

Operating Instructions

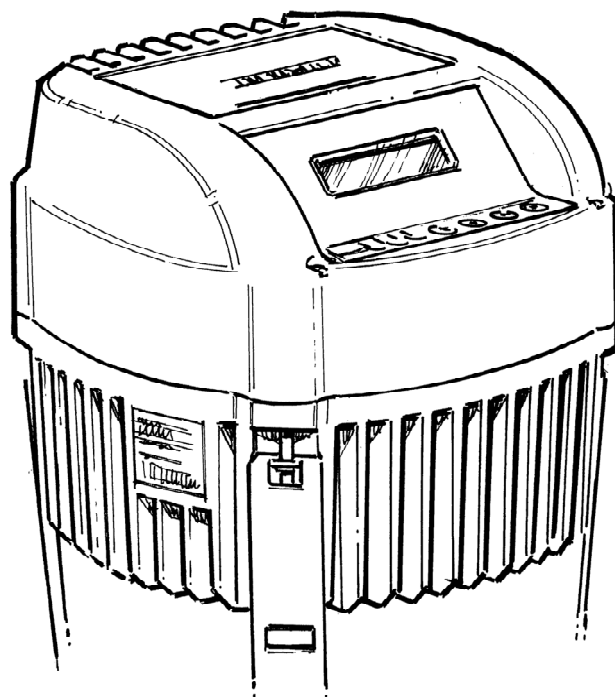
HYDROVAR®

HV 2.015 / 2.022

HV 4.022 / 4.030 / 4.040

HV 4.055 / 4.075 / 4.110

HV 4.150 / 4.185 / 4.220





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Follow the pump operating and maintenance instructions
We reserve the right to alter specifications

1 Important safety instructions

	Read and follow the operating and safety instructions carefully before starting operations! All modifications must be done by qualified technicians!	
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Warning that failure to observe the precaution may cause electric shock



Warning that failure to observe the precaution may cause personal injury or damage to property.

In addition to these operating instructions please pay attention to universal safety and accident prevention regulations.

Basically the HYDROVAR must be disconnected from the power supply before any work can be carried out on the electrical or mechanical part of the system. Installation, maintenance and repair work may be carried out only by trained, skilled and qualified personnel.

Unauthorized modification or changes to the system make all guarantees null and void.

During operation, the motor can be stopped by opening a digital input or manual operation whereby the HYDROVAR and the motor remain under voltage. For safety reasons, the HYDROVAR has to be disconnected from the power supply when carrying out work on the machinery.



When the HYDROVAR is connected to the power supply, the components of the power unit as well as certain components of the control unit are connected directly to mains.

Touching these components seriously endangers life!

Before removing the HYDROVAR 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 HYDROVAR (the capacitors in the intermediate circuit are discharged by the internal discharge resistors).

Voltages of up to 800 volts are possible (in case of error these also can be higher)

All work, carried out on the HYDROVAR, may only be performed by qualified and authorized staff.

Furthermore, take care not to short circuit the neighbouring components when connecting the external control wires. All cable ends which are not in use have to be isolated.



The HYDROVAR contains electronic safety devices which switch off the control element in the event of a fault, whereby the motor has zero current but remains energised and comes to a halt. The motor can also be halted by mechanical blocking. If it is switched off electronically the motor is current less from the mains voltage through the electronics of the HYDROVAR but is not potential-free in the circuit.

In addition voltage fluctuations, especially power failures can cause the system to switch itself off.

Repair of faults can cause the motor to start up again automatically!



The system may only be put into operation when it has been grounded. In addition to that, equipotential bonding of all conductive pipes must be ensured.

Please consider local installation standards!



High voltage tests of the HYDROVAR or the motor may damage the electronic components! Hence bridge the in- and outgoing terminals L1 - L2 - L3 / U-V-W before.

To avoid incorrect metering by capacitors incorporated in the electronic part isolate the motor from the HYDROVAR.



The operating instructions must be read, understood and followed by the operating personnel. We point out that we accept no liability for damage and operating disorders which are the result of non-compliance with the operating instructions.



Transport, handling, storage, disposal:

- Check the HYDROVAR immediately after delivery/receipt for damage or missing parts
- The HYDROVAR unit must be transported carefully.
- Avoid serious impacts

NOTICE!



Dispose of all packing materials and the HYDROVAR unit in accordance with local regulations. For more detailed information about the recycling of this product, please contact your local authority, your waste disposal service provider or the outlet where you purchased the product.

CAUTION!



Lifting aids (stacker, crane, crane mounting device, lifting blocks, sling ropes, etc.) must be suitable to handle the weight of the HYDROVAR.

CAUTION!



It is not allowed to carry the HYDROVAR around by using the connected cables.
Do not damage the cable during transport (do not squeeze, bend or drag).
The cable ends must be kept dry.

WARNING!

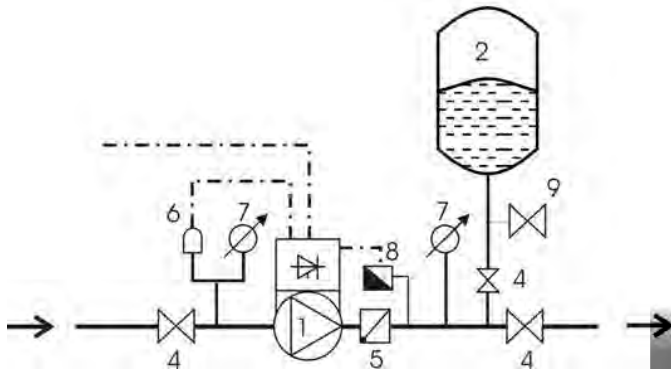


- Do not stand underneath suspended loads
- Take note of the general regulations on prevention of accidents
- The HYDROVAR must be secured against tipping over and slipping until it has been fixed in its final location.

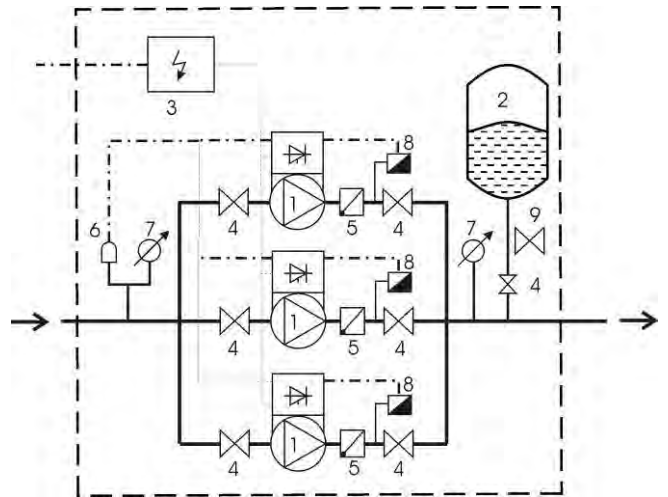
2 System design

The following diagrams show typical SINGLE and multi-pump systems using the HYDROVAR. Connection can be made directly to a water supply. In such a case, the use of a low pressure switch on the suction is recommended.

SINGLE pump layout



Multi pump layout



- | | | |
|------------------------|-----------------------|--------------------------|
| (1) pump with HYDROVAR | (4) gate valve | (7) pressure gauge |
| (2) diaphragm tank | (5) non return valve | (8) pressure transmitter |
| (3) distribution panel | (6) low water control | (9) drain tap |

2.1 Pressure tank

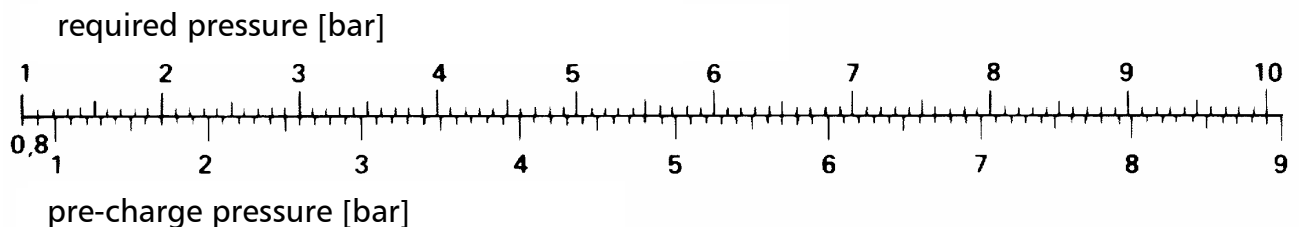
A diaphragm pressure tank is used on the discharge side of the pump to maintain pressure in the line when there is no water demand. This avoids the pump from continuing to run at zero demand. With the HYDROVAR, no large tanks are required for supply purposes. The tank must be permitted and suitable for systems pressure. The tank should have a capacity of min. 10% of the maximum system flow rate [l/min] of one pump (also valid for multi-pump system).

Example:

Maximum flow rate of the pump = 250 litres per minute

Minimum volume of the tank = $250 \times 0.10 = 25$ litres

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



NOTICE: To check and set the right pre-charge pressure, please reduce the water pressure to zero by turning the HYDROVAR off.

3 Product overview

3.1 Hardware configurations

The HYDROVAR modular concept basically consists of two main parts: the power unit and the control card. In its BASIC configuration (consisting of only the power unit) the HYDROVAR can be used as so called BASIC Inverter. In that configuration the HYDROVAR can be used as a sequence pump in a multi pump system, but also as a simple soft starter for SINGLE pump applications.

By attaching one of the additional control cards to the BASIC Inverter the HYDROVAR can be upgraded either to the so called SINGLE or the MASTER Inverter.

BASIC Inverter – HYDROVAR BASIC unit (not available for HV 4.150 – 4.220).

Application:

- Sequence pump in a multi pump system, SINGLE pump operation as soft-starter

SINGLE Inverter – HYDROVAR BASIC Inverter with included control card for SINGLE pump operation. This SINGLE Inverter is not able to support any optional modules like the Relay Card.

Application:

- Simple SINGLE pump applications

MASTER Inverter – HYDROVAR BASIC Inverter including the high level control card (supports also the optional modules like the Relay Card and all specific software features).

Application:

- SINGLE pump control including all extended features
- Multi pump system of MASTER and BASIC Inverters (up to 8 pumps)
- Multi pump system equipped with up to 8 MASTER Inverters
- Control of up to 5 fixed speed pumps when used in combination with the optional relay card

3.2 Operating modes

3.2.1 Actuator (for SINGLE pump operation only!)

In this mode the HYDROVAR operates as an actuator according an external speed signal or continuous operation on either one or two programmed frequencies by using the corresponding digital input.

Please consider that this mode is only possible with a HYDROVAR MASTER or SINGLE Inverter and is limited for SINGLE pump operation only

3.2.2 Controller

This mode is set as default operating mode and is used for a HYDROVAR in SINGLE pump operation when there is no connection to any other HYDROVAR via the internal RS485 interface.

3.2.3 Cascade Serial / Synchronous (not for SINGLE version)

In these modes various combinations among the versions BASIC and MASTER Inverter are possible.

In general each of the pumps needs to be equipped with a HYDROVAR unit. All the units are connected via the RS485 interface and communicate via the standard MODBUS-protocol (9600 Baud, RTU, N81).

To realise a fully controlled system at least one MASTER Inverter is needed, the remaining pumps could be fitted just with a BASIC Inverter.

The controller in the MASTER Inverter is continuously in communication with all the BASIC Inverters. All failures are indicated on the MASTER including the date and time.

All the control is done by the MASTER Inverter including automatic change over of the lag pumps to provide even wear and achieve even operating hours.

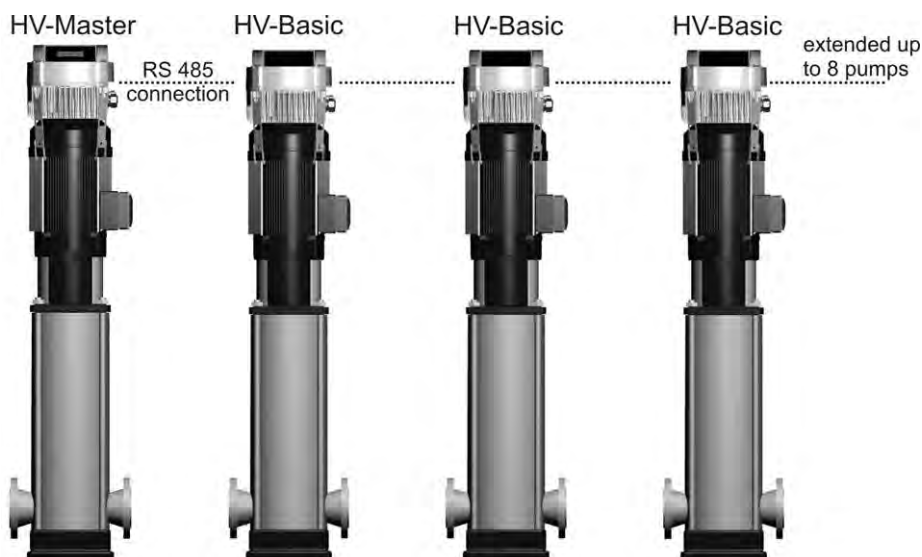
If the control card of a MASTER Inverter fails, each of the BASIC Inverters can be manually started by an external switch (manual operation) in order to ensure an emergency operation of the system.

Application Example

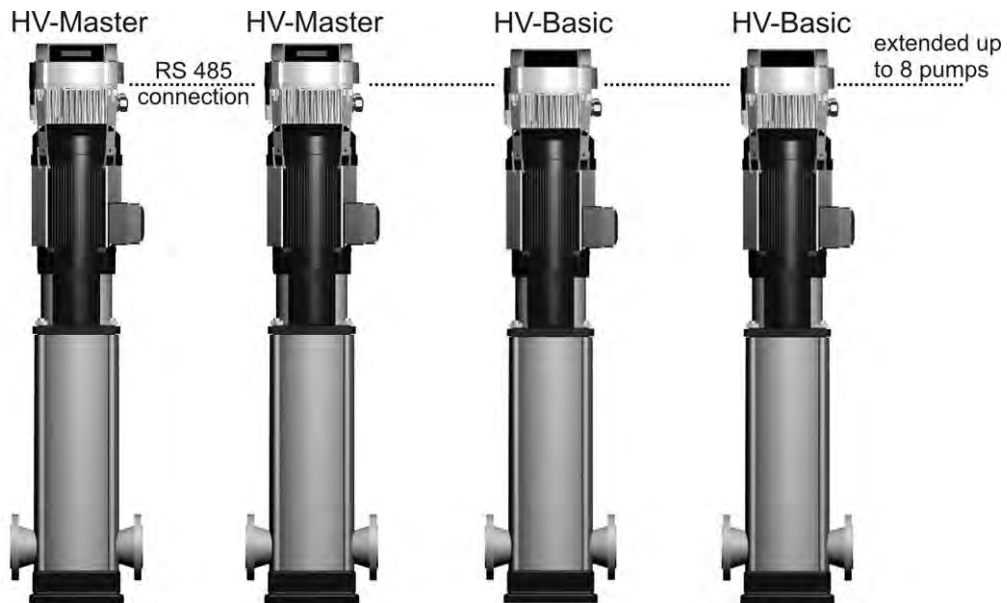
Each pump of the system (up to 8 pumps) is equipped with a HYDROVAR unit (at least one MASTER Inverter and remaining ones can be BASIC Inverters). All units are connected via the serial interface (RS485).

The combination of the different HYDROVAR units which are used in a multi-pump-system depends on the system requirements (i.e. in a 6 pump system 2 MASTER Inverters can be used due to reliability reasons and 4 BASIC Inverters without control card – or just any other combination).

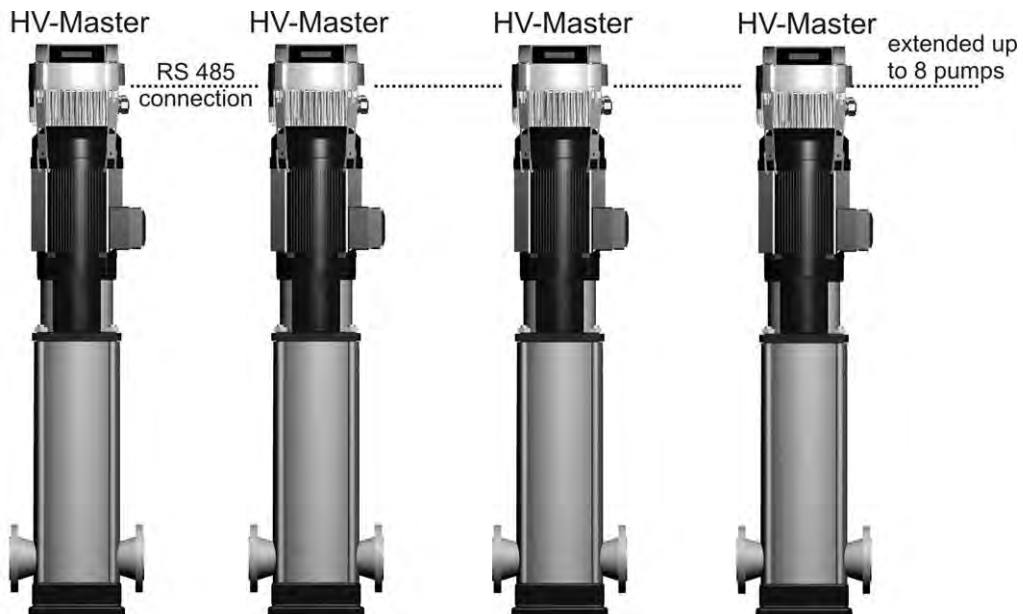
Minimum requirement: 1 MASTER Inverter and the other pumps equipped with BASIC Inverters



To increase the operating reliability of such a system, also a second MASTER Inverter is recommended:



Full-featured possibility: Each pump is equipped with a MASTER Inverter



In this mode it is possible to run all pumps in cascade serial mode and synchronous mode as well.

This configuration allows each pump of the system to become the lead pump. This also ensures a proper operation if one MASTER Inverter fails. In this case another HYDROVAR takes control. This ensures that the operating hours of each pump will be the same to ensure even wear of the pumps.

3.2.4 Cascade Relay (not for SINGLE version)

One pump is fitted with a HYDROVAR MASTER Inverter and up to 5 slave pumps can be switched ON and OFF on demand. For this purpose an additional relay card including 5 relays is attached to the MASTER Inverter.

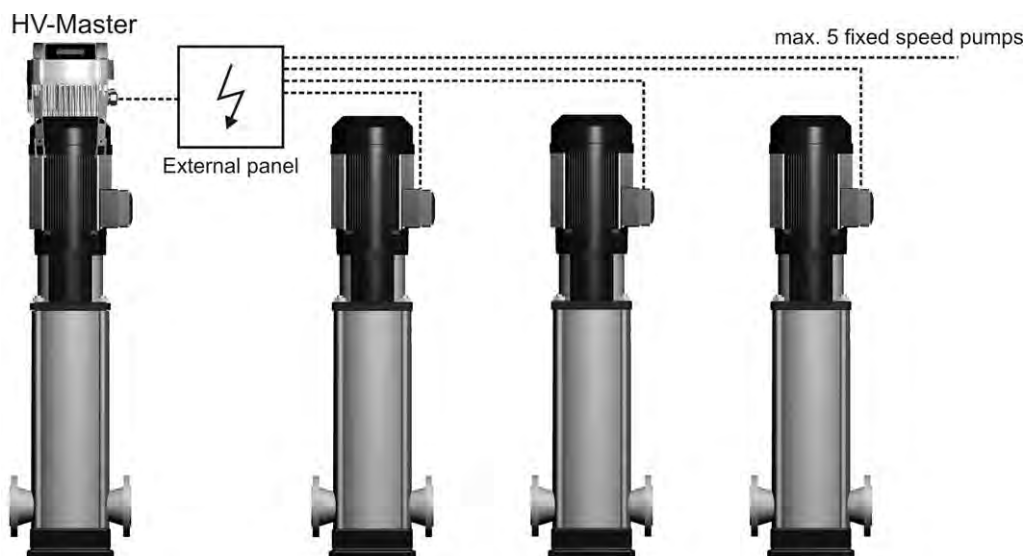
However an external switchboard is needed for all the motor relays as the relays in the HYDROVAR are not able to switch the pumps directly (just used as control contacts).

Also an automatic change over of the fixed speed pumps to provide even wear and achieve even operating hours is possible in this mode.

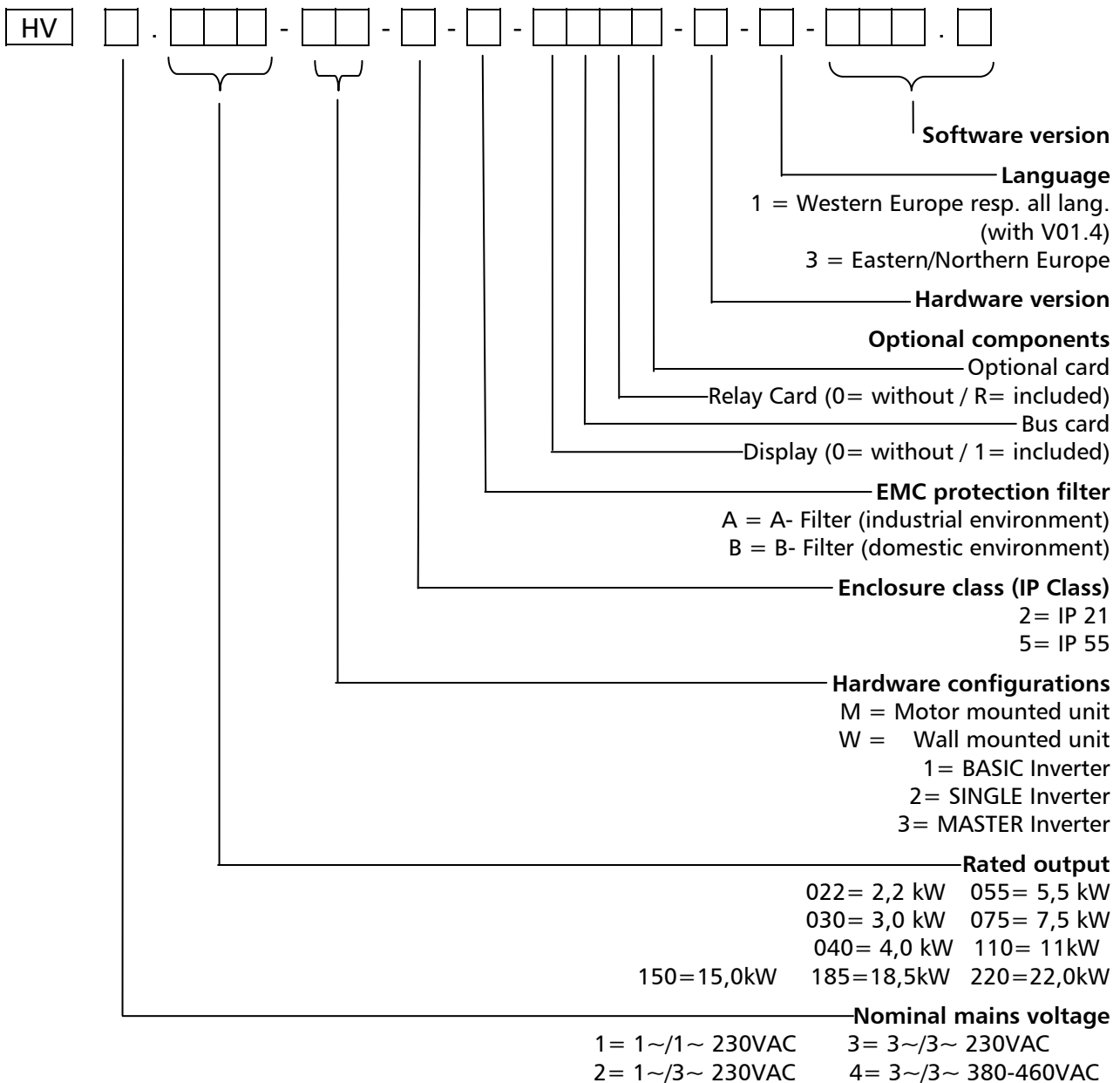
This configuration is a cost effective alternative compared with other solutions using VFD's on each pump, but in any case care has to be taken due to the lower reliability of such a system.

Application example

Booster sets up to 6 pumps where only one pump is speed controlled by the HYDROVAR and the others are fixed speed (1 HYDROVAR MASTER Inverter+5 fixed speed).



4 Type designation code



Example

HV 4 . 040 - M3 - 5 - B - 10R0 - G - 1 - V01 . 4

The mentioned HYDROVAR in this example is specified with following technical data:

Nominal mains voltage:	3~/3~ 380-460VAC
Rated output:	4 kW
Hardware configurations:	Motor mounted unit - MASTER Inverter
Enclosure class:	IP 55
EMC-filter:	B - Filter (domestic environment)
Optional components:	Display, Relay Card
Hardware version:	G
Language:	1 (Western Europe) respectively all languages
Software version:	V01.4

5 Technical Data

HYDROVAR		Incoming power supply (data only for dimensioning of the power supply line and not for calculating the efficiency of the HV)			
type	rated output	Voltage limits 48-62 Hz	nominal current input	recommended line protection	maximum cross-section
HV	[kW]	[V]	[A]	[A]	[mm ²]
2.015	1,5	1~230 ± 15%	14,0	20	4
2.022	2,2		20,0	25	
4.022	2,2	3~380-460 ± 15%	7,4	13	4
4.030	3		9,1	13	
4.040	4		11,7	16	
4.055	5,5	3~380-460 ± 15%	17,5	20	4
4.075	7,5		22,1	25	
4.110	11		29,9	32	
4.150	15	3x380-460 ± 15%	39,0	50	25
4.185	18,5		48,1	50	
4.220	22		55,9	63	

HYDROVAR		Output to the motor		
type	rated output	max. output voltage	nominal current output	motor connection cables
HV	[kW]	[V]	[A]	mm ²
2.015	1,5	3x U _{in}	7,0	4x1,5 – 4x4
2.022	2,2		10,0	
4.022	2,2	3x U _{in}	5,7	4x1,5 – 4x4
4.030	3		7,3	
4.040	4		9,0	
4.055	5,5	3x U _{in}	13,5	4x2,5 – 4x4
4.075	7,5		17,0	
4.110	11		23,0	
4.150	15	3x U _{in}	30,0	4x6 – 4x25
4.185	18,5		37,0	
4.220	22		43,0	

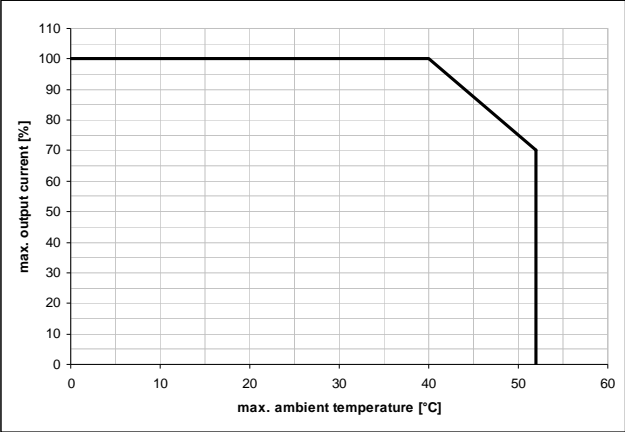


Make sure that the electrical data of the HYDROVAR match those of the electric pump. Improper combinations may cause errors and malfunction of the protection of the electric motor.

The nominal current of the motor must be lower than the rated current of the HYDROVAR to prevent overheating or shutdown due to OVERLOAD.

The max. output current of the HYDROVAR could reach 110% of the nominal current for max. 60 sec. before the error OVERLOAD will occur.

5.1 General technical data

Ambient temperature:	<p>0° C ... +40°C At higher temperatures a reduction of the output current or the use of the next HYDROVAR power size is necessary.</p>  <p>The insulation rating of the HYDROVAR is IP55 however and in common with other IP55 equipment, please note the following:</p> <ul style="list-style-type: none"> • Protect the HYDROVAR from direct sunlight! • Protect the HYDROVAR from direct rainfall • Outdoor installation without protection to keep especially the temperature limits of the HYDROVAR is not permitted!
Storage temperature:	<p>-25° C ... +55° C (+70°C during 24 hours max.)</p>
Humidity:	<p>RH max. 50% at 40°C, unlimited RH max. 90% at 20°C, max. 30 days per year 75% average per year (class F) Condensation is not permitted! During long periods of inactivity or shutdown, the HYDROVAR should remain connected to the power supply but the ext on/off inhibited to prevent running of the pump. This will maintain power to the internal heater and reduce internal condensation.</p>
Air pollution:	<p>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</p>
Altitude:	<p>Max. 1000m above sea level For installations over 1000 m above sea level, the maximum output power has to be de-rated by 1% for every additional 100m. If the installation site is over 2000 m above sea level, please contact your local distributor or service contact.</p>
Class of protection:	<p>HV 2.015 / 2.022 HV 4.022 / 4.030 / 4.040 IP 55, NEMA 4 (indoor use only) HV 4.055 / 4.075 / 4.110 HV 4.150 / 4.185 / 4.220</p>
Certifications:	<p>CE, UL, C-Tick, cUL</p>

5.2 EMC requirements (Electromagnetic compatibility)

The EMC requirements in general differ between two environments which depending on the intended use.

- **First environment – class B** (EN 61800-3: Class C2)

Environment that includes domestic premises, it also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes e.g. houses, apartments, commercial premises or offices in a residential building are typical examples of first environment locations.

