

xylem

Operating Instructions

HYDROVAR®

HV 1.1-HV 1.2

Incl. RS 485 - interface



V 2012/03A

771079212

MANUAL HV1_1-1_2-EN

ENGLISH

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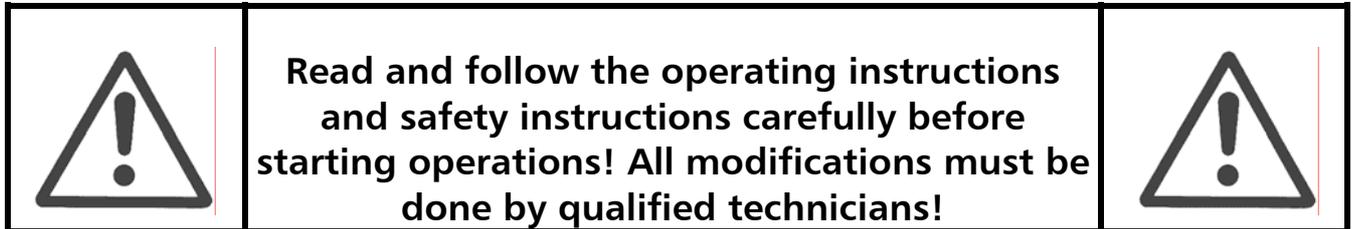


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Follow the Pump Operating and Maintenance Instructions
We reserv the right to alter specifications

1 Important safety instructions



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

The HYDROVAR drive head 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.

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

When in operation the motor can be stopped by remote control, whereby the drive head and the motor remain under voltage. For safety reasons, the unit must be disconnected from the power supply when carrying out work on the machinery as locking out the equipment by switching off the release mechanism or set value cannot prevent accidental starting of the motor.



When the drive head is connected to power supply, the components of the power unit as well as certain components of the master control unit are also connected to the power supply.

Touching these components seriously endangers life !

Before removing the frequency inverter cover the system must be disconnected from the power supply. After switching off the power supply wait **at least 5 minutes** before starting work on or in the HYDROVAR drive head (the capacitors in the intermediate circuit have to be discharged by the installed discharge resistors first).

Voltages of up to 400 volts are possible (if there are faults it can be higher).

All work carried out when the frequency inverter is open may only be performed by qualified authorised staff.

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



The HYDROVAR drive head 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 frequency converter 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 earthened. In addition, equipotential bonding of all pipes must be ensured.

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.

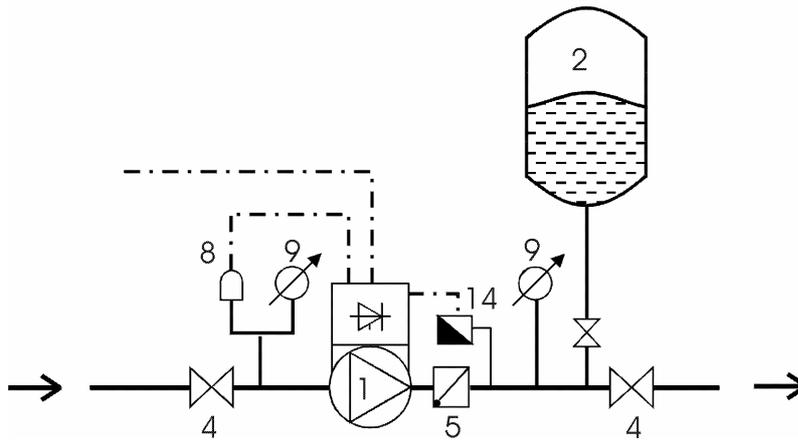
**Please
note:**

High voltage tests of the inverter or the motor may damage the electronic components! Hence bridge before the in- and outgoing terminals L -N -- U- V-W.

To avoid incorrect metering by capacitors incorporated in the electronic part isolate the motor from the Hydrovar Drive head.

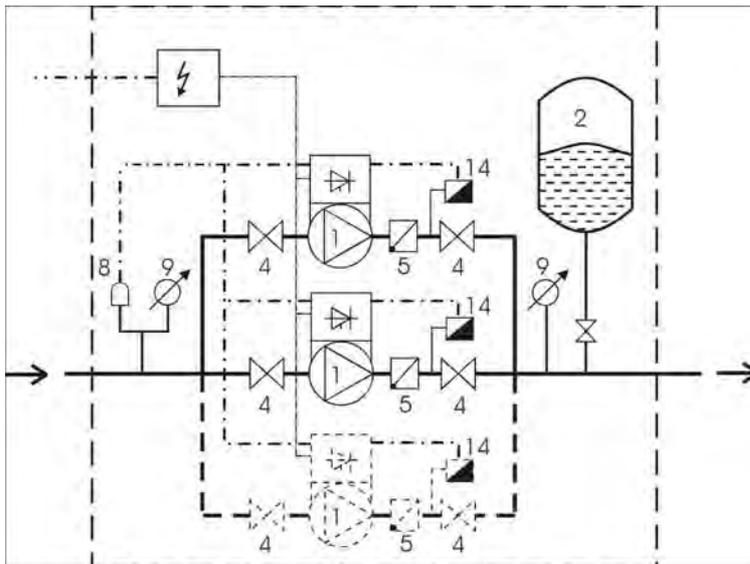
2 System Design

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 or water can be drawn from a break tank or well. In the case of break tanks and wells, level switches, should be used to shut down the pumps when water is low. In the direct connection, a pressure switch on the suction side should be used.



Single pump layout

- (1) pump with drive head
- (2) diaphragm tank
- (3) distribution panel
- (4) gate valves
- (5) non return valves
- (8) incoming pressure switch
- (9) pressure gauges
- (14) pressure transmitter



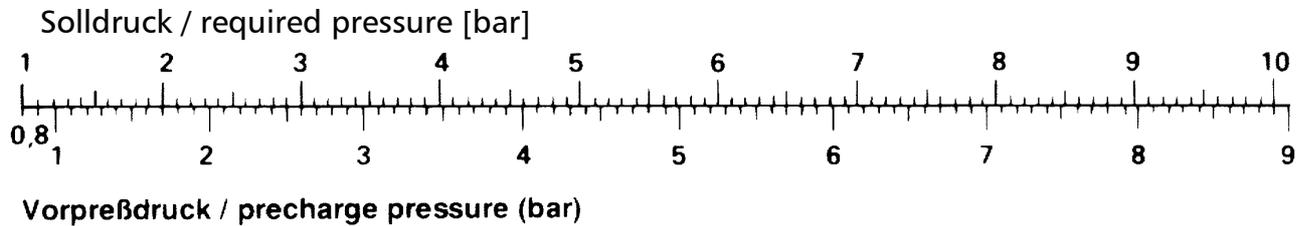
Multiple pump Layout

3 Pressure tank

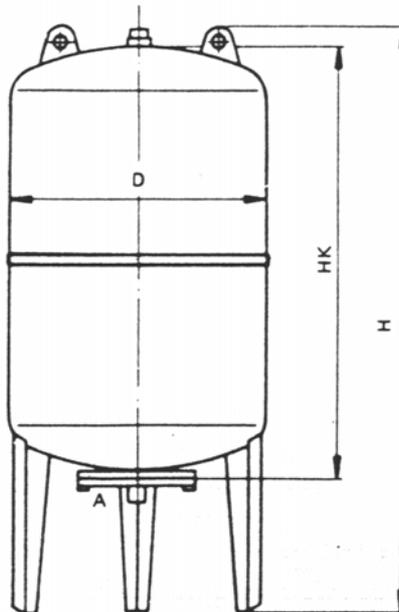
A diaphragm pressure tank is used on the discharge side of the pump or pumps to maintain pressure in the line when there is no demand. This will keep the pumps from continuing to run. With the Hydrovar control unit, it is not necessary to have a large tank for supply purposes. In selecting a tank, make sure it can withstand systems pressure. The tank should have a capacity of more than 10% of the maximum system flow rate l/min of one pump.

Ask of required certificates needed for your country!

Precharge the tank to the following:



Before checking the precharge pressure, take care, that the tank, is pressureless (no water inside).



4 Transducer

4.1 Pressure Transmitter

Series PA-21 R

The sensor of this transmitter is a piezoresistive silicon pressure sensor, mounted on a tape (TAP) freely floating in an oil chamber. The pressure is transferred to the sensor by a separate nickel diaphragm in the oil chamber.

Specifications

Range (FS): 10 bar (other ranges upon request)
Max. pressure- P_{max} : 20 bar
Class of protection : IP 67

Output signal: 0,5 – 4,5 V DC (ratiometric)
Supply: 5 VDC +/- 5 %

Operating temperature: -20...+80°C
Storage Temperature: -40...+100°C

connections:

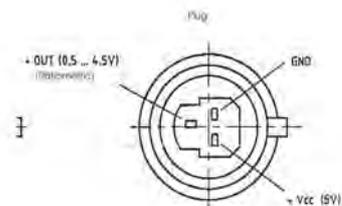
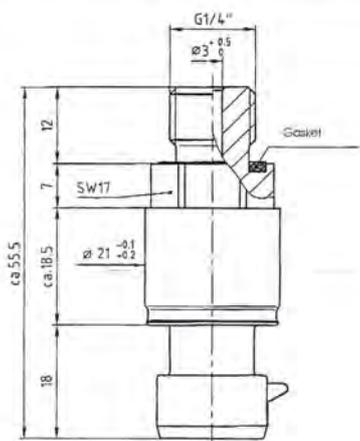
+ VCC	⇒ brown	= supply voltage
+ Out	⇒ white	= analogue output signal
GND	⇒ green	= Ground

Materials:

Body: steel and brass
diaphragm: nickel

Pressure Transmitter:

Plug:



4.2 Differential Pressure Transmitter

The sensors of this differential pressure transmitter are two piezoresistive silicon pressure sensors, mounted on a tape (TAP) freely floating in an oil chamber. The pressure is transferred to the sensor by a separate steel diaphragm in the oil chamber.

Specifications

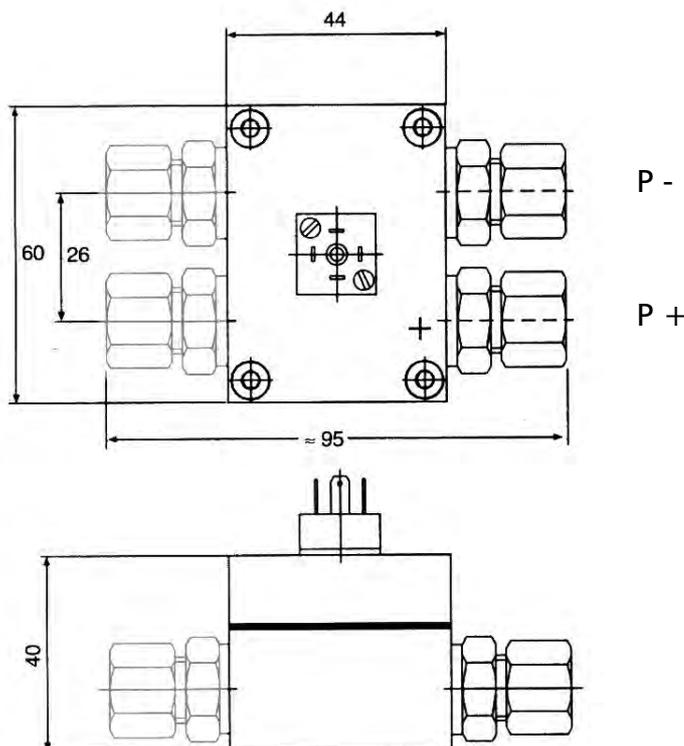
Range(FS):	4 bar	<i>differential</i>
Over-pressure- Pmax:	16 bar	<i>single-sided</i>
Class of protection :	IP 65	

Output Signal:	0,5 – 4,5 V DC (ratiometric)
Supply:	5 VDC +/- 10 %
Load Resistance:	> 5 k Ω

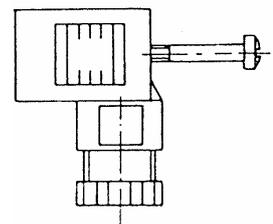
Linearity::	± 0.20 % FS; max. ± 0.5 % FS
Stability:	± 0.1 % FS; max. ± 0.2 % FS

Operating temperature:	-10...+80°C
Storage Temperature:	-40...+80°C

Material: Body and diaphragm: 1.4435 Stainless steel
Screw joint and cover: Steel electroplated for Emetorpipe d=8mm



Plug: mPm 193



Incl. 2m cable:

Out (white)
+ Vcc (brown)
GND (green)
Screen

5 Technical Data - Frequency Inverter And General Data

HYDROVAR		Hydrovar output to the Motor		Supply Voltage (U _{in})	Prefuse min.
Type	Rated output	Voltage	Max. current	Mains frequency 48-62 Hz	
HV 1.1	1,1 kW	3x 230 V	4,8 A	1x 220-240 V ± 15%	10 Ampere
HV 1.15	1,5 kW	3x 230V	7,0 A	1x 220-240 V ± 15%	10 Ampere
HV 1.2	2,2 kW	3x 230V	10,0 A	1x 220-240 V ± 15%	16 Ampere

Output voltage: 3x 0...U_{in} VAC / 0-70 Hz
(depends on the input voltage)

Min. frequency: 0 – max. frequency

Electrical efficiency: > 95%

Protection against: Short circuit, over- and undervoltage, overheating of the electronics (overload) and additional external protective functions via PTC (motor temperature) and low water switch.
A mains filter is fitted to ensure interference immunity.

The HV Series frequency converter complies with the general EMC provisions and has been tested according to the following standards:

- Disturbance voltage: EN 55011
- EMC – Immunity: EN 61000-4-3 and ENV 50204
- Electrostatic discharge: EN 61000-4-2

Ambient temperature: 5° C ... + 40° C

Storage temperature: -25° C ... + 55° C
(+70° C during max. 24 hours.)

Humidity: rH max. 50% at 40° C, unlimited
rH max. 90% at 20° C, max. 30 days per year
Condensation not permitted !

