INDEX

1. GENERAL DATA

With this manual, we would like to give you the most important information about the correct use and maintenance of the inverter.
The devices described in this manual are:

- **IMTP2.2M - IMTPD2.2M**: Single-phase Inverter for pump, max 2.2 kW (3 Hp)
- **ITTP2.2M - ITTPD2.2M**: Three-phase Inverter for pump, max 2.2 kW (3 Hp)
- **ITTP4.0M - ITTPD4.0M/W**: Three-phase Inverter for pump, max 4 kW (5.5 Hp)
- **ITTP5.5M - ITTPD5.5M/W:** Three-phase Inverter for pump, max 5.5 kW (7.5 Hp)
- **ITTP7.5M - ITTPD7.5W:** Three-phase Inverter for pump, max 7.5 kW (10 Hp)

The models for circulation pump control (D) differ from the models for standard centrifugal pumps for the accessories and for the output cables of the pressure transducers. The software on both inverter models is the same and is always marked with the letter D.
In models for standard centrifugal pumps (absolute pressure control) it is always supplied a pressure transducer K16, 16 Bar; in the models for circulation pumps (differential pressure control) the pressure transducers, suitable for high temperature, with reduced pressure range and high precision (K3T 3 Bar or K5T from 5 bars) are sold separately (N°2 transducers required: one for the delivery and one for the inlet).
This inverters are devices specially designed for centrifugal and circulating pump control, single type or twin/group type, thanks to a perfect feed-back of the absolute pressure or the differential pressure: it assures energy saving and it has many programmable functions, that are not in the other common directly supplied motor pumps.
The following instructions and rules about the standard configuration are as follows.
If you require technical assistance regarding specific parts at Service Sales please do specify the exact type of the inverter, followed by the serial number of the model.

2. WORKING OPERATIONS

This Pump–Inverter system is made up by a centrifugal pump, that is moved by an asynchronous motor. This system has to keep the absolute delivery pressure or the differential pressure (from delivery and inlet) steady, independently from the flow (consistent with the maximum load applicable to the motor, otherwise the maximum current absorption).
The input and output pressure are monitored by two pressure transducer, with 4-20mA output. The control logic works with a 15V output that supplies the pressure transducers.
DRY WORKING: to prevent the pump from working when there is a suction condition problem, caused by an insufficient inlet flow, the system reads the motor power and power factor, and if its are under setting values with a particular low pressure condition , it switches off the pump, and an advise appears on display.
The motor pump electric protection is controlled by the limitation of the current absorption (programmable). When the current protection is on, an alarm appears on display. When the condition disappear, the system restart with the normal functioning.

2.1 Structure of a frequency converter

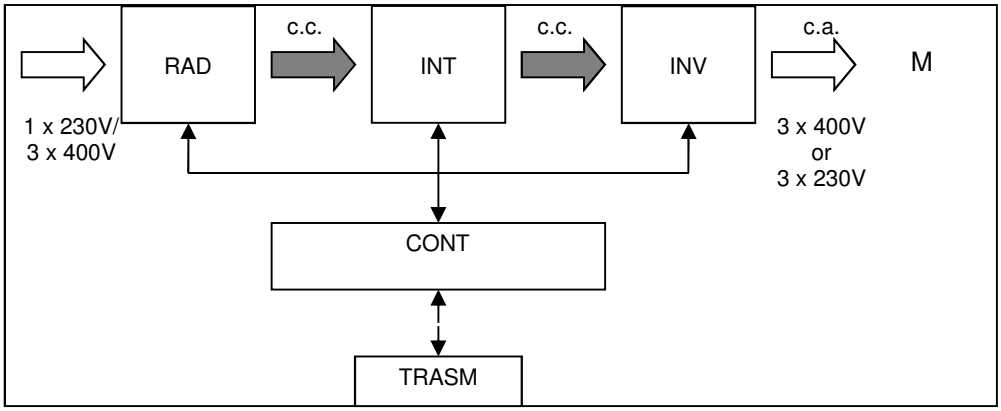

Figure 1: structure of a frequency converter

c.a.	Alternative current
c.c.	Direct current
RAD	Rectifier
INT	IGBT intermediate driver circuit
INV	IGBT bridge three-phase inverter
M	Motor
CONT	Control logic by micro-processor

3. WORKING CONDITIONS

Quantity	Simbol	Meas. Unit	IMTP(D) 2.2	ITTP(D) 2.2	ITTP(D) 4.0	ITTP(D) 5.5	ITTP(D) 7.5
Ambient working temperature	T_{amb}	°C	0..40				
Maximum relative humidity		% (40°C)	50				
Protection grade of the Inverter			IP55				
Nominal pump power connected to the Inverter	P_{2n}	kW Hp	2.2 3	2.2 3	4.0 5.5	5.5 7.5	7.5 10
Nominal voltage supply of the Inverter	V_{1n}	V	1x 100..244	3x 200..460	3x 200..460	3x 200..460	3x 200..460
Frequency supply Inverter	f_1	Hz	50-60				
Maximum Voltage Inverter output	V_2	V	= V_{1n}				
Inverter Output Frequency	f_2	Hz	0..140				
Nominal input current	I_{1n}	A	11	6	12	16	20.5
Nominal output current (to the motor)	I_{2n}	A	**9.5**	**5.5**	**11**	**14.5**	**19**
Maximum output Inverter current (duty=100%)	I_2	A	I_{2n} + 5%				
Storage temperature	T_{stock}	°C	-20..+60				

Table 1: Working conditions

- Vibrations and hits: they must be avoided by a correct assembling;
- For different environment conditions, please contact our Sales Department.

<u>This Inverter can not be installed in explosive environments.</u>

4. WARNINGS AND RISKS

<u>The following instructions give you important information for correct assembling and use of the product. Consequently, before installing the device, these instructions should be read by people who assemble or use it; besides, these instructions should be available to all person assigned to device setting and maintenance.</u>

Skilled workers
The installation, the starting and the maintenance of the product must be done by skilled workers, in order to avoid the risks of an incorrect use.

Dangers due to missed respect of the safety regulations
Failing to respect the safety regulations, could endangers others and damage the devices, which can lead to loss of warranty. The results of the non-observance of the security rules can be:

- Malfunctioning of the system
- Danger to others, by electrical and mechanical events

Security for the users
All the accident-prevention rules must be respected.

Security rules for assembling and control
Assembling, controlling and servicing the device must read this manual. All operations on this device must be done when the system is no longer in motion and without voltage supply.

Alterations and spare parts
Every machine, equipment or system alteration must be authorized by the manufacturer. For you and your system security, it is therefore important to use only original spare parts. The use of non-original components may endanger others and can lead to loss of warranty.

Wrong working conditions

The working security is guaranteed only for the conditions described in chapter 3 of this manual: The values shown cannot be exceeded.

Only a skilled worker can assemble and install this device.

For execute operation on the inverter with open case, it is necessary to switch off the power supply at least two minutes before, by the power interruptor or removing the socket from the power supply. To be sure the capacitors are completely discharged, you have to wait for the complete switching off of the internal led, placed on the rear part of the logic board.

IMTP(D)2.2 / ITTP(D)2.2/ ITTP(D)4.0 / ITTP(D)5.5 / ITTP(D)7.5 inverter are professional devices; these works with a power supply more than 1 kW; the skilled worker must communicate to the electrical corporation the device has been installed.

All Inverters are up to EMC legislation standards. Its works under the emission limits in industrial applications, and also in civil applications if equipped with this line filters (if it's necessary, please ask separately):

IMTP(D)2.2: EMC single-phase filter common mode double-stage, 250V – 10A type DETAS MDC20 (Electroil code: EF825005);

ITTP(D)2.2: EMC three-phase filter common mode double-stage, 440V – 5A type DETAS TDC05 (Electroil code: EF825006);

ITTP(D)4.0: EMC three-phase filter common mode double-stage, 440V – 10A type DETAS TDC10 (Electroil code: EF825007);

ITTP(D)5.5 – 7.5: EMC three-phase filter common mode double-stage, 440V – 20A type DETAS TDC20 (Electroil code: EF825008).

The installer has to be careful connecting the ground wire directly to the inverter frame (an eyelet terminal is preferred; for having a good contact it is important to remove the paint from the contact surface). It is necessary to avoid ground loop that is like an antenna for EMC emission.

Power supply must be admitted on working condition; don't lift or carry the motor pump (or the motor connected to the inverter) lifting it from the inverter.

5. ASSEMBLING AND INSTALLING

Read this manual and the motor pump one before device installation.
If the product shows clear damage signs, do not install it, but contact the assistant service.

Install the device in a place protected from ice, rain etc. Respect working limits and be careful about the motor and inverter's cooling.
Follow safety and accident-prevention rules carefully.

