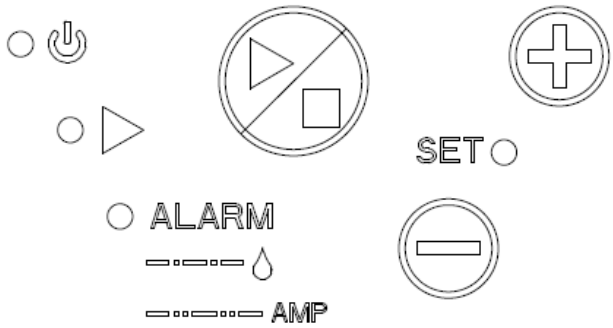
6. pressure sensor

The expansion tank, in water systems equipped with EPIC, compensates leaks (or minimum water consumption) and maintains the pressure when the pump is stopped, preventing excessively frequent start/stop cycles.
It is essential to choose the correct volume and pre-charge pressure of the expansion tank. Excessively low volumes do not allow effective compensation of minimum water consumptions or leaks when the pump is stopped. On the other hand, excessively high volumes complicate the control of the pressure made by EPIC, besides involving an economic and space waste.

Place an expansion tank with a volume equal to 10% of the maximum flow rate required, considered in litres/minute.
E.g.: if the maximum flow rate required is 60 litres/min, use a 6-litre expansion tank.

The pre-charge pressure of the expansion tank must be equal to 80% of the operating pressure.
E.g.: if the pressure set in EPIC, to which the system must be kept independently from water consumption, is 4 bar, the pre-charge pressure of the expansion tank must be about 3.2 bar.

9. Use and programming



The red STANDBY LED switches on when the device is powered.

Then, the green SET LED starts blinking to indicate that the device is ready to start in a constant pressure control mode.

STARTING THE PUMP Press PLAY to start the pump.
The green PLAY LED blinks with variable frequency: the closer the measured pressure is to the set pressure and the higher the frequency.

STOPPING THE PUMP
Press STOP to stop the pump. The green PLAY LED switches off.

MODIFICATION OF THE PRESSURE
Have a pressure gauge placed close to the pressure sensor. Open a tap with low flow to help the setting.

To modify the pressure:
· Start the pump.

· If the SET LED blinks, hold key + down until the SET LED remains on.

· Then press keys + or - to modify the pressure value.

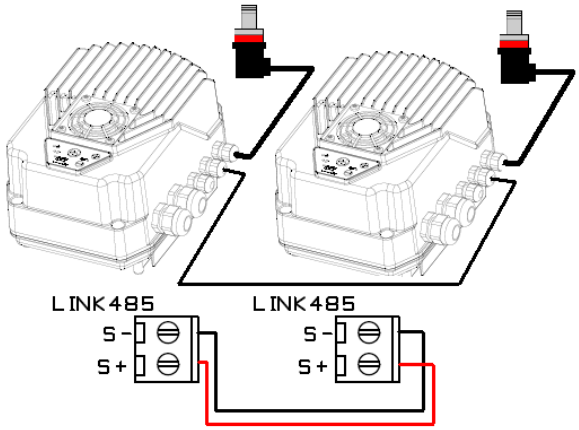
MANUAL START UP OF THE PUMP WITH FIXED FREQUENCY If the pressure sensor is disconnected or failed, the corresponding alarm is triggered (see alarm list). The pump can be started manually with fixed speed by holding the PLAY key down for at least 5 seconds.
The pump starts at a minimum frequency of 20 Hz. Press keys + or - to vary the frequency. If the SET LED is off, hold key + or - down until the SET LED switches on.

EXTERNAL FREQUENCY OPERATION The pump frequency (speed) can be varied with analogue input AN2 (0-10VDC).

Make sure the pressure sensor is not connected to analogue input AN1.

10. COMBO operating mode

To allow two EPIC devices to communicate with each other within a unit, connect the RS485 serial ports with a bipolar cable with minimum 0.35 mm^2 section.



Every EPIC must be equipped with its pressure sensor in COMBO operating mode.

We recommend equipping every device with independent circuit breaker and residual current protection in order to guarantee the operation of the unit in the event one unit fails.

We recommend following the procedure below upon the first start up:

1. Connect the two devices via serial with power supply disconnected.
2. Power one of the two devices.
3. Wait at least 30 seconds and then power the second device.

The device that has been switched on first is the MASTER device of the unit (as indicated by the blinking SET LED), while the second device is called SLAVE.

To start/stop the unit in COMBO mode, press PLAY or STOP from the MASTER device (blinking SET LED).

Pressure must be adjusted always from the MASTER device.

In the event one of the two units fails or triggers an alarm, the other unit restarts operation after 1 minute from the stop, guaranteeing continuity of service.

The device can alternate the operation of the pumps to maintain the same operation hours and, therefore, their wear, facilitating programmed maintenance operations.

11. Alarms and warnings

- LED Off: No power supply
- LED On: Correct power supply (1 x 230 VAC +/- 15%)
- Blinking Red LED: under-voltage
- Blinking Red and Yellow LEDs: over-voltage

- LED On: motor on.
  - Pressure control: pump operation at the required pressure.
  - Fixed frequency / external frequency: pump operation at fixed frequency.
- Blinking LED: Pressure control pump with measured pressure different from the required pressure. The blinking frequency of the LED increases when the required pressure is about to be reached.

- Blinking LED: EPIC in constant pressure regulation mode and regulation buttons deactivated.

  The SET LED switches on and regulation is activated by holding key + down for three seconds.

- LED off: EPIC in manual mode at fixed frequency or external frequency

  In COMBO operating mode, the SET LED is off in the SLAVE device.

- LED On: regulation activated.

The ALARM LED indicates an alarm based on a variable number of blinks followed by a three-second pause.

- 1 Blink: no water; automatic restore attempt after 5-10-20-40-80 minutes followed by definitive alarm (restart is possible only after deactivation).
- 2 Blinks: maximum motor current (consumed current higher than the set threshold).
- 3 Blinks: sensor alarm (no connected and efficient sensor, incorrect connection or output current lower than 2 mA).
- 4 Blinks: thermal alarm (NTC heat sink temperature higher than 70 °C).
- 5 Blinks: maximum inverter current alarm (restart is possible only after deactivation).
- 6 Blinks: master conflict alarm during COMBO operation (switch one of the inverters with triggered alarm off).
- 7 Blinks: no Master. Wait until the Slave becomes Master (it may require up to one minute)
- 8 Blinks: No control communication - power side (this alarm is normally triggered upon activation for a few seconds)
- Fast blinks without intermediate pauses: Digital inputs open.

Operating manual

IPFC

Index

1. IPFC Introduction

IPFC is a variable frequency drive designed to control and protect pumping systems by varying the output frequency to the pump.
IPFC can be applied to both new and existing pumping systems, and provides:

- energy and cost savings
- simplified installation and an overall lower pumping system cost
- longer life of the pumping system and relevant components
- improved reliability

IPFC, when connected to any pump, manages the system operation to maintain a certain constant physical quantity (pressure, differential pressure, flow, temperature, etc.) regardless of the conditions of use. The pump is operated only when needed thus avoiding unnecessary energy consumption.
IPFC at the same time is able to:

- protect the motor from overload and dry running
- implement soft start and soft stop to increase the system life and reduce current peaks
- provide an indication of current consumption, voltage, and power
- maintain a record of run time and display any errors and/or failures reported by the system
- control up to two additional pumps at a constant speed (Direct On Line)
- connect to other IPFC units for combined operation

Through the use of inductive filters (optional) IPFC eliminates dangerous surges that are induced in long cables, making IPFC suitable for control of submersible pumps.

2. Safety Instructions

The manufacturer strongly suggests carefully reading 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 instructions in this manual may result in dangerous and potentially lethal electric shock.
Pay attention to all standard safety and accident prevention regulations

The device must be connected to main power supply via a switch to ensure the complete disconnection from the network before any operation on the IPFC itself (including visual inspection) and/or on the connected load.

Disconnect IPFC from the main power supply before commencing any work.

Do not remove, for any reason, the cover and the cable plate without having first disconnected the device from the main power supply and having waited at least 5 minutes.

IPFC and pumping system must be grounded properly before operation.
For the entire period IPFC is powered, high voltage is present on the output terminals of the inverter whether or not the pump is running.

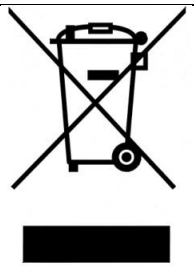
Tightening all screws on the cover with washers is recommended before powering the device. Otherwise, there may be a failure to connect the cover to ground, creating the risk of electric shock or even death.

Avoid any shock or significant impact during transport.

Check the IPFC immediately upon delivery and check for damage and/or missing parts. If either occurs, immediately notify the supplier.

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

Tampering or disassembly of any component will automatically void the warranty.
The manufacturer cannot be held responsible for any damages to people and/or property due to improper use of its products.



Devices marked with this symbol cannot be disposed of in household waste but must be disposed of at appropriate waste drop-off centres. It is recommended to contact the Waste Electrical and Electronic Equipment drop-off centres (WEEE) in the area. If not disposed of properly, the product can have potential harmful effects on the environment and on human health due to certain substances present within. Illegal or incorrect disposal of the product is subject to serious administrative and/or criminal penalties.

3. Technical Characteristics

Model	Vin +/- 15% [V]	Max V out [V]	Max I in [A]	Max I out [A]	P2 motor power* [kW]	Size
IPFC 109	1 x 230	1 x Vin	15	9	1,1	1
		3 x Vin		7	1,5	1
IPFC 114	1 x 230	1 x Vin	20	9	1,1	1
		3 x Vin		11	3	1
IPFC 306	3 x 380 - 460	3 x Vin	10	6	2,2	1
IPFC 309	3 x 380 - 460	3 x Vin	13,5	9	4	1
IPFC 314	3 x 380 - 460	3 x Vin	16	14	5,5	2
IPFC 318	3 x 380 - 460	3 x Vin	21	18	7,5	2
IPFC 325	3 x 380 - 460	3 x Vin	31	25	11	2
IPFC 330	3 x 380 - 460	3 x Vin	35	30	15	2
IPFC 338	3 x 380 - 460	3 x Vin	42	38	18,5	3
IPFC 348	3 x 380 - 460	3 x Vin	52	48	22	3
IPFC 365	3 x 380 - 460	3 x Vin	68	65	30	3
IPFC 375	3 x 380 - 460	3 x Vin	78	75	37	3
IPFC 385	3 x 380 - 460	3 x Vin	88	85	45	3

- Power frequency: 50 - 60 Hz (+/- 2%)
- Max. ambient temperature at nominal current: 40°C (104 °F)
- Max. altitude at nominal current: 1000 m
- Grade of protection: IP55 (SIZE 1,2) , IP54 (SIZE 3) *
- RS485 serial communication

* auxiliary cooling fan of the IPFC, used in wall mounted applications, has a protection rating of IP54.

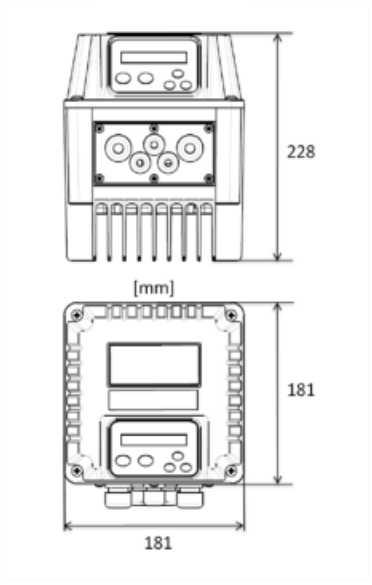
IPFC is able to power the motor with a higher current for a short period of time according to the linear relation: 101% of the nominal current for 10min., 110% nominal current for 1 min.

3.1 Weight and dimensions

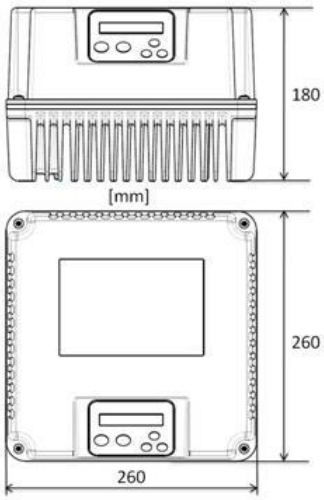
Model	Weight *	Size
	[Kg]	
IPFC 109	4	1
IPFC 114	4,3	1
IPFC 306	4,4	1
IPFC 309	4,4	1
IPFC 314	7	2
IPFC 318	7	2
IPFC 325	7	2
IPFC 330	7,2	2
IPFC 338	33	3
IPFC 348	33	3
IPFC 365	34	3
IPFC 375	34	3
IPFC 385	34	3

* Weight without packing.