Be careful: The relevant EMC regulations for which the HYDROVAR is tested in the first environment consider that the HYDROVAR is a restricted available product. That means the voltage of the inverter is less than 1000 V, it is neither a plug in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by a person or an organisation having necessary skills in installing and/or commissioning power drive systems, including their EMC aspects.

- **Second environment – class A** (EN 61800-3: Class C3)

Environment that includes all establishments other than those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes e.g. Industrial areas, technical areas of any building fed from a dedicated transformer are typical examples of second environment locations.

The HYDROVAR complies with the general EMC regulations and is tested according to the following standards: EN 61800-3/2004

EN 55011 (2002) Disturbance voltages / Disturbance field strength

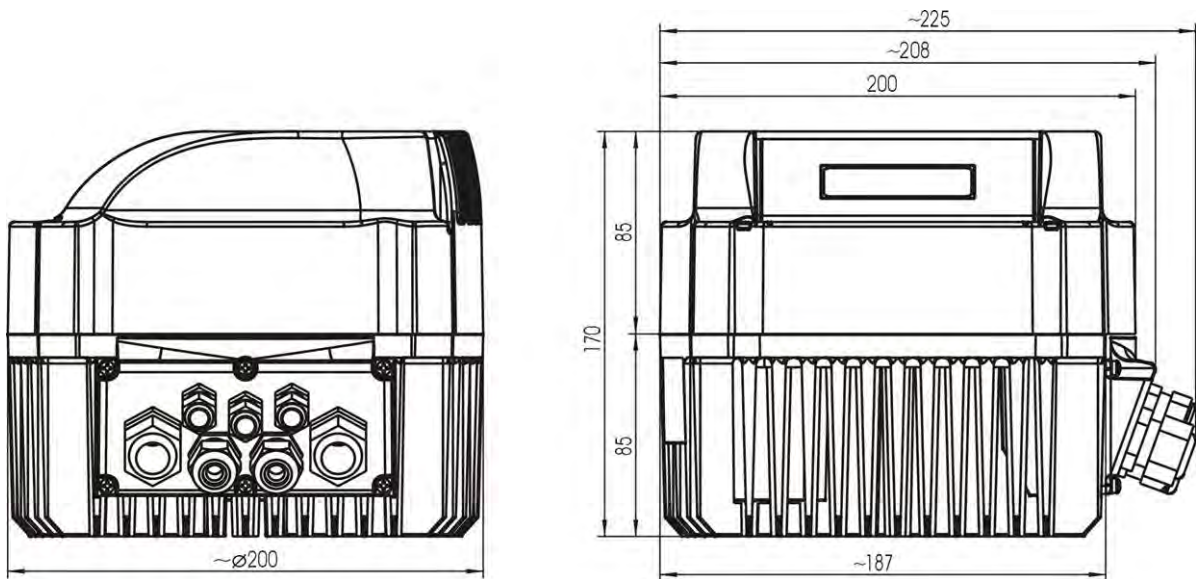
	First environment – class B / class C2	Second Environment – class A / class C3
Disturbance voltages	OK	OK
Disturbance field strength	*)	OK
*) Warning - In a domestic environment, this product may cause radio interference, in which case supplementary mitigation measures may be required.		

EN 61000-4-2 (2001) Electrostatic discharge
EN 61000-4-3 (2002) Electromagnetic field immunity test
EN 61000-4-4 (2001) Burst immunity test
EN 61000-4-5 (2001) Surge immunity test
EN 61000-4-6 (1996) Immunity of conducted RF-Disturbance

6 Dimensions and weights

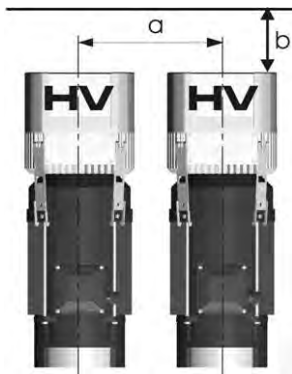
HV 2.015 / 2.022

HV 4.022 / 4.030 / 4.040



All dimensions in millimetres!
Lifting aids must have the proper dimensions.

Drawings are not to scale!



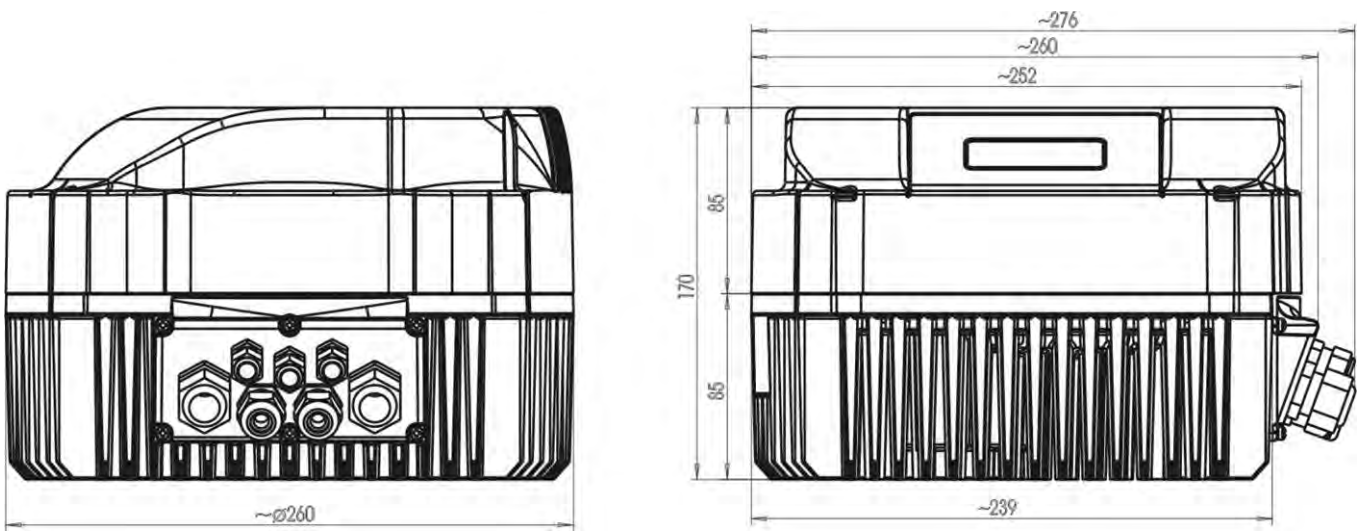
Type	Weight [kg]	
	BASIC	MASTER / SINGLE
HV 2.015	4,00	4,40
HV 2.022		
HV 4.022		
HV 4.030		
HV 4.040		

a ... minimum centre-distance between HYDROVAR units
b ... expansion space for maintenance

300 [mm]

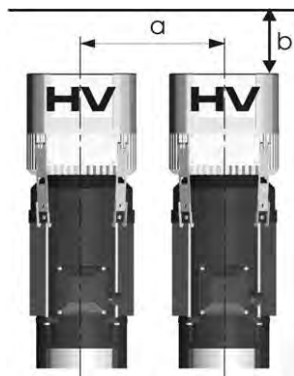
300 [mm]

HV 4.055 / 4.075 / 4.110



All dimensions in millimetres!
Lifting aids must have the proper dimensions.

Drawings are not to scale!

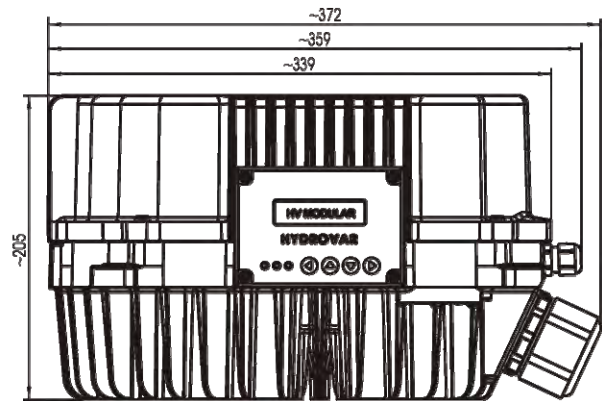
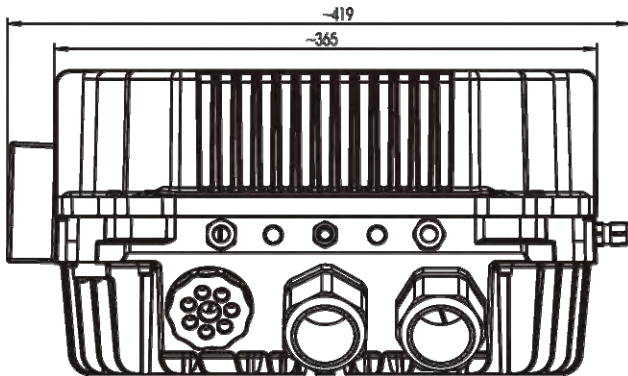


Type	Weight [kg]	
	BASIC	MASTER / SINGLE
HV 4.055	7,70	8,10
HV 4.075		
HV 4.110		

a ... minimum centre-distance between HYDROVAR units
b ... expansion space for maintenance

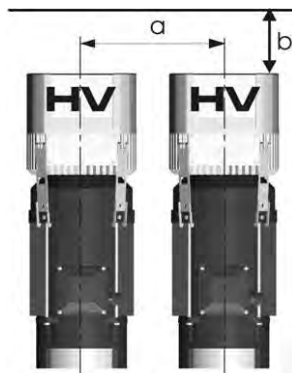
430 [mm]
300 [mm]

HV 4.150 / 4.185 / 4.220



All dimensions in millimetres!
Lifting aids must have the proper dimensions.

Drawings are not to scale!



Type	Weight [kg]
	MASTER
HV 4.150	14,00
HV 4.185	
HV 4.220	

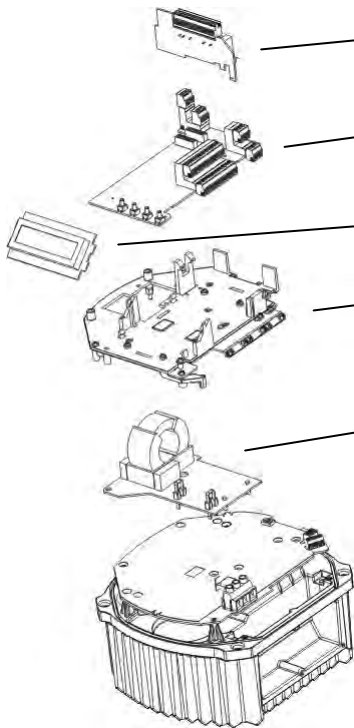
a ... minimum centre-distance between HYDROVAR
b ... expansion space for maintenance

550 [mm]
300 [mm]

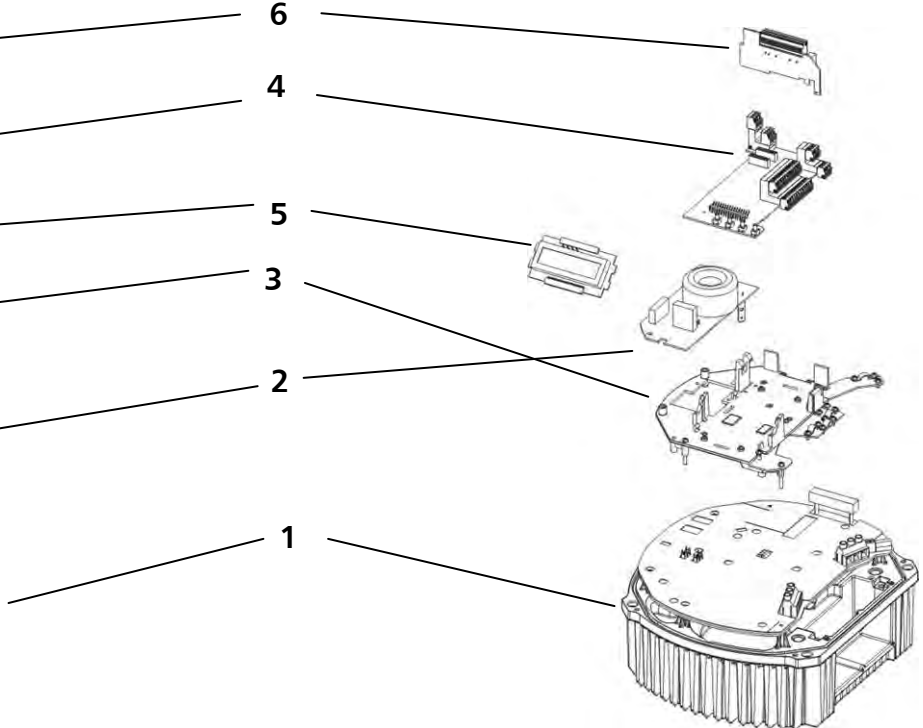
7 Modules

Regarding the application the specific configuration for the HYDROVAR can be chosen. Due to this possibility the HYDROVAR can be configured regarding the reliability and cost effectiveness for each type of application.

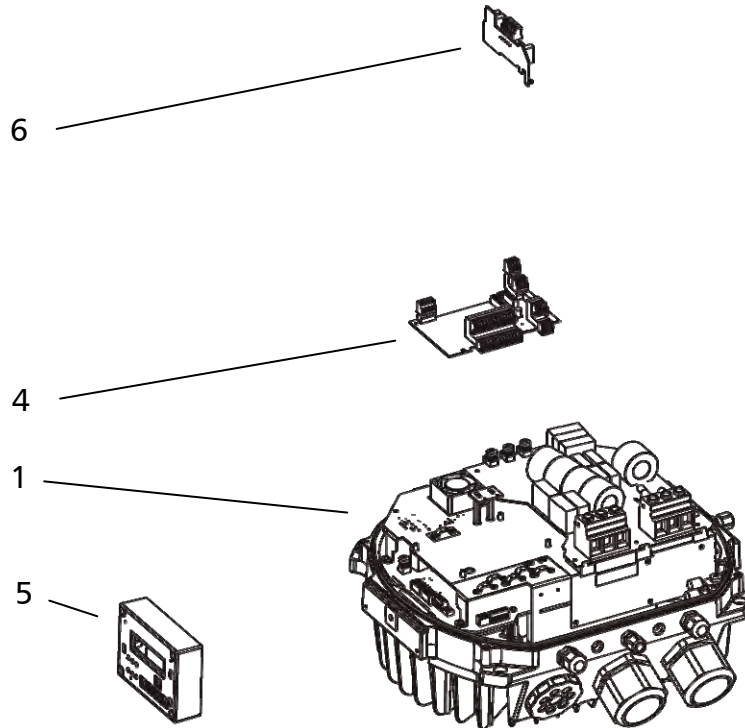
HV 4.022 / 4.030 / 4.040



HV 4.055 / 4.075 / 4.110



HV 4.150 / 4.185 / 4.220



Power unit

- (1) Without one of the control cards it can be used as BASIC Inverter or as simple soft starter in a SINGLE pump application!
When using a SINGLE or MASTER configuration the power unit is fitted with an additional control card (4)

- (2) **Filter card (not available for HV4.150-4.220, standard is class A)**
Ensures EMC compliance for domestic environments. (Class B)

Mounting Kit

- (3) Consists of the metal and plastic cover to fix the control card and the display (and the additional Relay Card if used). By the pre-mounted cable-clips, the screen of all signal cables has to be connected to HYDROVAR-ground to avoid any interferences on the signals

- (4) **Control card**
either for MASTER or SINGLE Inverter

- (5) **Display unit**
2 line plain text indication for programming and read out.

Relay Card

- (6) The optional Relay Card allows to control up to 5 fixed speed pumps (can be only used in combination with the MASTER Inverter).

8 Mechanical components

8.1 Included mounting material

Included components	Cable gland + Lock nut					closing glad			Motor PTC	Mounting clamps	Centring bit
	M 12	M 16	M 20	M 25	M 40	M 12	M 16	M 50			
Cable diameter [mm]	3,7 - 7	4,5 - 10	7 - 13	9 - 17	15 - 23						
2.015 – 2.022	2 (3)	2	2			3	1		1	4	1
4.022 – 4.040	2 (3)	2	2			3	1		1	4	1
4.055 – 4.110	2 (3)	2		2		3	1		1	4	1
4.150 – 4.185	4 (5)	2			2	4	2	1	1	4	1
4.220	4 (5)	2			2	4	2	1	1	4	1

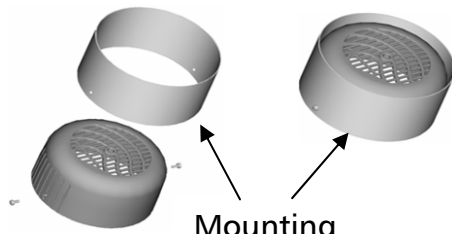
() max. available cable entries

8.2 Optional components

8.2.1 Mounting accessories

Mounting ring

Available for diameters: 140 mm
155 mm



CAUTION!

If the HYDROVAR is mounted on a motor with a plastic fan cover, a stainless-steel mounting ring must be used to support the weight of the HYDROVAR.

8.2.2 Sensors

- pressure-transducer
- differential-pressure-transducer
- level-sensor
- temperature-sensor
- flow indicator (orifice plate, inductive flow meter)

8.2.3 Filter

- Line-coils

8.2.4 Cable entry (only HV4.150 – 4.220)

- Multiple cable entry (M50)



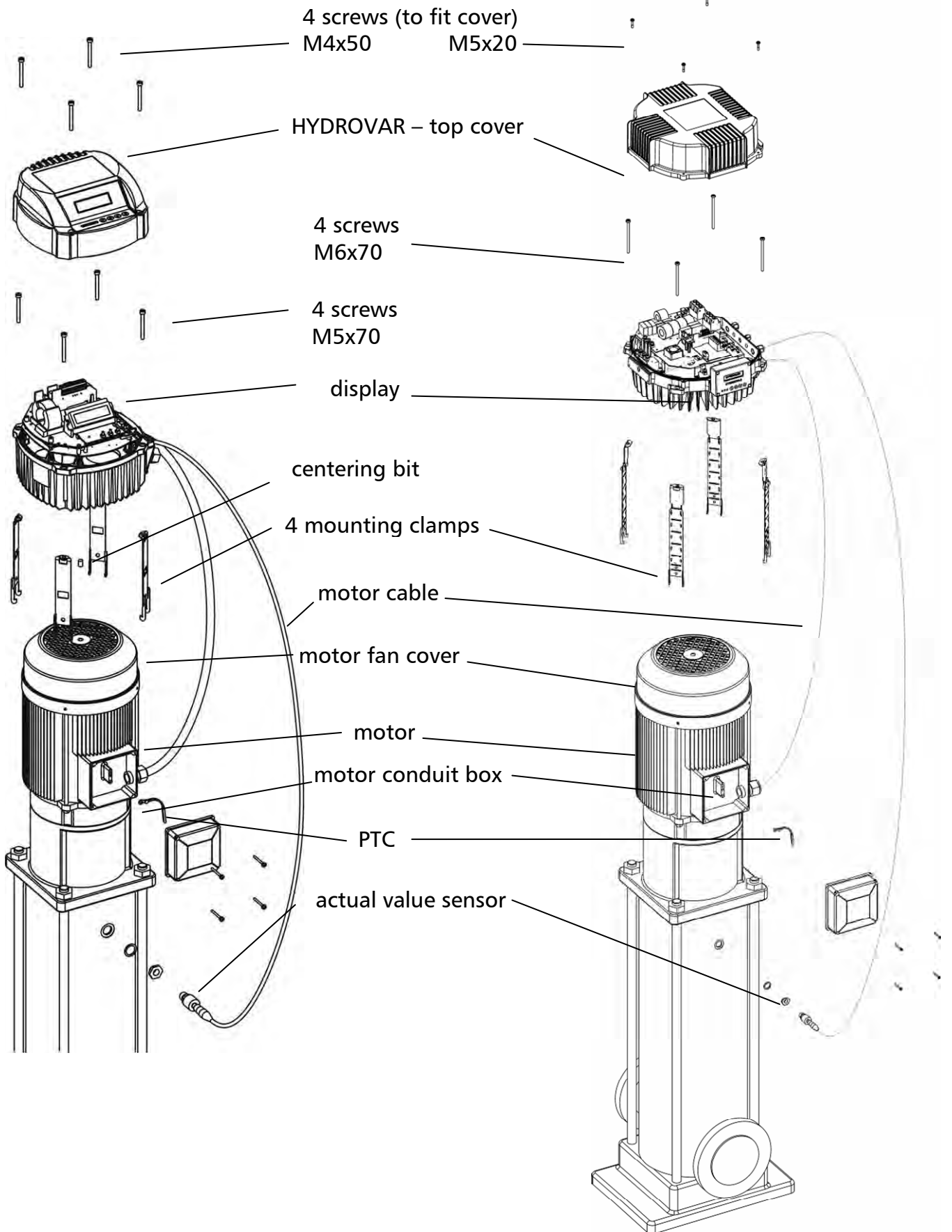
8.2.5 Ready-made motor cables

Available for HV 2.015 – 4.220

8.3 Assembly instructions

HV 2.015 – HV 4.110

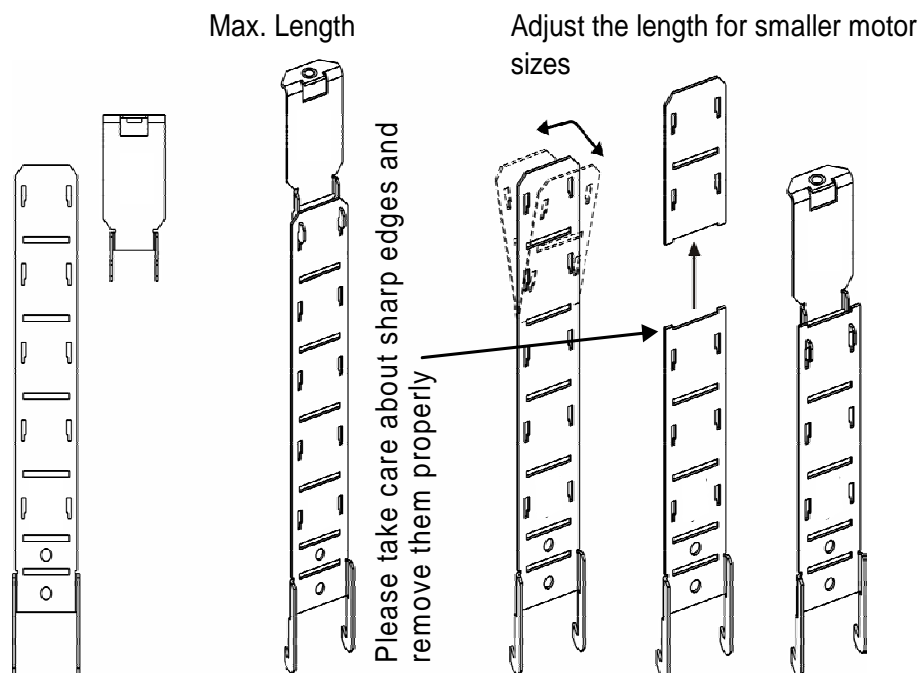
HV 4.150 – HV 4.220



To remove the HYDROVAR – cover, the 4 fastening screws must be opened.

- Ensure that there is no liquid on the unit before you open the cover.
- Centre the HYDROVAR on the motor fan cover using the rubber centre bit.
- If the HYDROVAR is mounted on a motor with plastic fan cover, a stainless steel mounting ring must be used.
- The HYDROVAR is installed on the motor fan cover by using the mounting brackets, the four screws and the relevant washers*.
- The HYDROVAR has to be centred and then the four screws must be tightened.
- Tighten each fastening screw until the two bottom teeth in the brackets start to grip the fan cover.
- After the electrical components are connected, the top cover of the HYDROVAR can be mounted and tightened by the four fastening screws.
- Make sure of a good connection of the ground wire.
- Ensure HYDROVAR cover gasket is in place before tightening the fastening screws.
- Ensure that the mounting of the cable glands is done properly and use closing plugs for cable entries which are not in use.

*For HV4.150-4.220: Measure the right distance with the acceptance, the clamp and the screw together



9 Electrical installation and wiring



All installations and maintenance has to be performed by properly trained and qualified personnel with proper tools!!
Use personal protection equipment.



In case of a failure, the electrical power has to be disconnected or switched off. Wait at least 5 minutes for capacitor discharge before servicing the HYDROVAR.
Otherwise it can cause shock, burns or death.

9.1 Means of protection

Ask your power supply company which means of protection are required.

Applicable:

- protective earthing
- AC and DC residual current operated protective devices (RCD)
- TN systems

Protective earthing:

- Please note that a current to earth can occur due to the capacitors in the input filter.
- A suitable protection unit has to be selected (according local regulations).

Residual current device (RCD/RCCB):

- When using an RCD, make sure that it also releases in the event of a short circuit inside the DC-part of the HYDROVAR to earth!
 - SINGLE phase HYDROVAR => use pulse sensitive RCDs
 - three phase HYDROVAR => use AC/DC sensitive RCDs
- The RCD has to be installed according local regulations!

Automatic circuit breaker:

- Use automatic circuit breaker with C-type characteristic curve
- Rating of the line-protection (see chapter Technical Data)

Internal protective devices of the HYDROVAR:

- The malfunctions short circuit, under- and overvoltage, overload and the overheating of the electronic components are monitored internally by the HYDROVAR.

External protective devices:

- Additional protective functions like motor overheat and low water protection, are controlled by external equipment.

9.2 EMC-electromagnetic compatibility

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

Earth / ground to ensure EMC

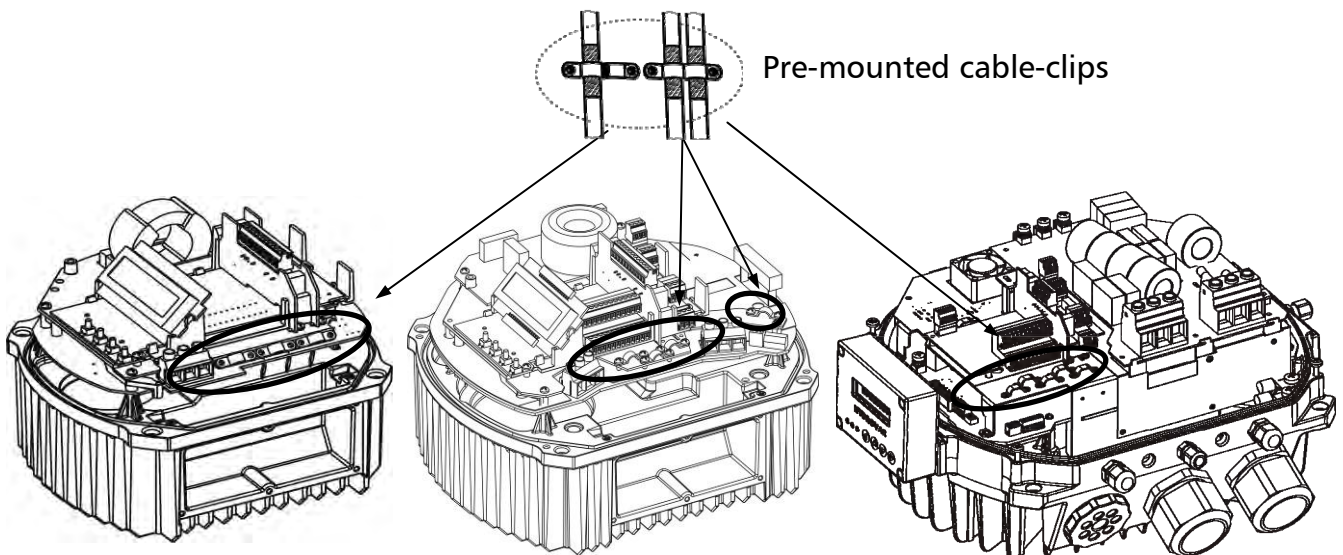
- **Protection earth**
It is important to connect the HYDROVAR to PE, because of the earth leakage current.
- **HF earth connection**
Ground cables should be as short as possible and with lowest impedance.

Signal cables

Control and signal cables should be screened types to prevent disturbances from outside.

The screen should be only connected to ground on one end; to prevent ground loops. The screen should be connected to HYDROVAR GND (use pre mounted cable-clips).

For small cable diameters the cable clips can be squeezed to ensure fixing.



To connect a screen with lowest impedance to ground, remove the insulation from the signal cable and connect the screen to ground.

Signal cables must be installed separate from motor- and power- supply cables
If signal cables are installed in parallel to power supply cables (motor cables) 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°.

Motor cables

To ensure the EMC compatibility and minimize noise level and leakage currents, keep the motor cable as short as possible (use shielded cables only if the total length exceeds 1.5 meters).

Additional component line choke (coil)

Line coils are available as an option and should be mounted between the HYDROVAR and the main fuse. The Line coil should be as near as possible to the HYDROVAR (max. 30cm).

Advantages:

- better efficiency
- reduction of harmonic currents

For the following applications additional line chokes are strongly recommended:

- high short circuit currents
- compensation-plants without a coil
- asynchronous motors which are responsible for a voltage drop >20% of the line voltage

EMC summary

- | |
|---|
| <ul style="list-style-type: none">• Install potential equalization according to local regulations• Do not install the power-cables in parallel to signal-cables• Use screened signal-cables• Connect both ends of the screen of the motor cable to ground• Connect only one end of the screen of a signal-cable to ground• Motor-cable as short as possible• Pigtails should be prevented |
|---|

9.3 Recommended Cable Types

To ensure the above mentioned points and to guarantee EMC compatibility and correct function of the HYDROVAR the recommended cable types should be used.

