Technical Manual
Stage Controller for Compressors & Condenser Fans

ELREHA

MSR x100

Software Version 020710

Nr. 5311032-05/05 E

MSR 1100
MSR 3100
MSR 3100 ST
MSR 5100
MSR 19100
MSR 23100
MSR 25100
MSR 29100

Please note Safety Instructions !

By replacing older types (x106, x206, x300): Controllers must be configured while start up !

NEW

- **Stage Controller for Compressor Compounds, Brine-Chillers and Condenser Fans**
- **Up to 4 Stages**
- **For Single- and Multi-Stage Compressors**
- **Inputs for 2-wire Pressure Transmitters, Pressostat and Temperature Sensors**
- **Automatic Base-Load Change (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**

Contents

Technical Data

Supply Voltage	see type survey
Power Consumption	appr. 3,5 VA
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 19"-module: char. height 10mm
Resolution	0,1
Control-/Display Range	see parameter listing
Data storage parameters	typ. 10 years
Real Time Clock	clock backup appr. 10 days
Indicator LED's	3 mm, red
Control Inputs (Optocpl.)	like mains voltage, 3mA max. (MSR 1100: 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 19"-module: DIN41612"F"-connector
Housing, Protection	
MSR 1100	77 x 35 mm, IP 54 from front
MSR 3100/23100	DIN-rail housing, IP 30
MSR 5100/25100	96 x 48 mm, IP 54 from front
MSR 19100/29100	19", 8 TE

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 condernser 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 ..... panel mounting, 12-24V AC/DC
MSR 3100 ..... for 35mm DIN-rail 230V~, 50-60 Hz
MSR 3100 ST ..... like above, but pluggable terminals
MSR 5100 ..... panel mounting, 230V~, 50-60 Hz
MSR 19100 ..... 19"-module, 8TE, 230V~, 50-60 Hz
MSR 23100 ..... for 35mm DIN-rail 110V~, 60 Hz
MSR 25100 ..... panel mounting, 110V~, 60 Hz
MSR 29100 ..... 19"-module, 8TE, 110V~, 60 Hz

Safety Instructions

Please read before Start-up

- Electrical Installation and Start Up must be done from authorized personnel.
- This product may only be used for the purposes listed on page 1.
- Please note the local safety instructions !
- Before using the controller, please check if the unit fits the application.
- 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 unit's type label.
- Please pay attention to the specified Temperature-/Humidity Limits. Outside these limits malfunctions may occur.
- **Never operate unit without housing.**
- **Please note maximum load of relay contacts (see technical data).**
- **Important ! Please note the starting-currents and current timing of the load.**

Manufacturer:

ELREHA Controls

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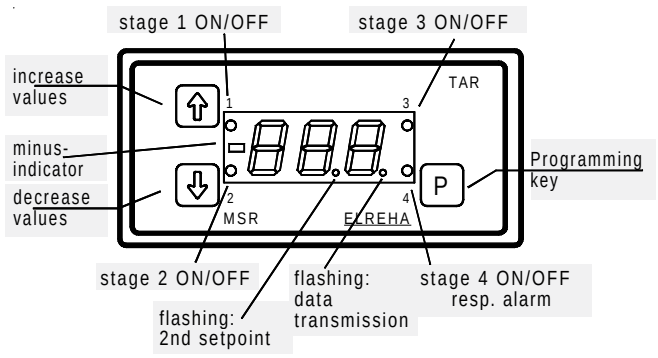
Operating

Operating Elements



All MSR-versions are marked in the same way

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.

Unlock Keys

To prevent un-authorized persons from editing parameter values, there is a locking function which allows only the most important parameters to be changed at any time. All other parameters must be unlocked beforehand. This means that at parameter **P48** a certain value is to be set (see parameter listing) :

Press key "P" ..... parameter number appears
Use "⇧/⇩" ..... select code parameter (P48)
Press "P" again ..... parameter value appears
Use "⇧" ..... set value to 88 or 70 (see parameters)
Press "P" again ..... value is stored, back to parameter no.

If no key is hit for about four minutes, the access code is cancelled and the editing function is locked automatically.
The display switches back to parameter P01 (P03 if pressostat is selected).

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.

Reading the current operating mode

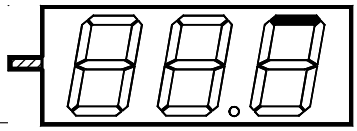
Press and hold "**P**" longer than > 3 seconds
One of this 3 values occur on the display:
106 = Mode for compressor compounds
206 = Mode for condenser fans
300 = Mode for brine chillers

Operating-Mode Display

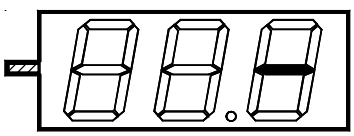
Parameter **P03** offers a quick information about the actual state of the controller unit.
If a 'Pressostat' is selected as input source, **P03** appears as standard display.

The following informations are possible:

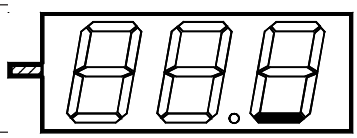
'Forward' Mode



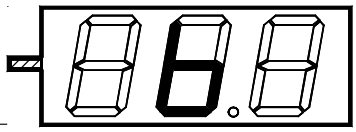
Unit is in 'Neutral'-Mode, no stage will be switched on or off



