E-Tech®

Installing and operating manual

DrivE-Tech®

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1. DrivE-Tech Introduction

DrivE-Tech is a variable frequency drive designed to control and protect pumping systems by varying the output frequency to the pump.
DrivE-Tech 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

DrivE-Tech, 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.
DrivE-Tech 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 DrivE-Tech units for combined operation

Through the use of inductive filters (optional) DrivE-Tech eliminates dangerous surges that are induced in long cables, making DrivE-Tech 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 DrivE-Tech itself (including visual inspection) and/or on the connected load. **Disconnect DrivE-Tech 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.** **DrivE-Tech and pumping system must be grounded properly before operation. For the entire period DrivE-Tech 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 DrivE-Tech 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.

3. Technical Characteristics

Model	Vin +/- 15% [V]	Max V out [V]	Max I in [A]	Max I out [A]	P2 motor power* [kW]	Size
DrivE-Tech 2.015	1 x 230	1 x Vin	15	9	1,1	1
		3 x Vin		7	1,5	1
DrivE-Tech 2.030	1 x 230	1 x Vin	20	9	1,1	1
		3 x Vin		11	3	1
DrivE-Tech 2.040	1 x 230	3 x Vin	38	18	4	2
DrivE-Tech 2.055	1 x 230	3 x Vin	53	25	5,5	2
DrivE-Tech 4.022	3 x 380 - 460	3 x Vin	10	6	2,2	1
DrivE-Tech 4.040	3 x 380 - 460	3 x Vin	13,5	9	4	1
DrivE-Tech 4.055	3 x 380 - 460	3 x Vin	16	14	5,5	2
DrivE-Tech 4.075	3 x 380 - 460	3 x Vin	21	18	7,5	2
DrivE-Tech 4.110	3 x 380 - 460	3 x Vin	31	25	11	2
DrivE-Tech 4.150	3 x 380 - 460	3 x Vin	35	30	15	2
DrivE-Tech 4.185	3 x 380 - 460	3 x Vin	42	38	18,5	3
DrivE-Tech 4.220	3 x 380 - 460	3 x Vin	52	48	22	3
DrivE-Tech 4.300	3 x 380 - 460	3 x Vin	68	65	30	3
DrivE-Tech 4.370	3 x 380 - 460	3 x Vin	78	75	37	3
DrivE-Tech 4.450	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 DrivE-Tech, used in wall mounted applications, has a protection rating of IP54.

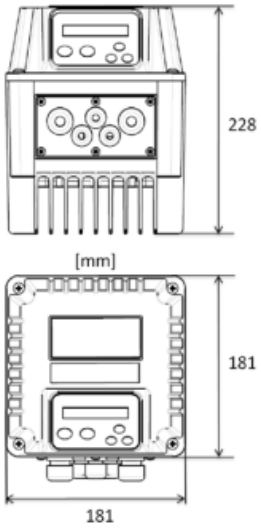
DrivE-Tech is able to power the motor with a higher current for a short period of time according to the linear relation: 101% of the nominal current for 10min., 110% nominal current for 1 min.

3.1 Weight and dimensions

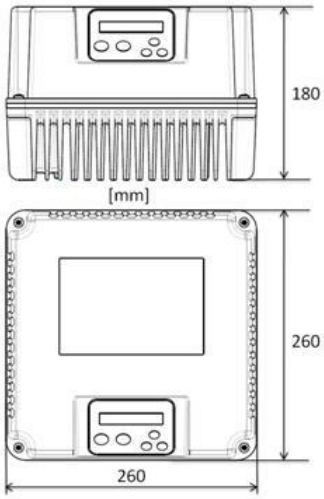
Model	Weight *	Size
	[Kg]	
DrivE-Tech 2.015	4	1
DrivE-Tech 2.030	4,3	1
DrivE-Tech 2.040	7,2	2
DrivE-Tech 2.055	7,2	2
DrivE-Tech 4.022	4,4	1
DrivE-Tech 4.040	4,4	1
DrivE-Tech 4.055	7	2
DrivE-Tech 4.075	7	2
DrivE-Tech 4.110	7	2
DrivE-Tech 4.150	7,2	2
DrivE-Tech 4.185	33	3
DrivE-Tech 4.220	33	3
DrivE-Tech 4.300	34	3
DrivE-Tech 4.370	34	3
DrivE-Tech 4.450	34	3

* Weight without packing.

