VR COMPACT BOOSTER SET



Operation & Maintenance Manual



Table of Contents

Important Health & Safety Information	3
1.1 Document Conventions	4
1.2 Health and Safety Information	6
1.3 Operating Limits for Standard Dutypoint Systems Pumpsets	10
2. System Information, Installation and Commissioning	
2.1 VR2 Booster Set Components	12
2.2 Low Level Float Switch Wiring Details	13
2.3 VR Control Panel	14
2.4 HAND/OFF/AUTO Switch Operation	22
2.4 Installation and Commissioning VR Booster Sets	23
3. User Maintenance and Troubleshooting	29
3.1 Routine User Maintenance	
3.2 Troubleshooting - Hydrovar-Equipped Pump Sets	
Appendix	36
Ap1. Lowara e-SV Manual	37
Ap2. Hydrovar Manual	



Important Health & Safety Information



1.1 Document Conventions

Throughout this manual, text may be accompanied by one of the following icons. Where these occur the conventions shown below are applied.

In general these conventions will also apply to OEM Manufacture's manuals that are included within this User Guide, however variations may occur, but these will be redefined at the beginning of their manual.

PLEASE READ THE FOLLOWING INFORMATION WHICH IS PROVIDED FOR YOUR SAFETY

Danger: Denotes attention to the possibility of the risk of personal injury or damage to adjacent property if the information is ignored.



Electric Shock: Denotes attention to the possibility of life-threatening electric shock if the information is ignored.



Warning: Denotes attention to a condition that may result in underperformance or damage to the equipment if the information is ignored.





Note: Denotes attention to an important factor applicable to the action being performed.





1.2 Health and Safety Information

Basic safety warnings relating to all products.

United Kingdom Health & Safety at Work Act 1974

Dutypoint Responsibility



Section 6(a) of this Act requires manufacturers to advise their customers on the safety and the handling precautions to be observed when installing, operating, maintaining and servicing their products. The user's attention is therefore drawn to the following:

- The appropriate sections of this manual must be read before working on the equipment.
- Installation, operating and maintenance must only be carried out by suitably trained/qualified personnel.
- Normal safety precautions must be taken and appropriate procedures observed to avoid accidents.

Refer to DUTYPOINT SYSTEMS for any technical advice or product information.

Customer / Contractor Responsibility



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/clothing.
- Is aware of appropriate health & safety warnings
- has read the information in this section of the manual.



Hand Control Mode



In the 'HAND' position the pump(s) controlled by the switch will normally run at full speed and completely independently of any control devices, and can result in pump(s) running against a closed valve head if there is no draw.

This can cause the system to be maintained at the maximum pressure produced by the pump plus any incoming pressure and additional pressure caused by water surge and can potentially damage the pump and other parts of the system.

The 'HAND' option should only be used with a competent operator in attendance, or when there is a continued demand sufficient to p ovide constant flow th ough the pumps to maintain the running pressure of the system to an acceptable level.

Pump Servicing



- Familiarise yourself with the relevant contents of this manual
- Installation, maintenance and repair work must only be carried out by trained, skilled and suitably qualified personnel.
- Disconnect or lock-out the power source to ensure that the pump(s) will remain inoperative. Locking out the equipment by switching off the release mechanism or set value WILL NOT prevent accidental starting of the motor.
- Allow the pump(s) to cool if over-heated.
- **CLOSE** the isolating valves on the suction and discharge connections of the affected pump(s).
- **VENT** the pump(s) slowly and cautiously *Refer to the relevant section of this manual.*
- **DRAIN** the pump(s).



High Voltages



Especially applicable when Variable Speed Controllers (Inverters) are fitted.

• When the inverter variable speed drive head is connected to the power supply the components of the power unit – as well as certain components of the master control unit – are also connected to the power supply.

TOUCHING THESE COMPONENTS CAN SERIOUSLY ENDANGER LIFE!

• Before removing the frequency inverter cover, the system must be disconnected from the power supply. After switching off the power supply **wait at least 5 minutes** before starting work on or in the inverter drive head – the capacitors in the intermediate circuit must be given time to discharge completely via the discharge resistors.

Up to 800 volts can be present – if there are faults this can be higher.

• All work carried out when the frequency inverter is open must be performed only by suitably qualified and properly authorised personnel.

When connecting external control wires care must be taken not to short circuit adjacent components. Bare cable ends which are not in use must be insulated.

THE SYSTEM MUST ONLY BE OPERATED WHEN IT HAS BEEN CORRECTLY EARTHED AND PIPES BONDED TO EARTH IN ACCORDANCE WITH IEE REGULATIONS

Electronic Safety Devices



- High voltage tests of the inverter or the motor may damage the electronic components. **Bridge before the incoming/outgoing terminals L-L2-L3 and U-V-W.**
- To avoid incorrect metering by capacitors incorporated in the electronic circuits, isolate the motor from the inverter drive head.



High voltage testing may damage electronic components



- High voltage tests of the inverter or the motor may damage the electronic components. Bridge before the incoming/outgoing terminals L-L2-L3 and U-V-W.
- To avoid incorrect metering by capacitors incorporated in the electronic circuits, isolate the motor from the inverter drive head.



1.3 Operating Limits for Standard Dutypoint Systems Pumpsets

Table showing standard operating limits which apply to cold water booster sets.

Table showing standard operating limits

Type of pumped liquids	Water with no gas or aggressive substances
Maximum pumped liquids temperature	+35°C domestic uses. (EN 60335-2-41). 40°C for other purposes
Minimum pumped liquid temperature	1°C to avoid icing
Operating ambient temperature	+5°C to 40°C for indoor installation. (CEI EN 60439-1).
Relative humidity	Max 50% at 40°C.
Air impurities	The air must be clean and free of acid vapours, corrosive gases and excessive amounts of dust.
Storage temperature	+5°C to 50°C.
Suction conditions	Minimum positive pressure 0.1 Bar. Maximum positive pressure 0.5 Bar



2. System Information, Installation and Commissioning



2.1 VR Booster Set Components

VR Components





2.2 Low Level Float Switch Wiring Details

This section contains details on how to wire the low level float switch

Introduction

Terminal 1 and 3 require a normally closed contact in order to allow the pumpset to operate. To facilitate this the unit will be supplied with a wire loop between 1 and 2.

To install a low level float switch this look has to be removed and the float switch wired to operate as an open on fail scenario.

If 2 or more float switches are required (due to twin compartment or multiple tanks) all float switches are wired into terminals 1 and 2 in parallel.

Terminal Wiring

1 2	2	1	3	1	4
] FAIL	L ED SIG	NAL FR	2 ROM

If installing a Dutypoint FS Series float switch the following terminals should be used:

BROWN: Terminal 1

BLACK: Terminal 2

BLUE: Not used - terminate safely



2.3 VR Control Panel

The Control Panel used with two or three pumps provides external user control, internal protection and fault monitoring circuitry.

VR2 Control Panel Layout





VR3 Control Panel Layout



External Features

Externally the panel provides:

- An overall System (Main) Isolator (single phase or 3 phase as appropriate).
- A separate Isolator for each inverter Controller, used to independently switch each controller and its pump on/off.
- A white Indicator Light to show Power On status
- An amber Indicator Light to show a Fault Condition warning.

Internal Features

The internal circuitry provides the following protection and monitoring:

- Power Feed via **D Type Rated** Magnetic Circuit Breakers (MCBs) giving overload current protection for each inverter/pump.
- A Low Water Detection Relay triggered by the system Low Level Float Switch. This sets the Fault Indicator on the front of the panel and sends a control signal to each inverter Controller.



- Inverter Failure Relays triggered by the failure signal from the individual inverter Units. This also sets the Fault Indicator on the front of the panel.
- A system "Volt Free" (0v) alarm line link which is broken in the event of any failure.
- A routing to connect the RS485 link between the inverter Controllers to allow them to fully interact with each other.
- A transformered 24V supply for the protection and indicator circuitry.

Two Pump - Single Phase Control Panel Wiring Diagram













VR3 - Single Phase Control Panel Wiring Diagram

















2.4 HAND/OFF/AUTO Switch Operation

It is important that the function of the HAND/OFF/AUTO switch is understood:

Hand	Off	Auto
When this is selected the pump(s) controlled by the switch will normally run at FULL SPEED and be independent of any control devices. This means that the pump(s) will run against a closed valve head if there is no draw. This can cause the system to be maintained at the maximum pressure produced by the pump plus any incoming pressure and additional pressure caused by water surge, and therefore potential damage can occur to the pump and other parts of the system when the 'HAND' option is selected.	When selected the pump(s) controlled by the switch will not run.	This is the normal operational setting allowing the pump to be controlled by the relevant sensing devices.

Warning



This option should ONLY BE USED where a competent operator is in attendance, or when there is a continuous demand sufficient to p ovide a constant flow th ough the pumps to reduce the running pressure of the system to an acceptable level.



2.4 Installation and Commissioning VR Booster Sets

- 1. Installation and pre-commissioning checks
- 2. Pressure vessel pre-charging
- 3. Venting pumps
- 4. Programming the controller
- 5. Operational and performance tests
- 6. Commissioning/handover check

Installation and Commissioning Overview

Before shipment, all *Dutypoint* pumpsets are pre-commissioned. Whilst important procedures such as venting and rotational direction checks need to be carried out on site, initial parameters including pressure settings and delay timers will be adjusted to suit the site conditions previously advised to *Dutypoint*.

In practice, a system can almost invariably be made to perform more efficiently if further re-commissioning is carried out on site.

Please note that engineer visits by *Dutypoint* are priced at one visit to commission one pump set. If there are multiple units on a site, special terms can be negotiated. To arrange a commissioning visit, please call the Technical Service Help line 01452 300590.

1. Installation and Pre-Commissioning Checks

The following checks should be carried out at the initial installation on site **BEFORE** any run tests are carried out.

Warning



Ensure that you have read and understood the SAFETY section at the front of this manual before proceeding.

Pipework and mechanical components

1. Ensure that the mounting area and any associated groundwork provides adequate support for the pumpset.



- 2. Ensure all supports/brackets are in place and secure.
- 3. Verify all pipe joints are sealed and tight.

Electrical



These checks MUST be carried out by a competent electricial. Ensure that the power source is sufficient t allow the running of two WARNING (twin pump sets) or three (triple pump sets) pumps together. (Refer to Section 2 of this manual).

- 1. Check the motor voltage and frequency information on all the motor nameplates and on controllers etc. correspond with that of the source power supply.
- 2. Check that all electrical connections are correctly made and secure. Pay particular attention to Earth and bonding connections.
- 3. Carry out specific checks for Earth bonding.
- 4. Carry out NICEIC certification checks as required for the installation, *e.g Earth Loop Impedance, Insulation Tests, etc.*
- 5. Carry out any other pre-start checks recommended by the pump manufacturer. Refer to the pump manual in Appendix A of this manual. **DO NOT POWER UP AT THIS STAGE.**

Final checks before commissioning

- 1. Re-check all equipment for any accidental damage caused during installation.
- 2. Carry out the Precharging and Venting procedures described next.



2. Pressure Vessel Precharging



Before commissioning starts the precharge of the pressure vessels should be checked.

On variable speed systems the precharge air pressure for vessels should be 90% of the maximum pressure generated by the pump in the pipework system

e.g: If the max. pressure generated by the pump in a system is 6 bar. This will require a pre-charge pressure of 6 × 90% = 5.4 bar.

Refer to the above table.

To verify the precharge pressure:

- 1. First check that the expansion or pressure vessel(s) are totally drained of water, and that the system is switched off and no electrical parts are live.
- 2. Locate the charging valve on each vessel, accessed by removing the plastic cover on the top of the vessel.
- 3. Connect a portable pressure gauge with a measuring range compatible with the expected pressures in your application, which has a flexible hose and Schrader- type connector to the charging valve.
- 4. Check the pre-charge pressure above the diaphragm in each pressure vessel [*Accumulator*]. correspond to criteria given in the text above.
- 5. If necessary, release or add additional air to correct.

3. Venting Pumps

It is important to bleed all air from the pump body before initial start-up.

Procedure for flooded su tion

Flooded Suction is defined as the condition where there is positive pressure on the suction (inlet) side of the pump(s) as is the case where the storage tank water level is at the same or higher level than the pump bleed point.



This procedure should be carried out individually for each pump in the Pumpset.

- 1. This procedure should be carried out individually for each pump in the Pumpset.
- 2. Open all valves on the suction (inlet) side of the pump.
- 3. Using the vent screw at the top of the pump (refer to Appendix A to locate), allow any air in the pump body and suction pipework to vent to atmosphere.
- 4. When water (under pressure from the storage tank feeding the pump on the suction side) escapes through the vent screw hole and no more air bubbles can be seen close the vent screw.
- 5. Switch on the electrical supply to the pump motor and start the pump in AUTO mode. As each motor starts verify that the direction of rotation correctly corresponds with the direction of the arrow shown on the body of the pump. If rotation is backward STOP, switch off the pump and investigate.
- 6. Slowly open the valve on the discharge manifold outlet to the system allowing water to be pumped into the system.
- 7. Switch off, re-close the discharge valve and repeat steps 3 to 6 several times to ensure that all air is released from the pump body and local pipework.
- 8. The above procedure should be carried out individually for each pump in the Pumpset.

Procedure for lift suction



Lift Suction is defined where the water storage tank is at a lower level than the pumpset. In this case a negative pressure condition may exist at the pump suction.

WARNING: The "Lift Suction" mode of operation required specific venting p ocedures. Please call Dutypoint Systems Technical Support on +44 (0)1452 300592 for advice before attempting to vent the pump(s).

The advised procedure should then be carried out individually for each pump in the pumpset.

4. Programming the Controller

Dutypoint Systems fit a design of Inverter/Controller that is most suitable for the design duty of the Pumpset.

Section 2 of this manual details the type of controller used in the various models, and manufacturer's information for them is detailed in the Appendices to this manual.

Carefully follow the appropriate step-by-step setting-up procedures contained in the manual, ensuring that any data required to be entered by the end user is accurately inserted where requested.

If in doubt please call Dutypoint Systems Technical Support on 01452 300592 for advice.



5. Operational and Performance Tests

Having checked that the Pumpset is installed, precharged, vented in accordance with the procedures set out earlier, carry out the following running tests before handing over the Pumpset for operational use.

- 1. Run each pump by selecting HAND (Manual) control.
- 2. Re-select to AUTO mode.
- 3. Create the conditions for a normal start and run and allow the selected 'Duty' pump to run. Whilst running observe the pressure values. Verify the pump motor speeds up / slows down in accordance with the desired control philosophy.

Duty/Standby Sets

- On Duty/Standby sets, wait for a normal stop to take place (or create the conditions where this would happen) and check that the 'Duty' pump stops. Whilst stopped simulate a fault by inhibiting the 'Duty' pump and then recreate the conditions for a normal start to take place. Check that the 'Standby' Pump now starts and runs in place of the inhibited 'Duty' pump and observe the pressure values. Verify that the pump motor speeds up / slows down in accordance with the desired control philosophy.
- 2. Wait for a normal stop to take place (or create the conditions where this would happen) and check the 'Standby' pump stops. Whilst stopped undo the inhibit to the 'Duty' pump which should now return to normal.

Duty/Assist Sets

- 1. For 'Duty/Assist' applications, run the system up to pressure using the 'Duty' Pump only, then deliberately create the condition(s) which will require the 'Assist' Pump to operate as well. (e.g. open taps to reduce the pressure in the system to a point where one pump only cannot maintain the required output. Verify that the 'Assist' Pump starts and runs together with the 'Duty' Pump and that the desired pressure is duly restored and maintained.
- 2. Close the taps again (thereby reducing the demand) and check the 'Assist' Pump slows down and stops, allowing the 'Duty' Pump to continue on its own.

6. Commissioning/Handover Check

- 1. Record any indicated voltage / amperage / pressure data / controller passwords for future reference.
- 2. Re-check all isolating valves are fully open and replace any cover(s).

With all the isolators ON and the switches and/or control programs set to AUTO, the pumpset is now fully operational in automatic control mode.



Note



No manual operation or attendance is required other than for routine servicing and maintenance checks.

Other than for maintenance purposes, the supply to the Controller(s) and the Pump motor(s) should never be switched off



3. User Maintenance and Troubleshooting



3.1 Routine User Maintenance

Dutypoint Pumpsets have been designed to keep major maintenance requirements to a minimum. Planned maintenance of the pumps and other principal components should therefore be undertaken at the intervals recommended in the manuals referenced below.

It is essential that a full test following the Pre-Commissioning procedure on page 42 is carried out on an annual basis.

In addition, the operator in charge should routinely make visual checks of the equipment during use, noting particularly any unusual noises or vibrations. This will give an immediate indication of any irregularity in the operation of the system.

DANGER



Do not commence any maintenance work until:

- 1. YOU HAVE READ THE SAFETY SECTION AT THE BEGINNING OF THIS MANUAL
- 2. YOU ARE DRESSED IN THE CORRECT PROTECTIVE CLOTHING
- 3. YOU HAVE ALL NECESSARY SAFETY EQUIPMENT TO HAND

Refer to the appropriate manufacturer's information that is provided in the appendices of this manual for the equipment being serviced.

Periodic user checks:

Recommended weekly user checks

- 1. Visually check the complete pumpsets system.
- 2. Observe the running of the pump(s) and note any unusual vibration, etc.

Recommended quarterly user checks

- 1. Visually check the complete pumpsets system
- 2. Observe the running of the pump(s) and note any unusual vibration, etc.
- 3. Check the cooling fan and vents on the Control Unit(s) and clear any dust or other obstructions
- 4. Operate each manual isolating valve three times to ensure continued efficient working



Recommended 6 monthly user checks

The pressure vessel should be drained and the pre-charge pressure checked. Refer to section XXXXX for details.

Essential 12 monthly (maximum interval) service

Carry out the full Pre-Commissioning procedure to verify correct safe operation. Refer to section XXXXXX for details.

Detailed Pump Maintenance

Please refer to the manufacturer's document.

Detailed Controller Maintenance

Please refer to the appropriate manufacturer's document.

Detailed Accessory Maintenance

If you have purchased additional accessories for your system, please refer to the appropriate manufacture's document supplied.



3.2 Troubleshooting - Hydrovar-Equipped Pump Sets

The information in this section is common to all Hydrovar-equipped Dutypoint pumpsets. For more detailed troubleshooting information that is specific to the type and model of pump and controller used in this product, please refer to the manufacturer's literature.

First step when a fault occurs:

When a fault first occurs, turn of the main power to the pumpset and leave off for around 1 minute. Switching power back on and re-energising the system may be sufficient to clear th fault.

Lack of Water Error 21

Possible cause(s)	Recommended action
Low water contact is opened	 Check incoming mains pressure is as expected The error will reset automatically when the low water contact is closed

Min. Threshold Error 22

Possible cause(s)	Recommended action
Minimum pressure requirement not reached within set period	 Turn off main electrical isolator Close discharge isolation valve Vent pumps Turn on main electrical isolator Check unit runs up to set pressure and pump motors shut down Open discharge vavle slowly ensuring set pressure is maintained

Pump will not start

Possible cause(s) Recommended action	
--------------------------------------	--



No electrical power	Check and rectify
Blown fuse	Check and rectify
Overload trip	Check and (if necessary) reset the overload trip value.

For control panel information refer to section 2.3 (twin pump models) or section 2.4 (triple pump models).

For pump and controller manufacturer's information refer to the appendices to this manual.

Low (or zero) output discharge rate

Possible cause(s)	Recommended action
The rotating part(s) of the pump is/are partially or completely obstructed e.g: impeller obstructed by foreign matter	Strip the pump to inspect and rectify
Pump not primed - WARNING: running the pump 'dry' can cause serious damage to the mechanical seal.	Having first checked the mechanical seal for damage, prime and air-bleed the pump and try again
Valve in suction pipework closed or partially closed.	Check all appropriate valves are fully open.
Incorrect pump rotation	Check and rectify.

For Pump and Controller manufacturer's information refer to the appendices to this manual.

Pump vibrates and/or is noisy

Possible cause(s)	Recommended action
Pump is cavitating	Increase the discharge back pressure slightly by progressively closing a manual isolating valve on the discharge side until the cavitation stops.



Motor bearings worn	Check and rectify
The rotating part(s) of the pump is(are) partially or completely obstructed. e.g: impeller obstructed by foreign matter.	Strip the pump to inspect and rectify

For pump and controller manufacturer's information refer to relevant manuals.

Pump runs continuously

Possible cause(s)	Recommended action
If the pump has a "Hand Control" option on it's control panel.	Switching to "Auto" should restore normal control. If normal control is not returned an immediate service visit is required.
Pump has no "Hand Control" option.	An immediate service visit is required.

Overload trip

Possible cause(s)	Recommended action
Pipework or the pump chamber has a partial blockage.	Check and rectify



Momentary loss of one phase of power supply.	Check and try again.
Discharge flow rate too high.	Reduce by the discharge flow rate by increasing the discharge back pressure slightly, progressively closing a manual isolating valve on the discharge side: then try again
Overload trip setting too low for rated duty	Check and (if necessary) reset the overload trip value

For pump and controller manufacturer's information refer to the relevant manual.

Appendix

- Ap 1. Lowara e-SV Pump O&M Manual
- Ap 2. Hydrovar O&M Manual




Apply the adhesive bar code nameplate here

Installation, Operation & Maintenance Manual

(English Pages extracted from original manual)

Contents

1.	1 · · ·	2
2.	u	3
3.	h)	3
4.	@	4
5.	# о	•
	\ [.] .0	6
6.	Maintenance	7
7.	Troubleshooting	7
8.	Technical Appendix	10



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1 Introduction and Safety

1.1 Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance

CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

1.1.1 Inexperienced users

This product is intended to be operated by qualified personnel only.

Be aware of the following precautions:

- Persons with diminished capacities should not operate the product unless they are supervised or have been properly trained by a professional.
- Children must be supervised to ensure that they do not play on or around the product.

1.2 Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product
- Product malfunction

Hazard levels

Hazard l	evel	Indication
	DANGER:	A hazardous situation which, if not avoided, will result in death or seri- ous injury
	WARNING:	A hazardous situation which, if not avoided, could result in death or seri- ous injury
	CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE	3:	 A potential situation which, if not avoided, could result in undesira- ble conditions A practice not related to personal
		injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:

WARNING:

These are examples of other categories that can occur. They fall under the ordinary hazard levels and may use complementing symbols:

- Crush hazard
- Cutting hazard
- Arc flash hazard

Hot surface hazard

Hot surface hazards are indicated by a specific symbol that replaces the typical hazard level symbols:



Description of user and installer symbols



Specific information for personnel in charge of installing the product in the system (plumbing and/or electrical aspects) or in charge of maintenance.

Specific information for users of the product.

Instructions

The instructions and warnings that are provided in this manual concern the standard version, as described in the sales document. Special version pumps may be supplied with supplementary instruction leaflets. Refer to sales contract for any modifications or special version characteristics. For instructions, situations, or events that is not considered in this manual or the sales document, contact the nearest Lowara Service Center.

1.3 Disposal of packaging and product

Observe the local regulations and codes in force regarding sorted waste disposal.

1.4 Warranty

For information about warranty, see the sales contract.

1.5 Spare parts



WARNING:

Only use original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the guarantee.

CAUTION:

Always specify the exact product type and part number when requesting technical information or spare parts from the Sales and Service Department.

For more information about the product's spare parts, see Figure 25, Figure 26, or Figure 27.

1.6 EC DECLARATION OF CONFORMITY (TRANSLATION)

LOWARA SRL UNIPERSONALE, WITH HEADQUARTERS IN VIA VITTORIO LOMBARDI 14 - 36075 MONTECCHIO MAGGIORE VI - ITALIA, HEREBY DECLARES THAT THE FOLLOWING PRODUCT:

ELECTRIC PUMP UNIT (SEE LABEL ON FIRST PAGE)

FULFILS THE RELEVANT PROVISIONS OF THE FOLLOWING EU-ROPEAN DIRECTIVES:

- MACHINERY DIRECTIVE: 2006/42/EC (THE TECHNICAL FILE IS AVAILABLE FROM LOWARA SRL UNIPERSONALE).
- ELECTROMAGNETIC COMPATIBILITY 2004/108/EC
- + ECO-DESIGN 2009/125/CE, REGULATION (EC) 640/2009 (3 \sim , 50 Hz, P_N^2 0,75 kW) IF IE2 or IE3 MARKED

AND THE FOLLOWING TECHNICAL STANDARDS

- EN 809, EN 60335-1, EN 60335-2-41, EN 62233
- EN 61000-6-1:2007, EN 61000-6-3:2007
- EN 60034-30

PUMP (SEE LABEL ON THE FIRST PAGE)

FULFILS THE RELEVANT PROVISIONS OF THE FOLLOWING EUROPEAN DIRECTIVES:

 MACHINERY 2006/42/EC (THE TECHNICAL FILE IS AVAILA-BLE FROM LOWARA SRL UNIPERSONALE).

AND OF THE FOLLOWING TECHNICAL STANDARDS:

• EN 809

MONTECCHIO MAGGIORE, 16.06.2011

AMEDEO VALENTE

(DIRECTOR OF ENGINEERING AND R&D)

rev.01

Lowara is a trademark of Lowara srl Unipersonale, subsidiary of Xylem Inc.

2 Transportation and Storage

2.1 Inspect the delivery

- 1. Check the outside of the package for evident signs of damage.
- 2. Notify our distributor within eight days of the delivery date, if the product bears visible signs of damage.

Unpack the unit

- 1. Follow applicable step:
 - If the unit is packed in a carton, remove the staples and open the carton.
 - If the unit is packed in a wooden crate, open the cover while paying attention to the nails and straps.
- 2. Remove the securing screws or the straps from the wooden base.

Inspect the unit

- 1. Remove packing materials from the product.
- Dispose of all packing materials in accordance with local regulations.
- 2. Inspect the product to determine if any parts have been damaged or are missing.
- 3. If applicable, unfasten the product by removing any screws, bolts, or straps.
- For your personal safety, be careful when you handle nails and straps.4. Contact your Sales and Service Department if anything is out of order.

2.2 Transportation guidelines

Precautions



WARNING:

- Observe accident prevention regulations in force.Crush hazard. The unit and the components can be heavy
- Use proper lifting methods and wear steel-toed shoes at all times.

Check the gross weight that is indicated on the package in order to select proper lifting equipment.

Position and fastening

The unit can be transported either horizontally or vertically. Make sure that the unit is securely fastened during transportation, and cannot roll or fall over.



WARNING:

Do not use eyebolts screwed on the motor for handling the whole electric pump unit.

- Use straps surrounding the motor if the power of the motor is between 0.25 kW and 4.0 kW.
- Use ropes or straps that are linked to the two flanges (eye bolts if provided) located near the mating zone between the motor and pump, if the power of the motor is between 5.5 kW and 55.0 kW.
- Eyebolts screwed onto the motor may be exclusively used to handle the individual motor or, in case of a not balanced distribution of weights, to partially lift the unit vertically starting from a horizontal displacement.
- To move the pump unit only, use straps firmly linked to the motor adapter.

For more information about how to securely harness the unit, see Figure 4.

Unit without motor

If the unit is not delivered with a motor, the calibrated fork-shaped shim is already inserted between the adapter and the transmission coupling. The shim is inserted to keep the impeller stack in the correct axial position. In order to prevent damage during transportation the shaft is also held into place with expanded polystyrene and plastic straps.

The bolt and nuts used to fasten the motor are not included. For more information about how to couple the motor, see *Figure 23*.

WARNING:



A pump and motor that are purchased separately and then coupled together results in a new machine under the Machinery directive 2006/42/EC. The person making the coupling is responsible for all safety aspects of the combined unit.

2.3 Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE

- Protect the product against humidity, heat sources, and mechanical damage.
- Do not place heavy weights on the packed product.

Ambient temperature

The product must be stored at an ambient temperature from -5°C to +40°C (23°F to 104°F).

3 Product Description

3.1 Pump design

This is a vertical, multistage, non-self priming pump, which can be coupled to standard electric motors. The pump can be used to pump:

- Cold water
- Warm water

The metallic parts of the pump that come in contact with water are made of the following:

Series	Material
1, 3, 5, 10, 15, 22	Stainless steel
33, 46, 66, 92, 125	Stainless steel and cast iron A special version is available where all parts are made of stainless steel.

The SV pumps 1, 3, 5, 10, 15, and 22 are available in different versions according to the position of the suction and delivery ports and the shape of the connection flange.

The product can be supplied as a pump unit (pump and electric motor) or only as a pump.

NOTICE:

If you have purchased a pump without motor, make sure that the motor is suitable for coupling to the pump.

Mechanical seal

Series	Basic characteristics
1, 3, 5	Nominal diameter 12 mm (0.47 in.), unbalanced, right hand rotation, K version (EN 12756)
10, 15, 22	Nominal diameter 16 mm (0.63 in.), unbalanced, right hand rotation, K version (EN 12756) Balanced with motor power \geq 5 kW
33, 46, 66, 92, 125	Nominal diameter 22 mm (0.86 in.), balanced, right hand ro- tation, K version (EN 12756)

Intended use

The pump is suitable for:

- Civil and industrial water distribution systems
- Irrigation (for example, agriculture and sporting facilities)
- Water treatment
- Boiler feed
- Washing plants
- Cooling (for example, air conditioning and refrigeration)
- Fire fighting applications



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Improper use

Improper use of the pump may create dangerous conditions and cause personal injury and damage to property.

An improper use of the product leads to the loss of the warranty.

Examples of improper use:

- Liquids not compatible with the pump construction materials
- Hazardous liquids (such as toxic, explosive, flammable, or corrosive liquids)
- Potable liquids other than water (for example, wine or milk)
- Examples of improper installation:
- · Hazardous locations (such as explosive, or corrosive atmospheres).
- Location where the air temperature is very high or there is poor ventilation.
- Outdoor installations where there is no protection against rain or freezing temperatures.



Do not use this pump to handle flammable and/or explosive liquids.

NOTICE:

- Do not use this pump to handle liquids containing abrasive, solid, or fibrous substances.
- Do not use the pump for flow rates beyond the specified flow rates on the data plate.

Special applications

Contact the Sales and Service Department in the following cases:

- If the density and/or viscosity value of the pumped liquid exceeds the value of water, such as water with glycol; as it may require a more powerful motor.
- If the pumped liquid is chemically treated (for example softened, deionized, demineralized etc.).
- If the pump will be installed horizontally, a special version and mounting brackets must be requested.
- Any situation that is different from the ones that is described and relate to the nature of the liquid.

3.2 Application limits

Maximum working pressure

This flow chart shows the maximum working pressure depending on the pump model and the temperature of the pumped liquid.

	p(bor)
	45 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -
	40
	35
	30 PN 40
	25
	20 PN 25
	5
05917_C_SC	-40 -20 0 20 40 60 80 100 120 140 t("C)

The following formula is valid for motors that are provided with the driveend bearing axially locked (such as the Lowara standard motors for e-SV), see *Figure 6*. For other situations, contact the Sales and Service Department.

 $P_{1max} + P_{max} \le PN$

P _{1max}	Maximum inlet pressure
-------------------	------------------------

- **P**_{max} Maximum pressure generated by the pump
- **PN** Maximum operating pressure

Liquid temperature intervals

Version	Gasket	Minimum	Maximum ⁵	Maximum
Standard	EPDM	-30°C (-22°F)	90°C (194°F)	120°C (248°F)
Special	FPM (FKM)	-10°C (14°F)	90°C (194°F)	120°C ⁶ (248°F)
Special	PTFE	0°C (32°F)	90°C (194°F)	120°C (248°F)

For special requirements, contact the Sales and Service Department.

Maximum number of starts per hour

This table shows the number of starts allowed per hour for motors supplied by Lowara:

kW	0.25 - 3.00	4.00 - 7.50	11.0 - 15.0	18.5 - 22.0	30.0 - 37.0	45.0	55.0
Starts per hour	60	40	30	24	16	8	4

NOTICE:

If you use a different motor from the standard one supplied with the electric-pump, check the relevant instructions to find out the permitted number of starts per hour.

3.3 Data plate

The data plate is a metal label that is located on the adaptor. The data plate lists key product specifications. For more information, see *Figure 1*.

The data plate provides information regarding the material of the gasket and the mechanical seal. For information about how to interpret the code on the data plate, see *Figure 2*.

Product denomination

See Figure 3 for an explanation of the identification code for the pump and for an example.

WRAS label - Installation Requirements and Notes (for UK market only)

A WRAS label on the pump means it is a Water Regulations Advisory Scheme approved product. This product is suited to be used with cold potable water for human consumption. For more information, refer to IRNs R001 and R420 in the WRAS Water Fittings and Materials Directory (www.wras.co.uk).

IMQ or TUV or IRAM or other marks (for electric pump only)

Unless otherwise specified, for products with a mark of electrical-related safety approval, the approval refers exclusively to the electrical pump.

4 Installation

Precautions

WARNING:

- Observe accident prevention regulations in force.
- Use suitable equipment and protection.
- Always refer to the local and/or national regulations, legislation, and codes in force regarding the selection of the installation site, and water and power connections.



WARNING:

- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.
- Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.

⁵ EN 60335-2-41 is the norm about electric-related safety pumps for household and similar applications

⁶ Maximum 100°C for water

4.1 Earthing grounding

WARNING:

- Always connect the external protection conductor to earth (ground) terminal before making other electrical connections.
- You must earth (ground) all electrical equipment. This applies to the pump equipment, the driver, and any monitoring equipment. Test the earth (ground) lead to verify that it is connected correctly.
- If the motor cable is jerked loose by mistake, the earth (ground) conductor should be the last conductor to come loose from its terminal. Make sure that the earth (ground) conductor is longer than the phase conductors. This applies to both ends of the motor cable.
- Add additional protection against lethal shock. Install a highsensitivity differential switch (30 mA) [residual current device RCD].