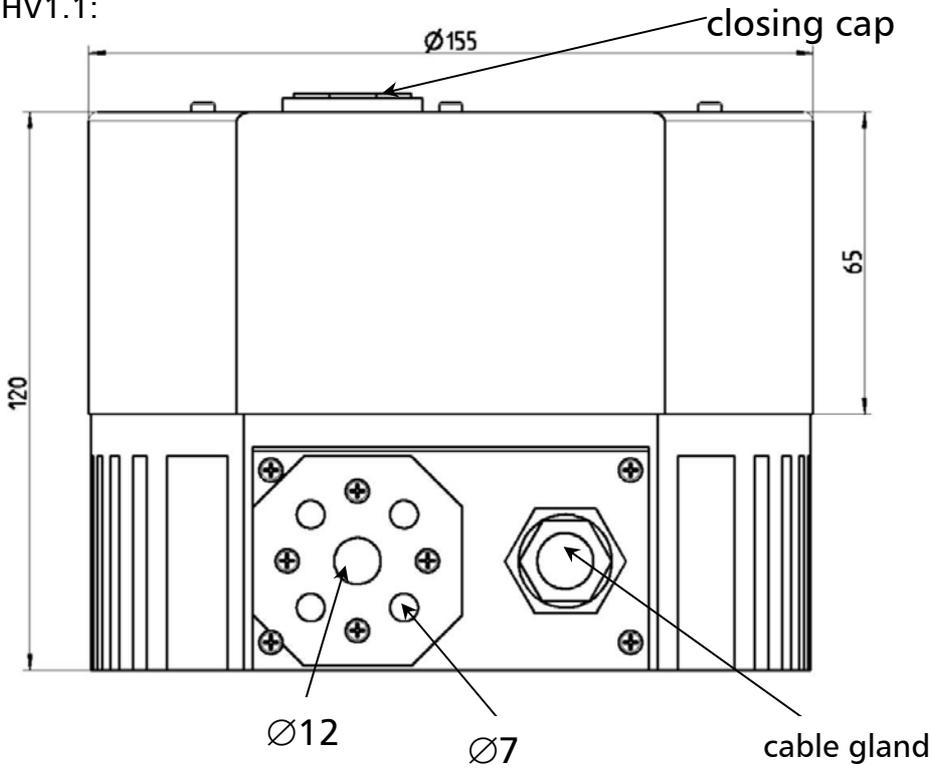
Air pollution: The air may contain dry dust as found in workshops where there is no excessive quantity of dust due to machines.
Excessive amounts of dust, acids, corrosive gases, salts etc. are not permitted

Altitude:: max. 1000m above sea level
At higher altitudes the max. available power has to be reduced. Please ask the manufacturer for further details.

Class of protection : IP55

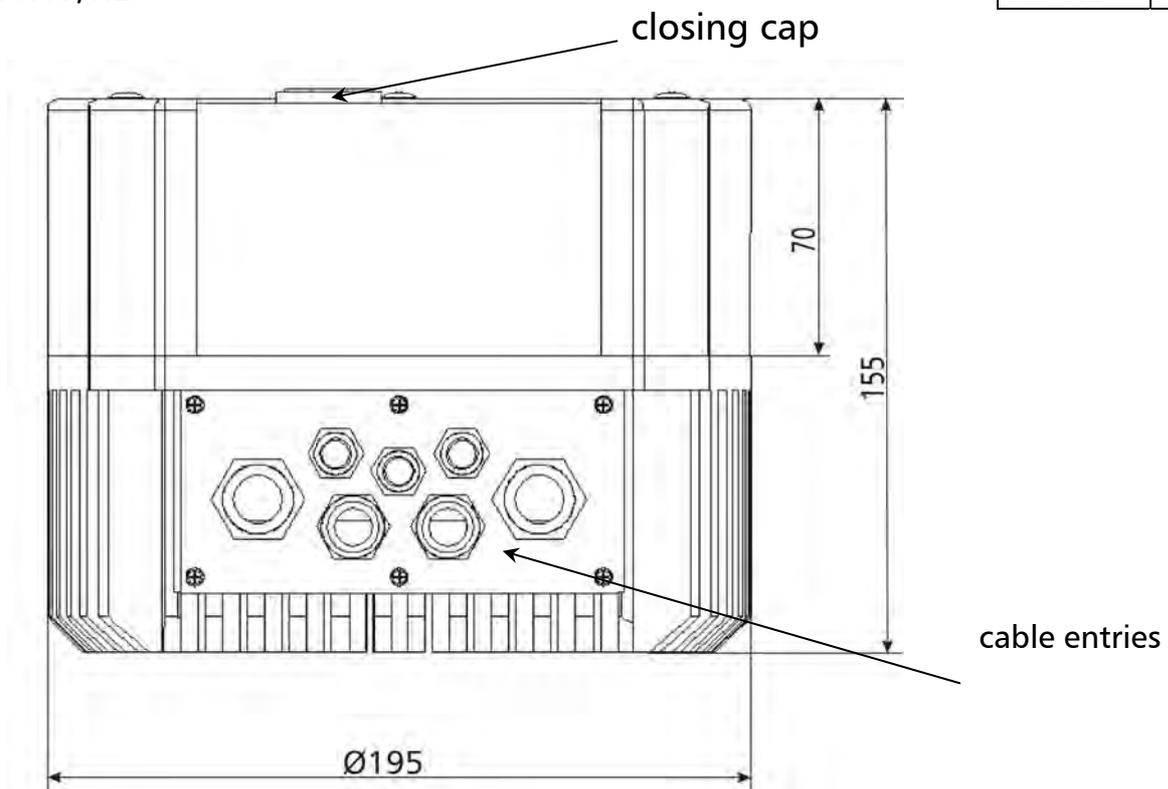
5.1 Dimensions

HV1.1:



Type:	Weight [Kg]
HV 1.1	2,00
HV 1.15	4,70
HV 1.2	4,70

HV1.15,1.2:

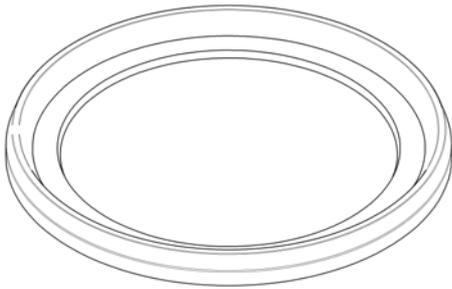


6 HYDROVAR mounting

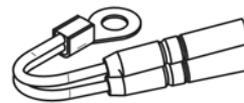
6.1 Mounting the HYDROVAR on the pump

6.1.1 Included components

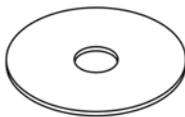
Variant for HV1.1:



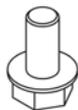
mounting and distance ring



thermistor



washer

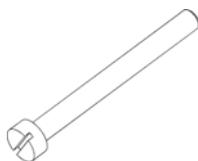


screw

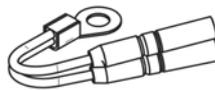


cable gland

Variant for HV1.15-1.2:



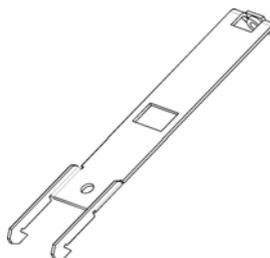
screw M5x50



thermistor



cable gland

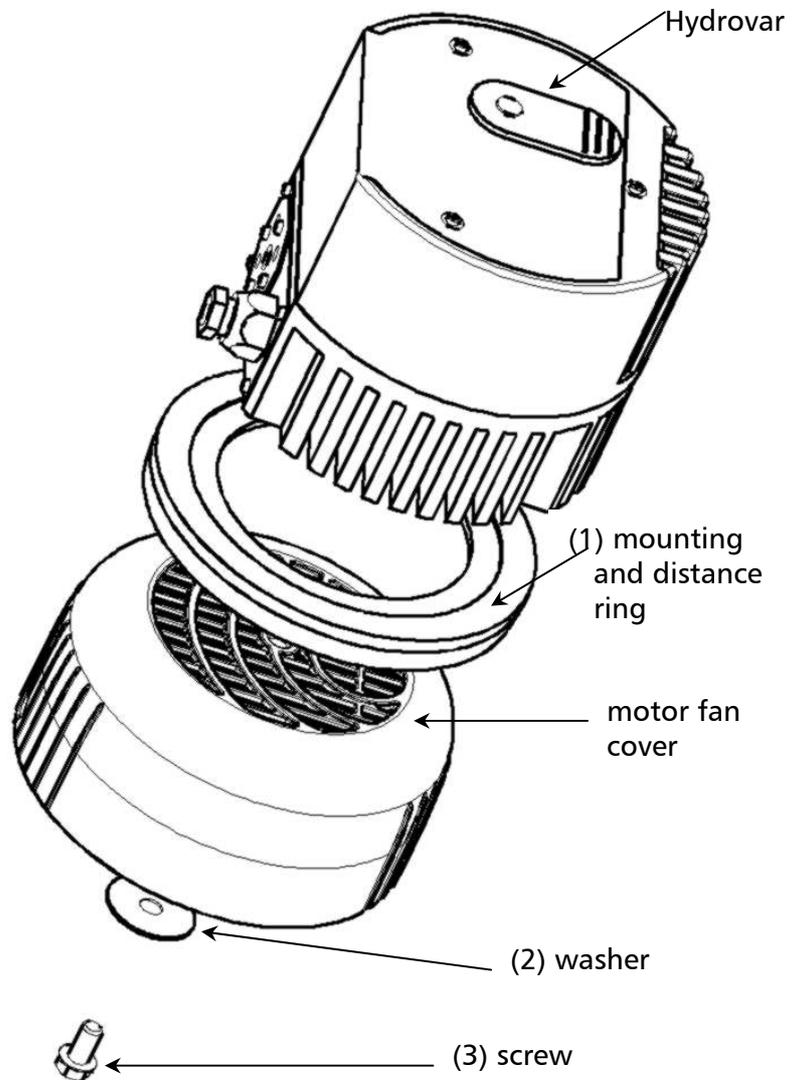


mounting clamp

6.1.2 Mechanical mounting

Variant for HV1.1

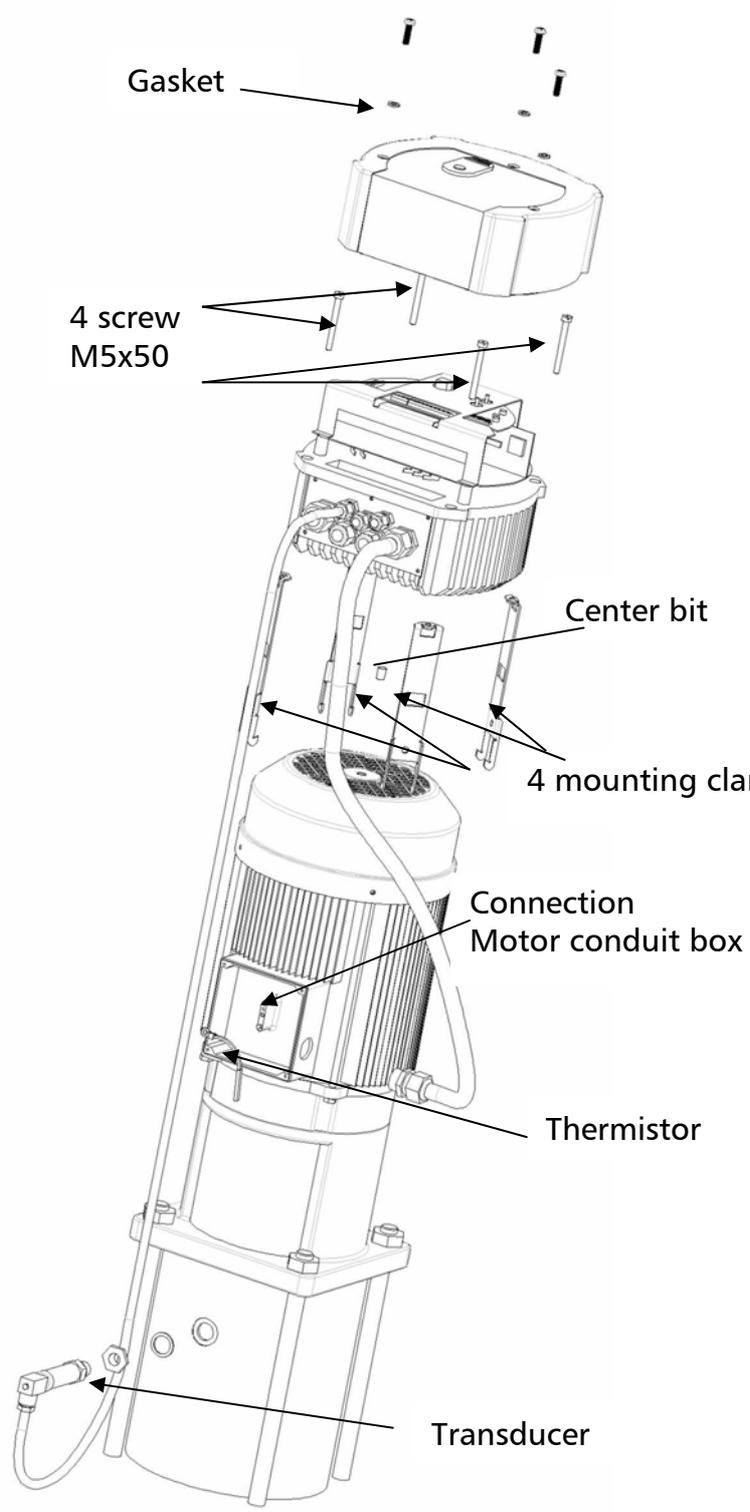
1. Remove the motor fan cover from your 3-phase motor by removing the mounting screws.
2. Put the mounting and distance ring (1) between the fan cover and the Hydrovar and fix them together with the screw (3) by using the included washer(2).
3. Use the fan cover screws to mount the fan cover/Hydrovar combination to the motor



Attention:

Don't forget the washer between the screw and the motor fan cover!

Variant for HV1.15-1.2:

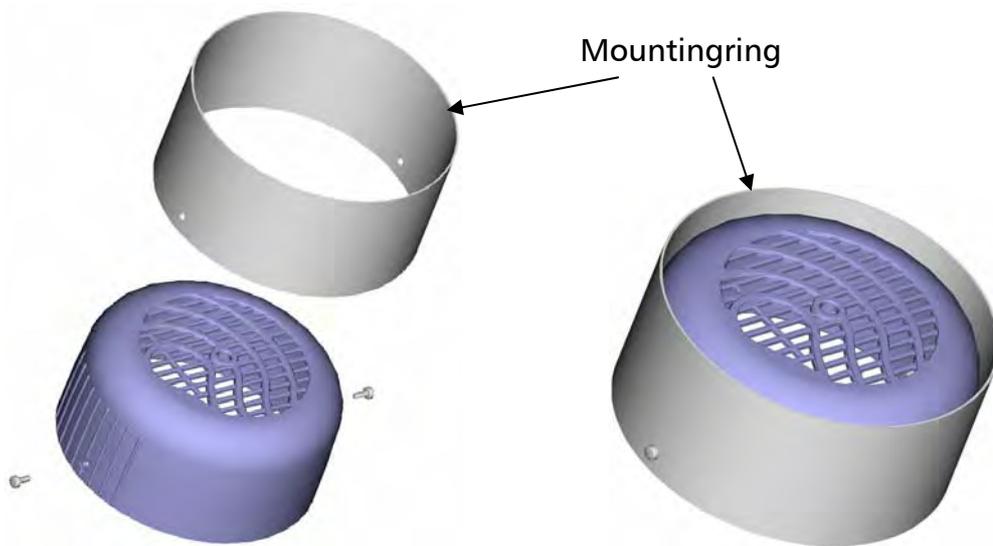


Mounting:

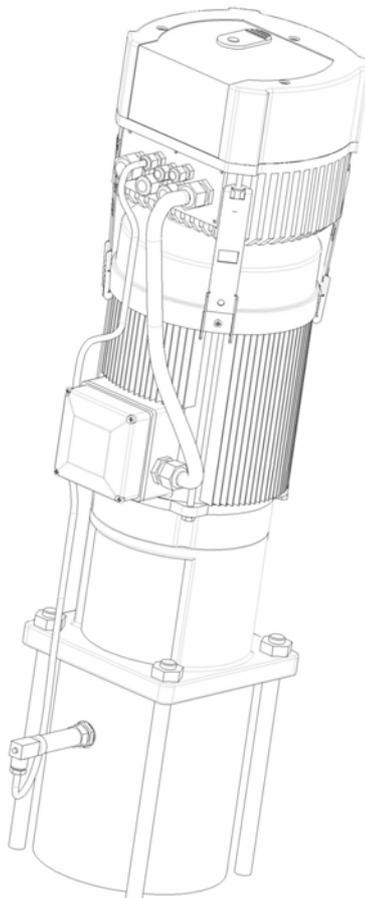
- Remove the 3 screws from the Hydrovar cover.
- Place the centre bit in the Hydrovar fan cover.
- Place the Hydrovar fan cover on the motor .
- Hang the 4 clamps by the Motor fan cover and mounted with the 4 screws.
- Mounted the cover with the 3 screws.



