



**ITT**

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# **HYDROVAR®**

**HV 2.015 / 2.022**

**HV 4.022 / 4.033 / 4.040**

**HV 4.055 / 4.075 / 4.110**

EN: ENGLISH

DE: GERMAN-DEUTSCH

IT: ITALIANO

FR: FRANÇAIS

NL: NEDERLANDS

PT: PORTUGUÊS

ES: ESPAÑOL

Motor-mounted

Motormontage

Montaggio su motore

Montée sur moteur

Montage op de motor

Montada em motor

Motor-Instalado



771079402 Manual HV 2.015-4.110-VL-A

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*Engineered for life*

# Operating Instructions

# **HYDROVAR<sup>®</sup>**

**HV 2.015 / 2.022**

**HV 4.022 / 4.033 / 4.040**

**HV 4.055 / 4.075 / 4.110**

**Motor-mounted**

English



**ITT**

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



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

**In addition to the instructions contained in 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 in the electrical or mechanical part of the system.

Installation, maintenance and repair work may only be carried out by trained, skilled and qualified personnel.

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

During operation, the motor can be stopped by open a digital input or manually operated, 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 power supply, the components of the power unit as well as certain components of the control unit are connected to the power supply.

**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 8 minutes** before starting work on or in the HYDROVAR (the capacitors in the intermediate circuit are discharged by the installed discharge resistors).

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

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

Furthermore, care must be taken not to short circuit the neighbouring components when connecting the external control wires and all cable ends which are not in use are isolated.



The HYDROVAR contains electronic safety devices which switch off the control element in the event of faults, 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 disconnected 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 off itself.

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



The system may only be put into operation when it has been grounded. In addition, 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 upon delivery/receipt of dispatch for damage or missing parts
- The HYDROVAR unit must be transported carefully and by competent personnel.
- Avoid serious impacts

**NOTICE!**

The use of the WEEE Symbol indicates that this product may not be treated as household waste.

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 household waste disposal service provider or the shop where you purchased the product.

**CAUTION!**

Lifting aids (stacker, crane, crane mounting device, lifting blocks, sling ropes, etc.) must have the proper dimensions so that they can bear 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!**

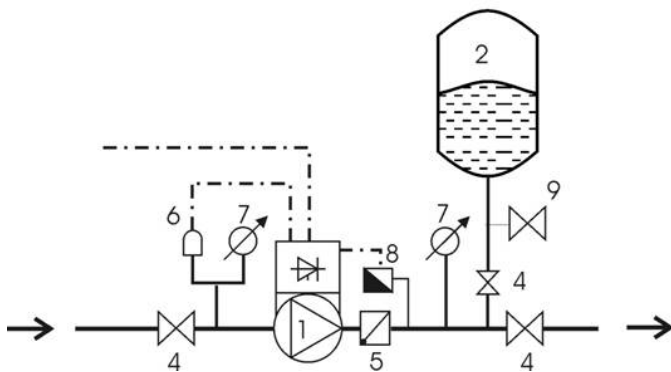
- Do not stand underneath suspended loads
- take note of the general regulations on prevention of accidents
- The HYDROVAR must be secured against tipping over and slipping until it has been fixed in its final location.



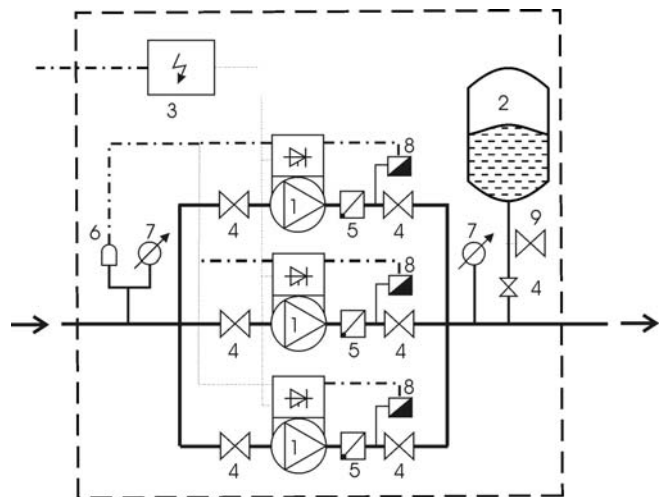
## 2 System Design

The following diagrams show typical single pump and multi-pump systems using the HYDROVAR control unit. Connection can be made directly to a water supply. In such a case, a pressure switch on the suction side should be used.

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

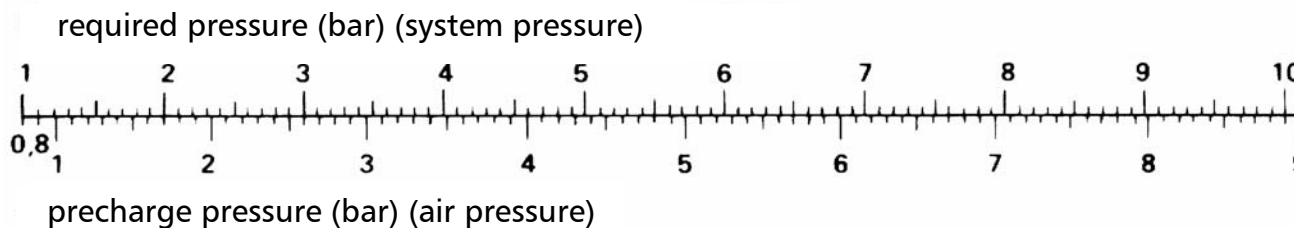
A diaphragm pressure tank is used on the discharge side of the pump to maintain pressure in the line when there is no demand. This will keep the pumps from continuing to run at zero demand. With the HYDROVAR, no large tanks are required for supply purposes. The tank must be permitted and suitable for 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 make the tank pressure less before.

### 3 Product Overview

#### 3.1 Hardware Configurations

The HYDROVAR Modul Concept consists mechanically of two main parts, the Power Unit and the Control Card. In its basic configuration (consists only of the Power Unit) the HYDROVAR can be used as "Basic Inverter" without the need of the Control Card. In that form 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 extending this "Basic Inverter" with the additional Control Card, the HYDROVAR is able to work in different modes and can be extended by the implementation of different modules.

#### General Versions:

**Basic Inverter** – HYDROVAR in its simplest configuration, consists only of the power unit.

Application: Single pump operation as soft-starter, sequence pump in a multi pump system

**Master Inverter** – Full featured HYDROVAR including the high level Control Card (supports also the optional modules like the optional "Relay Card" and all special 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"
- in combination with the optional "Relay Card" up to 5 fixed speed pumps can be controlled with this kind of configuration

**Single Inverter** – HYDROVAR with Control Card developed only for Single pump operation and less features in comparison with the Master Inverter. Additionally the Single Inverter isn't able to support any optional Modules like the Relay Card.

Application:

- Single pump control

#### 3.2 Operation Modes

##### 3.2.1 Actuator (for single pump operation only!)

In this mode the HYDROVAR operates as an Actuator with external speed signal or switching between 2 programmed frequencies by using the corresponding digital input. For this application the HYDROVAR operates like a standard frequency converter when an external controller is used.

**!!! Please consider that this mode is only possible by using a HYDROVAR Master or Single Inverter and is limited for single pump operation only!!!**

##### 3.2.2 Controller

This mode should be selected if only one HYDROVAR pump is in operation and there is no connection to any other HYDROVAR via RS485 interface.

### 3.2.3 Cascade Relay

One pump is fitted with a HYDROVAR “Master Inverter” and up to 5 full speed slave pumps can be switched ON and OFF on demand. For this purpose an additional relay card with 5 relays is used in the “Master Inverter”. Each Relay can be activated or deactivated depending on how many pumps are connected.

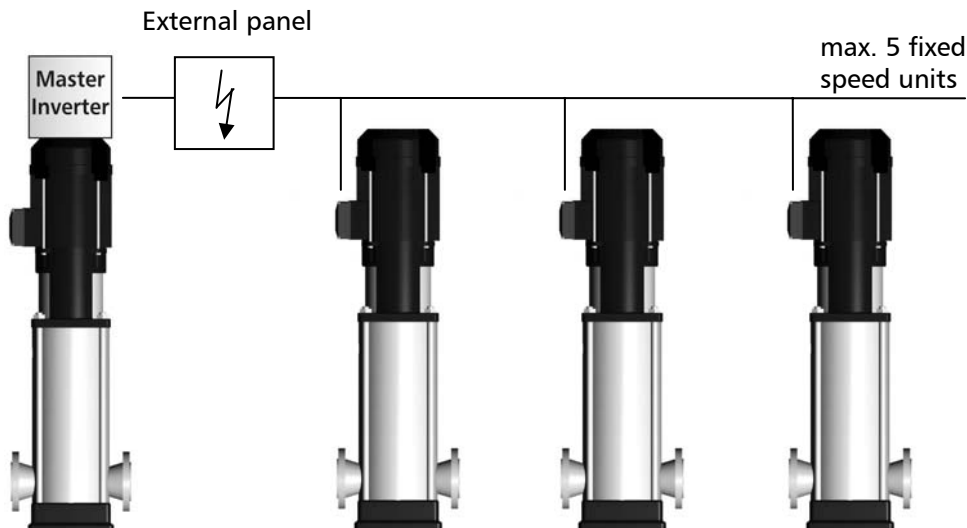
Basically an external panel is needed for all the motor relays, because the relays in the HYDROVAR can’t switch the pumps directly as they are just used as switch contacts.

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 would be a simple alternative compared with other solutions using VFD’s on each pump, but in any case care has to be taken due to the lower operating safety 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). This should be the standard configuration when the additional “Relay Card” is used.



### 3.2.4 Cascade Serial

In this mode there are various possibilities to combine the different versions of the HYDROVAR, which will be explained on the following pages.

In general each of the pumps is equipped with a HYDROVAR unit. All units are connected via the RS485 interface and are communicating via standard MODBUS-Format (fixed with 9600 Baud, RTU, N81).

To realise a fully controlled system at least one "Master Inverter" is needed, the other pumps could be fitted just with a "Basic Inverter".

The controller in the "Master Inverter" is informed about the status and a possible failure of the "Basic Inverters" all the time. All possible failures will be indicated on the Master unit, including also the date and real time when the failure happened.

The complete control will be done via the "Master Inverter" every time, but also an automatic change over of the lag pumps to provide even wear and achieve even operating hours will be possible .

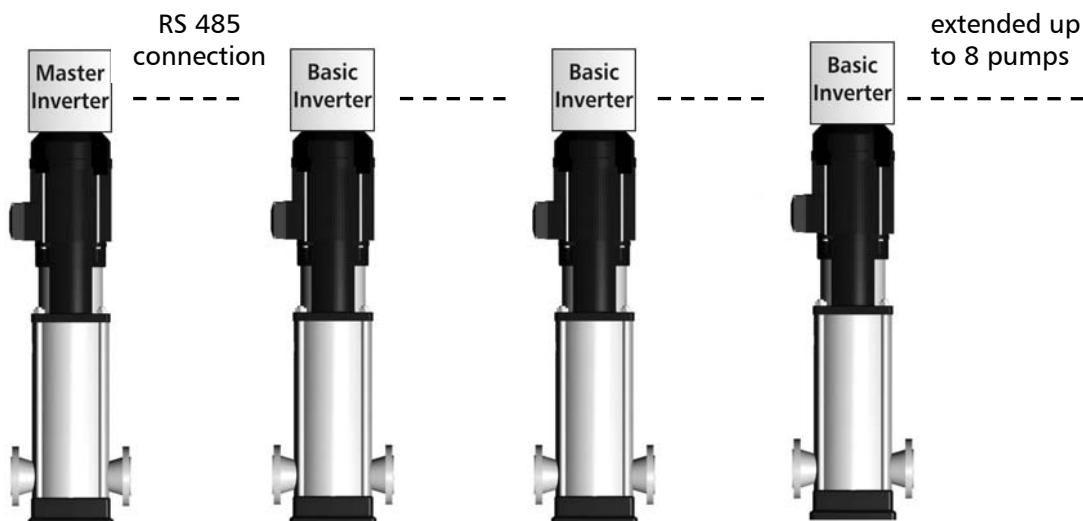
If the Control Card of a "Master Inverter" fails, each of the "Basic Inverters" can be manually started by an external switch (manual operation) in order to ensure an "emergency operation" of the system.

#### Application Example

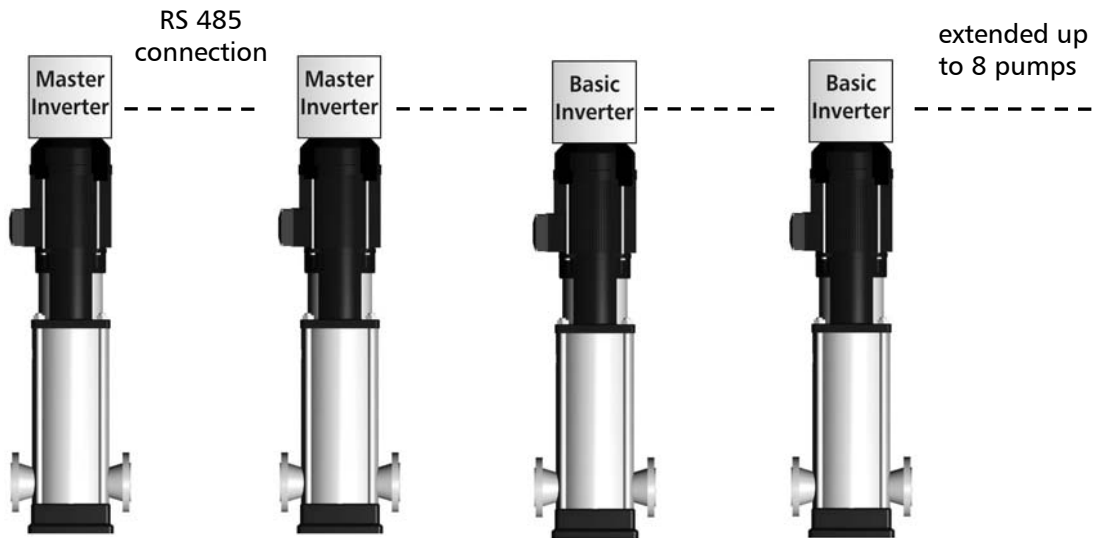
Each pump of the system (extended up to 8 pumps) is equipped with a HYDROVAR unit (at least one "Master Inverter" and the others can be "Basic Inverters" in order to ensure a proper control of the system) which are connected via the serial interface.

The combination of the different HYDROVAR units that 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 safety reasons and 4 "Basic Inverters" without Control Card – or just any other configuration)

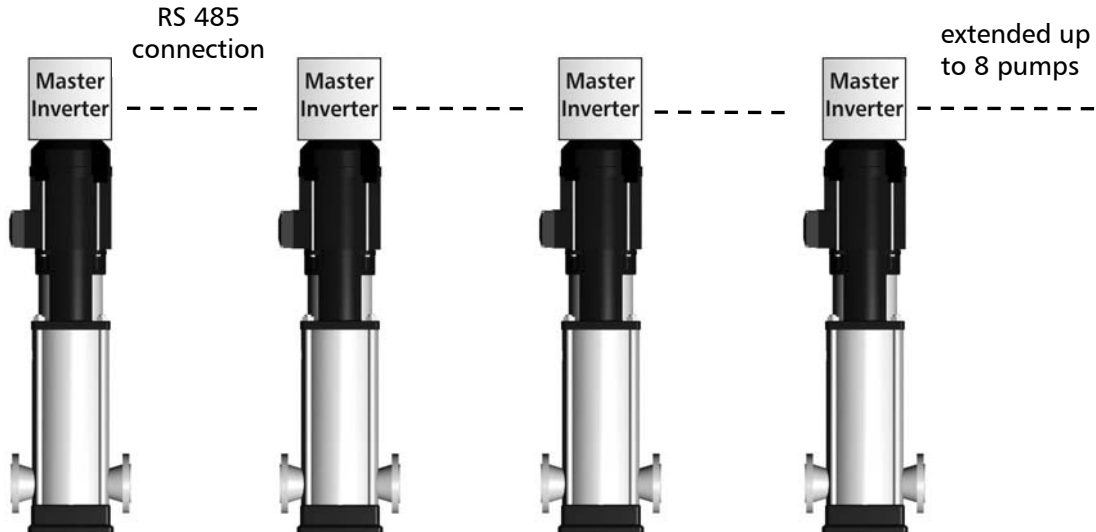
Minimum requirement: 1 "Master Inverter" and the others equipped with "Basic Inverters"



To increase the operating safety of such a system, also a second “Master Inverter” could be used:



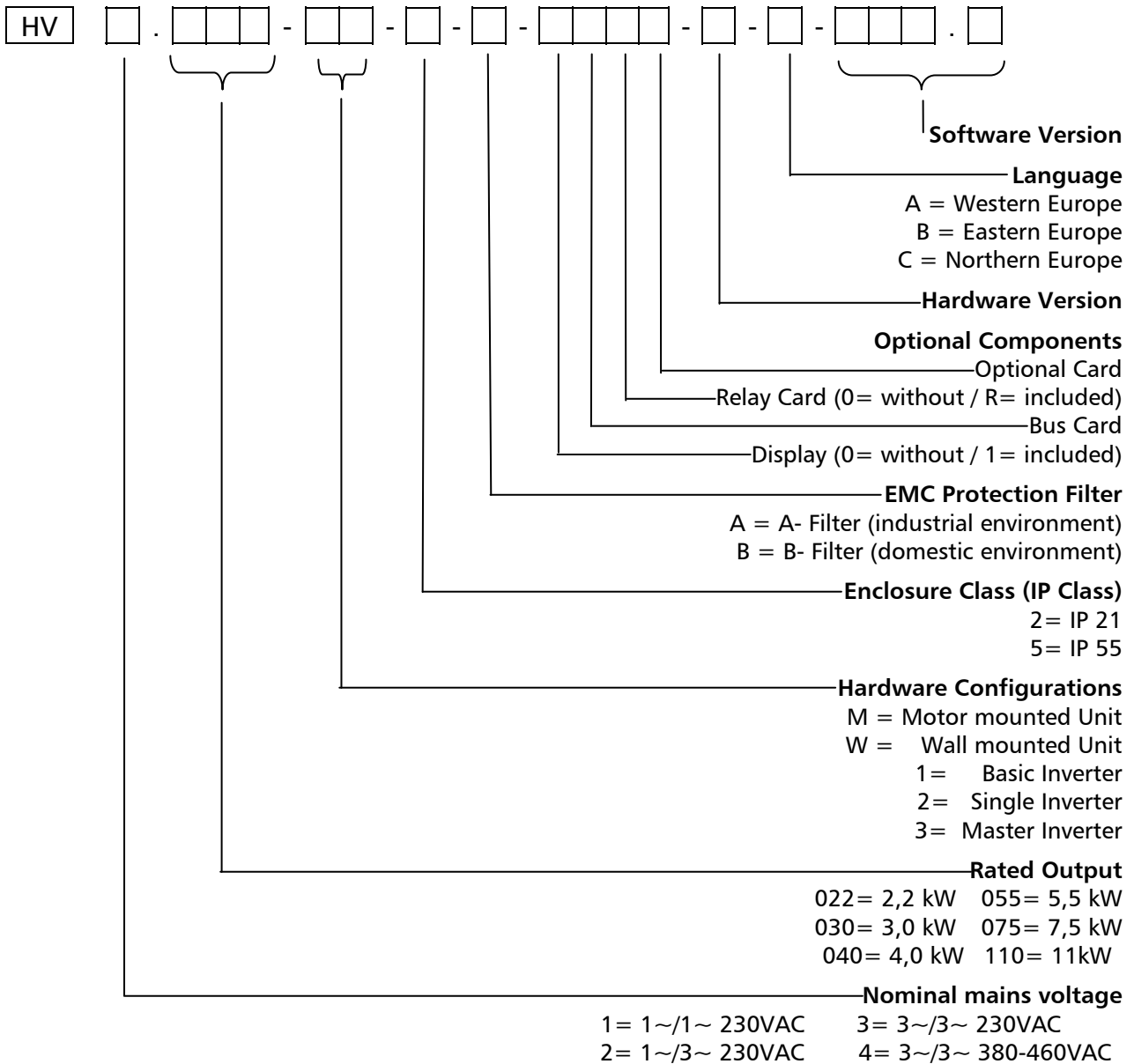
Full-featured Possibility: Each pump is equipped with a “Master Inverter”



In this mode it is possible to run all pumps in multi-controller mode and synchronous mode as well!