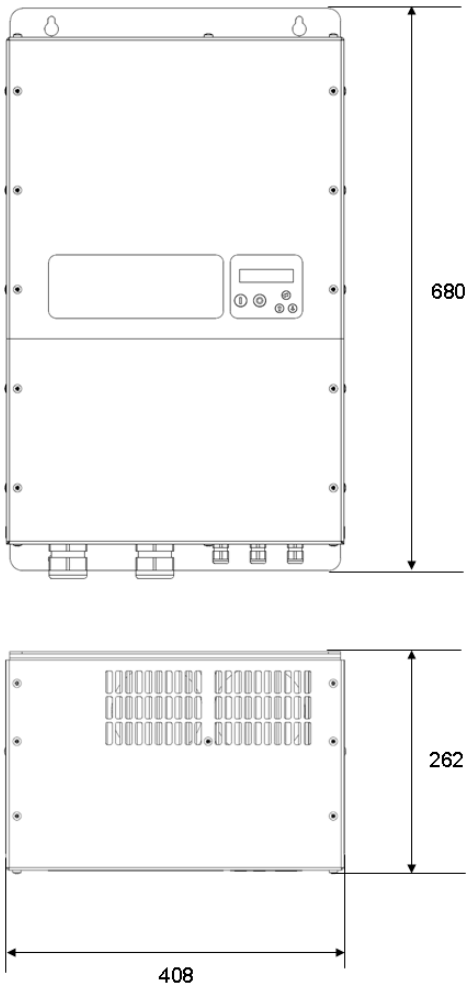
SIZE 1



SIZE 2

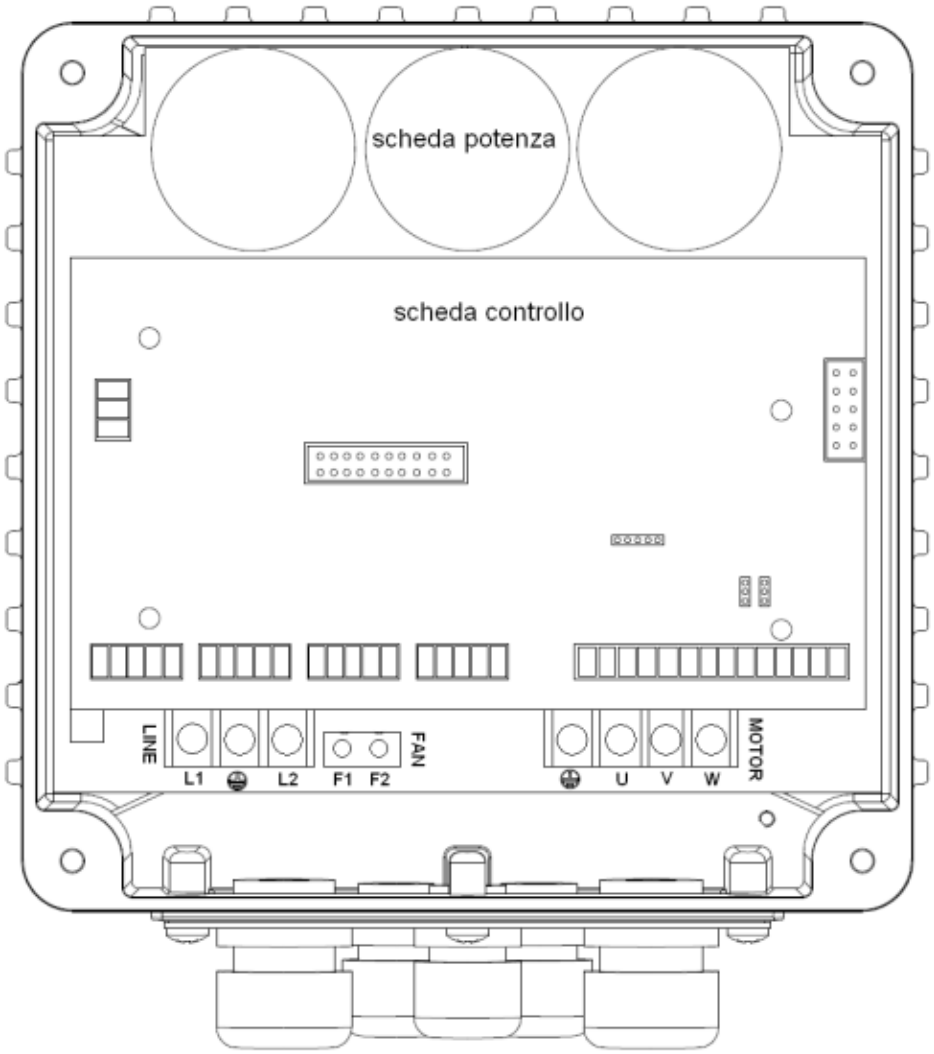


SIZE 3



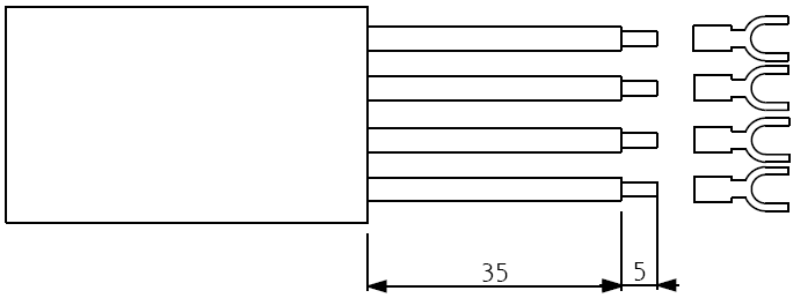
4. Electric wiring

Power board DrivE-Tech 2.015,2.030

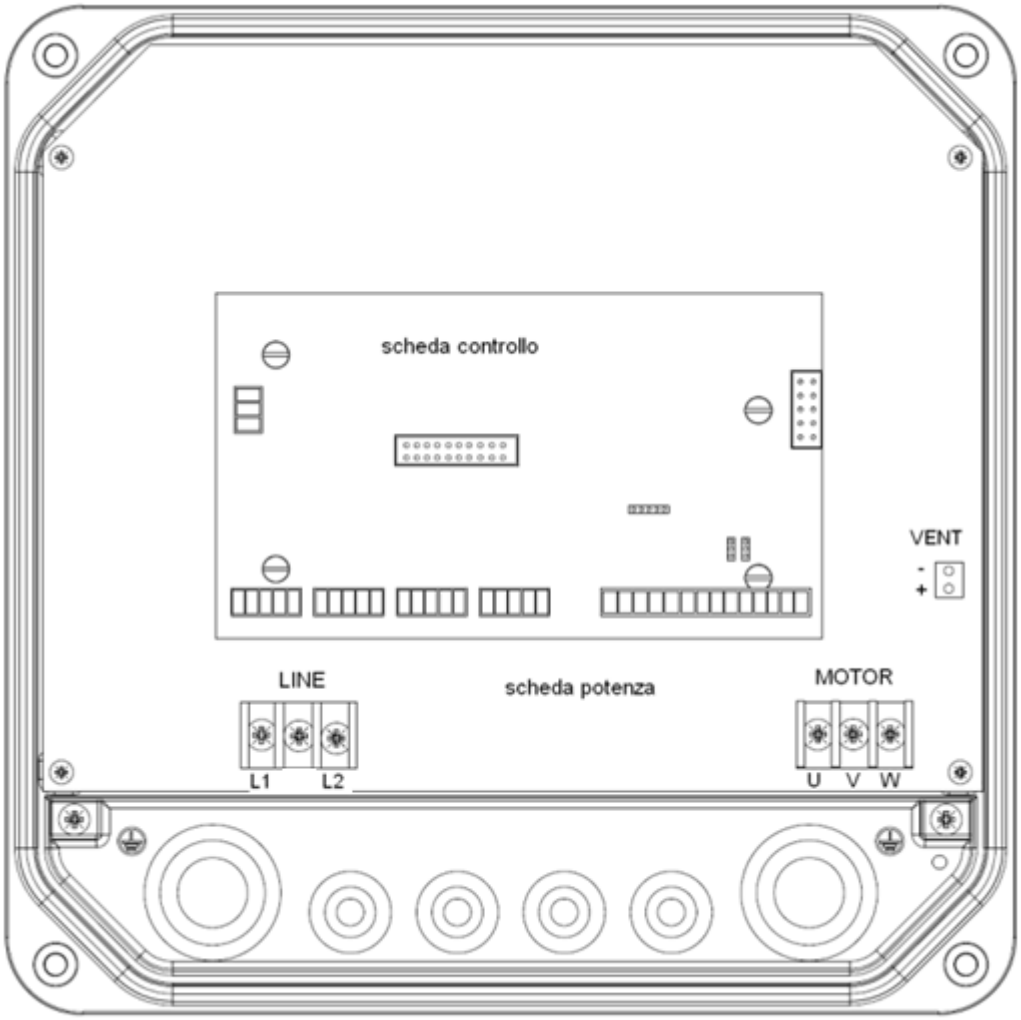


Power supply: **LINE: L1, L2,GND** **It is recommended to use cable lugs**	Output: **3 ph motor:** **GND,U,V,W,** **1 ph motor:** **earth, U (running), V (common)** **It is recommended to use cable lugs.**	230 V AC auxiliary fans (wall mounting kit) **FAN: F1, F2**

Recommended line and motor cables stripping

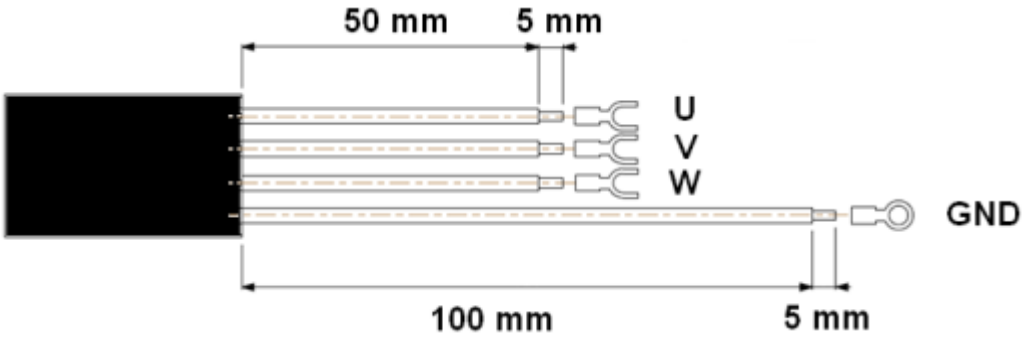


Power board DrivE-Tech 2.040, 2.055

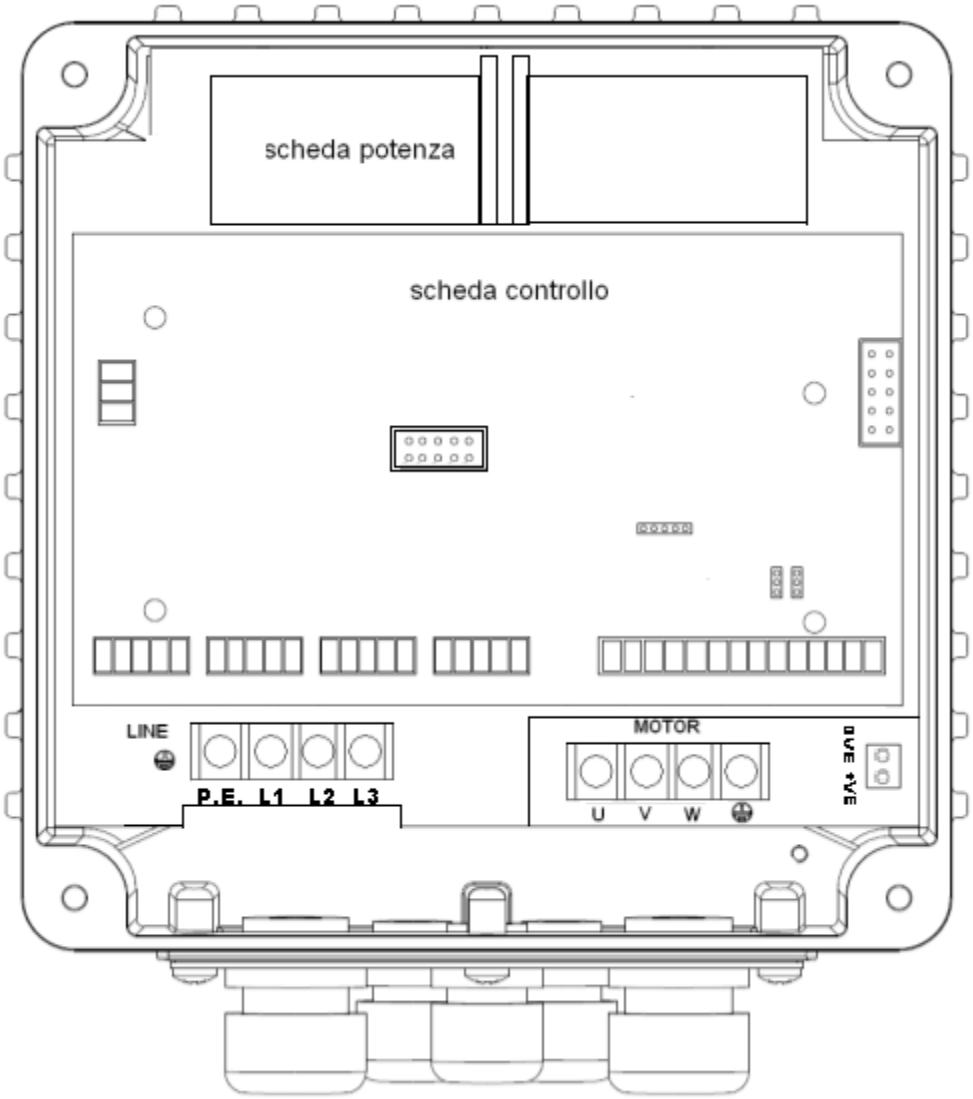


Power supply: **LINE: L1, L2, GND** **It is recommended to use cable lugs.**	Motor output: **MOTOR: U, V, W, GND** **It is recommended to use cable lugs.**	12 V dc auxiliary fans (wall mounting kit) **VENT: +, -** **WARNING: respect the polarity.**

