

Technical Manual
Stage Controller for Compressors &
Condenser Fans

ELREHA

Series **MSR x100 Master/Slave**

Software Version from 05221

Nr. 5311032-08/04 E



Please note
Safety
Instructions !

- Stage Controller for Compressor Compounds, Brine-Chillers and Condenser Fans
- By adding a Slave Module up to 8 stages controllable
- For Single- and Multi-Stage Compressors
- Inputs for 2-wire Pressure Transmitters, Pressostat and Temperature Sensors
- Automatic Stage Sequence Change
- Autoadaptive Trend Recognition
- Analogue Output 0-10V DC for Motordrives or Remote Displays
- 2nd Setpoint by internal clock
- Peak Load Limitation / Fast Backrun / Emergency Operation
- Alarm Limitations
- Compressor Idle Time
- Integrated operation time counters
- RS-485-Interface

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Technical Data

Supply Voltage	see type overview
Power Consumption	appr. 3,5 VA / module
Output Relays	4 x potential free
Contact Rating	8A cos phi=1, 3A ind. / 250V AC
Operating-/Storage-temperature	-10...+55°C / -30...+70°C
Ambient Humidity	max. 85% r.H., not condensing
Signal Inputs	4...20mA, Pressostat, 2x TF 201 / TF 501, selectable
Supply Voltage for 2-wire pressure transm.	appr. 24 VDC unreg., 23mA max
MSR 1100	appr. 12 VDC reg., 21mA max.
Display	LED 7-segm., red, char. height 13mm
Resolution	0,1
Control-/Display Range	see parameter listing
Data storage parameters ...	unlimited
Real Time Clock	clock backup appr. 10 days
Indicator LED's	3 mm, red
Digital Inputs MSR 31xx ...	like supply voltage, 3mA max.
MSR 11xx ...	external, potential free contact
Analogue Output	0-10 V DC, max. 3 mA
Resolution Analogue Outp. .	8 bit between limit parameters
Data Interface	E-Link (RS-485)
Electrical Connection	Screw terminals 2,5mm ²
Housing, Protection	
MSR 1100	77 x 35 mm, IP 54 from front
MSR 3100/23100	DIN-rail housing, IP 30

Further informations you will find on the parameter listing.

Accessories (please order separately)

- For usage with compressor compounds
- 2-wire pressure transmitter type DG 0/10 GSW with 4-20mA output signal
- For usage with condenser fans
- 2-wire pressure transmitter type DG 0/25 GSW with 4-20mA output signal
- For usage with brine-chillers
- 2 x temperature sensor TF 201 (PTC) or TF 501 (Pt 1000)
- For MSR 1100 only:
- Transformer 107-1300-0052 (220/12V / 5VA) or similar
- For 19"-module:
- 19"-subrack or panel housing



Type Overview

- MSR 1100 M** For standalone operation or as master, panel mounting, 12-24V AC/DC
- MSR 1100 S** Expansion (Slave) module, 12-24V AC/DC
- MSR 3100 M** For standalone operation or as master, for 35mm DIN-rail 230V~, 50-60 Hz
- MSR 23100 M** like above, but 115V~, 50-60 Hz
- MSR 3100 S** Expansion (Slave) module, for 35mm DIN-rail 230V~, 50-60 Hz
- MSR 23100 S** like above, but 115V~, 50-60 Hz

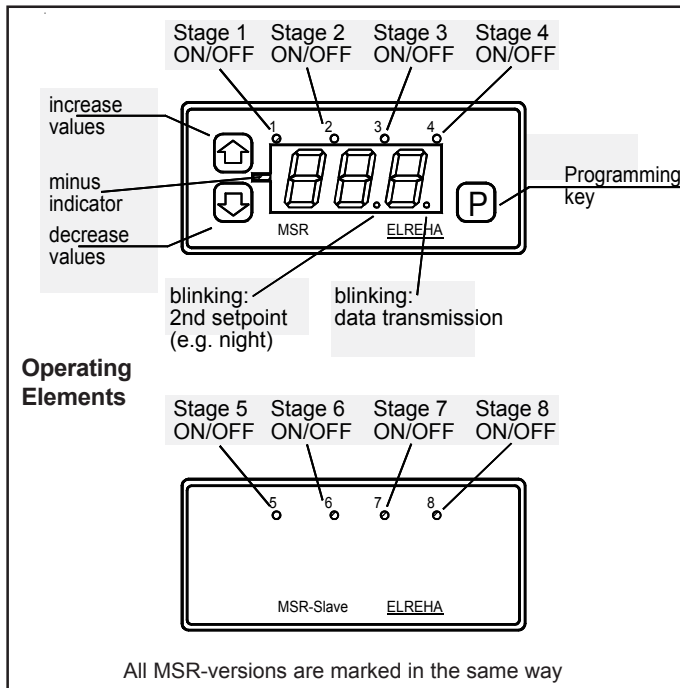
CONNECTION & SAFETY INFORMATION

Please read before Start-up 

The guarantee will lapse in case of damage caused by failure to comply with these operating instructions! We shall not be liable for any consequent loss! We do not accept liability for personal injury or damage to property caused by inadequate handling or non-observance of the safety instructions! The guarantee will lapse in such cases. Servicing or repair work may only be carried out by a specialist workshop.

-  • **Limit of Application:** This product is not designed nor manufactured for use in equipment or systems that are intended to be used under such circumstances that may affect human life. For applications requiring extremely high reliability, please contact the manufacturer first
- Electrical installation and putting into service must be done from authorized personnel.
- Please note the local safety instructions !
- Before installation: Check the limits of the controller and your application. Before starting up we recommend you to read the following instructions for use, since only by doing so you can avoid damage or malfunction and you will benefit all the advantages offered by this product.
-  • **During installation and wiring never work when the electricity is not cut-off !**
- **Never operate unit without housing.**
- **Connect the 'PE' terminal carefully to ground** because otherwise the operation of the internal noise filter will not work.
- Mounting the controller close to power relays is unfavourable in case of the electro-magnetic interference.
- Before applying voltage to the controller: Make sure that all wiring has been made in accordance with the wiring diagram in this manual. Check, if the supply voltage corresponds to the value printed on the type label.
- Respect the environmental limits for temperature and humidity. Outside these limits malfunctions may occur.
- Observe the maximum admitted current rate for the relays (see technical data). Compare with the peak start-up current of the controlled devices (valve, fan, compressor, heater..)
- Sensor cables may be up to some hundred meters in length. Use shielded sensor cable only. Don't install them in parallel with high-current cables to prevent inductive interference. A cross section of min. 0,5mm² is sufficient.
- Shielding has to be connected to PE at the end near the controller
- All used temperature sensors must be identical. Never use PTC (TF 201) and PT1000 (TF 501) mixed. This will not work.
- TF-type sensors are moisture-proof but they are not designed for being immersed in water for a long period of time. In such a case, always use dip-fittings.

Operating



Operating Elements

Parameters

All selectable parameters hold a parameter number (e.g. P03), you will find a listing on the next pages.

Calling up and editing

Press key 'P' parameter number appears
 Use '↑/↓' select desired parameter
 Press "P" again parameter value appears
 Use keys '↑/↓' adjust parameter value
 Press 'P' again value is stored, back to parameter no.

Auto scrolling

Hold '↑/↓'-keys to scroll values automatically.

Access Authorization

Key parameters have an access code requirement to prevent unauthorized changes from being made. All remaining parameters can be changed without an access code (see PARAMETER Listing on next page for parameters requiring code):

Press „P“ key parameter number is displayed
 Use "↑/↓" select „P54“
 Press „P“ again Display will show „00“
 Use "↑" set necessary code number (see parameters)
 Press „P“ again code is stored
 Use "↑/↓" select desired „P“ number to adjust

If no key is pressed within four minutes, the access code will cancel and authorization access lock will be restored automatically. The display switches back to parameter P01 (P03 if pressostat is selected).