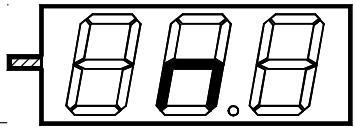
'Backrun'-Mode



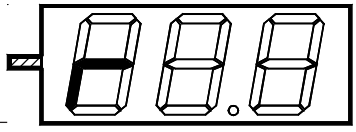
Limiter active



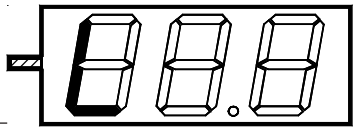
Setpoint 2 ('night') active



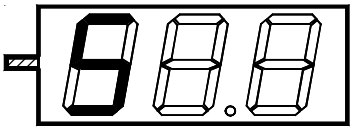
Fast Backrun



Peak Load Limit active



Minimum Idle-Time still running



Parameter Listing

Para-meter	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	Limited by P08/P09	
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 P04)		0	0	0...10.0	
P08*	X	X	X	88	Setpoint high limit (for P04)	+30.0	+30.0	+50.0	-100.0..+100.0	
P09*	X	X	X	88	Setpoint low limit (for P04)	-1.0	-1.0	-50.0	-100.0...P08	
P10*	X	X	X	88	Hysteresis / Neutral Zone	2	2	2	0.5...10.0	
P11			X	88	Limitation temperature. *Below this value, all stages will be de-activated with their fixed backrun delay*			-100.0	-100.0..+100.0	
P12			X	88	Hysteresis of limitation temperature P11			2	0,2...10.0	
P13*		X	X	88	Upper alarm limit (relative to P04) *Above this value and P15 is run down, alarm relay (if available) will be activated*	+31.0	+31.0	+100.0	-100.0..+100.0	
P14*	X	X	X	88	Lower alarm limit *Below this value all stages will be switched OFF in 1 sec steps, after P15 is run down, alarm relay will be activated.*	-1.0	-1.0	-100.0	-100.0..+100.0	
P15*	X	X	X	88	Alarm time delay	0	0	0	0...60 min	
P16	X	X	X	**70**	Power stages of compressor resp. fan 1	1	1	1	1...4	
P17	X	X	X	**70**	Power stages of compressor resp. fan 2	0	0	0	0...3	
P18	X	X	X	**70**	Power stages of compressor resp. fan 3	0	0	0	0...3	
P19	X	X	X	**70**	Power stages of compressor resp. fan 4	0	0	0	0...3	
P20	X	X	X	88	Forward time delay (valid for each stage)	10	10	10	0...600 sec	
P21	X	X	X	88	Backrun time delay (valid for each stage)	10	10	10	0...600 sec	
P22	X	X	X	88	Minimum idle time (valid f. each stage)	0	0	0	0...20 min	
P23	X	X	X	**70**	Switching mode relay K1 and relay K4	0	0	0	0=K1 act./K4 act. 1=K1 pass./K4 act. 2=K1 act./K4 pass. 3=K1 pass./K4 pass.	
P24	X	X	X	88	Number of remaining stages after peak load limitation	2	2	2	0...4	
P25	X	X	X	**70**	Base load change (Stage Sequence Change)	0	0	0	0=OFF, 1=ON	
P26	X	X	X	88	Operating mode of control input OK 1	0	0	0	0=OFF, 1=2nd setpoint 2=Peak Load Lim. 3=Fast Backrun	
P27	X	X	X	88	Operating mode of control input OK 2 (**Not available in MSR 1100, 3100 and 23100, must be set to "0"**)	0	0	0	0=OFF, 1=2nd setpoint 2=Peak Load Lim. 3=Fast Backrun	
P28	X	X	X	**70**	Sensor type	4	4	1	1 = TF 201 2 = TF 501 3 = customer spec. 4 = 4...20 mA 5=Pressostat	

Parameter Listing

Para-meter	Oper.-Mode			Code	Description	Default values			Ranges	Your Val.
	Compressor	Fans	Brine-chiller			Compressor	Fans	Brine.Chiller		
P29*	X	X	X	88	Calibration of pressure value resp. water return sensor value	0	0	0	-10.0...+10.0	
P30			X	88	Calibration of Limitation Sensor			0	-10.0...+10.0	
P31*	X	X		88	(Upper) Pressure value of transmitter at 20 mA	30.0	30.0		-1.0...+30.0	
P32*	X	X		88	(Lower) Pressure value of transmitter at 4 mA	-1.0	-1.0		-1.0...P31	
P33	X	X	X	-	Remaining time forward/backrun delay	-	-	-		
P34*	X	X	X	-	Remaining time until an alarm will be activated	-	-	-		
P35*	X	X	X	88	2nd setpoint 1 ('night'-setpoint, replaces P04)	0	0	0	-100.0..+100.0	
P36*	X	X	X	88	ON-time 'hours' of 2nd setpoint 1	0	0	0	0...23 h	
P37*	X	X	X	88	ON-time 'minutes' of 2nd setpoint 1	0	0	0	0... 59 min	
P38*	X	X	X	88	OFF-time 'hours' of 2nd setpoint 1	0	0	0	0...23 h	
P39*	X	X	X	88	OFF-time 'minutes' of 2nd setpoint 1	0	0	0	0... 59 min	
P40	X	X	X	88	Adress of the unit in a network	78	78	78	1...78	
P41	X	X	X	88	Data transmission speed (Baudrate)	4	4	4	1 = 1200 2 = 2400 3 = 4800 4 = 9600 5 = 19200	
P42*	X	X	X	88	Upper limit value of Analogue Output	0	0	0	-100.0..+100.0	
P43*	X	X	X	88	Lower limit value of Analogue Output	0	0	0	-100.0...P42	
P44*	X	X	X	88	Mode of Analogue Output	0	0	0	0=OFF 1=Proportional 2=Inversely Proport.	
P45	X	X	X	-	Clock time 'hours'	-		-		
P46	X	X	X	-	Clock time 'minutes'	-		-		
P47	X	X	X	-	Clock time 'seconds'	-		-		
P48	X	X	X	-	Access code	0	0	0	0...99	
r 01	X	X	X	cnbe	Operation time counter for relay K1 *value is the displayed value x 10*	0	0	0	9999 hours	-
r 02	X	X	X	cnbe	Operation time counter for relay K2 *value is the displayed value x 10*	0	0	0	9999 hours	-
r 03	X	X	X	cnbe	Operation time counter for relay K3 *value is the displayed value x 10*	0	0	0	9999 hours	-
r 04	X	X	X	cnbe	Operation time counter for relay K4 *value is the displayed value x 10*	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 **P28**.

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 Foreward/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 **P31/P32** 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 **P14**, all running stages will be de-activated in 1 second steps. After the alarm delay **P15** 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 **P28**.

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 Foreward/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 **P31/P32** 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 **P13**, then, after the alarm delay **P15** 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 **P28**.

Actual - and Status Display

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

P03 is a status display, which shows states like Foreward/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

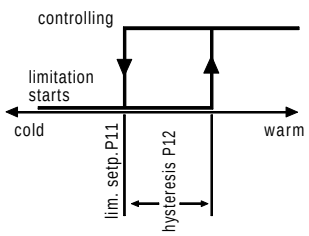
Correct the temperature displays by parameters **P29** and **P30**.

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 **P11**, a regular backrun will be initiated and all stages will switch off after their delay (**P21**). **P12** is the hysteresis value for P11.



Frost Protection
If the inlet temperature falls short of **P14**, stages will be switched off in 1 second steps. After the alarm delay **P15** is run down, the alarm relay (K4) switches if available.

Temperature Alarm
If the inlet temperature exceeds **P13**, the alarm relay (K4) switches after the alarm delay **P15** is run down.

All Operating Modes

P34 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 **P35** a 2nd setpoint 1 will be fixed and can be activated by the internal time-switch or the control inputs OK1/OK2.
Within the times set by **P36** thru **P39** the second setpoint is active. If not necessary, the times can be set to "0". Please note that initation by OK-input has more priority as the internal clock.

Stage Controller

The control characteristic of the stages differ depending on the *operating mode* and the *selected sensors (**P28**)*.
To prevent that the final user adjusts the setpoints to an inadmissible value, the setpoint range can be limited by **P08** and **P09**.

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 **P10** is located symmetrical around the control setpoint.

Forward (Stages on)

If the measured pressure value exceeds the setpoint **(P04 plus ½ P10** (hysteresis), the forward delay **P20** will be started. After this timer is run down, a stage will be switched ON and the timer starts again. Read at **P33** if a delay time is still running and when a stage will be switched on or off.