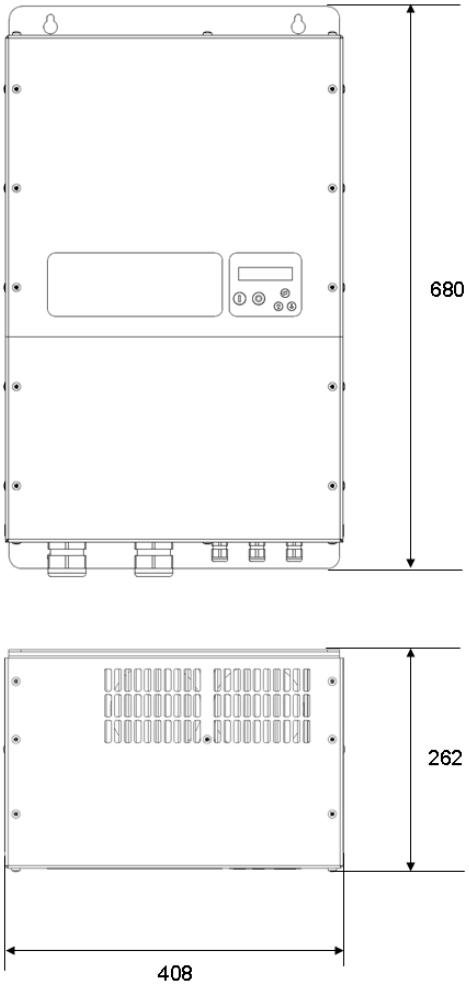
SIZE 1



SIZE 2

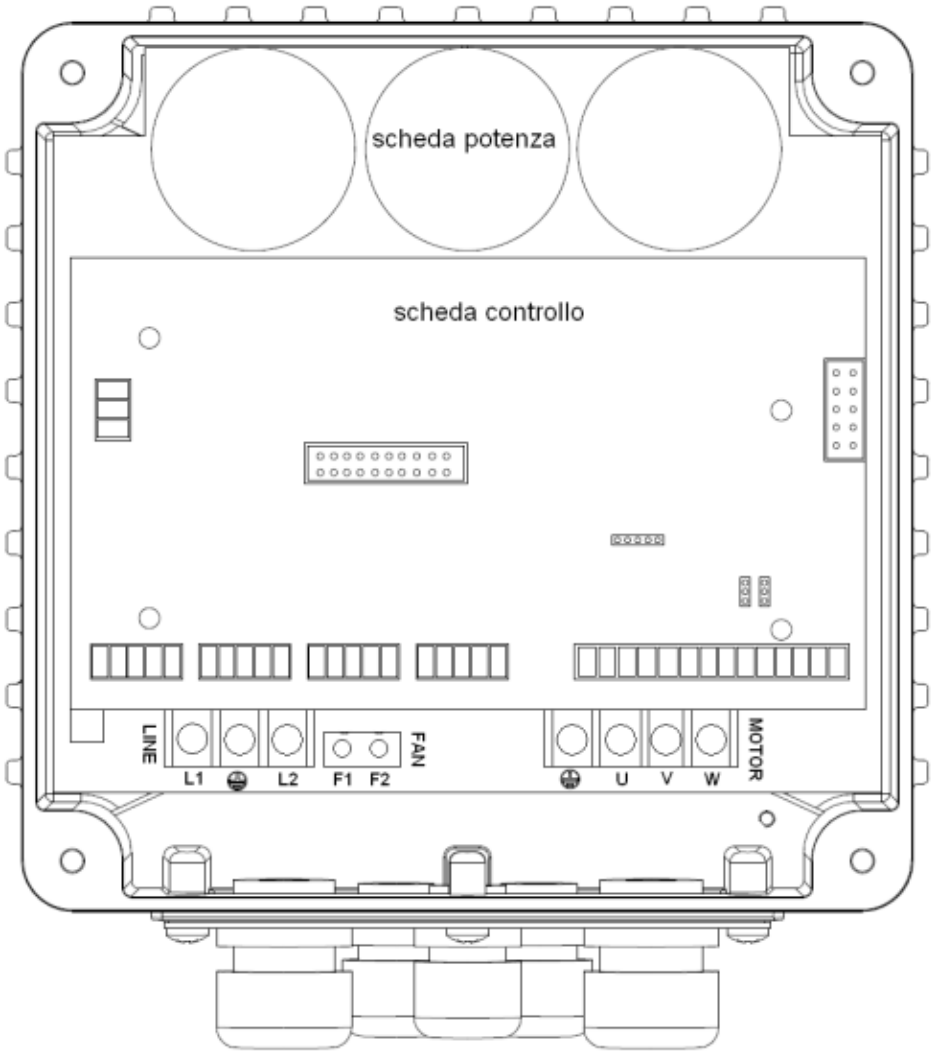


SIZE 3



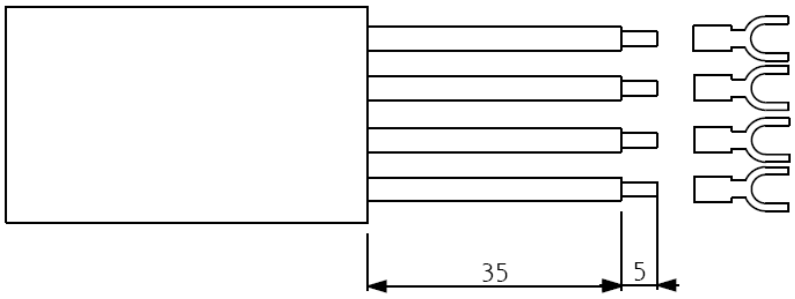
4. Electric wiring

Power board IPFC 109,114

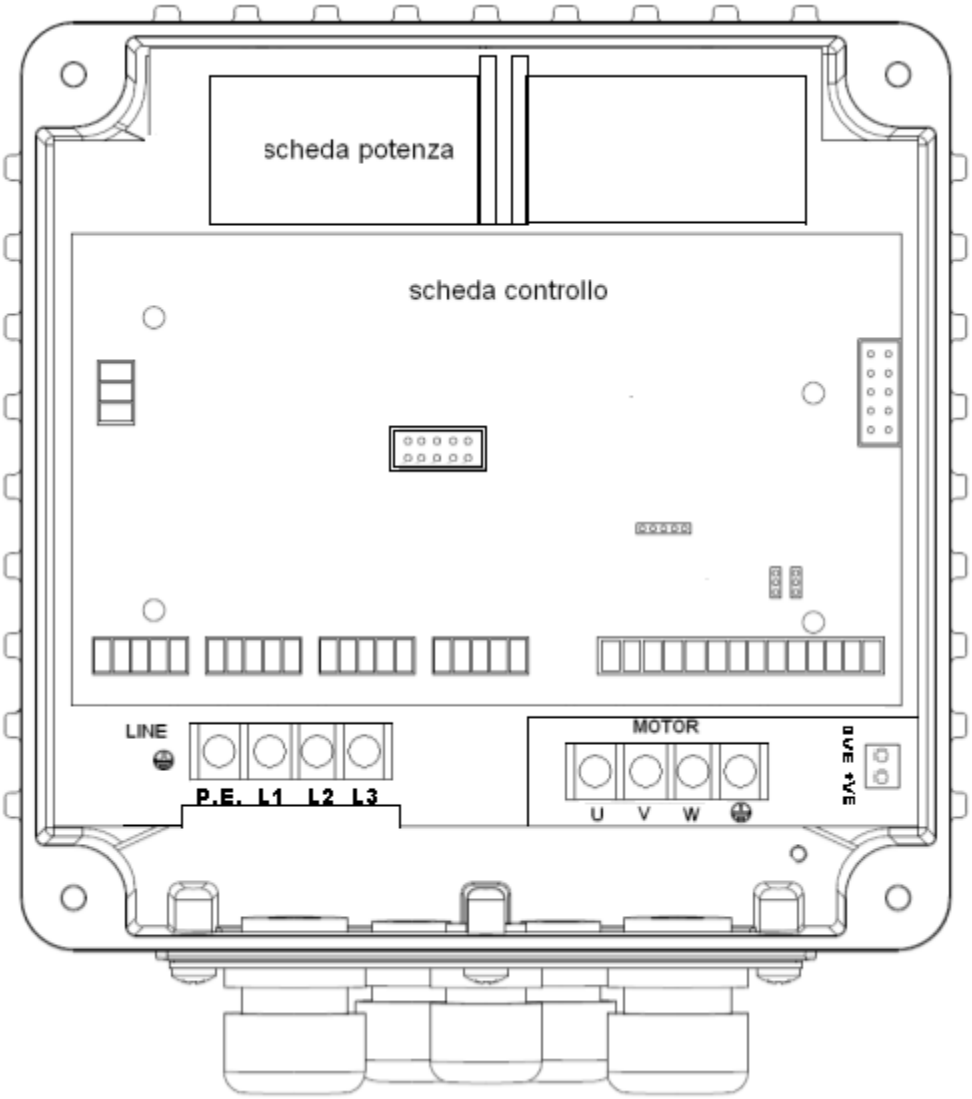


Power supply: **LINE: L1, L2,GND** **It is recommended to use cable lugs**	Output: **3 ph motor:** **GND,U,V,W,** **1 ph motor:** **earth, U (running), V (common)** **It is recommended to use cable lugs.**	230 V AC auxiliary fans (wall mounting kit) **FAN: F1, F2**

Recommended line and motor cables stripping

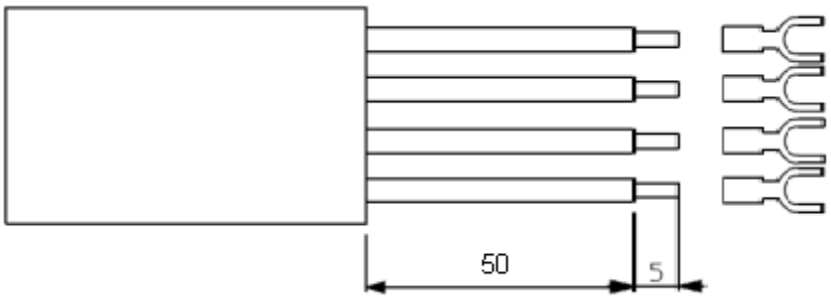


Power board IPFC 306,309

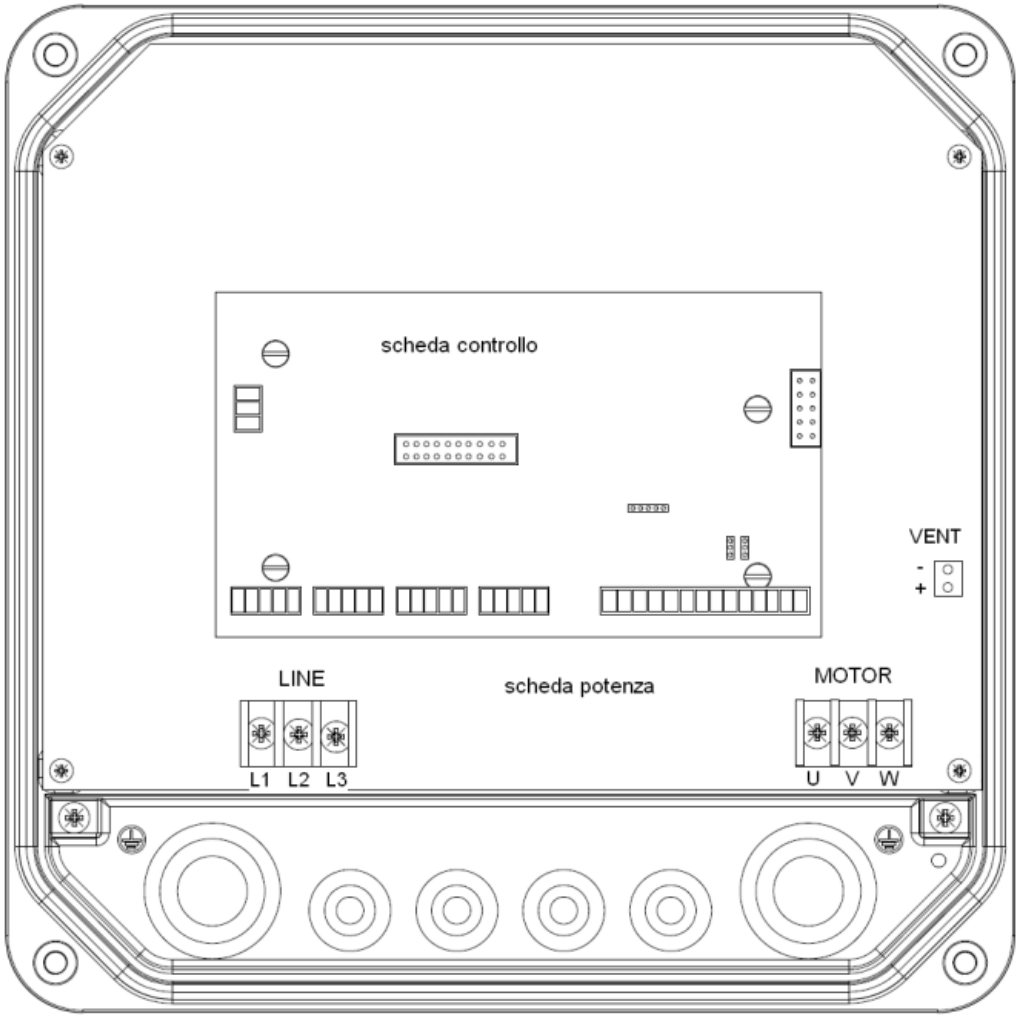


Power supply: **LINE: GND , L1, L2, L3,** **It is recommended to use cable lugs.**	Motor output: **MOTOR: U, V, W, GND** **It is recommended to use cable lugs.**	12 V dc auxiliary fan (wall mounting kit) : **0VE, + VE** **WARNING: respect the polarity.**

Cable stripping recommended for line input and output to the motor.