4.2 Facility requirements

4.2.1 Pump location



DANGER:

Do not use this pump in environments that may contain flammable/explosive or chemically aggressive gasses or powders.

Guidelines

Observe the following guidelines regarding the location of the product:

- Make sure that no obstructions hinder the normal flow of the cooling air that is delivered by the motor fan.
- Make sure that the installation area is protected from any fluid leaks, or flooding.
- If possible, place the pump slightly higher than the floor level.
- The ambient temperature must be between 0°C (+32°F) and +40°C (+104°F).
- The relative humidity of the ambient air must be less than 50% at +40°C (+104°F).
- · Contact the Sales and Service Department if:
- The relative air humidity conditions exceed the guidelines.
- The room temperature exceeds +40°C (+104°F).
- The unit is located more than 1000 m (3000 ft) above the sea level. The motor performance may need to be de-rated or replaced with a more powerful motor.

For information about which value to de-rate the motor with, see Table 8.

Pump positions and clearance

NOTICE:

Horizontal mounting of the pump requires special adaptation.

Provide adequate light and clearance around the pump. Make sure that it is easily accessible for installation and maintenance operations.

Installation above liquid source (suction lift)

The theoretical maximum suction height of any pump is 10.33m. In practice, the following affect the suction capacity of the pump:

- Temperature of the liquid
- Elevation above the sea level (in an open system)
- System pressure (in a closed system)
- · Resistance of the pipes
- Own intrinsic flow resistance of the pump
- Height differences

The following equation is used to calculate the maximum height above the liquid level which the pump can be installed:

 $(p_b*10.2 - Z) \ge NPSH + H_f + H_v + 0.5$

- **p**_b Barometric pressure in bar (in closed system is system pressure)
- NPSH Value in meter of the pump intrinsic flow resistance
- $\mathbf{H}_{\mathbf{f}}$ Total losses in meters caused by passage of liquid in the suction pipe of the pump
- $\mathbf{H}_{\mathbf{v}}$ Steam pressure in meters that correspond to the temperature of the liquid T $^{\circ}$ C
- 0.5 Recommended safety margin (m)

Z Maximum height at which the pump can be installed (m)

For more information, see Figure 7.

(pb*10.2 - Z) must always be a positive number.

For more information about the performance, see Figure 5.

NOTICE:

Do not exceed the pumps suction capacity as this could cause cavitation and damage the pump.

4.2.2 Piping requirements

Precautions



- Use pipes suited to the maximum working pressure of the pump. Failure to do so can cause the system to rupture, with the risk of injury.
- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.

NOTICE:

Observe all regulations issued by the municipal authorities if the pump is connected to the municipal water system. If required by the authorities, install appropriate backflow-prevention device on the suction side.

Suction and discharge piping checklist

Check that the following requirements are met:

- All piping is independently supported, piping must not place a burden on the unit.
- Flexible pipes or unions are used, in order to avoid transmission of pump vibrations to the pipes and vice versa.
- Use wide bends, avoid using elbows which cause excessive flow resistance.
- The suction piping is perfectly sealed and airtight.
- If the pump is used in an open circuit, then the diameter of the suction pipe is suited to the installation conditions. The suction pipe must not be smaller than the diameter of the suction port.
- If the suction piping must be larger than the suction side of the pump, then an eccentric pipe reducer is installed.
- If the pump is placed above liquid level, a foot valve is installed at the end of the suction piping.
- The foot valve is fully immersed into the liquid so that air cannot enter through the suction vortex, when the liquid is at the minimum level and the pump is installed above the liquid source.
- Appropriately sized on-off valves are installed on the suction piping and on the delivery piping (downstream to the check valve) for regulation of the pump capacity, for pump inspection, and for maintenance.
- In order to prevent back flow into the pump when pump is turned off a check valve is installed on the delivery piping.

WARNING:

Do not use the on-off valve on the discharge side in the closed position in order to throttle the pump for more than a few seconds. If the pump must operate with the discharge side closed for more than a few seconds, a bypass circuit must be installed to prevent overheating of the water inside the pump.

For illustrations that show the piping requirements, see Figure 12.

4.3 Electrical requirements

- The local regulations in force overrule these specified requirements.
- In the case of fire fighting systems (hydrants and/or sprinklers), check the local regulations in force.

Electrical connection checklist

- Check that the following requirements are met:
- The electrical leads are protected from high temperature, vibrations, and collisions.
- The power supply line is provided with:
 - A short-circuit protection device
 - A high-sensitivity differential switch (30 mA) [residual current device RCD] to provide additional protection against electric shock
 - · A mains isolator switch with a contact gap of at least 3 mm

The electrical control panel checklist

NOTICE:

The control panel must match the ratings of the electric pump. Improper combinations could fail to guarantee the protection of the motor.

Check that the following requirements are met:

- The control panel must protect the motor against overload and short-circuit.
- Install the correct overload protection (thermal relay or motor protector). Pump Type Protection

/ F -	
Single phase standard electric pump ≤ 1,5 kW	 Built-in automatic reset thermal- amperometric protection (motor protector) Short circuit protection (must be supplied by the installer)⁷
Three phase electric pump and other single phase pumps ⁸	 Thermal protection (must be supplied by the installer)
	 Short circuit protection (must be supplied by the installer)

The control panel must be equipped with a dry-running protection sys tem to which a pressure switch, float switch, probes, or other suitable device is connected.

- The following devices are recommended for use on the suction side of the pump:
- When the water is pumped from a water system, use a pressure switch. When the water is pumped from a storage tank or reservoir, use a float
- switch or probes. When thermal relays are used, relays that are sensitive to phase failure are
- recommended.

The motor checklist

WARNING:

- Read the operating instructions in order to ensure whether a protection device is provided if another motor other than the standard is used.
- If the motor is equipped with automatic thermal protectors, be aware of the risk of unexpected starts in connection to overload. Do not use such motors for fire-fighting applications and sprinkler systems.

NOTICE:

- Only use dynamically balanced motors with a half-sized key in the shaft extension (IEC 60034-14) and with normal vibration rate (N)
- The mains voltage and frequency must agree with the specifications on the data plate.
- Only use single-phase or three-phase motors whose size and power comply with the European standards

In general, motors can operate under the following mains voltage tolerances:

Frequency Hz	Phase ~	UN [V] ± %
50	1	$220 - 240 \pm 6$
	3	$230/400 \pm 10$
		$400/690 \pm 10$
60	1	$220 - 230 \pm 6$
	3	$220/380 \pm 5$
		$380/660 \pm 10$

Use cable according to rules with 3 leads (2+earth/ground) for single phase versions and with 4 leads (3+earth/ground) for three phase version.

Electric pump with motor:

Туре	Cable gland Outer cable diame	ter range in mm	
	M20 x 1.5, 6–12	M25 x 1.5, 13–18	M32 x 1.5, 18–25
SM	Х	-	-
PLM	Х	Х	Х
LLM	X	Х	Х

4.4 Install the pump

4.4.1 Mechanical installation

For information about the pump base and anchor holes, see Figure 13.

- Put the pump onto the concrete foundation or equivalent metal struc-1. ture.
- If the transmission of vibrations can be disturbing, provide vibrationdamping supports between the pump and the foundation. Remove the plugs covering the ports.
- 2. 3. Align the pump and piping flanges on both sides of the pump.
- Check the alignment of the bolts.
- Fasten the piping with bolts to the pump. 4. Do not force the piping into place.
- Anchor the pump securely with bolts to the concrete foundation or 5 metal structure.

4.4.2 Electrical installation

- 1. To facilitate the connection, the motor can be rotated to obtain the most convenient position for the connection:
 - a) Remove the four bolts that attach the motor to the pump.
 - Rotate the motor to the desired position. Do not remove the coub) pling between the motor shaft and the pump shaft.
 - c) Replace the four bolts and tighten them.
- Remove the screws of the terminal box cover. 2
- 3. Connect and fasten the power cables according to the applicable wiring diagram.

For wiring diagrams, see Figure 14. The diagrams are also available on the back of the terminal box cover.

- Connect the earth (ground) lead. a) Make sure that the earth (ground) lead is longer than the phase leads.
- b) Connect the phase leads. 4.
 - Replace the terminal box cover.

NOTICE:

Tighten the cable glands carefully to ensure protection against cable slipping and humidity entering the terminal box.

- If the motor is not equipped with automatic reset thermal protection, then adjust the overload protection according to the list below. 5
 - If the motor is used with full load, then set the value to the nominal current value of electric pump (data plate)
 - If the motor is used with partial load, then set the value to the operating current (for example measured with a current pincer).
 - If the pump has a star-delta starting system, then adjust the thermal relay to 58% of the nominal current or operating current (only for three-phase motors).

5 Commissioning, Startup, Ił **Operation, and Shutdown**

Precautions

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WARNING:

- Make sure that the drained liquid does not cause damage or iniuries.
 - The motor protectors can cause the motor to restart unexpectedly. This could result in serious injury.
 - Never operate the pump without the coupling guard correctly installed

CAUTION:

- The outer surfaces of the pump and motor can exceed 40°C (104°F) during operation. Do not touch with any part of the body without protective gear.
- Do not put any combustible material near the pump.

Overload thermal relay with operation class 10A + fuses aM (motor starting) or motor protection magneto-thermal switch with operation class 10A

fuses aM (motor starting), or magneto-thermal switch with curve C and Icn \geq 4.5 kA or other equivalent device.

NOTICE:

- Never operate the pump below the minimum rated flow, when dry, or without prime.
- Never operate the pump with the delivery ON-OFF valve closed for longer than a few seconds
- Never operate the pump with the suction ON-OFF valve closed.
- To prevent overheating of the internal pump-components, make sure that a minimum water flow is always guaranteed when the pump is running. If this cannot be achieved, then a bypass or re-circulate line is recommen-ded. Refer to the minimal nominal flow rate values given in the Appendix.
- Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump. Failure to do so can cause liquid to freeze and damage the pump.
- The sum of the pressure on the suction side (water mains, gravity tank) and the maximum pressure that is delivered by the pump must not exceed the maximum working pressure allowed (nominal pressure PN) for the pump
- Do not use the pump if cavitation occurs. Cavitation can damage the internal components.
- If you pump hot water, you must guarantee a minimum pressure on the suction side to prevent cavitation.

Noise level

For information about noise levels emitted by units equipped with a Lowara supplied motor, see Table 10.

5.1 Prime the pump

For information about plug placement, see Figure 15.

Installations with liquid level above the pump (suction head)

For an illustration that shows the pump parts, see Figure 16.

- 1. Close the on-off valve located downstream from the pump. Select the
- applicable steps: 2
 - Series 1, 3, 5: Loosen the drain plug pin (2). a)
 - Remove the fill and vent plug (1) and open the on-off valve upb)
 - stream until the water flows out of the hole.
 - Tighten the drain plug pin (2). Replace the fill and vent plug (1).
 - d)
- Series 10, 15, 22, 33, 46, 66, 92, 125 3.
 - Remove the fill and vent plug (1) and open the on/off valve up-stream until the water flows out of the hole. a)
 - b) Close the fill and vent plug (1). Fill plug (3) can be used instead of

Installations with liquid level below the pump (suction lift)

For an illustration that shows the pump parts, see Figure 17.

- 1. Open the on-off valve located upstream from the pump and close the on-off valve downstream. Select the applicable steps:
- 2 Series 1, 3, 5:

3.

- Loosen the drain plug pin (2).
- Remove the fill and vent plug (1) and use a funnel to fill the pump until water flows out of the hole. b)
- Replace the fill and vent plug (1). C)
- Tighten the drain plug pin (2) d)
- Series 10, 15, 22, 33, 46, 66, 92, 125:
- Remove the fill and vent plug (1) and use a funnel (4) to fill the pump until water flows out of the hole. a)
- Replace the fill and vent plug (1). Fill plug (3) can be used instead b) of (1).

5.2 Check the rotation direction (three-phase motor)

Follow this procedure before startup.

- Locate the arrows on the adaptor or the motor fan cover to determine 1. the correct rotation direction.
- Start the motor.
- 3. Quickly check the direction of rotation through the coupling guard or through the motor fan cover.
- Stop the motor.
- If the rotation direction is incorrect, do as follows:
 - Disconnect the power supply. a) In the terminal board of the motor or in the electric control panel, b) exchange the position of two of the three wires of the supply cable.
 - For the wiring diagrams, see Figure 14.
 - c) Check the direction of rotation again.

5.3 Start the pump

Before starting the pump, make sure that:

- · The pump is correctly connected to the power supply.
- The pump is correctly primed according to instruction in the Prime the pump.
- · The on-off valve located downstream from the pump is closed.
- 1. Start the motor.
- 2. Gradually open the on-off valve on the discharge side of the pump. At the expected operating conditions, the pump must run smoothly and quietly. If not, refer to *Troubleshooting*.

6 Maintenance

Precautions



WARNING

Disconnect and lock out electrical power before installing or servicing the pump.

WARNING:

- Maintenance and service must be performed by skilled and qualified personnel only.
- Observe accident prevention regulations in force.
- · Use suitable equipment and protection.
- Make sure that the drained liquid does not cause damage or injuries.

6.1 Service

The pump does not require any scheduled routine maintenance. If the user wishes to schedule regular maintenance deadlines, they are dependent on the type of pumped liquid and on the operating conditions of the pump.

Contact the Sales and Service Department for any requests or information regarding routine maintenance or service.

Extraordinary maintenance may be necessary to clean the liquid end and/or replace worn parts.

6.2 Torque values

For information about torque values, see Table 18, Table 19, or Table 20.

For information about the applicable thrust and torques on the flanges by the piping, see Figure 21.

6.3 Replace the electric motor

The pump is supplied with a calibrated fork-shaped shim designed to facilitate the motor coupling and replacement operations.

See instructions about how to replace the motor in Figure 23. If the calibrated fork-shaped shim is not available use a 5 ± 0.1 mm (0.2 ± 0.004 in.) shim.

6.4 Replace the mechanical seal

Series	Instruction
1, 3, 5	Contact the Sales and Service Department.
10, 15, 22: \leq 4 kW	Contact the Sales and Service Department.
10, 15, 22: > 4 kW	See the instructions in <i>Figure 24</i> . Use alcohol for cleaning and lubrication.
33, 46, 66, 92, 125	See the instructions in <i>Figure 24</i> . Use alcohol for cleaning and lubrication.

7 Troubleshooting

7.1 Troubleshooting for users

The main switch is on, but the electric pump does not start.

Cause	Remedy
The thermal protector incorpora- ted in the pump (if any) has trip- ped.	Wait until the pump has cooled down. The thermal protector will automati- cally reset.



Cause	Remedy
The protective device against dry running has tripped.	Check the water level in the tank, or the mains pressure.

The electric pump starts, but the thermal protection trips a varying time after.

Cause	Remedy
There are foreign objects (solids or fi- brous substances) inside the pump which have jammed the impeller.	Contact the Sales and Service De- partment.
The pump is overloaded because it is pumping liquid that is too dense and viscous.	Check the actual power require- ments based on the characteristics of the pumped liquid and then con- tact the Sales and Service Depart- ment.

The pump runs but delivers too little or no water.

Cause	Remedy
The pump is clogged.	Contact the Sales and Service Department.

The troubleshooting instructions in the tables below are for installers only.

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7.2 The main switch is on, but the electric pump does not start

Cause	Remedy
There is no power supply.	Restore the power supply.Make sure all electrical connections to the power supply are intact.
The thermal protector incorpora- ted in the pump (if any) has trip- ped.	Wait until the pump has cooled down. The thermal protector will automatically reset.
The thermal relay or motor pro- tector in the electric control panel has tripped.	Reset the thermal protection.
The protective device against dry running has tripped.	Check the:water level in the tank, or the mains pressureprotective device and its connecting cables
The fuses for the pump or auxili- ary circuits are blown.	Replace the fuses.

7.3 The electric pump starts, but the thermal protector trips or the fuses blow immediately after

Cause	Remedy
The power supply cable is dam- aged.	Check the cable and replace as necessary.
The thermal protection or fuses are not suited for the motor current.	Check the components and replace as necessary.
The electric motor is short cir- cuit.	Check the components and replace as necessary.
The motor overloads.	Check the operating conditions of the pump and reset the protection.

7.4 The electric pump starts, but the thermal protector trips or the fuses blow a short time after

Cause	Remedy
The electrical panel is situated in an ex- cessively heated area or is exposed to di- rect sunlight.	Protect the electrical panel from heat source and direct sunlight.
The power supply voltage is not within the working limits of the motor.	Check the operating conditions of the motor.
A power phase is missing.	Check the • power supply • electrical connection

7.5 The electric pump starts, but the thermal protector trips a varying time after

Cause	Remedy
There are foreign objects (solids or fibrous substances) inside the pump which have jammed the im- peller.	Contact the Sales and Service Depart- ment.
The pumps delivery rate is higher than the limits specified on the da- ta plate.	Partially close the on-off valve down stream until the delivery rate is equal or less than the limits specified on the da- ta plate.
The pump is overloaded because it is pumping liquid that is too dense and viscous.	Check the actual power requirements based on the characteristics of the pumped liquid and replace the motor accordingly.
The motor bearings are worn.	Contact the Sales and Service Depart- ment.

7.6 The electric pump starts, but the system's general protection is activated

Cause	Remedy
A short circuit in the electrical system.	Check the electrical system.

7.7 The electric pump starts, but the system's residual current device (RCD) is activated

e insulation of the electrical system

7.8 The pump runs but delivers too little or no water

Cause	Remedy
There is air inside the pump or the piping.	Bleed the air
The pump is not correctly primed.	Stop the pump and repeat the prime proce- dure. If the problem continues:
	 Check that the mechanical seal is not leaking.
	 Check the suction pipe for perfect tight- ness.
	Replace any valves that are leaking.
The throttling on the delivery side is too extensive.	Open the valve.
Valves are locked in closed or partially closed position.	Disassemble and clean the valves.
The pump is clogged.	Contact the Sales and Service Department.
The piping is clogged.	Check and clean the pipes.
The rotation direction of the impeller is wrong (three-phase version).	Change the position of two of the phases on the terminal board of the motor or in the electric control panel.
The suction lift is too high or the flow resistance in the suc-	Check the operating conditions of the pump. If necessary, do the following:
tion pipes is too great.	 Decrease the suction lift
	 Increase the diameter of the suction pipe

7.9 The electric pump stops, and then rotates in the wrong direction

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Cause	Remedy
There is a leakage in one or both of the following components:The suction pipeThe foot valve or the check valve	Repair or replace the faulty component.
There is air in the suction pipe.	Bleed the air.

7.10 The pump starts up too frequently

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Cause	Remedy
There is a leakage in one or both of the following components:The suction pipeThe foot valve or the check valve	Repair or replace the faulty component.
There is a ruptured membrane or no air pre- charge in the pressure tank.	See the relevant instruc- tions in the pressure tank manual.

7.11 The pump vibrates and generates too much noise

Cause	Remedy
Pump cavitation	Reduce the required flow rate by partially closing the on-off valve downstream from the pump. If the prob lem persists check the operating conditions of the pump (for example height difference, flow resistance, liquid temperature).
The motor bearings are worn.	Contact the Sales and Service Department.
There are foreign objects inside the pump.	Contact the Sales and Service Department.

For any other situation, refer to the Sales and Service Department.

Technical appendix



- Mechanical seal material identification code
- 1. 2. 3. 4. Capacity range Head range
- Minimum head (IEC 60335–2–41)
- Speed
- 5. 6. 7. 8.
- Frequency Maximum operating pressure Electric pump unit absorbed power
- 9.
- Pump/electric pump unit type O-ring material identification code 10.
- 11. Electric pump unit/ pump part number
- Protection class 12.
- Maximum operating liquid temperature (uses as IEC 60335–2–41) 13.
- 14. Motor nominal power
- 15. Rated voltage range
- 16. Serial number (date + progressive number) 17.
- Maximum operating liquid temperature (uses other than IEC 60335–2–41)



SV1125_M0005_A_sc

- Mechanical Seal 1.
 - Α Metal impregnated carbon
 - Resin impregnated carbon В
 - С Special resin impregnated carbon
 - Q1 Silicon carbide
 - Ē EPDM PTFE Т

- FPM (FKM) v
- 1.4401 (AISI 316) 3. G 4. Other o-ring gaskets

 - EPDM Е
 - PTFE Т FPM (FKM) v



Flow rate in m³/h 1. 2. Series name

3. Number of impellers

8/2A 8 impellers, 2 with outer diameter reduced

- A or B Reduction type
- A of D
 Recursive open

 1, 3, 5, 10, 15, 22
 F

 F
 AISI 304, round flanges (PN25) T

 304, oval flanges (PN16)
 R

 AISI 304, discharge port above suc R
 4.

tion, round flanges (PPN25) **N** AISI 316, round flanges (PN25) **V** AISI 316, Victaulic[®] couplings

(PN25) P AISI 316, Victaulic[®] couplings

(PN40) C AISI 316, clamp couplings

DIN32676 (PN25) **K** AISI 316, threaded couplings

DIN11851 (PN25) 33, 46, 66, 92, 125 **G** AISI 304/Cast Iron, round flanges **N** AISI 316, round flanges **P** AISI 316, round flanges (PN40)

1, 3, 5, 10, 15, 22 5.

Blank Standard version

- Low NPSH, round flanges, PN25 (F, N versions) L
- High temperature, 150°C, round flanges, PN25 (F, N versions) н
- High temperature, 180°C, round flanges, PN25 (N version) В
- Passivated and electro-polished (N, V, C, K versions) Е

33, 46, 66, 92, 125

- Blank Standard version
- L Low NPSH, round flanges (G, N versions)
- High temperature, 150°C, round flanges, PN25 (G, N versions) Н
- High temperature, 180°C, round flanges, PN25 (N version) В
- Е Passivated and electro-polished (N version)
- 6. Rated motor power (kW x 10)

/.	Blank	2–pole
	4	4-pole
8.	Blank	50 H

	6	60 Hz
9.	Μ	Single-phase

Т Three-phase

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5.		
	50 Hz ~ 2900 [rpm]	60 Hz ~ 3500 [rpm]
1SV	Line C Y and C	A C C C C C C C C C C C C C C C C C C C
3SV	Bit Age It and	0 20 40 60 0 0
5SV	Image: Standard	E 4 4 5 10 0 pmml
10SV	Life de la companya d	E 4 50 100 150 200 250 0 [mm])
15SV	1 1	B B C C C C C C C C C C C C C
22SV	Linger 16 12 12 12 12 12 12 12 12 12 12 12 12 12	E 10 5 s 0 0 5 s 10 5 s 10 10 10 10 10 10 10 10 10 10
33SV	Birdura Bir	Image: Constraint of the second sec
46SV	0 0 5 10 15 20 25 40 25 40 50 55 0 70	Image: Constraint of the second sec
66SV	20 20 20 25 20 20 20 25 20 20 20 20 20 20 20 20 20 20 20 20 20	
92SV	La solo di so	E 15 5 10 10 10 10 10 10 10 10 10 10
125SV	Litte a construction of a cons	12 14 15 15 15 15 15 15 15 15 15 15









8.

H (m)	0°C	10°C	20°C	30°C	40°C	45°C	50°C	55°C	60°C
0	1,00	1,00	1,00	1,00	1,00	0,95	0,90	0,85	0,80
500	1,00	1,00	1,00	1,00	1,00	0,95	0,90	0,85	0,80
1000	1,00	1,00	1,00	1,00	1,00	0,95	0,90	0,85	0,80
1500	0,97	0,97	0,97	0,97	0,97	0,92	0,87	0,82	0,78
2000	0,95	0,95	0,95	0,95	0,95	0,90	0,85	0,80	0,76





SV1125_M0027_B_sc

P2 (kW)	dB ± 2							
	50 Hz 2900	0 min ⁻¹	50 Hz 145	0 min ⁻¹	60 Hz 350	0 min ⁻¹	60 Hz 175	0 min ⁻¹
	IEC	LpA*	IEC	LpA*	IEC	LpA*	IEC	LpA*
0,25	-	<70	71	<70	-	-	71	<70
0,37	71R	<70	71	<70	-	-	71	<70
0,55	71	<70	80	<70	71	<70	80	<70
0,75	80R	<70	80	<70	80R	<70	80	<70
1,00	80	<70	90	<70	80	<70	90	<70
1,50	90R	<70	90	<70	90R	<70	90	<70
2,20	90R	<70	100	<70	90R	70	100	<70
3,00	100R	<70	100	<70	100R	70	100	<70
4,00	112R	<70	112	<70	112R	71	112	<70

P2 (kW)	dB ± 2							
5,50	132R	<70	132	<70	132R	73	132	<70
7,50	132R	<70	132	<70	132R	73	132	<70
11,00	160R	73	-	-	160R	79	160	<70
15,00	160	75	-	-	160	80	160	<70
18,50	160	75	-	-	160	80	-	-
22,00	180R	75	-	-	180R	80	-	-
30,00	200	74	-	-	200	78	-	-
37,00	200	74	-	-	200	78	-	-
45,00	225	78	-	-	225	83	-	-
55,00	250	84	-	-	250	89	-	-

Sound pressure level measured in a free field at 1 m distance from the electric pump.

11.



SV1125_M0010_A_sc



- Piping support On-off valve Flexible pipe or joint Check valve
- 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.
- Control panel Do not install elbows close to the pump

- Do not install elbows close to the pump Bypass circuit Eccentric reducer Use wide bends Positive gradient Piping with equal or greater diameter than the suction port Use foot valve Do not exceed maximum height difference 11.
- 12.
- Do not exceed maximum height difference Ensure adequate submersion depth 13. 14.









- 1. Fill and vent plug (a: vent open, b: vent closed)
- 1, 3, 5, 10, 15, 22 SV: G 3/8
 33, 46, 66, 92, 125 SV: G 1/2 Drain plug (a: central pin open, b: 2.
 - pin closed) • 1, 3, 5, 10, 15 22 SV: G 3/8

 - 33, 46, 66, 92, 125 SV: G 1/2
- Fill plug 3.
 - 10, 15, 22 SV: G 3/8
- 33, 46, 66, 92, 125 SV: G 1/2
 Plug for drum, if present (do not unscrew)
 Gauge connection plug, only 33, 46, 66, 92, 4
- 5. 125 ŠV: G 3/8
- 6.
- 125 SV: G 3/8 Version without plug and drum, only 33, 46, 66, 92, 125 SV Version with plug but no drum (do not un-screw), only 33, 46, 66, 92, 125 SV Version with plug and drum (do not un-screw), only 33, 46, 66, 92, 125 SV 7.
- 8.

16.



10, 15, 22, 33, 46, 66, 92, 125SV



SV1125_M0014_A_sc

SV1125_M0014_A_sc







- Fill and vent plug Drain plug Fill plug Funnel
- 1. 2. 3. 4.



SV1125_M0015_A_sc

| 18. | | | | | | | | | | | | | | | | | | |
|----------------|-----|----|-----|----|----|----|-----|----|------|----|------|----|------|----|-----|-----|-----|----|
| | Α | | В | | С | | D | | Е | | F | | G | | Н | | Ι | |
| | Ø | Nm | Ø | Nm | Ø | Nm | Ø | Nm | Ø | Nm | Ø | Nm | Ø | Nm | Ø | Nm | Ø | Nm |
| 1SV
3SV | M8 | 20 | M12 | 25 | - | - | - | - | - | - | G3/8 | 25 | - | - | M12 | 50 | M10 | 30 |
| 55 V | - | | | | | | | | | | | | | | M16 | 100 | - | |
| 10SV | M10 | 35 | M14 | 30 | 7 | | M8 | 25 | 1 | | | | | | | | M12 | 50 |
| 15SV | | | | | | | | | | | | | | | | | | |
| 22SV | 1 | | | | | | | | | | | | | | | | | |
| 33SV | M12 | 55 | M16 | 60 | M6 | 8 | M10 | 35 | G1/2 | 40 | G1/2 | 40 | R3/8 | 40 | M16 | 100 | - | - |
| 46SV | | | | | | | | | | | | | | | | | | |
| 66SV- | | | | | | | | | | | | | | | | | | |
| PN10 | - | | | | | | | | | | | | | | M20 | 200 | - | |
| 005 v-
PN25 | | | | | | | | | | | | | | | MZU | 200 | | |
| 92SV- | 1 | | | | | | | | | | | | | | M16 | 100 | - | |
| PN16 | | | | | | | | | | | | | | | | | | |
| 92SV- |] | | | | | | | | | | | | | | M20 | 200 | 7 | |
| PN25 | - | | | | | | | | | | | | | | 244 | 100 | _ | |
| 1258V-
PN16 | | | | | | | | | | | | | | | M16 | 100 | | |
| 125SV | - | | | | | | | | | | | | | | M24 | 350 | - | |
| PN25 | | | | | | | | | | | | | | | | | | |

A Impeller locking screws

B Tie rod nuts

C Drum (33, 46, 66, 92, 125 SV) and diffuser bushings (125 SV) locking plate screws

D Mechanical seal housing (33, 46, 66, 92, 125 SV) and diffuser (125 SV) locking screws

E Fill and vent plug

F Fill or drain plugs

G Gauge connection plugs **Ø** Diameter

H NRoundisonynter flange screws

- I Oval counter flange screws
- Ø Diameter

19.

| Α | | 71 | 80 | 90 | 100 | 112 | 132 | 160 | 180 | 200 | 225 | 250 |
|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|
| В | Ø | M6 | | M8 | | | M12 | M16 | | | | |
| | Nm | 6 | | 15 | | | 50 | 75 | | | | |
| СН | | 10 | | 13 | | | 19 | 24 | | | | |
| | | | | | | | | | | | | |

20.

| | 1, 3, 5, 10, 15, 22 SV | | | 1, 3, 5
SV | 10, 15, | 22 SV | 33, 46, 66, 92, 125 SV | | | | | | | | | | | | |
|----|------------------------|----|----|---------------|---------|-------|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Α | _ | 71 | 80 | 90 | 100 | 112 | 132 | 132 | 160 | 90 | 100 | 112 | 132 | 160 | 180 | 200 | 225 | 250 | |
| С | Ø | M6 | | | M8 | M8 | | M10 | | M10 | M10 | | | M12 | | | | | |
| | Nm | 15 | | | 25 | | 25 | 50 | 50 | | | 75 | | | | | | | |
| СН | 0 | 5 | | | 6 | | 6 | 8 | Ş | | 8 | | 10 | | | | | | |

A Motor size

B Adapter/motor screw

C Coupling screw

Ø Diameter

Nm Driving torque

| 21. | | | | | | | | | |
|-----------|----------|-----|------|---------|-------|--------|--------|-------|------------|
| | | | | | | | | | |
| | PUMP | | F | orces (| N) | Μ | loment | | |
| | TYPE | DN | Fx | Fy | Fz | Mx | Му | Mz | |
| | 1-3 SV | 25 | 200 | 180 | 230 | 240 | 160 | 190 | |
| | 5 SV | 32 | 260 | 240 | 300 | 310 | 210 | 250 | |
| | 10 SV | 40 | 330 | 300 | 370 | 390 | 270 | 310 | |
| | 15-22 SV | 50 | 450 | 400 | 490 | 420 | 300 | 340 | |
| | 33 SV | 65 | 1800 | 1700 | 2000 | 1500 | 1050 | 1200 | |
| My Fry | 46 SV | 80 | 2250 | 2050 | 2500 | 1600 | 1150 | 1300 | |
| | 66-92 SV | 100 | 3000 | 2700 | 3350 | 1750 | 1250 | 1450 | |
| Fx Fz Fz | 125 SV | 125 | 3700 | 3300 | 4100 | 2100 | 1500 | 1750 | |
| X MX MZ Z | | | | 1 | -125s | sv-for | za-FN | IG-en | _a_td_a_td |

22.











