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WATER SOLUTIONS

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VSD - F Inverter

OPERATION AND MAINTENANCE MANUAL

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flowtech WATER SOLUTIONS

OPERATION & MAINTENANCE

CONTENTS

General
Information

These instructions are to assist in the installation of the flowcon VSD - F Inverter please follow them carefully.

If, having read this Operation & Maintenance Manual, there is any doubt about any aspect of the installation please don't hesitate to contact our technical team.

Definitions of Safety Warnings and Precautions

WARNING!

Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

CAUTION!

Indicates a potentially hazardous situation which, if not avoided. Can result in minor to moderate injury, or serious damage to the product.

Safety

Information

It is essential that correct and safe working practices are adhered to at all times when installing, operating and/or maintaining any piece of equipment. Always consult safety data sheets, operating and maintenance manuals, Health & Safety legislation and recommendations and specific requirements of any equipment manufacturer, site controller, building manager or any other persons or organisation relating to the procurement, installation, operation and/or maintenance of any piece of equipment associated or in conjunction with any product provided by **flow**tech Water Solutions.

This document is intended for ALL installers, operators, users and persons carrying out maintenance of this equipment and must be kept with the equipment, for the life of the equipment and made available to all persons at all times. Prior to carrying out any work associated with the set it is essential that the following sheets are read, fully understood and adhered to at all times.

Equipment must only be installed, operated, used, and/or maintained by a competent person. A competent person is someone who is technically competent and familiar with all safety practices and all of the hazards involved.

Any damage caused to any equipment by misapplication, mishandling or misuse could lead to risk of Electrocution, Burns, Fire, Flooding, death or injury to people and/or damage to property dependent upon the circumstances involved. **flow**tech Water Solutions accepts no responsibility or liability for any damage, losses, injury, fatalities or consequences of any kind due to misapplication, mishandling or misuse of any equipment, or as a result of failure to comply with this manual.

Failure to install, operate, use or maintain the equipment in accordance with the information contained within this document could cause damage to the equipment and any other equipment subsequently connected to it, invalidating any warranties provided by **flow**tech Water Solutions to the buyer.

Safety Warnings &

Precautions

These instructions should be read and clearly understood before working on the system. Please read this manual carefully and all of the warning signs attached before installing or operating the equipment keep this manual handy for your reference. This equipment should be installed, adjusted and serviced by trained and qualified personnel. Failure to observe this precaution could result in bodily injury.

WARNING! - Install an emergency stop key separately from the isolator. Rotating shafts can be hazardous.

WARNING! - This equipment has a high leakage current and must be permanently fixed to earth.

WARNING! - Do not attach or remove wiring or connectors when the power is applied. Do not check signals during operation. When the power is turned on and the running command is on, the motor will start rotating. The stop key is only effective when the function is set. If there is a power failure and an operation instruction is given the unit may start automatically when the power is reinstated.

WARNING! - Make sure that the input voltage is correct. Be sure to install the unit in a room that is not exposed to direct sunlight and is well ventilated.

Avoid environments which have a high ambient temperature, high humidity or excessive condensation. Avoid dust. Corrosive gas, explosive gas, inflammable gas, grinding-fluid mist and salt damage, etc.

WARNING! - Do not connect the power source to any terminals except power connectors.

WARNING! - Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, you may be exposed to components at or above the line potential. Extreme care should he taken to protect against shock. Dangerous voltage may exist after the power light is off.

Wait more than 5 minutes after turning off the power supply before performing maintenance or inspection. Hazard of electric shock. Disconnect incoming power before working on this unit.

WARNING! - The inverter should be protected separately against ground fault.

Observe the regional regulations for electrical installation!

CAUTION! - It is strongly recommended that all electrical equipment conforms to National Electrical Codes and local regulations. Only qualified personnel should perform installation, alignment and maintenance. The manufacturer reserves the right to alter the technical data in order to make improvements or update information.

CAUTION! - Failure to observe these rules will render the guarantee invalid. The same applies to repair jobs and/or replacement. Your legal rights are not affected.

CAUTION! - The manufacturer declines all responsibility in the event of damage or injury caused as a result of tampering with the equipment.

CAUTION! - Do not switch on/off power supply to run/stop the motor/system! Start the unit only by using run button or external run command.

Customer / Contractor RESPONSIBILITIES

It is the responsibility of the customer and/or the contractor:

- To ensure that anyone working on the equipment is wearing all necessary protective gear and/or clothing.
- Is aware of appropriate health & safety warnings.
- Has read the information in this section of the manual.

Authorised operators

The product is intended for use by expert operators divided into end users and specialised technicians (see the symbols above).

It's forbidden, for the end user, carry out operations which must be done only by specialized technicians. The manufacturer declines any liability for damage related to the non-compliance of this warning.

Warranty

For the product warranty refer to the general terms and conditions of sale.

The warranty covers only the replacement and the repair of the defective parts of the goods (recognized by the manufacturer).

The Warranty will not be considered in the following cases:

- Whenever the use of the device does not conform to the instructions and information described in this manual.
- In case of changes or variations made without authorization of the manufacturer.
- In case of technical interventions executed by a non-authorized personnel.
- In case of failing to carry out adequate maintenance.

Technical assistance

Any further information about the documentation, technical assistance and spare parts, shall be requested from: Flowtech Water Solutions Ltd.

Technical description

Flowcon VSD - F Inverter is a frequency converter that could be mounted in a control box or on a motor.
The frequency converter is manufactured in accordance to EN61800-3:2005-07 acc. EN55011 limit B until a 7,5 kW, limit A1 until a 55kW.

Intended use

The frequency converter is made for pumps with three-phase motor, in domestic, civil and industrial systems.

Improper use

The device is designed and built only for the purpose described.
Improper use of the device is forbidden, as is use under conditions other than those indicated in these instructions.

Improper use of the product reduces the safety and the efficiency of the device, Flowtech shall not be responsible for failure or accident due to improper use.

Technical features

Supply voltage: 3~380 VAC-10% ÷ 3~480 VAC+5%
IP protection: IP55
Liquid Crystal Display
Keyboards: 6 pushbuttons
Digital input:
- 2 Float switches
- MAX/min curve enable
- 2nd set-point enable
- Remote On/off control

Analog input:
- Primary transducer
- Secondary transducer

Digital output: Up to 3 alarm output or Start/stop signal
Analog output: Remote parameter monitor
Connectivity: RS485 (optional)
Protections:
- Supply voltage failure.
- Current protection.
- Output Phases Short-circuit failure
- Electronic card over-temperature.
- Unbalanced / Missing phase.
- Primary sensor missing.
- Dry-run protection (only in Constant pressure mode and Proportional pressure mode).
- Hydraulic losses detection (only in Constant pressure mode).

Operating conditions

The product works properly only if the followings conditions are respected.
- Floating voltage rate: +/-10% max
- Floating frequency rate: 50-60 Hz +/-2%
- Ambient temperature: -10°C a +50°C
- Relative Humidity: from 20 to 90% without condensing
- Vibration: max 16,7 m/s2 (2 g) at 10-55Hz
- Altitude: Below 1000 m inside a building.

The current of the frequency converter must be equal or greater than the maximum current that the motor of the pump could absorb.

The system is made of:
Frequency converter
Transducer (pressure/temperature/flow are possible)
Mounting Screws
Motor Adapter Kit

Product overview

Flowcon VSD - F inverter is a frequency converter for pumps,that implement the following operating modes:

- Constant pressure;
- Proportional pressure;
- Constant temperature;
- Constant flow;
- Night mode;
- Fixed speed;

Constant pressure mode and Proportional pressure mode are available also in cascade mode.

