VAriable Speed COntroller

Operating manual

VASCO 214

Index

1. VASCO Introduction

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

VASCO, 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.
VASCO 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 VASCO units for combined operation

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

2. Safety Instructions

NASTEC 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 VASCO itself (including visual inspection) and/or on the connected load.** **Disconnect VASCO 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.**
	**VASCO and pumping system must be grounded properly before operation.** **For the entire period VASCO is powered, high voltage is present on the output terminals of the inverter whether or not the pump is running.** **Tightening all 4 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 VASCO 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.
NASTEC cannot be held responsible for any damages to people and/or property due to improper use of its products.

3. Technical Characteristics

model	Input Voltage	Output Voltage	Max motor current	P2 motor (≈)
VASCO 214	1 x 230 V AC ± 15%	1 x 230 V AC ± 15%	14 A	1.5 kW (2 HP)
		3 x 230 V AC ± 15%	11 A	3 kW (4 HP)

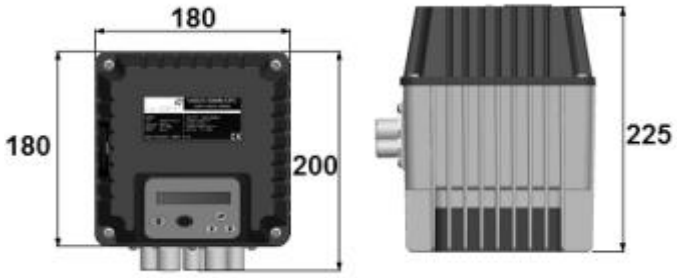
- Max. Ambient Temperature : 40°C (104 °F)
- Max. Altitude : 1000 m (3,280 ft)
- Protection Rating: IP 55 (NEMA 13)**
- Output : 2 x digital signals
- Input: 4 x analog (4-20 mA) + 2 x digital
- Comunication interface : serial RS 485
- Certification : CE
- EMC normatives applied: EN 55011 Class A,EN 61000-4-2,EN 61000-4-4,EN 61000-4-5,EN 61000-4-6

** auxiliary cooling fan of the VASCO, used in wall mounted applications, has a protection rating of IP20

VASCO 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.

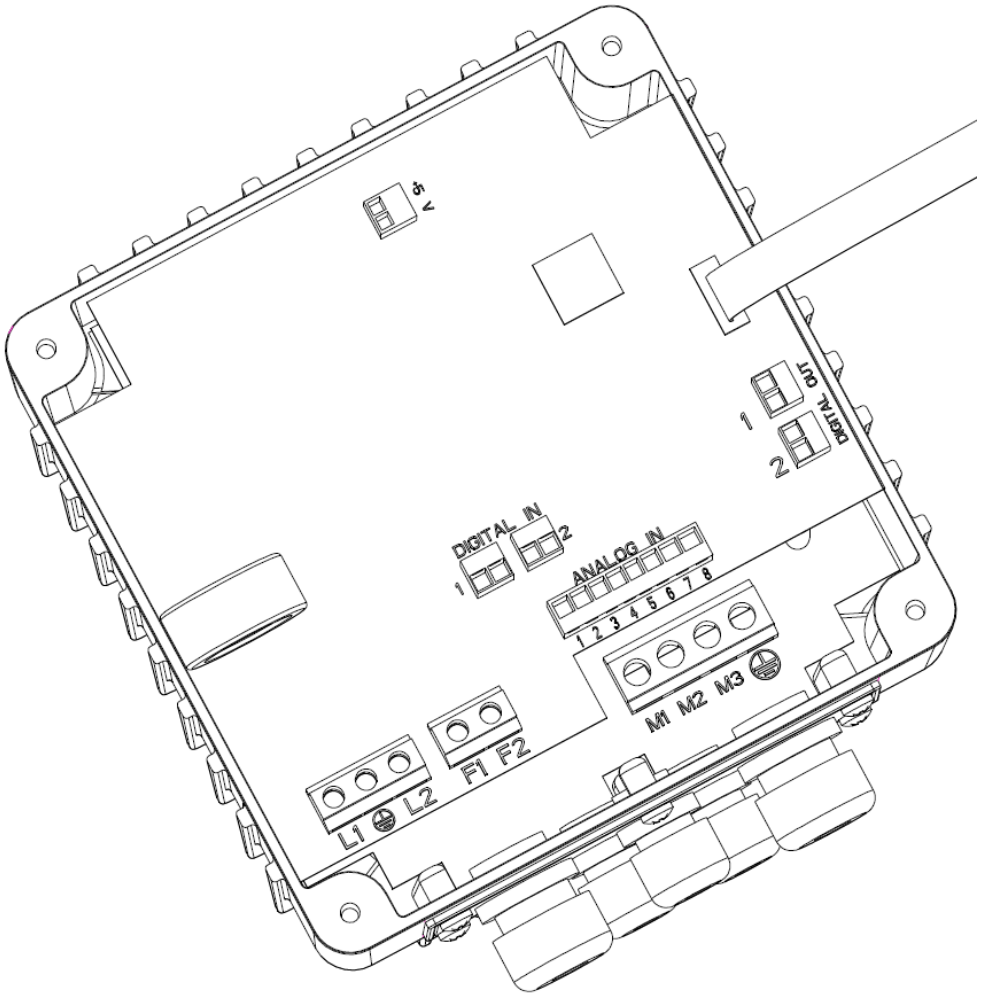
3.1 Weight and dimensions

model	weight
VASCO 214	4.3kg (9.5lb)



* Dimension in mm
* Weight with auxiliary cooling fan without packing

4. Electric wiring



Input lines • L1,L2 input power line • ground	Analog input • 1, 2 : ground • 3,4,5,6: signals • 7,8: 15 V dc power
Output line (to motor) • Three-phase connections: M1,M2,M3,ground • Single-phase connections: M1 (run),M2 (common),ground	Digital input 1. by software: NA/NC 2. by software: NA/NC
Auxiliary cooling fan power line230 V AC: • F1, F2	Digital output 1. Alarm signal / DOL1 control 2. Run signal / DOL2 control
auxiliary voltage supply for COMBO function (+ 5 V)	

	**Auxiliary relays driving DOL pumps are relays with no powered contact and are normally open. Max. voltage to the contacts is 250 V with max current of 5 A.** **It is advisable to use the shortest possible inverter power cable, pressure transducer cable and motor cable.** **Inductive filters are recommended in installations using cable lengths over 20 meters (76 feet) (filters are available upon request) and set the PWM value (using Advance Parameter menu) to 2,5 KHz.**
	**When the DOL pumps are not used (Installer Parameters- DOL1 pump, DOL2 pump) , digital output 1 and 2 can be used as alarm signal by closing the contact 1 and a run signal , by closing the contact 2 . If the DOL 1 pump is used (to be activated), contact 1 is used to drive this pump (ON-OFF) while contact 2 gives a run signal. If the DOL 2 pump is used (to be activated) the contact 2 is used to drive this pump.**

4.1 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.

5. VASCO Installation

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

<table>
<tr>
<td>  </td>
<td>In this application VASCO is cooled by the motor fan

Motor kit (available upon request) allows a solid coupling of the two units and it is composed of:

• Qty 4 rods
• Qty 4 x M5 nuts
• Qty 4 hooks
• Qty 1 cooling ring

Use the cooling ring for best cooling of VASCO during operation. Warning: when using the cooling ring, the cooling air of the motor is slightly warmer than without the VASCO; if the resulting motor temperature exceeds the indicated maximum allowable value, remove the cooling ring, leaving the VASCO to be cooled by itself.

If possible, coupling hooks should be attached to the motor shield instead of the cooling fan cover.</td>
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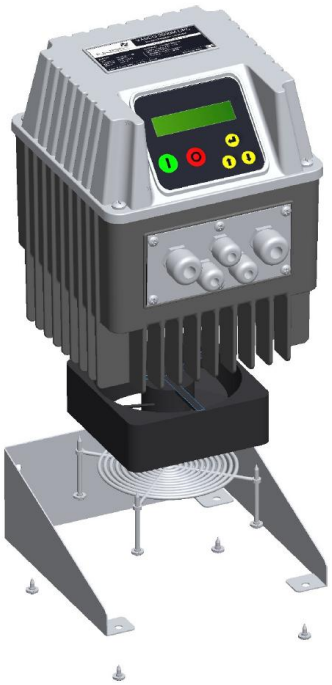
<td>  </td>
<td>In this application VASCO is cooled independently by its auxiliary cooling fan integrated in the radiator.