e-SV



| ^ | ^ | |
|----|---|--|
| -, | × | |
| ▰ | | |
| _ | - | |

| 20. | | | | | | | | |
|------------|---------|------------|--------|------------------|--------|-------------|--------|--|
| | | Т | | | | Т | | |
| | 50 Hz 2 | 900 min-1 | | 50 Hz 2900 min-1 | | | | |
| 1~ | H (m)* | 3~ | H (m)* | 1~ | H (m)* | 3~ | H (m)* | |
| 1SV02F003M | 12,2 | 1SV02F003T | 12,2 | 5SV13F022M | 98,3 | 5SV13F022T | 98,3 | |
| 1SV03F003M | 18 | 1SV03F003T | 18 | 5SV14F022M | 105,7 | 5SV14F022T | 105,7 | |
| 1SV04F003M | 23,7 | 1SV04F003T | 23,7 | 5SV15F022M | 113,1 | 5SV15F022T | 113,1 | |
| 1SV05F003M | 29,3 | 1SV05F003T | 29,3 | 5SV16F022M | 120,5 | 5SV16F022T | 120,5 | |
| 1SV06F003M | 34,8 | 1SV06F003T | 34,8 | - | - | 5SV18F030T | 135,8 | |
| 1SV07F003M | 40,2 | 1SV07F003T | 40,2 | - | - | 5SV21F030T | 157,9 | |
| 1SV08F005M | 48,1 | 1SV08F005T | 48,1 | - | - | 5SV23F040T | 174,4 | |
| 1SV09F005M | 53,7 | 1SV09F005T | 53,7 | - | - | 5SV25F040T | 189,2 | |
| 1SV10F005M | 59,4 | 1SV10F005T | 59,4 | - | - | 5SV28F040T | 211,5 | |
| 1SV11F005M | 65,1 | 1SV11F005T | 65,1 | - | - | 5SV30F055T | 227 | |
| 1SV12F007M | 73,3 | 1SV12F007T | 73,3 | - | - | 5SV33F055T | 249,2 | |
| 1SV13F007M | 79,2 | 1SV13F007T | 79,2 | 10SV01F007M | 11,8 | 10SV01F007T | 11,8 | |
| 1SV15F007M | 90,9 | 1SV15F007T | 90,9 | 10SV02F007M | 23,6 | 10SV02F007T | 23,6 | |
| 1SV17F011M | 105,2 | 1SV17F011T | 105,2 | 10SV03F011M | 35,7 | 10SV03F011T | 35,7 | |
| 1SV19F011M | 117 | 1SV19F011T | 117 | 10SV04F015M | 47,7 | 10SV04F015T | 47,7 | |
| 1SV22F011M | 134,6 | 1SV22F011T | 134,6 | 10SV05F022M | 60 | 10SV05F022T | 60 | |
| 1SV25F015M | 152,6 | 1SV25F015T | 152,6 | 10SV06F022M | 71, | 10SV06F022T | 71,8 | |
| 1SV27F015M | 164,3 | 1SV27F015T | 164,3 | - | - | 10SV07F030T | 83,6 | |

| | | Т | | | , | Т | |
|------------|---------|------------|--------|-------------|---------|-------------|--------|
| | 50 Hz 2 | 900 min-1 | | | 50 Hz 2 | 900 min-1 | |
| 1~ | H (m)* | 3~ | H (m)* | 1~ | H (m)* | 3~ | H (m)* |
| 1SV30F015M | 181,7 | 1SV30F015T | 181,7 | - | - | 10SV08F030T | 95,3 |
| 1SV32F022M | 197,2 | 1SV32F022T | 197,2 | - | - | 10SV09F040T | 106,3 |
| 1SV34F022M | 209,2 | 1SV34F022T | 209,2 | - | - | 10SV10F040T | 118 |
| 1SV37F022M | 225,9 | 1SV37F022T | 225,9 | - | - | 10SV11F040T | 129,6 |
| 3SV02F003M | 14,9 | 3SV02F003T | 14,9 | - | - | 10SV13F055T | 156 |
| 3SV03F003M | 22 | 3SV03F003T | 22 | - | - | 10SV15F055T | 179,5 |
| 3SV04F003M | 28,9 | 3SV04F003T | 28,9 | - | - | 10SV17F075T | 205 |
| 3SV05F005M | 37,2 | 3SV05F005T | 37,2 | - | - | 10SV18F075T | 216,9 |
| 3SV06F005M | 44,4 | 3SV06F005T | 44,4 | - | - | 10SV20F075T | 240,6 |
| 3SV07F007M | 52,5 | 3SV07F007T | 52,5 | - | - | 10SV21F110T | 253,6 |
| 3SV08F007M | 60 | 3SV08F007T | 60 | 15SV01F011M | 14 | 15SV01F011T | 14 |
| 3SV09F011M | 67,7 | 3SV09F011T | 67,7 | 15SV02F022M | 28,7 | 15SV02F022T | 28,7 |
| 3SV10F011M | 75 | 3SV10F011T | 75 | - | - | 15SV03F030T | 43,3 |
| 3SV11F011M | 82,3 | 3SV11F011T | 82,3 | - | - | 15SV04F040T | 58,4 |
| 3SV12F011M | 89,6 | 3SV12F011T | 89,6 | - | - | 15SV05F040T | 72,7 |
| 3SV13F015M | 98,1 | 3SV13F015T | 98,1 | - | - | 15SV06F055T | 87,6 |
| 3SV14F015M | 105,6 | 3SV14F015T | 105,6 | - | - | 15SV07F055T | 101,9 |
| 3SV16F015M | 119,9 | 3SV16F015T | 119,9 | - | - | 15SV08F075T | 117,4 |
| 3SV19F022M | 144,3 | 3SV19F022T | 144,3 | - | - | 15SV09F075T | 131,9 |
| 3SV21F022M | 159,3 | 3SV21F022T | 159,3 | - | - | 15SV10F110T | 147,7 |
| 3SV23F022M | 174 | 3SV23F022T | 174 | - | - | 15SV11F110T | 162,3 |
| 3SV25F022M | 188,5 | 3SV25F022T | 188,5 | - | - | 15SV13F110T | 191,3 |
| - | - | 3SV27F030T | 204,4 | - | - | 15SV15F150T | 222,1 |
| - | - | 3SV29F030T | 219,3 | - | - | 15SV17F150T | 251,6 |
| - | - | 3SV31F030T | 233,8 | 22SV01F011M | 14,7 | 22SV01F011T | 14,7 |
| - | - | 3SV33F030T | 248,5 | 22SV02F022M | 30,4 | 22SV02F022T | 30,4 |
| 5SV02F003M | 14,8 | 5SV02F003T | 14,8 | - | - | 22SV03F030T | 45,4 |
| 5SV03F005M | 21,8 | 5SV03F005T | 21,8 | - | - | 22SV04F040T | 60,9 |
| 5SV04F005M | 30 | 5SV04F005T | 30 | - | - | 22SV05F055T | 76 |
| 5SV05F007M | 38 | 5SV05F007T | 38 | - | - | 22SV06F075T | 93,2 |
| 5SV06F011M | 45,3 | 5SV06F011T | 45,3 | - | - | 22SV07F075T | 108,5 |
| 5SV07F011M | 52,7 | 5SV07F011T | 52,7 | - | - | 22SV08F110T | 124,6 |
| 5SV08F011M | 60,1 | 5SV08F011T | 60,1 | - | - | 22SV09F110T | 140,1 |
| 5SV09F015M | 68 | 5SV09F015T | 68 | - | - | 22SV10F110T | 155,4 |
| 5SV10F015M | 75,5 | 5SV10F015T | 75,5 | - | - | 22SV12F150T | 186,1 |
| 5SV11F015M | 82,8 | 5SV11F015T | 82,8 | - | - | 22SV14F150T | 216,6 |
| 5SV12F022M | 90,8 | 5SV12F022T | 90,8 | - | - | 22SV17F185T | 263,5 |

| | | Т | | | , | Г | |
|---------------|---------|----------------|--------|-------------|----------|----------------|--------|
| | 50 Hz 2 | 900 min-1 | | | 50 Hz 1, | 450 min-1 | |
| 3~ | H (m)* | 3~ | H (m)* | 3~ | H (m)* | 3~ | H (m)* |
| 33SV1/1AG022T | 17,4 | 46SV9/2AG300T | 224,8 | 1SV02F0024T | 3,1 | 22SV14F0224T | 53,9 |
| 33SV1G030T | 23,8 | 46SV9G370T | 240,9 | 1SV05F0024T | 7,7 | 22SV17F0304T | 65,3 |
| 33SV2/2AG040T | 35,1 | 46SV10/2AG370T | 252,7 | 1SV08F0024T | 12,2 | 33SV3/2AG0114T | 14,4 |
| 33SV2/1AG040T | 40,8 | 46SV10G370T | 267,6 | 1SV11F0024T | 16,7 | 33SV4/1AG0114T | 21,8 |
| 33SV2G055T | 47,8 | 46SV11/2AG450T | 280,4 | 1SV15F0024T | 22,6 | 33SV5G0154T | 29,4 |
| 33SV3/2AG055T | 57,7 | 46SV11G450T | 295,5 | 1SV19F0024T | 28,8 | 33SV6G0224T | 35,9 |
| 33SV3/1AG075T | 64,5 | 46SV12/2AG450T | 307,3 | 1SV22F0024T | 33,2 | 33SV7G0224T | 41,6 |
| 33SV3G075T | 71,5 | 46SV12G450T | 321,8 | 1SV27F0024T | 40,1 | 33SV8G0304T | 47,9 |
| 33SV4/2AG075T | 82 | 46SV13/2AG450T | 332,5 | 1SV30F0024T | 44,4 | 33SV9G0304T | 53,3 |
| 33SV4/1AG110T | 88,9 | 66SV1/1AG040T | 23,8 | 1SV34F0024T | 50 | 33SV10G0304T | 59 |
| 33SV4G110T | 95,9 | 66SV1G055T | 29,2 | 1SV37F0024T | 54,2 | 33SV11G0404T | 65,7 |
| 33SV5/2AG110T | 106 | 66SV2/2AG075T | 47,5 | 3SV02F0024T | 3,8 | 33SV12G0404T | 71,5 |
| 33SV5/1AG110T | 112,7 | 66SV2/1AG110T | 54,2 | 3SV05F0024T | 9,5 | 33SV13G0404T | 77,2 |
| 33SV5G150T | 120,4 | 66SV2G110T | 60,4 | 3SV08F0024T | 15,1 | 46SV2G0114T | 13 |
| 33SV6/2AG150T | 131,2 | 66SV3/2AG150T | 78,4 | 3SV11F0024T | 20,6 | 46SV3G0154T | 19,8 |
| 33SV6/1AG150T | 139,1 | 66SV3/1AG150T | 84,7 | 3SV14F0024T | 26,1 | 46SV4G0224T | 26,3 |
| 33SV6G150T | 145,6 | 66SV3G185T | 91,4 | 3SV19F0024T | 33,3 | 46SV5G0224T | 32,6 |
| 33SV7/2AG150T | 156 | 66SV4/2AG185T | 108,9 | 3SV23F0024T | 42,2 | 46SV6G0304T | 39,3 |
| 33SV7/1AG185T | 163,3 | 66SV4/1AG220T | 115,2 | 3SV27F0034T | 49,7 | 46SV7G0304T | 45,5 |
| 33SV7G185T | 170,3 | 66SV4G220T | 121,6 | 3SV33F0034T | 60,2 | 46SV8G0404T | 52,5 |
| 33SV8/2AG185T | 180,6 | 66SV5/2AG300T | 139,1 | 5SV03F0024T | 5,7 | 46SV9G0404T | 58,9 |
| 33SV8/1AG185T | 187,4 | 66SV5/1AG300T | 145,6 | 5SV06F0024T | 11,3 | 46SV10G0554T | 66,2 |
| 33SV8G220T | 194,1 | 66SV5G300T | 152 | 5SV09F0024T | 16,8 | 46SV11G0554T | 72,6 |
| 33SV9/2AG220T | 202,1 | 66SV6/2AG300T | 169,5 | 5SV12F0024T | 22,2 | 46SV12G0554T | 78,9 |
| 33SV9/1AG220T | 210,2 | 66SV6/1AG300T | 176 | 5SV15F0034T | 27,5 | 66SV1G0114T | 7,3 |

| | | Т | | Т | | | | | |
|----------------|---------|----------------|--------|--------------|----------|-----------------|--------|--|--|
| | 50 Hz 2 | 900 min-1 | | | 50 Hz 1. | 450 min-1 | | | |
| 3~ | H (m)* | 3~ | H (m)* | 3~ | H (m)* | 3~ | H (m)* | | |
| 33SV9G220T | 216,8 | 66SV6G370T | 182,4 | 5SV18F0034T | 33,1 | 66SV2G0154T | 14,8 | | |
| 33SV10/2AG220T | 226,4 | 66SV7/2AG370T | 199,9 | 5SV21F0034T | 38,4 | 66SV3G0224T | 22,3 | | |
| 33SV10/1AG300T | 234,5 | 66SV7/1AG370T | 206,4 | 5SV25F0054T | 45,3 | 66SV4G0304T | 29,7 | | |
| 33SV10G300T | 241,8 | 66SV7G450T | 212,8 | 5SV28F0054T | 51,7 | 66SV5G0404T | 37,5 | | |
| 33SV11/2AG300T | 252 | 66SV8/2AG450T | 230,3 | 5SV33F0074T | 60,5 | 66SV6G0404T | 44,7 | | |
| 33SV11/1AG300T | 259 | 66SV8/1AG450T | 236,8 | 10SV03F0054T | 9 | 66SV7G0554T | 52,8 | | |
| 33SV11G300T | 265,7 | 66SV8G450T | 243,2 | 10SV04F0054T | 12 | 66SV8G0554T | 60,1 | | |
| 33SV12/2AG300T | 275,9 | 92SV1/1AG055T | 24,5 | 10SV06F0054T | 17,9 | 92SV1G0114T | 8,3 | | |
| 33SV12/1AG300T | 282,8 | 92SV1G075T | 33,5 | 10SV08F0054T | 23,6 | 92SV2G0224T | 16,3 | | |
| 33SV12G300T | 289,8 | 92SV2/2AG110T | 49,4 | 10SV10F0054T | 28,9 | 92SV3G0304T | 24,4 | | |
| 33SV13/2AG300T | 300,5 | 92SV2G150T | 67,8 | 10SV13F0074T | 37,9 | 92SV4G0404T | 32,9 | | |
| 33SV13/1AG300T | 306,9 | 92SV3/2AG185T | 82,4 | 10SV15F0074T | 44,1 | 92SV5G0554T | 41,6 | | |
| 46SV1/1AG030T | 19,5 | 92SV3G220T | 102,2 | 10SV17F0114T | 49,6 | 92SV6G0554T | 49,5 | | |
| 46SV1G040T | 27,2 | 92SV4/2AG300T | 115,7 | 10SV19F0114T | 55,2 | 92SV7G0754T | 58 | | |
| 46SV2/2AG055T | 38,8 | 928V4G300T | 133,1 | 10SV21F0114T | 62,8 | 92SV8G0754T | 65,9 | | |
| 46SV2G075T | 52,6 | 928V5/2AG370T | 149 | 15SV03F0054T | 10,7 | 125SV1G0114T | 6,9 | | |
| 46SV3/2AG110T | 64,7 | 928V5G370T | 166,4 | 15SV05F0054T | 17,8 | 125SV2G0224T | 13,5 | | |
| 46SV3G110T | 80,8 | 92SV6/2AG450T | 183,3 | 15SV07F0074T | 24,6 | 125SV3/3BG0224T | 17,5 | | |
| 46SV4/2AG150T | 92,4 | 928V6G450T | 200,9 | 15SV09F0114T | 32,8 | 125SV4/4BG030T | 23,3 | | |
| 46SV4G150T | 107,3 | 92SV7/2AG450T | 216,8 | 15SV11F0114T | 40,1 | 125SV5/5AG040T | 31,4 | | |
| 46SV5/2AG185T | 117,2 | 125SV1G075T | 27,6 | 15SV13F0154T | 47,6 | 125SV6G055T | 40,4 | | |
| 46SV5G185T | 134,5 | 125SV2G150T | 53,8 | 15SV15F0154T | 54,8 | 125SV7G075T | 47,1 | | |
| 46SV6/2AG220T | 143,7 | 125SV3G220T | 80,7 | 15SV17F0224T | 62,5 | 125SV8G075T | 53,8 | | |
| 46SV6G220T | 161 | 125SV4G300T | 107,6 | 22SV04F0054T | 14,9 | | | | |
| 46SV7/2AG300T | 171,3 | 125SV5G370T | 134,5 | 22SV06F0114T | 22,6 | | | | |
| 46SV7G300T | 188,6 | 125SV6G450T | 161,4 | 22SV08F0114T | 30,8 | | | | |
| 46SV8/2AG300T | 198,2 | 125SV7G550T | 188,3 | 22SV10F0154T | 38,6 | | | | |
| 46SV8G300T | 213,1 | 125SV8/2AG550T | 211,5 | 22SV12F0224T | 46 | | | | |
| | | | • | | | | | | |
| | | Т | | | | Т | | | |
| | 60 Hz 3 | 500 min-1 | | | 60 Hz 3 | 500 min-1 | | | |
| 1~ | H (m)* | 3~ | H (m)* | 1~ | H (m)* | 3~ | H (m)* | | |
| 1SV02F0036M | 17,4 | 1SV02F0036T | 17,4 | - | - | 5SV10F0306T | 109,2 | | |
| 1SV03F0036M | 25,7 | 1SV03F0036T | 25,7 | - | - | 5SV11F0306T | 119,9 | | |
| 1SV04F0036M | 33,9 | 1SV04F0036T | 33,9 | - | - | 5SV12F0306T | 130,6 | | |
| 1SV05F0056M | 43,6 | 1SV05F0056T | 43,6 | - | - | 5SV13F0406T | 142,5 | | |
| 1SV06F0056M | 52,1 | 1SV06F0056T | 52,1 | - | - | 5SV14F0406T | 153,4 | | |
| 1SV07F0076M | 61 | 1SV07F0076T | 61 | - | - | 5SV15F0406T | 164,2 | | |
| 1SV08F0076M | 69,4 | 1SV08F0076T | 69,4 | - | - | 5SV16F0406T | 174,9 | | |
| 1SV09E0076M | 77.0 | 1SV09E0076T | 77.0 | | | 5SV17E0556T | 186.4 | | |

| | 60 Hz 3 | 500 min-1 | | | 60 Hz 3 | 500 min-1 | |
|-------------|---------|-------------|--------|--------------|---------|--------------|--------|
| 1~ | H (m)* | 3~ | H (m)* | 1~ | H (m)* | 3~ | H (m)* |
| 1SV02F0036M | 17,4 | 1SV02F0036T | 17,4 | - | - | 5SV10F0306T | 109,2 |
| 1SV03F0036M | 25,7 | 1SV03F0036T | 25,7 | - | - | 5SV11F0306T | 119,9 |
| 1SV04F0036M | 33,9 | 1SV04F0036T | 33,9 | - | - | 5SV12F0306T | 130,6 |
| 1SV05F0056M | 43,6 | 1SV05F0056T | 43,6 | - | - | 5SV13F0406T | 142,5 |
| 1SV06F0056M | 52,1 | 1SV06F0056T | 52,1 | - | - | 5SV14F0406T | 153,4 |
| 1SV07F0076M | 61 | 1SV07F0076T | 61 | - | - | 5SV15F0406T | 164,2 |
| 1SV08F0076M | 69,4 | 1SV08F0076T | 69,4 | - | - | 5SV16F0406T | 174,9 |
| 1SV09F0076M | 77,9 | 1SV09F0076T | 77,9 | - | - | 5SV17F0556T | 186,4 |
| 1SV10F0116M | 87,6 | 1SV10F0116T | 87,6 | - | - | 5SV19F0556T | 208 |
| 1SV11F0116M | 96,2 | 1SV11F0116T | 96,2 | - | - | 5SV21F0556T | 229,6 |
| 1SV12F0116M | 104,7 | 1SV12F0116T | 104,7 | - | - | 5SV23F0556T | 251 |
| 1SV13F0116M | 113,2 | 1SV13F0116T | 113,2 | 10SV01F0076M | 17 | 10SV01F0076T | 17 |
| 1SV15F0156M | 131,2 | 1SV15F0156T | 131,2 | 10SV02F0156M | 34,2 | 10SV02F0156T | 34,2 |
| 1SV17F0156M | 148,3 | 1SV17F0156T | 148,3 | 10SV03F0226M | 51,8 | 10SV03F0226T | 51,8 |
| 1SV18F0226M | 158,4 | 1SV18F0226T | 158,4 | - | - | 10SV04F0306T | 69,2 |
| 1SV20F0226M | 175,7 | 1SV20F0226T | 175,7 | - | - | 10SV05F0406T | 87,3 |
| 1SV22F0226M | 192,9 | 1SV22F0226T | 192,9 | - | - | 10SV06F0406T | 104,5 |
| 1SV24F0226M | 210,1 | 1SV24F0226T | 210,1 | - | - | 10SV07F0556T | 122,1 |
| 1SV26F0226M | 227,3 | 1SV26F0226T | 227,3 | - | - | 10SV08F0556T | 139,2 |
| 1SV28F0306M | 245,4 | 1SV28F0306T | 245,4 | - | - | 10SV09F0756T | 157,4 |
| 3SV02F0036M | 21,3 | 3SV02F0036T | 21,3 | - | - | 10SV10F0756T | 174,7 |
| 3SV03F0056M | 32,6 | 3SV03F0056T | 32,6 | - | - | 10SV11F0756T | 192 |
| 3SV04F0076M | 43,4 | 3SV04F0076T | 43,4 | - | - | 10SV13F1106T | 226,7 |
| 3SV05F0116M | 54,7 | 3SV05F0116T | 54,7 | - | - | 10SV15F1106T | 261,2 |
| 3SV06F0116M | 65,4 | 3SV06F0116T | 65,4 | 15SV01F0156M | 19,9 | 15SV01F0156T | 19,9 |
| 3SV07F0116M | 76,1 | 3SV07F0116T | 76,1 | - | - | 15SV02F0306T | 41,9 |
| 3SV08F0156M | 87,2 | 3SV08F0156T | 87,2 | - | - | 15SV03F0406T | 63 |
| 3SV09F0156M | 97,8 | 3SV09F0156T | 97,8 | - | - | 15SV04F0556T | 83,9 |
| 3SV10F0226M | 109,5 | 3SV10F0226T | 109,5 | - | - | 15SV05F0756T | 105,4 |
| 3SV11F0226M | 120,3 | 3SV11F0226T | 120,3 | - | - | 15SV06F1106T | 126,7 |
| 3SV12F0226M | 131 | 3SV12F0226T | 131 | - | - | 15SV07F1106T | 147,6 |
| 3SV13F0226M | 141,8 | 3SV13F0226T | 141,8 | - | - | 15SV08F1506T | 171,9 |
| 3SV14F0226M | 152,5 | 3SV14F0226T | 152,5 | - | - | 15SV09F1506T | 193,2 |
| - | - | 3SV15F0306T | 164,4 | - | - | 15SV10F1506T | 214,4 |

| | | Т | | Т | | | | |
|-------------|----------|-------------|--------|--------------|---------|--------------|--------|--|
| | 60 Hz 3. | 500 min-1 | | | 60 Hz 3 | 500 min-1 | | |
| ~ | H (m)* | 3~ | H (m)* | 1~ | H (m)* | 3~ | H (m)* | |
| - | - | 3SV17F0306T | 185,9 | - | - | 15SV11F1856T | 236,4 | |
| - | - | 3SV19F0306T | 207,3 | - | - | 15SV12F1856T | 257,8 | |
| - | - | 3SV21F0406T | 230,9 | 22SV01F0226M | 22,2 | 22SV01F0226T | 22,2 | |
| - | - | 3SV23F0406T | 252,5 | - | - | 22SV02F0406T | 44,5 | |
| 5SV02F0056M | 21,9 | 5SV02F0056T | 21,9 | - | - | 22SV03F0556T | 66,7 | |
| 5SV03F0076M | 32,7 | 5SV03F0076T | 32,7 | - | - | 22SV04F0756T | 89 | |
| 5SV04F0116M | 43,9 | 5SV04F0116T | 43,9 | - | - | 22SV05F1106T | 111,5 | |
| 5SV05F0156M | 55 | 5SV05F0156T | 55 | - | - | 22SV06F1106T | 133,5 | |
| 5SV06F0156M | 65,9 | 5SV06F0156T | 65,9 | - | - | 22SV07F1506T | 156,4 | |
| 5SV07F0226M | 76,5 | 5SV07F0226T | 76,5 | - | - | 22SV08F1506T | 178,6 | |
| 5SV08F0226M | 87,2 | 5SV08F0226T | 87,2 | - | - | 22SV09F1856T | 201,3 | |
| 5SV09F0226M | 97,8 | 5SV09F0226T | 97,8 | - | - | 22SV10F1856T | 223,5 | |

| | | Т | | Т | | | | |
|----------------|---------|----------------|--------|------------------|--------|-----------------|--------|--|
| | 60 Hz 3 | 500 min-1 | | 60 Hz 3500 min-1 | | | | |
| 3~ | H (m)* | 3~ | H (m)* | 3~ | H (m)* | 3~ | H (m)* | |
| 33SV1/1AG0306T | 24,5 | 33SV7/1AG3006T | 233,9 | 46SV5G3706T | 194,6 | 66SV5/2AG4506T | 191,9 | |
| 33SV1G0556T | 34,5 | 33SV7G3006T | 243,3 | 46SV6/2AG3706T | 210,5 | 66SV5/1AG4506T | 202 | |
| 33SV2/2AG0556T | 49,6 | 33SV8/2AG3706T | 259,3 | 46SV6/1AG3706T | 222 | 66SV5G4506T | 212,2 | |
| 33SV2/1AG0756T | 59,6 | 33SV8/1AG3706T | 268,7 | 46SV6G3706T | 233,6 | 92SV1/1AG1106T | 36,4 | |
| 33SV2G1106T | 69,4 | 33SV8G3706T | 278,1 | 46SV7/2AG4506T | 250,3 | 92SV1G1506T | 49,5 | |
| 33SV3/2AG1106T | 86 | 46SV1/1AG0556T | 29,1 | 46SV7/1AG4506T | 261,8 | 92SV2/2AG1856T | 69,9 | |
| 33SV3/1AG1106T | 94,7 | 46SV1G0756T | 39,9 | 46SV7G4506T | 273,4 | 92SV2/1AG2206T | 83,6 | |
| 33SV3G1506T | 104,2 | 46SV2/2AG1106T | 56,7 | 66SV1/1AG0756T | 31,4 | 92SV2G3006T | 97,9 | |
| 33SV4/2AG1506T | 119,8 | 46SV2/1AG1106T | 67,8 | 66SV1G1106T | 43,8 | 92SV3/2AG3706T | 117,4 | |
| 33SV4/1AG1506T | 128,9 | 46SV2G1506T | 78,2 | 66SV2/2AG1506T | 64,5 | 92SV3/1AG3706T | 131,5 | |
| 33SV4G1856T | 138,3 | 46SV3/2AG1856T | 95,5 | 66SV2/1AG1856T | 74,9 | 928V3G4506T | 144,9 | |
| 33SV5/2AG1856T | 155,8 | 46SV3/1AG1856T | 106,1 | 66SV2G1856T | 85,4 | 92SV4/2AG4506T | 163 | |
| 33SV5/1AG2206T | 163,9 | 46SV3G1856T | 117,2 | 66SV3/2AG2206T | 106,6 | 125SV1G1506T | 40,1 | |
| 33SV5G2206T | 173 | 46SV4/2AG2206T | 134,1 | 66SV3/1AG3006T | 117,4 | 125SV2/2AG2206T | 73 | |
| 33SV6/2AG2206T | 189 | 46SV4/1AG3006T | 144,2 | 66SV3G3006T | 127,8 | 125SV3/3BG3006T | 101,9 | |
| 33SV6/1AG3006T | 199,2 | 46SV4G3006T | 155,7 | 66SV4/2AG3706T | 149,1 | 125SV3G3706T | 117,5 | |
| 33SV6G3006T | 208,5 | 46SV5/2AG3006T | 171,6 | 66SV4/1AG3706T | 159,2 | 125SV4/4AG4506T | 146,1 | |
| 33SV7/2AG3006T | 224,6 | 46SV5/1AG3006T | 183,1 | 66SV4G3706T | 169,3 | 1258V5/5AG5506T | 182,6 | |

| | | Т | | Т | | | | |
|--------------|----------|---------------|--------|---------------|----------|------------------|--------|--|
| | 60 Hz 1, | 750 min-1 | | | 60 Hz 1, | 750 min-1 | | |
| 3~ | H (m)* | 3~ | H (m)* | 3~ | H (m)* | 3~ | H (m)* | |
| 1SV03F00246T | 6,6 | 5SV07F00246T | 18,8 | 22SV04F01146T | 22,2 | 46SV11G11046T | 105,7 | |
| 1SV05F00246T | 11 | 5SV09F00346T | 24 | 22SV05F01546T | 27,7 | 46SV12G11046T | 115,3 | |
| 1SV07F00246T | 15,3 | 5SV11F00346T | 29,5 | 22SV06F01546T | 33,3 | 46SV13G11046T | 124,9 | |
| 1SV09F00246T | 19,6 | 5SV13F00546T | 34,7 | 22SV07F02246T | 39,1 | 66SV1G01546T | 10,8 | |
| 1SV11F00246T | 23,9 | 5SV15F00546T | 40,4 | 22SV08F02246T | 44,6 | 66SV2G03046T | 21,1 | |
| 1SV13F00246T | 28,2 | 5SV17F00546T | 45,6 | 22SV09F02246T | 50,1 | 66SV3G04046T | 31,4 | |
| 1SV15F00246T | 32,4 | 5SV19F00746T | 50,8 | 22SV10F03046T | 55,6 | 66SV4G05546T | 42 | |
| 1SV17F00246T | 36,6 | 5SV21F00746T | 56,7 | 33SV2G01146T | 17 | 66SV5G07546T | 52,5 | |
| 1SV18F00246T | 38,7 | 5SV23F00746T | 61,9 | 33SV3G01546T | 25,7 | 66SV6G07546T | 62,7 | |
| 1SV20F00246T | 42,9 | 10SV03F00546T | 13 | 33SV4G02246T | 34 | 66SV7G11046T | 73,2 | |
| 1SV22F00246T | 47 | 10SV05F00546T | 21,6 | 33SV5G03046T | 42,7 | 66SV8G11046T | 83,7 | |
| 1SV24F00246T | 51,1 | 10SV07F00746T | 29,9 | 33SV6G03046T | 51,5 | 92SV1G01546T | 11,8 | |
| 1SV26F00346T | 55,2 | 10SV09F00746T | 38,5 | 33SV7G04046T | 59,9 | 92SV2G03046T | 23,4 | |
| 1SV28F00346T | 60 | 10SV11F01146T | 47,8 | 33SV8G05546T | 69 | 928V3G05546T | 35,4 | |
| 3SV02F00246T | 5,5 | 10SV13F01146T | 56,2 | 33SV9G05546T | 77,5 | 92SV4G07546T | 47,2 | |
| 3SV04F00246T | 10,9 | 10SV15F01546T | 65,1 | 33SV10G05546T | 85,9 | 928V5G07546T | 58,5 | |
| 3SV06F00246T | 16,3 | 15SV03F00546T | 15,4 | 33SV11G07546T | 94,9 | 92SV6G11046T | 70,2 | |
| 3SV08F00246T | 21,6 | 15SV04F00746T | 20,6 | 33SV12G07546T | 103,3 | 928V7G11046T | 81,9 | |
| 3SV10F00246T | 26,8 | 15SV05F01146T | 26,2 | 33SV13G07546T | 111,8 | 92SV8G15046T | 93,6 | |
| 3SV12F00246T | 32 | 15SV06F01146T | 31,3 | 46SV2G01546T | 19 | 125SV1G02246T | 10 | |
| 3SV14F00346T | 37,6 | 15SV07F01546T | 36,7 | 46SV3G02246T | 28,8 | 125SV2/2AG03046T | 18,3 | |
| 3SV15F00346T | 40,4 | 15SV08F01546T | 42,4 | 46SV4G03046T | 37,9 | 125SV3/3BG04046T | 25,5 | |
| 3SV17F00346T | 45,5 | 15SV09F02246T | 48 | 46SV5G04046T | 47,6 | 125SV4/4AG05546T | 36,5 | |
| 3SV19F00346T | 50,7 | 15SV10F02246T | 53,3 | 46SV6G05546T | 57,7 | 125SV5/5AG07546T | 45,6 | |
| 3SV21F00546T | 55,8 | 15SV11F02246T | 58,5 | 46SV7G05546T | 67,1 | 125SV6G11046T | 58,7 | |
| 3SV23F00546T | 61,9 | 15SV12F02246T | 63,8 | 46SV8G07546T | 77 | 125SV7G11046T | 68,5 | |
| 5SV03F00246T | 8,3 | 22SV02F00546T | 11 | 46SV9G07546T | 86,4 | 125SV8G15046T | 78,3 | |
| 5SV05F00246T | 13,7 | 22SV03F00746T | 16,5 | 46SV10G07546T | 95,7 | | | |

 \mathbf{T} Type

H Maximum Head

* Also applies to the other versions



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Installation, Operation, and Maintenance Manual



HVL 2.015-4.220



Table of Contents

| 1 | Introduction and Safety | 4 |
|---|---|----------|
| | 1.1 Introduction | |
| | 1.1.1 Qualified personnel | |
| | 1.2 Safety | |
| | 1.2.1 Satety message levels | 5
Г |
| | 1.3 User safety | כס
ר |
| | 1.5 Warranty | /
7 |
| | 1.5 Wallality | ,7
7 |
| | 1.7 FLI declaration of conformity (No LVD/EMCD05) | ,
8 |
| | 1.8 EU declaration of conformity | |
| | | |
| 2 | 2 Transportation and Storage | 10 |
| | 2.1 Inspect the delivery | 10 |
| | 2.1.1 Inspect the package | 10 |
| | 2.1.2 Inspect the unit | 10 |
| | 2.2 System lifting | |
| | 2.3 Iransportation guidelines | |
| | 2.4 Storage guidelines | 11 |
| z | Product Description | 12 |
| 5 | 3.1. System description | 12
12 |
| | 3.2 Product function and use | 1.3 |
| | 3.3 Applications | |
| | 3.3.1 Actuator | 13 |
| | 3.3.2 Controller | 13 |
| | 3.3.3 Cascade serial / Synchronous | |
| | 3.3.4 Cascade relay | 14 |
| | 3.4 The data plate | 14 |
| | 3.5 Technical Data | 15 |
| | 3.6 Motor thermal protection | |
| | 3.7 Dimensions and weights | |
| | 3.8 Design and layout | |
| | 3.9 Included mounting components | 20 |
| | 3.10 Optional components | |
| 4 | Installation | 22 |
| | 4.1 Installation site checklist | |
| | 4.2 Frequency converter and motor pre-installation check list | 22 |
| | | |
| 5 | o Mechanical Installation | 23 |
| | 5.1 Cooling | 23 |
| | 5.2 Lifting | 23 |
| | 5.3 Mounting | 23 |
| ٢ | | 24 |
| 0 | 6.1 Precautions | 20
26 |
| | 6.2 Protection devices | 20
27 |
| | 6.3 Wire type and ratings | 27
 |
| | 6.4 EMC compatibility | |
| | | |

| 6.4.1 EMC requirements
6.4.2 Wiring the cables | .30
.30 |
|---|------------|
| 6.4.5 KFI SWILCH | 21 |
| 6.5.1 AC Mains and motor connection | . JZ |
| 6.5.2 Motor connection | . JZ |
| 6.6 Control terminals | 37 |
| 6.6.1 Motor sensor connection | 35 |
| 6.6.2 Input for emergency basic operations | 36 |
| 6.6.3 Digital and analog I/O | 36 |
| 6.6.4 RS485 connection | .37 |
| 6.6.5 Status relays | .37 |
| 6.7 Premium card terminals | .38 |
| 6.7.1 Digital and analog I/O (X3) | .38 |
| 6.7.2 Relavs (X4) | 38 |
| | |
| 7 Operation | 10 |
| 7 1 Pre-start procedure | 40
40 |
| 7.2 Pre-startup inspections | 40
40 |
| 7.3 Apply power | <u>4</u> 0 |
| 7.4 Discharge time | <u>4</u> 1 |
| | - T I |
| | 40 |
| 8 Programming | 43 |
| 8.1 Display and control panel | .43 |
| 8.2 Functions of push buttons | 43 |
| | 44 |
| | 45 |
| 8.3.2 M20 STATUS | .49 |
| 8.3.3 M40 DIAGNOSTICS | .52 |
| 8.3.4 M60 SETTINGS | .54 |
| 8.3.5 M100 BASIC SETTINGS | .55 |
| 8.3.6 M200 CONF.INVERTER | .57 |
| 8.3.7 M300 REGULATION | .69 |
| 8.3.8 M400 SENSOR | /1 |
| 8.3.9 M500 SEQUENCE CONTR | 74 |
| | .78 |
| | .79 |
| 8.3.12 M800 REQUIRED VALUES | .81 |
| | .83 |
| 8.3.14 MI1000 TEST RUN | 86 |
| 8.3.15 MITUU SETUP | 87 |
| 8.3.16 MIZUU KS-485 INTERFACE | .89 |
| 0.3.17 WITSUU START-UP | 9Z |
| | |
| 9 Maintenance | .98 |
| 9.1 General | .98 |
| 9.2 Check error codes | 98 |
| 9.3 Check the functions and parameters | 98 |
| | |
| 10 Troubleshooting | .99 |
| 10.1 No error message on the display | .99 |
| 10.2 Error message on the display | 99 |
| 10.3 Internal error, on display or red LED ON1 | 01 |
| | |
| 11 Technical Reference | 02 |
| 11.1 Example: P105 ACTUATOR mode1 | 02 |
| | |

| 11.2 Example: P200 Ramp Settings | 102 |
|--|-----|
| 11.3 Example: P330 LIFT AMOUNT | 103 |
| 11.4 Example: P500 SUBMENU SEQUENCE CNTR | |
| 11.5 Example: P900 SUBMENU OFFSET | |
| 11.6 Programming flow charts | |

1 Introduction and Safety

1.1 Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

1.1.1 Qualified personnel



WARNING:

This product is intended to be operated by qualified personnel only.