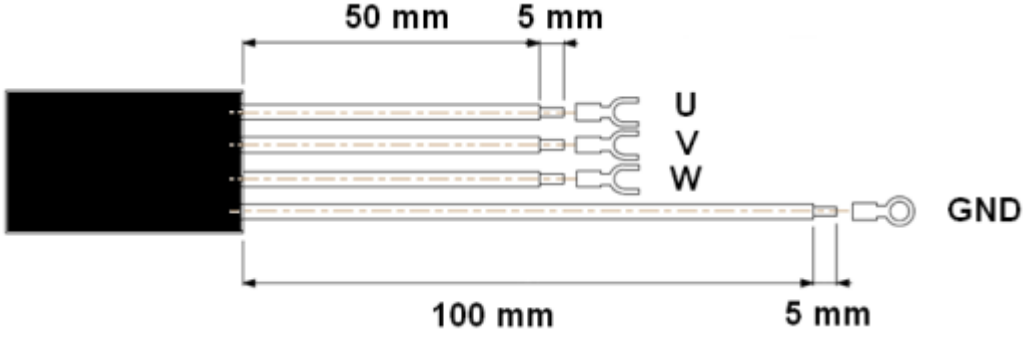


Power board IPFC 314,318,325,330

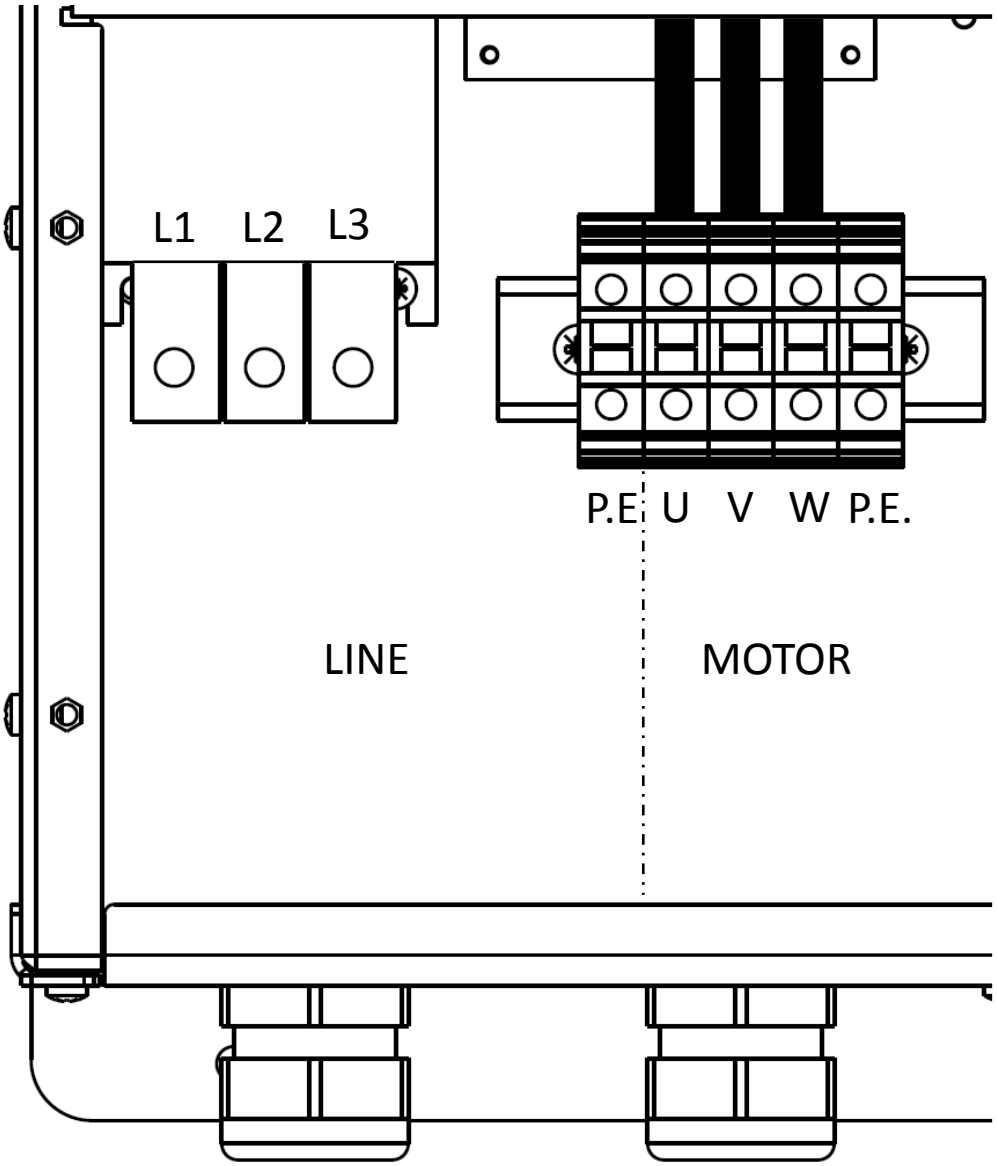


Power supply: **LINE: L1, L2, L3, GND** **It is recommended to use cable lugs.**	Motor output: **MOTOR: U, V, W, GND** **It is recommended to use cable lugs.**	12 V dc auxiliary fans (wall mounting kit) **VENT: +, -** **WARNING: respect the polarity.**

Cable stripping recommended for line input and output to the motor.

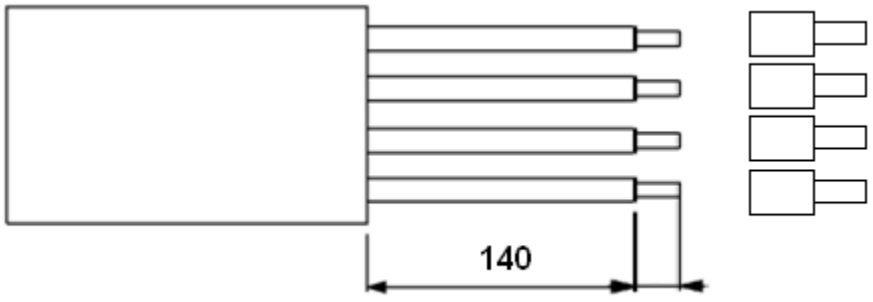


Power board IPFC 338,348,365,375,385

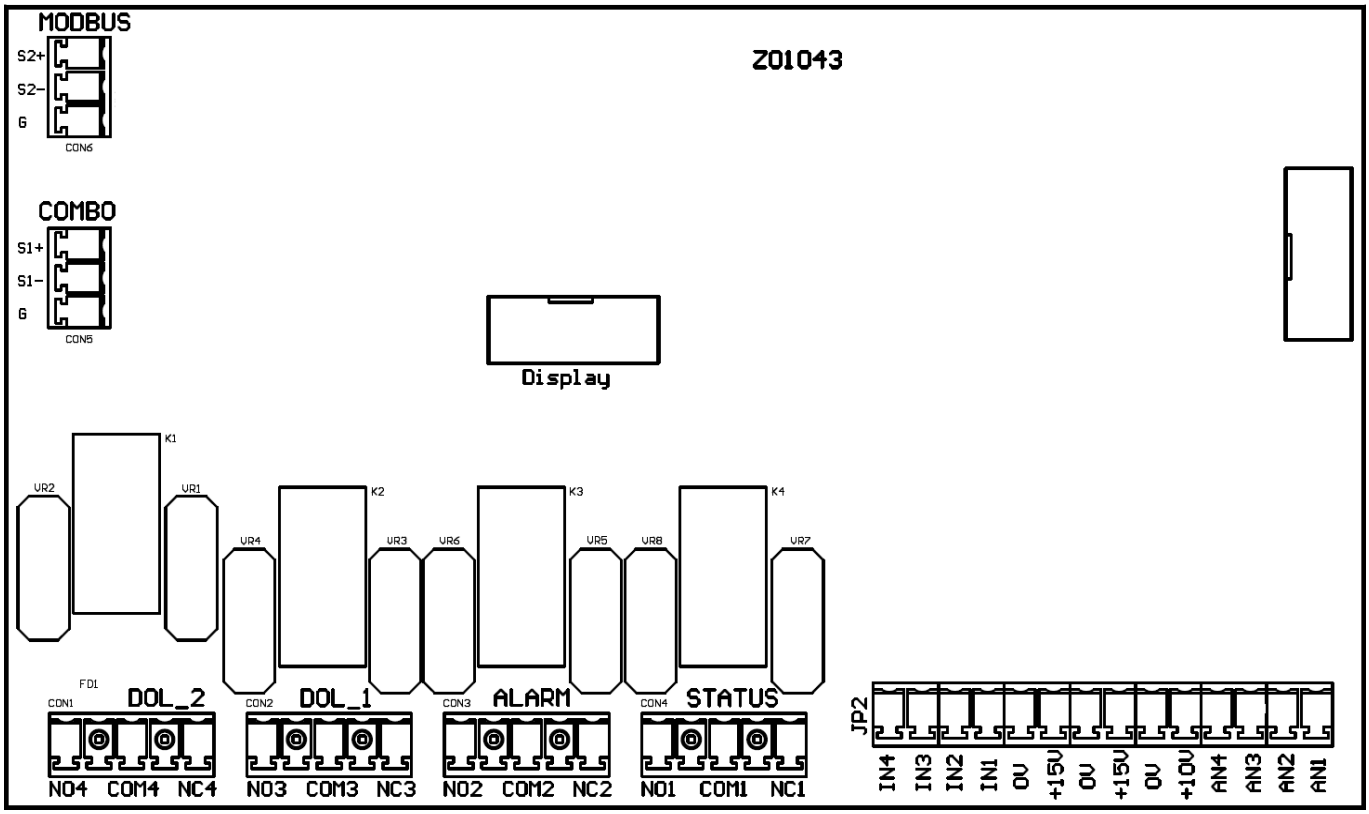


Power supply:	**Motor output:**
LINE: L1, L2, L3, P.E.	**MOTOR: U, V, W, P.E.**
It is recommended to use cable lugs.	**It is recommended to use cable lugs.**

Cable stripping recommended for line input and output to the motor.



Control board



Analog inputs (10 or 15 Vdc): 1. AN1: 4-20 mA: sensor 1 2. AN2: 4-20 mA: sensor 2 3. AN3: 4-20 mA / 0 - 10 Vdc (settable by jumper C.C.): external set **4.** AN4: 4-20 mA / 0 - 10 Vdc (settable by C.C.): trimmer for frequency regulation / external set 2	Digital outputs: • motor run signal: NO1, COM1: closed contact with motor running. NC1,COM1: closed contact with motor stopped. • alarm signal NO2,COM2: closed contact without alarm. NC2,COM2: closed contact with alarm or no power supply. • DOL1 pump relay: NO3,COM3: closed contact with DOL1 running. NC3,COM3: opened contact with DOL1 running. • DOL2 pump relay: NO4,COM4: closed contact with DOL2 running. NC4,COM4: opened contact with DOL2 running. Relays are no voltage contacts. Max. voltage to the contacts is 250 V with max current of 5 A.	RS485 for COMBO: • S1+ • S1- • G It is recommended to respect the polarity linking more IPFCs in series.
Digital inputs: • IN1 : motor start & stop • IN2: value set 1 & 2 switching • IN3: sensor 1 & 2 switching • IN4 : motor start & stop + alarms reset • 0V We recommend using only no voltage contacts. Opening or closing the digital contacts (depending on software configuration set (see IN/OUT. parameters) you can start or stop the motor.		RS485 for MODBUS: • S2+ • S2- • G It is recommended to respect the polarity.

4.1 Protections

The protections required upstream each IPFCs depends on the type of installation, and local regulations. We recommend to use overload protection with the characteristic curve of type C and type B circuit breaker, sensitive to both AC and DC current.

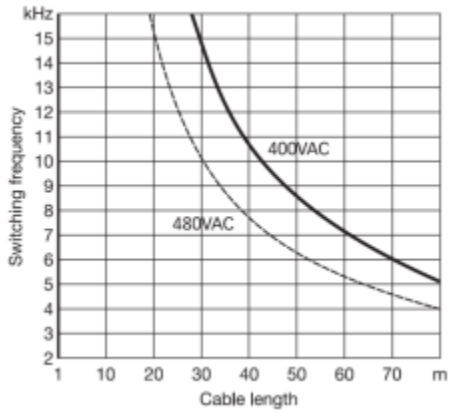
4.2 Electromagnetic compliance

To ensure electromagnetic compatibility (EMC) of the system, it is necessary to apply the following measures:

- Always connect the device to ground
- Use shielded signal cables by placing the screen at one end.
- Use motor cable as short as possible (<1 m / <3 ft). For longer lengths, it is recommended to use shielded cables connecting the screen at both ends.
- Separate signal, motor, and power supply cables.

Note: To enable the restoration of the display screen when there are electromagnetic interference, IPFC periodically provides some fast "refresh" of the display.