This configuration allows each pump of the system to become a lead pump. This ensures a proper operation if one “Master Inverter” fails, either another one is used to take the “full responsibility” and a steady control of the system. That ensures that the operating hours of each separate pump will be on the same level to ensure even wear of the pumps.

#### 4 Type designation code



#### Example

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

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:	A: Western Europe (DE, EN, FR, NL, IT, ES, PT)
Software Version:	V01.1

## 5 Technical Data

HYDROVAR		Power Supply			
Type	Rated output	Voltage limits 48-62 Hz	Rated current input	Recommended line protection	Maximum connection
HV	[kW]	[V]	[A]	[A]	[mm <sup>2</sup> ]
2.015	1,5	1~230 ± 15%	14,0	20	10
2.022	2,2		20,0	25	
4.022	2,2	3~380-460 ± 15%	7,6	13	10
4.030	3		9,1	13	
4.040	4		11,4	16	
4.055	5,5	3~380-460 ± 15%	15,1	20	10
4.075	7,5		19,6	25	
4.110	11		27,8	32	

HYDROVAR		Output to the motor		
Type	Rated Output	Max. Voltage Output	Rated Current output	Motor connection cables
HV	[kW]	[V]	[A]	mm <sup>2</sup>
2.015	1,5	3~ U <sub>in</sub>	7	4x1,5 – 4x4
2.022	2,2		10	
4.022	2,2	3~ U <sub>in</sub>	5,7	4x1,5 – 4x4
4.030	3		7,3	
4.040	4		9	
4.055	5,5	3~ U <sub>in</sub>	13,5	4x2,5 – 4x6
4.075	7,5		17	
4.110	11		23	

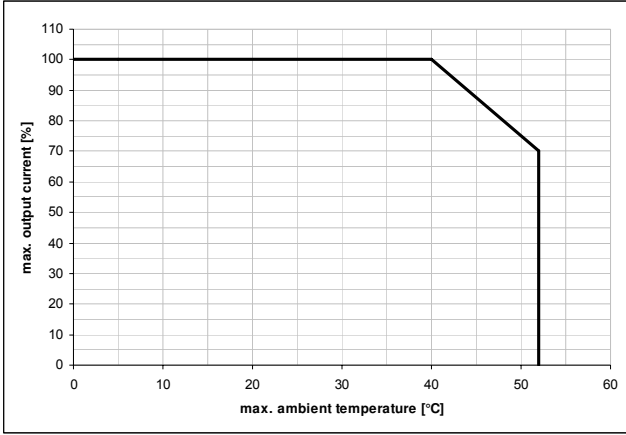


Make sure that the HYDROVAR's electrical data match those of the electric pump. Improper combinations may cause malfunctions and fail to ensure the protection of the electric motor.

The rated 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

<b>Ambient temperature:</b>	<p>0° C ... +40°C          At higher temperatures a reduction of the output current or the use of the next HYDROVAR type is necessary.</p>  <p>○ Protect the HYDROVAR against direct sunlight!          ○ Outdoor installation without protection of the HYDROVAR is not permitted!</p>
<b>Storage temperature:</b>	<p>-25° .C ... +55° C (+70°C during max. 24 hours.)</p>
<b>Humidity:</b>	<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)  <b>Condensation is not permitted!</b></p>
<b>Air pollution:</b>	<p>The air may contain dry dust as found in workshops where there is no excessive quantity of dust due to machines. Excessive amounts of dust, acids, corrosive gases, salts etc. are not permitted</p>
<b>Altitude:</b>	<p>max. 1000m above sea level          At sites over 1000 m above sea level, the maximum output power has to be derated by 1% for every additional 100m. If the installation site is higher than 2000 m above sea level, please contact your local distributor.</p>
<b>Class of protection:</b>	<p>HV 2.015 / 2.022          HV 4.022 / 4.033 / 4.040          IP 55, NEMA 4 (Indoor only)          HV 4.055 / 4.075 / 4.110</p>
<b>Certifications:</b>	<p>CE, UL, C-Tick, cUL</p>



## 5.2 EMC requirements (Electromagnetic compatibility)

The EMC requirements 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 1 000 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 61800-3/2005**

**EN 55011 (2002) Disturbance voltages / Disturbance field strength**

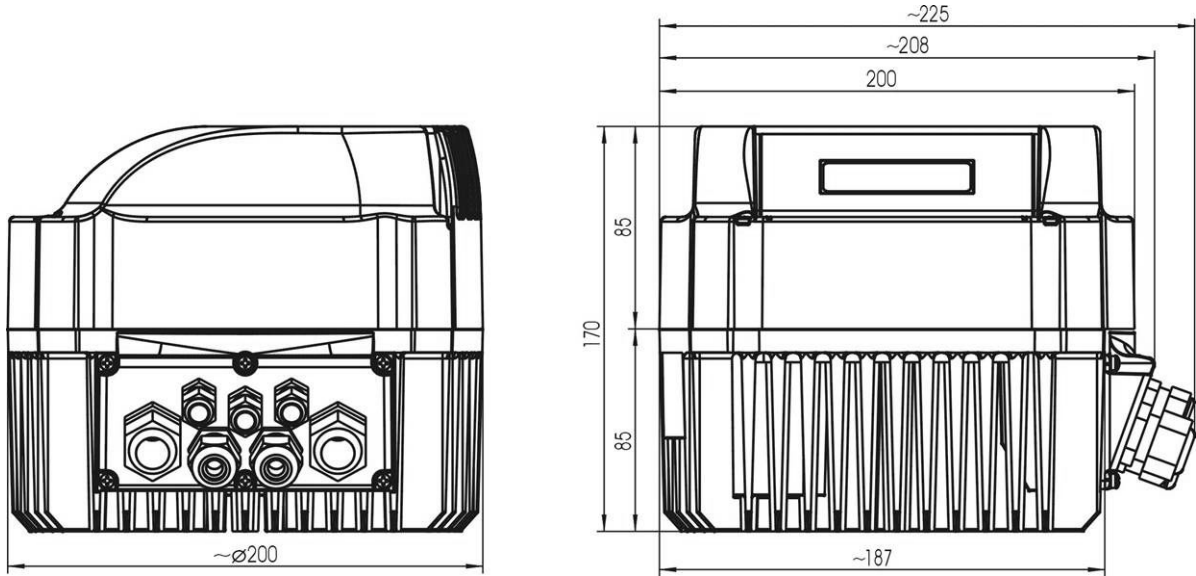
	First environment – class B / class C2	Second Environment – class A / class C3
Disturbance voltages	OK	OK
Disturbance field strength	*)	OK
*) Warning - In a domestic environment, this product may cause radio interference, in which case supplementary mitigation measures may be required.		

**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  
**EN 61000-4-11 (2001)** Voltage dips and interruptions

## 6 Dimensions and Weights

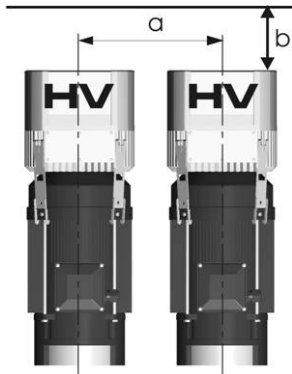
HV 2.015 / 2.022

HV 4.022 / 4.030 / 4.040



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

Drawings are not in 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		

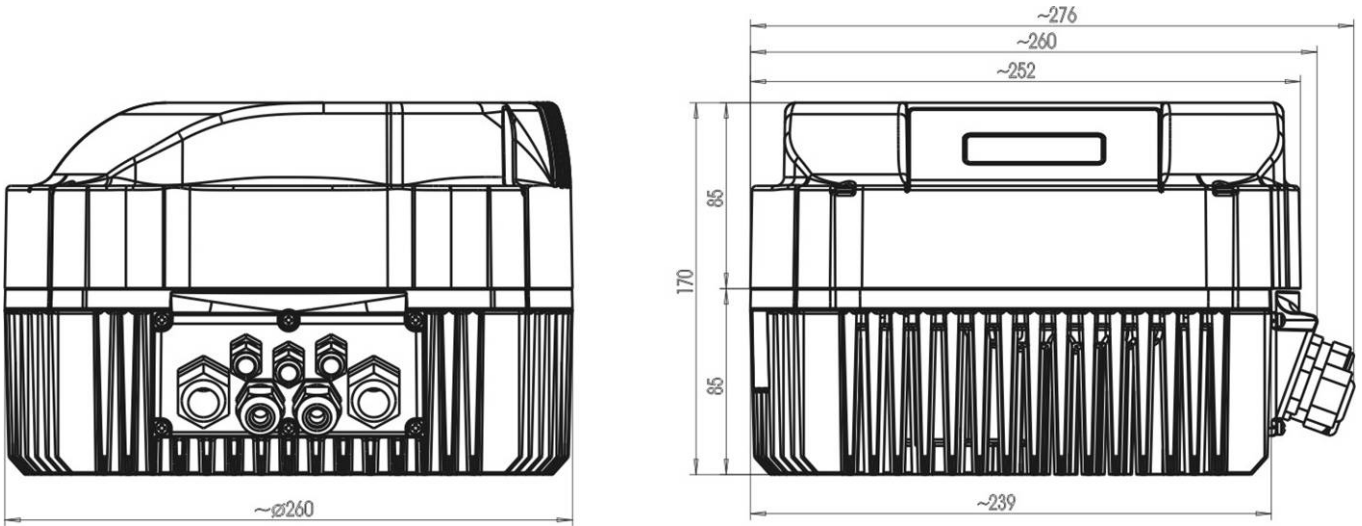
a ... minimum centre-distance between the HYDROVAR

300 [mm]

b ... expansion space for maintenance

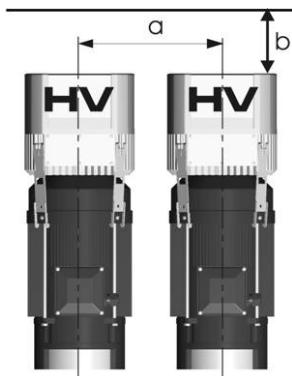
110 [mm]

**HV 4.055 / 4.075 / 4.110**



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

Drawings are not in scale!



Type	Weight [kg]	
	Basic	Master/ Single
HV 4.055	7,70	8,10
HV 4.075		
HV 4.110		

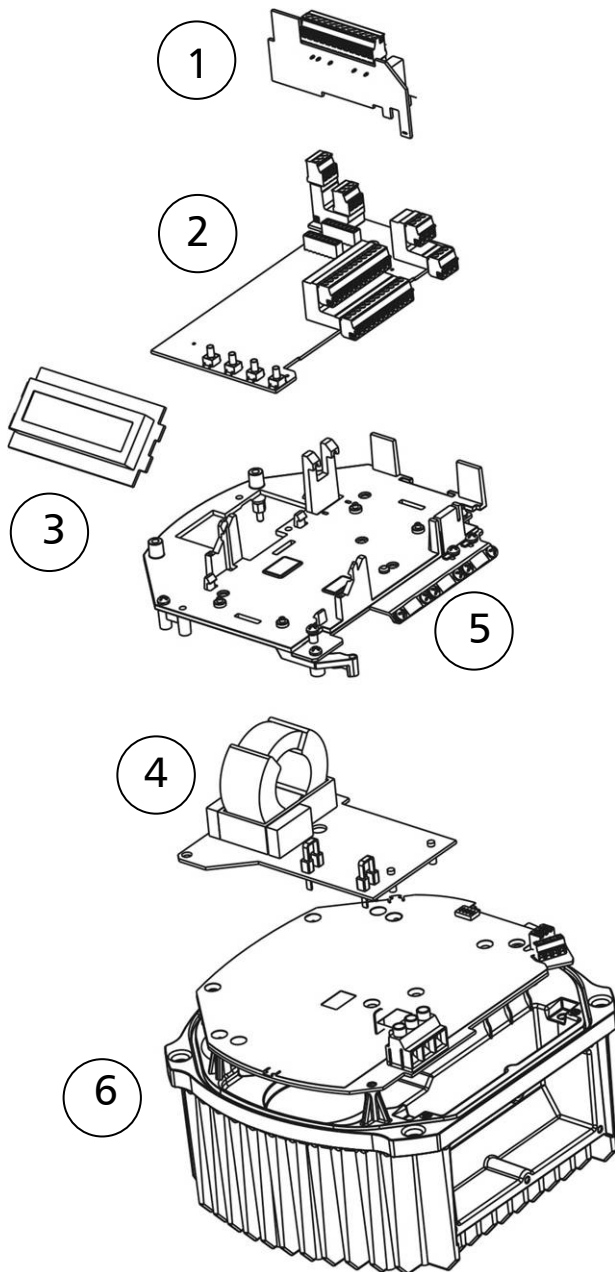
a ... minimum centre-distance between the HYDROVAR  
b ... expansion space for maintenance

430 [mm]  
110 [mm]

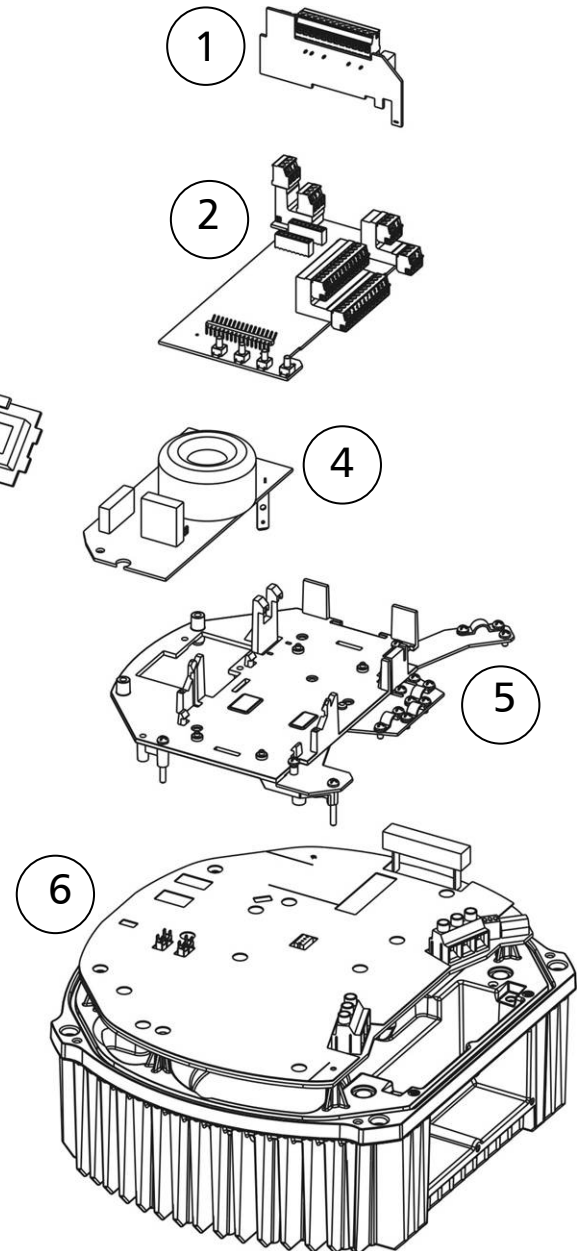
## 7 Modules

Regarding to your application the needed configuration which is available for the HYDROVAR can be selected. Due to this possibility the HYDROVAR can be configured regarding the operation safety and cost effectiveness for your specific application.

### HV 4.022 / 4.033 / 4.040



### HV 4.055 / 4.075 / 4.110



- (1) Relay Card**  
The optional Relay Card allows to control up to 5 fixed speed pumps (can be only used in combination with the Master Inverter).
- (2) Control Card**  
The control card is used for the Master/Single Inverter and includes the I/O's for the digital and analogue signals (i.e. actual value input, run/fault relay output) and the Display unit.
- (3) Display Unit**  
Depending to the installation position the display can be turned to your preferred position!  
(The push-buttons will change automatically when turning the display!)
- (4) Filter Card**  
Optional Filter Card to ensure EMC regulations for domestic environments.
- (5) Mounting Kit**  
The Mounting Kit consists of the Metal and the Plastic Cover. On the Plastic Cover there are fixed the Control Card, the Display and also the additional Relay Card if used. The Pre-mounted cable-clips, which are necessary to connect the screen of all signal cables to HYDROVAR-ground, are placed on the Metal Cover.  
**Power Unit**  
In its standard form it will be used as Basic Inverter or as simple soft starter in a single pump application!  
When using a Master configuration the power unit is fitted with an additional control card!
- (6)**

## 8 Mechanical Components

### 8.1 Included mounting material

Included components	Cable gland				Closing gland		Motor PTC	Mounting clamps	Center-piece	Terminals for max. [mm <sup>2</sup> ]
	M 12	M 16	M 20	M 25	M 12	M 16				
Cable diameter [mm]	3,5-7	4,5-10	7-13	9-17						
2.015- 2.022	2 (3)	2	2		3	1	1	4	1	10
4.022- 4.040	2 (3)	2	2		3	1	1	4	1	10
4.055- 4.110	2 (3)	2		2	3	1	1	4	1	10