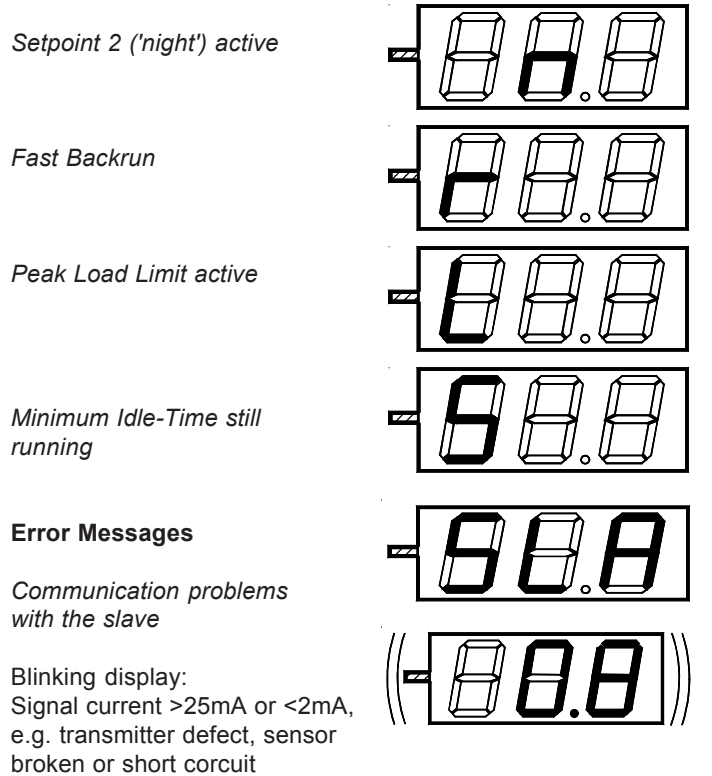
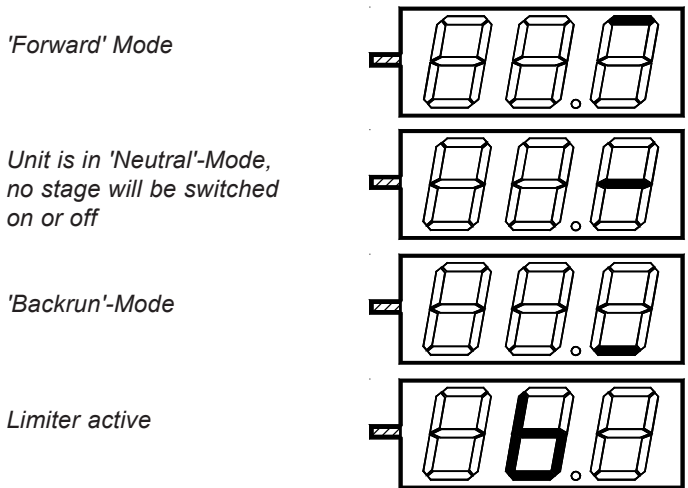
i After entering access code '70' to change parameters of the basic configuration, the unit initiates a fast backrun. The control functions start again, if the access code will be changed manually (e. g. to '88', to change other parameters) or automatically after 4 minutes.

i Reading the current operating mode
 Press and hold "P" longer than > 3 seconds
 One of this 3 values occur on the display:
 106 = Mode for compressor compounds
 206 = Mode for condenser fans
 300 = Mode for brine chillers

Operating-Mode Display / Error messages

Parameter **P03** offers a quick information about the actual state of the controller unit.
 If a 'Pressostat' is selected as input source, **P03** appears as standard display.

The following informations are possible:



Parameter Listing

Parameter	Oper.-mode			Code	Description	Default Values			Ranges	Your Val.
	Compressor	Fans	Brine-chiller			Compressor	Fans	Brine-Chiller		
P01	X	X	X	-	Temperature of water inlet sensor resp. pressure value	-	-	-		
P02			X	-	Temperature of Limitation sensor (water outlet)	-	-	-		
P03	X	X	X	-	Status of: forward/backward/peak load limitation					
P04*	X	X	X	-	Setpoint 1 (absolute, start of backrun)	0	0	0	within P12/P13	
P05		X	X	88	Setpoint 2 (relative to P04)		0	0	0...10.0	
P06		X	X	88	Setpoint 3 (relative to P05)		0	0	0...10.0	
P07		X	X	88	Setpoint 4 (relative to P06)		0	0	0...10.0	
P08		X	X	88	Setpoint 5 (relative to P07)		0	0	0...10.0	
P09		X	X	88	Setpoint 6 (relative to P08)		0	0	0...10.0	
P10		X	X	88	Setpoint 7 (relative to P09)		0	0	0...10.0	
P11		X	X	88	Setpoint 8 (relative to P10)		0	0	0...10.0	
P12*	X	X	X	88	Highest adjustable setpoint (for P04)	+30.0	+30.0	+50.0	-100.0..+100.0	
P13*	X	X	X	88	Lowest adjustable setpoint (for P04)	-1.0	-1.0	-50.0	-100.0...P08	
P14*	X	X	X	88	Hysteresis / Neutral Zone	2	2	2	0.5...10.0	
P15			X	88	Limitation temperature. <i>Below this value, all stages will be de-activated with their fixed backrun delay</i>			-100.0	-100.0..+100.0	
P16			X	88	Hysteresis of limitation temperature P15			2	0,2...10.0	
P17*		X	X	88	Upper alarm limit (relative to P04) <i>Value increased + P19 run down = alarm relay activated</i>	+31.0	+31.0	+100.0	-100.0..+100.0	
P18*	X	X	X	88	Lower alarm limit <i>Below this value all stages will be switched OFF in 1 sec steps, after P19 is run down, alarm relay will be activated.</i>	-1.0	-1.0	-100.0	-100.0..+100.0	
P19*	X	X	X	88	Alarm time delay	0	0	0	0...60 min	
P20	X	X	X	70	Power stages of compressor resp. fan 1	1	1	1	1...8	
P21	X	X	X	70	Power stages of compressor resp. fan 2	0	0	0	0...7	
P22	X	X	X	70	Power stages of compressor resp. fan 3	0	0	0	0...7	
P23	X	X	X	70	Power stages of compressor resp. fan 4	0	0	0	0...7	
P24	X	X	X	70	Power stages of compressor resp. fan 5	0	0	0	0...7	
P25	X	X	X	70	Power stages of compressor resp. fan 6	0	0	0	0...7	
P26	X	X	X	70	Power stages of compressor resp. fan 7	0	0	0	0...7	
P27	X	X	X	70	Power stages of compressor resp. fan 8	0	0	0	0...7	
P28	X	X	X	88	Forward time delay (valid for each stage)	10	10	10	0...600 sec	
P29	X	X	X	88	Backrun time delay (valid for each stage)	10	10	10	0...600 sec	
P30	X	X	X	88	Minimum idle time (valid for each stage)	0	0	0	0...20 min	
P31	X	X	X	70	Switching mode relay K1, K4 and K8 <i>(a) = active on, i.e. activated with alarm</i> <i>(p) = passive, i.e. de-activated with alarm</i> <i>Example: 7 compressors or or stages, relay 8 should be a passive alarm relay:</i> <i>P35 = 2 and P31 = 4</i>	0	0	0	0=K1(a), K4(a), K8(a) 1=K1(p), K4(a), K8(a) 2=K1(a), K4(p), K8(a) 3=K1(p), K4(p), K8(a) 4=K1(a), K4(a), K8(p) 5=K1(p), K4(a), K8(p) 6=K1(a), K4(p), K8(p) 7=K1(p), K4(p), K8(p)	
P32	X	X	X	88	Number of remaining stages after peak load limitation	2	2	2	0...4	
P33	X	X	X	70	Base load change (Stage Sequence Change)	0	0	0	0=OFF, 1=ON	
P34	X	X	X	88	Operating mode of digital input OK 1	0	0	0	0=OFF, 1=2nd setpoint 2=Peak Load Lim. 3=Fast Backrun	
P35					Master-/Slave-Mode <i>Fixes if the master module works standalone (1)</i> <i>or the slave module will be recognized (0 or 2).</i> <i>Additionally, the position of the alarm relay will be fixed.</i>	1	1	1	0=With Slave Module K4 is Alarm Relay 1=Single Operation (4 stages max.) 2=With Slave Module K8 is Alarm Relay	

