

ELREHA

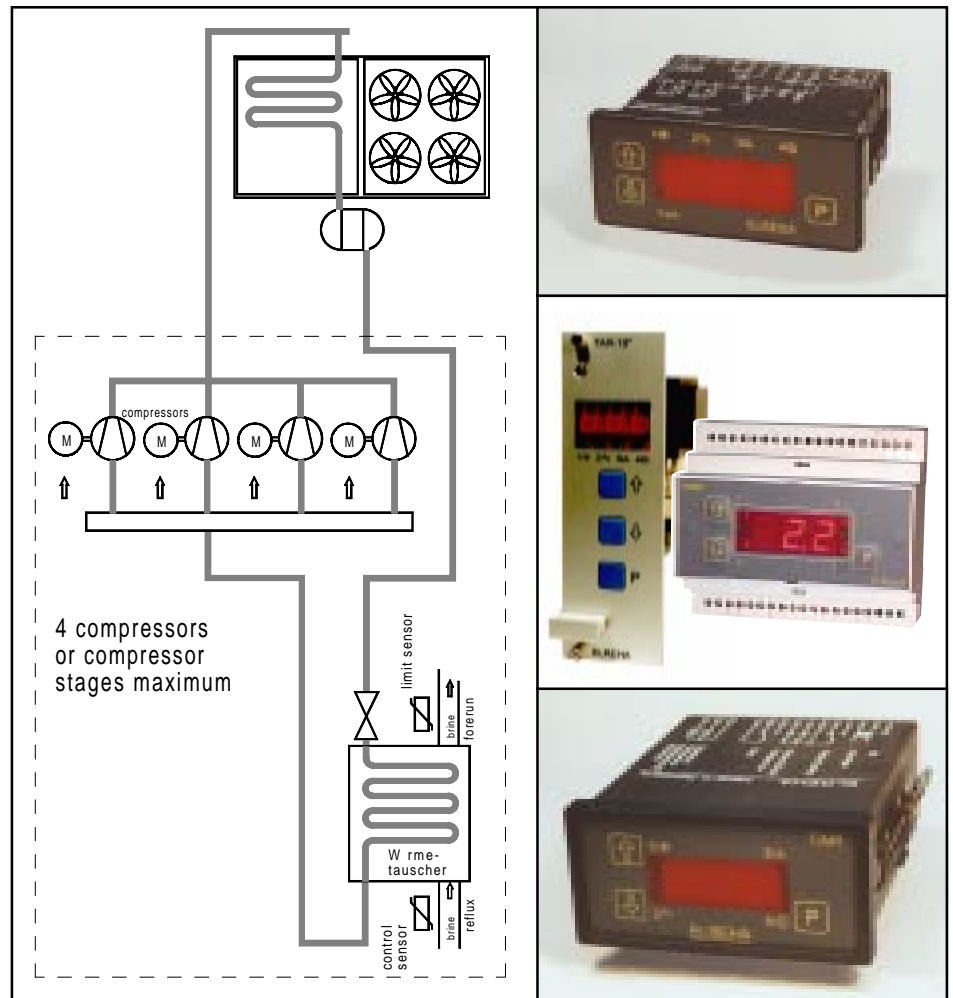
Technical Manual Brine-Chiller Controller

MSR

Software Version 990531

Nr. 5311032-02/06, E

MSR 1300
MSR 3300
MSR 5300
MSR 19300



- Controller for Brine-Chillers
- Up to 4 Stages
- For Single- and Multi-Stage Compressors
- Automatic Base-Load Change
- Analogue Output 0-10V DC
- 2 Temperature Sensors for temperature control and -limiting
- 2nd Setpoint by internal clock
- Peak Load Limitation / Fast Backrun
- Alarm Limitations
- Compressor Idle Time
- Integrated operation time counter
- RS-485-Interface

General Description

The MSR x300 has been developed to control chiller systems with up to four Single Compressors or Multi-Stage Compressors with up to 4 stages. 2 sensors measure the temperatures for controlling and limiting. Standard (TF 201) and Pt1000 sensors (TF 501) can be used.

The controller is available in four different housings and different supply voltages.

Some standard functions: Fast Backrun, Peak Load Limit, Restart Delay, Alarm Limits and Emergency Mode.

A scalable Analogue Output allows to drive rpm-controllers or to connect remote displays. A built-in time-switch allows to change the control setpoint twice a day (e.g. night-shift).

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Type Overview

MSR 1300	panel mounting, 12-24V AC/DC
MSR 3300	for 35mm DIN-rail 230V~, 50-60 Hz
MSR 5300	panel mounting, 230V~, 50-60 Hz
MSR 19300	19"-module, 8TE, 230V~, 50-60 Hz

Technical Data

Supply Voltage	see type overview
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
Signal Inputs	2x TF 201 / Pt1000, selectable
Display	LED 7-segm., red, char. height 13mm 19"-module: char. height 10mm
Resolution	0,1K
Control-/Display Range	see parameter listing
Data storage parameters ...	min. 10 years
Real Time Clock	clock backup appr. 10 days
Indicator LED's	3 mm, red
Control Inputs (Optocpl.)	230V, 3mA (1300: pot.free contact)
Analogue Output	0-10 V DC, max. 3 mA
Resolution Analogue Outp. .	8 bit between limit parameters
Data Interface	<i>E-Link</i> (RS-485)
Electrical Connection	Screw terminals 2,5mm 19"-module: DIN41612"F"-connector
Housing, Protection	
MSR 1300	77 x 35 mm, IP 54 from front
MSR 3300	DIN-rail housing, IP 30
MSR 5300	96 x 48 mm, IP 54 from front
MSR 19300	19", 8 TE

Further informations you will find on the parameter listing.