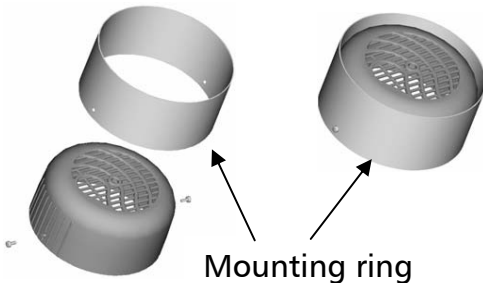
( ) max. available cable entries

### 8.2 Optional Components

#### 8.2.1 Fittings

##### Mounting ring

Available for the diameters: 140 mm  
155 mm



#### **CAUTION!**

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

#### 8.2.2 Sensors

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

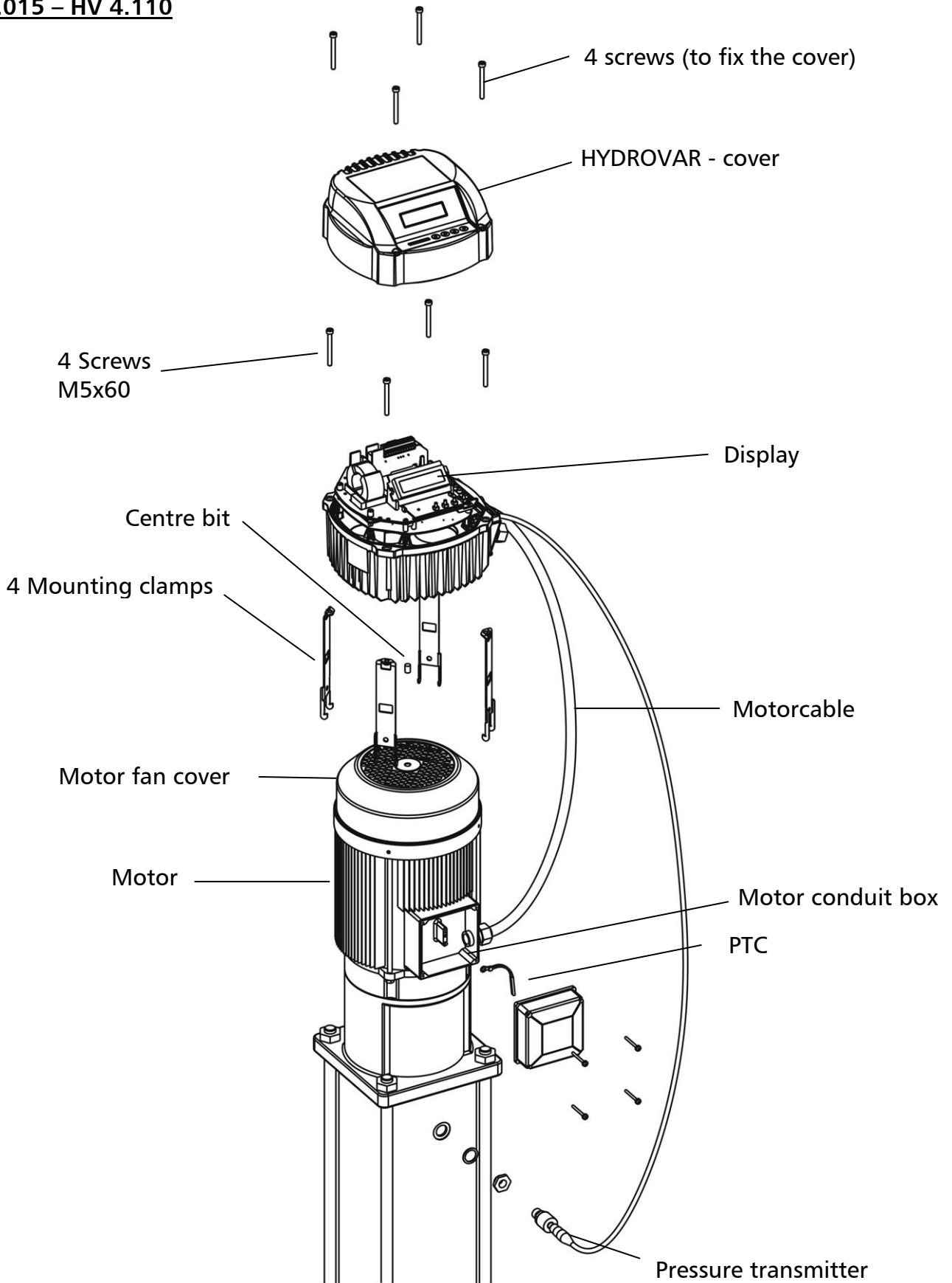
#### 8.2.3 Filter

- Line-coils

#### 8.2.4 Ready-made Motor cables

Available for HV 2.015 – 4.110

**8.3 Assemble Instruction**  
**HV 2.015 – HV 4.110**



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

- Ensure that there is no water on the unit before you open the cover.
- The HYDROVAR has to be positioned on the motor fan cover (check if the mounting of the motor fan cover is done properly).
- Try to centre it as good as possible 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 related 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 on the HYDROVAR can be mounted and tightened by the four fastening screws.
  - Make sure of a good connection of the ground wire.
  - Control the gasket of the HYDROVAR before tighten the fastening screws.
  - Ensure that the mounting of the cable glands is done properly and use closing glands for cable-bushings which aren't used.



## 9 Electrical installation and wiring



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



In case of a failure, the electrical power has to be disconnected or switched off. Wait at least 8 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 a 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 over-voltage, 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:

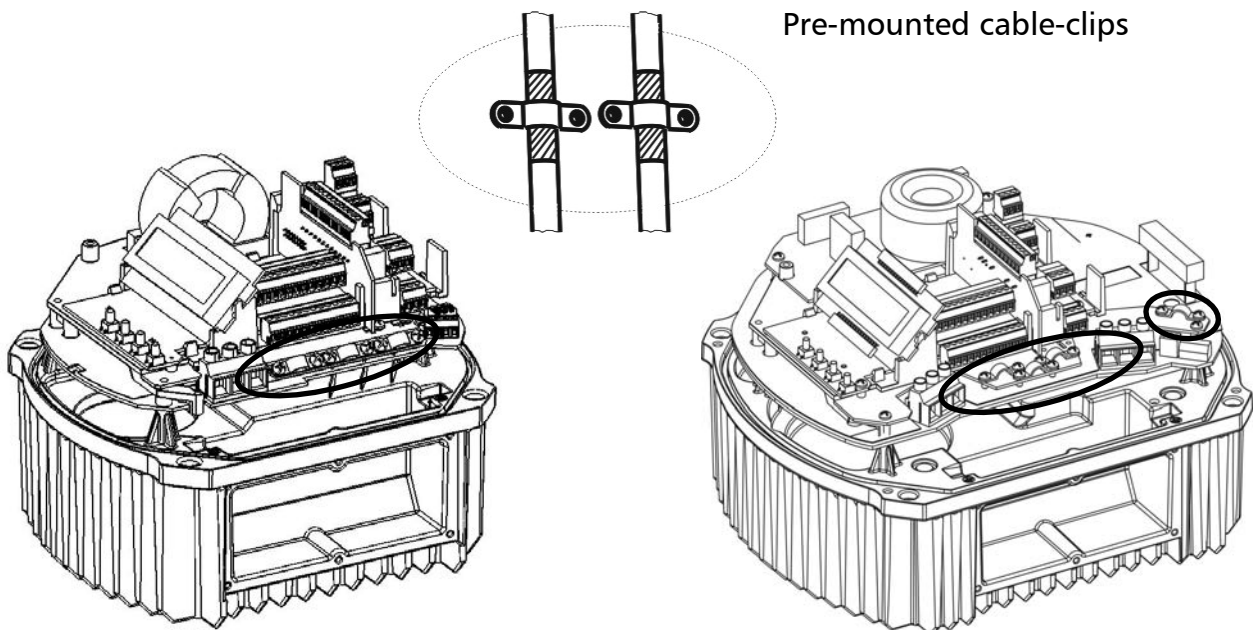
### Earth / ground to ensure EMC

- **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 side; otherwise it is possible that the screen has a ground current. The screen should be extensively connected with cable-clips to HYDROVAR GND (use pre mounted cable-clips).



To connect a screen with lowest impedance to ground, remove the isolation from the signal cable and connect the screen extensive 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.  
Don't cross power cables with 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.

### 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.

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

- Install potential equalization according local regulations
- Don't install the power-cable in parallel to signal-cables
- Use screened signal-cables
- Connect only one end of the screen of a signal-cable to ground
- If screened motor-cables are used, both ends of the screen have to be connected to ground
- Motor-cable as short as possible
- "Pigtails" should be prevented

### 9.3 Recommended Cable Types

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

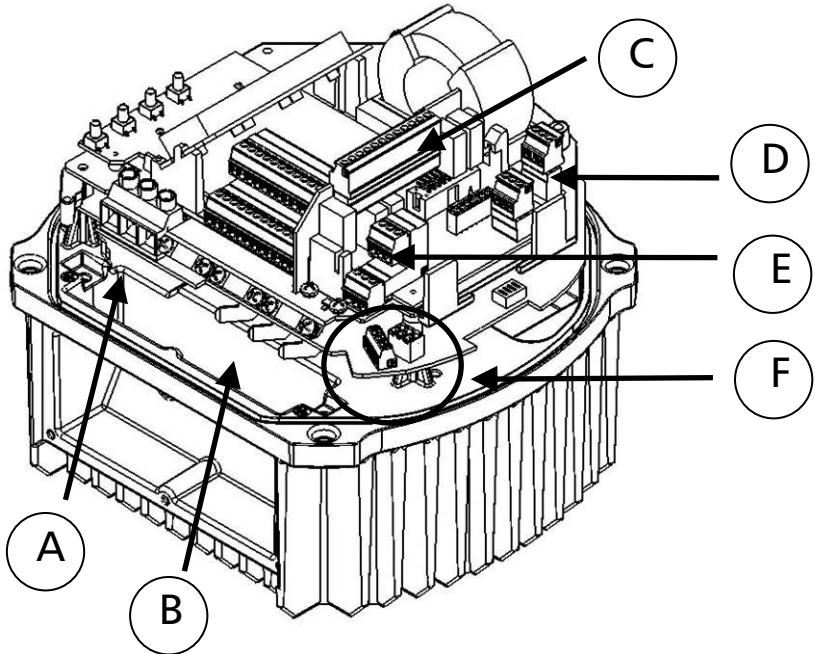
Application	Recommended Cable-Type
- Motor-cables HV 2.015-2.022 HV 4.022-4.040 HV 4.055-4.075 HV 4.110	4G1,5 + (2 x 0.75) FDF 4G1,5 + (2 x 0,75) FDF 4G2,5 + (2 x 0,75) FDF 4G 4 + (2 x 0,75) FDF
- Control- and Signal- Cables	JE-Y(ST)Y ... BD JE-LiYCY ... BD
- Cables connected to RS485 interface	JE-Y(ST)Y 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 / 4.033 / 4.040



(A) Power supply

(B) Motor connections

(C) Optional Relay Card

(D) Status-Relays

(E) RS-485 Interface

- User Interface

- Internal Interface

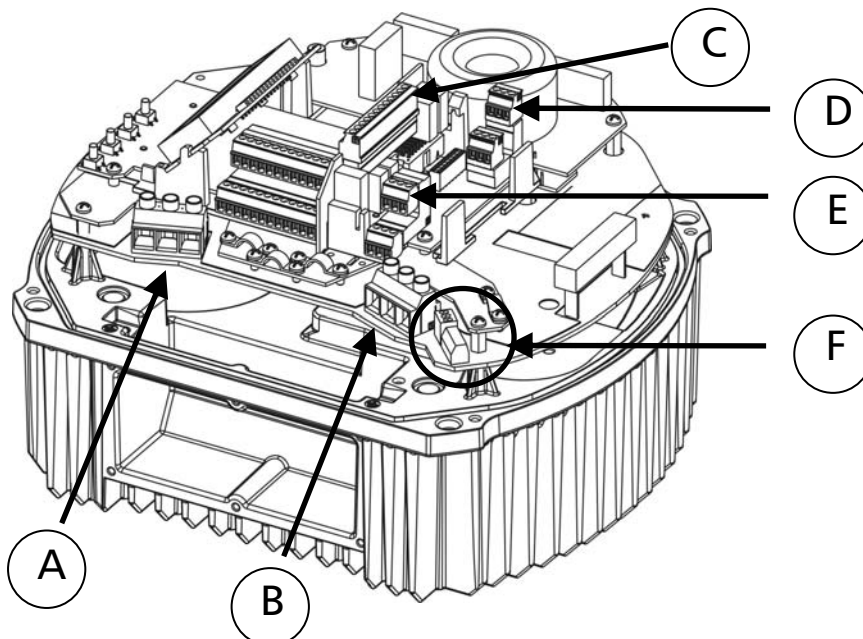
(F) Terminal block:

- START/STOP\_PTC

- SOLORUN

- RS-485 Interface

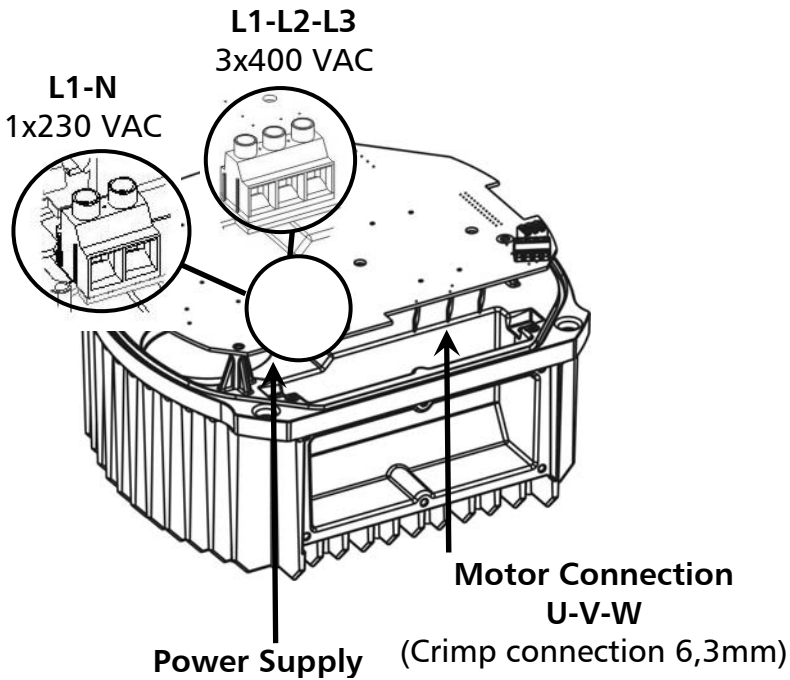
HV 4.055 / 4.075 / 4.110



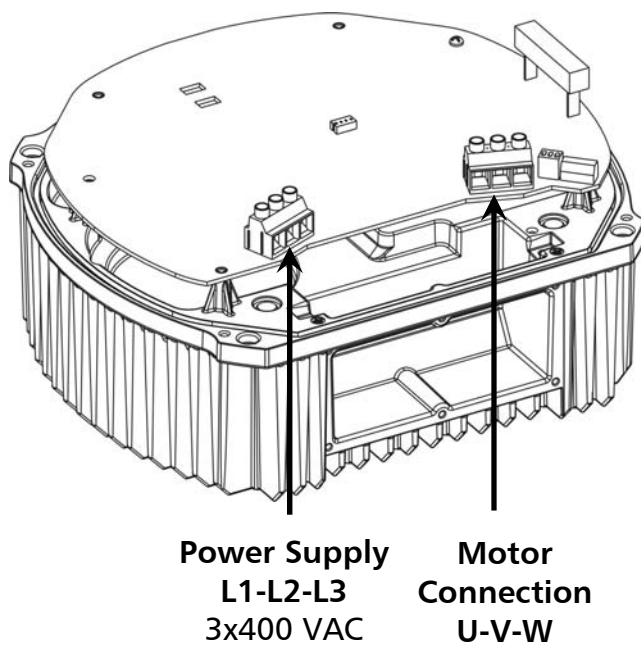
### 9.4.1 Main Voltage Terminals

The power supply is connected to the power section:  
 terminal L1 + 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 / 4.033 / 4.040



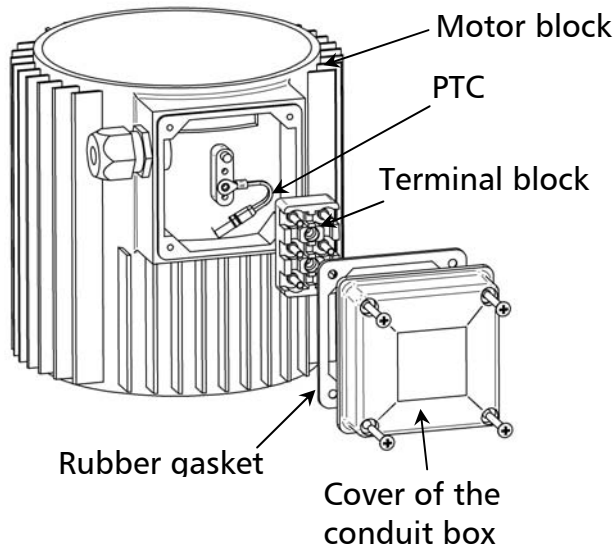
HV 4.055 / 4.075 / 4.110



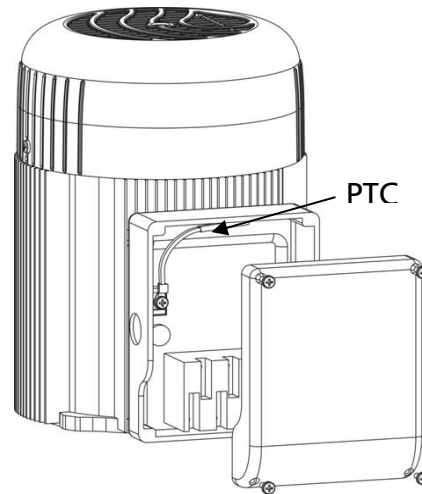
## 9.4.2 Motor connection

### Mounting of the PTC

Variant A :



Variant B :



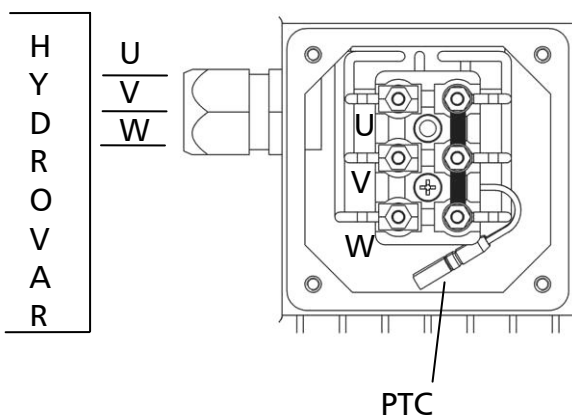
1. The cover of the conduit box must be opened and the terminal block inside removed
2. Fix the PTC (Variant A or B)
3. Remounting of the terminal block
4. Electrical connection of the motor cables

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

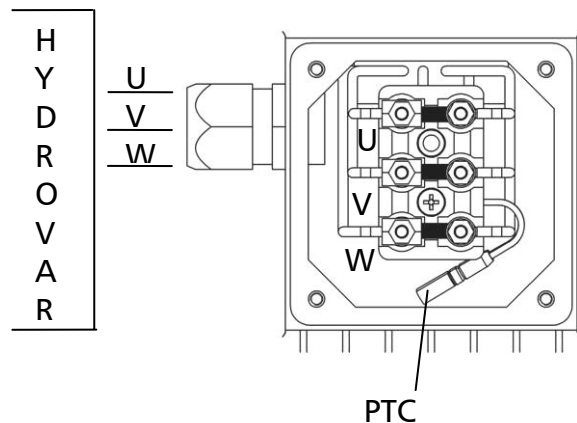
The connection of the motor cable depends on the type of the motor and can be done in star- or delta connection.

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



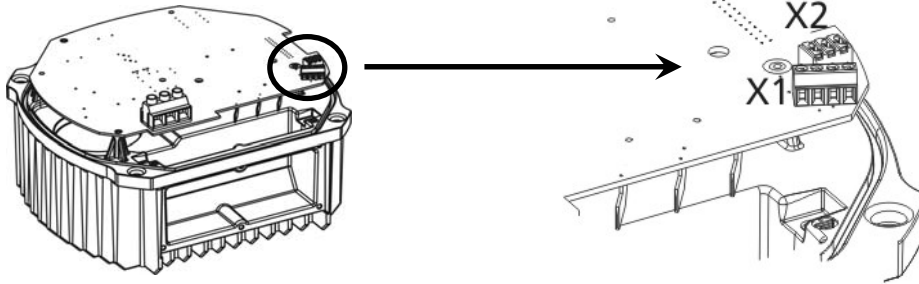
#### delta - connection



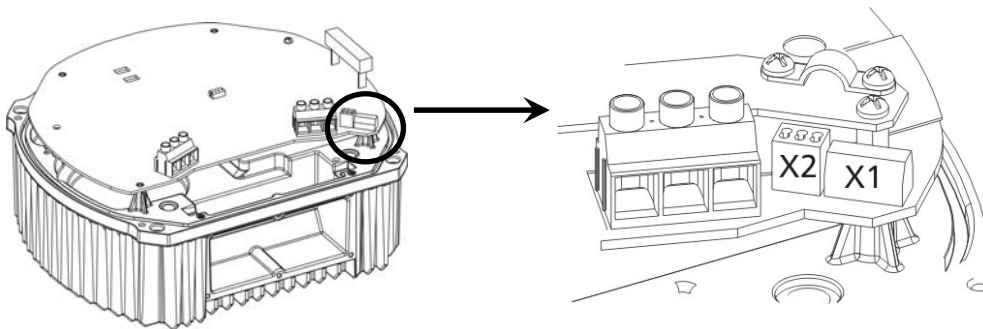
### 9.4.3 Power Unit

The Power unit in its basic form, which is used as Basic Inverter in multi-pump systems or as a simple soft starter in a single pump application, is fitted with two control terminal-blocks.