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

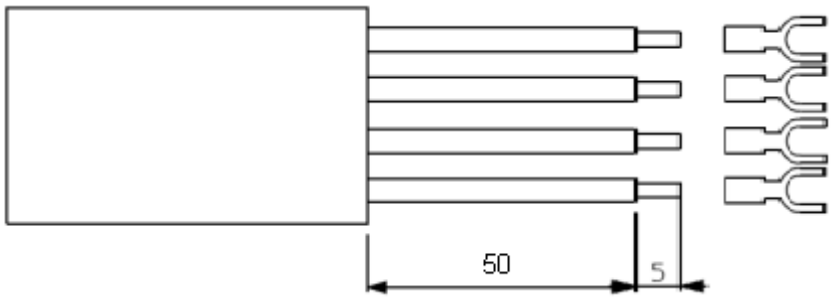


Power board DrivE-Tech 4.022,4.040

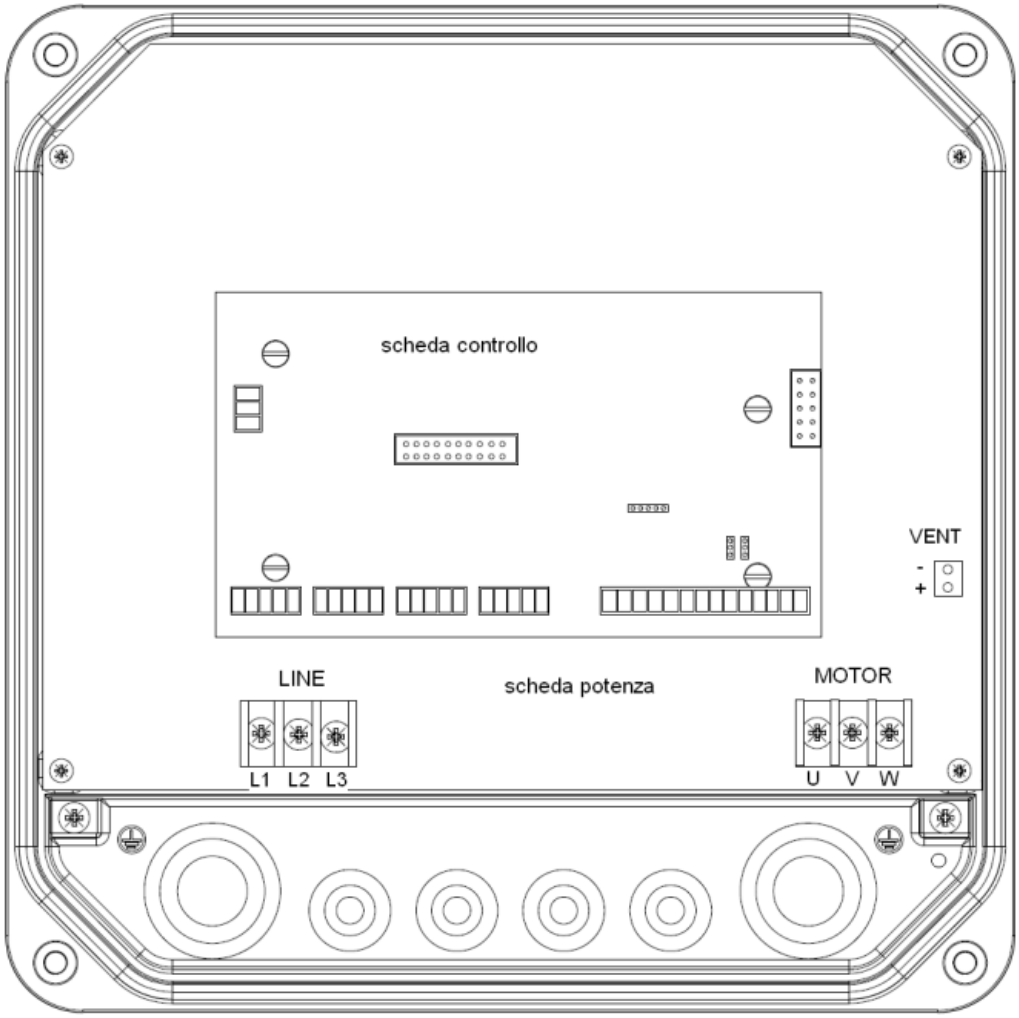


Power supply: **LINE: GND , L1, L2, L3,** **It is recommended to use cable lugs.**	Motor output: **MOTOR: U, V, W, GND** **It is recommended to use cable lugs.**	12 V dc auxiliary fan (wall mounting kit) : **0VE, + VE** **WARNING: respect the polarity.**

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

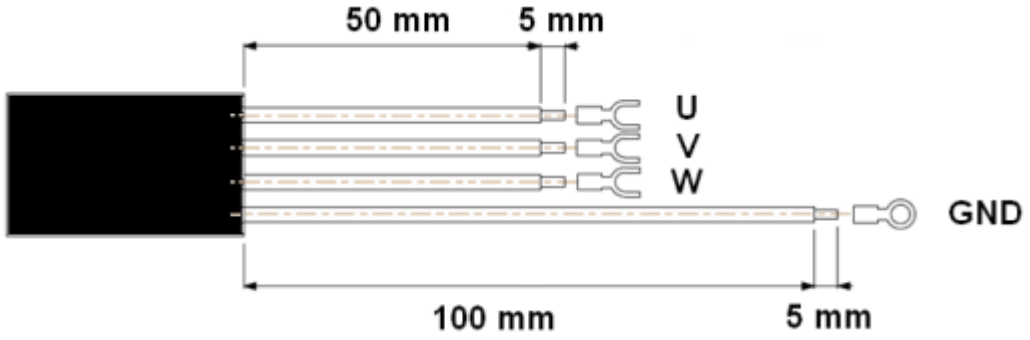


Power board DrivE-Tech 4.055,4.075,4.110,4.150

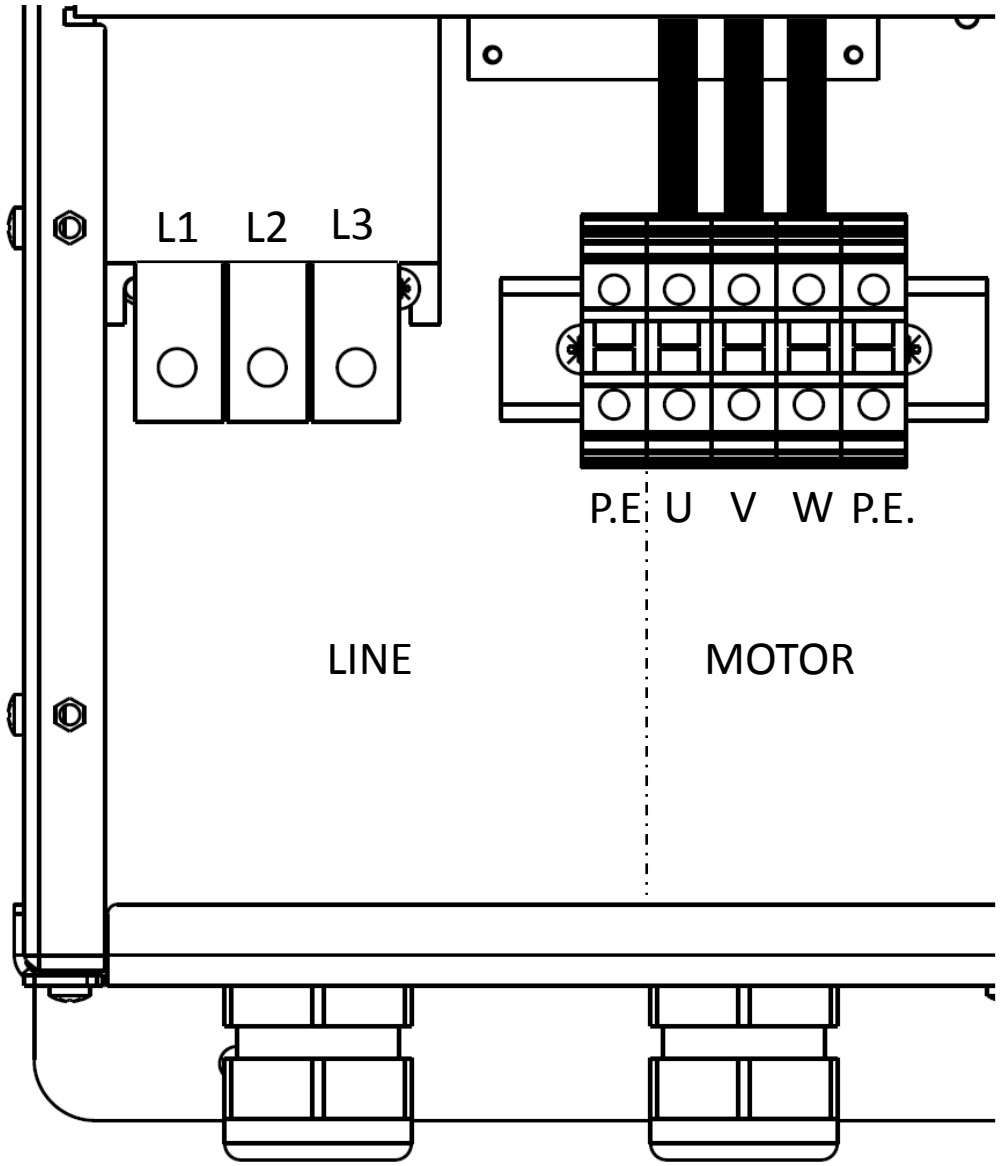


Power supply: **LINE: L1, L2, L3, GND** **It is recommended to use cable lugs.**	Motor output: **MOTOR: U, V, W, GND** **It is recommended to use cable lugs.**	12 V dc auxiliary fans (wall mounting kit) **VENT: +, -** **WARNING: respect the polarity.**