5.1 Case and fixing dimensions for motor board inverters

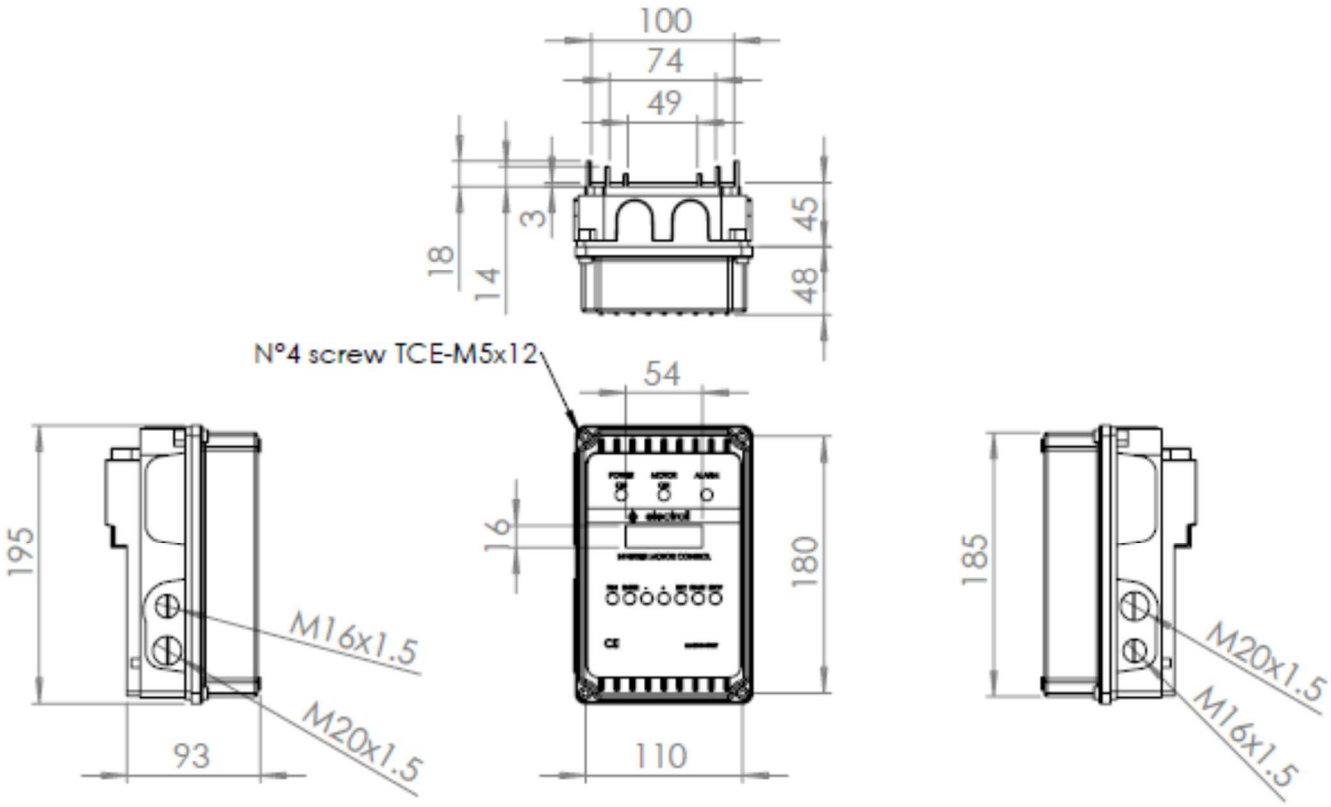

Figura 2: Case dimensions for IMTP(D)2.2M - ITTP(D)2.2M

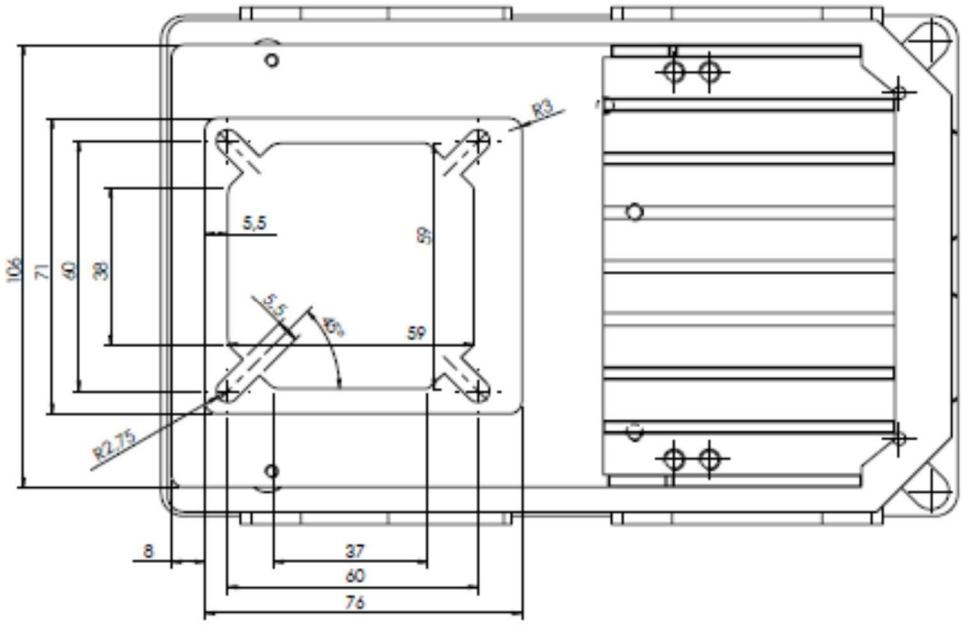

Figura 3: Fixing dimensions for IMTP(D) - ITTP(D) 2.2M fixing type M56-71

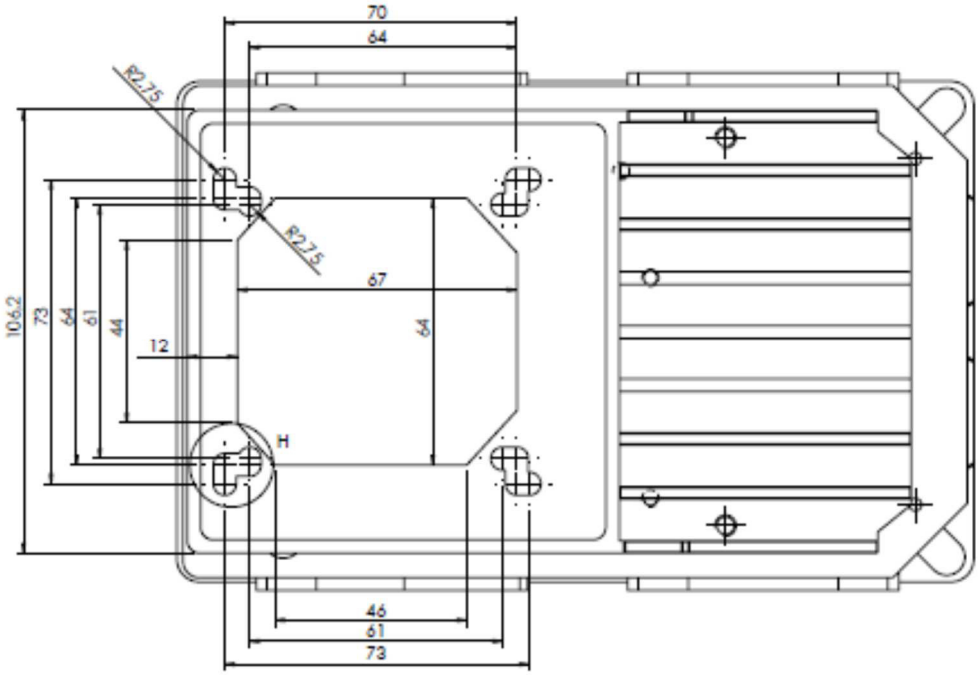

Figura 3: Fixing dimensions for IMTP(D) - ITTP(D) 2.2M fixing type M80T

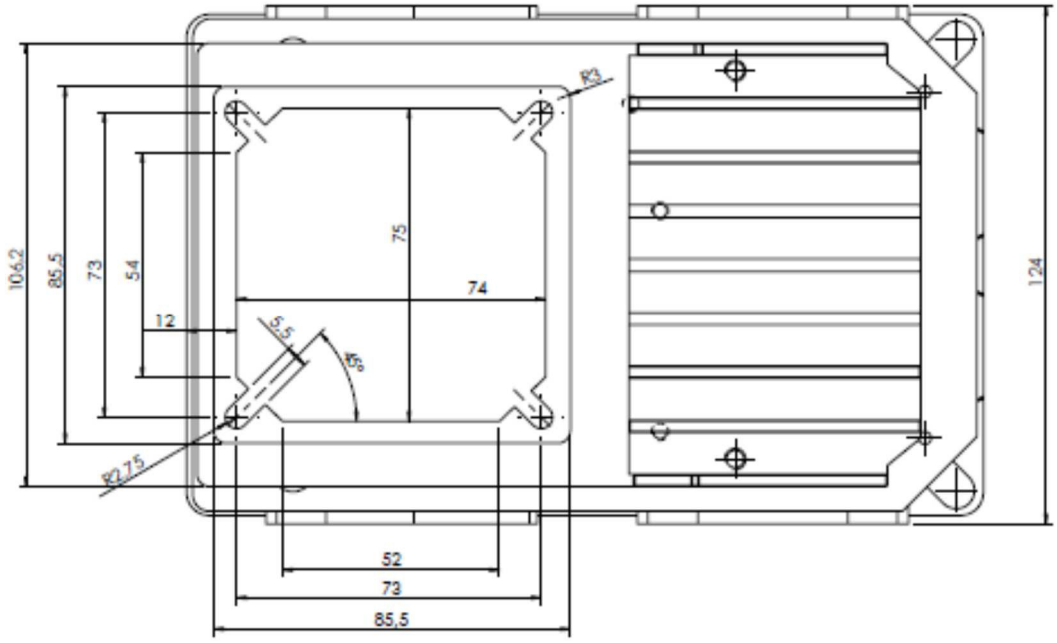

Figura 5: Fixing dimensions for IMTP(D)2.2M – ITTP(D)2.2M fixing type M80

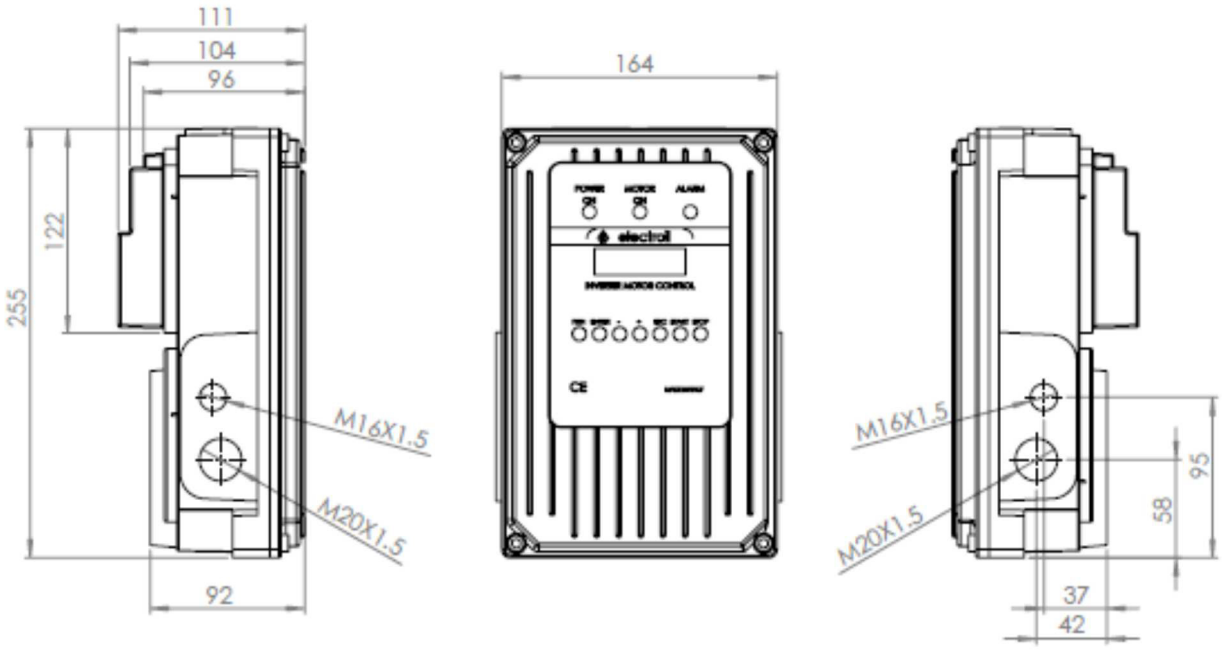

Figura 6: Case dimensions for ITTP(D) 4.0 - 5.5 M

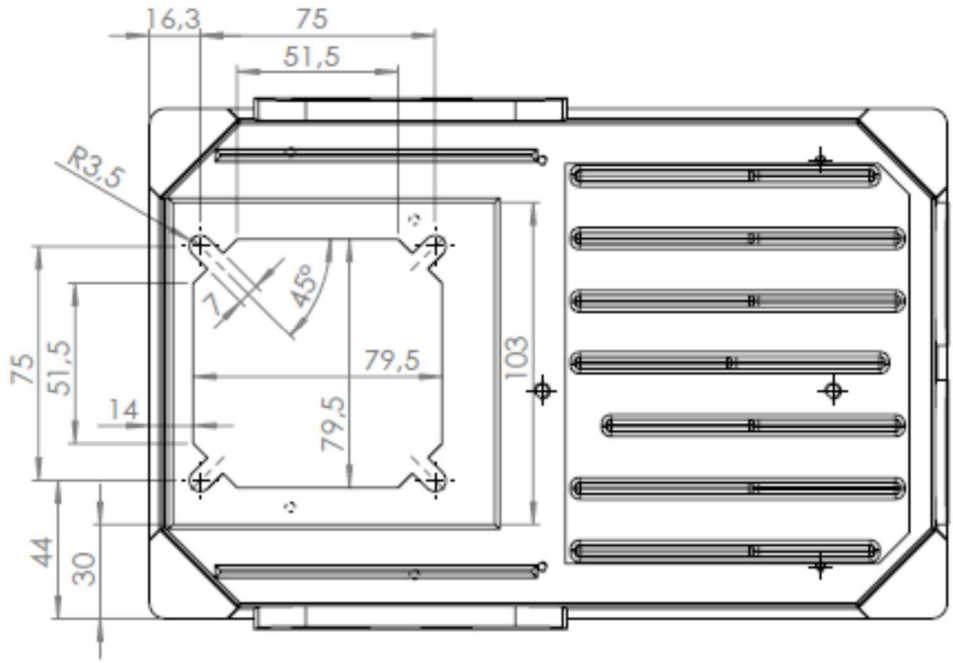

Figura 7: Fixing dimensions for ITTP(D) 4.0-5.5 M fixing type M80

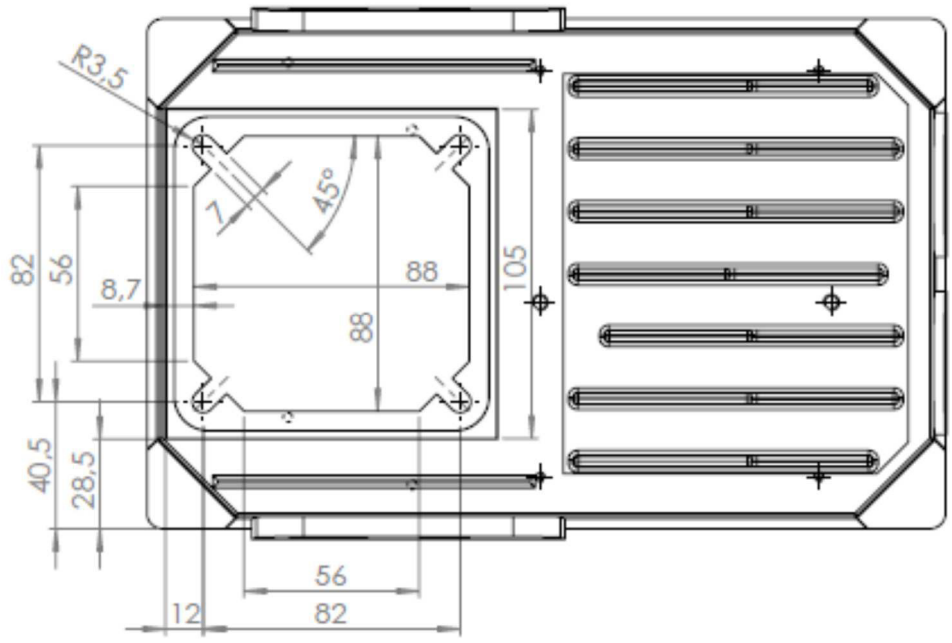

Figura 8: Fixing dimensions for ITTP(D) 4.0-5.5 M fixing type M132

5.2 Case and fixing dimensions for wall mounting inverters

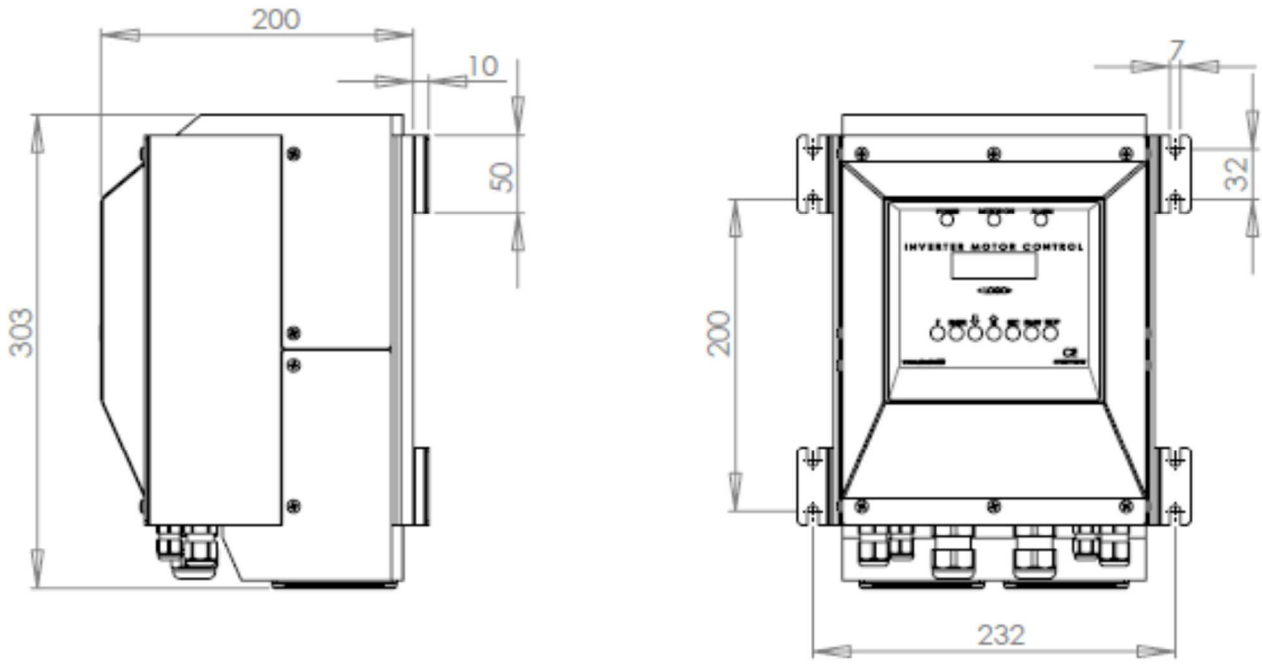

Figura 9: Dimensioni e quote di fissaggio a parete for ITTP(D) 4.0-5.5-7.5 W

5.3 Pump hydraulic connection

Connect the hydraulics according to the standard regulations.
This product can work when connected to the waterworks or taking water from a water tank.
If you connect the system to the waterworks, you have to respect the regulations in force issued by local authority (Common, local authority, etc…). It is important to put a pressure switch on the inlet leader; it switches off the motor power in case of low pressure (it is a dry-working external protection). The inverter have a port for a normally-closed generic contact: EN and GND (0V) on the logic board.
Verify the amount of pressure between the waterworks and the maximum pump pressure, does not exceed the maximum pump pressure value (nominal pressure).
Besides, it is important to put a pressure gauge on the inlet and on the outlet leader, so it is possible to regulate the differential pressure value, according to the real conditions of the system.
For the absolute pressure control, for centrifugal pumps, on the delivery side it is necessary to install a special pressure gauge (standard K16) with an output signal between 4 – 20 mA to connect on the specific electronic port.
For the Differential pressure control, for circulating pumps, on the inlet and delivery side it is necessary to install a special pressure gauge for high temperature (K3T or K5T) with an output signal between 4 – 20 mA to connect on the specifics electronic port.
As a rule it would be better to install flexible or rigid pipes on inlet and outlet branches, on-off valves on inlet and outlet branches, a no return valve. To avoid drying the system for replacement of the membrane surge tank (recommended), pressure gauge or pressure transducer, it would be better to install some on-off valves between the tank connection and the system. Put the pressure transducer downstream the non-return valve, if it is present. It would be better to install a cock, used during the system calibration; it is not necessary if there is an exit near the pump.

5.4 Electric wirings