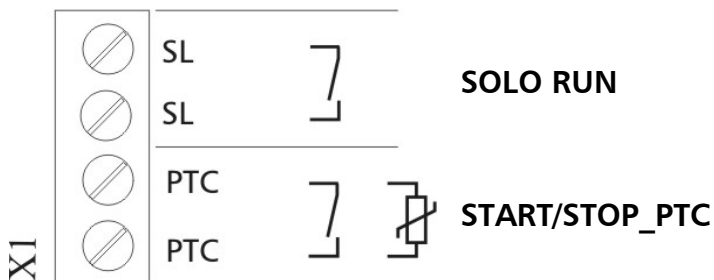
HV 2.015/2.022    HV 4.022 / 4.033 / 4.040



HV 4.055 / 4.075 / 4.110



X1 Control Terminals – Power Unit		
	PTC	PTC or Thermal switch START/STOP (external release) when using a Basic Inverter
	SL	SOLO RUN



To ensure a safe operation between the HYDROVAR and the motor if the HYDROVAR is used as Basic Inverter, a motor-thermo-switch or PTC and an external on/off switch should be connected to the power unit. They must be connected to X1/PTC in serial 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 aren't connected any external protective devices or they are connected directly to the Control Card when using a Master Inverter, bridge terminals X1/PTC, otherwise the HYDROVAR can't be started.

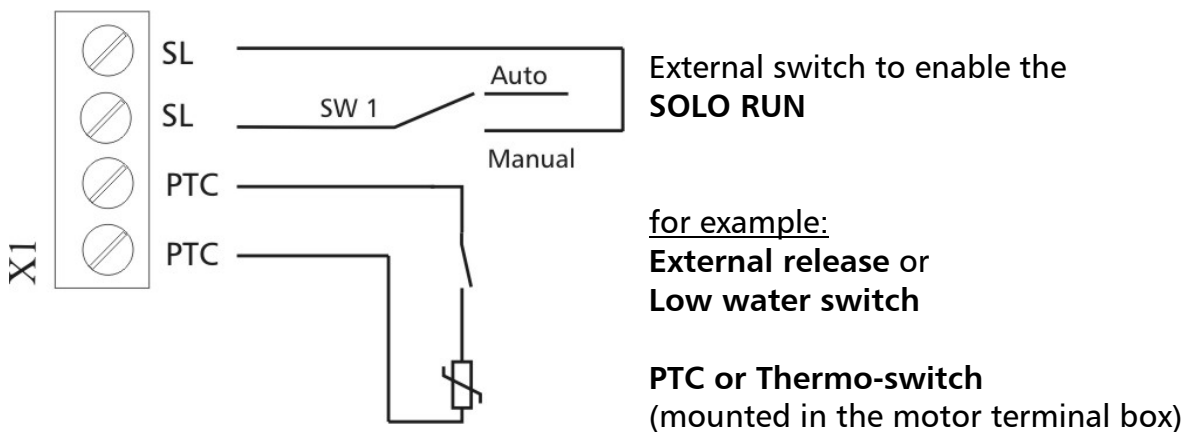
### 9.4.3.1 Solo Run

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 itself fails, or in case the Basic Inverter is just used as simple soft-starter.

- At 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 [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:

<b>Basic Inverter:</b>	PTC or Thermal switch	X1/PTC	Placed on the Power Unit
	External release	X1/PTC	
	Low water switch	X1/PTC	
<b>Master Inverter:</b>	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	Card

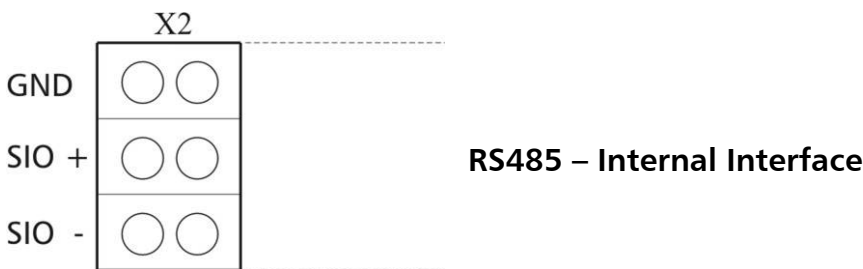


If the HYDROVAR is used as Basic Inverter in a multi-pump system, the internal interface on the power unit is used for the serial RS-485 connection to the other HYDROVAR in the system. (Be careful: Internal Interface is not active for Single Inverter configuration!)

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

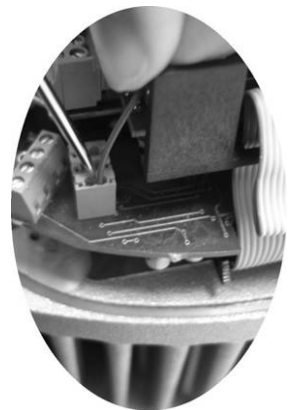
 ..... Parameter not available for a HYDROVAR Single Inverter

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. Even the terminals X4/4-6 on the Control Card, can be used.

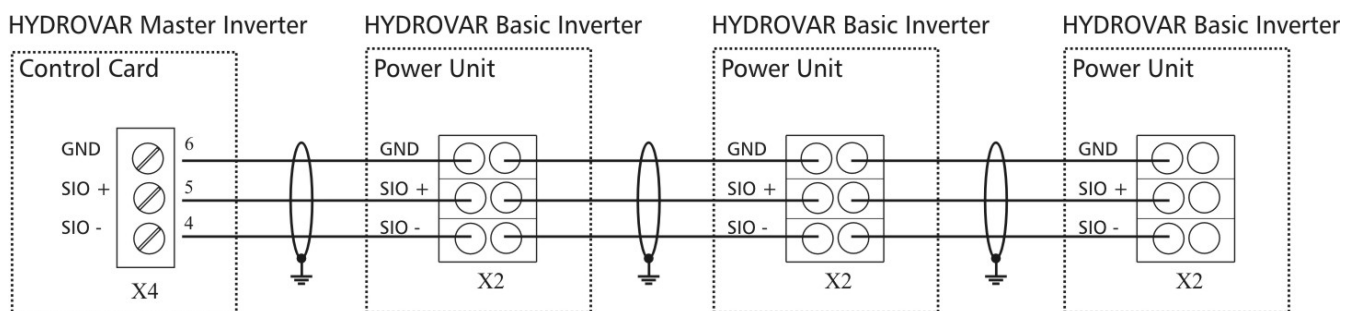


Mechanical connection of the Terminal:

- 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!

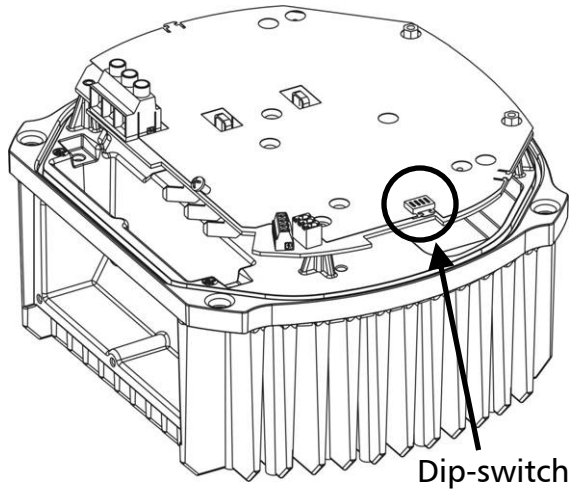


Connection example using one Master- and three Basic - Inverters:

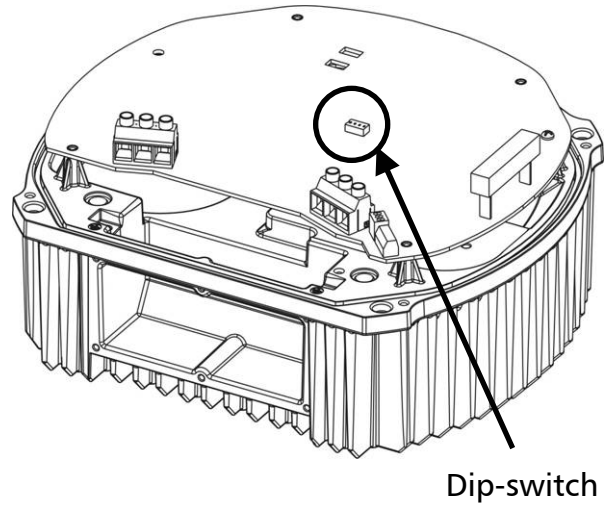




HV 2.015 / 2.022  
HV 4.022 / 4.033 / 4.040  
Basic Inverter



HV 4.055 / 4.075 / 4.110  
Basic Inverter



#### 9.4.4 Control Unit

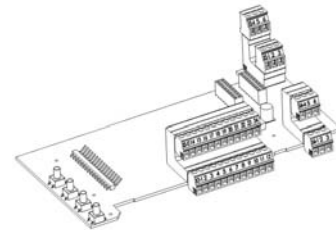
Regarding the Hardware configuration of your HYDROVAR there are available two different Control Cards.

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.

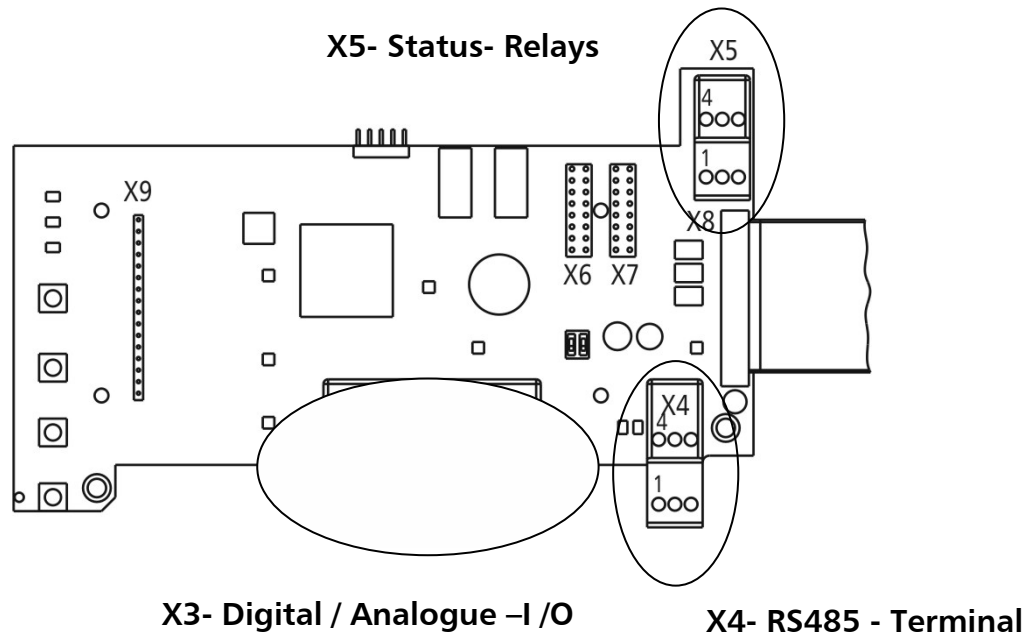
The second available control card included in the HYDROVAR Single Inverter is developed just for single pump operation. This control card also doesn't support any additional boards and includes just the minimum necessary software parameters.

##### 9.4.4.1 Control Card – HYDROVAR Master Inverter

The Control Card is connected to the power unit with a ribbon cable on terminal **X8**.



- The display is connected to terminal **X9** (the connection depends to the installation position).
- 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-unit have to be screened (See chapter 9.3 Recommended Cable Types).



**NOTE:**

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

Don't connect the ground of the Control Card to different 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	(Offset)	
	15	Voltage signal input (Required Value 2)	*Dig 4	0-10VDC
	16	GND, electronic ground	(Offset)	
	17	GND, electronic ground	(Offset)	
	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 [Ri=50Ω]
	22	GND, electronic ground	(Offset)	
	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 even as Digital Input without any additional configuration.  
Also the voltage signal input on terminal X3/15 can be used as Digital Input.

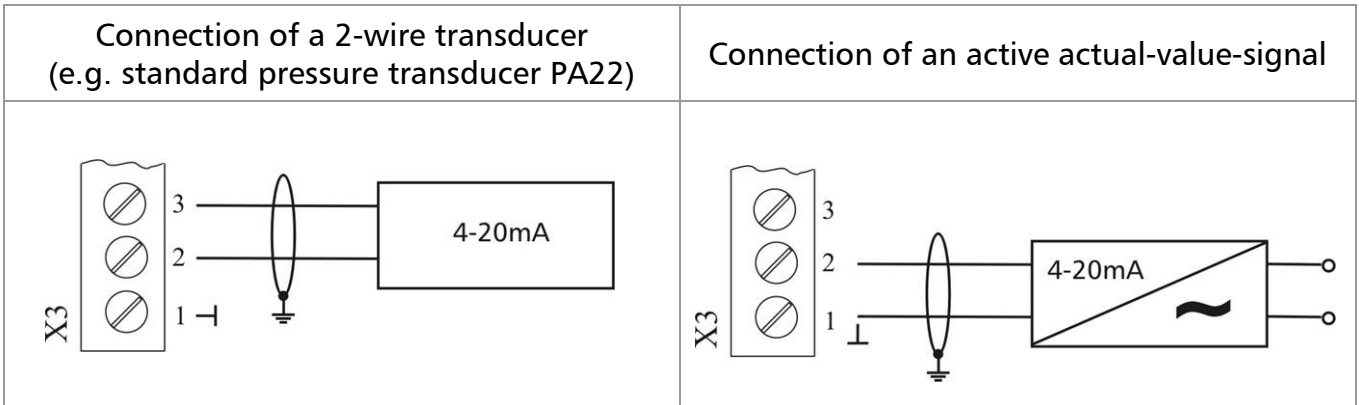
\*\* X3/3 and X3/24 – 24VDC and  $\Sigma$  max. 100mA

(Offset) These terminals could be used as Required Value and Offset Signal Input.  
The configuration could be done in Submenu REQUIRED VALUES [0800] and Submenu OFFSET [0900].



**Connection examples:**

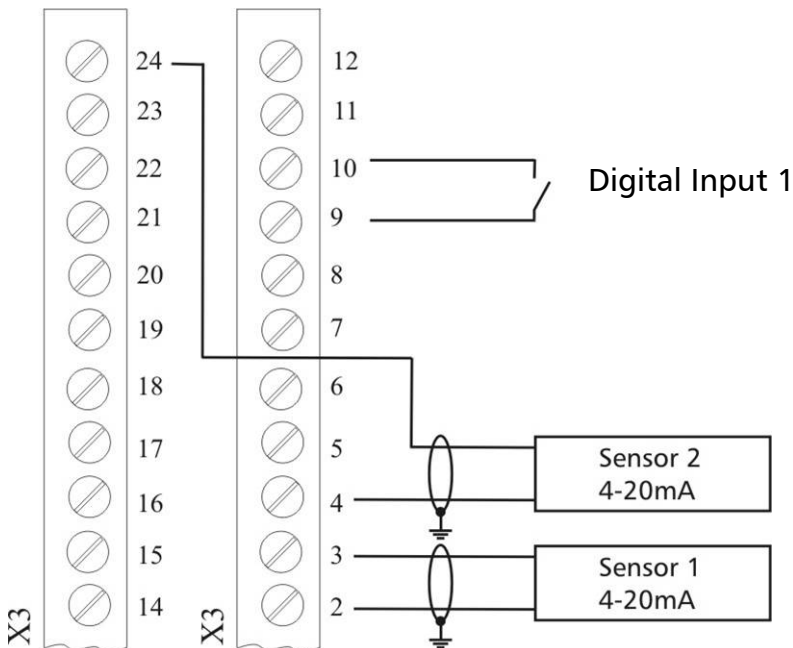
- **Sensor-Actual-value-signal Input**



<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**

Manual switching between two connected Sensors by closing Digital Input 1 (X3/9-10).  
How to program see SUBMENU SENSORS [0400].

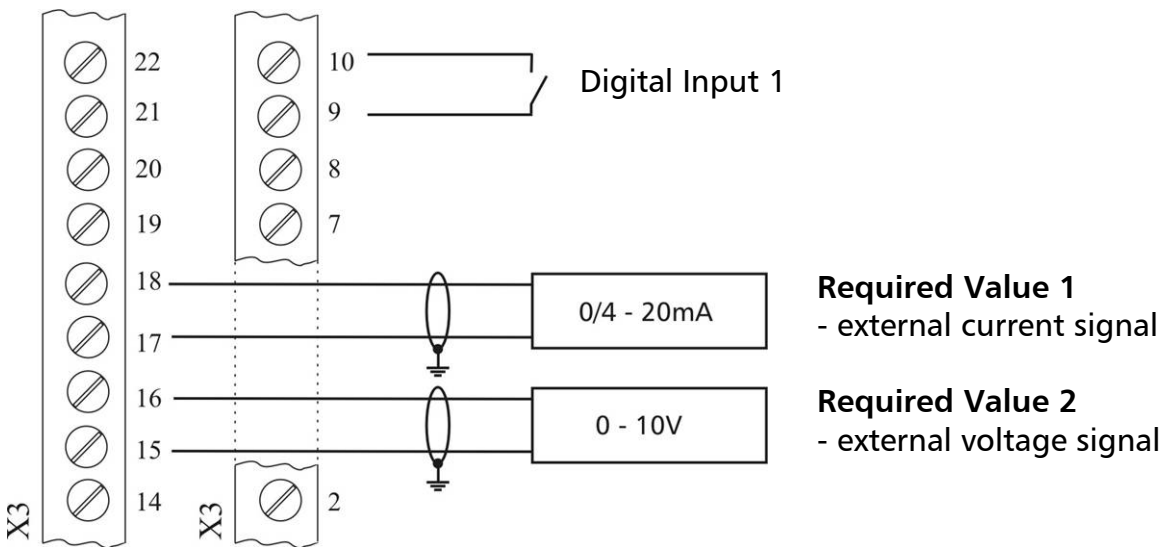


- **Switching between two different required values**

Manual switching between two connected required value signals (e.g.: 1 voltage and 1 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.

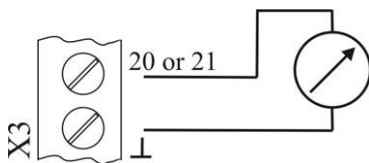
How to program see SUBMENU REQUIRED VALUES [0800].



- **Actual value – Frequency Indicator**

e.g. to display the actual motor frequency

How to program see SUBMENU OUTPUTS [0700].