4.3 Installation with long motor cables

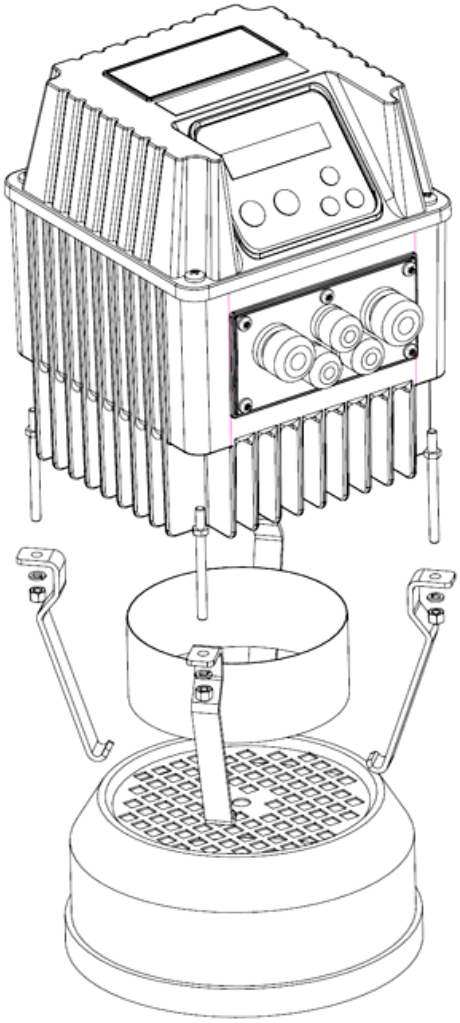
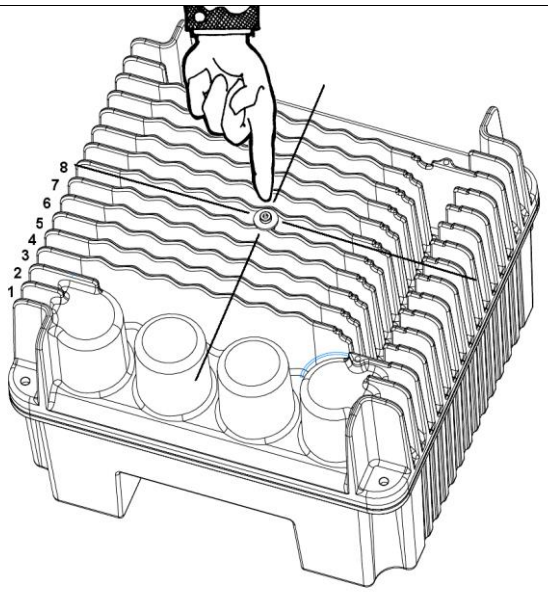
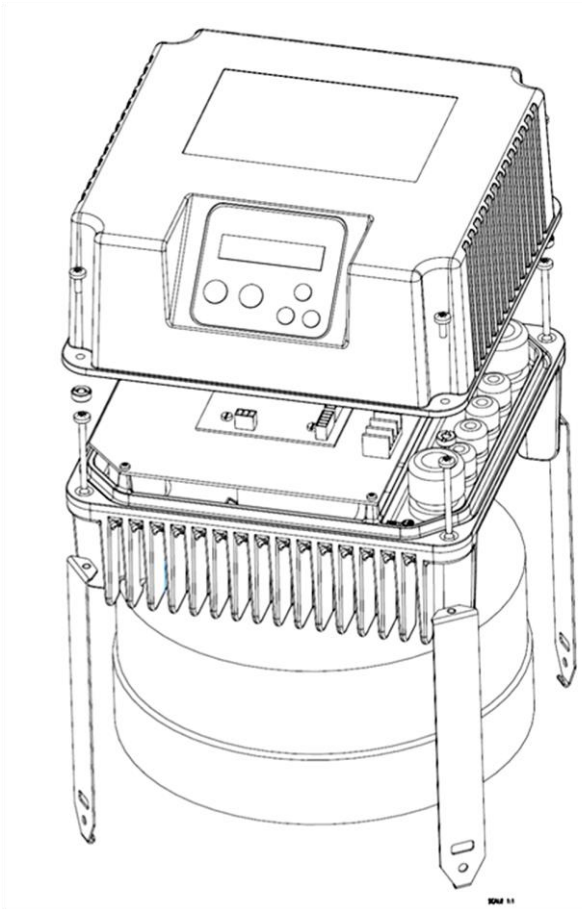
<table>
<tr>
<td rowspan="2">With long motor cables it’s recommended to decrease the commutation frequency from 10 kHz (default) to 2.5 kHz (advanced parameters). This reduces the probability of voltage spikes in the motor windings which may damage the insulation.</td>
<td> 
</td>
</tr>
<tr>
<td>To prevent dangerous overheating of dv / dt and sinusoidal filters it is recommended to set the correct PWM value in relation to the cable length.</td>
</tr>
<tr>
<td>For motor cable lengths up to 50 meters it’s recommended to place between IPFC and motor a dv / dt reactance, available on request.
  </td>
<td>For motor cable lengths greater than 50 meters it’s recommended to place between IPFC and motor a sinusoidal filter, available on request.
  </td>
</tr>
</table>

5. IPFC installation

IPFC can be installed directly on the fan cover **of the motor** or mounted on the **wall.**

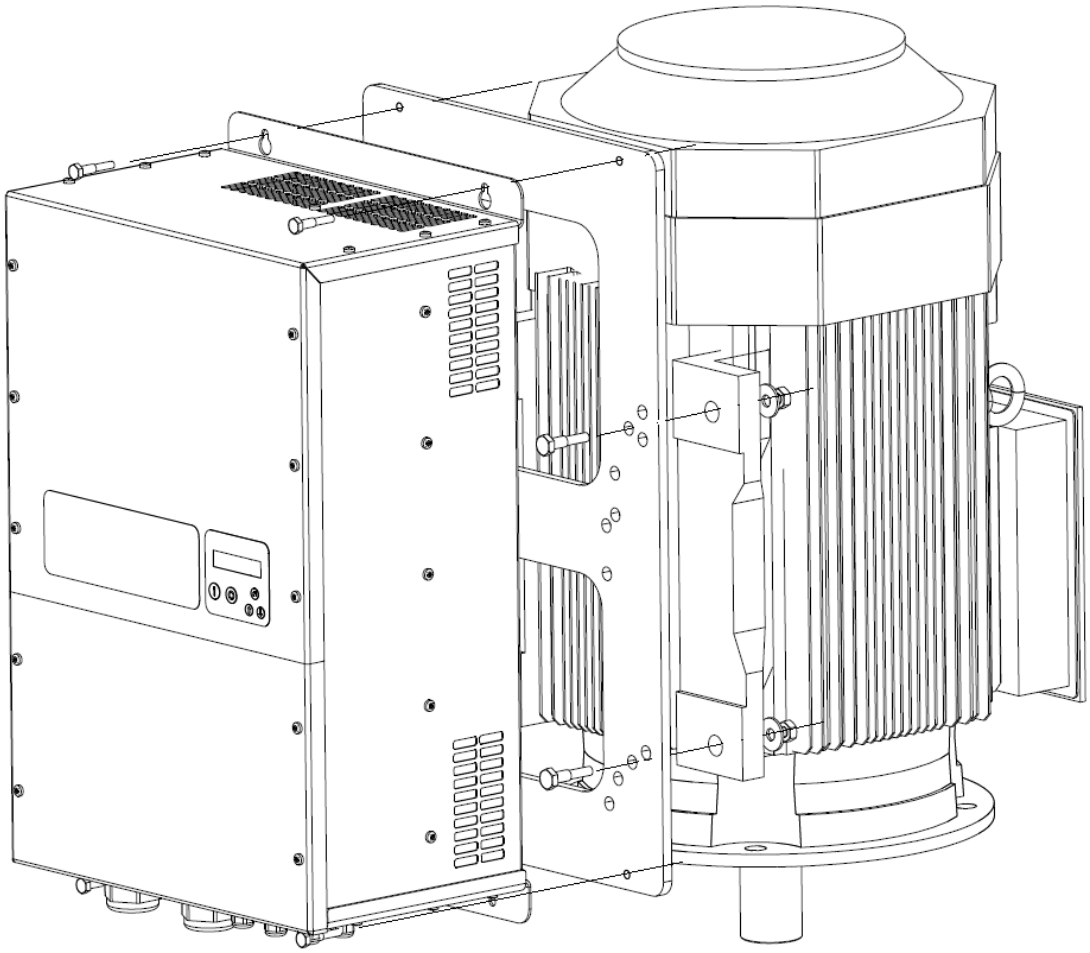
Motor mounting kit

In this application IPFC is cooled by the motor fan. Motor kit (available upon request) allows a solid coupling of the two units and it is composed of:

IPFC SIZE 1	IPFC SIZE 2
• n.°4 rods • n.°4 M5 nuts • n.° 4 hooks • n.° 1 cooling ring	• n.° 4 M5 screws. • n.° 4 clamps • n.° 4 clips to add if necessary • n.°1 centre pin
	 
Use the cooling ring for best cooling of IPFC during operation. Warning: when using the cooling ring, the cooling air of the motor is slightly warmer than without the IPFC; if the resulting motor temperature exceeds the indicated maximum allowable value, remove the cooling ring, leaving the IPFC to be cooled by itself.	

IPFC SIZE 3

- n.° 1 motor feet adaptor for MEC160,180,200,225
- n.° 4 M8 bolts,
- n.° 4 M10 bolts, nuts and washer

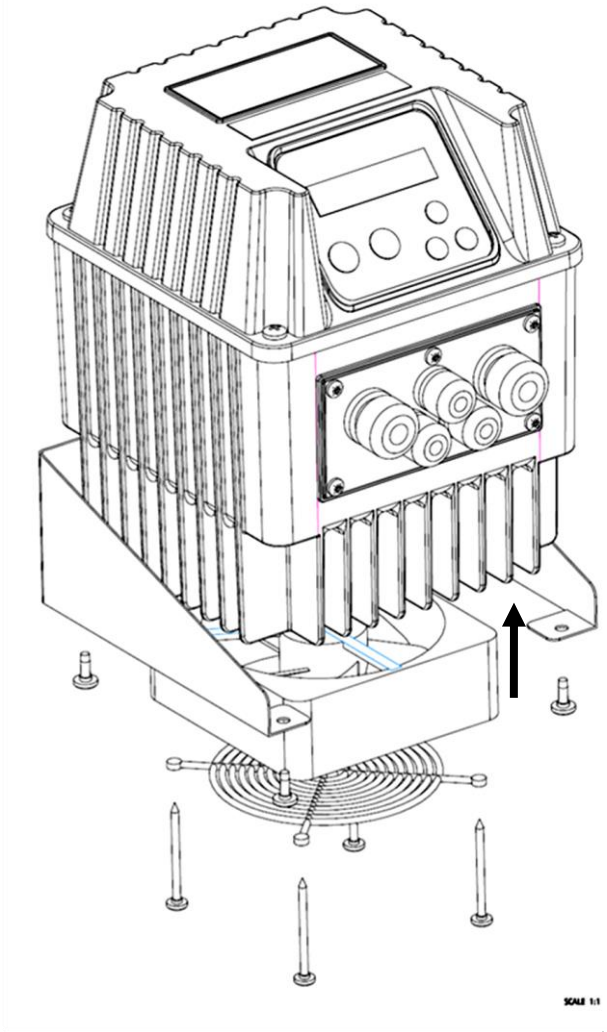


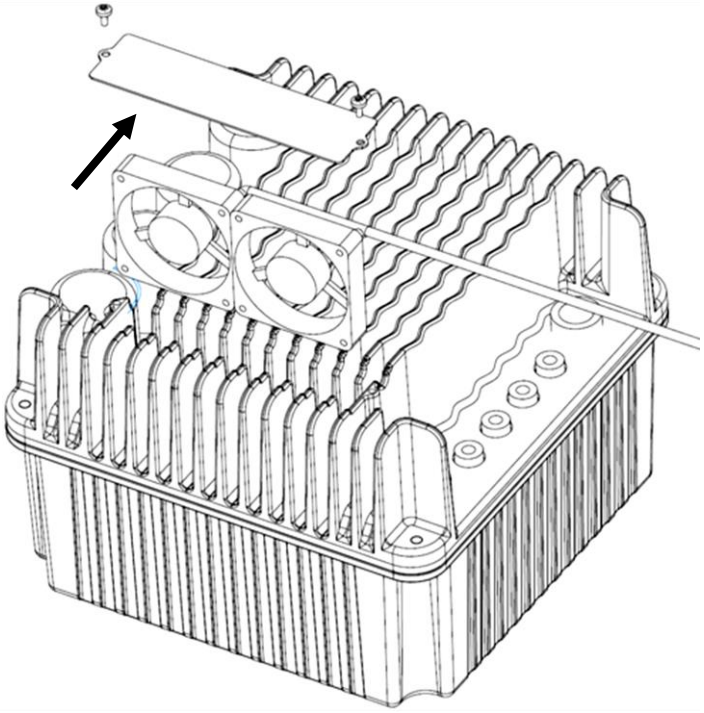
Wall mounting kit

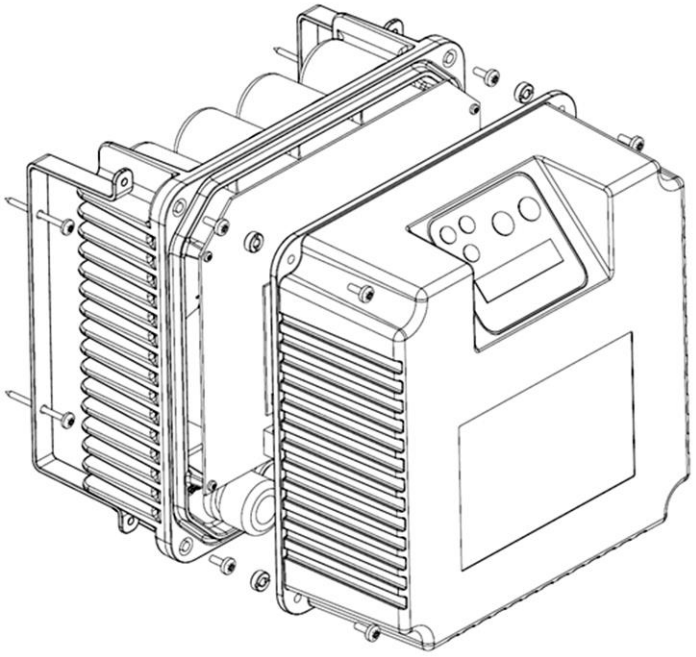
In this application IPFC is cooled independently by its auxiliary cooling fan integrated in the radiator.