Application	Recommended cable-type
- Motor-cables HV 2.015-2.022 HV 4.022 – 4.030- 4.040 HV 4.055-4.075 HV 4.110 HV 4.150 – 4.185 HV 4.220	4G1,5 + (2 x 0.75) 4G1,5 + (2 x 0,75) 4G2,5 + (2 x 0,75) 4G 4 + (2 x 0,75) 4G6 + (2 x 0,75) 4G10 + (2 x 0,75)
- Control- and signal- cables	JE-Y(ST)Y ... BD JE-LiYCY ... BD
- Cables connected to RS485 interface	JE-Y(ST)Y 2 x 2 x 0,8 BD

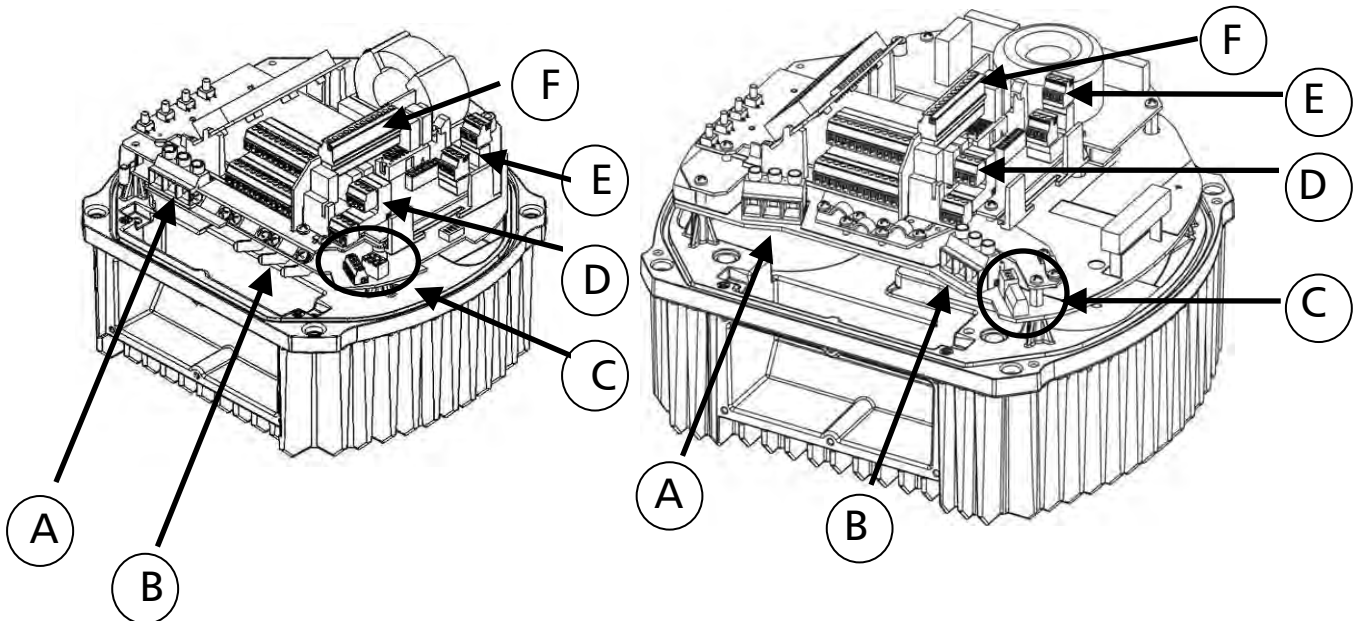
9.4 Wiring and connections

Remove the screws holding the top cover of the HYDROVAR.

Lift off the top cover. The following parts can be seen on a HYDROVAR MASTER / SINGLE Inverter:

HV 2.015 / 2.022 HV 4.022 / 4.030 / 4.040

HV 4.055 / 4.075 / 4.110



(A) Power supply

(B) Motor connections

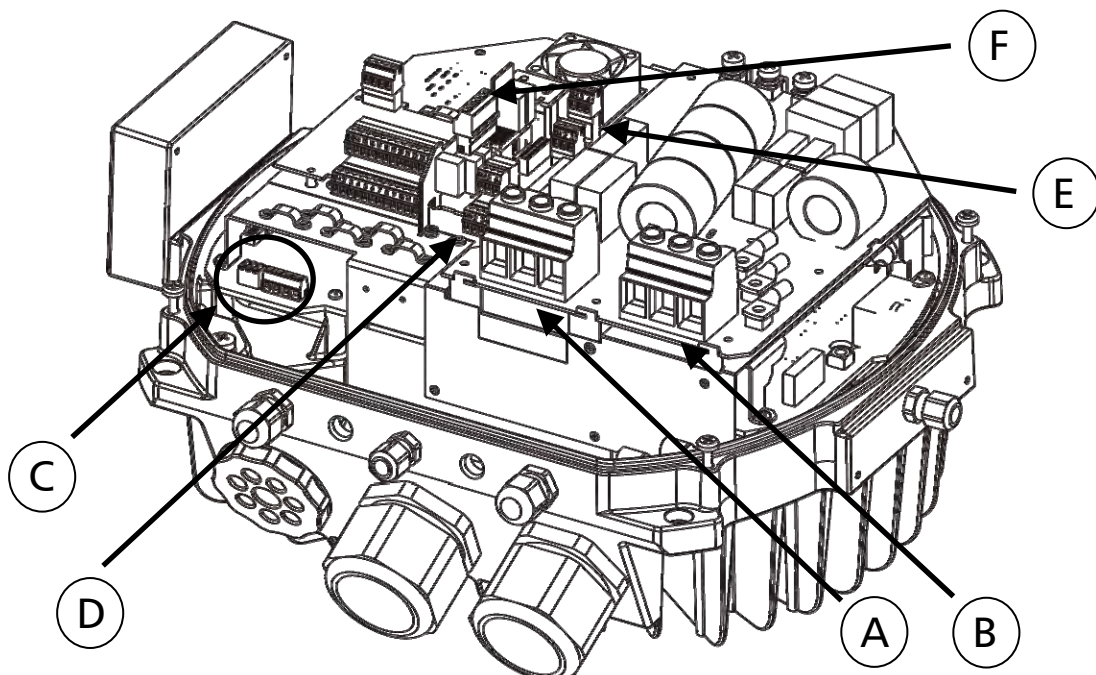
(C) Terminal block:

- START/STOP_PTC
- SOLORUN
- RS-485 Interface

(D) RS-485 Interface
- User interface
- Internal interface

(E) Status-Relays

(F) optional Relay Card



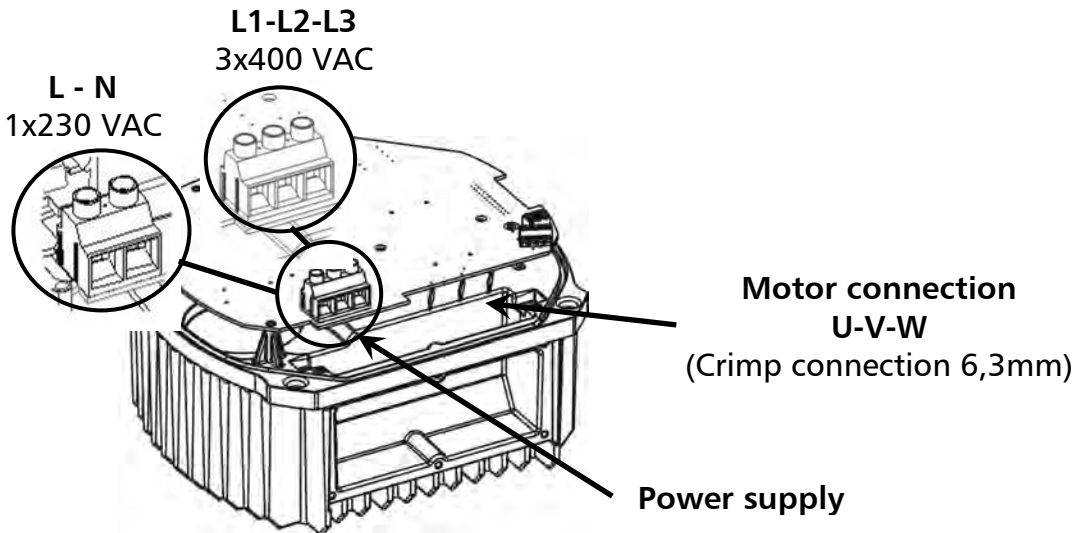
9.4.1 Main voltage terminals

The power supply is connected to the power section:

Terminal L + N (1 x 230 VAC, SINGLE-phase)

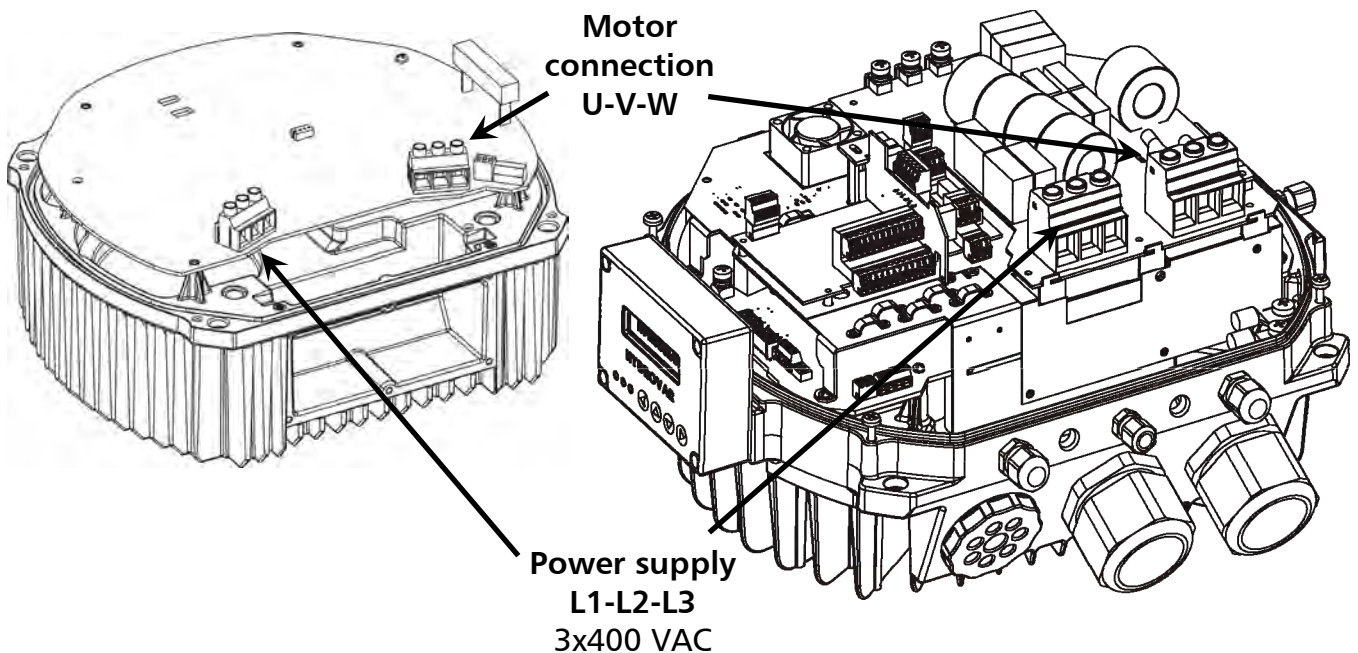
Terminal L1 + L2 + L3 (3 x 400 VAC, three-phase)

HV 2.015 / 2.022 HV 4.022 / 4.030 / 4.040



HV 4.055 / 4.075 / 4.110

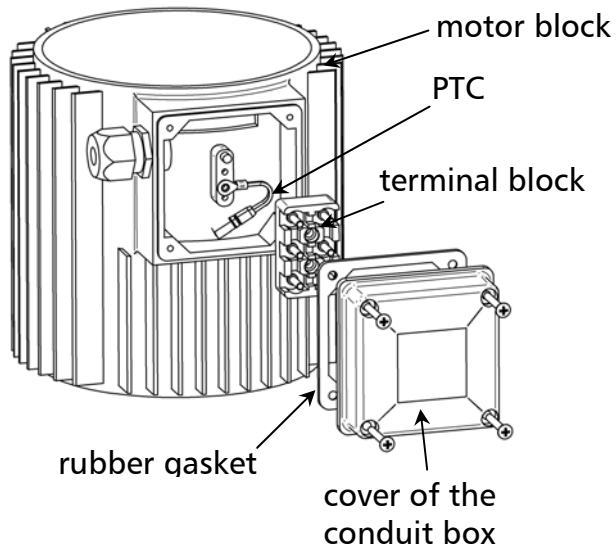
HV 4.150 / 4.185 / 4.220



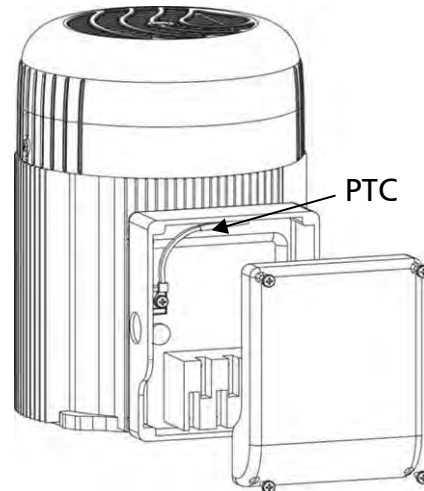
9.4.2 Motor connection

Mounting of the PTC

Method A :



Method B :



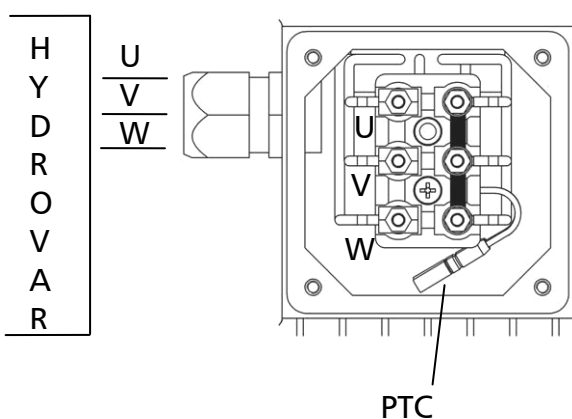
1. The cover of the conduit box must be opened and the terminal block inside removed
2. Fix the PTC (Method A or B)
3. Replace the terminal block
4. Electrical connection of the motor cables

The PTC must be fixed to the metal body of the motor. This is necessary to measure the right temperature of the motor!

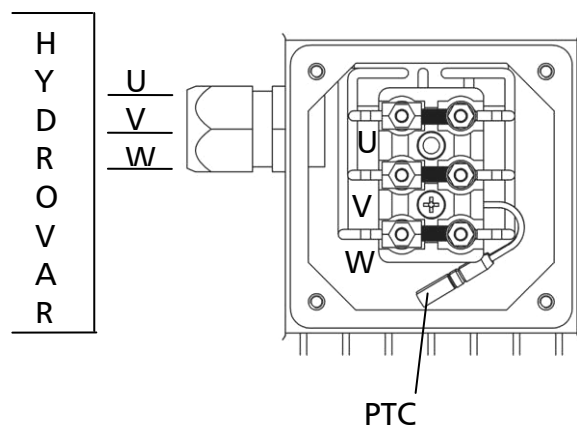
The connection of the motor cable depends on the type of motor and can be done in star- or delta connection.

The right connection of the motor has to be selected as shown on the motor label according to the output voltage of the HYDROVAR.

star - connection



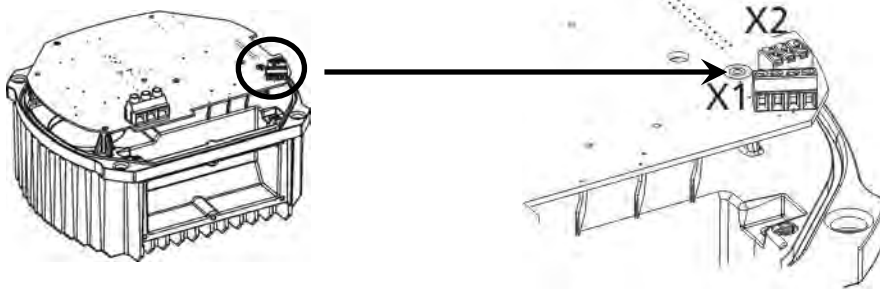
delta - connection



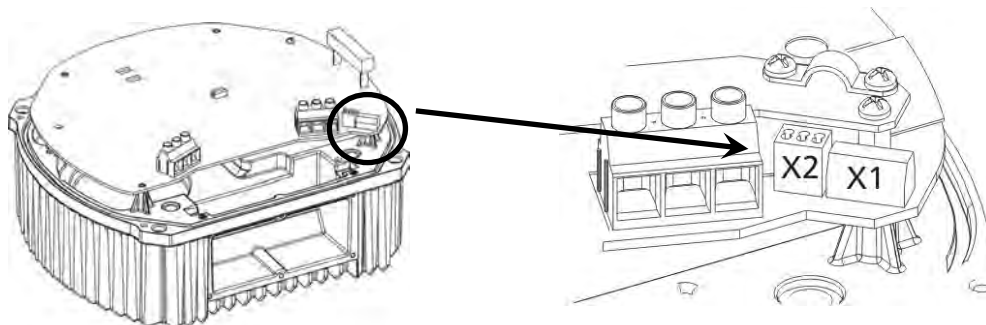
9.4.3 Power unit

On the power unit two control terminal blocks can be found.

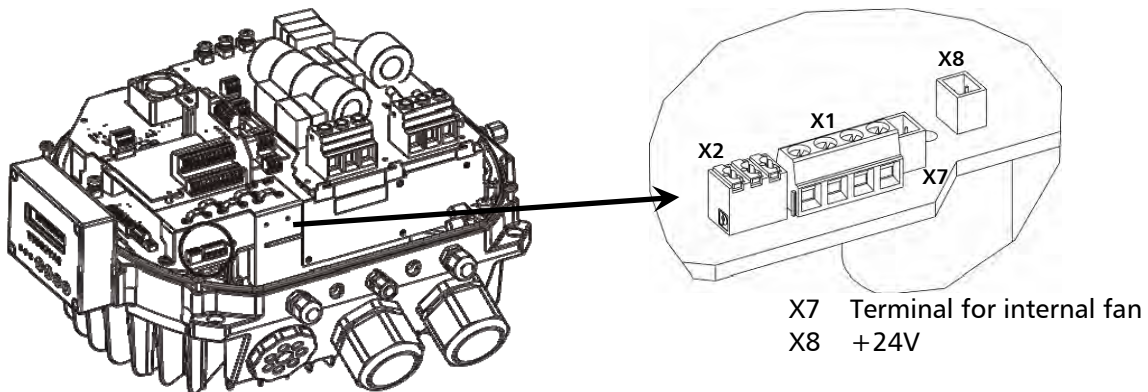
HV 2.015/2.022 HV 4.022 / 4.030 / 4.040



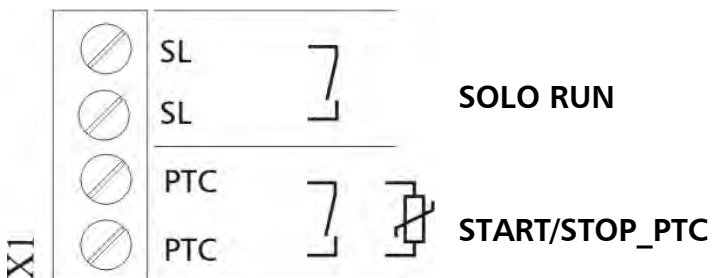
HV 4.055 / 4.075 / 4.110



HV 4.150 / 4.185 / 4.220



X1 Control terminals – power unit		
	PTC	PTC or thermal switch START/STOP (external release) when using a BASIC Inverter
	SL	SOLO RUN



To ensure safety operation between the HYDROVAR and the motor a motor-thermo-switch or PTC should be connected to the power unit. Additionally this input can be used as an external ON / OFF signal when using the HYDROVAR just as BASIC Inverter. Both the signals must be connected to X1/PTC in series and will stop the HYDROVAR in case of a failure! (Also a low-water switch or any other protective devices can be connected to these terminals!)

If there is no use of this input, terminals X1/PTC have to be bridged, otherwise the HYDROVAR will not start automatically.

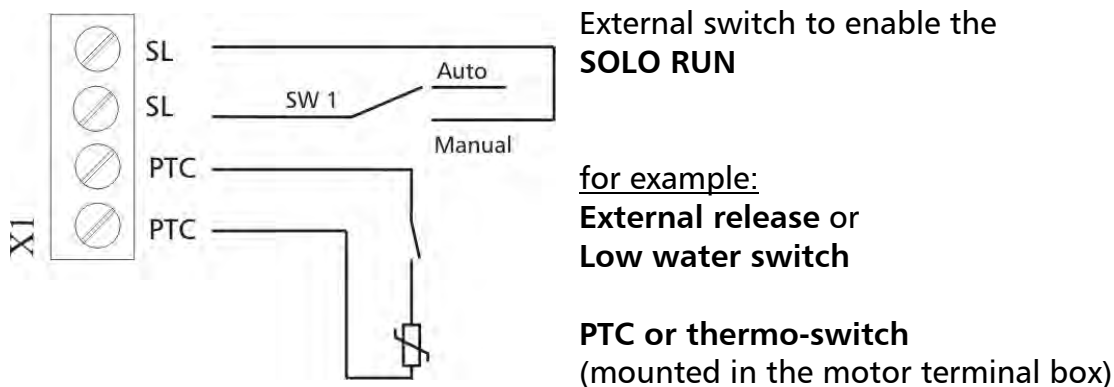
9.4.3.1 Solo run

The terminals X1/SL are used to release a BASIC Inverter (when used in a multi-pump application) when the communication to the MASTER Inverter fails, or even the MASTER Inverter fails itself, or in case the BASIC Inverter is just used as a simple soft-starter.

- By opened contact X1/SL the HYDROVAR works in standard operation. So a BASIC Inverter only starts up, if it is released and requested by a MASTER Inverter via the serial RS485-Interface.
- When contact X1/SL is closed the HYDROVAR starts up to pre-selected MAX. FREQUENCY (fixed speed) [0245] using Ramp 1 and 2 and even the fast ramps FminA and FminD. (X1/PTC must be closed too - all external connected safety devices are still active)

A manual start up is always possible, even the HYDROVAR is equipped with a control card. For example, if it is necessary because of safety reasons to operate the BASIC Inverters when the MASTER Inverters fail, it is possible to equip this terminal with an AUTO/MANUAL switch.


Connection Example



Recommended connections of external protective devices:

BASIC Inverter:	PTC or thermal switch	X1/PTC	Placed on the power unit
	External release	X1/PTC	
	Low water switch	X1/PTC	
MASTER Inverter:	PTC or thermal switch	X1/PTC	Placed on the power unit
	External release	X3/7-8	Placed on the control card
	Low water switch	X3/11-12	

If the HYDROVAR is used as a BASIC Inverter in a multi-pump system, the internal interface on the power unit is used for the serial RS-485 connection to the other HYDROVAR units in the system. (Be careful: Internal interface is not available in SINGLE Inverter configuration!)

X2 RS485-Interface – Power Unit			
X2/	SIO -	Internal SIO-interface: SIO- Internal SIO-interface: SIO+ GND, electronic ground	} Internal interface for multi-pump-systems
	SIO +		
	GND		

 Parameter not available for a HYDROVAR SINGLE Inverter

The internal RS-485 Interface on the power unit is used for the communication between up to 8 HYDROVARs in a multi-pump system (minimum 1 MASTER Inverter). For the connection to each HYDROVAR via the RS-485 interface the terminals X2/1-3 on the power unit can be used twice. Or the terminals X4/4-6 on the control card can be used.



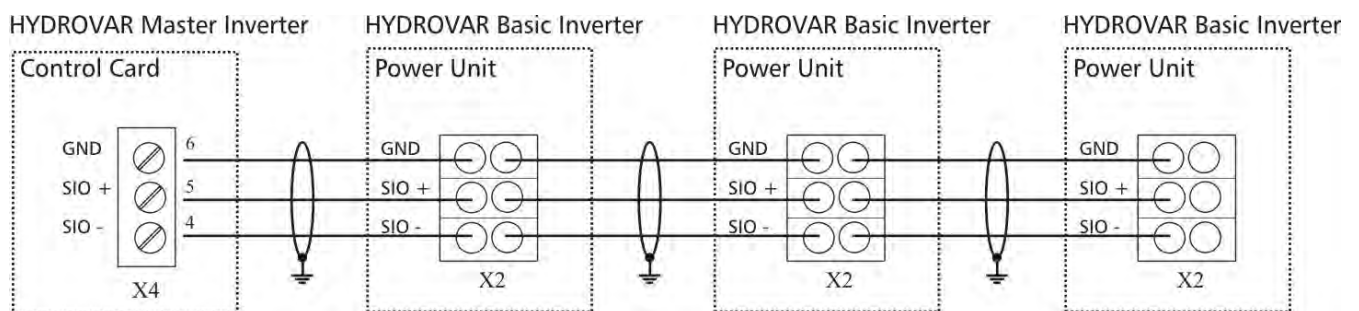
Mechanical connection of the terminal:

- Use recommended cable type (see chapter 9.3)
- Strip the end of the used wire (about 5 ... 6mm)
- push down the orange wedges by using a small screwdriver
- insert the stripped wire
- remove the screwdriver to fix the wire

- To remove, push down the orange wedges and pull out the wire!



Connection example using one MASTER - and three BASIC - Inverters:



9.4.3.2 Addressing

When using the cascade serial/synchronous mode in a multi-pump-application (where more than one MASTER Inverter or even BASIC Inverters are used), the right address must be set to ensure a proper communication within the system.

MASTER Inverter – The desired address of the MASTER Inverter has to be set via the HYDROVAR-software. In this case for all MASTER Inverters the below shown dip-switch on the power unit must be set to address 1 (default setting).

BASIC Inverter (not standard use for HV 4.150-4.220) – when using a BASIC Inverter in a multi-pump-system it is necessary to set the dip-switches on the power unit in order to get a separate address for each Inverter within your pump group (Pls. consider reserved addresses for the MASTER Inverters).

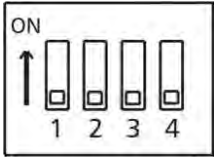
Example:

Multi-pump-system with 3 MASTER and 4 BASIC Inverters

- Set address 1-3 for the MASTER Inverters via appropriate software parameters (See submenu CONF INVERTER [0200] or submenu RS485-INTERFACE [1200])
- Address 4-7 for the BASIC Inverters via dip-switch

The pre-selected address is also responsible for the pump sequence.

Switch 1	Switch 2	Switch 3	Address
OFF	OFF	OFF	Address 1 (default setting) (Required setting for the use with control card)
OFF	OFF	ON	Address 2
OFF	ON	OFF	Address 3
OFF	ON	ON	Address 4
ON	OFF	OFF	Address 5
ON	OFF	ON	Address 6
ON	ON	OFF	Address 7
ON	ON	ON	Address 8

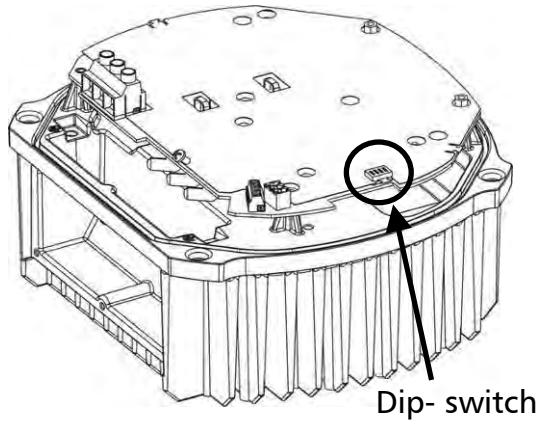


switch 4 not used!