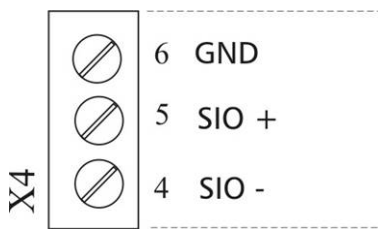
Possible connections:

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

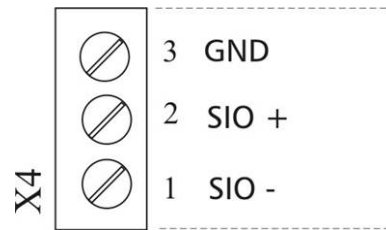


X4 RS485-Interface			
X4/	1	User SIO-Interface: SIO-	} User Interface for external usage
	2	User SIO-Interface: SIO+	
	3	GND, electronic ground	
X4/	4	Internal SIO-Interface: SIO-	} Internal Interface for multi-pump-systems
	5	Internal SIO-Interface: SIO+	
	6	GND, electronic ground	

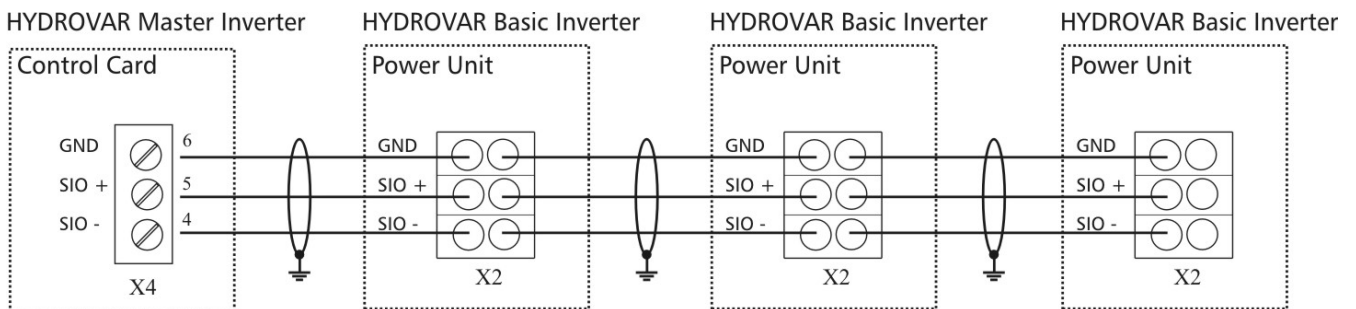
### RS-485 – Internal Interface



### RS-485 - User Interface



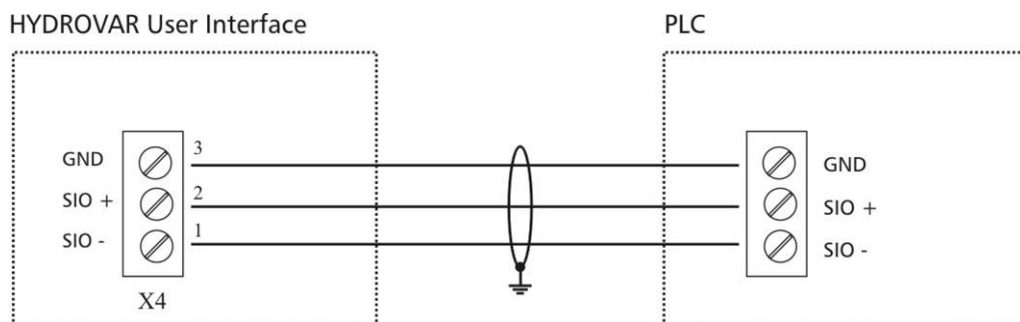
The **internal RS-485 Interface** is used for the communication between up to 8 HYDROVARs in a multi-pump application. For the connection of each HYDROVAR via the RS-485 interface the terminals X4/4-6 on the Control Card, and even the terminals X2/1-3 on the power unit can be used. (**Connection example:** using one Master- and three Basic -



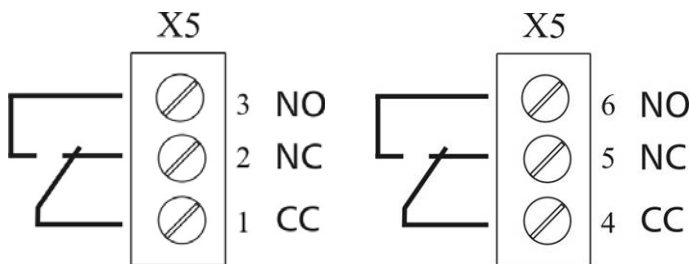
Inverters.)

By using the **RS-485 – 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 parameterising 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 general use] [Max. 220VDC] [0,25A general use] [Max. 30VDC] [2A general use]	
	2		NC		
	3		NO		
X5/	4	Status Relay 2	CC		
	5		NC		
	6		NO		

**Status Relay 1**
**Status Relay 2**

**Please Note:**

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

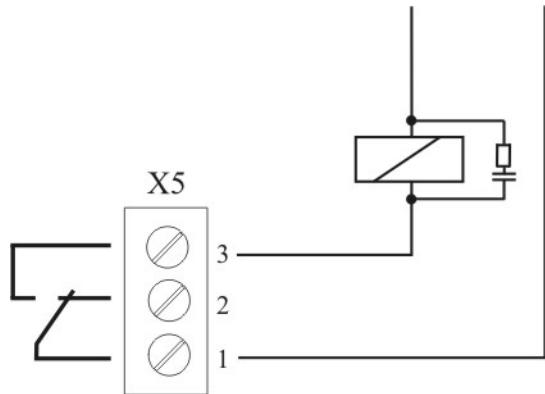
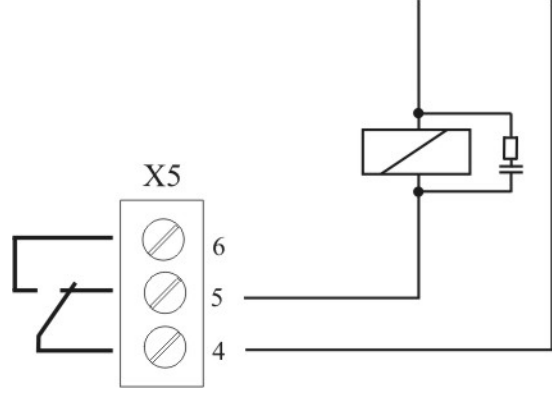
Both Status-Relays on the Control Card can be used regarding the programmed configuration.

Depending to the programming, both relays can be used to indicate the current status and failure messages of the HYDROVAR.

For example 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]).

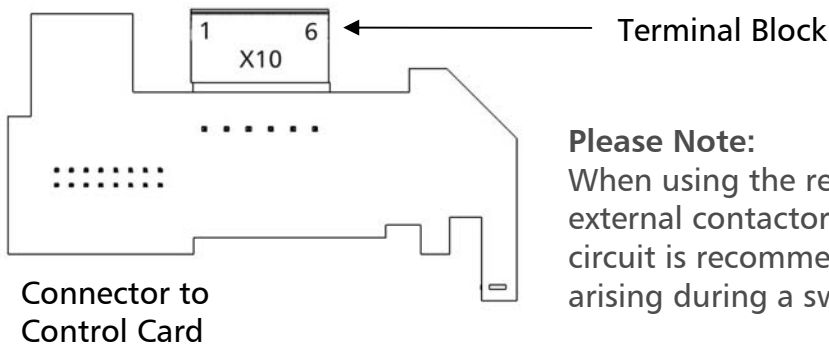
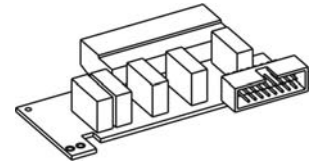
**Connection examples:**

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 - if the supply of the HYDROVAR is cut off</p>

### 9.4.4.2 Relay Card

Optional Component can be used only in combination with a HYDROVAR Master Inverter.

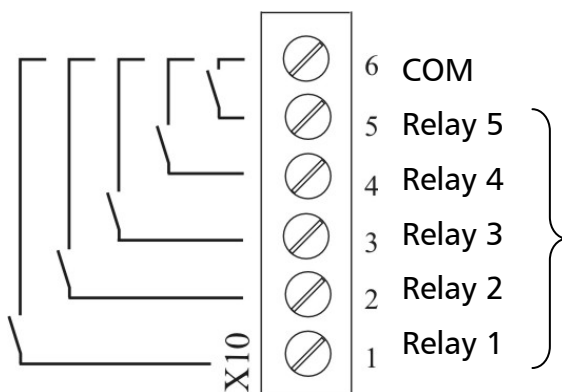
The Relay Card is connected to the Control Card using connection slot X6 (See chapter 9.4.4.1).



**Please Note:**  
When using the relay contacts for switching external contactors, a corresponding RC-snubber-circuit is recommended, to prevent disturbances arising during a switching action of the relay!

### Terminals Relay Card

X10 Relay Card					
X10/	1	Relay 1	}	[Max. 250VAC]	[1A general use]
	2	Relay 2			
	3	Relay 3			
	4	Relay 4			
	5	Relay 5			
	6	COMMON		[Max. 30VDC]	[1A general use]



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).

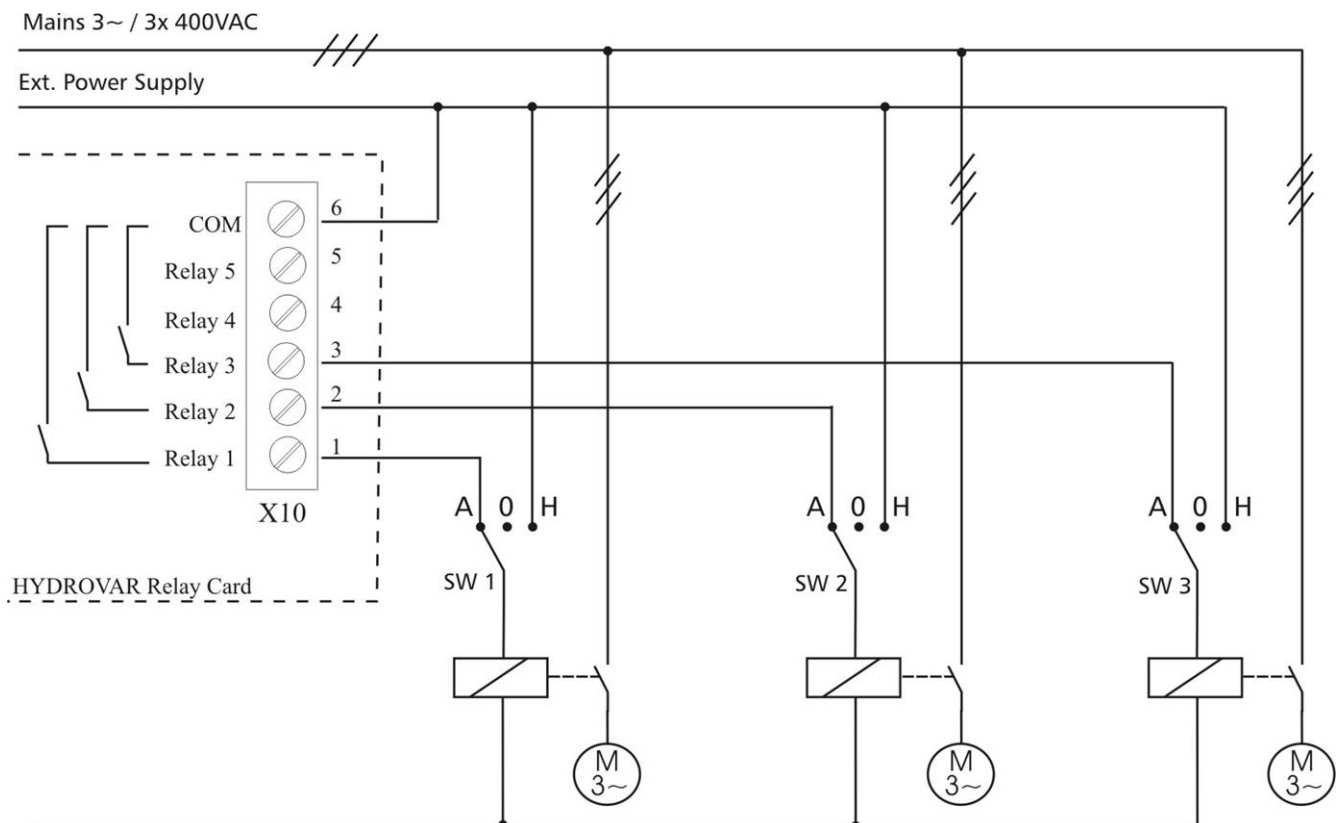
**Connection example:**

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/O/M – switch) is required.

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

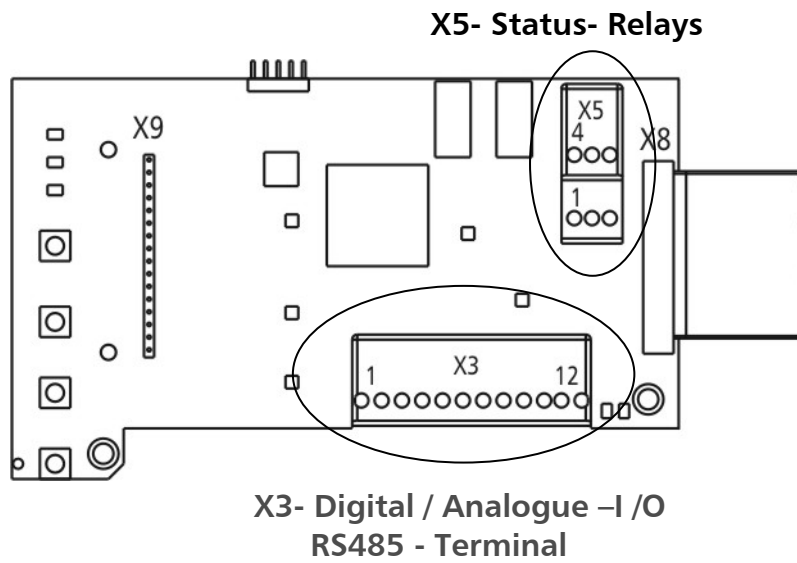
- During normal operation the switch is set to AUTO, so the Relay Card of the HYDROVAR would start and stop the follow-up pumps.
- The "HAND" position allows a manual operation of the pumps.
- If one of the additional switches is in OFF position, the related relay must be disabled in the submenu STATUS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



### 9.4.4.3 Control Card – HYDROVAR Single Inverter

The Control Card is connected to the power unit with a ribbon cable on terminal **X8**.

- The display is connected to terminal **X9**  
(The connection depends to the installation position).



### Control Terminals

All control cables connected to the control-unit have to be screened (See chapter 9.3 Recommended Cable Types).

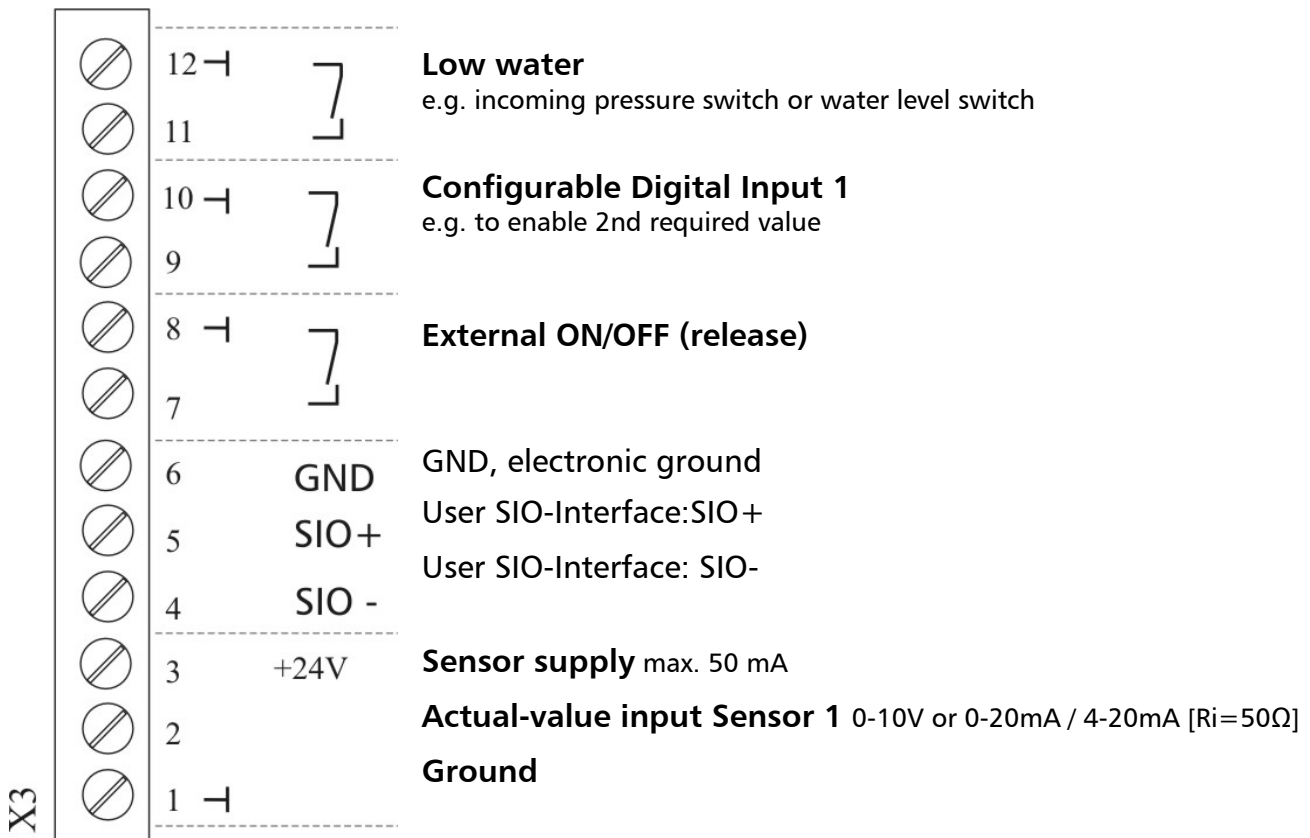


**NOTE:**

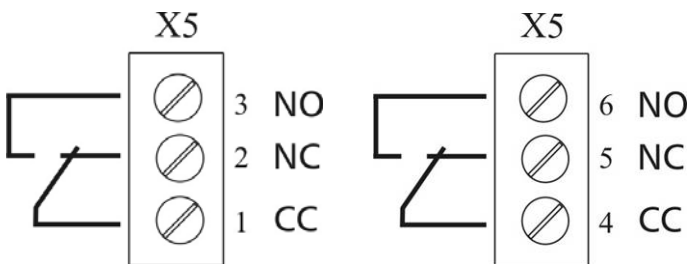
If unscreened control cables are used, signal interference may occur and could interfere the incoming signals and the function of the HYDROVAR.

Don't connect the ground of the Control Card to different 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. 50mA
	4	User SIO-Interface: SIO-	} <b>User Interface</b> 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 general use] [Max. 220VDC] [0,25A general use] [Max. 30VDC] [2A general use]
	2		NC	
	3		NO	
X5/	4	Status Relay 2	CC	
	5		NC	
	6		NO	

**Status Relay 1**
**Status Relay 2**

**Please Note:**

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

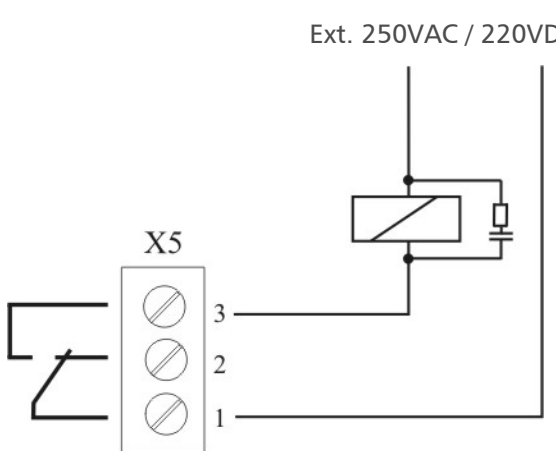
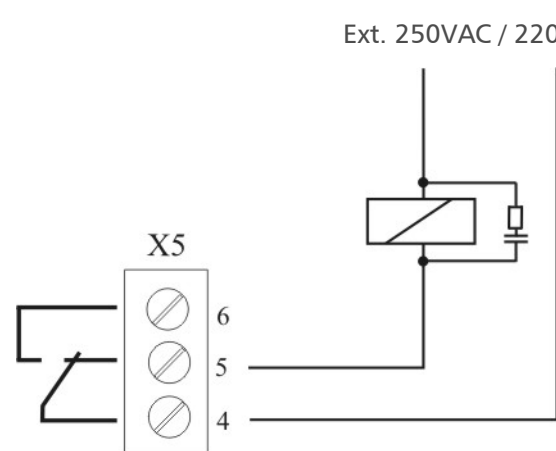
Both Status-Relays on the Control Card can be used regarding the programmed configuration.

