

Operating manual

This operating manual refers exclusively to the control unit.

This operating manual contains important information and precautionary notes. Please read the manual thoroughly prior to installation of unit, connection to the power supply and commissioning.

Important!

Operation and use of the switchgear and controlgear assembly shall be in compliance with EN 50110-1 - Operation of electrical installations.

The descriptions and instructions put forth in this manual refer to the standard KSB control unit models only.

The operating manual does not cover all design details and variants, nor does it cover all scenarios and situations that may arise during installation, operation or maintenance.

The manufacturer shall not accept any liability for the switchgear and controlgear assembly if the instructions set forth in this manual are not complied with.

If you need any additional information or instructions exceeding the scope of this manual, please contact your nearest KSB customer service centre.

For information on customer service centres, see the attached list of addresses.

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1 General

Caution This KSB device has been developed using state-of-the-art technology; it is manufactured with the utmost care and subject to continuous quality control.

This operating manual is intended to help you familiarise yourself with the device and its intended use.

The operating manual contains important information for reliable, safe, proper and efficient operation. Compliance with the operating manual is of vital importance to ensure reliability and a long service life of the device and to avoid any risks.

This operating manual does not take local regulations into account. The operator must ensure that everyone – including the installation personnel – observes these regulations.

 The device must not be operated beyond the limit values for the operating voltage, rated mains frequency, ambient temperature and switching capacity specified in the product literature. Make sure that operation is in accordance with the instructions laid down in this manual or in the contract documentation.

The name plate indicates the type series/size, main operating data and order/serial number; please quote this information in all queries, repeat orders and particularly when ordering spare parts. If you need any additional information or instructions exceeding the scope of this manual or in case of damage please contact KSB's nearest customer service centre.

2 Safety

This operating manual contains important information which must be observed when installing, operating and maintaining the device. For this reason, it must be read and understood by the installing personnel and the responsible technical staff/operators before the device is installed and commissioned. The manual must always be kept available at the place of installation of the device for future reference.

In addition to the general safety information laid down in this chapter on "Safety", the safety information provided in other sections must also be observed.

2.1 Symbols used in this operating manual

The safety information contained in this manual whose non-observance might cause hazards to persons is specially marked with the general hazard sign, namely



safety symbol to ISO 7000 - 0434.

The electrical danger warning symbol is



safety symbol to IEC 417 - 5036.

Special instructions concerning explosion protection are marked



The word



is used to introduce safety information whose non-observance may lead to damage to the device and its functions.

2.2 Personnel qualification and training

All personnel involved in operating, maintaining, servicing, inspecting and installing the device must be fully qualified to carry out the work involved. Areas of responsibility and personnel monitoring must be clearly specified by the operator. If the personnel in question does not already possess the requisite know-how, appropriate training and instruction must be provided. If required, the operator may commission the manufacturer/supplier to take care of such training. In addition, the operator is responsible for ensuring that the responsible personnel fully understands the contents of the operating manual.


2.3 Non-compliance with safety information

Non-compliance with safety information can jeopardise the safety of personnel, the environment and the equipment itself. Non-compliance with safety information will also lead to forfeiture of any and all rights to claims for damages. In particular, non-compliance can, for example, result in:

- Failure of important functions of the unit
- Failure of prescribed monitoring methods
- Hazard to persons by electrical, mechanical and chemical effects


2.4 Safety awareness

It is imperative to comply with the safety information contained in this manual, the relevant national health and safety regulations and the operator's own internal work, operation and safety regulations.

 When the device is used in conjunction with pumps installed in potentially explosive atmospheres, special attention must be paid to information marked by the Ex symbol.

2.5 Safety information for the operator/user

Electrical hazards must be eliminated. (For details, refer to the relevant country-specific safety regulations or the technical specifications of the local energy supply companies.)

 If the devices are used in conjunction with pumps installed in potentially explosive atmospheres, it is imperative to make sure that unauthorised modes of operation are prevented. Non-compliance with this requirement may result in the specified temperature limits being exceeded.

2.6 Safety information for maintenance, inspection and installation work

The operator is responsible for ensuring that all maintenance, inspection and installation work is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual. Any work on the device shall only be performed when the equipment is de-energised. Immediately following completion of the work, all safety-relevant and protective devices must be re-installed and/or re-activated. Please observe all instructions set out in the chapter on "Commissioning" before returning the device to service.

2.7 Unauthorised modification and manufacture of spare parts

Modifications or alterations of the equipment supplied are only permitted after consultation with the manufacturer. Original spare parts and accessories authorised by the manufacturer ensure safety. The use of other parts can invalidate any liability of the manufacturer for resulting damage.


2.8 Unauthorised modes of operation

The warranty relating to the operating reliability and safety of the device supplied is only valid if the device is used in accordance with its intended use. The limits stated in the product literature must not be exceeded under any circumstances.

2.9 Software changes/warranty


The Hyatronic N software has been specially created for this device and thoroughly tested. Changes or additions to the software or parts of the software can affect functioning of the device. As KSB has no influence on software changes or add-ons and cannot test these, they are not permitted.


2.10 Unauthorised modes of operation

 The warranty relating to the operating reliability and safety of the device supplied and its explosion-proof status is only valid if the device is used in accordance with its intended use as described in the following sections. The limits stated in the data sheet must not be exceeded under any circumstances.

The warranty relating to the operating reliability and safety of the device supplied is only valid if the device is used in accordance with its intended use. The limits stated in the product literature must always be complied with.

2.11 Explosion protection

 If Hyatronic N is used in conjunction with pumps installed in potentially explosive atmospheres, EC directive 94/9/EC (ATEX 100a) must be complied with. A special control unit must be used for pumps and sensors installed in potentially explosive atmospheres, as well as a minimum-level float switch for monitoring the submergence of the pump's impeller eye, which is a potential source of ignition sparks.

 The control unit itself must always be located outside any potentially explosive atmosphere!

3 Transport and temporary storage

3.1 Transport

Transport of the equipment requires proper preparation and handling. Floor-mounted cabinets must always be transported in upright position to keep the mounting plate from sagging. Prior to dispatch, the control unit was tested and inspected to ensure full compliance with specifications. Consequently, the device should be in perfect electrical and mechanical condition when received. It is recommended that the control unit be inspected for in-transit damage immediately upon receipt. If there are any complaints or objections, the recipient and carrier must jointly draw up a damage report.

3.2 Temporary storage

The equipment shall only be stored under dry and vibration-free conditions, if possible in its original packaging. Ambient temperature shall be within -10 °C to +70 °C.