Parameter Listing

Para- meter	Oper.- Mode			Code	Description	Default values			Ranges	Your Val.
	Compressor	Fans	Brine-chiller			Compressor	Fans	Brine Chiller		
P36	X	X	X	70	Sensor type	4	4	1	1 = TF 201 2 = TF 501 3 = customer spec. 4 = 4...20 mA 5 = Pressostat	
P37*	X	X	X	88	Calibration of pressure value resp. water return sensor value	0	0	0	-10.0...+10.0	
P38*			X	88	Calibration of Limitation Sensor			0	-10.0...+10.0	
P39*	X	X		88	(Upper) Pressure value of transmitter at 20 mA	30.0	30.0		-1.0...+30.0	
P40*	X	X		88	(Lower) Pressure value of transmitter at 4 mA	-1.0	-1.0		-1.0...P39	
P41	X	X	X	-	Remaining time forward/backrun delay	-	-	-		
P42*	X	X	X	-	Remaining time until an alarm will be activated	-	-	-		
P43*	X	X	X	88	2nd setpoint 1 ('night'-setpoint, replaces P04)	0	0	0	-100.0...+100.0	
P44*	X	X	X	88	Turn-ON time 'hours' of 2nd setpoint 1	0	0	0	0...23 h	
P45*	X	X	X	88	Turn-ON time 'minutes' of 2nd setpoint 1	0	0	0	0... 59 min	
P46*	X	X	X	88	Turn-OFF time 'hours' of 2nd setpoint 1	0	0	0	0...23 h	
P47*	X	X	X	88	Turn-OFF time 'minutes' of 2nd setpoint 1	0	0	0	0... 59 min	
P48*	X	X	X	88	Upper limit value of Analogue Output	0	0	0	-100.0...+100.0	
P49*	X	X	X	88	Lower limit value of Analogue Output	0	0	0	-100.0...P48	
P50*	X	X	X	88	Mode of Analogue Output	0	0	0	0=OFF 1=Proportional 2=Inversely Proport.	
P51	X	X	X	-	Clock time 'hours'	-	-	-		
P52	X	X	X	-	Clock time 'minutes'	-	-	-		
P53	X	X	X	-	Clock time 'seconds'	-	-	-		
P54	X	X	X	-	Access code	0	0	0	0...99	
r 01	X	X	X	cnbe	Operation time counter for relay K1 <i>value is the displayed value x 10</i>	0	0	0	9999 hours	-
r 02	X	X	X	cnbe	Operation time counter for relay K2 <i>value is the displayed value x 10</i>	0	0	0	9999 hours	-
r 03	X	X	X	cnbe	Operation time counter for relay K3 <i>value is the displayed value x 10</i>	0	0	0	9999 hours	-
r 04	X	X	X	cnbe	Operation time counter for relay K4 <i>value is the displayed value x 10</i>	0	0	0	9999 hours	-
r 05	X	X	X	cnbe	Operation time counter for relay K5 <i>value is the displayed value x 10</i>	0	0	0	9999 hours	-
r 06	X	X	X	cnbe	Operation time counter for relay K6 <i>value is the displayed value x 10</i>	0	0	0	9999 hours	-
r 07	X	X	X	cnbe	Operation time counter for relay K7 <i>value is the displayed value x 10</i>	0	0	0	9999 hours	-
r 08	X	X	X	cnbe	Operation time counter for relay K8 <i>value is the displayed value x 10</i>	0	0	0	9999 hours	-



X = Parameters visible depending on operation mode

***** = not available if a pressostat is used

Code 70 = control functions first starts if access code is reset (see 'operating')

cnbe = cannot be edited by the user

Functional Description

Selection of Operating Mode

The MSR can be configured for controlling compressor compounds, for condenser fans and brine chiller systems. While this configuration, all adjusted parameters will be erased and replaced by suggestive default values. Not necessary parameters will be suppressed.

- Switch power OFF
- Press and hold key 'P', switch on power
- Hold key 'P' until ' _ _ ' appears
- Let go key 'P'
- Select desired mode by key '↑'
- "1 _ _" = for compressors (input signal = pressure)
- "2 _ _" = for condenser fans (input signal = pressure)
- "3 _ _" = for brine-chillers (input signal = temperature)
- Press key 'P' once
- Display shows 'def', default values are loaded
- The actual value appears, ready for start up.

Operation Mode 1 (compressor compounds)

Input signals of the controller

The input signal comes from a 2-wire pressure transmitter with a 4-20 mA-signal or a pressostat, selectable by parameter **P36**.

Actual - and Status Display

P01 shows the pressure value of the transmitter. If the controller was configured for working with a pressostat, **P03** becomes the standard display.

P03 is a status display, which shows states like Forward/Backrun, Neutral State and others (see 'Operating'). From every state of the controller, 4 minutes after the last keypress the display switches back to the actual value.

Calibration of Transmitter and Actual Value

A pressure transmitter delivers its measured value by a 4-20 mA-signal. By **P39/P40** you select the pressure values which are shown and processed with 4 or 20 mA input current. With **P29** the actual value display (P01) can be adjusted.

Sensor Failures

If the input current is >25 mA or < 2 mA the MSR expects a malfunction of the transmitter. All stages will be switched ON with the selected delay, the display flashes. After the alarm delay is run down (**P15**) the alarm relay (K4) switches if available.

Limit values

If the pressure value falls short of the limitation value **P18**, all running stages will be de-activated in 1 second steps. After the alarm delay **P19** is run down, the alarm relay (K4) switches if available.

Operation Mode 2 (condenser fans)

Input signals of the controller

The input signal comes from a 2-wire pressure transmitter with a 4-20 mA-signal or a pressostat, selectable by parameter **P36**.

Actual - and Status Display

P01 shows the pressure value of the transmitter. If the controller was configured for working with a pressostat, **P03** becomes the standard display.

P03 is a status display, which shows states like Forward/Backrun, Neutral State and others (see 'Operating'). From every state of the controller, 4 minutes after the last keypress the display switches back to the actual value.

Calibration of Transmitter and Actual Value

A pressure transmitter delivers its measured value by a 4-20 mA-signal. With **P39/P40** you select the pressure values which are shown and processed with 4 or 20 mA input current. With **P29** the actual value display (P01) can be adjusted.

Sensor Failures

If the input current is >25 mA or < 2 mA the MSR expects a malfunction of the transmitter. All stages will be switched ON with the selected delay, the display flashes. After the alarm delay is run down (**P15**) the alarm relay (K4) switches if available.

Limit values

If the pressure value exceeds the limitation value **P17**, then, after the alarm delay **P19** is run down, the alarm relay (K4) switches if available.

Operation Mode 3 (Brine-Chillers)

Input signals of the controller

2 Temperature Sensors TF 201 (PTC) or TF 501 (Pt1000). The control sensor should be mounted at water reflux (brine backflow, chiller inlet). The second sensor measures the temperature limitation value at chiller's outlet. Select sensors by **P36**.

Actual - and Status Display

P01 shows the inlet temperature, **P02** shows the outlet temperature.

P03 is a status display, which shows states like Forward/Backrun, Neutral State and others (see 'Operating'). From every state of the controller, 4 minutes after the last keypress the display switches back to the actual value.

Calibration of Sensors and Actual Value

Correct the temperature displays by parameters **P37** and **P38**.

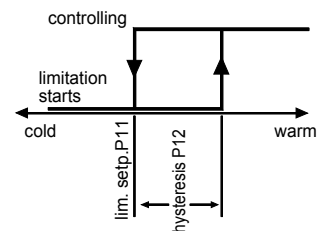
Sensor Failures

The display flashes, if a sensor has short circuit or is broken or a temperature exceeds the display range. All stages will be switched off with their backrun delay. After the alarm delay is run down (**P15**) the alarm relay (K4) switches if available.

Limit Values

Temperature Limitation

If the outlet temperature at sensor 2 falls short of **P15**, a regular backrun will be initiated and all stages will switch off after their delay (**P29**). **P16** is the hysteresis value for P11.