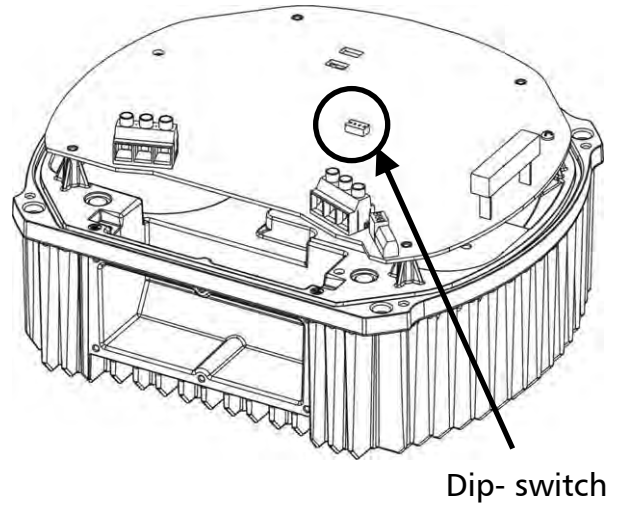
Setting of the correct address:

- **The HYDROVAR must be disconnected from power supply at least for 5 minutes before removing the top-cover** (open four fastening screws)!
- Use the dip-switch which is on the power unit (see picture next page!)
- Set the desired address for each HYDROVAR
E.g. Address 4 -> switch 1 is set to OFF
switch 2 and 3 are set to ON
- Mount the cover on the HYDROVAR and tighten the four fastening screws
- Reconnect HYDROVAR to power supply

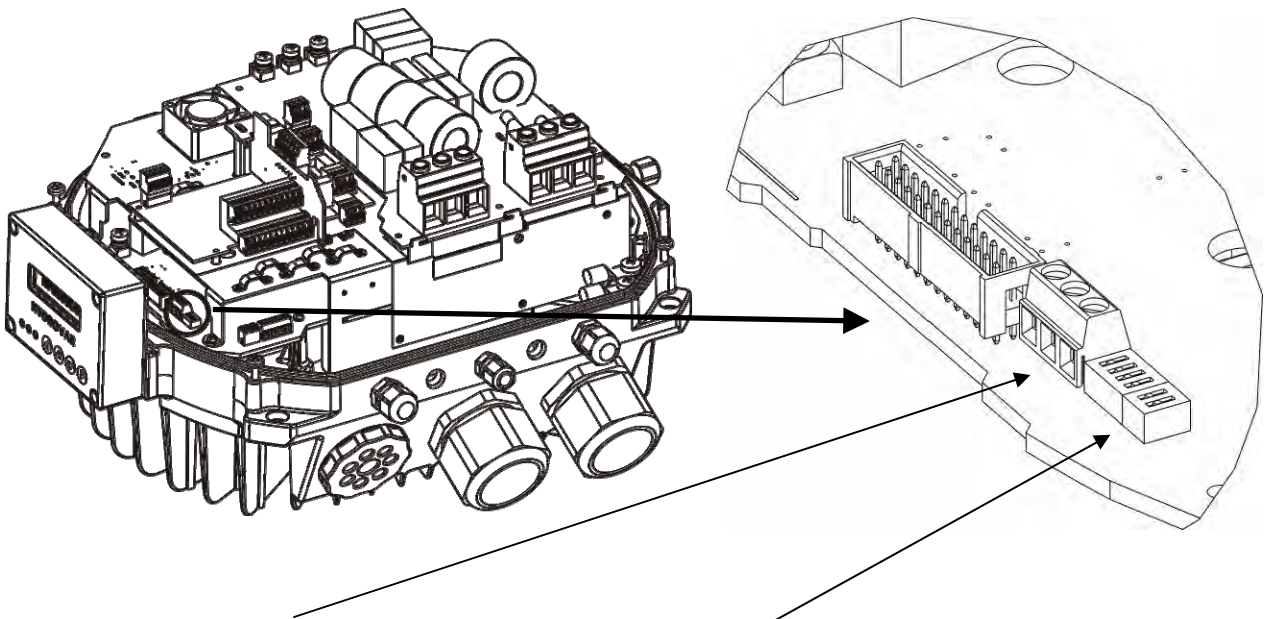
HV 2.015 / 2.022
HV 4.022 / 4.030 / 4.040
BASIC Inverter



HV 4.055 / 4.075 / 4.110
BASIC Inverter



HV 4.150 / 4.185 / 4.220



Terminal for external LED (X22)
possibility to connect a LED to show the
status without display operation.

Dip- switch for addressing (S1)
(S2) reserved for changing the switching
frequency – function not active

9.4.4 RFI – switch

For HYDROVAR HV4.055 – HV4.220 additional filter capacitors are included, which provide an improved filter characteristic in order to avoid RFI (Radio Frequency Interferences) when the HYDROVAR is used as wall mounted device with longer motor cables between the HYDROVAR and the motor.

In general the default settings should not be changed and remain in default position.

NOTE: Due to the additional filter capacity the earth leakage current will increase, if the filter is active. Therefore in case of using ELCB-relays (earth-leakage circuit breakers, RCD), they must be suitable for VFD's (see also chapter 9.1).

HV4.150 – HV4.220 switch S1 and S2

S1 – used only for internal high voltage testing

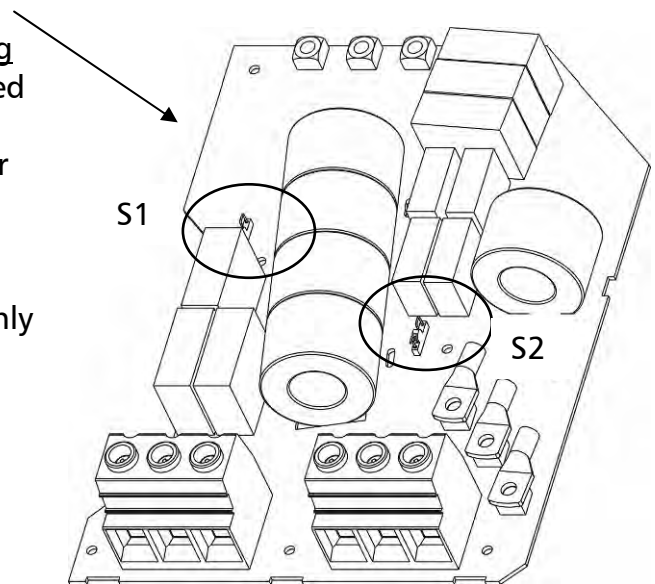
Closed (default setting): should not be changed by the end user

Open: only for tests done by the manufacturer

S2 – activation HF filter capacitor

Closed (default setting): RFI filter active for symmetric power supply net (standard in mainly all countries)

Open: RFI filter deactivated for asymmetric power supply net (e.g. USA).



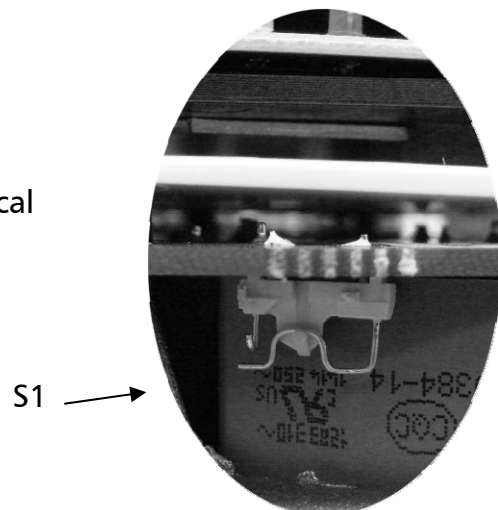
HV4.055 – HV4.110

(Placed at the front side of the HYDROVAR under the control card)

S1 – activation HV filter capacitor

Open (default setting): change of position by the end user only after consultation of your local service partner.

Closed: only for specific requirements referred to RFI



WARNING: The switch may not be opened in case the HYDROVAR is still connected to the main supply. Before changing the position of the switch (ON/OFF) you have to be sure that the HYDROVAR is disconnected from the mains supply.

9.4.5 Control unit

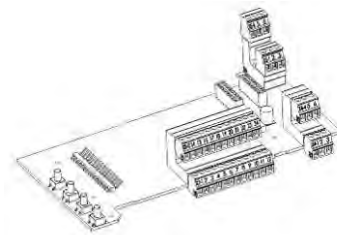
Regarding the hardware configuration of the HYDROVAR two different control cards are available.

The control unit of the HYDROVAR MASTER Inverter basically consists of the control card and the additional boards which are connected to the control card via slot connectors. This configuration is able to support all special software features and optional boards.

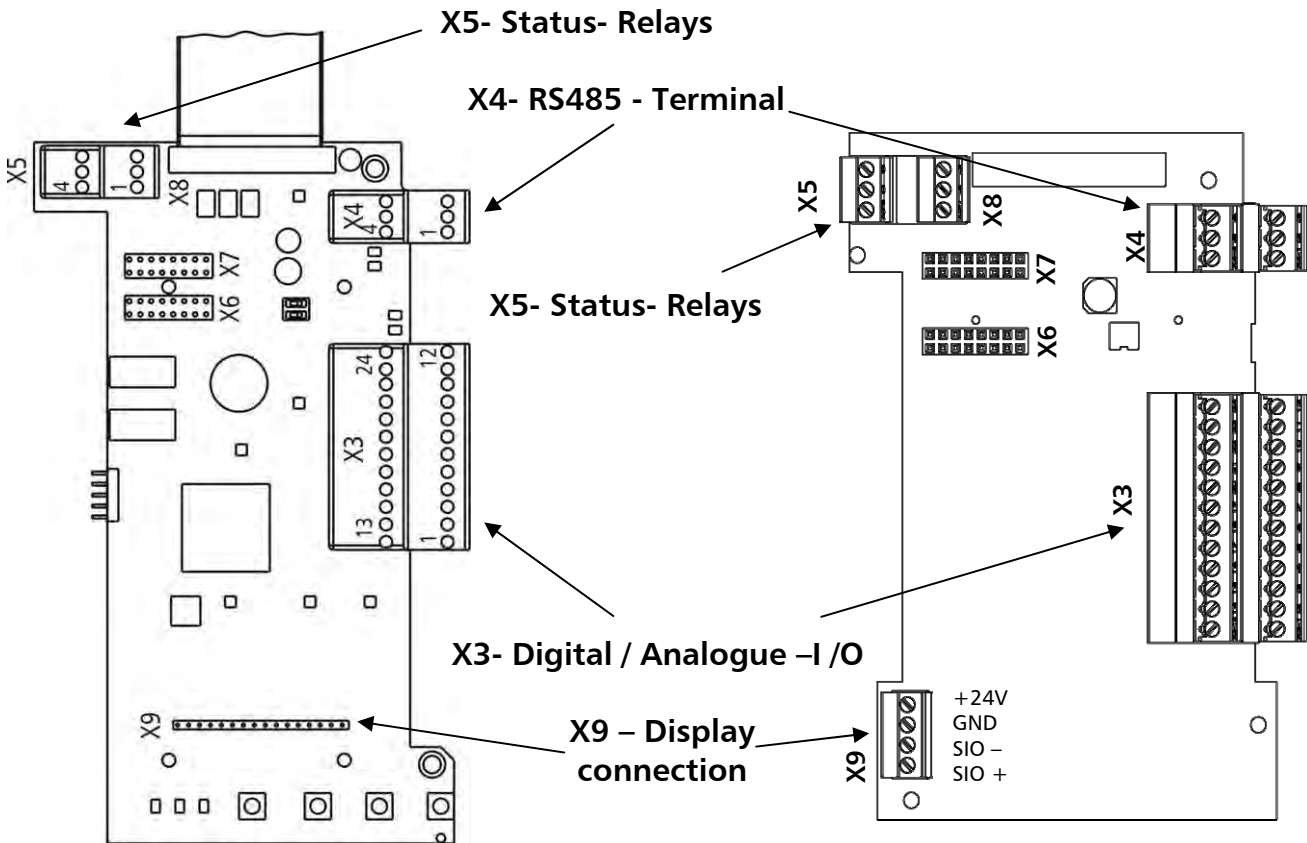
The second available control card included in the HYDROVAR SINGLE Inverter is developed just for SINGLE pump operation. This control card doesn't support any additional boards and includes just the necessary software parameters for SINGLE pump applications.

9.4.5.1 Control card – HYDROVAR MASTER Inverter

The control card is connected to the power unit via a ribbon cable on terminal X8.



- The display is connected to terminal X9
The display can be mounted in normal position (0°) or upside down (180°) – for HV2.015-4.110
- The connection terminals X6 and X7 can be used if optional boards are available.
E.g. the additional relay card can be connected to the control card at connection slot X6.



Control terminals

All control cables connected to the control card have to be screened (See chapter 9.3 recommended cable types).

External volt free contacts must be suitable for switching <10 VDC.



NOTE: If unscreened control cables are used, signal interference may occur and could also interfere incoming signals and the function of the HYDROVAR.

Do not connect the ground of the control card to other voltage potentials.

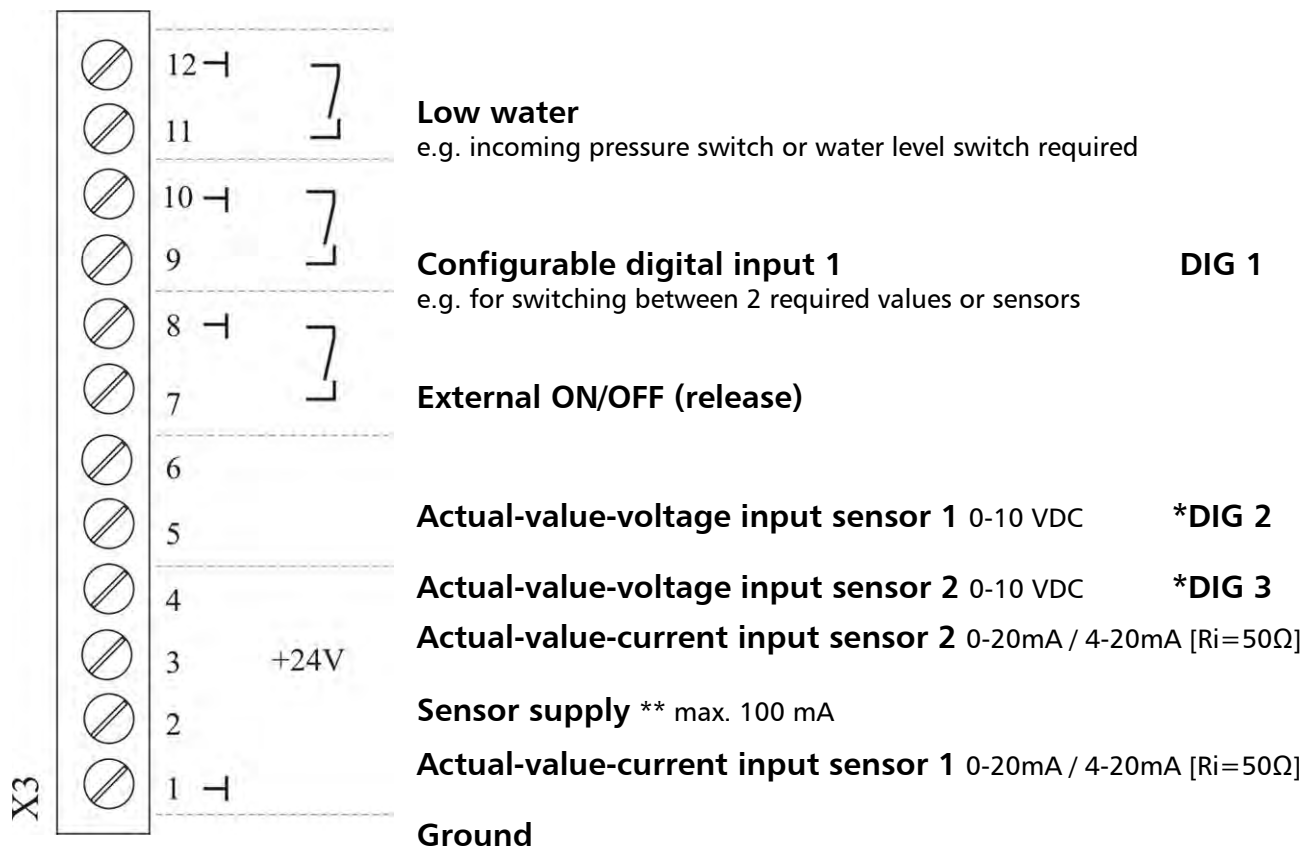
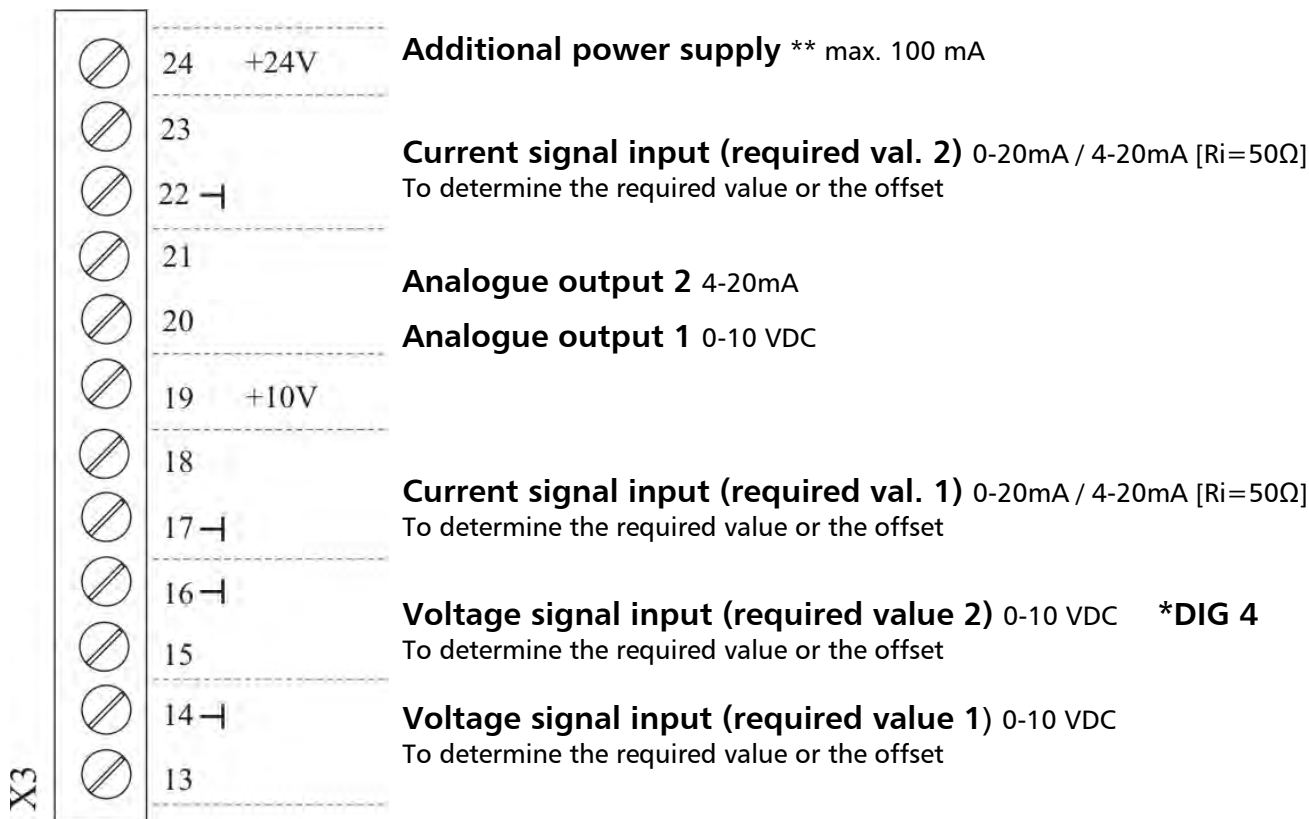
All electronic ground terminals and GND of the RS 485-interface are connected internally.

X3 Digital and Analogue I/O				
X3/	1	GND, electronic ground		
	2	Actual value current input sensor 1	0-20mA / 4-20mA [Ri=50Ω]	
	3	Power supply for external sensors	24VDC, ** max. 100mA	
	4	Actual value current input sensor 2	0-20mA / 4-20mA [Ri=50Ω]	
	5	Actual value voltage input sensor 2	*Dig 3	0-10 VDC
	6	Actual value voltage input sensor 1	*Dig 2	0-10 VDC
	7	External ON/OFF (release)		Active low
	8	GND, electronic ground		
	9	Configurable digital input 1	Dig 1	Active low
	10	GND, electronic ground		
	11	Low water		Active low
	12	GND, electronic ground		
	13	Voltage signal input (required value 1)	(Offset)	0-10VDC
	14	GND, electronic ground		
	15	Voltage signal input (required value 2)	*Dig 4 (Offset)	0-10VDC
	16	GND, electronic ground		
	17	GND, electronic ground		
	18	Current signal input (required value 1)	(Offset)	0-20mA / 4-20mA [Ri=50Ω]
	19	+10V internal ref. for analogue output		10,00VDC, max. 3mA
	20	Analogue output 1		0-10VDC, max. 2mA
	21	Analogue output 2		4-20mA
	22	GND, electronic ground		
	23	Current signal input (required value 2)	(Offset)	0-20mA / 4-20mA [Ri=50Ω]
	24	+24V power supply for control inputs		24VDC, ** max. 100mA

* Terminals 5 and 6 can be used as actual value voltage input and also as digital input. Also the voltage signal input on terminal X3/15 can be used as digital input.

** X3/3 and X3/24 → Σ max. 100mA

(Offset) These terminals can be used as required value or offset signal input. Configuration: see submenu REQUIRED VALUES [0800] and submenu OFFSET [0900].

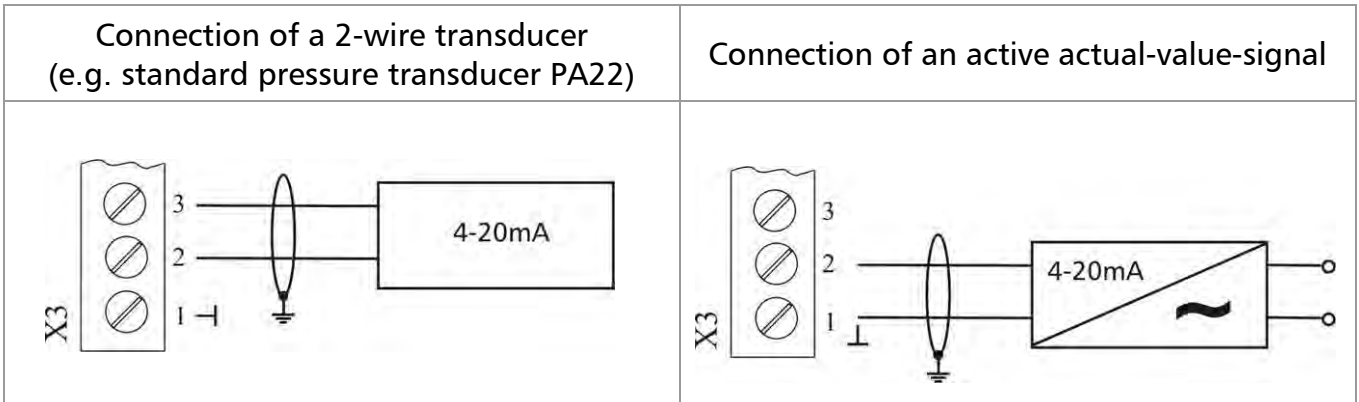


* Terminals X3/5 and 6 can be used as actual value voltage input and also as digital input. Also the voltage signal input on terminal X3/15 can be used as digital input.

** X3/3 and X3/24 → Σ max. 100mA

Connection examples:

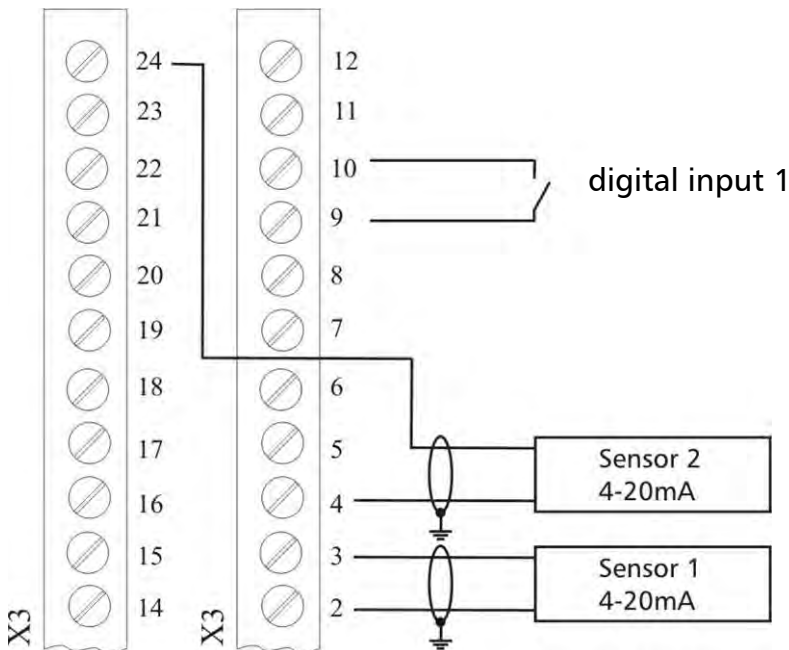
• **Sensor-Actual-value-signal Input**



<u>Possible connections:</u>		<u>Standard pressure transducer PA22:</u>
Actual-value-signal input 0/4-20mA	X3/4 ... Sensor 2	
+24VDC sensor supply	X3/3	brown
Actual-value-signal input 0/4-20mA	X3/2 ... Sensor 1	white
Ground	X3/1	

• **Switching between two connected sensors**

External switching between two connected sensors by closing digital input 1 (X3/9-10).
How to program see SUBMENU SENSORS [0400].

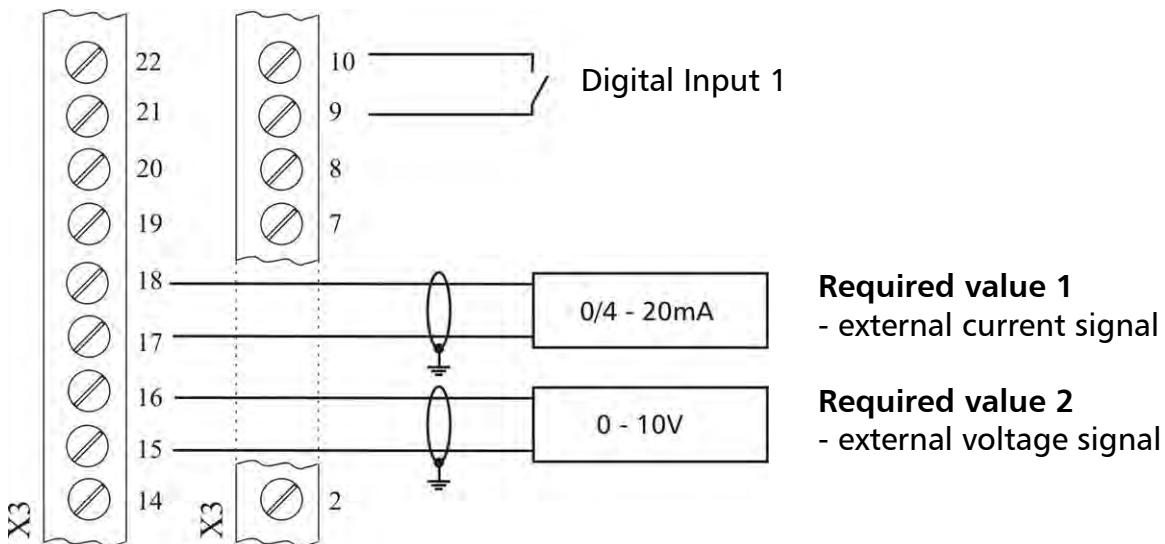


- **Switching between two different required values**

External switching between two connected required value signals (e.g.: between voltage and current signal input) by closing digital input 1 (X3/9-10).

In ACTUATOR mode it is possible to switch between two different frequencies by the digital inputs. The connected input signals (current or voltage) are proportional to the frequency.

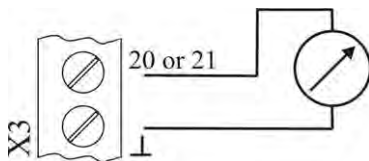
How to program see SUBMENU REQUIRED VALUES [0800].



- **Actual value – frequency indicator**

e.g. to display the actual motor frequency

How to program see SUBMENU OUTPUTS [0700].

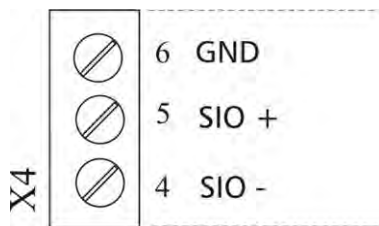


Possible connections:

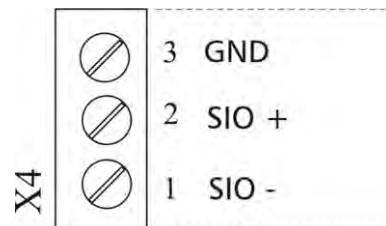
Analogue output 1 (0-10V): X3/20
Analogue output 2 (4-20mA): X3/21

X4 RS485-Interface			
X4/	1	User SIO-Interface: SIO-	} User interface for external communication
	2	User SIO-Interface: SIO+	
	3	GND, electronic ground	
X4/	4	Internal SIO-Interface: SIO-	} Internal interface for multi-pump-systems
	5	Internal SIO-Interface: SIO+	
	6	GND, electronic ground	

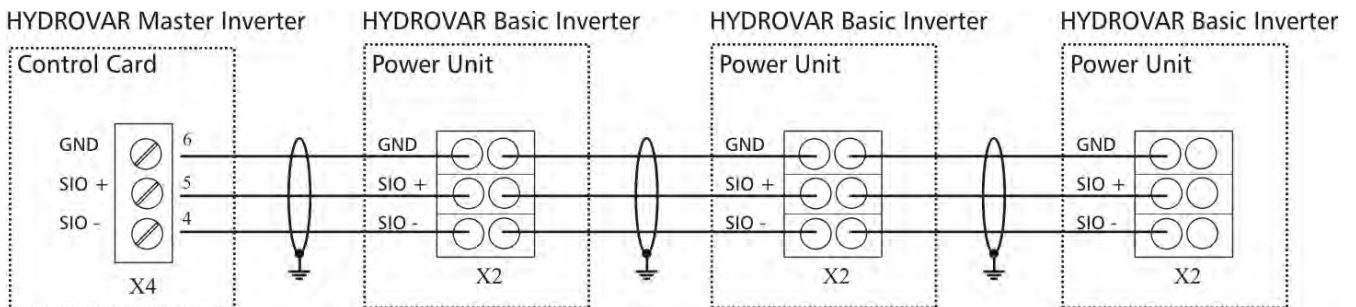
RS-485 – Internal interface



RS-485 - User interface

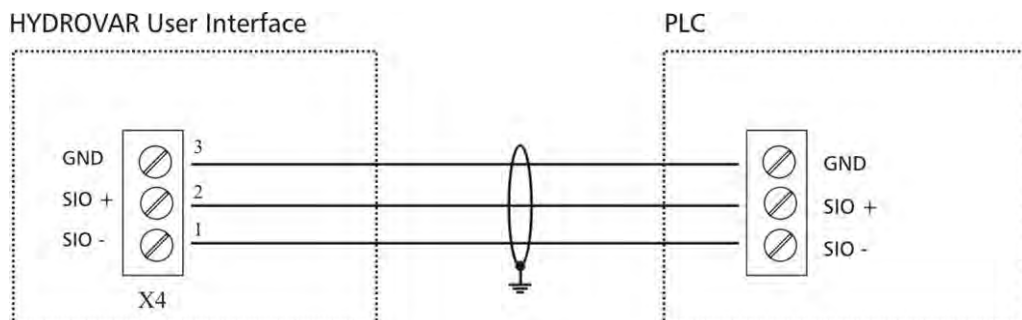


The **internal RS-485 Interface** is used for the communication between up to 8 HYDROVAR in a multi-pump application. For the connection of each HYDROVAR via the RS-485 interface the terminals X4/4-6 on the control card, and either the terminals X2/1-3 on the power unit can be used. (**Connection example:** using one MASTER - and three BASIC Inverters)



By using the **RS485 – User interface** on the control card, one or more HYDROVAR can communicate via the standardized Modbus protocol with an external-control-device (e.g. PLC). This interface can be used for parameterization and controlling the HYDROVAR via external devices. **Also active for HYDROVAR SINGLE Inverter - configuration.**

Do not use the internal interface as user interface and vice versa!