Don't forget the gaskets for the 3 screws .
Ensure that there is no water on the unit before you open the cover.

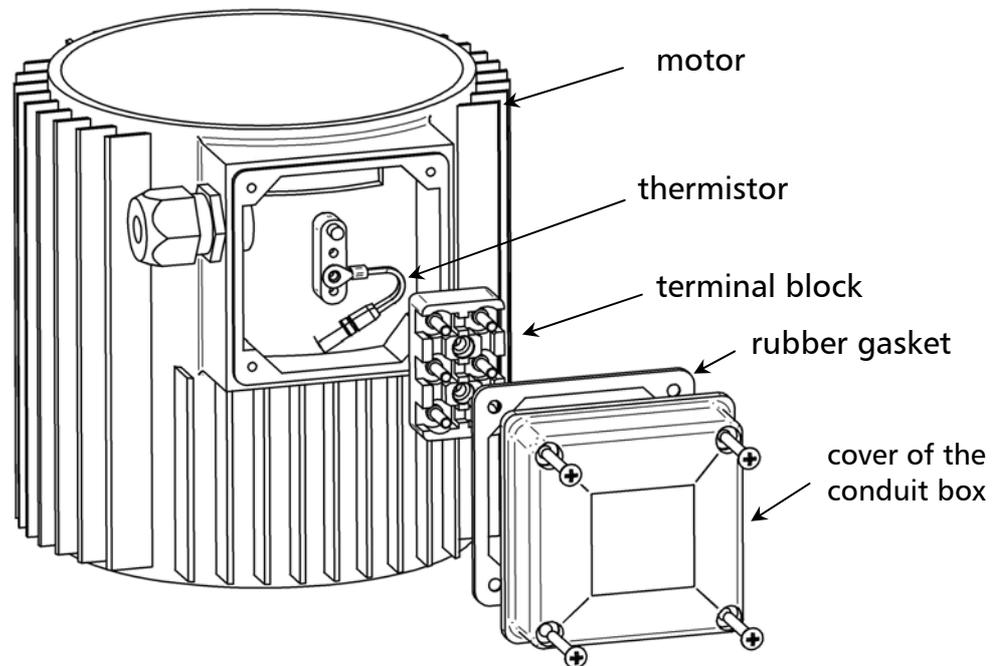


If you use a motor with plastic fan cover, you must use a mountingring.

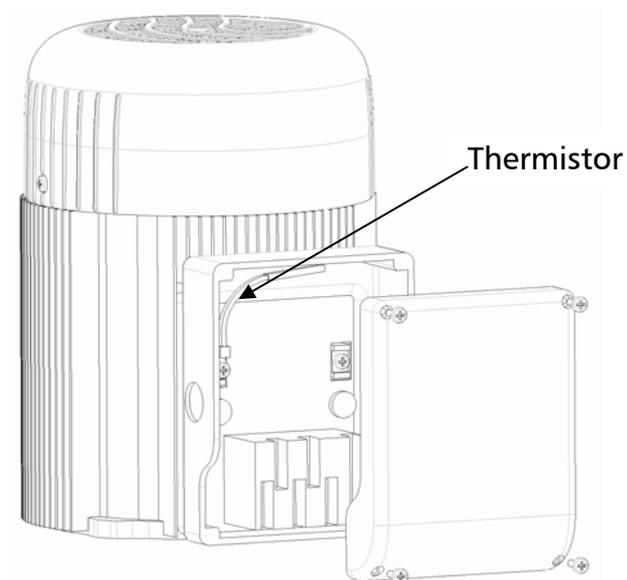


6.1.3 Mounting the thermistor (4)

Variant A:



Variant B:

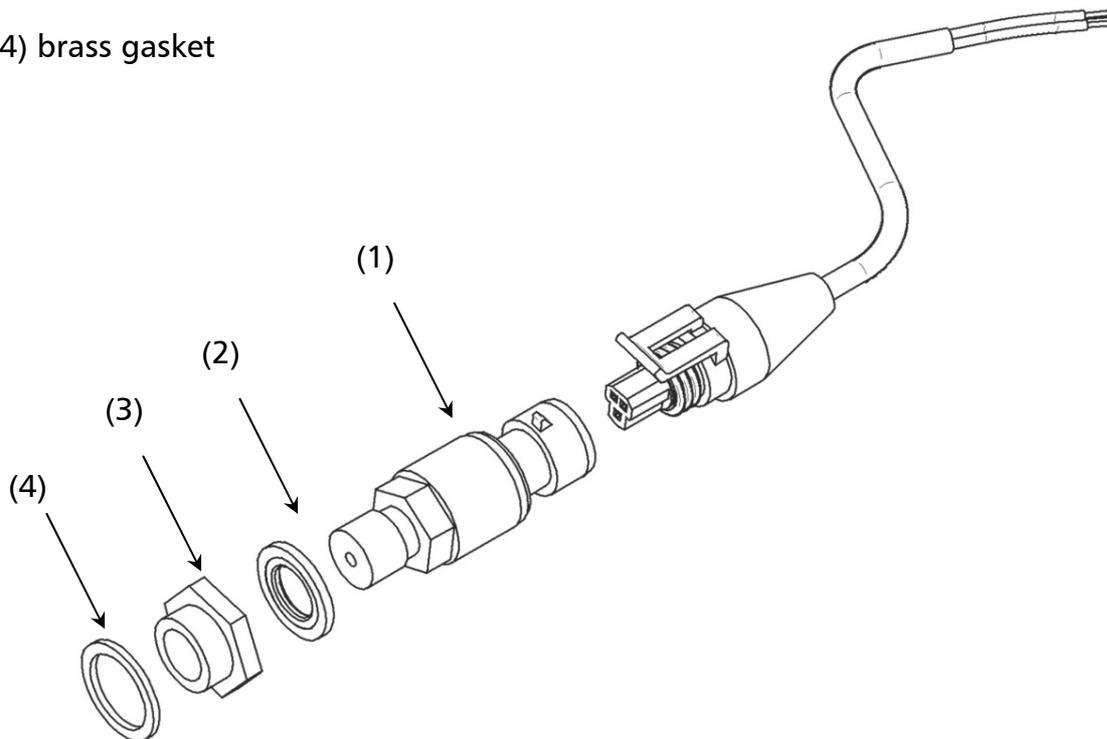


1. Open the cover of the conduit box and remove also the terminal block inside.
2. Fix the thermistor (Variant A or B)
3. Electrical connection of the motor cables see chapter 7.3.

6.1.4 Mounting of the pressure transducer

In the delivery of the pressure transducer there are included:

- (1) pressure transducer
- (2) gasket
- (3) reducer $\frac{3}{8}'' - \frac{1}{4}''$
- (4) brass gasket



1. The transducer has an mechanical connection of G $\frac{1}{4}''$. If it is necessary put the reducer ($\frac{3}{8}'' - \frac{1}{4}''$) into the pump or pipe by using included gaskets.
2. Electrical connection to the Hydrovar see chapter (6.2.4)

6.2 Electric installation and wiring

Note:

All installations and maintenance MUST be performed by trained and qualified personal with proper tools!!



Warning:

In case of a failure, disconnect and lockout electrical power and wait five minutes for capacitor discharge before servicing the Hydrovar. Otherwise it can cause shock, burns, or death.

6.2.1 Means of protection

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

Applicable: AC and DC current-operated circuit breaker (FI), TN systems, protective circuits.

When using a FI protection switch, make sure that it also releases in the event of a DC fault, use for each Hydrovar a separate FI-switch!

6.2.2 Wiring the Hydrovar to the motor

Remove the 3 screws holding the top of the Hydrovar. Carefully lift the top, loose the earth screw and put the Hydrovar cover aside.

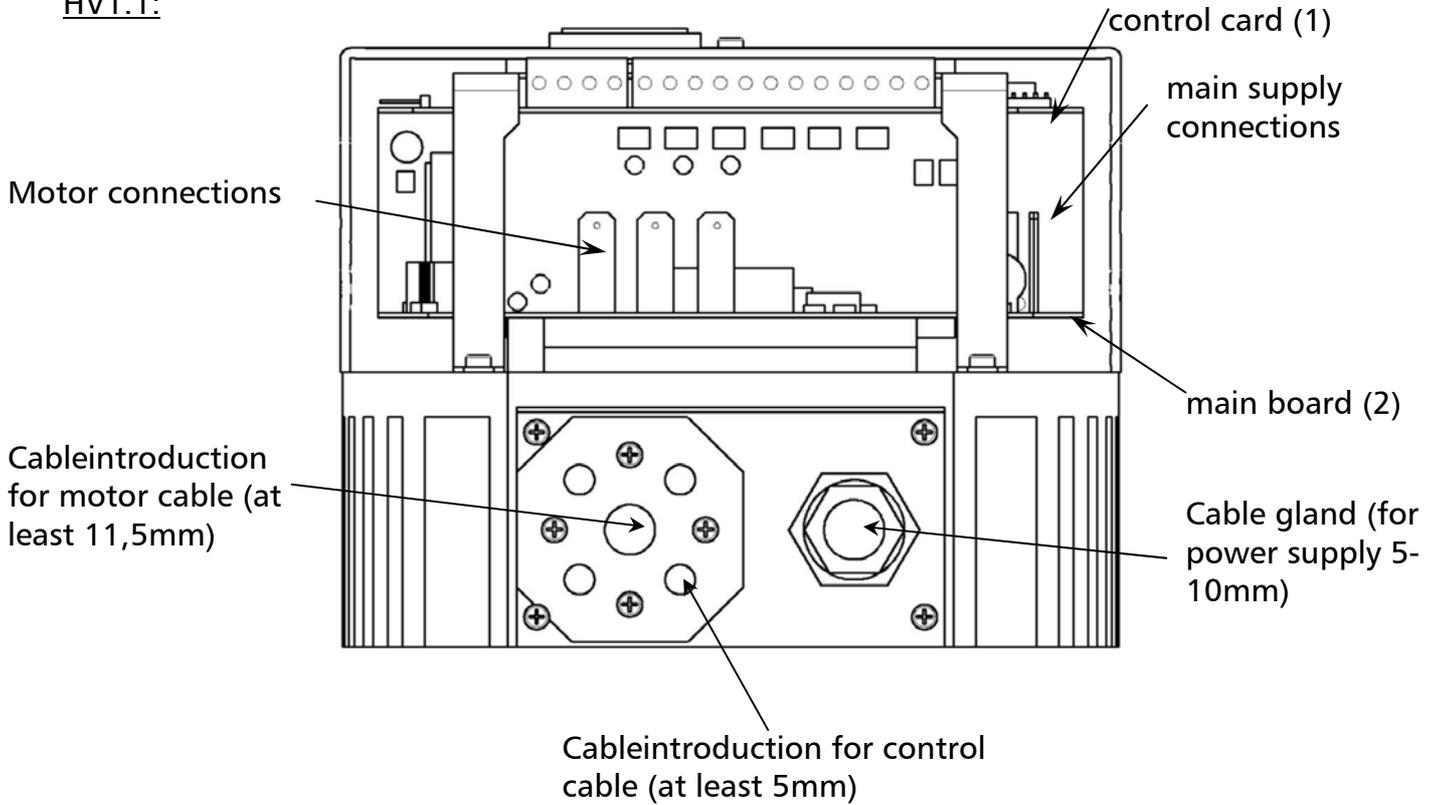
Now you can see the 2 main parts

(1) control card with all terminals for the control signals and the RS485 interface

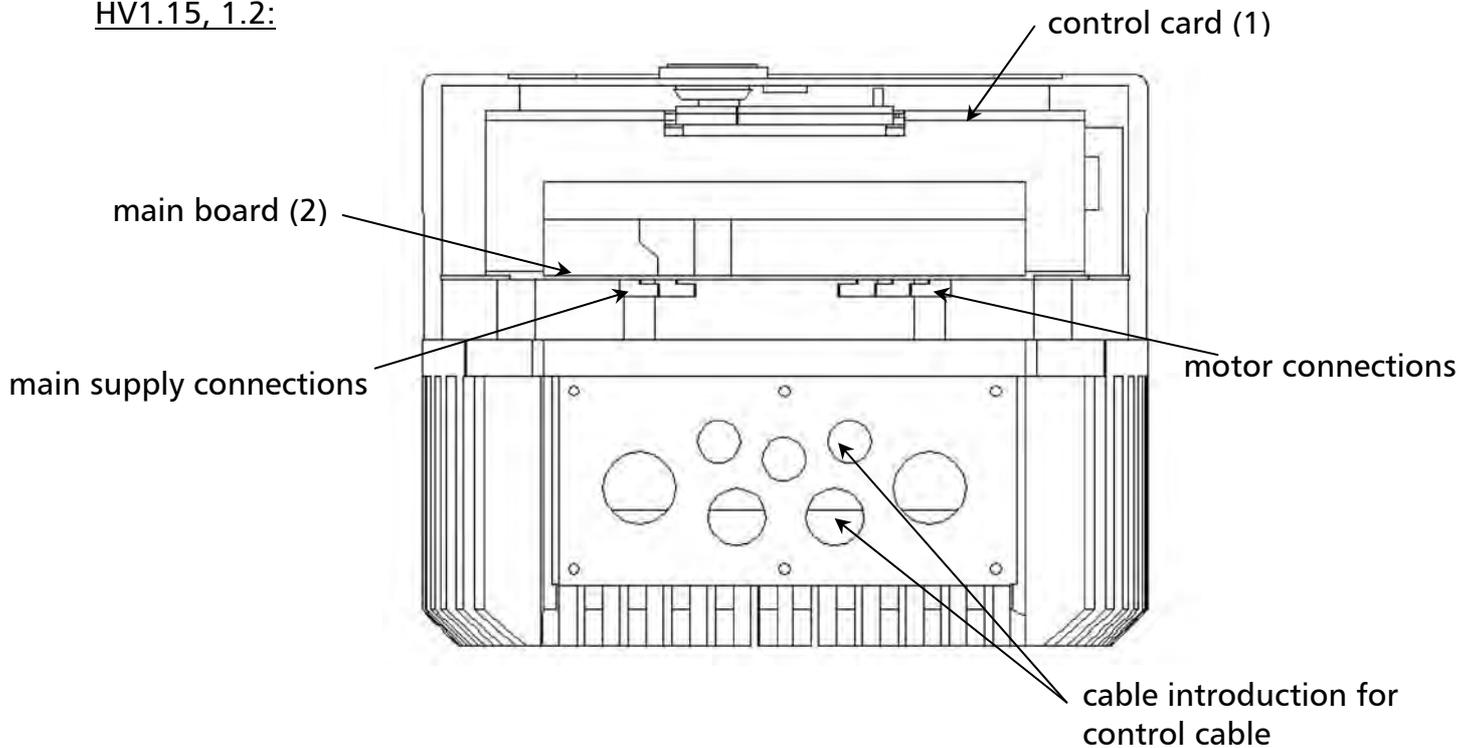
(2) main card with all power components and terminals for power supply and motor

6.2.2.1 Main part overview

HV1.1:



HV1.15, 1.2:



6.2.2.2 Connecting the power cables

a) **motor cable:**

Locate the motor connections, labeled U, V, W inside the Hydrovar. Connect wires to the terminals and rout the cable through the cable gland.