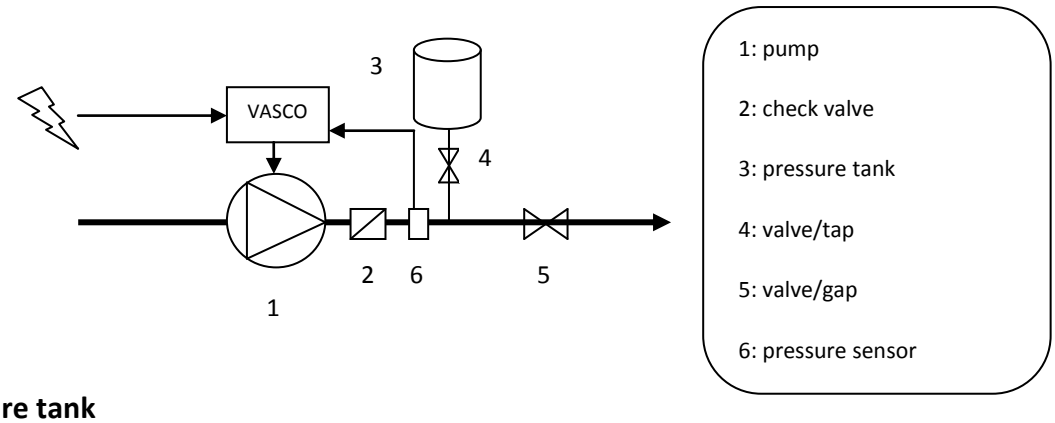
Wall-mounted kit is composed of:

• Qty 1 230V AC cooling fan
• Qty 4 screws to fix cooling fan
• Qty 1 protection grill
• Qty 1 metal bracket in AISI 304
• Qty 4 screws to fix VASCO to wall bracket</td>
</tr>
</table>

	**Make sure to properly attach the grid of the auxiliary cooling fan.** **Make sure to remove the auxiliary cooling fan if Vasco is coupled to a motor. Failure to do so creates a high risk of overheating the motor and VASCO unit.**

5.1 VASCO Installation for constant pressure control

Vasco 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 for 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 VASCO to control the pressure evenly.

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

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

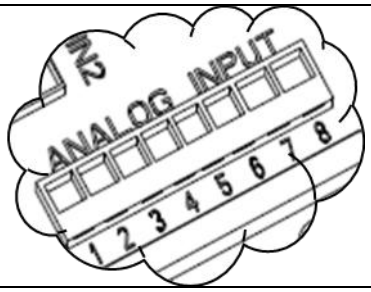
Pre-charge pressure of the pressure tank should be at least 1 bar (15 psi) less than the set-pressure of the system.

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

5.1.2 Pressure sensor

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

Connect the sensor cable wires to the analog input terminals as follows:

1 (ground, if available) **6** (signal 4-20 mA) **8** (power supply 15 V dc)	

If Nastec pressure transducer SP01 is used, connect the red wire to terminal 8 and the black wire to the terminal 6.

VASCO accepts the signal of a second pressure sensor to be activated automatically by Vasco if the first pressure sensor fails (positions 1, 6, 8) . Simply connect the second pressure sensor wires to terminals 1 (ground, if available), 5 (signal, 4 – 20 mA), and 7 (power supply 15 V dc).

6. VASCO Use and Programming

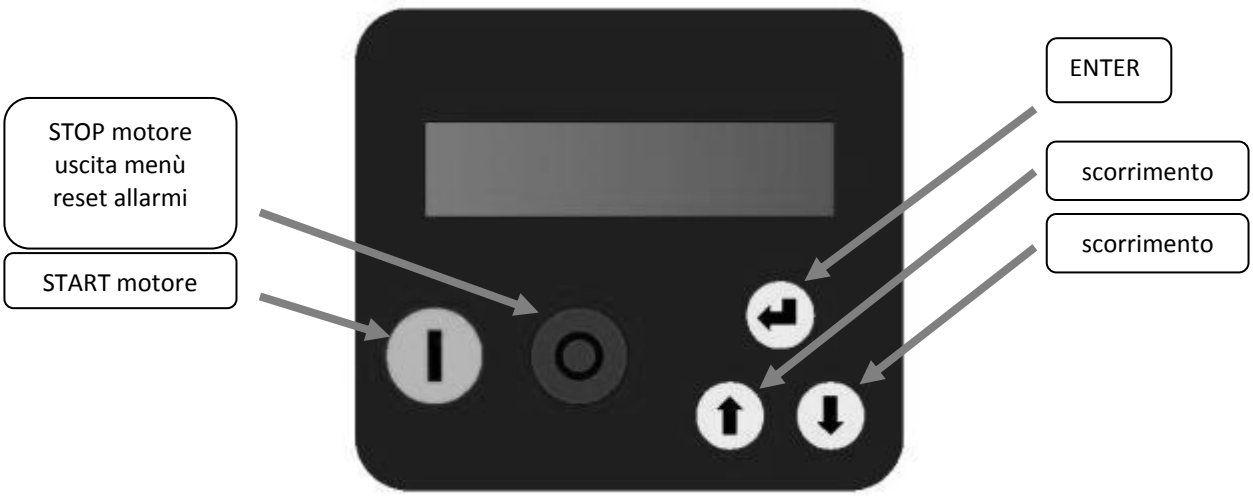
VASCO software is extremely simple to use, but allows a wide variety of parameters to be set for ideal system calibration.
Setting Parameters are organized in 2 levels:

1: **Installer level**
A password is required for this level; these parameters are adjustable by trained professionals
Default password: **001**
From the menu a different password can be set up.

2. **Advanced level**
A second and different password is required; improper setting of these advanced parameters could compromise the integrity and the life of VASCO 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 VASCO display



Screen is a back-lit LCD displaying 2 rows of 16 digits each. If the menu indication is longer than 16 digits, the row will scroll.
Alarms are indicated by an audible signal.

6.2 Initial configuration

When VASCO 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.

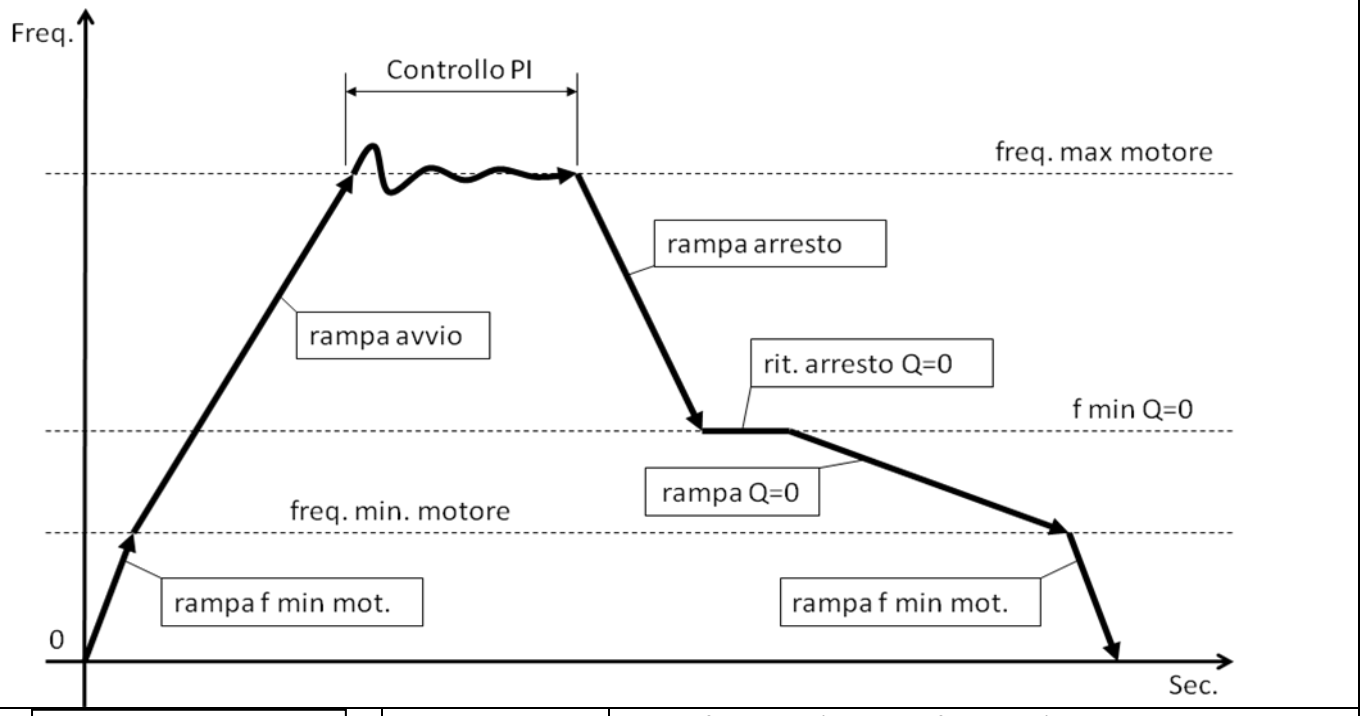
The initial setting procedure can be repeated (by using the 2rd level password) to reconfigure VASCO or if VASCO is installed in a different system.