Frost Protection

If the inlet temperature falls short of **P18**, stages will be switched off in 1 second steps. After the alarm delay **P19** is run down, the alarm relay (K4) switches if available.

Temperature Alarm

If the inlet temperature exceeds **P17**, the alarm relay (K4) switches after the alarm delay **P19** is run down.

All Operating Modes

P42 always show the remaining time of the alarm delay.

2nd Control Setpoint 1 / 'night'-shift

Sometimes it is desired to shift the setpoints e.g. to spare energy at night. With **P43** a 2nd setpoint 1 will be fixed and can be activated by the internal time-switch or the digital input OK1.

Within the times set by **P44 - P47**, the second setpoint is active. If not necessary, the times can be set to "0". Please note that initiation by input OK1 has a higher priority than the internal clock.

Stage Controller

The control characteristic of the stages differ depending on the *operating mode* and the *selected sensors*. To prevent that the final user adjusts the setpoints to inadmissible values, the setpoint range can be limited by **P12** and **P13**.

Stage Controller + Pressure Transmitter (Compressors)

The control setpoint is preset by **P04** as a pressure value. There is no need for an access code. The hysteresis **P14** is located symmetrical around the control setpoint.

Forward (Stages on)

If the measured pressure value exceeds the setpoint (**P04 plus 1/2 P10** (hysteresis)), the forward delay **P28** will be started. After this timer is run down, a stage will be switched ON and the timer starts again. Read at **P41** if a delay time is still running and when a stage will be switched on or off.

Neutral zone

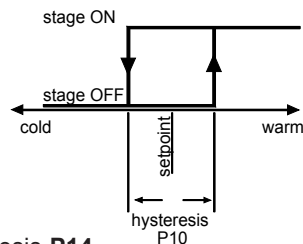
If the actual pressure value is located within the limits set by **P14** (hysteresis, located around the setpoint **P04**), then no stage will be activated or de-activated.

Backrun (Stages will be switched off)

If the actual pressure value falls short of **P04 minus 1/2 P10**, the backrun delay **P29** will be started. After this timer is run down, one stage will be switched off, the timer starts again, and so on.

Stage Controller + Press. Transmitter (Condenser Fans)

The control setpoint is preset by **P04** as a pressure value (this is the setpoint for stage 1 at the same time). There is no need for an access code. The following stages switch in a distance to the previous stage (**P05-P11**). The hysteresis **P14** is located symmetrical around the setpoints.



Forward (Stages on)

If the measured pressure value exceeds one of the setpoints (**P04 - P11 plus 1/2 P14** (hysteresis)), the forward delay **P28** will be started. After this timer is run down, the corresponding stage will be activated and the timer starts again. Read at **P41** if a delay time is still running and when a stage will be switched on or off.

Neutral zone

If the actual pressure value is located within the limits set by **P14** (hysteresis, located around all setpoints), then no stage will be activated or de-activated.

Backrun (Stages will be switched off)

If the actual pressure value falls short of a setpoint - **1/2 P14**, the backrun delay **P29** will be started. After this timer is run down, the corresponding stage will be switched off, the timer starts again, and so on.

Stage Controller + Pressostat (Compressors or Fans)

The MSR gets the Forward/Backrun informations from a Pressostat (or another potential free contact). Functions depending on analog informations are not available if this sensor is selected.

Forward (Stages on)

If the Pressostat is switched to 'Forward', the forward delay **P28** will be started. After this timer is run down, a stage will be switched ON and the timer starts again. Read at **P41** if a delay time is still running and when a stage will be switched on or off.

Neutral zone

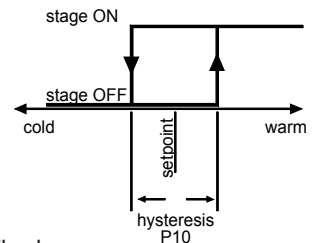
If the contacts of the Pressostat are open (mid position), then no stage will be activated or de-activated.

Backrun (Stages will be switched off)

If the Pressostat is switched to 'Backrun', the backrun delay **P29** will be started. After this timer is run down, one stage will be switched off, the timer starts again, and so on.

Stage Controller for Brine-Chillers

The control setpoint is preset by **P04** as a temperature value (this is the setpoint for stage 1 at the same time). There is no need for an access code. The following stages switch in a distance to the previous stage (**P05-P11**). The hysteresis **P14** is located symmetrical around the setpoints.



Forward (Stages on)

If the measured temperature value exceeds one of the setpoints **plus 1/2 P10** (hysteresis), the forward delay **P28** will be started. After this timer is run down, the corresponding stage will be activated and the timer starts again. Read at **P41** if a delay time is still running and when a stage will be switched on or off.

Neutral zone

If the actual value is located within the limits set by **P14** (hysteresis, located around each setpoint), then no stage will be activated or de-activated.

Backrun (Stages will be switched off)


If the actual temperature value falls short of a setpoint - **1/2 P14**, the backrun delay **P29** will be started. After this timer is run down, the corresponding stage will be switched off, the timer starts again, and so on.

Motor Control

The MSR-device is able to control up to 8 single motors or multi-stage machines with up to eight stages. The kind of machines and the number of stages will be fixed by parameters **P16 - P19**.

Example:

Compressor/ Fan	Programming								Relay Outputs							
	P20	P21	P22	P23	P24	P25	P26	P27	K1	K2	K3	K4	K5	K6	K7	K8
8x single	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1x 6-stages	6	0	0	0	0	0	0	0	1.1	1.2	1.3	AI	1.4	1.5	1.6	-
1x 6-stages	6	0	0	0	0	0	0	0	1.1	1.2	1.3	1.4	1.5	1.6	-	AI
3x 2-stages	2	2	2	0	0	0	0	0	1.1	1.2	2.1	AI	2.2	3.1	3.2	-
2x 2-stages and 2x single	2	2	1	1	0	0	0	0	1.1	1.2	2.1	AI	2.2	3	4	-

 **The position of the alarm relay depends on parameter P35. Standard: If the 4th (with single operation) resp. die 8th stage is not selected, then an alarm relay is available automatically. With P31 you can preset the alarm relay characteristic 'passive' (de-activated while an alarm) or active.**

Automatic Base Load Change (Stage Sequence Change)


The built-in base load change function (**P33 ON/OFF**) regards the relative runtimes of the single stages and cares for approximately the same motor runtimes after a longer time. If multistage machine types are used, only the runtime of the leading stage (= motor on) will be considered.

Trend Analysis (STAN)

The stage controllers of the series MSR contain an autoadaptive algorithm to recognize actual value tendencies (**STAN = Switch Tendency Analysis**). This algorithm effects an essential reduction of on/off cycles of the machines and a noticeable improved control accuracy. **STAN** works foreseeing, recognizes the trend of the actual value and decides, based on the captured data, about the necessity of switching on/off a machine.

A typical example of a conventional control is the following state: Machines run, the actual value approaches itself to the setpoint, the forward delay of the next stage is still running. If the next stage will switch on now, the tendency will be increased, probably the setpoint range will be left quickly to low values. The high deviation to low values then effects mostly that multiple or all machines switch off and a quick rise of the pressure with essential overshoot of the setpoint range. The plant 'oszillates'. This behaviour must be suppressed by increasing the switch delay times, but this makes the control slow and enables wider setpoint deviations.

STAN avoids the effects in this example: **STAN** recognizes that the actual value moves to the setpoint direction and disables that machines or stages will switch on. If the tendency continues, the setpoint will be reached without additional power. Oszillating or essential decreasing of the setpoint range will be avoided safely. **STAN** works completely autoadaptive, no parameters must be set. Because of the fuzzy logic of the algorithm, disadvantageous effects like moving setpoint deviations will be recognized, so they cannot affect the tendency analysis.

 **If the MSR works as a brine/chiller controller, STAN keeps disabled.**

Load Limitation


By the digital input OK1 a load limitation function can be initiated, e.g. for saving energy. **P32** fixes how many stages remain for control purposes after this function has been initiated, the stages will be disabled within a few seconds.