Neutral zone

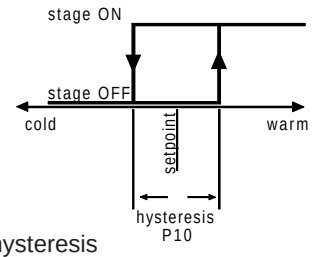
If the actual pressure value is located within the limits set by **P10** (hysteresis, located around the setpoint), then no stage will be activated or de-activated.

Backrun (Stages will be switched off)

If the actual pressure value falls short of **P04 minus ½ P10**, the backrun delay **P21** 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, P06, P07**). The hysteresis **P10** is located symmetrical around the setpoints.



Forward (Stages on)
If the measured pressure value exceeds one of the setpoints **(P04 - P07) plus ½ P10** (hysteresis), the forward delay **P20** will be started. After this timer is run down, the corresponding stage will be activated and the timer starts again. Read at **P33** 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 **P10** (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 **- ½ P10**, the backrun delay **P21** 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 **P20** will be started. After this timer is run down, a stage will be switched ON and the timer starts again. Read at **P33** if a delay time is still running and when a stage will be switched on or off.

Neutral zone

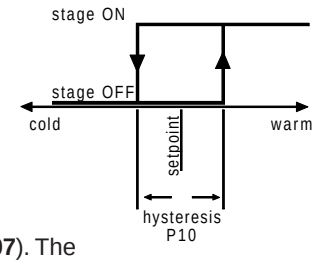
If the contacts of the Pressostat are open (mid position), then no stage will be activated or de-activated.

Backrun (Stages will be switched off)

If the Pressostat is switched to 'Backrun', the backrun delay **P21** 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, P06, P07**). The hysteresis **P10** is located symmetrical around the setpoints.



Forward (Stages on)
If the measured temperature value exceeds one of the setpoints **(P04 - P07) plus ½ P10** (hysteresis), the forward delay **P20** will be started. After this timer is run down, the corresponding stage will be activated and the timer starts again. Read at **P33** 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 **P10** (hysteresis, located around all setpoints), 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 **- ½ P10**, the backrun delay **P21** 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-unit can control up to 4 single motors or multi-stage machines with up to four stages.
The kind of machines and the number of stages will be fixed with parameters **P16** thru **P19**.

Example:

	Programming				***Relay outputs Machine***			
	P16	*P17*	P18	P19	K1	K2	K3	K4
4 single machines	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
1 multistage (4 stages)	*4*	*0*	*0*	*0*	*1.1*	*1.2*	*1.3*	*1.4*
2 dual stage machines	*2*	*2*	*0*	*0*	*1.1*	*1.2*	*2.1*	*2.2*
1 dual stage and two single machines	*2*	*1*	*1*	*0*	*1.1*	*1.2*	*2*	*3*

!! If stage No.4 is not selected, relay K4 works as an alarm relay automatically !!

Automatic Base Load Change (Stage Sequence Change)

The built-in base load change function (**P25** 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.

Load Limitation

Via one of the both control inputs OK1/OK2 a load limitation function can be initiated, e.g. for saving energy. **P24** fixes how many stages remain for control purposes after this function has been started, 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 **P22** is over. P22 affects all relay stages.

Relay Switching Mode

With **P23** the switching mode of relay K1 and K4 can be changed for special purposes:

P23 = 0 K1 and K4 active ON
Standard setting

P23 = 1 K1 active OFF (relay de-activated), K4 active ON
*With this setting e.g. an **emergency operation** can be realized, compressor 1 will be controlled by the N/C so it would run continuously if the MSR fails.*

P23 = 2 K1 active ON, K4 active OFF
*Advisable if only 3 compressors/stages should be controlled and you want to use relay K4 as an active OFF **alarm relay**.*

P23 = 3 K1 active OFF, K4 active OFF
Can be used for emergency operation & alarm relay controlling 3 compressors or if compressor 1 and 4 should run in emergency mode.

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 increased 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 foreward 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 complety 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.

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 △T 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.

Control Inputs

The control inputs OK1/OK2 are normally connected to mains voltage. If this voltage is interrupted, the functions set with **P26** and **P27** will be initiated.

Using the **MSR 1100** this function must be started by opening an external, potential free switch connected to terminals 18 and 19. Input OK2 is not available.

! Never connect mains voltage to these terminals !

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

0= Control Input is **de-activated**

1= No voltage at the input (1100: contact open) changes to the **2nd setpoint**. The internal time switch is deactivated, that means the control input has a prior rank.

2= No voltage at the input (1100: contact open) initiates a **Peak Load Limitation.** The no. of stages, which remain for control purposes will be set by P24.

3= No voltage at the input (1100: contact open) starts a **Fast Backrun**, all stages will be de-activated in 1 sec. steps.

Note: To prevent from being activated unintended, the functions of OK1/OK2 are de-activated while programming parameters P26/P27.

If the same function is selected for both inputs, then OK 2 has the higher priority.

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.

P42.... fixes the actual value the analogue output delivers 10V (resp. 0V, if P44=2) DC voltage.
P43.... fixes the actual value the analogue output delivers 0V (resp. 10V, if P44=2) DC voltage.
P44.... switches the analoue output ON or OFF and fixes it if the voltage should rise (P44=1) or fall (P44=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.

P43 = "0", P42 = "+10", P44 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.

P43 ="4.0", P42 ="6.0", P44 ="2"

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 and the date can be set with parameters **P45** thru **P47**.
The time switch is de-activated if ON and OFF-time are identical.

Operation Time Counter

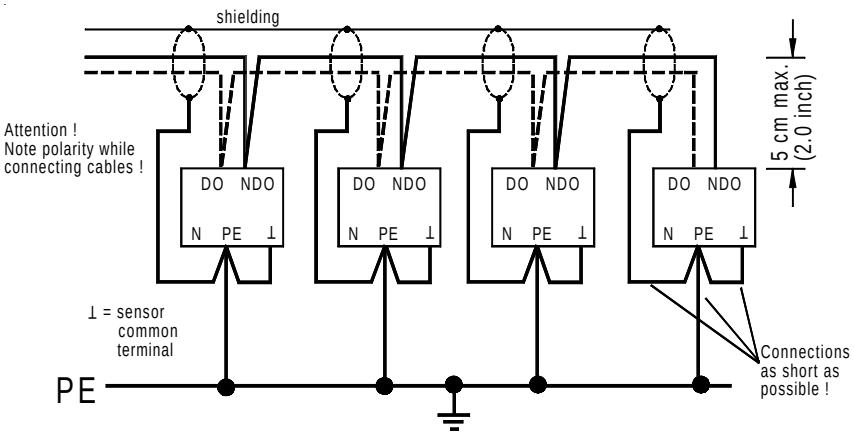
Each relay output owns an individual operation time counter. This counter measures and totalizes the time this output was activated. The values can be read at "**r01**" thru "**r04**".
Because the display has 3 digits only, the stored value is "*displayed value x 10*".
After 9999 hours the counter will be reset to "0". A reset by the user is not possible.