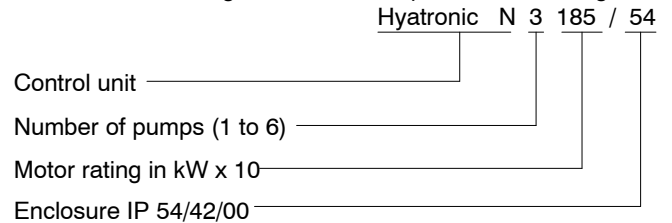
4 Description

4.1 Product description






The descriptions and instructions set forth in this manual refer to the standard version. KSB standard control units are low-voltage switchgear and controlgear assemblies to EN 60439 designed to control and protect one to six three-phase motors. Motors up to and including 4 kW are started up DOL (single- and three-phase, export and special versions up to 37 kW); motors from 5.5 kW (three-phase only) are started in star-delta configuration.

4.2 Designation

The control unit designation is made up of letters and digits.

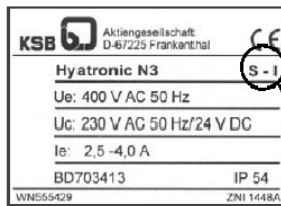


4.2.1 Pictogram symbols

	Unit operational
	Fault
	Manual mode
	Automatic mode
	Pump

4.2.2 Name plate

Example: Hyatronic N3



The series No. conveys important information for KSB Service.

Fig. 1: Name plate

The name plate is attached at the top of the control cabinet door.

- Line 1: Designation, number of pumps, rating x 10
- Line 2: Input voltage
- Line 3: Control voltage
- Line 4: Setting range for motor current
- Line 5: Circuit diagram number, enclosure

4.3 Technical specifications

Rated voltage:	400 VAC / 50 Hz
Setting range:	1.6 to 63 A
Control voltage:	230 VAC / 24 VDC
Operating temperature:	-10 °C to +50 °C
Rated insulation voltage:	500 VAC
Enclosure:	IP 54
EMC class	"B"

4.4 Components installed

- Master switch with emergency OFF function (up to 250 A rated system current)
- Cut-out switch with emergency OFF function (from 250 A rated system current)
- Manual-0-automatic selector switch per pump
- Display
- Control transformer
- Motor protection switch per pump up to 30 kW (37 kW)
- Motor protection relay per pump (from 37 kW)
- NH fuse load-break switch (from 37 kW)
- Mains contactor per pump
- Star contactor per pump (from 5.5 kW), except export/special version
- Delta contactor per pump (from 5.5 kW), except export/special version
- Time relay per pump (from 5.5 kW), except export/special version
- Green lamp ("system operational" message)
- Red lamp (general fault message)
- PLC pump control
- Terminal strip for connection of mains, pumps, float switches, bimetal switch
- Additional connections for float switches, high water/lack of water/dry running protection

4.5 Options (acc. to scope of supply)

- In case of analog sensors, analog PLC modules are required
- Thermistor tripping unit per pump
- Ammeter per pump

- Operating hours counter for each pump
- Voltmeter with changeover switch
- Monitoring relay (phase sequence/failure, over-/undervoltage)
- Heater with thermostat
- Mains-independent alarm unit
- Telecommunications module
- Outdoor cabinet
- Warning light for outdoor cabinet
- Further options available

5 Installation at site

5.1 Ambient conditions

The place of installation must be well ventilated and neither be exposed to direct sunlight nor adverse weather. Sufficient space is to be provided for dismantling and ventilation. Unauthorised access must be prevented.



The control units must be protected against flooding.



The control units are not explosion-proof and therefore must only be operated outside potentially explosive atmospheres.

5.2 Electrical connection



Electrical connection must only be carried out by a trained electrician.

- All connections shall be effected in accordance with the technical specifications issued by the local energy supply company.
- Type of current and voltage of the mains must be checked!
- Motor wiring shall be performed in accordance with the supplied circuit diagram.
- Set the motor protection switch of the pumps to rated current.
- Size of power cable as per DIN VDE 0100, Part 430.
- For maximum mains fusing refer to the supplied circuit diagram.
- Cable entries not used shall be closed with a plug.

Caution

Cables laid on site shall be connected in accordance with the supplied circuit diagram.

Caution

Only pumps with matching technical data shall be connected to this switchgear and controlgear assembly – risk of damage!

Caution

Sensors shall be installed in compliance with the product literature and connected in accordance with the supplied circuit diagram. Motor monitoring via thermal circuit breaker (TCB) or PTC thermistor shall be connected in accordance with the supplied circuit diagram. For pumps without motor monitoring, the relevant terminals must be bridged.

Caution

Pumps without thermal circuit breaker/PTC thermistor must not be operated as explosion-proof pumps.

6 Functions

6.1 General

Each pump is switched on and off with a selector switch (manual-0-automatic).

"0" position: The pump is switched off. When the switch is set to "manual" mode, the pump can be started up directly. However, this should be done above the stop level and for short periods only, e.g. for checking the direction of rotation. In manual and automatic mode, thermal monitoring of the motor is effected by the integrated thermal circuit breaker (TCB). The motor protection switch ensures overload and short circuit protection. In all other cases, the selector switch must be set to "automatic". To control up to six pumps, up to six digital level transmitters (e.g. float switches) or an analog transmitter producing a 4-20 mA signal (e.g. level sensor) can be connected to the level control equipment. Depending on the filling level, one or more pumps will then be automatically started or stopped. In addition, the pumps can be monitored for dry running using a digital transmitter (mandatory minimum level monitoring if the pumps are installed in potentially explosive atmospheres!).

Caution If an analog transmitter is used, an analog module must be installed in the control cabinet in addition to the PLC (not included in standard version).



Control units used for controlling pumps installed in potentially explosive atmospheres must always (also in manual mode) be operated in conjunction with a redundant minimum-level float switch to prevent the pumps from starting up below the minimum fluid level. This prevents the fluid level from dropping below the impeller eye of the pumps, and, hence, the generation of ignition sparks by an exposed rotating impeller.

Operating periods

To reduce the frequency of starts in case of filling level fluctuations, parameters for start or stop delays can be set, if required (see Section 6.6, Page 11).

Direction of action

Depending on whether the system is to be used to fill or to drain a tank, the direction of action can be set by entering the respective parameters (see Section 6.6, Page 11).

Functional check run

The integrated (real-time) timer allows daily/weekly functional check runs (short start-up and operation) of each pump. The cycle times can be set as follows (example): see Section 6.9, example of functional check run, Page 12.

Caution Fluid is also pumped during functional check runs! Make sure that during functional check runs the minimum permissible liquid level is maintained. Otherwise the dry running protection equipment will trigger a fault message!

Pump changeover

Pump changeover only needs to be activated if the pumps are running in prolonged base-load operation (e.g. for maintaining a certain water level in cases where the same amount of water flows in as is pumped off). See Section 6.9, example of pump changeover, Page 12.

