Control of the system, MLP RO pump station

Operating instructions

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Humidification pump
The pump is driven by a three-phase motor powered by magnet controlled protective motor switches. The control consists of a PLC-control system regulating the area humidity. The regulation takes place by means of PI regulators to ensure a precise regulation of the area humidity.

The PLC program is built up in such a way that you on the first start-up choose the number of active sections. If e.g. three sections are chosen, section 4 is disconnected in safety circuits and on display. On extensions, this choice can be repeated by using password 196.

In the control six hour meters are built in. One hour meter to indicate the operation time of the pump to be used when determining the service intervals, one hour meter for the RO pump and one hour meter for each of the four sections summarizing the humidification time.

Safety equipment
- **Pressure switch**
  The control is equipped with a locking device from the pressure switch placed on the inlet side of the RO pump, ensuring that the pump stops if the water pressure disappears.
  If the water pressure falls under shift pressure of the pressure switch, the display will show alarm text. Restart is done by pressing "Alarm reset".

- **Max hygrostat to secure against over-humidification**
  If the humidity rises to a value higher than the one adjusted on the max-hygrostat, the system is stopped and the alarm lamp will light. The display shows in which section the max-hygrostat is released.
  The system has two possibilities for switching on after error (chosen in the F6 area).

  If automatic switch on is chosen:
  If the system, before switching off, has run for minimum one hour (adjustable) without any MaxHygrostat error, it will be switched on automatically when the humidity is under the set value again. If a new error appears before one hour has passed (adjustable) it will not be switched on, but has to be switched on manually by pressing "Alarm reset".

  If manual switch on is chosen:
  The system only restarts after acknowledge by pressing "Alarm reset".

- **Thermostat**
  For protection of the high pressure pump the control is provided with a multi-stage measurement of temperature.

- **Phase sequence relay**
  The control is equipped with a phase sequence relay securing against wrong connection of the power cable. Both light-emitting diodes on relay E1, which is placed in the cabinet on the right, must light.
  In case of light in both diodes, the pumps will operate in the right direction. The relay also secures against safety break.

Selecting RO type

The software of the control is made universally as to language choice choice of MLP RO-type. The choice of RO-type takes place at the first pass by the fact that VERS RO xxx 1003 appears on the display.
Here you choose between different options. (Options are only possible together with the hardware changes)

Selecting options

You can choose between following options
- Load-dependent by-pass - fan control - raw water mixer.
The choice takes place as to the diagram below.
The screen will display VERS.   60_0 . Then press "Enter". The cursor will now blink under 0. Use the arrow keys to make the choice followed by "Enter"

	60 0	60 1	60 2	60 3	60 4	60 5	60 6
Load-dependent by-pass		X	X	X			
Raw water mixer			X		X		X
Fan control				X	X	X	

Selecting language

Having chosen RO-type, language choice must be made. The display shows LANGUAGE 1/3 xxx - where the variable is set to 1 - for DANISH - 2 - for ENGLISH - 3 - for GERMAN.

Version 60 0 rel 1006 >

To be used for 1 department with pressure release valve or for 4 departments with solenoid valve sets.
This has to be set up during the initial start.

Ex.1: 1 department with pressure release valve on the pump station:

Choose version: 60 X
Choose number of departments: 1
Press 2 for English
Press 0 for no membrane flush during start
Press F5
Type in password: 8599
Choose 0 at *Valve set* (default is 1)

Ex. 2: 3 departments with 3 solenoid valve sets

Choose version: 60 X
Choose number of departments: 3
Press 2 for English
Press 0 for no membrane flush during start

After having chosen type, language and options these only can be altered by typing the PASSWORD 8599. It is also possible to reset the whole system to the default settings by first activating the emergency stop and the deactivate it and holding the rest button for at least 25 seconds.
Using the password 8599 gives the possibility to change the membrane flush time. These may not be altered by others than authorized personnel from ML System a/s. If ML System a/s detects that the flush time has been altered all guarantee for the membrane will become void.

