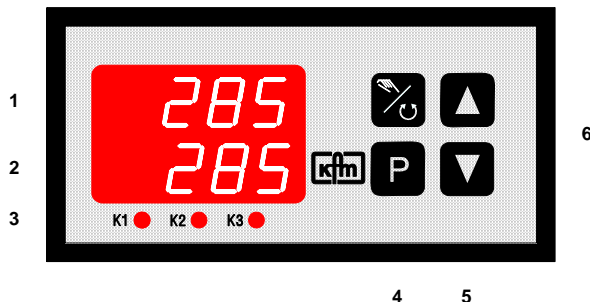


- 1 Digital display actual value
- 2 2nd digital display (if aktive)
- 3 LED-display relais function
- 4 Key for setpoint and parameter mode
- 5 Setpoint adjustment
- 6 Parameter mode lock switch (back face)



### Brief description:

KFM 91 is a microprozessor based industry controller series in panel mounting- format 48 x 96 mm. Design and operating elements are especially devised for easy and convenient handling and operation.

An assembly system renders possible the simple basic version as well as a plurality of variants with up to 3 relays, several digital and analog out- and inputs and other additional devices.

### Types:

(depending on configuration):

indicator	9101.
one stage controller	9110.
two stage controller	9120.
heating / cooling controller	9130.
positioner / follow-up controller	9140.
two- point- PID controller	9150.
three- point- PID controller	9160.
three- point- step controller	9170.
continuous controller	9180.
setpoint generator	9193.

### Sub-types:

basic function	suffix (*) .0
basic function + 1 additional contact	.1
basic function + 2 additional contacts	.2
2 x basic function	.3
extension: logik output	..L

### function extensions

cascade controller	suffix (*) 991k
program controller	991p
ramp set point value	991r
step controller	991t

### Additional devices\*:

additional analog inputs	(*) (99) a
external set value incl. switch-over	(99) bwa
second set value incl. switch-over	(99) bwz
binary input to switch special functions	(99) b..
additional switching contacts	(99) f..
analog signal outputs	(99) o.
serial interface RS 232/485	(99) s.
other interfaces on demand	

\* In case of more than 1 extension there is at the data plate only once '99' , f.e. 91700-99bwa-ogx. For more information see corresponding data sheets.'

### Inputs:

max. 2 measuring inputs, acc. to sub-type:	type suffix
Pt100 DIN, 0...400°C	none (or 0)
Pt100 DIN, 0...100°C	1.
thermo couple Ni Cr NI (type K)0...1200°C	n.
thermo couple Fe Cu NI (type J)0... 900°C	f.
thermo couple Pt Rh Pt (type S)0...1700°C	p.
feedback device 0...100 up to 1000 Ω	w.
standard signal 0(4)...20mA, 0(2)...10V	e.

### Ranges:

Pt 100: 0...400°C, switchable to °F, optional: other ranges; for standard signal range adjustable -999 to 1000. Setpoint ranges can be limited by menu

### Displays:

2 four- figured digital displays, decimal point adjustable, upper display: actual value, lower display: other selectable data,

up to 3 LEDs for relays function display.

#### Display of function:

Hold down the P-key for more than 5 sec to get a short-cut message of the configured function on the display (=position 3-5 of list number) (in case of locked parameter mode only ).

#### Measuring line monitoring:

Display "Err 1...4" in case of measuring line fault and adjustable safety shut down of all outputs

### Outputs:

up to 3 relays with potential free change over switch, as control outputs or as additional contacts, capacity: 250V 2A, incl. spark extinction (for normally open contacts) 1-2 continuous outputs 0/4...20mA, 0/2...10V as control or signal outputs(apparent ohmic load 500 Ω)

### Installation:

Before installation inspect the controller for any visible signs of damage caused during transport  
Check power supply acc. to name plate.  
Push the housing from the front into the DIN- panel cut-out and secure from behind with the fastening devices supplied.