6.2 Operating the control panel

- Master switch with emergency OFF function
- Control panel cursor keys
- Manual-0-automatic switch per pump
 - "0" position The pump is switched off and non-operational.
 - "Automatic" position If the switches are set to "Automatic", the pumps will be started or stopped by the control unit as a function of the fluid level.
 - "Manual" position: The pump is started up manually.

Caution However, this should be done above the stop level and for short periods only, e.g. for checking the direction of rotation. The control units must never be operated unsupervised in "manual" mode as this mode enables continuous operation without level control! Risk of dry running! Depending on the design variant the manual position of the switch is either of the maintained or momentary type.

6.3 Control panel

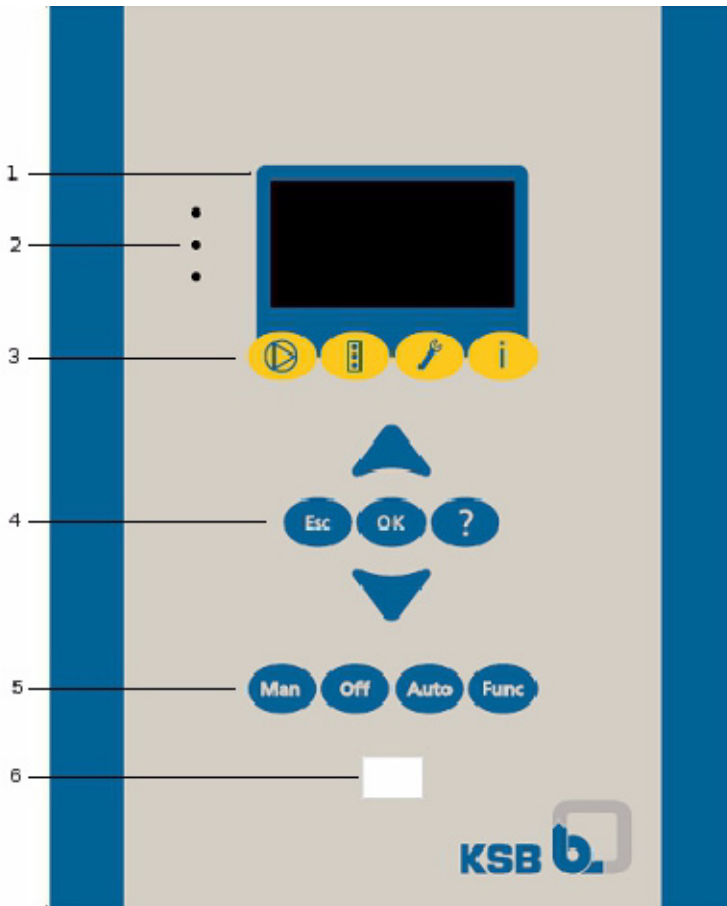


Fig. 2: Hyatronic N control panel

- 1 = Display
- 2 = "Traffic light" LEDs
- 3 = Function keys
- 4 = Navigation keys
- 5 = Man, Off, Auto and Func keys are without function
- 6 = Service interface (no function)

The following information can be displayed on the control panel:

- Alerts and warnings in plain text
- Operation and status indications per pump
- Status information
- Operating hours per pump
- Operating hours of the system
- Parameterisation/settings
- Electronic name plate
- Languages: German, English, French

6.3.1 Control panel display

The six-row display contains the following information:

Parameter No.	Product code
Current selection	
Parameter information	
Current level	

Fig. 3: Information shown on control panel

Control panel display	Description
Parameter No.	Shows the selected parameter No. or the selected pump (in main menu).
Product code	Shows the product variant.
Current selection/parameter information	List of selectable parameters/parameter information
Current level	Shows the current level reading.

Table 1: Information shown on control panel

6.3.2 LEDs

The "traffic light" signals provide information about the pump system's operating status:

- Red: one or several alerts are active
- Yellow: no function
- Green: trouble-free operation

6.3.3 Function keys

For direct access to the elements of the first menu level:

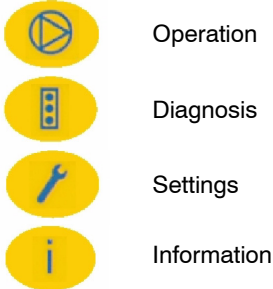


Fig. 4:

6.3.4 Navigation keys

For navigating the menus and confirming settings:

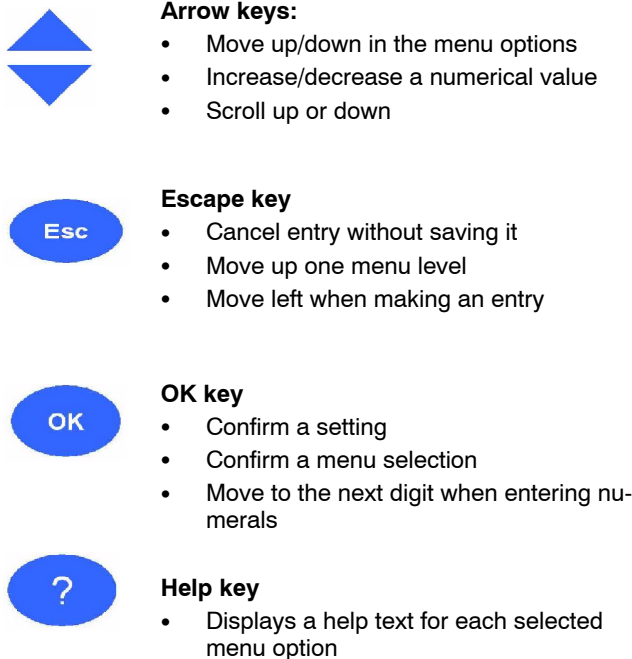


Fig. 5:

6.4 Access levels

Access level	Characteristics
Standard	<ul style="list-style-type: none"> • No log-in required • Restricted access to parameters
Customer	<ul style="list-style-type: none"> • Log-in required • Access to main parameters
Service	<ul style="list-style-type: none"> • Log-in required
Factory	<ul style="list-style-type: none"> • Access to all parameters

Table 2: Access levels

6.4.1 Displaying and changing parameters

The parameter number also serves as navigation path. The first digit of the parameter number indicates one of the following menus:



Fig. 6:

The menus are called up directly via the four function keys. Subsequent steps are carried out via the navigation keys.

Note If you press one of the function keys while editing a parameter, the display will return to the first menu level without saving the parameter.