The control panel

The control system consists of a Siemens PLC 200-S7 and a control panel Siemens TD200. The control panel is used to show actual values and to change the various parameters used in the calculations of the control system.

The display shows the messages in two lines. If there are more than two messages, a flashing arrow - up or down - will mark that there are more messages. By pressing the arrow keys up / down you can scroll through the messages.

If you want to change a value, the cursor is placed on the desired line and you press enter. If the value is protected by a password, the display asks for password, and the values are changed by using the key arrows till you reach the desired value, and then press enter.
When the password is entered, the control system shows the actual value, and you can change with the key arrows up/down. When the desired value is reached, press enter, and the desired value will be entered in the control system.

The display is constructed with four F-keys which combined with the SHIFT key make eight areas for output and changes of values. The keys F4 and F8 are only used as reset keys.
The functions in F1-F2-F3 are reached by pressing the key directly. The F5-F6-F7 are reached by pressing SHIFT - now a flashing "S" appears in the lowest right corner. Now you can press the actual F key.

The display is in standard mode when none of the F-keys have been chosen. You press an F-key for example to read or change values.
You return by pressing alarm reset or another F-key.
Anyhow the display returns to standard mode after five minutes.

Password:
The setups in F5-7 are protected by password as described in the following.
If you need to use it, the display writes
PASSWORD   0

Another password for which you can be presented is when the display writes
PASSWORD REQUIRED
PASSWORD   0xxx
Here it is a password in order to enter and change the setup of the display for communicating with the PLC unit. The setup may by no means be changed.
You get out of this and back to normal setup by pressing the ESC key.

Normal indications

Indication in display	Explanation	Range	Standard
HUM. SECT.1 xx %RH	The humidity in % of the section concerned		
HUM. SECT.2 xx %RH	The humidity in % of the section concerned		
HUM. SECT.3 xx %RH	The humidity in % of the section concerned		
HUM. SECT.4 xx %RH	The humidity in % of the section concerned		

Alarm indications

Indication in display	Explanation	Range	Standard
- ALARM -	System in alarm - is always shown together with one of the following:		
MLPRO > 500 PUMP TOO HOT	The temperature of the pump is too high. Wait for the tank to cool and reset by pressing the reset-key		
MLPRO < 800 PUMP HOT - EMPTYING	The temperature of the pump is too high. The tank is emptied and the system automatically switches on again.		
SENSOR xx	The signal from the sensor of the section concerned is outside the range. The section is switched off, but will automatically be switched on when the signal is within the range again.		
INLET PRESSURE LOW	The inlet pressure of the system has been under the shift pressure of the pressure switch. Correct the error and recouple by pressing the reset-key.		
MAX.HYG xxx	The max-hygrostat of the section concerned has exceeded the set humidity. Recouple by pressing the reset-key.		
OVERFLOW	The tank is overfilled. Recouple by pressing the reset-key when the water level has dropped. Control the stop point of the level bar.		

Further indications

In the F1 area - Humidity

Indication in display	Explanation	Range	Standard
SP1 xx %RH	The desired humidity of the section concerned	0-MAX.SP	50
SP2 xx %RH	The desired humidity of the section concerned	0-MAX.SP	50
SP3 xx %RH	The desired humidity of the section concerned	0-MAX.SP	50
SP4 xx %RH	The desired humidity of the section concerned	0-MAX.SP	50

Note: SP x = 0 describes that FLU (see description under the F7 range) is put out of operation.

In the F2 area - Hour meters

Indication in display	Explanation	Range	Standard
SECT. 1 x.x HOUR	Indication of the time humidified in the individual section		
SECT. 2 x.x HOUR	Indication of the time humidified in the individual section		
SECT. 3 x.x HOUR	Indication of the time humidified in the individual section		
SECT. 4 x.x HOUR	Indication of the time humidified in the individual section		
PUMP x.x HOUR	Indication of the total operating time of the pump.		
PUMP RO x.x HOUR	Indication of the total operating time of the RO pump.		