Check voltage and frequency of the power supply are the same of the nominal values of the control system, that are written on the box. Be certain of having a good short-circuit protection in your electric system.
Before working, be certain all the circuit is without voltage (also the connections voltage clear). Disconnect the inverter from the power supply before working on electrical or mechanical parts of the system.

Wait at least 2 minutes after the power supply disconnection before working on the inverter; this allow the capacitors discharge (after 2 minutes delay, opening the inverter case, check that the led on the electronic power must be completely switched off in order to be sure that are completely discharged).

If the local regulation about electric system provides for a magneto-thermal differential switch, install one. Select the protection with curve for alternative current or pulsing current (type A or C).
The unit is equipped with all those technical arrangements required to ensure a good functioning under normal installation.
The control system has a entry-filter and it conforms to the EMC directive, also have a current overload protection which guarantees absolute protection when the Inverter is combined with motors that not exceed the maximum power.
IMPORTANT: For EMC is necessary that the power wires of control panel and motor power wires (when the motor are separated from the inverter) are shielded type (or armoured) with individual conductors of appropriate section (current density <= 5 A/mm2). These cables must be the minimum length necessary. The screen conductor must be connected to the ground by both sides. On motor use the metal case for connection to the ground of the screen.
To avoid loops that can create mass disturbances radiated (antenna effect), the motor operated by the frequency converter must be connected on the ground individually, always with a low-impedance using the metallic box of the machine.
The wires from power supply to frequency converter and wires from frequency converter – motor (if the motor is separated to the Inverter) must be spaced as much as possible, not to create loops, not place them parallel at distance less than 50 cm.

5.5 Motor-pumps phases connection

The single-phase inverter **IMTP(D)2.2** must be installed on asynchronous three-phase motor with 100-240Vac 50/60 Hz voltage supply. Phases must be configured to delta mode if the motor is 230V Δ / 400V λ (most common case, as in Figure 10).
Connect the N°3 motor terminals to the U, V, W inverter output connectors (fig. 13).

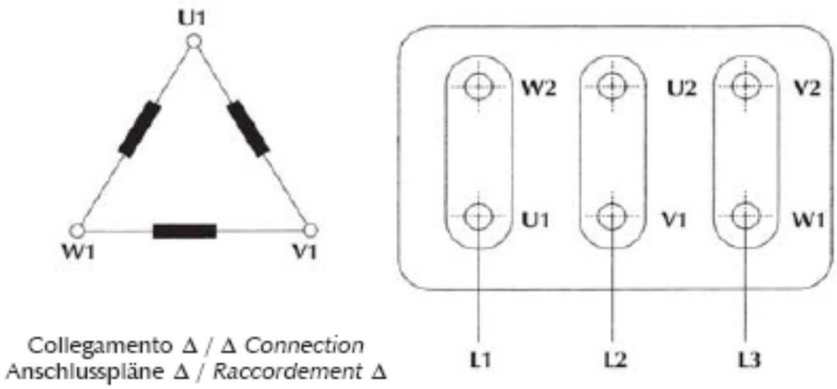

Figure 10 – Delta motor phases connection

The three-phase inverters **ITTP(D)2.2** and **ITTP(D) 4.0/5.5/7.5** must be installed on asynchronous three-phase motor with 200-460 Vac 50/60 Hz voltage supply. The phases must be connected in star mode if the motor is 230V Δ / 400 V λ (most common case, as in Fig 11).
Connect the N°3 motor terminals to the U, V, W inverter output connectors (fig. 14,16).