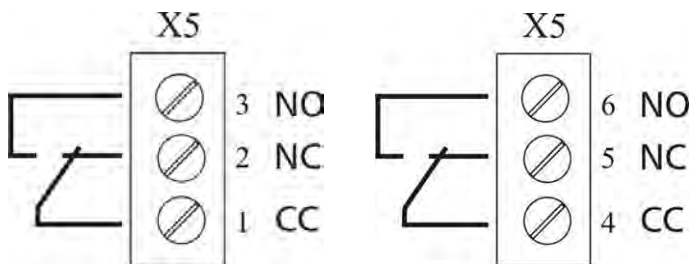


X5 Status-Relays

X5/	1	Status Relay 1	CC	} [Max. 250VAC] [0,25A] [Max. 220VDC] [0,25A] [Max. 30VDC] [2A]
	2		NC	
	3		NO	
	4	Status Relay 2	CC	
	5		NC	
	6		NO	

Status Relay 1

Status Relay 2



Notice:

When using the relay contacts for driving an external relay, a corresponding RC-snubber-circuit or varistor is necessary, to prevent disturbance of the HYDROVAR!

Both Status-Relays on the control card can be used regarding the programmed configuration.

Factory setting: The two relays are used as pump-running or fault-signal-relay. For this application see connection example below (How to program see parameters CONF REL 1 [0715] and CONF REL 2 [0720]).

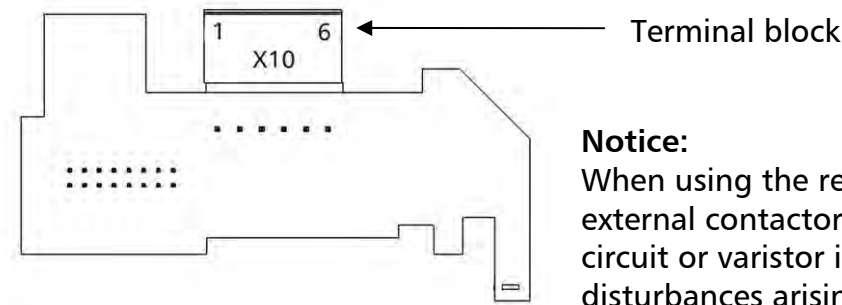
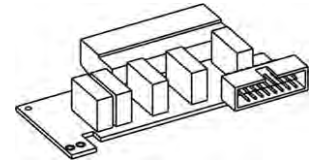
Connection examples:

Pump running signal	Fault signal
<p>Ext. 250VAC / 220VDC</p>	<p>Ext. 250VAC / 220VDC</p>
<p><u>X5/ 1 and 3 closed:</u> - motor run indication</p>	<p><u>X5/ 4 and 5 closed:</u> - if there is a fault/error</p>

9.4.5.2 Relay Card

This optional component can be used only in combination with a HYDROVAR MASTER Inverter.

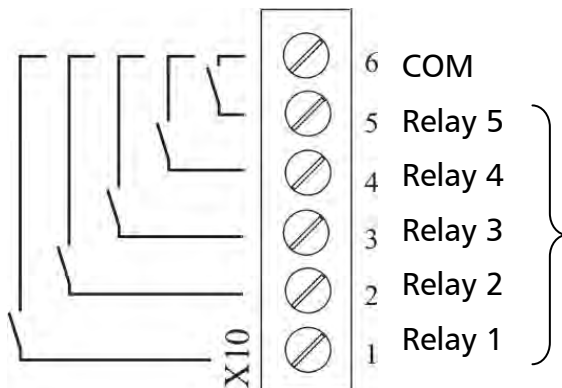
The Relay Card is connected to the control card using connection slot X6 (See chapter 9.4.4.1).



Notice:
When using the relay contacts for switching external contactors, a corresponding RC-snubber-circuit or varistor is necessary, to prevent disturbances arising during a switching action of the relay!

Terminals Relay Card

X10 Relay Card			
X10/	1	Relay 1	} [max. 250VAC] [0,25A] [max. 220VDC] [0,25A] [max. 30VDC] [0,25A]
	2	Relay 2	
	3	Relay 3	
	4	Relay 4	
	5	Relay 5	
	6	COMMON GND	



Contacts for switching the fixed speed pumps.

Please consider that the fixed speed pumps can't be switched directly by the Relay card (an external panel for the contactors of the D.O.L or STAR/DELTA starters is necessary).

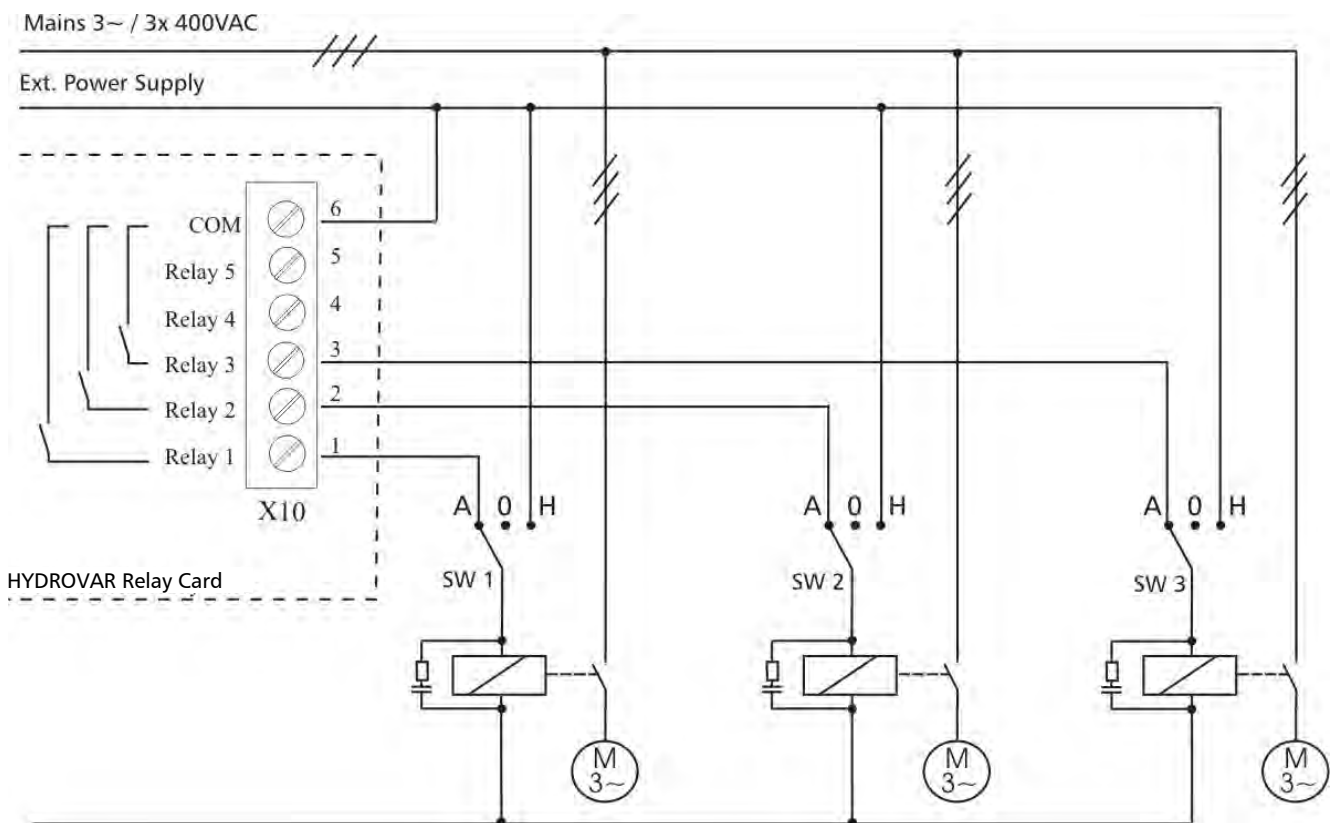
Connection example:

The following wiring diagram shows a standard cascade control system where the HYDROVAR is fitted with an additional Relay Card, in selected mode Cascade Relay.

To switch the fixed speed pumps via the internal Relay Card, an external panel for the contactors of the D.O.L or STAR/DELTA starters (and optional A/0/M – switch) is required.

In the example below 3 fixed speed pumps are connected to the Relay Card. For such an application, an optional HAND/OFF/AUTO switch (SW1, SW2, and SW3) is recommended.

- During normal operation the switch is set to AUTO, so the Relay Card of the HYDROVAR starts and stops the connected pumps.
- The HAND position allows a manual operation of the pumps.
- If one of the additional switches is in OFF position, the related relay must be disabled in the submenu STATUS [20] to ensure correct operation of the multi-pump system.

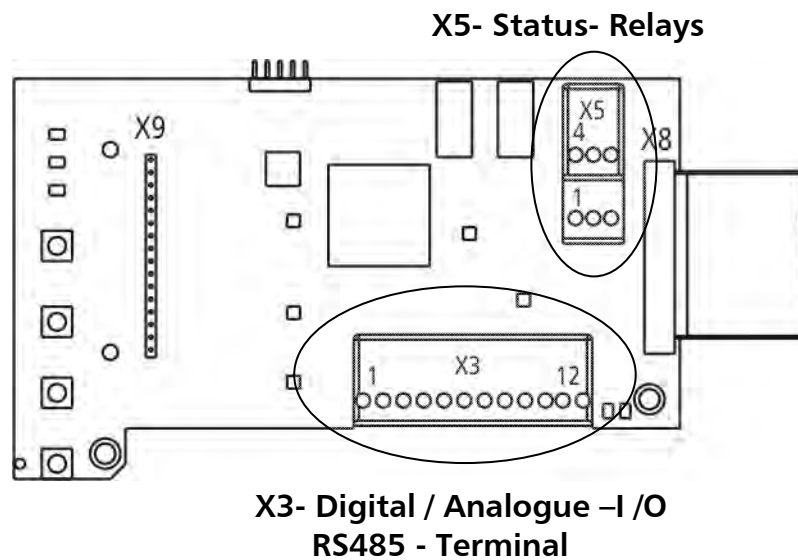


9.4.5.3 Control card – HYDROVAR SINGLE Inverter (not for HV 4.150 – HV 4.220)

The control card is connected to the power unit via a ribbon cable on terminal **X8**.

The display is connected to terminal **X9**

The display can be mounted in normal position (0°) or upside down (180°).



Control Terminals

All control cables connected to the control-unit have to be screened (See chapter 9.3 recommended cable types).

External volt free contacts must be suitable for switching <10 VDC.



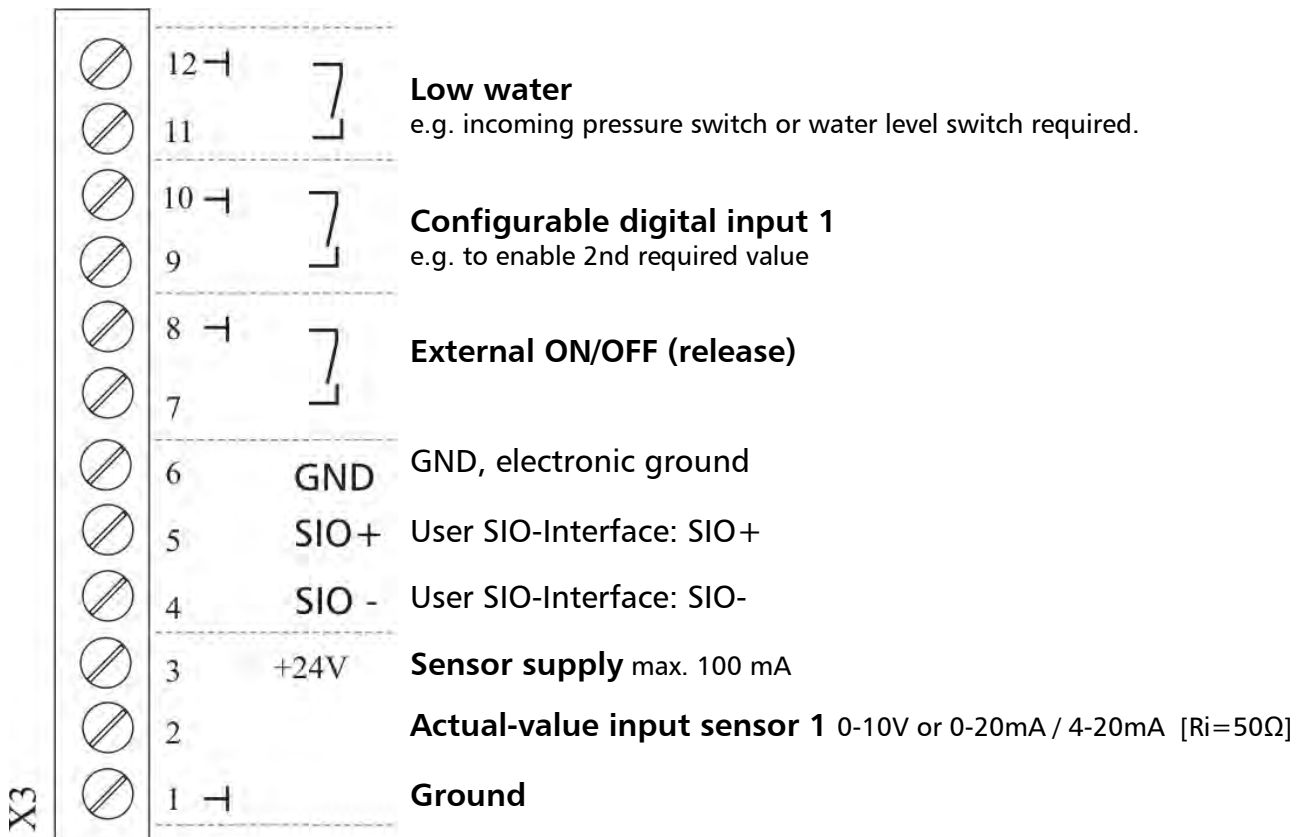
NOTE:

If unscreened control cables are used, signal interference may occur and could interfere with incoming signals and the function of the HYDROVAR.

Don't connect the ground of the control card to other voltage potentials.

All electronic ground terminals and GND of the RS 485-interface are connected internally.

X3 Digital and Analogue I/O			
X3/	1	GND, electronic ground	
	2	Actual value input sensor 1	0-10VDC or 0-20mA / 4-20mA [Ri=50Ω]
	3	Power supply for external sensors	24VDC, max. 100mA
	4	User SIO-Interface: SIO-	} User Interface for external usage
	5	User SIO-Interface: SIO+	
	6	GND, electronic ground	
	7	External ON/OFF (release)	active low
	8	GND, electronic ground	
	9	Configurable digital input 1	active low
	10	GND, electronic ground	
	11	Low water	active low
	12	GND, electronic ground	

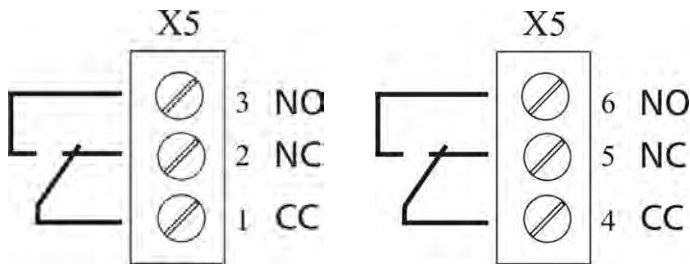


X5 Status-Relays

X5/	1	Status Relay 1	CC	} [Max. 250VAC] [0,25A] [Max. 220VDC] [0,25A] [Max. 30VDC] [2A]
	2		NC	
	3		NO	
	4	Status Relay 2	CC	
	5		NC	
	6		NO	

Status Relay 1

Status Relay 2



Notice:

When using the relay contacts for driving an external relay, a corresponding RC-snubber-circuit or varistor is recommended, to prevent disturbances arising during a switching action of the relay!

Both Status-Relays on the control card can be used regarding the programmed configuration.

Factory setting: The two relays are used as pump-running or fault-signal-relay. For this application see connection example below (How to program see parameters CONF REL 1 [0715] and CONF REL 2 [0720]).

Connection examples:

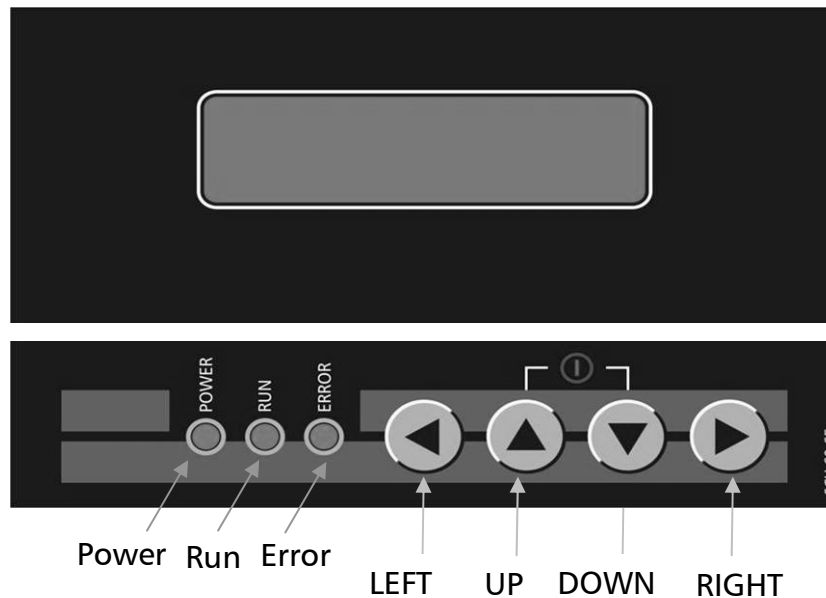
Pump running signal	Fault signal
<p>Ext. 250VAC / 220VDC</p>	<p>Ext. 250VAC / 220VDC</p>
<p><u>X5/ 1 and 3 closed:</u> - motor run indication</p>	<p><u>X5/ 4 and 5 closed:</u> - if there is a fault/error</p>

10 Programming



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

10.1 Display – Control panel of the MASTER / SINGLE Inverter



10.2 Function of the push buttons

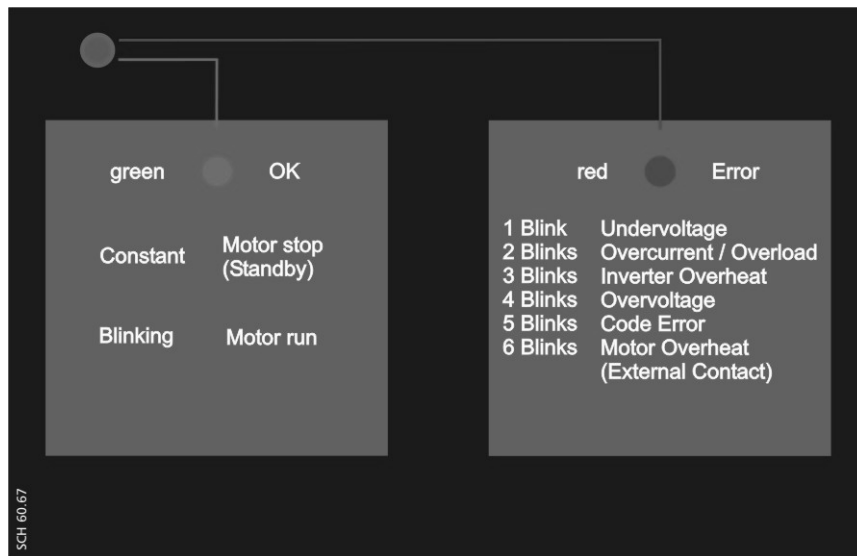
- ▲ Start of the HYDROVAR in the 1st Window
- ▼ Stop of the HYDROVAR in the 1st Window
- ◀ and ▶ Reset: by pressing of both buttons simultaneously for 5 seconds

- ▲ 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 pressing: enter submenu / Change to next parameter in the menu
- ◀ Short pressing: leave submenu / Change to previous parameter in the menu

- ▶ Long Pressing: Acknowledgement of a determined action
- ◀ Long Pressing: Change back to the main menu

10.3 Display of the BASIC Inverter



Status LED - green

Constant	Motor stopped (Standby)
Blinking	Motor run

Error LED - red

The type of error is indicated by the blinking-code of the ERROR LED.

1 blink	Undervoltage
2 blinks	Overcurrent / Overload
3 blinks	Inverter overheat
4 blinks	Overvoltage
5 blinks	Code Error
6 blinks	Motor overheat (external contact is open)

For detailed information see chapter 11 Failure messages.

10.4 Software parameters

In the following chapters all available parameters of the main and secondary menu are listed. The upper window shows the factory setting and the line below the possible range of settings.

The general parameter description is written for the **HYDROVAR MASTER Inverter** (Full featured HYDROVAR including the high level control card which supports also the optional modules like the optional Relay Card and all specific software features).

When using a **HYDROVAR SINGLE Inverter** (HYDROVAR with control card only for SINGLE pump operation) there are less software features in comparison to the HYDROVAR MASTER Inverter. All parameters which are not active for a HYDROVAR SINGLE Inverter are marked with the following symbol:



... Parameter not available for a HYDROVAR SINGLE Inverter

Parameters which are transferred automatically within the whole group of HYDROVAR units are marked with the following symbol:



... Global parameter (interchanged on all HYDROVAR within one system)

NOTICE! All changes will be saved automatically especially in case of a disconnection of the power supply!

00	00 MAIN MENU	
----	--------------	--

The 1st window, REQUIRED VALUE [02] and EFFECTIVE REQUIRED VALUE [03] depend on the selected mode which has been chosen with parameter MODE [0105]. The differences within the windows in the different modes are shown below:

a) Active MODE [0105] = Controller (Default setting)

	XYLEM STOP	XX.X Hz X.XX Bar	1 st display at mode Controller
--	---------------	---------------------	--

This window shows the status of the HYDROVAR.

ON	Automatic and external released	Stop of the HYDROVAR by pressing ▼
STOP	Manually stopped	Start of the HYDROVAR by pressing ▲
OFF	External release (X3/7-8) is open	To start up the HYDROVAR close external release or bridge terminal X3/7-8

b) Active MODE [0105] = Cascade Relay / Cascade Serial / Cascade Synchron

	* ADR X STOP	PX XX.X Hz X.XX Bar	1 st display at mode cascade serial and cascade relay	S
--	-----------------	---------------------------	--	----------

This window shows the status of the HYDROVAR.

* Indicates the HYDROVAR which actually controls the system

ADR X	Pump address
P X	<p>Cascade relay mode: Indicates the number of pumps which are running e.g.: P3 MASTER + 2 fixed speed pumps are running</p> <p>Cascade serial/synchron mode: Indicates the sequence of the pumps in the system, depending on the MASTER PRIORITY [0570] and SWITCH INTERVAL [0555]</p>

ON	Automatic and external released	Stop of the HYDROVAR by pressing ▼
STOP	Manually stopped	Start of the HYDROVAR by pressing ▲
OFF	External release (X3/7-8) is open	To start up the HYDROVAR close external release or bridge terminal X3/7-8

Indication for MODE – Controller / Cascade Relay / Cascade Serial / Cascade Synchron

02	02 REQUIRED VAL D1 X.XX Bar	Set the desired required value with ▲ or ▼	G
----	--------------------------------	--	----------

The current REQUIRED VALUE and its source (by the additional information) are shown in this window.

- D1 internal - required value 1 (set by parameter 0820)
- D2 internal - required value 2 (set by parameter 0825)
- U1 required value 1 - voltage signal input (Connected to X3/13)
- U2 required value 2 - voltage signal input (Connected to X3/15)
- I1 required value 1 – current signal input (Connected to X3/18)
- I2 required value 2 – current signal input (Connected to X3/23)

03	03 EFF REQ VAL D1 X.XX Bar	Effective required value
----	-------------------------------	--------------------------

Shows the current required value that is calculated based on ACTUAL VALUE INCREASE [0505], ACTUAL VALUE DECREASE [0510] and LIFT AMOUNT [0330]. If the required value is influenced by an offset signal (SUBMENU OFFSET [0900]) the current active required value is also shown in this window.

E.g. Multi-pump-application with two pumps

REQUIRED VALUE [02]:	5.00 bar
ACT. VALUE INCREASE [0505]:	0.50 bar
ACT. VALUE DECREASE [0510]:	0.25 bar
-> REQ VAL EFF [03]:	5.25 bar

After starting the second pump the pressure will be increased to a system pressure of 5.25 bar. With this parameter you are able to see the calculated new required value.

c) Active MODE [0105] = Actuator

Frequency STOP	XX.X Hz X.XX Bar	1 st display in Mode actuator
-------------------	---------------------	--

If parameter MODE [0105] is set to actuator the parameter REQUIRED VALUE [02] will change to ACTUAT. FREQ. and is equivalent to parameter [0830].

By using this parameter it is possible to run the HYDROVAR up to two pre-selected frequencies to manually control the HYDROVAR.

02	02 ACTUAT.FRQ. D1 XX.X Hz	Set the desired frequency with either ▲ or ▼
----	------------------------------	--

The selected frequency in this parameter is only active in the actuator mode. The configuration must be done with parameter C.REQ.VAL.1 [0805] or C.REQ.VAL 2 [0810] and parameter SW REQ.VAL [0815].

For manual setting of the frequency the parameters ACTUATOR FREQUENCY 1 [0830] and ACTUATOR FREQUENCY 2 [0835] can be used.

For detailed information how to run the HYDROVAR by manual control, see submenu REQUIRED VALUES [0800].

Parameter [03] is not shown in Mode - Actuator

04	04 START VALUE OFF	Regulation Restart Value	G
----	-----------------------	--------------------------	----------

Possible settings: 0 – 99 % – OFF

This parameter defines the start value after pump stop in percentage of the required value.

E.g. REQUIRED VALUE [02]: 5.0 bar
START VALUE [04]: 80 % --> 4.0 bar

If the pump system has reached the required pressure of 5.0 bar and there is no more consumption, the HYDROVAR shuts off the pump.

When the consumption increases, and the pressure drops the pump normally starts. If a START VALUE [04] of 4.0 bar has been selected the pump won't start until the pressure drops below.

The following parameters in the main-menu are valid for all selected modes:

05	05 LANGUAGE ENGLISH	Language selection	
----	------------------------	--------------------	--

Possible settings: To select the desired language press ▲ or ▼

The information on the display and all parameters are available in various languages. The languages available are split in different language blocks which support different language sets.

For detailed information see chapter 4.

With the following two parameters the current date and time, can be set. This is used to display failure messages with accurate date and time when the failure occurred.

06	06 DATE DD.MM.YYYY	Current date	S
----	-----------------------	--------------	----------

Set the date by pressing ► for approx. 3 sec.

► to set current DAY / MONTH / and YEAR.

07	07 TIME HH:MM	Current time	S
----	------------------	--------------	----------

Set the time by pressing ► for approx. 3 sec.

► to set current HOUR and MINUTE.

08	08 AUTO - START ON	Auto Start
----	-----------------------	------------

Possible settings:	ON – OFF
--------------------	----------

Select ON with ▲ or OFF with the ▼ button.

If AUTO-START = ON the HYDROVAR starts automatically (in case of demand) after reconnection of power following disconnection.

If AUTO-START = OFF the HYDROVAR won't start automatically after reconnection of power following disconnection.

After remedy of the failure or reconnection of the power supply the following message is shown: AUTO START = OFF

	XYLEM STOP	XX.X Hz X.XX Bar	Press ▲ to restart the HYDROVAR.
--	---------------	---------------------	----------------------------------

09	09 OPERAT. TIME 0000 h.	Operating hours
----	----------------------------	-----------------

Total operating hours. How to reset see parameter CLR OPERAT. [1135].

