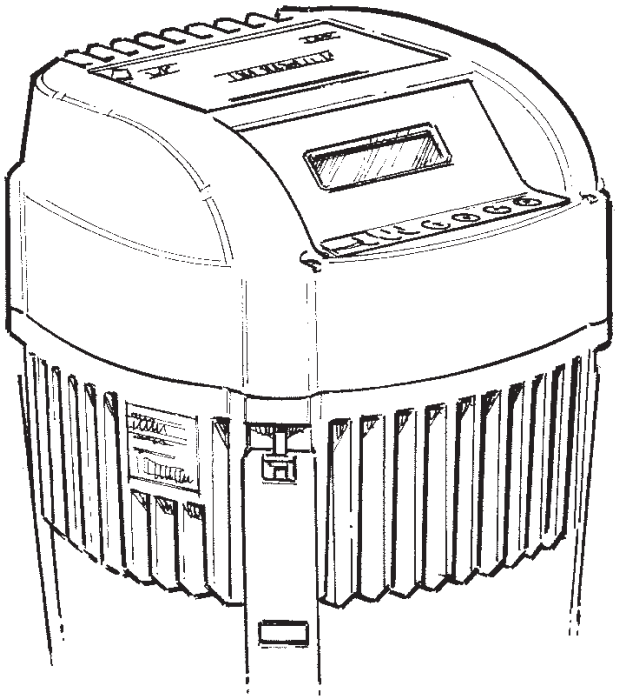
INSTRUCTION MANUAL

IM223R06



Hydrovar Pump Control

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

xylem

Let's Solve Water

INDEX

INDEX

! SAFETY INSTRUCTIONS

Section 1

Important: Read all safety information prior to installation of the Controller.

NOTE

This is a **SAFETY ALERT SYMBOL**. When you see this symbol on the controller, pump or in this manual, look for one of the following signal words and be alert to the potential for personal injury or property damage. Obey all messages that follow this symbol to avoid injury or death.

DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
CAUTION	Used without a safety alert symbol indicates a potentially hazardous situation which, if not avoided, could result in property damage.
NOTE	Indicates special instructions which are very important and must be followed.

NOTE

All operating instructions must be read, understood, and followed by the operating personnel. Xylem Inc. accepts no liability for damages or operating disorders which are the result of non-compliance with the operating instructions.

1. This manual is intended to assist in the installation, operation and repair of the system and must be kept with the system.
2. Installation and maintenance **MUST** be performed by properly trained and qualified personnel.
3. Review all instructions and warnings prior to performing any work on the system.
4. Any safety decals **MUST** be left on the controller and/or pump system.
5. **DANGER** Hazardous voltage — The system **MUST** be disconnected from the main power supply before removing the cover or attempting any operation or maintenance on the electrical or mechanical part of the system. Failure to disconnect electrical power before attempting any operation or maintenance can result in electrical shock, burns, or death.
6. **CAUTION** Hazardous Pressure — When in operation, the motor and pump could start unexpectedly and cause serious injury.

Section 1A

Review Hydrovar components and ensure that all parts are included. Inspect all components supplied for shipping damage.

Included Hydrovar components:

1. Hydrovar motor mount variable speed drive
2. Pressure transducer with cable
3. Conduit plate caps and reducers
4. 4 Attachment brackets, (bottom hook, extender, and screws)
5. Precision screwdriver.
6. Instruction and Operation Manual

SYSTEM DESIGN

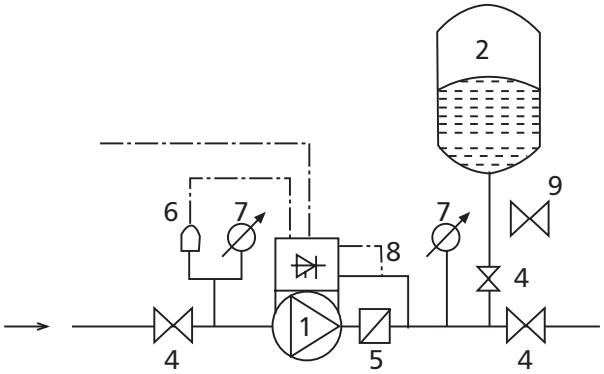
Section 2

The following diagrams show typical single and multi-pump systems using the HYDROVAR Variable Speed Drive. Connect directly to water supply. Use of a low suction pressure switch is recommended.

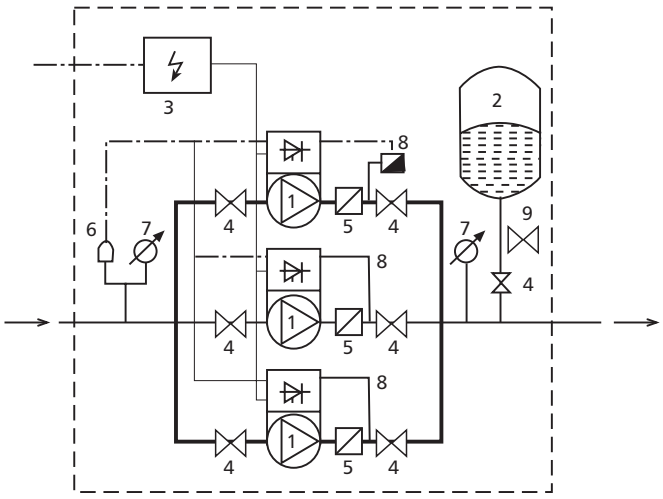
NOTE

Systems MUST be designed by qualified technicians only and meet all applicable state and local code requirements.

Single Pump Layout



Multi-Pump Layout



(1) pump with HYDROVAR
(2) diaphragm tank
(3) fusible disconnect
(4) gate valve
(5) check valve or ball valve
(6) low suction pressure switch
(7) pressure gauge
(8) pressure transducer
(9) pressure relief valve

General

NOTE

All plumbing work must be performed by a qualified technician. Always follow all local, state and provincial codes.

A proper installation requires a pressure relief valve, a ¼" female N.P.T. threaded fitting for the pressure sensor, and properly sized pipe. Piping should be no smaller than the pump discharge and/or suction connections. Piping should be kept as short as possible. Avoid the use of unnecessary fittings to minimize friction losses.

⚠CAUTION
Hazardous Pressure

Some pump and motor combinations supplied with this system can create dangerous pressure. Select pipe and fittings according to your pipe suppliers' recommendation. Consult local codes for piping requirements in your area.

All joints must be airtight. Use Teflon tape or another type of pipe sealant to seal threaded connections. Use caution when using thread sealant as any excess that gets inside the pipe may plug the pressure sensor.

Galvanized fittings or pipe should never be connected directly to the stainless steel discharge head or casing as galvanic corrosion may occur. Barb type connectors should always be double clamped.

SYSTEM DESIGN

Pressure Tank, Pressure Relief Valve and Discharge Piping

Use only "pre-charged" tanks on this system. Do not use galvanized tanks. Select an area that is always above 34° F (1.1° C) in which to install the tank, pressure sensor and pressure relief valve. If this is an area where a water leak or pressure relief valve blow-off may damage property, connect a drain line to the pressure relief valve. **Run the drain line from the pressure relief valve to a suitable drain or to an area where water will not damage property.**

Pressure Tank, System Pressure

Sizing – A diaphragm tank (not included) is used to cushion the pressure system during start-up and shut-down. It should be sized to at least 20% of the total capacity of your pump. Example: If your pump is sized for 100 GPM then size your tank for at least 20 gal. total volume, not draw down. Pre-charge your bladder tank to 15-20 PSI below your system pressure. The controller is pre-set for 50 PSI at the factory. Therefore a 35-40 PSI pre-charge in your tank would be required. Use the higher tank pre-charge setting if the system drifts over 5 PSI at a constant flow rate. **NOTE:** Pre-charge your tank before filling with water!

CAUTION

⚠CAUTION
Hazardous Pressure

Maximum working pressure of HydroPro diaphragm tank is 125 psi.

Installing the Pressure Sensor

The pressure sensor requires a ¼" FNPT fitting for installation. Install the pressure sensor with the electrical connector pointing up to avoid clogging the pressure port with debris. Install the pressure sensor in a straight run of pipe away from elbows or turbulence. For optimum pressure control install the pressure sensor in the same straight run of pipe as the pressure tank. Ensure the pressure sensor is within 10 feet of the pressure tank. Installing the pressure sensor far away from the pressure tank may result in pressure oscillations. **Do not install the pressure sensor in a location where freezing can occur.** A frozen pipe can cause damage to the pressure sensor.

The pressure sensor cable is 30' as standard. The cable can be shortened for a cleaner installation. Longer cable lengths are available, consult factory. Maximum recommended pressure sensor cable length is 300 feet. Avoid leaving a coil of pressure sensor cable as this can induce unwanted transient voltages and noise into the system. Do not run the pressure sensor cable alongside the input or output wiring. Maintain a distance of at least 8" between the pressure sensor cable and input or output wiring.

WARNING

Discharge pressure within the piping system prior to removing pressure transducer or disconnecting any part of the piping system. Open a valve until pressure on an external gauge reads 0 psi.

Section 3

3.1 Hardware Configurations

The HYDROVAR variable speed drive consists of two separate components: the power unit and the control card. In its basic configuration (consisting of only the power unit) the HYDROVAR can be used as a Basic Inverter. In that configuration the HYDROVAR can be used as a sequence pump in a multi pump system, or as a simple soft starter for single pump applications.

By extending this Basic controller with the additional control card, the HYDROVAR is able to work in different modes and can be used for multipump applications.

Three types of drives are available. They are each capable of different levels of control. They are:

Master controller:

- Full variable speed controller of itself in a single pump configuration, with more features than the Single controller
- Full variable speed control of the attached motor and up to 7 additional Master or Basic controllers.
- Full variable speed control of the attached motor and on/off, fixed speed control of up to 5 additional pumps. (This requires an additional relay card.)

Basic controller:

- Single pump soft start control
- Full variable speed control when connected to a Master controller

Single controller:

- Full variable speed control of a single pump with fewer features than the Master controller

3.2 Modes of Operation

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.

> **NOTE**
>
> This mode can only be programmed with a Master or Single controller, and is for single pump systems 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.

→ Typical single pump operation

3.2.3 Cascade Relay

One pump is fitted with a HYDROVAR Master controller and up to 5 fixed speed pumps can be switched ON and OFF on demand. For this purpose an additional Relay Card with 5 relays is used in the Master controller.

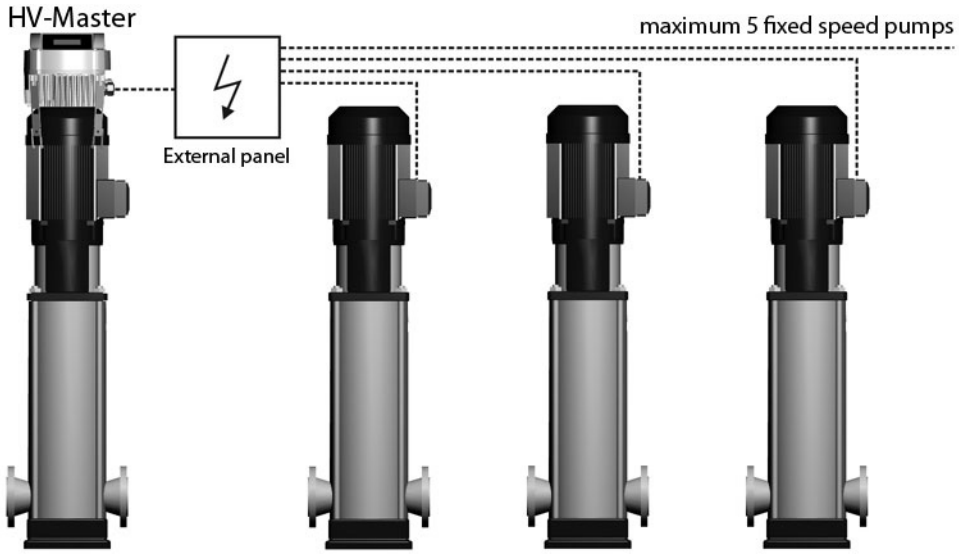
Separate motor starters are needed for each motor relay, because the relays in the HYDROVAR are control contacts only.

Lead/Lag switching of the fixed speed pumps to provide even wear and achieve even operating hours can be programmed in this mode.

This configuration is a cost effective alternative compared with other solutions using VFD's on each pump, but additional equipment is required, and you only have fixed speed control of the pumps.

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 and Cascade Synchron

In these modes each of the pumps is equipped with a HYDROVAR unit. All units are connected and communicate via the RS485 interface.

At least one Master controller is used. The other pumps can be controlled by Basic or Master drives. The Master controller continually reads the status and failures of the Basic controllers. All failures are indicated on the master unit, including the date and time.

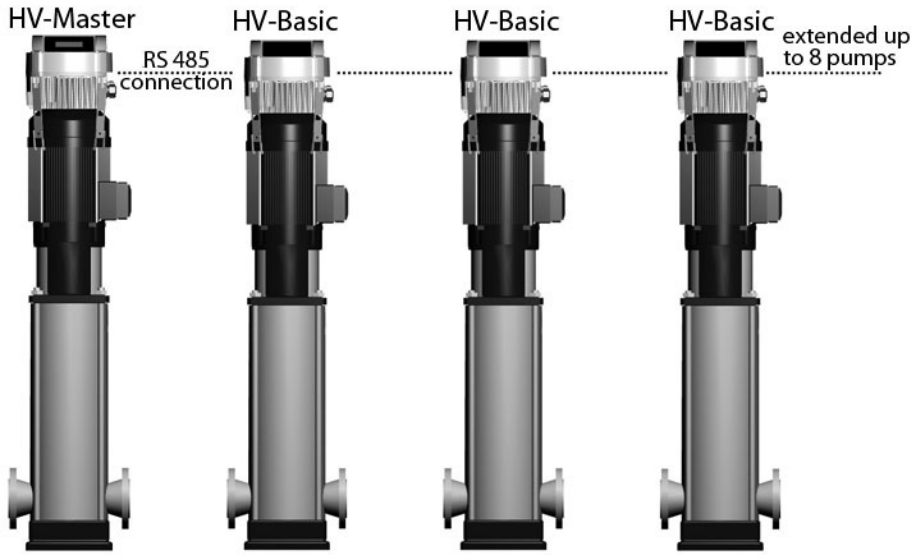
The Master controller has complete control of all pumps in the system, including automatic alternation of the lead and lag pumps, which provides even wear and achieves even operating hours for each pump.

If the control card of a Master controller fails, each of the Basic controllers can be manually started by an external switch (manual operation) for "emergency operation" of the system.

Application Example

Each pump, (up to 8 pumps), is equipped with a HYDROVAR unit. At least one Master controller will be connected to up to seven Basic controllers. All units are connected via the serial interface (RS485).

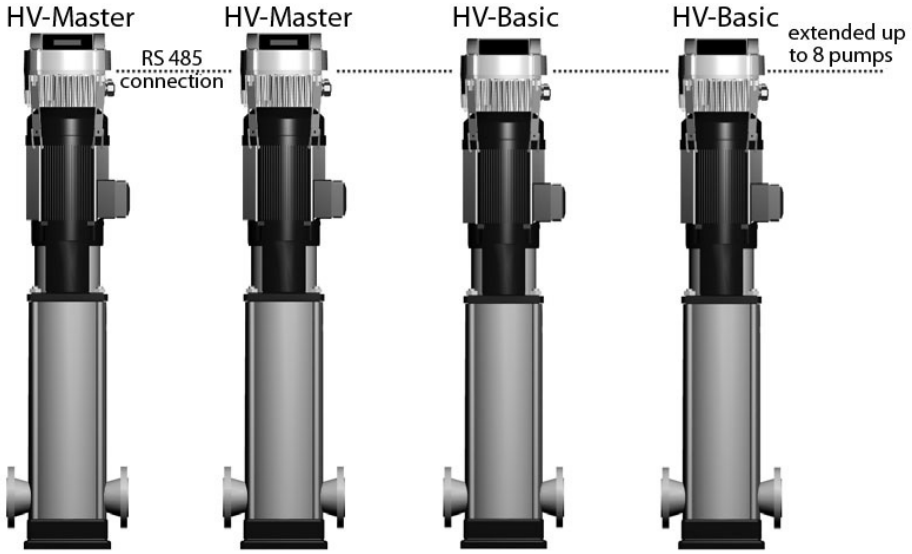
The combination of the different HYDROVAR units that are used in a multi-pump-system depends on the system requirements (i.e. in a 6 pump system 2 or more Master controllers can be used to increase reliability, and up to 4 Basic controllers without control card.



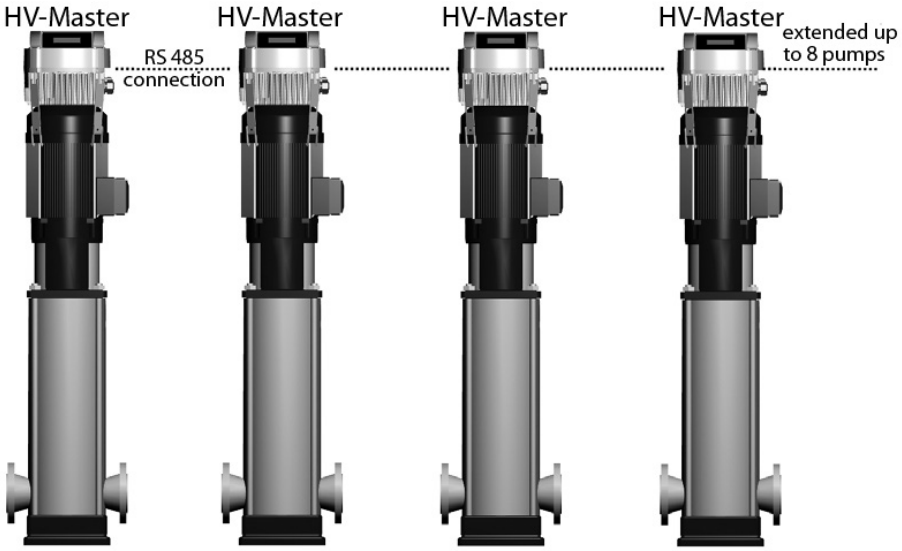
Minimum requirement: 1 Master controller and the other pumps equipped with Basic controllers.

PRODUCT OVERVIEW

To increase the reliability of a system, (in the event of a Master controller failure) a second Master controller can be used.



Full-featured possibility: Each pump is equipped with a Master controller.



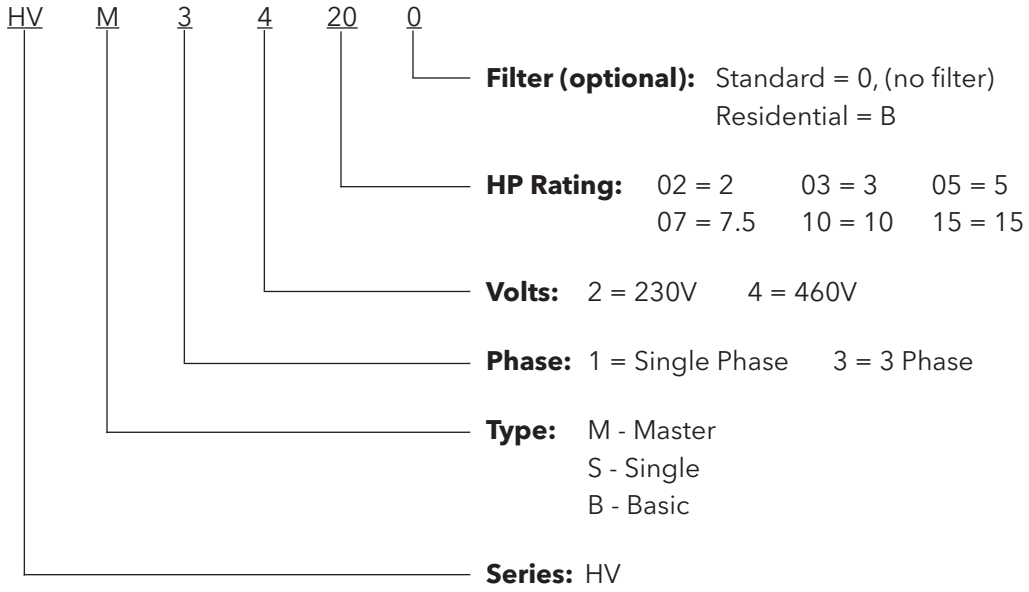
In this mode it is possible to run all pumps in cascade serial mode and synchronous mode as well.