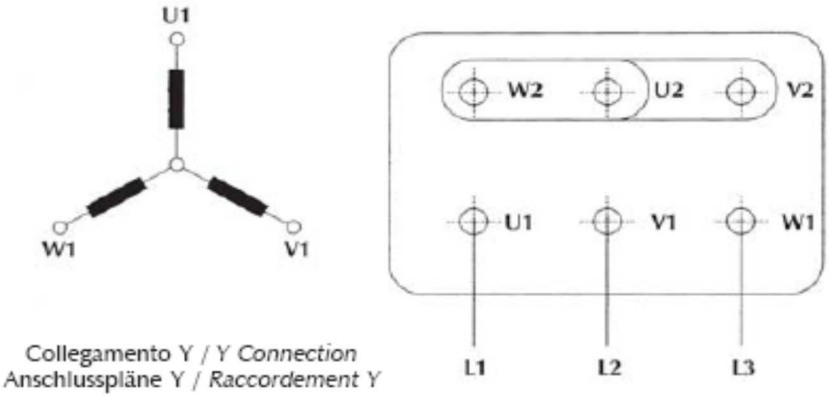

Figure 11 – Star motor phases connection

The inverter have an output over-current protection; it is not necessary to install any additional safety device between the inverter and the pump in order to protect the motor in case of failure.

5.6 Electric connection to Line and Motor

Supply for IMTP(D)2.2 device is a single-phase voltage 100-240Vac, 50/60Hz.
Supply for ITTP(D)2.2 and ITTP(D)4.0/5.5/7.5 device is a three-phase voltage 200-460Vac, 50/60Hz.
The plant to which the inverter is connected must be conforms to safety regulations in use:
• Differential automatic switch: I Δ n = 30mA
• Magnetic-thermal automatic switch with intervention current proportionate to the power of the pump installed (see Table 1)
• Ground connection with total resistance less than 100 Ω

Pump power (kW)	Magnetic-Thermal protection (A)
0.37 (0.5 Hp)	4
0.75 (1 Hp)	6
1.5 (2 Hp)	12
2.2 (3 Hp)	16
3 (4 Hp)	20
4 (5.5 Hp)	25
5.5 (7.5 Hp)	32
7.5 (10 Hp)	40

Table 2: Magnetic-Thermal protection

To make electrical connections observe the following instructions (reference to Figure from 12 to 16):

5.6.1 Common connections for all models:

Open the inverter box unscrewing all the cover screws.
In case the inverter is switched-off from the line switch, wait at least two minutes before operating on the Inverter, in order to ensure that the capacitors are fully discharged.

- For the motor mounting version (M), fix the bottom of the inverter box to terminal motor case with the 4 screws; For the wall mounting version (W), fix the inverter to the wall with the N°4 special fixing;
- If is necessary, for the board motor inverters, disconnect the two cables connectors (3 and 26 poles) on the logic board, then reconnect before to re-close the cover;
- Connect the N°3 motor terminals U, V, W on the power board;
- Connect the two line wires on L, N, for single-phase Inverter IMTP(D)2.2 and the ground cable with ring terminal on the GND screw (fig. 13), or the three line wires and ground on L1, L2, L3, GND for ITTP(D)2.2/../7.5 (use the up-level connector extension for ITTP(D)4.0/../7.5W) fig. 14, 16;

5.6.2 Pressure transducer connection for the absolute pressure control (centrifugal pumps):

TRANSDUCER TYPE		CONNECTIONS ON THE LOGIC BOARD OF IMTP 2.2 – ITTP 2.2
Input	**Output**	**Connections**
8 – 30 Vdc	4 – 20 mA	**J8-1 (+15V)** Positive of the voltage supply **J8-2 (PS1)** Transducer output

Table 3: Pressure transducer connection for IMTP2.2-ITTP2.2

TRANSDUCER TYPE		CONNECTIONS ON THE LOGIC BOARD OF ITTP 4.0/../ITTP 7.5		
Input	**Output**	**Connections**	**SW3-1**	**SW3-2**
8 – 30 Vdc	4 – 20 mA	**J6-1 (+)** +Vdc alimentazione trasduttore **J8-1 (AI1)** Uscita trasduttore di pressione	ON	ON

Table 4: Pressure transducer connection for ITTP 4.0-5.5-7.5

Terminals of the pressure transducers in use: K16 (16 Bar), K25 (25 Bar):
- Brown wire: +Vdc
- White wire: Pressure signal output (4 – 20 mA)

5.6.3 Pressure transducers connection for differential pressure control (circulating pumps):

TRANSDUCER TYPE		CONNECTIONS ON THE LOGIC BOARD OF IMTPD2.2 – ITTPD2.2
Input	**Output**	**Connections**
8 – 30 Vdc	4 – 20 mA	**J8-1 (+15V)** +Vdc, Positive of the voltage supply **J8-2 (PS1)** Transducer output P2, on the Delivery side **J8-3 (PS2)** Transducer output P1, on the Inlet side

Table 5: Pressure transducer connection for IMTPD2.2-ITTPD2.2

TRANSDUCER TYPE		CONNECTIONS ON THE LOGIC BOARD OF ITTPD4.0/../ITTPD7.5		
Input	**Output**	**Connections**	**SW3-1**	**SW3-2**
8 – 30 Vdc	4 – 20 mA	**J6-1 (+)** +Vdc, Positive of the voltage supply **J8-1 (AI1)** Transducer output P2, on the Delivery side **J8-2 (AI2)** Transducer output P1, on the Inlet side	ON	ON

Table 6: Pressure transducer connection for ITTPD 4.0-5.5-7.5

Terminals of the pressure transducers in use: K3T (3 Bar), K5T (5 Bar), with temperature compensation to maintain accuracy of 0.5% F.S. between 0-90°C:
- Brown wire: +Vdc
- White wire: Pressure signal output (4 – 20 mA)

5.6.4 Connections for float switch or probe level:

Connect the float switches or probe level Normally Closed contact between terminals EN and GND (or +5V) on the logic board, replacing the wire connected by the constructor:

- J9-5,8 for IMTP(D)2.2-ITTP(D)2.2 (fig. 12);
- J11-1,2 for ITTP(D)4.0/5.5/7.5 (fig. 15).

5.6.5 Master Slave Group communication with RS485:

For the group communication with RS485 (2 wires bus) between 2 or more inverters of the same type, connect the two wires into the terminals signed with A and B:

- J10-1,2 of the logic board for IMTP(D)2.2M-ITTP(D)2.2M;
- J2-1,2 for ITTP(D)4.0/5.5/7.5.

5.6.6 Connections for Motor ON output:

- For IMTP(D)2.2M-ITTP(D)2.2M model: Relay output contact capacity 250V, 2 Ampere max closed when the motor is running, between the M.ON terminals (pole 1 of J11, fig. 12) and COM (pole 3 of J11, fig. 12);

- For ITTP4.0 /../ 7.5 models: there is a 12Vdc-100mA max output on the poles marked with M (J10-3) and 0V (J10-8) of the logic board in fig. 15, to which it is possible to connect the 12Vdc coil of a relay.

5.6.7 Alarm output connections:

- For IMTP(D) 2.2M-ITTP(D) 2.2M model: Relay output contact capacity 250V, 2 Ampere max. closed when the inverter is in an alarm condition, between the terminals marked ALARM (pole 2 of J11, fig.12) and COM (pole 3 of J11, fig.12).

- For ITTP4.0 /../ 7.5 models: there is a 12Vdc-100mA max output on the poles marked with M (J10-4) and 0V (J10-8) of the logic board in fig. 15, to which it is possible to connect the 12Vdc coil of a relay.

5.6.8 Control of an auxiliary ON/OFF pump;

- For IMTP2.2 and ITTP2.2: there is a relay output contact (J11-3,4, AUX-COM, fig.12) that close, with a 3 seconds delay, when the pressure is less than the reference value and the motor velocity arrive to the maximum, then re-open when the pressure is higher than the reference value and the flow arrive to the minimum stop value; this relay contact is 2 Ampere - 250Vac maximum, useful to drive a contactor for an auxiliary ON-OFF pump, and work only when the control mode is in Pressure (single pump absolute pressure control); Warning: connect only contactors or relay coils with maximum voltage of 250Vac – do not exceedes;

- For ITTP4.0/../7.5: the output is 12VDC-100mA on the poles marked with AUX and 0V (J10-6,8) on the logic board (fig. 15) which can be connected to 12Vdc coil of a relay, to control a second ON / OFF pump, with the same logic insertion mode described above for the IMTP2.2-ITTP2.2 inverters; This output is active only when the control mode is in Pressure (single pump, absolute pressure control);

5.6.9 Terminal connection for the pressure Set Point selection (only for ITTP(D) 4.0-5.5-7.5):

In the absolute pressure control mode, single or group mode (on the master), setting digital input D3 and D4 (J11-5,6, fig.15) it's possible to select a maximum of N°4 pressure reference set points, with the default values described on the table below (adjustable pressure values):

Set Point	D3 (J11-5)	D4 (J11-6)	Default value	Note
P1	0	0	4.00 Bar	Standard configuration, contacts D3 and D4 opened
P2	0	1	3.00 Bar	Contact D4 (J11-6) closed on +5V (J11-1)
P3	1	0	2.00 Bar	Contact D3 (J11-5) closed on +5V (J11-1)
P4	1	1	1.50 Bar	Contact D3 and D4 contemporary closed on +5V (J11-1)

Table 7: Digital input for the selection of the reference pressure

5.6.10 Remote START/STOP input connection (only ITTP(D) 4.0-5.5-7.5):

Into the Advanced Function menu select Control Type > Start/Stop Input > Remote, then will be possible to start and stop the Motor closing contacts D1 (J11-3) with +5V (J11-1) on the logic board (fig. 15).

5.6.11 Remote 0-10V input for the pressure reference value connection (only ITTP(D) 4.0-5.5-7.5):

In the absolute pressure control mode, single or group mode (on the master), selecting on the Advanced Function menu > Control Type > Pressure reference Input: 0-10V Input, connect between J8-6 (+10V signal) and J8-7 (0V) and contemporary connect a wire between J8-7 and J8-8 on the logic board (fig. 15).

5.6.12 Remote 4-20 mA for the pressure reference value connection (only ITTP(D) 4.0-5.5-7.5):

In the absolute pressure control mode, single or group mode (on the master), selecting on the Advanced Function menu > Control Type > Pressure reference Input: 4-20mA Input, connect between J8-1 (4-20mA signal) and J6-1 (+15V) of the logic board (fig. 15).

When finished all connections, replace and close the box cover using the previously removed screws.

Before the possible re-opening of the inverter box, switch-off the voltage supply and wait, at least, two minutes to be sure that the capacitors are completely discharged (danger: contact with electric high voltage parts).