Minimum Idle Time


If a load is switched off by a relay, this relay can be switched on again not before the time set with **P30** is over. P30 affects all relay stages.

Relay Switching Mode

With **P31** the switching mode of relay K1, K4 and K8 can be changed for special purposes, e.g. for emergency operation or for using active OFF alarm relays (see parameter listing)

 **Essential Advantages Overview:**

- Trend recognition, the direction of the actual value's move will be recognized and the switch characteristic of the machines will be changed.
- Intelligent detection of 'oszillating', permanent setpoint deviations, which have no effect on the trend recognition.
- Autoadaptive, while run-up or service **STAN** requires no parameters to be set.

 **The single Advantages:**

- Essential reduction of on/off cycles and so an increased lifetime of components, especially of compressors.
- More accurate, more regular control with less setpoint deviations than a "normal" stage controller. This affects lower energy consumption and the cold production works with a constant, high efficiency ratio.
- The existing expansion valves work more regular and so more efficient, based upon the lower suction pressure variations resp, condenser pressure variations.
- The average ΔT falls. This affects a lower icing of the evaporators, and the product quality rises because of the lower de-humidifying (counters of meat/cheese, meat storages).
- The reaction times of the plant meet the demands, because the delay times must not be increased additionally to damp the switching behaviour.

Digital Input OK1

The digital input OK1 is normally connected to mains voltage. If this voltage is interrupted, the functions set with **P34** will be initiated.



Using the **MSR 1100 M** this functions must be started by opening an external, potential free switch connected to terminals 18 and 19.

! Never connect mains voltage to these terminals !

This external contact must be suitable for 5VDC/1mA.

- P34 = 0 Digital Input is **de-activated**
- P34 = 1 No voltage at the input (1100 M: contact open) changes to the **2nd setpoint**. The internal time switch is deactivated, i.e. the control input has a prior rank.
- P34 = 2 No voltage at the input (1100 M: contact open) initiates a **Peak Load Limitation**. The no. of stages, which remain for control purposes will be set by P24.
- P34 = 3 No voltage at the input (1100 M: contact open) starts a **Fast Backrun**, all stages will switch off 1 sec. steps.

Note: To prevent from being activated unintended, the functions of OK1 are de-activated while programming parameter P34.

Real time clock

The **MSR** Controller contains a real time clock (without a date function) which can be used for changing the control setpoint. The timer has a data backup for about 10 days in case of power failure.
 The time of the day can be set by parameters **P51 - P53**.
 The time switch is de-activated if ON and OFF-time are identical.

Voltage Output / Analogue Output

The MSR-Controller owns an analogue output with a 0-10 V DC-signal. Because this output is scalable, it can be used both to forward an image of the actual value **P01** or as proportional controller output.

- P48**.... fixes the actual value the analogue output delivers 10V (resp. 0V, if P50=2) DC voltage.
- P49**.... fixes the actual value the analogue output delivers 0V (resp. 10V, if P50=2) DC voltage.
- P50**.... switches the analoue output ON or OFF and fixes it if the voltage should rise (P50=1) or fall (P50=2) if the actual value rises.

Example for a Actual Value Forwarding:
 You want to use a remote display or similar, which shows 0 bar with 0V input and 10 bar with 10V input.

P49 = "0", P48 = "+10", P50 must be "1".

Example for a Proportional Controller:
 You want to control a three-way valve. This valve should be half open at 5.0 bar. If the pressure falls, the valve should open, from 4 bar the valve should be full open. If the pressure rises, the valve should be narrowed, from 6 bar it should be closed.

P49 ="4.0", P48 ="6.0", P50 ="2"

Operation Time Counter

Each relay output owns an individual operation time counter. This counter measures and totalizes the time this output was activated. The values can be read at "**r01**" thru "**r08**". Because the display has 3 digits only, the stored value is "*displayed value x 10*". After 9999 hours the counter will be reset to "0". A reset by the user is not possible.

Start Up Examples

MSR as Compressor Compound Controller

Requirement:

8 single compressors, stage 1 configured for emergency operation, automatic base-load change.

Control setpoint 2 bar, neutral zone 0,5 bar. pressure transmitter 4-20 mA, range 0-10 bar. Night operation (2nd setpoint) within 19:00 and 7:00, 0,5 bar higher. Forward/Backrun delay 10 sec. The user want to see the actual pressure value on a remote display with 0-10V-input. While a peak load limitation initiated by OK1, 2 stages remain for control purposes.



Please always note the Safety Information on page 2 !

Select Operation Mode

- Switch OFF power supply
- Push and hold key 'P', switch ON power
- Hold key 'P' until ' _ _ ' appears
- Let go key 'P'
- Select '1 _ _ ' by key '↑'
- (compressor compound mode)
- Push key 'P' once
- 'def' appears, default values are loaded
- Actual values appear, ready for start up.

Basic Configuration



Enter Code Number '70' at **P54**

- P20=1 (single compressor at relay K1)
- P21=1 (single compressor at relay K2)
- P22=1 (single compressor at relay K3)
- P23=1 (single compressor at relay K4)
- P24=1 (single compressor at relay K5)
- P25=1 (single compressor at relay K6)
- P26=1 (single compressor at relay K7)
- P27=1 (single compressor at relay K8)
- P31=1 (relay K1 inverted, load at N/C)
- P33=1 (base load change ON)
- P35=0 (slave module applied)
- P36=4 (transmitter with 4-20 mA signal)



Enter Code Number '88' at **P54**

Adjustments

- P39=10.0 (press. value transmitter at 20 mA)
- P40=0.0 (press. value transmitter at 4 mA)
- P04=2.0 (control setpoint)
- P14=0.5 (neutral zone / hysteresis)
- P28=10 (forward delay in sec.)
- P29=10 (backrun delay in sec.)
- P32=2 (2 stages remain after peak load lim.)
- P34=2 (OK 1 configured for peak load lim.)
- P43=2.5 (2nd control setpoint)
- P44=19 (2nd setpoint ON 'hours')
- P45=00 (2nd setpoint ON 'minutes')
- P46=07 (2nd setpoint OFF 'hours')
- P47=00 (2nd setpoint OFF 'minutes')
- P48=10 (analog outp. -> 10VDC at 10 bar)
- P49=0 (analog output -> 0V at 0 bar)
- P50=1 (analog output works proportional)
- P51=--(clock time 'hours')
- P52=--(clock time 'minutes')
- P53=--(clock time 'seconds')

Display correction

The actual pressure display **P01** can be calibrated by using **P37**.

MSR as Condenser Fan Controller

Requirement:

3 single fans, no emergency mode, automatic base-load change.

Control at 15, 16, 17 bar, neutral zone 0,5 bar each. Pressure transmitter 4-20 mA, range 0-25 bar. Night operation (2nd setpoint) within 20:00 and 6:30, 2 bar higher. Forward/Backrun delay 30 sec.



Please always note the Safety Information on page 2 !

Select Operation Mode

- Switch OFF power supply
- Push and hold key 'P', switch ON power
- Hold key 'P' until ' _ _ ' appears
- Let go key 'P'
- Select '2 _ _ ' by key '↑'
- (condenser fan mode)
- Push key 'P' once
- 'def' appears, default values are loaded
- Actual values appear, ready for start up.