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

Section 4

Hydrovar Variable Speed Drive Type and Catalog Number

Hydrovar Example Product Code



The following applies to this example:

HV - Hydrovar Variable Speed Drive

M - Master Drive, (full control and communications)

3 - 3 Phase input power

4 - 460 Volt input power

20 - 20 Horsepower rated

Blank: Standard Commercial Filter, (not residential)

Section 4 (continued)

Hydrovar Product Numbering Chart

Voltage	Phase	Normal Duty HP	Drive Type	Model Number
230 V	1	2	MASTER	HVM1202
			BASIC	HVB1202
			SINGLE	HVS1202
		3	MASTER	HVM1203
			BASIC	HVB1203
			SINGLE	HVS1203
460 V	3	3	MASTER	HVM3403
			BASIC	HVB3403
			SINGLE	HVS3403
		5	MASTER	HVM3405
			BASIC	HVB3405
			SINGLE	HVS3405
		7.5	MASTER	HVM3407
			BASIC	HVB3407
			SINGLE	HVS3407
		10	MASTER	HVM3410
			BASIC	HVB3410
			SINGLE	HVS3410
		15	MASTER	HVM3415
			BASIC	HVB3415
			SINGLE	HVS3415

Section 5

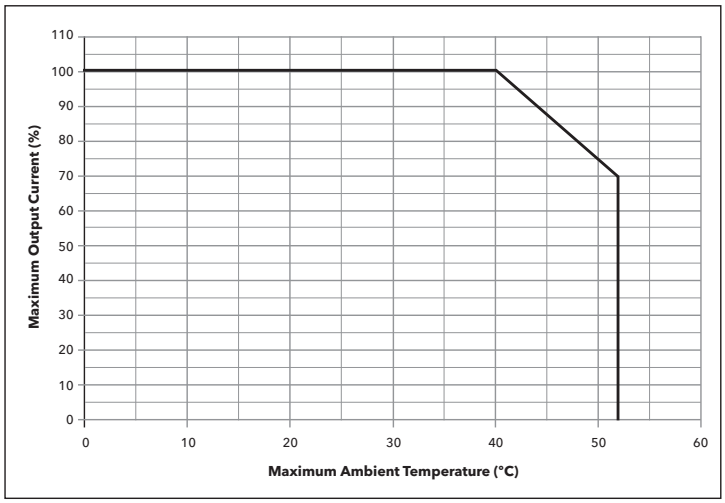
Hydrovar		Power Supply			
	Rated Output	Voltage Limits 48-62 HZ	Rated Current Input	Recommended Line Protection	Maximum Wire Size
Cat #*	**HP**	**V**	**Amps**	**Amps**	**AWG**
HVM1202	2	1 Ph, 220-240V -10%, +15%	14	20	14
HVM1203	3		20	25	10
HVM3403	3	3 Ph, 380-460V +-15%	7.6	10	14
HVM3405	5		11.4	15	14
HVM3407	7.5		15.1	20	12
HVM3410	10		19.6	20	10
HVM3415	15		27.8	30	8

* Listed catalog numbers are for master drives. Details also apply to corresponding basic and single units.

Hydrovar		Output to the Motor		
	Rated Output	Voltage Limits 48-62 HZ	Rated Current Output	Motor Connection Wires
Cat #*	**HP**	**V**	**Amps**	**AWG**
HVM1202	2	3 Ph, 240V	7	14
HVM1203	3		10	14
HVM3403	3	3 Ph, 480V	5.7	14
HVM3405	5		9	14
HVM3407	7.5		13.5	14
HVM3410	10		17	12
HVM3415	15		23	10

TECHNICAL DATA

5.1 General Technical Data

Ambient temperature:	0° C ... +40° C, 32° F... +104° F At higher temperatures reduce the output current as shown below or upsize to the next largest HYDROVAR.  The enclosure rating of the HYDROVAR is NEMA 1 however, please note the following: • Protect the HYDROVAR from direct sunlight! • Indoor installation only.
Storage temperature:	-25° C ... +55° C, -10° F ... +130° F
Humidity:	RH maximum 50% at 104° F, unlimited RH maximum 90% at 70° F, maximum 30 days per year 75% average per year (class F) Condensation is not allowed and will void warranty! During long periods of inactivity or shutdown, the HYDROVAR should remain connected to the power supply but turned off to prevent inadvertant pump run. This will maintain power to the internal heater and reduce internal condensation.
Air pollution:	The air may contain dry dust as found in workshops where there is excessive dust due to machines. Excessive amounts of dust, acids, corrosive gases, salts etc. are not permitted
Altitude:	Maximum 1000 m, 3280 feet above sea level. At sites over 1000 m above sea level, the maximum output power should be de-rated by 1% for every additional 100 m. For installations higher than 2000 m above sea level, please contact your local distributor.
Class of protection:	NEMA 1 (Indoor use only)
Certifications:	CE, UL, C-Tick, cUL

5.2 EMC Requirements (Electromagnetic Compatibility)

The EMC requirements depend on the intended use.

Class B environment (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. Examples of class B environments include houses, apartments, commercial premises or offices in a residential building.

CAUTION: The relevant EMC regulations for which the HYDROVAR was tested in class B environments is based on the restricted use of the product and the following limitations:1) the drive voltage is less than 1000 V; 2) it is neither a plug in device nor a movable device and, 3) when used in the class B environment, it is intended to be installed and utilized by technicians with the necessary training and skills required for installing and/or using power drive systems, including specific training with respect to EMC requirements.

Class A environment (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 class A environment locations.

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

EN 55011 (2002) Disturbance voltages / Disturbance field strength

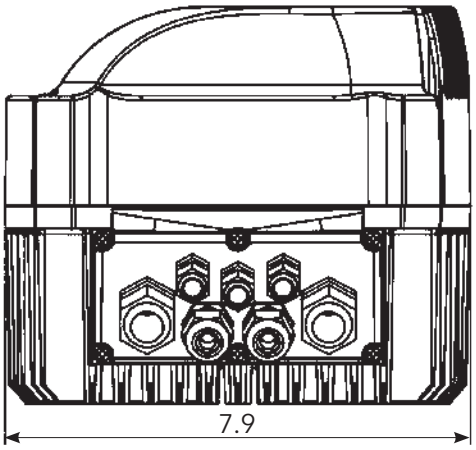
	First environment	**Second Environment**
	– class B / class C2	– class A / class C3
Disturbance voltages	OK	OK
Disturbance field strength	*	OK
* Warning - In a domestic environment, this product may cause radio interference, in which case supplementary mitigation measures may be required.		

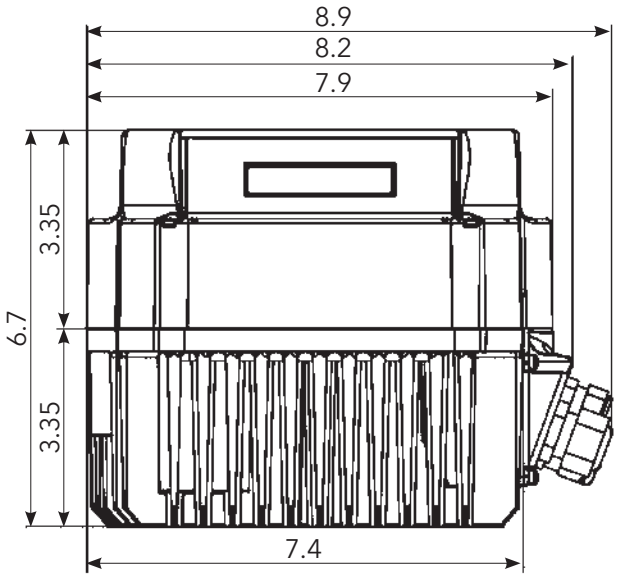
EN 61000-4-2 (2001) Electrostatic discharge
EN 61000-4-3 (2002) Electromagnetic field immunity test
EN 61000-4-4 (2001) Burst immunity test
EN 61000-4-5 (2001) Surge immunity test
EN 61000-4-6 (1996) Immunity of conducted RF-Disturbance

DIMENSIONS AND WEIGHTS

Section 6

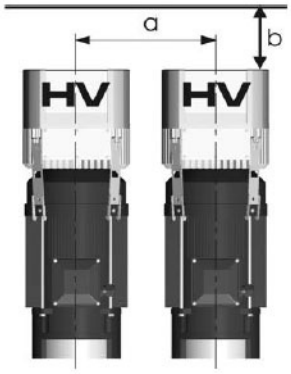
HVM1202, HVM1203, HVM3403, 3405





All dimensions in inches!
Dimensions are nominal

Drawings are not to scale!



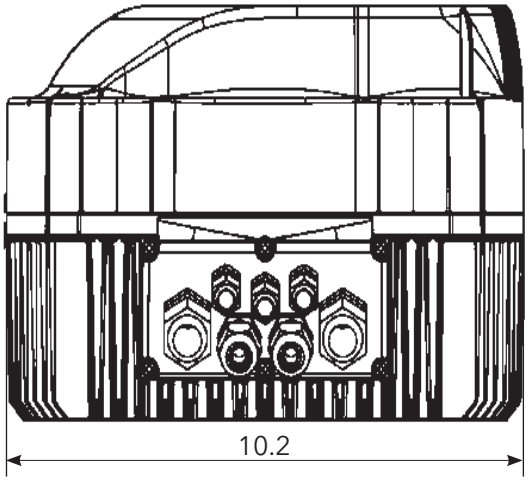
Type	Weight [lbs]	
	Basic	Master / Single
2, 3 HP 1 Ph	8.8	9.7
3, 5 HP 3 Ph		

a … minimum center-distance between HYDROVARs 12"

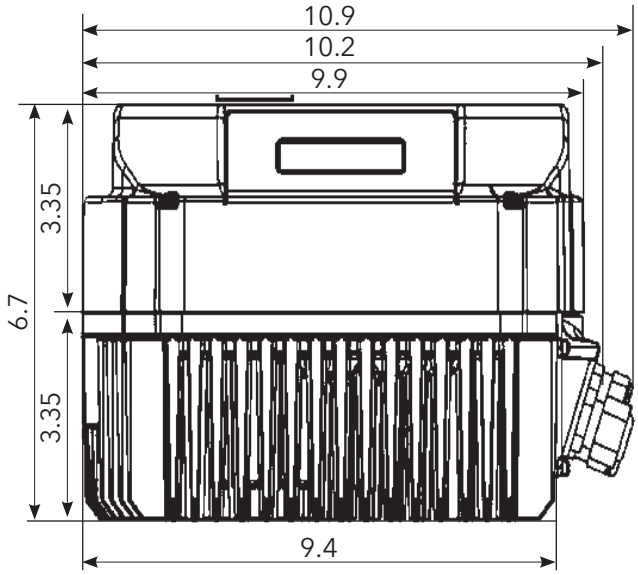
b … header space for maintenance 12"

DIMENSIONS AND WEIGHTS

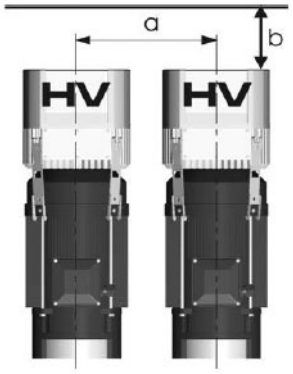
HVM3407, HVM3410, HVM3415



All dimensions in inches!



Drawings are not to scale!
Dimensions are nominal



Type	Weight [lbs]	
	Basic	Master / Single
7.5, 10, 15 HP	16.9	17.8
3 Ph		

a … minimum centre-distance between HYDROVARs 17"

b … minimum header space for maintenance 12"

ADDITIONAL COMPONENTS

Section 7

7.1 Cable Glands Provided

Included components	Cable gland and lock nut 				Conduit plugs 		Thermistor 	Mounting clamps 	Centring - bit
Gland sizer	M	M	M	M	M	M			
	12	16	20	25	12	16			
Cable size AWG	#8-#1	4,5-10	7-1 3	9-17					
2.015- 2.022	2 (3)	2	2		3	1	1	4	1
4.022- 4.040	2 (3)	2	2		3	1	1	4	1
4.055- 4.110	2 (3)	2		2	3	1	1	4	1

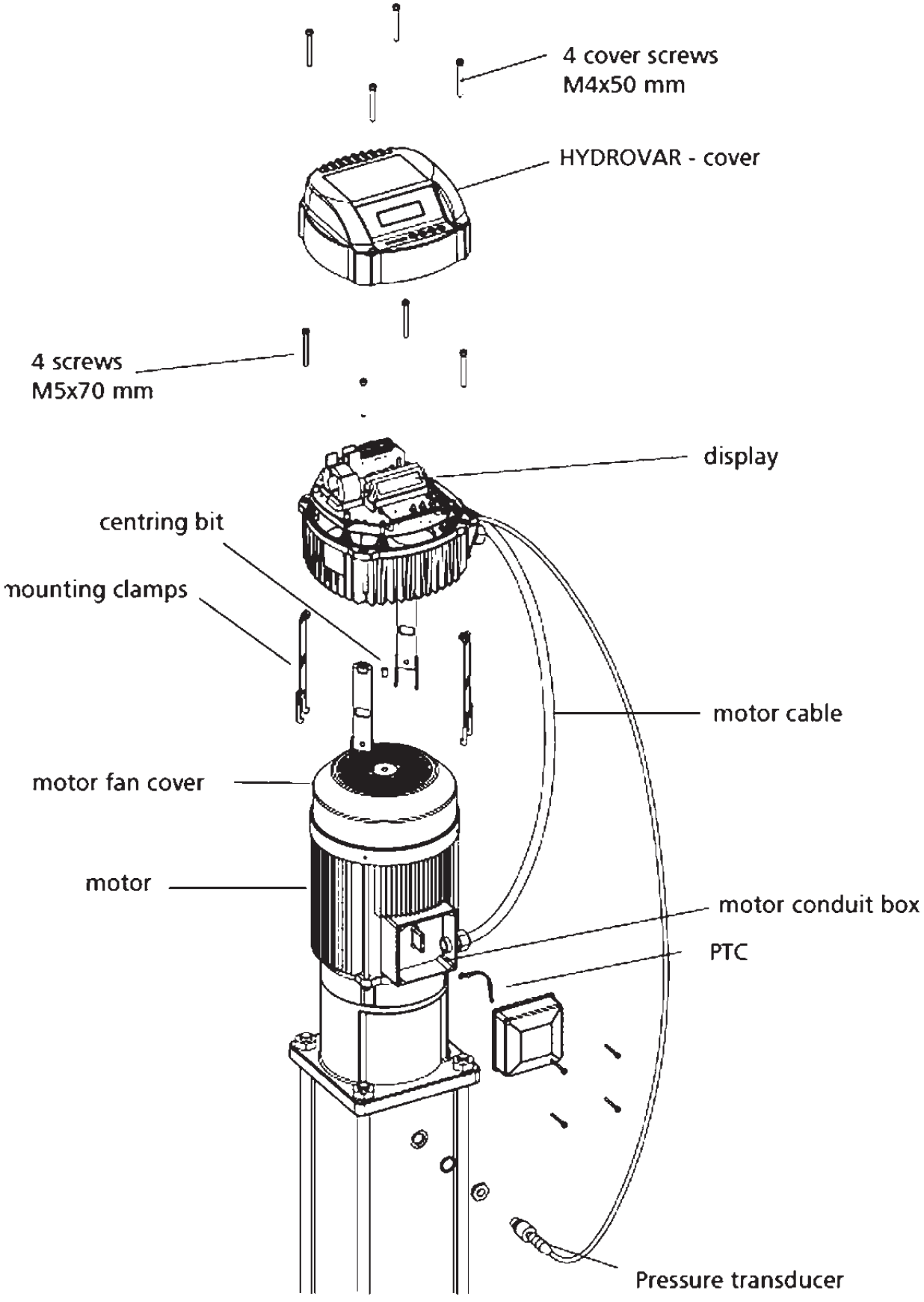
( ) maximum available cable entries

7.2 Assembly Instructions – All models

To remove the HYDROVAR cover, loosen the 4 fastening screws.

- Verify that there is no liquid on the unit before you open the cover.
- The HYDROVAR is installed on the motor fan cover using the mounting brackets, the four screws and the relevant washers.
- Center the HYDROVAR and tighten the four screws holding the brackets.
- Tighten each screw until the two bottom teeth in the brackets start to grip the fan cover.
- After the electrical components are connected, the top cover of the HYDROVAR can be mounted and tightened by the four fastening screws.
- Ensure the integrity of the ground wire connection. Failure to properly ground the controller or motor will create an electrical shock hazard.
- Ensure HYDROVAR cover gasket is in place before tightening the cover screws.
- Ensure cable glands are properly installed and close conduit openings that are not being used with conduit plugs.

7.2 Assembly Instructions – All models *(continued)*



ELECTRICAL INSTALLATION AND WIRING

Section 8

NOTE

All installations and maintenance must be performed by properly trained and qualified personnel. Use personal protection equipment.

NOTE

In case of a failure, the electrical power must be disconnected or switched off. Wait at least 5 minutes for capacitor discharge before servicing the HYDROVAR. Shock, burns or death are possible hazards if the capacitor discharges during maintenance, repair, or assembly.

8.1 Equipment Protection

Follow state, and local codes for proper equipment protection.

Applicable:
- proper grounding
- AC and DC Ground Fault Circuit Interrupter (GFCI)

Proper grounding:

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

Ground Fault Circuit Interrupter (GFCI):

- When using a GFCI, make sure that it also releases in the event of a short circuit inside the DC-part of the HYDROVAR to ground!
  - single phase HYDROVAR => use pulse sensitive GFCI's
  - three phase HYDROVAR => use AC/DC sensitive GFCI's
- The GFCI should be installed according to local regulations!