### Electrical wiring:

- Plug bar on the back face of the controller; connect up the controller at the rear following the wiring diagram; wire cross section max. 1,5 mm<sup>2</sup>
- To avoid cross interference *all low voltage measuring lines and pilot wires* must be encased in a **shielded cable** (the shielding must be earthed one-sided).
  - The control leads must be **fused externally** to protect the output relays.
  - Phase wire and neutral wire must not be transposed.

### Putting into operation:

Switch on power supply. Digital display and control lamps will light up according to the setpoint after some seconds. If nothing happens check the fine-wire fuse on the back panel of the controller and the electrical wiring. Adjust set value and check other adjustments.

### Maintenance:

*All electronic controllers in the KFM range are virtually maintenance-free.* Provided that the controller is correctly installed and put into operation and is protected against mechanical damage and inadmissible operating conditions, it should give years of trouble-free service.  
*In case of faults* repair work by the customer should be restricted to the externally accessible leads and connections and components the customer is expressly permitted to deal with himself. (bridge circuits, fuses).

*All further work, especially on internal components will terminate warranty, makes subsequent inspection and fault repair more difficult and can cause considerable damage to the circuitry.*

*For repair remittance* remove plug board with connected leads on the rear side, loosen fastening devices and remove controller from the panel.

*In case of remittance please give precise details of the fault to reduce time and cost of repair.*


### Error messages:

- |           |   |
|-----------|---|
| Err 1...6 | Fault on measuring input nr. ...<br>check measuring lines for short circuit or breakage<br>check measuring input by connecting a RTD                      |
| Err 55    | Fault on loading the parameter;<br>press any key, the controller starts in emergency operation mode,<br>configuration of the parameters has to be checked |
| Err 50    | Hardware error in program section   |
| Err 52    | Hardware error in data section<br>no further operation possible, remit controller for repair  |
|           | Error messages during self adaptation:  |
| Err 202   | Ambient conditions are not suitable for self adaptation;<br>adjust parameter manually   |
| Err 205   | routine exceeded the setpoint<br>raise setpoint or lower actual value and start adaptation again  |
| Err 206   | Fault on measuring input during adaptation;<br>check the wiring and start adaptation again  |


### Operating status:

635

The *upper display* shows the actual value (channel / measuring input 1), the *lower display* remains empty or (depending on the version and settings) shows

- the attendant unit of measure (°C, °F, %...)
- an additional actual value, the setpoint value or the controller output value Y
- or the additional actual value only when the  key is pressed.

Alternative type:



switch over the *upper display* to the several actual values by pressing the  key, the lower display shows the number of the attendant measuring input.

### Setpoint value setting:

press  - key *shortly* (do *not* hold down)


SP  
635

The *upper display* shows the abbreviation of the activated setpoint adjustment mode, the *lower display* shows the adjusted value.





The indicated value can now be changed by the  (lower) and  (higher) -keys. Each variation of the set value is *immediately* active, without any more operating steps. The arrow keys have a built-in accelerator mode: longer pressing causes faster alterations.

**Return to operating level:**



Press  - key *shortly* (or automatically after 30 seconds without any key-action)



*optional:* Press  - key *shortly* again: \*SP =set values of further control loops (\*=no.) / SP\* =further set values of the control loop / SPE =external setpoint (display mode only); *flashing* display signifies that the function is not active at the moment.

### Manual operation: (optional)


Hold down  - key and press  - key, then release both keys.  
(*optional: switch on and off using separate  - key*)  
(for multi-channel controllers first enter the channel number \*, and press  - key, then:)


635  
H

The *lower display* shows "H \*" and - if activated - the output position. The *upper display* still shows the actual value. The automatic control is interrupted. Manual control is now possible using the ... - keys.

**Return to operating level *only*** by pressing the  - key (if present: the  - key) .  
(no automatic return from the manual mode)

*optional: starting the self adaptation (ref. to chapter Optimization):*

On manual operation level  - key >5 sec ;  
the *lower display* indicates "-Ad-".

*Cancel:*  - key >5 sec again

Access from operating level.