20	20 SUBMENU STATUS	Status of all units within a pump group
----	--------------------------	---

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

21	21 STATUS UNITS 00000000	Status of all units	<div style="border: 1px solid black; padding: 2px; display: inline-block;">G</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">S</div>
----	------------------------------------	---------------------	--

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

- In **Cascade serial/synchron** mode the status of all (max. 8) connected units is shown (whereas 1=activated / 0=deactivated)
- In **Cascade relay** mode (MASTER is equipped with additional Relay Card) the status of the 5 Relay- switching contacts is shown.

E.g. Mode – Cascade serial/synchron

	21 STATUS UNITS 11001000	Unit 1, 2 and 5 are running	<div style="border: 1px solid black; padding: 2px; display: inline-block;">G</div>
--	------------------------------------	-----------------------------	--

E.g. Mode – Cascade relay

	21 STATUS UNITS 10100 - - -	Relay Contact 1 and 3 are closed	<div style="border: 1px solid black; padding: 2px; display: inline-block;">G</div>
--	---------------------------------------	----------------------------------	--

22	22 SELECT DEVICE * 1 *	Select device	<div style="border: 1px solid black; padding: 2px; display: inline-block;">S</div>
----	----------------------------------	---------------	--

Possible settings:	1-8
--------------------	-----

Check the current status, the motor hours and the last failures which occurred. The selection is depending on the selected mode [105].
Select desired unit by pressing ▲ or ▼.

Mode **CASCADE SERIAL/SYNCHRON:**

The selection specifies the address of the HYDROVAR units

- E.g.
- Device 1 -> MASTER Inverter with pre-selected address 1
 - Device 2 -> BASIC Inverter with pre-selected address 2
 - Device 3 -> BASIC Inverter with pre-selected address 3

For set the address on a BASIC Inverter, see chapter addressing.

To set the address on a MASTER Inverter, see parameter [106] or submenu [1200] RS485-Interface.

Mode CASCADE RELAY:

Device		enabled by
1	MASTER Inverter	
2	fixed speed pump	Relay 1 X10 /1
3	fixed speed pump	Relay 2 X10 /2
4	fixed speed pump	Relay 3 X10 /3
5	fixed speed pump	Relay 4 X10 /4
6	fixed speed pump	Relay 5 X10 /5
7	not used	
8	not used	

23	23 STATUS DEVICE Stopped	Status of the selected device	G
			S

Possible messages: Running, Stopped, Disabled, OFF, Preparing (Mode Casc. Serial/Synchr)
 relay on, relay off (Mode: Cascade Relay)
 Solorun, Faulted (all Modes)

Shows the status of the device

Mode CASCADE RELAY:

relay_on -> Relay contact is closed -> fixed-speed-pump is running
 relay_off -> Relay contact is opened -> fixed-speed-pump is stopped

Mode CASCADE SERIAL/SYNCHRON:

running -> Pump is running
 stopped -> Pump is stopped, because there is no request
 disabled -> Pump is stopped manually
 (Stopped with buttons or disabled with parameter ENABLE DEVICE [24])
 or by external device (external on/off contact open)
 OFF -> Pump is not connected to power supply
 Pump is not connected via RS485 interface
 preparing -> A new unit is connected to the multi-pump system and
 Data is transferred
 solo run -> Solorun is activated (X1/SL closed)
 faulted -> A failure occurred on the current unit

24	24 ENABLE DEVICE Enable	Enable – Disable of the selected device	G
			S

Possible settings: Enable - Disable

The selected device can be enabled or disabled manually.
 (Either in cascade relay / serial / synchron or controller mode).

25	25 MOTOR HOURS XXXXX h	Motor-runtime of the selected device	G
----	---------------------------	--------------------------------------	---

Total time how long the motor is being powered by the HYDROVAR. How to reset see parameter CLR MOTORH. [1130].

Error memory

All errors, including these of the BASIC Inverter are shown and saved at the MASTER Inverter in this menu. The errors saved in this menu include the failure message text of the current HYDROVAR where the failure happened, and also date and time when the failure occurred. (For more information about errors, see chapter 11 failure messages)

26	26 1st ERROR ERROR XX	Latest error happened on selected device	G
----	--------------------------	--	---

Message: ERROR XX, FAILURE TEXT, DATE, TIME

Press ▲ or ▼ to scroll up or down!

27	27 2nd ERROR ERROR XX	2nd error of the selected device	G
----	--------------------------	----------------------------------	---

Message: ERROR XX, FAILURE TEXT, DATE, TIME

Press ▲ or ▼ to scroll up or down!

28	28 3rd ERROR ERROR XX	3rd error of the selected device	G
----	--------------------------	----------------------------------	---

Message: ERROR XX, FAILURE TEXT, DATE, TIME

Press ▲ or ▼ to scroll up or down!

29	29 4th ERROR ERROR XX	4th error of the selected device	G
----	--------------------------	----------------------------------	---

Message: ERROR XX, FAILURE TEXT, DATE, TIME

Press ▲ or ▼ to scroll up or down!

30	30 5th ERROR ERROR XX	5th error of the selected device	G
----	--------------------------	----------------------------------	---

Message: ERROR XX, FAILURE TEXT, DATE, TIME

Press ▲ or ▼ to scroll up or down!

40	40 SUBMENU DIAGNOSTICS	
----	-----------------------------------	--

41	41 PROD. DATE XX.XX.XXXX	production date of the HYDROVAR (MASTER /SINGLE only)
----	-----------------------------	---

In this parameters the current temperature, voltage and frequency of the chosen HYDROVAR can be monitored even during operation of the unit.
These parameters are only to read!

42	42 SEL. INVERTER * 1 *	Selection of the desired unit	G
----	---------------------------	-------------------------------	----------

Possible settings: 1-8

43	43 TEMP. INVERTER XX % XX°C	Temperature of the selected unit	G
----	-------------------------------------	----------------------------------	----------

The current value determines the temperature inside the selected HYDROVAR and is shown in °C and also in percent of the max. allowed temperature.

44	44 CURR. INVERTER XXX %	Current of the selected unit	G
----	----------------------------	------------------------------	----------

This value determines the output current of the HYDROVAR in percent to the max. rated current output.

45	45 VOLT. INVERTER XXX V	Voltage of the selected unit	G
----	----------------------------	------------------------------	----------

This value determines the input voltage connected to the HYDROVAR.

46	46 OUTPUT FREQ. XX.X Hz	Output frequency of the selected unit	G
----	----------------------------	---------------------------------------	----------

This value determines the output frequency generated from the HYDROVAR

47	47 VER.INVERTER 01	Specification version of the selected device	G
----	-----------------------	--	----------

This parameter gives information about the software version of the BASIC drive (located on the main board).

Possible indications:

00	All power sizes (HV2.015-4.110) prior production 05/2008
01	Power sizes HV2.015-4.040 - related to control board software V01.3 and above
02	Power sizes HV4.055-4.220 - related to control board software V01.3 and above

60	60 SUBMENU SETTINGS	
----	----------------------------	--



Before entering the submenu settings these instructions must be read carefully to prevent incorrect settings which will cause malfunction.

All parameters can also be set during operation. Therefore different parameters in the extended submenu should be used only by trained and qualified persons.
It is suggested stopping the HYDROVAR by pressing ▼ in the main menu during changing parameters

61	61 PASSWORD 0000	entering password (0066 = Default) by pressing ▲ or ▼
----	---------------------	---

NOTICE: If the submenu is opened with the correct password it will remain open for a time period of 10 minutes without the need of enter the password again to access the secondary menu.

	61 PASSWORD 0066	Confirm by pressing ► and the first window of the sub menu is shown
--	---------------------	---

62	62 JOG 0.0Hz X.XX Bar	Both current output frequency and actual value are shown.
----	-----------------------------	---

- By pressing ▲ or ▼ in this menu, the internal controller of the HYDROVAR is deactivated and it changes to manual mode.
- Using the ▲ and ▼ buttons any constant speed can be set without further control to achieve the set point!
- If this value becomes 0.00 Hz the HYDROVAR stops.
- As soon as the window is left by pressing ◀ or ▶, the HYDROVAR returns to the selected mode.

0100	0100 SUBMENU BASIC SETTINGS	
------	-----------------------------	--

0105	0105 MODE Controller	Selection of the operation mode
------	----------------------	---------------------------------

Possible settings: Controller, Cascade Relay, Cascade Serial, Cascade Synchron, Actuator

Controller (Default Setting):

This mode should be selected if only one HYDROVAR MASTER /SINGLE Inverter is used and no connection to any other HYDROVAR via RS-485 interface is needed.

Cascade Relay: 

The standard application for this mode is one MASTER –Inverter fitted with an additional Relay Card to control up to 5 fixed speed pumps.

No connection to any other HYDROVAR via RS-485 Interface possible.

Advantages: costs, realizing of simple systems

Disadvantage: quality of regulation, reliability

Cascade Serial: 

Has to be selected if more than one HYDROVAR controlled pump operate together via the RS-485 interface.

The standard application for this mode is a multi-pump system with up to 8 pumps, each fitted with a HYDROVAR MASTER Inverter or a combination of MASTER and BASIC Inverters.

Advantages: reliability, switch over for operating hours optimizing, switch over in case of a failure (duty standby) and automatic duty assist.

Cascade Synchron: 

The Synchronous Controller mode is working in the same way like the cascade serial mode. The only difference is that all pumps in the multi pump system are running at the same frequency.

Advantages: In the synchronous mode the pumps can operate in a better efficiency range and the system is able to provide additional energy saving compared to standard Cascade Serial mode.

Actuator: (For SINGLE pump operation only!)

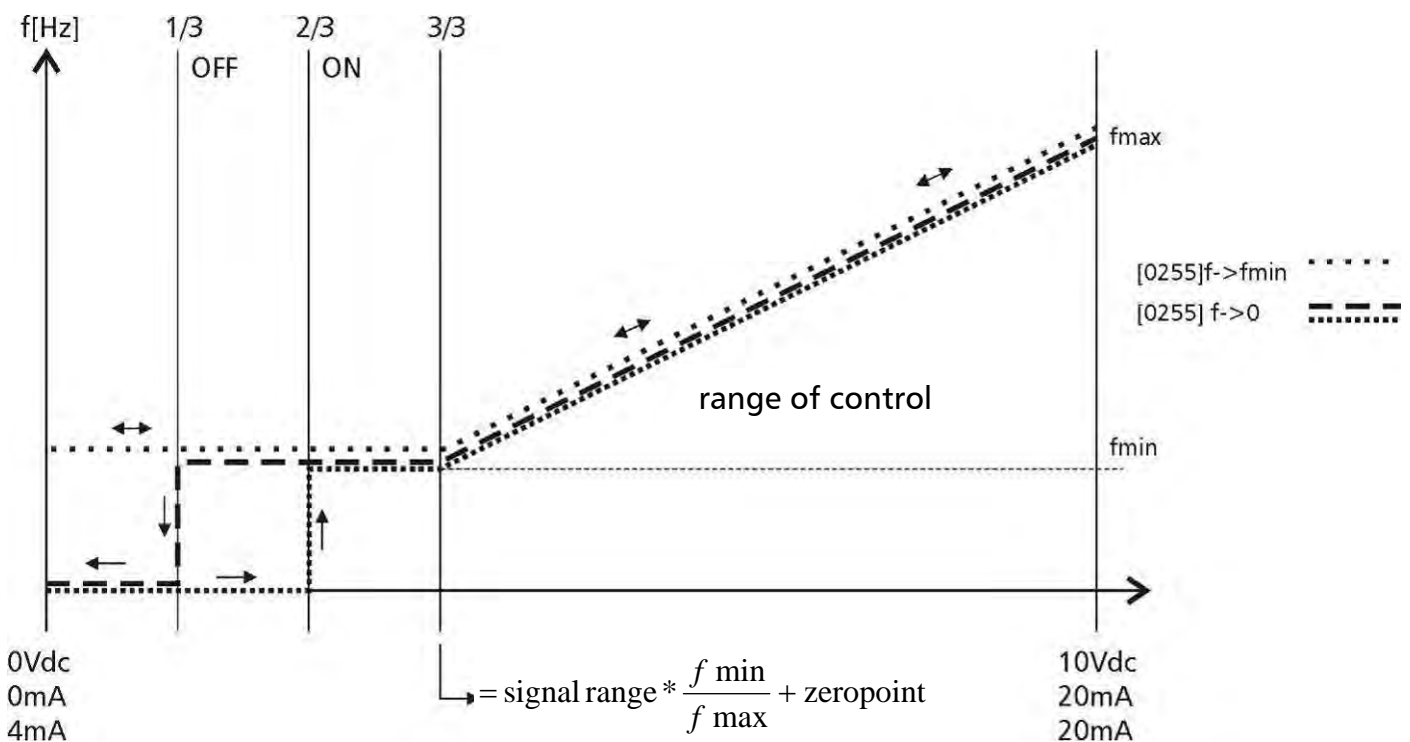
The actuator mode has to be used if a fixed speed setting is required or an external speed signal is connected and the HYDROVAR is just used like a standard VFD.

In this case, the internal controller is shut off, so the HYDROVAR does not control the set value but runs the connected motor at a frequency proportional to the input signal which is connected to the analogue inputs or is set directly on the HYDROVAR.

X3/13: Voltage signal input (Required value 1)	0-10V	0 - MAX.FREQ.[0245]
X3/15: Voltage signal input (Required value 2)	0-10V	0 - MAX.FREQ.[0245]
X3/18: Current signal input (Required value 1)	4-20mA	0 - MAX.FREQ.[0245]
	0-20mA	0 - MAX.FREQ.[0245]
X3/23: Current signal input (Required value 2)	4-20mA	0 - MAX.FREQ.[0245]
	0-20mA	0 - MAX.FREQ.[0245]

- A manual switching between the analogue inputs is possible by using the corresponding digital inputs.
- The frequency varies along the programmed Ramps 1 (accelerative) and 2 (declarative). The functions thermal protection and external ON/OFF remain still active.
- The functions External ON/OFF, Motor Overheat, Lack of water and all other internal protections still work.

In the actuator mode it is also possible to work with pre-selected frequencies for a manual control of the HYDROVAR. It is possible to set two different frequencies in the submenu REQUIRED VALUES [0800]. A changeover of these frequencies can be done with parameter SW REQ. VAL [0815].





0106	0106 PUMP ADDR. * 1 *	Select desired address for the MASTER Inverter
-------------	--------------------------	--

Possible settings:	1-8
--------------------	-----

Set desired address on each MASTER Inverter and press ► button for approx. 3 sec. and the following messages will appear:

Addressing	->	1220 PUMP ADDR.	or	1220 PUMP ADDR.
Addressing		* 1 *		- 1 -

Addressing done

Addressing failed - retry

When using MASTER and BASIC Inverters together in a multi-pump-system you have to consider that the BASIC Inverters have their separate address. Otherwise a correct function of the system couldn't be guaranteed.

For detailed information see chapter 9.4.3.2 Addressing.

0110	0110 SET PASSW. 0066	Set Password by pressing ▲ or ▼
-------------	-------------------------	---------------------------------

Possible settings:	0000 - 9999
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The pre-set password (0066) can be changed.

After the password has been changed, it is recommended to note the new password somewhere.

0115	0115 LOCK FUNCT. OFF	Possible settings with ▲ or ▼
-------------	-------------------------	-------------------------------

Possible settings:	ON - OFF
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OFF: All parameters in the main menu can be changed without the need of a password.

ON: If the LOCK FUNCTION is activated, no changes can be done in all the parameters. However the HYDROVAR can be started or stopped by using the push buttons (▲ or ▼). In order to change the set value, the LOCK FUNCTION must be set to OFF.

0120	0120 DISP. CONTR. 75 %	Display Contrast
-------------	---------------------------	------------------

Possible settings:	10 – 100%
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Can be adjusted between 10 - 100%, for improved appearance of the display.

0125	0125 DISP. BRIGHT 100 %	Display Brightness
-------------	----------------------------	--------------------

Possible settings:	10 – 100%
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The backlight intensity of the display can be adjusted.

0200	0200 SUBMENU CONF INVERTER	
------	-------------------------------	--

0202	0202 SOFTWARE HV V01.4	Software version of the control board
------	---------------------------	---------------------------------------

If a Remote Display is connected also its software version is shown in this window.

0202	0202 SW RD V01.0 HV V01.4	Software version of the Remote display (RD) and the control board (HV)
------	------------------------------	--

0203	0203 SET VER.INV sel:00 act:00	Selection of the SW version on the power board
------	-----------------------------------	--

G

Possible settings:	00 - 02
--------------------	---------

Manual selection of the required (sel.) and indication of the active (act.) software version on the power board.

All available versions can be selected if version of BASIC is production date > 05/2008.

After pressing ► button for 5 seconds the selected specification is activated and DONE is displayed.

Following parameters [0285], [0286], [0290] and [0291] are added to the menu (**only on units 5.5-22kW!**)

The required version can only be activated if all devices are updated to the new version; else version will be automatically re set to the next lower version.

Setting 00: all units with production date prior 05/2008

Setting 01: BASIC 1.5-4kW (starting with control board software V01.3

Setting 02: BASIC 5.5-22kW (starting with control board software V01.3

} see [47]

0205	0205 MAX. UNITS 06	Maximum number of units
------	-----------------------	-------------------------

G
S

Possible settings:	1 - 8
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Select: The maximum number of units which can operate at the same time.

For example:

Cascade Serial:

1 MASTER - and 2 BASIC Inverters are installed in a multi-pump-system
→ reasonable values = 1...3

Cascade Relay:

1 MASTER Inverter and 3 fixed speed pumps -> reasonable values = 2...4

0210	0210 INVERTER ALL	Selection of the HYDROVAR address for parameterizing	<div style="border: 1px solid black; padding: 2px; width: 20px; margin: 0 auto;">G</div> <div style="border: 1px solid black; padding: 2px; width: 20px; margin: 0 auto;">S</div>
Possible settings:		ALL, 1-8	

If several HYDROVAR MASTER Inverters and even BASIC Inverters are connected via the RS-485 interface, the parameterization of all the settings in SUMBENU [200] can be done via one unit and will be taken over by other units in this group.

If only a specific unit needs to be programmed you have to press the ► button for 3 sec. and then choose this unit (1-8) for which the parameterization should be done.

With setting ALL each HYDROVAR in the group is programmed

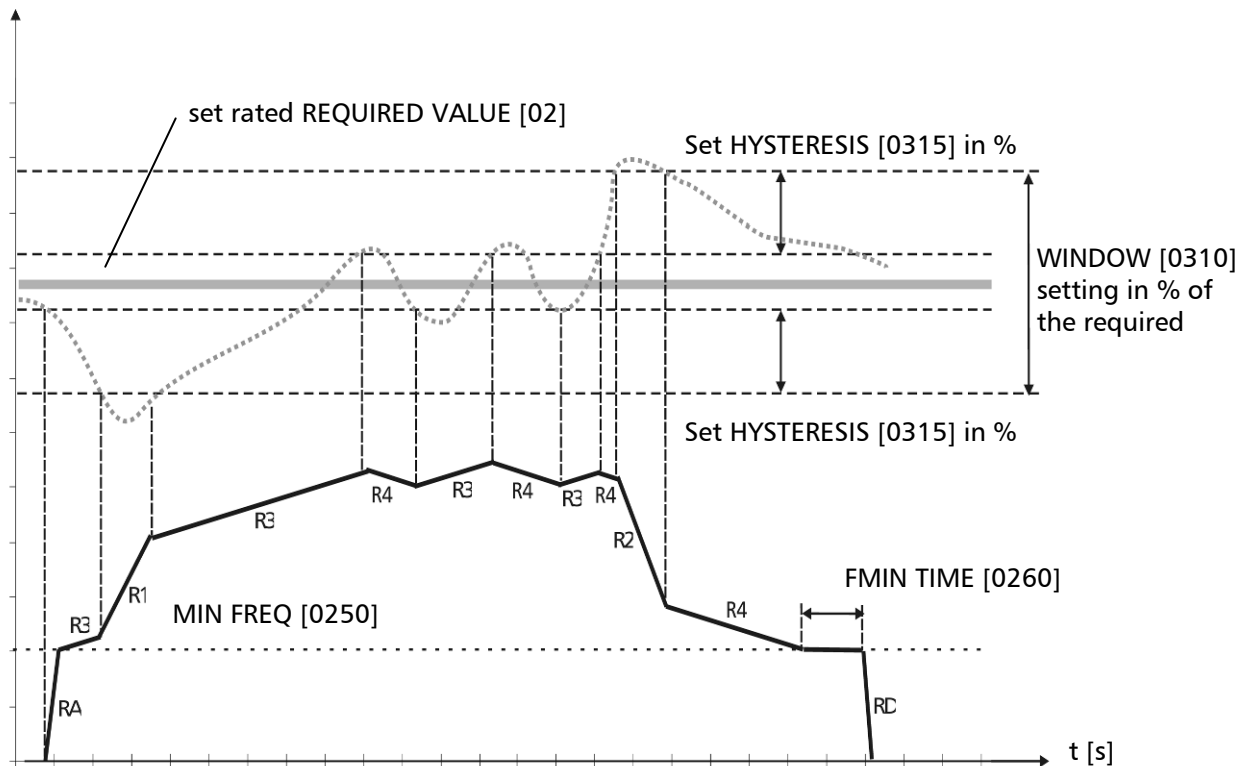
Be careful, if you change back to ALL the new settings will be copied to all units!

The following parameters in Submenu 200 do have different factory settings depending on the power rating. Therefore the factory setting shown in the document may differ to the factory settings of the unit itself. All factory settings shown in the document are related to power ratings up to 4kW whereas higher power ratings use other settings.

Ramp settings:

- Time settings of the ramps influence the control of the pump.
- The fast ramps 1 and 2 are determined by the type (power) of the HYDROVAR and the type of the pump.
Default = 4 sec.; depending on the power of the HYDROVAR they should be increased up to 15s for higher power ratings to avoid overload error.
- The slow ramps 3 and 4 determine the regulation speed of the internal HYDROVAR controller for small devices or constant consumption and depend on the system, which has to be controlled. (Default = 70 sec.)
- The Ramps FminA and FminD are used for a start-up and shut off. These parameters allow fast acceleration and deceleration and especially should be used for applications where pumps or other devices are powered, which shouldn't work below a determined frequency for a certain time. (to prevent damages or decrease abrasion)

To adjust the Ramps, press ▲ or ▼



- RA: Ramp F_{min} acceleration
- RD: Ramp F_{min} deceleration
- 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

- Actual Value
- Output Frequency

0215	0215 RAMP 1 4 sec	Ramp 1: Fast acceleration time	G
-------------	----------------------	--------------------------------	----------

Possible settings: 1 – 250 (1000) sec

- Excessively fast running up time may cause an error (OVERLOAD) during the HYDROVAR starts up.
- Excessively slow running up time may cause a drop of the outgoing pressure during operation.

0220	0220 RAMP 2 4 sec	Ramp 2: Fast deceleration time	G
-------------	----------------------	--------------------------------	----------

Possible settings: 1 – 250 (1000) sec

- Excessively fast running down time tends to cause an error (OVERVOLTAGE).
- Excessively slow running down time tends to generate over pressure.

0225	0225 RAMP 3 70 sec	Ramp 3: Slow acceleration time	G
-------------	-----------------------	--------------------------------	----------

Possible settings: 1 – 1000 sec

- Excessively fast running up time may lead to oscillation and/or an error (OVERLOAD).
- Excessively slow running up time can cause a drop of the outgoing pressure during variation of the demand.

0230	0230 RAMP 4 70 sec	Ramp 4: Slow deceleration time	G
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Possible settings: 1 – 1000 sec

- Excessively fast running down time leads to oscillation of the HYDROVAR and thereby of the pump.
- Excessively slow running down time can cause pressure fluctuations during variation of the demand.

0235	0235 RAMP FMIN A 2.0 sec	Ramp F_{min} acceleration	G
-------------	-----------------------------	-----------------------------	----------

Possible settings: 1.0 – 25.0 sec

Fast running up time to start up the HYDROVAR till the selected MIN. FREQUENCY [0250] is reached.

Beyond the minimum frequency, RAMP1 [0215] (fast acceleration ramp) starts to work.

- Excessively fast running up time may cause an error (OVERLOAD) during the HYDROVAR starts up.

0240	0240 RAMP FMIN D 2.0 sec	Ramp F_{min} deceleration	G
------	-----------------------------	-----------------------------	---

Possible settings: 1.0 – 25.0 sec

Fast running down time, to stop the HYDROVAR immediately below the selected MIN. FREQUENCY [0250].

- Excessively fast running down time tends to cause an error (OVERVOLTAGE)

0245	0245 MAX. FRQ. 50.0 Hz	Maximum frequency	G
------	---------------------------	-------------------	---

Possible settings: 30.0 – 70.0 Hz

This parameter determines the maximum speed of the pump.
The standard setting is according to the nominal frequency of the connected motor.



Settings higher than standard may overload the motor!
Settings of 10% above nominal frequency cause 33% higher power consumption!

0250	0250 MIN. FREQ. 20.0 Hz	Minimum frequency	G
------	----------------------------	-------------------	---

Possible settings: 0.0 – f_{max} (0.0 – 30.0 Hz if [203] is 00 (default))

At operation below the set min. frequency the HYDROVAR operates with the fast ramps [0235/0240].



As per default the max. setting of this parameter is limited to 30Hz. To enable the MIN. FREQ. for settings > 30Hz first the parameter [203] must be changed to setting 01 or 02 -> see page 64 for more detailed information.

The min. frequency depends on the selected pump type and application.
Especially for borehole applications the min. frequency must be set to ~30Hz.

0255	0255 CONF. FMIN f-> 0	Operation at minimum frequency	G
------	--------------------------	--------------------------------	---

Possible settings: f->0 or f-> f_{min}

f->0: After reaching the required pressure and no further consumption the frequency is going down to the selected MINIMUM FREQUENCY [0250] and the HYDROVAR will keep running for the selected FMIN TIME [0260]. After this time the HYDROVAR will stop automatically.

$f \rightarrow f_{\min}$ With this setting the pump will never stop automatically. Only the frequency will go down to the selected MINIMUM FREQUENCY [0250]. To stop the pump the external ON/OFF must be opened or the ▼ button must be pressed.

Applications: circulation systems

The setting $f \rightarrow f_{\min}$ can overheat the pump, when there is no flow through the pump => bypass line for circulation pumps!

0260	0260 FMIN TIME 0 s	Delay time before shut off below MIN. FREQ.	G
-------------	-----------------------	---	----------

Possible settings: 0 – 100 sec

After running the pump for this selected time at minimum frequency, the pump will stop, if parameter CONFIG. FMIN [0255] is set to $f \rightarrow 0$

NOTE: Problems with shut off the pump at no demand (too small or no pressure tank) may be solved as the system pressure is increasing during this delay-time.

0265	0265 BOOST 5 %	Setting of the motor starting voltage in % of connected supply voltage	G
-------------	-------------------	--	----------

Possible settings: 0 – 25% of the input voltage

This parameter determines the characteristics of the voltage/frequency curve. In particular, it refers to the voltage increase during the motor starting stage as a percentage of the nominal voltage. Take care that settings are kept as low as possible so that the motor does not become thermally overloaded at lower frequencies. If the boost is set too low, a failure (OVERLOAD) may occur because the starting-current is too high.

0270	0270 KNEE FRQ. 50.0 Hz	Knee frequency	G
-------------	---------------------------	----------------	----------

Possible settings: 30.0 – 90.0 Hz

With this parameter you can set the frequency, at which the HYDROVAR should generate its maximum output voltage (=value of connected input voltage). For standard applications this frequency should be set according the MAX. FRQ. [0245] (Default Setting 50Hz).



Be careful: This parameter should be used for special applications only! Incorrect setting can cause an overload error and even a damage of the motor.

0275	0275 POWER REDUCT. OFF	Reduction of the maximum output current
-------------	-----------------------------------	---

Possible settings: OFF, 85%, 75%, 50%

If a motor with lower nominal power is used, the maximum output current should be adjusted accordingly.

The reduction of the maximum output current also affects the overload-detection!

HV type	Output current [A]			
	OFF = 100%	85%	75%	50%
2.015	7,00	5,95	5,25	3,50
2.022	10,00	8,50	7,50	5,00
4.022	5,70	4,85	4,28	2,85
4.030	7,30	6,21	5,48	3,65
4.040	9,00	7,65	6,75	4,50
4.055	13,50	11,48	10,13	6,75
4.075	17,00	14,45	12,75	8,50
4.110	23,00	19,55	17,25	11,50
4.150	30,00	25,50	22,50	15,00
4.185	37,00	31,45	27,75	18,50
4.220	43,00	36,55	32,25	21,50

0280	0280 SEL.SW.FRQ. Auto	Selection of the switching frequency
-------------	----------------------------------	--------------------------------------

Possible settings: Auto, 8 kHz, 4 kHz

- **Auto (default setting)**

In standard operation the HYDROVAR works with a switching frequency of 8kHz in order to reduce the noise level. At rising temperature inside the HYDROVAR the switching frequency is decreased to 4kHz automatically.

- **8 kHz** - Selection with lowest noise level, but without decrease at rising temperature.