- Correct and reliable transport, storage, installation, operation, and maintenance are required for the trouble-free and safe operation of the frequency converter. Only qualified personnel are allowed to install or operate this equipment.
- Qualified personnel are defined as trained staff, who are authorized to install, commission, and maintain equipment, systems, and circuits in accordance with pertinent laws and regulations. Also, the personnel must be familiar with the instructions and safety measures that are described in this document.
- Persons with diminished capacities should not operate the product unless they are supervised or have been properly trained by a professional.
- Children must be supervised to ensure that they do not play on or around the product.

1.2 Safety



WARNING:

- The operator must be aware of safety precautions to prevent physical injury.
- Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.
- Do not change the service application without the approval of an authorized Xylem representative.



CAUTION:

You must observe the instructions contained in this manual. Failure to do so could result in physical injury, damage, or delays.

1.2.1 Safety message levels

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product
- Product malfunction

Definitions

| Safety message level | | Indication | |
|----------------------|--------------------|--|--|
| | DANGER: | A hazardous situation which, if not avoided, will result in death or serious injury | |
| | WARNING: | A hazardous situation which, if not avoided, could result
in death or serious injury | |
| \triangle | CAUTION: | A hazardous situation which, if not avoided, could result
in minor or moderate injury | |
| $\widehat{\nearrow}$ | Electrical Hazard: | The possibility of electrical risks if instructions are not followed in a proper manner | |
| | | A potential situation which, if not avoided, could result in undesirable conditions A practice not related to personal injury | |

Hot surface hazard

Hot surface hazards are indicated by a specific symbol that replaces the typical hazard level symbols:



CAUTION:

1.3 User safety

General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Hard hat
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

NOTICE:

Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections.

Precautions before work

Observe these safety precautions before you work with the product or are in connection with the product:

- Provide a suitable barrier around the work area, for example, a guard rail.
- Make sure that all safety guards are in place and secure.
- Make sure that you have a clear path of retreat.
- Make sure that the product cannot roll or fall over and injure people or damage property.
- Make sure that the lifting equipment is in good condition.
- Use a lifting harness, a safety line, and a breathing device as required.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product has been thoroughly cleaned.
- Disconnect and lock out power before you service the pump.
- Check the explosion risk before you weld or use electric hand tools.

Precautions during work

Observe these safety precautions when you work with the product or are in connection with the product:

- Never work alone.
- Always wear protective clothing and hand protection.
- Stay clear of suspended loads.
- Always lift the product by its lifting device.
- Beware of the risk of a sudden start if the product is used with an automatic level control.
- Beware of the starting jerk, which can be powerful.
- Rinse the components in water after you disassemble the pump.
- Do not exceed the maximum working pressure of the pump.
- Do not open any vent or drain valve or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.
- Never operate a pump without a properly installed coupling guard.
Wash the skin and eyes

Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

| Condition | Action |
|---------------------------------------|---|
| Chemicals or hazardous fluids in eyes | Hold your eyelids apart forcibly with your fingers. Rinse the eyes with eyewash or running water for at least 15 minutes. Seek medical attention. |
| Chemicals or hazardous fluids on skin | Remove contaminated clothing. Wash the skin with soap and water for at least 1 minute. Seek medical attention, if necessary. |

1.4 Protecting the environment

Emissions and waste disposal

Observe the local regulations and codes regarding:

- Reporting of emissions to the appropriate authorities
- Sorting, recycling and disposal of solid or liquid waste
- Clean-up of spills

Exceptional sites



CAUTION: Radiation Hazard

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

currently valid legislation.

Recycling guidelines

Always follow local laws and regulations regarding recycling.

Waste and emissions guidelines



Do not dispose of equipment containing electrical components together with domestic waste. Collect it separately in accordance with local and

1.5 Warranty

For information about warranty, see the sales contract.

1.6 Spare parts



WARNING:

Only use original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the guarantee.

For more information about the product's spare parts, refer to the Sales and Service department.

1.7 EU declaration of conformity (No LVD/EMCD05)

| 1. Apparatus model/Product: | \rightarrow data plate | | | | |
|---|---|-----------------|--|--|--|
| 2. Name and address of the manufacturer: | Xylem Service Italia S.r.l. | | | | |
| | Via Vittorio Lombardi 14 | | | | |
| | 36100 Vicenza VI | | | | |
| | Italy | | | | |
| 3. This declaration of conformity is issued under | er the sole responsibility of the | e manufacturer. | | | |
| 4. Object of the declaration: | able speed drive) HYDROVAR [®] for
e following models | | | | |
| | HVL2.015-A0010 | HVL4.015-A0010 | | | |
| | HVL2.022-A0010 | HVL4.022-A0010 | | | |
| | HVL2.030-A0010 | HVL4.030-A0010 | | | |
| | HVL2.040-A0010 | HVL4.040-A0010 | | | |
| | HVL3.015-A0010 | HVL4.055-A0010 | | | |
| | HVL3.022-A0010 | HVL4.075-A0010 | | | |
| | HVL3.030-A0010 | HVL4.110-A0010 | | | |
| | HVL3.040-A0010 | HVL4.150-A0010 | | | |
| | HVL3.055-A0010 | HVL4.185-A0010 | | | |

5. The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

Directive 2014/35/UE of 26 February 2014 (electrical equipment designed for use within certain voltage limits)

HVL3.075-A0010

HVL3.110-A0010

HVL4.220-A0010

Directive 2014/30/UE of 26 February 2014 (electromagnetic compatibility)

6. References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

- EN 61800-5-1:2007
- EN 61800-3:2004+A1:2012 (*), EN 61000-6-1:2007, EN 61000-6-2:2005, EN 61000-6-4:2007+A1:2011

(*) Category C3

7. Notified body: -

8. Additional information: -Signed for and on behalf of: Montecchio Maggiore,18/04/2016 Amedeo Valente Director of Engineering and R&D *Rev. 00*

Xylem Service Italia S.r.l.

Alshuh

1.8 EU declaration of conformity

1. Unique identification of the EEE:

2. Name and address of the manufacturer:

No HVL Xylem Service Italia S.r.l. Via Vittorio Lombardi 14 36100 Vicenza VI Italy

3. This declaration of conformity is issued under the sole responsibility of the manufacturer.

4. Object of the declaration:

Frequency converter (variable speed drive) HYDROVAR $^{(\!\!\!R)}$ for electric pump in one of the following models

| HVL2.015-A | 0010 | HVL4.015-A0010 |
|------------|------|----------------|
| HVL2.022-A | 0010 | HVL4.022-A0010 |
| HVL2.030-A | 0010 | HVL4.030-A0010 |
| HVL2.040-A | 0010 | HVL4.040-A0010 |
| HVL3.015-A | 0010 | HVL4.055-A0010 |
| HVL3.022-A | 0010 | HVL4.075-A0010 |
| HVL3.030-A | 0010 | HVL4.110-A0010 |
| HVL3.040-A | 0010 | HVL4.150-A0010 |
| HVL3.055-A | 0010 | HVL4.185-A0010 |
| HVL3.075-A | 0010 | HVL4.220-A0010 |
| HVL3.110-A | 0010 | |

5. The object of the declaration described above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

6. References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared: -

7. Additional information: -

Signed for and on behalf of:

Montecchio Maggiore, 18/04/2016

Amedeo Valente

Director of Engineering and R&D Rev. 01

Xylem Service Italia S.r.l.

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2 Transportation and Storage

2.1 Inspect the delivery

2.1.1 Inspect the package

- 1. Inspect the package for damaged or missing items upon delivery.
- 2. Note any damaged or missing items on the receipt and freight bill.
- File a claim with the shipping company if anything is out of order.
 If the product has been picked up at a distributor, make a claim directly to the distributor.

2.1.2 Inspect the unit

- Remove packing materials from the product.
 Dispose of all packing materials in accordance with local regulations.
- 2. Inspect the product to determine if any parts have been damaged or are missing.
- 3. If applicable, unfasten the product by removing any screws, bolts, or straps. For your personal safety, be careful when you handle nails and straps.
- 4. Contact the local sales representative if there is any issue.

2.2 System lifting



WARNING:

Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.



WARNING: Crush Hazard

1) Always lift the unit by its designated lifting points. 2) Use suitable lifting equipment and ensure that the product is properly harnessed. 3) Wear personal protective equipment. 4) Stay clear of cables and suspended loads.

Lifting diagrams



2.3 Transportation guidelines

Precautions



WARNING:

- Stay clear of suspended loads.
- Observe accident prevention regulations in force.
- Do not damage the cables during transport; do not squeeze, bend or drag the cable.
- Always keep the cable ends dry.
- Secure the unit against tipping over and slipping until it is mounted and fixed in its final location.
- Lift and handle the product carefully, using suitable lifting equipment (stacker, crane, crane mounting device, lifting blocks, sling ropes, etc.).
- Always lift the unit by its lifting handle. Never lift the unit by the motor cable or by the hose.

2.4 Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE:

Protect the product against humidity, heat sources, and mechanical damage.

NOTICE:

Do not place heavy weights on the packed product.

3 Product Description

3.1 System description

System layout

The images show a typical single-pump and multi-pump system using the unit. When the system is connected directly to the water supply use a low-pressure switch on the suction side.



Figure 1: Single-pump system



Figure 2: Multi-pump system

- 1. Pump with HYDROVAR
- 2. Diaphragm pressure tank
- 3. Distribution panel
- 4. Gate valve
- 5. Non-return valve
- 6. Low water control
- 7. Pressure gauge
- 8. Pressure sensor
- 9. Drain tap

Pressure tank

A diaphragm pressure tank is used on the discharge side of the pump to maintain pressure in the pipes when there is no water demand. The unit stops the pump from continuing to run at zero demand and reduce the size of the tank that is required for supply purposes.

The tank must be permitted and suitable for systems pressure.

The capacity of the tank must be 10% of the maximum system flow rate of the pump or pumps (0.1 times the flow rate in l/min or gal/min). Turn off the unit to reduce the water pressure to check and set the correct pre-charged pressure.

The pre-charge pressure of the tank can be determined by using the following table:

Required pressure or Start Value when active [bar]



3.2 Product function and use

Description

HYDROVAR is a pump-mounted variable speed, microprocessor-based system controller. It can be mounted onto virtually any model of fan cooled motor and is simple to integrate into BMS systems with ModBus or Bacnet communication as standard.

In a variable speed controlled system, the pump works every time with the speed where it produces at the reduced flow exactly the required head. Therefore there is no wasted energy given to the system like on/off or bypass control.

Intended use

HYDROVAR is made for the following pump applications:

- Pressure, level, and flow regulation
- Closed loop systems
- Irrigation applications with single or multiple pumps

Improper use

The product must not be used for constant torque applications.

Approvals and certifications



The unit complies with UL508C thermal memory retention requirements.

3.3 Applications

Application alternatives

The application alternatives for the product are the following:

- Actuator
- Controller
- Cascade serial / Synchronous
- Cascade relay

3.3.1 Actuator

This mode is used for a unit in a single pump operation only. The unit operates as an actuator according an external speed signal or continuous operation on either one or two programmed frequencies. This is done by using the corresponding digital input.

3.3.2 Controller

This mode is set as the default operating mode and is used for a unit in a single pump operation.

3.3.3 Cascade serial / Synchronous

In these applications, each of the pumps (up to eight pumps) must be equipped with a unit.

The units are connected via the RS485 interface and communicate via the provided protocol.

The combination of the different units which are used in a multi-pump-system depends on the system requirements.

It is possible to run all pumps in cascade serial mode and synchronous mode as well. If one unit fails, then each pump of the system can become the lead pump and can take control.

3.3.4 Cascade relay

Description

One pump is fitted with the unit and up to five slave pumps can be switched to on/off on demand. The unit uses an additional Premium Card for this purpose.

For switching the slave pumps an external switchboard has to be installed.

Example

The example shows a booster set with four pumps where only one speed-controlled pump and the others are fixed speed.



HYDROVAR
 External panel

3.4 The data plate

Type definition code



Figure 3: Definition code and placement

| No. | Description | Alternatives |
|-----|----------------------|-------------------------------|
| 1 | Brand | HVL - HYDROVAR |
| 2 | Power supply | 2: 1~ 230 VAC |
| | | 3: 3~ 230 VAC |
| | | 4: 3~ 380-460 VAC |
| 3 | Shaft power *10 [kW] | 015: 1.5 kW (2.0 HP) |
| | | 022: 2.2 kW (3.0 HP) |
| | | 030: 3.0 kW (4.0 HP) |
| | | 040: 4.0 kW (5.0 HP) |
| | | 055: 5.5 kW (7.5 HP) |
| | | 075: 7.5 kW (10.0 HP) |
| | | 110: 11.0 kW (15.0 HP) |
| | | 150: 15.0 kW (20.0 HP) |
| | | 185: 18.5 kW (25.0 HP) |
| | | 220: 22.0 kW (30.0 HP) |
| 4 | Enclosure rate | A: IP 55 / Type1 |
| 5 | Bus communication | 0: Standard communication |

| No. | Description | Alternatives |
|-----|------------------|--|
| 6 | Optional cards | 0: No optional cards |
| 7 | Internal display | 1: Standard internal display installed |
| 8 | Other options | 0: No other options installed |

Example

| HVL | 4. | 075 | . A - | 00 | - 10 |
|-----|----|-----|-------|----|------|
| 1 | 2 | 3 | 4 | 56 | 78 |

| No. | Example | Description |
|-----|---------|-------------------------------------|
| 1 | HVL | HYDROVAR |
| 2 | 4 | Power Supply: 3~ 380-460 VAC |
| 3 | 075 | Shaft power: 7.5 kW (10.0 HP) |
| 4 | A | Enclosure rate: IP 55 / Type1 |
| 5 | 0 | Standard communication |
| 6 | 0 | No optional cards installed |
| 7 | 1 | Standard internal display installed |
| 8 | 0 | No other options installed |

3.5 Technical Data

Electrical specification

| | | | | | | | | | | HVL | | | | | | | | | | | |
|---|-------|--------|--------|-------|-------------------|-------------|--------|---------|-----------|-------|-------|--------------------------|-------|-------|--------|-------|-------|-------|-------|-------|-------|
| | 2.015 | 2.022 | 2.030 | 2.040 | 3.015 | 3.022 | 3.030 | 3.040 | 3.055 | 3.075 | 3.110 | 4.015 | 4.022 | 4.030 | 4.040 | 4.055 | 4.075 | 4.110 | 4.150 | 4.185 | 4.220 |
| Input | Input | | | | | | | | | | | | | | | | | | | | |
| Mains Supply | | L | Ν | | L1 L2 L3 L1 L2 L3 | | | | | | | | | | | | | | | | |
| Nominal
input voltage
(Vin): | | 208-24 | 10±10% | 6 | | 208-240±10% | | | | | | | | | 380-46 | 0±15% |) | | | | |
| Maximum
Input Current,
continuous
[A]: | 11.6 | 15.1 | 22.3 | 27.6 | 7.0 | 9.1 | 13.3 | 16.5 | 23.5 | 29.6 | 43.9 | 3.9 | 5.3 | 7.2 | 10.1 | 12.8 | 16.9 | 24.2 | 33.3 | 38.1 | 44.7 |
| efficiency,
rated [%],
typically: | 94.0 | 93.5 | 93.5 | 93.5 | 96.0 | 96.0 | 96.0 | 96.0 | 96.0 | 96.0 | 96.0 | 96.0 | 96.5 | 96.5 | 96.5 | 97.0 | 97.0 | 97.0 | 97.0 | 97.0 | 97.0 |
| Output | | | | | | | | | | | | | | | | | | | | | |
| Output
voltage (V) | | 0-3 | 240 | | | C |)-100% | of supp | ly voltag | le | | 0–100% of supply voltage | | | | | _ | | | | |
| Maximum
output
current,
continuous
[A]: | 7.5 | 10 | 14.3 | 16.7 | 7.5 | 10 | 14.3 | 16.7 | 24.2 | 31 | 44 | 4.1 | 5.7 | 7.3 | 10 | 13.5 | 17 | 24 | 32 | 38 | 44 |
| Output
frequency
(Hz) | | | | | | | | | | | 15-70 | | | | | | | | | | |

Environmental specification

| Storage temperature | -30°C [-22°F] to 70°C [158°F] |
|-------------------------|---|
| Relative humidity | 5%-95% - Condensation is not permitted |
| Operational temperature | -10°C [-14°F] to 55°C [131°F] |
| | 100% power rating -10°C [-14°F] to 40°C [104°F] |
| | with de-rating 40°C [104°F] to 55°C [131°F] |

3 Product Description

| Air pollution | The air may contain dry dust as found in workshops where there is excessive dust due to machines. Excessive amounts of dust, acids, corrosive gases, salts etc are not permitted. |
|---------------|--|
| Altitude | Max. 1000 m above sea level. For installation over 1000 m above sea
level, the maximum output power has to be de-rated by 1% for every
additional 100 m. If the installation site is over 2000 m above sea
level, please contact your local distributor or service contact. |

Installation specification

| Protection | Motor drive input have to be protected by an external circuit breaker/
fuse |
|---|--|
| Motor wire type | shielded power cable |
| Maximum motor cable length (no EMC compliant), screened | 50m (164ft) |
| Maximum motor cable length (no EMC compliant), unscreened | 100m (328ft) |

EMC compliance

In accordance with IEC 61800-3 and EN 61000 series standards, shield cable will be used for motor drive output and communication.

Installations must be done according EMC correct installations and avoiding pigtails (on the drive side), otherwise EMC cannot be guaranteed.

Class of protection

- IP55, Enclosure Type 1
- Protect the product from direct sunlight
- Protect the product from direct rainfall
- Outdoor installation without protection, to especially keep the temperature limits of the product, is not permitted

3.6 Motor thermal protection

Motor thermal protection can be implemented using various techniques: PTC sensor in motor windings or Software Thermal Control (STC).

Protection against motor overheating comes from par. 290 "STC Motor Protection", which by default is pre-sett to data value "STC trip".

NOTICE: The STC function is initialized at 1.125 x rated motor current and rated motor frequency. The STC function provides class 20 motor overload protection in accordance with the NEC.

Motor thermal protection prevents the motor from overheating. The STC function is an electronic feature that simulates a bimetal relay that is based on internal measurements. The characteristic is shown in the following figure.



The X-axis shows the ratio between Imotor actual and Imotor nominal. The Y-axis shows the time in seconds before the STC cuts off and trips the frequency converter. The curves show the characteristic nominal speed, at twice the nominal speed and at 20% of the nominal speed. The curve shows that at lower speed the STC cuts off at lower heat due to less cooling of the motor. In that way, the motor is protected from overheating even at low speed. The STC function calculates the motor temperature that is based on actual current and speed.

The calculated percentage of allowed maximum temperature is visible as a readout in par. 293 "Motor Thermal".

With the STC the motor is protected from being overheated and there is no need for any further motor protection. That means when the motor is heated up the STC timer controls how long the motor can be operated at the high temperature before it is stopped in order to prevent overheating.

Motor thermal protection can also be achieved using an external thermistor: set par. 290 "STC Motor Protection" to data value "Thermistor trip".

3.7 Dimensions and weights

Reading instructions

All measurements are in millimeters (inches).

The images are not to scale.

Free distance

| Area | Models | Free distance |
|--|--|--------------------|
| Above the unit | All | > 300 mm (12 in) |
| Center-distance between units (to ensure space for cabling): | HVL 2.015 ÷ 2.022 3.015 ÷ 3.022
4.015 ÷ 4.040 | > 300 mm (12 in) |
| | HVL 2.030 ÷ 2.040 3.030 ÷ 3.055
4.055 ÷ 4.110 | > 430 mm (17 in) |
| | HVL 3.075 ÷ 3.110 4.150 ÷ 4.220 | > 550 mm (21,6 in) |

Dimensional drawings



Figure 4: HVL2.015, HVL2.022, HVL3.015, HVL3.022, HVL4.015 ÷ HVL4.040



Figure 5: HVL2.030, HVL2.040, HVL3.030 ÷ HVL3.055, HVL4.055 ÷ HVL4.110



Figure 6: HVL3.075 ÷ HVL3.110, HVL4.150 ÷ HVL4.220

Weight

| Models | Maximum Weight |
|---|--------------------|
| HVL 2.015 ÷ 2.022 3.015 ÷ 3.022 4.015 ÷ 4.040 | 5,6 Kg (12,3 lbs) |
| HVL 2.030 ÷ 2.040 3.030 ÷ 3.055 4.055 ÷ 4.110 | 10,5 Kg (23 lbs) |
| HVL 3.075 ÷ 3.110 4.150 ÷ 4.220 | 15,6 Kg (34,4 lbs) |

3.8 Design and layout

Parts and descriptions

The unit can be fitted with the features the application requires.



| Position number | Description |
|-----------------|-----------------------------------|
| 1 | Power board, heatsink, EMC filter |
| 2 | Control board |
| 3 | Cover |
| 4 | Plastic cover |

3.9 Included mounting components

| Included Cable outer diameter | | Model | | | | |
|-----------------------------------|---------------|-------------|------------------|---|---|--------------------------------------|
| components | | (mm) | inches | HVL 2.015 ÷ 2.022
3.015 ÷ 3.022 4.015
÷ 4.040 | HVL 2.030 ÷ 2.040
3.030 ÷ 3.055 4.055
÷ 4.110 | HVL 3.075 ÷ 3.110
4.150 ÷ 4.220 |
| Cable Gland(s) and
Lock Nut(s) | M12 | 3.5 ÷ 7.0 | 0.138 ÷
0.275 | 3 | 3 | 3 |
| | M16 | 5.0 ÷ 10.0 | 0.197 ÷
0.394 | 2 | 2 | 2 |
| | M20 | 7.0 ÷ 13.0 | 0.275 ÷
0.512 | 2 | | |
| | M25 | 10.0 ÷ 17.0 | 0.394 ÷
0.669 | | 2 | |
| | M32 | 13.0 ÷ 21.0 | 0.512 ÷
0.827 | | | 2 |
| | M40 | 19.0 ÷ 28.0 | 0.748 ÷
1.102 | | | 2 |
| Entry Thread
Reducer | M40 ->
M32 | | | | | 2 |
| Plug(s) for Cable | M12 | | | 3 | 3 | 3 |
| Gland(s) | M16 | | | 2 | 2 | 2 |
| Screws | M5x30 | | | 4 | | |
| | M5x40 | | | 4 | | |
| | M6x40 | | | | 4 | 4 |
| | M6x50 | | | | 4 | 4 |
| Spade | RF-U 4 | | | 2 | 2 | |
| Connector(s) for PE | BF-U 4 | | | 2 | 2 | |
| | GF-U 4 | | | 2 | 2 | |
| Spares sealing ring | | | | | | 2 |
| Centering pin | | | | 1 | 1 | 1 |
| Mounting Clamps | | | | 4 | 4 | 4 |

For HVL 3.075 \div 3.110 or HVL 4.150 \div 4.220, if the cables outer diameter is incompatible with the included cable glands, use the supplied Entry Thread Reducers (and spares sealing rings).



3.10 Optional components

Components

| Component | Description |
|-----------------------|--|
| Motor cables | The motor cable that is ready to connect to the unit. |
| Mounting ring | If the motor fan is made of plastic, then a mounting ring is used. |
| | It is available in two diameters: 140 mm (5.5 in) and 155 mm (6.1 in). |
| Sensors | The following sensors can be used with the unit: |
| | Pressure-transducer |
| | Differential pressure-transducer |
| | Temperature-sensor |
| | Flow indicator (orifice plate, inductive flow meter) |
| | Level-sensor |
| Premium Card HYDROVAR | Card to control up to five slave pumps and to connect additional analog and digital I/Os |
| Wi-Fi Card HYDROVAR | To connect and interact wireless with HYDROVAR |

4 Installation

4.1 Installation site checklist



DANGER:

Never install the system controller in an explosive or flammable environment.

WARNING:

- Always refer to the local and national regulations, legislation, and codes in force regarding selection of installation site, and water and power connections.
- Keep the manual, drawings, and diagrams accessible for detailed installation and operation instructions. It is important that the manual is available for equipment operators.
- Install the unit on the motor fan cover. Keep motor cables as short as possible. Check the motor characteristics for actual tolerances.
- For wall mounting installations with long motor cables, use the output filter option to protect the motor.
- Ensure that the ingress protection rating of Hydrovar (IP55, Type1) is suitable for the installation environment.



CAUTION:

- Ingress protection. IP55 (Type 1) rating can only be guaranteed if the unit is properly closed.
- Make sure that there is no liquid on the unit before opening the plastic cover.
- Ensure all cable glands and unused holes for glands are properly sealed.
- Ensure that the plastic cover is properly closed.
- Device damage through contamination. Do not leave Hydrovar uncovered.

4.2 Frequency converter and motor pre-installation check list

- Compare the model number of the unit on the nameplate to what was ordered to verify the proper equipment.
- Ensure each of the following are rated for same voltage:
 - Mains (power)
 - Frequency converter
 - Motor
- Ensure that the frequency converter output current rating is equal to or greater than motor service factor current for peak motor performance.
 - Motor size and frequency converter power must match for proper overload protection.
 - If frequency converter rating is less than motor, full motor output cannot be achieved.

5 Mechanical Installation

5.1 Cooling

- The frequency converter is cooled by means of air circulation. To protect the unit from overheating, it must be ensured that the ambient temperature does not exceed the maximum temperature stated for the frequency converter and that the 24-hour average temperature is not exceeded.
- Derating for temperatures between 40°C (104°F) and 50°C (122°F) and elevation 1000 m (3300 ft) above sea level must be considered.
- Improper mounting can result in overheating and reduced performance.



CAUTION:

During the normal operation, the heat sink surfaces may be so hot that only the buttons should be touched to avoid burns.

5.2 Lifting

- Check the weight of the unit to determine a safe lifting method.
- Ensure that the lifting device is suitable for the task.
- If necessary, plan for a hoist, crane, or forklift with the appropriate rating to move the unit.
- For lifting, use hoist rings on the unit, when provided.

5.3 Mounting

• Install the unit on the motor fan cover. Keep motor cables as short as possible. Check the motor characteristics for actual tolerances.



- 1. Actual value sensor
- 2. Motor conduit box
- 3. Motor fan cover
- 4. Motor cable
- 5. Mounting clamps
- 6. Centring pin
- 7. Screws for mounting clamps
- 8. Plastic cover
- 9. Screws for plastic cover

Refer to callouts in preceding image.

1. Fit the rubber centering pin [6] on the bottom of the HYDROVAR[®].

NOTICE:

Always use a stainless steel mounting ring if the motors fan cover is made of plastic.

- 2. Center the unit on the motor fan cover [3] using the centering pin [6].
- 3. Adjust mounting clamps [5] length for smaller motor sizes, as indicated in the picture that follows.

NOTICE:

Take care about sharp edges and remove them properly.

- 4. Fasten the unit:
 - a. Fasten the mounting clamps [5] and relative screws [7].
 - b. Tighten the screws [7] until the two bottom teeth in the brackets grip the fan cover.
 - c. Tighten the screws until the unit is securely fastened.
- 5. Remove the screws for plastic cover [9].
- 6. Remove the plastic cover [8].
- 7. Make the electrical connections.
 - For more information about how to make the electrical connections, see *Electrical Installation*.

NOTICE:

You can remove the metal plate to make the electrical installation easier.

8. Mount and fasten the plastic cover [8] using 2,0 Nm tightening torque.



Electrical Hazard:

Make sure that all the cable glands are mounted properly and that all the unused cable entries use closing plugs.

Mounting clamps



6 Electrical Installation

6.1 Precautions



WARNING:

• EQUIPMENT HAZARD. Rotating shafts and electrical equipment can be hazardous. All electrical work must conform to national and local electrical codes. Installation, startup, and maintenance must be performed by trained and qualified personnel. Failure to follow these guidelines could result in death or serious injury.



Electrical Hazard:

• All electrical wiring must be carried out by an authorized electrician, in accordance with the electrical regulations locally in force.

NOTICE:

WIRING ISOLATION. Run input power, motor wiring and control wiring in three separate metallic conduits or use separated shielded cable for high frequency noise isolation. Failure to isolate power, motor and control wiring could result in less than optimum frequency converter and associated equipment performance.

For your safety comply with the following requirement:

• Electronic control equipment is connected to hazardous mains voltage. Extreme care should be taken to protect against electrical hazards when applying power to the unit.

Earth (grounding) requirements



WARNING:

For operator safety, it is important to ground the frequency converter properly in accordance with national and local electrical codes as well as instructions contained within this document. Ground currents are higher than 3.5 mA. Failure to ground the frequency converter properly could result in death or serious injury.

NOTICE:

It is the responsibility of the user or certified electrical installer to ensure correct grounding (earthing) of the equipment in accordance with national and local electrical codes and standards.

- Follow all local and national electrical codes to ground electrical equipment properly.
- Proper protective grounding for equipment with ground currents higher the 3.5 mA must be established. See the Leakage current (>3.5 mA) section for details.
- A dedicated ground wire is required for input power, motor power and control wiring.
- Use the clamps provided with the equipment for proper ground connections.
- Do not ground one frequency converter to another in a "daisy chain" fashion.
- Keep the ground wire connections as short as possible.
- Using high-strand wire to reduce electrical noise is recommended.
- Follow motor manufacturer wiring requirements.

Leakage current (>3.5 mA)

Follow national and local codes regarding protective earthing of equipment with a leakage current > 3.5 mA. Frequency converter technology implies high frequency switching at high power. This will generate a leakage current in the earth connection. A fault current in the frequency converter at the output power terminals might contain a DC component which can charge the filter capacitors and cause a transient earth current. The

earth leakage current depends on various system configurations including RFI filtering, screened motor cables, and frequency converter power.

EN/EC61800-5-1 (Power Drive System Product standard) requires special care if the leakage current exceeds 3.5 mA. Earth grounding must be reinforced in one of the following ways:

- Earth ground wire of at least 8 AWG or 10 mm² Cu (or 16mm2 Al).
- Two separate earth ground wires of the same cross sectional area.

See EN60364-5-54 section 543.7 for further information.

On HYDROVAR, the phase conductor and the corresponding protective earthing conductor can be of the same cross-sectional area, provided they are made of the same metal (because the cross-sectional area of the phase conductor is less than 16 mm²).

The cross-sectional area of every protective earthing conductor which does not form a part of the supply cable or cable enclosure shall, in any case, be not less than:

- 2.5 mm² if mechanical protection is provided or
- 4 mm² if mechanical protection is not provided. For cord-connected equipment, provisions shall be made so that the protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.