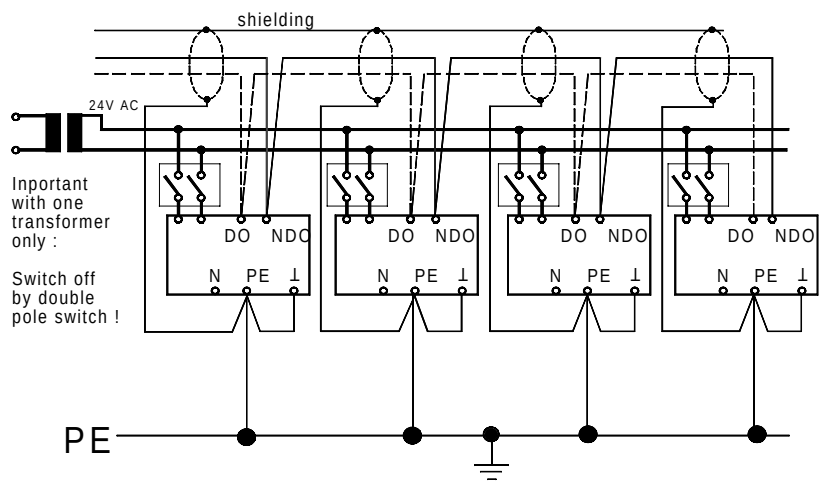
INSTALLATION

- Before applying voltage to the controller:
  Make sure that all wiring has been made in accordance with the wiring diagram in this manual. Please check if the supply voltage corresponds to the value printed on the unit's type label.
- Important for the installation of the MSR 1100:
  Don't connect the secondary coil of the transformer to PE!
- Use 2-wire pressure transmitters only, 3-wire transmitters can only be used with an external power supply.
- **Important ! Please note the starting-currents and current timing of your load to prevent damages of the relay contacts.**
- Sensor leads should be shielded cable with one end of the shielding connected to ground. This avoids irregular switching caused by electro-magnetic interference.
- The wire gauge of the sensor cables is not critical, if it should be lenghtened, 0,5 sqmm are adequate.
- Mounting the controller close to power relays is unfavourable in case of the electro-magnetic interference.
- Please note that TF-type temperature sensors are water-proof but not pressure protected. To measure liquid media please use dip-fittings.
- Important for the installation of the MSR 1100:
  The external contacts for initiating the OK-input must be suitable for 5VDC/1mA.

Networking of MSR controllers

All MSR-controllers can be networked via their built-in RS-485-interface. This network can be controlled by a host unit.
Normally this host is a PC with a qualified software which allows remote control of units and recording of all parameters.





Because all units are connected parallel at the data cable (party-line), every unit has its own network address (**P40**) to ensure a specific communication.

The communication speed is fixed by **P41** (Default value 9600 Baud).

If multiple, networked controller units are supplied from one transformer (**MSR 1100 only**), a double pole switch must be used to switched off the single positions.
If not, the unit will be supplied by a half-wave via the shielding, and the unit continues working (depending on the secondary voltage of the transformer).

Start Up Examples

MSR as Compressor Compound Controller

Requirement:

4 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 via OK 1, 2 stages remain for control purposes.

Please always note the Security Informations 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 **P48**

- P16=1 (single compressor at relay K1)
- P17=1 (single compressor at relay K2)
- P18=1 (single compressor at relay K3)
- P19=1 (single compressor at relay K4)
- P23=1 (relay K1 inverted, load at N/C)
- P25=1 (base load change ON)
- P28=4 (transmitter with 4-20 mA signal)

Enter Code Number '**88**' at **P48**

Adjustments

- P31=10.0 (press. value transmitter at 20 mA)
- P32=0.0 (press. value transmitter at 4 mA)
- P04=2.0 (control setpoint)
- P10=0.5 (neutral zone / hysteresis)
- P20=10 (forward delay in sec.)
- P21=10 (backrun delay in sec.)
- P24=2 (2 stages remain after peak load lim.)
- P26=2 (OK 1 configured for peak load lim.)
- P35=2.5 (2nd control setpoint)
- P36=19 (2nd setpoint ON 'hours')
- P37=00 (2nd setpoint ON 'minutes')
- P38=07 (2nd setpoint OFF 'hours')
- P39=00 (2nd setpoint OFF 'minutes')

- P42=10 (analog output delivers 10VDC at 10bar)
- P43=0 (analog output delivers 0V at 0 bar)
- P44=1 (analog output works proportional)
- P45=--(clock time 'hours')
- P46=--(clock time 'minutes')
- P47=--(clock time 'seconds')

Display correction

The actual pressure display **P01** can be calibrated by using **P29**.

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 Security Informations 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 **P48**

- P16=1 (single fan at relay K1)
- P17=1 (single fan at relay K2)
- P18=1 (single fan at relay K3)

- P25=1 (base load change ON)
- P28=4 (transmitter with 4-20 mA signal)

Enter Code Number '**88**' at **P48**

Adjustments

- P31=25.0 (press. value transmitter at 20 mA)
- P32=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)
- P10=0.5 (neutral zone / hysteresis)
- P20=20 (forward delay in sec.)
- P21=20 (backrun delay in sec.)
- P23=0 (no emergency mode)
- P35=17.0 (2nd control setpoint 1)
- P36=20 (2nd setpoint ON 'hours')
- P37=00 (2nd setpoint ON 'minutes')
- P38=06 (2nd setpoint OFF 'hours')
- P39=30 (2nd setpoint OFF 'minutes')

- P45=--(clock time 'hours')
- P46=--(clock time 'minutes')
- P47=--(clock time 'seconds')

Display correction

The actual pressure display **P01** can be calibrated by using **P29**.

MSR as Brine-Chiller Controller

Requirement:

2 dual-stage compressors, no emergency mode, automatic base load change.
Control at 4, 6, 8, 10 °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 Security Informations 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 **P48**

- P16=2 (compressor 1 ON, relay K1) (compr. 1 power stage ON, relay K2)
- P17=2 (compressor 2 ON, relay K3) (compr. 2 power stage ON, relay K4)
- P25=1 (base load change ON)
- P28=2 (temperature sensor TF 501)

Enter Code Number '**88**' at **P48**

Adjustments

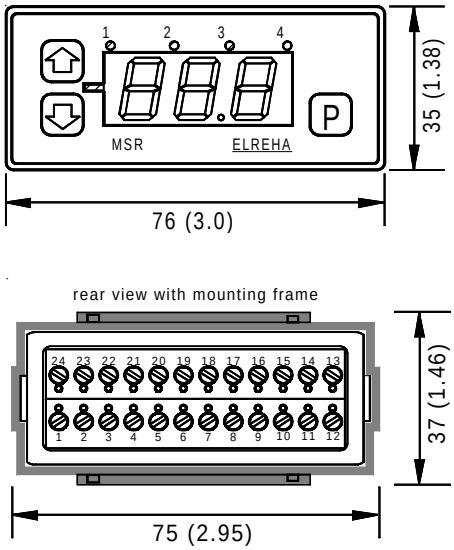
- P04=4.0 (control setpoint stage 1)
- P05=2.0 (setpoint stage 2 in a distance to P04)
- P06=2.0 (setpoint stage 3 in a distance to P05)
- P07=2.0 (setpoint stage 4 in a distance to P06)
- P10=0.5 (neutral zone / hysteresis)
- P20=25 (forward delay in sec.)
- P21=25 (backrun delay in sec.)
- P23=0 (no emergency mode)
- P35=6.0 (2nd control setpoint 1)
- P36=20 (2nd setpoint ON 'hours')
- P37=30 (2nd setpoint ON 'minutes')
- P38=06 (2nd setpoint OFF 'hours')
- P39=00 (2nd setpoint OFF 'minutes')