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

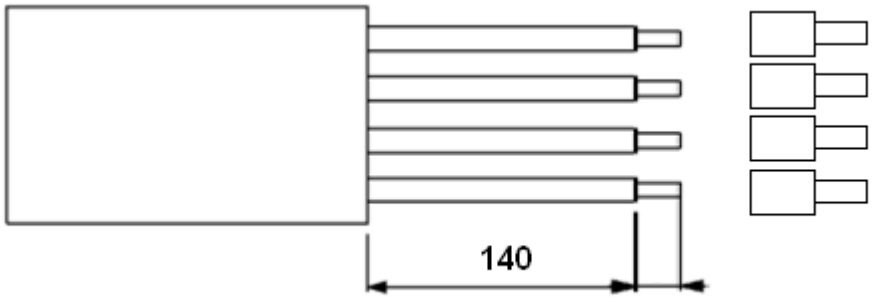


Power board DrivE-Tech 4.185,4.220,4.300,4.370,4.450

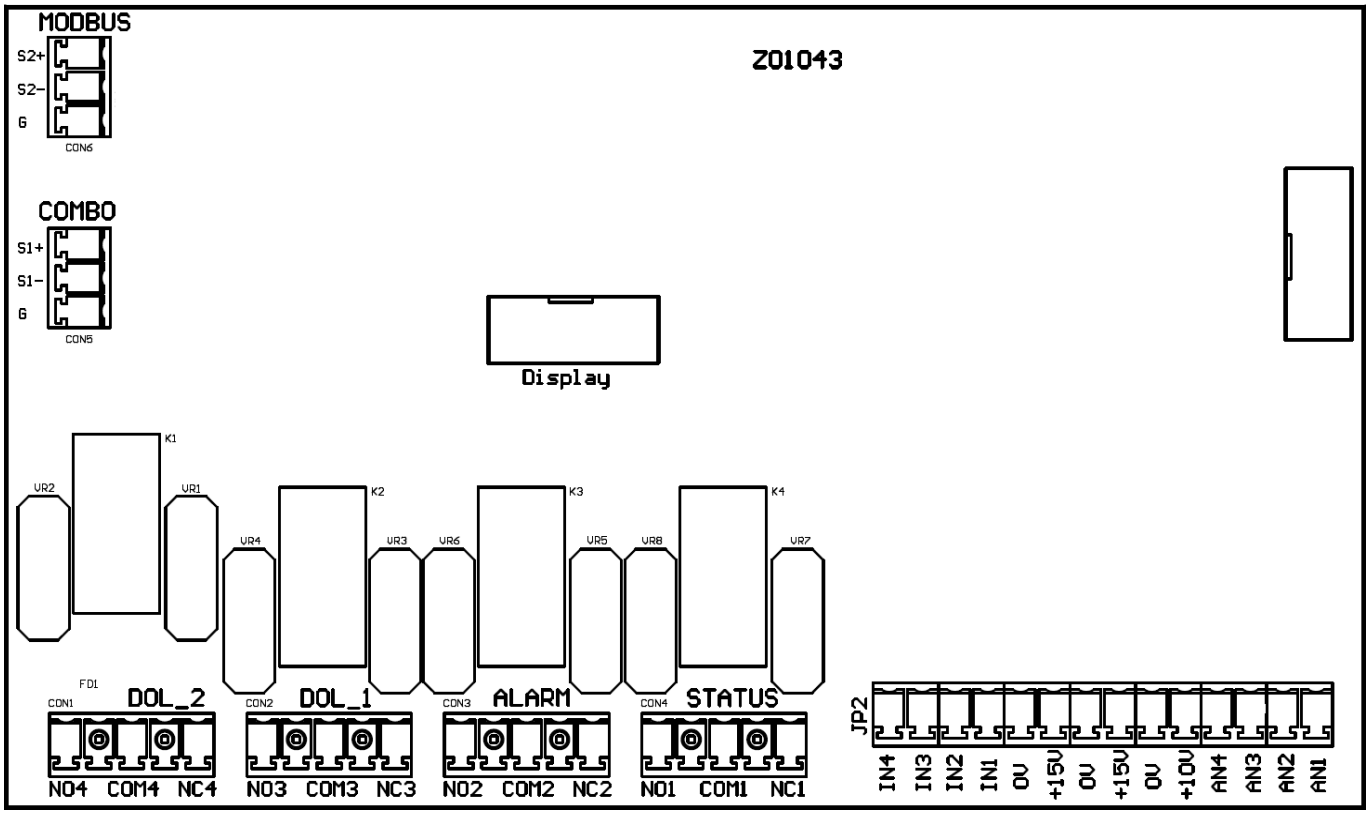


Power supply: **LINE: L1, L2, L3, P.E.** **It is recommended to use cable lugs.**	**Motor output:** **MOTOR: U, V, W, P.E.** **It is recommended to use cable lugs.**

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 DrivE-Techs 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 DrivE-Techs 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.

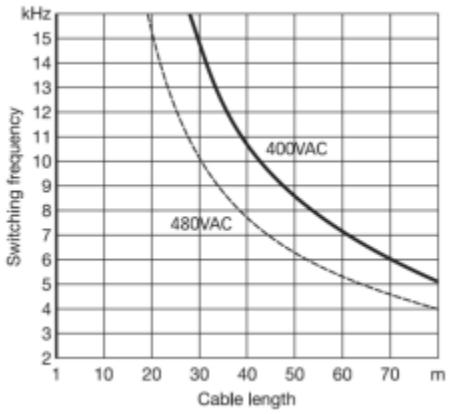
4.2 Electromagnetic compliance

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, DrivE-Tech periodically provides some fast "refresh" of the display.

4.3 Installation with long motor cables

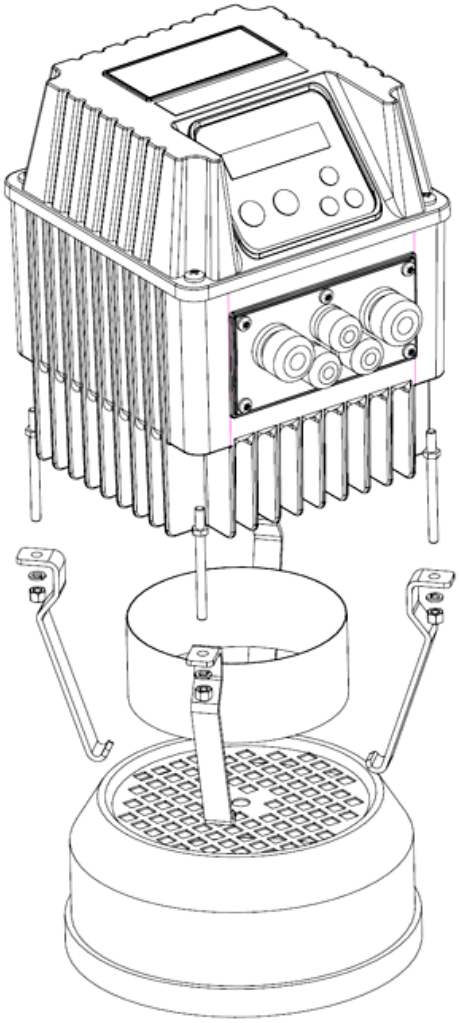
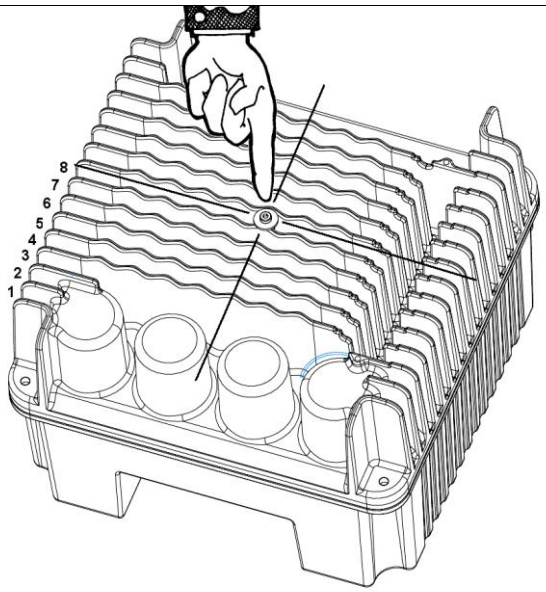
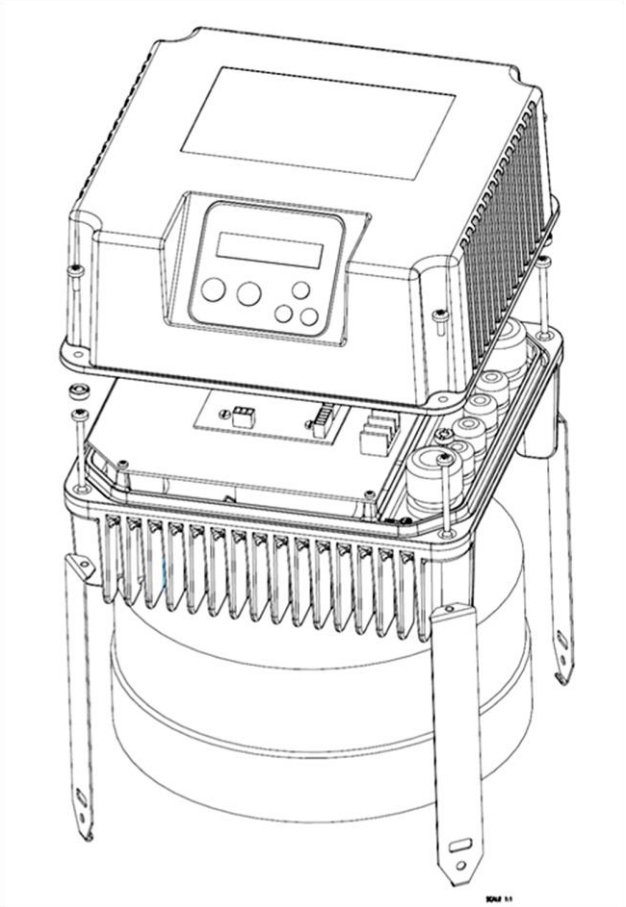
<table>
<tr>
<td rowspan="2">With long motor cables it’s recommended to decrease the commutation frequency from 10 kHz (default) to 2.5 kHz (Motor parameters). This reduces the probability of voltage spikes in the motor windings which may damage the insulation.</td>
<td> 
</td>
</tr>
<tr>
<td>To prevent 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 DrivE-Tech 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 DrivE-Tech and motor a sinusoidal filter, available on request.
 </td>
</tr>
</table>