Pushbuttons functions

The user interface is made by a 6 pushbuttons keyboard. Every pushbutton has a specific function described in the following table.

Through this button you can start the pump.

Through this button you can stop the pump.

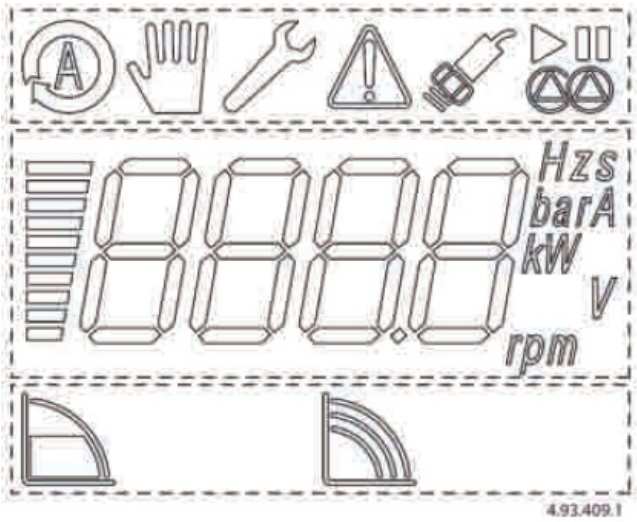

Through this button you have access to the frequency converter programming parameters. If you already are on the programming functions, by pushing this button you go up on the menu.


Through this button you have access to frequency converter programming parameters. If you changed a parameter, by pushing this button you can confirm the indicated value.

Through this button you can decrease parameters or to change the visualized parameter.

Through this button you can increase parameters or to change the visualized parameter.

Interface



The graphic interface of the display is divided in three visualization areas:

- System icons
- Display area
- Operating icons

System icons

AUTO MODE
The system is operating in auto mode.

MANUAL MODE
The system is operating in manual mode.

SET-UP MODE ACTIVATED
It shows that the set-up menu is activated. When an icon is blinking you are modifying a parameter. You can confirm with ENTER.

ALARM
It indicates that there is a fault on the system, the error number appears on the display. When you are on the setup mode the alarm icon will not appear. If it is blinking it indicates a warning.

SENSOR STATE
It indicates that the system is connected to the transducer, if it is blinking there is a fault on the transducer.


PUMP STATE
It indicates if the pump is running or in standby state.


CASCADE MODE
It indicates that the cascade control mode is working. The 2 upper symbols shows if the pump is in stand-by. The lower symbol informs if the pump is the master (lit icon) or slave (blinking icon).

Display area

It is composed from an incremental bar proportional with the displayed value and its measure unit. The display is backlit, the light will turn off after 20 seconds of system inactivity.

Operating icons


Constant pressure mode
The system keeps the pressure constant when the quantity of water requested by the user changes.


Proportional pressure mode
The system keeps the pressure proportional to the quantity of water requested by the user.


Constant temperature mode
The system keeps the temperature constant at a set point.


Constant flow mode
The system keeps the flow constant.


Fixed speed mode
The system works at a fixed speed that user can choose according to need.

Submersible pump applications or long cables
To operate a submersed pump (or surface pump), where the distance from the frequency converter is more than 5 m.

Submersible motor must operate with a frequency between 30 Hz (minimum operating frequency) and 50 Hz (maximum frequency) for 50 Hz motors, and between 30 and 60 Hz for 60 Hz motors.

The running up time from 0 to 30 Hz and the running down time from 30Hz to 0, must be as short as possible, according to the motor power to operate.

Safety

Before using the product it is necessary to acknowledge all the information about safety. All the technical information, operating procedures, and the indications described in this manual, from transport and handling to final dismantling.

The specialized technicians must observe the rules, standards and laws of the country where the frequency converter is sold.

The device is conformed with actual safety standards.
Any improper use may harm people, animals and items.

The manufacturer declines all responsibility in case of different use from the expected one described in this manual.

Do not remove or modify the markings placed on the device. The device must not be started in case of defective parts.

The frequency converter should never be opened or tampered with and guards that come with it should never be removed.

The frequency converter must be installed, adjusted and maintained by qualified personnel who understand the risks involved.

The frequency converter must be fitted with voltage surge and overload protection devices, in accordance with the prevailing safety standards.

The voltage levels inside the frequency converter are dangerous until the backlight of the display shuts down, and then always after 10 minutes that the supply voltage is disconnected.

The connections of the alarms can distribute power even when the frequency converter is turned off. Ensure that there is no residual voltage on the terminals of the alarms.

All the power terminals and other terminals must be inaccessible after installation is completed.

The maximum output frequency must not exceed the design frequency of the pump being controlled. Operating at a frequency higher than the allowable frequency can cause higher current absorption and damage to the device.

If it is necessary to remove the frequency converter, remove only the covers required in order to disconnect the electrical cables.

Take care not to damage the electronic cards.

Residual risks
The device, for its design and designation (in accordance to intended use and safety standard), has no residual risks.

Safety icons and information
Heat-sink Hot surface

Self-protection devices
During the installation of the pump, the pump start, and maintenance, is strongly recommended that the right tools are used.

Transport and handling

The product is packed to protect the contents. During transport do not stack heavy objects on it.
Make sure that during transport the vehicle that is used, is big enough for the total dimension of the package.

No particular vehicle is needed to move the packed device. The vehicles used must be suited for the dimensions and weights of the chosen device. (see technical catalogue dimensions and weights).

Handling
Handling is simplified by the handles placed on the box. Take care moving the package, avoid impact.
Do not bring into contact with other materials that could tamper with the frequency converter.

The manufacturer declines any responsibility if the conditions described are not respected.
If the weight is more than 25 kg the package must be handled by 2 people simultaneously.

Installation

In the case of motor mounting the frequency converter, respect the minimum distance suggested in the instruction manual from the pump.
Do not install the control box or the frequency converter in direct sunlight, or near sources of heat.

Unpacking
Make sure that the device has not been tampered with.
Once the machine is unpacked, the packaging must be disposed of or recycled in accordance with the standard of the country were the device is sold.

Motor mounted
Connect the heat-sink with the motor adapter, using the provided screws.

Wall mounted
Install the frequency converter on the wall, or inside an electric control box with the specific adapter, using the provided screws.

Electrical connection

The electrical connections must be done by a qualified electrician, in accordance with the local standards.
Follow the safety standards
Execute the ground connection
Follow the indications reported in this manual

Be careful during electrical connection that no piece of wire, sheath or foreign objects fall into the frequency converter.

The supply terminal board, and the motor terminal board accommodate cables with maximum section as reported in TABLE 1. In this case wiring tips should be used.

Wrong connections could tamper the electronic circuit of the frequency converter.
Before any kind of electrical operation on the frequency converter, just installed wait 10 minutes.

Power supply connection

Electrical supply must comply with the description.
If the electric control box is connected to an electric plant with a differential switch (ELCB) or a Ground Fault Circuit Interrupter (GFCI) as a further protection, these devices must comply the following characteristics:

Suitable to control leakage current and, in case of short pulsed leakage current.
Must operate in case of a fault alternating current, and in case of fault current with DC content, such as fault pulse DC current and flat DC current.

The electric control box must have installed a B-type differential switch or GFCI.

These protections must be signed with the followings symbol.

For the electrical connection of each size.