5.7 Connections on the electronic board

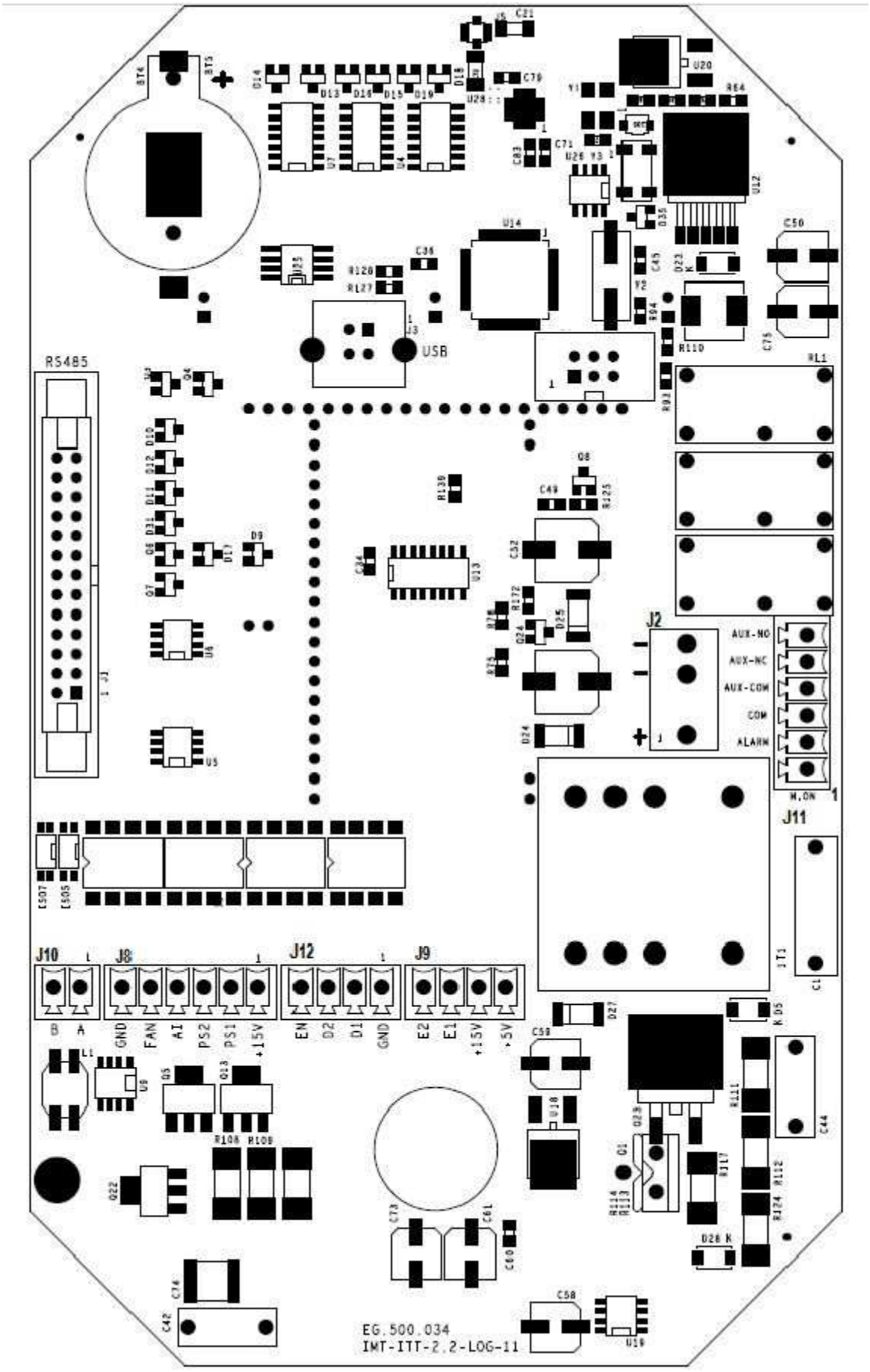

Figure 12: Logic board of IMTP(D)2.2-ITTP(D)2.2

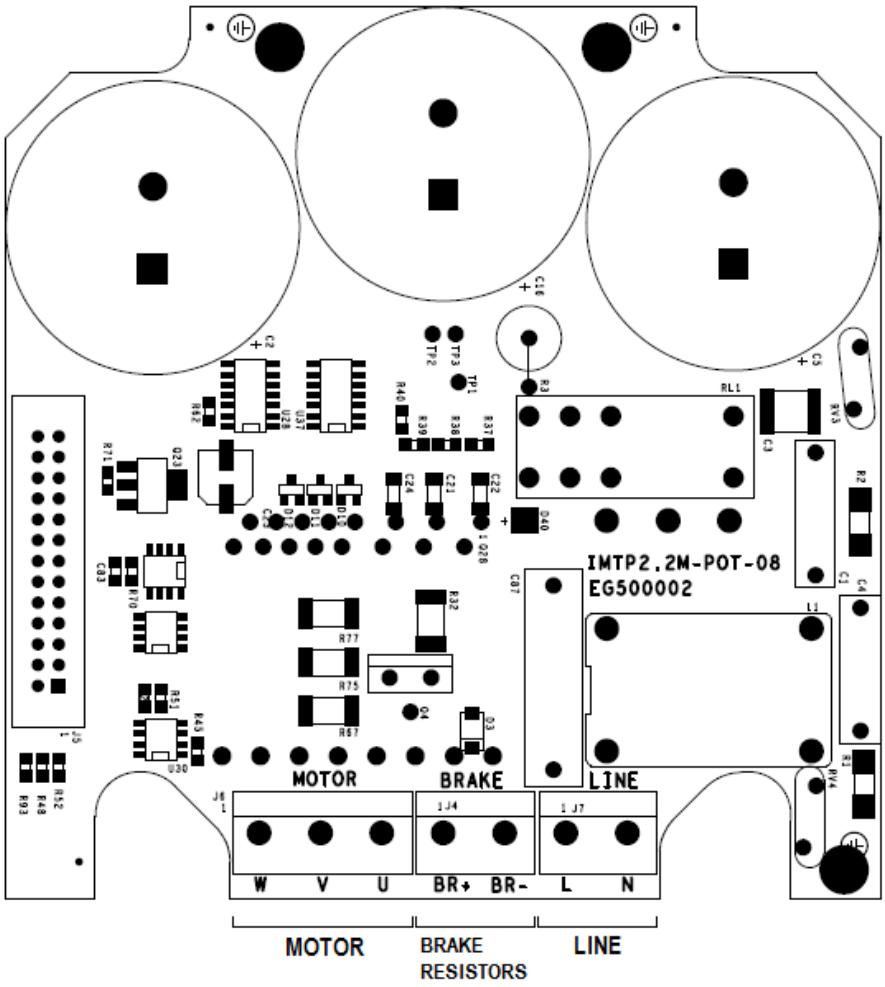

Figure 13: Power board of IMTP(D) 2.2

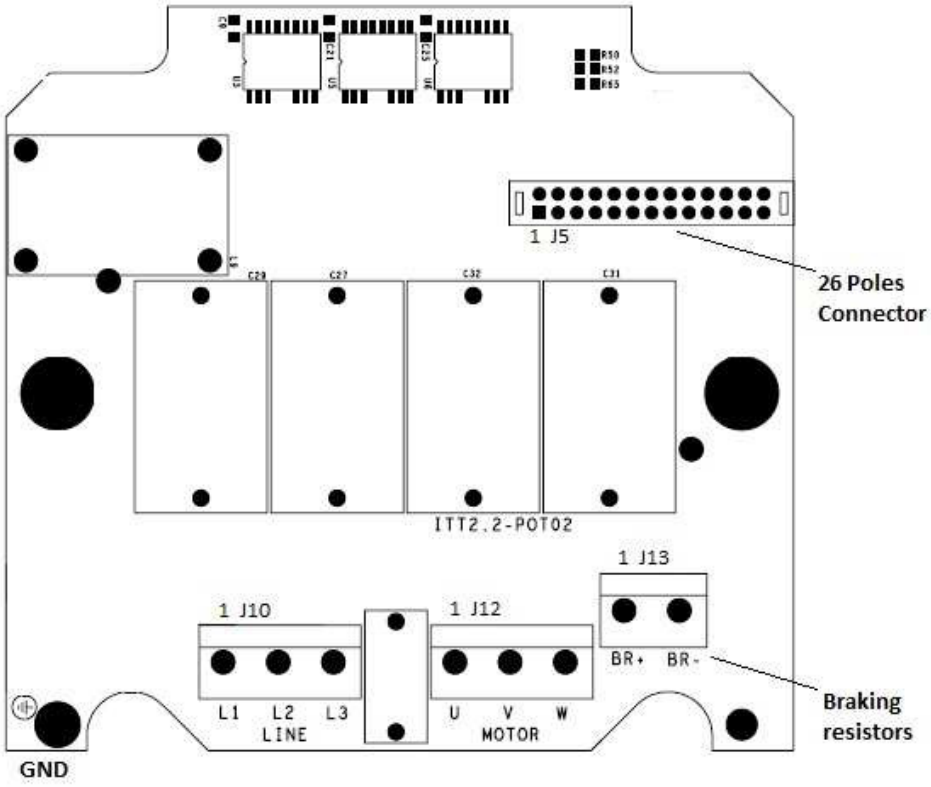

Figure 14: Power board of ITTP(D) 2.2

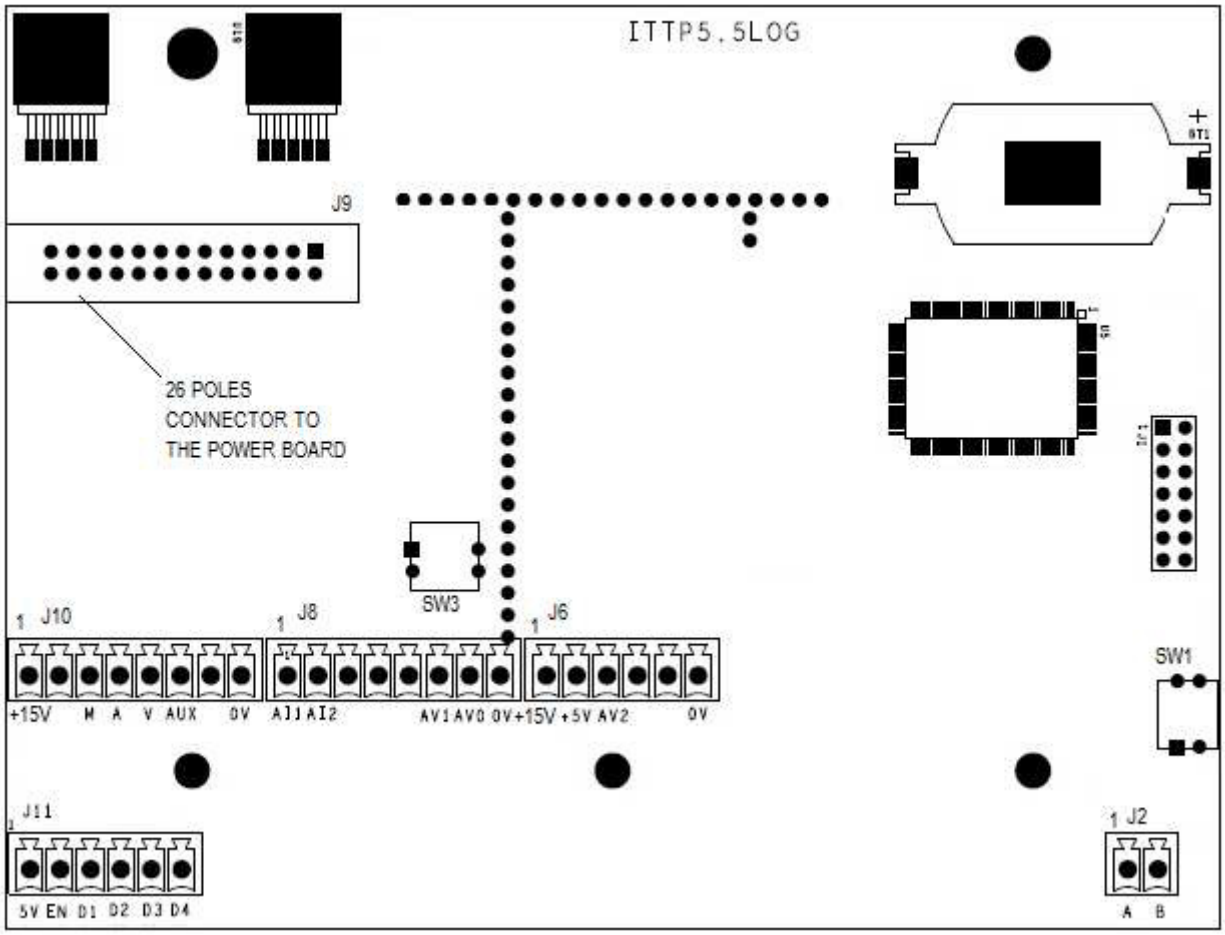

Figure 15: Logic board of ITTP(D) 4/../7.5

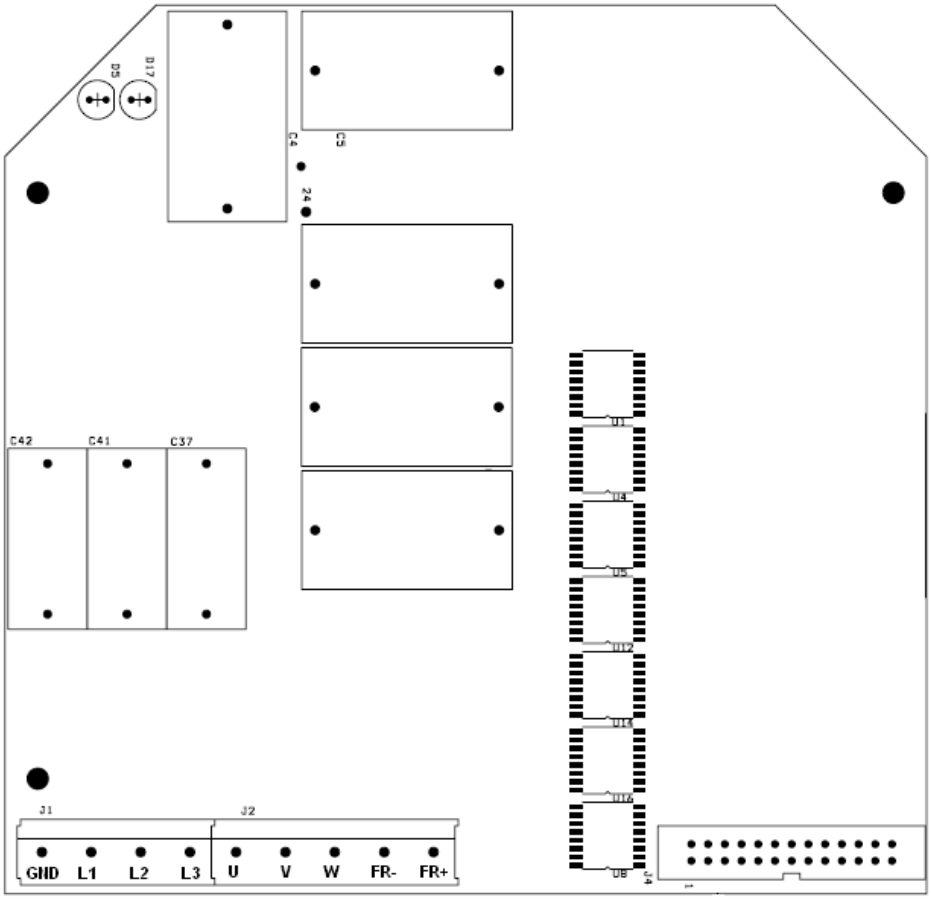

Figure 16: Power board of ITTP(D) 4/../7.5

6. STARTING AND PROGRAMMING

The starting and programming operations must be executed exclusively by experienced and qualified staff. Use the appropriate equipment and protections. To supply voltage on the Inverter verify that the Inverter box is completely closed, after having carefully followed all the instructions wiring above.

The pump can't operate in dry running; functioning under these conditions (even for a short time) irreparably damage the pump itself. For that, the control system reacts after 40 seconds with an alarm, stopping the pump.
Make the air purging on the pump.

6.1 First Inverter Starting – Check procedure

- Press START and set the *nominal current absorbing* for the phases connection in use (see 5.3);
- Press START and on *rotation direction* request, maintaining pulsed the START button until the reading of electrical data measures and select the direction (0,1) with "+" and "-" buttons, finally confirming with ENTER, then exit from menu with ESC.
- Be sure that the pump is fully of water and *close completely the outlet of the pump*.
- Pressing START for the Self-Regulation Check for the registration of the curve of the pump. During the Check the display show "EXECUTING CHECK"; at the end of the check the Inverter automatically save data and the pump may work normally.

During Self-regulation Check the pump may arrive at the nominal velocity, with maximum pressure. If you need, limits the maximum pressure previously (Pump Data).

6.2 Installer checks after Inverter setting

6.2.1 Check the minimum flow protection (for the absolute pressure control): At the first installation open the delivery on the pump flow, press START, wait a few seconds to reach the pressure set-point, then close the pump delivery valve (slowly) and make sure that the motor stops (after a few seconds) showing on display "MINIMUM FLOW". In case the motor does not stop you must select MOTOR DATA - POWER STOP and set a higher value than the default (103%) set by the factory. The absolute stop power value is showed, at regular times, on display at the top-central position.

6.2.2 Check the dry-working protection: After installation, if it's possible, close the delivery of the pump in order that the pump run dry; After a time of about 40 seconds (or the set delay time), the pump should stop, displaying "DRY WORKING". If, after this time, the pump does not stop, you must enter into ADVANCED FUNCTIONS – PRESSURE CONTROL, setting a higher value of the parameter COSFI LIMIT (by default set to 0.5). Save data after modifying.

6.3 Programming Functions

- **Display user interface (2x16 characters):**

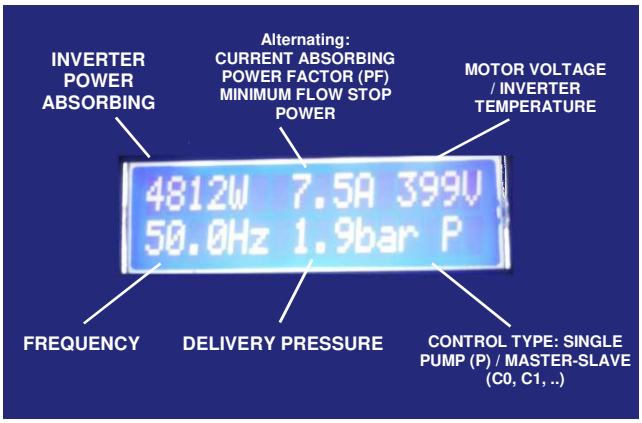

Figura 17: display data

First line: Power absorbing, Current absorbing / Power factor / Minimum flow stop power, motor voltage / IGBT temperature;
Second line: Motor frequency, absolute delivery pressure (P2 - Bar), for differential pressure control: Differential pressure (dP=P2-P1 Bar).

6.3.1 List of KEYS on the control panel

Command	Description
MODE	To enter on main functions menu
ENTER	To enter on the function and modify the values
↑ +	Scrolling up the items on the menu or positive change in the value of parameters; after the variation press ENTER. Increase the reference pressure value during functioning.
↓ -	Scrolling down the items on the menu or negative change in the value of parameters; after the variation press ENTER. Decrease the reference pressure value during functioning.
ESC	To exit to the function and automatically saving
START	Start the motor-pump rotation
STOP	Pump stop; If pressed with the key "-" during 5 seconds, RESET the factory data.

Table 8: List of commands on the control panel