6.2 Protection devices

Fuses and Circuit Breakers

- An electronically activated function within the frequency converter provides overload protection in the motor. The overload calculates the level of increase to activate timing for the trip (controller output stop) function. The higher the current draw, the quicker the trip response. The overload provides Class 20 motor protection. See Warnings and alarms for details on the trip function.
- Hydrovar must be provided with short-circuit and over-current protection to avoid overheating of the cables in the installation. Input fusing and/or circuit breakers are required to provide this protection. Fuses and Circuit Breakers must be provided by the installer as part of installations.
- Use recommended fuses and/or circuit breakers on the supply side as protection in case of component breakdown inside the adjustable frequency drive (first fault). Use of recommended fuses and circuit breakers ensures possible damage to the adjustable frequency drive is limited to damages inside the unit. For other circuit breaker types, ensure that the energy into the adjustable frequency drive is equal to or lower than the energy provided by recommended types.
- The fuses below are suitable for use on a circuit capable of delivering 100,000 Ams (symmetrical), 480V maximum. With the proper fusing the adjustable frequency drive Short Circuit Current Rating (SCCR) is 100,000 Ams.

| | | | Circuit
breaker | | | | |
|------------|-------|----------|--------------------|------------|--------------------|---------|-----------|
| Voltage | | | U | IL | | Non UL | |
| supply | IIVL | Bussmann | Edison | Littelfuse | Ferraz-
Shawmut | Fuse | ABB |
| | | | Тур | e T | | Type gG | MCB \$200 |
| | 2.015 | JJN-20 | TJN (20) | JLLN 20 | A3T20 | 20 | S201-C20 |
| 1~ 230 VAC | 2.022 | JJN-25 | TJN (25) | JLLN 25 | A3T25 | 25 | S201-C25 |
| | 2.030 | JJN-35 | TJN (35) | JLLN 35 | A3T35 | 35 | S201-C32 |
| | 2.040 | JJN-35 | TJN (35 | JLLN 35 | A3T35 | 35 | S201-C40 |

Table 1: Recommended fuses and circuit breakers

| | | | Circuit
breaker | | | | |
|------------|-------|----------|--------------------|------------|--------------------|---------|-----------|
| Voltage | | | U | IL | | Non UL | |
| supply | ΠVL | Bussmann | Edison | Littelfuse | Ferraz-
Shawmut | Fuse | ABB |
| | | | Тур | oe T | | Type gG | MCB \$200 |
| | 3.015 | JJN-15 | TJN (15) | JLLN 15 | A3T15 | 16 | S203-C16 |
| | 3.022 | JJN-15 | TJN (15) | JLLN 15 | A3T15 | 16 | S203-C16 |
| | 3.030 | JJN-20 | TJN (20) | JLLN 20 | A3T20 | 16 | S203-C20 |
| 3~ 230 VAC | 3.040 | JJN-25 | TJN (25) | JLLN 25 | A3T25 | 25 | S203-C25 |
| | 3.055 | JJN-30 | TJN (30) | JLLN 30 | A3T30 | 25 | S203-C32 |
| | 3.075 | JJN-50 | TKN (50) | JLLN 50 | A3T50 | 50 | S203-C50 |
| | 3.110 | JJN-60 | TJN (60) | JLLN 60 | A3T60 | 63 | S203-C63 |
| | 4.015 | JJS-10 | TJS (10) | JLLS 10 | A6T10 | 10 | S203-C10 |
| | 4.022 | JJS-10 | TJS (10) | JLLS 10 | A6T10 | 10 | S203-C13 |
| | 4.030 | JJS-15 | TJS (15) | JLLS 15 | A6T15 | 16 | S203-C13 |
| | 4.040 | JJS-15 | TJS (15) | JLLS 15 | A6T15 | 16 | S203-C16 |
| 3~ 380-460 | 4.055 | JJS-20 | TJS (20) | JLLS 20 | A6T20 | 20 | S203-C20 |
| VAC | 4.075 | JJS-20 | TJS (20) | JLLS 20 | A6T20 | 20 | S203-C25 |
| | 4.110 | JJS-30 | TJS (30) | JLLS 30 | A6T30 | 30 | S203-C32 |
| | 4.150 | JJS-50 | TJS (50) | JLLS 50 | A6T50 | 50 | S203-C50 |
| | 4.185 | JJS-50 | TJS (50) | JLLS 50 | A6T50 | 50 | S203-C50 |
| | 4.220 | JJS-60 | TJS (60) | JLLS 60 | A6T60 | 63 | S203-C63 |

Type gG fuses in the table are reporting the fuses rated current.

Residual Current Devices, RCDs (GFCIs)

Where Ground Fault Circuit Interrupters (GFCIs) and residual current devices (RCDs), also know as earth leakage circuit breakers (ELCDs), are used, comply with the following:

- for HVL 2.015 ÷ 2.040, use GFCIs (RCDs) which are capable of detecting AC currents and pulsating currents with DC components. These GFCIs (RCDs) are marked with the following symbol:
- for HVL 3.015 ÷ 3.110 and 4.015 ÷ 4.220, use GFCIs (RCDs) which are capable of detecting AC and DC currents. These GFCIs (RCDs) are marked with the following symbols:
- Use GFCIs (RCDs) with an inrush delay to prevent faults due to transient earth currents.
- Dimension GFCIs (RCDs) according to the system configuration and environmental considerations.

NOTICE:

When an earth leakage circuit breaker or ground fault circuit interrupter is selected, the total leakage current of all the electrical equipment in the installation must be taken into account.

6.3 Wire type and ratings

- All wiring must comply with local and national regulations regarding cross section and ambient temperature requirements.
- Use cables with a minimum heat resistance of +70 °C (158 °F); to obey the UL (Underwriters Laboratories) regulations, it is recommended that all power connections be made with a minimum 75°C rated copper wire of the following types: THW, THWN.

| HVL | Power supply ir | nput cable + PE | Motor output cables + PE | | |
|-------|---------------------------------------|----------------------------|---------------------------------------|----------------------------|--|
| | Wire numbers x Max.
copper section | Wire numbers x Max.
AWG | Wire numbers x Max.
copper section | Wire numbers x Max.
AWG | |
| 2.015 | 3 x 2mm ² | 3 x 14AWG | 4 x 2mm ² | 4 x 14AWG | |
| 2.022 | | | | | |
| 2.030 | 3 x 6mm ² | 3 x 10AWG | 4 x 6mm ² | 4 x 10AWG | |
| 2.040 | | | | | |
| 3.015 | 4 x 2mm ² | 4 x 14AWG | 4 x 2mm ² | 4 x 14AWG | |
| 3.022 | | | | | |
| 3.030 | 4 x 6mm ² | 4 x 10AWG | 4 x 6mm ² | 4 x 10AWG | |
| 3.040 | | | | | |
| 3.055 | | | | | |
| 3.075 | 4 x 16mm ² | 4 x 5AWG | 4 x 16mm ² | 4 x 5AWG | |
| 3.110 | | | | | |
| 4.015 | 4 x 2mm ² | 4 x 14AWG | 4 x 2mm ² | 4 x 14AWG | |
| 4.022 | | | | | |
| 4.030 | | | | | |
| 4.040 | | | | | |
| 4.055 | 4 x 6mm ² | 4 x 10AWG | 4 x 6mm ² | 4 x 10AWG | |
| 4.075 | | | | | |
| 4.110 | | | | | |
| 4.150 | 4 x 16mm ² | 4 x 5AWG | 4 x 16mm ² | 4 x 5AWG | |
| 4.185 | | | | | |
| 4.220 | | | | | |

Table 2: Recommended power connections cables

Table 3: Tightening torques for power connections

| | Tightening torque | | | | |
|---------------|-------------------|---------------------------------|----|-------|--|
| HVL | Mains and m | Mains and motor cable terminals | | tor | |
| | Nm | lb-in | Nm | lb-in | |
| 2.015 ÷ 2.022 | 0.8 | 7.1 | 3 | 26.6 | |
| 3.015 ÷ 3.022 | | | | | |
| 4.015 ÷ 4.040 | | | | | |
| 2.030 ÷ 2.040 | 1.2 | 10.6 | 3 | 26.6 | |
| 3.030 ÷ 3.055 | | | | | |
| 4.055 ÷ 4.110 | | | | | |
| 3.075 ÷ 3.110 | 1.2 | 10.6 | 3 | 26.6 | |
| 4.150 ÷ 4.220 | | | | | |

Control cables

All control cables that are connected to the control board must be screened. External volt free contacts must be suitable for switching < 10 VDC.

NOTICE:

If unscreened control cables are used, then signal interference with the incoming signals and the function of the unit can be compromised.

Table 4: Recommended control cables

| Hydrovar Control | Copper section | | Tightening torque | |
|--------------------|-----------------|-------|-------------------|---------|
| Cables | mm ² | AWG | Nm | lb-in. |
| All I/O conductors | 0.2 ÷ 1.6 | 25÷16 | 0.5-0.6 | 4.5-5.4 |

6.4 EMC compatibility

6.4.1 EMC requirements

Hydrovar fulfills the product standard EN61800-3:2004 + A1:2012, which defines categories (C1 to C4) for device application areas.

Depending on the motor cable length, a classification of Hydrovar by category (based on EN61800-3) is reported in the following table:

Table 5: EMC categories

| HVL | Hydrovar classification by categories based on 61800-3 |
|---------------|--|
| 2.015 ÷ 2.040 | C1 (*) |
| 3.015 ÷ 3.110 | C2 (*) |
| 4.015 ÷ 4.220 | C2 (*) |

(*) 0,75 motor cable length; contact Xylem for further information

NOTICE: No external EMC filters are required to make Hydrovar compliant with the limit values of each category reported in the preceding table; motor cable shall be shielded.

6.4.2 Wiring the cables

To ensure electromagnetic compatibility the following points must be observed for cable installation:

- Ground cables should be as short as possible and with lowest impedance.
- Signal cables should be screened types to prevent disturbances from outside. Connect the shield to ground on one end only (to prevent ground loops), preferably to HYDROVAR GND using the pre mounted cable-clips; to connect a shield with lowest impedance to ground, remove the insulation from the signal cable and connect the shield to ground, as shown in the following image.
- Shielded Motor cable should be as short as possible; connect the shield to ground on both ends!



NOTICE:

Signal cables must be installed separate both from motor cable and power supply cable. If signal cables are installed in parallel to power supply cable or to motor cable for a longer distance, the distance between these cables should be more than 200mm. Do not cross power cables and control cables - if this is not possible, cross them only in an angle of 90°.

6.4.3 RFI switch

In case mains power supply is impedance-grounded (IT), the AC drive must have the EMC protection level C4 as per product standard EN61800-3:2004 + A1:2012: it is then necessary to deactivate the RFI filter of Hydrovar, by unscrewing the RFI switch depicted in the following image.



WARNING:

Do not make changes on Hydrovar when it is connected to mains: Make sure that the unit is disconnected from the power supply before removing the screw.



6.5 AC mains and motor connection terminals

Unscrew the dedicated 6 screws and remove the plastic cover of Hydrovar, in order to proceed wiring the power supply and the motor terminal, as described in the following paragraphs.

6.5.1 AC Mains (power supply) connection

- 1. Size wiring based upon the input current of Hydrovar
 - Comply with local and national electrical codes for cable sizes.
- 2. Connect 1-phase AC input power wiring to terminals L and N: make sure phase and neutral are properly aligned to provided terminals L and N.



3. Connect 3-phase AC input power wiring to terminals L1, L2, and L3.



- 4. Ground the cable in accordance with grounding instructions provided.
- 5. If a double earthing is necessary, use the earth terminal under the heatsink of the drive.



6.5.2 Motor connection



WARNING:

INDUCED VOLTAGE. Run output motor cables from multiple frequency converters separately. Induced voltage from output motor cables run together can charge equipment capacitors even with the equipment turned off and locked out. Failure to run output motor cables separately could result in death or serious injury.

- Comply with local and national electrical codes
- Do not install power factor correction capacitors between the frequency converter and the motor
- Do not wire a starting or pole-changing device between Hydrovar and the motor

• Connect 3-phase motor wiring to terminals U, V, and W.



- Ground the cable in accordance with grounding instructions provided
- Torque terminals in accordance with the informations provided.
- Follow motor manufacturer wiring requirements
- The connection of the motor cable depends on the type of motor and can be done in star or delta connection: the right connection of the motor has to be selected as shown on the motor label according to the output voltage of the Hydrovar.
- The connection of the motor cable shield can be done using a pigtail connected to a PE screw (see image below), or by using a metallic cable gland in case of motor with metallic conduit box connected to PE.



MOT_CONN_A-SC

6.6 Control terminals

Unscrew the dedicated 6 screws and remove the plastic cover of the Hydrovar, in order to proceed wiring the control terminals, as described in the following paragraphs; for reference, the wiring harness scheme is reported on the backside of the plastic cover too.



COVER_B-SIDE_A_SC

Figure 7: Cover

Do not connect the ground of the control card to other voltage potentials. All ground terminals and ground of the RS485 connection are connected internally.



Figure 8: Control board

6.6.1 Motor sensor connection

Terminals X1/7 and X1/8 are used to connect a motor sensor (PTC or thermal switch) to stop the unit in case of failure; any other protective device can be connected to these terminals.

As described in par. 3.6 Motor thermal protection, this input can be enabled by setting par. 290 "STC Motor Protection" to data value "Thermistor trip".

Table 6: PTC terminals

| Terminals | Description |
|-----------|--------------------------------------|
| X1/7 | PTC or thermal switch input |
| X1/8 | PTC or thermal switch input (Ground) |

6.6.2 Input for emergency basic operations

Terminals X1/20 and X1/21 are used to connect an external switch which forces (when closed) Hydovar to perform a manual start-up till reaching the maximum frequency (fixed speed) set by par. 245 "Maximum Frequency

Table 7: SL terminals

| Terminals | Description |
|-----------|---|
| X1/20 | External switch (SOLO RUN) input |
| X1/21 | External switch (SOLO RUN) input (Ground) |

6.6.3 Digital and analog I/O

Several terminals, from X1/1 to X1/24, are used to connect analog and digital I/Os to correspondent input signals, most of them configurable by specific parameters.

| Item | Terminals | Description | Comments |
|---|-----------|---|--|
| | X1/1 | Power supply for external sensor 1 | 24VDC, Σ max. 100mA |
| Sensor 1 | X1/2 | Actual value current/voltage input sensor 1 | 0-20mA / 4-20mA / 0-10
VDC / 2-10 VDC |
| | X1/3 | Ground for external sensor
1 | GND, electronic ground (for X1/2) |
| | X1/4 | Power supply for external sensor 2 | 24VDC, Σ max. 100mA |
| Sensor 2 | X1/5 | Actual value current/voltage input sensor 2 | 0-20mA / 4-20mA / 0-10
VDC / 2-10 VDC |
| | X1/6 | Ground for external sensor
2 | GND, electronic ground (for X1/5) |
| Auxiliary | X1/9 | Auxiliary voltage supply | 10VDC, max. 3mA |
| | X1/10 | Ground for auxiliary voltage supply | GND, electronic ground (for X1/9) |
| Digital Input | X1/14 | Configurable digital input 1 | Active low |
| | X1/15 | Ground for configurable
digital input 1 | GND, electronic ground (for X1/14) |
| Low water | X1/16 | Low water input | Active low |
| | X1/17 | Ground for low water input | GND, electronic ground (for X1/16) |
| External ON/OFF | X1/18 | External ON/OFF input | Active low |
| | X1/19 | Ground for external ON/OFF input | GND, electronic ground (for X1/18) |
| External fan (Not to be
used: only for Wall
Mounting kit connection!) | X1/22 | External fan control | |
| | X1/23 | Ground for external fan
control | GND, electronic ground (for X1/22) |

6.6.4 RS485 connection

Terminals X1/11, X1/12 and X1/13 are used for the communication among up to 8 Hydrovar in a multi-pump application; a dedicated termination resistor switch (BUS1, see image below) is made available to add a parallel terminator resistor to this RS485 port: if the resistor is needed put BUS1 switch on ON position.

Terminals X1/24, X1/25 and X1/26 are used for the communication (via Modbus or Bacnet protocol) with an external-control-device (e.g. PLC, BMS or a PC too); a dedicated termination resistor switch (BUS2, see image below) is made available to add a parallel terminator resistor to this RS485 port: if the resistor is needed put BUS2 switch on ON position.



Table 9: RS485 ports

| Terminals | Description | Comments | |
|-----------|---------------------------------|---------------------------------------|--|
| X1/11 | RS485 port 1: RS485-1N | | |
| X1/12 | RS485 port 1: RS485-1P | PC/05 part 1 for multi nump system | |
| X1/13 | GND, electronic ground | 1 N3403 Port i for multi-pump systems | |
| BUS1 | Termination resistor for port 1 | | |
| X1/24 | RS485 port 2: RS485-2N | | |
| X1/25 | RS485 port 2: RS485-2P | RS485 port 2 for external | |
| X1/26 | GND, electronic ground | communication | |
| BUS2 | Termination resistor for port 2 | | |

6.6.5 Status relays

Terminals X2/4, X2/5 and X2/6 are used to make available Status Relay 1 contacts, for driving an external relay used as pump status configurable indicator.

Terminals X2/1, X2/2 and X2/3 are used to make available Status Relay 2 contacts, for driving an external relay used as pump status configurable indicator.

| Terminals | Description | Comments |
|-----------|--------------------|-------------------------|
| X2/1 | Status Relay 2: NO | Status Relay 2 |
| X2/2 | Status Relay 2: NC | Maximum 250 VAC, 0.25 A |
| X2/3 | Status Relay 2: CC | Maximum 220 VDC, 0.25 A |
| | | Maximum 30 VDC, 2 A |
| X2/4 | Status Relay 1: NO | Status Relay 1 |
| X2/5 | Status Relay 1: NC | Maximum 250 VAC, 0.25 A |
| X2/6 | Status Relay 1: CC | Maximum 220 VDC, 0.25 A |
| | | Maximum 30 VDC, 2 A |

Table 10: Status relays

6.7 Premium card terminals

6.7.1 Digital and analog I/O (X3)

Several terminals, from X3/1 to X3/12, are used to connect additional analog and digital I/Os to correspondent input signals, most of them configurable by specific parameters.

| tem | Terminals | Description | Comments |
|---------------|-----------|---|--|
| | X3/1 | Configurable digital input 2 | Active low |
| Digital Input | X3/2 | Ground for configurable
digital input 2 | GND, electronic ground (for
X3/1) |
| | X3/3 | Analog output signal 1 | 4-20mA |
| Signal 1 | X3/4 | Ground for analog output
signal 1 | GND, electronic ground (for
X3/3) |
| | X3/5 | Analog output signal 2 | 0-10 VDC |
| Signal 2 | X3/6 | Ground for analog output
signal 2 | GND, electronic ground (for
X3/5) |
| Sensor 3 | X3/7 | Power supply for external sensor 3 | 24VDC, Σ max. 100mA |
| | X3/8 | Actual value current/voltage input sensor 3 | 0-20mA / 4-20mA / 0-10
VDC / 2-10 VDC |
| | X3/9 | Ground for external sensor
3 | GND, electronic ground (for
X3/8) |
| Sensor 4 | X3/10 | Power supply for external sensor 4 | 24VDC, Σ max. 100mA |
| | X3/11 | Actual value current/voltage input sensor 4 | 0-20mA / 4-20mA / 0-10
VDC / 2-10 VDC |
| | X3/12 | Ground for external sensor
4 | GND, electronic ground (for
X3/11) |
| | | | |

Table 11: PC I/O terminals

6.7.2 Relays (X4)

Several terminals, from X4/1 to X4/6, are used to connect up to 5 fixed speed pumps through an external panel.

| Terminals | Description | Comments |
|-----------|-------------------|-------------------------|
| X4/1 | Relay 1: NO | Maximum 250 VAC, 0.25 A |
| X4/2 | Relay 2: NO | Maximum 220 VDC, 0.25 A |
| X4/3 | Relay 3: NO | Maximum 30 VDC, 0.25 A |
| X4/4 | Relay 4: NO | |
| X4/5 | Relay 5: NO | |
| X4/6 | Ground for relays | |

Table 12: Relay terminals

7 Operation

7.1 Pre-start procedure



Electrical Hazard:

If input and output connections have been connected improperly, there is potential for high voltage on these terminals. If power leads for multiple motors are improperly run in same conduit, there is potential for leakage current to charge capacitors within the frequency converter, even when disconnected from mains input. For initial start up, make no assumptions about power components. Follow pre-start procedures. Failure to follow pre-start procedures could result in personal injury or damage to equipment.

- 1. Make sure input power to unit is OFF and locked out. Do not rely on the frequency converter disconnect switches for input power isolation.
- 2. In case of 1-phase AC input power, verify that there is no voltage on input terminals L and N, phase-to-phase and phase-to-ground.
- 3. In case of 3-phase AC input power, verify that there is no voltage on input terminals L1, L2 and L3, phase-to-phase and phase-to-ground.
- 4. Verify that there is no voltage on output terminals U, V and W, phase-to-phase and phase-to-ground.
- 5. Confirm continuity of the motor by measuring ohm values on U-V, V-W and W-U.
- 6. Check for proper grounding of the frequency converter as well as the motor.
- 7. Inspect the frequency converter for loose connections on terminals.
- 8. Record the following motor-nameplate data: power, voltage, frequency, full load current, and nominal speed. These values are needed to program motor nameplate data later.
- 9. Confirm that the supply voltage matches voltage of frequency converter and motor.

7.2 Pre-startup inspections

| Item to Inspect | Description | Checked |
|-----------------------------|--|---------|
| Auxiliary equipment | Look for auxiliary equipment, switches, disconnects, or input fuses/circuit breakers that may reside on input power side of the frequency converter or output side to motor. Ensure they are ready for full speed operation. Check function and installation of any sensors used for feedback to the frequency converter. Remove power factor correction caps on motor(s), if present. | |
| Cable routing | • Ensure that input power, motor wiring and control wiring are separated or in three separate metallic conduits for high frequency noise isolation. | |
| Control wiring | Check for broken or damaged wires and connections. Check that control wiring is isolated from power and motor wiring for noise immunity. Check the voltage source of the signals, if necessary. The use of shielded cable or twisted pair is recommended. Ensure that the shield is terminated correctly. | |
| Cooling clearance | • Measure that top and bottom clearance is adequate to ensure proper air flow for cooling. | |
| EMC considerations | Check for proper installation with regard to electromagnetic capability. | |
| Environmental conditions | See equipment tech label for the maximum ambient operation temperature limits. Humidity levels must be 5–95% non-condensing. | |
| Fusing and circuit breakers | Check for proper fusing or circuit breakers. Check that all fuses are inserted firmly and in operational condition and that all circuit breakers are in the open position. | |

| Item to Inspect | Description | Checked |
|-------------------------------|--|---------|
| Grounding (earthing) | Check for good earth connections (ground connections) that are tight and free of oxidation. Grounding (earthing) to conduit is not a suitable ground (earth). | |
| Input and output power wiring | Check for loose connections.Check that motor and mains are in separate conduit or separated screened cables. | |
| Switches | Ensure that all switch and disconnect settings are in the proper positions. | |
| Vibration | Check that the unit is mounted solidly.Check for an unusual amount of vibration. | |

Checked by:

Date:

7.3 Apply power

NOTICE:

- HIGH VOLTAGE. Frequency converters contain high voltage when connected to AC mains. Installation, start-up and maintenance should be performed by qualified personnel only. Failure to comply could result in death or serious injury.
- UNINTENDED START. When the frequency converter is connected to AC mains, the motor may start at any time. The frequency converter, motor, and any driven equipment must be in operational readiness. Failure to comply could result in death, serious injury, equipment, or property damage.
- POTENTIAL HAZARD IN THE EVENT OF INTERNAL FAILURE! Risk of personal injury when the frequency converter is not properly closed. Before applying power, ensure all safety covers are in place and securely fastened.
- 1. Confirm that the input voltage is balanced with 3%. If not, correct voltage imbalance before proceeding. Repeat this procedure after the voltage correction.
- 2. Ensure that optional equipment wiring, if present, matches the installation application.
- 3. Ensure that all operator and start enable devices are in the OFF position. Panel doors should be closed or cover mounted.
- 4. Apply power to the unit. DO NOT start the frequency converter at this time. For units with a disconnect switch, turn to the ON position to apply power to the frequency converter.

7.4 Discharge time



WARNING:

Disconnect and lock out electrical power and wait for the minimum waiting time specified below. Failure to wait the specified time after power has been removed before performing service or repair could result in death or serious injury.

Frequency converters contain DC-link capacitors that can remain charged even when the frequency converter is not powered. To avoid electrical hazards, disconnect:

- AC mains
- Any permanent magnet type motors
- Any remote DC-link power supplies, including battery backups, ups and DC-link connections to other frequency converters.

Wait for the capacitors to discharge completely before performing any service or repair work. Refer to the following table for wait times:

| HVL | Minimum waiting times (min) |
|---------------|-----------------------------|
| 2.015 ÷ 2.040 | 15 |
| 3.015 ÷ 3.055 | 4 |

| HVL | Minimum waiting times (min) |
|---------------|-----------------------------|
| 3.075 ÷ 3.110 | 15 |
| 4.015 ÷ 4.110 | 4 |
| 4.150 ÷ 4.220 | 15 |

High voltage may be present even when the warning LED indicator lights are off.
8 Programming

Notice

NOTICE:

Read and follow the operating instructions carefully before you start programming. This is to prevent incorrect settings which cause malfunction. All modifications must be done by qualified technicians!

8.1 Display and control panel



8.2 Functions of push buttons

| Push button | Description |
|---------------|---|
| A | Start of the unit in the 1 st window. |
| ▼ | Stop of the unit in the 1 st window. |
| ◄ and ► | Reset: press both buttons simultaneously for 5 seconds. |
| A | Increase of a value / selection of the submenu. |
| ▼ | Decrease of a value / selection of the submenu. |
| ▲ + short ▼ | Change to faster scrolling up of a value. |
| ▼ + short ▲ | Change to faster scrolling down of a value. |
| Short press ► | Enter submenu / change to next parameter in the menu. |
| Short press ◀ | Leave submenu / change to previous parameter in the menu. |
| Long press < | Change back to main menu. |

Functions associated to each push button may change, but they are shown in every moment, for reference, on the lowest row of the display.

8.3 Software parameters

Parameters are organized in 2 distinct groups:

- The set of parameters only defining menus
- The set of parameters necessary for HYDROVAR configuration

Referring to the first set (those parameters defining menus), each of them is presented with an image of the display containing (for example) the following information:

| M20 STATU | JS | | |
|---------------------------|------|------|-------|
| := | ME | NU | |
| Actual value Output Freq. | | | |
| ENTER | PREV | NEXT | ENTER |

where:

- M20: is the Menu number
- STATUS: is the Menu name
- Actual value: is the input signal supplied by the selected transducer (set by submenu 400), expressed with the dimension unit set by parameter 405
- OUTPUT FREQ.: current frequency supplied by the drive to the motor
- ENTER/PREV/NEXT: actual functions of the related push buttons

Referring to the second set (those parameters configuring HYDROVAR), each of them is presented with an image of the display containing (for example) the following information:

| P09 OPERAT.TIME | | | |
|---------------------------|---------|-----------|------------|
| ٥ | XXX | XX.XX | |
| Actual value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

where:

- P09: is the parameter number
- OPERAT.TIME: is the parameter name
- XXXXX.XX: is the current parameter value
- Actual value: is the input signal supplied by the selected transducer (set by submenu 400), expressed with the dimension unit set by parameter 405
- Output frequency: current frequency supplied by the drive to the motor
- Left/Up/Down/Right fct.: actual functions of the related push buttons

The parameters are applicable for all HYDROVAR with the following exceptions:

• If a setting is transferred automatically on all HYDROVAR within one system, this is marked with the symbol (Global):



• If a parameter is read-only, this is marked with the symbol (Read-only):

8.3.1 M00 MAIN MENU

Menu scope

This submenu includes the following software parameters:

- Home
- Selection of required value
- Regulation restart value
- Language selection
- Date and time setup
- Auto start
- Operating hours

HOME

The information shown on the display depends on the selection done in parameter 105 **MODE**; for more details, see *P105 MODE* (page 55)

When P105 **MODE** is set to **Controller** or **Actuator**, display shows the following information:

| CONTROLLER | | | | |
|------------------------|-------|------|------|--|
| Actual Value | | | | |
| Status HV Output Freq. | | | | |
| PREV | START | STOP | NEXT | |
| | | | | |
| ACTUATOR | | | | |
| Actual Value | | | | |

where:

PREV

Status HV

START

- Actual value: is the input signal supplied by the selected transducer (set by menu 400)
- Status HV: is the HYDROVAR status (ON / OFF / STOP) depending on manual setting on push buttons and external contact X1/18-19)

NEXT

• Output frequency: current frequency supplied by the drive to the motor

Output Freq.

STOP

• PREV/START/STOP/NEXT: actual functions of the related push buttons

When parameter 105 **MODE** is set to **Cascade Relay**, display shows the following information:

| CASCADE RELAY #1+4 | | | |
|------------------------|-------|------|------|
| 🕷 Actual Value | | | |
| Status HV Output Freq. | | | |
| PREV | START | STOP | NEXT |

where:

- Cascade Relay: is the value of parameter 105
- #1+4: is the indication that the system is running with 1 Master (#1) and, for example, 4 fixed speed pumps (+4)
- Actual value: is the input signal supplied by the selected transducer (set by menu 400)

- Status HV: is the HYDROVAR status (ON / OFF / STOP) depending on manual setting on push buttons and external contact X1/18-19)
- Output frequency: current frequency supplied by the drive to the motor
- PREV/START/STOP/NEXT: actual functions of the related push buttons

When. 105 **MODE** is set to **Cascade Serial** or **Cascade Synchron**, display shows the following information:

| | CASCAD | E SERIAL | @1-P4 |
|------------------------|--------|----------|-------|
| ≎∦ | Actua | l Value | |
| Sta | tus HV | Output | Freq. |
| PREV | START | STOP | NEXT |
| | | | |
| CASCADE SYNCHRON @1-P4 | | | |
| Actual Value | | | |

| Status I | ΗV | Output I | Freq. |
|----------|-------|----------|-------|
| PREV | START | STOP | NEXT |

where:

- Cascade Serial or Cascade Synchron: is the value of parameter 105
- @1: shows, for example, the value of parameter 1220 (PUMP ADDR.)
- P4: shows, for example, the address of the pump which is currently acting as Master of the cascade, depending on settings of menu 500
- Actual value: is the input signal supplied by the selected transducer (set by menu 400)
- Status HV: is the HYDROVAR status (ON / OFF / STOP) depending on manual setting on push buttons and external contact X1/18-19)
- Output frequency: current frequency supplied by the drive to the motor
- PREV/START/STOP/NEXT: actual functions of the related push buttons

P02 REQUIRED VAL.

The information shown on the display depend on the selection done in parameter 105; for more details, see *P105 MODE* (page 55)

When parameter 105 **MODE** is set to **Controller**, **Cascade Relay**, **Cascade Serial** or **Cascade Synchron**, display shows the following information:

| P02 REQUIRED VAL. | | | D1 |
|---------------------------|---------|-----------|------------|
| ¢ | XXX.XX | k bar | |
| Actual Value Output Freq. | | | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

where:

- **REQUIRED VAL.**: is the parameter description
- D1: is (for example) the selected source for the parameter, set by submenu 800
- XXX.XX: is the current parameter value
- bar: is the dimension unit set by parameter 405
- Actual value: is the input signal supplied by the selected transducer (set by submenu 400), expressed with the dimension unit set by parameter 405

- Output frequency: current frequency supplied by the drive to the motor
- Left/Up/Down/Right: actual functions of the related push buttons

When parameter 105 MODE is set to Actuator, display shows the following information:

| P02 ACTUAT.FRQ. | | | D1 |
|--------------------------|---------|-----------|------------|
| ٥ | XX.X | Hz | |
| Actual Value Output Free | | | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

where:

- ACTUAT.FRQ.1.: is the parameter description
- D1: is (for example) the selected source for the parameter, set by submenu 800
- XX.X: is the current parameter value
- Hz: is the dimension unit
- Actual value: is the input signal supplied by the selected transducer (set by submenu 400), expressed with the dimension unit set by parameter 405
- Output frequency: current frequency supplied by the drive to the motor
- Left/Up/Down/Right: actual functions of the related push buttons

P03 EFF.REQ.VAL.

The information shown on the display depends on the selection done in par. 105; for more details, see *P105 MODE* (page 55)

When parameter 105 MODE is set to Controller, Cascade Relay, Cascade Serial or Cascade Synchron, display shows the following information:

| P03 EFF.REQ.VAL | | | D1 |
|--------------------------|---------|-----------|------------|
| ۵ | XXX.XX | x bar | |
| Actual Value Output Freq | | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. |

where:

- EFF.REQ.VAL.: is the parameter description
- D1: is (for example) the selected source for the parameter, set by submenu 800
- XXX.XX: is the current parameter value
- bar: is the dimension unit set by parameter 405
- Actual value: is the input signal supplied by the selected transducer (set by submenu 400), expressed with the dimension unit set by parameter 405
- Output frequency: current frequency supplied by the drive to the motor
- Left/Up/Down/Right:actual functions of the related push buttons

When parameter 105 MODE is set to Actuator, P03 is not shown!

Parameter 03 EFF.REQ.VAL. shows the current required value that is calculated based on parameter 505 ACT.VAL.INC., parameter 510 ACT.VAL.DEC. and parameter 330 LIFT AMOUNT. If the required value is influenced by an offset signal (set by submenu 900), then the current active required value is also shown in this window.

P04 START VALUE

| P04 START VALUE | | | |
|---------------------------|---------|-----------|------------|
| ¢ | 100 |)% | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter defines, in percentage (0-100%) of the required value (P02 **REQUIRED VAL.**), the start value after pump stops.

If P02 **REQUIRED VAL.** is met and there is no more consumption, then the pump stops. The pump starts again when the pressure drops below P04 **START VALUE**.

Value 100% makes this parameter not effective (100%=off)!

P05 LANGUAGE

| P05 LANGUAGE | | | |
|---------------------------|---------|-----------|------------|
| ٥ | Eng | lish | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter selects the display language.

P06 DATE

| P06 DATE | | | |
|---------------------------|---------|-----------|------------|
| ☆ XX.XX.20XX | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter set current date.

P07 TIME

| P07 TIME | | | | |
|-----------|---------------------------|-----------|------------|--|
| ⇔ HH.MM | | | | |
| Actu | Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

This parameter set current time.