IT power grid supply configuration
IT power grid supply, is also known as “isolated ground supply” because the star point of the power supply is not related to ground. This kind of power grid supply is to use an insulation controller that constantly monitors the galvanic isolation between ground and the various power devices.

The converter is able to work also with this typology of power grid supply.

If the frequency inverter is to be used in an IT mains, the relevant IT mains jumpers.

Contact with live components
Risk of fatal injury due to electric shock!
- Never remove the center housing part from the heat sink.
- Mind the capacitor discharge time.

After switching off the frequency inverter, wait 10 minutes until dangerous voltages have discharged.

Motor connection
Motor cable must be connected directly to the output terminal board of the frequency converter.
To comply with the EMC standard a 4-pole shielded cable with external shield protection must be used.
The motor cable must never run parallel to the power line of the frequency converter.

Transducers connection.

A transducer is an analog instrument with an output signal of 4-20 mA (or different) that continuously reads a parameter of the system.

For some operating modes it is possible to connect up to 2 transducers:

- Constant pressure mode (the difference of pressure between delivery pipe and suction pipe).
- Proportional pressure mode (the difference of pressure between delivery pipe and suction pipe).
- Constant temperature mode (the difference of temperature between delivery pipe and suction pipe).
- Night mode (a primary pressure transducer, or temperature or flow rate, and a secondary temperature transducer).

Transducer general characteristics	Values
Nominal supply voltage	24 VDC
N° of wires	2 or 3 wires
Output signal (current)	0/4 ÷ 20mA
Output signal (voltage)	0-10V
Minimum drivable load resistance	500 Ohm

Float switch connection

It is possible to connect up to 2 float switches.
To program the float switches, refer to section 10.1 (Dry-run protection). In the picture is shown a connection example (NC).

Connection of the input for max/min curve operation
It's possible to connect a switch to enable operation at Max/Min curve.

Connection of the input for second set point operation
It is possible to connect a switch to enable operation with 2nd set-point.

Remote On/Off control connection
It is possible to connect a switch for remote on/off control.

Remote alarm connection
It is possible to connect up to 2 alarm signals either in Volt free configuration, or with external supply voltage configuration (+24VDC maximum current 4A).

Connection of the output for remote parameter monitoring
It is possible to use the analogic output for remote monitoring of the frequency converter's parameters.

Cascade mode connection

Frequency converters are prearranged for use in pressure boosting sets with a number from 2 to 6 pumps in the following versions:

Pressure boosting sets with 2-6 variable speed pumps.
Pressure boosting sets with 1 variable speed pump and up to 5 fixed speed pumps.

Cascade mode installation
Connect the frequency converters to the motors.

Connect the transducer (either pressure, temperature or flow rate) to the delivery manifold of the pressure boosting set.

It is advised to install the pressure transducers on the same point of the delivery manifold and complete the installation with a pressure gauge.

Cascade mode electrical connection
Connect the supply cables to the motors and to the power supply following the instructions.

The connection with the power supply must be made with installation of a tripolar circuit breaker (one for each frequency converter) with proper size and with a B-type differential switch.

Cascade mode expansion board installation
The cascade mode expansion board must be installed perpendicularly to the control board, checking that the connectors are properly connected, and that the board fits into the slides.

Make sure that the cascade expansion board is properly connected, otherwise it's not possible to use the cascade mode.

Cascade mode connection with 2-6 variable speed pumps
By means a proper cable make the connection of the clamps E4-E5-E6 of the first frequency converter to the clamps E8-E9-E10 of the next frequency converter.

Check the correct connection sequence and check that terminals of each cable are connected to the right clamp.

To comply with the standards of electromagnetic compatibility, for cable length greater than 1 meter, it is recommended the use of a shielded cable with protection sheath connected on the ground on each frequency converter.

Cascade mode with 1 variable speed pump and 5 fixed speed pumps.
Connect the clamps with contactors according to the diagram, and connect the motor cable and the power supply cable of the related fixed speed pump to the contactor.

Relay D2 e D3 max 400 VAC/VDC maximum current 0,5 A at 25°C and 0,2 A at 85°C.
Relay D4 – D6 max 250VDC o 30VDC cmaximum current 1 A.

The connection with the power supply must be made with installation of a tripolar circuit breaker of proper size.

Programming guide

Parameters
On the frequency converter the following information is displayed:
Parameters of pump status
Programming parameters
Alarms

Parameter of pump status
They allow to visualize:
- Working frequency of the pump
- The measure of the transducer (in case of differential mode the measure is referred to the difference between the 2 transducers).
- The current absorption.
- Starting from the basic display by pushing of the directional plus or minus arrows.

Example:

Programming parameters

To show the programming parameters, select menu. Will be displayed progressively:

UP – User settings: these are the basis settings that the user may change.

AP – Advanced settings: these settings are available only to qualified personnel. To enter password is required (see section 8.5).

SA – Technical assistance settings: these are the advanced parameters, only technical assistance personnel are allowed to access this menu. Password is required (see section 8.5).

PC – Constant pressure mode settings: These settings regulate the constant pressure mode. A password is required to set these parameters.

PP – Proportional pressure mode settings: These settings regulate the proportional pressure mode. A password is required to set these parameters.

tC – Constant temperature mode settings: These settings regulate the constant temperature mode. A password is required to set these parameters.

CF – Constant flow mode settings: These settings regulate the constant flow mode. A password is required to set these parameters.

MAn – Fixed speed mode settings: These parameters allow activation of the fixed speed mode and the working frequency. Only qualified personnel are allowed to access this menu. Password is required.

AE – Advanced parameter: this allows for the display of secondary parameters which can be useful for system diagnostics.

AE01	Software release
AE02	Last 10 alarms
AE03	Supply voltage (V)
AE04	Frequency converter output voltage(V)
AE05	Total working hours
AE06	Number of starts

Supply voltage visualization example

By pushing the menu button the UP parameter appears. Select the AE parameter by pushing the plus up to arrive at the correct parameter AE, confirm with enter. Select the parameter AE02 by pushing the plus button and confirm with enter. Supply voltage is displayed.

Programming
To enter programming, select menu. Use the plus or minus buttons to move to the programming parameter to be modified and select enter to confirm. Use the pushbuttons plus or minus to move to the parameter to be modified and select enter, with the plus or minus buttons increase or decrease the value. From this moment the setup icon start blinking until the value is confirmed with enter.

To exit the program, push menu until when you arrive to the basic display.
When you go in the setup mode the icon will appear.

Example of parameter variation.
In order to modify the set-point pressure from 3.0 bars to 2.8 bars:
Select menu and then with the plus or minus buttons until you move to programming parameter UP. Confirm with enter and then with the plus or minus buttons move to the parameters UP06. Confirm with enter and then with the plus or minus buttons change the value up to the desired value. From this moment the setup icon will start blinking until the value is confirmed with enter. To exit the program, push menu until you arrive on the basic display, when you exit the setup mode the icon will disappear.

Password insertion
Please contact the office for passwords.

Factory reset
This parameter allows to reset the frequency converter to factory settings.

WARNING: Before resetting the frequency converter, make sure that the system is Off, and that the pump/s are stopped. Once the reset is done it's possible to configure the previous settings only manually setting all the modified parameters.

To reset the frequency converter it is necessary change the value of the parameter AP50 from no to yes, and push the button enter.

During this phase the display is turned off for few seconds, then it will turn off, and it becomes possible to reprogram the frequency converter.

Operating mode programming

Parameters to check when starting up the unit
Check that the motor voltage is matching or it's lower than the Mains Supply voltage.