Selecting a parameter (example: 3-1-2-1)

1. Selecting menu 3 (3-1-2-5):
Press "Settings" function key.
⇒ The menu options of menu 3 are displayed.
⇒ The first menu option is highlighted and displayed as menu level **3-- --1** in the top left of the screen.
2. Selecting menu level 3-1 (3-1-2-1):
Press "OK" to confirm.
⇒ The menu options of menu level 3-1 are displayed.
⇒ The first menu option is highlighted and displayed as menu level **3-1-1** in the top left of the screen.
3. Selecting menu level 3-1-2 (3-1-2-1):
Use the arrow keys to select **3-1-2** and press "OK" to confirm.
⇒ The menu options of menu level 3-1-2 are displayed.
⇒ The first menu option is highlighted and displayed as menu level **3-1-2-1** in the top left of the screen.
4. Selecting parameter 3-1-2-1 (3-1-2-1):
⇒ The parameter is displayed and can be set as required.

Logging in to Hyatronic N

Select parameter 3-4-1
⇒ Select log-in level
⇒ Press OK to confirm
Password: 0000

Caution You need to log in to be able to edit all parameters.

Note The bar above the entry displays the current value in relation to the value range.

1. Press "OK".
2. Use the arrow keys to set the parameter value required.
3. To move one digit to the right press "OK".
4. To move one digit to the left press "Esc".

Saving the parameter value

1. To leave the parameter without saving its value press "Esc" several times.
2. To save the parameter value press "OK".

6.5 PLC menu structure

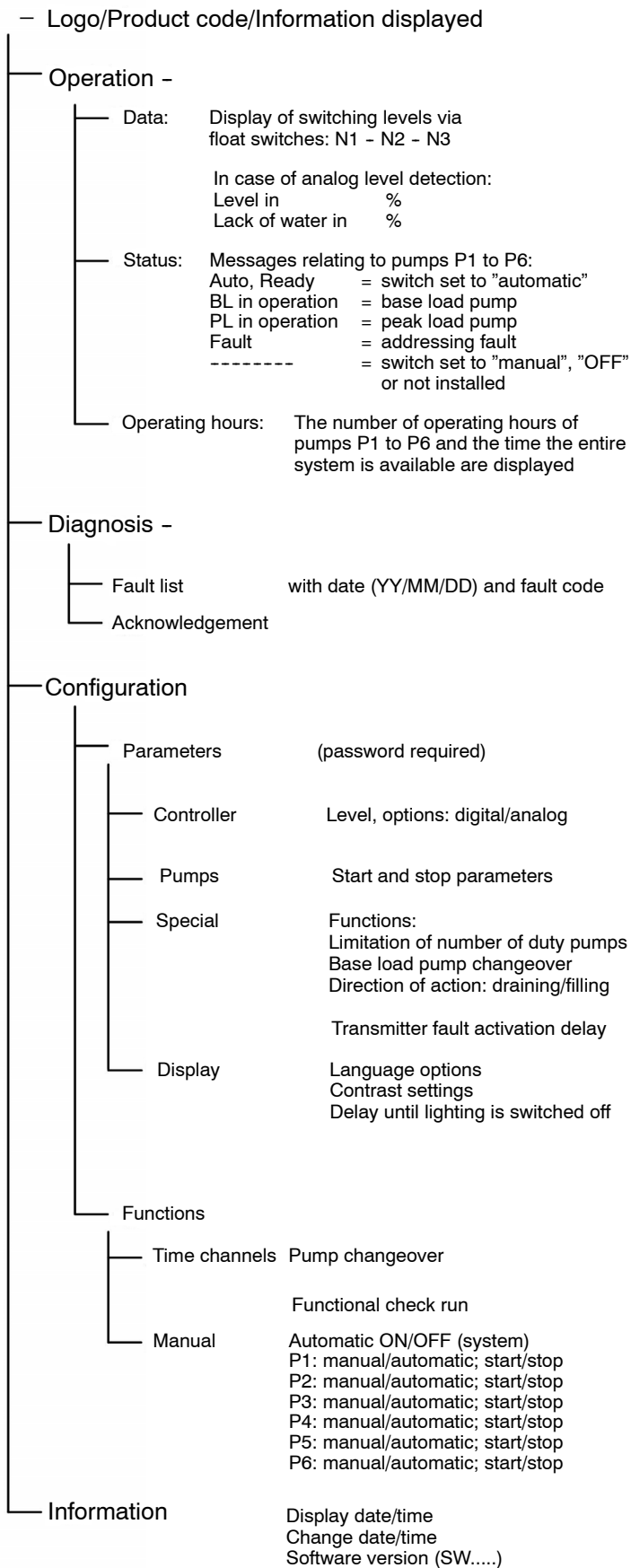


Fig. 7:
10

6.6 Parameter list

In order to be able to change parameters, the following password must be entered:

Parameter 3-4-1 Login level

Initial password (Customer access level): 0000

After entering the initial password it is recommended to set your own password (parameter 3-4-1) and keep it safe.