Accessories (please order separately)

- 2 x temperature sensor TF 201 (PTC) or
- 2 x temperature sensor TF 501 (Pt 1000)

For MSR 1300 only:

- Transformer 107-1300-0017 (14V / 5VA) or
- Transformer 107-1300-0018 (22V / 5VA)

For 19"-module:

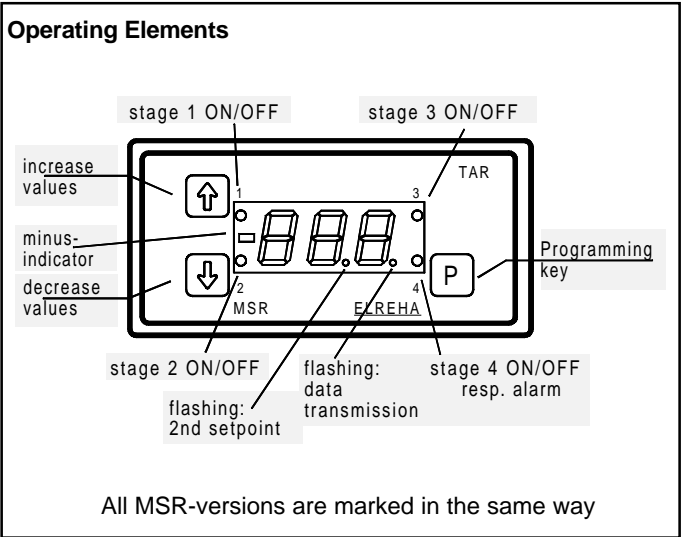
- 19"-subrack or panel housing

Manufacturer:


Elektronische
Regelungen GmbH

D-68766 Hockenheim	Telefon	0 62 05 / 2009-0
Schwetzingen Str. 103	Telefax	0 62 05 / 2009-39
Germany	Technischer	0 62 05 / 2009-25
	Service	0 62 05 / 2009-26

Operating



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).

Note:

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.

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.

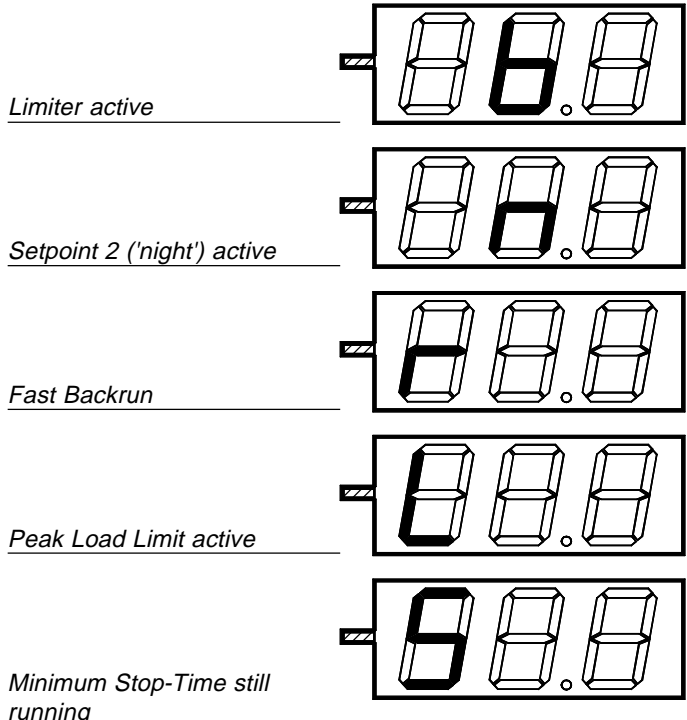
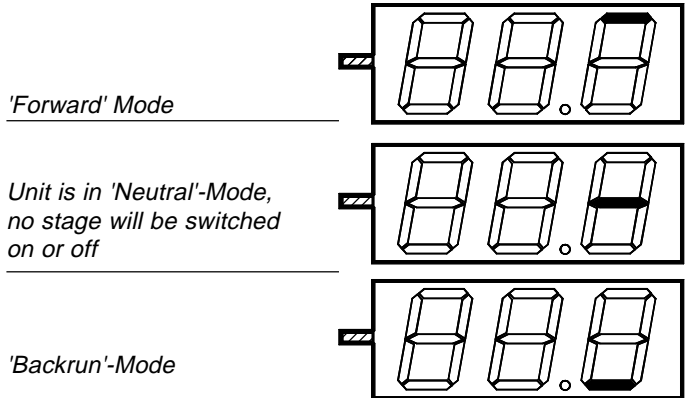
Auto scrolling

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

Operating-Mode Display

Parameter **P03** offers a quick information about the actual state of the controller unit.

The following informations are possible:



Parameter Listing

Parameter-No.	Code	Description	Default-Value	Ranges	Your Value
P01	-	Temperature of Control sensor (water return)	-	-	-
P02	-	Temperature of Limitation sensor (water forerun)	-	-	-
P03	-	Status of: forward/backward/peak load limitation			
P04	-	Setpoint 1 (absolute), switch-OFF point	0	Set with P08/P09	
P05	-	Setpoint 2 (relative to P04)	0	0...10.0 K	
P06	-	Setpoint 3 (relative to P05)	0	0...10.0 K	
P07	-	Setpoint 4 (relative to P06)	0	0...10.0 K	
P08	88	Setpoint high limit (for all stages)	+50.0	-100.0°C...+100.0°C	
P09	88	Setpoint low limit (for all stages)	-50.0	-100.0°C...P08	
P10	88	Hysteresis (for all stages)	2	0.5...10.0K	
P11	88	Limitation temperature <i>below this value, all stages will be de-activated with their fixed backrun delay</i>	-100.0	-100.0°C...+100.0°C	
P12	88	Hysteresis of limitation temperature	2	0,2...10.0K	
P13	88	Upper alarm limit (relative to P04) <i>Above this value and P15 is run down, alarm relay (if available) will be activated</i>	+100.0	-100.0...+100.0	
P14	88	Lower temperature limit <i>Below this value all stages will be switched OFF in 1 second steps, after P15 is run down, alarm relay (if available) will be activated.</i>	-100.0	-100.0...+100.0	
P15	88	Alarm time delay	0	0...60 min	
P16	70*	Power stages compressor 1	1	1...4	
P17	70*	Power stages compressor 2	0	0...3	
P18	70*	Power stages compressor 3	0	0...3	
P19	70*	Power stages compressor 4	0	0...3	
P20	88	Forward time delay (valid for each stage)	10	0...600 sec	
P21	88	Backrun time delay (valid for each stage)	10	0...600 sec	
P22	88	Minimum compr. stop time (valid f. each stage)	0	0...20 min	
P23	70	Switching mode relay K1 and relay K4	1	0=K1 act.on/K4 act.on 1=K1 act.off/K4 act.on 2=K1 act.on/K4 act.off 3=K1 act.off/K4 act.off	
P24	88	Number of remaining stages after peak lo. lim.	2	0...4	
P25	70*	Base load change	0	0=off, 1=on	
P26	88	Operating mode control input OK 1	0	0=off, 1=night setpoint 2=peak load limit 3=fast backrun	
P27	88	Operating mode control input OK 2 (Not available in MSR 1xxx and 3xxx types, must be set to "0")	0	0=off, 1=night setpoint 2=peak load limit 3=fast backrun	
P28	70*	Sensor type	4	1= TF 201 (PTC) 2= TF 501 (Pt1000) 3= customer spec.	

Parameter Listing (continuation)

Parameter-No.	Code	Description	Default-value	Ranges	Your value
P29	88	Calibration of control sensor	0	-10.0 K...+10.0 K	
P30	88	Calibration of limitation sensor	0	-10.0 K...+10.0 K	
P33	-	Remaining time forward/backrun delay	-	-	
P34	-	Remaining time until an alarm will be activated	-	-	
P35	88	2nd control setpoint 1 ('night'-setpoint)	0	-100.0...+100.0°C	
P36	88	ON-time control 2nd setpoint 'hours'	0	0...23 h	
P37	88	ON-time control 2nd setpoint 'minutes'	0	0... 59 min	
P38	88	OFF-time control 2nd setpoint 'hours'	0	0...23 h	
P39	88	OFF-time control 2nd setpoint 'minutes'	0	0... 59 min	
P40	88	Address of unit in network	78	1...78	
P41	88	Data transmission rate (Baudrate)		1 = 1200 2 = 2400 3 = 4800 4 = 9600 5 = 19200	
P42	88	Upper limit analogue output	30.0	-100.0...+100.0	
P43	88	Lower limit analogue output	-1.0	-100.0...P42	
P44	88	Mode analogue output	0	0=off 1=proportional 2=antiproportional	
P45	-	Clock time 'hours'	-		-
P46	-	Clock time 'minutes'	-		-
P47	-	Clock time 'seconds'	-		-
P48	-	Access code	0	0...99	
r 01	cnbe	Operation time counter for relay K1 <i>value is displayed value x 10</i>	0	9999 hours	-
r 02	cnbe	Operation time counter for relay K2 <i>value is displayed value x 10</i>	0	9999 hours	-
r 03	cnbe	Operation time counter for relay K3 <i>value is displayed value x 10</i>	0	9999 hours	-
r 04	cnbe	Operation time counter for relay K4 <i>value is displayed value x 10</i>	0	9999 hours	-

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

cnbe = cannot be edited by the user

Functional Description

Sensor Input

The MSR-unit gets its informations from 2 temperature sensors. Both TF 201 or Tf 501 (Pt1000) types can be used. Select type by parameter **P28**.

The temperature control value is captured at water reflux (brine back flow, chiller inlet). The second sensor measures the temperature limitation value at chiller's outlet.

Actual- and Status Display

Parameter **P01** shows the water reflux temperature, **P02** shows the forerun temperature. If no key is pressed for about 4 minutes, the display will switch back to P01.

P03 is a status display, which shows operating states like forward/backrun, neutral state, and so on (see page 3).

Display Correction

If it should be necessary to correct the actual value because of contact resitances or similar, use **P29/P30** to enter a correction factor.

Sensor failure

If one of the temperature sensors fails or if one of the sensors it out of the specified range, the display flashes. Then all stages will be switched off with their preset backrun delay. After the alarm time delay (**P15**) is run down, the alarm relay (K4, if available) will be activated.

Stage controller

The control setpoint is preset with **P04** as a pressure value. There is no need for an access code. The hysteresis **P10** is located symmetrical around the control setpoint. To prevent from faulty operation, the setpoint range can be restricted by **P08/P09**.

Forward (Stages on)

If the measured pressure value exceeds on of the setpoints (**P04 - P07**) plus $\frac{1}{2}$ **P10** (hysteresis), the forward delay **P20** will be started. After this timer is run down the corresponding stage will be activated. 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 between the bounds set with **P10** (hysteresis) and a setpoint, 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 - $\frac{1}{2}$ **P10**, the backrun delay **P21** will be started. After this timer is run down, one stage will be switched off.

2nd Control Setpoint 1 / 'night'-shift

Sometimes it is wished 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 with **P36** thru **P39** the second setpoint is active. If not necessary, the times can be set to "0". The OK-inputs are configurable, to switch to the 2nd setpoint 1 too. Please note that this external activation has more priority as the internal clock.

Peak Load Limitation

One or both of the control inputs OK1 or OK2 can initiate a peak load limitation e.g. to save energy at a certain time determined by the plant. **P24** fixes the remaining stages if the peak load limit is active.