If the motor Voltage is different from 400V set the parameter SA01 "Nominal Motor Voltage" in order to match the value written in the motor label.
Once the frequency converter is turned on for the first time, after a short check phase on the display it's shown Er13.

If the entered rated current value is not correct there is the risk of pump damage or to have an unexpected overcurrent alarm Parameter UP03 Nominal pump frequency
The nominal frequency of the pump must be set.

If the entered rated frequency value entered is not correct there is the risk of higher current absorption or pump damage.

If the selected programmed mode is different from the purpose of the plant there is a risk of pump damage and/or plant damage.

Constant pressure operating mode
Constant pressure operating mode keeps constant the pressure at a point of the system.

In this operating mode the frequency converter keeps constant the pressure at a set-point value decided by the user through parameter UP06.

It is possible to have different configurations of this operating mode related with the different types and number of transducers installed:

- Constant pressure with 1 pressure transducer (absolute or differential transducer)
- Constant pressure with 2 pressure transducers in differential mode.

Constant pressure mode with single transducer (absolute or differential)
This configuration uses a feedback given by a pressure transducer.
Parameters to program or check (recommended sequence):

Par.	Description	Suggested value
AP01	Maximum pump pressure	Based on pump type
AP02	Primary transducer supply	Data sheet transducer
AP03	Primary transducer measuring unit	1 [bar]
AP04	Primary transducer minimum value	Data sheet transducer
AP05	Primary transducer maximum value	Data sheet transducer
UP02	Nominal pump current	See motor plate
UP03	Nominal pump frequency	See motor plate
UP05	Operating mode	PC
UP06	Primary set-point	Demand [bar]

Constant pressure mode with 2 pressure transducers (differential mode)
If it is required to use a differential pressure feedback, between delivery and suction of the pump by using 2 transducers it's necessary to connect the first transducer and the second transducer as shown in section 6.7.
Parameters to program or check (recommended sequence):

Par.	Description	Suggested value
AP01	Maximum pump pressure	Based on pump type
AP02	Primary transducer supply	Data sheet transducer
AP03	Primary transducer measuring unit	1 [bar]
AP04	Primary transducer minimum value	Data sheet transducer
AP05	Primary transducer maximum value	Data sheet transducer
AP06	Secondary transducer supply	Data sheet transducer
AP07	Secondary transducer measuring unit	1 [bar]
AP08	Secondary transducer minimum value	Data sheet transducer
AP09	Secondary transducer maximum value	Data sheet transducer
AP10	Secondary transducer mode	DiFF
UP02	Nominal pump current	See motor plate
UP03	Nominal pump frequency	See motor plate
UP05	Operating mode	PC
UP06	Primary set-point	On demand [bar]

To ensure the system works properly, the primary transducer (B1-B4 clamps) must be always connected to the delivery pipe, and the secondary transducer (B5-B8 clamps) must be always connected to the suction pipe.

Minimum run frequency and pre-pause frequency settings

The frequency converter is equipped with an automatic stop system in case of low water. In the case where the system does not guarantee the correct stop of the pump, it is possible to set manually the following values:

- Frequency before stop
- Minimum run frequency

In order to manually set these parameters it is necessary to change the value of parameter AP17 from "Auto" to "Man". Then the pre-pause frequency values (PC02 and PC04 parameters) and the minimum frequency values (PC01 and PC03 parameters), must be set using the calculation formulas described in the next section.

Frequency before stop and minimum run frequency calculation formulas

Adjusting the pre-pause frequency (PC02 and PC04 parameters) allows you to properly stop the pump when the water demand is low and the pump operation is no longer required (e.g. a leakage or a small flow of a few liter per minute).

In this case the pump must be stopped for some seconds and the flow is guaranteed by the reserve stored in the vessel.

The frequency before stop Hz P can be calculated as follows:

50 Hz pumps

$Hz=2+ \sqrt{(Hset \div Hmax)} \times 50$ (*)

60 Hz pumps

$Hz=2+ \sqrt{(Hset \div Hmax)} \times 60$ (*)

where:

- H set is the working pressure in bar
- H max is the maximum pump pressure, in bar, when flow is equal to 0.

(*) For the maximum pump pressure it's required:

For the pumps operating with suction lift subtract the suction lift value (in bar).
For the pumps installed with suction positive add the positive suction head value (in bar).
The minimum run frequency (PC01 and PC03 parameters) must be set 6-7 Hz lower than the frequency before stop.

Proportional pressure mode

The proportional pressure operating mode reduce the pressure proportionally with the water demand of the system.

In this operating mode the frequency converter keeps a set-point pressure at the maximum frequency, this set-point pressure could be set with the parameter UP06.

The slope of the pressure-flow rate line could be set through the percentage of the pressure when flow is equal to 0.

It is possible to have different configurations of this operating mode related with the different types and number of transducers installed:

- Proportional pressure with 1 pressure transducer (absolute or differential transducer).
- Proportional pressure with 2 pressure transducers in differential mode.
- For detailed program settings see the following configuration sections.

Proportional pressure mode with single transducer (differential or absolute)

This configuration uses a feedback given by a pressure transducer (connected as shown in section 6.7).
Parameters to program or check (recommended sequence):

Par.	Description	Suggested value
AP01	Maximum pump pressure	Based on pump type
AP02	Primary transducer supply	data sheet transducer
AP03	Primary transducer measuring unit	1 [bar]
AP04	Primary transducer minimum value	Data sheet transducer
AP05	Primary transducer maximum value	Data sheet transducer
UP02	Nominal pump current	see motor plate
UP03	Nominal pump frequency	See motor plate
UP05	Operating mode	PP
UP06	Primary set-point	On demand [bar]
PP01	Percentage of the pressure with zero flow	50 [%]

Proportional pressure mode with 2 pressure transducers (differential mode).
If it is required to use a differential pressure feedback, between delivery and suction of the pump by using 2 transducers it's necessary to connect the first transducer and the second transducer as shown in section 6.7.
Parameters to program or check (recommended sequence):

Par.	Description	Suggested value
AP01	Maximum pump pressure	Based on pump type
AP02	Primary transducer supply	Data sheet transducer
AP03	Primary transducer measuring unit	1 [bar]
AP04	Primary transducer minimum value	Data sheet transducer
AP05	Primary transducer maximum value	Data sheet transducer
AP06	Secondary transducer supply	Data sheet transducer
AP07	Secondary transducer measuring unit	1 [bar]
AP08	Secondary transducer minimum value	Data sheet transducer
AP09	Secondary transducer maximum value	Data sheet transducer
AP10	Secondary transducer mode	DiFF
UP02	Nominal pump current	Motor plate
UP03	Nominal pump frequency	See motor plate
UP05	Operating mode	PP
UP06	Primary set-point	On demand [bar]
PP01	Percentage of the pressure with zero flow	50 [%]

To allow the system to work properly, the primary transducer (B1-B4 clamps) must be always connected to the delivery pipe, and the secondary transducer (B5-B8 clamps) must be always connected to the suction pipe.

Enabling stop at minimum frequency.
The proportional pressure mode provides that the pump never stops. If it is required to stop the pump when it's working at the minimum operating frequency (parameter SA03) it's necessary change the value of the parameter AP16 from "Off" to "FM".
The system will restart when the difference between the set-point pressure and system pressure becomes lower than the value of parameter PP08.

Constant temperature operating mode.
Constant temperature operating mode keeps constant the temperature at a point in the system.
In this operating mode the frequency converter keeps constant the temperature.