Depending to the programming, both relays can be used to indicate the current status and failure messages of the HYDROVAR.

For example 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:**

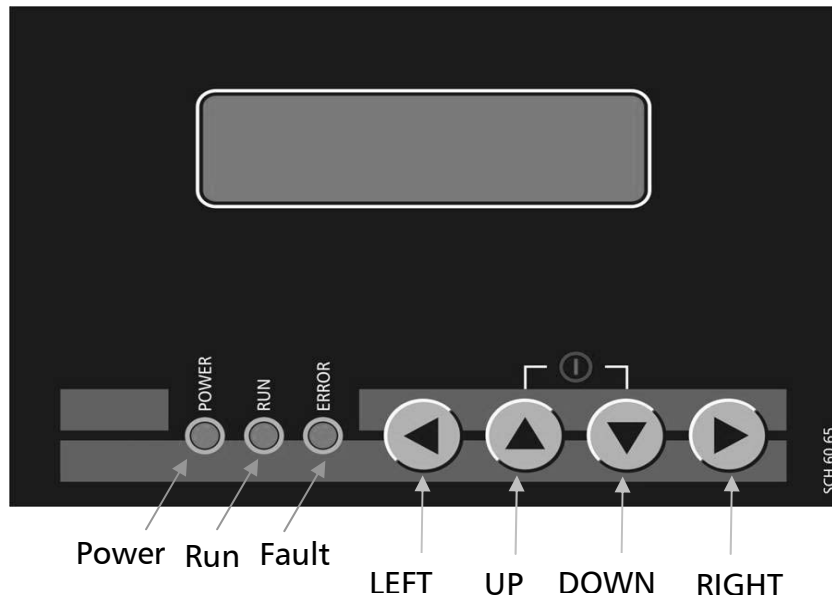
Pump running signal	Fault signal
 <p style="text-align: center;">Ext. 250VAC / 220VDC</p>	 <p style="text-align: center;">Ext. 250VAC / 220VDC</p>
<u>X5/ 1 and 3 closed:</u> - motor run indication	<u>X5/ 4 and 5 closed:</u> - if there is a Fault/Error - if the supply of the HYDROVAR is cut off

## 10 Programming



Read and follow the operating instructions carefully before 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

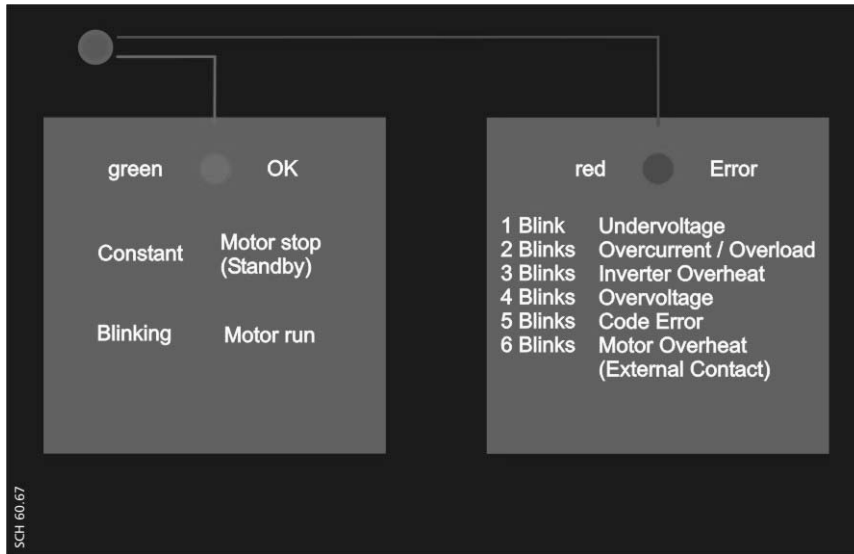


### 10.2 Function of the push buttons

- ▲ 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 about 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 an determined action
- ◀ Long Pressing: Change back to the main menu



### 10.3 Display of the Basic Inverter



<b>Status LED - green</b>	
Constant	Motor stopped (Standby)
Blinking	Motor run

<b>Error LED - red</b>	
The Type of shown error which occurred 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 concerning the possible reason and how to reset each error, see chapter 11 Failure Messages.

## 10.4 Software Parameters

In the following chapters all available parameters of the secondary menu are listed. On the Index window there is shown the factory setting and in the line below the possible 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 special software features).

When using a **HYDROVAR Single Inverter** (HYDROVAR with control card developed 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

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

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

The 1<sup>st</sup> Window, REQUIRED VALUE [02] and EFFECTIVE REQUIRED VALUE [03] depend on the selected mode which has been chosen with parameter MODE [0105]. The difference between the windows in the different modes is shown below:

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

ITT STOP	XX.X Hz X.XX Bar	1 <sup>st</sup> display at Mode Controller
-------------	---------------------	--

This window shows the status of the HYDROVAR.

ON	Manually 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**

	* ADR X STOP	PX XX.X Hz X.XX Bar	1 <sup>st</sup> display at Mode Cascade Serial and Cascade Relay
--	-----------------	---------------------------	--



This window shows the status of the HYDROVAR.

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

\* Indicates the Regulation Master

ON	Manually 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

**Valid for MODE – Controller / Cascade Relay / Cascade Serial**

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

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

D1	Internal - Required Value 1 (pre-selection with Parameter 0820)
D2	Internal - Required Value 2 (pre-selection with Parameter 0825)
U1	Voltage Signal Input - Required Value 1 (Connected to X3/13)
U2	Voltage Signal Input - Required Value 2 (Connected to X3/15)
I1	Current Signal Input – Required Value 1 (Connected to X3/18)
I2	Current Signal Input – Required Value 2 (Connected to X3/23)

<b>03</b>	03 EFF REQ VAL D1 X.XX Bar	Effective Required Value
-----------	-------------------------------	--------------------------

Shows the current required values which is calculated regarding to ACTUAL VALUE INCREASE [0505], ACTUAL VALUE DECREASE [0510] and LIFT AMOUNT [0330]. Even if the required value is recalculated by an offset signal (SUBMENU OFFSET [9000]) the current active required value is 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 would 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 <sup>st</sup> display in Mode Actuator
-------------------	---------------------	--

If parameter MODE [0105] is set to Actuator the parameter REQUIRED VALUE [02] will change to ACTUAT. FREQ. 1 and is equivalent to Parameter 0830. REQUIRED VALUE EFFECTIVE [03] will change to ACTUAT. FREQ. 2 and is equivalent to Parameter 0835.

By using the following two parameters it is possible to run the HYDROVAR with the two pre-selected frequencies for manual control of the HYDROVAR.

<b>02</b>	02 ACTUAT.FRQ. 1 XX.X Hz	Set the desired frequency with either ▲ or ▼
-----------	-----------------------------	--

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

<b>03</b>	03 ACTUAT.FRQ. 2 XX.X Hz	Set the desired frequency with either ▲ or ▼
-----------	-----------------------------	--

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

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

**Non –valid for Mode - Actuator**

<b>04</b>	04 START VALUE OFF	Regulation Restart Value
-----------	-----------------------	--------------------------

Possible settings: 0 – 100 % – OFF

This parameter determines 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 before the pressure drops below.

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

<b>05</b>	05 LANGUAGE ENGLISH	Language selection
-----------	------------------------	--------------------

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

The information on the display and all parameters can be called up in various languages. The languages available are split in different blocks which support different languages.

Which of the available region block is included in your HYDROVAR could be seen in the Type designation code. For detailed information see chapter 4.

With the following two parameters the current date and time, has to be set. That is necessary to save and display failure messages with the accurate date and time when the failure happened.

<b>06</b>	06 DATE DD.MM.YYYY	Current Date
-----------	-----------------------	--------------

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

After Pressing ► you will enter a Submenu where the current DAY / MONTH / and YEAR can be set.



<b>07</b>	07 TIME HH:MM	Current Time
-----------	------------------	--------------

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

Enter the submenu by pressing ► to set current HOUR and MINUTE.



<b>08</b>	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 a remedy of a failure or disconnection of the power supply.

If AUTO-START = OFF, the HYDROVAR won't start automatically after a remedy of a failure or disconnection of the power supply.

After remedy of the failure or reconnection of the power supply the following message is shown:

ITT <b>STOP</b>	XX.X Hz X.XX Bar	Press ▲ to restart the HYDROVAR.
--------------------	---------------------	----------------------------------

<b>09</b>	09 OPERAT. TIME 0000 h.	Operating Hours
-----------	----------------------------	-----------------

Total time the HYDROVAR is being connected to the power supply. How to reset see Parameter CLR OPERAT. [1135].

20	20 SUBMENU STATUS	Status of all units in 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
----	-----------------------------	---------------------

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



- In **Cascade Serial** mode the status of all (max. 8) connected units is shown (whereas 1=activated / 0=deactivated)
- In **Cascade Relay** mode (Master is fitted with additional relay card) the status of the 5 Relay- switching contacts is shown.

e.g. Mode – Cascade Serial

21 STATUS UNITS 11001000	Unit 1, 2 and 5 are running
-----------------------------	-----------------------------

e.g. Mode – Cascade Relay

21 STATUS UNITS 10100 - - -	Relay Contact 1 and 3 are closed
--------------------------------	----------------------------------

22	22 SELECT DEVICE * 1 *	Select device
----	---------------------------	---------------

Possible settings: 01-08

If you would like to check the following parameters which show the current status, the motor hours and the last failures which occurred, you have to select the desired unit which should be checked.

Regarding to the selected MODE [0105] the desired unit can be chosen:

#### Mode **CASCADE SERIAL**:

The number of the device depends to the pre-selected Address.

- e.g. Device 01 -> Master Inverter with pre-selected Address 1  
 Device 02 -> Basic Inverter with pre-selected Address 2  
 Device 03 -> Basic Inverter with pre-selected Address 3

For selecting desired address on a Basic Inverter, see chapter 9.4.3.2 Addressing.  
 To set the address on a Master Inverter, see Submenu 1200 RS485-Interface.

**Mode CASCADE RELAY:**

Device		enabled by
01	Master Inverter	
02	fixed speed pump	Relay 1 X10 / 1
03	fixed speed pump	Relay 2 X10 /2
04	fixed speed pump	Relay 3 X10 /3
05	fixed speed pump	Relay 4 X10 /4
06	fixed speed pump	Relay 5 X10 /5
07	not used	
08	not used	

<b>23</b>	<b>23 STATUS DEVICE</b> Stopped	Status of the selected device
-----------	------------------------------------	-------------------------------

Readable:	Running, Stopped, Disabled, OFF relay on, relay off Preparing, Solorun, Faulted	(Mode: Cascade Serial) (Mode: Cascade Relay)
-----------	---	---

Shows the status of the individual device in the system


**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:**

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 at the moment and  
 prepares the required data  
 Solorun -> Solorun is activated (X1/SL closed)  
 Faulted -> A Failure occurred on the current unit

<b>24</b>	<b>24 ENABLE DEVICE</b> Enable	Enable – Disable of the selected device
-----------	-----------------------------------	---

Possible settings:	Enable - Disable
--------------------	------------------

The selected Device can be enabled or disabled manually.  
 (Even in Cascade Relay and Cascade Serial Mode).





25	25 MOTOR HOURS XXXX h	Motor-Runtime of the selected device
----	--------------------------	--------------------------------------

Total time how long the motor is being powered by the HYDROVAR and basis for the switching order of the follow up pumps. 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
----	--------------------------	--

Readable: 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
----	--------------------------	----------------------------------

Readable: 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
----	--------------------------	----------------------------------

Readable: 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
----	--------------------------	----------------------------------

Readable: 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
----	--------------------------	----------------------------------

Readable: 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
----	-----------------------------	---------------------------------

In this parameters the current temperature, voltage and current of the chosen inverter can be monitored even during operation of the HYDROVAR.  
These parameters are only readable!

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

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

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

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

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

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
----	----------------------------	------------------------------

This value determines the voltage which is applied from Power supply at the moment.

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

This value determines the output frequency supplied from the HYDROVAR at the moment.

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 suggest stopping the HYDROVAR by pressing ▼ in the main menu during the first start-up.

61	61 PASSWORD 0000	Select Password (0066 = Default) by pressing ▲ or ▼
----	---------------------	---

**NOTICE: The password must be entered at each entry into the submenu**

	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 will be shut off and the inverter changes to manual mode.
- Using the ▲ and ▼ buttons any constant speed can be set without influence of the actual value of the control signal!
- If this value becomes 0.00 Hz the HYDROVAR stops.
- As soon as the window will be left by pressing ◀ or ▶, the HYDROVAR restart its normal mode.

0100	0100 SUBMENU BASIC SETTINGS	
0105	0105 MODE Controller	Selection of the Operation Mode
Possible settings:		Controller, Cascade Relay, Cascade Serial, Actuator

**Controller (Default Setting):**

This mode should be selected if only one HYDROVAR Master-Inverter is in operation and no connection to any other HYDROVAR via RS-485 interface has been done.

**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.

There is no connection to any other HYDROVAR via RS-485 Interface.

Advantages: costs, realizing of simple systems

**Cascade Serial:** 

If more than one speed controlled pump has to operate together via the RS-485 interface, this mode must be selected.

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: operation safety, switch interval, switching over in case of a failure

### Actuator: (For single pump operation only!)

The Actuator mode has to be used if an external speed signal is connected and the HYDROVAR is just used like a standard frequency converter.

In this case, the internal controller is shut off, so the HYDROVAR won't control the set value but it is responsible for running the connected motor at a frequency proportional to the input signal connected to the analogue inputs:

X3/13: Voltage signal input (Required value 1)  $\Rightarrow$  0 - 10V = 0 - MAX. FREQ. [0245]

X3/15: Voltage signal input (Required value 2)  $\Rightarrow$  0 - 10V = 0 - MAX. FREQ. [0245]

X3/18: Current signal input (Required value 1)  $\Rightarrow$  4-20 mA = 0 - MAX. FREQ. [0245]

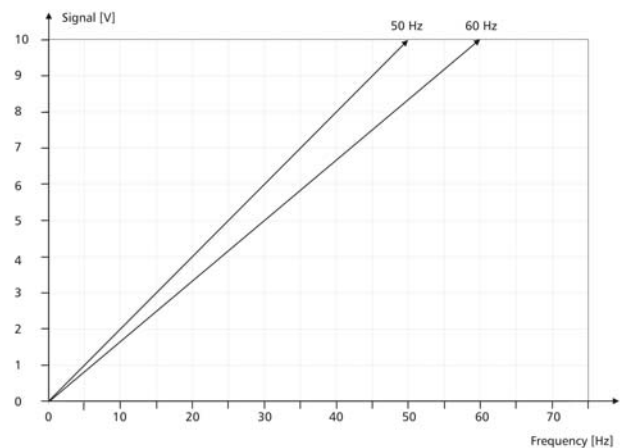
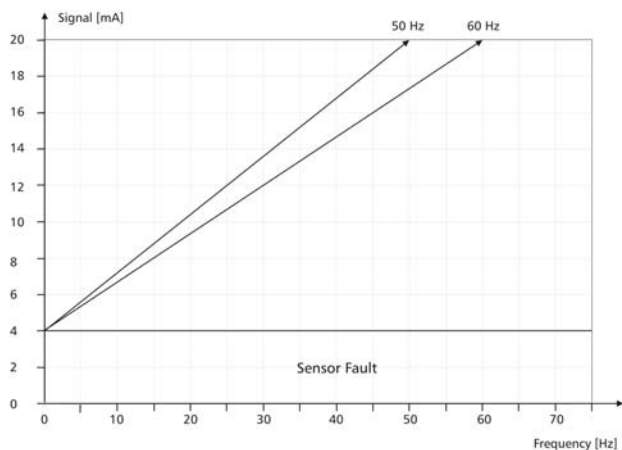
0-20 mA = 0 - MAX. FREQ. [0245]

X3/23: Current signal input (Required value 2)  $\Rightarrow$  4-20 mA = 0 - MAX. FREQ. [0245]

0-20 mA = 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 and 2. 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 a pre-selected frequency 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].



<b>0110</b>	<b>0110 SET PASSW.</b> 0066	Set Password by pressing ▲ or ▼
-------------	--------------------------------	---------------------------------

Possible settings:

The pre-set password (0066) can be changed if necessary.  
After the password has been changed, it is recommended to make some notes about the new password.

<b>0115</b>	<b>0115 LOCK FUNCT.</b> OFF	Possible settings with ▲ or ▼
-------------	--------------------------------	-------------------------------

Possible settings: ON - OFF

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 the main menu. The HYDROVAR can be just started or stopped by using the push buttons (▲ or ▼). In order to change the set value, the LOCK FUNCTION must be reset to OFF.

<b>0120</b>	<b>0120 DISP. CONTR.</b> 70 %	Display Contrast
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Possible settings: 10 – 100%

Can be adjusted between 10 - 100%, for improved clarity of the display depending on the installation position.

<b>0125</b>	<b>0125 DISP. BRIGHT</b> 100 %	Display Brightness
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Possible settings: 10 – 100%

The backlight illumination of the Display can be adjusted.

<b>0200</b>	<b>0200 SUBMENU CONF INVERTER</b>	
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<b>0205</b>	<b>0205 MAX. UNITS 01</b>	Maximum number of units
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Possible settings:	01 - 08
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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 -> Max. Units = 3

**Cascade Relay:**

1 Master Inverter and 3 fixed speed pumps -> Max. Units = 4

<b>0210</b>	<b>0210 INVERTER ALL</b>	Selection of the Power Unit for parameterizing
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Possible settings:	ALL, 1-8
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If several HYDROVAR Master Inverters and even Basic Inverters are connected via the RS-485 interface, the parameterizing could be done on one unit and will be adopted to all other units in this group (ALL – Default setting).

If only a specific unit has to be programmed you have to push the ► button for approx. 3sec. and chose afterwards the specific unit (1-8) for which the parameterizing should be done.

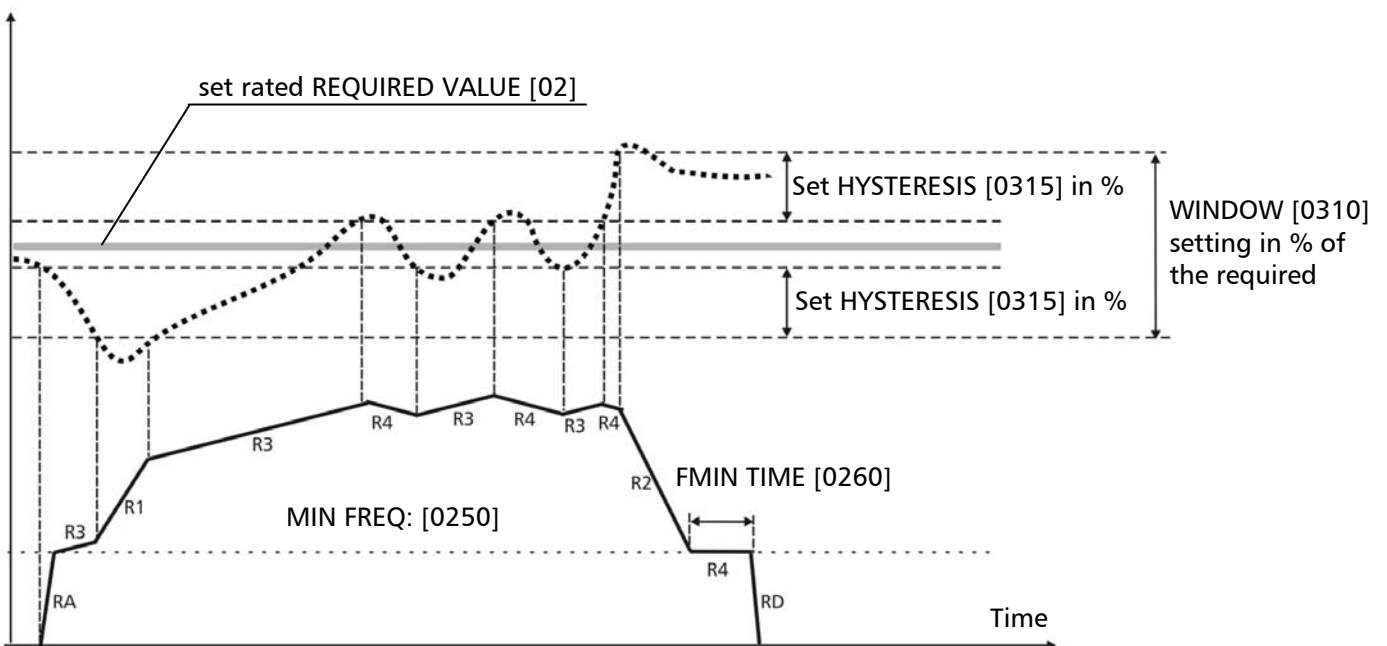
Be careful, if you change back to ALL the configuration of this set would be reloaded!