Parameter No.:	Parameter name:	Description	Unit	Range	Factory setting	Operating mode
Controller						
	Controller					
3-1-1-2	30	Baseload N1	%	0 ... 99		O
3-1-1-2-1	30	Baseload on	%	0 ... 99		O
3-1-1-2-2	30	Baseload off	%	0 ... 99		O
3-1-1-3	31	Peakload N2	%	0 ... 99		O
3-1-1-3-1	31	Baseload on	%	0 ... 99		O
3-1-1-3-2	31	Baseload off	%	0 ... 99		O
3-1-1-4	32	Peakload N3	%	0 ... 99		O
3-1-1-4-1	32	Baseload on	%	0 ... 99		O
3-1-1-4-2	32	Baseload off	%	0 ... 99		O
3-1-1-5	33	Peakload N4	%	0 ... 99		O
3-1-1-5-1	33	Baseload on	%	0 ... 99		O
3-1-1-5-2	33	Baseload off	%	0 ... 99		O
3-1-1-6	34	Peakload N5	%	0 ... 99		O
3-1-1-6-1	34	Baseload on	%	0 ... 99		O
3-1-1-6-2	34	Baseload off	%	0 ... 99		O
3-1-1-7	35	Peakload N6	%	0 ... 99		O
3-1-1-7-1	35	Baseload on	%	0 ... 99		O
3-1-1-7-2	35	Baseload off	%	0 ... 99		O
3-1-1-9	17, 4, 28	function ch1	-- --	Digital/analog	analog	X / O
Pumps						
	Pumps					
3-1-2-6	54	Baseload t on	s	0 ... 999.9	0	X / O
3-1-2-7	56	BL overshoot time	s	0 ... 999.9	10.0	X / O
3-1-2-8	56	BL overshoot time special	s	0 ... 999.9	10.0	X / O
3-1-2-11	62	Peakload on time	s	0 ... 999.9	5.0	X / O
3-1-2-12	63	Peakload off time	s	0 ... 999.9	5.0	X / O
3-1-2-24	175	stop frequence absolut-relativ	-- --	absolut/relativ	-- --	X / O
Special						
	Special					
3-1-3-1	171	control direct.	-- --	Drain/fill	Drain	X / O
3-1-3-2	179	low water start	s	0 ... 99.9	7.0	O
3-1-3-7	150	max num. p.	-- --	1 ... 6	6	X / O
3-1-3-11	160	Baseload change	-- --	Yes/no	nein	X / O
3-1-3-13	185	LW Sensor	-- --	Press./Flow		X
3-1-3-15	172	Trans.fault t	s	0 ... 99.9	5	X / O
3-1-3-19	179	Lack of water t	s	0 ... 99.9	7.0	O
3-1-3-20	179	Lack of water niveau	%	0 ... 999	0	O
3-1-3-26	187	Lack of water start flow	s	0 ... 99.9	7.0	X
3-1-3-27	187	Lack of water flow time	s	0 ... 99.9	7.0	X
3-1-3-28	192	function relay1	-- --	SSM/SBM ¹⁾	SSM	X / O
3-1-3-29	215	Profibus number	-- --	0 ... 999	0	X / O
3-1-3-30	219	Lack of water Signal	-- --	0/1	0	X / O
3-1-3-31	219	Automatic off signal	-- --	0/1	0	X / O
Display						
	Display					
3-1-4-1		German/English/French	-- --	DE/EN/FR	EN	
3-1-4-2		Display contrast	-- --			
2-1-4-3		Backlight Time	sec	1 ... 1000	30	
3-1-4-3		LCD backlighting		OFF/ON/AUTO	AUTO	
4-1-2		setting Date				
4-1-2-1		setting year	J	2012 - 3000		
4-1-2-2		setting month	M	0 - 12		
4-1-2-3		setting Day	T	0 - 31		
4-1-2-4		setting weekday		Mo - Su		
4-1-2		setting Time				
4-1-4-1		setting hour	h	0 - 24		
4-1-4-2		setting minute	min	0 - 59		
4-1-4-3		setting second	sec	0 - 59		

1) SSM - general fault message, SBM - general "system operational" message

In case of level control, relevant parameters are marked as follows: X in case of float switches
O in case of analog measurement

Table 3, editable parameters

6.7 Values displayed

Display parameters

Parameter No.:	Description	Unit
1-1-3	Niveau	%
1-1-4	Niveau digital	-
1-2-1	Pump Status 1	-
1-2-2	Pump Status 2	-
1-2-3	Pump Status 3	-
1-2-4	Pump Status 4	-
1-2-5	Pump Status 5	-
1-2-6	Pump Status 6	-
1-3-1	Operating Hours Pump 1	h
1-3-2	Operating Hours Pump 2	h
1-3-3	Operating Hours Pump 3	h
1-3-4	Operating Hours Pump 4	h
1-3-5	Operating Hours Pump 5	h
1-3-6	Operating Hours Pump 6	h
1-3-7	System Operating Hours	h
1-3-8	System Operating Frequency Converter	h
4-1-1	Date	DD:MM:JJ
4-1-3	Hours	HH:MM:SS
4-2-1	Softwareversion PLC	-
4-2-2	Softwareversion	-
4-2-3	Software-Revision	-

Table 4

6.8 Messages (alerts)

All monitoring and protective functions trigger warnings or alerts, and a message is output on the control unit display. If more than one message is output, the last one is displayed. Alerts have priority over warnings. To display current messages, choose the Diagnosis menu and then Warnings (2-2-1) or Alerts (2-3-1).

6.8.1 Resetting and acknowledging alerts

You can acknowledge alerts once the cause has been rectified. Alerts can be acknowledged individually in the alerts list in the Diagnosis menu under 2-1. When the system is reset, this causes all alerts to be reset too. The reset can be carried out via the control panel using the OK key (only possible in the start menu). You may have to press the ESC key several times to return to the start menu. Resetting alerts may cause the system to re-start.

Caution If the motor protection switch has tripped (addressing fault), switch off the power supply before reactivating the motor protection switch. The addressing fault can only be acknowledged by switching off the power supply or via remote acknowledgement.

6.8.2 Alert history

You can display the alert history in the Diagnosis menu under 2-1-1. The last few alerts are listed here.

You can use the navigation keys and the OK key to select an entry from the list.

Information about when the alert has come and gone is then displayed.

Display description

C: HHHH:MM Hours (H) and minutes (M) since alert has come

G: HHHH:MM Hours (H) and minutes (M) since alert has gone

6.9 Configuration examples

Manual mode

The individual pumps can also be operated manually without using the manual-0-automatic selector switches fitted in the door.

These functions can also be accessed via parameters 3-2-2-4 to 3-2-2-15.

Only pumps which have been recognised by the PLC as available can be switched to manual mode. Status information on the individual pumps can be accessed in the relevant menus.

Pump changeover

The following parameters must be set to enable pump changeover.

Parameter	Description
3-2-1-1	Start time of day of pump changeover
3-2-1-3	Repetition of pump changeover daily/weekly

Table 5

Functional check run

The following parameters must be set to enable the functional check run.

Parameter	Description
3-2-1-4	Start time of day of functional check run
3-2-1-5	Duration of functional check run
3-2-1-6	Repetition of functional check run daily/weekly

Table 6

7 Sensors

7.1 Digital control via float switches

The pumps are switched on and off as a function of the float switch positions. To achieve this, the float switches must be installed in the tank at different heights. The float switches must neither come to rest on the floor nor bump against the tank cover, if installed. Make sure that the float cannot get caught on any projecting parts, juts or similar in the tank. Depending on the function required, float switches which close the circuit in upper or lower position must be used (Fig. 9 and Fig. 10).

In order to protect the pumps against dry running, an additional float switch must be installed and connected to the control unit (see supplied circuit diagram).

Caution For high water monitoring, a separate alarm switchgear with its own float switch is required. This function is not integrated in the control unit.

7.1.1 Float switches with large hysteresis (e. g. EURO 2000)

The necessary delay for starting and stopping the pumps is ensured by the hysteresis of the float switches. Only one pump can be controlled via each float switch. The current level given in the display, thus, corresponds to that of the pumps running.