6.3.2 LED description

LED	Description
Power ON	Green fixed: input voltage supply ON
Motor ON	Green fixed: Motor running; Green flashing: before stopping for minimum flow
Alarm	• Red fixed: Alarm condition that require a manually re-start (STOP+START) • Red flashing - high frequency: Alarm, motor stop protection with automatic re-start; • Red flashing - low frequency (5s): Problem on the pressure transducer or a serial bus RS485 problem on the group functioning – without stopping pumps. See alarm list on table 13.

Table 9: Led description

6.3.3 MAIN MENU FUNCTIONS DESCRIPTION

Main Menu	Submenu	Description	Range	Default
Lingua/Language	Italiano / English / Spanish / Swedish / Russian	Display language - Default: English NOTE: only N°3 languages for ITTP(D) 4-5.5-7.5; the indicated languages may change depending on the sales country.	Italiano / English / Spanish / Swedish / Russian	English
Date adjurnment	Day [dd] Month [MM] Year [yy] Hour [hh] Minute [mm] Second [ss]	Allow to do the data regulation (day – month – year) and the time (hour – minute – second). It Is important to set in following conditions: Single Pump with programming; **0** Group of pumps in Master-Slave.		
Pressure reference / Differential Pressure reference (dP=P2-P1)	Set P1(dP1): _._ [BAR] Set P2(dP2): _._ [BAR] Set P3(dP3): _._ [BAR] Set P4(dP4): _._ [BAR]	N°4 set-point for absolute pressure reference and for the Differential Pressure reference; The same parameter can change directly during pump functioning, pushing "+" or "-" on the control panel.	Absolute: 1.0 .. Pmax Differential: 0.1 .. Pmax	Absolute: *(3bar) P1=4.0 bar P2=3.0 bar P3=2.0 bar P4=1.5 bar Differential: *(3bar) dP1=0.40 bar dP2=0.30 bar dP3=0.20 bar dP4=0.15 bar
Motor data (PASSWORD required)	1. Nominal Power [kW] 2. Nominal Voltage [V] 3. Nominal Current [A] 4. Rotation [0/1] 5. Nominal Frequency [Hz] 6. Nominal RPM 7. P.F. 8. Minimum Flow stop power [%] 9. Dry Working stop power [%]	1. Nominal Power: motor rated power (read motor label) 2. Nominal Voltage: motor rated voltage 3. Nominal Current: motor rated current, according to the motor phases connection in use (star/delta, see 5.4). 4. Rotation direction (0/1) 5. Nominal Frequency of the Motor 6. Nominal RPM motor (read on the motor label) *(not for 2.2M); 7. *(6) Power Factor of the motor (read motor label); 8. *(7) Power value for the minimum flow protection (% referring to the value measured during check with closed delivery) – Not active for Differential pressure control; 9. *(8) Power value for the dry working protection (% referring to the value measured during check with closed delivery)	0.1 .. Pot max *(210 .. 440V) 200 .. 440V 0.1 .. I max 0 / 1 *(50 .. 140Hz) 60 .. 140 Hz 700..3552 RPM *(0.50 .. 0.95) 0.60 .. 0.95 *(50 .. 150%) 10 .. 150% *(30 .. 100%) 0 .. 100%	230V for IMTP(D)2.2; 400V for ITTP(D)2.2/../7.5 0.1 0 *(50Hz) 60 Hz 2920 RPM *(0.80) 0.82 *(105%) 103% 80%
Pump data (PASSWORD required)	Maximum Pressure [BAR] Self regulation Check [ON/OFF]	Maximum pressure limitation With Check=ON, at the next START begin the check, to store all electrical and hydraulic curves of the motor-pump.	*(0.5 .. 30 bar) 1.0 .. 50 bar ON/OFF	Absolute Press.: 10 bar 16 bar Differential: 5 bar ON
Sensor data (PASSWORD required)	MIN [mA; V] MAX [mA; V] Range [BAR] N° of transducers with DP control	MIN: minimum output value pressure transducer MAX: maximum output value pressure transducer Range: measure range of pressure transducer	0 .. 16 mA *(16 .. 22 mA) 4 .. 22 mA 0.1 .. 50.0 bar	4 mA 20 mA Absolute Press.: 16 bar Differential: 5 bar

		Number of transducers in differential pressure control (connect on AN1 a single pressure transducer with dP=P2-P1 4-20mA output) *(not for 2.2M)	1-2	2
Advanced functions (PASSWORD required)	Enter to Advanced Functions menu	To enter to advanced functions menu for advanced regulations (see table 11).		
Data Saving /Reset	Saving data modified or Reset factory data	*YES:* save modify *NOT*: back to previus data *DEFAULT FACTORY DATA*: • Absolute Pressure control: reset factory data for centrifugal pumps; • Differential Pressure control: reset factory data for circulating pumps.		