- **4 kHz** - Reduce the temperature in the HYDROVAR

0285	0285 SKIPFRQ CTR 0,0 Hz	Skip frequency centre	G
-------------	-----------------------------------	-----------------------	----------

Possible settings: $f_{\min} - f_{\max}$

0286	0286 SKIPFRQ RNG 0,0 Hz	Skip frequency range	G
-------------	-----------------------------------	----------------------	----------

Possible settings: 0,0 – 5,0 Hz

0290	0290 CURR. LIMIT OFF	Current limit functionality
-------------	--------------------------------	-----------------------------

Possible settings: OFF - ON

0291	0291 CURR. LIMIT 100 %	Current limit
-------------	----------------------------------	---------------

Possible settings: 10,0 - 100 %

Following parameters [0285] - [0291] are limited for power ratings starting from 5,5kW (Size 2 and Size 3) with production date 05/08 and control board software V01.3 or above
 → otherwise they are not visible and therefore not active.

0300	0300 SUBMENU REGULATION	
------	----------------------------	--

0305	0305 JOG 0.0Hz X.XX Bar	Both the current output frequency and actual value are shown.
------	-------------------------------	---

- By pressing ▲ or ▼ in this menu, the internal controller of the HYDROVAR is deactivated and it changes to manual mode.
- Using the ▲ and ▼ buttons any constant speed can be set without further control to achieve the set point!
- If this value becomes 0.00 Hz the HYDROVAR stops.
- As soon as the window is left by pressing ◀ or ▶, the HYDROVAR returns to the selected mode.

0310	0310 WINDOW 5%	range of ramp control	G
------	-------------------	-----------------------	----------

Possible settings: 0 – 100% of required value

- Determines the band, where the slow ramp changes to the fast ramp
- for steep pump-curves and closed loop systems ~20-30%

0315	0315 HYSTERESIS 80%	Hysteresis for ramp switching	G
------	------------------------	-------------------------------	----------

Possible settings: 0 – 100%

- Determines the band, where the normal regulation is done (change between the slow ramps)
- for an accurate control (without automatic shut-off) ~99%, e.g. constant flow control

0320	0320 REG. MODE normal	Regulation mode	G
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Possible settings: normal, inverse

Normal: Speed is increased with falling actual value signals. (e.g.: control at constant output pressure)

Inverse: Speed is reduced with falling actual value signal. (e.g.: control at constant suction pressure or at constant level on the suction side)

0325	0325 FRQ. LIFT 30.0 Hz	Frequency limit for required lift value
------	---------------------------	---

Possible settings:	0.0 Hz – 70.0 Hz
--------------------	------------------

Control according to a system curve (increase of the set pressure, depending on the flow rate/speed to cover friction losses).

The setting determines the output-frequency where the set pressure starts to be increased. The right setting should be equal to the frequency when the pump reaches the set pressure at zero flow (Can be determined by using the JOG MODE [0305]).

0330	0330 LIFT AMOUNT 0.0 %	Lift amount for required lift value
------	---------------------------	-------------------------------------

Possible settings:	0.0 – 200.0%
--------------------	--------------

This value states how much the set value should be continually increased, till the maximum speed (maximum volume) is reached.

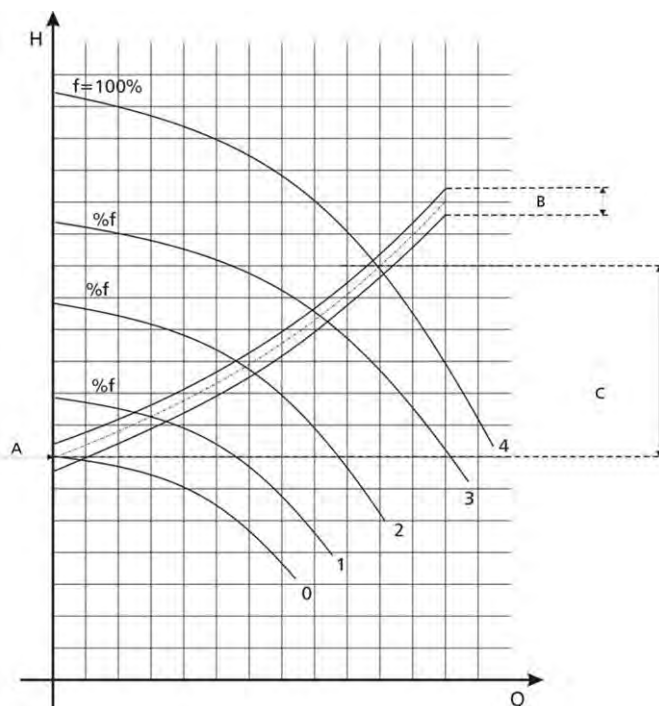
Application example:

- 1) Enter the set pressure (see main menu parameter REQ. VAL [02])
- 2) Find out the frequency where set pressure is reached at zero demand (use JOG MODE [0305]) and set the value in parameter FREQU. LIFTING
- 3) Set desired lift at maximum speed in % of the set pressure in the parameter LIFT-AMOUNT [0330].

A ... set pressure

B ... window

C ... lift intensity in % of set pressure



0400	0400 SUBMENU SENSOR	
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In this submenu all actual value sensors which are connected to the HYDROVAR can be configured, (up to two transducers with current output or voltage signal output).


It is not possible to install two different transducer types because main configuration is the same for all connected sensors. Transducers must be always the same type.

0405	0405 DIMENS. UNIT Bar	Dimension unit
-------------	---------------------------------	----------------

Possible settings: bar, psi, m³/h, g/min, mH₂O, ft, °C, °F, l/sec, l/min, m/sec, ..., %

Chose the desired dimension unit by pressing ▲ or ▼.

By changing the DIMENSION UNIT, you have to consider changing the SENSOR RANGE [0420] according to the new DIMENSION UNIT too!

0410	0410 CONF SENSOR Sensor 1	Selection of the sensor	
-------------	-------------------------------------	-------------------------	---

Possible settings: - Sensor 1 - Sensor 2 - Auto
 - Switch Dig1 - Switch Dig2 - Switch Dig3 - Switch Dig4
 - Auto Lower - Auto Higher - (Sensor 1 – Sensor 2)

This parameter determines how the connected sensors are used and which one is active. It is also possible to measure the difference of two connected sensors or to configure an automatic switchover in case of a faulty sensor.

Sensor 1	Sensor 1 is constantly active. 0/4-20mA signal connected to X3/2 and X3/3 (+24V) 0-10V signal connected to X3/6 and X3/3 (+24V)
Sensor 2	Sensor 2 is constantly active. 0/4-20mA signal connected to X3/4 and X3/3 (+24V) 0-10V signal connected to X3/5 and X3/3 (+24V)
Auto	Automatic switch over in case of a faulty transmitter.
Switch Dig1	Manual switching by closing digital input 1 (X3/9-10)
Switch Dig2	Manual switching by closing digital input 2 (X3/6-GND)
Switch Dig3	Manual switching by closing digital input 3 (X3/5-GND)
Switch Dig4	Manual switching by closing digital input 4 (X3/15-GND)
Auto Lower	The sensor with the lower actual value (or available sensor in case of a faulty sensor) is used automatically
Auto Higher	The sensor with the higher actual value (or available sensor in case of a faulty sensor) is used automatically
Sens.1 – Sens.2	The difference of both connected sensors is taken as actual value

0415	0415 SENSOR TYPE 4 – 20mA	Selection of the sensor type and input terminal
-------------	--------------------------------------	--

Possible settings:	- analog I 4-20mA	- analog I 0-20mA	- analog U 0-10V
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For correct operation the suitable signal input type regarding to the connected sensor has to be selected.

Sensor type:		Terminals:
- analog I 4-20mA - analog I 0-20mA	The actual value is represented by a current signal connected to following terminals:	X3/2 -> Sensor 1 * X3/4 -> Sensor 2
- analog U 0-10V	The actual value is given from a voltage signal connected to following terminals:	X3/6 -> Sensor 1 * X3/5 -> Sensor 2

* ... Sensor 2 is not available for the SINGLE Inverter configuration

0420	0420 SENS. RANGE 20mA = 10.00 Bar	Sensor range	G
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Possible settings:	0.00 – 10000
--------------------	--------------

Determines the end value (=20mA or 10V) of the connected sensor.
The maximum sensor range -> 20mA = 100% of the sensor range must be set.

For example:

10 bar pressure sensor	=> 20mA = 10bar
0.4 bar differential pressure sensor	=> 20mA = 0.4 bar
Flowmeter (Flowrate= 36m ³ /h)	=> 20mA = 36m ³ /h

0425	0425 SENS. CURVE linear	Sensor curve
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Possible settings:	linear, quadratic
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Internal calculation based on the actual value

Possible setting and its application:

- **linear:** Pressure control, differential pressure control, level, temperature and flow control (inductive or mechanical).
- **quadratic:** Flow control using an orifice plate together with a differential pressure sensor.

0430	0430 SENS 1 CAL 0 0% = actual value	Sensor 1 zero point calibration
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Possible settings: - 10% up to +10%

This parameter is used to calibrate the minimum value of Sensor 1. After setting the dimension unit and the sensor range the zero point for this sensor can be adjusted. Adjustable range between -10 % and +10 %.

0435	0435 SENS 1 CAL X 0% = actual value	Sensor 1 upper range value calibration
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Possible settings: - 10% up to +10%

To set the calibration for the upper range value of sensor 1, this parameter can be used. After setting the right dimension unit and sensor range the upper range value can be adjusted between -10 and +10%.

0440	0440 SENS 2 CAL 0 0% = actual value	Sensor 2 zero point calibration	
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Possible settings: - 10% up to +10%

Zero point calibration for Sensor 2, for explanation see Parameter 0430.

0445	0445 SENS 2 CAL X 0% = actual value	Sensor 2 upper range value calibration	
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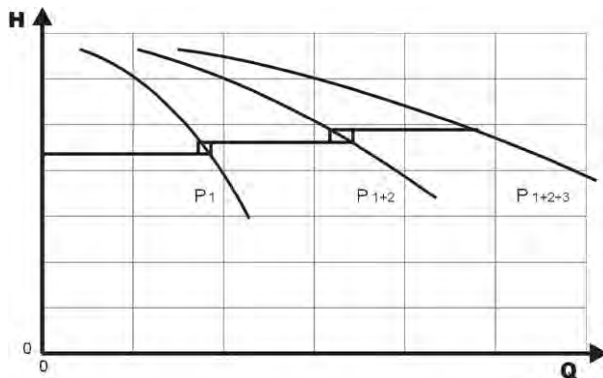
Possible settings: - 10% up to +10%

Upper range calibrations for Sensor 2, for explanation see Parameter 0435.

Using the parameters of this submenu, all necessary settings can be done for running a multi-pump system (even in cascade relay and cascade serial / synchron mode).

Application Example:

- 1) Lead pump reaches its ENABLE FREQUENCY [0515]
- 2) Actual value falls and reaches the cut in-value of the 1st assist pump
Cut in-value = REQUIRED VALUE [02] – ACT. VAL. DEC. [0510]
→ the 1st assist pump is switched on automatically
- 3) After the start up the new required value is calculated in the following way:
NEW REQUIRED VALUE = REQ.VAL. [02] – ACT.VAL.DEC [0510] + ACT.VAL.INC. [0505].
The new required value is shown in the main menu as parameter EFF.REQ.VAL. [03].





Calculations of the new required value for multi pump applications:

k ... number of active pumps (k > 1)

$$p = p_{\text{set}} + (k-1) \cdot [\text{lift value} - \text{fall value}]$$

- Lift value = Fall value ⇒ **Pressure constant** independent how many pumps are in operation
- Lift value > Fall value ⇒ **Pressure rises** when assist pump switches on
- Lift value < Fall value ⇒ **Pressure falls** when assist pump switches on



The following 3 parameters are responsible for starting the assist pumps and to calculate the new required value as well.

0505	0505 ACT.VAL.INC. 0.35 Bar	Lift value	 
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Possible settings: 0.00 – to the pre selected sensor range


0510	0510 ACT.VAL.DEC. 0.15 BAR	Drop value	 
-------------	--------------------------------------	------------	--

Possible settings: 0.00– to the pre selected sensor range

0515	0515 ENABLE FRQ 48.0 Hz	enable frequency for the next power unit	 
-------------	-----------------------------------	--	--


Possible settings: 0.0 – 70.0 Hz

Using this parameter the desired release frequency for the following pumps can be selected. If a pump in the system reaches this frequency and the system pressure drops below the REQUIRED VALUE [02] - ACTUAL VALUE DECREASE [0510], the next pump is started.

0520	0520 ENABLE DLY 5 sec	Enable delay time (for cascade relay only!)	
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Possible settings: 0 – 100 sec

If the conditions for starting an assist pump are fulfilled, the fix speed pump will start after this selected time.

0525	0525 SW DELAY 5 sec	Switch delay (for cascade relay only!)	
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Possible settings: 0 – 100 sec

Delay time between two switching actions of the fix speed pump. That parameter prevents the system against repeated switching actions caused by the variation of the consumption.

0530	0530 DISABLE FRQ 30 Hz	Disable frequency (for cascade relay only!)	
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Possible settings: 0.0 – 120.0 Hz


The frequency to switch off the fixed speed pumps in cascade relay- mode can be set by this parameter.

If the MASTER Inverter goes below that frequency for longer than the pre-selected DISABLE DLY [0535] and the system pressure is higher than the EFFECTIVE REQ. VALUE [03] (REQUIRED VALUE [02] + ACTUAL VAL. INC [0505]), the first assist pump stops.

0535	0535 DISABLE DLY 5 sec	Disable delay time (for cascade relay only!)	
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Possible settings:	0 – 100 sec
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Delay time before switching off the assist up pumps in cascade relay mode.

0540	0540 DROP FRQ 42 Hz	Drop frequency (for cascade relay only!)	
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Possible settings:	0.0 – 70.0 Hz
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This parameter is used to prevent the system from pressure hammers. Before a following pump starts up, the MASTER Inverter will drop to the selected frequency. If the DROP FREQUENCY is reached, the follow-up-pump gets released and the MASTER Inverter will continue with normal operation.

0545	0545 OVERVALUE OFF	Overvalue (for cascade relay only!)	
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Possible settings:	OFF – pre selected sensor range
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If this selected value is reached, an immediate shut-off of the follow-up-pumps is executed.

E.g. REQUIRED VALUE [02]: 5.00 bar
 OVERVALUE [0545]: 7.50 bar

If three pumps are running (1 MASTER Inverter + 2 follow-up-pumps) and a system pressure of 7.50 bar is reached, one after another assist pump is switched off.

This parameter prevents the system against overpressure in case the HYDROVAR has been parameterized incorrectly.

0550	0550 OVERVAL DLY 0 sec	Overvalue delay (for cascade relay only!)	
-------------	----------------------------------	--	---

Possible settings:	0.0 – 10.0 sec
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Delay time to switch off an assist pump in case the actual value exceeds the OVERVALUE [0545] limit.

0555	0555 SWITCH INTV 24 hours	Switch interval for cyclic changeover (for cascade serial / synchron only!)	G S
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Possible settings: 0 – 250 hours

This parameter allows an automatic change over of the MASTER pump and the assist pumps, in order to provide even wear and achieve even operating hours of the pumps.

The switch interval is used for HYDROVAR MASTER Inverters only (connected via the RS-485 interface) by using operation mode Cascade Serial or Cascade Synchron.

Synchronous Control

By using the synchronous control mode all pumps in the system maintain the set pressure by running at the same frequency.

The 2nd pump starts, when the 1st pump reaches the ENABLE FRQ. [0515] and the system pressure drops below ACTU.VAL.DEC. [0510] -> both pumps will run synchronously.

The assist pump will stop, when the frequency drops below the set SYNCHR. LIMIT [0560]. This function creates a hysteresis effect which prevents the assist pump against a frequent on/off operation.

To find out the right setting:

- Start the first pump in JOG Mode [62]; Increase the frequency till you reach the required value. Check the frequency (= f_0) at zero consumption
- Set the synchronous limit ($f_0 + 2..3$ Hz)
- Set the synchronous window between 1 or 2 Hz (depending on the pump curve and set point).

0560	0560 SYNCHR. LIM. 0.0 Hz	Frequency limit for synchronous control	G S
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Possible settings: 0 .0 Hz - Max. frequency

This parameter is used for switching off the first assist pump in synchronous mode. So if the frequency of both pumps drops below this selected value, the first assist pump stops.

0565	0565 SYNCHR. WND. 2.0 Hz	Frequency window for synchronous control	G S
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Possible settings: 0.0 – 10 Hz

Frequency limit for switching off the next assist pump.

E.g. switching off the 3rd pump:

All 3 pumps are running at a frequency < SYNCHR. LIM. [0560] + SYNCHR. WIN. [0565]

or: switching off the 4th pump:

All 4 pumps are running at a frequency < SYNCHR. LIM. [0560] + 2x SYNCHR. WIN. [0565]

0570	0570 MSTPRIORITY ON	MASTER priority (for cascade serial / synchron only!)	G S
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Possible settings: ON - OFF

This parameter determines the alternation order when MASTER and BASIC Inverters are used within one system. In such a case you have to select if either the MASTER or the BASIC Inverters should be switched on first.

ON- all MASTER Inverters in the system are released (unless it is stopped by a failure or manually) before the first BASIC Inverter gets released.

For example: Address 1-3.....MASTER Inverters
 Address 4-8.....BASIC Inverters

<u>Switching order:</u>	Adr 1	Adr 2	Adr 3	Adr 4	Adr 5	Adr 6	Adr 7	Adr 8
	MASTER	MASTER	MASTER	BASIC	BASIC	BASIC	BASIC	BASIC

OFF- One MASTER (which is responsible for the controlling according the set value) is running. With rising consumption all BASIC Inverters have to be released before any other MASTER starts running.

<u>Switching order:</u>	Adr 1	Adr 4	Adr 5	Adr 6	Adr 7	Adr 8	Adr 2	Adr 3
	MASTER	BASIC	BASIC	BASIC	BASIC	BASIC	MASTER	MASTER

0600	0600 SUBMENU ERRORS	
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0605	0605 MIN. THRESH. disabled	minimum threshold limit
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Possible settings: disabled - max. SENSOR RANGE

- An adjusted value >0.00 has to be reached within the programmed DELAY TIME [0610]
- If this value can't be reached, the HYDROVAR stops with the failure message MIN. THRESHOLD ERROR.
- To disable the minimum threshold limit, press ▼ till disabled is shown on the display.

0610	0610 DELAY - TIME 2 Sec	minimum threshold limit delay time	G
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Possible settings: 1 – 100 sec

Delay time to switch-off the HYDROVAR in case the actual value drops below the min. threshold limit or a connected external low water protection at terminals X3/11-12 has been opened.

Notice: The min. threshold function is also active during start up of the pump! Therefore the delay time has to be set higher than the duration that is needed, to reach a value above the limit.

0615	0615 ERROR RESET ON	Automatic error reset	G
------	------------------------	-----------------------	----------

Possible settings: ON – OFF


ON: Allows an automatic restart for 5 times in case of a failure. If the failure is still active after the 5th restart, the HYDROVAR will shut off and the appropriate error message is shown.

The internal counter of the automatic error reset is decreased by 1 after each operating hour, so if an error could be reset after 3 restarts, there are 3 further restarts possible after one hour, 4 after two hours and 5 automatic restarts after 3 operating hours. A manual reset can be done by switching an external ON/OFF (X3/7-8) contactor.

Not each error can be reset automatically.
(For detailed information see chapter 11 failure messages)

OFF: if the ERROR RESET is set to OFF, each failure would be shown on the display directly and must be reset manually.


0700	0700 SUBMENU OUTPUTS	
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0705	0705 ANALOG OUT1 Output Frequency	Analogue output 1	
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Analogue output 0 – 10V = 0 - 100%

Terminal: X3/20

Possible settings: - Actual value
- Output frequency (0 - fmax)

0710	0710 ANALOG OUT2 Actual value	Analogue output 2	
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Possible settings: Actual Value, Output frequency

Analogue output 4 – 20mA = 0 - 100%

Terminal: X3/21

Possible settings: - Actual value
- Output frequency (0 - fmax)

0715	0715 CONF REL 1 Running	Configuration of the status relay 1 (X5/1-2-3)
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0720	0720 CONF. REL 2 Errors	Configuration of the status relay 2 (X5/4-5-6)
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Possible settings: Power, Errors, Warnings, StandBy, Errorreset, Errors of BASICS, Warnings+BASICS

config.	explanation of status	Action if status=YES
Power	HYDROVAR is connected to power supply	Relay 1: X5/ 1-3 closed Relay 2: X5/ 4-6 closed
Running	Motor is running	Relay 1: X5/ 1-3 closed Relay 2: X5/ 4-6 closed
Errors	An error is indicated on the HYDROVAR (incl. power failure)	Relay 1: X5/ 1-2 closed Relay 2: X5/ 4-5 closed
Warnings	A warning is indicated on the HYDROVAR	Relay 1: X5/ 1-2 closed Relay 2: X5/ 4-5 closed
StandBy	Pump is released manually and by external release, no error/warning is indicated and HYDROVAR doesn't run	Relay 1: X5/ 1-3 closed Relay 2: X5/ 4-6 closed
Errorreset	If Parameter ERRORRESET [0615] is activated and a Warning occurs 5 times -> Error ->	Relay 1: X5/ 1-3 closed Relay 2: X5/ 4-6 closed
Error of BASICS	A failure is indicated at least on one BASIC	Relay 1: X5/ 1-2 closed Relay 2: X5/ 4-5 closed
Warnings + BASICS	A warning is indicated on the HYDROVAR or at least on one BASIC	Relay 1: X5/ 1-2 closed Relay 2: X5/ 4-5 closed

0800	0800 SUBMENU REQUIRED VALUES	
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0805	0805 C.REQ.VAL 1 digital	Configuration required value 1
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
Possible settings:	- digital	- analog U 0-10V	
	- analog I 0-20mA	- analog I 4-20mA	

Digital	The internal required value 1 is used. Setting in the main menu in Parameter 02 or parameter [0820].
analog U=0 – 10V	The required value 1 is determined by the value of a voltage signal (0 – 10V) connected to terminals X3/13- X3/14 (GND).
analog I=0 – 20mA	The required value 1 is determined by the value of a current signal (4 – 20mA or 0 – 20mA) connected to terminals X3/18- X3/17 (GND).
analog I=4 – 20mA	<u>Notice:</u> If the incoming current signal drops below 4mA (4-20mA setting), a warning message is shown on the display. If the failure is still active after 20 seconds, an error message will be shown.

The changeover between the 1st and the 2nd required value can be done either internally or externally via the digital inputs. With the following parameters the source of the required values and the change over can be configured.

0810	0810 C.REQ.VAL 2 OFF	Configuration required value 2
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Possible settings:	- OFF	- digital	- analog U 0-10V
	- analog I 0-20mA		- analog I 4-20mA

OFF	Required value 2 is not used.
digital	The internal required value 2 is used. Setting in the main menu in Parameter 02 or Parameter [0825].
analog U 0 – 10V	The required value 2 is determined by the value of a voltage signal (0 – 10V) connected to terminals X3/15- X3/16 (GND). 
analog I 0 – 20mA	The required value 2 is determined by the value of a current signal (4 – 20mA or 0 – 20mA) connected to terminals X3/23- X3/22 (GND). 
analog I 4 – 20mA	<u>Notice:</u> If the incoming current signal falls below 4mA (4-20mA setting), a warning message is shown on the display. If the failure is still active after 20 seconds, an error message will be shown.



0815	0815 SW REQ. VAL Setpoint 1	Switching between required value 1 and 2
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Possible settings:	- Setpoint 1	- Setpoint 2
	- Switch Dig 1	- Switch Dig 2
	- Switch Dig 3	- Switch Dig 4

- Setpoint 1: Only required value 1 is active (No switching possible)
- Setpoint 2: Only required value 2 is active (No switching possible)
- Switch Dig 1: Manual switching by closing digital input 1 (X3/9-10)
- Switch Dig 2: Manual switching by closing digital input 2 (X3/6-10)
- Switch Dig 3: Manual switching by closing digital input 3 (X3/5-10)
- Switch Dig 4: Manual switching by closing digital input 4 (X3/15-16)

0820	0820 REQ.VAL.1 XX.X Bar	Required value 1 (digital)
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Possible settings:	0.0 – to the pre selected sensor range
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0825	0825 REQ.VAL.2 XX.X Bar	Required value 2 (digital)
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Possible settings:	0.0 – to the pre selected sensor range
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Set the desired required value with either ▲ or ▼.

This pre-selected required value is active in all modes except Actuator if parameter C.REQ.VAL.1 [0805] or C.REQ.VAL.2 [0810] is set to digital, and parameter SW REQ.VAL. [0815] is set to setpoint 1/2 or the REQUIRED VALUE 1/2 is selected via digital input.

This pre-selected required value could also be taken over in the main menu with parameter REQUIRED VAL. [02] if the current required value is active.

0830	0830 ACTUAT.FRQ 1 XX.X Hz	Required frequency 1 for actuator
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Possible settings:	0.0 – MAX. FREQ. [0245]
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0835	0835 ACTUAT.FRQ 2 XX.X Hz	Required frequency 2 for actuator
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Possible settings:	0.0 – MAX. FREQ. [0245]
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Set the frequency with either ▲ or ▼

The selected frequency in this parameter is only active in the actuator mode if parameter C.REQ.VAL.1 [0805] or C.REQ.VAL.2 [0810] is set to digital, and parameter SW REQ.VAL [0815] is set to setpoint 1/2 or the ACTUATOR FREQUENCY 1/2 is selected via digital input.

0900	0900 SUBMENU OFFSET		
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The different analogue inputs on terminals X3/13-24 can be used also to connect a second actual value signal as offset source for the required value.

0905	0905 OFFS. INPUT OFF	Selection of the Offset Input	
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Possible settings:	OFF	analog U1 0-10V analog I1 0-20mA / 4-20mA	analog U2 0-10V analog I2 0-20mA / 4-20mA
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OFF	Offset disabled
analog U 1 0-10V	Offset will be calculated according to the voltage signal (0 – 10V) connected to terminals X3/13 (Required Value 1) - X3/14 (GND).
analog U 2 0-10V	Offset will be calculated according to the voltage signal (0 – 10V) connected to terminals X3/15 (Required Value 2)- X3/16 (GND)
analog I 1 0/4 – 20mA *	Offset will be calculated according to the current signal (4 – 20mA or 0 – 20mA) connected to terminals X3/18 (Required Value 2) - X3/17 (GND).
analog I 2 0/4 – 20mA *	Offset will be calculated according to the current signal (4 – 20mA or 0 – 20mA) connected to terminals X3/23 (Required Value 2) - X3/22 (GND).

- Notice: If the incoming current signal drops below 4mA, a warning message is shown on the display but the HYDROVAR keeps operating without the Offset function.

0907	0907 OFFSET RANGE 100	Representation of the sensor range	
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Possible settings:	0 – 10000
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The Offset Range can be set to a number between 0 and 10000. Its value depends on the maximum range of the connected offset sensor. Settings of the x- axis are shown in the chart below.

E.g.: 16 bar sensor can be set as range: 16; 160; 1600

The higher the set offset ranges the higher is the resolution on the signal input.



0910	0910 LEVEL 1 0	Offset active between 0 and LEVEL 1
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Possible settings: 0 – OFFSET RANGE



0912	0912 OFFSET X1 0	Offset signal value
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Possible settings: 0 – LEVEL 1

Designation of the x – coordinate as absolute value



0913	0913 OFFSET Y1 0,00 bar	Desired value
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Possible settings: 0 – standardization of the sensor

Desired value; designation of the y – coordinate as absolute value



0915	0915 LEVEL 2 100	Offset active between LEVEL 2 and OFFSET RANGE
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Possible settings: LEVEL 1 – OFFSET RANGE



0917	0917 OFFSET X2 100	Offset signal value
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Possible settings: LEVEL 2 – OFFSET RANGE

Designation of the x – coordinate as absolute value



0918	0918 OFFSET Y2 0,00 bar	Desired value
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Possible settings: 0 – standardization of the sensor

Desired value; designation of the y – coordinate as absolute value

Example for using the Offset function:

Constant pressure system with required value of 5 bar.

Additionally a flow sensor is connected to the Offset input.

Parameter [907] - Offset Range = 160 (max. range of flow sensor = $16\text{m}^3/\text{h}$)

System requirement 1:

5 bar constant pressure while the flow rate is between $5\text{m}^3/\text{h}$ and $12\text{m}^3/\text{h}$.

Below the $5\text{m}^3/\text{h}$ the pressure should be decreased with the limitation to have max. 2,5 bar at a flow rate of $2\text{m}^3/\text{h}$.

Settings:

Parameter [0910] - Level 1 = 50 = $5\text{m}^3/\text{h}$ (first limit where the offset function is active)

Parameter [0912] - Offset X1 = 20 = $2\text{m}^3/\text{h}$ (fixed point according the requirements)

Parameter [0913] - Offset Y1 = 2,5 = 2,5bar (max. allowed pressure at this flow rate)

System requirement 2:

5 bar constant pressure while the flow rate is between $5\text{m}^3/\text{h}$ and $12\text{m}^3/\text{h}$.