For this operating mode must be defined the type of system where the frequency converter will operate:

- **Heating systems (Heat):** in these systems an increase of the pump frequency will correspond to an increase of the temperature of the transducer.
- **Cooling systems (Cool):** in these systems an increase of the pump frequency will correspond a decrease of the temperature of the transducer.

It is possible to have different configurations of this operating mode related with the different types and number of transducers installed:

- Constant temperature with 1 temperature transducer (absolute or differential transducer).
- Constant pressure with 2 temperature transducers in differential mode.

For detailed program settings see the followings configuration sections.

Constant temperature mode with single transducer (absolute or differential transducer).
This configuration uses a feedback given by a pressure transducer.
Parameters to program or check (recommended sequence):

Par.	Description	Suggested value
AP02	Primary transducer supply	Data sheet transducer
AP03	Primary transducer measuring unit	4 [°C]
AP04	Primary transducer minimum value	Data sheet transducer
AP05	Primary transducer maximum value	Data sheet transducer
UP02	Nominal pump current	See motor plate
UP03	Nominal pump frequency	See motor plate
UP05	Operating mode	tC
UP06	Primary set-point	seconds [°C]
tC01	System type	Heat/Cool

Constant temperature mode with 2 temperature transducers (differential mode)
If it is required to use a differential pressure feedback, between delivery and suction of the pump by using 2 transducers it's necessary to connect the first transducer and the second transducer.
Parameters to program or check (recommended sequence):

Par.	Description	Suggested value
AP02	Primary transducer supply	Data sheet transducer
AP03	Primary transducer measuring unit	4 [°C]
AP04	Primary transducer minimum value	Data sheet transducer
AP05	Primary transducer maximum value	Data sheet transducer
AP06	Secondary transducer supply	Data sheet transducer
AP07	Secondary transducer measuring unit	4 [°C]
AP08	Secondary transducer minimum value	Data sheet transducer
AP09	Secondary transducer maximum value	Data sheet transducer
AP10	Secondary transducer mode	DiFF
UP02	Nominal pump current	See motor plate
UP03	Nominal pump frequency	See motor plate
UP05	Operating mode	tC
UP06	Primary set-point	On demand [°C]
tC01	System type	Heat/Cool

Automatic pump stop at minimum frequency.
In this operating mode typically the pump runs continuously without stop. If it is required to stop the pump when it's working at the minimum operating frequency (parameter SA03) it's necessary to change the value of the parameter AP16 from "Off" to "FM".

The system will restart when the temperature of the system will reach the value of parameter tC02.

Constant flow operating mode.
Constant flow rate mode keeps constant the flow in a point of the system.
This configuration uses a feedback given by a flow sensor (connected as shown in section 6.7).
Parameters to program or check (recommended sequence):

Par.	Description	Suggested value
AP02	Primary transducer supply	Data sheet transducer
AP03	Primary transducer measuring unit	2 [mc/h]
AP04	Primary transducer minimum value	Data sheet transducer
AP05	Primary transducer maximum value	Data sheet transducer
UP02	Nominal pump current	See motor plate
UP03	Nominal pump frequency	See motor plate
UP05	Operating mode	CF
UP06	Set-point	On demand [mc/h]

Fixed speed operating mode.
In this mode the system works as a traditional pump with fixed curve.

Fixed speed operating mode controlled by keyboard.
Parameters to program or check (recommended sequence):

Par.	Description	Suggested value
UP02	Nominal pump current	See motor plate
UP03	Nominal pump frequency	See motor plate
UP05	Operating mode	Man
Man1	Primary fixed speed operating frequency	On demand [Hz]

To allow which the system works properly, the operating frequency is limited between parameter SA03 (minimum operating frequency) and parameter UP03 (nominal frequency of the pump).

Fixed speed operation by an external reference.
If it is necessary to control the frequency from an external unit it is required to make the connection as described in section 6.8.
Parameters to program or check (recommended sequence):

Par.	Description	Suggested value
UP02	Nominal pump current	See motor plate
UP03	Nominal pump frequency	See motor plate
UP05	Operating mode	Man
AP02	Primary transducer supply	On demand
AP04	Primary transducer minimum value	0
AP05	Primary transducer maximum Value	100
Man3	Remote control activation	On
Man4	Minimum value for remote control	On demand [Hz]

The maximum frequency (parameter UP03) will be related to the maximum value of the external reference.

Night mode

Night mode is an optional operating mode which reduces the frequency of the system when the temperature is below a certain value.
This option use a feedback of a temperature transducer connected. (secondary transducer electrical connection).

Because on Flowcon VSD - F inverter only two analog inputs are available, this option does not allow other options or operating modes which need 2 transducers (i.e. differential mode).
Parameters to program or check (recommended sequence):

Par.	Description	Suggested value
AP06	Secondary transducer supply	Data sheet transducer
AP07	Secondary transducer measuring unit	4 [°C]
AP08	Secondary transducer minimum value	Data sheet transducer
AP09	Secondary transducer maximum value	Data sheet transducer
AP10	Secondary transducer mode	nMOd
AP18	Night mode enable	On
AP19	Night mode activation	On demand [°C]
AP20	Night mode activation time	On demand [s]
AP21	Night mode disable threshold	On demand [°C]

At this point the symbol will appear on the frequency converter display.

The frequency converter will work at the minimum operating frequency when the measured temperature of the transducer goes below the temperature set in parameter AP19 for the time set in parameter AP20. The system will return in normal mode when the temperature will rise above the threshold value set in parameter AP21.

Secondary functions

Dry-run protection

The frequency converter is equipped with a dry-run protection for the pumps. When the pressure of the system remain for a time higher than the dry-run time (AP22) lower than the value of the dry-run pressure (AP24) the protection system will stop the pump.
It is possible to install up to 2 float switches for the dry-run protection (see section 6.8 for electrical connection).

Programming primary float switch

The float switch input is default active, parameter AP40 is set on 2 (nO), parameter AP41 (restart time) is set on 3s by default.
Through parameter AP41 is possible to set a restart time from 1 up to 60 seconds.

Programming secondary float switch

The float switch input is default active, parameter AP42 is set on 2 (nO), parameter AP43 (restart time) is set on 3s by default.
Through parameter AP43 is possible to set a restart time from 1 up to 60 seconds.

Enabling Max/Min curve operation

It's possible to connect to the frequency converter an input signal to enable the operation with the maximum curve or minimum curve. For electrical connection see section 6.9.

It is possible to enable this operating mode by changing the parameter AP44 on value 2 "nO" or 3 "nC" (function of the input configuration).

Set parameter AP45 on 1 if it is required which the frequency converter operates at nominal frequency (UP03).
Set parameter AP44 on 2 if it is required which the frequency converter operates at minimum frequency (SA03).

Enabling second set-point operation
It is possible to connect to the frequency converter an input signal in order to use an alternative setpoint. For electrical connection see section 6.10.

It is possible to enable this operating mode by changing the parameter AP46 on value 2 “nO” or 3 “nC” (function of the input configuration).

If the digital input is enabled the system does not use the primary set-point (parameter UP06), but it uses the secondary set-point (parameter UP07).

Enabling remote On/Off control
It’s possible to connect to the frequency converter an input signal to start and stop the pump from a remote unit. For the electrical connection see section 6.11.

This option is enabled by parameter AP47 on the value “nO”.

If the digital input is active the frequency converter is stopped and the display shows “Off”, otherwise if the digital input is deactivated the frequency converter will work normally.