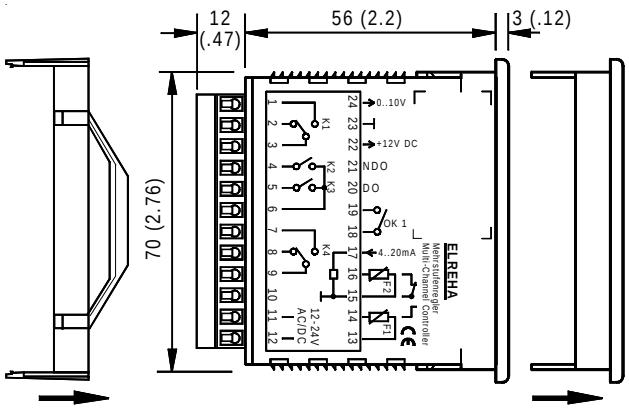
- P45=--(clock time 'hours')
- P46=--(clock time 'minutes')
- P47=--(clock time 'seconds')

Display correction

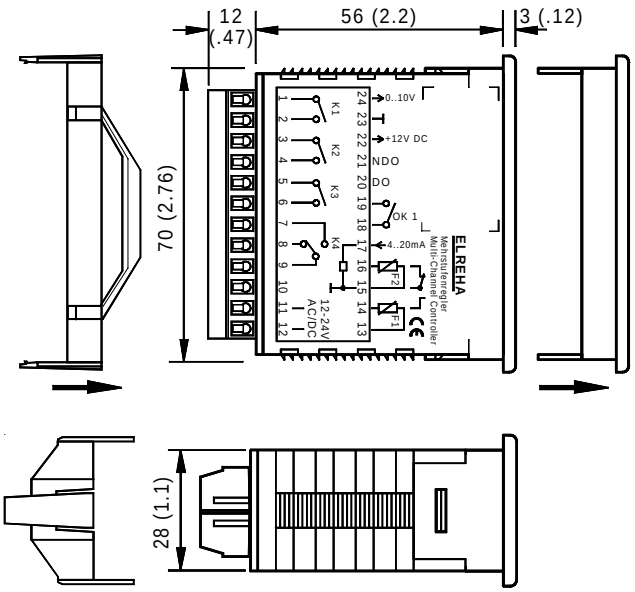
The 2 actual temperature displays can be calibrated by **P29** (P01, inlet temperature) and **P30** (P02, outlet temperature).

Dimensions MSR 1100

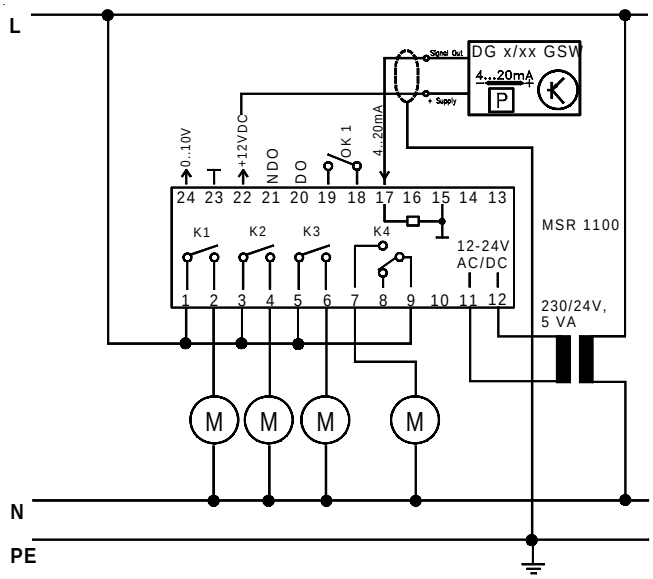




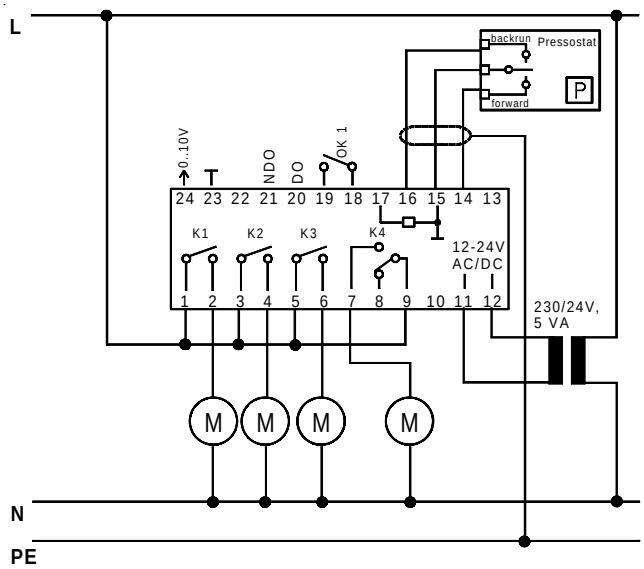
From september 2001 the units will be produced with the follwing, changed pinout:



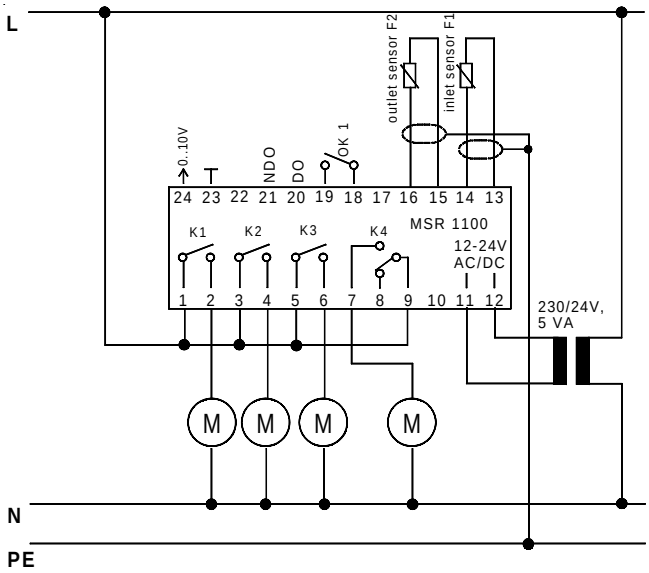
Connection MSR 1100 (simplified pictures)



MSR 1100 with 2-wire pressure transmitter.