You must take a motor cable at least \varnothing 11.5mm if you want protection IP55. (only HV1.1)

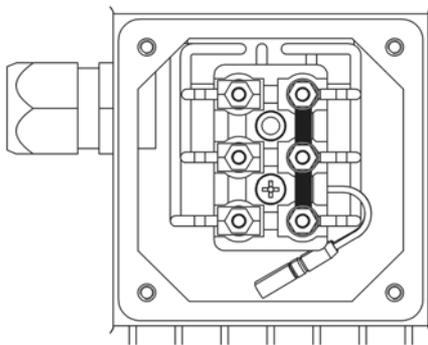
The earth-wire of the cable has to be fixed with the screws with the earth-symbol to the cooling body of the Hydrovar.

Connections in the conduit box

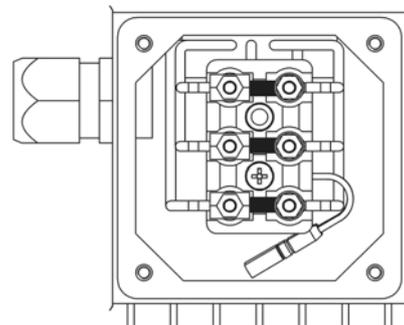
The connection of the motor cable depends on the type of the motor and can be done in star or delta connection:

(you have to use the connection for a motor voltage of 3x230V shown on the motor label)

Star-connection



Delta-connection

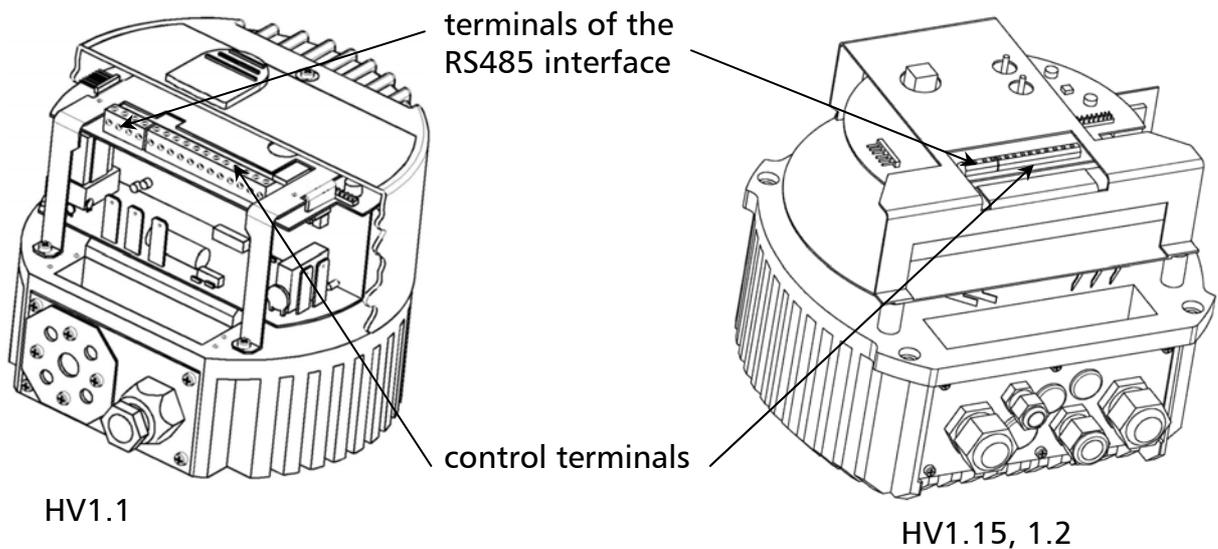


b) supply cable

The main power cable is connected to the terminals labelled L1, N for the 230 VAC, single phase input (shown in the diagram 6.2.2.1).

6.2.3 Control

By using the HYDROVAR drive head for constant pressure control, together with a pressure or differential pressure transmitter, or, if required, according to external manual control by reference of 0,5-4,5VDC, this external signal has to be connected to the terminals X2/1, X2/2 and X2/3 of the control terminals.



6.2.4 Terminals

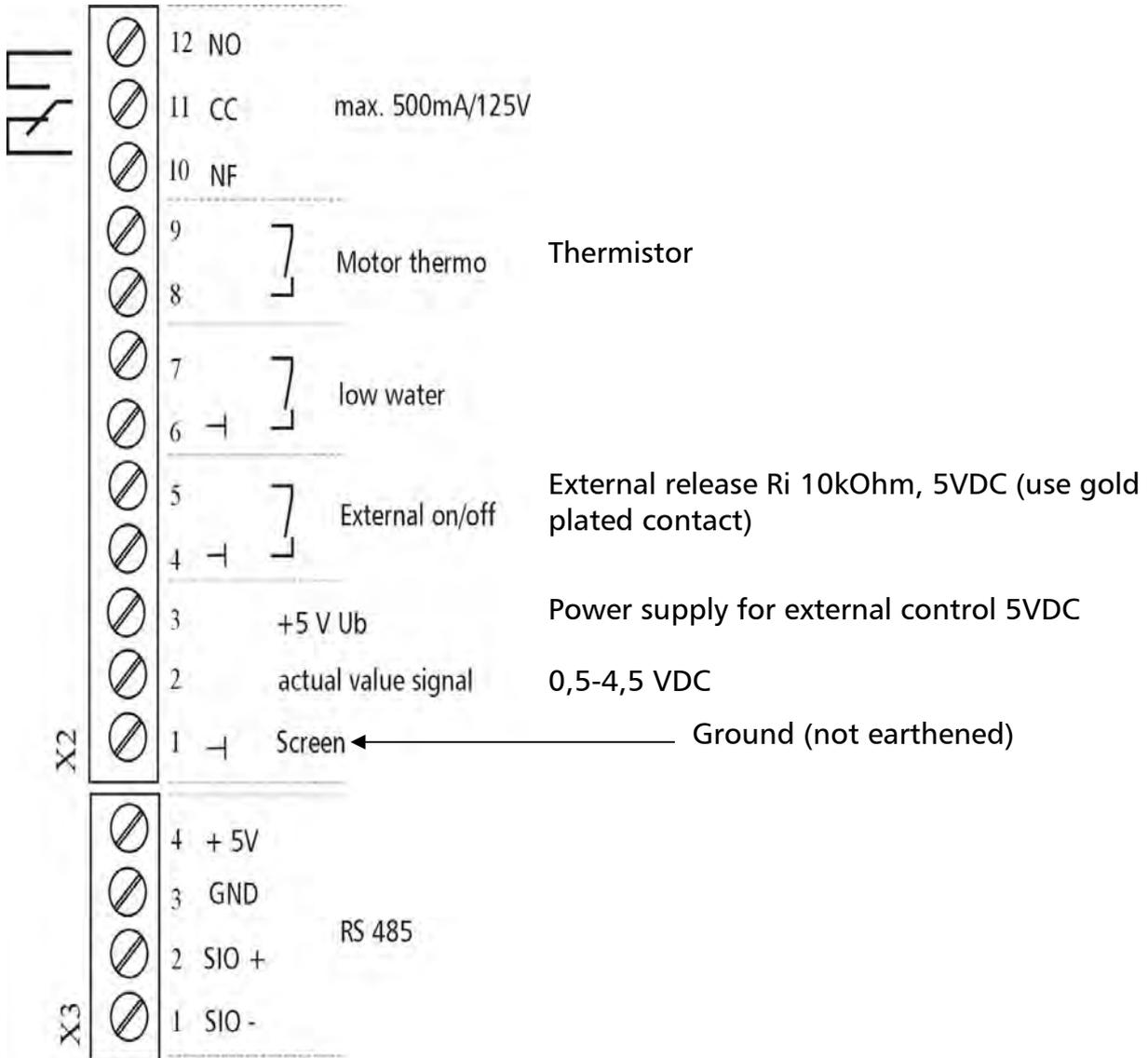
All externally used cables have to be **shielded**. Do not connect the mass of the electronic components to other higher potentials.

All electronic ground and GND of the RS 485-interface are internally connected.
For external off/on and low water, switch contacts suitable for <10 V are necessary.
The control cable must be at least Ø 5mm.

If unshielded control cables are used, signal interference may occur and interfere with the function of the inverter.

When connecting together the variable speed pumps (max. 4 pumps) via the interface RS 485, the terminals X3/1 and X3/2 and X3/3 are to be connected in parallel by means of a shielded cable to every HYDROVAR drive head and programmed accordingly (∅ Programming Sequential Operations see chapter 13.7)

Control-Terminals:



6.3 Front plate

HV 1.1-1.2:

indication LED

push buttons



7 Operation without external programming device

Attn:	Before you start the system, the pump must be filled and all wiring and piping have to be done!
--------------	---



The Hydrovar is delivered with these settings as standard!

- ◆ *Change Pressure: enabled*
- ◆ *Auto Start: enabled*

Other possibilities to use the push buttons of the Hydrovar:

The Pump could be

- STARTED with the  button (if Autostart is disabled, the pump can be started by pressing the  button and then the  button at the first startup or after a power supply failure) or
- STOPPED with the  button.

Both buttons are on the front plate of the Hydrovar

- **Change pressure without programming device:**

To change the pressure without the *external programming device* you have to follow:

1. Start the pump with the push button  on the front plate of the Hydrovar
2. Then press the  and  buttons together for longer than 3 sec.
3. The colour of the LED changes to orange
4. Now you can change the pressure with the  and  buttons.
The only way to check the set pressure is given by a pressure gauge.
5. If there is no action for more than 5 sec., the HYDROVAR returns to normal operation automatically, and the new required pressure is saved.

8 Possible indications of the LED on the HYDROVAR

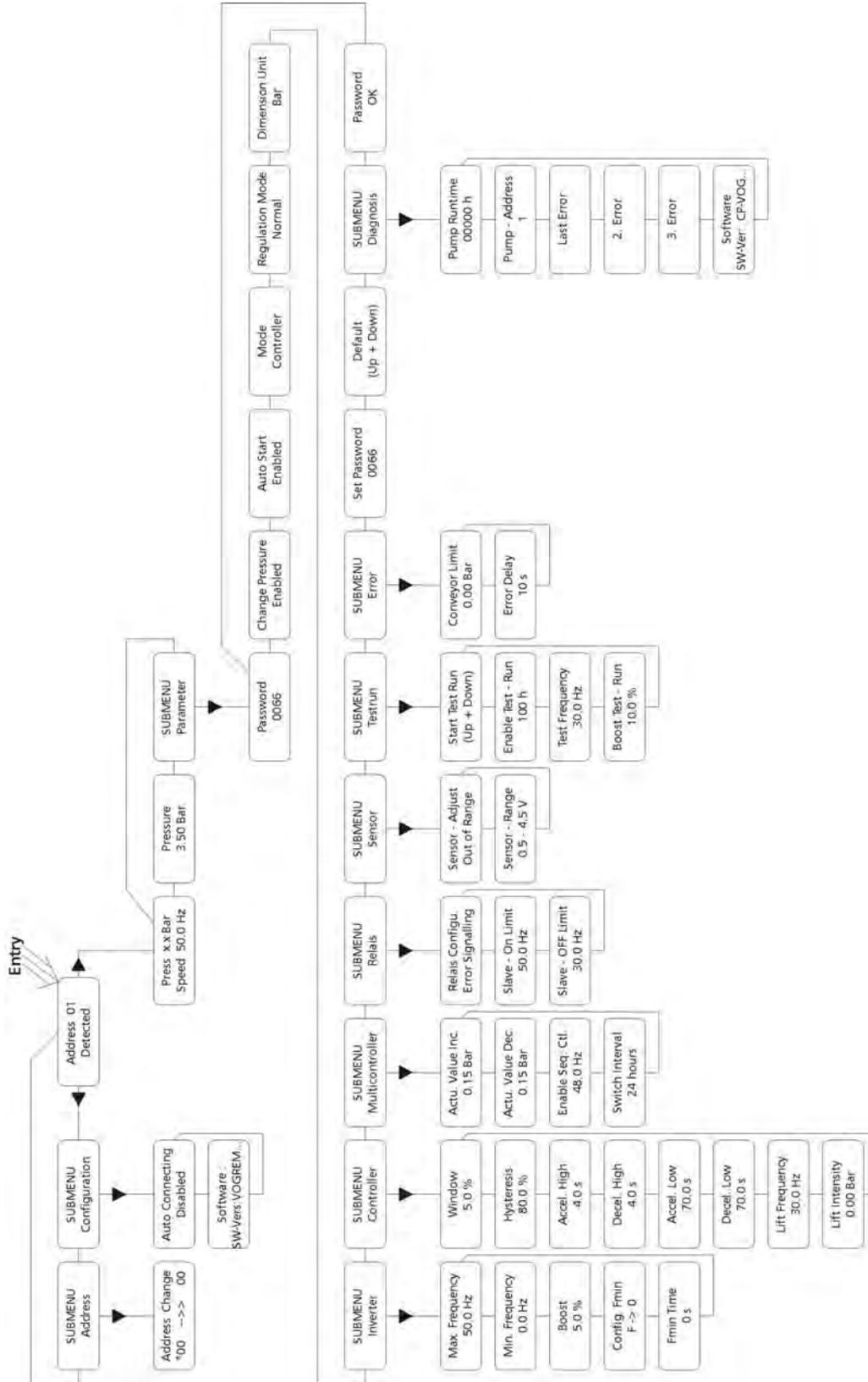
- .) **Green shining** ⇒ Motor stopped
(via external stop with terminals X2/4; X2/5
or the unit is stopped with the  button on the front
plate)
- .) **Green slow flashing** ⇒ Inverter is active, but the motor has stopped
- .) **Green fast flashing** ⇒ Motor runs

- .) **Orange shining** ⇒ required pressure can be changed without the
programming device with the buttons  and ,
or the external programming device is connected and the
pump is stopped with the button  on the Hydrovar or
with the external release input (terminals X2/4 and X2/5).
- .) **Orange slow flashing** ⇒ connected remote control and the inverter is released,
but the pump is not running (because of the required
pressure is reached).
- .) **Orange fast flashing** ⇒ connected external programming device and the pump
is running.