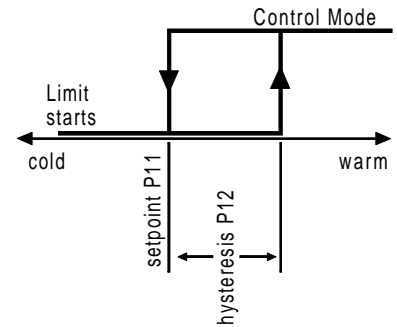
Minimum Stop Time

If a compressor is switched OFF, it is impossible to start it again during the time set with **P22**.

Critical Values

Temperature Limit

If the temperature value measured with the limit sensor falls short of the **P11** bound, all stages will be switched OFF with their preset delay. With **P12** a hysteresis for P11 can be fixed.



Freezing Protection

If the temperature measured with the control sensor falls short of **P14** all stages will be switched OFF in 1 second steps. If the alarm delay timer **P15** is run down, alarm relay (if available) and buzzer will be activated.

Temperature Alarm

If the actual temperature exceeds **P13**, then timer **P15** starts. After it has run down, the alarm relay (if available) will be activated.

P34 informs about the remaining time until an alarm occurs.

Compressor Control

The MSR-unit can control up to 4 single compressors or multi-stage compressors with up to four stages. The kind of compressors and the number of stages will be fixed with parameters **P16** thru **P19**.

Example:

	Programming				Relay outputs Compressor			
	P16	P17	P18	P19	K1	K2	K3	K4
4 single compressors	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 compr.	2	2	0	0	1.1	1.2	2.1	2.2
1 dual stage and two single compressors	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

The built-in base load change function (**P25** ON/OFF) regards the relative runtimes of the individual compressors and cares for

approximately the same compressor runtimes after a longer time. Both compressor types, single- and multistage types will be considered automatically if the load will be changed.

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.

Control Inputs	Voltage Output / Analogue Output
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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 1300** this function must be started by opening an external, potential free switch (see 'connections')
! Never connect main voltage to these terminals !

- 0= Control Input is **de-activated**
- 1= No voltage at the input (1300: contact open) changes to the **second setpoint**. The internal time switch is deactivated, that means the control input has a prior rank.
- 2= No voltage at the input (1300: contact open) initiates a **Peak Load Limit**. For control purposes the no. of stages set with P24 are remaining.
- 3= No voltage at the input (1300: 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.

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

- P42**.... fixes the pressure the analogue output delivers 10V (resp. 0V, if P44=2) DC voltage.
- P43**.... fixes the pressure 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 pressure value rises.

Example 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.

$$P43 = "0", P42 = "+10", P44 \text{ must be } "1".$$

Example 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

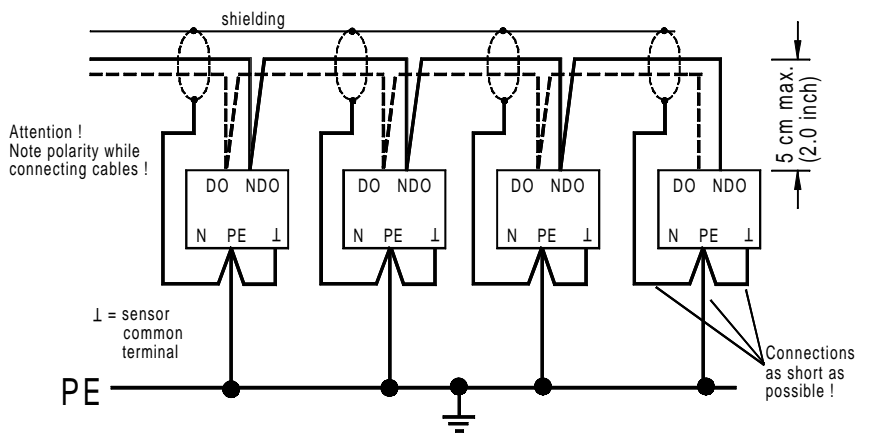
The **MSR** Controller contains a real time clock without a date function which can be used for changing the control setpoint. The timer has a data retention for about 10 days in case of power failure. The time of the day and the date can be set with parameters **P45** thru **P47**. The time switch is 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.

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 on the data cable (party-line), every unit has its own network address (**P40**) to ensure a specific communication. The communication speed is fixed with **P41** (Default value 9600 Baud).



Connection and SAFETY instructions

Installation / Run-Up



Please read before run-up

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.
- Please pay attention to the specified ambient conditions (Temperature-/humidity limits). Outside these limits malfunctions could be possible.
- **Never operate unit without housing.**
- In case of malfunction please contact our technical support.
- **Please note maximum load of relay contacts (see technical data).**
- **Important ! Please note the starting-currents and current timing of your compressors.**
- 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 cross-section of the sensor cables is not critical, if it should be lengthened, 0,5 sqmm are adequate.
- Mounting the controller close to power relays is unfavourable.



Upon applying voltage to the controller the display shows the actual control temperature value. After you have entered the access code (see chapter "unlock keys") you have to program the configuration of the controller to suit your application:

- sensor type (P28)
- number of compressor stages (P16 - P19)
- control inputs OK1/OK2 mode (P26, P27)
- if the units should be networked:
 - address in network (P40) and baudrate (P41)
- clock's time (P45-P47)