Wall-mounted kit is composed of:

IPFC SIZE 1	IPFC SIZE 2
• n.° 1 auxiliary fan 230V AC (IPFC 109,114) or 12 VDC (IPFC 306,309) • n.° 4 screws to fix cooling fan • n.° 1 protection grill • n.° 1 metal bracket in AISI 304 • n.° 4 screws to fix IPFC to wall bracket	• n.° 2 12 V DC fans. • n.° 1 fans cover. • n.° 2 fans cover fixing screws • n.° 2 wall fixing brackets • n.° 4 M5 screws for IPFC fixing to the brackets • n.°1 holes reference sheet



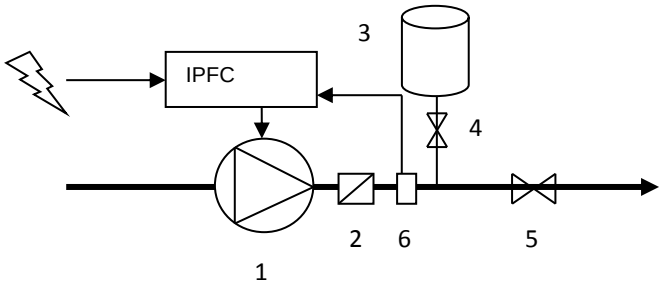




Make sure the manufacturer that the electric motor is suited for operation in the inverter
Make sure to properly attach the grid of the auxiliary cooling fan.
Make sure to remove the auxiliary cooling fan if IPFC is coupled to a motor. Failure to do so creates a high risk of overheating the motor and IPFC unit.

5.1 IPFC Installation for constant pressure control

IPFC controls the pump speed to maintain constant pressure at a set point independent of the water demand in the system. A basic schematic is shown below:



1: pump

2: check valve

3: pressure tank

4: valve

5: valve

6: pressure sensor

5.1.1 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 IPFC 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 80% 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 3.2 bar
If the set-pressure of the system is 60 psi, the pre-charge pressure of the tank should be 48 psi

5.1.2 Pressure sensor

IPFC requires a pressure sensor with a linear output signal within the range 4 – 20 mA. The pressure transducer can be powered by any range of DC Voltage which includes the value 15 V dc.

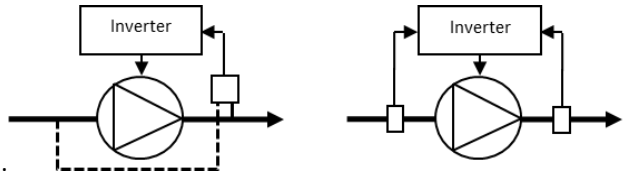
IPFC accepts the signal of a second pressure sensor in order to:

- realize constant differential pressure (AN1 – AN2).
- substitute first pressure sensor when it fails
- switch pressure sensor by closing digital input IN2

SENSOR 1	• AN1: 4-20 mA (-) signal • +15V: 15 Vdc (+) power supply
SENSOR 2	• AN2: 4-20 mA (-) signal • +15V: 15 Vdc (+) power supply

5.2 IPFC installation for differential constant pressure applications

IPFC can manage the pump speed in order to keep constant the pressure difference between the dischage and suction side of the pump in circulation systems. To do this, it is usually installed a differential pressure sensor. Alternatively, it is possible to use two identical pressure sensors: one in suction side and one in discharge side of the pump. The difference of values is performed by the IPFC itself.



N.B. If during the operation it is expected that the pressure in the suction side falls below the atmospheric pressure, it is necessary to use absolute pressure sensors and not relative ones.

5.2.1 Sensors wiring

The IPFC can be connected to linear pressure sensors with 4 - 20 mA output. The supply voltage range of the sensors must include the 15 VDC with which the IPFC feeds the analog inputs.
If you are using a differential pressure sensor it is necessary to connect the sensor to the analog input 1:

DIFFERENTIAL SENSOR	• AN1: 4-20 mA (-) signal • +15V: 15 Vdc (+) supply

In case two pressure sensors are used, the pressure sensor in the discharge side must be connected to the analog input 1 while the pressure sensor in the suction side must be connected to the analog input 2:

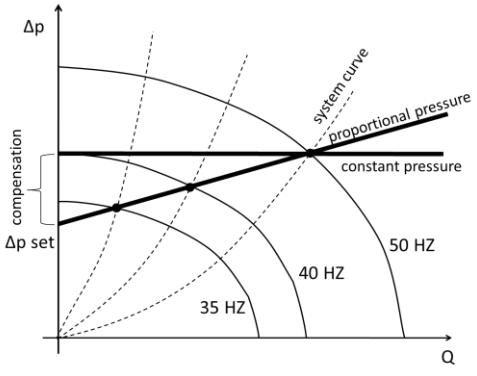
SENSOR 1 (discharge)	• AN1: 4-20 mA (-) signal • +15V: 15 Vdc (+) supply
SENSOR 2 (suction)	• AN2: 4-20 mA (-) signal • +15V: 15 Vdc (+) supply

In the IN/OUT parameters menu it is therefore necessary to set the logic AN1, AN2 as "difference".

5.2.2 Programming

In circulation systems pump starting and stopping is usually controlled by an external contact that can be connected to the digital input 1 (IN1, 0V) and configured as N.O or N.C in the IN/OUT parameters menu. It is then recommended to set the following parameters:

Control parameter	**Recommended value**
Freq. min control	Same as minimum motor frequency
Delta control	0 bar
Delta start	0 bar
Stop delay	99 sec
IN/OUT parameter	**Recommended value**
Function AN1,AN2	Difference 1-2



Constant differential pressure

The "set value" corresponds to the differential pressure to be kept constant.
Set the "set value" equal to the pressure difference measured between the discharge and the suction side of the pump at maximum load (all utilities opened) and at maximum frequency (50 Hz).

Proportional differential pressure

In case it is needed to use a control logic based on proportional differential pressure (in order to achieve a further energy saving), it is necessary to set the "set value" equal to the pressure difference between the discharge and suction side of the pump at minimum frequency (20 Hz) and "compensation" in order to reach the maximum set value at maximum frequency (50 Hz) and maximum load (all utilities opened).

6. IPFC Use and Programming

IPFC 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 (MENU' CONTROL PARAMETERS, MENU' IN/OUT PARAMETERS, MENU' CONNECTIVITY PARAM.)**
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.

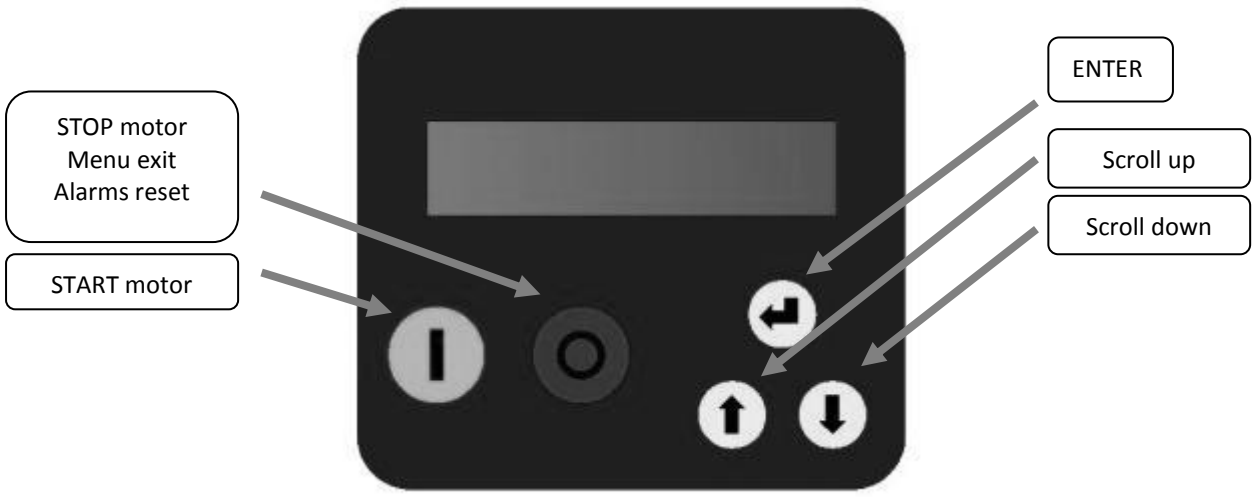
2. **Advanced level (MENU' MOTOR PARAMETERS)**
A second and different password is required; improper setting of these advanced parameters could compromise the integrity and the life of IPFC and pump;

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).

6.1 IPFC display



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

6.2 Initial configuration

When IPFC is switched on for the first time, the initial setting menu is displayed for the initial setting of parameters to configure pump characteristics, pressure sensor range, and system characteristics.
If the initial setting procedure is not completed properly, it is impossible to run the pump. Initial setting procedure can be repeated if necessary.
The initial setting procedure can be repeated (by using the 2rd level password) to reconfigure IPFC or if IPFC is installed in a different system.
A brief description of parameters and their allowable ranges are listed below:

Parameter	Default	Description
Language XXXXXX	XXXX	End user communication language
Unit XXXXX	bar	Unit
Motor type XXXXXX	three-phase	Type of motor connected: • single phase (IPFC 109, 114) • asynchronous three-phase • synchronous PM (permanent magnets)
Rated motor Amp. I = XX.X [A]	XX	Rated current of the motor per it's nameplate indication increased by 10%. The voltage drop caused by the inverter leads to higher input current than nominal. Make sure motor is capable of accepting increased current.
Rated motor freq f = XXX [Hz]	50	Rated frequency of the motor per its nameplate.
Control mode: Constant value [bar]		
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.
MOTOR TUNING press ENT		If the device is "FOC-ready", motor calibration must be carried out before commissioning. Carefully read the pertinent chapter.
Motor test START/STOP		Press START/STOP to run a test at rated frequency **Warning: make sure to run the system without damaging pump and system**
Rotation sense ---> / <---	--->	If, during the test, the motor runs in reverse, it is possible to change the wiring sequence via software without physically changing wires at the terminals.
COMBO ON/OFF	OFF	Activation or deactivation of COMBO operation.
Autorestart ON/OFF	OFF	If ON is selected, after a lack of voltage, IPFC returns to its normal status; if IPFC was powering the pump before the voltage drop, it resumes powering the pump automatically. Warning, 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 IPFC; these parameters can be set up individually in the parameters menu.

6.2.1 FOC motor control

Introduction

FOC (Field Oriented Control) motor control implemented in FOC-ready inverters provides the following advantages compared to traditional control:

- Optimal control of the current at each work point.
- Quick and precise speed adjustment.
- Lower energy consumption.
- Reduction of torque oscillations (vibrations) for smoother and more regular operation throughout the frequency range and lower system noise.
- Lower mechanical stress on the motor, pump and hydraulic system.

FOC control of FOC-ready devices can be used with:

- Asynchronous three-phase motors
- Permanent magnet three-phase synchronous motors

The control is sensorless, i.e. not requiring the use of any sensors.

Calibration of the FOC control

To enable the device to perform FOC control, it is necessary to:

1. Perform all system wiring. Connect the load (pump) to the inverter with a cable of appropriate length and possible presence of a dV/dt or sinusoidal filter.
2. Power the system and follow the initial configuration procedure by specifying:
   a) Motor type: three-phase asynchronous or permanent magnet synchronous.
   b) Rated voltage of the motor.
   c) Rated frequency of the motor.
   d) Rated current of the motor increased by 5%.
3. Perform the Auto tuning process to allow the inverter to learn the electrical information of the load connected to it (motor, cable and any filter). The calibration process can take up to one minute.
4. Wait for the calibration process to complete successfully.

	**During the calibration process the motor remains stationary but is powered for the entire calibration period.** **Disconnect the device from the power supply before any intervention on the equipment and on the loads connected to it.** **Carefully follow the safety instructions in the installation and operating manual of the device.**

	**The calibration process can take up to one minute. Wait until it has completed.** **The calibration process must be performed during the final electrical configuration of the system, i.e. with the motor, the cable and any filter applied.** **If there is any variation of the motor, cable or filter applied, it is necessary to repeat the calibration process by accessing the motor parameters menu (default password 002).** **An incorrect configuration of the motor's rated voltage, frequency or current will lead to erroneous results in the calibration process and therefore to a malfunctioning of the motor.** **Setting the rated motor current higher than the tag value can seriously damage both the motor and the inverter.** **During calibration the motor coils are heated by the test current. If the motor is self-ventilated the absence of motor rotation does not allow the heat to be dispersed by force.** **It is therefore recommended to allow the motor to cool between one calibration and the next.**

If the calibration process is not successful, it is necessary to check:

- The connections between the inverter and the load (including any motor filters in between).
- The rated voltage, frequency and current values set.