**Unlock** the access first:

Turn the switch on the rear panel of the controller to position "U" = unlocked  
(Lock access after the adjustments: Switch position to "L" = locked).



After the parameter level (refer to the instructions to each level ) has been invoked, the first setting is shown and can be modified.



It is **not** possible to invoke the parameter level when the switch is locked .  
In this case the display shows the abbreviation of the configured controller type.

Confirm the entry and / or **move on** to next parameter:  
press the **P** -key *briefly*

**Settings in detail:**

(not available on all types)

Level 1:	Invoke: Hold down the <b>P</b> - key for more than 5 sec. until the display changes	<i>factory setting:</i>	<i>notes:</i>
<b>CH</b>	channel selection (no.) for multi-channel controller (only)		
<b>*P</b>	proportional range Xp (%) (ref. to chapter "Optimization")	25,0	___
<b>*I</b>	integral action time Tn (min) (ref. to chapter "Optimization")	7,0	___
<b>*d</b>	rate time Tv (min) (ref. to chapter "Optimization")	0,2	___
<b>*Sh</b>	sensitivity of response Xsh (%)	0,1	___
<b>*SA..</b>	switching interval (absolut value) for following (additional) contact no...	5,0*	___
<b>SP..</b>	set point for independent additional contact no...	0,0	___
<b>*Sd..</b>	switching difference for additional contact no...	3,0	___
		(*201,701/SA3:10,0)	

**Return to operating status:**

*Briefly press the **P** - key (or automatically after 30 sec.)*

Level 2:	Invoke: Hold down <b>P</b> - key and press <b>V</b> - key, hold down both keys for more than 5 sec. until display changes.		
<b>Unit</b>	switch-over the displayunit (°C / °F)	C	___
<b>*bLo/*bHI</b>	start / end of display range for voltage- / current -input (only)	#	___
<b>*ELo/*EHI</b>	start / end of range for external setpoint (only), referring to signal	#	___
<b>*SLo/*SHI</b>	start / end of range for signal output (only), referring to signal	#	___
<b>nSt</b>	modification of decimal point characters (0 / 1 / 2)	0	___
<b>*Lo / *HI</b>	start / end of setpoint range (°C /°F or value)	#	___
<b>dSPL</b>	select display function for lower display (AUS / SP / Y / IST2)	AUS	___
	(AUS = off, SP = setpoint, Y = output, Ist2 = actual value of channel / measuring input 2)		

**Return to operating status:**

*Briefly press the **P** - key (or automatically after 30 sec.)*

\* = channel no. in case of multiple measuring inputs or control loops. # = *acc. to range*

## 1. manual optimization

An optimum adaptation of the control parameters (P,I,D) is necessary in order to balance an appearing deviation as quickly, non-oscillating and exactly as possible, according to the given operating conditions.

Generally these adjustments require a lot of professional knowledge that cannot be replaced by this brief information.

The following informations are for help purpose only:

### **P = proportional band Xp (%):**

*lower value = longer impulses, more sensitive reaction*

*higher value = shorter impulses, less sensitive reaction*

- Examples:* - Oscillating temperature without distinct initial overshoot: Xp too low;  
- The setpoint is reached very slowly after initial exceeding: Xp too high.

### **I = integral action time Tn (min):**

*lower value= shorter impulse gaps, faster balancing*

*higher value= longer impulse gaps, slower balancing*

- Examples:* - the set value is reached very slowly without overshooting: Tn too high;  
- high initial overshoot followed by fading oscillation: Tn too low.

### **D = rate time Tv (min):**

increases the controller reaction in case of fast actual value or setpoint alterations (adjust only if necessary). Higher values cause higher increase.

## 2. Self-adaptation

The self-adaptation is an automatic procedure that determines and self-adjusts the optimum control parameters Xp, Tn and Tv.