Table 10: Main Menu description

***(…) only for parmeters IMTP(D)/ITTP(D)2.2M**

6.3.4 ADVANCED FUNCTIONS MENU

ADVANCED FUNCTIONS MENU	Sub-menu ADVANCED FUNCTIONS	Description	Range	Default
Programming	Timer: ON/OFF P1 (start 1) A1 (stop 1) … P7 (start 7) A7 (stop 7)	Timer=ON (enabled) it's possible to set untill N°7 start/stop, setting in this format: Day : Month – Hour : Minute	ON/OFF	OFF
Motor Limits	1. Maximum speed [%] 2. Minimum speed [%] 3. Acceleration [s] 4. Deceleration [s] 5. Maximum current [%] 6. Joule braking *(not for 2.2M) 7. Magnetization [%]	1. Maximum Motor Velocity 2. Minimum Motor Velocity 3. Motor acceleration 4. Motor deceleration 5. Maximum Motor current 6. Joule braking *(not for 2.2M) 7. Magnetization current (to increase the starting motor torque) Values % on respect the nominal values	*(90 .. 110%) 80 .. 110% *(20 .. 80%) 10 .. 80% *(1 .. 9.9 s) 1 .. 99.0 s *(1 .. 9.95 s) 0.1 .. 99.0 s *(80 .. 120%) 90 .. 110% 100 .. 9900 J *(80 .. 120%) 70 .. 130%	100% Absolute:*(50%) 40% Differential: 20% Absolute:*(2s) 3s Differential:5s Absolute:*(2s) 3s Differential:5s 100% 1000J 100%

Pressure Control	1. Pressure Hysteresis [BAR] 2. Max Pressure *(not for 2.2M) 3. *(2) Dry working stop delay [s] 4. *(3) Dry working re-start time [min] 5. Pipe filling delay [s] *(not for 2.2M) 6. Filling Pressure limit [BAR] *(not for 2.2M) 7. *(4) Minimum flow stop delay [s] 8. *(5) Minimum flow restart delay [s] 9. Alarm restart delay [s] *(not for 2.2M) 10. *(6) Dry operating PF limit 11. *(7) Enable OFF Stop Delay (from V.11.08) 12. *(8) DP-flow reduction power [%] 13. *(9) DP-flow reduction max value [%] 14. *(10) Alternating time [min] 15. *(11) Intake pressure	1. Pressure control hysteresis	0.1 .. 3.00 bar	P. Absolute: 0.3 bar Differential: 0.05 bar
		2. Max Pressure *(not for 2.2M)	110 .. 200%	125%
		3. *(2) Dry working stop delay time for pump filling	10 .. 300 s	40 s
		4. *(3) Dry working re-start delay time after firsts 5th times; after the 5th, the Inverter require a manual re-start (STOP + START) *(not for 2.2M)	*(0.1 .. 25') 0.1 .. 45'	15'
		5. Pipe filling time at the minimum speed when the pressure measured during the motor starting is lower than the Filling Pressure Limit (next point) *(not for 2.2M)	0 .. 999 s	0 s
		6. Pressure limit for the reduces speed motor starting, during pipe filling	0.1 .. 30 bar	0.5 bar
		7. *(4) Delay time for the Minimum flow protection stop (only for the Absolute pressure control)	*(1 .. 99 s) 4 .. 120 s	12 s 15 s
		8. *(5) Delay time for the motor re-start after the minimum flow stop – (only for the Absolute Pressure control);	0 .. 120 s	0
		9. Delay time to re-start the motor after a protection stop	4 .. 180 s	10 s
		10. *(6) When the Power Factor undertake this value, the pump stop for dry operating protection	0 .. 0.90	*(0.45) 0.5
		11. *(7) Switch-off delay after EN contact opening (from V.11.08)	*(0÷99s)	0s
		12. *(8) Power value limit for the reduction of the Differential pressure	*(110 .. 200%) 105 .. 120%	120%
		13. *(9) Differential Pressure reduction when the power is under the limit of previous point	*(70 .. 100%) 20 .. 100%	85% 100%
		14. *(10) Time of the alternating starting priority of two or more pumps in Master-Slave group mode	*(1 .. 999) 2 .. 9999	60
		15. *(11) Intake pressure setting: make use to avoid over-elongation with intake pressures over 2 Bar; the minimum reference pressure will be the same to the intake pressure + 0.5 Bar + hysteresis.		0 bar

Control Type	1. Mode: 1.1 Pump Speed 1.2 Pump Pressure 1.3 Master-Slave RS485 1.4 Differential Pressure 1.5 MasterSlave DP 2. Pumps number (2..8) 3. Code (0..7) 4. Reference Speed [RPM] 5. Start-Stop Input *(not for 2.2M) 6. Pressure reference Input *(not for 2.2M)	1. Set Control Type mode: 1.1 Pump speed control: directly regulation of the speed in absence of pressure sensor; security stop for minimum flow and dry working conditions, only with manually re-start. 1.2 Single Pump pressure control 1.3 Master-Slave Group functioning for the absolute pressure control by RS485 serial bus 1.4 Differential pressure control for a single pump: dP=P2 (outlet) – P1 (inlet); 1.5 Differential pressure control in group by RS485 serial bus; 5 Pumps Number: Number of pumps (for group functioning mode 1.3 or 1.5) 3. Code 4. Reference Speed value (only for speed control mode) 5. Start-Stop Input: 5.1 Keyboard; 5.2 Remote (for connections, see par. 5.6.8) *(not for 2.2M); 6 Pressure reference Input: 6.1 Keyboard; 6.2 0-10V Input (for connections, see par. 5.6.9); 16.4-20 mA Input (for connections, see par. 5.6.10) *(not for 2.2M)	 2 .. 8 0 (Master) 1 .. 7 (Slaves) *(600 ..8300 RPM) 1200 .. 3000 RPM	Pump pressure 2 0 *(2800 RPM) 2920 RPM Keyboard Keyboard
P.I.D. factors	$K_{proportional}$ $K_{integral}$ $K_{derivative}$ Pressure ramp	1. $K_{proportional}$: Pressure error multiplayer 2. $K_{integral}$: Integral of pressure error multiplier 3. $K_{derivative}$ (not for 2.2M) 4. Pressure ramp [bar/s]	1 .. 100 1 .. 100 0 .. 100 *(0.01..4.99 bar/s) 0.1 .. 10.0 bar/s	25 25 25 P. Absolute: *(0.5 bar/s) 0.25 bar/s Differential: *(0.10 bar/s) 0.5 bar/s
Alarm history	Alarm N° Type	Visualization of last 100 alarm in chronologic order (see table 12 and 13)		

Table 11: advanced functions sub-menu

***(…) only for parmeters IMTP(D)/ITTP(D)2.2M**

6.4 Alarms

6.4.1 Alarm list for Inverter models IMTP(D)2.2M – ITTP(D)2.2M:

Alarm Number	Alarm Type	Description
1	Current Peak	Immediately stop probably caused by short-circuit Automatic re-start; final stop after 10 consecutive occurrences
2	Over-Voltage	Normally caused by over voltage pick supply. Automatic re-start; final stop after 10 consecutive occurrences
3	Inverter Temperature	Over temperature IGBT protection (90°C) Automatic re-start; final stop after 10 consecutive occurrences

4	Motor overheating	Motor thermal protection related to nominal current set, for motor insulations saving at high temperatures. Automatic re-start; final stop after 10 consecutive occurrences
5	Dry working	Null input flow or air presence; Automatic re-start; final stop after 5 consecutive occurrences
6	Pressure sensor problem	Pressure sensor output problem Automatic re-start; final stop after 10 consecutive occurrences
7	Minimum flow	The pump stop for minimum flow limit achievement. It's a normal working condition of the system (no demand of water on the delivery) even thug is on the alarm list, Automatic re-start; no limits
8	Enable OFF	Opened contact EN: stop the motor; the motor restart when the contact will close again
9	Input Voltage under limit	Input voltage under the minimum working limit. Automatic re-start; final stop after 10 consecutive occurrences
10	Delivery/Suction Pressure Transducers inverted	Inversion delivery/suction on the pressure reading, caused by an uncorrected wiring (only for Differential pressure control mode).

Table 12: Alarm list for IMTP(D)-ITTP(D) 2.2 M

6.4.2 Alarm list for Inverter models ITTP(D) 4.0 – 5.5 – 7.5:

Alarm Number	Alarm Type	Description
1	Current Peak	Immediately stop probably caused by short-circuit Automatic re-start; final stop after 10 consecutive occurrences
2	Over-Voltage	Normally caused by over voltage pick supply. Automatic re-start; final stop after 10 consecutive occurrences
3	Inverter Temperature	Over temperature IGBT protection (90°C) Automatic re-start; final stop after 10 consecutive occurrences
4	I^2T exceeded	Motor thermal protection related to nominal current set, for motor insulations saving at high temperatures. Automatic re-start; final stop after 10 consecutive occurrences
5	Dry working	No flow on the suction or air presence; Automatic re-start; final stop after 5 consecutive occurrences
6	Pressure transducer problem	Pressure sensor output problem Automatic re-start; final stop after 10 consecutive occurrences
7	Minimum flow	The pump stop for minimum flow limit achievement. It's a normal working condition of the system (no demand of water on the delivery) even thug is on the alarm list, Automatic re-start; no limits
8	Enable OFF	Opened contact EN: stop the motor; the motor restart when the contact will close again
9	Over-temperature microprocessor	The microprocessor temperature exceed a limit value, then the system must stop until the temperature return low. Automatic re-start; final stop after 10 consecutive occurrences
10	Over-current	High current combined with a low limited velocity. Automatic re-start; final stop after 10 consecutive occurrences
11	Braking current peak	Current peak on the braking resistors; Automatic re-start; final stop after 10 consecutive occurrences
12	Error current reading	Mistake on the current reading; the motor stop to prevent possible damage caused by the faulty current control. Automatic re-start; final stop after 10 consecutive occurrences
13	Input Voltage under limit	Input voltage under the minimum working limit. Automatic re-start; final stop after 10 consecutive occurrences
14	Unbalanced current	Unbalanced currents on the three phases (>15% on RMS value) Automatic re-start; final stop after 10 consecutive occurrences
15	INPUT-OUTPUT cables inverted	Connection error: Voltage supply connected on the output and Motor cable connected on the entrance: reverse in order to enable the motor
16	Delivery/Suction Pressure Transducers inverted	Inversion delivery/suction on the pressure reading, caused by an uncorrected wiring (only for Differential pressure control mode).