Basic Configuration



Enter Code Number '70' at **P54**

- P20=2 (fan 1 ON at relay K1)
- P21=2 (fan 1, stage 2 at relay K2)
- P22=2 (fan 2 ON, at relay K3)
- P23=0 (fan 2, stage 2 at relay K4)
- P24=0 (fan 3 ON at relay K5)
- P25=0 (fan 3, stage 2 at relay K6)
- P26=0 (relay K8 is automatically configured)
- P27=0 (as an alarm relay)
- P33=1 (base load change ON)
- P35=2 (slave module applied, K8 is alarm rel.)
- P36=4 (transmitter with 4-20 mA signal)



Enter Code Number '88' at **P54**

Adjustments

- P39=25.0 (press. value transmitter at 20 mA)
- P40=0.0 (press. value transmitter at 4 mA)
- P04=15.0 (control setpoint stage 1)
- P05=1.0 (setpoint stage 2 in a distance to P04)
- P06=1.0 (setpoint stage 3 in a distance to P05)
- P07=1.0 (setpoint stage 4 in a distance to P06)
- P08=1.0 (setpoint stage 5 in a distance to P07)
- P09=1.0 (setpoint stage 6 in a distance to P08)
- P14=0.5 (neutral zone / hysteresis)
- P28=20 (forward delay in sec.)
- P29=20 (backrun delay in sec.)
- P31=0 (no emergency mode)
- P43=17.0 (2nd control setpoint 1)
- P44=20 (2nd setpoint ON 'hours')
- P45=00 (2nd setpoint ON 'minutes')
- P46=06 (2nd setpoint OFF 'hours')
- P47=30 (2nd setpoint OFF 'minutes')
- P51=--(clock time 'hours')
- P52=--(clock time 'minutes')
- P53=--(clock time 'seconds')

Display correction

The actual pressure display **P01** can be calibrated by using **P37**.

MSR as Brine-Chiller Controller

Requirement:

4 dual-stage compressors, no emergency mode, automatic base load change.

Control at 4 - 12°C, hysteresis 0,5 K each. Temperature sensor TF 501, night operation (2nd setpoint) within 20:30 and 6:00, 2 K higher. Forward/Backrun delay 25 sec.



Please always note the Safety Information on page 2 !

Select Operation Mode

- Switch OFF power supply
- Push and hold key 'P', switch ON power
- Hold key 'P' until ' _ _ ' appears
- Let go key 'P'
- Select '3 _ _ ' by key '↑'
- (Brine-Chillers)
- Push key 'P' once
- 'def' appears, default values are loaded
- Actual values appear, ready for start up.

Basic Configuration



Enter Code Number '70' at **P54**

- P20=2 (compressor 1 ON, relay K1)
(compr. 1 power stage ON, relay K2)
- P21=2 (compressor 2 ON, relay K3)
(compr. 2 power stage ON, relay K4)
- P22=2 (compressor 3 ON, relay K5)
(compr. 1 power stage ON, relay K6)
- P23=2 (compressor 4 ON, relay K7)
(compr. 2 power stage ON, relay K8)
- P33=1 (base load change ON)
- P35=0 (slave module applied)
- P36=2 (temperature sensor TF 501)



Enter Code Number '88' at **P54**

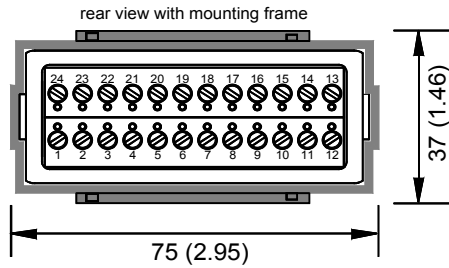
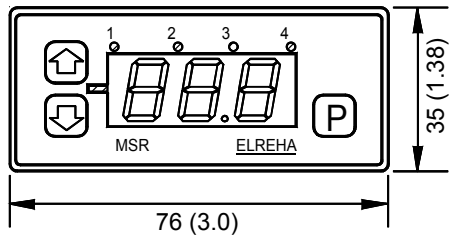
Adjustments

- P04=4.0 (control setpoint stage 1)
- P05=1.0 (setpoint stage 2 in a distance to P04)
- P06=1.0 (setpoint stage 3 in a distance to P05)
- P07=1.0 (setpoint stage 4 in a distance to P06)
- P08=1.0 (setpoint stage 5 in a distance to P07)
- P09=1.0 (setpoint stage 6 in a distance to P08)
- P10=1.0 (setpoint stage 7 in a distance to P09)
- P11=1.0 (setpoint stage 8 in a distance to P10)
- P14=0.5 (neutral zone / hysteresis)
- P28=25 (forward delay in sec.)
- P29=25 (backrun delay in sec.)
- P31=0 (no emergency mode)
- P43=6.0 (2nd control setpoint 1)
- P44=20 (2nd setpoint ON 'hours')
- P45=30 (2nd setpoint ON 'minutes')
- P46=06 (2nd setpoint OFF 'hours')
- P47=00 (2nd setpoint OFF 'minutes')
- P51=--(clock time 'hours')
- P52=--(clock time 'minutes')
- P53=--(clock time 'seconds')

Display correction

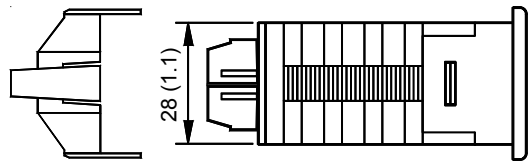
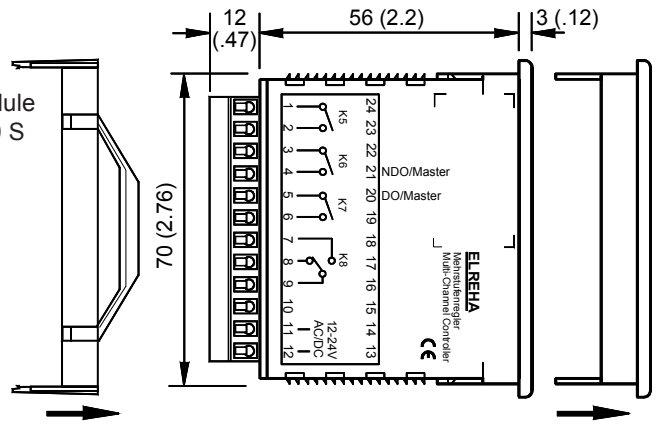
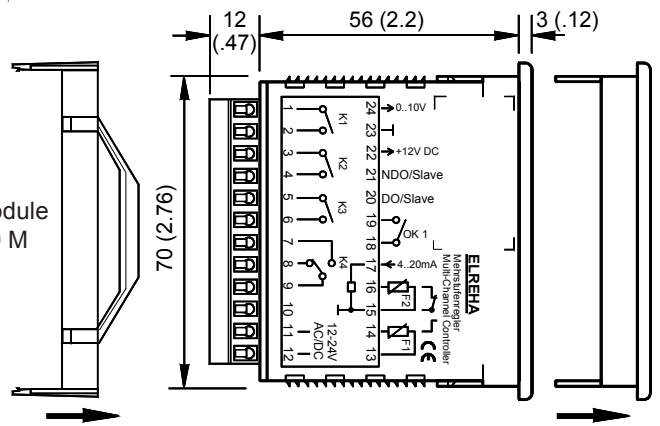
The 2 actual temperature displays can be calibrated by **P37** (P01, inlet temperature) and **P38** (P02, outlet temperature).