Fuses:

- Use Very fast acting Class T fuses
- Bussman T-tron type JJN and JJS fuses are acceptable (or equal)

Internal equipment protection:

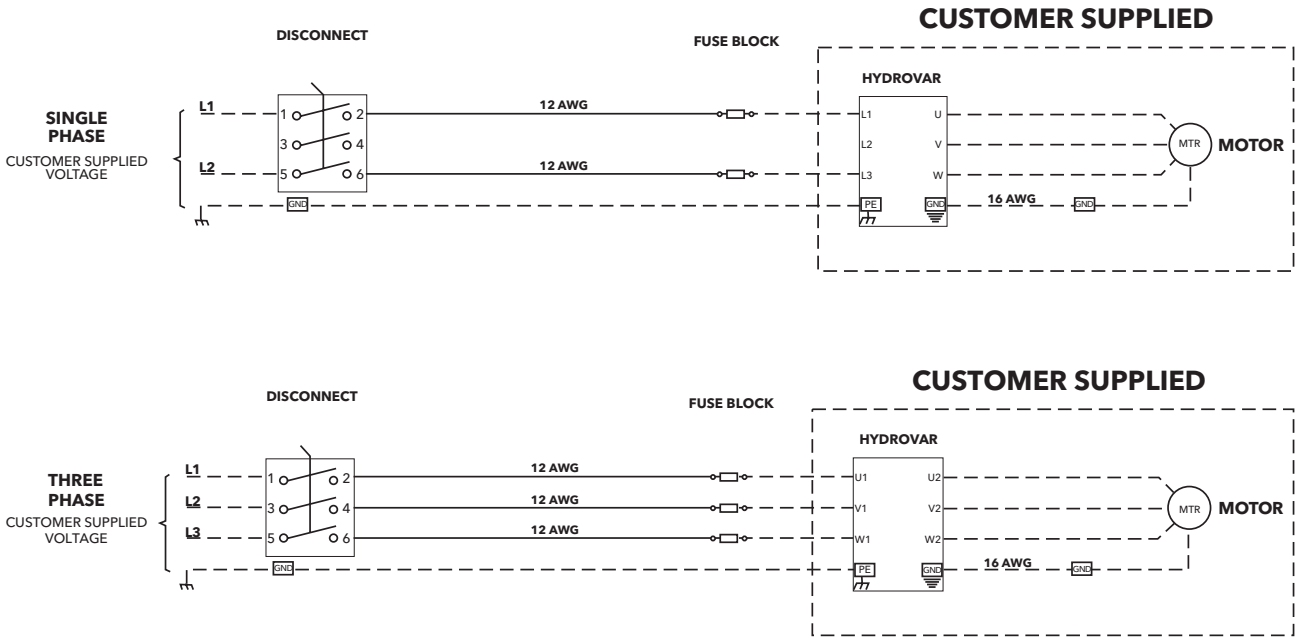
- The Hydrovar has internal protections against the following malfunctions: short circuit; under and over-voltage, overload and the overheating of the electronic components.

External protective devices:

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

ELECTRICAL INSTALLATION AND WIRING

Fused Disconnect Box:



Disconnect Part Number	Input Voltage	Disconnect	HP / AMP Rating	Wire Range	Tightening Torque	Fuse Supplier	AMP Rating	Part Number	Voltage Rating
HFD512C1	230/1/60	OT25F3	2 HP / 25A	#18-8AWG	7 IN/LB	Bussman	20	KTK-R-20	600V
HFD512E1	230/1/60	OT40F3	3 HP / 40A	#18-8AWG	7 IN/LB	Bussman	30	KTK-R-30	600V
HFD534A1	460/3/60	OT16F3	3 HP / 16A	#18-8AWG	7 IN/LB	Bussman	10	KTK-R-10	600V
HFD534B1	460/3/60	OT16F3	3 HP / 16A	#18-8AWG	7 IN/LB	Bussman	15	KTK-R-15	600V
HFD534C1	460/3/60	OT25F3	3 HP / 25A	#18-8AWG	7 IN/LB	Bussman	20	KTK-R-20	600V
HFD534C2	460/3/60	OT25F3	3 HP / 25A	#18-8AWG	7 IN/LB	Bussman	20	KTK-R-20	600V
HFD534E2	460/3/60	OT40F3	3 HP / 40A	#18-8AWG	7 IN/LB	Bussman	30	KTK-R-30	600V

NOTE: Recommended protection (not included with drive only). This fused disconnect is available as part of the PHV series packaged Hydrovar, see price book.

8.2 EMC – Electromagnetic Compatibility

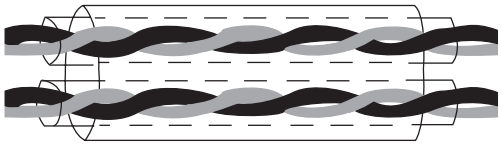
To ensure electromagnetic compatibility the following points must be observed for cable installation:

Control Cables

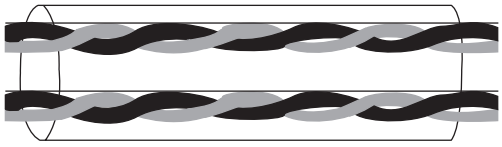
General Recommendations

Use shielded cables, temperature rated at 60° C (140° F) or above:

- Control cables must be multi-core cables with a braided copper wire screen.



Double Shielded
Example: JAMAK by Draka NK Cables



Single Shielded
Example: NOMAK by Draka NK Cables

- The screen must be twisted together into a bundle not longer than five times its width and connected to terminal X1-1 (for digital and analog I/O cables) or to either X1-28 or X1-32 (for RS485 cables).

Route control cables to minimize radiation to the cable:

- Route as far away as possible from the input power and motor cables (at least 20 cm (8 in)).
- Where control cables must cross power cables make sure they are at an angle as near 90° as possible.
- Stay at least 20 cm (8 in) from the sides of the drive.

Use care in mixing signal types on the same cable:

- Do not mix analog and digital input signals on the same cable.
- Run relay-controlled signals as twisted pairs (especially if voltage > 48 V). Relay-controlled signals using less than 48 V can be run in the same cables as digital input signals.

NOTE! Never mix 24 VDC and AC power signals in the same cable.

Motor Wires

To ensure the EMC compatibility and minimize noise level and leakage currents, use the shortest possible motor wires. Use shielded wires only if the total length exceeds 6 feet.)

Line Reactors

Line reactors are available as an option and should be mounted between the HYDROVAR and the main fuse. The Line reactor should be as close to the HYDROVAR as possible, (max. 12").

Advantages:

- more efficient
- reduction of harmonic currents

For the following applications additional line reactors 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 proper grounds according to local codes and regulations
- Do not install the power wires in parallel to control wires
- Use screened control cables
- Connect both ends of the motor wire screen to ground
- Connect only one end of the control wire screen to ground
- Motor wires should be as short as possible

ELECTRICAL INSTALLATION AND WIRING

8.3 Recommended Wire Types

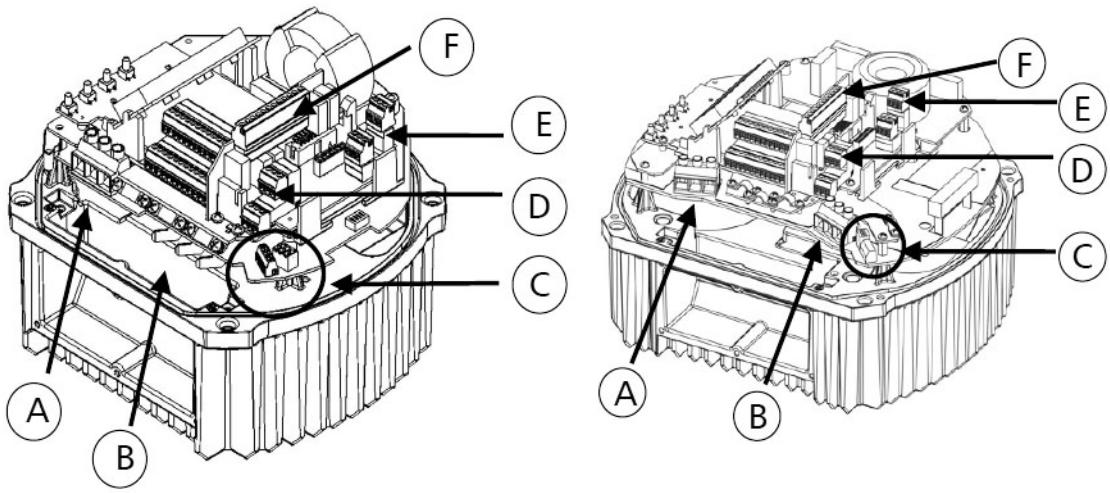
For maximum 40° C ambient temperature, recommend use of 75° C wire of the following types:
RHW, THHW, THW, THWN, XHHW, USE, ZW.

8.4 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 Drive:

1 Ph / 2, 3 HP **3 Ph / 3, 5 HP** **3 Ph / 7.5, 10, 15 HP**



(A) Power supply

(B) Motor connections

(C) Terminal block:
- START/STOP
- SOLORUN (hand mode)
- RS-485 Interface

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

(E) Status-Relays

(F) Optional Relay Card

ELECTRICAL INSTALLATION AND WIRING

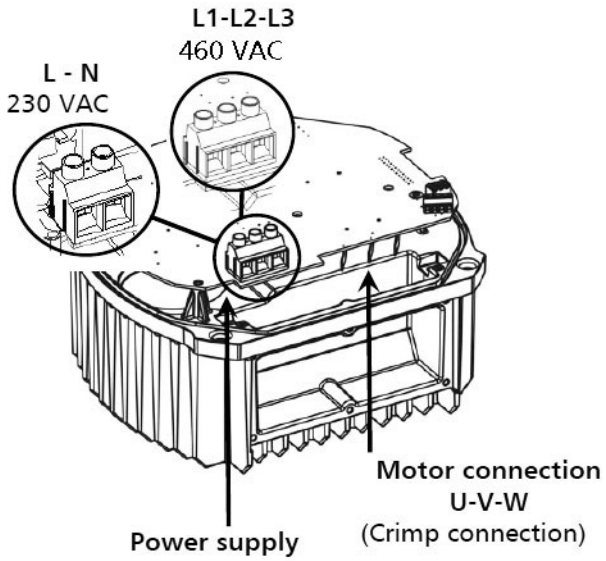
8.4.1 Input Voltage Terminals

The power supply is connected to the power section:

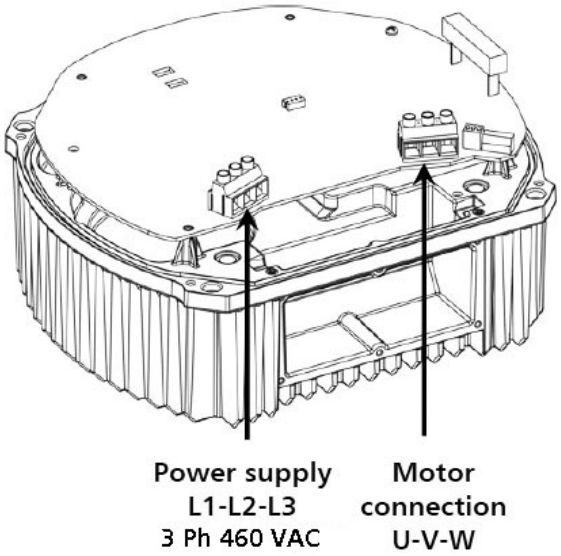
Terminal L + N (230 VAC, single-phase)

Terminal L1+ L2 + L3 (460 VAC, three-phase)

2, 3 HP / 1Ø **3, 5 HP / 3Ø**



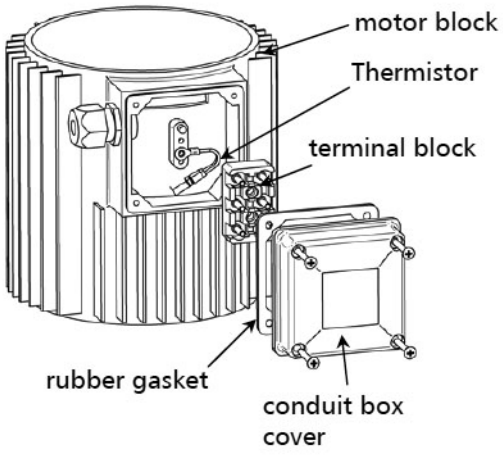
7.5, 10, 15 HP / 3Ø



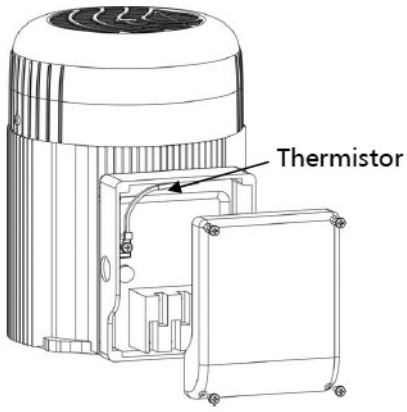
8.4.2 Motor Connection

Attaching the Thermistor

Method A :



Method B :



1. Remove conduit box cover
2. Attach the thermistor (Method A or B)
3. Replace the terminal block, if necessary
4. Wire the motor according to the motor manufacturer's instructions.

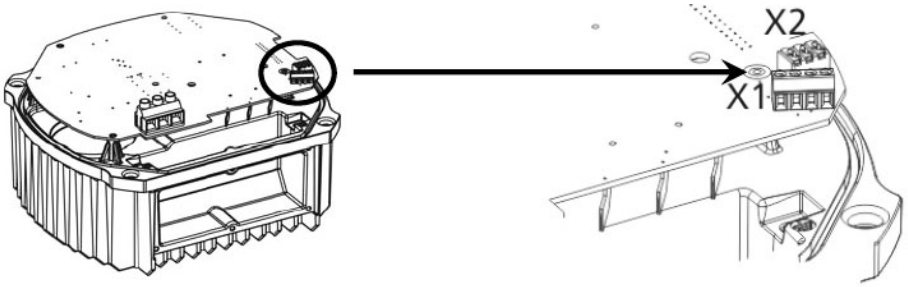
NOTE! The thermistor must be attached to the motor. This is required to measure the motor temperature!

8.4.3 Power Unit

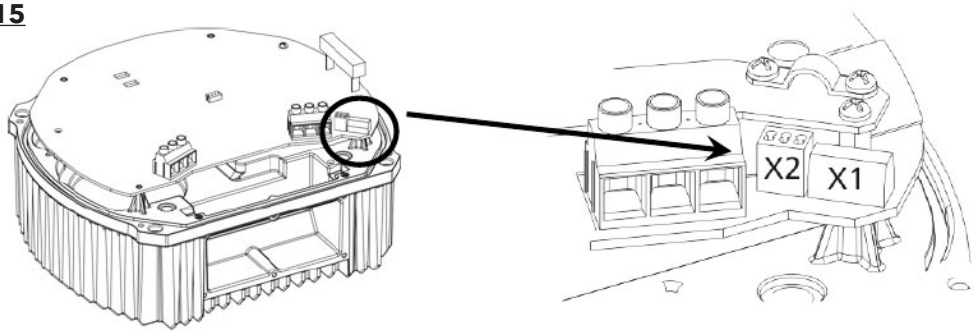
The basic drive has two control terminal blocks.

HVB 1202, 1203

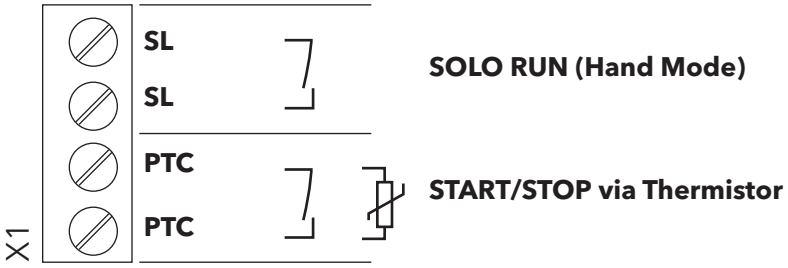
HVB 3403, 3405



HVB 3407, 3410, 3415



X1 Control terminals – power unit		
	PTC	Terminals have Jumper between them. Remove jumper and attach Thermistor leads
	SL	SOLO RUN (Hand Mode)



To protect the motor against thermal overload, a thermistor should be connected to the drive at the terminals labeled PTC. This input can also be attached to an external ON / OFF switch when using the HYDROVAR as a Basic drive. Either the thermistor or on/off switch must be closed between X1/PTC or the drive will stop running! A low water switch or other protective device can also be connected to these terminals!

If these terminals are not used, they must be jumpered, otherwise the HYDROVAR will not start.

8.4.3.1 Solo Run (Hand Mode)

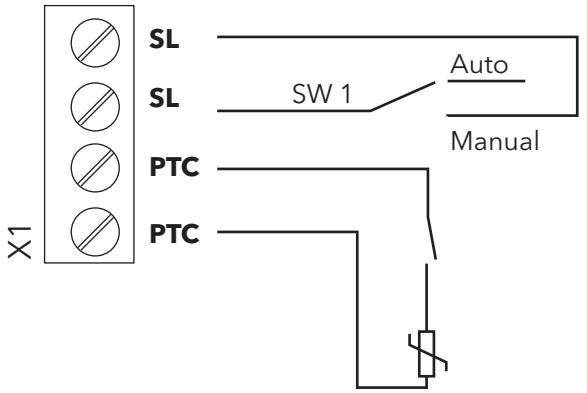
Terminals **X1/SL** are used to enable a Basic drive (when used in a multi-pump application) when the communication from the Master drive fails, or if the Master drive itself fails, or to use the Basic drive as a soft-starter.

- If the circuit is open between the two X1/SL terminals, the HYDROVAR works in standard operation as controlled by a Master drive.
- When contact between the two X1/SL terminals is closed, (contact between X1/PTC terminals must also be closed), the HYDROVAR starts up to the pre-selected Max Frequency, (set via fixed speed, (parameter 0245) using ramps 1 and 2 or the fast ramps FminA and FminD).

A manual override switch can be placed between the 2 X1/SL terminals. When the circuit is open, the drive will work with the Master. When it is closed, the drive will operate manually.

ELECTRICAL INSTALLATION AND WIRING

Connection Example



External switch to enable the SOLO RUN (Hand Mode)

Example:
Low water or other emergency off switch

Thermistor (mounted in the motor terminal box)

Recommended connections of external protective devices:

Basic drive	Thermistor	X1/PTC	
	Emergency switch	X1/PTC	As described above
	Low water switch	X1/PTC	

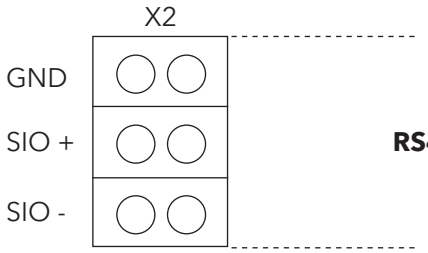
Master drive	Thermistor	X1/PTC	As described above
	External release	X3/7-8	On the control card
	Low water switch	X3/11-12	

When the HYDROVAR is used as a Basic drive in a multi-pump system, the X2 terminals on the power unit are used for the serial RS-485 connection to the other HYDROVAR units in the system. (Note: Internal interface is not available on Single Inverters!)

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

S ……. Terminals **not available for HYDROVAR Single drives**

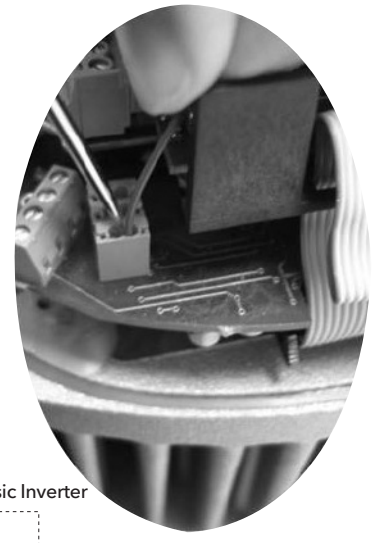
The **internal RS-485 Interface** on the power unit is used for the communication between up to 8 HYDROVARs in a multi-pump system (minimum 1 Master drive). Use the same terminals to continue on to the next HYDROVAR if required. Terminals X4/4-6 can also be used for RS-485 communication on all Master drives.



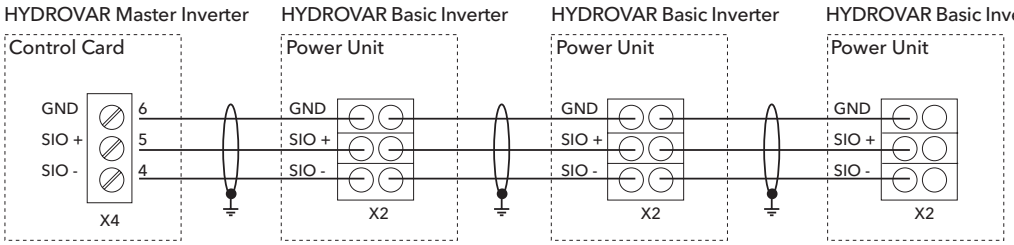
RS485 – internal interface

Terminating Control Wires:

- Use recommended cable type (see section 8.2)
- Strip the end of the wire aproximately 1/4"
- Push down the orange wedges using a small screwdriver
- Insert the stripped wire
- Remove the screwdriver to complete the connection
- To remove, push down the orange wedges and pull out the wire!