Float switch function:

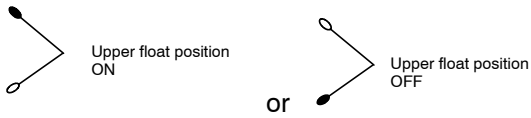


Fig. 8:

Tank drainage:

Example: Installation with 3 pumps

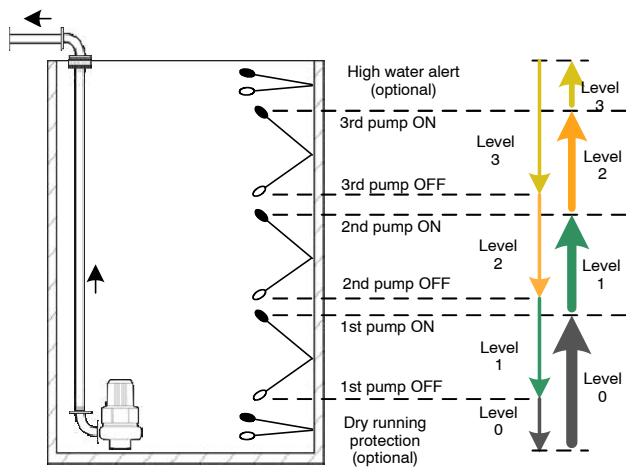


Fig. 9: Float switch positions for 3 pumps

Tank filling:

Example: Installation with 3 pumps

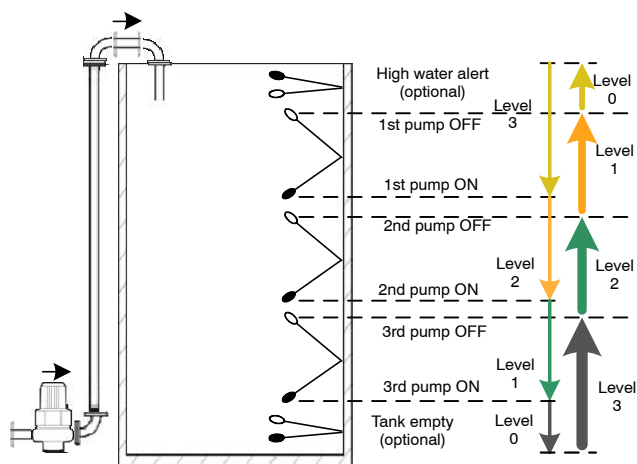


Fig. 10: Float switch positions for 3 pumps

7.1.2 Float switches with small hysteresis (e. g. Regul éco)

The start signal for the respective pumps is provided by the float switches for levels 1-n. However, only the level 0 float switch provides the signal to stop all pumps at once. Cascaded stopping of the pumps can be realised upon request. Only one pump can be controlled via each float switch. With this version, the level values given in the display only serve as information on the current level yet not on the number of pumps currently running.

Float switch function:

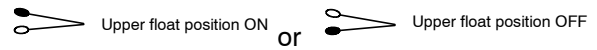


Fig. 11:

Tank drainage:

Example: Installation with 3 pumps

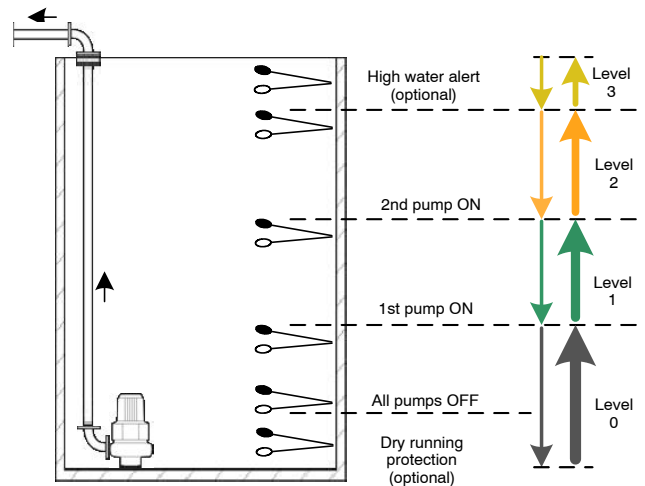


Fig. 12: Float switch positions for 3 pumps

Tank filling:

Example: Installation with 3 pumps

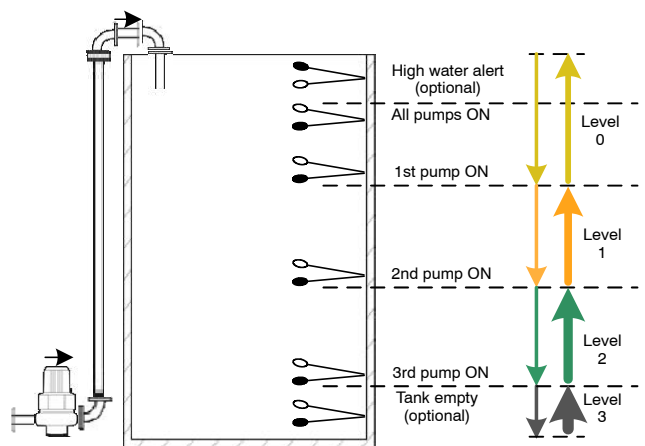


Fig. 13: Float switch positions for 3 pumps

7.2 Analog control via sensor

Caution If an analog sensor is used, an analog module must be installed in the control cabinet in addition to the PLC. The standard level control unit does not include this module.

A transmitter providing an analog signal of 4...20 mA/2...10 V, e.g. a level sensor, can be connected to the PLC's channel 1. Each pump will then be started up depending on the measured level. Users can individually set the start and stop levels for up to 6 pumps (parameters 30 to 35, range: 0..100 %). The current level is indicated in the display in percent. 0 - measuring range limit [m] = 0 - 100 %

Caution In installations with less than 6 pumps, all other levels must be set to 99 % (see the following examples in Fig. 14/Fig. 15 with 3 pumps).

Caution For high water monitoring, a separate alarm switchgear with its own float switch is required. This function is not integrated in the control unit.

7.2.1 Tank drainage

In this version, the level value given in the display means as follows:

- 0 % = tank is empty
- 100 % = tank is full

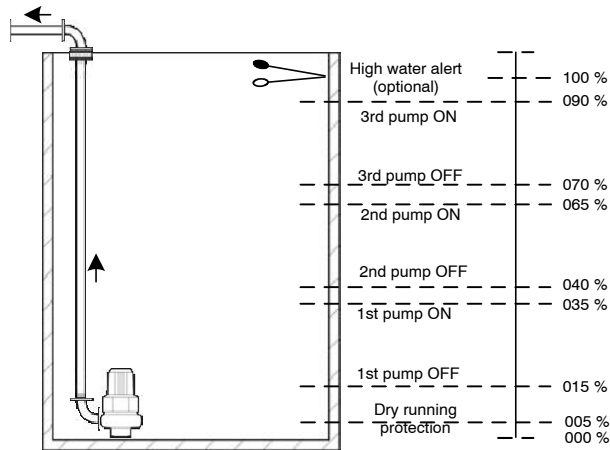



Fig. 14: Example of start and stop levels in an installation with 3 pumps

Start and stop level values (example: drainage):

Parameter:	Setting:
30 Level1 Baseload ON	35 %
30 Level1 Baseload OFF	15 %
31 Level2 Peakload1 ON	65 %
31 Level2 Peakload1 OFF	40 %
32 Level3 Peakload2 ON	90 %
32 Level3 Peakload2 OFF	70 %
33 Level4 Peakload3 ON	99 %
33 Level4 Peakload3 OFF	99 %
34 Level5 Peakload4 ON	99 %
34 Level5 Peakload4 OFF	99 %
35 Level6 Peakload5 ON	99 %
35 Level6 Peakload5 OFF	99 %

Caution If a level sensor is installed, its signal is also used for dry running protection (parameter 179.3). For this reason, a bridge must be fitted to the respective digital input (see supplied circuit diagram). In this example, the dry running protection (parameter 179) level is at 5 %.