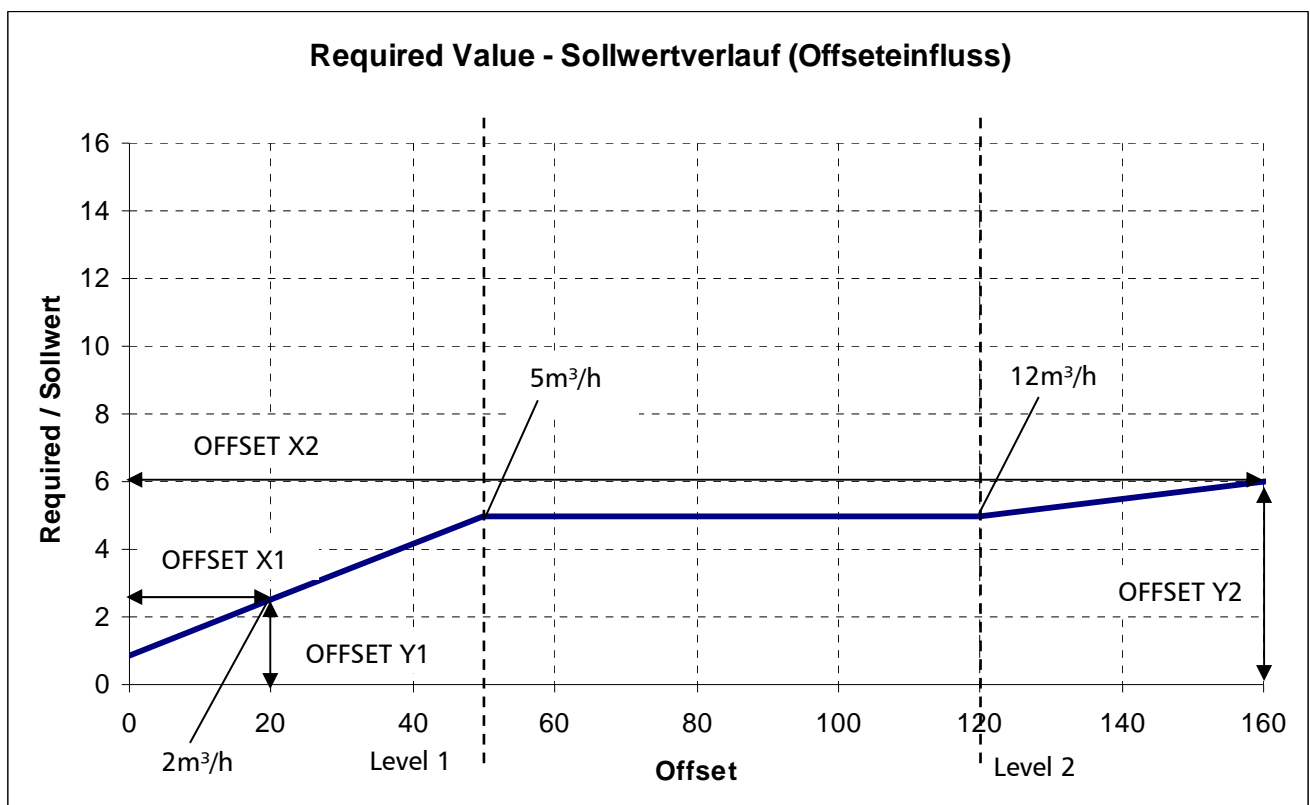
Above the $12\text{m}^3/\text{h}$ the pressure should be increased with the limitation to have max. 6,0 bar at max. flow rate of $16\text{m}^3/\text{h}$.

Settings:

Parameter [915] - Level 2 = 120 = $12\text{m}^3/\text{h}$ (second limit where the offset function is active)

Parameter [917] - Offset X2 = 160 = $16\text{m}^3/\text{h}$ (fixed point according the requirements)

Parameter [918] - Offset Y2 = 6 = 6bar (required pressure at this flow rate)



1000	1000 SUBMENU TEST RUN	
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1005	1005 TEST RUN after 100 hrs	Automatic test run	G
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Possible settings: OFF – 100 h.

The Automatic Test Run starts up the pump after the last stop to prevent the pump from blocking.

Test Run Time, Frequency and Boost can be selected in the parameters below.

To disable the automatic test run, press ▼ until OFF appears on the display.

The test run is only active when the HYDROVAR is stopped but manually released and external ON/OFF contact (X3/7-8) is closed!

1010	1010 TESTRUN FRQ. 30.0 Hz	Frequency for manual and automatic test run	G
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Possible settings: 0 – Fmax

1015	1015 TESTR. BOOST 10.0 %.	Setting of the motor starting voltage in % of rated input voltage	G
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Possible settings: 0 – 25% of maximum input voltage is possible

1020	1020 TESTR. TIME 5 sec	Test Run time	G
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Possible settings: 0-180 sec.

1025	1025 SEL. DEVICE 01	Select Inverter for manual test run	S
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Possible settings: 01-08

1030	1030 TESTRUN MAN Press ► 3 sec.	Manual Test Run, Confirm test run for selected unit
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With this parameter it is possible to perform a manual Test Run for one selected unit. (Even fixed speed pumps in Cascade Relay Mode can be included into the test run function)

By pressing ► button for approx. 3 sec. a test run will be started.

1100	1100 SUBMENU SETUP	
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1110	1110 FACTORY SET EUROPE	Restores the HV to factory setting
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Possible settings:	EUROPE, USA
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To restore the HYDROVAR to factory settings select Europe or USA.
For reset press ► button till DONE appears.

1120	1120 PASSWORD 2 0000	Enter password by pressing ▲ or ▼
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The below mentioned parameters are available after entering the right password!
For more information, pls. contact your local distributor!

1125	1125 CLR ERRORS UNIT X	Clear error memory of selected unit or on ALL units (Cascade Serial/Synchron)
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Possible settings:	1 – 8, ALL
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To clear the error memory either (1-8) for one specific unit or ALL for all units, can be selected.
For reset press ► button till RESET appears.

1130	1130 CLR MOTORH. UNIT X	Clear motor hours for selected unit or on ALL (Cascade Serial/Synchron)
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Possible settings:	1 – 8, ALL
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Set desired unit where the Motor Hours should be cleared (or ALL) and press ► button till RESET appears.

1135	1135 CLR OPERAT. Press ► 3 sec.	Clear operation time
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The operation time indicates the total time the HYDROVAR is already connected to power supply. For reset the operation time of the current HYDROVAR press ► button till RESET appears.

1200	1200 SUBMENU RS485- INTERFACE	
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User Interface

The following 3 Parameters are necessary for the communication between the HYDROVAR and an external device (e.g. PLC) via standardized Modbus-protocol. Set desired address, Baudrate and Format according the system requirements.

1205	1205 ADDRESS 1	Set desired address for the user interface
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Possible settings:	1 - 247
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1210	1210 BAUDRATE 9600	Baudrate for user interface
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Possible settings:	1200, 2400, 4800, 9600, 14400, 19200, 38400
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1215	1215 FORMAT RTU N81	Format for user interface
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Possible settings:	RTU N81, RTU N82, RTU E81, RTU O81, ASCII N72, ASCII E71, ASCII O71
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Internal Interface

If several MASTER Inverters are connected via the internal RS-485 interface (max. 8 / using cascade serial mode) each HYDROVAR needs its own allocated pump-address number (1-8). **Each address may only be used once!**

1220	1220 PUMP ADDR. 1	Select desired address for the MASTER Inverter	
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Possible settings:	1-8
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Set desired address for the current MASTER Inverter and press ► button for approx. 3 sec. and the following messages will appear:

Addressing	->	1220 PUMP ADDR.	or	1220 PUMP ADDR.
Addressing		* 1 *		- 1 -

Addressing done

Addressing failed - retry

When using MASTER and BASIC Inverters together in a multi-pump-system you have to consider that the BASIC Inverters have their separate address. Otherwise a correct function of the system couldn't be guaranteed.

For detailed Information see chapter 9.4.3.2 Addressing.

11 Failure messages



If the HYDROVAR is stopped by an error (warning), the HYDROVAR as well as the motor remain under voltage.

Before any work is carried out on the electrical or mechanical part of the system, the HYDROVAR must be disconnected from power supply.

Difference between warnings and errors:

- **Warnings** are shown on the display and even by the red failure led. If a warning is active and the cause is not remedied within 20 seconds an error will be shown and the HYDROVAR stops.
However it is possible that the HYDROVAR keeps running (depends to the different warnings).
- **Errors** are indicated on the HYDROVAR display and by the red failure LED placed on the control panel. In case of an error 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 failure appeared.

The following information describes each error which can occur on the HYDROVAR (even on the MASTER /SINGLE and the BASIC Inverter). Additionally the possible countermeasures to reset these errors are described.

- Please note that an **automatic error-reset** can be activated in SUBMENU ERRORS to reset an occurred failure automatically for 5 times. For more information about this function see parameter ERROR-RESET [0615].
- All **error signals and warnings** can be **indicated** via the two **status-relays** on terminals X5/1-2-3 or X5/4-5-6 depending on the configuration.
(How to program see parameter CONF REL 1 [0715] and CONF REL 2 [0720])

11.1 BASIC Inverter

The HYDROVAR in configuration BASIC Inverter (only the power unit), is able to indicate the following errors by the red LED:

red LED Code	Error	probable cause
1 blink	UNDERVOLTAGE	DC voltage of the HYDROVAR too low
2 blinks	OVERCURRENT or OVERLOAD	Current rise at the output too high or power limit of the HYDROVAR is reached
3 blinks	INVERTER OVERHEAT	Too high temperature inside the HYDROVAR
4 blinks	OVERVOLTAGE	DC voltage of the HYDROVAR too high
5 blinks	CODE ERROR	Internal error
6 blinks	MOTOR OVERHEAT EXTERNAL CONTACT	PTC in the conduit box has reached its release temp. or external contact is open

Reset:	<p>To reset the CODE ERROR and the OVERCURRENT ERROR , the power supply has to be cut > 60 seconds.</p> <p>A reset of all other errors can be done by open/close the START/STOP_PTC input (X1/PTC) on the power unit.</p>
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If the **BASIC Inverter** is used in combination with a **MASTER Inverter**, each failure can be indicated on the **MASTER Inverter** too and will be saved in the failure memory including date and time when the failure appeared.

ERR. BASIC Addr. X	<p>Indication on the MASTER Inverter:</p> <p>For detailed failure information on the specific unit, SUBMENU STATUS [20] has to be entered and the affected device has to be selected with it's pump address!</p>
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If a **MASTER Inverter** is used in such a system, the errors which occurred on the **BASIC Inverter** can be reset by the **MASTER** without interfere the operation of the other **HYDROVAR** units in the system (also valid for automatic Error-reset).

11.2 MASTER / SINGLE Inverter

Each error is shown on the display in plain text and saved in the error memory.

The errors can be reset automatically (depending on the setting in parameter ERROR-RESET [0615]) or manually in following ways:

- cutting the power supply for > 60 seconds
- pressing ◀ and ▶ simultaneously for about 5 seconds
- open and close the External ON/OFF (Terminals X3/7-8)

No error-message on the display

Error	probable cause	measure
no AUTOSTART after power failure	Parameter AUTOSTART [08] is set to OFF	Check parameter AUTOSTART [08]
No operation even system pressure < set pressure	Pressure higher than the start value or REGULATION MODE has been changed to INVERSE.	check parameter START VALUE [04] and/or REGULATION MODE [0320]



Error-message on the display

Error	probable cause	measure
OVERCURRENT ERROR 11	Current rise at the output too high	<ul style="list-style-type: none"> • check connection-terminals of the HYDROVAR • check the connection-terminal of the motor and the motor-cable • check the windings of the motor

Reset:

- cutting of the power supply for >60 seconds.
- automatic Error-reset not possible for that kind of failure!

Error	probable cause	measure
OVERLOAD ERROR 12	Power limit of the HYDROVAR is exceeded	<ul style="list-style-type: none"> • check Parameter RAMP 1/2 [0215/0220] (too short) and BOOST [0265] (too low) • check motor connection (star/delta) and cable • Pump blocked • Motor turns in the wrong direction before running (Non return-valve defect) Not allowed operation point or MAX. FREQUENCY [0245] too high check also the BOOST [0265].
OVERVOLTAGE ERROR 13	DC voltage of the HYDROVAR too high	<ul style="list-style-type: none"> • Parameter RAMP 2 [0220] too fast • Power supply too high • Voltage peaks too high • (Solution: Line filters, Line inductance, RC-element)
INVERT. OVERHEAT ERROR 14	too high temperature inside the HYDROVAR	<ul style="list-style-type: none"> • no proper cooling • contamination of the motor vents • ambient temperature too high
THERMO MOT/EXT ERROR 15	An external protective device connected to terminal X1/PTC has released (e.g. PTC which is connected has reached its release temperature)	<ul style="list-style-type: none"> • close X1/PTC if there is no external protective device connected • close external on/off switch if connected to these terminals • For detailed information how the terminal X1/PTC could be used see chapter 9.4.3
PHASELOSS ERROR 16	One phase of the power supply has been lost -> automatic power reduction (just available for the units HV4.055-4.220)	<ul style="list-style-type: none"> • check power supply under full load – check if phase failure at the input • check circuit breakers • visual inspection of points at the input terminals
UNDERVOLTAGE	DC voltage of the HYDROVAR too low	<ul style="list-style-type: none"> • supply voltage too low • phase failure at the input • asymmetry of the phases
COMM LOST	The communication between the Power Unit and the control card doesn't work correctly	<ul style="list-style-type: none"> • check if the addressing of BASIC Inverter [DIP SW.] has been done correctly (retry!) • check if each unit has allocated its own pump address • check if the connection from control card to the power unit is made properly (ribbon cable)

Reset:	<ul style="list-style-type: none"> cutting off the power supply for >60 seconds manual reset by closing external ON/OFF (Terminals X3/7-8) manual reset by pressing ◀ and ▶ simultaneously for about 5 seconds Auto-reset possible if ERROR-RESET [0615] is set to ON 	
LACK OF WATER ERROR 21	<p>Low water contact (X3/11-12) is opened (just active if motor is running)</p> <ul style="list-style-type: none"> incoming pressure or min. level too low bridge X3/11-12, if there is no ext. low water protection adjust Parameter DELAY TIME [0610] if the failure happens only for short time 	
Reset:	<ul style="list-style-type: none"> Automatically if low water contact (X3/11-12) will be closed! 	
MIN. THRESHOLD ERROR 22	<p>defined value of parameter MIN.THRESHOLD [0605] was not reached during the pre-selected DELAY-TIME [0610]</p> <ul style="list-style-type: none"> check booster unit, adjust parameter DELAY TIME [0610] Parameter ERROR RESET [0615] set to ON, to enable 5 restarts (e.g. in empty system) 	
FAILURE SENSOR 1	<p>Sensor signal on terminals X3/2 <4mA</p> <p><u>active Sensor:</u> WARNING (20 sec.)-> ERROR</p> <p><u>non-active sensor:</u> WARNING</p>	<ul style="list-style-type: none"> ACTUAL VALUE signal (pressure transducer) faulty wrong connection Sensor or cable fault check configuration of the sensors in submenu SENSORS [0400]
ACT. VAL. SENSOR 1 ERROR 23		
FAILURE SENSOR 2	<p>Sensor signal on terminals X3/4 <4mA</p> <p><u>active Sensor:</u> WARNING (20 sec.)-> ERROR</p> <p><u>non-active Sensor:</u> WARNING</p>	<ul style="list-style-type: none"> ACTUAL VALUE signal (pressure transducer) faulty wrong connection Sensor or cable fault check configuration of the sensors in submenu SENSORS [0400]
ACT. VAL. SENSOR 2 ERROR 24		
SETPOINT 1 I<4mA	<p>Current signal input of required values is active, but no signal 4-20mA is connected</p> <p>WARNING (20 sec.)-> ERROR</p>	<ul style="list-style-type: none"> check external analogue signal on terminals X3/17-18 check configuration of the required values in Submenu REQUIRED VALUES [0800] 
SETPOINT 1 I<4mA ERROR 25		
SETPOINT 2 I<4mA	<p>Current signal input of required values is active, but no signal 4-20mA is connected</p> <p>WARNING (20 sec.)-> ERROR</p>	<ul style="list-style-type: none"> check external analogue signal on terminals X3/22-23 check configuration of the required values in Submenu REQUIRED VALUES [0800] 
SETPOINT 2 I<4mA ERROR 26		

Reset:	<ul style="list-style-type: none"> • cutting off the power supply for >60 seconds • manual reset by closing External ON/OFF (Terminals X3/7-8) • manual reset by pressing ◀ and ▶ simultaneously for about 5 seconds • Auto-reset possible if ERROR-RESET [0615] is set to ON
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11.3 Internal errors

To quit the following errors you have to cut the power supply for >60 seconds. If the error message is still shown on the display, contact customer service and provide a detailed description of the error.

Internal errors Error-message on the display - red LED on		
ERROR 1	EEPROM-ERROR (data block malfunction)	Reset - after repeated error-message ⇒ change control card
ERROR 4	Button error (e.g.: jammed key)	<ul style="list-style-type: none"> • check push buttons, • Display-board may be defective
ERROR 5	EPROM-error (Checksum error)	Reset - after repeated error-message ⇒ change control card
ERROR 6	Program error: Watchdog error	Reset - after repeated error-message ⇒ change control card
ERROR 7	Program error: Processor pulse error	Reset - after repeated error-message ⇒ change control card
CODE ERROR	Code error: invalid processor command	<ul style="list-style-type: none"> • check the installation of the cables, connection of the screen and potential equalization • check earth/ground • install additional inductances for the signal-cables (e.g. ferrites)

Examples:

Booster unit	
Problem: no stop of the HYDROVAR	
Parts to check	measure
<ul style="list-style-type: none"> • existing demand • non return valve is not closed • pre charge pressure in the pressure tank • incorrect setting of WINDOW and RAMPHYSTERESIS • shut down ramp too slow • suction line too long 	<ul style="list-style-type: none"> • check pipes and valves • change non return valve • adjust according the diagram • set WINDOW [0310] (ca.10%) and HYSTERESIS [0315] (80-50%) • set RAMP 2 [0220] to 4...13 sec. • the MINIMUM FREQUENCY [0250] should be activated for pressure increase at 0 demand

Control on constant flow	
Problem: control fluctuations	
Parts to check	measure
control characteristics are set too low	enlarger WINDOW [0310] and set HYSTERESIS [0315] to 99% to control with RAMP 3 and 4

Circulating pump	
Problem: oscillation of the motor speed	
Parts to check	measure
control settings too fast	<ul style="list-style-type: none"> • increase RAMP 3 [0225] and 4 [0230]: 100...200sec • WINDOW [0310] (ca.20%) and HYSTERESIS [0315] (ca.99%)
Problem: ACTUAL VALUE can't be hold	
Parts to check	measure
HYSTERESIS is set too big	HYSTERESIS [0315]: 90-99%

General	
Problem:	pressure fluctuations, analogue signal not constant
Solution:	<ul style="list-style-type: none"> • check cables and connection of the screen • check earth connection of the transmitter cable • use screened cables

Maintenance

The HYDROVAR does not require any special maintenance. However, the cooling fan and the vents should be free of dust. Also the temperature around the unit should be checked from time to time.

All modifications must be done by qualified personnel! For mounting and repairs at the HYDROVAR, qualified service technicians are available.

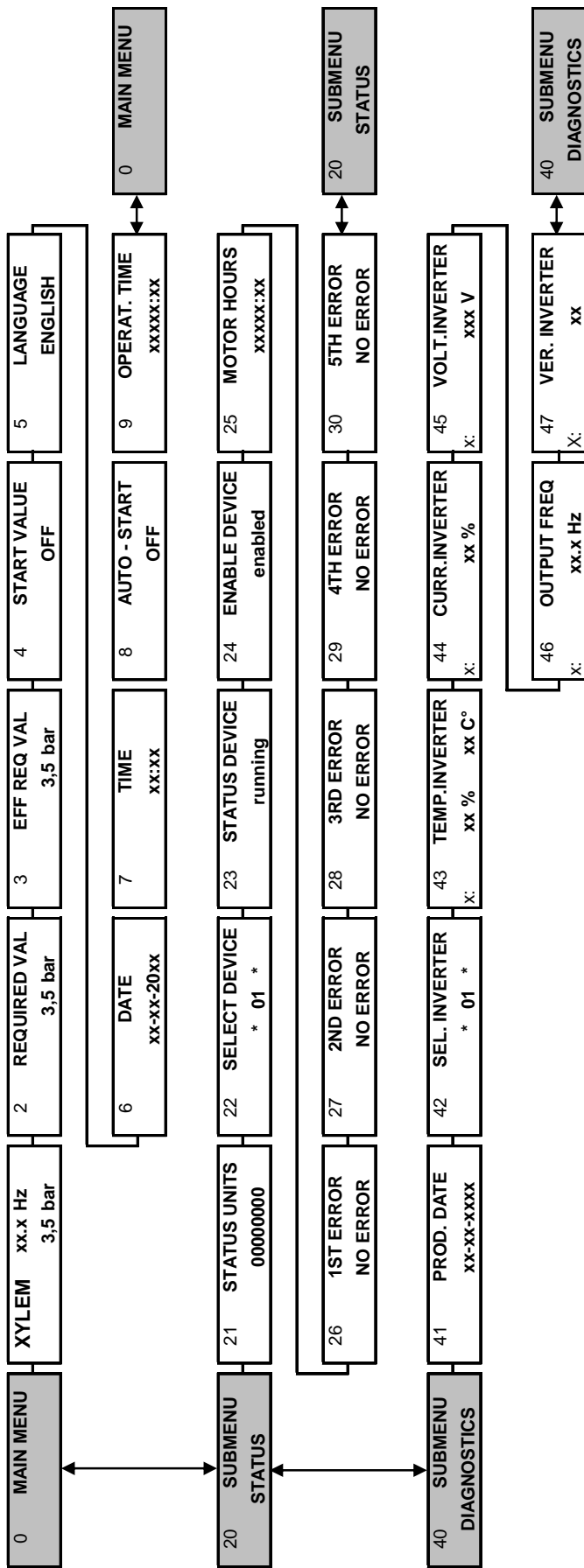
Demounting:

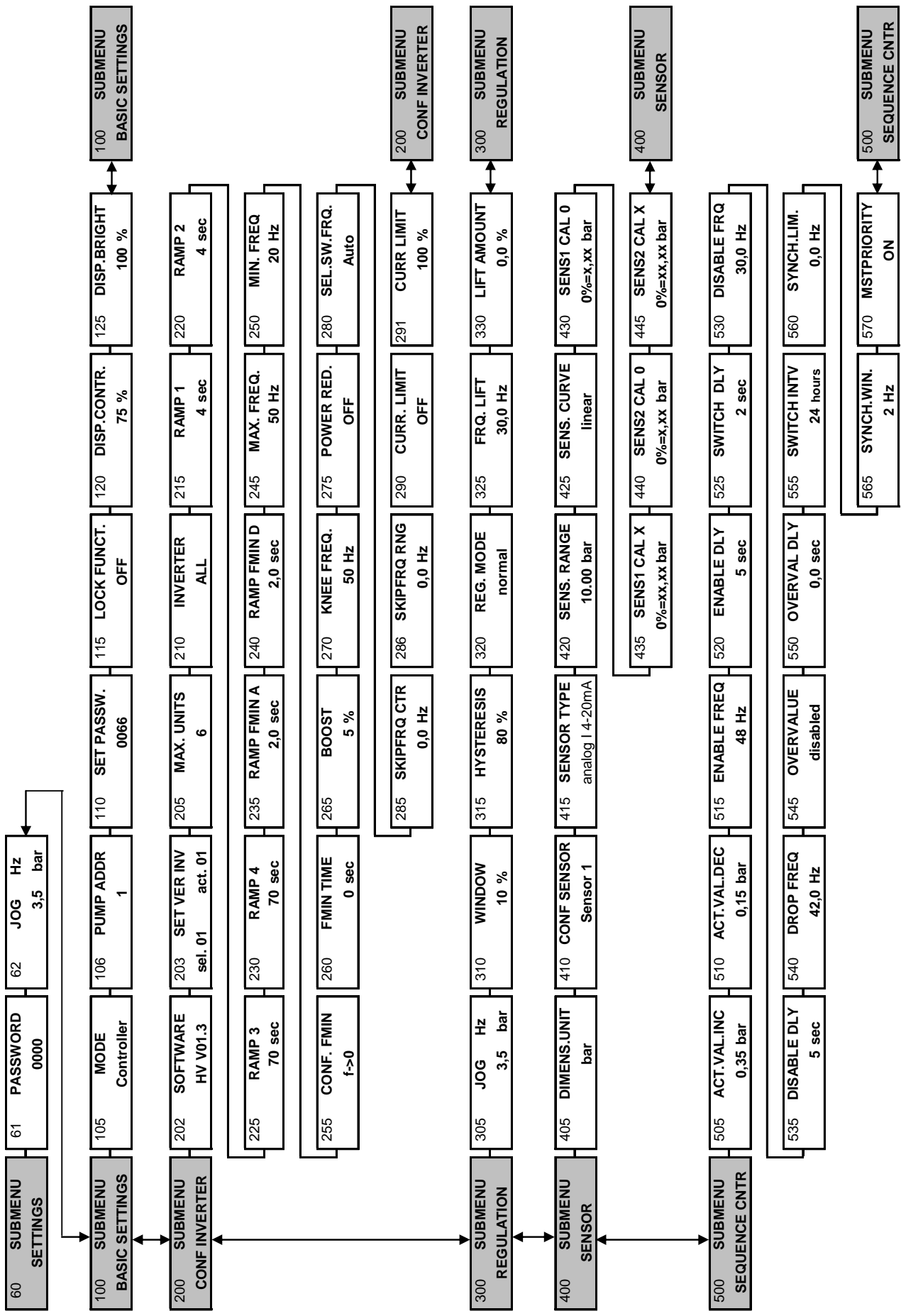
The HYDROVAR must be disconnected from the power supply before any work can be carried out. Consider the pump- and motor-instruction.

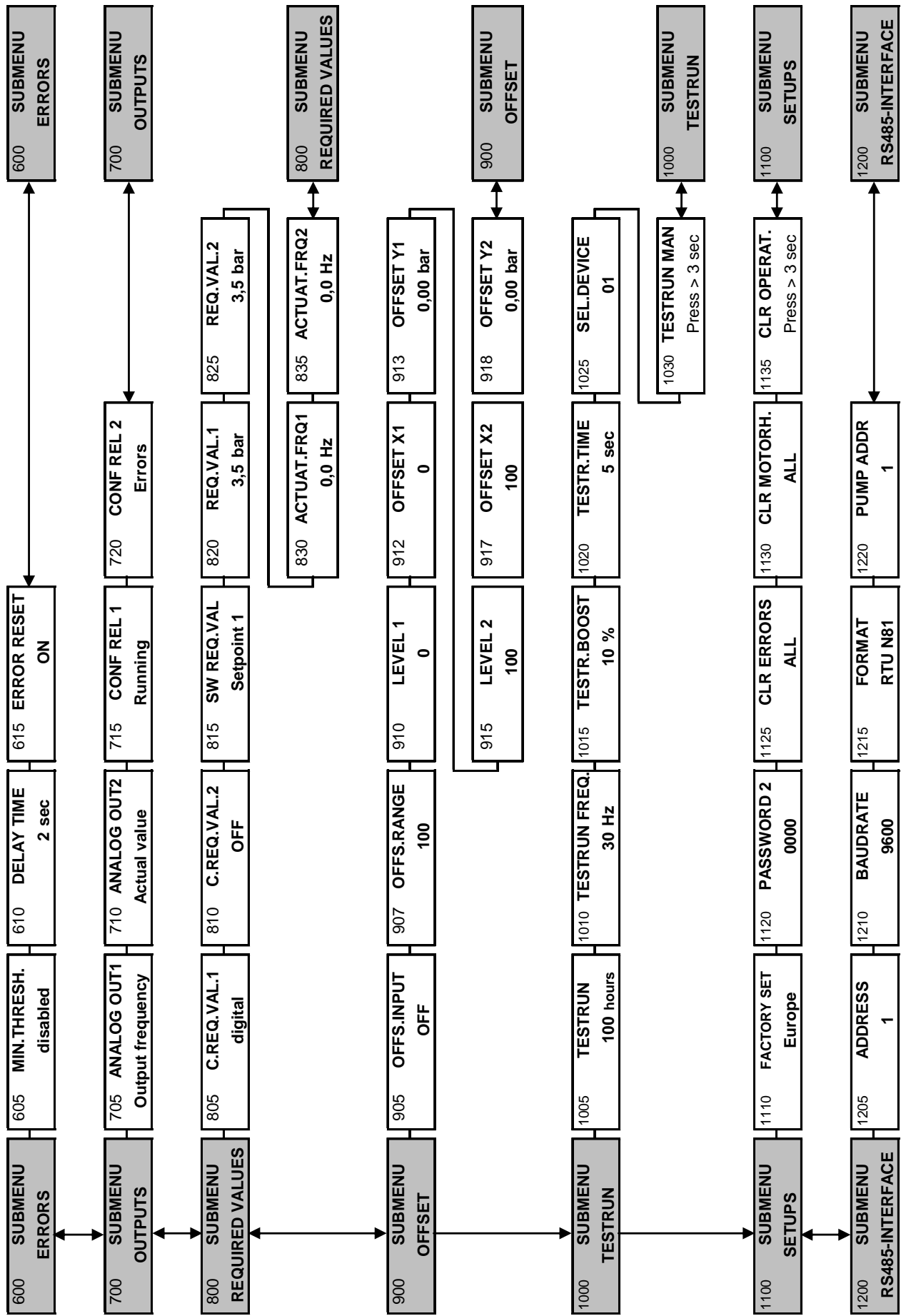
Please wear your personal protection equipment.

For further information, please ask your distributor!

Programming flow chart









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