P08 AUTO-START G



If AUTO-START = On, then the HYDROVAR starts automatically (in case of demand) following a power disconnection.

P09 OPERAT.TIME

| P09 OPERAT.TIME | | | |
|-----------------|---------------------------|-----------|------------|
| ⇔ 0000h | | | |
| Actu | Actual Value Output Freq. | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter shows the total operating time (in hours).

For an instruction on how to reset the counter, see P1135 CLR.OPERAT..

8.3.2 M20 STATUS

MENU SCOPE

Using this submenu it is possible to check the status (including failures and motor hours) of all connected units.





This parameter gives a overview about the status of the connected units.

The information shown on the display depend on the selection done in parameter 105 MODE; for more details, see P105 MODE (page 55).

When parameter 105 MODE is set to Cascade Serial or Cascade Synchron, display shows (for example) the following information:

| P21 STATUS UNITS | | | | |
|--|--|--|--|--|
| ⇔ 11001000 | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. Up fct. Down fct. Right fct. | | | | |

where the status of all (max. 8) connected units is shown (whereas 1=activated / 0=deactivated).

When parameter 105 MODE is set to Cascade Relay, display shows (for example) the following information:

| P21 STATUS UNITS | | | |
|--|---------------------------|--|--|
| \$ 10100 | | | |
| Actu | Actual Value Output Freq. | | |
| Left fct. Up fct. Down fct. Right fct. | | | |

where (HYDROVAR is equipped with additional Premium Card) the status of the 5 Relayswitching contacts is shown. (where as 1=activated / 0=deactivated).

P22 SELECT DEVICE

This parameter lets the user select a specific unit (1-8) in a cascade system, so that current status, motor hours and last failures occurred can be checked.

The information shown on the display depends on the selection done in parameter 105 MODE; for more details, see *P105 MODE* (page 55).

| P22 SELECT DEVICE | | | |
|-------------------|---------|-----------|------------|
| ¢ | 1 | | |
| Actual Value | | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

When P105 MODE is set to Cascade Serial or Cascade Synchron, the value selected for P22 SELECT DEVICE specifies the address of the HYDROVAR units,

When P105 MODE is set to Cascade Relay, the value selected for P22 SELECT DEVICE follows the subsequent table:

| Device | | enabled by |
|--------|------------------|---------------|
| 1 | MASTER Inverter | |
| 2 | fixed speed pump | Relay 1 X4 /1 |
| 3 | fixed speed pump | Relay 2 X4 /2 |
| 4 | fixed speed pump | Relay 3 X4 /3 |
| 5 | fixed speed pump | Relay 4 X4 /4 |
| 6 | fixed speed pump | Relay 5 X4 /5 |
| 7 | N/A | N/A |
| 8 | N/A | N/A |

P23 STATUS DEVICE



This parameter shows the status of the selected device (by means of parameter 22 SELECT DEVICE).

The information shown on the display depend on the selection done in parameter 105 MODE; for more details, see P105 MODE (page 55).

When P105 MODE is set to Cascade Serial or Cascade Synchron, display shows (for example) the following information:

| P23 STATUS DEVICE | | | |
|-------------------|---------|-----------|------------|
| Stopped | | | |
| Actual Value | | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

where the value displayed may change as per the following table:

| Displayed value | Description |
|-----------------|--|
| Running | The pump runs. |
| Stopped | The pump is stopped since the pump is not requested. |
| Disabled | The pump is manually stopped using the: - buttons - parameter P24 ENABLE DEVICE - external device |
| OFF | The pump is not connected to the power supply or the RS485. |
| Preparing | A new unit is connected to the system and data is transferring. |
| Fault | A failure that occurred on the current unit. |

When P105 MODE is set to Cascade Relay, the value displayed may change as per the following table:

| Displayed value | Description |
|-----------------|--|
| Relay On | The relay contact is closed and the fixed-speed pump operates. |
| Relay Off | The relay contact is open and the fixed-speed pump is stopped |
| Fault | A failure that occurred on the current unit. |

G P24 ENABLE DEVICE

> By using this parameter, the user can manually enable and disable the selected device (by means of parameter 22 SELECT DEVICE).

When parameter 105 MODE is set to Controller, Cascade Relay, Cascade Serial or **Cascade Synchron**, display shows the following information:

| P24 ENABLE DEVICE | | | |
|-------------------|---------------------------|-----------|------------|
| Enabled | | | |
| Act | Actual Value Output Freq. | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

where possible settings are "Enabled" or "Disabled".

P25 MOTOR HOURS

G 👁

This parameter shows the operation time in hours of the selected device. Thus, the time period during which HYDROVAR has powered the motor.

| F | P25 MOTOR HOURS | | | | |
|---|---------------------------|---------|-----------|------------|--|
| | XXXXX h | | | | |
| | Actual Value Output Freq. | | | | |
| | Left fct. | Up fct. | Down fct. | Right fct. | |

For information about how to reset the count, see parameter 1130 CLR.MOTOR H.

P26 thru P30: ERROR memory

G 👁

These parameters hold the error memory information. All errors are saved and shown in these parameters.



The errors include the following information:

- XX = error code / Error = description
- Date and time of when the error occurred

G P35 KWH COUNTER

This parameter registers the power consumption of the motor as a mean value over 1 hour.

| P35 KWH COUNTER | | | |
|-----------------|---------|-----------|------------|
| ¢ | XXXXX | kWh | |
| Actual Value | | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

For information about how to reset the counter, see parameter 1140 CLR.KWH CNT.

8.3.3 M40 DIAGNOSTICS

MENU SCOPE

This submenu includes the following software parameters:

- Production date
- Actual temperature
- Actual output current
- Actual input voltage
- Actual output frequency
- Software version of the Power Board

During operation, the information in these parameters is read-only. No changes are permitted.



Shows the production date of the control board; the display format is YYYYWW (year, week).

| P41 PROD.DATE | | | |
|-------------------|---------|-----------|------------|
| \$ | 20YY | NW | |
| Actual Value Outp | | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

P42 SEL.INVERTER

Select the desired inverter unit (1-8).

| P42 SEL.INVERTER | | | |
|------------------|----------|-----------|------------|
| \$ | - | 1 | |
| Actu | al Value | Output I | Freq. |
| Left fct. | Up fct. | Down fct. | Right fct. |

P43 TEMP.INVERTER

Shows the temperature inside the selected (by mean of parameter 42) unit,

| P43 TEMP.INVERTER | | | |
|-------------------|-----------|-----------|------------|
| ¢ | XX% | XX°C | |
| Act | ual Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

with the following data:

- Temperature inside (°C)
- % of the maximum temperature

P44 CURR.INVERTER G

Shows the output current in percentage of the maximum rated current for the selected (by mean of parameter 42) unit.

| P44 CURR.INVERTER | | | |
|-------------------|---------|-----------|------------|
| ✿ XXX % | | | |
| Actual Value | | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

P45 VOLT.INVERTER G

Shows the input voltage (V) for the selected (by mean of parameter 42) unit.

| P45 VOLT.INVERTER | | | |
|-------------------|---------|-----------|------------|
| ¢ | XXX | (V | |
| Actual Value | | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

P46 OUTPUT FREQ.



Shows the output frequency (Hz) for the selected (by mean of parameter 42) unit.



P47 VER.INVERTER : POWER

Shows information about the software version of the power board for the selected (by means of parameter 42) unit.

| P47 VER.INVERTER | | | |
|------------------|----------|-----------|------------|
| ٥ | 1.0 | 0 | |
| Actu | al Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

For details, see table below.

| Displayed value | Versions (power sizes) | Additional information |
|-----------------|------------------------|------------------------|
| 1.00 | All | First Release 12/2015 |

8.3.4 M60 SETTINGS

MENU SCOPE

This submenu includes the following software parameters:

- PASSWORD
- JOG



CAUTION:

Read these instructions carefully before changing any parameter in this sub menu. The settings must be carried out by trained and qualified persons. Incorrect settings will cause malfunction.

It is possible to change all parameters during operation, but it is highly recommended that the unit is stopped when changing parameters.

P61 PASSWORD

Enter the system password, which gives access to all system parameters: default setting is 00066.

| P61 PASSWORD | | | |
|--------------|----------|-----------|------------|
| ¢ | XX | XX | |
| Actu | al Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

When a correct password is entered, the system remains unlocked for 10 minutes. For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right

(►) push button.

P62 JOG

This parameter deactivates the internal controller of HYDROVAR and changes to manual mode. Display shows the following information:

| P62 JOG | | | |
|-----------|----------|-----------|------------|
| ٥ | X.XX | Hz | |
| Actu | al Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

Where:

- JOG: is the parameter description
- X.XX: is the current parameter value (0Hz P245 MAX.FREQ.); at 0.0 Hz, the unit stops.
- Actual value: is the input signal supplied by the selected transducer (set by submenu 400), expressed with the dimension unit set by parameter 405
- Output frequency: current frequency supplied by the drive to the motor
- Left/Up/Down/Right fct.: actual functions of the related push buttons

8.3.5 M100 BASIC SETTINGS

MENU SCOPE

This submenu includes the following software parameters:

- Operation mode
- Pump address
- Password
- Lock function
- Display contrast
- Display brightness

P105 MODE

By using this parameter, the user can select an operation mode.

| P105 MODE | | | |
|--------------|---------|-----------|------------|
| \$ | Conti | roller | |
| Actual Value | | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

where possible settings are:

| MODE | Operable unit(s) |
|------------------|---|
| Controller | 1 Hydrovar |
| (Default) | |
| Cascade Relay | 1 Hydrovar and Premium Card |
| Cascade Serial | More than one pump |
| Cascade Synchron | All pumps operate on the same frequency |
| Actuator | 1 Hydrovar |

The Actuator mode is used if the HYDROVAR is a standard VFD with:

- Fixed speed requirements or
- An external speed signal is connected.

For more information, see Example: P105 ACTUATOR mode (page 102).

P106 PUMP ADDR.

Selects an address (1-8) for each HYDROVAR



If several MASTER inverters are connected via the internal RS-485 interface (maximum eight in **Cascade Serial** mode), then the following must apply:

- Each HYDROVAR needs an individual pump-address (1-8)
- Each address can only be used once.

P110 SET PASSW.

Set a system password (00000 - 09999); default setting is 00066.

| P110 SET PASSW. | | | | |
|-----------------|---------|-----------|------------|--|
| O0066 | | | | |
| Actual Value | | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

P115 LOCK FUNCT.

By using this parameter, the user can lock or unlock parameter settings in the main menu.

| P115 LOCK FUNCT. | | | | |
|------------------|---------|-----------|------------|--|
| \$ | Of | F | | |
| Actual Value | | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

where possible settings are:

| Setting | Description |
|---------|---|
| ON | No parameters can be changed without the system password. |
| OFF | All parameters in the main menu can be changed. |

P120 DISP.CONTR.

Adjust the display contrast (10 - 100%)

| P120 DISP.CONTR. | | | | |
|------------------|---------|-----------|------------|--|
| ⇔ 75 % | | | | |
| Actual Value | | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

P125 DISP.BRIGHT.

Adjust the backlight brightness of the display (10 - 100%)

| P125 DISP.BRIGHT. | | | | |
|--|--|----------|------|--|
| ✤ 100 % | | | | |
| Actual Value | | Output F | req. | |
| Left fct. Up fct. Down fct. Right fct. | | | | |

P130 DISP.ROTATION

This parameter enables the rotation, by 180°, of display and push buttons relative to standard position.

| P130 DISP.ROTATION | | | | |
|--------------------|---------|-----------|------------|--|
| * FALSE | | | | |
| Actual Value | | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

P135 BACK.COMP.

| P135 BACK.COMP. | | | | |
|-----------------|---------|-----------|------------|--|
| ¢ | NO |) | | |
| Actual Value | | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

This parameter activates the Backward Compatibility mode: when set to YES, it forces HYDROVAR to work in a multi-pump application acting and communicating as the previous generation HYDROVAR (HV 2.015-4.220).

HVL and HV 2.015-4.220 multi-pump communication protocol are not compatible! Thus in a multi-pump application where there is present at least one previous generation HYDROVAR (HV 2.015-4.220), all the other HVL model shall be forced in backward compatibility mode. For further information check the dedicated HVL Backward compatibility Set-up and programming guide.

8.3.6 M200 CONF.INVERTER

MENU SCOPE

This submenu includes the following software parameters:

- Software
- Number of units
- Ramp settings
- Motor settings
- Frequency settings
- STC protection



Shows information about the software version of the control board.

| P202 SOFTWARE | | | | |
|---------------|----------|-----------|------------|--|
| ✤ 1.00 | | | | |
| Actu | al Value | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

For details, see the table below.

| Displayed value | Additional information |
|-----------------|------------------------|
| 1.00 | First Release 12/2015 |

P205 MAX.UNITS

Set the maximum number of units that operate simultaneously.

| P205 MAX.UNITS | | | | |
|----------------|----------|---|-----------|------------|
| ٥ | | 6 | | |
| Actu | al Value | | Output F | req. |
| Left fct. | Up fct. | | Down fct. | Right fct. |

Reasonable values are:

| Value | MODE |
|-------|----------------|
| 1-8 | Cascade Serial |
| 2-6 | Cascade Relay |

P210 INVERTER G

Select the HYDROVAR address for parameterization.

| P210 INVERTER | | | | |
|---------------|---------|-----------|------------|--|
| ¢ | All | | | |
| Actual Value | | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Possible settings are:

| Setting | Description |
|---------|--|
| All | All units in the group are programmed at the same time;
in any case all new settings are copied to all units. |
| 1-8 | Used if one specific unit is programmed. Select that unit (1– 8). |

P215 RAMP 1 G

NOTICE:

- Fast running up time can cause errors (overload) during the startup.
- Slow running up time can cause a drop of the outgoing operating pressure.

| P215 RAM | P 1 | | |
|---------------------------|---------|-----------|------------|
| ¢ | 4 s | ec | |
| Actual Value Output Freq. | | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter adjusts the fast acceleration time, and it effects the control of the pump; the ramp depends on the type of HYDROVAR and the type of pump.

| HVL | Possible setting (sec) | Default setting (sec) |
|---------------|------------------------|-----------------------|
| 2.015 ÷ 2.040 | 1-250 | 4 |
| 3.015 ÷ 3.040 | | |
| 4.015 ÷ 4.040 | | |
| 3.055 ÷ 3.110 | 1-1000 | 8 |
| 4.055 ÷ 4.110 | | |
| 4.150 ÷ 4.220 | 1-1000 | 12 |

For more information, see *Example: P200 Ramp Settings* (page 102).

P220 RAMP 2 G

NOTICE:

- Fast running down time often causes overvoltage.
- Slow running down time often causes over-pressure.

| P220 RAMP 2 | | | |
|---------------------------|---------|-----------|------------|
| ¢ | 4 s | ec | |
| Actual Value Output Freq. | | | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter adjusts the fast deceleration time, and it effects the control of the pump; the ramp depends on the type of HYDROVAR and the type of pump.

| HVL | Possible setting (sec) | Default setting (sec) |
|---------------|------------------------|-----------------------|
| 2.015 ÷ 2.040 | 1-250 | 4 |
| 3.015 ÷ 3.040 | | |
| 4.015 ÷ 4.040 | | |
| 3.055 ÷ 3.110 | 1-1000 | 8 |
| 4.055 ÷ 4.110 | | |
| 4.150 ÷ 4.220 | 1–1000 | 12 |

For more information, see Example: P200 Ramp Settings (page 102).



NOTICE:

- Fast running up time can cause oscillation and overload.
- Slow running up time can cause a drop of the outgoing operating pressure, during variation of the demand.

| P225 RAMP 3 | | | |
|---------------------------|---------|-----------|------------|
| ¢ | 70 s | ec | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter adjusts the slow acceleration time, thus determining:

- The regulation speed of the internal HYDROVAR controller for small changes in demand.
- The constant outgoing pressure.

The ramp (default value 70 sec, possible setting 1-1000 sec) depends on the system which has to be controlled. For more information, see *Example: P200 Ramp Settings* (page 102).

P230 RAMP 4

NOTICE:

- Fast running down time can cause oscillation of the unit and the pump
- Slow running down time can cause pressure fluctuations during variation of the demand.

| P230 RAMP 4 | | | |
|---------------------------|---------|-----------|------------|
| ٥ | 70 s | Sec | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter adjusts the slow deceleration time, thus determining:

- The regulation speed of the internal HYDROVAR controller for small changes in demand.
- The constant outgoing pressure.

The ramp (default value 70 sec, possible setting 1-1000 sec) depends on the system which has to be controlled. For more information, see *Example: P200 Ramp Settings* (page 102).

P235 RAMP FMIN A

NOTICE:

Fast running up time can cause errors (overload) during start.

| P235 RAMP FMIN A | | | |
|---------------------------|---------|-----------|------------|
| | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter (default value 2.0 sec, possible setting 1.0-25.0 sec) sets the ramp Fmin acceleration (fast running up time), and it operates HYDROVAR until the selected P250 **MIN.FREQ.** is reached; after Fmin is passed, P215 **RAMP 1** starts to work. For more information, see *Example: P200 Ramp Settings* (page 102).

P240 RAMP FMIN D

NOTICE:

G

Fast running down time often causes overvoltage.

| P240 RAMP FMIN D | | | |
|---------------------------|---------|-----------|------------|
| ✤ 2.0 sec | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter (default value 2.0 sec, possible setting 1.0- 25.0 sec) sets the ramp Fmin deceleration (fast running down time), and it stops HYDROVAR when it gets below P250 **MIN.FREQ.** For more information, see Example: P200 Ramp Settings.

P245 MAX.FREQ.

NOTICE:

Settings higher than standard can cause overload of the motor.

| P245 MAX.FREQ. | | | |
|---------------------------|---------|-----------|------------|
| ⇔ 50.0 Hz | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter (default value 50 Hz, possible setting 30.0-70.0 Hz) sets the maximum frequency, and thus the maximum speed of the pump; the standard setting according to the nominal frequency of the connected motor.

P250 MIN.FREQ.

NOTICE:

The minimum frequency depends on the selected pump type and application. For borehole applications in particular, the minimum frequency must be set to \geq 30 Hz^{*}.

| P250 MIN.FREQ. | | | |
|---------------------------|---------|-----------|------------|
| \$ | 20.0 | Hz | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter (default value 20 Hz, possible setting 0.0 Hz- P245 **MAX.FREQ.**) sets the minimum frequency; operations below this value are done with P235 **RAMP FMIN A** and P240 **RAMP FMIN D**.



This parameter defines the operation at minimum frequency.



Possible settings are:

| Setting | Description |
|-----------|---|
| f-> 0 | Once the required pressure is reached and no further
consumption is needed, the frequency goes down to the
selected P250 MIN.FREO .: HYDROVAR will then keep
running for the selected P260 FMIN TIME and after this
time stops automatically. |
| f -> fmin | With this setting the pump never stop automatically: the frequency goes down to the selected P250 MIN.FREQ To stop the pump the external ON/OFF must be opened or the provided push button must be pressed. |

NOTICE:

For circulation systems, the setting "f -> fmin" can overheat the pump in case there is no flow through it!

P260 FMIN TIME

This parameter (default value 0 sec, possible setting 0-100 sec) sets the delay time before a shut-off below P250 **MIN.FREQ.** occurs.

| P260 FMIN TIME | | | | |
|---------------------------|---------|-----------|------------|--|
| ¢ | 0 s | ec | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

It is used to prevent problems with a shut off of the pump at no demand (too small or no pressure tank), as the system pressure increases during this delay time. This parameter is only active if P255 **CONF.FMIN** is set to "f -> 0".

P261 SKIP FRQ.CTR.

This parameter (possible setting P250 **MIN.FREQ.** - P245 **MAX.FREQ.**) sets the skip frequency center.

| P261 SKIP FRQ.CTR. | | | | |
|---------------------------|---------|-----------|------------|--|
| ⇔ 20.0 Hz | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

P262 SKIP FRQ.RNG.

This parameter (possible setting 0.0 - 5.0 Hz) sets the skip frequency range.

| P262 SKIP FRQ.RNG. | | | | |
|---------------------------|---------|-----------|------------|--|
| ۵ | 0.0 | Hz | | |
| Actual Value Output Freq. | | | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

P265 MOTOR NOM.POWER

Sets the nominal power of the motor coupled with HYDROVAR, as reported in the motor nameplate.

| P265 MOTOR NOM.POWER | | | | |
|---------------------------|---------|-----------|------------|--|
| ⇔ 1.5 kW | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Possible settings are:

| HVL | Undersized motor 2 | Undersized motor 1 | Default | Oversized motor |
|-------|--------------------|--------------------|-------------------|-------------------|
| 2,015 | 0.75 kW - 1.0 hp | 1.1 kW - 1.5 hp | 1.5 kW - 2.0 hp | 2.2 kW - 3.0 hp |
| 2,022 | 1.1 kW - 1.5 hp | 1.5 kW - 2.0 hp | 2.2 kW - 3.0 hp | 3.0 kW - 4.0 hp |
| 2,030 | 1.5 kW - 2.0 hp | 2.2 kW - 3.0 hp | 3.0 kW - 4.0 hp | 4.0 kW - 5.0 hp |
| 2,040 | 2.2 kW - 3.0 hp | 3.0 kW - 4.0 hp | 4.0 kW - 5.0 hp | 5.5 kW - 7.5 hp |
| 3,015 | 0.75 kW - 1.0 hp | 1.1 kW - 1.5 hp | 1.5 kW - 2.0 hp | 2.2 kW - 3.0 hp |
| 3,022 | 1.1 kW - 1.5 hp | 1.5 kW - 2.0 hp | 2.2 kW - 3.0 hp | 3.0 kW - 4.0 hp |
| 3,030 | 1.5 kW - 2.0 hp | 2.2 kW - 3.0 hp | 3.0 kW - 4.0 hp | 4.0 kW - 5.0 hp |
| 3,040 | 2.2 kW - 3.0 hp | 3.0 kW - 4.0 hp | 4.0 kW - 5.0 hp | 5.5 kW - 7.5 hp |
| 3,055 | 3.0 kW - 4.0 hp | 4.0 kW - 5.0 hp | 5.5 kW - 7.5 hp | 7.5 kW - 10.0 hp |
| 3,075 | 4.0 kW - 5.0 hp | 5.5 kW - 7.5 hp | 7.5 kW - 10.0 hp | 11.0 kW - 15.0 hp |
| 3,110 | 5.5 kW - 7.5 hp | 7.5 kW - 10.0 hp | 11.0 kW - 15.0 hp | 15.0 kW - 20.0 hp |
| 4,015 | 0.75 kW - 1.0 hp | 1.1 kW - 1.5 hp | 1.5 kW - 2.0 hp | 2.2 kW - 3.0 hp |
| 4,022 | 1.1 kW - 1.5 hp | 1.5 kW - 2.0 hp | 2.2 kW - 3.0 hp | 3.0 kW - 4.0 hp |
| 4,030 | 1.5 kW - 2.0 hp | 2.2 kW - 3.0 hp | 3.0 kW - 4.0 hp | 4.0 kW - 5.0 hp |
| 4,040 | 2.2 kW - 3.0 hp | 3.0 kW - 4.0 hp | 4.0 kW - 5.0 hp | 5.5 kW - 7.5 hp |
| 4,055 | 3.0 kW - 4.0 hp | 4.0 kW - 5.0 hp | 5.5 kW - 7.5 hp | 7.5 kW - 10.0 hp |
| 4,075 | 4.0 kW - 5.0 hp | 5.5 kW - 7.5 hp | 7.5 kW - 10.0 hp | 11.0 kW - 15.0 hp |
| 4,110 | 5.5 kW - 7.5 hp | 7.5 kW - 10.0 hp | 11.0 kW - 15.0 hp | 15.0 kW - 20.0 hp |
| 4,150 | 7.5 kW - 10.0 hp | 11.0 kW - 15.0 hp | 15.0 kW - 20.0 hp | 18.5 kW - 25.0 hp |
| 4,185 | 11.0 kW - 15.0 hp | 15.0 kW - 20.0 hp | 18.5 kW - 25.0 hp | 22.0 kW - 30.0 hp |
| 4,220 | 15.0 kW - 20.0 hp | 18.5 kW - 25.0 hp | 22.0 kW - 30.0 hp | 30.0 kW - 40.0 hp |

P266 MOTOR NOM.VOLT.

Sets the motor nominal voltage, as reported in the motor nameplate, according to

- the chosen motor connection
- the output voltage of the HYDROVAR

| P266 MOTOR NOM.VOLT. | | | |
|---------------------------|---------|-----------|------------|
| ☆ 230 V | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Possible settings are:

| HVL | Possible setting (V) | Default setting (V) |
|---------------|----------------------|---------------------|
| 2.015 ÷ 2.040 | 208-240 | 230 |
| 3.015 ÷ 3.110 | 208-240 | 230 |
| 4.015 ÷ 4.220 | 380-460 | 400 |

P267 MOTOR NOM.FRQ.

Sets the motor nominal frequency, as reported in the motor nameplate

| P267 MOTOR NOM.FRQ. | | | | |
|---------------------------|---------|-----------|------------|--|
| ⇔ 50.0 Hz | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

P268 MOTOR NOM.CURR.

Sets the motor nominal current, as reported in the motor nameplate, according to

- the chosen motor connection
- the output voltage of the HYDROVAR

| P268 MOTOR NOM.CURR. | | | | |
|---------------------------|---------|-----------|------------|--|
| ☆ 7.5 A | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

P269 MOTOR NOM.SPEED

Sets the motor nominal speed, as reported in the motor nameplate

| P269 MOTOR NOM.SPEED | | | |
|---------------------------|---------|-----------|------------|
| ⇔ 3000 rpm | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

P270 MOTOR POLES

This parameter (possible setting 2 or 4) sets the number of motor poles (display showing, for example, the following information)

| P270 MOT | OR POLES | | |
|--------------|----------|-----------|------------|
| ٥ | 2 | | |
| Actual Value | | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

P275 AMPI

NOTICE:

- For the best adaptation of HYDROVAR, run AMPI on a cold motor
- AMPI cannot be performed while the motor runs
- AMPI cannot be performed on a motor with a bigger power rating than HYDROVAR that is, when a 5.5 kW motor is coupled with a 4 kW drive
- Avoid generating external torque during AMPI.

This parameter activates the Automatic Motor Parameter Identification; possible settings are "Off" (**AMPI**not active), "Full" or "Reduced" (procedure to be performed only in case LC filters are applied on the motor cable).

For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right (▶) push button.

| P275 AMPI | | | | |
|-----------|----------|-----------|------------|--|
| \$ | Ful | l | | |
| Actu | al Value | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Once the **AMPI** procedure is activated (when either "Full" or "Reduced" option is selected), it takes up to 3 min for the identification of the motor: during this period HYDROVAR prevents the user from any action ("Running" message on the display, pushbuttons deactivated).

Possible outcomes are "OK" (**AMPI** succeeded in self-configuring the motor) or "Fault" (**AMPI** result unsuccessful): once one of these two messages is displayed, HYDROVAR unlocks the push buttons to standard related functions.

P280 SWITCHING CONTROL

| P280 SWITCHING CONTROL | | | | | | |
|------------------------|---------------------------|-----------|------------|--|--|--|
| ☆ HVC | | | | | | |
| Actu | Actual Value Output Freq. | | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | | |

Sets the motor control method. Possible settings are "V/f" or "HVC" (default) "V/f" represents the Scalar Control: the open loop volts/hertz control of an induction motor is by far most popular method of speed control because of its simplicity.

"HVC" represents the HYDROVAR Vector Control: this method improves dynamic and stability, both when speed reference is changed and in relation to the load torque. This type of control is adaptive to motor load and adaptation to speed and torque changes is less than 3 milliseconds. Motor torque can remain constant regardless to speed changes.

P281 BOOST G

NOTICE:

- If this parameter is set too low or too high, then there is a risk for overload due to too high starting current.
- Keep the settings as low as possible to reduce the risk of thermal overload of the motor at lower frequencies.

| P281 BOO | ST | | |
|-----------|-----------|-----------|------------|
| ٥ | 5 % | | |
| Actu | ial Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter (possible setting 0-25%) sets the motor starting voltage in % of connected supply voltage, thus determining the characteristics of the voltage/frequency curve. The default value depends on the type of HYDROVAR:

| HVL | Default setting (%) |
|---------------|---------------------|
| 2.015 ÷ 2.040 | |
| 3.015 ÷ 3.040 | 5 |
| 4.015 ÷ 4.040 | |
| 3.055 ÷ 3.110 | 8 |
| 4.055 ÷ 4.110 | 0 |
| 4.150 ÷ 4.220 | 10 |

P282 KNEE FREQ. G

NOTICE:

This parameter must be used for special applications only. An incorrect setting can cause overload or damage of the motor.

| P282 KNEE FREQ. | | | | |
|---------------------------|---------|-----------|------------|--|
| | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

This parameter (default value 50 Hz, possible setting 30.0- 90.0 Hz) sets the knee frequency, where HYDROVAR generates its maximum output voltage. For standard applications, set this value according to nominal frequency of the motor.

P283 SEL.SW.FREQ.



This parameter sets the switching frequency.

| P283 SEL.SW.FREQ. | | | | | |
|-------------------|----------|-----------|------------|--|--|
| ¢ | 10 k | Hz | | | |
| Actu | al Value | Output F | req. | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | |

HYDROVAR, in any case, can decrease automatically the switching frequency applying the derating criteria. Possible settings are:

| | Possible setting | | | | | |
|-------|------------------|-------|-------|-------|---------|--------|
| HVL | | | | | Default | |
| 2,015 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 2,022 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 2,030 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 2,040 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 3,015 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 3,022 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 3,030 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 3,040 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 3,055 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 3,075 | | 2 kHz | 4 kHz | 8 kHz | 10 kHz | 16 kHz |
| 3,110 | | 2 kHz | 4 kHz | 8 kHz | 10 kHz | 16 kHz |
| 4,015 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 4,022 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 4,030 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 4,040 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 4,055 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 4,075 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 4,110 | Random
~5 kHz | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16 kHz |
| 4,150 | | 2 kHz | 4 kHz | 8 kHz | 10 kHz | 16 kHz |
| 4,185 | | 2 kHz | 4 kHz | 8 kHz | 10 kHz | 16 kHz |
| 4,220 | | 2 kHz | 4 kHz | 8 kHz | 10 kHz | 16 kHz |

P284MIN.SW.FREQ.

G

This parameter sets the minimum switching frequency HYDROVAR can generate.

| P284 MIN.SW.FREQ | | | | | |
|------------------|---------------------------|-----------|------------|--|--|
| ٥ | 2 kl | Hz | | | |
| Actu | Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | |

This parameter is useful to force HYDROVAR to generate:

- switching frequencies in a certain bandwidth (upper limit defined by P283 lower limit defined by P284)
- a fixed switching frequency (when P283 = P284).

Possible settings are:

| HVL | Default | | | | |
|-------|---------|-------|-------|--------|-------|
| 2,015 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 2,022 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 2,030 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 2,040 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 3,015 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 3,022 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 3,030 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 3,040 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 3,055 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 3,075 | 2 kHz | 4 kHz | 8 kHz | 10 kHz | 16kHz |
| 3,110 | 2 kHz | 4 kHz | 8 kHz | 10 kHz | 16kHz |
| 4,015 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 4,022 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 4,030 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 4,040 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 4,055 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 4,075 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 4,110 | 2 kHz | 5 kHz | 8 kHz | 10 kHz | 16kHz |
| 4,150 | 2 kHz | 4 kHz | 8 kHz | 10 kHz | 16kHz |
| 4,185 | 2 kHz | 4 kHz | 8 kHz | 10 kHz | 16kHz |
| 4,220 | 2 kHz | 4 kHz | 8 kHz | 10 kHz | 16kHz |

P290 STC MOTOR PROT.

This parameter sets the protection technique against motor overheating.

| P290 STC MOTOR PROT. | | | | |
|---------------------------|---------|-----------|------------|--|
| STC Trip | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Possible settings are "Thermistor trip" or "STC trip" (default).

P291 STC MOTOR THERMAL

| P291 STC MOTOR THERMAL | | | | | |
|------------------------|---------------------------|-----------|------------|--|--|
| ✤ 77 % | | | | | |
| Actu | Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | |

This parameter shows the calculated percentage of allowed maximum temperature (for the motor) calculated by STC, based on actual current and speed.

P295 CURR.LIM.FUNCT.

This parameter activates (ON) or deactivates (OFF, default) the current limit functionality.

| P295 CURR.LIM.FUNCT. | | | | | | |
|----------------------|---------------------------|-----------|------------|--|--|--|
| ✤ OFF | | | | | | |
| Actu | Actual Value Output Freq. | | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | | |

P296 CURR.LIMIT SET

This parameter (default value 110%, possible setting 10-300%) sets the current limit for motor (in % of rated motor current)

If the set value is higher than HYDROVAR maximum rated output, then current is still limited to the maximum rated output.

| P296 CURR.LIMIT SET | | | | | |
|---------------------------|---------|-----------|------------|--|--|
| ✤ 110 % | | | | | |
| Actual Value Output Freq. | | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | |

8.3.7 M300 REGULATION

MENU SCOPE

This submenu includes the following software parameters:

- Jog
- Window
- Hysteresis
- Regulation mode
- Lift settings

P305 JOG

This parameter deactivates the internal controller of HYDROVAR and changes to manual mode.