	**The motor cannot be started until the calibration process has been completed.** **If the calibration process cannot be completed, it is possible to manually enter the parameters or stator resistance (Rs) and stator inductance (Ls) in the motor parameters menu (default password 002).** **These data can be provided by the motor manufacturer or obtained through measurements.** **If you do not have these data and the self calibration process is not successful, it is recommended to contact technical assistance.**

Adjustment of the FOC control

The FOC control algorithm checks current (torque) and speed with defined response dynamics.

The FOC dynamic is set by default to a value sufficient to guarantee precise and oscillation-free control in most applications.

In some cases, however, it may be necessary to increase (if there are frequency oscillations) or to lower (in the event of overcurrent or igbt trip alarms) the "FOC dynamic" setting in the motor parameters menu (default password 002) according to the following table :

CONFIGURATION	FOC DYNAMIC
Motor cables shorter than 100 m and no filter between inverter and motor.	200
Motor cables shorter than 100 m and a dV/dt filter between the inverter and the motor.	150
Motor cables longer than 100 m and a dV/dt filter between the inverter and the motor.	100
Presence of a sinusoidal filter between the inverter and the motor.	50

	**The incorrect setting of the FOC dynamic can cause:** • **Speed oscillations if the FOC dynamic is too slow.** • **Overcurrent or igbt trip alarms if the FOC dynamic is too fast.** **It is recommended to intervene promptly by appropriately adjusting the "FOC Dynamic" parameter if the conditions listed above are present.** **Lack of intervention could lead to damage to the inverter, the motor and the system.**

6.3 Initial view

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

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

Inv: ON/OFF Mot: ON/OFF p = XX.X [bar]	*p is the pressure value read by the pressure transducer.* *By pressing ENTER the pressure set value is displayed <XXX.X>*
Inv: ON/OFF Mot: ON/OFF f = XXX [Hz]	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).
Inv: ON/OFF Mot: ON/OFF V_in = X.XX [V] I= XX.X	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.
Inv: ON/OFF Mot: ON/OFF cosphi = XXX	cosphi index means the angle phi between the voltage and current absorbed by the motor
Inv: ON/OFF Mot: ON/OFF P = XXXXX [W]	P is the power in Watts supplied to the pump.
Inv: ON/OFF Mot: ON/OFF STATUS: NORMAL Inverter Life xxxxx h : xx m Motor Life xxxxx h : xx m %f 25 50 75 100 %h XX XX XX XX XXXXXXXXXXXXXXX XXXXXXX h : XX m	NORMAL status means no alarms. If an alarm occurs, a message blinks on the display and an audible signal is activated. Pressing ENTER accesses: IPFC lifetime, PUMP lifetime, consumption statistic, alarm list. To return to previous views, press ENTER.
Menù ENT to access	

First row gives the IPFC status:

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

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

6.4 Menu view

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

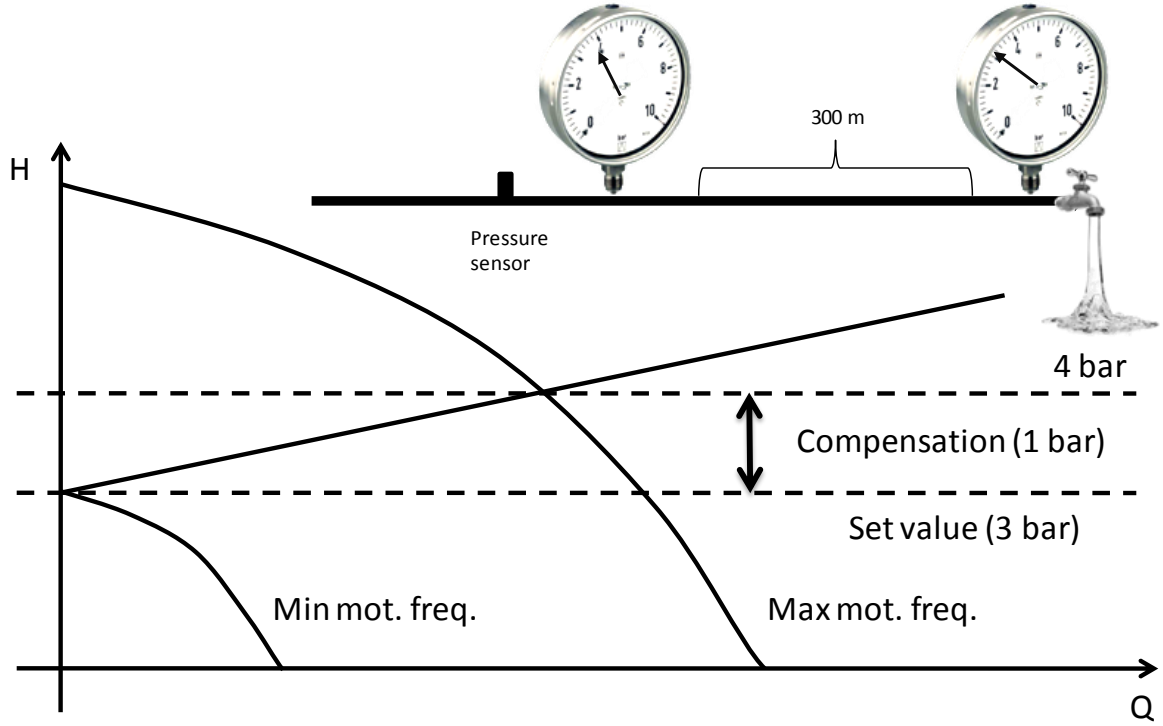
	MENU' Control. param.		Installer password required to enter level 1 (default 001)
	MENU' Motor param.		Advanced password required to enter level 2 (default 002)
	MENU' IN/OUT. param.		Installer password required to enter level 1 (default 001)
	MENU' Connect. param.		Installer password required to enter level 1 (default 001)
	MENU' Change init.set.		Advanced password required to enter level 2 (default 002)

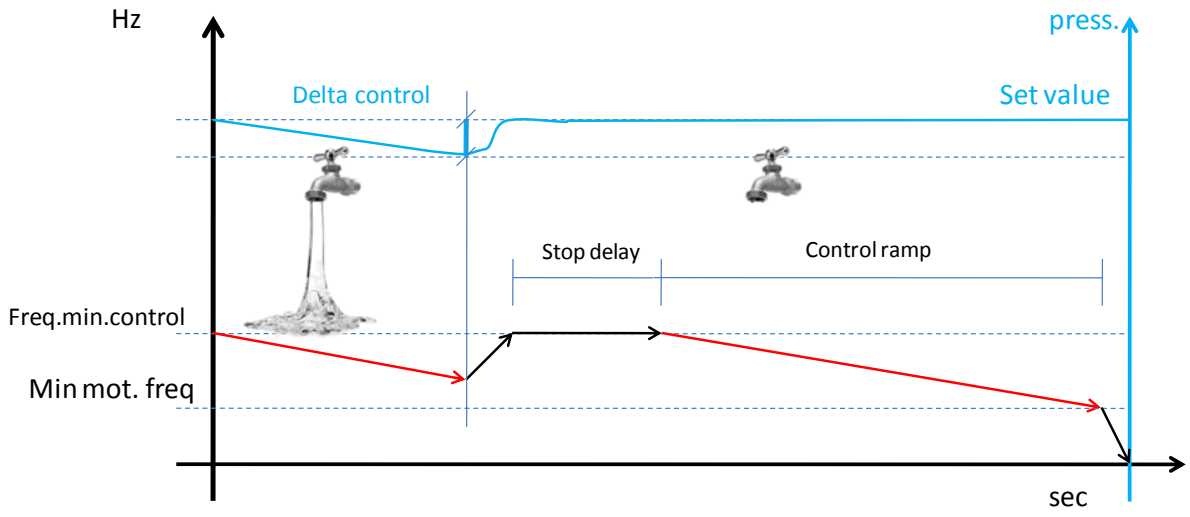
To exit the Menu level and return to initial display, press STOP button.

6.5 Control parameters

Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
Control mode • Constant value • Fix speed • Const.value 2set • Fix speed 2 val. • External speed	Constant value	Mode of control: • Constant value: IPFC changes the pump speed to keep the set value constant regardless water demand. • Fix speed: IPFC feeds the pump at set frequency, so the pump speed is kept constant. • Const. value 2 set: the two values are selected by opening or closing the digital input IN2. • Fix speed 2 val: the two valus are selected by opening or closing the digital input IN2. • External speed: control motor frequency by using analogical input AN4.					
Max alarm value XXX.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.	✓	✓	✓	✓	✓

Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
Min alarm value XXX.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 XXX.X [bar]	3	Set value to be kept constant.	✓				
Compensation XXX.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 XXX.X [bar]	3	Set value to be kept constant.			✓		
Compensation 2 XXX.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 XX [s]	5	Time to update set value for compensation.	✓		✓		

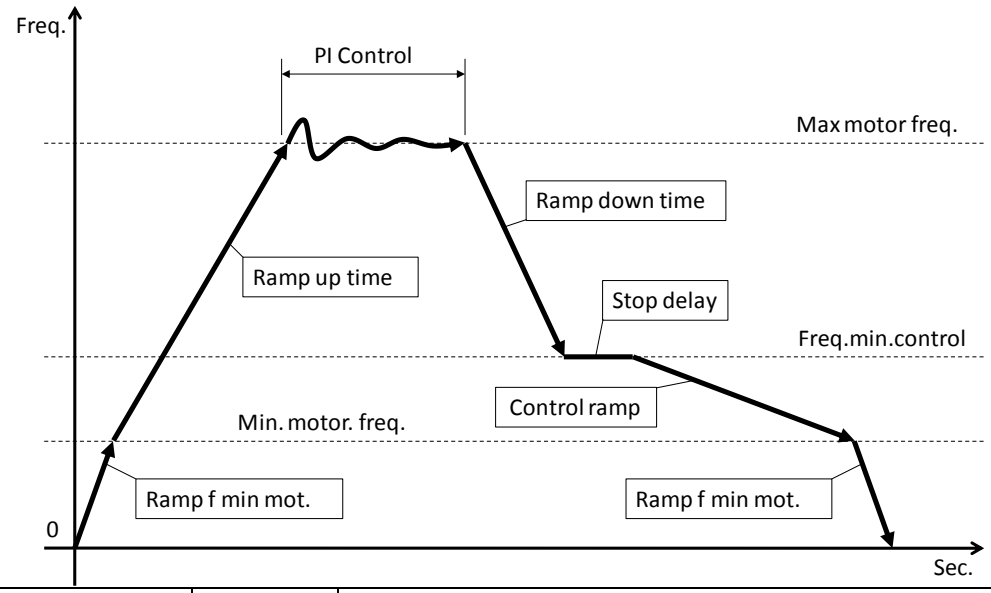
Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
To ensure proper operation of pressure control is recommended to place the sensor near the pump. To compensate the pressure loss in the pipes (proportional to flow) it is possible to vary the pressure 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. XXX [Hz]	50	Frequency value to feed the pump.		✓			
Operating freq. 2 XXX [Hz]	50	Frequency value to feed the pump.				✓	
Freq.min.control XXX [Hz]	50	Minimum frequency below which the pump tries to stop.	✓		✓		✓
Stop delay XX [s]	5	Delay for which the pump tries to stop below freq.min.control.	✓		✓		✓
Control ramp XXX.X [s]	20	Ramp time from freq.min.control to min.motor freq. If, during this time, the read value goes below the (set value - delta control), IPFC powers the motor again; otherwise, IPFC will stop the pump.	✓		✓		✓

Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
Delta control XXX.X [bar]	0.1	Value drop below the set value required to restart the pump during control ramp.	✓		✓		
							
Delta start XXX.X [bar]	0.5	Value drop below the set value required to start the pump from stop condition.	✓		✓		
Delta stop XXX.X [bar]	0.5	Value increase respect to set value which must be passed so that there is a forced shutdown of the pump.	✓		✓		
Ki Kp		Kp and Ki parameters allow the dynamic control of system by IPFC; set values (Ki=50, Kp=005) are usually enough to get a valid dynamic control.	✓		✓		
Pump DOL 1 ON/OFF	OFF	Function to activate (ON) the first auxiliary pump DOL 1 (Direct On Line pump).	✓		✓		
Pump DOL 2 ON/OFF	OFF	Function to activate (ON) the second auxiliary pump DOL 2 (Direct On Line pump).	✓		✓		
COMBO ON/OFF	OFF	Enabling or disabling COMBO operation as described in COMBO chapter.	✓		✓		