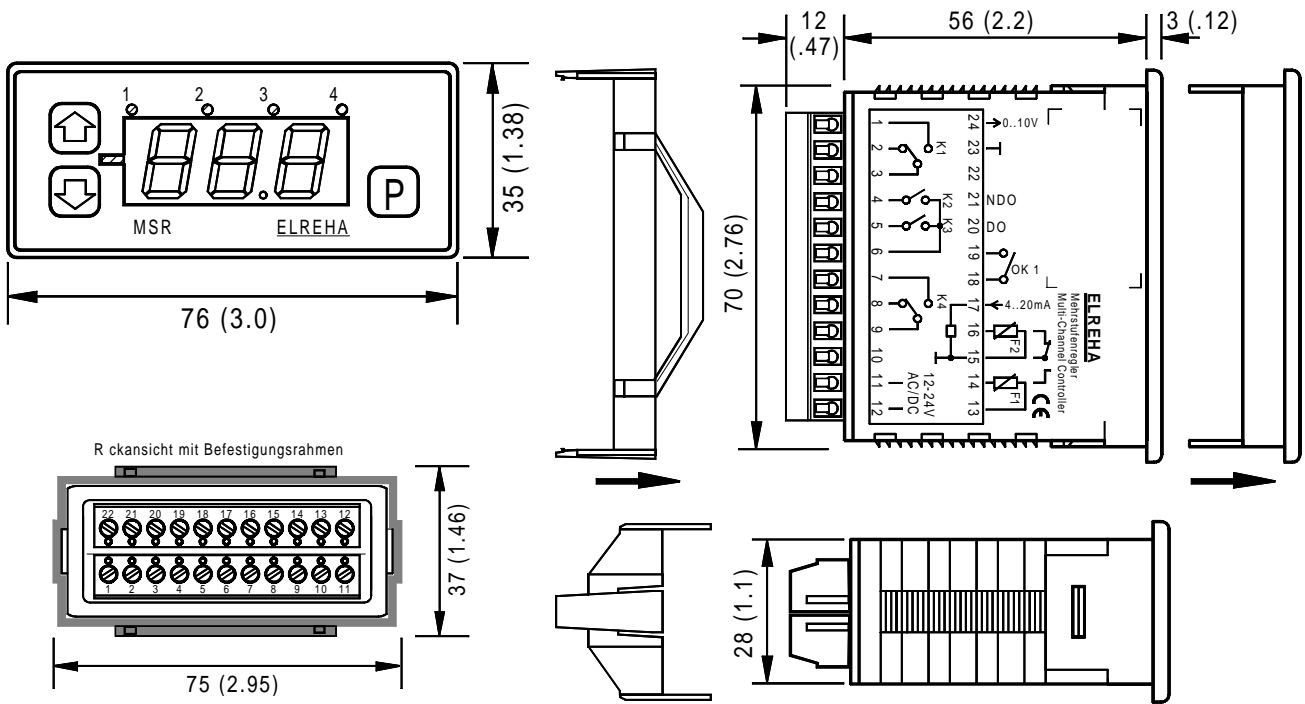
The basic setup is now complete and you can edit the missing setpoints, delay times etc.

Note: The control functions remain de-activated while the access code '70' is active. 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.

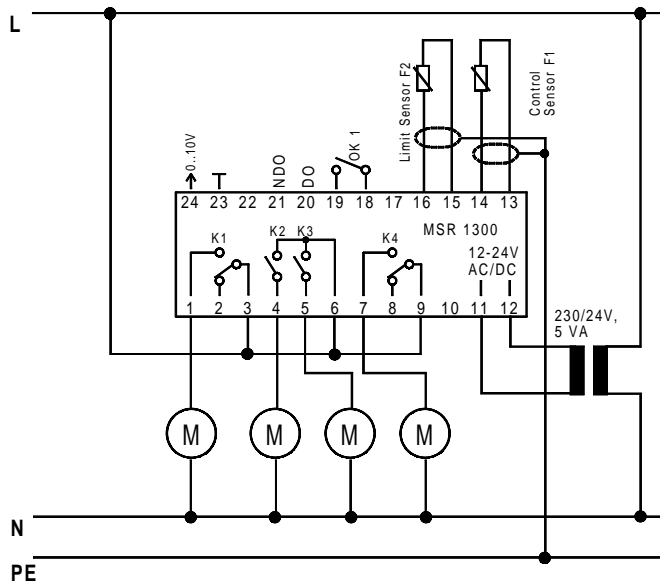
Correction of actual values

If you have to adjust the actual value displays, enter a correction factor at **P29** and **P30**.

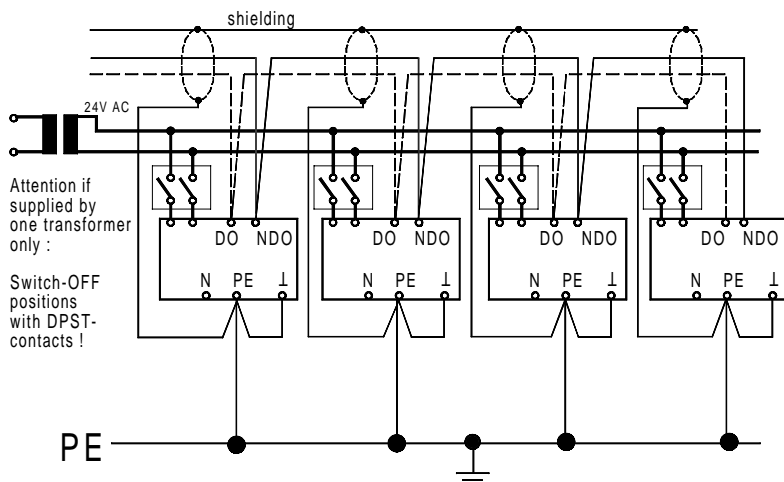
Dimensions MSR 1300



Wiring MSR 1300



Simplified diagram of the MSR 1300 wiring with two temperature sensors.