- .) **Red shining** ⇒ error signalling (type of the Error is shown on the
display of the external programming device)
- .) **Red flashing** ⇒ signalling of a fatal error (HYDROVAR has to be cut
from the power supply!)

9 Operation in the main menu

Menu overview



General for working with the external programming device:

With ← and → you can select the different parameters in the menu.

To enter a submenu, press the ↓ button. To leave the submenu, you have to press the buttons ← or → for longer than 3 sec.

With ↑ or ↓ you can change the parameters.

Each change in the settings is saved after leaving this parameter with the buttons ← or →.

When you have changed a parameter and you leave it, the LCD shows you the following message

SAVE
PARAMETER

for about 2 sec.

10 Connecting the external programming device to the HYDROVAR

After connection of the HYDROVAR – head to the power supply and plug in of the external programming device, there can be shown two different messages:

1. If the AUTOCONNECTION (14.1.1) is disabled (standard) you reach:

Address 01
Lost

This message is shown, when the Remote Control is new connected

At this time the Hydrovar searches for an available address

If address 01 is available, the display changes to

Address 01
Detected

The actual pump-address is shown

Statusinformations by systems with activated Multicontroller:

P1: Masterpump

P2: Slavepump

P3: Slavepump

P4: Slavepump

P.: Follownumber is not useful

Hold: pump stops through the pressure transmitter

Run: pump runs

Stop: pump stops through the leadpump

Disabled: pump stops through the stopbutton or the terminal block

Error: pump stops through an error

↓ Follow pump stopped

↑ Regulator from the follow pump is release

Pump don't work at the follow pump

If the actual pump address 01 is not available the display does not change and you will see again

Address 01
Lost

Then you could change the address with ↑ and ↓ and confirm the selected address with →.

Press → on the controller and you enter the INVERTERMENU (see chapter 12)

2. If the AUTOCONNECTION (14.1.1) is enabled, following message is shown:

SCAN
CONNECTION

This message is shown during the connecting, when **AUTOCONNECTING** (chapter 14.1.1) is enabled

In this time the Hydrovar searches for the given or entered address!

Then the display changes to the 1st display

PRESS X.X bar
SPEED X.X Hz

The actual input value [bar] and the actual output frequency [Hz] are displayed.

11 Typical applications

11.1 Setting Single Pump Constant Pressure

At the first startup, "Change Pressure" and "Autostart" of the external programming unit are enabled. After connecting, on the display of the programming unit there is shown

Scan
Connection

and scanning a valid pump address.

This message is shown when the external programming device is set up to the Hydrovar

After a few seconds, the display changes automatically to the 1st display

Press x.x bar
Speed x.x Hz

This window shows the actual values of the Hydrovar (a required pressure of 3,5 bar is previously set)

Press → on the controller to change to

Pressure
xx.x bar

To select required pressure use the buttons ↑ and ↓.

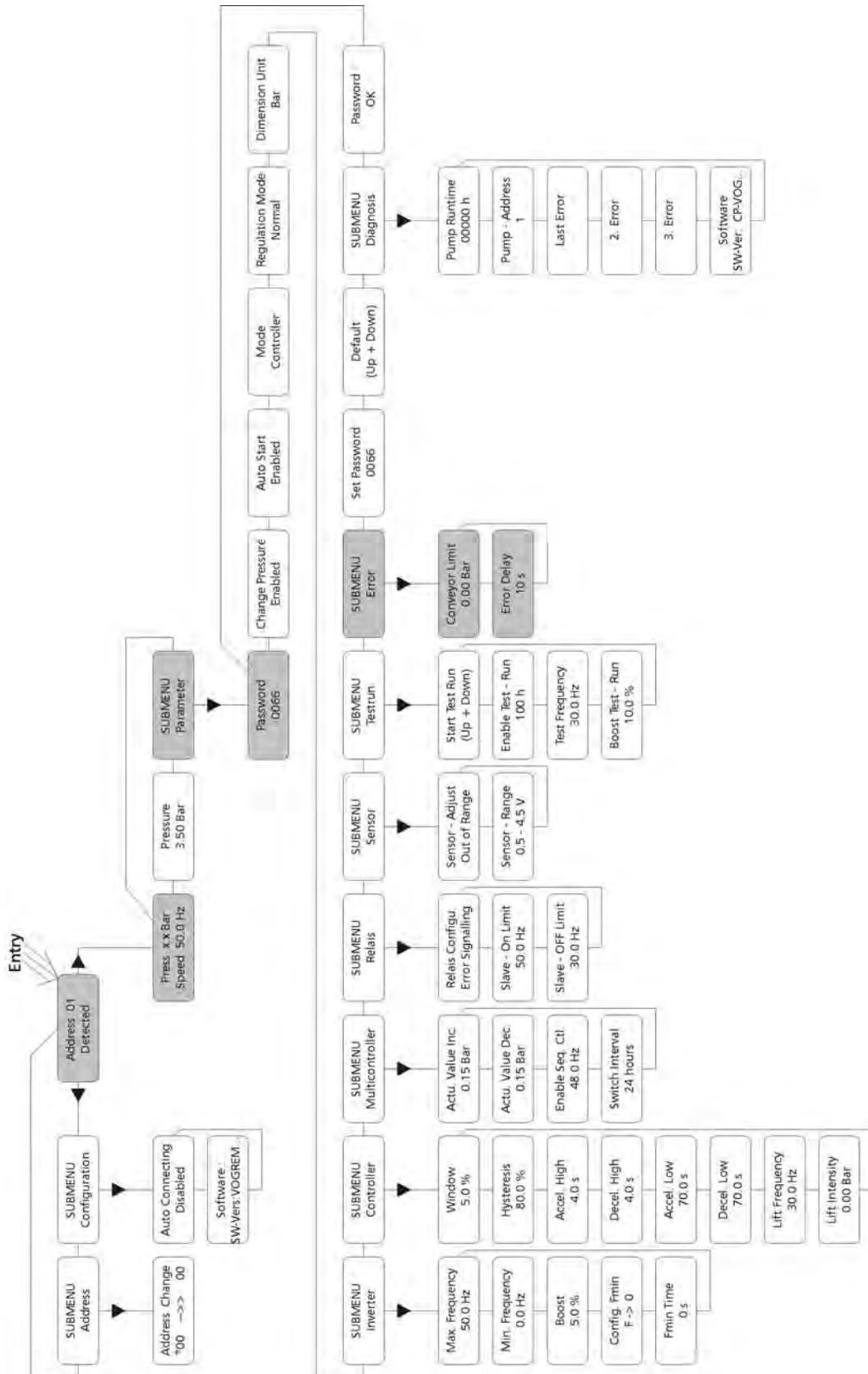
After changing of the value, you have to confirm with the →-button. Then you will get the message "SAVE PARAMETER" for a short time, when the new setting is saved!

After changing of the value, you have to confirm with the →-button.

Then press ← on the controller to change back to the 1st display

Press x.x bar
Speed x.x Hz

11.2 Single Pump - Pump Protection



Note:

Low/no suction depends on the installation of a suction line pressure switch, or float switch for a tank. This is connected to the Hydrovar as described earlier in the Electrical Installation section (see chapter 6.2).

The cut off setting for this switch should be the maximum NPSH required by the pump.

To set run out protection:

Note:

Run out protection is available for one pump systems and multiple pump systems with a common suction pipe. In multiple pump systems with separate suction pipes, you can not avoid dry running by measuring the system pressure, because the pressure is produced from another pump in the system.

From the 1st display, press the → button twice, until you reach

SUBMENU
PARAMETER

Then press the ↓ button and the display will change to

PASSWORD
0000



Password:

The Password protection prevents untrained personal from accidentally changing the base setting

Press the ↑ button until you reach the number 0066

PASSWORD
0066

Press the → button repeatedly until you reach

SUBMENU
ERROR

Press the ↓ button to enter the submenu and change to

CONVEYOR LIMIT
0,0 bar

CONVEYOR LIMIT

"0.0 bar" means disabled conveyor limit.

An adjusted value >0 has to be reached till the programmed "ERROR DELAY"-time. Doesn't this value be reached the failure "CONVEYOR CONTROL ERROR" will be indicated and the pump stops.

By pressing the ↑ and ↓ button, enter the pressure setting (bar) at which you want the pump to shutoff.

CONVEYOR LIMIT
0 bar

Typically a setting of about 1 bar less than the standard pressure setting would be entered. After changing of the value, you have to confirm with the → button.

Then you will get the message "SAVE PARAMETER" for a short time, when the new setting is saved!

Press the → button to change to

ERROR DELAY
10 s

ERROR DELAY:

Adjustable between 0...100 sec.

Delayed switch-off in the event of low water, terminal X2/6-X2/7) and also for the conveyor limit (see chapter 13.11.1).

By pressing the \uparrow and \downarrow button, you will be entering the amount of time (sec) that the pump will run at the programmed conveyor limit before it automatically shuts off.

ERROR DELAY
10 s

After changing of the value, you have to confirm with the \rightarrow button. Then you will get the message "SAVE PARAMETER" for a short time, when the new setting is saved!

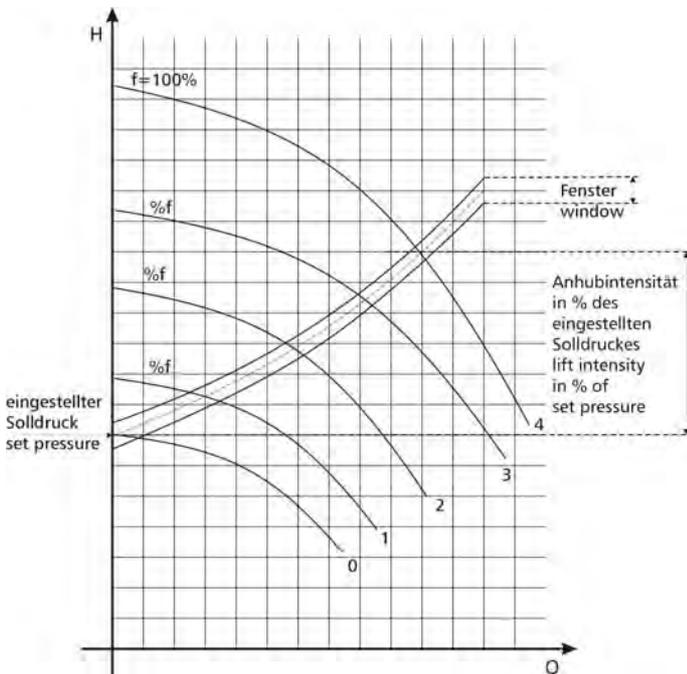
Hold the \rightarrow button down for 3 seconds and you will be returned to:

SUBMENU
ERROR

Hold the \rightarrow button down again for 3 seconds to return to the 1st display

PRESSURE x.x bar
SPEED xx Hz

11.3 Single Pump – System Curve Compensation

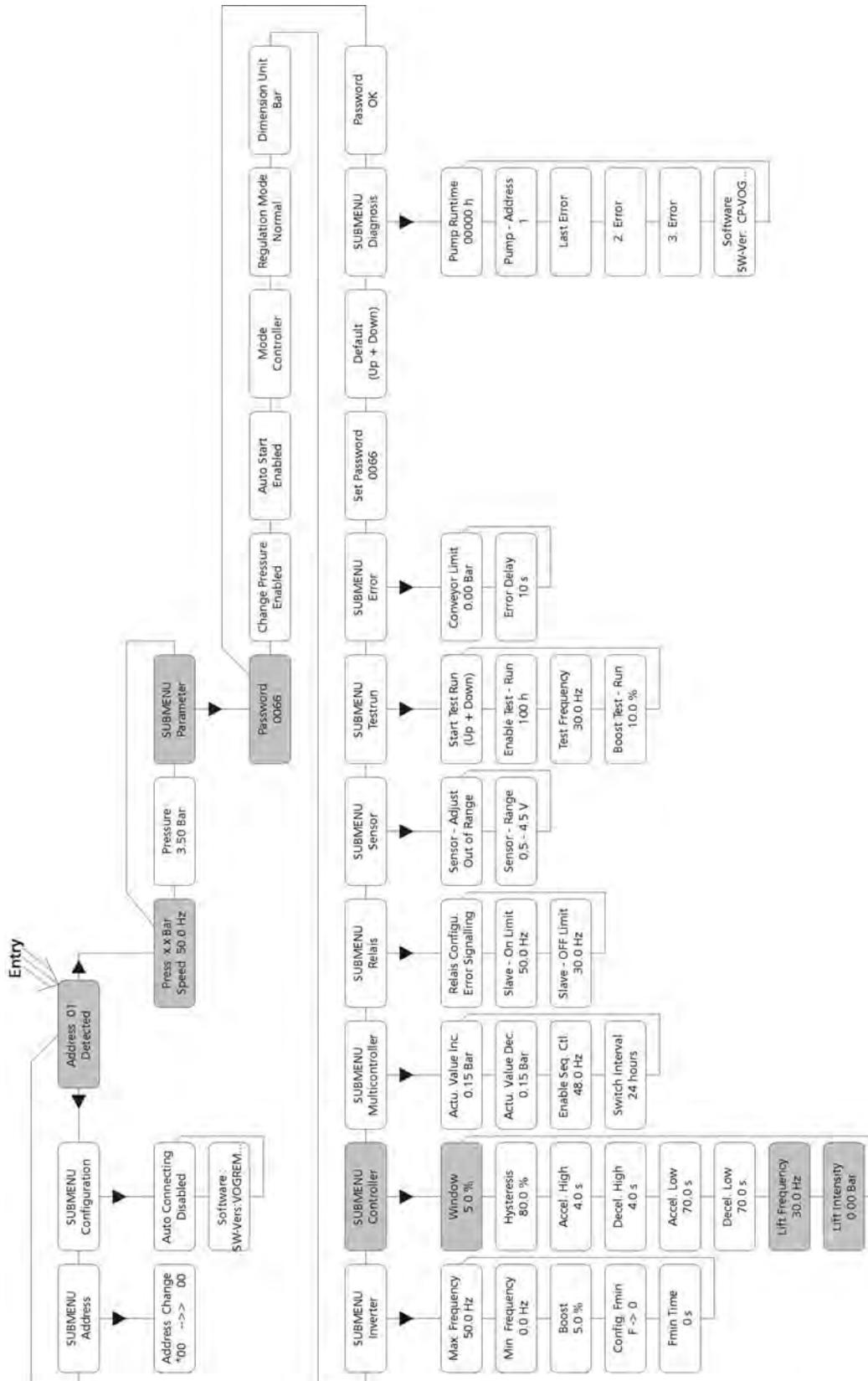


The Hydrovar can automatically compensate for system friction losses due to increased flow. Tables are available in most pump catalogues indicating the amount of friction loss that can be expected in various sizes of pumps at different flow rates. Use these tables to determine the friction loss for the pipe size you are using at maximum flow rate.