Display shows the following information:

| P305 JOG | | | |
|---------------------------|---------|-----------|------------|
| ¢ | x.xx | Hz | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Where:

- JOG: is the parameter description
- X.XX: is the current parameter value (0Hz P245 MAX.FREQ.); at 0.0 Hz, the unit stops.
- Actual value: is the input signal supplied by the selected transducer (set by submenu 400), expressed with the dimension unit set by parameter 405
- Output frequency: current frequency supplied by the drive to the motor
- Left/Up/Down/Right fct.: actual functions of the related push buttons

P310 WINDOW

| P310 WINDOW | | | |
|---------------------------|---------|-----------|------------|
| ¢ | 10 | % | |
| Actual Value Output Freq. | | | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

This parameter (default value 10%, possible setting 0-100%) sets the range for ramp control; from slow to fast.

P315 HYSTERESIS

This parameter (default value 80%, possible setting 0-100%) sets the hysteresis for ramp switching. It determines where the normal regulation is done; value = 99% indicates an accurate control without automatic shut-off.

| P315 HYSTERESIS | | | |
|-----------------|--------------|------|-----------------|
| ¢ | 8 | 80 % | |
| | Actual Value | Out | put Freq. |
| Left fct | . Up fct. | Down | fct. Right fct. |

P320 REG.MODE

This parameter selects the regulation mode.

| P320 REG.MODE | | | | |
|---------------|---------------------------|---------|-----------|------------|
| ✤ Normal | | | | |
| | Actual Value Output Freq. | | | eq. |
| Left fc | t. | Up fct. | Down fct. | Right fct. |

Possible setting are:

| Setting | Description |
|---------|---|
| Normal | Increased speed with falling actual value signal. |

| S | etting | Description |
|----|--------|---|
| lr | nverse | Reduced speed with falling actual value signal. |

P325 FRQ.LIFT

This parameter (default value 30.0 Hz, possible setting 0.0-70.0 Hz) sets the frequency limit for the required lift value where the required pressure starts to be increased.

| P325 | FRQ.LIF | Т | | |
|---------|----------|---------|-----------|------------|
| \$ | ÷ | 30.0 H | Ηz | |
| | Actual \ | /alue | Output F | req. |
| Left fo | t. | Up fct. | Down fct. | Right fct. |

The correct frequency is when the pump reaches the set pressure at zero flow. This can be determined by using P305 **JOG**.

P330 LIFT AMOUNT

This parameter (default value 0.0 %, possible setting 0.0-200.0%) sets the lift amount for the required lift value in HVAC systems or for compensation of friction losses in long pipe work.

| P330 LIFT AMOUNT | | | |
|---------------------------|---------|-----------|------------|
| ✤ 0.0 % | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

It determines the increase of the set value until the maximum speed (and maximum volume) is reached.

For an application example, see Example P330 LIFT AMOUNT.

8.3.8 M400 SENSOR

MENU SCOPE

In this submenu it is possible to configure all actual-value sensors that are connected to the HYDROVAR. However, the following limitations apply:

- It is possible to have maximum two transducers with current output or voltage-signal output.
- The transducer types: it is not possible to install two different transducer types because the main configuration is the same for all connected sensors.

This submenu includes the following software parameters:

- Dimension unit
- Configuration
- Type of sensor
- Sensor range
- Sensor curve
- Calibration

P405 DIMENSION UNIT

Selects the unit of measure for the system.

| P405 DIMENSION UNIT | | | |
|--------------------------------|----------|------|------------|
| ¢ | ba | r | |
| Actu | Output F | req. | |
| Left fct. Up fct. Down fct. Ri | | | Right fct. |

In case a change of this parameter is needed, consider to change P420 **SENSOR RANGE** to the corresponding dimension unit too!

P410 CONF.SENSOR

Sets how the connected sensors are used and which sensor is active.

It is also possible to measure the difference of two connected sensors or to configure an automatic switch-over in case of a faulty sensor.

| P410 CONF.SENSOR | | | |
|---------------------------|---------|-----------|------------|
| Sensor 1 | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Possible setting are:

Table 13: Possible settings

| Setting | Property | Description |
|-----------------|-----------------------|---|
| Sensor 1 | Constantly active | 0/4 - 20 mA signal: connected to X1/2
and X1/1 (+24V) |
| | | 0/2 - 10 V signal: connected to X1/2,
X1/1 (+24V) and X1/3 (GND) |
| Sensor 2 | Constantly active | 0/4 - 20 mA signal: connected to X1/5
and X1/4 (+24V) |
| | | 0/2 - 10 V signal: connected to X1/5,
X1/4 (+24V) and X1/6 (GND) |
| Auto | Automatic switch over | In case of faulty sensor |
| Switch Dig1 | Manual switching | Close digital input 1 (X1/14 - X1/15) |
| Switch Dig2 | Manual switching | Close digital input 2 (X3/1 - X3/2, on
Premium Card) |
| Switch Dig3 | Manual switching | Close digital input 3 (X3/5 - GND) |
| Switch Dig4 | Manual switching | Close digital input 4 (X3/15 - 16) |
| Auto Lower | Automatic switch over | The sensor with the lower actual value is active |
| Auto Higher | Automatic switch over | The sensor with the highest actual value is active |
| Sens.1 - Sens.2 | - | The difference of the connected sensors as actual value |

P415 SENSOR TYPE

Selects the sensor type and the input terminal.

| P415 SENSOR TYPE | | | |
|---------------------------|---------|-----------|------------|
| ⇔ 4-20 mA | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Possible setting are:

Table 14: Selection of the sensor type and input terminal

| Setting | Input Terminals | Actual Value |
|---|--|---|
| Analog I 4 - 20 mA Analog I 0- 20 mA | X1/2:
Sensor 1 X1/5:
Sensor 2 | It is determined by a current signal
connected to the given input
terminal. |
| Analog U 0-10 V | X1/2:
Sensor 1 X1/5:
Sensor 2 | It is determined from a voltage signal
connected to the given input
terminal. |

P420 SENSOR RANGE

Sets the end range value (20 mA or 10 V) of the connected sensor.

| P420 SENSOR RANGE | | | |
|---------------------------|---------|-----------|------------|
| 20mA - 10.00bar | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

In particular, the end range value (20mA or 10V) shall be always equal to the 100% of the sensor range (i.e. for a 0.4bar differential pressure sensor, will be 20mA=0.4bar)

P425 SENSOR CURVE

Sets the mathematical function (curve) to determine the Actual Value based on the Sensor signal.

| P425 SENSOR CURVE | | | |
|---------------------------|---------|-----------|------------|
| ✤ Linear | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Possible setting are:

| Setting | Application |
|-----------|---|
| Linear | Pressure control Differential Pressure control Level Temperature Flow control (inductive or mechanical) |
| Quadratic | • Flow control (using an orifice plate with a differential pressure sensor) |

P430 SENS.1 CAL.0

This parameter is used to calibrate the minimum value of Sensor 1.

| P430 SENS.1 CAL.0 | | | |
|---------------------------|---------|-----------|------------|
| ٥ | 0 % | ,
D | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

After setting P405 **DIMENSION UNIT** and P420 **SENSOR RANGE**, the zero point for this sensor can be adjusted between -10 % and +10 %.

P435 SENS.1 CAL.X

This parameter is used to calibrate the upper range value of sensor 1.

| P435 SENS.1 CAL.X | | | |
|-------------------|----------|-----------|------------|
| \$ | 0 % | /o | |
| Actu | al Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

After setting P405 **DIMENSION UNIT** and P420 **SENSOR RANGE**, the upper range value can be adjusted between -10 and +10%.

P440 SENS.2 CAL.0

This parameter is used to calibrate the minimum value of Sensor 2.

| P440 SENS.2 CAL.0 | | | |
|-------------------|----------|-----------|------------|
| ⇔ 0 % | | | |
| Actu | al Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

After setting P405 **DIMENSION UNIT** and P420 **SENSOR RANGE**, the zero point for this sensor can be adjusted between -10 % and +10 %.

P445 SENS.2 CAL.X

This parameter is used to calibrate the upper range value of sensor 2.

| P445 SENS.2 CAL.X | | | |
|-------------------|----------|-----------|------------|
| ٥ | 0 % | | |
| Actu | al Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

After setting P405 **DIMENSION UNIT** and P420 **SENSOR RANGE**, the upper range value can be adjusted between -10 and +10%.

8.3.9 M500 SEQUENCE CONTR.

MENU SCOPE

In this submenu it is possible to configure parameters for running a multi-pump system. This submenu includes the following software parameters:

- Actual value (increase, decrease)
- Frequency (enable, disable, drop)
- Delay (enable, switch, disable)
- Overvalue
- Overvalue delay
- Switch intervals
- Synchronous frequency limit and window

For example and more information, see P500 *Example: P500 SUBMENU SEQUENCE CNTR*. (page 104).

P505 ACT.VAL.INC.

| P505 ACT.VAL.INC. | | | |
|---------------------------|---------|-----------|------------|
| ✤ 0.35 bar | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Sets the lift value on the range 0.00 - P420 SENSOR RANGE.

P510 ACT.VAL.DEC.

| P510 ACT.VAL.DEC. | | | |
|---------------------------|---------|-----------|------------|
| ✿ 0.15 bar | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Sets the drop value on the range 0.00 - P420 SENSOR RANGE.

P515 ENABLE FRQ. G

This parameter (default value 48.0Hz, possible setting 0.0-70.0Hz) sets the desired release frequency for the following pumps.

| P515 ENABLE FRQ. | | | |
|---------------------------|---------|-----------|------------|
| \$ | 48.0 | Hz | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

The next pump starts when this value is reached and the system pressure drops below the difference (P02 **REQUIRED VAL.** - P510 **ACT.VAL.DEC.**).

P520 ENABLE DLY.

This parameter only applies to cascade relay!

| P520 ENABLE DLY. | | | |
|------------------|----------|-----------|------------|
| ٥ | 5 se | ec | |
| Actu | al Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

It sets the enable delay time: the fixed-speed pump starts after the selected time.

P525 SWITCH DLY.

This parameter only applies to cascade relay!

| P525 SWITCH DLY. | | | | |
|--|--|--|--|--|
| ⇔ 5 sec | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. Up fct. Down fct. Right fct. | | | | |

It sets the switch delay time, thus avoiding repeated switching caused by consumption variation.

P530 DISABLE FRQ.

This parameter only applies to cascade relay!

| P530 DISABLE FRQ. | | | |
|--|--|--|--|
| ⇔ 30 Hz | | | |
| Actual Value Output Freq. | | | |
| Left fct. Up fct. Down fct. Right fct. | | | |

It sets the frequency to switch off the fixed speed pumps. If the MASTER Inverter goes below this frequency for longer time than the pre-selected P535 **DISABLE DLY.** and the system pressure is higher than P03 **EFF.REQ.VAL.**, the MASTER stops another assist pump.

P535 DISABLE DLY.

This parameter only applies to cascade relay!

| P535 DISABLE DLY. | | | |
|---------------------------|---------|-----------|------------|
| ¢ | 5 se | €C | |
| Actual Value Output Freq. | | | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

It sets the delay time before switching off the assist pumps.

P540 DROP FRQ.

This parameter only applies to cascade relay!

| P540 DROP FRQ. | | | |
|---------------------------|---------|-----------|------------|
| ⇔ 42 Hz | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

It is used to prevent the system from pressure hammers. Before the MASTER starts a new assist pump, it drops to this frequency and then (when the frequency is reached) the assist pump is started; at that point the MASTER Inverter returns to normal operation.

P545 OVERVALUE

This parameter only applies to cascade relay!

| P545 OVERVALUE | | | | |
|--|--|--|--|--|
| | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. Up fct. Down fct. Right fct. | | | | |

This parameter prevents the system against overpressure in case the HYDROVAR has been parameterized incorrectly: if this selected value is reached, an immediate shut-off of the follow-up-pumps is executed.

Possible settings are "Off" (default) or P420 SENSOR RANGE.

P550 OVERVAL.DLY.

This parameter only applies to cascade relay!

| P550 OVERVAL.DLY. | | | | | |
|--|--|--|--|--|--|
| | | | | | |
| Actual Value Output Freq. | | | | | |
| Left fct. Up fct. Down fct. Right fct. | | | | | |

This parameter sets the delay time to switch off an assist pump in case the actual value exceeds P545 **OVERVALUE** limit.

P555 SWITCH INTV. G

This parameter only applies to cascade serial and synchronous!

| P555 SWITCH INTV. | | | | |
|--|--|--|--|--|
| 24 hours | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. Up fct. Down fct. Right fct. | | | | |

This parameter sets the switch interval for the cyclic change-over: it allows an automatic change-over of the MASTER pump and the assist pumps.

As soon as the switch time is reached the next pump becomes MASTER and the counter restarts; this gives even wear and similar operating hours to all pumps. The switch interval is active as long as the MASTER does not stop.

For information about how to find the correct setting, see *Example: P500 SUBMENU SEQUENCE CNTR*. (page 104).

P560 SYNCHR.LIM.



This parameter only applies to cascade synchronous!

| P560 SYNCHR.LIM. | | | | |
|--|--|--|--|--|
| ⇔ 0.0 Hz | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. Up fct. Down fct. Right fct. | | | | |

This parameter sets the frequency limit: the first assist pump shuts off if the frequency goes below this parameter's value.

For information about how to find the correct setting, see *Example: P500 SUBMENU SEQUENCE CNTR*. (page 104).

P565 SYNCHR.WND.

This parameter only applies to cascade synchronous!

| P565 SYNCHR.WND. | | | | |
|--|--|--|--|--|
| ⇔ 2.0 Hz | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. Up fct. Down fct. Right fct. | | | | |

This parameter sets the frequency window: the limit for switching off the next assist pump. For information about how to find the correct setting, see *Example: P500 SUBMENU SEQUENCE CNTR.* (page 104).

8.3.10 M600 ERROR

MENU SCOPE

This submenu includes the following software parameters:

- Minimum threshold limit
- Delay time
- Automatic error reset

P605 MIN.THRESH.

| P605 MIN.THRESH. | | | | |
|--|--|--|--|--|
| Disabled | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. Up fct. Down fct. Right fct. | | | | |

Selects the minimum threshold limit: if an adjusted value > 0.00 is not reached within the P610 **DELAY-TIME**, the unit stops (failure message: **MIN.THRESH.**ERROR).



NOTICE:

The minimum threshold function is also active during the start-up of the pump. Therefore, the delay time must be set higher than the time required to start up the pump and fill the system.
| P610 DELA | Y-TIME | | |
|-----------|----------|-----------|------------|
| ¢ | 2 s | ec | |
| Actu | al Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

Selects the delay time of the minimum threshold limit: it shuts off the HYDROVAR if the actual value drops below P605 **MIN.THRESH.** or if a low-water protection (at terminals X1/16-17) becomes open.

P615 ERROR RESET G

| P615 ERROR RESET | | | |
|------------------|----------|-----------|------------|
| ¢ | ON | l | |
| Actu | al Value | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

Selects automatic reset of errors; if a manual reset is selected, switch an external ON/OFF contactor to the terminal X1/18-19. Possible setting are:

| Setting | Description | |
|---------|---|--|
| ON | Allows an automatic restart five times when an error occurs Shuts off the unit after the fifth restart. The internal counter is decreased by one after each operating hour. | |
| OFF | Each error shown on the display.Each error must be reset manually. | |

8.3.11 M700 OUTPUTS

MENU SCOPE

This submenu includes the following software parameters:

- Analog output 1 and 2
- Configuration of status relay 1 and 2

P705 ANALOG OUT.1

| P705 ANALOG OUT.1 | | | |
|--------------------------------------|---------|-----------|------------|
| Output frequency | | | |
| Actual Value Output Freq. | | | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

Selects the first analog output, which is connected to terminal X3/3-4 on the Premim Card (analogue output 0 - 10 V = 0 - 100%).

P710 ANALOG OUT.2



Selects the second analog output, which is connected to terminal X3/5-6 on the Premim Card (analog output 4 - 20 mA = 0 - 100%).

P715 CONF.REL.1

| P715 CONF.REL.1 | | | |
|--|--|--|------|
| ✤ Running | | | |
| Actual Value Output Freq. | | | req. |
| Left fct. Up fct. Down fct. Right fct. | | | |

Selects the status relay 1 (X2/4 - 5 - 6). Possible settings are:

| Setting | Description | Action if status = YES |
|------------|--|---------------------------|
| Power | HYDROVAR is connected to the power supply. | Relay 1: X2/ 4 - 6 closed |
| Running | The motor is running | Relay 1: X2/ 4 - 6 closed |
| Errors | An error is indicated on HYDROVAR
(including power failure). | Relay 1: X2/ 5 - 6 closed |
| Warnings | A warning is indicated in the
HYDROVAR | Relay 1: X2/ 5 - 6 closed |
| StandBy | The pump is released manually and
by external release, no error/warning
is indicated and the HYDROVAR does
not run. | Relay 1: X2/ 4 - 6 closed |
| Errorreset | If the parameter P615 ERROR RESET
is activated and a warning occurs five
times - > Error - > | Relay 1: X2/ 4 - 6 closed |

P720 CONF.REL.2

| P720 CONF.REL.2 | | | |
|--|---------------------------|--|--|
| ⇔ Errors | | | |
| Actu | Actual Value Output Freq. | | |
| Left fct. Up fct. Down fct. Right fct. | | | |

Selects the status relay 2 (X2/1 - 2 - 3). Possible settings are:

| Setting | Description | Action if status = YES |
|---------|---|---------------------------|
| Power | HYDROVAR is connected to the power supply. | Relay 2: X2/ 1 - 3 closed |
| Running | The motor is running | Relay 2: X2/ 1 - 3 closed |
| Errors | An error is indicated on HYDROVAR
(including power failure). | Relay 2: X2/ 2 - 3 closed |

| Setting | Description | Action if status = YES |
|------------|--|---------------------------|
| Warnings | A warning is indicated in the
HYDROVAR | Relay 2: X2/ 2 - 3 closed |
| StandBy | The pump is released manually and
by external release, no error/warning
is indicated and the HYDROVAR does
not run. | Relay 2: X2/ 1 - 3 closed |
| Errorreset | If the parameter P615 ERROR RESET
is activated and a warning occurs five
times - > Error - > | Relay 2: X2/ 1 - 3 closed |

8.3.12 M800 REQUIRED VALUES

MENU SCOPE

This submenu includes the following software parameters:

- Configuration of the required value
- Switching between required values
- Required frequencies for Actuator mode

For an example, see *Example: P105 ACTUATOR mode* (page 102).

P805 C.REQ.VAL.1

| P805 C.REQ.VAL.1 | | | |
|--|---------------------------|--|--|
| Digital | | | |
| Actu | Actual Value Output Freq. | | |
| Left fct. Up fct. Down fct. Right fct. | | | |

Configures the required value 1. Possible setting are:

| Setting | Description | Connected to terminals (Premium Card) |
|-----------------|---|---------------------------------------|
| Digital | The internal required value 1 is used.
For setting, see P02 REQUIRED VAL.
or P820 REQ.VAL.1 | - |
| Analog U 0-10V | The required value 1 is set by the value of voltage signal. | X3/8-9 |
| Analog I 0-20mA | The required value 1 is set by the value of current signal. | X3/7-8 |
| Analog I 4-20mA | The required value 1 is set by the value of current signal. | X3/7-8 |

P810 C.REQ.VAL.2

| P810 C.REQ.VAL.2 | | | |
|---------------------|---------|-----------|------------|
| \$ | OF | F | |
| Actual Value Output | | | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

Configures the required value 2. Possible settings are:

| Setting | Description | Connected to terminals (Premium Card) |
|---------------------------|---|---------------------------------------|
| Off | Required value 2 not used. | - |
| Digital
Digital | The internal required value 2 is used.
For setting, see P02 REQUIRED VAL. or
P825 REQ.VAL.2 | - |
| Analog U 0-10V | The required value 2 is set by the value of voltage signal. | X3/11-12 |
| Analog I 0-20mA | The required value 2 is set by the value of current signal. | X3/10-11 |
| Analog I 4-20mA | The required value 2 is set by the value of current signal. | X3/10-11 |

P815 SW.REQ.VAL.

| P815 SW.REQ.VAL. | | | |
|---------------------------|---------|-----------|------------|
| Setpoint 1 | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Configure the switching between required value 1 and 2. Possible setting are:

| Setting | Switching possibilities | Action |
|--------------|-------------------------|---|
| Setpoint 1 | No | Only required value 1 is active |
| Setpoint 2 | No | Only required value 2 is active |
| Switch Dig 1 | Manual | Close digital input 1 (X1/14-15) |
| Switch Dig 2 | Manual | Close digital input 2 (X3/1-2) on
Premium Card |

P820 REQ.VAL.1

| P820 REQ.VAL.1 | | | |
|---------------------------|---------|-----------|------------|
| ✤ XX.X bar | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Sets the digital required value 1 in bar (possible setting 0.0 - P420 **SENSOR RANGE**).

- The value is active in all operation mode (but not Actuator mode), if the following applies:
- P805 C.REQ.VAL.1 is set to Digital.
- P815 **SW.REQ.VAL.** is set to **Setpoint 1** or the REQUIRED VALUE 1 is selected via digital input (open).

If the current required value is active, P02 **REQUIRED VAL.** can override the pre-selected required value.

P825 REQ.VAL.2

| ſ | P825 REQ.VAL.2 | | | |
|---|---------------------------|---------|-----------|------------|
| | \$ | XX.X | bar | |
| | Actual Value Output Freq. | | | |
| | Left fct. | Up fct. | Down fct. | Right fct. |

Sets the digital required value 2 in bar (possible setting 0.0 - P420 **SENSOR RANGE**). The value is active in all operation mode (but not Actuator mode), if the following applies:

- P810 C.REQ.VAL.2 is set to Digital.
- P815 **SW.REQ.VAL.** is set to **Setpoint 1** or the REQUIRED VALUE 2 is selected via digital input (open).

If the current required value is active, P02 **REQUIRED VAL.** can override the pre-selected required value.

P830 ACTUAT.FRQ1

| P830 ACTUAT.FRQ1 | | | |
|---------------------------|---------|-----------|------------|
| ⇔ 0.0 Hz | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Set the required frequency 1 for Actuator mode (possible setting 0.0 Hz - P245 **MAX.FREQ.**).

The selected frequency is only active in Actuator mode, if the following applies:

- P805 C.REQ.VAL.1 is set to Digital.
- P815 **SW.REQ.VAL.** is set to **Setpoint 1** or the ACTUATOR FREQUENCY 1 is selected via digital input (open).

P835 ACTUAT.FRQ2

| P835 ACTUAT.FRQ2 | | | |
|---------------------------|---------|-----------|------------|
| ⇔ 0.0 Hz | | | |
| Actual Value Output Freq. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. |

Set the required frequency 2 for Actuator mode (possible setting 0.0 Hz - P245 **MAX.FREQ.**).

The selected frequency is only active in Actuator mode, if the following applies:

- P810 C.REQ.VAL.2 is set to Digital
- P815 **SW.REQ.VAL.** is set to **Setpoint 2** or the ACTUATOR FREQUENCY 2 is selected via digital input (closed).

8.3.13 M900 OFFSET

Menu scope

This submenu includes the following software parameters:

- Offset (input, range)
- Level (1, 2)

- Offset (X1, Y1)
- Offset (X2, Y2)

For an example of the offset function and more information, see *Example: P900 SUBMENU OFFSET* (page 105).

P905 OFFS.INPUT

| P905 OFFS.INPUT | | | |
|---------------------------|---------|-----------|------------|
| ¢ | OF | F | |
| Actual Value Output Freq. | | | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

Selects the offset input. Possible setting are:

| Setting | Offset calculation |
|---------------|---|
| Off | Disabled |
| An. U1 0-10V | Calculated from the voltage signal (0 - 10 V) connected to the terminals X3/7-8-9 (Required Value 1) |
| An. U2 0-10V | Calculated from the voltage signal (0 - 10 V) connected to the terminals X3/10-11-12 (Required Value 2) |
| An. I1 0-20mA | Calculated from the current signal (0 - 20 mA) connected to the terminals X3/7-8 (Required Value 1) |
| An. I1 4-20mA | Calculated from the current signal (4 - 20 mA) connected to the terminals X3/7-8 (Required Value 1) |
| An. 12 0-20mA | Calculated from the current signal (0 - 20 mA) connected to the terminals X3/10-11 (Required Value 2) |
| An. 12 4-20mA | Calculated from the current signal (4 - 20 mA) connected to the terminals X3/10-11 (Required Value 2) |

If the incoming current signal drops to below 4 mA, a warning message is shown on the display; however, HYDROVAR continues to operate without the offset function.

P907 OFFSET RANGE

| P907 OFFSET RANGE | | | |
|---------------------|---------|-----------|------------|
| ¢ 100 | | | |
| Actual Value Output | | | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

Set the representation of the sensor range: the value depends on the maximum range of the connected offset sensor. A higher offset range gives a higher signal input resolution. For an example of the offset function and more information, see *Example: P900 SUBMENU OFFSET* (page 105).

P910 LEVEL 1

| P910 LEVE | L1 | |
|--------------|---------|----------------------|
| ۵ | 0 | |
| Actual Value | | Output Freq. |
| Left fct. | Up fct. | Down fct. Right fct. |

Selects the first level until the offset function 1 is active.

For an example of the offset function and more information, see *Example: P900 SUBMENU OFFSET* (page 105).

P912 OFFSET X1

| P912 OFFS | SET X1 | | |
|--------------|---------|-----------|------------|
| \$ | 0 | | |
| Actual Value | | Output F | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

Sets the offset signal value (X1), which is a fixed point.

For an example of the offset function and more information, see *Example: P900 SUBMENU OFFSET* (page 105).

P913 OFFSET Y1

| P913 OFFSET Y1 | | | | | |
|----------------|---------------------------|-----------|------------|--|--|
| \$ | ✤ 0.00 bar | | | | |
| Actu | Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | |

Set the maximum allowed pressure at P912 OFFSET X1.

For an example of the offset function and more information, see *Example: P900 SUBMENU OFFSET* (page 105).

P915 LEVEL 2

| P915 LEVEL 2 | | | | |
|--------------|-----------|-----------|------------|--|
| \$ | 100 | | | |
| Actu | ual Value | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Selects the second limit where the offset function 2 starts to be active.

For an example of the offset function and more information, see *Example: P900 SUBMENU OFFSET* (page 105).

P917 OFFSET X2

| P917 OFFSET X2 | | | | |
|----------------|----------|-----------|------------|--|
| ٥ | 100 | | | |
| Actu | al Value | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Sets the offset signal value (X2), which is a fixed point.

For an example of the offset function and more information, see *Example: P900 SUBMENU OFFSET* (page 105).

P918 OFFSET Y2



Set the required pressure at this flow rate.

For an example of the offset function and more information, see *Example: P900 SUBMENU OFFSET* (page 105).

8.3.14 M1000 TEST RUN

Menu scope

This submenu includes the following software parameters:

- Automatic test run
- Test run frequency
- Test run boost
- Test run time
- Selecting Inverter for test run
- Manual test run





Controls the automatic test run, which starts up the pump after the last stop, to prevent the pump from blocking (possible setting are "**Off**" or "After 100 hrs".

Automatic test run is only active when both of the following occur:

- HYDROVAR is stopped but manually released.
- The external ON/OFF contact (X1/18 19) is closed.

P1010 TEST RUN FRQ.

| P1010 TEST RUN FRQ. | | | | | |
|---------------------|--------------|--------------------|-----|--|--|
| ¢ | ⇔ 30.0 Hz | | | | |
| | Actual Value | Output Freq. | | | |
| Left fct. | Up fct. | Down fct. Right fc | xt. | | |

Sets the frequency for manual and automatic test run.

P1015 TEST R.BOOST

| P1015 TEST R.BOOST | | | | |
|---------------------------|---------|-----------|------------|--|
| ✤ 10.0 % | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Sets the motor starting voltage (possible setting 0 -25%) as a percentage of the rated input voltage.

P1020 TEST R.TIME

| P1020 TEST R.TIME | | | | | |
|-------------------|---------|--------------|----------|--|--|
| ¢ | 5 sec | | | | |
| Actual Value | | Output Freq | | | |
| Left fct. | Up fct. | Down fct. Ri | ght fct. | | |

Sets the time for the test run.

P1025 SEL.DEVICE

| P1025 SEL.DEVICE | | | | | |
|------------------|----------|----|-----|---------|------------|
| ¢ | * 1 * | | | | |
| Actual Value | | | Οι | itput F | req. |
| Left fct | . Up fci | t. | Dov | vn fct. | Right fct. |

Selects the inverter for the manual test run.

P1030 TEST RUN MAN.

| P1030 TEST RUN MAN. | | | | |
|---------------------------|---------------------------------------|--|--|--|
| Press > for 3 sec | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Left fct. Up fct. Down fct. Right fct | | | |

Performs a manual test run for the unit selected by P1025 **SEL.DEVICE**: this function is also valid for fixed-speed pumps in Cascade relay mode.

For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right (▶) push button.

8.3.15 M1100 SETUP

MENU SCOPE

This submenu includes the following software parameters:

- Restore factory setting
- Password 2
- Clear error memory

- Clear motor hours
- Clear operation time

P1110 FACTORY SET

| P1110 FACTORY SET | | | | | |
|-----------------------|------------------------|---------|-----------|------------|--|
| 4 | Constant Sector Europe | | | | |
| Actual Value Output F | | | req. | | |
| Left f | ct. | Up fct. | Down fct. | Right fct. | |

Restores the factory settings. Possible settings are:

| Setting | Offset calculation | |
|---------|--|--|
| Europe | Restore the factory setting for European versions. | |
| USA | Restore the factory setting for US versions. | |

For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right (▶) push button.

P1120 PASSWORD 2

| P1120 PASSWORD 2 | | | | |
|---------------------------|---------|-----------|------------|--|
| ¢ 0000 | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Enter the system password, which gives access to factory parameters.

For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right (▶) push button.

P1125 CLR.ERRORS

| P1125 CLR.ERRORS | | | | |
|---------------------------|---------|-----------|------------|--|
| ⇔ ALL | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Used to clear the error memory either (1-8) for one specific unit or ALL for all units in Cascade Serial or Synchronous.

For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right (▶) push button.

P1130 CLR.MOTOR H.

| I | P1130 CLR.MOTOR H. | | | | | |
|---|--------------------|---------|-----|--------------|---------|--|
| | | | | | | |
| | Actual Value | | | itput Freq. | | |
| | Left fct. | Up fct. | Dov | vn fct. Righ | nt fct. | |

Used to clear the motor hours either (1-8) for one specific unit or ALL for all units in Cascade Serial or Synchronous.

For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right (▶) push button.

P1135 CLR.OPERAT.

| P1135 CLR.OPERAT. | | | | | |
|---------------------------|---------|--------------|----------|--|--|
| ✿ Press ► 3 sec | | | | | |
| Actual Value Output Freq. | | | | | |
| Left fct. | Up fct. | Down fct. Ri | ght fct. | | |

Clear the operation time, which stores the total time the HYDROVAR is connected to power supply.

For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right (▶) push button.

P1140 CLR.KWH CNT.

| P1140 CLR.KWH CNT. | | | | | |
|--------------------|--------------|--|-----------|------------|--|
| ⇔ ALL | | | | | |
| | Actual Value | | | eq. | |
| Left fct. | Up fct. | | Down fct. | Right fct. | |

Used to clear the kilowatt-hours counter either (1-8) for one specific unit or ALL for all units in Cascade Serial or Synchronous.

For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right (▶) push button.

8.3.16 M1200 RS-485 INTERFACE

MENU SCOPE

This submenu includes the following software parameters:

- User interface (address, baudrate, format)
- Internal interface (pump address)

The following parameters are necessary for the communication between HYDROVAR and an external device (e.g. PLC) via standardized Modbus-protocol. Set desired address, Baudrate and Format according the system requirements. P1203 PROTOCOL



Sets the desired communication protocol. Possible settings are:

- Disabled
- Modbus RTU
- Modbus ASCIIBACNet MS/TP

P1205 ADDRESS

| P1205 ADDRESS | | | | | | |
|---------------|---------|---|-----------|------------|--|--|
| ¢ | | 1 | | | | |
| Actual Value | | | Output F | req. | | |
| Left fct. | Up fct. | | Down fct. | Right fct. | | |

Sets the desired address (possible setting 1 - 247) for the user interface.

P1210 BAUD RATE

| P1210 BAUD RATE | | | | | |
|---------------------------|---------|-----------|------------|--|--|
| ¢ 9600 | | | | | |
| Actual Value Output Freq. | | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | |

Set the **BAUD RATE** for the user interface.

Possible settings are:

- 1200
- 2400
- 4800
- 9600
- 14400
- 19200
- 38400
- 57600
- 76800
- 115200

P1215 FORMAT



Set the data **FORMAT** for the communication port, depending on the value of P1203 **PROTOCOL**

Possible settings are:

- 8, E, 1
- 8, O, 1
- 8, N, 2
- 8, N, 1
- 7, E, 1
- 7, 0, 1
- 7, N, 2
- 7, N, 1

P1220 PUMP ADDR.



Selects an address for each inverter.

P1221 BACNET DEV. ID

| P1221 BACNET DEV.ID | | | | | |
|----------------------------------|--|--|--|--|--|
| \$ 84001 | | | | | |
| Actual Value Output Freq | | | | | |
| Left fct. Up fct. Down fct. Righ | | | | | |

Sets Bacnet Device Object ID

P1225 SSID NUMBER

| P1225 SSID NUMBER | | | | | | |
|-------------------|---------------------------------------|--|--|--|--|--|
| ✿ 01234567 | | | | | | |
| Actu | Actual Value Output Freq. | | | | | |
| Left fct. | Left fct. Up fct. Down fct. Right fct | | | | | |

This parameter shows the identification number of the Wi-Fi network generated when the wireless module is assembled into HYDROVAR.

In particular, the network name will be: "hydrovar__P1225__", where P1225 is the value of this parameter, expressed as an 8 character word.

Example: if P1225 = a1b2c3d4, wifi network name = "hydrovara1b2c3d4"

P1226 SEC.KEY NUMBER



This parameter shows the security key number to access the Wi-Fi network generated when the wireless module is assembled into HYDROVAR.