Advanced or critical parameters must be set up and/or confirmed by pressing Enter; remaining parameters (some of them suggested) can be scrolled without any modification, if accepted.

A brief description of parameters and their allowable ranges are listed below:

Parameter	Suggested value	Description
Language Italiano / English	English	End user communication language
Motor type threephase/singlephase	Three phase	Motor type
Rated motor Volt. V = XXX [V]	230	Motor rated voltage (as shown in the motor plate) Average voltage drop due to the inverter is between 20 V and 30 V RMS based on load condition, so when the input voltage is 230 V the average output voltage will be between 200 V and 210 V RMS.
Voltage boost V = XX [%]	10	Refers to the voltage increase during the start up of the motor. Warning: An excessive value can seriously damage the motor. Contact the motor manufacturer for further information. If a single-phase motor is used, a value of 25% is suggested to increase the starting torque.
Rated motor Amp I = XX.X [A]	11	Rated current of the motor per it's nameplate indication increased by 15%. 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.
Max motor freq. f = XXX [Hz]	50	Maximum frequency of the motor. Note: by reducing the maximum frequency of the motor, maximum current will be reduced as well.
Min motor freq. f = XXX [Hz]	20	Min. frequency depends on the selected pump type; for submersible pumps with water filled motors, is not advisable to set minimum frequency lower than 30 Hz in order to protect the integrity of the thrust bearings.
Ramp up time t = XX [sec]	3	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 VASCO setup, and can also cause false overload alarms.

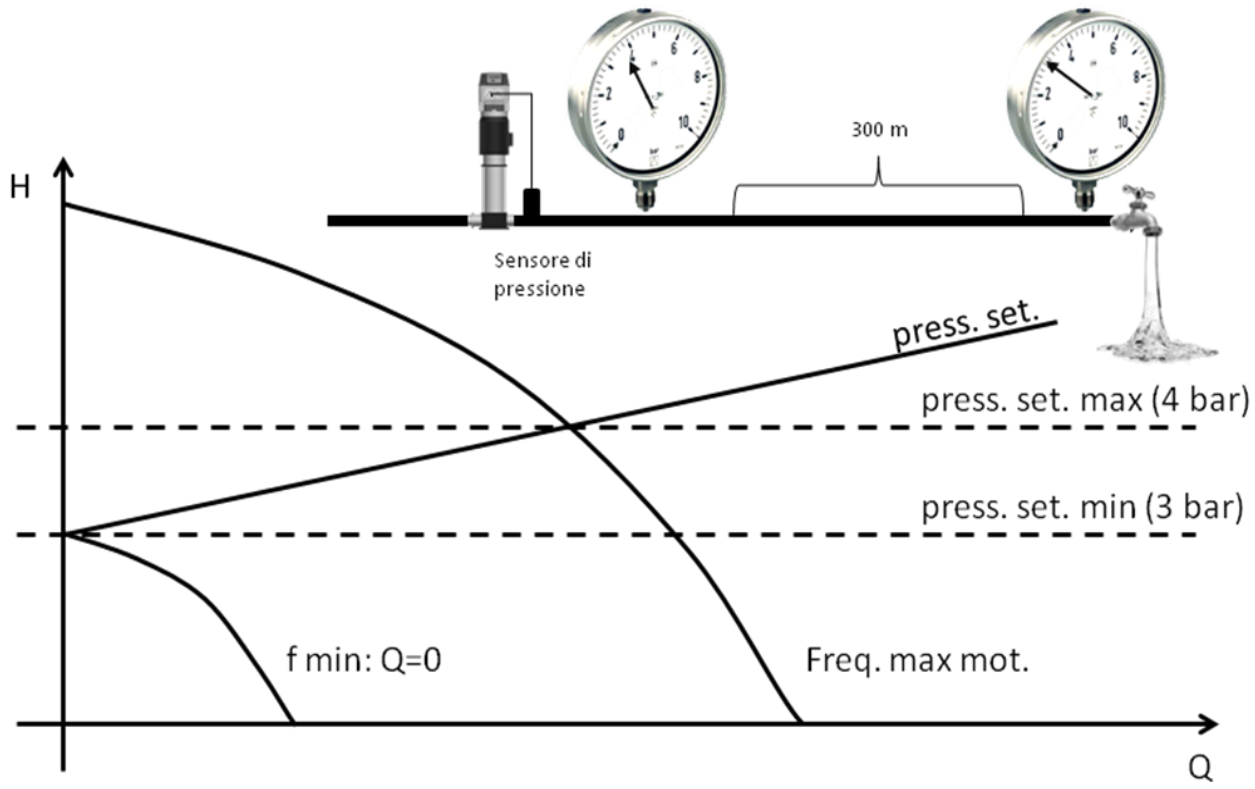
Ramp down time t = XX [sec]	3	Ramp-down time to reach zero speed. Longer times keep the system pressurized, while protecting the system components. Excessively long ramp-down times can create difficulties in VASCO setup. Excessively short ramp-down times can cause false overload alarms.
Ramp f min mot. t = XX [sec]	1	Time to reach the minimum frequency of the motor and vice versa.



PWM f = XX [kHz]	10	Carrier frequency (switching frequency). It is possible to chose PWM in the range of 2.5 ,4, 8, 10, 12 kHz . Higher values give a more sinusoidal wave with fewer losses. If long cables are used (>20 m / >76 ft) (submersible pump) it is recommended to install an inductive filter between VASCO 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.
Control mode • Constant press. • Fix speed • Const.press.2val • Fix speed 2 val.	Constant press.	Mode of control: • Constant pressure: VASCO changes the speed of pump to keep the pressure constant, independent of water demand • Fixed frequency: VASCO feeds the pump a set frequency, so the speed of motor is kept constant. • Constant pressure control with two values; the two values are selected by opening or closing the digital input 2. • Fixed frequency control with two values to be selected by opening or closing the digital input 2.
Control mode: Constant press.		
F.s. press.sens. 20mA = XX.X [bar]	10	Maximum pressure of pressure transducer; Set the pressure value of the transducer when output signal is 20 mA equivalent to the highest value of pressure range (i.e. 0 – 10 bars transducer range) 10 bars = 20 mA
Offset sensors Press ENT		Zero point adjustment of the transducer (4mA) as offset compensation; automatically done by pressing Enter. If the transducer is not connected or connected improperly, the signal ALL. SENS. PRESS is activated when pressing ENTER.

Max system pres. 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.
Min system pres. p = XX.X [bar]	00.0	Minimum pressure allowed in the system. If the pressure goes lower than the set value, an alarm occurs and the pump is stopped. Pump is automatically restarted if the pressure goes higher than the minimum value for a period of at least 5 seconds. This parameter is particularly useful in the event a system pipe breaks. It is suggested to set a value higher than 0.
Dry run cosphi cosphi = X.XX	0.65	If the pump goes into dry-running, the cosphi reaches its lowest level. To set this value, contact the pump manufacturer or test by closing the suction and checking the value on the VASCO display; a value can be set by assuming a dry cosphi equivalent to 60% of the rated cosphi specified by the manufacturer.
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.
Min set pressure p = XX.X [bar]	3	The pressure value to be kept constant when the water flow is close to zero.
Max set pressure p = XX.X [bar]	=min set pressure	The pressure value to be kept constant when the water flow is very high.

To ensure proper operation of pressure control it is recommended to place the sensor near the pump or group of pumps. To compensate for pressure loss in the pipeline (proportional to flow) that occurs between the pressure sensor and the point of demand, it is possible to vary the set-pressure in a linearly with respect to frequency. In particular, the minimum frequency for Q = 0 is associated with the minimum set pressure, while at the maximum frequency is associated the maximum set pressure value (see below for further information)



During initial configuration it is suggested to leave the Min set-pressure identical to the Max set-pressure. Upon completing the installation, you can run the following test to verify the correct value of Max set-pressure to be set in the Installer menu parameters

1.Install a pressure gauge at the point of demand farthest away from the pressure transducer (or at the point where the greatest loss of pressure is expected)

2. Fully open the valve

3. Check the pressure indicated on the pressure gauge

4. Set the Max set pressure value according to the formula [Min set Pressure + (Min set Pressure - pressure gauge value)]