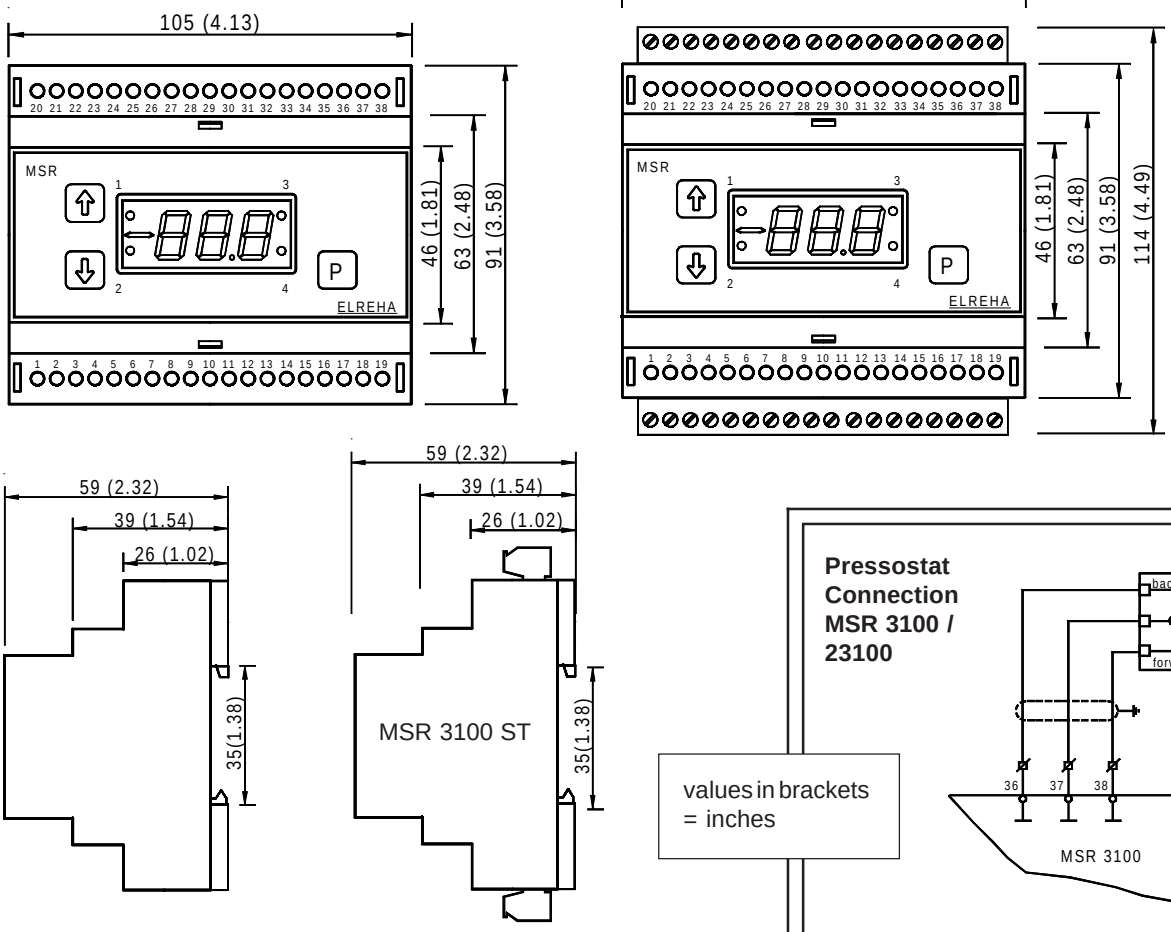


MSR 1100 with Pressostat



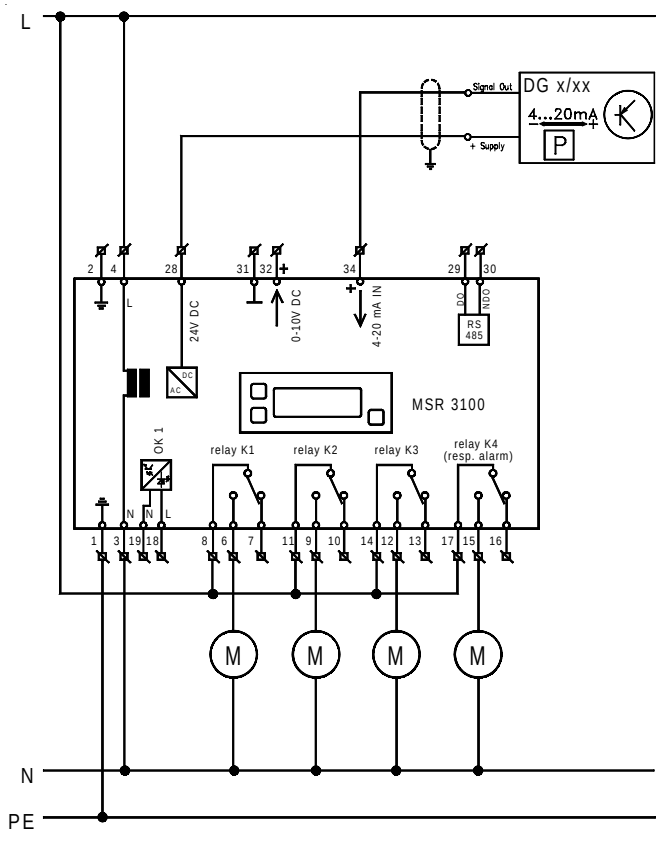
MSR 1100 with 2 temperature sensors for controlling a brine-chiller.

Dimensions MSR 3100 / 23100 / 3100 ST

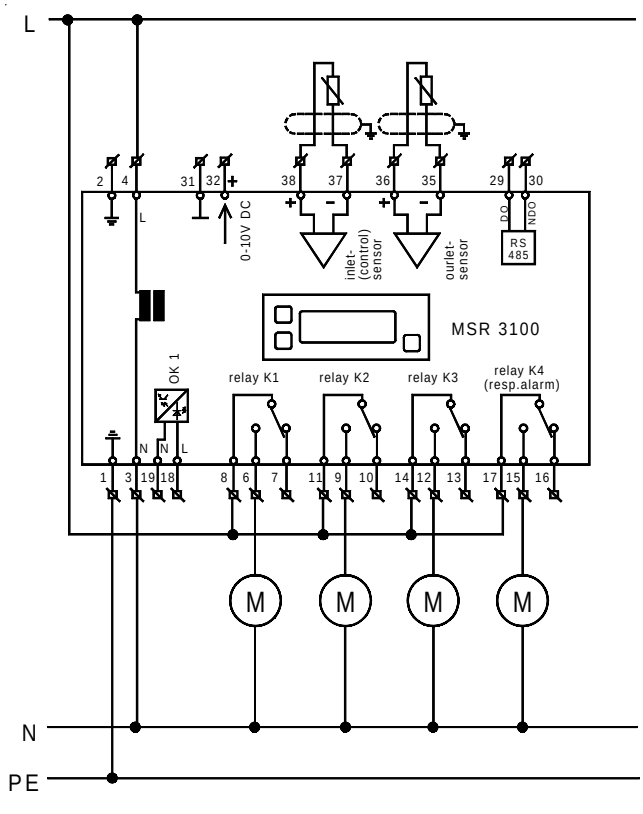


Pressostat Connection MSR 3100 / 23100

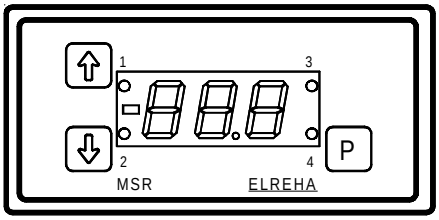
Transmitter Connection MSR 3100 / 23100 (simplified picture)