5. DrivE-Tech installation

DrivE-Tech can be installed directly on the fan cover **of the motor** or mounted on the **wall.**

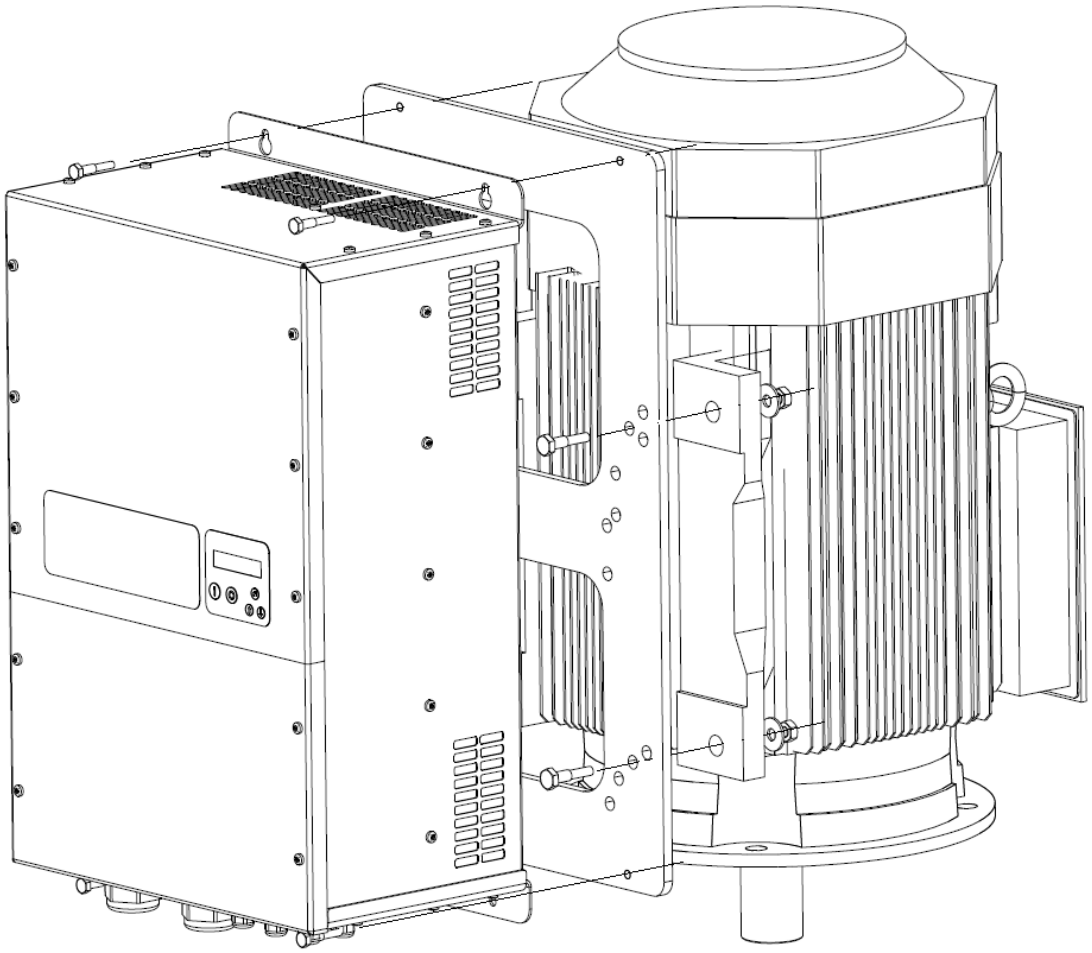
Motor mounting kit

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

DrivE-Tech SIZE 1	DrivE-Tech 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 DrivE-Tech during operation. Warning: when using the cooling ring, the cooling air of the motor is slightly warmer than without the DrivE-Tech; if the resulting motor temperature exceeds the indicated maximum allowable value, remove the cooling ring, leaving the DrivE-Tech to be cooled by itself.	 

DrivE-Tech SIZE 3

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

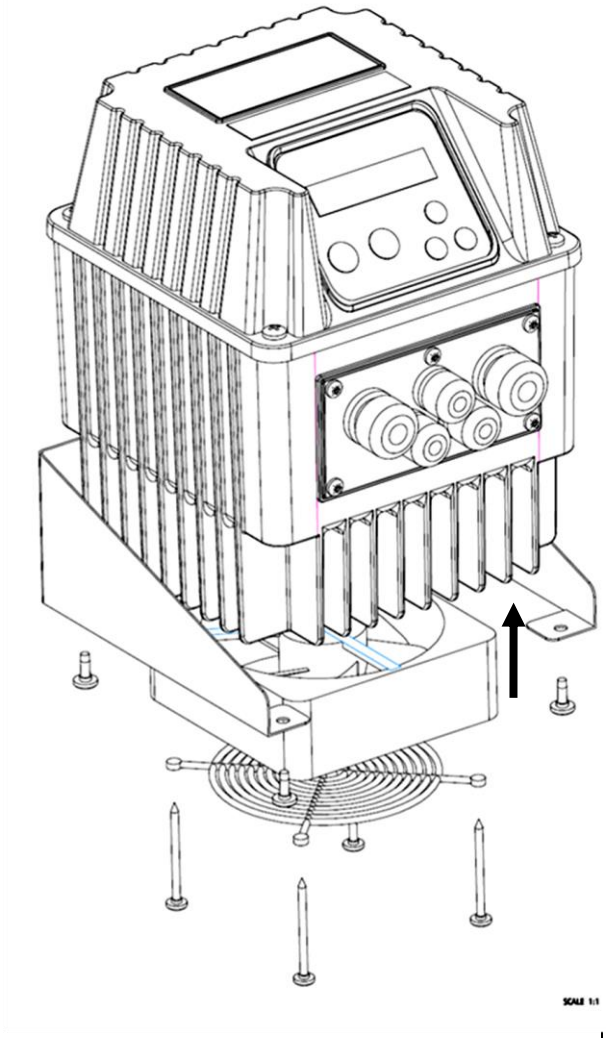


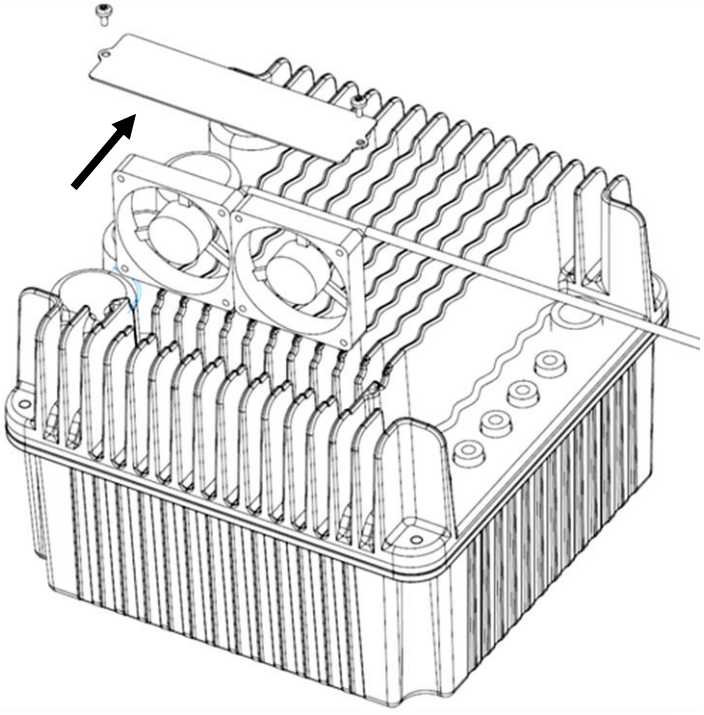
Wall mounting kit

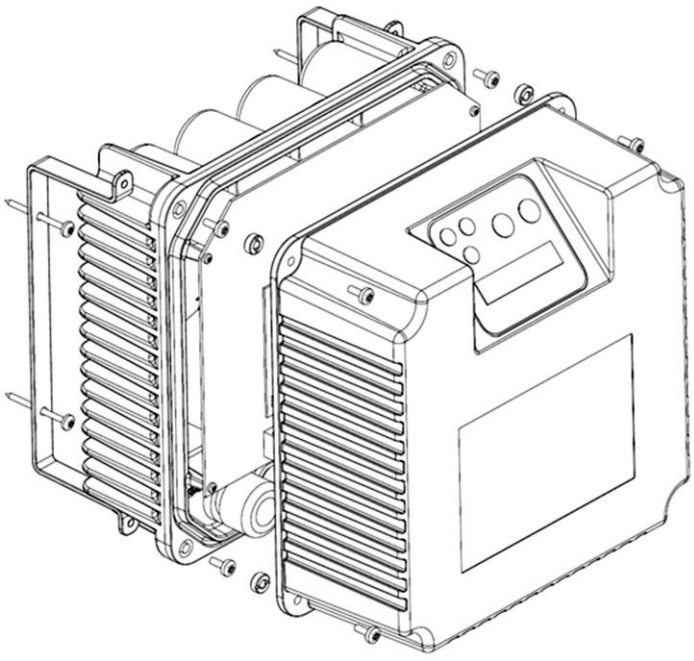
In this application DrivE-Tech is cooled independently by its auxiliary cooling fan integrated in the radiator.