Test f min Q=0 ENT to begin		By pressing ENTER, minimum stop frequency can be automatically detected. (see the Technical Appendix for further information). It is suggested to start the test with outlet valve fully open (eq. to the maximum flow) and then closing the outlet gradually until fully closed (zero water flow).
Tuning: START/STOP ----------		By pressing START, pump starts to run. Once the valve is completely closed and the frequency value stabilizes (process can take up to 1 minute) it is possible to stop the pump by pressing STOP. The frequency value (at zero flow) is automatically recorded by VASCO. Press STOP button to proceed.
Set f. min Q=0 fmin = XXX [Hz]		By pressing ENTER it is possible to slightly change the recorded frequency value to so that the pump will stop even in the event of minor leakage or low-demand water use **(increase the recorded value of 1 or 2 Hz).** As an alternative it is always possible to set the minimum frequency without using the automatic procedure.
Delta start pres p = XX.X [bar]	0.5	This value represents the pressure drop below the set pressure required to start the pump.
Autorestart ON/OFF	OFF	If ON is selected, after a lack of voltage, VASCO returns to its normal status; if VASCO 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 VASCO; these parameters can be set up individually in the INSTALLER Parameters menu or ADVANCED Parameters menu.
Control mode: Fix speed		
F.s. press. sens. 20mA = XX.X [bar]	10	Set max pressure of pressure transducer; Set the pressure value of the transducer when output signal is 20 mA equivalent to the highest value of pressure range (i.e. 0 – 10 bars transducer range) 10 bars = 20 mA
Offset sensors Press ENT		Zero point adjustment of the transducer (4mA) as offset compensation; automatically done by pressing Enter. If the sensor is not connected or connected improperly the signal ALL. SENS. PRESS is activated when pressing ENTER.
Max system pres. 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.
Min system pres. p = XX.X [bar]	00.0	Minimum pressure allowed in the system. If the pressure goes lower than the set value, an alarm occurs and the pump is stopped. Pump is automatically restarted if the pressure goes higher than the minimum value for a period of at least 5 seconds. This parameter is particularly useful in the event a system pipe breaks. It is suggested to set a value higher than 0.
Dry run cosphi cosphi = X.XX	0.65	If the pump goes into dry-running, the cosphi reaches its lowest level. To set this value, contact the pump manufacturer or test by closing the suction and checking the value on the VASCO display; a value can be set by assuming a dry cosphi equivalent to 60% of

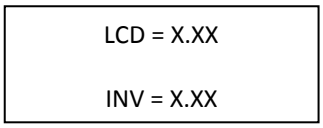
		the rated cosphi specified by the manufacturer.
Motor test START/STOP		Press START/STOP to run a test at rated frequency **Warning: make sure to run the system without damaging pump and system**
Rotation sense ---> / <---	--->	If, during the test, motor runs in reverse, it is possible to change the wiring sequence via software without physically changing wires in the terminals.
Operating freq. f = XXX [Hz]	= Max motor freq.	Set the frequency value (or the speed) to supply the motor.
Autorestart ON/OFF	OFF	If ON is selected, after a lack of voltage, VASCO returns to its normal status; if VASCO 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 VASCO; these parameters can be set up individually in the INSTALLER Parameters menu or ADVANCED Parameters menu..
Control Mode : Const.press.2val		
F.s. press. sens. 20mA = XX.X [bar]	10	Maximum pressure of pressure transducer; Set the pressure value of the transducer when output signal is 20 mA equivalent to the highest value of pressure range (i.e. 0 – 10 bars transducer range) 10 bars = 20 mA
Offset sensors Press ENT		Zero point adjustment of the transducer (4mA) as offset compensation; automatically done by pressing Enter. If the transducer is not connected or connected improperly, the signal ALL. SENS. PRESS is activated when pressing ENTER.
Max system pres. 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.
Min system pres. p = XX.X [bar]	00.0	Minimum pressure allowed in the system. If the pressure goes lower than the set value, an alarm occurs and the pump is stopped. Pump is automatically restarted if the pressure goes higher than the minimum value for a period of at least 5 seconds. This parameter is particularly useful in the event a system pipe breaks. It is suggested to set a value higher than 0.
Dry run cosphi cosphi = X.XX	0.65	If the pump goes into dry-run, the cosphi reaches its lowest level. To set this value, contact the pump manufacturer or test by closing the suction and checking the value on the VASCO display; a value can be set by assuming a dry cosphi equivalent to 60% of the rated cosphi specified by the manufacturer.
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, motor runs in reverse, it is possible to change the wiring sequence via software without physically changing wires in the terminals.
Min set pressure p = XX.X [bar]	3	The pressure value to be kept constant when the the water flow is close to zero.

Max set pressure p = XX.X [bar]	= Min set pressure	The pressure value to be kept constant when the water flow is very high.
Min set press. 2 p = XX.X [bar]	3	The pressure value to be kept constant when the water flow is close to zero.
Max set press. 2 p = XX.X [bar]	= Min set press. 2	The pressure value to be kept constant when the water flow is very high.
Test f min Q=0 ENT to begin		By pressing ENTER, minimum stop frequency can be automatically detected.(see the Technical Appendix for further information). It is suggested to start the test with outlet valve fully opened (eq. to the maximum flow), and then closing the outlet gradually until fully closed (zero water flow).
Tuning: START/STOP ----------		By pressing START, pump starts to run. Once the valve is fully closed and the frequency value stabilizes, (process can take up to 1 minute) it is possible to stop the pump by pressing STOP. The frequency value (at zero flow) is automatically recorded by Vasco. Press STOP button to proceed.
Set f. min Q=0 fmin = XXX [Hz]		By pressing ENTER it is possible to slightly change the recorded frequency value to so that the pump will stop even in the event of minor leakage or low-demand water use **(increase the recorded value of 1 or 2 Hz).** As an alternative it is always possible to set the minimum frequency without using the automatic procedure.
Set f. min: Q=0 2 fmin = XXX [Hz]		By pressing ENTER it is possible to slightly change the recorded frequency value to so that the pump will stop even in the event of minor leakage or low-demand water use **(increase the recorded value of 1 or 2 Hz).** As an alternative it is always possible to set the minimum frequency without using the automatic procedure.
Delta start pres p = XX.X [bar]	0.5	This value represents the pressure drop below the set pressure required to start the pump.
Autorestart ON/OFF	OFF	If ON is selected, after a lack of voltage, VASCO returns to its normal status; if VASCO 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 VASCO; these parameters can be set up individually in the INSTALLER Parameters menu or ADVANCED Parameters menu..
Control mode: Fix speed 2 val.		
F.s. sens. press. 20mA = XX.X [bar]	10	Set max pressure of pressure transducer; Set the pressure value of the transducer when output signal is 20 mA equivalent to the highest value of pressure range (i.e. 0 – 10 bars transducer range) 10 bars = 20 mA
Offset sensors Press ENT		Zero point adjustment of the transducer (4mA) as offset compensation; automatically done by pressing Enter. If the sensor is not connected or connected improperly the signal ALL. SENS. PRESS is activated when pressing ENTER.

Max system pres. 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.
Min system pres. p = XX.X [bar]	00.0	Minimum pressure allowed in the system. If the pressure goes lower than the set value, an alarm occurs and the pump is stopped. Pump is automatically restarted if the pressure goes higher than the minimum value for a period of at least 5 seconds. This parameter is particularly useful in the event a system pipe breaks. It is suggested to set a value higher than 0.
Dry run cosphi cosphi = X.XX	0.65	If the pump goes into dry-run, the cosphi reaches its lowest level. To set this value, contact the pump manufacturer or test by closing the suction and checking the value on the VASCO display; a value can be set by assuming a dry cosphi equivalent to 60% of the rated cosphi specified by the manufacturer.
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, motor runs in reverse, it is possible to change the wiring sequence via software without physically changing wires in the terminals.
Operating freq. f = XXX [Hz]	= Max motor freq.	Set the frequency value (or the speed) to feed the pump.
Operating freq.2 f = XXX [Hz]	= Max motor freq.	Set the frequency value (or the speed) to feed the pump.
Autorestart ON/OFF	OFF	If ON is selected, after a lack of voltage, VASCO returns to its normal status; if VASCO 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; seting parameters are recorded by VASCO; these parameters can be set up individually in the INSTALLER Parameters menu or ADVANCED Parameters menu.

6.3 Initial view

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



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

Inv: ON/OFF Mot: ON/OFF p_mis = XX.X [bar]	*P_mis is the pressure value read by the pressure transducer* *By pressing ENTER the pressure set value is displayed*

	Inv: ON/OFF Mot: ON/OFF f = XXX [Hz]	f value is the supply frequency to the motor; 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 = X.XX [V] I= XX.X [A]	V is the voltage supplied to the motor. This value is displayed only if motor is OFF; if motor is ON, A value equal to the absorbed motor current is displayed
	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 XXXXXXXXXXXXXXX XXXXXXX h : XX m Menù ENT to access	NORMAL status means no alarms. If an alarm occurs, a message blinks on the display and an audible signal is activated. Pressing ENTER accesses: VASCO lifetime, PUMP lifetime, alarm list. PUMP lifetime is recorded while pump is powered. To return to previous views, press ENTER.