 This is not sufficient when controlling pumps installed in potentially explosive atmospheres. A redundant minimum-level float switch is additionally required in this case!

7.2.2 Tank filling

In this version, the level value given in the display means as follows:

- 0 % = tank is full
- 100 % = tank is empty

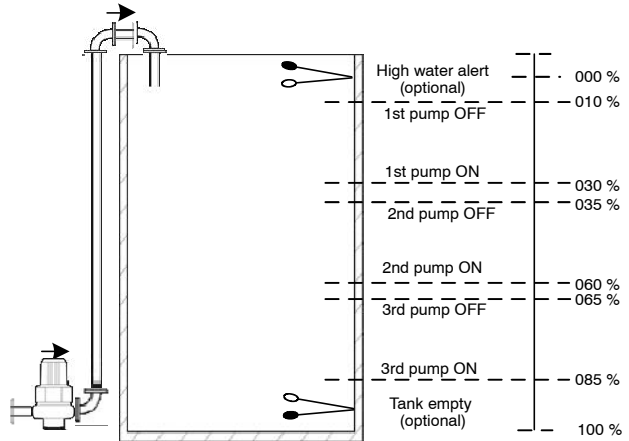


Fig. 15: Example of start and stop levels in an installation with 3 pumps

Start and stop level values (example: filling):

Parameter:	Setting:
30 Level1 Baseload ON	30 %
30 Level1 Baseload OFF	10 %
31 Level2 Peakload1 ON	60 %
31 Level2 Peakload1 OFF	35 %
32 Level3 Peakload2 ON	85 %
32 Level3 Peakload2 OFF	65 %
33 Level4 Peakload3 ON	99 %
33 Level4 Peakload3 OFF	99 %
34 Level5 Peakload4 ON	99 %
34 Level5 Peakload4 OFF	99 %
35 Level6 Peakload5 ON	99 %
35 Level6 Peakload5 OFF	99 %

Caution In order to protect the pumps against dry running, an additional digital transmitter (e.g. pressure switch) must be installed on the suction side and connected to the control unit (see supplied circuit diagram).

7.3 Dry running protection

7.3.1 Pressure/flow (digital)

A level sensor can be connected to the digital input X2/X3 (depending on version; see supplied circuit diagram) (parameter 185 = pressure/flow). If it drops off for more seconds than given under "Time" (parameter 187), the "Lack of water" message will be displayed and the pumps will be sequenced out. If the signal is available at the input again for more seconds than given under "Start" (parameter 187), the system will automatically restart.

7.3.2 Level (analog)

If a level detection sensor is connected to the analog input (see supplied circuit diagram), a limit (parameter 179) can be defined. If this value is not reached for more seconds than given under "Time" (parameter 179), the "Lack of water" message will be displayed and the pumps will be sequenced out. If the limit is achieved again for more seconds than given under "Start" (parameter 179), the system will automatically restart.



This is not permitted when controlling pumps installed in potentially explosive atmospheres.

8 Commissioning/start-up

8.1 General

The installation shall only be commissioned if all pertinent VDE (German Association of Electrical Engineers) specifications are met. Before starting up the switchgear and controlgear assembly make sure that:

- The pump cables have been connected
- Thermal protection (TCB) or thermistor (PTC) have been connected
- Cables have been connected according to the supplied circuit diagram (clockwise rotating field for three-phase drives)
- Float switches or level sensor have been installed and connected



Only after the mentioned equipment has been connected by a trained electrician may commissioning of the switchgear and controlgear assembly start.



Compliance with the terminal plan of the circuit diagram and the pump's operating instructions is of paramount importance when performing this work.

8.2 Commissioning/start-up

The following must always be done:

- Set master switch to "0".
- Set manual-0-automatic selector switch to "0".
- Verify whether the setting of the motor protection switch matches the rated current of the motor and adjust, if necessary.
- Set motor protection switch to "1".



The time relay for switching from star to delta is factory-set to 3 seconds and must be adjusted, if necessary.



Energise the system by switching the site-supplied fusing (e.g. automatic circuit breaker) "ON".

- Set master switch to "1".
- Check the pumps' direction of rotation if three-phase motors are used. To this end, temporarily set manual-0-automatic selector switch to "Manual". This must only be done for a short period and if the liquid level is above stop level. If either one or several pumps are running in the wrong direction of rotation, de-energise the system.
- Set master switch to "0".
- Switch site-supplied fusing (e.g. automatic circuit breaker) "OFF".
- If individual pumps are running in the wrong direction of rotation, interchange two cores of the motor cable.
- If all pumps are running in the wrong direction of rotation, interchange two cores of the power cable.
- Repeat commissioning after completion of the corrective measures.
- The respective pump's/system's operating manual must be complied with.

8.3 Shutdown

- Set manual-0-automatic selector switch to "0".
- If a master switch is fitted, set the same to "0".



De-energise the system before opening the control cabinet and the motor terminal box.



Use a voltmeter to verify that all phases are actually dead before commencing any work at the control cabinet.

8.4 Returning to service

- Set manual-0-automatic selector switch to "0".
- Verify whether the setting of the motor protection switch matches the rated current of the motor and adjust, if necessary.
- Energise the system.
- Verify direction of rotation. To this end, temporarily set manual-0-automatic selector switch to "Manual" (only if liquid level is above start level).
- The respective pump's operating manual must be complied with.

9 Typical applications

Level-dependent pump control with 3 pumps and analog control. The water level in the tank is identified by a sensor (4-20 mA signal). The measuring range limit (20 mA) equals 100 % of the displayed level. The switching points or the absolute water level in the tank must be determined by conversion.

Example: Tank drainage

The connected sensor provides a measuring range from 0 to 20 m. At 5 m one pump is to run, at 10 m two pumps are to run and at 15 m all three pumps are to run. Below 5 m all pumps are to be stopped.