In particular, the security key number will be: "xylem_P1226_", where P1226 is the value of this parameter, expressed as an 8 character word.

Example: if P1226 = b5c6d7e8, security key number = "xylemb5c6d7e8"

8.3.17 M1300 START-UP

MENU SCOPE

This submenu includes all the parameters necessary for a quick start-up of HYDROVAR:

- Language
- Motor Configuration (Power, Voltage, ...)
- Single/Multi Pump configuration
- Required Value

P1301 LANGUAGE



This parameter selects the display language.

P1302 MOTOR NOM.POWER

| P1302 MOTOR NOM.POWER | | | | | | |
|-----------------------|--|--|--|--|--|--|
| ⇔ 1.5 kW | | | | | | |
| A | Actual Value Output Freq. | | | | | |
| Left fct. | Left fct. Up fct. Down fct. Right fct. | | | | | |

This parameter set the nominal power of the motor coupled with HYDROVAR, as reported on the motor nameplate. For possible setting, see *P265 MOTOR NOM.POWER* (page 63)

P1303 MOTOR NOM.VOLT.

| P1303 MOTOR NOM.VOLT. | | | | | |
|--------------------------------------|--|--|--|--|--|
| ⇔ 230 V | | | | | |
| Actual Value Output Freq. | | | | | |
| Left fct. Up fct. Down fct. Right fc | | | | | |

Sets the motor nominal voltage, as reported in the motor nameplate, according to

- the chosen motor connection
- the output voltage of the HYDROVAR

For possible setting, see P266 MOTOR NOM.VOLT. (page 63)

P1304 PRE-SET MOTOR ?

| P1304 PRE-SET MOTOR ? | | | | | | |
|-----------------------|--------------|-------------|------------|--|--|--|
| | | | | | | |
| | Actual Value | Output Free | ļ . | | | |
| Left fct. | Up fct. | Down fct. R | ight fct. | | | |

By selecting "**Yes**", the user is declaring the use of a Lowara IE3 surface 2-poles motor 50Hz (without Motor Filter): in this case, the motor's electrical parameters are already available to HYDROVAR, so the start-up procedure skips to P1308 **STC MOTOR PROT**.

By selecting "NO", the user is declaring the use of any other motor: in this case the motor's electrical parameters need to be set into HYDROVAR, so the start-up procedure goes to the next step (P1305 **MOTOR NOM.CURR.**)

P1305 MOTOR NOM.CURR.

| P1305 | P1305 MOTOR NOM.CURR. | | | | | |
|--|-----------------------|--------------|--|--|--|--|
| ¢ | ✤ 7.5 A | | | | | |
| | Actual Value | Output Freq. | | | | |
| Left fct. Up fct. Down fct. Right fct. | | | | | | |

Sets the motor nominal current, as reported in the motor nameplate, according to

- the chosen motor connection
- the output voltage of the HYDROVAR

P1306 MOTOR NOM.SPEED



Sets the motor nominal speed, as reported in the motor nameplate.

P1307 AMPI

| P1307 | AMPI | | |
|----------|--------------|-------------|------------|
| ¢ | | Full | |
| | Actual Value | Output Fre | q. |
| Left fct | . Up fct. | Down fct. F | Right fct. |

This parameter activates the Automatic Motor Parameter Identification; possible settings are "Off" (AMPI not active), "Full" or "Reduced" (procedure to be performed only in case LC filters are applied on the motor cable).

For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right (▶) push button.

For further information, see P275 AMPI (page 65)

P1308 STC MOTOR PROT.

| P1308 STC MOTOR PROT. | | | | |
|---------------------------|---------|-----------|------------|--|
| STC Trip | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

This parameter sets the protection technique against motor overheating; possible the settings are "Thermistor trip" or "STC trip" (default).

P1309 MODE

| P1309 MODE | | | | | |
|---------------------------|------------|-----------|------------|--|--|
| \$ | Controller | | | | |
| Actual Value Output Freq. | | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | |

This parameter selects which operating mode to set the unit to. For possible setting, see *P105 MODE* (page 55).

P1310 PUMP ADDR.

| P1310 PUMP ADDR. | | | | | |
|------------------|----------|-----------|------------|--|--|
| ٥ | 1 | | | | |
| Actu | al Value | Output F | req. | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | |

This parameter selects an address (1-8) for each HYDROVAR. If several MASTER inverters are connected via the internal RS-485 connection (maximum eight in Cascade serial mode), then the following must apply:

- Each HYDROVAR needs an individual pump-address (1-8)
- Each address can only be used once.

P1311 CONTROL MODE

| P1311 CONTROL MODE | | | | | |
|--------------------|-----|---------|------------|------------|--|
| Constant | | | | | |
| Actual Value | | | Output Fre | eq. | |
| Left fct | . ι | Jp fct. | Down fct. | Right fct. | |

For this parameter please note that, once entered into edit mode (by pressing the provided push button), the user can confirm the new value by pressing for 3 sec the right (▶) push button.

This parameter sets the pressure control mode for the pump system (single and multi pump): depending on the setting ("Constant" or "Differential") a set of further parameters are automatically configured.

Whenever P1311 **CONTROL MODE** is set to a new value, each parameter in the below table is overwritten to its own specified value, regardless of previous different settings.

| | P1311 = Constant | P1311 = Differential |
|-----------------|------------------|----------------------|
| P225 RAMP 3 | 70 sec | 90 sec |
| P230 RAMP 4 | 70 sec | 90 sec |
| P250 MIN.FREQ. | 20 Hz | 25 Hz |
| P255 CONF.FMIN | f -> 0 | f -> fmin |
| P260 FMIN TIME | 0 sec | 3 sec |
| P315 HYSTERESIS | 80% | 90% |
| P410CONF.SENSOR | Sensor 1 | Sens.1 - Sens.2 |

P1312 DIMENSION UNIT

Selects the unit of measure for the system.

| P1312 DIMENSION UNIT | | | | | |
|----------------------|-----------|-----------|------------|--|--|
| ⇔ bar | | | | | |
| Actu | ual Value | Output F | req. | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | |

For further information, see P405 DIMENSION UNIT (page 71)

P1313 START-UP COMPLETED?

| P1313 START-UP COMPLETED? | | | | | | |
|---------------------------|--------------|-----------|------------|--|--|--|
| ¢ | ⇔ No | | | | | |
| ļ | Actual Value | Output F | req. | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | | |

If the application the is a multi-pump, then the startup procedure for the first [N-1] pumps is stopped here when selecting Yes.

If the application the is a single-pump or the last pump of a Multi-pump, then select No .

P1314 SENSOR RANGE

| P1314 SENSOR RANGE | | | | |
|--------------------|--------------|-----------|------------|--|
| 20mA - 10.00bar | | | | |
| | Actual Value | Output F | req. | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Sets the end range value (20 mA or 10 V) of the connected sensor. In particular, the end range value (20 mA or 10 V) must be always equal to the 100% of the sensor range (that is, for a 0.4 bar differential pressure sensor, is 20 mA=0.4 bar).

P1315 REQUIRED VAL.

| P1315 REQUIRED VAL. | | | | | | |
|---------------------|---------------------------|-----------|------------|--|--|--|
| ¢ | XXXXX bar | | | | | |
| ŀ | Actual Value Output Freq. | | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | | |

For further information, see PO2 REQUIRED VAL. (page 46).

P1316 START VALUE

| P1316 START VALUE | | | | | |
|-------------------------------------|---------------------------|--|--|--|--|
| ¢ 100 % | | | | | |
| Actu | Actual Value Output Freq. | | | | |
| Left fct. Up fct. Down fct. Right f | | | | | |

Sets the end range value (20 mA or 10 V) of the connected sensor. In particular, the end range. This parameter defines, in percentage (0-100%) of the required value (P1314 **REQUIRED VAL.**), the start value after pump stops.

If P1315 **REQUIRED VAL.** is met and there is no more consumption, then the pump stops. The pump starts again when the pressure drops below P04 **START VALUE**. Value 100% makes this parameter not effective (100%=off)!

P1317 MIN.THRESH.

| P1317 MIN.THRESH. | | | | |
|---------------------------|---------|-----------|------------|--|
| Disabled | | | | |
| Actual Value Output Freq. | | | | |
| Left fct. | Up fct. | Down fct. | Right fct. | |

Selects the minimum threshold limit: if an adjusted value > 0.00 is not reached within the P1317 **DELAY-TIME**, then the unit stops (failure message: MIN.THRESH.ERROR).

P1318 DELAY-TIME

| P1318 DELAY-TIME | | | | | |
|------------------|----------|-----------|------------|--|--|
| ⇔ 2 sec | | | | | |
| Actu | al Value | Output F | req. | | |
| Left fct. | Up fct. | Down fct. | Right fct. | | |

Selects the delay time of the minimum threshold limit: it shuts off the HYDROVAR if the actual value drops below P1317 **MIN.THRESH.** or if a low-water protection (at terminals X1/16-17) becomes open.

P1319 DATE



Using this parameter current date can be set.

P1320 TIME

| P1320 | TIME | | | | |
|-----------|---------------------------|----------|-----------------|--|--|
| ¢ | ŀ | H.MM | | | |
| | Actual Value Output Freq. | | | | |
| Left fct. | Up fo | ct. Down | fct. Right fct. | | |

Using this parameter current time can be set.

P1321 AUTO-START

| P1321 AUTO-START | | | |
|---------------------|---------|-----------|------------|
| ٥ | ON | l | |
| Actual Value Output | | | req. |
| Left fct. | Up fct. | Down fct. | Right fct. |

If **AUTO-START** = ON, then the HYDROVAR starts automatically (in case of demand) after reconnection of power following disconnection.

P1322 START-UP COMPLETED?

| P1322 START-UP COMPLETED? | | | |
|--|--|--|------|
| ⇔ No | | | |
| Actual Value Output Freq. | | | req. |
| Left fct. Up fct. Down fct. Right fct. | | | |

If the user configured the whole application by selecting "YES" then the HYDROVAR will not make available the Start-up menu at every power-on.

By selecting "NO" at next power-on, the HYDROVAR will offer to the user the start-up procedure.

P1323 ADDRESS

| P1323 ADDRESS | | | | |
|---------------|----------|---------------------|--|--|
| \$ | • | 1 | | |
| Actu | al Value | Output Freq. | | |
| Left fct. | Up fct. | Down fct. Right fct | | |

Sets the desired address (possible setting 1 - 247) for the user interface.

9 Maintenance

9.1 General



Electrical Hazard:

Before any service or maintenance disconnect the system from the power supply and wait at least 5 minutes before starting work on or in the unit (the capacitors in the intermediate circuit are discharged by the internal discharge resistors).

The unit does not require any special maintenance.

Check list

- Make sure that the cooling fan and the vents are free from dust.
- Make sure that the ambient temperature is correct according to the limits of the unit.
- Make sure that qualified personal perform all modifications of the unit.
- Make sure that the unit is disconnected from the power supply before any work is carried out. Always consider the pump- and motor-instruction.

For further information, contact the local distributor.

9.2 Check error codes

Check the error codes in parameters P26 - P30 on a regular basis.

For more information about the parameters, see *P26 thru P30: ERROR memory* (page 52). For detailed information about the error codes, see *Warnings and errors* (page 99).

9.3 Check the functions and parameters

If the hydraulic system is changed then follow this procedure.

- 1. Make sure that all functions and parameters are correct.
- 2. Adjust the functions and parameters if necessary.

10 Troubleshooting

Precaution

NOTICE:

• Always disconnect the unit from the power supply before you perform any installation and maintenance tasks.

Warnings and errors

- Warnings and errors are shown on the display and/or by the red LED.
- When a warning is active and the cause is not remedied within 20 seconds, then an error is shown and the unit stops. For some warnings, the unit keeps running depending on the type of error.
- When an error is active, the connected motor is stopped immediately. All errors are shown in plain text and saved in the error memory including date and time when the error appeared.
- An automatic error-reset can be activated in P600 **SUBMENU ERRORS** to reset an occurred error automatically five times. For more information about this function, see P615 **ERROR RESET**.
- All error signals and warnings can be indicated via the two status-relays on terminals X2/1-3 or X2/4-6 depending on the configuration. For more information, see P715 CONF REL 1 and P720 CONF REL 2.

The errors can be reset automatically (depending on the setting in parameter P615 **ERROR RESET**) or manually in the following ways:

- Disable the power supply for more than 60 seconds.
- Press ◀ and ► simultaneously for 5 seconds.
- Open and close the external ON/OFF (X1/18-19).

10.1 No error message on the display

| Error | Cause | Remedy |
|---|--|---|
| No AUTO-START after the power failure. | Parameter P08 AUTO-START is set to OFF. | Check parameter P08 AUTO-START. |
| The system pressure is not steady. | Pressure higher than the START VALUE or REG.
MODE has been changed to Inverse . | Check parameter P04 START VALUE and/or P320 REG. MODE . |

10.2 Error message on the display

| Error | Cause | Remedy |
|-------------------------|---|--|
| OVERCURRENT
ERROR 11 | Power limit exceeded -
too high motor current
(fast rise detected). | Check the following: The connection terminals of the unit The connection terminals of the motor and the motor cable The winding of the motor Make sure all the connections, cables, and windings are OK and reset the error by disabling the power for more than 60 seconds. |

The automatic error-reset is not available for this failure so the power supply has to be cut for more than 60 seconds to reset the error.

| Error | Cause | Check the following: |
|---|---|---|
| OVERLOAD
ERROR 12 | Power limit exceeded - motor
current too high (slow rise
detected). | Is the parameter P215/P220 RAMP 1/RAMP 2 too short and P265 BOOST too low? Do the cables and connection work? Is the pump is blocked? Does the motor rotate in the wrong direction before running (non-return valve defect)? Not allowed operation point or P245 MAX.FREQ. is too high, also check the P265 BOOST value. |
| OVERVOLTAGE
ERROR 13 | The voltage is too high. | Is the parameter P220 RAMP 2 too fast? Is the power supply too high? Are the voltage peaks too high? If the error is power or voltage-related, line filters, line inductors, or RC-elements can be installed to resolve the issue. |
| INVERT. OVERHEAT
ERROR 14 | The temperature inside the unit is too high. | Is the unit properly cooled? Are the units motor vents contaminated? Is the ambient temperature too high? |
| THERMO MOT/EXT
ERROR 15 | The PTC sensor has reached its release temperature. | Close X1/PTC if there is no external protective device connected Refer to <i>Motor sensor connection</i> (page 35) for detailed information |
| PHASELOSS
ERROR 16 | One phase of the power
supply does not work. | The power supply under full load If phase failure occurs at the input. The circuit breakers And visually inspect the points at the input terminals. |
| UNDERVOLTAGE | The voltage is too low. | Is the supply voltage too low? Is there phase failure at the input? Is there asymmetry between the phases? |
| COMM LOST | The communication between
the power unit and the control
board does not work correctly. | Is the connection between the control board and the power unit correct? |
| LACK OF WATER
ERROR 21 | The low water sensor
connection, terminals
X3/11-12, is opened. The
sensor is only active when the
pump runs. | The incoming pressure or minimum water level values are set too low, then change the settings. The error only happens for a short time, then adjust parameter P610 DELAY TIME. If a sensor is not used, then the terminals X3/11-12 must be bridged.¹ |
| MIN. THRESHOLD
ERROR 22 | The defined value of parameter P605 MIN.THRESH. was not reached during the preselected P610 DELAY TIME . | The booster unit and adjust the parameter P610
DELAY TIME. Set the parameter P615 ERROR RESET set to ON,
to enable five restarts in the empty system. |
| FAILURE SENSOR 1,
ACT. VAL. SENSOR 1
ERROR 23 | Sensor signal on terminals
X3/2 is less than 4 mA which
an active sensor must deliver. | The Actual value signal from the pressure transducer is faulty. The connection is faulty. The sensor or cables are faulty. Check the configuration of the sensors in P400 SUBMENU SENSOR. |

¹ The unit is reset when the terminals X3/11-12 are closed.

| Error | Cause | Check the following: |
|---|---|--|
| FAILURE SENSOR 2,
ACT. VAL. SENSOR 2
ERROR 24 | Sensor signal on terminals
X3/4 is less than 4 mA which
an active sensor must deliver. | The Actual value signal from the pressure transducer is faulty. The connection is faulty. The sensor or cables are faulty. Check the configuration of the sensors in P400 SUBMENU SENSOR. |
| SETPOINT 1 I<4mA,
SETPOINT 1 I < 4 mA
ERROR 25 | Current signal input of
required values is active, but
no signal between 4-20 mA is
connected. | External analog signal on terminals X3/17-18 Configuration of the required values in P800
SUBMENU REQUIRED VALUES. |
| SETPOINT 2 I < 4 mA,
SETPOINT 2 I < 4 mA
ERROR 26 | Current signal input of
required values is active, but
no signal between 4-20 mA is
connected. | External analog signal on terminals X3/22-23 Configuration of the required values in P800
SUBMENU REQUIRED VALUES. |

10.3 Internal error, on display or red LED ON

To reset errors, the power supply has to be cut for more than 60 seconds. If the error message is still shown on the display, then contact your local distributor and provide a detailed description of the error.

| Error | Cause | Remedy |
|---------|---|---|
| ERROR 1 | EEPROM-ERROR, data block malfunction | Reset the unit. If the error message repeats then change control board. |
| ERROR 4 | Button error, for example a jammed key | Check and make sure that the push buttons are OK. If the push buttons are faulty, then change the display-board. |
| ERROR 5 | EPROM-ERROR, checksum
error | Reset the unit. If the error message repeats then change control board. |
| ERROR 6 | Program error: Watchdog
error | Reset the unit. If the error message repeats then change control board. |
| ERROR 7 | Program error: Processor
pulse error | Reset the unit. If the error message repeats then change control board. |
| CODE | Code error: invalid | Check and make sure that the: |
| ERROR | processor command | Installation of the cables, connection of the screen and potential equalization is correct. Ground is correctly installed. |
| | | Signal is strong enough, if not, install additional ferrite
inductances to boost the signal. |

11 Technical Reference

11.1 Example: P105 ACTUATOR mode

Graph



Position numbers

- 1. Signal range * (f_{min} / f_{max}) + zeropoint
- 2. Range of control

11.2 Example: P200 Ramp Settings

Graph



Position numbers

- 1. P02 REQUIRED VAL.
- 2. P315 HYSTERESIS in % of P310 WINDOW.

- 3. P310 WINDOW in % of P02 REQUIRED VAL.
- 4. P260 FMIN TIMEFMIN TIME
- 5. P250 MIN.FREQ.
- 6. Actual value
- 7. Output frequency

Description

RA:RAMP FMIN A

RD: RAMP FMIN D

R1: RAMP 1 - speed ramp fast increase

- R2: RAMP 2 speed ramp fast decrease
- R3: RAMP 3 speed ramp slow increase
- R4: RAMP 4 speed ramp slow decrease

Adjust ramp settings

To adjust the ramps presented above, see separate sections in *M200 CONF.INVERTER* (page 57).

11.3 Example: P330 LIFT AMOUNT

Follow these instructions to set the lift amount.

- 1. Enter the set pressure. See *P02 REQUIRED VAL*. (page 46).
- 2. Close all valves in the system and start the HYDROVAR® to read the frequency displayed.

Another possibility to find out the frequency for the set pressure at zero demand is to use the P305 **JOG** mode. For more information, see *P305 JOG* (page 69).

- 3. Set the frequency value (set pressure at zero demand) in P325 **FRQ. LIFT**. For more information, see *P325 FRQ.LIFT* (page 71).
- 4. Set the P330 LIFT AMOUNT (increase in % of the set pressure) to compensate the friction losses in the system.

Example: set pressure = 4 bar, lift amount: a) 0% (= 4 bar, no lift), b) 100% (= 8 bar), c) 200% (=12 bar)

For more information see *P330 LIFT AMOUNT* (page 71). This is set as % of the set pressure.



Graph Position numbers

- 1. The pressure at zero demand (all valves closed).
- 2. The pressure plus lift amount to compensate the friction loss.

11.4 Example: P500 SUBMENU SEQUENCE CNTR.

Graph



Calculation process for the sequence centre value

- 1. Lead pump reaches its P515 **ENABLE FRQ**.
- Actual value falls to the cut in-value of the 1st assist pump. The 1st assist pump switches on automatically. (Cut in-value = P02 REQUIRED VAL - P510 ACT.VAL.DEC)
- 3. A new required value, P03 EFF.REQ.VAL is calculated after the start up. P03 EFF.REQ.VAL = P02 REQUIRED VAL - P510 ACT.VAL.DEC + P505 ACT.VAL.INC

Calculations of the new required value for multi pump applications

k.... number of active pumps (k > 1)

- p = p_{set} + (k-1) * (P505 ACT.VAL.INC P510 ACT.VAL.DEC)
- P505 ACT.VAL.INC = P510 ACT.VAL.DEC → Pressure constant, independent of how many pumps are in operation.
- P505 ACT.VAL.INC > P510 ACT.VAL.DEC→ Pressure rises when assist pump switches on.
- P505 ACT.VAL.INC < P510 ACT.VAL.DEC → Pressure falls when assist pump switches on.

To find out the right setting for Syncronous control

- 1. Start the first pump in P62 **JOG** mode.
- 2. Increase the frequency until the required value is met. Check the frequency at zero consumption, f_0 .
- 3. Set the synchronous limit, $f_0 + 2..3$ Hz.
- 4. Set the synchronous window between 1 or 2 Hz depending on the pump curve and the set point.

11.5 Example: P900 SUBMENU OFFSET

General settings

Constant pressure system with the required value of 5 bar.

Additionally a flow sensor is connected to the offset input.

Parameter P907 OFFS.RANGE = 160 (maximum range of flow sensor = 16 m³/h).

System requirement 1

- Constant pressure: 5 bar
- Flow rate: 5 12 m³/h

Below 5 m³/h decrease the pressure to maximum 2,5 bar at a flow rate of 2 m³/h. Settings:

- Parameter P910 LEVEL $1 = 50 = 5 \text{ m}^3/\text{h}$. First limit where the offset function is active.
- Parameter P912 OFFSET X1 = $20 = 2 \text{ m}^3/\text{h}$. Fixed point according to the requirements.
- Parameter P913 **OFFSET Y1** = 2,5 = 2,5 bar. Maximum allowed pressure at this flow rate.

System requirement 2

- Constant pressure: 5 bar
- Flow rate: 5 12 m³/h

Above 12 m³/h increase the pressure with the limitation to have maximum 6,0 bar at maximum flow rate of 16 m³/h.

Settings:

- Parameter P915 LEVEL 2 = 120 = 120 m³/h. Second limit where the offset function is active.
- Parameter P917 **OFFSET X2** = 160 = 16 m³/h. Fixed point according to the requirements.
- Parameter P918 OFFSET Y2 = 6 = 6 bar. Required pressure at this flow rate.

Graph

See graph below for more details.



Position numbers

- 1. LEVEL 1
- 2. LEVEL 2
- 3. OFFSET X1
- 4. OFFSET X2
- 5. OFFSET Y1
- 6. OFFSET Y2

11.6 Programming flow charts

Submenu 0 - 40

| Submenu 0–40 | ID | Name | Example menu |
|--------------|------|---------------|--------------------------------------|
| | 0 | MAIN | |
| | HOME | | Actual value |
| | 2 | REQUIRED VAL. | 3,5 bar |
| | 3 | EFF.REQ.VAL. | 3,5 bar |
| | 4 | START VALUE | Off |
| | 5 | LANGUAGE | English |
| | 6 | DATE | xx.xx.20xx |
| | 7 | TIME | xx:xx |
| | 8 | AUTO-START | Off |
| | 9 | OPERAT.TIME | xxxxx:xx |
| | 20 | STATUS | |
| | 21 | STATUS UNITS | 0000000 |
| | 22 | SELECT DEVICE | *1* |
| | 23 | STATUS DEVICE | Running |
| | 24 | ENABLE DEVICE | Enabled |
| | 25 | MOTOR HOURS | xxxxx:xx |
| | 26 | 1ST ERROR | No Error |
| | 27 | 2ND ERROR | No Error |
| | 28 | 3RD ERROR | No Error |
| | 29 | 4TH ERROR | No Error |
| | 30 | 5TH ERROR | No Error |
| | 35 | KWH COUNTER | kWh |
| | 40 | DIAGNOSTICS | |
| | 41 | PROD.DATE | xx.xx.20xx |
| | 42 | SEL.INVERTER | * 11 |
| | 43 | TEMP.INVERTER | x: <xx %="" <xx="" c<="" td=""></xx> |
| | 44 | CURR.INVERTER | x: xx % |
| | 45 | VOLT.INVERTER | x: xxx V |
| | 46 | OUTPUT FREQ. | x: xx.x Hz |
| | 47 | VER.INVERTER | x: xx |

Submenu 60 - 300

| Submenu 60–300 | ID | Name | Example menu |
|--|--------------|----------------------------|-------------------------|
| $60 + 61 + 62 \leftrightarrow 60$ | 60 | SETTINGS | |
| | 61 | PASSWORD | 0000 |
| | 62 | JOG | xx.x Hz |
| | | | 3,5 bar |
| 100 105 106 110 115 120 125 - 100 | 100 | BASIC SETTINGS | I |
| | 105 | MODE | Controller |
| | 106 | PUMP ADDR. | 1 |
| | 110 | SET PASSW. | 0066 |
| | 115 | LOCK FUNCT. | OFF |
| | 120 | DISP.CONTR. | 75 % |
| | 125 | DISP.BRIGHT. | 100 % |
| | 200 | CONF.INVERTER | |
| | 202 | SOFTWARE | HV V01.4 |
| | 205 | MAX.UNITS | 6 |
| | 210 | INVERTER | All |
| | 215 | RAMP 1 | 4 sec |
| 268 269 270 275 280 281 | 220 | RAMP 2 | 4 sec |
| | 225 | RAMP 3 | 70 sec |
| | 230 | RAMP 4 | 70 sec |
| | 235 | RAMP FMIN A | 2,0 sec |
| | 240 | RAMP FMIN D | 2,0 sec |
| | 245 | MAX.FREQ. | 50 Hz |
| | 250 | MIN.FREQ. | 20 Hz |
| | 255 | CONF.FMIN | f->0 |
| | 260 | FMIN TIME | 0 sec |
| | 261 | SKIP FRQ.CTR. | 20.0 Hz |
| | 262 | SKIP FRQ.RNG. | 0.0 Hz |
| | 265 | MOTOR NOM.POWER | 1.5 kW |
| | 266 | MOTOR NOM.VOLT. | 230 V |
| | 267 | MOTOR NOM.FRQ. | 50.0 Hz |
| | 268 | MOTOR NOM.CURR. | 7.5 A |
| | 269 | MOTOR NOM.SPEED | 3000 rpm |
| | 270 | MOTOR POLES | 2 |
| | 275 | AMPI | Full |
| | 280 | SWITCHING CONTROL | HVC |
| | 281 | BOOST | 5 % |
| | 282 | KNEE FREQ. | 50.0 Hz |
| | 283 | SEL.SW.FREQ. | 10 kHz |
| | 290 | STC MOTOR PROT. | STC Trip |
| | 291 | STC MOTOR THERMAL | 77 % |
| | 295 | CURR.LIM.FUNCT. | Off |
| | 296 | CURR.LIMIT SET | 110 % |
| 300 - 305 - 310 - 315 - 320 - 325 - 330 ↔ 300 | 300 | REGULATION | |
| | 305 | JOG | 0.0 Hz |
| 108 H | ↓L 2.015-4.2 | 20 Installation, Operation | 3,5dbMaintenance Manual |

| Submenu 60-300 | ID | Name | Example menu |
|----------------|-----|-------------|--------------|
| | 310 | WINDOW | 10 % |
| | 315 | HYSTERESIS | 80 % |
| | 320 | REG.MODE | Normal |
| | 325 | FRQ.LIFT | 30,0 Hz |
| | 330 | LIFT AMOUNT | 0,0 % |

Submenu 400 - 500

| Submenu 400-500 | ID | Name | Example menu |
|--|-----|-----------------|--------------------|
| 400+405+410+415+420+425+430
435+440+445+400 | 400 | SENSOR | |
| | 405 | DIMENSION UNIT | bar |
| | 410 | CONF.SENSOR | Sensor 1 |
| | 415 | SENSOR TYPE | Analog I 4 - 20 mA |
| | 420 | SENSOR RANGE | 10.00 bar |
| | 425 | SENSOR CURVE | linear |
| 500 + 505 + 510 + 515 + 520 + 525 + 530
535 + 540 + 545 + 550 + 555 + 560 | 430 | SENS.1 CAL.0 | 0% = x.xx bar |
| | 435 | SENS.1 CAL.X | 0% = xx.xx bar |
| | 440 | SENS.2 CAL.0 | 0% = xx.xx bar |
| | 445 | SENS.2 CAL.X | 0% = xx.xx bar |
| | 500 | SEQUENCE CONTR. | |
| | 505 | ACT.VAL.INC. | 0,35 bar |
| | 510 | ACT.VAL.DEC. | 0,15 bar |
| 565 ←> 500 | 515 | ENABLE FRQ. | 48 Hz |
| | 520 | ENABLE DLY. | 5 sec |
| | 525 | SWITCH DLY. | 2 sec |
| | 530 | DISABLE FRQ. | 30,0 Hz |
| | 535 | DISABLE DLY. | 5 sec |
| | 540 | DROP FRQ. | 42,0 Hz |
| | 545 | OVERVALUE | Disabled |
| | 550 | OVERVAL.DLY. | 0.0 sec |
| | 555 | SWITCH INTV. | 24 hours |
| | 560 | SYNCHR.LIM. | 0,0 Hz |
| | 565 | SYNCHR.WND. | 2.0 Hz |

Submenu 600 - 1200

| Submenu 600-1200 | ID | Name | Example menu |
|-----------------------------------|------|------------------|-------------------|
| 600 + 605 + 610 + 615 ← 600 | 600 | ERROR | I |
| | 605 | MIN.THRESH. | Disabled |
| | 610 | DELAY-TIME | 2 sec |
| | 615 | ERROR RESET | On |
| 700 - 705 - 710 - 715 - 720 ← 700 | 700 | OUTPUTS | |
| | 705 | ANALOG OUT.1 | Output frequency |
| | 710 | ANALOG OUT.2 | Actual value |
| | 715 | CONF.REL.1 | Running |
| | 720 | CONF.REL.2 | Errors |
| 800 805 810 815 820 825 | 800 | REQUIRED VALUES | |
| | 805 | C.REQ.VAL.1 | Digital |
| | 810 | C.REQ.VAL.2 | Off |
| 830 835 + 800 | 815 | SW.REQ.VAL. | Setpoint 1 |
| | 820 | REQ.VAL.1 | 3,5 bar |
| | 825 | REQ.VAL.2 | 3,5 bar |
| | 830 | ACTUAT.FRQ1 | 0.0 Hz |
| | 835 | ACTUAT.FRQ2 | 0.0 Hz |
| | 900 | OFFSET | |
| | 905 | OFFS.INPUT | Off |
| 915 917 918 +> 900 | 907 | OFFSET RANGE | 100 |
| | 910 | LEVEL 1 | 0 |
| | 912 | OFFSET X1 | 0 |
| | 913 | OFFSET Y1 | 0,00 bar |
| | 915 | LEVEL 2 | 100 |
| | 917 | OFFSET X2 | 100 |
| | 918 | OFFSET Y2 | 0,00 bar |
| | 1000 | TEST RUN | |
| | 1005 | TEST RUN | |
| | 1010 | TEST RUN FRQ. | 30.0 Hz |
| | 1015 | TEST R.BOOST | 10% |
| | 1020 | TEST R.TIME | 5 sec |
| | 1025 | SEL.DEVICE | *1* |
| | 1030 | TEST RUN MAN. | Press > for 3 sec |
| | 1100 | SETUP | 1 |
| | 1110 | FACTORY SET | Europe |
| | 1120 | PASSWORD 2 | 0000 |
| 1200 1205 1210 1215 1220 ← 1200 | 1200 | RS-485 INTERFACE | |
| | 1203 | PROTOCOL | Modbus RTU |
| | 1205 | ADDRESS | 1 |
| | 1210 | BAUD RATE | 9600 |
| | 1215 | FORMAT | RTU N81 |
| | 1220 | PUMP ADDR. | 1 |
| | 1221 | BACNET DEV. ID | 84001 |

Submenu 1300

| Submenu 1300 | ID | Name | Example menu |
|-------------------------------|------|---------------------|--------------|
| 1300-1301-1302-1303-1304-1305 | 1300 | START-UP | |
| | 1301 | LANGUAGE | English |
| 1306-1307-1308-1309-1310 | 1302 | MOTOR NOM.POWER | |
| | 1303 | MOTOR NOM.VOLT. | |
| | 1304 | PRE-SET MOTOR ? | Yes |
| | 1305 | MOTOR NOM.CURR. | |
| | 1306 | MOTOR NOM.SPEED | |
| | 1307 | AMPI | Full |
| 1316 1317 1318 1319 1320 | 1308 | STC MOTOR PROT. | STC Trip |
| | 1309 | MODE | Controller |
| | 1310 | PUMP ADDR. | 1 |
| | 1311 | CONTROL MODE | Constant |
| | 1312 | DIMENSION UNIT | bar |
| | 1313 | START-UP COMPLETED? | No |
| | 1314 | SENSOR RANGE | |
| | 1315 | REQUIRED VAL. | |
| | 1316 | START VALUE | 100 % |
| | 1317 | MIN.THRESH. | Disabled |
| | 1318 | DELAY-TIME | 2 sec |
| | 1319 | DATE | XX.XX.20XX |
| | 1320 | TIME | HH.MM |
| | 1321 | AUTO-START | On |
| | 1322 | START-UP COMPLETED? | No |
| | 1323 | ADDRESS | 1 |

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- 2) A leading global water technology company

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