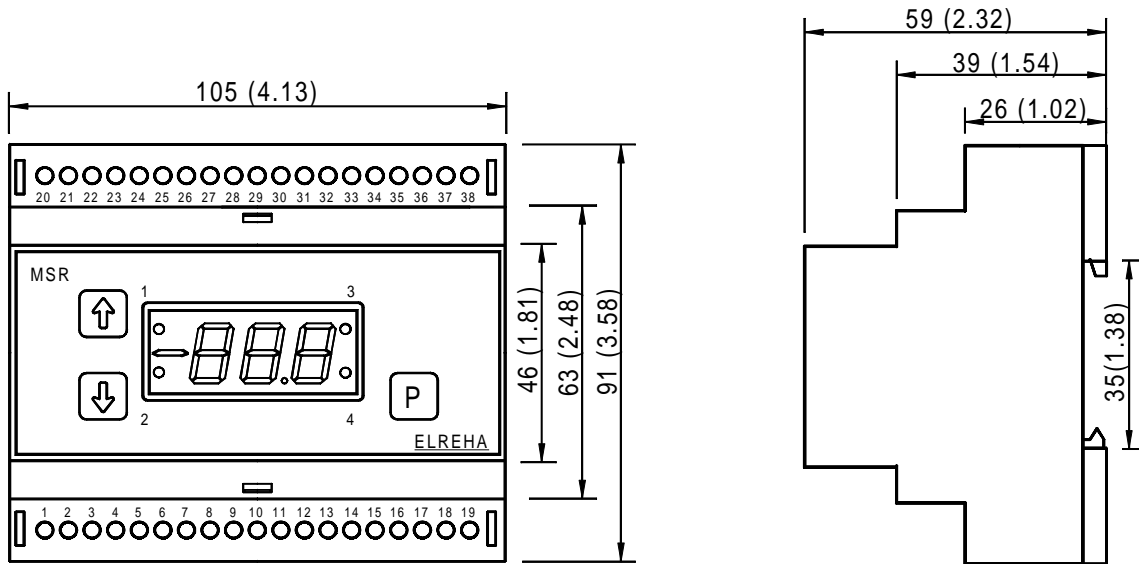


Attention if supplied by one transformer only :

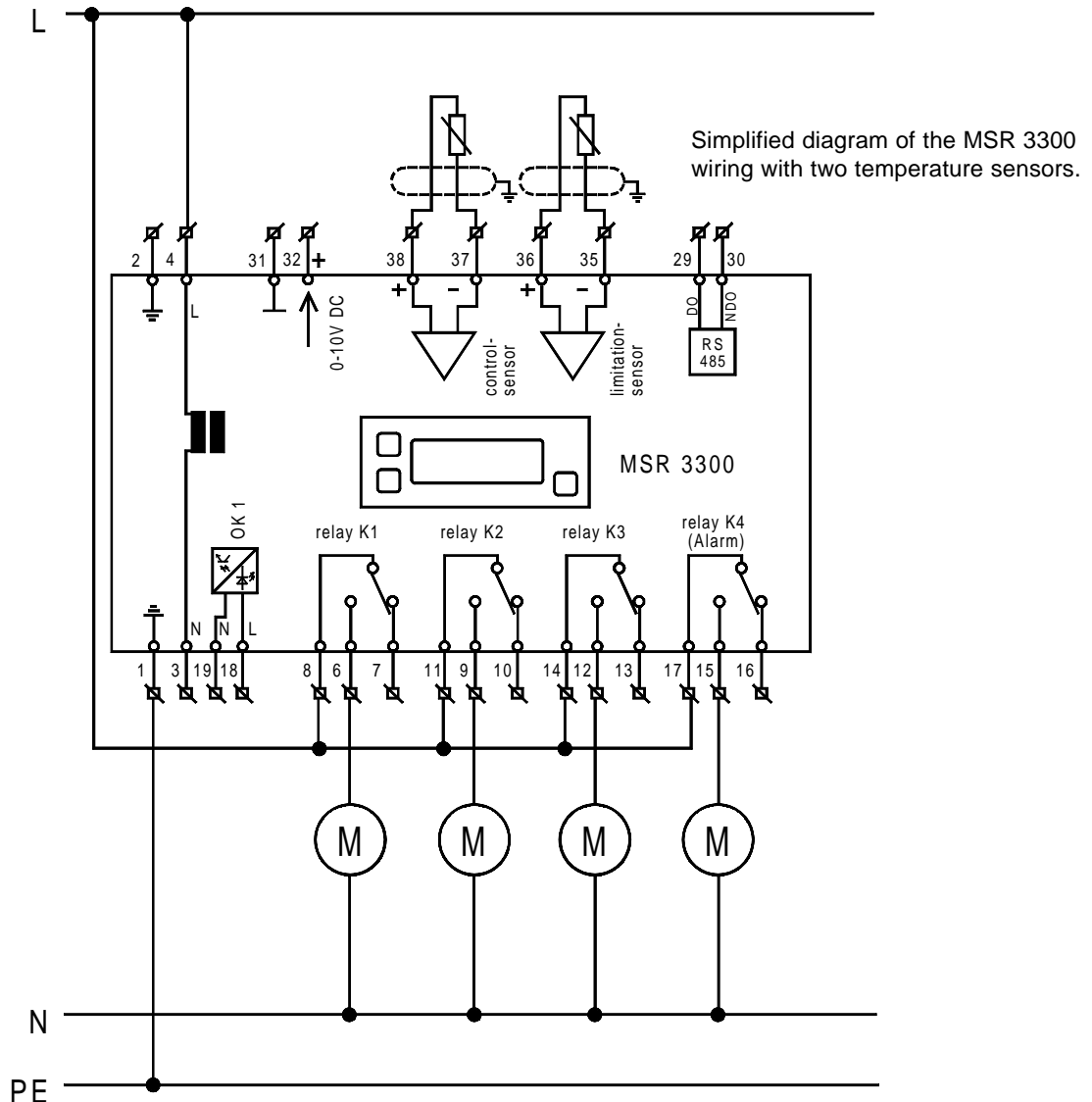
Switch-OFF positions with DPST-contacts !

If networked controllers (1xxx types only) are supplied by one transformer only and the single positions must be switched off, use double-pole switches only.