Wall-mounted kit is composed of:

DrivE-Tech SIZE 1	DrivE-Tech SIZE 2
• n.° 1 auxiliary fan 230V AC (DrivE-Tech 2.015,2.030) or 12 VDC (DrivE-Tech 4.022,4.040) • n.° 4 screws to fix cooling fan • n.° 1 protection grill • n.° 1 metal bracket in AISI 304 • n.° 4 screws to fix DrivE-Tech 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 DrivE-Tech fixing to the brackets • n.°1 holes reference sheet



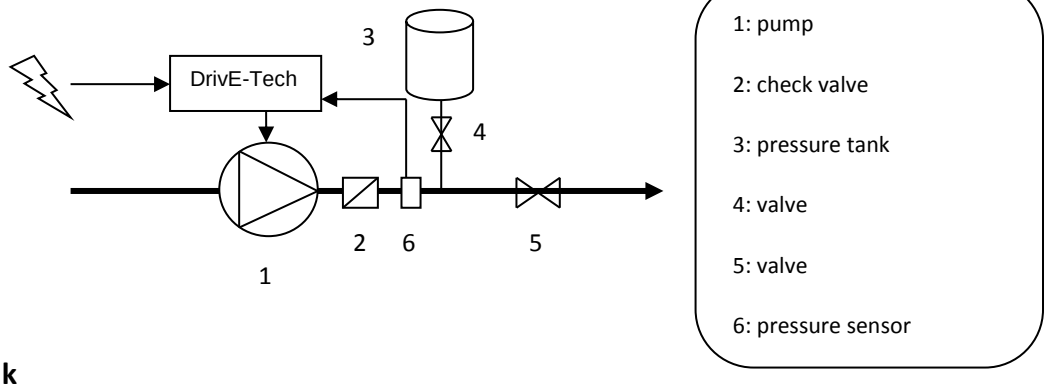




Make sure the manufacturer that the electric motor is suited for operation in the inverter
Make sure to properly attach the grid of the auxiliary cooling fan.
Make sure to remove the auxiliary cooling fan if DrivE-Tech is coupled to a motor. Failure to do so creates a high risk of overheating the motor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

5.1 DrivE-Tech Installation for constant pressure control

DrivE-Tech 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:



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 DrivE-Tech 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

DrivE-Tech 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.

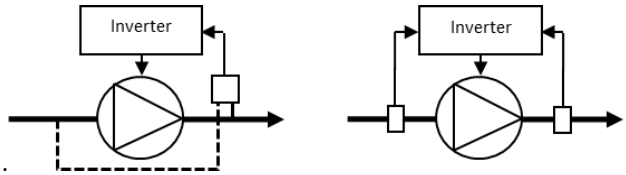
DrivE-Tech accepts the signal of a second pressure sensor in order to:

- 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 DrivE-Tech installation for differential constant pressure applications

DrivE-Tech 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 DrivE-Tech 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 DrivE-Tech 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 DrivE-Tech 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:

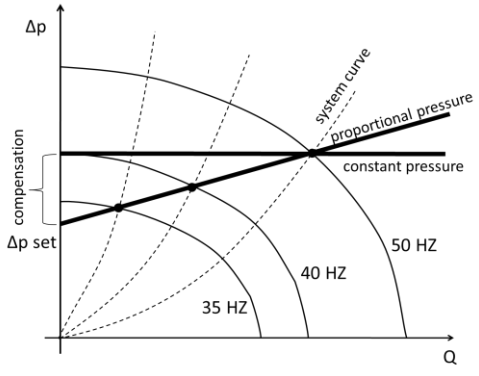
SENSOR 1 (discharge)	• AN1: 4-20 mA (-) signal • +15V: 15 Vdc (+) supply
SENSOR 2 (suction)	• AN2: 4-20 mA (-) signal • +15V: 15 Vdc (+) supply

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. DrivE-Tech Use and Programming

DrivE-Tech 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.

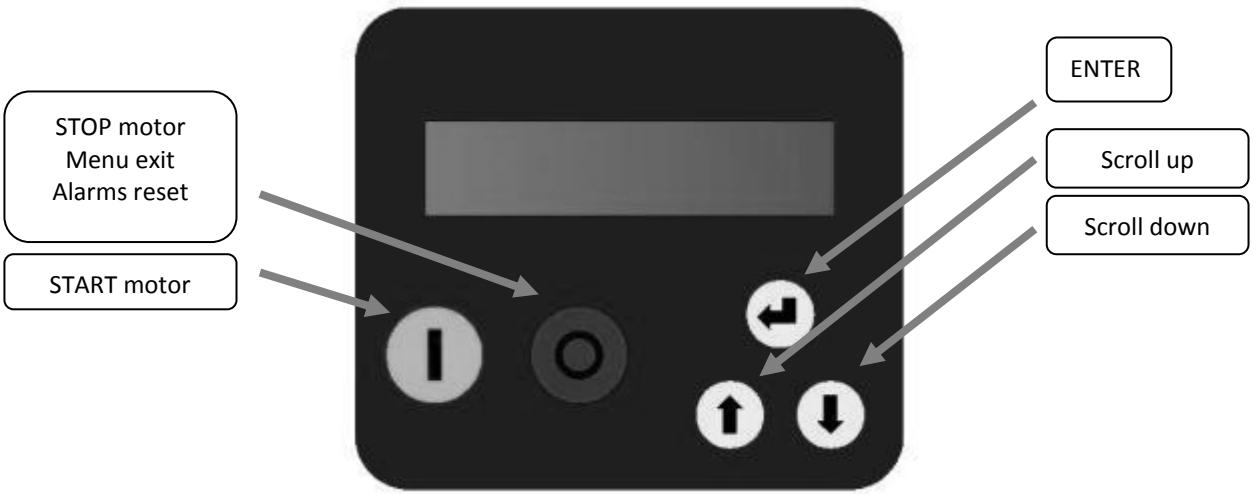
2. **Advanced level (MENU' MOTOR PARAMETERS)**
A second and different password is required; improper setting of these advanced parameters could compromise the integrity and the life of DrivE-Tech and pump;

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 DrivE-Tech 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 DrivE-Tech 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 DrivE-Tech or if DrivE-Tech 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 singlephase/threephase	threephase	Type of motor connected (DrivE-Tech 2.015,2.030)
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 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, DrivE-Tech returns to its normal status; if DrivE-Tech 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 DrivE-Tech; these parameters can be set up individually in the parameters menu.

6.3 Initial view

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

LCD = X.XX INV = X.XX

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: DrivE-Tech lifetime, PUMP lifetime, consumption statistic, alarm list. To return to previous views, press ENTER.
Menù ENT to access	

First row gives the DrivE-Tech status:

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

If COMBO function is activated, the DrivE-Tech 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:

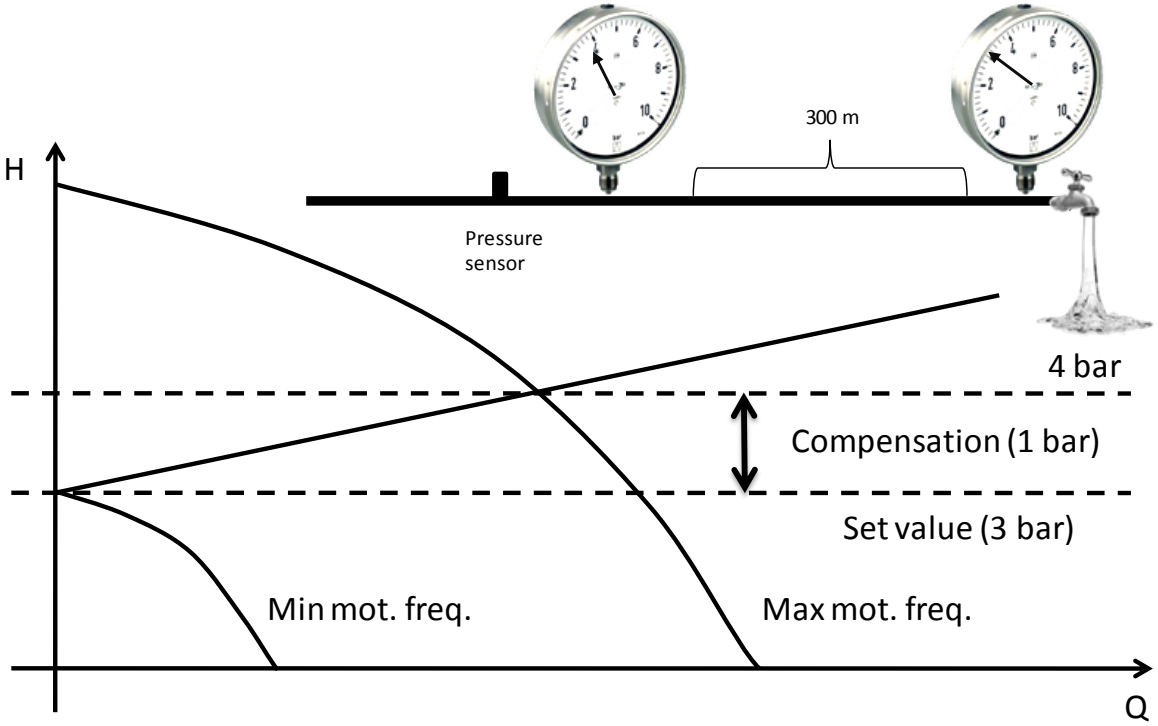
	MENU' Control. param.		Installer password required to enter level 1 (default 001)
	MENU' Motor param.		Advanced password required to enter level 2 (default 002)
	MENU' IN/OUT. param.		Installer password required to enter level 1 (default 001)
	MENU' Connect. param.		Installer password required to enter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