Remote alarm settings
It’s possible to connect to the frequency converter up to 2 alarm signals.
Output signals are default active (parameters AP32 and AP34 set on value “On”).

The parameter AP33 allows to select the activation condition for the relay connected to terminals A1-A5.

The values and conditions for relay activation are here below reported.

Value AP33	Condition
1	Operation
2	Stand-by
3	Off
4	Alarm Er01
5	Alarm Er02
6	Alarm Er03
7	Alarm Er04
8	Alarm Er05
9	Alarm Er06
10	Alarm Er07
11	Alarm Er08
12	Alarm Er09
13	Alarm Er10
14	Alarm Er11
15	Alarm Er12
16	Alarm Er13
17	Alarm Er14
18	Alarm Er15
19	Alarm Er16

20	Alarm Er17
21	Alarm Er18
22	Alarm Er19
23	All alarms

The parameter AP35 allows to select the activation condition for the relay connected to terminals A6-A10.

The values and conditions for relay activation are here below reported.

Value AP35	Condition
1	Alarm Er01
2	Alarm Er02
3	Alarm Er03
4	Alarm Er04
5	Alarm Er05
6	Alarm Er06
7	Alarm Er07
8	Alarm Er08
9	Alarm Er09
10	Alarm Er10
11	Alarm Er11
12	Alarm Er12
13	Alarm Er13
14	Alarm Er14
15	Alarm Er15
16	Alarm Er16
17	Alarm Er17
18	Alarm Er18
19	Alarm Er19
20	All alarms

Programming of remote parameter monitoring

It's possible to connect to the frequency converter an output signal to monitor the parameters on a remote unit. For electrical connection see section 6.13.

Set parameter AP38 to select the parameter to monitor as is described in the table here below.

AP38 Value	Condition
0	Off
1	Pressure (bar)
2	Flow rate (m3/h)
3	Temperature (°C)
4	Frequency (Hz)
5	Motor current (A)

Set the parameter AP39 with the full-scale value of the output signal.

Enabling remote set-point

It's possible to modify the value of the set-point from a remote source instead from the keyboard.
For electrical connection see section 6.7 (secondary transducer electrical connection).
Set parameter AP06, to define the supply of the signal, AP07 on the required measuring unit and AP09 to the signal full-scale.

Change the value of parameter AP10 to “REM”. In this configuration the frequency converter uses the feedback from the primary transducer, but the set-point value is acquired from the signal of the secondary transducer.

Enabling periodical start system

It’s possible to enable a function which allows the pump working whenever it is in stand-by for a long time.
To enable this function it is necessary to change parameter AP25 to the value, in hours, of the stand-by time after it is required which the pump starts, AP26 allows to set the working frequency and parameter AP27 allows to set the working time expressed in minutes.
To disable this function set parameter AP25 to “OFF” i.e. “0” value.

Enabling the systems leakage control

It’s possible to enable a function that checks the number of starts executed by the frequency converter.
To enable this function change the value of parameter AP28 to “On” and set the maximum number of starts that could be done in 20 minutes in the parameter AP29.
If the number of starts is more than the expected the frequency converter will stop with the alarm “Er12”. Valid only under constant pressure.

Enable motor heating system.

It’s possible to enable a function that allows to supply the motor even when the pump is stopped or in stand-by.
Change the value of the parameter AP30 to “On” and with parameter AP31 set the heating power that must be provided to the motor.

Enabling Safe-start

Safe-start function prevent a peak of pressure in the system pipework. Safe-start function operates any time there is a supply disconnection of the frequency converter.

To enable this function it is necessary to set parameter AP49 to value “On”.

At every disconnection of the supply voltage of the system, when the supply is restored, the frequency converter will start at a defined frequency (selectable through the parameter AP52) and it will operate at this frequency for a time, defined in the parameter AP53. After that time the system will return to operate in normal mode. If this option is active in the master pump the safe-start function will work even in cascade mode.

Cascade mode programming

Make sure that the cascade mode expansion board are properly connected, otherwise it will be not possible to use the cascade modes. Boosting set with 2-6 variable speed pumps.

After the electrical connection (see section 7.4), set parameter AP11 on the value UU for each frequency converter, define which frequency converter will work on master mode and for this frequency converter change the parameter AP12 from SLA (slave) to MAS (master).

For each other frequency converter define the address through the parameter AP13 (SLA1, SLA2, SLA3, SLA4, SLA5).

Boosting set with 1 variable speed pump and 1-5 fixed speed pumps.
After the electrical connection (see section 7.4), set parameter AP11 on the frequency converter on the value “UF” and the parameter AP54 with the number of pumps of the booster set (Both fixed speed pumps and variable speed pumps).

Enabling twin-pump operation
This operating mode works only with 2 pumps and works with the followings operating modes:
- Constant pressure mode
- Proportional pressure mode
- Constant temperature mode
- Constant flow rate mode

In this operating mode only one pump works and the other one is for total reserve.

To enable twin-pump mode the parameter AP11 must be set to “dP”, define which frequency converter works as master “MAS” and on this converter change the parameter AP12 to “MAS”.

Only on this frequency converter should be connected all the transducers and signals.

Alternating pumps function
Alternating pumps function allows a more uniform use of the pumps. This function is active by default (parameter AP48 is set to “On”) and it’s possible to change the alternating time, in minutes, through parameter AP49.

Plant starting

After completing hydraulic and electrical connection and checked the preloaded pressure (for booster set with membrane tank), start the plant as indicated below:

Prime the pumps (see the pumps’ instructions).

Pump with suction lift:
- Fill the suction pipe and the pump body by means of the plug hole located close to the delivery port of the pump.
- Fill the suction tube by pouring water through the plug hole on the suction manifold of the pump.

Pump with positive suction head:
Open the gate-valve in the suction pipeline.

With sufficient head, the water will overcome the resistance of the non-return valve fitted in the suction side of the pump and will fill the pump body.

Otherwise, prime the pump with the plug hole near the delivery port.
Never run the pump for more than five minutes with a closed gate valve.

Starting pump

Press the play button to change the pump status from STOP to run. The pump starts up with the acceleration ramp set to reach the wished set-point.

When the motor start turning, check the direction of rotation.
If the pump has been primed correctly, after a few seconds the pressure will begin to increase on the display.

If, after a few seconds of operation the pressure remains at 0.0 bar, stop the pump by selecting stop as priming has not been carried out correctly and the pump is idling. Re-prime the pump and repeat the starting up procedure.

Cascade mode plant starting
Check that all the cascade mode parameters are with the desired values, the parameters that can change the cascade mode operation are:

PC14 / PP13 Cascade mode start fall pressure setup.
PC15 / PP14 Cascade mode restart delay.
PC16 / PP15 Cascade mode fall pressure limit setup.

To do the plant starting follow the instructions under paragraph 12.

Inversion of the direction of rotation
To change the direction of rotation of the motor push the menu button and then with the plus or minus buttons move up to the programming parameter UP. Confirm with enter and with the plus or minus buttons move up to the parameter UP04, confirm with enter and by pushing of the plus button change the value, confirm with enter. To exit the program, push menu until you arrive on the basic display, when you are out from the setup mode the icon will disappear.

Vessel pressure

Once the new working pressure is entered, the tank preloaded pressure must be changed to 2/3 if the working pressure (i.e. 4 bar working pressure, tanks to be preloaded at 2.7 bar).