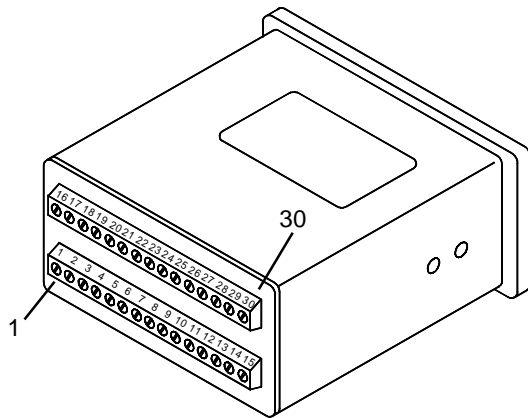
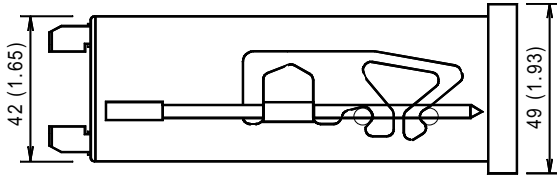
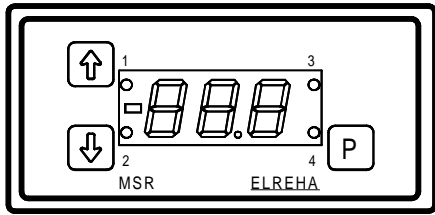
Dimensions MSR 3300