Connection Example Using One Master and Three Basic Drives:



8.4.3.2 Addressing

When using the cascade serial/synchron mode in a multi-pump-application (where more than drive is used), each drive must be addressed correctly.

Master drive – The address of the Master drive is set using the Hydrovar software. Dip switches are used to program the Basic drives to a specific address. On all Master drives the dip switches must be set to address 1 (default setting, see below).

Basic Drive – When using a Basic drive in a Multi-pump-system the dip switches must be set to the appropriate address for each drive in the system. The addresses for the Basic drives start after the last address of the final Master drive in the system. The S1 switchbank is located on the lower board behind the control panel. (See pictures below for locations.)

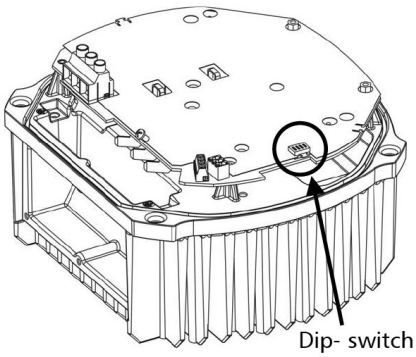
Example:

Multi-pump-system with 3 Master and 4 Basic drives

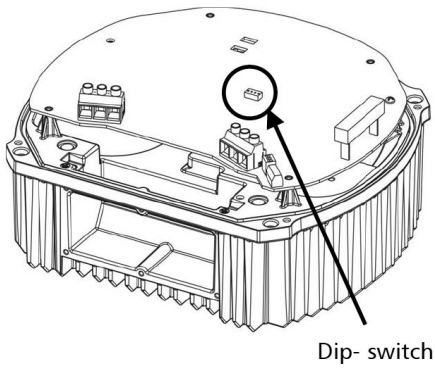
- Set address 1-3 for the Master Inverters via appropriate software parameters (See submenu CONF INVERTER [0100] or submenu RS485-INTERFACE [1200])
- Address 4-7 for the Basic Inverters via dip-switches

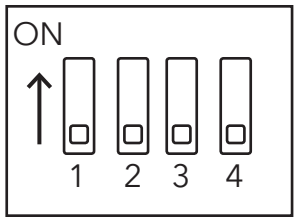
The pre-selected address also defines the initial pump sequence.

HVB 1202 / 1203, HVB 3403 / 3405
Basic Inverter



HVB 3407 / 3410 / 3415
Basic Inverter



Switch 1	Switch 2	Switch 3	Address	
OFF	OFF	OFF	Address 1 (default setting) (Required setting for the use with control card)	
OFF	OFF	ON	Address 2	
OFF	ON	OFF	Address 3	
OFF	ON	ON	Address 4	
ON	OFF	OFF	Address 5	
ON	OFF	ON	Address 6	
ON	OFF	ON	Address 7	
ON	ON	ON	Address 8	**Switch 4 not used!**

Setting the correct address on Basic drives:

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

8.4.4 Control Terminals

All control wires connected to the control-unit must be screened (See section 8.2 for recommended wire types).
External voltage free contacts must be suitable for switching <10 VDC.

NOTE

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

Do not connect the control card ground to other voltage potentials. All electronic ground terminals and GND of the RS 485-interface are connected internally.

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

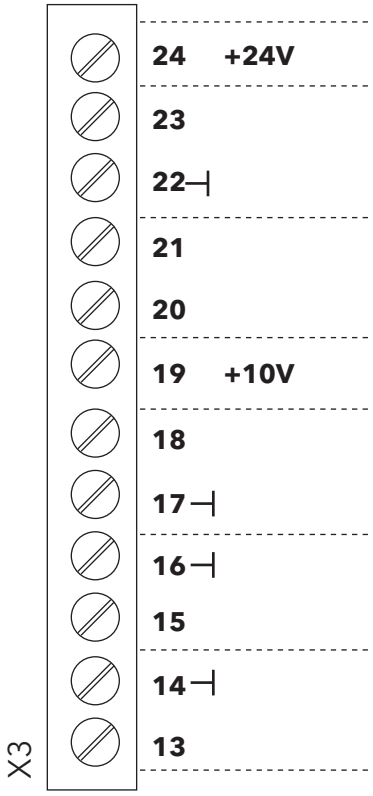
* Terminals 5 and 6 can be used as actual value voltage input and also as digital input. Also the voltage signal input on terminal X3/15 can be used as digital input.

** X3/3 and X3/24 → maximum 100mA

*** Must be connected through a switch or a jumper

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

ELECTRICAL INSTALLATION AND WIRING



Additional power supply ** max. 100 mA

Current signal input (required val. 2) 0-20mA / 4-20mA [Ri=50Ω]
To determine the required value or the offset

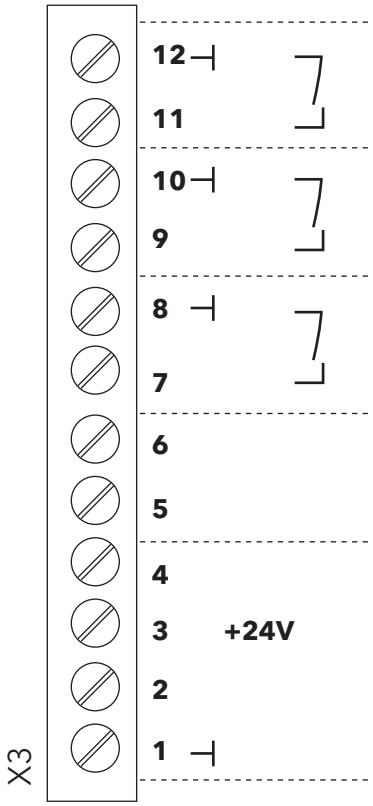
Analogue output 2 4-20mA

Analogue output 1 0-10 VDC

Current signal input (required val. 1) 0-20mA / 4-20mA [Ri=50Ω]
To determine the required value or the offset

Voltage signal input (required value 2) 0-10 VDC ***DIG 4**
To determine the required value or the offset

Voltage signal input (required value 1) 0-10 VDC
To determine the required value or the offset



Low water
incoming pressure switch or water level switch required (or jumper)

Configurable digital input 1 **DIG 1**
for switching between 2 required values or sensors

External ON/OFF (E-Stop) (Connect through switch or jumper)

Actual-value-voltage input sensor 1 0-10 VDC ***DIG 2**

Actual-value-voltage input sensor 2 0-10 VDC ***DIG 3**

Actual-value-current input sensor 2 0-20mA / 4-20mA [Ri=50Ω]

Sensor supply voltage ** maximum 100 mA

Actual value current input sensor 1 0-20mA / 4-20mA [Ri=50Ω]

Ground

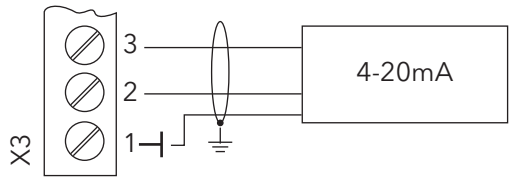
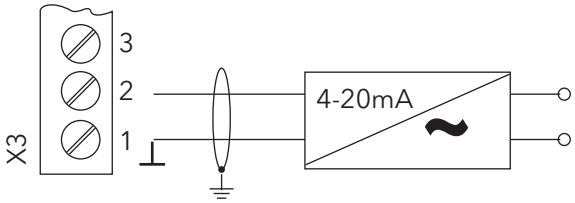
* Terminals X3/5 and 6 can be used as actual value voltage input and also as digital input. Also the voltage signal input on terminal X3/15 can be used as digital input.

** X3/3 and X3/24 → Σ maximum 100mA

ELECTRICAL INSTALLATION AND WIRING

Connection Examples:

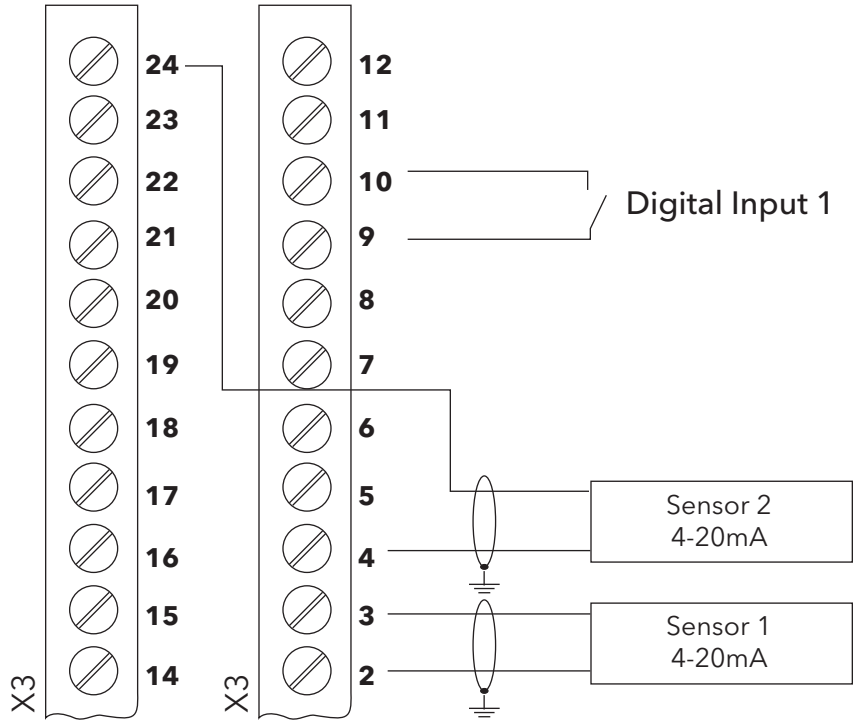
- **Sensor-Actual-value-signal Input**

Connecting a 3-wire transducer (e.g. standard pressure transducer)	Connecting an active actual-value-signal
	

Possible Connections:		**Standard Pressure Transducer:**
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	screen / shield

- **Switching between two individual sensors**

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



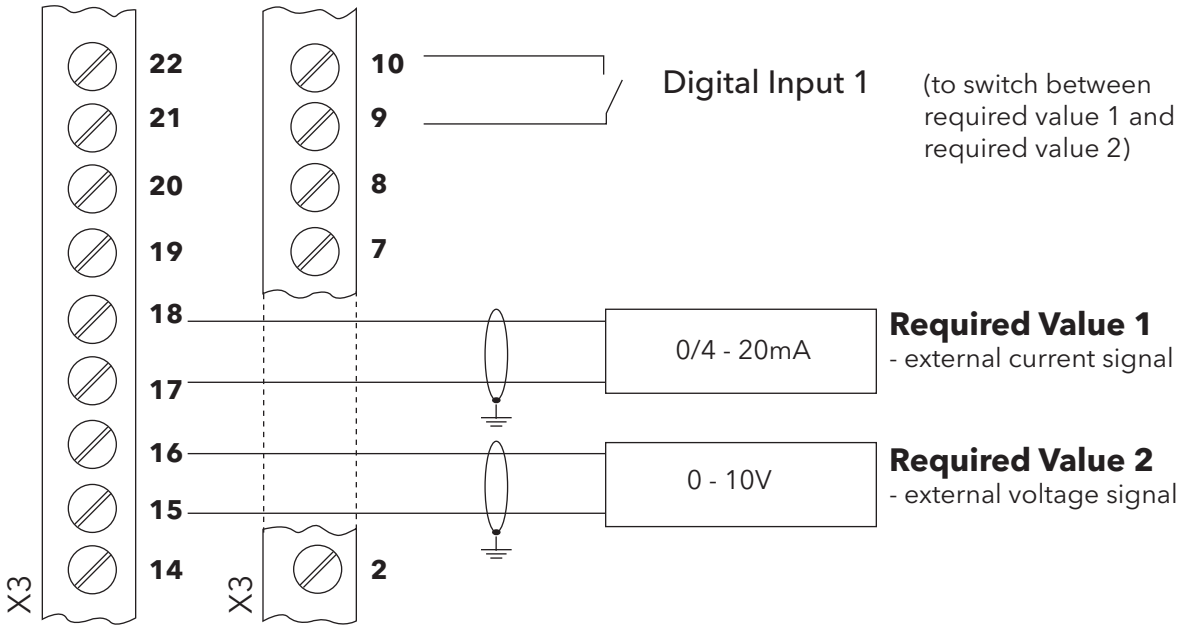
ELECTRICAL INSTALLATION AND WIRING

- **Switching between two different required values**

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

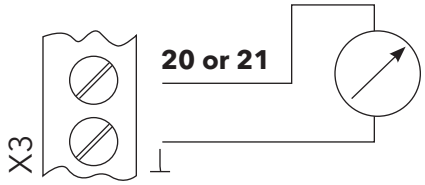
  In ACTUATOR mode the drive can switch between two different frequencies from the digital inputs. The input signals (current or voltage) will be proportional to the frequency.

  (For programming see SUBMENU REQUIRED VALUES [0800].)



- **Actual value – Frequency Indicator**

  e.g. to display the actual motor frequency
  How to program see SUBMENU OUTPUTS [0700].

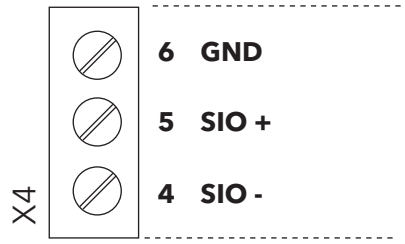


Possible connections:
Analogue output 1 (0-10V): X3/20
Analogue output 2 (4-20mA): X3/21

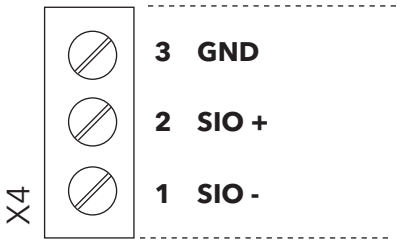
X4 RS485-Interface			
X4/	1	User SIO-Interface: SIO-	User interface for external communication
	2	User SIO-Interface: SIO+	
	3	**GND**, electronic ground	
	4	Internal SIO-Interface: SIO-	Internal interface between Hydrovars for multi-pump systems
	5	Internal SIO-Interface: SIO+	
	6	**GND**, electronic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

ELECTRICAL INSTALLATION AND WIRING

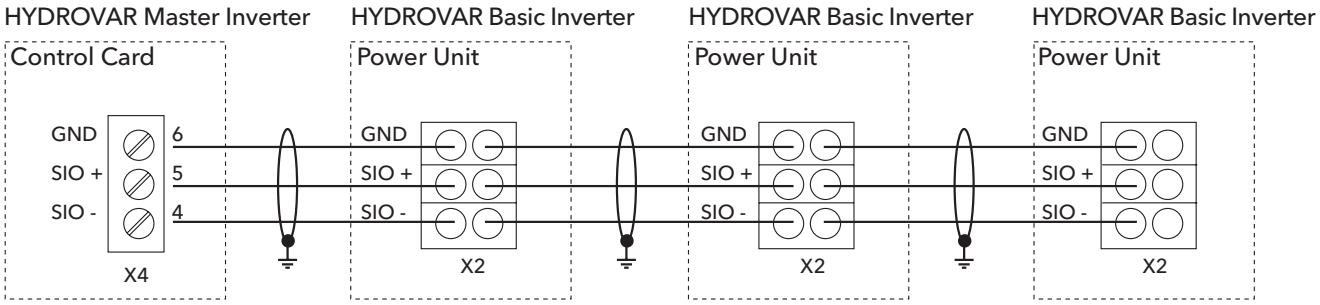
RS-485 – Internal interface



RS-485 - User interface

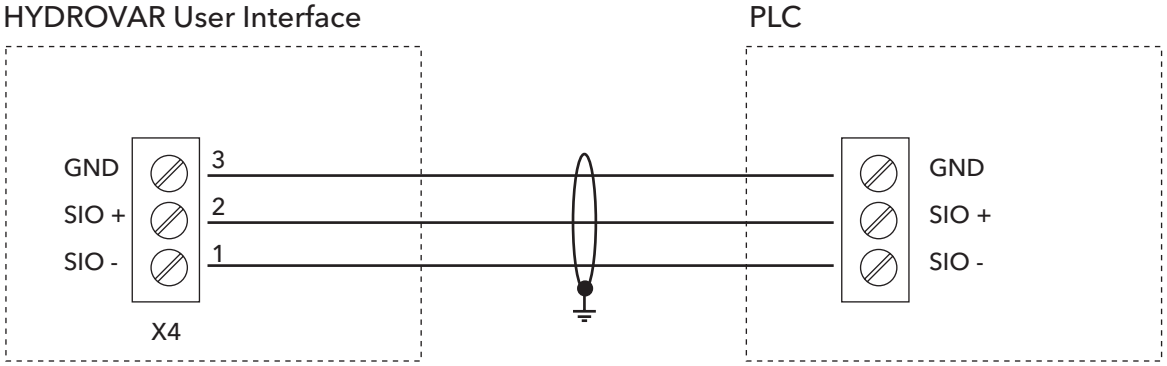


The **internal RS-485 Interface** is used for communicating between up to 8 HYDROVARs in a multi-pump application. This connection uses terminals X4/4-6 on the control card, or terminals X2/1-3 on the power unit. (Example: using one master and three basic drives.)



Using the **RS-485 – User interface** on the control card, one or more HYDROVAR can communicate by standard Modbus-protocol with an external control device (e.g. PLC). This interface can be used for controlling the HYDROVAR with external devices. **Also available on HYDROVAR Single drives.**

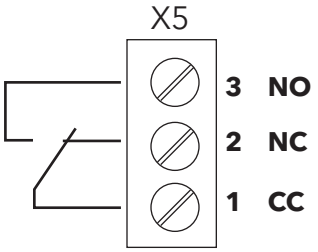
Do not use the internal interface for communicating with Modbus!



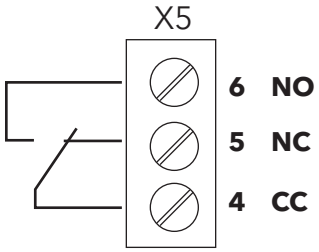
ELECTRICAL INSTALLATION AND WIRING

X5 Status-Relays				
X5/	1	Status Relay 1	CC	[Max. 250VAC] [250mA] [Max. 220VDC] [250mA] [Max. 30VDC] [2A]
	2		NC	
	3		NO	
	4	Status Relay 2	CC	
	5		NC	
	6		NO	

Status Relay 1



Status Relay 2

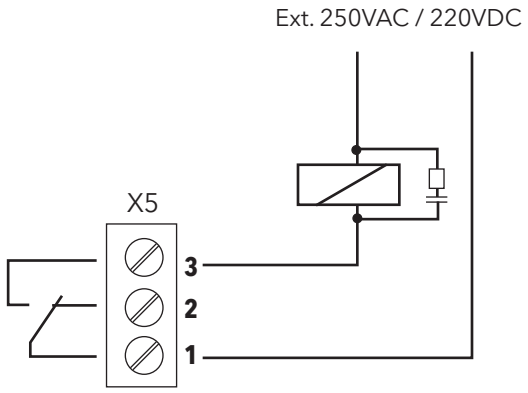
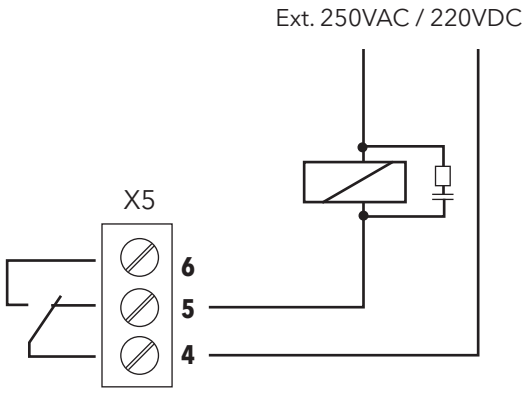


Notice:
Do not transmit any voltage or electronic noise on these contacts.