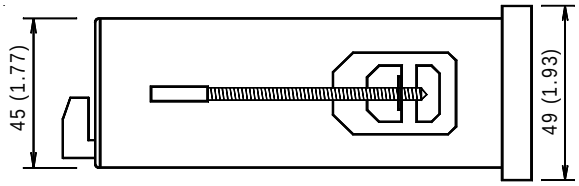


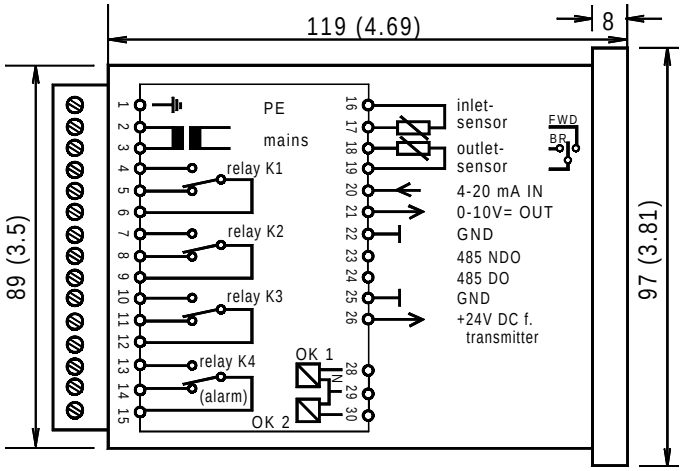
Temperature Sensor Connection MSR 3100 / 23100 (for chillers, simplified picture)



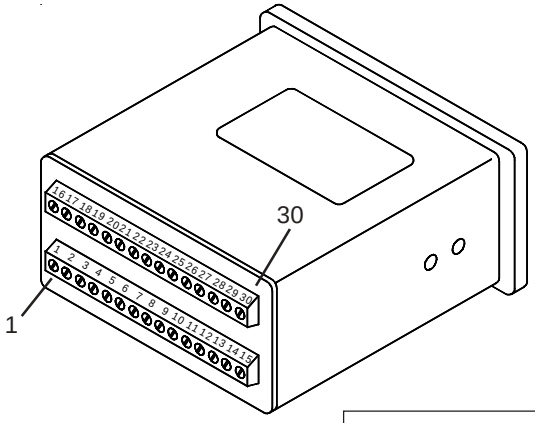
Dimensions MSR 5100 / 25100





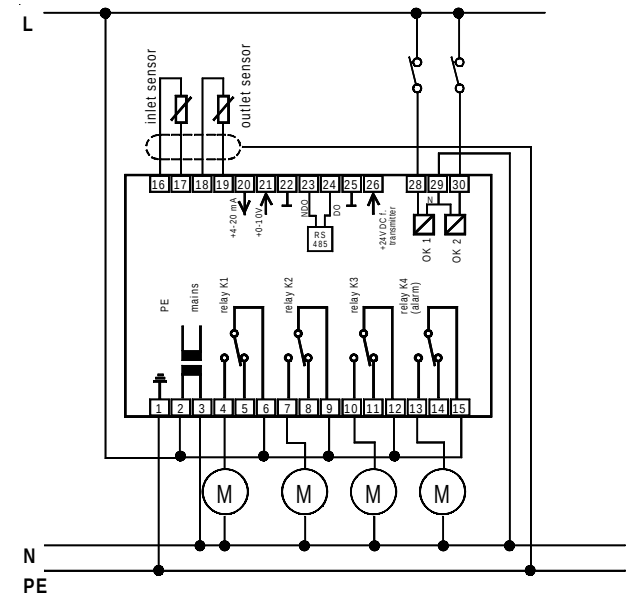


Panel housing acc. to DIN 43700 / IEC 61554
cut-out: 92 x 45 mm (w x h)
tolerances max: +0,8 (w), +0,6 (h)

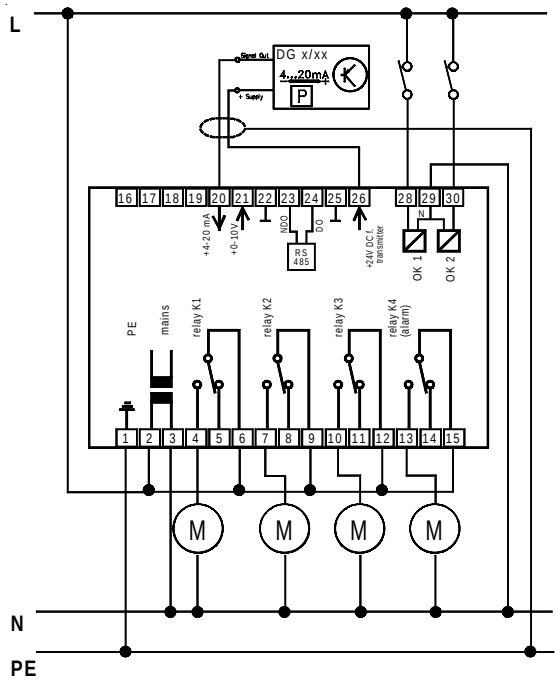


values in brackets = inches

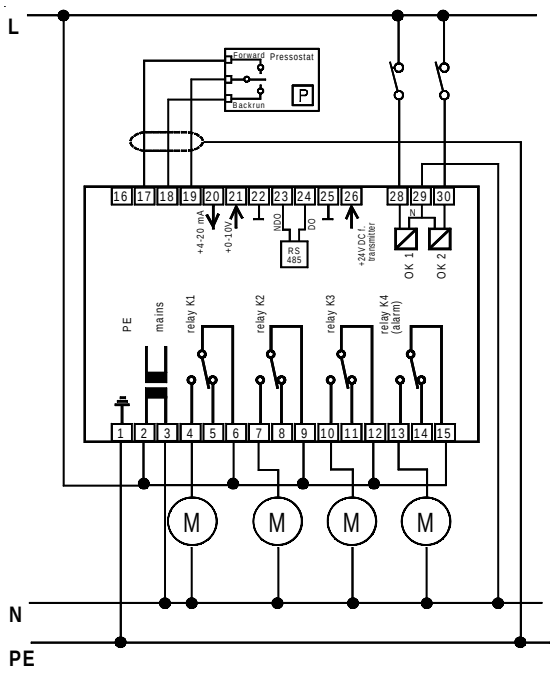
MSR 5100/25100 with temperature sensors (simplified pic.)