17	Maximum pressure	The pressure has exceeded the set-point value + percentage value of the set-point. Increase the maximum pressure percentage to 200%. Menu→Advanced functions→Pressure control→Maximum pressure.

Table 12: Alarm list for ITTP(D) 4.0-5.5-7.5 M

6.5 Group Functioning - data transmission via serial bus RS485

Pumps controlled by inverters communicating with RS485 in control logic MASTER – SLAVE differential type:

1. Connecting all Inverters with a bipolar signal cable for RS485, respecting the polarity A and B (for connections, follow the instructions on par. 5.6.5);
2. Set the MASTER inverter: Advanced Functions > Control Type > Mode: Master Slave (DP); Code = 0; N° Pumps ≥2;
3. Set on the remaining SLAVES Inverters (maximum 7): Advanced Functions > Control Type > Mode: Master Slave (DP); Code (≥1); N° Pumps (≥2).

IMPORTANT NOTE: Use one sensor for every Inverter (two sensors for Differential pressure control) to guarantee the redundancy and the group functioning continuity in case of damage of one of the Motors/Sensors/Inverters; when the sensors have problems, the Master Inverter read the output of the sensors connected to a slave Inverter. For group mode, it is important the good state of charge of the lithium battery of the Master Inverter, to maintain the date and time.

During group functioning in case of voltage trip, Master fault or serial bus cable damage, the Slave Inverters continuous functioning in single mode, reading their pressure sensors. Although there is not a stop of the complete system, restore the damaged cable/sensor/inverter in order to guarantee the perfect pressure control and the perfect alternation of the pumps and its duration.

6.6 Replacing the lithium battery

The 3V lithium battery (type CR2032 for IMTP(D)2.2 and ITTP(D)2.2, CR2430 for ITTP(D)4.0/../7.5) is used exclusively for storing date and time even in the absence of power supply for a long time (the battery can live 6-8 years without inverter power supply). The lithium battery should be replaced when the user notice that the inverter does not maintain stored date and time in the absence of power supply.
NOTE: Even with exhausted or absent lithium battery remain stored all inverter functional settings indefinitely.
To replacing the lithium battery it needs:

1. Disconnect the power cable from the line;
2. Open the inverter box;
3. Wait for the complete shutdown of the led which indicates the charge of capacitors before touching any part of electronic boards;
4. Replace the battery present under the cover of the inverter.

7. SOLUTION ON THE MOST COMMON INSTALLATION AND WORKING PROBLEMS

N°	Possible problem	Possible solution
1	Pressing start button the motor don't start or start and stop after few seconds and the inverter show Over-Current alarm or Current Pick alarm	Check if the input/output of the inverter are respectly connected between line and motor, without inversion (Warning: input/output inversion can damage the electronic board of the inverter). Check the correct connection of the pump (star/delta): possible mistake. Check if all the three wires to the motor are connected good and the three current are balanced. Check if the motor power size is not so high on respect to the inverter size. Check if the inverter is not on Master-Slave condition (Advanced Functions -> Group Functioning) set to slave, without the Master inverter connected and switched on: in this situation waiting 30s after pressing start button, the inverter will start automatically alone.
2	Pressing start button the motor don't start or start and stop immediately and the inverter show Under Voltage alarm	Check that all the input voltage supply wires are connected good on the entrance of the inverter: if the inverter input is three-phases but on the connection there are only two, the inverter switch on and can start the motor, but haven't enough power to supply it. Check that before the inverter the supply line wires size are good to have a limited voltage drop, then a sufficient voltage value on the inverter.

3	During working at the maximum power the inverter reduce continuously the output power to the motor then stop the motor and the inverter show Over Temperature IGBT alarm /Inverter Temperature alarm	Temperature of the electronic board of the inverter is too high and the inverter must remain stop for few minutes to reduce the internal temperature before the automatic restart. For wall mounting type be sure that the inverter stand on a wall, in vertical position, protected from directly sunlight, and the air flow is totally free; for motor mounting type check that the air flow from the motor fan is good to limit the aluminum temperature of the inverter case under 60°C; the inverter cannot work continuously at the maximum power with a ambient temperature higher than 40°C and with high temperature can reduce automatically the output power (-10%, -20% then stop for few minutes). .
4	Pressure Transducer don't measure the correct pressure value (error > 1 Bar)	Check if the pressure transducer is connected on the delivery of the pump on a correct position, not so close to the impellers and before the valve to close the flow.
5	Pressure Transducer measure a pressure too high when the motor is running then the Inverter reduce the motor velocity at the minimum value (low frequency)	Check that the pressure cable is separated from the motor cable, that is a source of noise; specially when the cable of the pressure transducer is too long (long distance between inverter and motor) it's very important to use a shielded type two wire cable, as far as possible to the motor supply cable. Connect the shield to ground only on one terminal, if possible connect it directly on a metal screw to ground near the motor.
6	The Inverter cannot work because remain in Pressure Transducer Problem alarm condition	Check If the wires of the pressure transducer are correctly connected brown on +, white on S contact on the board. Check wiring connection on the cable of the pressure transducer. Warning: In case you need to cut the pressure transducer cable to add a longer cable be sure to switch off the inverter at least 1 minute before to cut this cable, otherwise you can cause a short circuit on the transducer input of the electronic board (damage) if the internal capacitors are not totally discharged.
7	The distance between Pressure transducer and Pump is high (long pipe) and the pressure continuously go up and down	You must reduce the velocity of the feedback control reducing the Proportional factor and the Integral factor (Advanced Functions -> P.I.D. Factors). Try to set these values to half and test the system, then, if not enough, reduce more and test again until the pressure control remain stable.
8	The Inverter stop the motor for Minimum Flow with a high flow condition and then re-start and stop again, continuously	A small water membrane Tank charged with 1.5-2 Bar air pressure is required for a correct working; check it. The condition may also caused by a not correct pump curve saving during the automatic check: possibly the delivery was not totally closed and the Inverter checked a higher curve of the pump; repeat the automatic check (Pump data -> check ON, then exit to the menu and press START) closing totally the outlet and try again the functioning. Verify if there is a no-return inlet valve on the pump and if it's working good without loses. It's possible to reduce the flow before stopping reducing the parameter F1 It's possible to reduce the flow before stopping reducing the parameter Minimum Flow Power stop % on Motor Data.
9	The inverter don't switch off the pump when the valve on delivery is totally closed	Probably check was done with pump not perfectly filled up; remake the check procedure after a complete filling of the pump and try again if pump switch off correctly in minimum flow condition. If the problem remain, try to grow up the function: Advanced Functions -> Motor data -> Minimum flow power stop, upgrading 2% every time and testing pump, till find the correct working.
10	The hydraulic system have a big tank (>40 l) and, after check did correctly with closed delivery, the pump stop for minimum flow with a high flow, and then re-start and stop again, continuously	Probably during the automatic check there was a flow of water to full up the big tank, for that the pump curve saved by the inverter is not the correct curve (with null flow and maximum pressure). Maintain full of water the tank (pressure near maximum value); repeat the automatic check (Pump data -> check ON, then exit to the menu and press START). When the check finish try to work again testing the minimum flow stop condition of the motor that must be with a small flow.
11	The Inverter stop the motor for Dry Working condition	Sometimes the problem is caused by the same Automatic Check error that previous point (see possible solution like above). In other cases possibly there is air mixed with the water on the inlet of the pump (verify pipes and junctions).

12	The pump don't switch off for dry working when the inlet pipe and the pump are empty	In normal working condition, with pump and pipes filled up, remake a check procedure (Pump data -> Check=ON) and try again. If the problem remain grow up the parameter: Motor Data -> Dry Working power stop, from 80% default value doing 10% steps, testing every time the pump. If the problem cannot disappear also with Dry working power stop more than 100%, verify that pump haven't any defect (fault seal, impellers, etc) that can cause a big power absorbing also without water, in dry condition.
13	A group of two or more inverters cannot communicate between each other in Master-Slave mode	For the BC inverters type read on left. For the RS type check the correct connection RS485 by a two wires cable (A to A and B to B). Verify the communication set to Master-Slave on Advanced Functions -> Group Functioning (code 0 for the inverter Master, code 1, 2, etc for all the others Inverters Slave)
14	The Inverter conduct on the input voltage supply line electromagnetic noises that disturb other electronic devices	Check Ground cable connections (Ground system must be radial type, with resistance less than 10 Ohm). All the Inverters have an internal Input EMC filtering stadium, but is available also an additional EMC Input filter (various types, contact the service) for bigger noise suppression with sensitive devices connected on the line.
15	With a long cable between Inverter and Motor sometimes the inverter stop the motor in Pick Current alarm	The motor can have high pick voltage value caused by the high frequency of the PWM combined with the high capacitance to ground of the long cable: we suggest to use an additional inverter output filter for cable longer than 40 meters connecting it directly on the Inverter output. Available various types of output filters, contact the service to receive informations.
16	The Differential Circuit Breaker on the line sometimes switch off the inverter	Check the Ground system resistance (must be less than 10 Ohm). Use only differential circuit breaker type A (specific for Inverters).
17	The Magneto-Thermal Circuit Breaker on the line switch off the inverter when the pump run at the maximum power	All the inverters may have a high pick value of the sinusoidal caused by the harmonics (5^{th} , 7^{th} , $11^{th,}$ etc.) and depending by the resistance of the line, but this condition don't increase the energy absorbing value depending by the area under this current curve. Only you need to use a Magneto-Thermal Circuit Breaker with a higher Current value than the value that you can use for the direct pump controlled. Usually it's enough a switch one step higher than the switch useful for the simple motor (see table of the Magneto-Thermal protection suggested on the handbook).

Table 13: Solution of the most common installation and working problems

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Secondo le norme vigenti europee: garanzia di 2 anni calcolato a partire dalla data di fornitura dell'apparecchio salvo restando ulteriori disposizioni di legge o contrattuali.
Per ricorrere a prestazioni di garanzia, si deve presentare alla ditta fornitrice il certificato di garanzia e la ricevuta o fattura di vendita.
La garanzia è esclusa o interrotta anticipatamente se i danni sono da imputare alle seguenti cause:
Influssi esterni, installazione non professionale, inosservanza delle istruzioni per l'uso, interventi da parte di sedi non autorizzate, impiego di pezzi di ricambio non originali nonché normale usura. /
Under the current European low: guarantee of 2 years calculated from the date of delivery of prejudice further provisions of law or contract.
To receive service assistance in guarantee, it must submit to the company providing the guarantee certificate completed.
The guarantee is excluded or interrupted in anticipation if the damage is caused to the following:
External influences, non-professional installation, non-compliance with instructions, interventions by unauthorized locations, use of not original spare parts and normal wear.