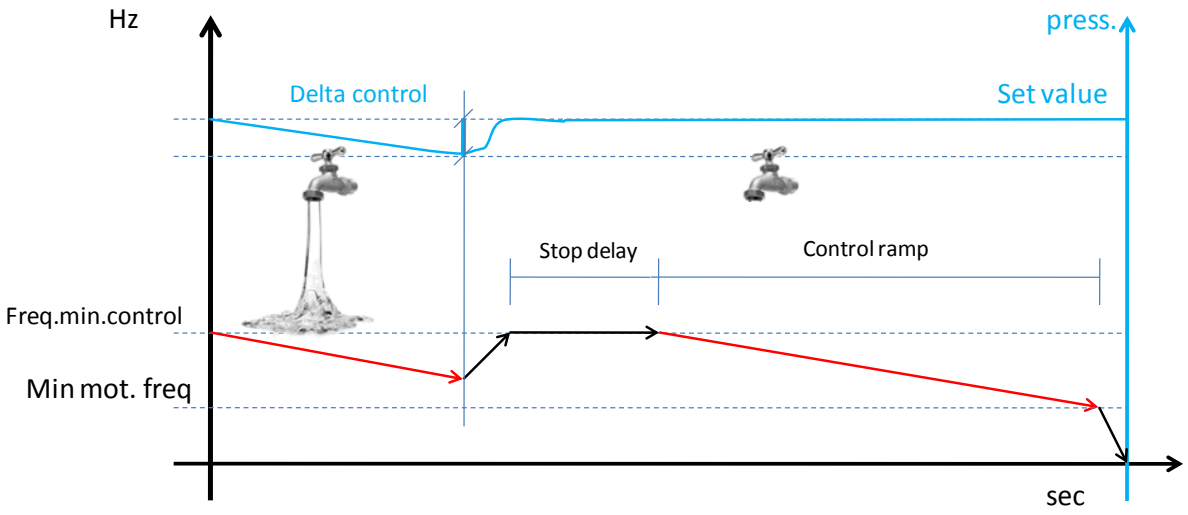
To exit the Menu level and return to initial display, press STOP button.

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: DrivE-Tech changes the pump speed to keep the set value constant regardless water demand. • Fix speed: DrivE-Tech 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.					

Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
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.	✓	✓	✓	✓	✓
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.	✓		✓		

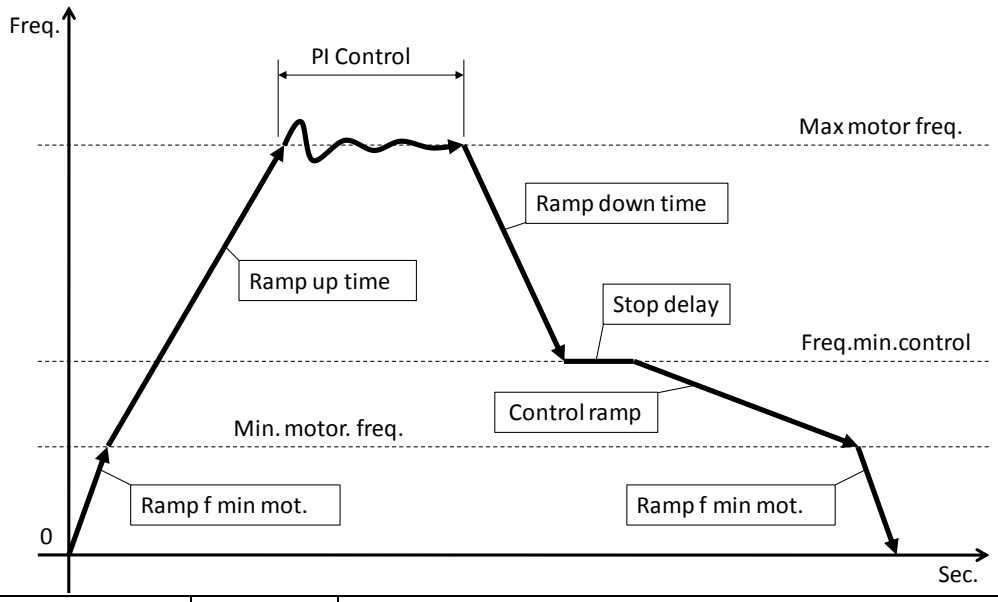
Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
To ensure proper operation of pressure control is recommended to place the sensor near the pump. To compensate the pressure loss in the pipes (proportional to flow) it is possible to vary the pressure 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), DrivE-Tech powers the	✓		✓		✓

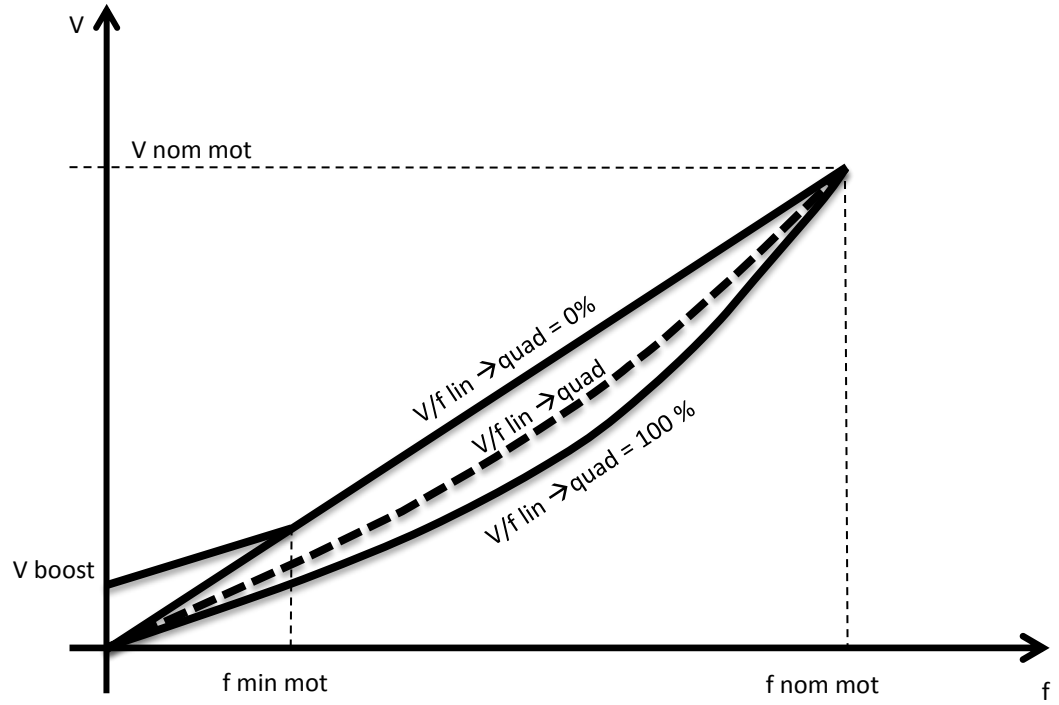
Parameter	Default	Description	Constant value	Fix speed	Const.value 2 set	Fix speed 2 val.	External speed
		motor again; otherwise, DrivE-Tech will stop the pump.					
Delta control XXX.X [bar]	0.1	Value drop below the set value required to restart the pump during control ramp.	✓		✓		
							
Delta start 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 DrivE-Tech; 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	DrivE-Tech address: • 00 master • 01 to 07 slaves	✓		✓		
Alternance ON/OFF	OFF	Function to allow alternating between the DrivE-Techs 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 DrivE-Techs in the group. 0 stays for 5 minutes.	✓		✓		
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 DrivE-Tech 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 DrivE-Tech 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 DrivE-Tech 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 DrivE-Tech 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.
Autorestart ON/OFF	OFF	If ON is selected, after a lack of voltage, DrivE-Tech returns to its normal status; if DrivE-Tech 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).

Parameter	Default	Description
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) DrivE-Tech 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) DrivE-Tech 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) DrivE-Tech 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) DrivE-Tech 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) DrivE-Tech 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) DrivE-Tech 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) DrivE-Tech 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) DrivE-Tech runs the motor if the digital input 4 is closed; motor will be stopped if the digital input 4 is opened.
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

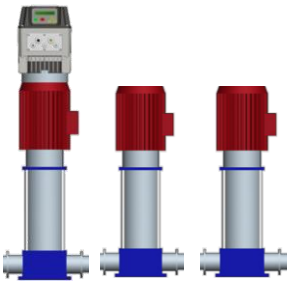
Anytime a protection occurs a blinking message is displayed together with an audible alarm; on STATUS in the initial view, the protection is displayed; by pressing the STOP button. Only from this position (STATUS) in the initial view is it possible to try to reset the alarm; if DrivE-Tech does not reset 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 DrivE-Tech terminals
NO WATER	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.

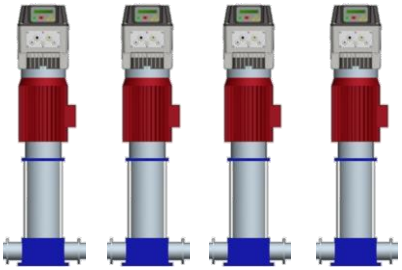
(DRY RUN COSPHI)		If pump's cosphi is lower than the set dry-running cosphi for at least 2 seconds, DrivE-Tech stops the pump. DrivE-Tech tries to run the pump every 10, 20, 40, 80, 160 minutes and then the pump is stopped. WARNING: if dry running protection occurs, DrivE-Tech will try to start the pump automatically. Be sure to cut power supply to DrivE-Tech 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 DrivE-Tech. DrivE-Tech 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 DrivE-Tech 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 DrivE-Techs in the group	• The address of each DrivE-Tech 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, DrivE-Tech will stop the pump. DrivE-Tech 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, DrivE-Tech will try to start the pump automatically. Be sure to cut power supply before attempting maintenance DrivE-Tech 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. DrivE-Tech 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. DrivE-Tech 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

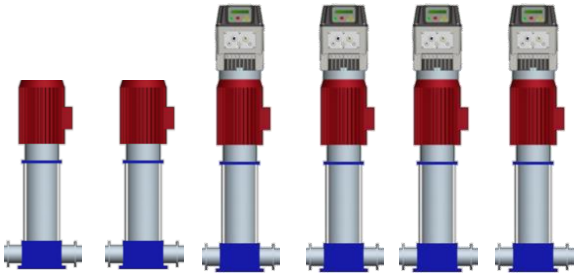
When the water needs vary considerably, it is advisable to share the water request between several pumps ensuring better efficiency and reliability.
A first method consists of a single pump driven directly by DrivE-Tech and another 1 or 2 pumps directly connected to the mains DOL (Direct On Line); DOL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



In this method, energy consumption and reliability of the pumping system is maximized: DrivE-Tech 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).