Status Relay 1 is programmed for "Pump Run" when closed between terminals 1 and 3.
Status Relay 2 is programmed for "Fault" when closed between 4 and 5.

Factory setting: The output relays are used to signal pump-running or fault-signal.
See connection example below (To program see parameters
CONF REL 1 [0715] and CONF REL 2 [0720]).

Connection examples:

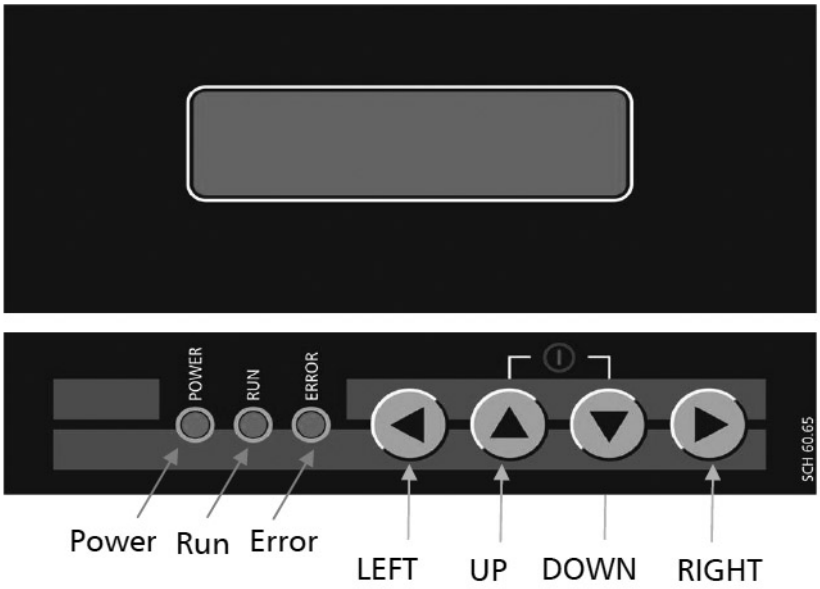
Pump Run Signal	Fault Signal
	
X5/ 1 and 3 closed: - motor run indication	X5/ 4 and 5 closed: - signals a fault/error

Section 9

NOTE

Read and follow the operating instructions carefully before programming to avoid incorrect settings which will cause drive errors! All programming must be completed by qualified technicians!

9.1 Display – Control Panel of the Master / Single Drive



9.2 Function of the Push Buttons

▲ Start the HYDROVAR

▼ Stop the HYDROVAR

◀ and ▶ Reset: pressing both buttons simultaneously for 5 seconds

▲ Increase a value / selection in the submenu

▼ Decrease a value / selection in the submenu

▲ + short ▼ Scroll slower

▼ + short ▲ Scroll faster

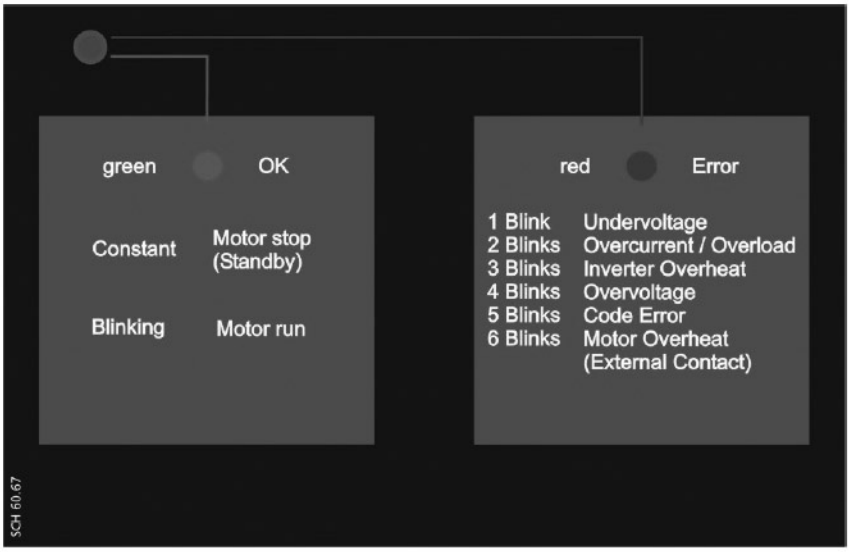
▶ Tap: enter submenu / Next parameter in the menu

◀ Tap: leave submenu / Previous parameter in the menu

▶ Press and hold: Select a specific action

◀ Press and hold: Back to the main menu

9.3 Basic Drive Display



Status LED - green	
Constant	Motor stopped (Standby)
Blinking	Motor run

Error LED - red	
The type of error is indicated by the number of blinks of the red ERROR LED.	
1 blink	Undervoltage
2 blinks	Overcurrent / Overload
3 blinks	Drive thermal overload
4 blinks	Overvoltage
5 blinks	Code Error
6 blinks	Motor thermal overload (external contact is open)

For detailed information see chapter 11 Failure messages.

9.4 Software parameters

In the following chapters all parameters of the main menu and submenus are listed. The upper window shows the factory setting and the line below the possible range of settings. The general parameter description is written for the HYDROVAR Master Inverter (Full featured HYDROVAR including the high level control card which also supports the optional modules like the optional Relay Card and all specific software features).

When using a **HYDROVAR Single drive** there are fewer software features available than with the HYDROVAR Master drive. All parameters which are not active for the HYDROVAR Single drive are marked with the following symbol:

... Parameter not available for HYDROVAR Single drive

Parameters which are available on all HYDROVAR drives are marked with the following symbol:

G **... "global" parameter (available on all HYDROVAR drives)**

NOTICE! All changes are saved automatically and will not be lost with the removal of power supply!

00	**00 MAIN MENU**	

The 1st windows, REQUIRED VALUE [02] and EFFECTIVE REQUIRED VALUE [03], depend on parameter MODE [0105]. The differences within the windows in the various modes are shown below:

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

	XYLEM XX.X Hz STOP X.XX PSI	1st window display in Controller mode

This window shows the current run status of the drive.

ON	Running	Stop the HYDROVAR by pressing ▼
STOP	Manually stopped	Start the HYDROVAR by pressing ▲
OFF	E-Stop (X3/7-8) is open	To start the HYDROVAR close E-Stop or bridge terminal X3/7-8

b) For Active MODE [0105] = Cascade Relay, Cascade Serial, or Cascade Synchron

	* ADR X PX XX.X Hz STOP X.XX PSI	Display for cascade serial and cascade relay modes 

This window shows the drive status.
* Indicates which HYDROVAR controls the system. The parameters are described further below:

ADR X	Pump address, (1, 2, 3.....8)
P X	**Cascade relay mode:** Indicates the number of pumps that are running (ex. P3 …. Master + 2 fixed speed pumps are running) **Cascade serial/synchron mode:** Indicates where the drive is in the existing sequence.

ON	Running	Stop the HYDROVAR by pressing ▼
STOP	Manually stopped	Start the HYDROVAR by pressing ▲
OFF	E-Stop (X3/7-8) is open	To start the HYDROVAR close E-Stop circuit or bridge terminal X3/7-8

Parameters 02 and 03 for Modes: Controller, Cascade Relay, Cascade Serial, Cascade Synchron

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

The current REQUIRED VALUE and its source (D1 in this example) are displayed.
The available sources are listed below:

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

03	03 EFF REQ VAL D1 X.XX PSI	Effective required value

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

Example: Multi-pump-application with two pumps
REQUIRED VALUE [02]: 75.00 PSI
ACT. VALUE INCREASE [0505]: 10.00 PSI
ACT. VALUE DECREASE [0510]: 5.00 PSI
-> REQ VAL EFF [03]: 80.00 PSI

The second pump will increase system pressure to 80.00 PSI.

c) Parameters 02 and 03 for Active MODE [0105] = Actuator

	Frequency XX.X Hz STOP X.XX PSI	Display in Mode actuator

If parameter MODE [0105] is set to Actuator, the parameter REQUIRED VALUE [02] will change to ACTUAL. FREQ. and is equivalent to parameter [0830]. This allows the HYDROVAR to run to up to two pre-selected frequencies to manually control the drive.

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

Use this parameter to program the drive to up to 2 set frequencies. Requires programming parameter 0805, 0810, and 0815. To manually set the frequency use parameters ACTUATOR FREQUENCY 1 (0830) and ACTUATOR FREQUENCY 2 (0835).

Parameter [03] is not used in Mode: Actuator

04	04 START VALUE OFF	Regulation Restart Value	G
Possible settings:		0 – 99 % – OFF	

This parameter defines the restart value after the pump has stopped in % of the required value.

E.g. REQUIRED VALUE [02]: 50.0 PSI
START VALUE [04]: 80 % --> 40.0 PSI

If the pump system has reached the required pressure of 50.0 PSI and meets demand the HYDROVAR shuts off the pump. When demand increases, and the pressure drops the pump starts. If a START VALUE [04] of 80% has been selected the pump won't start until the pressure drops below 40 PSI, (80% of 50 PSI).

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

05	05 LANGUAGE ENGLISH	Language selection	
Possible settings:		To select the desired language press ▲ or ▼	

The information on the display and all parameters are available in various languages. Scroll up and down through the available options.

The following two parameters set the current date and time. This is useful for tracking timing of failure messages.

06	06 DATE DD.MM.YYYY	Current date	S
		Set the date by pressing ▶ for approx. 3 sec.	

▶ to set current DAY / MONTH / and YEAR.

07	07 TIME HH:MM	Current time	S
		Set the time by pressing ▶ for approx. 3 sec.	

▶ to set current HOUR and MINUTE.

08	08 AUTO - START ON	Auto Start	G

Possible settings:	ON – OFF

Select ON with ▲ or OFF with the ▼ button.

If AUTO-START = ON the HYDROVAR starts automatically after reconnecting power following interruption.

If AUTO-START = OFF the HYDROVAR will not start automatically after reconnecting power following interruption.

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

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

09	09 OPERAT. TIME 0000 h.	Operating hours	

Total operating hours. To reset to 0 see parameter CLR OPERAT. [1135].

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

Use this submenu to check the status (including failures and motor hours) of all connected units.

21	21 STATUS UNITs 00000000	Status of all units	G S

This parameter gives a quick overview about the run status of the connected drives.

- In **Cascade serial/synchron** mode the status of all (max. 8) connected units is shown (1=running / 0=stopped)
- In **Cascade relay** mode the status of the 5 Relay- switching contacts is shown.

E.g. Mode – Cascade serial/synchron

	21 STATUS UNITs 11001000	Unit 1, 2 and 5 are running	G

E.g. Mode – Cascade relay

	21 STATUS UNITs 10100 - - -	Relay Contact 1 and 3 are closed	G

22	22 SELECT DEVICE * 1 *	Select device	S

Possible settings:	1-8

Check the current status, the motor hours and the most recent failures of any given drive. The drive selection is determined by the current selected mode [105]. Select desired unit by pressing ▲ or ▼.

CASCADE SERIAL/SYNCHRON:

The selection specifies the address of the HYDROVAR units

E.g. Device 1 -> Master Inverter with pre-selected address 1
Device 2 -> Basic Inverter with pre-selected address 2
Device 3 -> Basic Inverter with pre-selected address 3

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

Mode CASCADE RELAY:

Device		Enabled By	
1	Master Inverter		
2	fixed speed pump	Relay 1	X10: 1
3	fixed speed pump	Relay 2	X10: 2
4	fixed speed pump	Relay 3	X10: 3
5	fixed speed pump	Relay 4	X10: 4
6	fixed speed pump	Relay 5	X10: 5
7	not used		
8	not used		

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

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

Shows the status of the device

Mode CASCADE RELAY:

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

Mode CASCADE SERIAL/SYNCHRON:

running -> Pump is running
stopped -> Pump is stopped
disabled -> Pump is disabled by an external input.
(Stopped with buttons or disabled with parameter ENABLE DEVICE [24]) or by external on/off contact open
preparing -> A new unit is connected to the multi-pump system and Data is being transferred
solo run -> Solorun (Hand Mode) is activated (XSL closed)
faulted -> A failure has occurred on the current unit

24	24 ENABLE DEVICE Enable	Enable – Disable of the selected device	G S
Possible settings:		Enable - Disable	

Allows the drive to be be enabled or disabled by an external switch between X3 7 and 8. (Either in cascade relay / serial / synchron or controller mode).

25	25 MOTOR HOURS XXXXX h	Runtime of the selected drive	G

Total number of hours the motor has run. To reset see parameter CLR MOTORH. [1130].

Error memory

All errors, including those occuring on Basic Inverters are saved on the Master Inverter in this menu. The errors saved in this menu include the failure message text of the drive where the failure happened, and the date and time when the failure occurred. (For more information about errors, see chapter 10 failure messages.)

26	26 1st ERROR ERROR XX	Most recent error on the selected drive	G
Message:		ERROR XX, FAILURE TEXT, DATE, TIME	

Press ▲ or ▼ to scroll up or down!

27	27 2nd ERROR ERROR XX	2nd most recent error on the selected drive	G
Message:		ERROR XX, FAILURE TEXT, DATE, TIME	

Press ▲ or ▼ to scroll up or down!

28	28 3rd ERROR ERROR XX	3rd most recent error on the selected drive	G
Message:		ERROR XX, FAILURE TEXT, DATE, TIME	

Press ▲ or ▼ to scroll up or down!

29	29 4th ERROR ERROR XX	4th most recent error on the selected drive	G
Message:		ERROR XX, FAILURE TEXT, DATE, TIME	

Press ▲ or ▼ to scroll up or down!

30	30 5th ERROR ERROR XX	5th most recent error on the selected drive	G
Message:		ERROR XX, FAILURE TEXT, DATE, TIME	

Press ▲ or ▼ to scroll up or down!

40	**40 SUBMENU DIAGNOSTICS**	

41	41 PROD. DATE XX.XX.XXXX	Production date of the HYDROVAR (Master/Single only)

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

42	42 SEL. INVERTER * 1 *	Select the desired unit	**G**

Possible settings:	1-8

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

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

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

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

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

This value displays the input voltage supplied to the HYDROVAR.

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

This value displays the output frequency generated by the HYDROVAR.

47	47 VER. INVERTER 01	Software version of the selected drive	**G**

This parameter displays the software version of the BASIC drive (located on the main board).

Possible indications:

00	All power sizes (2-15 HP) prior production 05/2008
01	Sizes HV 2 - 5 HP - related to control board software V01.3
02	Sizes HV7.5 - 15 - related to control board software V01.3

60	**60 SUBMENU SETTINGS**	

NOTE

Carefully read these instructions before changing the remaining parameters. Improper settings can cause the drive to malfunction.

These parameters can be changed during operation. Therefore they should be changed only by trained and qualified technicians. It is recommended to stop the HYDROVAR by pressing ▼ in the main menu before changing parameters in submenues.

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

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

	61 PASSWORD 0066	Confirm by pressing ▶ and the first window of the sub menu is shown
62	62 JOG 0.0Hz X.XX PSI	Both current output frequency and actual value are shown.

- By pressing ▲ or ▼ in this menu, the drive switches from control via external input (transducer) to manual frequency control.
- Use the ▲ and ▼ buttons to change output frequency and pump speed to achieve the desired pressure and flow.
- If this value becomes 0.00 Hz the HYDROVAR stops.
- Exit this menu by pressing ◀ or ▶, and the HYDROVAR returns to the previously selected mode.

0100	**0100 SUBMENU BASIC SETTINGS**	

0105	0105 MODE Controller	Select the operating mode

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

Controller (Default Setting):

Select this mode when only one HYDROVAR Master/Single Drive is used and there is no connection to any other HYDROVAR via RS-485 interface.

Cascade Serial: 

Selected if multiple HYDROVAR controlled pumps operate together via the RS-485 interface.

The standard application for this mode is a multi-pump system with up to 8 pumps, each controlled by a HYDROVAR Master Drive or a combination of Master and Basic Drives. Advantages: reliability, lead/lag for balanced usage and wear and tear, automatic alternation in the event of a drive failure (duty standby).

Cascade Synchron: 

The Synchronous Controller mode is similar to cascade serial mode. The difference is that all pumps in the multi pump system run at the same frequency.

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

Actuator: (For single pump operation only!)

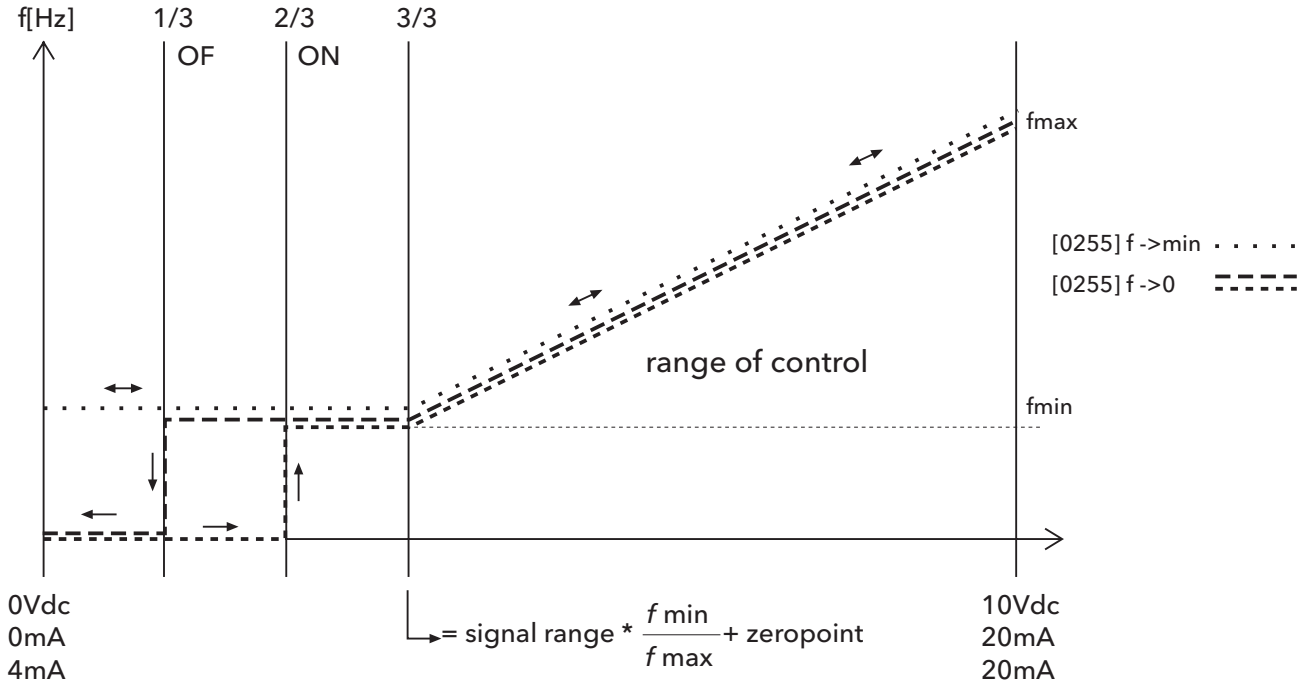
Actuator mode is used if a fixed speed setting is required or an external speed signal is connected to control the speed of the drive.