First row gives the VASCO status:

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

If COMBO function is activated, the VASCO 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:

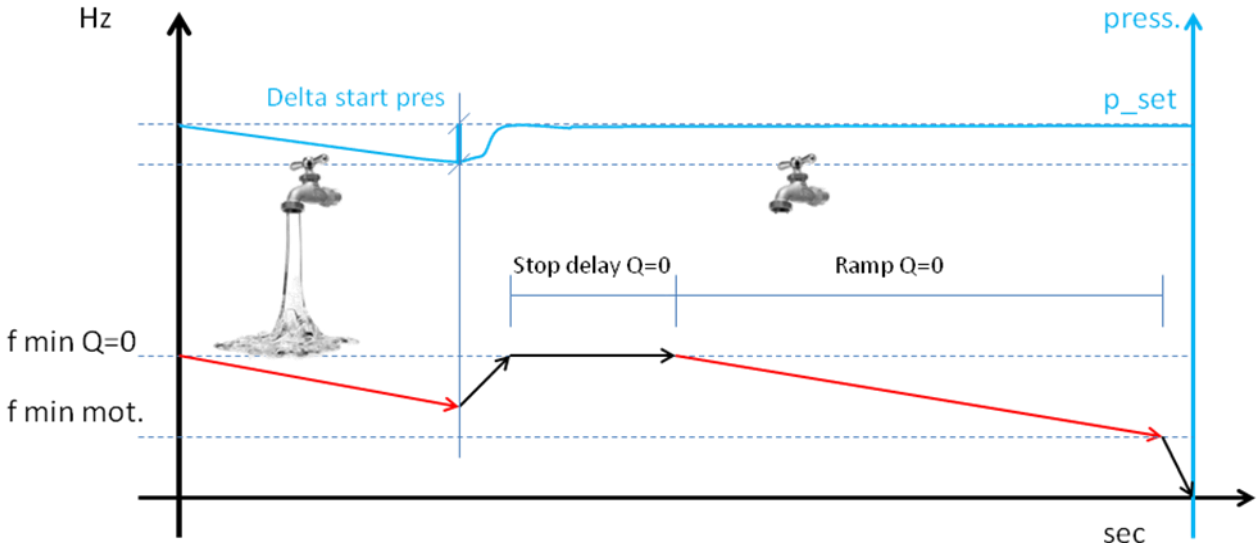
	MENU’ Install. param.		Installer password required to enter level 1 (default 001)
	MENU’ Advanced. param.		Advanced password required to enter level 2 (default 002)

	MENU' Retrive init.set		Installer password required to enter level 1 (default 001) It is possible to return to original set parameters.
	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 Installer parameters

Many of the Installer parameters are set during the Initial Configuration (chapter 6.2 Initial Configuration).
However, through the Installer Parameters menu, it is possible to change the set parameters or set others in order to perfect the calibration of VASCO to the pumping system.

Parameters	Default set	Description
Control mode: constant press.		
Stop delay Q=0 t = XX [s]	5	Delay for which the pump will stop once the minimum frequency is reached (f min Q=0)
Ramp Q=0 t = XX [s]	20	Ramp time from freq min Q=0 to motor freq min. If, during this time, the p checked goes below the (p_set -delta start pres), VASCO powers the motor again; otherwise, VASCO will stop the pump following the min freq. of motor ramp.
		
Ki XXX Kp XXX	Ki = 100 Kp = 002	Kp and Ki parameters allow the dynamic control of the system by VASCO; set values (Ki=100, Kp=002) are usually enough to get a valid dynamic control; if the set pressures do not allow a valid control, proceed as follows: increase or reduce Ki while keeping Kp constant; if the problem persists , increase Kp value and increase or reduce the Ki value again until a good dynamic control is reached.
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		Function to enable multiple VASCO's to work in parallel as described in the technical appendix (see the relevant chapter). Up to 8 VASCO units can be connected in parallel. VASCO's communication through RS 485 gates is granted by a private Nastec protocol.
COMBO: ON		
Address XX	00	Vasco's address in parallel operation. • 00 : VASCO master • 01 --> 07: VASCO slave
Address: 00 (Master)		
Num.system pumps XX	02	Number of pumps to be connected in parallel
Alternance ON/OFF	OFF	Function to allow the alternating between the VASCO's connected in parallel in order to have equal use of each pump of the group; in this way Master will reorganize the starting priority of the pumps by checking the life of each of them. **This parameter is present even if a single DOL pump is activated**
Delta stop pres. p = XX.X [bar]	01.0	The pressure value to add to the p_set to stop the last connected pump. PI control is controlled by the previous pump. **This parameter is present even if a single DOL pump is activated**
COMBO: OFF		
Digital input 1 N.O. / N.C.	N.O.	By selecting N.A. (normally open) VASCO 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) VASCO 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.A. (normally open) VASCO 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) VASCO runs the motor if the digital input 2 is closed; motor will be stopped if the digital input 2 is opened.
Change PASSWORD1 ENT		Pressing ENT allows the installer level password (1st level) (default 001) to be changed.
Control mode: fix speed		
Digital input 1 N.O. / N.C.	N.O.	By selecting N.A. (normally open) VASCO 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) VASCO 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.A. (normally open) VASCO 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) VASCO runs the motor if the digital input 2 is closed; motor will be stopped if the digital input 2 is opened.
Change PASSWORD1 ENT		Pressing ENT allows the installer level password (1st level) (default 001) to be changed.
Control mode: const.press.2val		

Stop delay Q=0 t = XX [s]	5	Delay for which the pump will stop once the minimum frequency is reached (f min Q=0)
Ramp Q=0 t = XX [s]	20	Ramp time from freq min Q=0 to motor freq min. If, during this time, the p checked goes below the (p_set -delta start pres), VASCO powers the motor again; otherwise, VASCO will stop the pump following the min freq. of motor ramp.
Ki XXX Kp XXX	Ki = 100 Kp = 002	Kp and Ki parameters allow the dynamic control of system by VASCO; set values (Ki=100, Kp=002) are usually enough to get a valid dynamic control; if the set pressure do not consent a valid control, proceed as follows; increase or reduce Ki while keeping Kpconstant; if the problem persists, increase Kp value and increase or reduce the Ki value again till a good dynamic control is reached.
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).
Digital input 1 N.O. / N.C.	N.O.	By selecting N.A. (normally open) VASCO 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) VASCO 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.A. (normally open) VASCO 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) VASCO runs the motor if the digital input 2 is closed; motor will be stopped if the digital input 2 is opened.
Change PASSWORD1 ENT		Pressing ENT allows the installer level password (1st level) (default 001) to be changed.
Control mode: fix speed 2 val.		
Digital input 1 N.O. / N.C.	N.O.	By selecting N.A. (normally open) VASCO 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) VASCO 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.A. (normally open) VASCO 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) VASCO runs the motor if the digital input 2 is closed; motor will be stopped if the digital input 2 is opened.
Change PASSWORD1 ENT		Pressing ENT allows the installer level password (1st level) (default 001) to be changed.

6.6 Advanced parameters

All the advanced parameters, due to their importance, are already set during initial setup (*cap. 6.2 Initial Configuration)*. However, it is always possible to modify individual parameters or modify the password 2:

Parameters	Default set	Description
Change PASSWORD1 ENT		Pressing ENT allows the installer level password (1st level) (default 001) to be changed.

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 VASCO does not reset the alarm it is displayed again together an audible sound

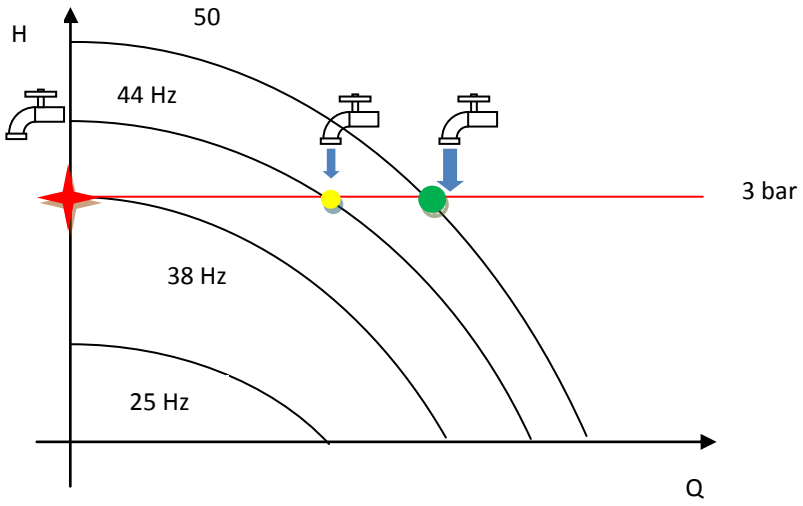
ALARM MESSAGE	ALARM DESCRIPTION	POSSIBILE SOLUTIONS
OVERCURRENT MOT.	Motor overload: input current of the motor is higher than the rated motor current setting parameter. Motor voltage drop caused by the inverter causes the motor input current to be 10% higher than rated. Contact motor manufacturer to check if motor is capable of accepting this current.	• Make sure that the motor current setting parameter is 10% higher than rated. • Check other possible causes of over current
UNDER VOLTAGE	Supply voltage Vin < 160V	Check possible causes of undervoltage
OVER VOLTAGE	Supply voltage Vin > 275V	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 VASCO 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. If pump's cosphi is lower than the set dry-running cosphi for at least 2 seconds, VASCO stops the pump. VASCO tries to run the pump every 10, 20, 40, 80, 160 minutes and then the pump is stopped. WARNING : if dry running protection occurs, VASCO will try to start the pump automatically. Be sure to cut power supply to VASCO before performing any maintenance.
PRESS.SENS.FAULT	Pressure sensor error	• Check the pressure transducer • Check the wiring of pressure transducer
OVER PRESSURE	Measured pressure value has reached the maximum pressure accepted by the system.	• Check possible causes of reaching max pressure • Check the max pressure value setting
UNDER PRESSURE	Measured pressure value has reached the lowest pressure accepted by the system.	• Check possible causes reaching min pressure (i.e. broken pipe, open pressure relief valve, etc.) • Check the min pressure value setting.
OVERLOAD INV.	The current drawn by the load exceeds the capacity of VASCO. VASCO 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 Vasco nominal current • If single phase motors are used, set the boost voltage to 25% and reduce the ramp up time to less than 5 sec. • 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 VASCOs in the group	• The address of each VASCO needs to be different