This Diagram shows a typical system curve. The system pressure set point is shown at shutoff and pressure increase is shown for increasing flow.

Calculate the pressure required to overcome friction loss at maximum flow.

11.4 Entering Compensation Values



Instructions:

From the 1st display, press the → button twice, until you reach

SUBMENU
PARAMETER

Then press the ↓ button and the display will change to

PASSWORD
0000



Password:

The Password protection prevents untrained personal from accidentally changing the base setting

Press the ↑ button until you reach the number 0066

PASSWORD
0066

Press the → button repeatedly until you reach

SUBMENU
CONTROLLER

Press the ↓ button to enter the submenu and change to

WINDOW
5,0 %

Now press the → button until you reach the parameter "LIFT FREQUENCY"

LIFT FREQUENCY
30 Hz

LIFT FREQUENCY:

This indicates the frequency at which the increase of the set pressure should begin. It should be the speed at which the pump works at the set pressure and at delivery rate of 0 m³/h. On a 50 Hz system, there is virtually no flow below about 30 Hz, on a 60 Hz system about 40Hz.

Press the ↑ and ↓ button until you reach desired frequency.

LIFT FREQUENCY
30 Hz

After changing of the value, you have to confirm with the → button. Then you will get the message "SAVE PARAMETER" for a short time, when the new setting is saved!

Now press the → button to change to

LIFT INTENSITY
0,0 bar

LIFT INTENSITY:

This value states, how much the required value should be continually increased, till the maximum speed (maximum volume) is reached. Further description, see chapter 13.6.8.

Press the ↑ and ↓ button until you reach desired value

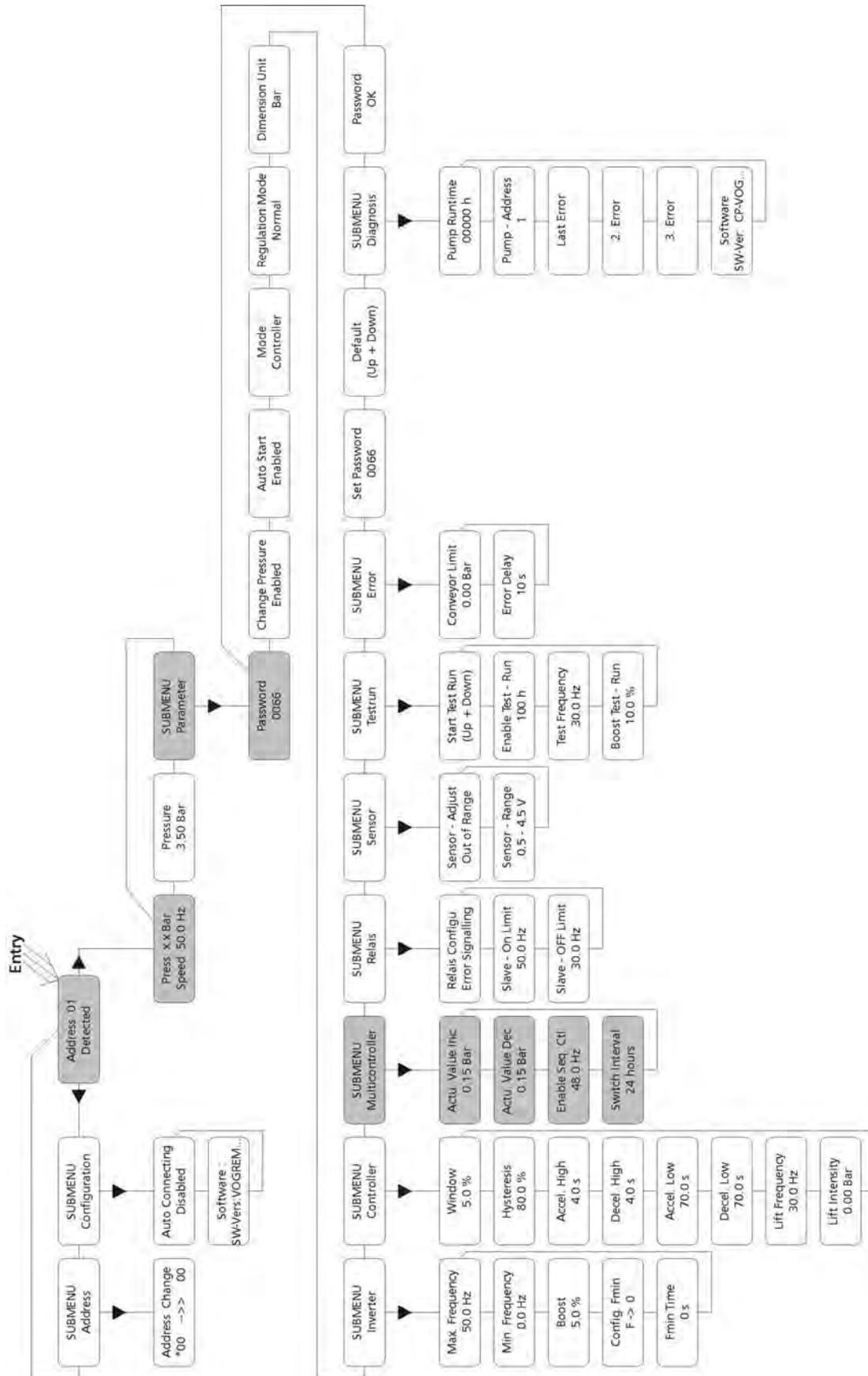
LIFT INTENSITY
0,0 bar

After changing of the value, you have to confirm with the → button. Then you will get the message "SAVE PARAMETER" for a short time, when the new setting is saved!

Hold the → button down for 3 seconds to return to:

SUBMENU
CONTROLLER

11.5 Multiple pump constant pressure and system compensation



When two, three or four Hydrovar speed controlled pumps are connected together in a system via the RS485-interface, they can be programmed to work together to maintain system pressure up to the maximum flow rate of all the pumps combined.

As the first pump reaches its maximum speed and flow, the second pump will automatically turn on (and so on). In addition, the sequence of the pump that will run first (lead pump) can be automatically varied to reduce premature wear on any one pump in the system.

Instructions:

!! Refer to chapter 11.1 (setting single pump constant pressure).

Follow these instructions for setting the required pressure and then continue with the following steps.

From the 1st display, press the → button twice, until you reach

SUBMENU
PARAMETER

Then press the ↓ button and the display will change to

PASSWORD
0000

	<p><u>Password:</u> The Password protection prevents untrained personal from accidentally changing the base setting</p>
---	--

Press the ↑ button until you reach the number 0066

PASSWORD
0066

Press the → button repeatedly until you reach

SUBMENU
MULTICONTROLLER

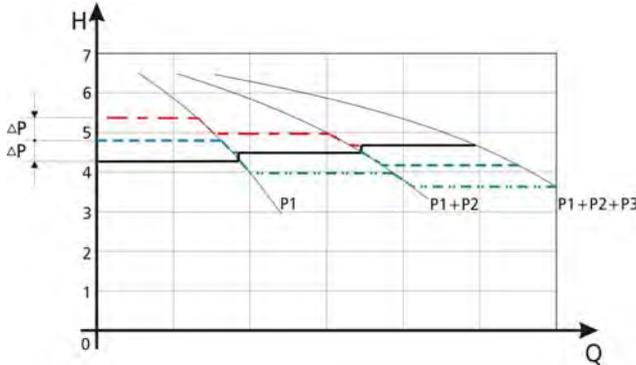
Press the ↓ button to enter the submenu and change to

ACTUAL VALUE INCREASE
0.15 bar

ACTUAL PRESSURE INCREASE (= Lift value):

This value, together with the fall value (ACTUAL VALUE DECREASE) determines the increase of the required value after starting of the following pumps (see attached application example on next page)

Generally a slight pressure drop is allowed on the first pump before the next is started. This allows for brief systems fluctuations without pump cycling. Once the next pump starts, however, you will want the system to resume its normal set pressure.



To do this, enter the amount of pressure drop you will allow before the next pump starts (=value of parameter ACTUAL VALUE DECREASE). The diagram shows the pressure drop and increase.

To increase the pressure even more to compensate for system loss at higher flows, enter the total of the system drop allowed before next pump starts and the increased pressure (ACTUAL VALUE INCREASE) desired.

For example, if the pressure drop allow 0,35 bar before the next pump starts, and the increased pressure needed to compensate for system losses is 0,2 bar, you would enter $0,35 + 0,20 = 0,55$ bar (= calculated value of the parameter ACTUAL VALUE INCREASE) to compensate for both system pressure drop and compensation requirements.

Application example:

- 1) Pump 1 reaches the speed of ENABLE SEQ: CONTROL
- 2) Pressure falls and reaches the start-value of the 2nd pump (= REQUIRED VALUE – ACTUAL VALUE DECREASE)
- 3) Pump 2 is switched on automatically
- 4) The required value is calculated new, after the start of the 2nd pump in the following way!

$$\text{New required value} = \text{REQUIRED VALUE} - \text{ACTUAL VALUE DECREASE} + \text{ACTUAL VALUE INCREASE}$$

Generally:

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

- Lift value = Fall value ⇒ **Pressure constant** when pumps switch on
- Lift value > Fall value ⇒ **Pressure rises** when lag-pump switches on
- Lift value < Fall value ⇒ **Pressure falls** when lag-pump switches on

Note:

This value is cumulative. An extra 0,2 bar will be added to the total system pressure with each additional pump which turns on. For example, if the initial system pressure was 3,5 bar, pump two would create 3,7 bar, pump three would create 3,9 bar, and pump four would create 4,1 bar system pressure.

Enter the required value by pressing the ↑ and ↓ button

ACTUAL VALUE INCREASE
0,15 bar

After changing of the value, you have to confirm with the → button.
Then you will get the message "SAVE PARAMETER" for a short time, when the new setting is saved!

Press the → button to change to

ACTUAL VALUE DECREASE
0,15 bar

ACTUAL PRESSURE DECREASE (= Fall value):

This value determines amount of pressure drop you will allow before the next pump starts. (see application example on previous page)

Enter the required value by pressing the ↑ and ↓ button

ACTUAL VALUE DECREASE
0,15 bar

After changing of the value, you have to confirm with the → button.
Then you will get the message "SAVE PARAMETER" for a short time, when the new setting is saved!

Press the → button to change to

ENABLE SEQ. CONTROL
48 Hz

ENABLE SEQUENCE CONTROL:

The follow-up pump only starts, when the start-value is reached (see chapter 13.7.2) and the lead pump has reached the programmed release-frequency. (Adjustable from 0.0 Hz to 70 Hz). Normally this start frequency is set 1 to 2Hz lower than the MAX. FREQUENCY (see chapter 13.5.1)

If you don't want to start a following pump this value has to be set higher than the MAX. FREQUENCY. (see application example on previous page)

Enter the required value by pressing the ↑ and ↓ button

ENABLE SEQ. CONTROL
49 Hz

After changing of the value, you have to confirm with the → button.
Then you will get the message "SAVE PARAMETER" for a short time, when the new setting is saved!

Press the → button to change to

SWITCH INTERVAL
24 HOURS

SWITCH INTERVAL

This time determines the interval of the changeover of the master pump in order to achieve even operating hours of all pumps in the system. Adjustable between 0 and 250 hours

Enter the required value by pressing the ↑ and ↓ button

SWITCH INTERVAL
24 HOURS

After changing of the value, you have to confirm with the → button.
Then you will get the message "SAVE PARAMETER" for a short time, when the new setting is saved!

	Use the settings of this submenu (lift value, fall value, enable sequence control and switch interval) for each pump in the Hydrovar system
---	---

Hold the → button down for 3 seconds to return to:

SUBMENU CONTROLLER

Hold the → button down again for 3 seconds to return to the 1st display

PRESSURE x.x bar SPEED xx Hz

	If you set the addresses in a multiple pump system the first time, connect only the Hydrovar unit where you want to set the address to power supply otherwise all Hydrovars in the system connected over the RS485-interface will change their address, too
---	---

In the following section you will **give the pump an address number**. Generally, the first programmed pump will be number 1, the second will be number 2, and so on. The purpose of this is to help the Hydrovar sequence the start and stop activity of the pumps in the system including the selection of the lead and lag pumps.

From the 1st display, hold the → button for longer than 3 sec. to get the display, where the actual address is show

Address 01 Detected

or

When there is no active address, there is shown

Address 01 L O S T

Then press the ← button twice to change to

Submenu Address

Press the ↓ button to enter the submenu and change to

Address Change 00 --> 00 *

Addresses from 01 to 04 and also 00 can be set in this parameter. To change the address it is not necessary to cut the interface connection to other HYDROVARs.

On the left side there is shown the address of the HYDROVAR, which you are actually speaking (select the address by using the buttons ↑ or ↓). On the right side, then you can give the HYDROVAR a new address also with the buttons ↑ and ↓. You only can give an address, which is not used in the pump group!

To change between left and right side, press button ← or →. The star shows the actual used side.

To save the new selected address press both buttons (↑ and ↓) together for 2 sec. If it was successfully you will see the same address on both sides.

Example:

To change the Hydrovar with address 01 to address 04:

press the ← button to change the * to the left side

Address Change
00* --> 00

Select the address of the Hydrovar, you want to change the address with the ↑ and ↓ button

Address Change
01* --> 00

press the → button to change the * to the right side

Address Change
01 --> 00*

Select the address you want to give this Hydrovar with the ↑ and ↓ button

Address Change
01 --> 04*

To confirm and save the new selected address press both buttons (← and →) together for 2 sec. If it was successfully you will see the same address on both sides.

Address Change
04 --> 04*

The definition of the address you have to do for each pump in the system.

Hold the → button down for 3 seconds to return to:

SUBMENU
Address

Hold the → button down again for 3 seconds to return to the 1st display

PRESSURE x.x bar
SPEED xx Hz

12 Settings at the Invertermenu

1st display

PRESS X.X bar
SPEED X.X Hz

The actual input value [bar] and the actual output frequency [Hz] are displayed.