In the F3 range - Indication of pump temperature

Indication in display	Explanation	Range	Standard
MLPRO > 500 PUMP TEMP xxxx °C	Indication of the pump working temperature in °C		

Change of values

F5-F6-F7

Indication in display	Explanation	Range	Standard
PASSWORD xxxx	Password for changing values.		197

The password for changing operating parameters in F5-F6-F7 is **197**.

If the password is set to **196**, a text is shown in the display saying that the number of active sections can be changed between 1-4.

The password is reset again by pressing the reset-key.

In the F5 range - Scaling of sensors

Indication in display	Explanation	Range	Standard
1-HIE x.xx *LOE x.xx	HIE - Highest electric signal from the humidity sensors. LOE - Lowest electric signal from the humidity sensors.	1,00 - 25,00 0 - 20,0	V - 8,00 MA - 4.20 V - 2,00 MA - 1,80
1-HI xx *LO xx	HI - Indication at the highest electric signal. LO - Indication at the lowest electric signal.	10 - 200 0 - 200	80,0 20
2-HIE x.xx *LOE x.xx	HIE - Highest electric signal from the humidity sensors. LOE - Lowest electric signal from the humidity sensors.	1,00 - 25,00 0 - 20,0	V - 8,00 MA - 4.20 V - 2,00 MA - 1,80
2-HI xx *LO xx	HI - Indication at the highest electric signal. LO - Indication at the lowest electric signal.	10 - 200 0 - 200	80,0 20
3-HIE x.xx *LOE x.xx	HIE - Highest electric signal from the humidity sensors. LOE - Lowest electric signal from the humidity sensors.	1,00 - 25,00 0 - 20,0	V - 8,00 MA - 4.20 V - 2,00 MA - 1,80
3-HI xx *LO xx	HI - Indication at the highest electric signal. LO - Indication at the lowest electric signal.	10 - 200 0 - 200	80,0 20
4-HIE x.xx *LOE x.xx	HIE - Highest electric signal from the humidity sensors. LOE - Lowest electric signal from the humidity sensors.	1,00 - 25,00 0 - 20,0	V - 8,00 MA - 4.20 V - 2,00 MA - 1,80
4-HI xx *LO xx	HI - Indication at the highest electric signal. LO - Indication at the lowest electric signal.	10 - 200 0 - 200	80,0 20

In the F6 range - Common parameters

Indication in display	Explanation	Range	Standard
MAX.SP xx %RH	The maximum limit for adjustment of the set points.	40-90	60
INTEGRATION xx MIN	Time indication before the integration regulation is 100%	0-100	25
PRESSOSTAT x.x SEC	Time delay of missing water pressure	0-10,0	20,0
FAN.CONTR. xx 0/2 (OPTION)	Choice of function for the fan control of the humidifying modules. (0) No fan automatic (1) Automatic control (2) The fans are operating constantly	0-2	0,0
MAX.HYG.AUT 0/1 xxxx	Choice of reset function for Max Hygrostat security. (0) Manual reset (1) Automatic reset - however max. once an hour.	0-1	0
MLPRO > 500 TEMP LIMIT1 xxxx °C	The limit value for step 1 of the temperature protection. The system will start producing fresh RO-water if this limit is exceeded. This function only runs once every 12 hours.	10-60	30
MLPRO > 500 TEMP LIMIT2 xxxx °C	The limit value for step 2 of the temperature protection. The bypass valve of the pump will open and flush the water if this limit is exceeded.	10-60	40
MLPRO > 500 TEMP LIMIT3 xxxx °C	The limit value for step 3 of the temperature protection. The pump will stop if this limit is exceeded and will not start before the system has cooled down and is re-started.	10-60	50
AUT.HYG.TIME xx.x SEC	Settting the security time for automatic reset of Max Hygrostat-circuit.	0-10,0	1,0
RV.MIX.MODE 0/1 xxxx (OPTION)	Choice of active raw water mixer (0) Not active (1) active	0-1	0,0
Bypass < xx l/t (OPTION)	Setting the opening level of the bypass fan	0-1000	60,0