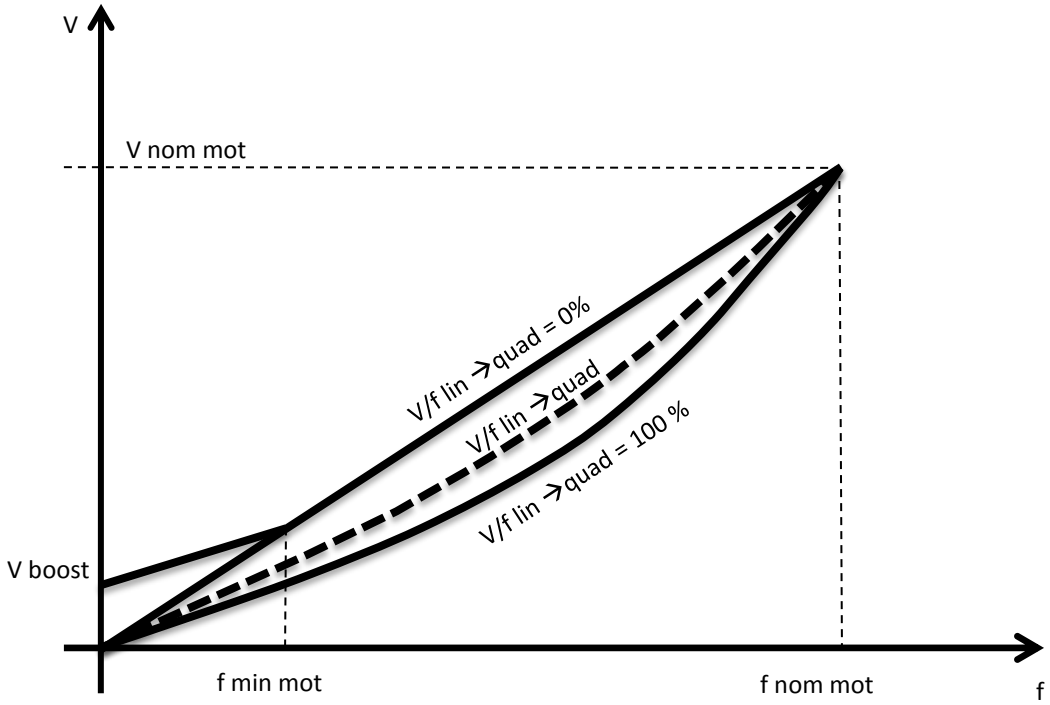
Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
Address XX	00	IPFC address: • 00 master • 01 to 07 slaves	✓		✓		
Alternance ON/OFF	OFF	Function to allow alternating between the IPFCs connected in COMBO (or pumps connected in DOL) in order to allow equal use of each pump in the group; master will reorganize the starting priority of the pumps by checking the life of each of them.	✓		✓		
Alternance period XX [h]	0	Maximum difference in terms of hours between IPFCs in the group. 0 stays for 5 minutes.	✓		✓		
COMBO synchrony ON/OFF	OFF	With this parameter it is possible to activate the synchronous operation (same speed) of the pumps in COMBO. It is however necessary to appropriately lower the parameter "f. min. control".	✓		✓		
Start delay AUX t = XX [s]	0	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	✓		✓		
PI control Direct/Reverse	Direct	Direct: increasing motor speed also misured value increases Reverse: increasing motor speed, misured value decreases.	✓		✓		
Periodic autorun t = XX [h]	0	Pump periodic autorun after XX hours of inactivity. Value 0 makes function disabled. Warning, review the advice in chapter 1.	✓	✓	✓	✓	✓
Dry run cosphi X.XX	0.65	Cosphi value below which the unit stops the motor and give “no water” alarm.	✓	✓	✓	✓	✓
Restarts delay XX [min]	10	Restart delay after a dry running alarm. At each tentative (max 5) restart delay will be doubled.	✓	✓	✓	✓	✓

6.6 Motor parameters

Parameters	Default	Description
Rated motor Volt. XXX [V]	XXX	Motor rated voltage (as shown on motor nameplate).

Voltage boost XX.X [%]	0%	Voltage increase during the motor start up. Warning: An excessive value can seriously damage the motor. Contact the motor manufacturer for further information.
Rated motor Amp. XX.X [A]	XX	Rated motor current as per its nameplate indication increased by 5%.
Rated motor freq XXX [Hz]	50	Rated motor frequency as per its nameplate.
Max motor freq. XXX [Hz]	50	Maximum motor frequency. Note: by reducing the maximum motor frequency, maximum current will be reduced as well.
Min motor freq. XXX [Hz]	20	Minimum motor frequency.
Ramp up time XXX.X [sec]	4	Ramp-up time to reach the speed required to achieve the set pressure (or frequency value). Longer times delay the system reaching the preset value but better protect system components. Excessively long ramp-up times can create difficulties in IPFC setup, and can also cause false overload alarms.
Ramp down time XXX.X [sec]	4	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 IPFC setup. Excessively short ramp-down times can cause false overload alarms.
Ramp f min mot. XXX.X [sec]	1.5	Time to reach the minimum motor frequency and vice versa.
		
PWM XX.X [kHz]	8	Carrier frequency (switching frequency). It is possible to choose PWM in the range of 2.5 ,4, 6, 8, 10 kHz . Higher values give a more sinusoidal wave with fewer losses for the motor but higher losses for the inverter (increased inverter heating). If long cables are used (>20 m / >76 ft) (submersible pump) it is recommended to install an inductive filter between IPFC and the motor (available upon request) and to set the value of PWM to 2.5 kHz. This reduces the risk of voltage spikes, which can damage motor and cable insulation.

V/f lin. --> quad. XXX [%]	85 %	V / f characteristic with which IPFC 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 reduction of energy consumption and a lower level of heat and acoustic noise.



Rotation sense ---> / <---	--->	If, during the test, the motor runs in reverse, it is possible to change the wiring sequence via software without physically changing wires at the terminals.
MOTOR TUNING press ENT		If the device is "FOC-ready", motor calibration must be carried out before commissioning. Carefully read the pertinent chapter.
Mot. resistance Rs=XXX.XX [Ohm]		Manual setting of the stator resistance.
Mot. inductance Ls=XXX.XX [mH]		Manual setting of the stator inductance.
FOC dynamic XXX		Setting of the control dynamic of the FOC algorithm.
Autorestart ON/OFF	OFF	If ON is selected, after a lack of voltage, IPFC returns to its normal status; if IPFC was powering the pump before the voltage drop, it resumes powering the pump automatically. Warning, review the advice in chapter 1.

6.7 IN/OUT parameters

Parameter	Default	Description
Unit XXXXX	bar	Unit [bar,%,ft,in,cm,m,K,F,C,gpm,l/min,m3/h,atm,psi]
F. scale sensor XXX.X	16	Sensor full scale.
Min.value sensor XXX.X	0	Sensor minimum value.
Offset input 1 [%]	20%	Zero correction for analog input 1 (4-20 mA) (20 mA x 20% = 4 mA).
Offset input 2 [%]	20%	Zero correction for analog input 2 (4-20 mA) (20 mA x 20% = 4 mA).
Offset input 3 [%]	0%	Zero correction for analog input 3 (0-10V) (10V x 00% = 0 V).
Offset input 4 [%]	0%	Zero correction for analog input 4 (0-10V) (10V x 00% = 0 V).
AN1,AN2 function XXXXXX	Independent	Function logic for analog input AN1,AN2 (independent, lower value, higher value, difference 1-2).
Digital input 1 N.O. / N.C.	N.O.	By selecting N.O. (normally open) IPFC 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) IPFC runs the motor if the digital input 1 is closed; motor will be stopped if the digital input 1 is opened.
Digital input 2 N.O. / N.C.	N.O.	By selecting N.O. (normally open) IPFC 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) IPFC runs the motor if the digital input 2 is closed; motor will be stopped if the digital input 2 is opened.
Digital input 3 N.O. / N.C.	N.O.	By selecting N.O. (normally open) IPFC 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) IPFC runs the motor if the digital input 3 is closed; motor will be stopped if the digital input 3 is opened.
Digital input 4 N.O. / N.C.	N.O.	By selecting N.O. (normally open) IPFC 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) IPFC runs the motor if the digital input 4 is closed; motor will be stopped if the digital input 4 is opened.

Parameter	Default	Description
Dig.In.2/3 delay [s]	3	Digital input IN2 & IN3 delay. Digital input IN1 has 1 second fix delay.

6.8 Connectivity parameters

Parameters	Default	Description
MODBUS address XXX	1	MODBUS address from 1 to 247
MODBUS baudrate XXXXX [bps]	9600	MODBUS baudrate from 1200 bps to 57600 bps
MODBUS data format XXXXX	RTU N81	MODBUS data format: RTU N81, RTU N82, RTU E81, ETU O81

7. Protections and alarms

Anytime a protection occurs a blinking message is displayed together with an audible alarm; on STATUS in the initial view, the protection is displayed; by pressing the STOP button. Only from this position (STATUS) in the initial view is it possible to try to reset the alarm; if IPFC does not reset the alarm it is displayed again together an audible sound.

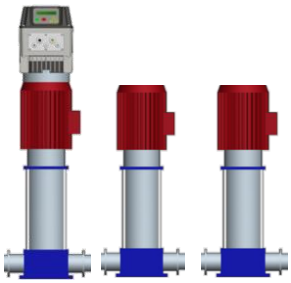
ALARM MESSAGE	ALARM DESCRIPTION	POSSIBILE SOLUTIONS
OVERCURRENT MOT.	Motor overload: input current of the motor is higher than the rated motor current setting parameter. Motor voltage drop caused by the inverter causes the motor input current to be higher than rated. Contact motor manufacturer to check if motor is capable of accepting this current.	• Make sure that the motor current setting parameter is higher than rated. • Check other 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	• Make sure than ambient temperature is less than 40 °C (104 °F). • Check if auxiliary cooling fan is working properly and if mounting space is adequate for proper cooling. • Reduce the PWM value (*Advance Parameter Menu*)
NO LOAD	No load	• Check if load is properly connected to the IPFC terminals

NO WATER (DRY RUN COSPHI)	Motor cosphi is lower than the set value of dry running cosphi	• Check if the pump is primed • Check the set value of dry running cosphi. Dry running cosphi is approximately 60% of the rated cosphi (at rated frequency) listed on the motor plate. If pump's cosphi is lower than the set dry-running cosphi for at least 2 seconds, IPFC stops the pump. IPFC tries to run the pump every 10, 20, 40, 80, 160 minutes and then the pump is stopped. WARNING: if dry running protection occurs, IPFC will try to start the pump automatically. Be sure to cut power supply to IPFC before performing any maintenance.
SENSOR FAULT	Sensor error	• Check the transducer • Check the wiring of transducer
MAX. VALUE ALARM	Measured value has reached the maximum value accepted by the system.	• 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.	• 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 drawn by the load exceeds the capacity of IPFC. IPFC is still able to continue to power the load for 10 minutes with an output current of 101% of nominal and for 1 minute with an output current of 110% of nominal	• Increase the ramp-up time • Make sure that the load current is at least 10% below the IPFC nominal current • Check the voltage drop along the supply cable to the motor
NO COMMUNICATION	Communication between Master and slave(s) has been interrupted	• 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 IPFCs in the group	• The address of each IPFC needs to be different
KEYBOARD FAULT	A Button on the keyboard has been pressed for more than 150 seconds	• Make sure buttons are not depressed • Call service assistance
ACTIVE DIG.IN.X	Digital input X opened /closed	• Check the input digital configuration (IN/OUT Parameters menu)
ALARM SLAVE XX	slave XX error detected by master	• check the status of the slave

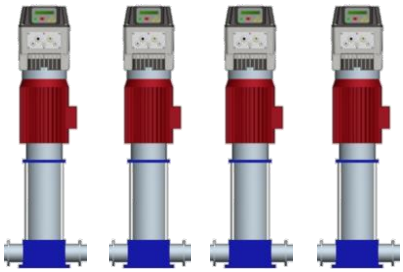
	If pumps cosphi is lower than the dry-running cosphi for at least 2 seconds, IPFC will stop the pump. IPFC will try to run the pump every 10, 20, 40, 80, 160 minutes and then the pump is stopped. ATTENTION: if dry-running protection occurs, IPFC will try to start the pump automatically. Be sure to cut power supply before attempting maintenance IPFC 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. IPFC 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. IPFC 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.

8. Auxiliary pumps during constant pressure control

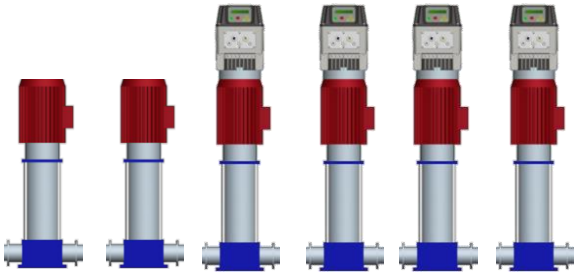
When the water needs vary considerably, it is advisable to share the water request between several pumps ensuring better efficiency and reliability.
A first method consists of a single pump driven directly by IPFC and another 1 or 2 pumps directly connected to the mains DOL (Direct On Line); DOL pumps are controlled by IPFC and connected to the mains through 1 or 2 contactors.



In this method, DOL pumps are not started and stopped smoothly with the corresponding increase in energy consumption and mechanical wear (startup current). Also note that DOL pumps are not protected by IPFC.
A second method of sharing water demand (named COMBO mode) consists of using additional pumps in parallel (up to 8), with each one driven by a IPFC.



In this method, energy consumption and reliability of the pumping system is maximized: IPFC monitors and protects each pump. It is possible to assemble a booster system composed of pumps connected in COMBO mode and another 1 or 2 DOL pumps to cover additional water demand (menaged only by master).