Dimensions MSR 1100

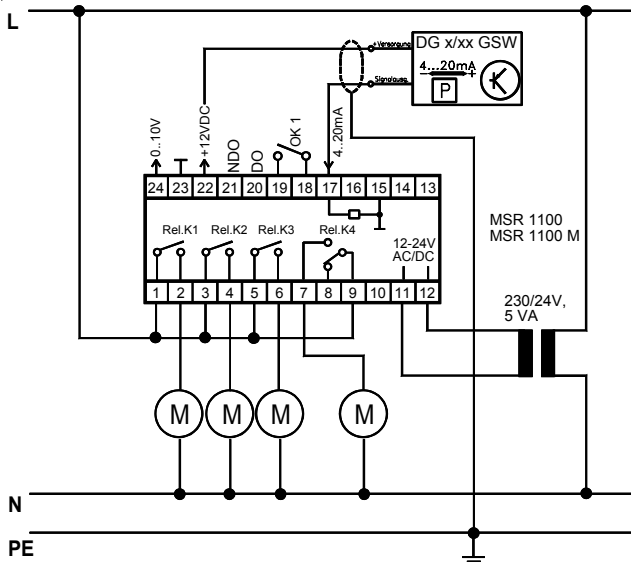


Master module
MSR 1100 M

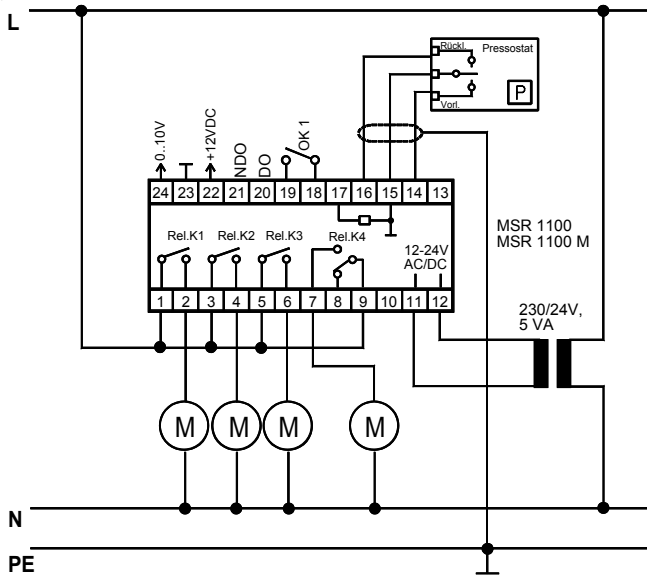
Slave module
MSR 1100 S



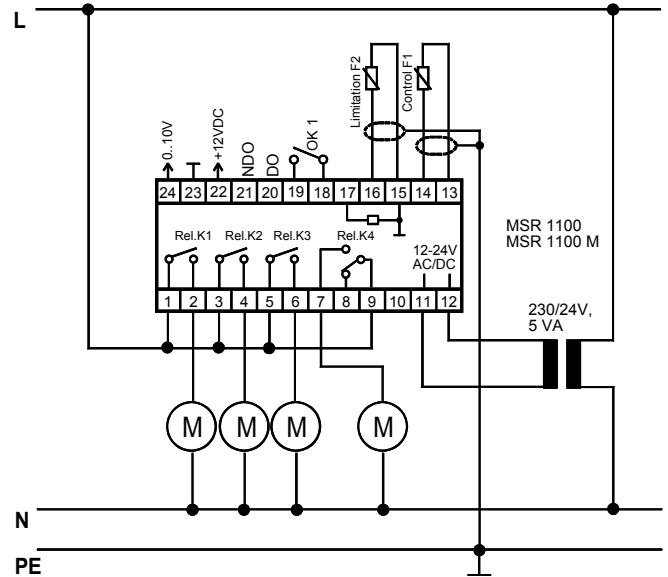
Connection MSR 1100 (simplified pictures)



MSR 1100 with 2-wire pressure transmitter.

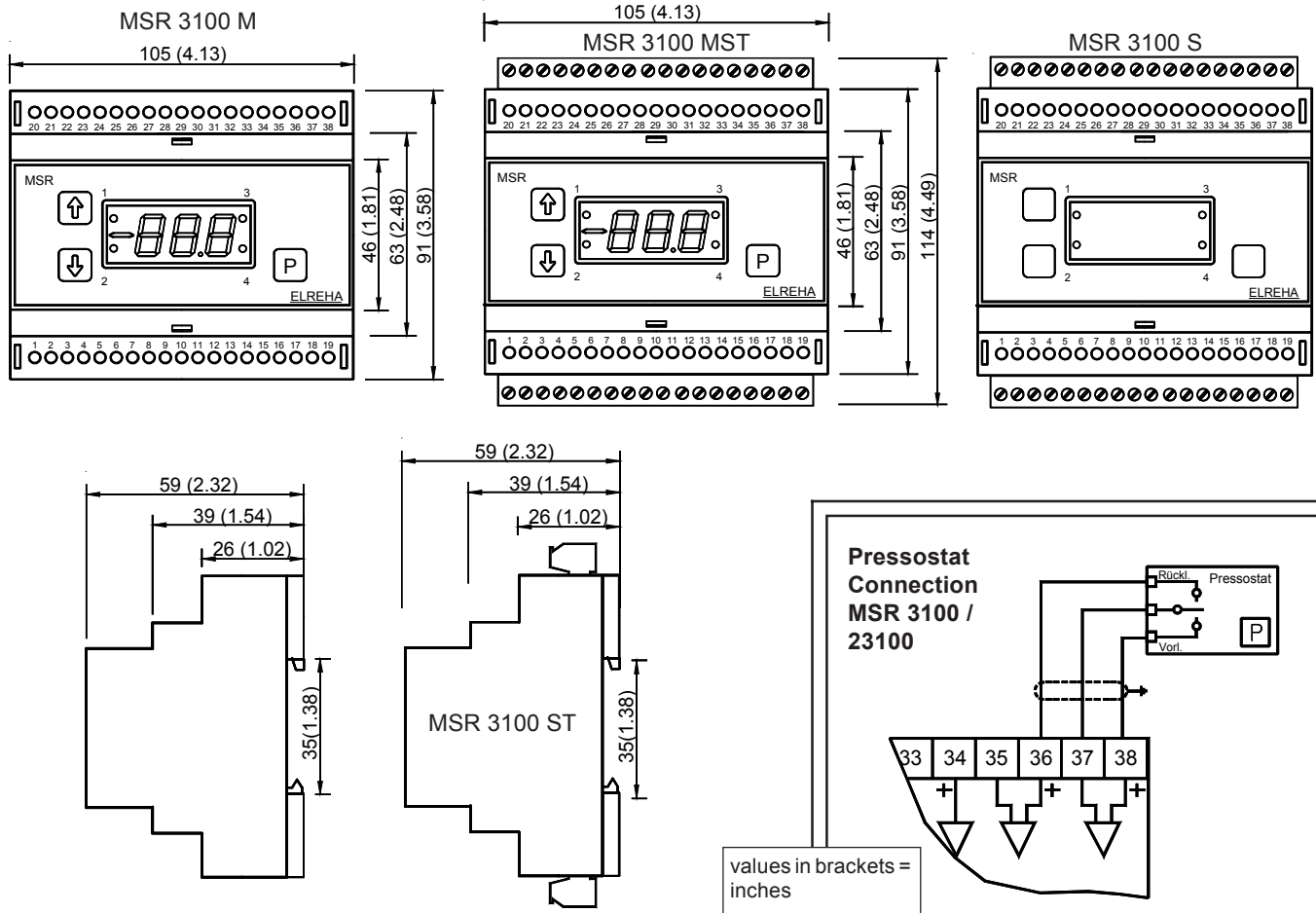


MSR 1100 with Pressostat

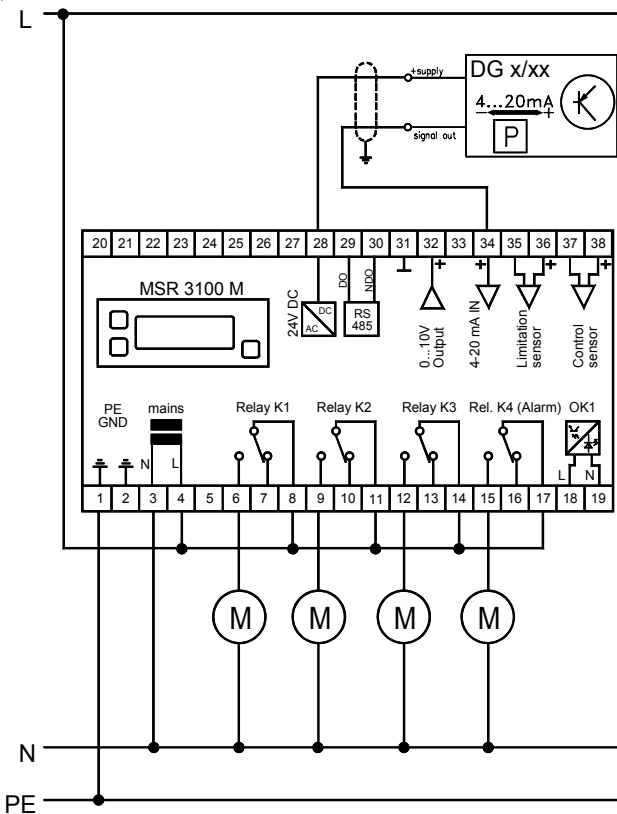


MSR 1100 with 2 temperature sensors for controlling a brine-chiller.