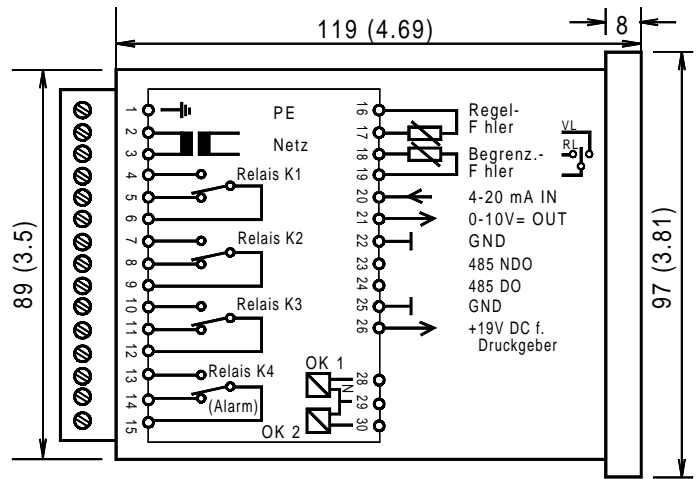
Wiring MSR 3300



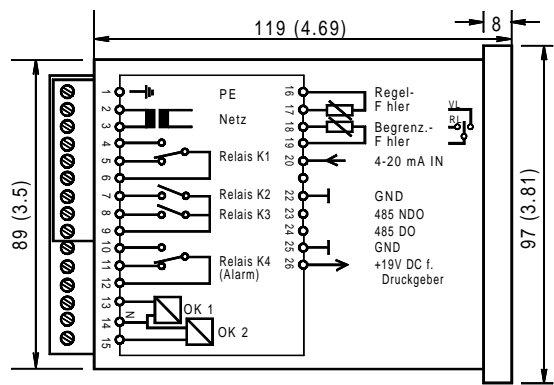
Dimensions MSR 5300



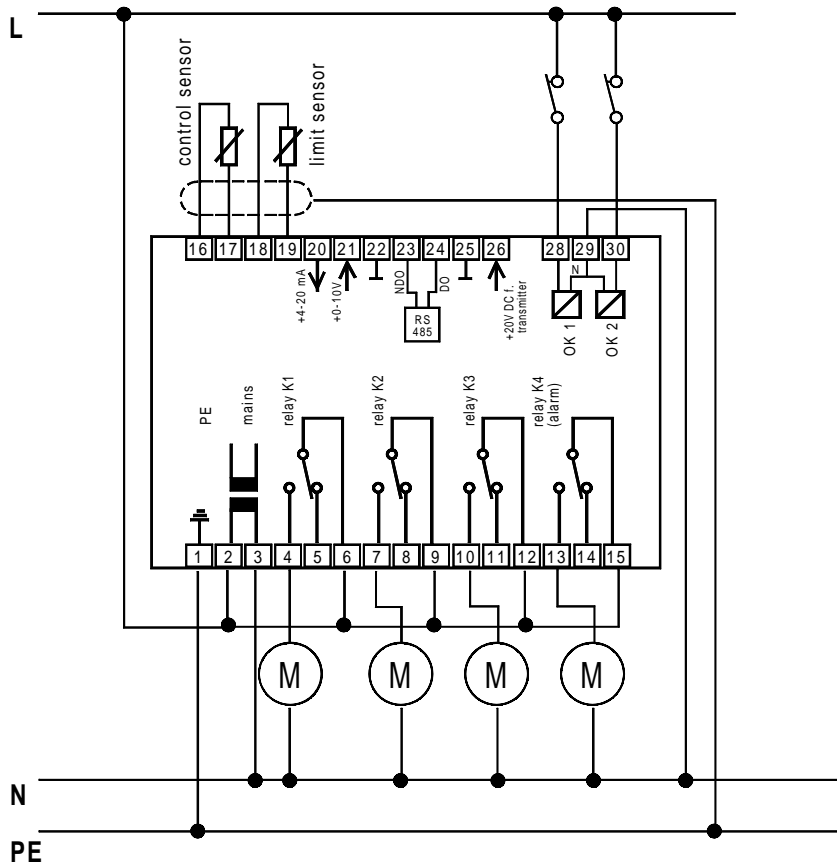
Connection from 6/99



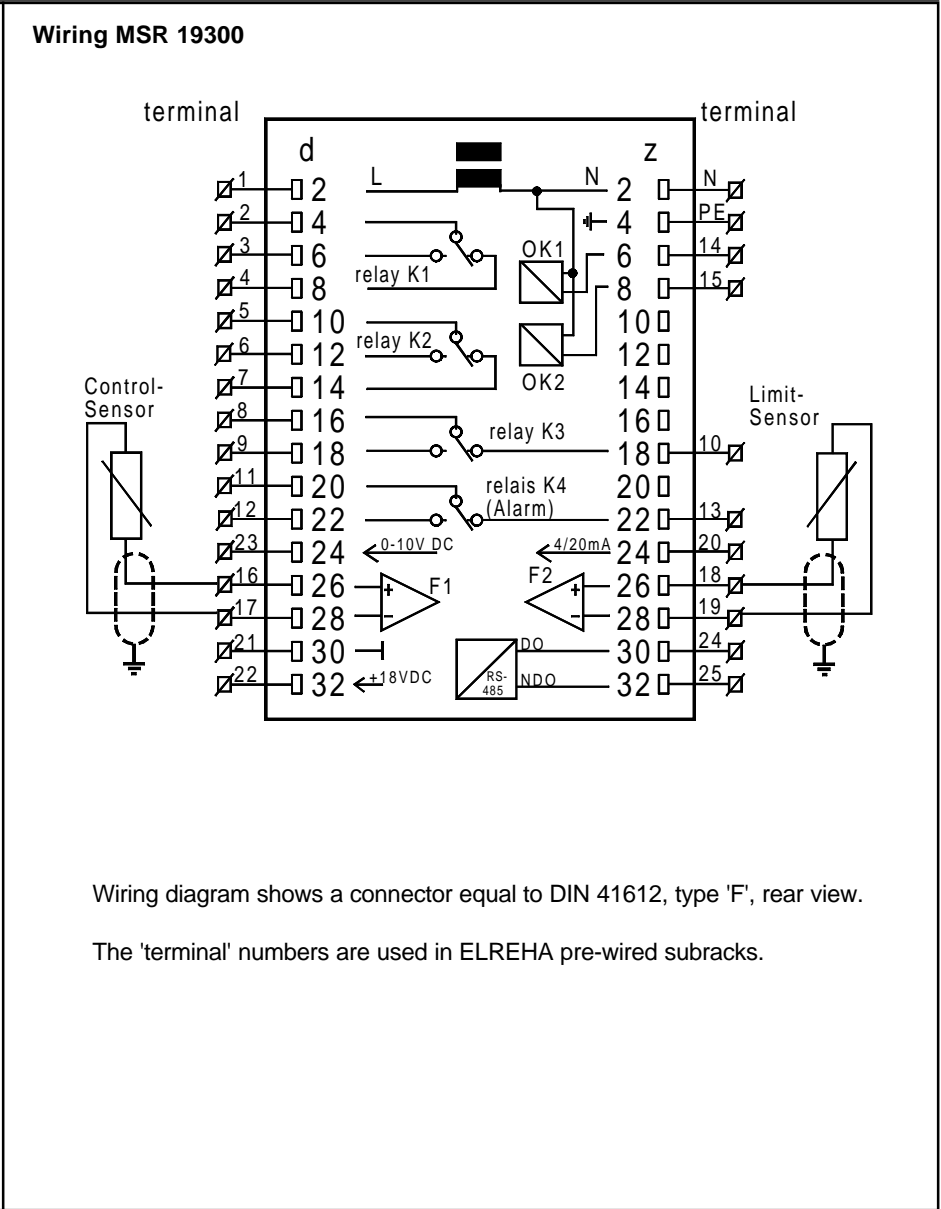
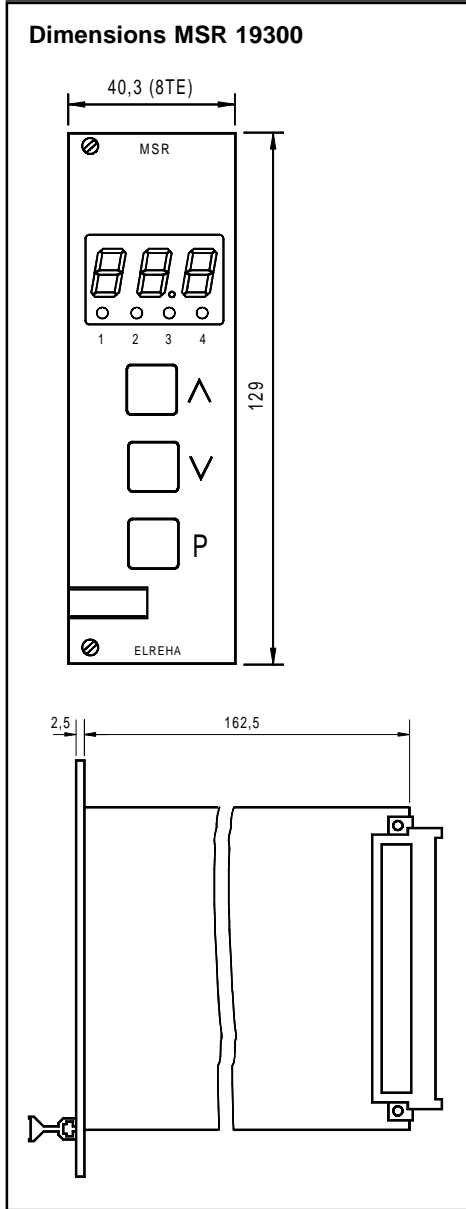
Connections of an older MSR 5300-version



Wiring MSR 5300



Simplified diagram of the MSR 5300 wiring with two temperature sensors.



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

The 'terminal' numbers are used in ELREHA pre-wired subracks.

EG-Statement of Conformity



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 conformity 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**

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

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

Hockenheim
 Ort/city

31.5.1999
 Datum/date

[Signature]
 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 7.5.01 by: tkd/jr	checked: 7.5.01 by: ek/al	approved: 7.5.01 by: mv/sha
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