In this mode, the HYDROVAR does not control the set value but runs the connected motor at a frequency proportional to the input signal from the analogue input, or is programmed on the HYDROVAR. The following input signals can be used:

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

- Manual switching between the analogue inputs can be controlled by the corresponding digital inputs.
- The frequency varies along the programmed Ramps 1 (accelerating) and 2 (decelerating). The functions thermal protection and external ON/OFF remain active.
- The functions “External ON/OFF”, “Motor Overheat”, “Lack of water” and all other internal protections still work.

In actuator mode the drive can work with pre-selected frequencies for manual control of the HYDROVAR. Two different frequencies can be set in the submenu REQUIRED VALUES [0800]. Switch between these frequencies using parameter SW REQ. VAL [0815].



0106	0106 PUMP ADDR. * 1 *	Select desired address for the Master Inverter	S
Possible settings:		1-8	

Set desired address on each Master Inverter and press ▶ button for approximately 3 seconds and the following messages will appear:

Addressing Addressing	->	1220 PUMP ADDR. * 1 *	or	1220 PUMP ADDR. - 1 -
		Address Set		Address failed - retry

When using Master and Basic drives together in a multi-pump system the Basic Inverters have separate addresses. For detailed Information see chapter 8.4.3.2 Addressing.

0110	0110 SET PASSW. 0066	Set Password by pressing ▲ or ▼
Possible settings:		0000 - 9999

Caution: Resetting the password is not recommended! However, the pre-set password (0066) can be changed. After the password has been changed, the new password should be recorded where multiple people have access to it.

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

OFF: All parameters in the MAIN menu (only) can be changed without entering the password.

ON: If the LOCK FUNCTION is activated, no changes can be made in any parameter without first entering the password. The HYDROVAR can be started and stopped with the up/down arrows. To change the set value, the LOCK FUNCTION must be set to OFF.

0120	0120 DISP. CONTR. 75 %	Display Contrast

Possible settings:	10 – 100%

Can be adjusted between 10 - 100%, to improve the display.

0125	0125 DISP. BRIGHT 100 %	Display Brightness

Possible settings:	10 – 100%

The backlight intensity of the display can be adjusted.

0200	**0200 SUBMENU CONF INVERTER**	

0202	0202 SOFTWARE HV V01.3	Software version of the control board

0202	0202 SW RD V01.0 HV V01.3	Software version of the Remote display (RD) (not available) and the control board (HV)

0203	0203 SET VER.INV sel:01 act:01	Activate additional settings. Contact factory to use.	G

Possible settings:	00 - 02

Activates skip frequency parameter and current limit functions. These functions are not commonly used, and may have undesirable effects. They should only be used to solve application problems in the field. Press and hold the right arrow for 5 seconds to activate the function, and "Done" is displayed.The following parameters [0285], [0286], [0290] and [0291] are added to the parameter list.)

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

Setting 01: Basic 2 - 5 HP (on control board software V01.3)

Setting 02: Basic 7.5 - 15 HP (on control board software V01.3)

0205	0205 MAX. UNITS 06	Maximum number of units	G S

Possible settings:	1 - 8

Select: The maximum number of units that can be set up as a multi-pump system.

0210	0210 INVERTER ALL	Selection of the HYDROVAR address for parameterizing	G S

Possible settings:	ALL, 1-8

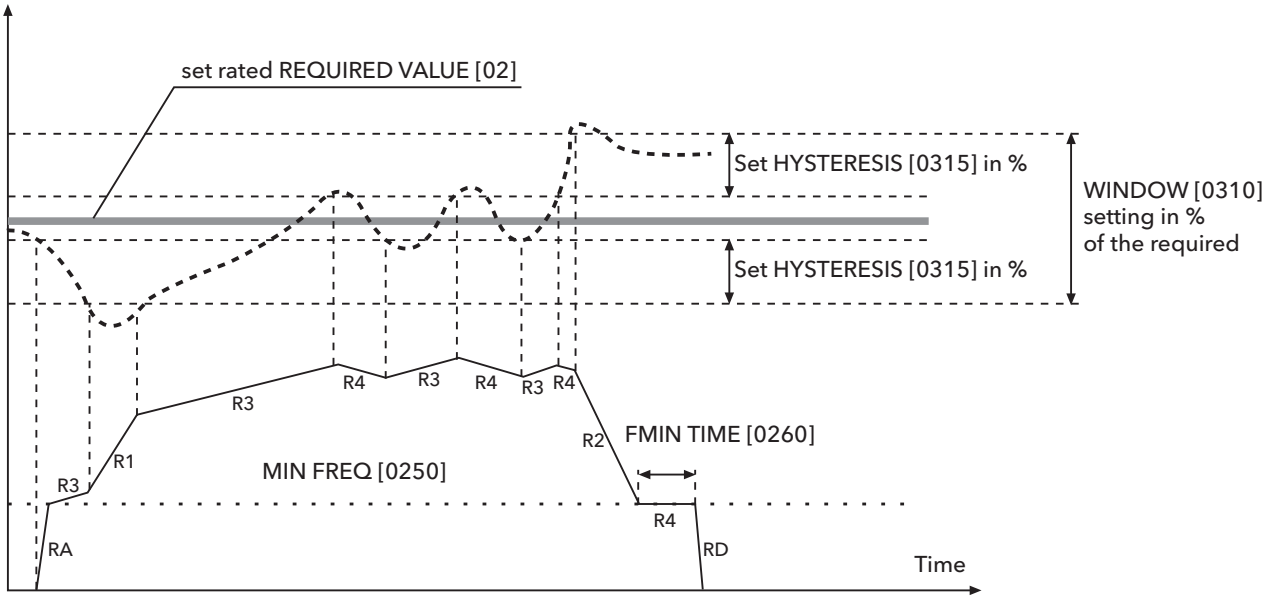
If several HYDROVAR Master Inverters and even Basic Inverters are connected via the RS-485 interface, the parameters in SUMBENU [200] can be entered on one unit and will be carried over to the other units in the group. If programming only one unit press the ▶ button for 3 seconds and then choose the unit (1-8) for which the parameters are being entered.

Select "ALL" to program all the units simultaneously.

Caution, if you select "ALL" the new settings will be copied to all units!

Ramp settings:

- The ramps influence the rate of change in speed.
- The fast ramps 1 and 2 control the rate of acceleration and deceleration of the drive when the system pressure is outside the hysteresis window, set at Parameter (0310). Default = 4 seconds. The ramps should be lengthened, (increased) up to 15 seconds for higher horsepower drives to avoid overload error.
- The slow ramps 3 and 4 determine the acceleration/deceleration rates of the drive when the pressure is within the hysteresis window. (Default = 70 sec.)
- The Ramps FminA and FminD are used for start-up and shut off. These parameters allow faster acceleration and deceleration and should be used for applications where pumps shouldn't operate below a determined frequency for a certain time. (to prevent damages or decrease wear) To adjust the Ramps, press ▲ or ▼.



RA: Ramp F_{min} acceleration

RD: Ramp F_{min} deceleration

R1: Ramp 1 – speed ramp fast increase

R2: Ramp 2 – speed ramp fast decrease

R3: Ramp 3 – speed ramp slow increase

R4: Ramp 4 – speed ramp slow decrease

····· Actual Value

——— Output Frequency

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

Possible settings:	1 – 250 (1000) sec

- Rapid acceleration may cause an error (OVERLOAD) during drive startup.
- Slow acceleration may cause a drop in outgoing pressure during startup.

0220	0220 RAMP 2 4 sec	Ramp 2: Fast acceleration time	G

Possible settings:	1 – 250 (1000) sec

- Rapid deceleration may cause error (OVERVOLTAGE).
- Slow deceleration may generate over pressure.

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

Possible settings:	1 – 1000 sec

- Rapid acceleration may lead to oscillation and/or an error (OVERLOAD).
- Slow acceleration may cause a drop in outgoing pressure during varying demand.

0230	0230 RAMP 4 70 sec	Ramp 4: Slow acceleration time	G

Possible settings:	1 – 1000 sec

- Rapid deceleration may lead to pump oscillation.
- Slow deceleration may cause pressure fluctuations during varying demand.

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

Possible settings:	1.0 – 25.0 sec

Acceleration rate during startup until MIN. FREQUENCY [0250] is reached. Beyond the minimum frequency, RAMP1 [0215] (fast acceleration ramp) applies.

- Rapid acceleration may cause error (OVERLOAD) during drive startup.

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

Possible settings:	1.0 – 25.0 sec

Deceleration rate applied when the drive has dropped below the MIN. FREQUENCY [0250].

- Rapid deceleration may cause error (OVERVOLTAGE)

0245	0245 MAX. FRQ. 60 Hz	Maximum frequency	G

Possible settings:	30.0 – 70.0 Hz

This parameter determines the maximum frequency output to the motor. This should be set to the motor nominal frequency. Default is 60 Hz.

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

0250	0250 MIN. FRQ. 20.0 Hz	Minimum frequency	G

Possible settings:	0.0 – f_{max}

At operation below MIN. FREQUENCY (0250) the HYDROVAR operates with the fast ramps F_{min} A and D, (0235/0240).

The pump type and application should be considered when setting MIN. FREQ. For submersible applications the min. frequency must be set to ~30Hz.

0255	0255 CONF. F_{MIN} f -> 0	Operation at minimum frequency	G

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

f->0: After reaching the required pressure with no demand the frequency drops to the selected MINIMUM FREQUENCY [0250] and the HYDROVAR will continue to run for the selected F_{MIN} TIME [0260]. After this time the HYDROVAR will stop automatically.

f->f_{min}: The pump will never stop automatically. The frequency will only drop down to the selected MINIMUM FREQUENCY [0250]. To stop the pump the external ON/OFF (E-stop) must be opened or the ▼ (Stop) button must be pressed.

Applications: circulation systems

Caution: The setting f->f_{min} can overheat the pump if there is no flow through the pump. Use when there is a bypass line for circulation pumps!

0260	0260 F_{MIN} TIME 0 s	Delay time before shut off below MIN. FREQ.	G

Possible settings:	0 – 100 sec

After running below MIN. FREQ.for this selected time, the pump will stop if parameter CONFIG. FMIN [0255] is set to f -> 0.

0265	0265 BOOST 5 %	Motor starting voltage in % of connected supply voltage	G

Possible settings:	0 – 25% of the input voltage

This parameter determines the characteristics of the voltage/frequency curve. In particular, it refers to the voltage increase during startup as a percentage of the nominal voltage. This setting should be kept as low as possible to protect the motor from thermal overload at lower frequencies. If the boost is set too low, a failure (OVERLOAD) may occur because the starting current is too high.

0270	0270 KNEE FRQ. 60.0 Hz	Knee frequency	G

Possible settings:	30.0 – 90.0 Hz

This parameter determines the frequency at which the HYDROVAR generates its maximum output voltage (value of the connected input voltage). For standard applications this frequency should be set to MAX. FRQ. [0245] (Default Setting 60Hz).

CAUTION

This parameter should rarely be adjusted! Incorrect setting can cause an overload error and damage to the motor. Contact factory before changing.

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

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 Horsepower	**Output current [A]**			
	OFF = 100%	85%	75%	50%
230V, 2 HP	7	5.95	5.25	3.5
230V, 3 HP	10	8.50	7.50	5.00
460V, 3 HP	5.7	4.85	4.28	2.85
460V, 5 HP	7.3	6.21	5.48	3.65
460V, 7.5 HP	13.5	11.48	10.13	6.75
460V, 10 HP	17	14.45	12.75	8.5
460V, 15 HP	23	19.55	17.25	11.5

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

Possible settings:	Auto, 8 kHz, 4 kHz

- **Auto (default setting)**
  In standard operation the HYDROVAR works with a switching frequency of 8 kHz in order to reduce the noise level. At rising temperature inside the HYDROVAR the switching frequency is decreased to 4 kHz automatically.
- **8 kHz -** Selection with lowest noise level, but without decrease at rising temperature.
- **4 kHz -** Reduce the temperature in the HYDROVAR

0285	0285 SKIPFRQ CTR 0.0 Hz	Skip frequency start point	G
Possible settings:		f_{min} - f_{max}	

0286	0286 SKIPFRQ RNG 0.0 Hz	Skip frequency range	G
Possible settings:		0.0 – 5.0 Hz	

0290	0290 CURR. LIMIT OFF	Current limit functionality
Possible settings:		OFF - ON

0291	0291 CURR. LIMIT 100 %	Current limit
Possible settings:		10.0 - 100 %

Previous parameters [0285] - [0291] are limited for power ratings starting from 7.5kW with production date 05/08 and control board software V01.3 → otherwise they are not visible and therefore not active.

0300	**0300 SUBMENU REGULATION**	

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

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

0310	0310 WINDOW 5%	Hysteresis Window	G
Possible settings:		0 – 100% of required value	

- Determines the width of the set point hysteresis window.
- For steep pump-curves and closed loop systems ~20-30%.

0315	0315 HYSTERESIS 80%	Hysteresis for ramp switching	G
Possible settings:		0 – 100%	

- Determines the percentage of the hysteresis window, at which the ramps change from slow to fast.
- For an accurate control (without automatic shut-off) ~99%, e.g. constant flow control.

0320	0320 REG. MODE normal	Regulation mode	**G**

Possible settings:	normal, inverse

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

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

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

Possible settings:	0.0 Hz – 70.0 Hz

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

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

0330	0330 LIFT AMOUNT 0.0 %	Lift amount for required lift value	**G**

Possible settings:	0.0 – 200.0%

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

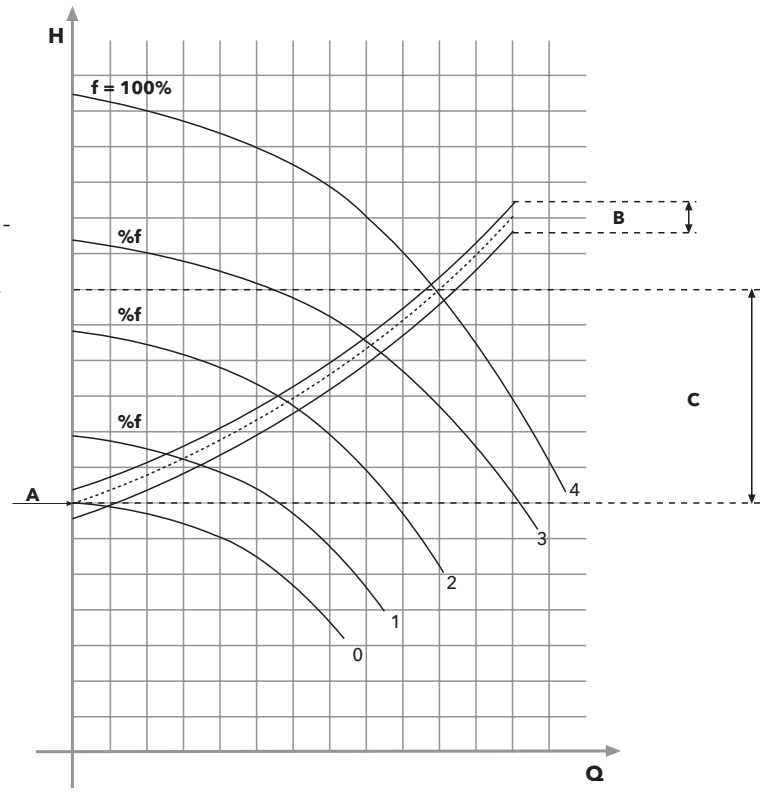
Application Example:

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

A … set pressure

B … window

C … lift intensity in % of set pressure



0400	**0400 SUBMENU SENSOR**	

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

Two different transducer types can not be used because the configuration is the same for all connected sensors. Transducers must be always the same type.

0405	0405 DIMENS. UNIT PSI	Dimension unit

Possible settings: bar, psi, m^3/h, g/min, mH2O, ft, °C, °F, l/sec, l/min, m/sec, …, %

Choose the desired Dimension Unit by pressing ▲ or ▼.

When DIMENSION UNIT, you must also change the SENSOR RANGE [0420] according to the new DIMENSION UNIT!

0410	0410 CONF SENSOR Sensor 1	Selection of the sensor

Possible settings:
- Sensor 1
- Sensor 2
- Auto
- Switch Dig 1
- Switch Dig 2
- Switch Dig 3
- Switch Dig 4
- Auto Lower
- Auto Higher
- (Sensor 1 – Sensor 2)

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

Sensor 1	Sensor 1 is constantly active. 0/4-20mA signal ……. connected to X3/2 and X3/3 (+24V) 0-10V signal ……. connected to X3/6 and X3/3 (+24V)
Sensor 2	Sensor 2 is constantly active. 0/4-20mA signal ……. connected to X3/4 and X3/3 (+24V) 0-10V signal ……. connected to X3/5 and X3/3 (+24V)
Auto	Automatic switch over in case of a faulty transducer.
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 between connected sensors is taken as actual value

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

Possible settings: - analog I 4-20mA - analog I 0-20mA - analog U 0-10V

For choosing the correct sensor input.

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

* … Sensor 2 is not available for the Single Inverter configuration

0420	0420 SENS. RANGE 20mA = 300 PSI	Sensor range

Possible settings:	0.00 – 10000

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

Example:

300 PSI pressure sensor => 20mA = 300 PSI

0425	0425 SENS. CURVE linear	Sensor curve

Possible settings:	linear, quadratic

Internal calculation based on the actual value.

Possible setting and its application:

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

0430	0430 SENS 1 CAL 0 0% = actual value	Sensor 1 zero point calibration

Possible settings:	- 10% up to +10%

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

0435	0435 SENS 1 CAL X 0% = actual value	Sensor 1 upper range value calibration

Possible settings:	- 10% up to +10%

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

0440	0440 SENS 2 CAL 0 0% = actual value	Sensor 2 zero point calibration	S

Possible settings:	- 10% up to +10%

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

0445	0445 SENS 2 CAL X 0% = actual value	Sensor 2 upper range value calibration	S

Possible settings:	- 10% up to +10%

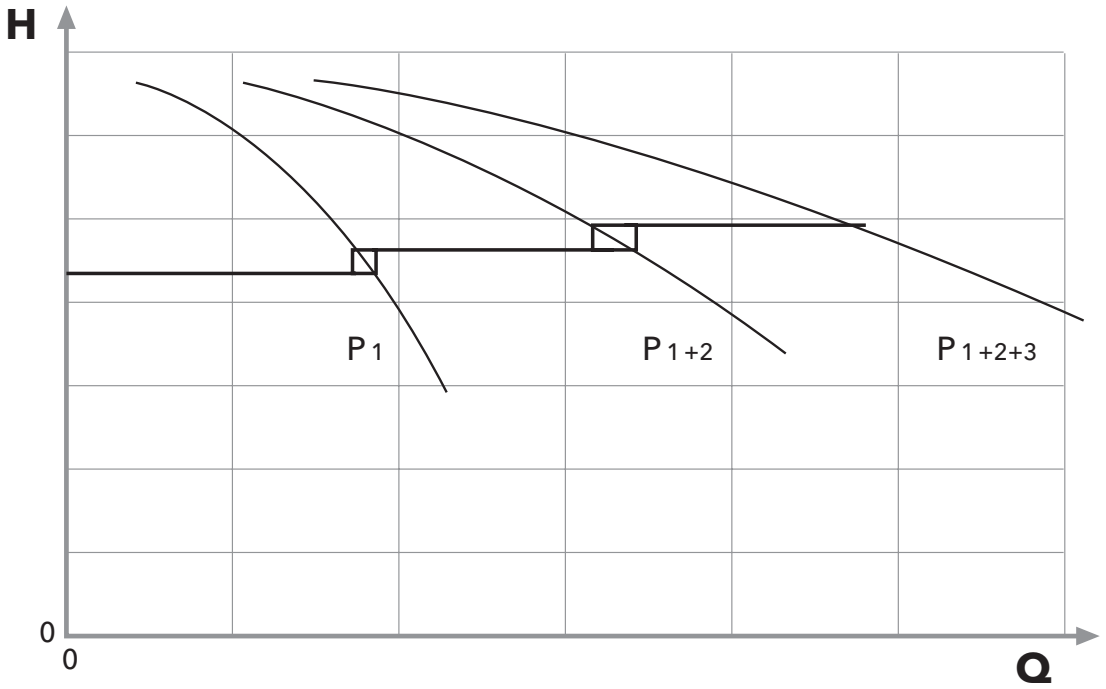
Upper range calibrations for Sensor 2, for explanation see Parameter 0435.