KEYBOARD FAULT	A Button on the keyboard has been pressed for more than 30 seconds	• Make sure buttons are not depressed • Call service assistance
DIGITAL INPUT	Digital input opened /closed	• Check the input digital configuration (under Installer Parameters menu , digital input 1 and 2)
	If pumps cosphi is lower than the dry-running cosphi for at least 2 seconds, VASCO will stop the pump. VASCO 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, VASCO will try to start the pump automatically. Be sure to cut power supply before attempting maintenance VASCO 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. VASCO 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. VASCO 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. Minimum stop frequency at 0 delivery (f min Q=0) during constant pressure control.

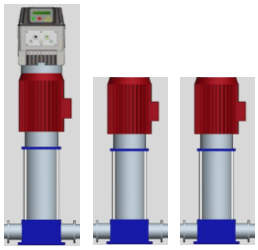
Minimum stop frequency is the minimum frequency value that, while maintaining the p_set , water delivery is zero.
Below scheme graphically shows the function:



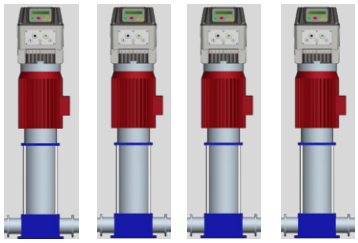
Progressively closing the water delivery valve reduces flow, causing VASCO to reduce the pump speed by reducing the output frequency, to maintain a constant pressure (i.e. 3 bar).
Once the water flow stops (output completely closed), pump will run at minimum frequency to maintain the set pressure.
Upon determining that the water requirement has stopped, VASCO stops the pump to save energy. Thus, the pump will be stopped when minimum frequency is reached.
Once the pump is stopped at min. frequency value, set pressure is maintained in the system.
To maintain the pressure on the pump output line, it is necessary to install a small pressure tank able to compensate for minor water leakage and to limit the number of pump restarts.
It is important to pinpoint that a particular set pressure corresponds to a single value of min. stop frequency.
So, if the end user wants to change the set pressure, a new value of min. stop frequency should also be set.

9. Auxiliary pumps during constant pressure control

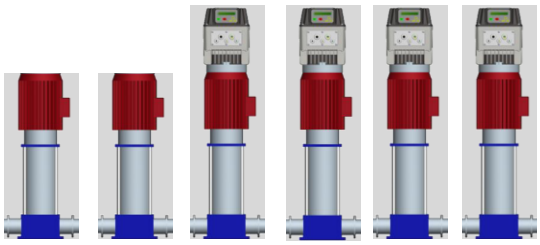
When the water needs vary considerably, it is advisable to share the water request between several pumps ensuring better efficiency and reliability.
A first method consists of a single pump driven directly by VASCO and another 1 or 2 pumps directly connected to the mains DOL (Direct On Line); DOL pumps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



In this method, energy consumption and reliability of the pumping system is maximized: VASCO 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.

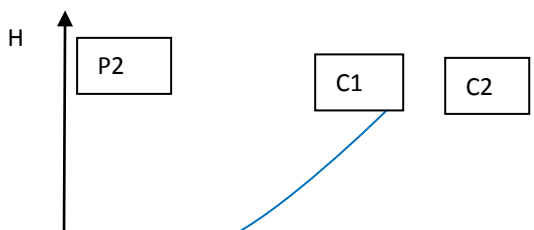


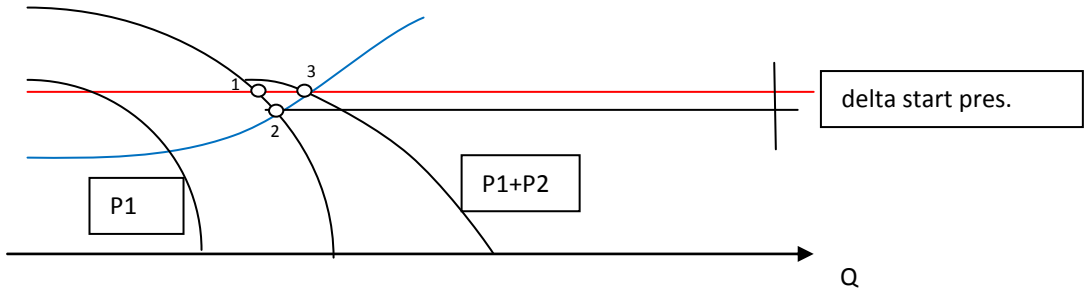
9.1 DOL pumps

Each DOL pump is switched on by a contactor controlled by the digital output 1 and 2 present in the VASCO.

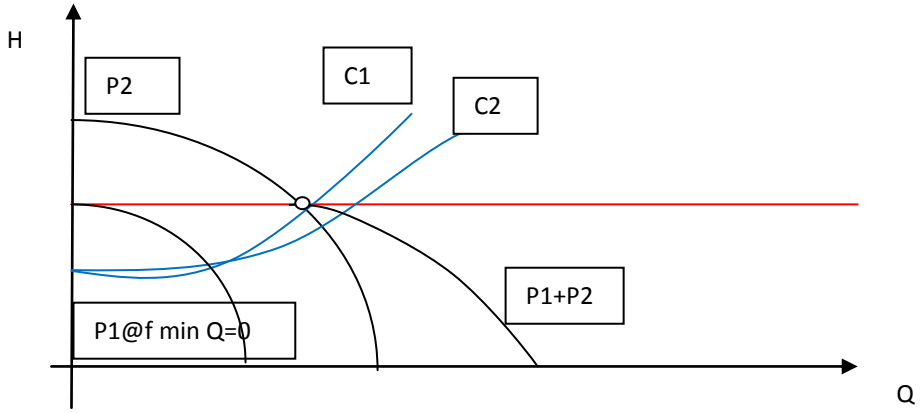
	Vasco relays driving the DOL pumps are relays with no voltage contacts and are normally open. Max voltage to the contacts is 250 V, max current 5 A.

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 first digital contact 1 (allowing a third pump to be controlled by the second digital contact 2).





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 (p_set – delta start pres), VASCO will run the DOL by closing the digital contact 1. 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 it's 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 it's speed to maintain the pset in the system.