Use of megaohmeter

Measuring the resistance of an installation incorporating the frequency converter is not allowed, because the electronics may be damaged. If it is necessary, disconnect the frequency converter and use the megaohmeter directly on the terminal box of the pump.

Maintenance

Inspect the tank preloaded pressure of the delivery vessel periodically.

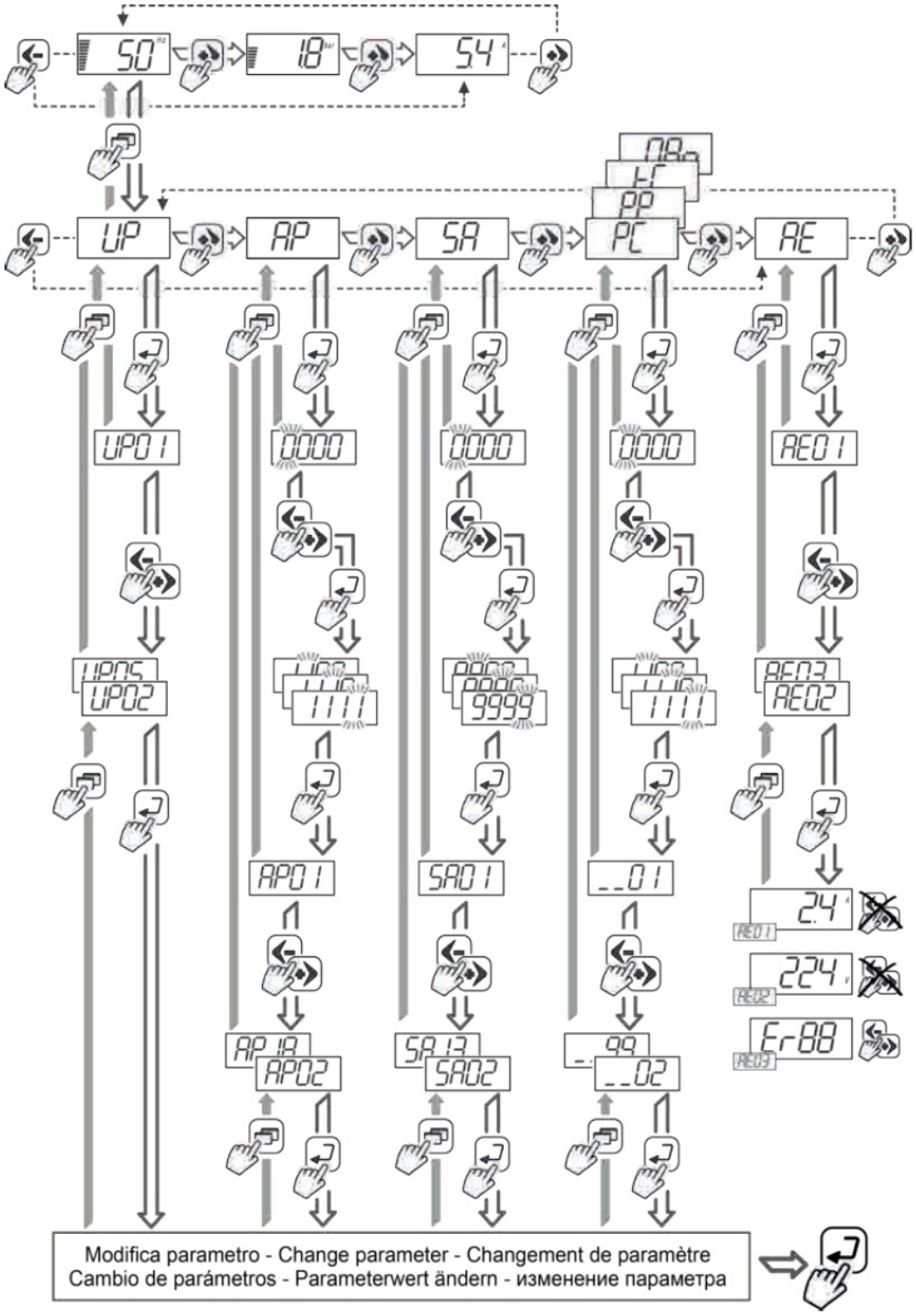
Disposal

Observe the local regulations and dispose of any control gear accordingly. This product contains electrical and electronic components and should be disposed accordingly.

Separate the components using anti-cut water resistant gloves. Is preferred to help to make a further use or dismantling.

The device must be dismantled in different way from normal. For disposal must be followed the actual laws and regulation of the country where the disposal is made, other than the international laws and norms for ambient protection.

Parameter table list



Parameters UP – user parameters

N°	Description		Values	Standard	Modification
UP01	Restart mode power failure		rA = automatic rM = manual	rA	
UP02	Nominal pump current	(A)		s.m.	
UP03	Nominal pump frequency	(Hz)		50	
UP04	Direction of rotation			E---	
UP05	Operating mode		PC = Constant pressure PP = Proportional pressure tC = Constant temperature CF = Constant flow rate Man = Fixed speed	PC	
UP06	Primary set-point			1,5	
UP07	Secondary set-point			1,5	

Parameter AP – Advanced parameters

N°	Description		Values	Standard	Modification
AP01	Maximum pump pressure	(bar)		0	
AP02	Primary transducer supply		1 = 0-10V 2 = 4-20mA 3 = 0-20mA	2	
AP03	Primary transducer measuring unit		1 = bar 2 = m3/h 3 = Hz 4 = °C	1	
AP04	Primary transducer minimum value			0	
AP05	Primary transducer maximum value			10	
AP06	Secondary transducer supply		1 = 0-10V 2 = 4-20mA 3 = 0-20mA	2	
AP07	Secondary transducer measuring unit		1 = bar 2 = m3/h 3 = Hz 4 = °C	1	
AP08	Secondary transducer minimum value			0	
AP09	Secondary transducer maximum value			10	
AP10	Secondary transducer mode		Off DiFF = Differential mode nMOd = Night mode REM = Remote control	Off	

AP11	Cascade mode		Off UU = Cascade 2-6 converters UF = Single converter cascade dP = Twin pump	Off	
AP12	Master/Slave setting		MAS = master SLA = slave	SLA	
AP13	Pump address		SLA1÷SLA5	SLA1	
AP14	Rump-up	(s)		3	
AP15	Rump down	(s)		3	
AP16	Stand-by mode setting		Off FM = minimum frequency PrP = pre-pause frequency	Off	
AP17	Frequency before stop and minimum run frequency automatic calculation		Auto = automatic Man = manual	Auto	
AP18	Night mode enable		On, Off	Off	
AP19	Night mode activation	(°C)		20	
AP20	Night mode activation time	(min)		60	
AP21	Night mode disable threshold	(°C)		20	
AP22	Dry-run time	(s)		10	
AP23	First dry-run time	(s)		60	
AP24	Dry-run pressure	(bar)		1,5	
AP25	Periodically start system activation time	(Ore)		0	
AP26	Periodically start system frequency	(Hz)		40	
AP27	Periodically start system operating time	(min)		1	
AP28	System leakage control		On,Off	Off	
AP29	Maximum number of starts in 20 minutes			60	
AP30	Motor heating setting		On, Off	Off	
AP31	Motor heating power	(%)		10	
AP32	First relay alarm setting		On, Off	On	
AP33	First relay alarm condition			1	
AP34	Second relay alarm setting		On, Off	On	
AP35	Second relay alarm setting			1	