**Operation**, if contained in supply schedule:

(Parameter-safety-switch on the rear panel of the controller has to be unlocked: position "u")

### **Check starting assumptions:**

Actual value at least 20% below the adjusted set value, (e.g.:heating phase), otherwise first:

Lower actual value adequately by manual operation (position of final control element) (quick circuits) or increase setpoint adequately, if admissible. (faster procedure for slower circuits)

**Call manual operation level:** Press **▼** - key plus **▲** - key (optional: separate key).

Check controller output: must not be higher than 85% , reduce if necessary.

Start self-adaptation: Hold down **■** - key for more than 5 sec. on manual operation level.

During operation the lower display shows: "-Ad-",

the upper display still shows permanently the actual value.

Information about computer operation: First the self-adaptation program waits for stabilization of the actual value according to the given controller output (actual value alteration < 0,1% / min), then it increases the output signal about 10% or, in case of three- point- step controller operation, it triggers an output impulse with about 10% of the adjusted regulating time.

The optimum parameters are computed according to the unit- step response.

**Cancel:** Press **■** - key for more than 5 sec. = return to manual operation level

After successfully finishing the procedure the controller will return **automatically** to operating level.

**Unsuccessful adaptation** ( Display shows error code, ref.to chapter error messages):

Press **■** - key again: Return to manual operation level

eliminate the indicated error

start adaptation again: **■** - key > 5 sec.

or return to operating level: **■** - key shortly

*Access from the operating level.*

**Unlock** the access first: Turn the switch on the rear panel of the controller to position "U" (= unlocked). *It is **not** possible to configure the controller with **locked** switch.*  
(Lock access after the adjustments: Switch position to "L"= locked)

Hold down the **P** - key and press the **▲** - key,  
hold down both keys for more than 5 sec. until the display changes

**Code**  
0

Enter the code number (password) **▼...▲** (1...9999), factory setting: 1  
**move on** to next input: *briefly* press **P** - key

**Code**

Alternatively: Hold down key after entering code for more than 10 sec.  
Possibility to modify code number (optional)

**Conf**  
702

Select control function (*type dependent*): the displayed ID number for the configured control function can be changed by pressing the **▲** - key.  
(Example Type 930K31: choose (92..) 200, 201, 700, 701)

**Return** to operating level: *briefly* press the **P** - key  
or

**move on** to following **adjustments**: hold down **P** - key for more than 5 sec.

*Note: when switching is continued after a function has been changed, the display will first flash for several seconds, only then will the controller return to the selected level.*

**ISE**  
00

Configurations are displayed in succession (type and design dependent)  
and can be changed: **▼...▲**  
(move on to next input: press **P** - key *shortly*)

		<i>factory setting</i>
<b>Ist*</b>	correction value to change the controller display (+ / -)	0.0
<b>EinG</b>	type of measuring input Pt 100 / DC-signal: "rtd / lu"	rtd
<b>Ain*</b>	type of DC signal for input No.*:rtd/ 0/4-20mA/ 0/2...10V (observe different terminal connection I/U)	4...20 mA (91...rtd)
<b>SP 2/E</b>	kind of 2nd/ external setpoint: Add/ Sub/ AbS (adding / subtracting / absolute)	AbS
<b>*Y' '</b>	travel time of the actuator "6...600" (sec.)	60 sec.
<b>*cy' '</b>	switching frequency for 2-point controllers: "2...120" (sec.)	20 sec.
<b>*out</b>	adjusting kind of output signal "0...20/ 4...20(mA)/ 0...10/ 2..10(V)"	4...20 mA
<b>*out</b>	adjusting output characteristics direct / inverted "di / in" (for 2 output signals:"in in / in di / di in / di di")	in
<b>*td</b>	for 2 output signals: deadpoint between output 1 and 2 "0...10%"	0
<b>AP</b>	correction of the output signal operation position	50%
<b>FG A/E</b>	automatical adjustment for teletransmitter input (ref. sheet 99ar)	
<b>Sou*</b>	adjusting type of information signal "0..20/4..20(mA)/0..10/2..10(V)"	4...20 mA
<b>Sou*</b>	adjusting kind of information signal "Ist/Soll.." (actual/ setp.value) (*Sou1= signal 1, Sou2= signal 2)	4...20 mA
<b>*Y_S</b>	behaviour of the output in case of measuring line fault: relay position:"rel1 / rel2 / AUS" ( AUS = relays off) continuous output position: "0...100" (%)	rel2(70.),rel1(20.) 0
<b>reL..</b>	function selection for add. switching contacts : add. contact 1 (relay-no.*) add. contact 2 (relay-no.*) select the corresponding measuring input / control circuit	SoA(701),StA(201) Su A CH 1
<b>Adr</b>	relay condition in case of measuring line fault: "SiE/SiA"(on/off) bus adress (adress no.) (for interface equipment only)	Si A 5