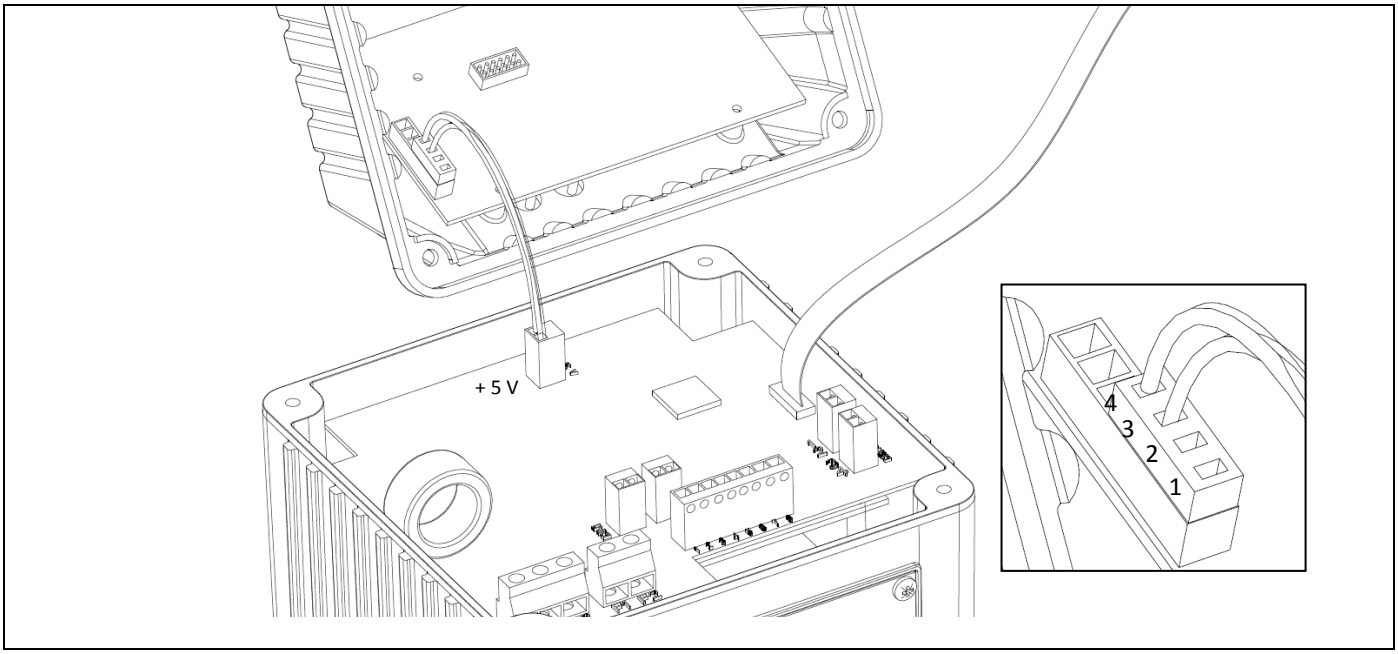
	**If two pumps are connected in parallel, the first driven by VASCO and the second with a DOL connection, it is necessary during the initial setting procedure makes sure that the value "delta pressure restart" will be sufficiently high to ensure the first pump, once the DOL pump is switched on, will 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.**

9.2 COMBO function

In the "Installer parameters" menu it is possible to enable the COMBO function that allows serial communication between up to 8 VASCOs, each one connected to a pump. The operating principle (switch on/off) of pumps is similar to as stated in chapter 9.1.

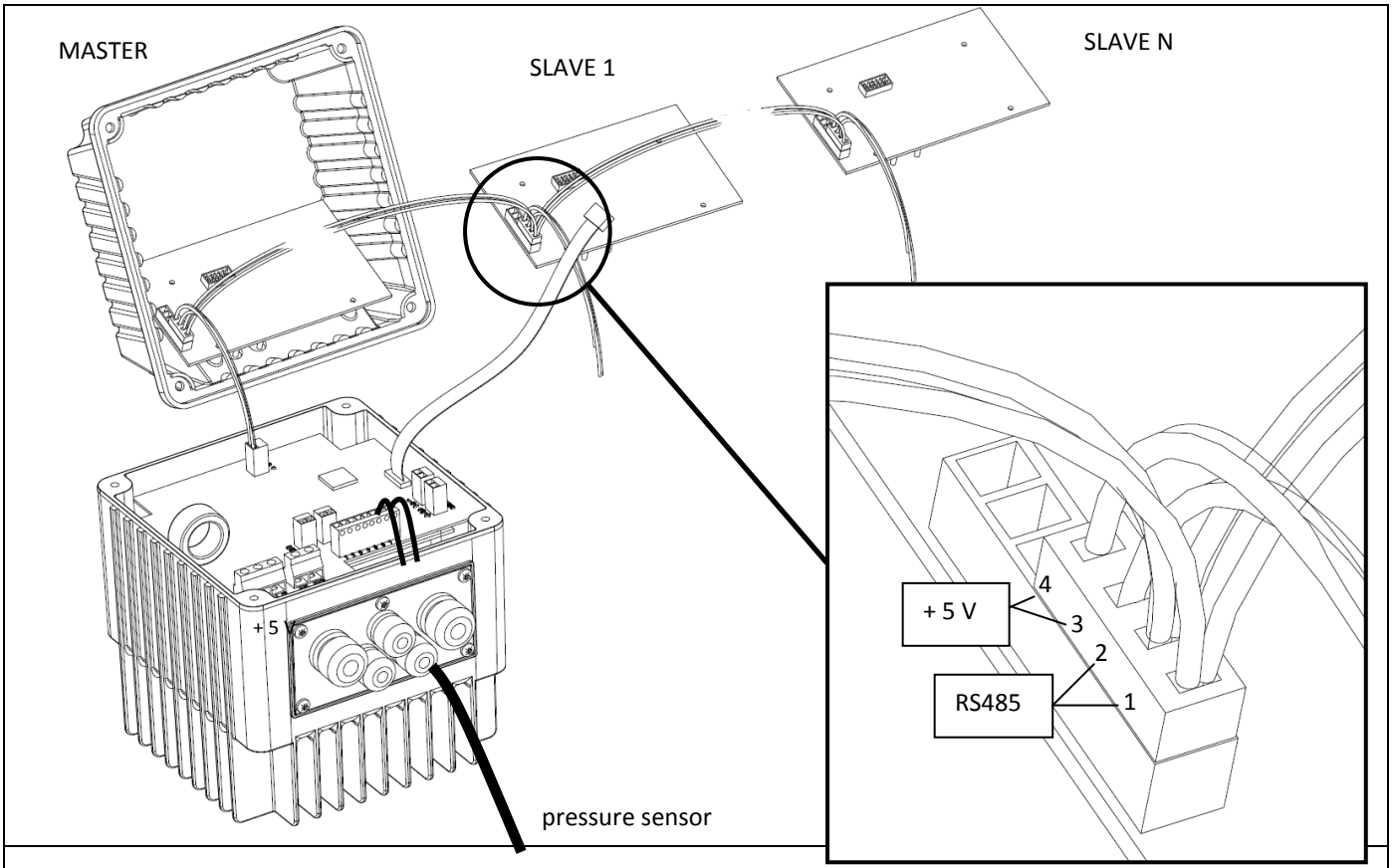
Power supply cable connection for control board

If COMBO function is required, make sure to previously connect the black/red cable, included in the VASCO package, between the control board and LCD boards attached to the cover (3 and 4 pins).



RS485 serial connection

VASCO's communication is made through a private NASTEC protocol using the RS485 port. Each VASCO must be connected to each other by using a bipolar cable wired on the 1 and 2 pins on the rear side of the LCD board attached to the VASCO cover.



To achieve the COMBO function in a system consisting of several interconnected VASCOs, simply use a single pressure sensor connected to the VASCO Master (address 00). The value of the pressure is communicated to the slaves via the serial port.
To prevent the shutdown of the system due to pressure sensor failure, connecting a 2nd pressure sensor to the VASCO master is recommended; make sure that the two pressure sensors are identical.
Remember to perform the offset operation of the sensors in the VASCO master (Installer Parameters menu) .
As a further help, you can connect another two DOL pumps to the VASCO Master to cover additional water demand; they will be operated only when all the COMBO pumps are already in operation.

Master setup

1. Supply power to the VASCO 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' Param. install.

6. Press ENT
7. Insert password (default 001).
8. Scroll until:

Combo ON/OFF

9. Set ON
10. Set:

Address XX	00	Vasco's address in parallel operation. • 00 : VASCO master
Num.system pumps XX		Number of pumps to be connected in parallel. Only required if *min set press is* different from *max set press*
Alternance ON/OFF	ON	Function to allow alternating between the VASCOs 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.
Delta stop pres. p = XX.X [bar]	01.0	The pressure value to add to the p_set to the stop the pump connected last. PI control is provided by the previous pump.

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

Menù ENT to access

13. Scroll until:

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

Slave setup

Follow Master setup until point 11.

1. Set:

	Address XX	Vasco's address in parallel operation. • 01 --> 07: VASCO slaves

2. Press STOP (red button)
3. Press STOP again

Menù ENT to access

4. Scroll until:

Inv: ON/OFF Mot: ON/OFF NO COMMUNICATION

5. Press STOP (red button) in order to reset the alarm.

Whenever the user accesses the Menu screen of the VASCO master, the communication between VASCOs is automatically interrupted. Restoring communication is required after exiting the Menu screen in the VASCO master. Press the STOP button at the STATUS screen (showing NO COMMUNICATION) of each VASCO slave.
VASCO slaves will keep all their own parameters with the exclusion of AUTORESTART function; where the setup value ON/OFF is provided by the Master. All Installer Parameters are passed to VASCO slaves with the exclusion of the following parameters:

- ***Dry run cosphi***
- ***f min Q=0***
- ***Ramp Q=0***
- ***ki***
- ***kp***
- ***Rotation sense.***
- **Digital input 1**
- **Digital input 2**

As a consequence, all the above parameters must be setup independently on each inverter

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.