The parameterizing and the adoption of the pre-set parameters is only valid for the parameters in this submenu.

Ramp settings:

- Time setting of the Ramps influence the control of the pump and shouldn't be changed at standard operation.
- 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)
- The Ramps 3 and 4 determine the speed of the internal HYDROVAR controller and depend on the system, which has to be controlled. (Default = 70 sec.)
- The Ramps FminA and FminD are used for a fast start-up and shut off time. These parameters 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 Fmin Acceleration
- RD: Ramp Fmin 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



<b>0215</b>	0215 RAMP 1 4 Sec	Ramp 1: Fast acceleration time
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Possible settings: 1 – 250 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.

<b>0220</b>	0220 RAMP 2 4 Sec	Ramp 2: Fast deceleration time
-------------	----------------------	--------------------------------

Possible settings: 1 – 250 sec

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

<b>0225</b>	0225 RAMP 3 70 Sec	Ramp 3: Slow acceleration time
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Possible settings: 1 – 250 sec

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

<b>0230</b>	0230 RAMP 4 70 Sec	Ramp 4: Slow deceleration time
-------------	-----------------------	--------------------------------

Possible settings: 1 – 250 sec

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

<b>0235</b>	<b>0235 RAMP FMIN A</b> 2.0 Sec	Ramp Fmin Acceleration
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Possible settings:	1.0 – 25.0 sec
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Fast running up time to start up the HYDROVAR till the selected MIN. FREQUENCY [0250]. Above 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.

<b>0240</b>	<b>0240 RAMP FMIN D</b> 2.0 Sec	Ramp Fmin Deceleration
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Possible settings:	1.0 – 25.0 sec
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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)

<b>0245</b>	<b>0245 MAX. FRQ.</b> 50.0 Hz	Maximum Frequency
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Possible settings:	30.0 – 70.0 Hz
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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 setting may overload the motor!  
Settings of 10% above nominal frequency cause a 33% higher power consumption!

<b>0250</b>	<b>0250 MIN. FRQ.</b> 15.0 Hz	Minimum Frequency
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Possible settings:	0.0 – 30.0Hz
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At operation below the set min. frequency the HYDROVAR operates with the fast Ramps [0235/0240].



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

<b>0255</b>	0255 CONF. FMIN f -> 0	Operation at Minimum Frequency
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Possible settings:	f->0 or f-> $f_{min}$
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**f->0:** After reaching the required pressure the frequency will go 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-> $f_{min}$ :** 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-> $f_{min}$  can overheat the pump, when there is no flow through the pump. => bypass line for circulation pumps!

<b>0260</b>	0260 FMIN TIME 0 s	Delay time to shut off below minimum frequency
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Possible settings:	0 – 100 sec
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After running the pump for this selected time at minimum frequency, the pump will stop, if parameter CONFIG. FMIN [0255] is set to f -> 0

NOTICE: Problems with shut off the pump at 0 demand (too small or no pressure tank) may be solved as the system pressure is increasing during this delay-time.

<b>0265</b>	0265 BOOST 5 %	Setting of the motor starting voltage in % of connected supply voltage
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Possible settings:	0 – 25% of the input voltage
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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.

<b>0270</b>	<b>0270 KNEE FRQ.</b> 50.0 Hz	Knee Frequency
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Possible settings: 30.0 – 70.0 Hz

In this parameter you can set the frequency, at which the HYDROVAR should deliver its maximum output voltage (**for special applications only!**).  
For standard applications this frequency should be set according the MAX. FRQ. [0245] (Default Setting 50Hz).



**Be careful: This parameter is limited for special applications only! False setting can cause an overload error and even a damage of the motor.**

<b>0275</b>	<b>0275 POWER REDUCT.</b> OFF	Reduction of the maximum output current
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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	5,95	5,25	3,5
2.022	10	8,50	7,50	5,00
4.022	5,7	4,85	4,28	2,85
4.033	7,3	6,21	5,48	3,65
4.040	9	7,65	6,75	4,5
4.055	13,5	11,48	10,13	6,75
4.075	17	14,45	12,75	8,5
4.110	23	19,55	17,25	11,5

<b>0280</b>	<b>0280 SEL.SW.FRQ.</b> Auto	Selection of the switching frequency
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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 would be decreased to 4kHz automatically.

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

• **4kHz** - Reduce the temperature in the motor and even inside the inverter.

<b>0300</b>	<b>0300 SUBMENU REGULATION</b>	
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<b>0305</b>	<b>0305 JOG    0.0Hz X.XX Bar</b>	Both current output frequency and actual value are shown.
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- By pressing ▲ or ▼ in this menu, the internal controller of the HYDROVAR will be shut off and the inverter changes to manual mode.
- With the ▲ and ▼ buttons any constant speed can be set without influence of the actual value of the control signal!
- If this value becomes 0.00 Hz the HYDROVAR stops.
- As soon as the window will be left by pressing ◀ or ▶, the HYDROVAR restart normal mode.

<b>0310</b>	<b>0310 WINDOW 10 %</b>	Regulation Window
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Possible settings:	0 – 100% of required value
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- Determines the band, where the slow Ramp changes to the fast Ramp
  - for steep pump-curves and closed loop systems ~20-30%

<b>0315</b>	<b>0315 HYSTERESIS 80%</b>	Ramp Hysteresis
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Possible settings:	0 – 100%
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- Determines the band, where the normal Regulation is done (Change between the slow Ramps)
- for an accurate controlling (without automatic shut-off) ~99%, e.g. constant flow control

<b>0320</b>	<b>0320 REG. MODE normal</b>	Regulation mode
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Possible settings:	normal, invers
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**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)

<b>0325</b>	<b>0325 FRQ. LIFT</b> 30.0 Hz	Frequency limit for required lift value
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Possible settings:	0.0 Hz – 70.0 Hz
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Control according to a system curve (increase of the set pressure, depending upon the delivery rate or 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. (Shut off level can be found out by using the JOG MODE [0305])

<b>0330</b>	<b>0330 LIFT AMOUNT</b> 0.0 %	Lift amount for required lift value
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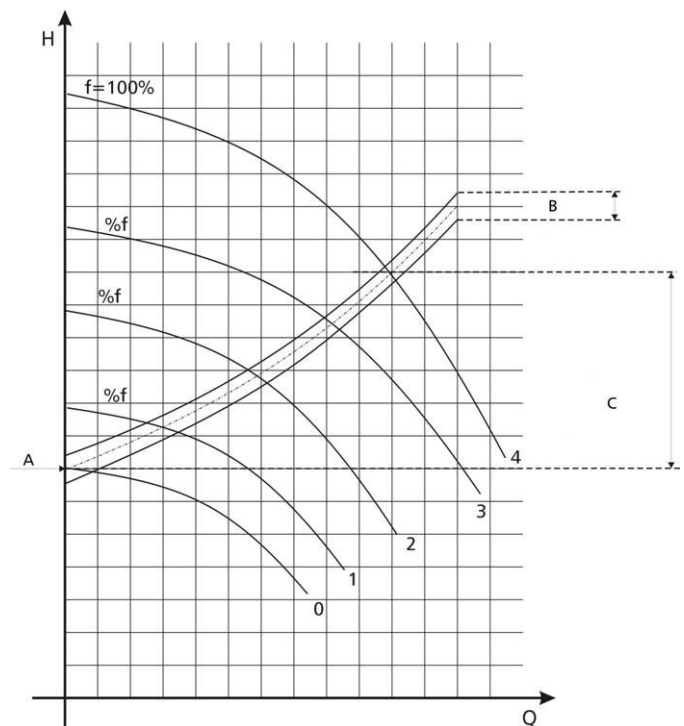
Possible settings:	0.0 – 200.0%
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This value states how much the set value should be continually increased, till the maximum speed (maximum volume) is reached.

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



<b>0400</b>	<b>0400 SUBMENU SENSOR</b>	
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Within this submenu all sensors which are connected to the HYDROVAR can be configured. (Either two transducers with current signal input or voltage signal input)


It isn't possible to install two different transducer types because configurations are the same for all connected sensors.

Connection of the Sensors: See chapter 9.4.4.1

<b>0405</b>	<b>0405 DIMENS. UNIT Bar</b>	Dimension Unit
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Possible settings: bar, psi, m<sup>3</sup>/h, g/min, mH<sub>2</sub>O, 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 to change the SENSOR RANGE [0420] according to the new DIMENSION UNIT too!

<b>0410</b>	<b>0410 CONF SENSOR Sensor 1</b>	Selection of the Sensor	
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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 switch over 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





<b>0430</b>	<b>0430 SENS 1 CAL0</b> 0% = 00.00 bar	Sensor 1 zero value calibration
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Possible settings: - 10% up to +10% of the sensor range

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

e.g. DIMENS. UNIT [0405] = bar  
 SENS. RANGE [0420] = 10.00 bar  
 SENS 1 CAL0 [0430] = 2% -> 00,20 bar

<b>0435</b>	<b>0435 SENS 1 CALx</b> 0% = 10.00 bar	Sensor 1 full value calibration
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Possible settings: - 10% up to +10% of the sensor range

To set the calibration for the maximum value of Sensor 1, this parameter can be used. After setting the right Dimension Unit and Sensor range the maximum value can be adjusted between -10 and +10% of the Sensor Range.

e.g. DIMENS. UNIT [0405] = bar  
 SENS. RANGE [0420] = 10.00 bar  
 SENS 1 CAL0 [0430] = -2% -> 09,80 bar

<b>0440</b>	<b>0440 SENS 2 CAL0</b> 0% = 00.00 bar	Sensor 2 zero value calibration
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Possible settings: - 10% up to +10% of the sensor range

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



<b>0445</b>	<b>0445 SENS 2 CALx</b> 0% = 10.00 bar	Sensor 2 full value calibration
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Possible settings: - 10% up to +10% of the sensor range

Full value calibration for Sensor 2, for explanation see Parameter 0435.



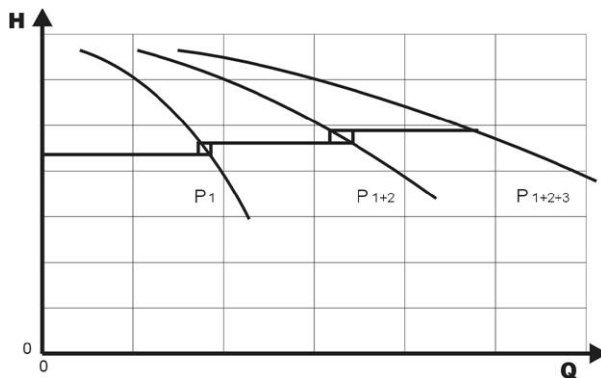
<b>0500</b>	0500 SUBMENU SEQUENCE CNTR.	
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Using the parameters in this submenu, all necessary settings can be done for running a multi-pump system (even in Cascade Relay and Cascade Serial Mode).

Application Example:

- 1) Lead pump reaches its ENABLE FREQUENCY [0515]
- 2) Actual value falls and reaches the cut in-value of the 1<sup>st</sup> follow up pump  
 Cut in-value = REQUIRED VALUE [02] – ACT. VAL. DEC. [0510]  
 → the 1<sup>st</sup> follow up 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].




Calculation of the new required value for multi pump applications:


k ... Number of active pumps (k > 1)  
 $p = p_{set} + (k-1) \cdot [\text{lift value} - \text{fall value}]$

- Lift value = Fall value ⇒ **Pressure constant** even all pumps are in operation
- Lift value > Fall value ⇒ **Pressure rises** when lag-pump switches on
- Lift value < Fall value ⇒ **Pressure falls** when lag-pump switches on


The following 3 parameters are responsible for starting the lag pumps and for calculation of the new required value as well.

<b>0505</b>	0505 ACT.VAL.INC. 0.35 Bar	Lift Value	
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Possible settings: 0.00 – to the pre selected sensor range

<b>0510</b>	0510 ACT.VAL.DEC. 0.15 BAR	Fall Value	
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Possible settings: 0.00– to the pre selected sensor range

<b>0515</b>	0515 ENABLE FRQ 48.0 Hz	Enable frequency for the next power unit	
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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 switched on.

<b>0520</b>	0520 ENABLE DLY 5 sec	Enable delay time ( <b>For Cascade Relay Only!</b> )
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Possible settings: 0 – 100 sec

If the above parameters for switching on a follow up pump are satisfied, the follow-up-pump will start after this selected time.

<b>0525</b>	0525 SW DELAY 5 sec	Switch Delay ( <b>For Cascade Relay Only!</b> )
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Possible settings: 0 – 100 sec

Delay Time between two switching actions of the follow-up-pumps. That parameter prevents the system against repeated switching actions caused by the variation of the consumption.



<b>0530</b>	<b>0530 DISABLE FRQ</b> 30 Hz	<b>Disable Frequency (For Cascade Relay Only!)</b>
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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 follow-up-pump stops.

<b>0535</b>	<b>0535 DISABLE DLY</b> 5 sec	<b>Disable Delay time (For Cascade Relay Only!)</b>
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Possible settings: 0 – 100 sec



Delay time before switching off the follow up pumps in Cascade Relay mode.

<b>0540</b>	<b>0540 DROP FRQ</b> 42 Hz	<b>Drop Frequency (For Cascade Relay Only!)</b>
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Possible settings: 0.0 – 70.0 Hz



This parameter is used to prevent systems from water 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.

<b>0545</b>	<b>0545 OVERVALUE</b> OFF	<b>Overvalue</b>
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Possible settings: OFF – pre selected Sensor range



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 Basic Inverter) and a system pressure of 7.50 bar is reached, one after another basic units shuts off immediately.

This parameter prevent the system against Overpressure in case the HYDROVAR has been parameterized incorrectly.

<b>0550</b>	<b>0550 OVERVAL DLY</b> 0 sec	Overvalue Delay
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Possible settings: 0.0 – 10.0 sec

Delay time to switch-off a follow-up-pump in case the actual value exceeds the OVERVALUE [0545] Limit.



<b>0555</b>	<b>0555 SWITCH INTV</b> 24 hours	Switch Interval for cyclic changeover <b>(For Cascade Serial only!)</b>
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Possible settings: 0 – 250 hours

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



The Switch Interval is valid for HYDROVAR Master Inverters only (connected via the RS-485 interface) and using operation mode Cascade Serial.

### Synchronous Control

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

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

The follow-up pump will stop, when the frequency drops below the set SYNCHR. LIMIT [0560]. This function creates a hysteresis effect which prevents the follow-up 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).

<b>0560</b>	<b>0560 SYNCHR. LIM.</b> 0.0 Hz	Frequency limit for synchronous regulation
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Possible settings: 0.0 Hz - Max. Frequency

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



<b>0565</b>	0565 SYNCHR. WND. 2.0 Hz	Frequency window for synchronous regulation
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Possible settings: 0.0 – 10 Hz



Frequency limit for switching off the next follow-up pump.

e.g. Switching of the 3<sup>rd</sup> pump:

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

or: Switching of the 4<sup>th</sup> pump:

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

<b>0570</b>	0570 MSTPRIORITY ON	Master Priority (For Cascade Serial only!)
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Possible settings: ON - OFF



This Parameter determines the switching order when Master and Basic Inverters are Used together. In such a case you have to choose if 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 Master	Adr 2 Master	Adr 3 Master	Adr 4 Basic	Adr 5 Basic	Adr 6 Basic	Adr 7 Basic	Adr 8 Basic
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**OFF-** One Master (which is responsible for the controlling according the set value) is running. With rising consumption all Basic Inverters has to be released before any other Master starts running.

<u>Switching order:</u>	Adr 1 Master	Adr 4 Basic	Adr 5 Basic	Adr 6 Basic	Adr 7 Basic	Adr 8 Basic	Adr 2 Master	Adr 3 Master
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<b>0600</b>	0600 SUBMENU ERRORS	
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<b>0605</b>	0605 MIN. THRESH. disabled	Minimum Threshold limit
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Possible settings:	disabled - max. SENSOR RANGE
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- 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 and indicates the Failure Message "MIN. THRESHOLD ERROR".
- To disable the Minimum Threshold limit, press ▼ till "disabled" is shown on the display.

<b>0610</b>	0610 DELAY - TIME 2 Sec	Minimum Threshold limit delay time
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Possible settings:	0 – 100 sec
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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 have 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 higher than that.

<b>0615</b>	0615 ERROR RESET ON	Automatic Error reset
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Possible settings:	ON – OFF
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**ON:** Allows an automatic restart for 5 times in case of a failure. If the failure is still active after the 5<sup>th</sup> restart, the HYDROVAR will shut off and the appropriate error message is shown.

The internal counter of the automatic error reset is being decreased 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 the External ON/OFF (X3/7-8).

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.

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

Terminal: X3/20

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

For wiring see chapter 9.4.4!

<b>0710</b>	<b>0710 ANALOG OUT2 Actual value</b>	<b>Analogue Output 2</b>	
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Possible settings:	Actual Value, Output frequency
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Analogue output 4 – 20mA = 0 - 100%

Terminal: X3/21

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

For wiring see chapter 9.4.4!

Both Status-Relays can be used to indicate the current status and fault condition of the HYDROVAR. For wiring see chapter 10.3.4.

<b>0715</b>	<b>0715 CONF REL 1 Running</b>	<b>Configuration of the Status Relay 1 (X5/1-2-3)</b>
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<b>0720</b>	<b>0720 CONF. REL 2 Errors</b>	<b>Configuration of the Status Relay 2 (X5/4-5-6)</b>
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Possible settings:	Power, Errors, Warnings, StandBy, Errorreset
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<b>Config.</b>	<b>Explanation</b>	<b>Action</b>
Power	HYDROVAR is connected to power supply	Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed
Running	Motor is running	Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed
Errors	An error is indicated on the HYDROVAR	Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed
Warnings	A warning is indicated on the HYDROVAR	Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed
StandBy	Pump is released manually and by external release, no error/warning is indicated and HYDROVAR doesn't run	Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed
Errorreset	If Parameter ERRORRESET [0615] is activated and a Warning occurs 5 times -> Error ->	Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed



<b>0800</b>	<b>0800 SUBMENU REQUIRED VALUES</b>	
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The changeover between 1<sup>st</sup> and the 2<sup>nd</sup> required value can be done internally or externally via the digital inputs. With the following parameters the source of the required values and the change over can be configured.