Press → on the controller to change to

PRESSURE
XX.X bar

There you can set required pressure with the buttons ↑ and ↓

Press → on the controller to change to

SUBMENU
PARAMETER

To enter the submenu "Parameter", press ↓ button

Press → on the controller to change to 1st display

13 Settings at the Submenu-Parameter



Important: Before entering the secondary menu these instructions must be read carefully to prevent incorrect settings which will cause malfunction.

After entering the *SUBMENU PARAMETER*, the display

... will change to

PASSWORD
0000

Set Password 0066 by pressing \uparrow and \downarrow

PASSWORD
0066

Note: The password must be entered at each entry

Confirm by pressing \rightarrow and the first parameter of the sub menu is shown

Change Pressure
Enabled

13.1 Pressure change

Change Pressure
Enabled

You can decide between \uparrow (Enabled) or \downarrow (Disabled)

If the pressure setting is enabled, you can change the required pressure on the Hydrovarhead with *decrease* and *increase* (see *chapter 7*) without an external programming device.

Press \rightarrow on the controller to change to

13.2 Auto start

Auto Start
Enabled

You can select between \downarrow Disabled and \uparrow Enabled

Autostart **Enabled** means, that the pump starts again automatically after an interruption of the power supply (power failure).

If Autostart **Disabled** is set, the pump has to be restarted manually after a power failure, by pressing ∇ and \blacktriangle .

Press \rightarrow on the controller to change to

13.3 Mode

Mode Controller

Select with buttons ↓ and ↑ between:
Multicontroller ⇒ sequence control for max. 4 pumps

Controller ⇒ pressure control for a single pump If only one HYDROVAR-pump is in operation, set **Controller**.

If more than one HYDROVAR-pumps are working together via the RS485-interface, the **Multicontroller** must be selected.

Actuator ⇒ external frequency setting. The application **Actuator** is only used, if you have an external controller and the HYDROVAR works like a standard frequency converter (external frequency signal 0,5-4,5VDC to the terminals X2/1 and X2/2).

Press → on the controller to change to

13.4 Control Response

Regulation Mode Normal

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 of constant suction pressure or at constant level before the pump).

Press → on the controller to change to

13.4.1 Dimension unit

Dimension unit Bar

Here you could choose your favourite unit (with buttons ↓ and ↑) Bar, psi or % for the 1st display.

Press → on the controller to change to

13.5 Submenu Inverter

Submenu Inverter

To enter this menu you have to press the ↓ key, to leave the menu, press the → key longer than 3 sec.

Press → on the controller to change to

13.5.1 Maximum Frequency

Max. Frequency 50.0 Hz

Possible setting between min. 40 and max. 70 Hz.
Attention: Settings higher than 50 Hz may overload the motor!

Settings of 10% above nominal frequency cause 33% more power consumption!

Press → on the controller to change to

13.5.2 Minimum frequency

Min. Frequency 0.0 Hz

Here you can set the minimum frequency.

Attention!: If there is set $F > F_{min}$ in the parameter CONFIG FMIN (see chapter 13.5.4) the pump will not stop in the normal mode. It will keep running with the set minimum frequency.

!! Possibility of overheating of the pump !!

Press → on the controller to change to

13.5.3 Boost

BOOST 5.0 %

The stated value determines the course of the U/f-curve.

Setting of the motor starting voltage in % of rated voltage.

Settings of 0...25% of maximum output voltage are possible. However, care should be taken that settings are kept as low as possible so that the motor does not become thermally overloaded.

Press → on the controller to change to

13.5.4 Operation of the minimum frequency

Config. Fmin $F \Rightarrow F_{min}$

If you have selected „F->0“ the frequency will go down to the selected minimum frequency (13.5.2).

Then the inverter will run for the selected time(13.5.5)and after this time the Hydrovar will stop automatically.

With the selection is „F-> F_{min} “ you can not run the pump below the set minimum frequency. In the controller, actuator and multicontroller mode the pump will never run below the set minimum frequency (the pump will only stop with the external on/off-terminals or in case of a failure).

Press → on the controller to change to

13.5.5 Delay time for Fmin

Fmin Time 0 s

After running the pump for this selected time at minimum frequency, the pump will stop, if parameter

CONFIG Fmin (see chapter 13.5.4) it set to $F \Rightarrow 0$ Adjustable between 0 and 100s.

To leave the submenu press the → key longer than 3 sec.!

13.6 Submenu Controller

Submenu Controller

To enter this menu you have to press the ↓ key, to leave the menu, press the → key longer than 3 sec.

13.6.1 Window - %

Window 5 %

This value indicates the max. variation of the outgoing pressure (ref. Ramp window in chapter 13.6.6).

Possible setting: between 0% - 100% of required pressure.

Press → on the controller to change to

13.6.2 Ramp Hysteresis

Hysteresis 80%

Level, where the fast ramp changes to the slow ramp within the window.

Possible setting: between 0%..100% of the window

Press → on the controller to change to

13.6.3 Fast acceleration time

Time setting at Ramp 1, 2, 3, or 4 will influence the control of the pump and SHOULD NOT BE CHANGED at normal operation. Possible setting for each ramp 0,05 - 1000 sec.

Accel. High 4 Sec

Excessively fast running up time may overload the inverter.

Excessively slow running up time may cause a break down of the outgoing pressure.

Press → on the controller to change to

13.6.4 Fast deceleration time

Decel. High 4 Sec

Excessively fast running down time tends to cause oscillation or hunting or can cause an error

(OVERVOLTAGE) during pump down of the pump.

Excessively slow running down time tends to generate over pressure.

Press → on the controller to change to

13.6.5 Slow acceleration time

Accel. Low
70 Sec

A too slow running up time during variation of demand the outgoing pressure may break.
A too fast running up time may lead to over oscillation and /or overload of the inverter.

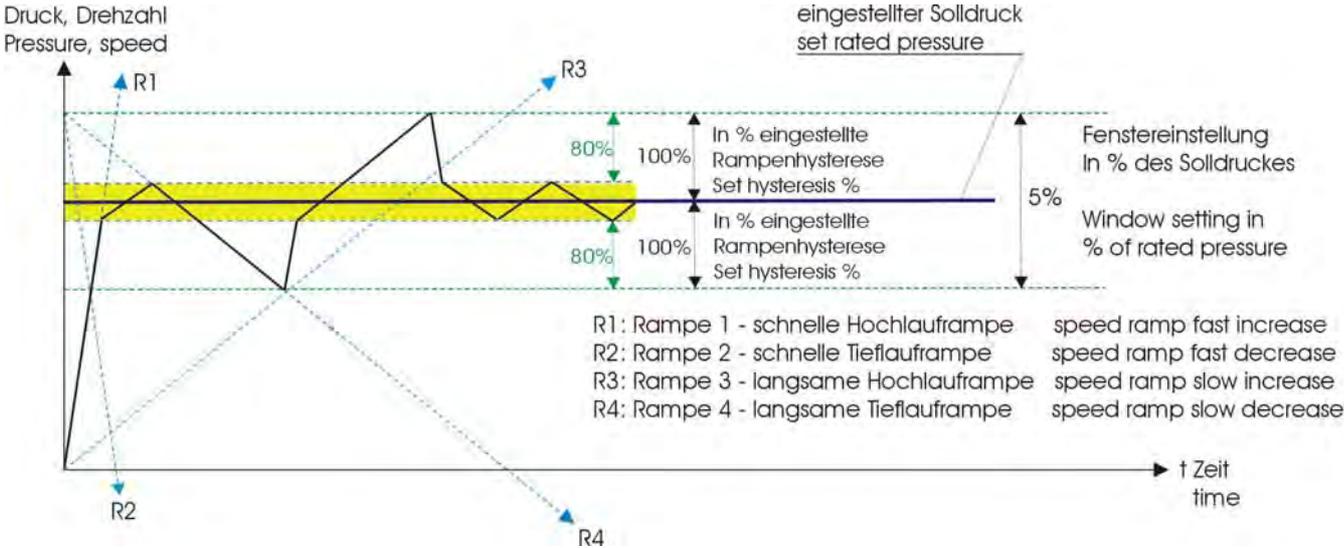
Press → on the controller to change to

13.6.6 Slow deceleration time

Decel. Low
70 Sec

A too fast setting leads to oscillation
A too slow setting delays the switching off too much and may generate over pressure.

Ramp Window



Press → on the controller to change to

13.6.7 Compensation Frequency

Control according to a system curve (increase of the set pressure depending on the delivery rate or speed).

LIFT FREQUENCY
30.0 Hz

Adjustable between 6 Hz and the set MAXIMUM FREQUENCY, this setting states at which frequency the set pressure should be increased. That is the speed at which the pump works at the set pressure and at delivery rate 0.

Press → on the controller to change to

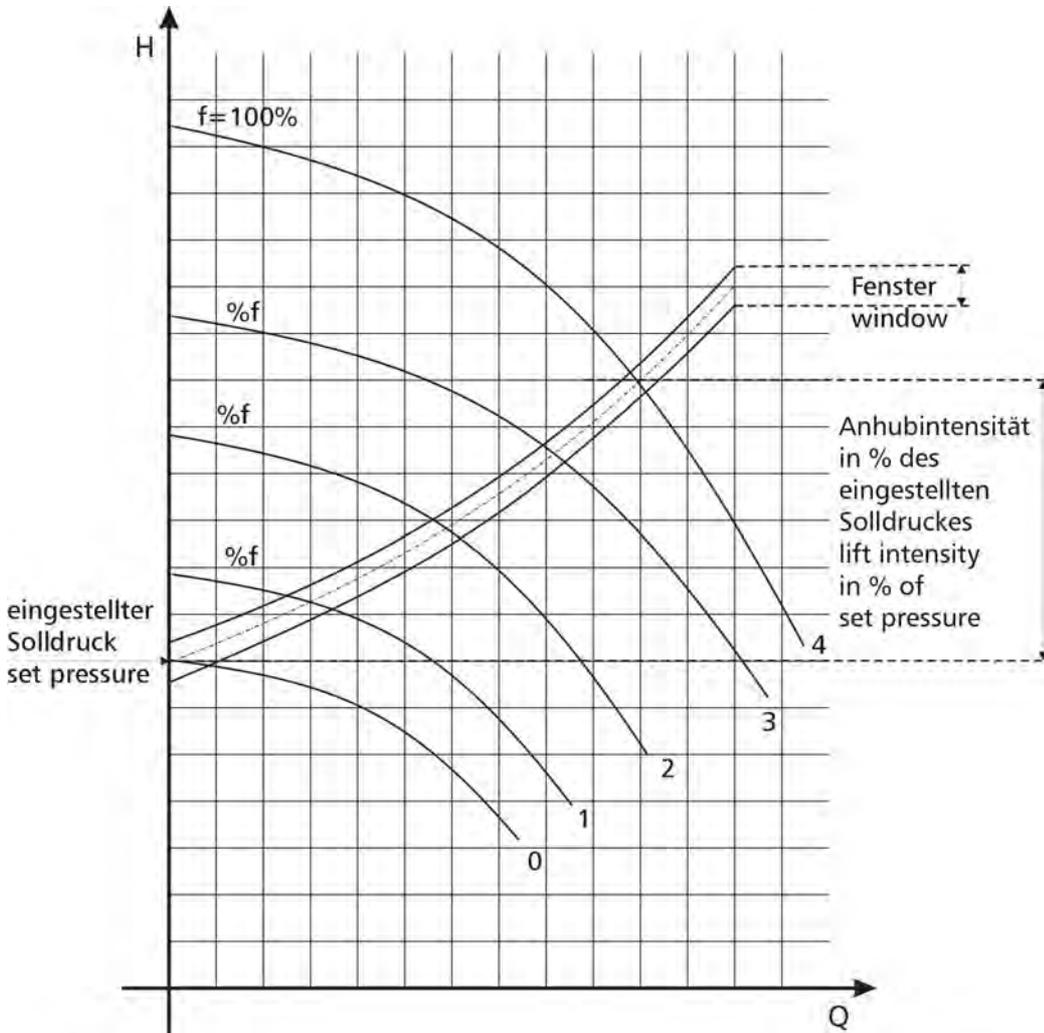
13.6.8 Lift-Intensity

LIFT – INTENS. 0.0 bar

Adjustable from 0 to 100% of the range of the used pressure transmitter.

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

Figure: **Lift-Intensity**



To leave the submenu press the → key longer than 3 sec.!

13.7 Submenu Multicontroller

Submenu
Multicontroller

To enter this menu you have to press the ↓ key, to leave the menu, press the → key longer than 3 sec.

13.7.1 Lift Value

ACTU. VALUE INC.
0.15 BAR

Adjustable between 0 and 2,5 bar.
This value, together with the fall value determines the

increase of the required value after starting of the following pumps (see attached application example in chapter 13.7.2)

Press → on the controller to change to

13.7.2 Fall Value

For scaling the required value for 1 to 4 pumps

Actu. Value Dec. 0.15 bar

Adjustable between 0 and 2,5 bar.
 This value determines the start value of the 2nd and the other following pumps. (*Start-Value* = REQUIRED VALUE – ACT. VALUE DEC.)

Application example:

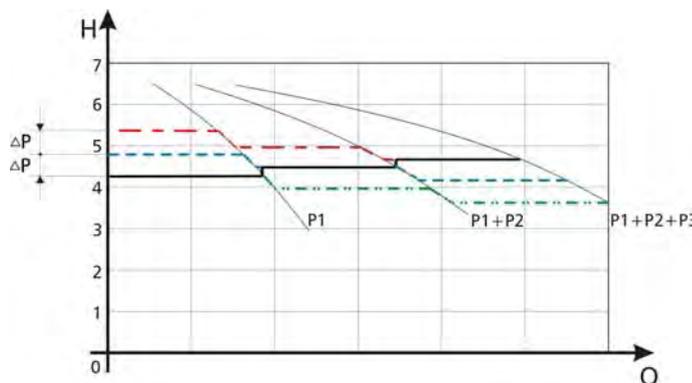
- 1) Pump 1 reaches f_{max} (maximum speed)
- 2) Pressure falls and reaches the start-value of the 2nd pump
 (= REQUIRED VALUE – ACTU. VALUE DEC.)
- 3) Pump 2 is switched on automatically
- 4) The required value is calculated new, after the start of the 2nd pump in the following way!

$$\text{New required value} = \text{REQUIRED VALUE} - \text{ACTU. VALUE DEC.} + \text{ACU. VALUE INC.}$$

Generally:

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** when pumps switch on
- Lift value > Fall value ⇒ **Pressure rises** when lag-pump switches on
- Lift value < Fall value ⇒ **Pressure falls** when lag-pump switches on



Press → on the controller to change to

13.7.3 Release – Follow up pump

Enable Seq. Ctl. 48.0 Hz

The follow-up pump only starts, when the start-value is reached (see chapter 13.7.2) and the lead

pump has reached the programmed release-frequency. (Adjustable from 0.0 Hz to 70 Hz). If you don't want to start a following pump this value has to be set higher than the MAX. FREQUENCY (see chapter 13.5.1)

Press → on the controller to change to

13.7.4 Switch Interval

Switch Interval 24 hours

For changing the master pump and follow-up pump in order to achieve even operating hours of the pumps. Adjustable between 0 and 250 hours

To leave the submenu press the → key longer than 3 sec.!