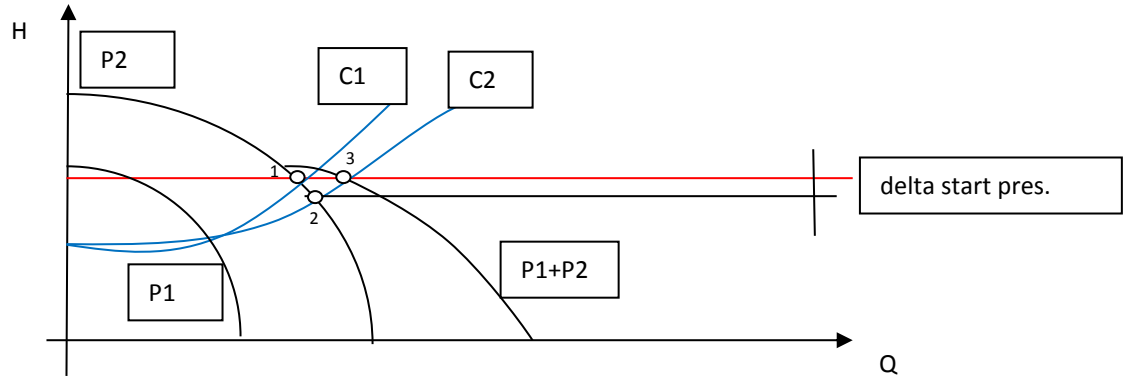


8.1 DOL pumps

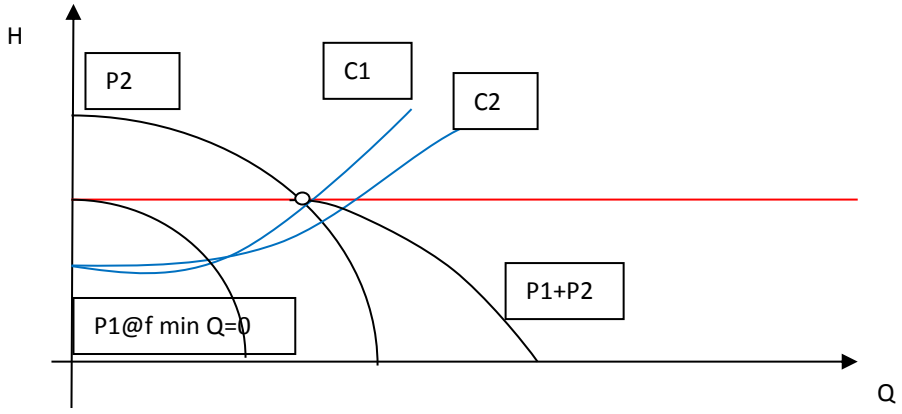
Each DOL pump is switched on by a contactor controlled by the digital output DOL1 and DOL2 present in the DrivE-Tech.

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

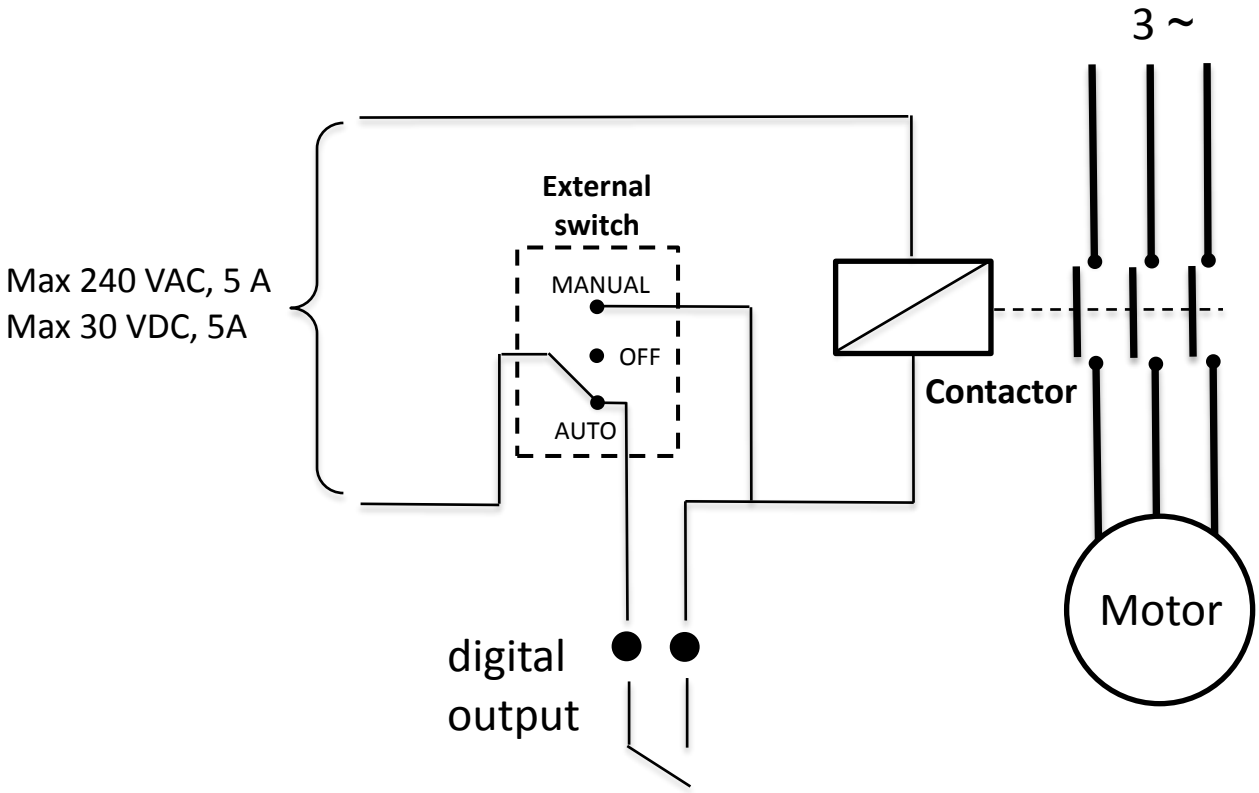
Two pumps are connected in parallel, with one pump (pump 1, P1) run by the inverter, while the second pump (pump 2, P2) is directly connected to the main power ("Direct On Line" connection). Start/Run of the second pump is controlled by the relay DOL1 (allowing a third pump to be controlled by the relay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

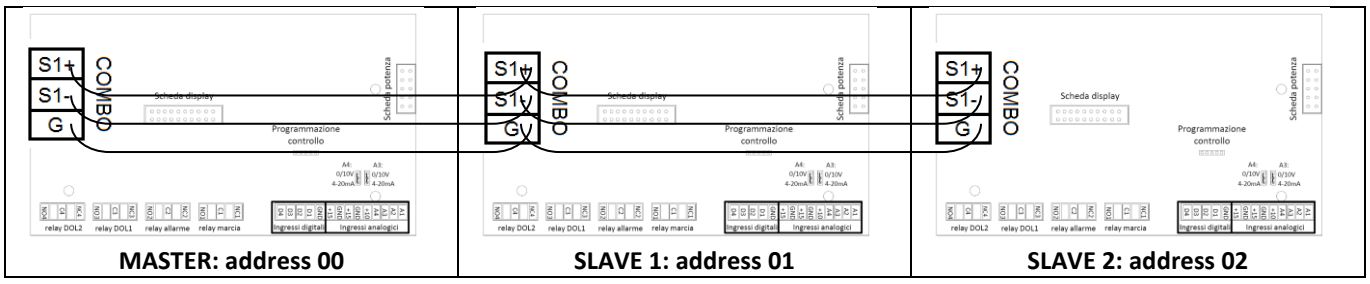
In the “Control parameters” menu it is possible to enable the COMBO function that allows serial communication between up to 8 DrivE-Techs, each one connected to a pump. The operating principle (switch on/off) of pumps is similar to as stated in chapter 8.1.

To achieve the COMBO function in a system consisting of several interconnected DrivE-Techs, use a pressure sensor connected to each DrivE-Tech. 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 DrivE-Tech Master to cover additional water demand; they will be operated only when all the COMBO pumps are already in operation.

RS485 serial connection

DrivE-Tech’s communication is made through a private protocol using the RS485 port. Each DrivE-Tech 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 setup

1. Supply power to the DrivE-Tech 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	DrivE-Tech's address in parallel operation. • 00 : DrivE-Tech master
Alternance ON/OFF	OFF	Function to allow alternating between the DrivE-Techs 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	DrivE-Tech's address in parallel operation. • 01 --> 07: DrivE-Tech 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 DrivE-Tech master, the communication between DrivE-Techs 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 DrivE-Tech	• 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 DrivE-Tech 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 DrivE-Tech 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 DrivE-Tech. • 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 DrivE-Tech 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 DrivE-Tech is power supplied) LCD = _.__	INV version (shown when DrivE-Tech 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 2004/108/CE

Low Voltage Directive 2006/95/CE

R&TTE Directive 1999/05/EU

DrivE-Tech 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 Klasse A
EN 61000
EN 60146
EN 50178
EN 60204-1

Franklin Electric S.r.l

Riccardo Fornasa
Director of Engineering - R&D

NOTE

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