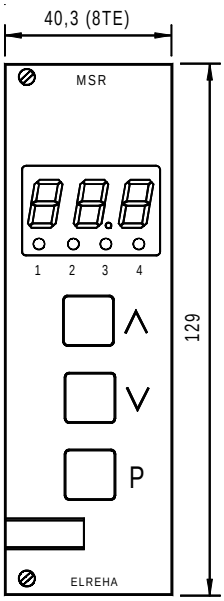
MSR 5100/25100 with 2-wire transmitter. (simplified picture)

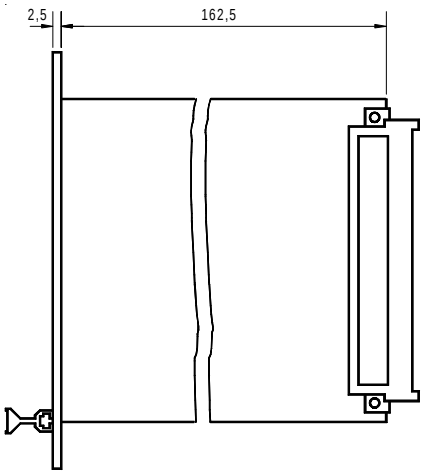


MSR 5100/25100 with Pressostat (simplified picture)



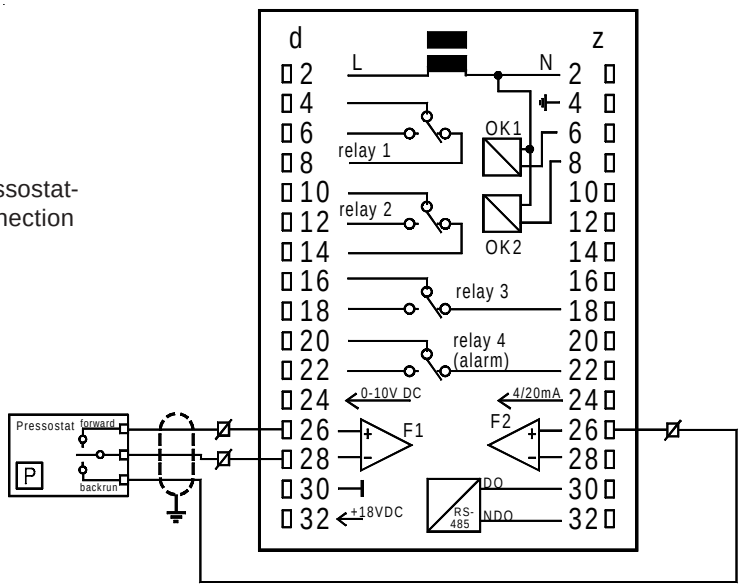
Dimensions MSR 19100 / 29100



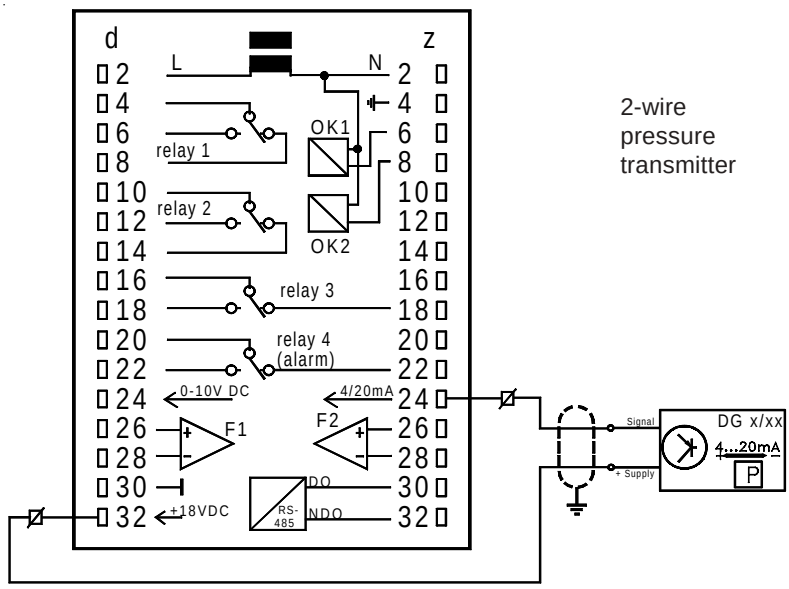


Connection

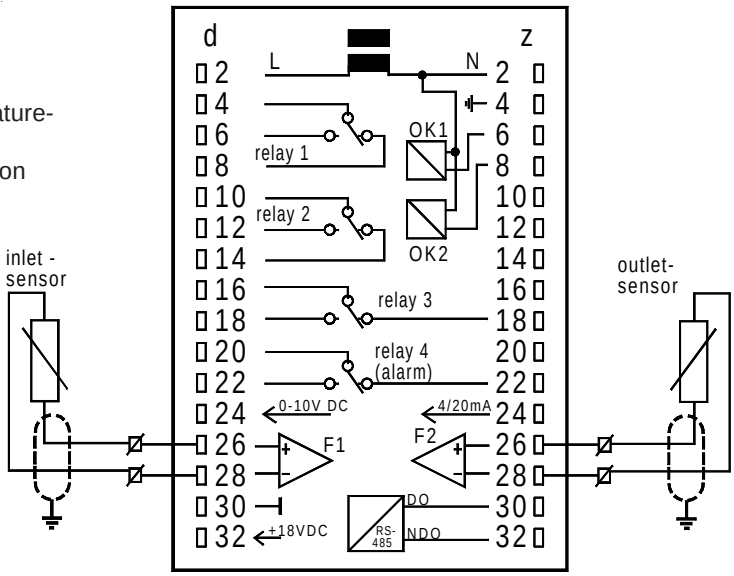
Pressostat-connection



2-wire pressure transmitter



Temperature-sensor connection



- Wiring diagram shows a connector equal to DIN 41612, type 'F', rear view.

EG-Statement of Conformity

CE –

We state the following: When operated in accordance with the technical manual, the criteria have been met that are outlined in the guidelines of the council for alignment of statutory orders of the member states on electro-magnetic consistency (89/336/EWG). This declaration is valid for those products covered by the technical manual which itself is part of the declaration. Following standards were consulted for the confirmity testing with regard to electromagnetic consistency :

IEC 1000-4-1, IEC 1000-4-2, IEC 1000-4-3*, IEC 1000-4-4, IEC 1000-4-5, EN 55011 B, EN 50081, part 1 and 2; EN 50082, part 1 and 2, EN 61010 part 1, EN 61010-1/A2 part 1/A1

This statement is made from the manufacturer / importer
ELREHA Elektronische Regelungen GmbH
68766 Hockenheim
(Name / Anschrift / *name / adress*)

by:
Klaus Birkner, **Developement and and leader of the EMC-Laboratory**

Hockenheim Ort/*city*
31.5.1999 Datum/*date*
..... Unterschrift/*sign*

**The conformity with IEC 1000-4-3 is derived from the IEC 1000-4-2 and IEC 1000-4-4 test results. The correlation with IEC 1000-4-3 is based on test results which are located on site at the manufacturer.*

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 6.9.04 by: tkd/jr	checked: 6.9.04 by: ek/al	approved: 6.9.04 by: mv/mh	