AP36	Expansion board relay alarm condition				
AP37	Expansion board relay alarm setting				
AP38	Remote parameter		0 = Off 1 = bar 2 = m3/h 3 = °C 4 = Hz 5 = Motor current 6 = Drive voltage	1	
AP39	Remote parameter signal value			0	
AP40	Float switch 1 activation		off nO nC	nO	
AP41	Float switch 1 delay time	(s)		3	
AP42	Float switch 2 activation		off nO nC	nO	
AP43	Float switch 2 delay time	(s)		3	
AP44	Maximum/Minimum curve activation		off nO nC	nO	
AP45	Maximum/Minimum curve setting		1 = Maximum curve 2 = minimum curve	1	
AP46	2nd set-point activation		off nO nC	off	
AP47	Remote control activation		off nO	off	
AP48	Alternating pumps activation		off on	On	
AP49	Alternating pumps switching time	(min)		120	
AP50	Reset to factory set-up		nO, yES	nO	
AP51	Safe-start activation		On, Off	Off	
AP52	Safe-start operating frequency	(Hz)		32	
AP53	Safe-start time	(min)		1	
AP54	Number of pump of the booster set			1	
AP55	Delta/Star start delay time	(s)		1	

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Parameter SA – service assistance settings

N°	Description		Values	Standard	Modification
SA01	Nominal motor voltage	(V)		400	
SA02	Carrier frequency	(Hz)		7010	
SA03	Minimum operating frequency	(Hz)		30	
SA04	Phase missing percentage	(%)		0	
SA05	Restore attempt number			6	
SA06	Attempt time	(s)		60	
SA07	I2t Threshold limit	(%)			
SA08	Motor heating delay time	(s)			

Parameter PC – Pressure constant settings

N°	Description		Values	Standard	Modification
PC01	Minimum run frequency for primary set-point	(Hz)	Auto	auto	
PC02	Frequency before stop for primary set-point	(Hz)	Auto, Man	Auto	
PC03	Minimum run frequency for secondary set-point	(Hz)		Auto	
PC04	Frequency before stop for secondary setpoint	(Hz)		Auto	
PC05	Time before stop	(s)		30	
PC06	Set-point pressure step up	(bar)		0,3	
PC07	Pressure step up ramp	(bar/s)		0,3	
PC08	Pressure step up time	(s)		3	
PC09	Restart fall pressure set-up	(bar)		0,3	
PC10	System dynamic			3	
PC11	Pressure PID (proportional gain)			3000	
PC12	Pressure PID (integral time constant)			400	
PC13	Pressure PID (derivative time constant)			1000	

PC14	Cascade mode start fall pressure set-up	(bar)		0,3	
PC15	Cascade mode restart delay	(s)		10	
PC16	Cascade mode fall pressure limit set-up	(bar)		0,6	

Parameter PP – Proportional pressure settings

N°	Description		Values	Standard	Modification
PP01	Percentage of the pressure with zero flow	(%)		50	
PP02	Minimum run frequency proportional pressure	(Hz)		auto	
PP03	Frequency before stop proportional pressure	(Hz)		auto	
PP04	Time before stop	(s)		30	
PP05	Set-point pressure step up	(bar)		0,3	
PP06	Pressure step up ramp	bar/s		0,3	
PP07	Pressure step up time	(s)		3	
PP08	Restart fall pressure set-up	(bar)		0,3	
PP09	System dynamic			3	
PP10	Pressure PID (proportional gain)			3000	
PP11	Pressure PID (integral time constant)			400	
PP12	Pressure PID (derivative time constant)			1000	
PP13	Cascade mode start fall pressure set-up	(bar)		0,3	
PP14	Cascade mode restart delay	(s)		10	
PP15	Cascade mode fall pressure limit set-up	(bar)		0,6	

Parameter tC – Constant temperature setting

N°	Description		Values	Standard	Modification
tC01	System type		HEAt COOL	HEAt COOL	
tC02	Restart temperature	(°C)		10	
tC03	System dynamic			3	
tC04	Temperature PID (proportional gain)			3000	
tC05	Temperature PID (integral time constant)			400	
tC06	Temperature PID (derivative time constant)			1000	
tC07	Set-point time limit	(s)		60	

Parameter CF – Constant flow rate settings

N°	Description		Values	Standard	Modification
CF01	Flow rate PID (proportional gain)			3000	
CF02	Flow rate PID (integral time constant)			400	
CF03	Flow rate PID (derivative time constant)			1000	
CF04	Dry-run detection percentage	(%)		95	
CF05	Dry-run time limit	(s)		60	

Parameter MAn – Fixed speed pump settings

N°	Description		Values	Standard	Modification
MAn1	Primary fixed speed operating frequency	(Hz)		45	
MAn2	Secondary fixed speed operating frequency	(Hz)		45	
MAn3	Remote control activation		On, OFF	Off	
MAn4	Minimum value for remote control	(Hz)		30	

Alarms

Code	Description	Causes
Er01	Blockage due to no water; Failed to reach set-point.	No water in the suction tank. The system stops and restarts itself automatically: - One attempt every 10 minutes for 6 times - One attempt every hour for 24 times - One attempt every 24 hours for 30 times
Er02	Primary pressure transducer fault	Cable not connected, broken connection, transducer faulty.
Er03	Secondary pressure transducer fault	Cable not connected, broken connection, transducer faulty.
Er04	Blockage due to low supply voltage	Supply voltage lower than 330V - The system automatically restart when the clamp voltage is higher than 345V.
Er05	Blockage due to high rectified supply voltage	Supply voltage higher than 520V - The system automatically restart when the clamp voltage is lower than 520V.
Er06	Blockage due to overcurrent in the electro pump motor	
Er07	Blockage due to unbalanced output phases	
Er08	Blockage due to direct short circuit between the phases of output terminals	
Er09	Blockage due to missing output phases	
Er10	Blockage due to internal overheating	
Er11	Blockage due to overheating of the power module	
Er12	Blockage due to exceeded of number of starts	
Er13	Blockage due to missing/wrong setting of main parameters	
Er14	Blockage due to float switch 1 intervention	The system will restart after a time, defined in parameter AP41, from the state variation of the float switch.
Er15	Blockage due to float switch 2 intervention	The system will restart after a time, defined in parameter AP43, from the state variation of the float switch.
Er16	Internal Hardware error	Contact technical assistance.
Er17	Not implemented	
Er18	Cascade mode communication error	Check the RS485 connection.
Er19	Cascade expansion card failure	Cascade expansion card not connected or faulty.

Troubleshooting chart

Fault	Probable cause	Possible solution
Short-circuit	- Motor or cable short-circuit - Wrong power supply connection - Wrong connection of the cable shield	- Check motor connections - Check power supply voltage
Frequency converter overheating	- Ambient temperature too high - One or more frequency converter fans faulty	- Check the condition of installation (see section 3.1) - Change the defective fans
Low supply voltage	- Supply voltage lower than 330V	- Check the supply line
High supply voltage	- Supply voltage higher than 520V	- Check the supply line
Overcurrent	- Step up/down ramp too high - Improper connection of the motor - Wrong motor settings	- Increase the time of the ramps (see section 16.2) - Check the parameters of the motor (see section 16.1) - Check the frequency converter settings and motor data (see - section 16.1)
Electronic card overheating	Electronic card overheating	- Check the condition of installation (see section 3.1) - Reduce the carrier frequency
Dry-run	The pump is running with no water	- Check the suction and delivery manifold and the priming - conditions - Check the performances curves of the pump

1) For electrical reparation, disconnect the supply voltage from the frequency converter. Refer to the safety regulation described in section 4.

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