0500	**0500 SUBMENU SEQUENCE CNTR.**		S

This submenu defines parameters for multi-pump systems.

Application Example:

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



Calculations of the new required value for multi pump applications:

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

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

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

0505	0505 ACT. VAL. INC. 5 PSI	Lift value	G S
Possible settings:		0.00 – to the pre selected sensor range	

0510	0510 ACT. VAL. DEC. 2 PSI	Drop value	G S
Possible settings:		0.00– to the pre selected sensor range	

0515	0515 ENABLE FRQ 48.0 Hz	Enable frequency for the next drive	G S
Possible settings:		0.0 – 70.0 Hz	

Sets the frequency for the next pump to turn on. If a pump in the system reaches this frequency and the system pressure drops below the REQUIRED VALUE [02] - ACTUAL VALUE DECREASE [0510], the next pump is started.

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

Delay, in seconds, after the current pump reaches the enable frequency, before the next pump turns on.

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

Delay time between two switching actions of the fix speed pump. The parameter prevents the system repeated switching actions caused by varying demand.

0530	0530 DISABLE FRQ 30 Hz	Disable frequency (for cascade relay only!)	S

Possible settings:	0.0 – 120.0 Hz

The frequency to switch off the fixed speed pumps in cascade relay-mode.

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

0535	0535 DISABLE DLY 5 sec	Disable delay time (for cascade relay only!)	S

Possible settings:	0 – 100 sec

Delay time before switching off the assist pumps in cascade relay mode.

0540	0540 DROP FRQ 42 Hz	Drop frequency (for cascade relay only!)	S

Possible settings:	0.0 – 70.0 Hz

This parameter is used to prevent the system from pressure hammers. Before a following pump starts up, the Master Inverter will drop to the selected frequency. If the DROP FREQUENCY is reached, the follow-up-pump gets released and the Master Inverter will continue with normal operation.

0545	0545 OVERVALUE OFF	Overvalue (for cascade relay only!)	S

Possible settings:	OFF – pre selected sensor range

If this selected value is reached, an immediate shut-off of the fixed speed pumps is executed.

E.g. REQUIRED VALUE [02]: 70 PSI
OVERVALUE [0545]: 100 PSI

If three pumps are running (1 Master Inverter + 2 fixed speed pumps) and a system pressure of 100 PSI is reached, one after another assist pump is switched off.

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

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

Possible settings:	0.0 – 10.0 sec

Delay time to switch off an assist pump in case the actual value exceeds the OVERVALUE [0545] limit.

0555	0555 SWITCH INTV 24 hours	Switch interval for lead / lag alternation **(for cascade serial / synchron only!)**	G S

Possible settings:	0 – 250 hours

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

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

Synchronous Control

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

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

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

To determine the correct setting:

- Start the first pump in JOG Mode [62]; Increase the frequency till you reach the required value. Check the frequency (= f0) at zero consumption
- Set the synchronous limit (f0 + 2..3 Hz)
- Set the synchronous window between 1 or 2 Hz (depending on the pump curve and set point).

0560	0560 SYNCHR. LIM. 0.0 Hz	Frequency limit for synchronous control	G S

Possible settings:	0.0 Hz - Max. frequency

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

0565	0565 SYNCHR. WND. 2.0 Hz	Frequency window for synchronous control	G S

Possible settings:	0.0 – 10 Hz

Frequency limit for switching off the next assist pump.

E.g. switching off the 3RD PUMP:

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

Or: switching off the 4TH PUMP:

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

0570	0570 MSTPRIORITY ON	Master priority **(for cascade serial / synchron only!)**	G S

Possible settings:	ON - OFF

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

ON - all Master Inverters in the system start (unless it is stopped manually or by a failure) before the first Basic Inverter runs.

For example: Address 1-3.....Master Inverters
Address 4-8……Basic Inverters

Switching order:	Adr 1 Master	Adr 2 Master	Adr 3 Master	Adr 4 Basic	Adr 5 Basic	Adr 6 Basic	Adr 7 Basic	Adr 8 Basic

OFF - One master (which controls the overall system) is running. With rising consumption all Basic Inverters are turned on before other Masters run.

Switching order:	Adr 1 Master	Adr 4 Basic	Adr 5 Basic	Adr 6 Basic	Adr 7 Basic	Adr 8 Basic	Adr 2 Master	Adr 3 Master

0600	**0600 SUBMENU ERRORS**	

0605	0605 MIN. THRESH. disabled	Minimum threshold limit

Possible settings:	disabled - max. SENSOR RANGE

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

0610	0610 DELAY - TIME 2 Sec	Minimum threshold limit delay time	G

Possible settings:	1 – 100 sec

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

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

0615	0615 ERROR RESET ON	Automatic error reset	G

Possible settings:	ON – OFF

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

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

Not all errors can be reset automatically. (For detailed information see chapter 10 failure messages)

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

0700	**0700 SUBMENU OUTPUTS**	

0705	0705 ANALOG OUT1 Output Frequency	Analogue output 1	S

Analogue output 0 – 10V = 0 - 100% Terminal: X3/20

Possible settings: - Actual value
- Output frequency (0 - f_{max})

0710	0710 ANALOG OUT2 Actual value	Analogue output 2	S

Possible settings:	Actual Value, Output frequency

Analogue output 4 – 20mA = 0 - 100% Terminal: X3/21

Possible settings: - Actual value
- Output frequency (0 - f_{max})

0715	0715 CONF REL 1 Running	Configuration of the status relay 1 (X5/1-2-3)

0720	0720 CONF. REL 2 Errors	Configuration of the status relay 2 (X5/4-5-6)

Possible settings: Power, Errors, Warnings, StandBy, Errorreset, Errors of Basics, Warnings+Basics

Config.	Explanation of status	Action if status=YES
Power	HYDROVAR is connected to power supply	Relay 1: X5/ 1-3 closed Relay 2: X5/ 4-6 closed
Running	Motor is running	Relay 1: X5/ 1-3 closed Relay 2: X5/ 4-6 closed
Errors	An error is indicated on the HYDROVAR (incl. power failure)	Relay 1: X5/ 1-2 closed Relay 2: X5/ 4-5 closed
Warnings	A warning is indicated on the HYDROVAR	Relay 1: X5/ 1-2 closed Relay 2: X5/ 4-5 closed
StandBy	Pump is manually turned off or E-stop activated, no error/warning is indicated and HYDROVAR doesn't run	Relay 1: X5/ 1-3 closed Relay 2: X5/ 4-6 closed
Errorreset	If Parameter ERRORRESET [0615] is activated and a Warning occurs 5 times -> Error ->	Relay 1: X5/ 1-3 closed Relay 2: X5/ 4-6 closed
Error of Basics	A failure is indicated at least on one Basic drive	Relay 1: X5/ 1-2 closed Relay 2: X5/ 4-5 closed
Warnings + Basics	A warning is indicated on the Master or at least one Basic drive	Relay 1: X5/ 1-2 closed Relay 2: X5/ 4-5 closed

0800	0800 SUBMENU REQUIRED VALUES	

0805	0805 C.REQ.VAL 1 digital	Configuration required value 1

Possible settings:	- digital	- analog U 0-10V
	- analog I 0-20mA	- analog I 4-20mA

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

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

0810	0810 C.REQ.VAL 2 OFF	Configuration required value 2

Possible settings:	- OFF	- digital	- analog U 0-10V
	- analog I 0-20mA		- analog I 4-20mA

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

0815	0815 SW REQ. VAL Setpoint 1	Switching between required value 1 and 2

Possible settings:	- Setpoint 1 - Switch Dig 1 - Switch Dig 3	- Setpoint 2 - Switch Dig 2 - Switch Dig 4

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

0820	0820 REQ.VAL.1 XX.X PSI	Required value 1 (digital)

Possible settings:	0.0 – to the pre selected sensor range

0825	0825 REQ.VAL.2 XX.X PSI	Required value 2 (digital)

Possible settings:	0.0 – to the pre selected sensor range

Set the desired required value with either ▲ or ▼.

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

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

0830	0830 ACTUAT.FRQ 1 XX.X Hz	Required frequency 1 for actuator

Possible settings:	0.0 – MAX. FREQ. [0245]

0835	0835 ACTUAT.FRQ 2 XX.X Hz	Required frequency 2 for actuator

Possible settings:	0.0 – MAX. FREQ. [0245]

Set the frequency with either ▲ or ▼.

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

0900	**0900 SUBMENU OFFSET**		S

The Offset function allows for a change in setpoint based on a separate process parameter, (ex., flow rate). Use of this function is not recommended. Contact factory for further information.

0905	0905 OFFS. INPUT OFF	Selection of the Offset Input	S

Possible settings:	OFF	analog U1 0-10V analog I1 0-20mA / 4-20mA	analog U2 0-10V analog I2 0-20mA / 4-20mA

0907	0907 OFFSET RANGE 100	Representation of the sensor range	S

Possible settings:	0 – 10000

The Offset Range can be set to a number between 0 and 10000. Its value depends on the maximum range of the connected offset sensor.

E.g.: 300 PSI sensor can be set as range: 300; 3000; 30000
The higher the offset range the higher the resolution on the signal input.

0910	0910 LEVEL 1 0	Offset active between 0 and LEVEL 1	S

Possible settings:	0 – OFFSET RANGE

0912	0912 OFFSET X1 0	Offset signal value	S

Possible settings:	0 – LEVEL 1

Designation of the x – coordinate as absolute value.

0913	0913 OFFSET Y1 0.00 PSI	Desired value	S

Possible settings:	0 – standardization of the sensor

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

0915	0915 LEVEL 2 100	Offset active between LEVEL 2 and OFFSET RANGE	S

Possible settings:	LEVEL 1 – OFFSET RANGE

0917	0917 OFFSET X2 100	Offset signal value	S

Possible settings:	LEVEL 2 – OFFSET RANGE

Designation of the x – coordinate as absolute value.

0918	0918 OFFSET Y2 0.00 PSI	Desired value	S

Possible settings:	0 – standardization of the sensor

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

Example for using the Offset function:

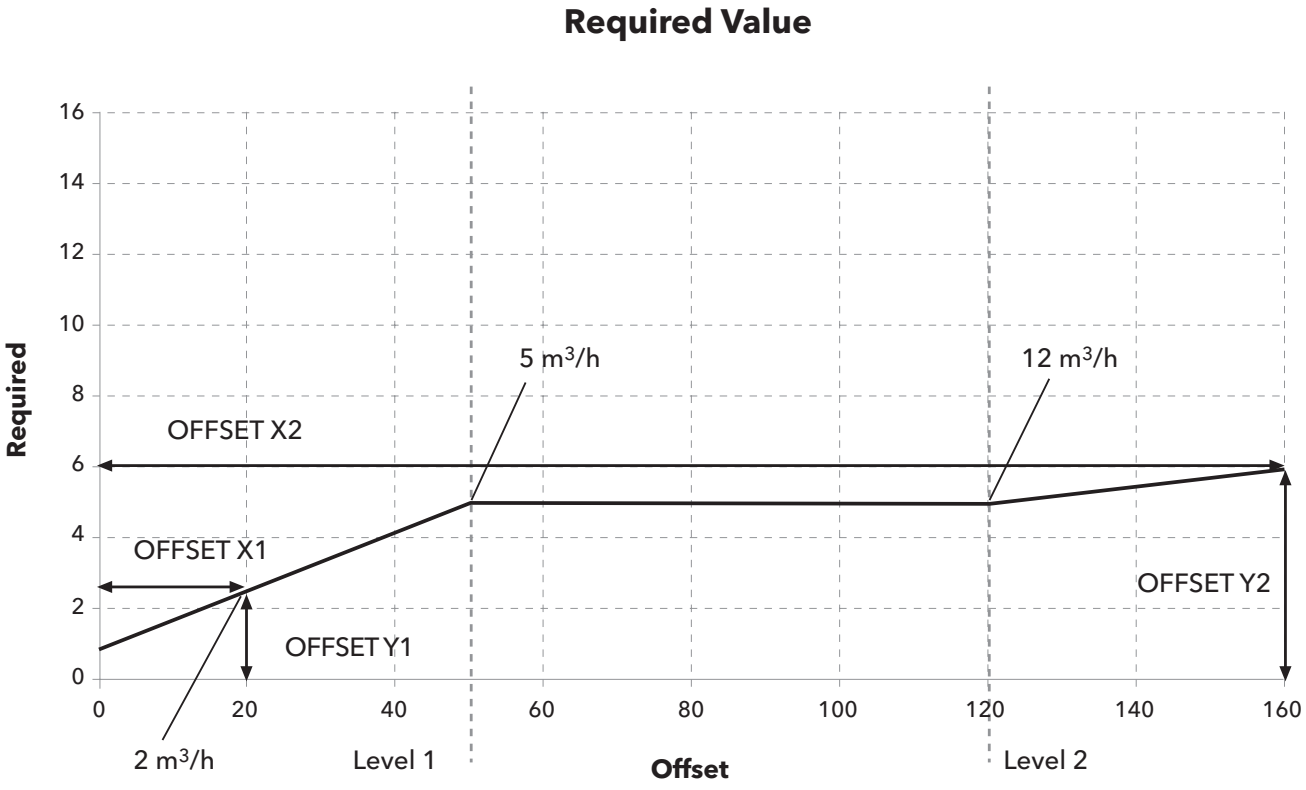
Constant pressure system with required value of 70 PSI.
Additionally a flow sensor is connected to the Offset input.
Parameter [907] - Offset Range = 300 (maximum range of flow sensor = 70 GPM)

System requirement 1:
5 bar constant pressure while the flow rate is between 20 GPM and 50 GPM.
Below 20 GPM the pressure should be decreased to maximum 36 PSI at a flow rate of 8 GPM.

Settings:
Parameter [0910] - Level 1 = 50 = 20 GPM (first limit where the offset function is active)
Parameter [0912] - Offset X1 = 20 = 8 GPM (fixed point according the requirements)
Parameter [0913] - Offset Y1 = 2.5 = 36 PSI (max. allowed pressure at this flow rate)

System requirement 2:
70 PSI constant pressure while the flow rate is between 20 GPM and 50 GPM.
Above the 50 GPM the pressure should be increased with the limitation to have maximum 87 PSI at maximum flow rate of 16m³/h.

Settings:
Parameter [915] - Level 2 = 120 = 50 GPM (second limit where the offset function is active)
Parameter [917] - Offset X2 = 160 = 16m³/h (fixed point according the requirements)
Parameter [918] - Offset Y2 = 6 = 87 PSI (required pressure at this flow rate)



1000	**1000 SUBMENU TEST RUN**	

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

The Automatic Test Run starts the pump when it has not run for the number of hours set.

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

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

The test run is only active when the HYDROVAR is stopped because of low/no demand and external ON/OFF (E-stop) contact (X3/7-8) is closed!

1010	1010 TESTRUN FRQ. 30.0 Hz	Frequency for manual and automatic test run	G
Possible settings:		0 – Fmax	
1015	1015 TESTR. BOOST 10.0 %	Setting the motor starting voltage boost in % of rated input voltage	G
Possible settings:		0 – 25% of maximum input voltage	
1020	1020 TESTRUN TIME 5 sec	Test Run time	G
Possible settings:		0-180 sec.	
1025	1025 SEL. DEVICE 01	Select Inverter for manual test run	S
Possible settings:		01-08	
1030	1030 TESTRUN MAN Press ▶ 3 sec.	Manual Test Run, Confirm test run for selected unit	

Perform a manual Test Run for one selected unit. (Even fixed speed pumps in Cascade Relay Mode can be included in the test run function.)

By pressing ▶ button for approximately 3 seconds a test run will be started.

1100	**1100 SUBMENU SETUP**	

1110	1110 FACTORY SET USA	Restores the HV to factory setting

Possible settings:	EUROPE, USA

To restore the HYDROVAR to factory settings select Europe or USA.
For reset press ▶ button until "DONE" appears.

1120	1120 PASSWORD 2 0000	Enter password by pressing ▲ or ▼

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

1125	1125 CLR ERRORS UNIT X	Clear error memory of selected unit or on ALL units (Cascade Serial/Synchron)

Possible settings:	1 – 8, ALL

To clear the error memory either (1-8) for one specific unit or ALL for all units, can be selected.
For reset press ▶ button till "RESET" appears.

1130	1130 CLR MOTORH. UNIT X	Clear motor hours for selected unit or on ALL units (Cascade Serial/Synchron)

Possible settings:	1 – 8, ALL

Set desired unit where the Motor Hours should be cleared (or ALL) and press ▶ button until "RESET" appears.

1135	1135 CLR OPERAT. Press ▶ 3 sec.	Clear operation time

The operation time indicates the total time the HYDROVAR is already connected to power supply. For reset the operation time of the current HYDROVAR press ▶ button till "RESET" appears.

1200	**1200 SUBMENU RS485-INTERFACE**	

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 to the system requirements.

1205	1205 ADDRESS 1	Set desired address for the user interface

Possible settings:	1 - 247

1210	1210 BAUDRATE 9600	Baudrate for user interface

Possible settings:	1200, 2400, 4800, 9600, 14400, 19200, 38400

1215	1215 FORMAT RTU N81	Format for user interface

Possible settings:	RTU N81, RTU N82, RTU E81, RTU O81, ASCII N72, ASCII E71, ASCII O71

Internal Interface

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

1220	1220 PUMP ADDR. 1	Select desired address for the Master Inverter	

Possible settings:	1 - 8

Set desired address for the current Master Inverter and press ▶ button for approximately 3 seconds and the following messages will appear:

Addressing Addressing	->	1220 PUMP ADDR. * 1 *	or	1220 PUMP ADDR. - 1 -
		Address Set		Address failed - retry

When using Master and Basic Inverters together in a multi-pump system the Basic Inverters require a separate address.

For detailed Information see chapter 8.4.3.2 Addressing.

Section 10

NOTE

If the HYDROVAR is stopped by an error (warning), the HYDROVAR and the motor remain under voltage. Before any work is carried out on the electrical or mechanical part of the system, the HYDROVAR must be disconnected from power supply for at least 5 minutes.

Difference between warnings and errors:

- **Warnings** are shown on the display and indicated by the red failure LED. If a warning is active and the cause is not remedied within 20 seconds an error will be shown and the HYDROVAR stops. **Note:** Not all warnings will result in an error.
- **Errors** are indicated on the HYDROVAR display and by the red failure LED on the control panel. In case of an error the connected motor is stopped immediately. All errors are shown in plain text and saved in the error memory including date and time when the failure occurred.

The following information describes the errors which can occur on the HYDROVAR (on the Master/Single and the Basic Inverter). Additionally the possible countermeasures to reset these errors are described.