10. Trouble-shooting chart

LCD does not switch on after powering the VASCO	• 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 (L1,L2, ground).
Power line of VASCO 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 VASCO it is recommended to wait at least 1 minute before restarting.
When performing the Offset operation of the pressure device, AL. SENS. PRESS. alarm occurs	• Check that the sensor cable is properly connected to the sensor device and to the VASCO. • Make sure that the sensor and its cable are not damaged. • Check that the operating range of pressure 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 (Installer Parameters menu). Start by reducing the Ki value from 100 to 30. If it is not enough, reduce the Kp value from 2 to 1 .
During constant pressure control, pump stops and starts continuously.	• Make sure that the value f min Q=0 (minimum frequency with Q=0) (Installer Parameters menu) is properly set up. Otherwise repeat the procedure. • Increase the value of parameter stop delay (Installer Parameter menu) • Increase the time value ramp Q=0 parameter (Installer Parameters value).
DOL pump stops and starts continuously	• Increase *delta start pressure* in accordance with chapter 9.1. • 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 p_mis drops too much before VASCO starts the pump.	• Decrease the delta start pressure (Installer 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 (Installer Parameters menu). As a starting point, increase the Ki value by 50 units. If it is not enough, increase the Kp value by one unit.

11. 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.

VASCO model	LCD version (shown when VASCO is power supplied) LCD = _.__	INV version (shown when VASCO 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 sommersible: cable section [mm2]:____	
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 below software scheme.		

12. Software scheme

Inv: ON/OFF Mot: ON/OFF p_mis = XX.X [bar]	Inv: ON/OFF Mot: ON/OFF f = XXX.X [Hz]	Inv: ON/OFF Mot: ON/OFF V_in = XXX [V] / I = XX.X [A]	Inv: ON/OFF Mot: ON/OFF cosphi = X.XX	Inv: ON/OFF Mot: ON/OFF P = XXXXX [W]	Inv: ON/OFF Mot: ON/OFF STATUS:NORMAL	MENU' ENT to access

password 1: Installer level (default: 001) **password 2: advanced level (default: 002)**			**ENTER** Inverter life xxxxx h : xx m Motor life xxxxx h : xx m XXXXXXXXXXXXX XXXXXXX h : XX m
MENU Install. param.	MENU Advanced param.	MENU Retrive init.set	MENU' Change init.set
ENTER **password 1**	**ENTER** **password 2**	**ENTER** **password 1**	**ENTER** **password 2**
Control mode • Constant press. • Fix speed • Const.press.2val • Fix speed 2 val.	Motor type threephase/singlephase	ENT to retrive Init config.	Language Italiano / English
Control mode: Cost. Press.	Rated motor Volt. V = XXX [V]		Motor type threephase/singlephase
F.s. press.sens. 20mA = XX.X [bar]	Voltage boost V = XX [%]		Rated motor Volt. V = XXX [V]
Offset sensors Press ENT	Rated motor Amp I = XX.X [A]		Voltage boost V = XX [%]
Max system pres. p = XX.X [bar]	Rated motor freq f = XXX [Hz]		Rated motor Amp I = XX.X [A]
Min system pres. p = XX.X [bar]	Max motor freq. f = XXX [Hz]		Rated motor freq f = XXX [Hz]
Dry run cosphi cosphi = X.XX	Min motor freq. f = XXX [Hz]		Max motor freq. f = XXX [Hz]

Min set pressure p = XX.X [bar]	Ramp up time t = XX [sec]		Min motor freq. f = XXX [Hz]
Max set pressure p = XX.X [bar]	Ramp down time t = XX [sec]		Ramp up time t = XX [sec]
Test f min Q=0 ENT to begin	Ramp f min mot. t = XX [sec]		Ramp down time t = XX [sec]
Tuning: START/STOP ----------	PWM f = XX [kHz]		Ramp f min mot. t = XX [sec]
Set f. min Q=0 fmin = XXX [Hz]	Autorestart ON/OFF		PWM f = XX [kHz]
Stop delay Q=0 t = XX [s]	Change PASSWORD2 ENT		Control mode • Constant press. • Fix speed • Const.press.2val • Fix speed 2 val.
Ramp Q=0 t = XX [s]			**Control mode: Constant press.**
Delta start pres p = XX.X [bar]			F.s. press.sens. 20mA = XX.X [bar]
Ki XXX			Offset sensors Press ENT
Kp XXX			Max system pres. p = XX.X [bar]
Pump DOL 1 ON/OFF			Min system pres. p = XX.X [bar]
Pump DOL 2 ON/OFF			Dry run cosphi cosphi = X.XX
COMBO ON/OFF			Motor test START/STOP

COMBO: ON			Rotation sense ---> / <---
Address XX			Min set pressure p = XX.X [bar]
Address : 00 (Master)			Max set pressure p = XX.X [bar]
Num.system pumps XX			Test f min Q=0 ENT to begin
Alternance ON/OFF			Tuning: START/STOP ----------
Delta stop pres. p = XX.X [bar]			Set f. min Q=0 fmin = XXX [Hz]
Address: 01 --> 07 (Slave)			Delta start pres p = XX.X [bar]
Address XX			Autorestart ON/OFF
COMBO: OFF			INITIAL SETUP COMPLETED
Rotation sense ---> / <---			Control mode: Fix speed
Digital input 1 N.O. / N.C.			F.s. press. sens. 20mA = XX.X [bar]
Digital input 2 N.O. / N.C.			Offset sensors Press ENT
Change PASSWORD1 ENT			Max system pres. p = XX.X [bar]
Control mode: Fix speed			Min system pres. p = XX.X [bar]
F.s. press. sens. 20mA = XX.X [bar]			Dry run cosphi cosphi = X.XX

Offset sensors Press ENT			Motor test START/STOP
Max system pres. p = XX.X [bar]			Rotation sense ---> / <---
Min system pres. p = XX.X [bar]			Operating freq. f = XXX [Hz]
Dry run cosphi cosphi = X.XX			Autorestart ON/OFF
Operating freq. f = XXX [Hz]			INITIAL SETUP COMPLETED
Rotation sense ---> / <---			**Control Mode : Const.press.2val**
Digital input 1 N.O. / N.C.			F.s. press. sens. 20mA = XX.X [bar]
Digital input 2 N.O. / N.C.			Offset sensors Press ENT
Change PASSWORD1 ENT			Max system pres. p = XX.X [bar]
Control Mode : Const.press.2val			Min system pres. p = XX.X [bar]
F.s. press. sens. 20mA = XX.X [bar]			Dry run cosphi cosphi = X.XX
Offset sensors Press ENT			Motor test START/STOP
Max system pres. p = XX.X [bar]			Rotation Sense ---> / <---
Min system pres. p = XX.X [bar]			Min set pressure p = XX.X [bar]

Dry run cosphi cosphi = X.XX			Max set pressure p = XX.X [bar]
Min set pressure p = XX.X [bar]			Min set press. 2 p = XX.X [bar]
Max set pressure p = XX.X [bar]			Max set press. 2 p = XX.X [bar]
Min set press. 2 p = XX.X [bar]			Test f min Q=0 ENT to begin
Max set press. 2 p = XX.X [bar]			Tuning: START/STOP ----------
Test f min Q=0 ENT to begin			Set f. min Q=0 fmin = XXX [Hz]
Tuning: START/STOP ----------			Set f. min: Q=0 2 fmin = XXX [Hz]
Set f min Q=0 fmin = XXX [Hz]			Delta start pres p = XX.X [bar]
Set f min Q=0 2 fmin = XXX [Hz]			Autorestart ON/OFF
Stop delay Q=0 t = XX [s]			INITIAL SETUP COMPLETED
Ramp Q=0 t = XX [s]			**Control mode: Fix speed 2 val.**
Delta start pres p = XX.X [bar]			F.s. press.sens. 20mA = XX.X [bar]
Ki XXX			Offset sensors Press ENT
Kp XXX			
Pump DOL 1 ON/OFF			Max system pres. p = XX.X [bar]

Pump DOL 2 ON/OFF			Min system pres. p = XX.X [bar]
Rotation sense ---> / <---			Dry run cosphi cosphi = X.XX
Digital input 1 N.O. / N.C.			Motor test START/STOP
Digital input 2 N.O. / N.C.			Rotation sense ---> / <---
Change PASSWORD1 ENT			Operating freq. f = XXX [Hz]
Control mode: Fix speed 2 val.			Operating freq.2 f = XXX [Hz]
F.s. sens. press. 20mA = XX.X [bar]			Autorestart ON/OFF
Offset sensors Press ENT			INITIAL SETUP COMPLETED
Max system pres. p = XX.X [bar]			
Min system pres. p = XX.X [bar]			
Dry run cosphi cosphi = X.XX			
Rotation sense ---> / <---			
Operating freq. f = XXX [Hz]			
Operating freq.2 f = XXX [Hz]			

Digital input 1 N.O. / N.C.			
Digital input 2 N.O. / N.C.			
Change PASSWORD1 ENT			