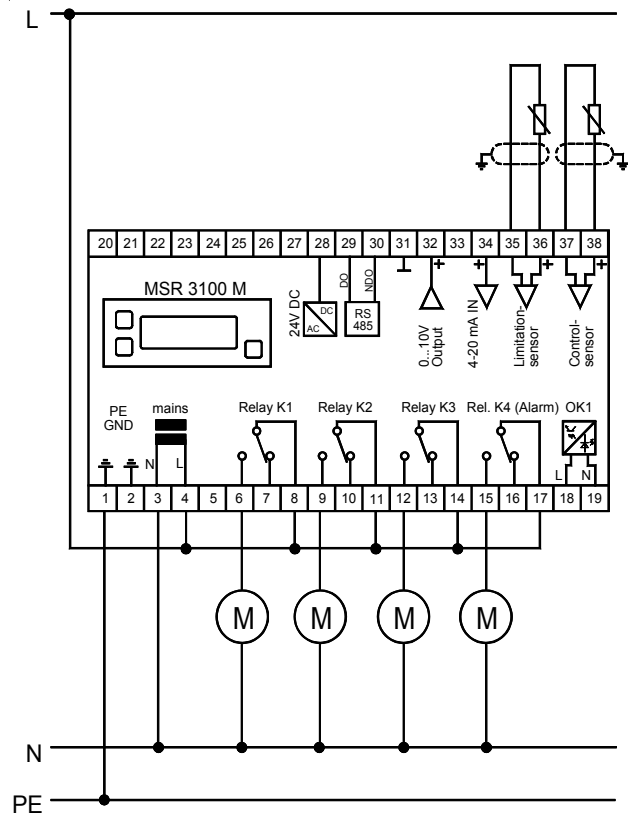
Dimensions MSR 3100 / 23100 / 3100 ST



Transmitter Connection MSR 3100 / 23100 (simplified picture)



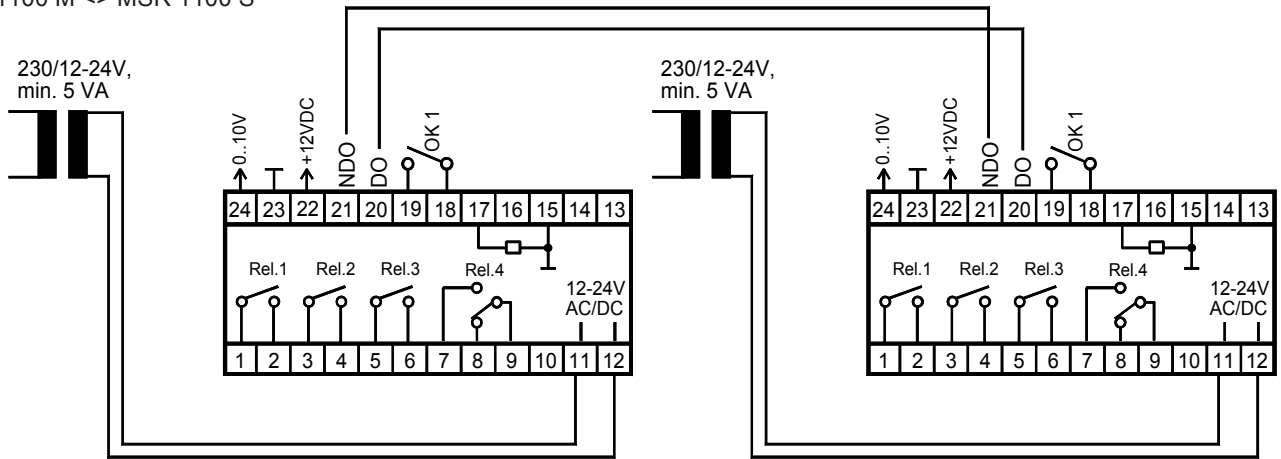
Temperature Sensor Connection MSR 3100 / 23100 (for chillers, simplified picture)



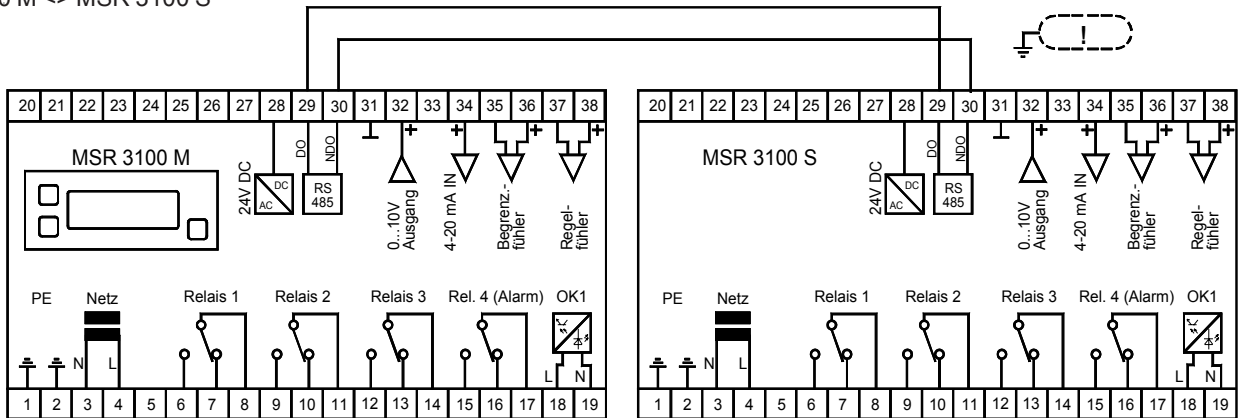
Adding a Slave Module

- The "Master-" and the "Slave-" device must be seen as one unit. The MSR 1100-type device can be supplied from a single or several transformers but may not be switched off separately.
- They must be mounted close together, to keep the connection cable as short as possible.
- Parameter P35 must be set to "0" or "2". With this, the master expects a slave module.
- If communication problems occur, the error message "SLA" appears.
- If communication fails for more than 30 sec., the stages switch off beginning with relay K8 in 1 sec. steps. If the communication problem is solved, the slave switches its stages on, beginning with relay K5.
- If less than 8 stages are selected, the position of the alarm relay depends on parameter P35.

Connection
MSR 1100 M <-> MSR 1100 S



Connection
MSR 3100 M <-> MSR 3100 S



EG-Konformitätserklärung



Für das beschriebene Erzeugnis wird hiermit bestätigt, daß bei bestimmungsgemäßem Gebrauch die Anforderungen eingehalten werden, die in der Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedsstaaten über die elektromagnetische Verträglichkeit (89/336/EWG) und der Niederspannungsrichtlinie (73/23/EWG) sowie der Änderungsrichtlinien (93/68/EWG) festgelegt sind. Diese Erklärung gilt für alle Exemplare, auf die sich die vorliegende Bedienungsanleitung (die selbst Bestandteil dieser Erklärung ist) bezieht. Zur Beurteilung des Erzeugnisses hinsichtlich elektromagnetischer Verträglichkeit und der Niederspannungsrichtlinie wurden jeweils die aktuellen Ausgaben der betreffenden Grund- und Fachgrundnormen herangezogen.

Diese Erklärung wird verantwortlich vom Hersteller/Importeur

abgegeben durch:

ELREHA Elektronische Regelungen GmbH
D-68766 Hockenheim

Werner Roemer, Technischer Leiter

(Name / Anschrift)

Hockenheim.....**04.07.2003**.....
 Ort Datum  Unterschrift

This manual, which is part of the product, has been set up with care and our best knowledge, but mistakes are still possible. If you have any problems, difficulties or questions please don't hesitate asking our technical support. Technical details can be changed without notice, especially the software. Please note that the described functions are only valid for units containing the software with the version-number shown on page 1. Units with an other software number can work a little bit different. You will find this software number on the label of the unit too.

set up 21.4.06 by: tkd/jr	checked: 24.4.06 by: ek/al	approved: 25.4.06 by: mv/mh	
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