<b>0805</b>	<b>0805 C.REQ.VAL 1 digital</b>	<b>Configuration Required Value 1</b>
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Possible settings:	- digital	- analog U 0-10V	
	- analog I 0-20mA	- analog I 4-20mA	

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

<b>0810</b>	<b>0810 C.REQ.VAL 2 OFF</b>	<b>Configuration Required Value 2</b>
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Possible settings:	- OFF	- digital	- analog U 0-10V
	- analog I 0-20mA	- analog I 4-20mA	

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

<b>0815</b>	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-GND)  
 Switch Dig 3: Manual switching by closing Digital Input 3 (X3/5-GND)  
 Switch Dig 4: Manual switching by closing Digital Input 4 (X3/15-GND)

<b>0820</b>	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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Set the required value with either ▲ or ▼.

This pre-selected required value is active in Mode Cascade Relay and Cascade Serial if Parameter C.REQ.VAL.1 [0805] is set to digital, and Parameter SW REQ.VAL. [0815] is set to Setpoint 1 or the REQUIRED VALUE 1 is chosen via digital input.

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

<b>0825</b>	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 Mode Cascade Relay and Cascade Serial if Parameter C.REQ.VAL.2 [0810] is set to digital, and Parameter SW REQ.VAL. [0815] is set to Setpoint 2 or the REQUIRED VALUE 2 is selected via digital input.

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

<b>0830</b>	0830 ACTUAT.FRQ 1 XX.X Hz	Required frequency 1 for Actuator (digital)
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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] is set to digital, and Parameter SW REQ.VAL [0815] is set to Setpoint 1 or the ACTUATOR FREQUENCY 1 is selected via digital input.

<b>0835</b>	0835 ACTUAT.FRQ 2 XX.X Hz	Required frequency 2 for Actuator (digital)
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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.2 [0810] is set to digital, and Parameter SW REQ.VAL [0815] is set to Setpoint 2 or the ACTUATOR FREQUENCY 2 is selected via digital input.

<b>0900</b>	<b>0900 SUBMENU OFFSET</b>		
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All analogue inputs can also be used to connect an Offset-signal used for the recalculation of the required value.

<b>0905</b>	<b>0905 OFFS. INPUT OFF</b>	<b>Selection of the Offset Input</b>	
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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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<b>OFF</b>	Offset deactivated
<b>analog U 1 0-10V</b>	Offset will be calculated according to the voltage signal (0 – 10V) connected to terminals X3/13 (Required Value 1)- X3/14 (GND).
<b>analog U 2 0-10V</b>	Offset will be calculated according to the voltage signal (0 – 10V) connected to terminals X3/15 (Required Value 2)- X3/16 (GND)
<b>analog I 1 0/4 – 20mA *</b>	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).
<b>analog I 2 0/4 – 20mA *</b>	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 falls below 4mA, a warning message is shown on the display. If the failure is still active after 20 seconds, an error message will be shown.

<b>0910</b>	<b>0910 LEVEL 1 XX.X %</b>	<b>Start level of the 1<sup>st</sup> Offset.</b>	
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Possible settings:	0 – 100% of additional analogue input
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<b>0915</b>	<b>0915 LEVEL 2 XX.X %</b>	<b>Start level of the 2<sup>nd</sup> Offset.</b>	
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Possible settings:	0 – 100% of additional analogue input
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<b>0920</b>	0920 INTENSITY 1 +XX.X %	<b>Only in combination with Level 1!</b>	
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Possible settings: -500.0% up to +500.0% of the sensor range

Intensity of the 1<sup>st</sup> Offset of the required value at the zero point of the second analogue input.

<b>0925</b>	0925 INTENSITY 2 +XX.X %	<b>Only in combination with Level 2!</b>	
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Possible settings: -500.0% up to +500.0% of the sensor range

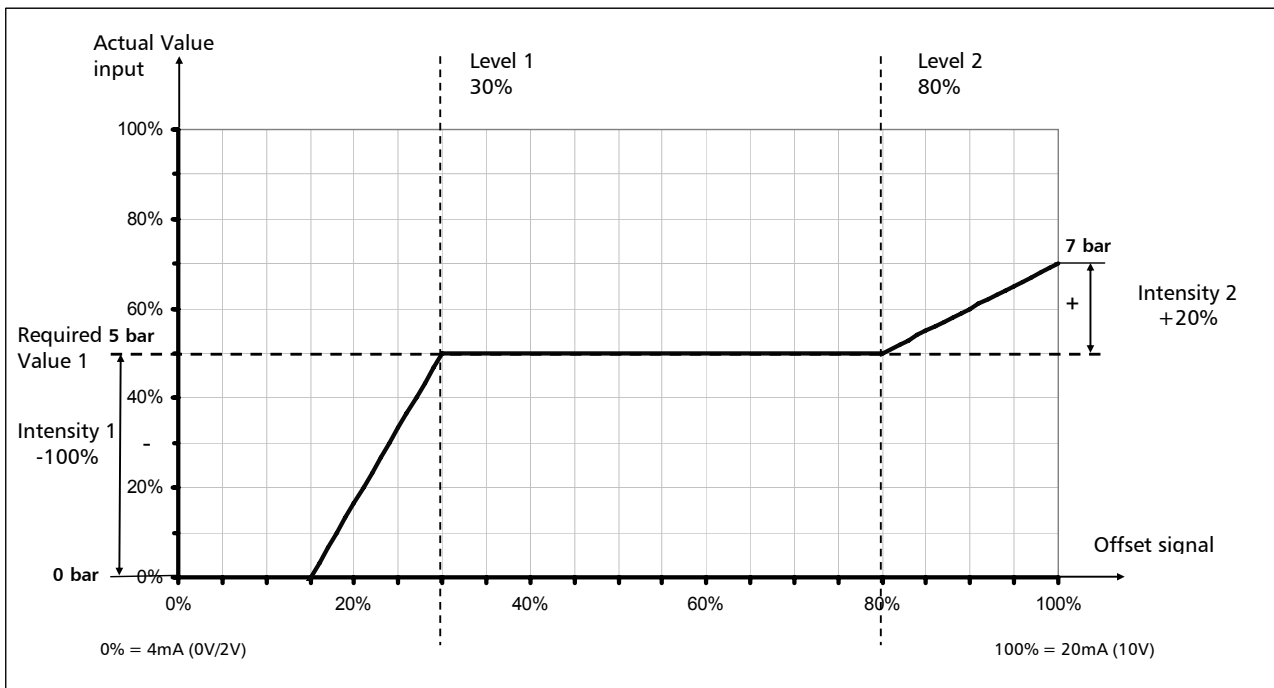
Intensity of the 2<sup>nd</sup> Offset of the required value at the maximum point of the second analogue input.

**Example for using the Offset function:**

SENSOR RANGE: 20mA  $\triangleq$  10 bar  
 REQUIRED VALUE: 5 bar

LEVEL 1: 30% of the Offset signal  
 LEVEL 2: 80% of the Offset signal

INTENSITY 1: -100%  $\triangleq$  -10bar (refer to the sensor range) = -5bar  
 INTENSITY 2: +20%  $\triangleq$  +2 bar (refer to the sensor range) = 7 bar



At parameter LEVEL 1 [0910] you have entered the start value (in percent from the Offset Signal input (30%)), where the OFFSET starts to be active. Also proceed with the second level (80%).

Intensity one and two are depending on the Sensor range of the actual value signal. The Intensity 1 that you have entered is valid till you reach Level 1, after reaching Level 1 the Required Value has no offset.

The standard Required Value will be valid till you reach the Level 2. After reaching level 2, the new value, depending on the Intensity 2, is valid.

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

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

Test Run Time, Frequency and Boost could be chosen in the parameters below.

For deactivating the automatic test run press ▼ until "OFF" appears on the display.

**The test run is only active, when the pump is stopped but External ON/OFF contact (X3/7-8) is closed and even pump is manually released!**

1010	1010 TESTRUN FRQ. 30.0 Hz	Frequency for manual and automatic test run
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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
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Possible settings: 0 – 25% of maximum input voltage is possible

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

1025	1025 SEL. DEVICE 01	Select Inverter for manual testrun	
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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 ensure a manual Test Run only for a selected unit. (Even fixed speed pumps in Cascade Relay Mode could be activated)

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

1100	1100 SUBMENU SETUPS	
1120	1120 PASSWORD 2 0000	Enter password by pressing ▲ or ▼

The below mentioned parameters are just available after entering the password!  
For more information, contact your distributor!

1125	1125 CLR ERRORS UNIT X	Clear Error Memory of selected unit or ALL units (Cascade Serial)
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Possible settings:	1 – 8, ALL
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To clear the Error Memory either one specific unit (1-8) or 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 for ALL (Cascade Serial)
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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 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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How to connect the RS485-Interface correctly, see chapter 9.4.4 Control Unit

### User Interface

The following 3 Parameters are necessary for 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 RS-485 interface (max. 8 / using Cascade Serial Mode) each pump must be allocated its own pump-address number (1-8).

**Each address may only be used once!**

1220	1220 PUMP ADDR. 1	Select desired Adress 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 appears:

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

Addressing false - retry

When using Master and Basic Inverters together in a multi-pump-system you have to consider that also the Basic Inverters must have their separate address because 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 being stopped by an error (warning), both the HYDROVAR and the motor remains under voltage. So before any work can be carried out on the electrical or mechanical part of the system, the HYDROVAR must be disconnected from power supply.

It has to be differed between warnings and errors:

- **Warnings** are shown on the display (and even by the red failure led) but it is possible that the HYDROVAR keeps running (depends to the different warnings). If a warning is active and the cause can't be remedied during 20 seconds in most cases an error will be shown.
- **Errors** are indicated on the HYDROVAR and by the red failure LED placed on the control panel, and the connected motor is stopped immediately. All errors are shown on the Display and saved in the Error Memory including date and time when the failure happened.

The below mentioned points describe each error which can occur on the HYDROVAR (even on the Master and the Basic Inverter). Also the possible countermeasures to reset these errors are described.

- Please notice 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 also **indicated** at 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

If the HYDROVAR is used as Basic Inverter (consists only of the Power unit), the following errors are indicated by a failure code:

Red Led Code	Error	Probability 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 exceeded
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 (see chapter 11.3)
6 blinks	MOTOR OVERHEAT EXTERNAL CONTACT	PTC in the conduit box has reached its release temp. or external contact is open

How to remedy the failure cause, see chapter 11.2!

<b>Reset:</b>	<p>To Reset the CODE ERROR and the OVERCURRENT ERROR it is necessary to cut the power supply for &gt; 60 seconds.</p> <p>A reset of all other errors can be done by open/close the START/STOP_PTC input (X1/SL) 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 happened.

<b>FAULT DEVICE X</b>	<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!</p>
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When a Master Inverter is used in such a system, it is also possible to reset the errors which occurred on the Basic Inverter by the Master without interfere the operation of the other Inverters in the system (also the automatic Error-reset is active if parameter ERROR-RESET [0615] is set to ON).

## 11.2 Master / Single Inverter

Each error is shown on the display in plain text and saved in the Error Memory including date and time when the failure occurred.

The errors can be reset automatically, depending on the setting in parameter ERROR-RESET [0615], or manually after the cause has been remedied in different ways:

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

### No error-message on the display - No red LED

Error	Probability cause	Solution
no AUTOSTART after power failure	Parameter AUTOSTART 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 INVERS.	check parameter START VALUE [04] and/or REGULATION MODE [0320]

### Error-message on the display - red LED on

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

#### Reset:

- cutting off the power supply for >60 seconds.
- an automatic Error-reset isn't possible for that kind of failure!

Error	Probability cause	Solution
<b>OVERLOAD ERROR 12</b>	Power limit of the HYDROVAR is exceeded	<ul style="list-style-type: none"> <li>• check Parameter RAMP 1/2 [0215/0220] (too short) and BOOST [0265] (too low)</li> <li>• check motor connection (star/delta) and cable</li> <li>• Pump blocked</li> <li>• Motor turns in the wrong direction before running (Non return-valve defect)</li> <li>• Not allowed operation point or MAX. FREQUENCY [0245] too high check also the BOOST [1015] in the submenu TEST RUN [1000]</li> </ul>
<b>OVERVOLTAGE ERROR 13</b>	DC voltage of the HYDROVAR too high	<ul style="list-style-type: none"> <li>• Parameter RAMP 2 [0220] too fast</li> <li>• Power supply too high</li> <li>• Voltage peaks too high</li> <li>• (Solution: Line filters, Line inductance, RC-Element)</li> </ul>
<b>INVERT. OVERHEAT ERROR 14</b>	too high temperature inside the HYDROVAR	<ul style="list-style-type: none"> <li>• no proper cooling</li> <li>• contamination of the motor vents</li> <li>• ambient temperature too high</li> </ul>
<b>THERMO MOT/EXT ERROR 15</b>	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"> <li>• close X1/PTC if there is no external protective device connected (e.g. PTC, low water switch)</li> <li>• close external on/off switch if connected to these terminals</li> <li>• For detailed information how the terminal X1/PTC could be used see chapter 9.4.3</li> </ul>
<b>PHASELOSS ERROR 16</b>	One phases of the power supply has been lost -> automatic Power reduction (just available for the units HV4.055-4.110)	<ul style="list-style-type: none"> <li>• check power supply (even under full load) – phase failure at the input</li> <li>• check circuit breakers circuit points at the input terminals</li> </ul>
<b>UNDERVOLTAGE</b>	DC voltage of the HYDROVAR too low	<ul style="list-style-type: none"> <li>• supply voltage too low</li> <li>• phase failure at the input</li> <li>• asymmetry of the Phases</li> </ul>
<b>COMM LOST</b>	The communication between the Power Unit and the Control card doesn't work correctly	<ul style="list-style-type: none"> <li>• check if the addressing [1220] has been done correctly (retry!)</li> <li>• check if each unit has allocated his own pump address</li> <li>• check if the connection from control card to the power unit is made properly (ribbon cable)</li> </ul>

<b>Reset:</b>	<ul style="list-style-type: none"> <li>○ cutting off the power supply for &gt;60 seconds</li> <li>○ manual reset by closing External ON/OFF (Terminals X3/7-8)</li> <li>○ manual reset by pressing ◀ and ▶ simultaneously for about 5 seconds</li> <li>○ Auto-reset possible if ERROR-RESET [0615] is set to ON</li> </ul>	
<b>LACK OF WATER ERROR 21</b>	<p>Low water contact (X3/11-12) is opened</p> <p>(just active if motor is running)</p>	<ul style="list-style-type: none"> <li>• protection of incoming pressure or min. level to less</li> <li>• bridge X3/11-12, if there is no ext. low water protection</li> <li>• adjust Parameter DELAY TIME [0610] if the failure happens only for short time</li> </ul>
<b>Reset:</b>	<ul style="list-style-type: none"> <li>○ Automatically if Low water contact (X3/11-12) will be closed!</li> </ul>	
<b>MIN. THRESHOLD ERROR 22</b>	<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"> <li>• check booster unit, adjust Parameter DELAY TIME [0610]</li> <li>• Parameter ERROR RESET [0615] set to ON, to enable 5 restarts (e.g. in empty system)</li> </ul>
<b>FAILURE SENSOR 1</b>	<p>Sensor signal on terminals X3/2 &lt;4mA</p> <p><u>active Sensor:</u> WARNING (20 sec.)-&gt; ERROR</p> <p><u>non-active Sensor:</u> WARNING</p>	<ul style="list-style-type: none"> <li>• ACTUAL VALUE signal (pressure transducer) faulty</li> <li>• wrong connection</li> <li>• Sensor (Transducer) or cable fault</li> <li>• check configuration of the Sensors in Submenu SENSORS [0400]</li> </ul>
<b>ACT. VAL. SENSOR 1 ERROR 23</b>		
<b>FAILURE SENSOR 2</b>	<p>Sensor signal on terminals X3/4 &lt;4mA</p> <p><u>active Sensor:</u> WARNING (20 sec.)-&gt; ERROR</p> <p><u>non-active Sensor:</u> WARNING</p>	<ul style="list-style-type: none"> <li>• ACTUAL VALUE signal (pressure transducer) faulty</li> <li>• wrong connection</li> <li>• Sensor (Transducer) or cable fault</li> <li>• check configuration of the Sensors in Submenu SENSORS [0400]</li> </ul>
<b>ACT. VAL. SENSOR 2 ERROR 24</b>		
<b>SETPOINT 1 I&lt;4mA</b>	<p>Current signal input of required values is active, but no signal 4-20mA is connected</p> <p>WARNING (20 sec.)-&gt; ERROR</p>	<ul style="list-style-type: none"> <li>• check external analogue signal on terminals X3/17-18</li> <li>• check configuration of the required values in Submenu REQUIRED VALUES [0800]</li> </ul>
<b>SETPOINT 1 I&lt;4mA ERROR 25</b>		

<b>SETPOINT 2 I&lt;4mA</b>	Current signal input of required values is active, but no signal 4-20mA is connected WARNING (20 sec.)-> ERROR	<ul style="list-style-type: none"> <li>• check external analogue signal on terminals X3/22-23</li> <li>• check configuration of the required values in Submenu REQUIRED VALUES [0800]</li> </ul>
<b>SETPOINT 2 I&lt;4mA ERROR 26</b>		

<b>Reset:</b>	<ul style="list-style-type: none"> <li>○ cutting off the power supply for &gt;60 seconds</li> <li>○ manual reset by closing External ON/OFF (Terminals X3/7-8)</li> <li>○ manual reset by pressing ◀ and ▶ simultaneously for about 5 seconds</li> <li>○ Auto-reset possible if ERROR-RESET [0615] is set to ON</li> </ul>
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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 (corresponding 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"> <li>• check push buttons,</li> <li>• Display-board may be defect</li> </ul>
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"> <li>• check the installation of the cables, connection of the screen and potential equalization</li> <li>• check earth/ground</li> <li>• install additional inductances for the signal-cables (e.g. ferrites)</li> </ul>

**Examples:**
**Booster unit**

<b>Problem: no stop of the HYDROVAR</b>	
<b>Parts to check</b>	<b>Solution</b>
<ul style="list-style-type: none"> <li>existing demand</li> <li>non return valve is not closed</li> <li>pre charge pressure in the pressure tank</li> <li>no correct settings of WINDOW and RAMPHYSTERESIS</li> <li>shut down Ramp too slow</li> <li>suction line too long</li> </ul>	<ul style="list-style-type: none"> <li>check pipes and valves</li> <li>change non return valve</li> <li>adjust according the diagram (Look at chapter 2.1)</li> <li>set WINDOW [0310] (ca.10%) and HYSTERESIS [0315] (80-50%)</li> <li>set RAMP 2 [0220] to 4...15 sec.</li> <li>the MINIMUM FREQUENCY [0250] should be activated for pressure increase at 0 demand</li> </ul>

**Control on constant flow**

<b>Problem: control fluctuations</b>	
<b>Parts to check</b>	<b>Solution</b>
control characteristics are set to low	enlarger WINDOW [0310] and set HYSTERESIS [0315] to 99% to control with RAMP 3 and 4

**Circulating pump**

<b>Problem: oscillation of the motor speed</b>	
<b>Parts to check</b>	<b>Solution</b>
control settings too fast	<ul style="list-style-type: none"> <li>increase RAMP 3 [0225] and 4 [0230]: 100...200sec</li> <li>WINDOW [0310] (ca.20%) and HYSTERESIS [0315] (ca.99%)</li> </ul>

<b>Problem: ACTUAL VALUE can't be hold</b>	
<b>Parts to check</b>	<b>Solution</b>
HYSTERESIS is set too big	HYSTERESIS [0315]: 90-99%

**General**

<b>Problem:</b>	pressure fluctuations, analogue signal not constant
<b>Solution:</b>	<ul style="list-style-type: none"> <li>check cables and connection of the screen</li> <li>check earth connection of the Transmitter</li> <li>use screened cables</li> </ul>



## 12 Maintenance

The HYDROVAR does not require any special maintenance.

However, the cooling fan and the vents should be freed of dust occasionally. 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. Look at the pump- and motor-instruction.

Please take your personal protection equipment.

For further information, please ask your distributor!

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