Switching point 1 (Base load) 25 %, if the level is higher, one pump is running

Switching point 2 (Peakload1 ON) 50 %, if the level is higher, two pumps are running

Switching point 3 (Peakload2 ON) 75 %, if the level is higher, three pumps are running

At a water level of 8 m $(8/20 \cdot 100) = 40\%$ will be displayed.

Example: Tank filling

Here, the switching sequence is the other way round. Low water levels will require a larger number of pumps in operation than high water levels. If 4 mA are measured, 100 % will be displayed. In the example, one pump is to run at 15 m, two pumps are to run at 10 m and three pumps are to run at 5 m. Above 15 m, all pumps are to be stopped.

Switching point 1: 25 %, if the level is lower, one pump is running

Switching point 2: 50 %, if the level is lower, two pumps are running

Switching point 3: 75 %, if the level is lower, three pumps are running

If a water level of 8 m (12 m from top) is measured, $(12/20 \cdot 100) = 60\%$ will be displayed.

Starting of the second and third pump can be individually delayed via the "Peakload t ON" parameter. The stop delay (after-run time) of each pump can be set using the parameters "Baseload OFF" or "Peakload OFF". If the pump start and stop delays are set too short, very unsteady water levels may result in unstable system behaviour. Other settings (e.g. start and stop points for the individual levels) are described in detail in the parameter list.

10 Maintenance/checklist for commissioning maintenance

(For pump maintenance, refer to the pump's operating manual.)

Read the operating manual	<input type="checkbox"/> <input type="radio"/>
Check power supply Compare against name plate data	<input type="checkbox"/> <input type="radio"/>
Check earth conductor to ensure proper functioning (to EN 60439)	<input type="checkbox"/> <input type="radio"/>
Check direction of rotation	<input type="checkbox"/> <input type="radio"/>
Check automatic switching: Manual-0-automatic selector switch Pump changeover after each start/stop cycle Starting of stand-by pumps at peak load Changeover to stand-by pump if duty pump fails Set selector switch back to automatic mode	<input type="checkbox"/> <input type="radio"/>
Check setting of motor protection relay/switch	<input type="checkbox"/> <input type="radio"/>
Check current requirement of pump(s)	<input type="checkbox"/> <input type="radio"/>
Check changeover time from star to delta, required: approx. 3 sec	<input type="checkbox"/> <input type="radio"/>
Check connection of temperature switches (thermal circuit breakers). Do not interchange cables on pump side	<input type="checkbox"/> <input type="radio"/>
Re-tighten terminals: Pump(s) Mini control system Level transmitter	<input type="checkbox"/> <input type="radio"/>
Check fuses Size, characteristics, 3-pole mechanically interlocked	<input type="checkbox"/> <input type="radio"/>
Check switching mechanism Check level transmitter for jamming/incrustations and clean, if required	<input type="checkbox"/> <input type="radio"/> <input type="radio"/>
Check start and stop points	<input type="checkbox"/> <input type="radio"/>
Check alarm system for proper functioning	<input type="checkbox"/> <input type="radio"/>
Determine spare parts requirements; advise operating personnel	<input type="checkbox"/> <input type="radio"/>
Provide new operating manual (if necessary).	<input type="checkbox"/> <input type="radio"/>

11 Trouble-shooting

Pump not running	Fault lamp is lit	Pump has started, but stops above stop level	Fault lamp lights up after pump has started	Pump does not stop	Cause	Remedy
*					Manual-0-automatic selector switch set to "0"	Set to "Automatic".
*					Motor protection switch set to "0"	To switch on, set switch to "I".
*	*				Thermal circuit breakers not connected or not fitted.	Connect; if not fitted, connect bridge.
*					No control voltage	Check control fuse, replace with spare fuse, if necessary (Call in customer service to check after replacing a fuse).
*					No voltage in control unit power cable	Check.
*					Motor fuse has tripped.	Replace fuse (Call in customer service to check after replacing a fuse)
*	*	*	*		Thermal circuit breaker has tripped (applies to submersible motor pumps without jacket cooling only).	Pump will re-start after cooling down. (If thermal circuit breaker trips repeatedly, both pump and motor have to be checked mechanically and electrically by KSB's customer service!)
	*		*		Wrong setting of motor protection switch	Set to rated motor (pump set) current.
	*		*		Phase failure	Check power cable.
				*	Incorrect pump selection	Contact customer service centre.
	*				High water caused by pump not running	See "Pump not running".
*					Pump does not start up	ATEX: <ul style="list-style-type: none"> - Minimum-level float switch failed to release pump start-up - Fluid level below minimum level

Fault message	Description/cause	Remedy
Transmitter fault	Analog measured value signal supplied to the PLC input is < 4 mA (analog), or float switch is defective (digital)	Check measured value signal transmitter or check float switch (e.g. when the tank is being drained, the lowest float switch trips before the float switch at the next higher level).
Addressing fault	The mains contactor does not pick up (possible cause: 1 Contactor coil is defective. 2 Lower monitoring circuit (thermal circuit breaker) or motor protection switch or 3 upper limiting circuit tripped) or mains contactor picked up but 4 response contact is defective.	1 Replace mains contactor. In case of 2 , 3 : Determine cause and remedy problem. 4 Check response contact and replace, if required
Lack of water	Applies to tank drainage only: Water level is below the minimum permissible limit, i.e. the pumps might run dry	Increase water level
Automatic mode disabled	The selector switches of all pumps are set to a mode other than "automatic".	Delete the message on the display (press the + key); switch on selector switches; acknowledge fault
Automatic OFF	The automatic mode has been disabled via the display or the digital input	Set operating mode selector switch to "Auto", acknowledge fault

If the problem cannot be remedied with the above steps, call in KSB's customer service. Further investigation or switching point modifications may only be performed by KSB's customer service.



This work must be performed by a qualified electrician or a duly trained, experienced person as defined in DIN EN 50110-1.

12 Recycling

Hyatronic N consists of materials that can be separately recycled. Plastic components are marked in accordance with ISO 11 469.

EC Declaration of Conformity

Manufacturer:

KSB SE & Co. KGaA
Johann-Klein-Straße 9
67227 Frankenthal (Germany)

The manufacturer herewith declares that **the product:**

Hyatronic N

KSB order number:

- is in conformity with the provisions of the following Directives as amended from time to time:
 - EC Electromagnetic Compatibility Directive 2004/108/EC
 - EC Low-voltage Directive 2006/95/EC

The manufacturer also declares that

- the following harmonised international standards have been applied:
 - EN 60204-1,
 - EN 60439-1,
 - EN 61000-6-2, EN 61000-6-3

Frankenthal, 1 February 2012



Dr. Joachim Schullerer
Head of Product Development Automation
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