13.8 Submenu Relay

Submenu Relay

To enter this menu you have to press the ↓ key, to leave the menu, press the → key longer than 3 sec.

13.8.1 Relay Configuration

Relay Configu. Simple Multicnt.

Possible selections with buttons ↓ and ↑:
Simple Multicnt. ⇒ allows to start a following constant speed pump. (see chapter 13.8.2 / 13.8.3.)
Run Signalling ⇒ Run indication over the relay
Error Signalling ⇒ fault indication over the relay

Attn: Max. contact load 500mA / 125V

Press → on the controller to change to

13.8.2 Start frequency of the slave pump

Slave-On Limit 50,0 Hz

Here you can set the frequency of the speed controlled HYDROVAR-pump, when the full speed slave pump should start, if "simple multicontroller" is set in the parameter Relay configuration (see chapter 13.8.1). In this case, the slave pump runs with full speed and the HYDROVAR-pump controls the additional demand.

Press → on the controller to change to

13.8.3 Stop frequency of the slave pump

Slave-Off Limit

Here you can set the frequency of the speed

30.0 Hz controlled HYDROVAR-pump, where the full speed slave pump should stop, if "simple multicontroller" is set in the parameter Relay configuration (see chapter 13.8.1).

To leave the submenu press the → key longer than 3 sec.!

13.9 Submenu Sensor

Submenu Sensor To enter this menu you have to press the ↓ key, to leave the menu, press the → key longer than 3 sec.

13.9.1 Sensor – Adjust

**SENSOR_ADJUST ?
Out of range** *Zero adjustment of the transmitter*
Depressurise the system and press keys ↓ + ↑ simultaneously. After adjustment "adjusted" appears on the display. If "out of range" is shown on the display, no adjustment is possible (e.g. when pressure is in the system....)

Press → on the controller to change to

13.9.2 SensorMax-Adjust

**SENSORMAX-ADJUST
0,5 – 4,5 V** The analogue input (terminal X2/2) is prepared for a transmitter signal of 0,5 – 4,5VDC.
When there is used a transmitter with another signal range, you can also choose an input signal of 0,5 – 2,5VDC (for example a 4-20mA-transmitter with an external load resistor of 125 ohm/0,25W) with the buttons ↓ + ↑.

To leave the submenu press the → key longer than 3 sec.!

13.10 Submenu Test-Run

Submenu Testrun To enter this menu you have to press the ↓ key, to leave the menu, press the → key longer than 3 sec.

13.10.1 Start of manual test run

**Start Test Run
↑ + ↓** By simultaneously pressing ↑ + ↓ a test run will be released even if the test cycle is not set.
After starting this test run, the pump will speed up with the fasten ramp 1 to the in the parameter 13.10.3 setted speed and then will ramp down with the fasten ramp 2.

Press → on the controller to change to

13.10.2 Sequence for automatic test run

Time Test Run 100 h

Adjustable between 1...100 hours.
The test run starts the pump at the set time after the last stop for 20 seconds with the in parameter 13.10.3 set speed.
Deactivating test run: Set 0 hours, by using ↑ and ↓.
Repeating the test run: Select test run and set the desired hours using the key ↑.

Press → on the controller to change to

13.10.3 Test Run: Frequency

Test Frequency 30.0 Hz

Frequency for manual and automatic test run.
Can be set from 0 Hz up to 70 Hz.

Press → on the controller to change to

13.10.4 Test Run: Boost

BOOST Test Run 10.0 %.

Start voltage in % of rated voltage in order to ensure that the motor starts safely. Adjustable between 0% and 25%

To leave the submenu press the → key longer than 3 sec.!

13.11 Submenu Error

Submenu Error

To enter this menu you have to press the ↓ key, to leave the menu, press the → key longer than 3 sec.

13.11.1 Conveyor Limit

Conveyor Limit 0.0 bar

Disabled or adjustable between 0 and 10 bar of the analogue input signal range.

"0.0 bar" means disabled conveyor limit.

An adjusted value >0 has to be reached till the programmed "ERROR DELAY"-time. Doesn't this value be reached the failure "ERROR WATER" will be indicated and the pump stops.

Press → on the controller to change to

13.11.2 Error Delay

Error Delay 10 Sec.

Adjustable between 0...100 sec.
Delayed switch-off in the event of low water,
(Terminal X2/6-X2/7) and also for the conveyor limit (see chapter 13.11.1).

To leave the submenu press the → key for 3 sec.!

13.12 Set Password

Set Password 0066

The pre-set password can be changed if necessary
with the ↑ and ↓ keys.

Press → on the controller to change to

13.13 Default Settings

Default ↑ + ↓

To load DEFAULT – PARAMETER, press buttons ↑ + ↓
together, till the timer is run down.

Press → on the controller to change to

13.14 Submenu Diagnosis

Submenu Diagnosis

To enter this menu you have to press the ↓ key, to
leave the menu, press the → key longer than 3 sec.

13.14.1 Pump Runtime

Pump Runtime 0000 Std.

Shows the running hours of the pump.

Press → on the controller to change to

13.14.2 Pump Address

Pump-Address 1

This window shows the adjustment of the pump
address (only read).

Press → on the controller to change to

13.14.3 Error memory

The last three error messages are always stored in an internal memory. The
error signals can not be deleted!

Last Error
.....

Shows the last error:

2nd Error
.....

Shows the Error before the last error:

3rd Error
.....

Shows the Error before Error 2

Press → on the controller to change to

13.14.4 Software Version

Software
CP – VOG: 004

In this parameter, there is shown the used software version of the HYDROVAR.

To leave the submenu press the → key for 3 sec.!

13.15 Set Password

Password
O.K.

Here the set or changed password must be confirmed.

14 Controller menu (of the programming device)

To reach the controller menu, you have to press → on the controller for longer than 3 sec., when the

1st display

PRESS X.X bar
SPEED X.X Hz

The actual input value [bar] and the actual output frequency [Hz] are displayed.

is shown. Then the display will change to

Address 01
Detected

The actual pump-address is shown

Then press ← on the controller to change to

14.1 Controller menu Configuration

Submenu
Configuration

To enter this menu you have to press the ↓ key, to leave the menu, press the → key longer than 3 sec.

14.1.1 Automatic connection to the programming device

Auto Connecting Enabled

!Only valid for programming device!

Auto connecting enabled: that after plug in of the programming device, it changes automatically to the inverter menu. During this auto connection the programming device is looking for a valid address and "SCAN CONNECTION" is shown on the display (see chapter 10.2).

Auto connecting will be stored after leaving the submenu Configuration.

Auto connecting disabled: there is no automatic connecting with the pump (choose the address)

Press → on the controller to change to

14.1.2 Software Version of the programming device

Software: Software: VOGREM-004

In the second line of the display, there is shown the version of the software of the programming device and also the date of programming of this software.

To leave the submenu press the → key for 3 sec.!

14.2 Submenu address

Submenu Address

To enter this menu you have to press the ↓ key, to leave the menu, press the → key longer than 3 sec.

14.2.1 Change of pump address

Address Change 00--> 00 *

Addresses from 01 to 04 and also 00 can be set in this parameter. To change the address it is

not necessary to cut the interface connection to other HYDROVARs.

On the left side there is shown the address of the HYDROVAR, which you want to speak (select the address by using the buttons ↑ or ↓). On the right side, then you can give the HYDROVAR a new address also with the buttons ↑ and ↓. You only can give an address, which is not used in the pump group!

To change between left and right side, press button ← or →. The star shows the actual used side.

To save the new selected address press both buttons (← and →) together for 2 sec. If it was successfully you will see the same address on both sides.

To leave the submenu press the → key for 3 sec.!

15 Possible Error messages

15.1 Low Water

XXX
Error Water

Remedy:
Check incoming pressure

If incoming pressure is normal the unit restarts itself. If there is no external low water protection (e.g. circulating systems), you have to bridge terminals X2/6 and X2/7.

15.2 Overheating – Motor

XXX
Error-Mot-Temp

Possible causes: insufficient cooling,
ambient temperature is too high or motor

overloaded. After the cause has been remedied, the malfunction has to be reset by cutting off the power supply for >30 seconds.

15.3 Overvoltage

XXX
Error-Overvolt

Possible cause: Check mains supply, supply
voltage too high, peak voltage owing to

switch heavy loads on the network, or RAMP 2 is too fast! Find the cause and take countermeasures (e.g. network filter, RC-elements). Disconnect the power supply for > 30 seconds (acknowledgement).

15.4 Undervoltage

XXX
Error-Undervolt

Possible cause: Check mains supply, faulty
fuse or phase Unsymmetry.

Disconnect the power supply for > 30 seconds (acknowledgement).

15.5 Overload

XXX
Error Overload

Possible causes: false data settings or the
pump is working at a capacity significantly in

excess of its performance data.

Ramp 1 too fast: (see chapter 13.6.3)

Max. frequency too high: (see chapter 13.5.1)

Boost too low: (see chapter 13.5.3)

Disconnect the power supply for > 30 seconds (acknowledgement).

15.6 Overheating of the heat sink

XXX Error KK-Temp

The thermal sensor, mounted on the cooling body of the HYDROVAR indicates over temperature. Possible causes: insufficient cooling, ambient temperature is too high or motor overloaded. After the cause has been remedied, the malfunction has to be reset by cutting off the power supply for >30 seconds.

15.7 Sensor fault

XXX Sensor Fault

The voltage level of the incoming analogue input signal is supervised.

If the signal falls below the 0,5VDC-level, an Error will be displayed.

Possible causes: break of the sensor cable or the sensor itself, bad connection of the plug of the sensor. After the cause has been remedied, the malfunction has to be reset by cutting off the power supply for >30 seconds.

15.8 Conveyor limit fault

XXX Error Water

The value of the programmed Conveyor limit is not reached within the programmed delay

time Error Delay(see chapter 13.11.1 and 13.11.2).

Possible causes can be: break of the pipe before or after the pump, closed valve before the pump, air in the pump. After the cause has been remedied, the malfunction has to be reset by cutting off the power supply for >30 seconds.

15.9 Additional internal processor Error messages:

ERROR 1	:	EEPROM-ERROR (corresponding data block malfunction)
ERROR 2	:	Not used
ERROR 3	:	Processor RAM error
ERROR 4	:	Not used
ERROR 5	:	Processor ROM error
ERROR 6	:	Watchdog error
ERROR 7	:	Clock error (quarz)
ERROR 8	:	Programme error

These ERROR signals are acknowledged by disconnecting the power supply for > 30 seconds.

If the error signal should appear again, contact customer service and provide a detailed description of the error.

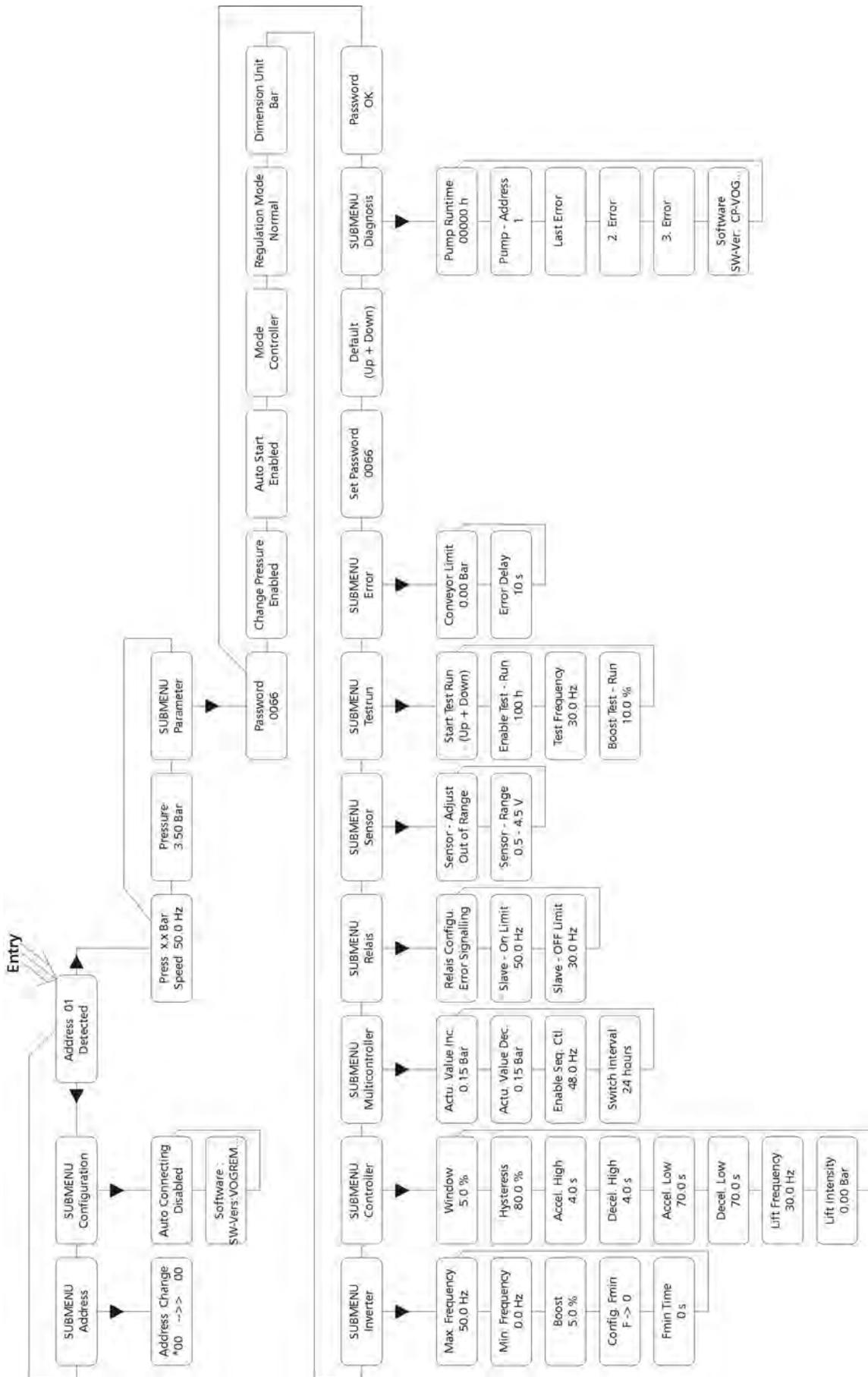
16 Maintenance

The HV1.1-1.2 control unit does not require special maintenance.
However, the cooling fan and the vent should be freed of dust occasionally.

Notes:

When replacing the control card in a plant with more than one pump ensure, that the same control card version (V/STK/X) is used in all Hydrovar units.

Fur further information, please ask your distributor!





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