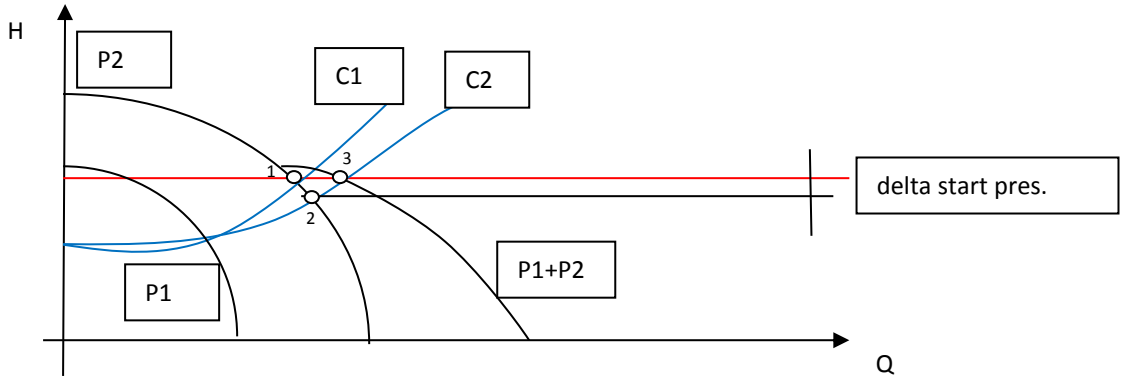


8.1 DOL pumps

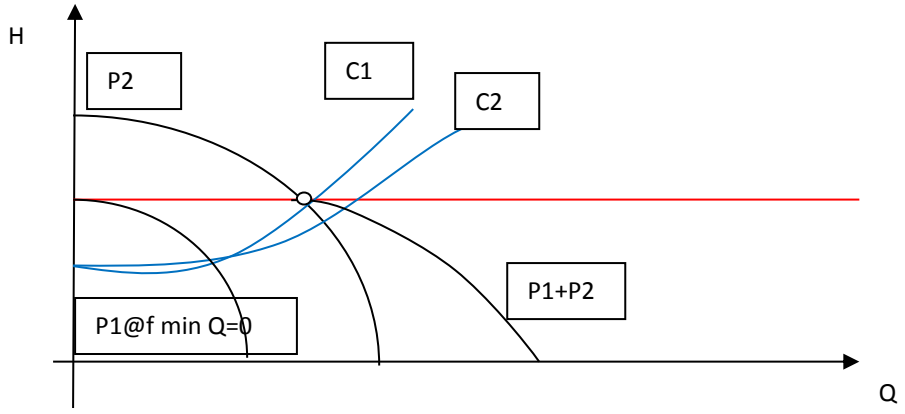
Each DOL pump is switched on by a contactor controlled by the digital output DOL1 and DOL2 present in the IPFC.

	**IPFC relays driving the DOL pumps are relays with no voltage contacts. Max voltage to the contacts is 250 V, max current 5 A.**

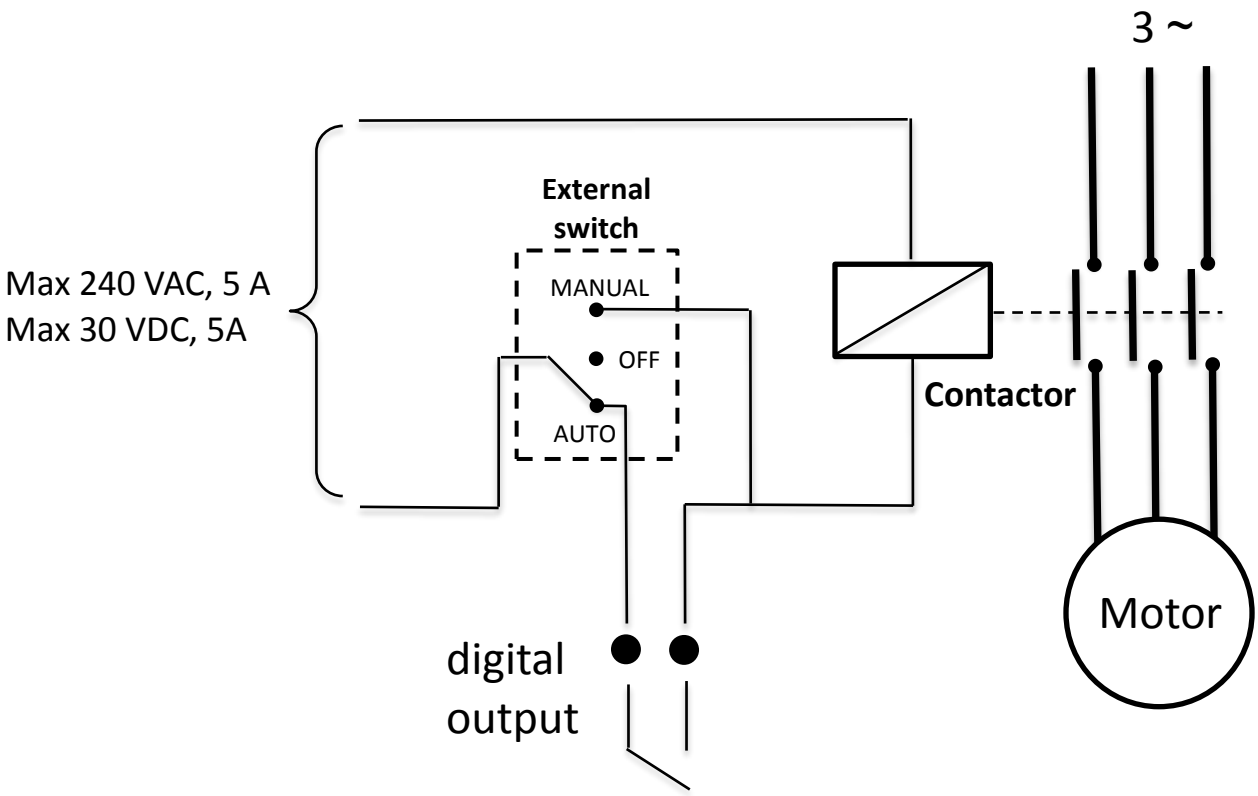
Two pumps are connected in parallel, with one pump (pump 1, P1) run by the inverter, while the second pump (pump 2, P2) is directly connected to the main power ("Direct On Line" connection). Start/Run of the second pump is controlled by the relay DOL1 (allowing a third pump to be controlled by the relay DOL2).



If pump 1 (P1) is already running to maintain the desired set pressure (red line) , an additional water request changes the system curve from C1 to C2 ; since pump 1 (P1) is running at maximum speed, it is not possible to maintain the set pressure by increasing the speed, so the system pressure will drop till reaching the new working point 2.
If pressure at the point 2 is (set value – delta control), IPFC will run the DOL by relay DOL1. The DOL pump will run at its nominal speed while the pump 1 will drop it speed equal to the P1 pattern to maintain set pressure.
If water demands decreases, returning to the system curve C1, pump 1 will reduce the pump speed to maintain constant pressure in the system. When pump 1 reaches a frequency equivalent to the minimum frequency, while still maintaining set pressure, the DOL pump will be switched off and pump 1 will increase the speed to maintain the p_set in the system.



	**If two pumps are connected in parallel, the first driven by IPFC and the second with a DOL connection, it is necessary makes sure that the value "delta control" will be sufficiently high to ensure the first pump, once the DOL pump is switched on, will reach a frequency higher than its minimum frequency value.** **By proper setting of the minimum frequency, excessive pump ON/OFF cycling is avoided, thus preventing damage to the DOL pump.**



8.2 COMBO function

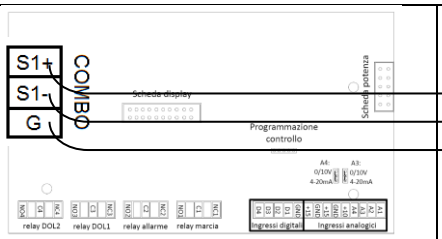
In the "Control parameters" menu it is possible to enable the COMBO function that allows serial communication between up to 8 IPFCs, each one connected to a pump. The operating principle (switch on/off) of pumps is similar to as stated in chapter 8.1.

To achieve the COMBO function in a system consisting of several interconnected IPFCs, use a pressure sensor connected to each IPFC. The value of the *set pressure* is communicated to the slaves via the serial port.

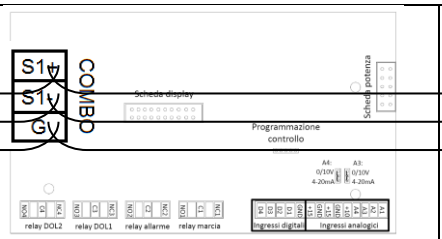
As a further help, you can connect another two DOL pumps to the IPFC Master to cover additional water demand; they will be operated only when all the COMBO pumps are already in operation.

RS485 serial connection

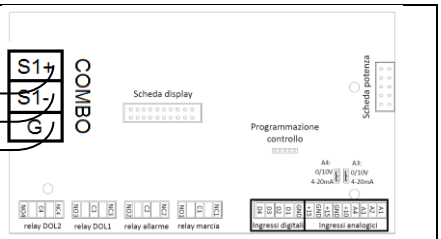
IPFC's communication is made through a private protocol using the RS485 port. Each IPFC must be connected to each other by using a tripolar cable (0,5 mm^2) wired on S+,S-,G pins on control board.



MASTER: address 00



SLAVE 1: address 01



SLAVE 2: address 02

Master setup

1. Supply power to the IPFC master.
2. If not yet completed, perform the initial configuration as described on chapter 6.2
3. Initial view is shown:

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

4. Scroll until:

Menù
ENT to access

5. Press ENT

MENU'
Control. param.

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

8. Scroll until:

Combo
ON/OFF

9. Set ON
10. Set:

Address XX	00	IPFC's address in parallel operation. • 00 : IPFC master
Alternance ON/OFF	OFF	Function to allow alternating between the IPFCs 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.
Start delay AUX t = XX [s]	0	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

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	IPFC's address in parallel operation. • 01 --> 07: IPFC slaves

2. Press STOP (red button).
3. In the *Motor 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 IPFC master, the communication between IPFCs 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.

9. Trouble-shooting chart

LCD does not switch on after powering the IPFC	• Check the connecting flat cable between the LCD board (attached to the cover) and the control board • Check the fuses • Check that the power cables are properly connected.
Power line of IPFC is interrupted by the differential protection contactor	• Check the leakage current to ground of EMC filter • Following a rapid off/on the power supply, the differential contactor can interrupt the power. After turning off the IPFC it is recommended to wait at least 1 minute before restarting.
When performing sensor test operation, SENSOR OFF alarm occurs	• Check that the sensor cable is properly connected to the sensor device and to the IPFC. • Make sure that the sensor and its cable are not damaged. • Check that the operating range of sensor is of 4 -20 mA type and the value of 15 V is within the voltage feed range of the sensor.
Frequency and pressure oscillation on constant pressure control mode	• Check if the water tank and its air pressure are correctly set. It may be necessary to increase the tank volume or reduce the pre-charge pressure. • Check the ki & kp parameters (Control parameters menu). At first, it is suggestable to increase the Ki value. If it not enough reduce of one unit the Kp value.
DOL pump stops and starts continuously	• Increase *delta control.* • Check to see if the water tank and it's air pressure are correctly set. It may be necessary to increase the tank volume or reduce the pre-charge pressure.
Measured pressure drops too much before IPFC starts the pump.	• Decrease the delta start value (Control Parameters menu) . • Check to see if the water tank and it's air pressure are correctly set. It may be necessary to increase the tank volume or reduce the pre-charge pressure. • Modify the value of ki & kp parameters (Control Parameters menu). At first, it is suggestable to reduce the Ki value. If it is not enough increase of one unit the Kp value.

10. Technical Assistance

For more technical information contact the authorized reseller providing the following information. The solution to the problem will be found faster and easier if full information is provided.

Model/Serial Code	LCD version (shown when IPFC is power supplied) LCD = _.__	INV version (shown when IPFC is power supplied) INV = _.__
Line Voltage: ___ [V]	Line Frequency: ☐ 50 Hz ☐ 60 Hz	
description of problem:		
installation type: ☐ wall mounted ☐ on motor fan cover		
motor type: ☐ single phase ☐ three phase ☐ submersible ☐ surface		
if submersible: cable lenght [m]: _____	if submersible: cable section [mm^2]:____	
P2 motor [kW]:____	rated motor Volt [V]:___	rated motor Amp [A]:__ rated motor Hz:___
if single phase: capacitor _____ [UF]	if singlephase: starting Amp I st = _____ [A]	pump performances Q = ____ [l/min] H = ____ [m]
tank volume: _____ [liters]	precharge pressure: _____ [bar]	
number of DOL pumps: ___	number of COMBO pumps: ___	
medium ambient temperature: _____ [°C]	pressure sensor 4 mA = ___ [bar] 20 mA = ___[bar]	
digital inputs used:	digital ouputs used:	
electric and hydraulic scheme of the system (more detailed as possible)		
set parameters: please fill the **instal. param.** and **adv. param columns** in the software scheme.		

DECLARATION OF CONFORMITY

In according with:

Machine Directive 2006/42/EC

EMC Directive 2014/30/EU

Low Voltage Directive 2014/35/EU

R&TTE Directive 2014/53/EU

IPFC is an electronic device to be connected to other electrical equipment with which it is to form individual units. It must, therefore, that the putting into service of this unit (with all its subsidiary equipments) to be performed by qualified personnel.

The product conforms to the following regulations:

EN 55011 Class A
EN 61000
EN 60146
EN 50178
EN 60204-1

PENTAX S.p.A.

Viale dell'industria, 1

37040 Veronella (VR) – Italia

Gianluigi Pedrollo

NOTE