In the F7 range - Setting parameters for the humidity regulators

Indication in display	Explanation	Range	Standard
1*PRO xx - PER xx.x	PRO - Proportional belt for humidity regulation of the section PER -The period (a pulse & and a pause) in the section indicated in seconds.	0-50 10-1000	20 60,0
1*MON xx.x -PAU xx.x	MON - The lowest pulse time during which can be humidfied in the section. (If the calculated time is less, the time is added to the calculation for the next period). Time is indicated in seconds. PAU -The time of the forced pause that minimum is held in each period. The time is indicated in seconds.	0-50,0 1-200,0	5,0 10,0
1*FLU xx.x - FLOW xx	FLU -The minimum time during which the section humidifies to ensure exchange of water in the hoses. The operation time is set in minutes per 30 minutes. FLOW - The capacity in the section - in liter per hour	0-2,0 0-1000	0,2 50
2*PRO xx - PER xx.x	PRO - Proportional belt for humidity regulation of the section PER -The period (a pulse & and a pause) in the section indicated in seconds.	0-50 10-1000	20 60,0
2*MON xx.x -PAU xx.x	MON- The lowest pulse time during which can be humidfied in the section. (If the calculated time is less, the time is added to the calculation for the next period). Time is indicated in seconds. PAU -The time of the forced pause that minimum is held in each period. The time is indicated in seconds.	0-50,0 1-200,0	5,0 10,0
2*FLU xx.x - FLOW xx	FLU -The minimum time during which the section humidifies to ensure exchange of water in the hoses. The operation time is set in minutes per 30 minutes. FLOW - The capacity in the section - in liter per hour	0-2,0 0-1000	0,2 50
3*PRO xx - PER xx.x	PRO - Proportional belt for humidity regulation of the section PER -The period (a pulse & and a pause) in the section indicated in seconds.	0-50 10-1000	20 60,0
3*MON xx.x -PAU xx.x	MON- The lowest pulse time during which can be humidfied in the section. (If the calculated time is less, the time is added to the calculation for the next period). Time is indicated in seconds. PAU -The time of the forced pause that minimum is held in each period. The time is indicated in seconds.	0-50,0 1-200,0	5,0 10,0

3*FLU xx.x - FLOW xx	FLU -The minimum time during which the section humidifies to ensure exchange of water in the hoses. The operation time is set in minutes per 30 minutes.	0-2,0	0,2
	FLOW - The capacity in the section - in liter per hour	0-1000	50
4*PRO xx - PER xx.x	PRO - Proportional belt for humidity regulation of the section	0-50	20
	PER -The period (a pulse & and a pause) in the section indicated in seconds.	10-1000	60,0
4*MON xx.x -PAU xx.x	MON- The lowest pulse time during which can be humidfied in the section. (If the calculated time is less, the time is added to the calculation for the next period). Time is indicated in seconds.	0-50,0	5,0
	PAU -The time of the forced pause that minimum is held in each period. The time is indicated in seconds.	1-200,0	10,0
4*FLU xx.x - FLOW xx	FLU -The minimum time during which the section humidifies to ensure exchange of water in the hoses. The operation time is set in minutes per 30 minutes.	0-2,0	0,2
	FLOW - The capacity in the section - in liter per hour	0-1000	50

Reset to standard values

All settings can be reset to standard settings by pressing emergency stop for at least 10 seconds.
Then the emergency stop is loosened while the red reset key is pressed, the display writes after approx. 5 sec. *INITIALIZING*. Then you can release the reset key