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

10.1 Basic Inverter

The Basic Hydrovar (power unit only), may indicate the following errors by the red LED:

Red LED Code	Error	Probable Cause
1 blink	UNDERVOLTAGE	DC is too low
2 blinks	OVERCURRENT or OVERLOAD	Current rise at the output too high or current limit is reached
3 blinks	INVERTER OVERHEAT	Excessive temperature inside the HYDROVAR
4 blinks	OVERVOLTAGE	Excessive DC voltage
5 blinks	CODE ERROR	Internal error
6 blinks	MOTOR OVERHEAT EXTERNAL CONTACT	PTC in the conduit box has reached its release temperature or external contact is open

Reset:	To reset the CODE ERROR and the OVERCURRENT ERROR, cut power supply for > 60 seconds. To reset all other errors open/close the START/STOP_PTC input (X1/PTC) on the power unit.

If the **Basic Inverter is used in combination with a Master Inverter,** each failure can be indicated on the Master Inverter too and will be saved in the failure memory including date and time when the failure appeared.

ERR. Basic Addr. X	Indication on the Master Inverter: For detailed failure information on the specific unit, SUBMENU STATUS [20] has to be entered and the affected device has to be selected with it's pump address!

If a Master Inverter is used in such a system, the errors which occurred on the Basic Inverter can be reset by the Master without interfering with the operation of the other HYDROVAR units in the system (also valid for automatic Error-reset).

FAILURE MESSAGES

10.2 Master / Single Inverter

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

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

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

No error-message on the display		
Error	**Probable Cause**	**Measure**
no AUTOSTART after power failure	Parameter AUTOSTART [08] is set to "OFF"	Check parameter AUTOSTART [08]
No operation when system pressure < set pressure	Pressure higher than the start value or REGULATION MODE has been changed to INVERSE.	Check parameter START VALUE [04] and/or REGULATION MODE [0320]

Error-message on the display		
Error	**Probable Cause**	**Measure**
OVERCURRENT ERROR 11	Current rise at the output too high	• check connection-terminals of the HYDROVAR • check the connection-terminal of the motor and the motor-cable • check the windings of the motor

Reset:	• The power supply for >60 seconds. • Automatic Error-reset not possible for this failure!

FAILURE MESSAGES

Error	Probable Cause	Measure
OVERLOAD ERROR 12	Power limit of the HYDROVAR is exceeded	• Check Parameter RAMP 1/2 [0215 / 0220] (too short) and BOOST [0265] (too low) • Check motor connection, cable and power supply • Pump blocked • Motor turns in the wrong direction • MAX. FREQUENCY [0245] too high
OVERVOLTAGE ERROR 13	DC voltage too high	• Parameter RAMP 2 [0220] too fast • Power supply too high • Voltage peaks too high (Solution: Line filters)
INVERT. OVERHEAT ERROR 14	Excessive temperature inside the HYDROVAR	• Improper cooling • Contamination of the motor vents • Ambient temperature too high
THERMO MOT/EXT ERROR 15	An external protective device connected to terminal X1/PTC has released (e.g. PTC which is connected has reached its release temperature).	• Close X1/PTC if there is no external protective device connected. • Close external on/off switch if connected to these terminals. • For detailed information, see chapter 8.4.3.
PHASELOSS ERROR 16	One phase of the power supply has been lost.	• Check power supply under full load. – Check if phase failure at the input. • Check circuit breakers • Visual inspection of points at the input terminals.
UNDERVOLTAGE	DC voltage	• Supply voltage too low • Phase failure at the input • Asymmetry of the phase imbalance
COMM LOST	The communication between the Power Unit and the control card is lost.	• Check if the addressing of Basic Inverter [DIP SW.] has been done correctly. • Check if each unit has its own pump address. • Check if the connection from control card to the power unit is made properly (ribbon cable).

Reset:	• Cut off power supply for > 60 seconds. • Manual reset by closing external ON/OFF (Terminals X3/7-8) • Manual reset by pressing ◀ and ▶ simultaneously for about 5 seconds • Auto-reset possible if ERROR-RESET [0615] is set to ON

FAILURE MESSAGES

LACK OF WATER ERROR 21	Low water contact (X3/11-12) is opened (only active if motor is running)	• Incoming pressure or minimum level too low • Bridge X3/11-12, if there is no ext. low water protection • Adjust Parameter DELAY TIME [0610] if the failure happens only for a short time
Reset:	• Automatically if low water contact (X3/11-12) is closed!	
MIN. THRESHOLD ERROR 22	Defined value of parameter MIN.THRESHOLD [0605] was not reached during the preselected DELAY-TIME [0610]	• Check booster unit, adjust parameter DELAY TIME [0610] • Parameter ERROR RESET [0615] set to ON, to enable 5 restarts
FAILURE SENSOR 1 **ACT. VAL. SENSOR 1 ERROR 23**	Sensor signal on terminals X3/2 <4mA Active Sensor: WARNING (20 sec.)-> ERROR Non-active sensor: WARNING	• ACTUAL VALUE signal (pressure transducer) faulty • Poor connection • Sensor or cable fault • check configuration of the sensors in submenu SENSORS [0400]
FAILURE SENSOR 2 **ACT. VAL. SENSOR 2 ERROR 24**	Sensor signal on terminals X3/2 <4mA Active Sensor: WARNING (20 sec.)-> ERROR Non-active sensor: WARNING	• ACTUAL VALUE signal (pressure transducer) faulty • Poor connection • Sensor or cable fault • check configuration of the sensors in submenu SENSORS [0400]
SETPOINT 1 I<4mA **SETPOINT 1 I<4mA ERROR 25**	Current signal input of required values is active, but no signal 4-20mA is connected WARNING (20 sec.)-> ERROR	• Check external analogue signal on terminals X3/17-18 • Check configuration of the required values in Submenu REQUIRED VALUES [0800]
SETPOINT 2 I<4mA **SETPOINT 2 I<4mA ERROR 26**	Current signal input of required values is active, but no signal 4-20mA is connected WARNING (20 sec.)-> ERROR	• Check external analogue signal on terminals X3/22-23 • Check configuration of the required values in Submenu REQUIRED VALUES [0800]
Reset:	• Cut off power supply for > 60 seconds. • Manual reset by closing external ON/OFF (Terminals X3/7-8) • Manual reset by pressing ◀ and ▶ simultaneously for about 5 seconds • Auto-reset possible if ERROR-RESET [0615] is set to ON	

FAILURE MESSAGES

10.3 Internal Errors

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

Internal errors Error-message on the display - red LED on		
ERROR 1	EEPROM-ERROR (data block malfunction)	Reset - after repeated error-message ⇒ change control card
ERROR 4	Button error (e.g.: jammed key)	• Check push buttons, • Display-board may be defective • Assure drive cover securely attached to base with no interference (pinched wires, debris, etc.)
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	• Check installation of cables, connection of the screen and balanced power supply. • Check earth/ground. • Install additional inductances for the signal-cables (e.g. ferrites).

Examples:

Booster Unit	
Problem: HYDROVAR will not stop	
Cause:	**Check:**
• Demand exceeds pump capacity • Pre-charge pressure in pressure tank • Incorrect setting of WINDOW and RAMP HYSTERESIS • Shut down ramp too slow • Suction line too long	• Check pipes and valves • Set WINDOW [0310] (< 10%) and HYSTERESIS [0315] (80-50%) • Set RAMP 2 [0220] to 4...13 sec. • MINIMUM FREQUENCY [0250] should be activated for pressure increase at 0 demand

FAILURE MESSAGES

Control on Constant Flow	
Problem: Control Fluctuations	
Cause:	**Check:**
Control characteristics are set too low	• Increase WINDOW [0310] and set HYSTERESIS [0315] to 99% to control with RAMP 3 and 4.

Circulating Pump	
Problem: Oscillation of the motor speed	
Cause:	**Check:**
Control settings too fast	• Increase RAMP 3 [0225] and 4 [0230]: 100...200sec. • WINDOW [0310] (20%) and HYSTERESIS [0315] (99%).
Problem: ACTUAL VALUE can't be maintained	
Cause:	**Check:**
HYSTERESIS is set too big	HYSTERESIS [0315]: 90-99%

General	
Problem: Pressure fluctuations, analogue signal not constant	
Solution:	• Check cables and connection of the screen • Check earth connection of the transmitter cable • Use screened cables

MAINTENANCE

Section 11 – Maintenance

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

All modifications must be done by qualified personnel! For mounting and repairs, only qualified service technicians should attempt.

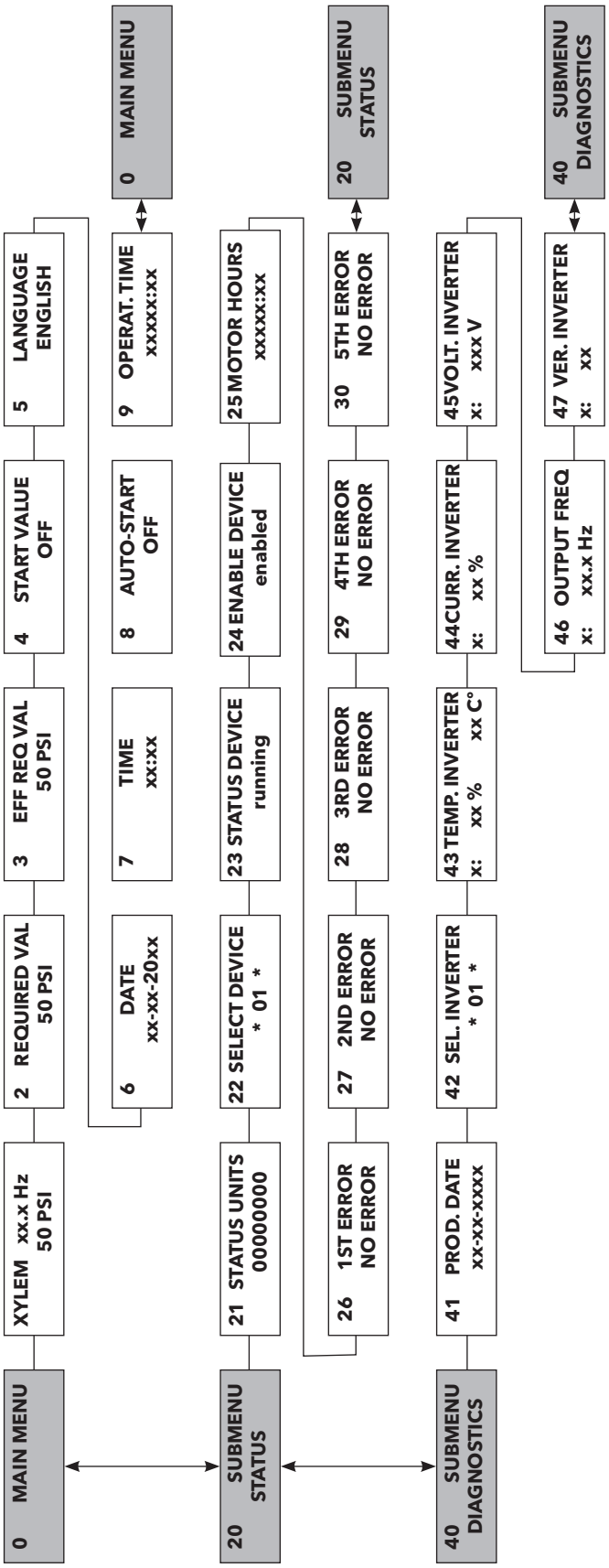
Disconnecting:

The HYDROVAR must be disconnected from the power supply for at least 5 minutes before any work can be carried out. Consider pump and motor instructions. Always wear your personal protection equipment.

For further information, please contact your distributor!

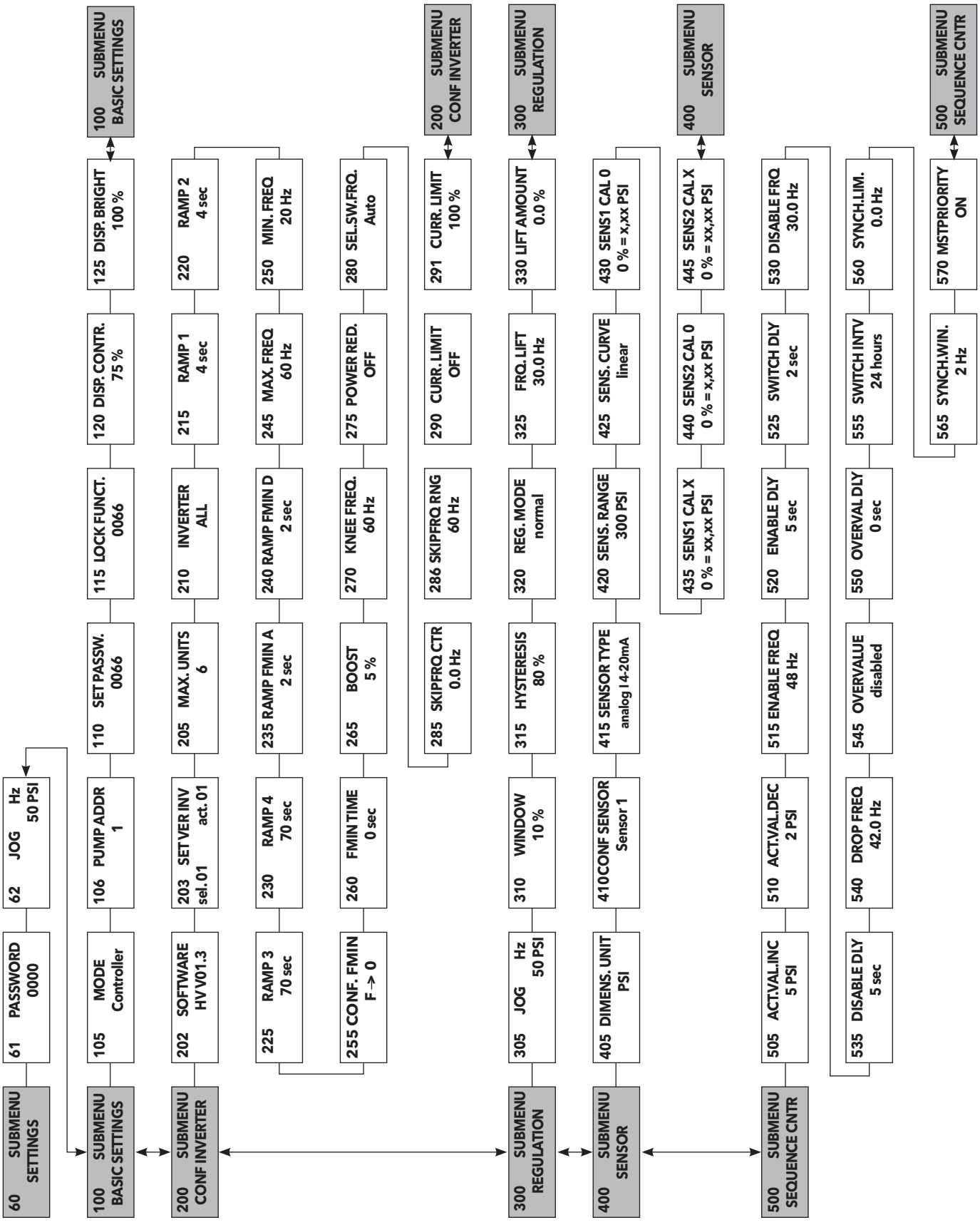
PROGRAMMING FLOW CHART

Section 12



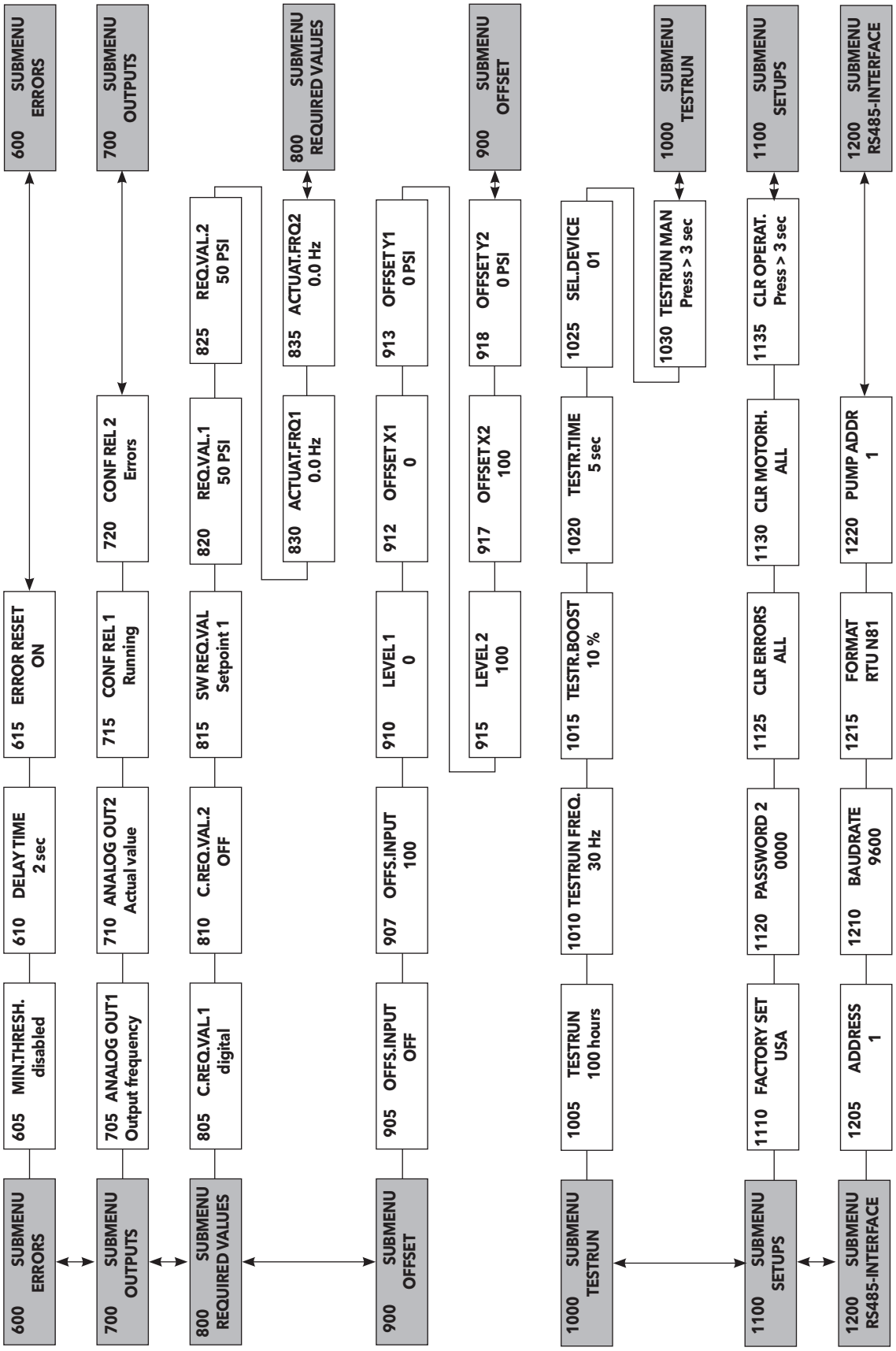
PROGRAMMING FLOW CHART

Section 12 (continued)



PROGRAMMING FLOW CHART

Section 12 (continued)



NOTES

COMMERCIAL WARRANTY

For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of one (1) year from the date of installation or twelve (12) months from the date of shipment (which date of shipment shall not be greater than eighteen (18) months after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, GUARANTEES, CONDITIONS OR TERMS OF WHATEVER NATURE RELATING TO THE GOODS PROVIDED HEREUNDER, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND EXCLUDED. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

xylem
Let's Solve Water

Xylem Inc.
2881 East Bayard Street Ext., Suite A
Seneca Falls, NY 13148
Phone: (800) 453-6777
Fax: (888) 322-5877

 IM223 Revision 6 March 2016