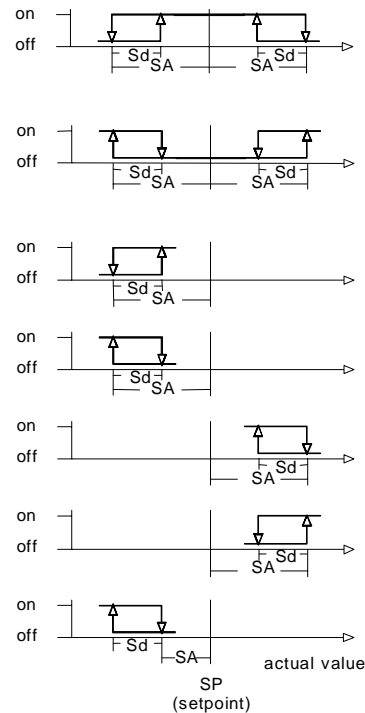
**Return** to operating level: *briefly* press the **P** - key again

\* = In case of multiple measuring inputs or control loops: relay- or channel number

**Selectable switching functions** (depending on version):  
For setting please refer to configuration level under „reL...“

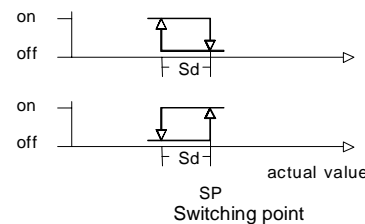
**Switching functions for trailing contacts:**

- LC A** Break contact on either side of setpoint (Limit comparator). Relay drops out as deviation increases (**Aus** = off)
- LC E** Make contact on either side of setpoint (Limit comparator). Relay picks up as deviation increases (**Ein** = on)
- Su A** Break contact below setpoint. Relay drops out as actual value decreases (**Aus** = off)
- Su E** Make contact below setpoint. Relay picks up as actual value decreases (**Ein** = on)
- So A** Break contact above setpoint. Relay drops out as actual value increases (**Aus** = off)
- So E** Make contact above setpoint. Relay picks up as actual value increases (**Ein** = on)
- St A** Heating stage below setpoint. Relay drops out actual value increases (**Aus** = off)



**Switching functions for independent contacts:**

- US A** Relay drops out with increasing actual value (**Aus** = off)
- US E** Relay picks up with increasing actual value (**Ein** = on)



*Service function:*

**Ein/Aus** contact is constantly switched on (**Ein**) or off (**Aus**) respectively

*Only for units with program option*

- Pr A** Relay switched off (**aus**) during SP program level, otherwise switched on
- Pr E** Relay switched on (**ein**) during SP program level, otherwise switched off

*Special function:*

**SF6** as SoA but switching point at setpoint, control output around SA below

**In each case additional settings follow under "reL." after the selection is acknowledged (P key)**  
(depending on version):

**Ist./Y** assigned value: actual value no. ... or Y (actuating signal)

**CH../SP.**(only) for trailing contacts: assigned control circuit / channel (no.) or assigned setpoint (1SP., rSP, SP.1, ..)  
for independent contacts: assignment of parameter input (channel no.)

"Safety" shut down (in case of measuring line fault):

- SI E** Relay for "Safety" behaviour in event of measuring circuit error: relay **on**
- SI A** Relay for "Safety" behaviour in event of measuring circuit error: relay **off**

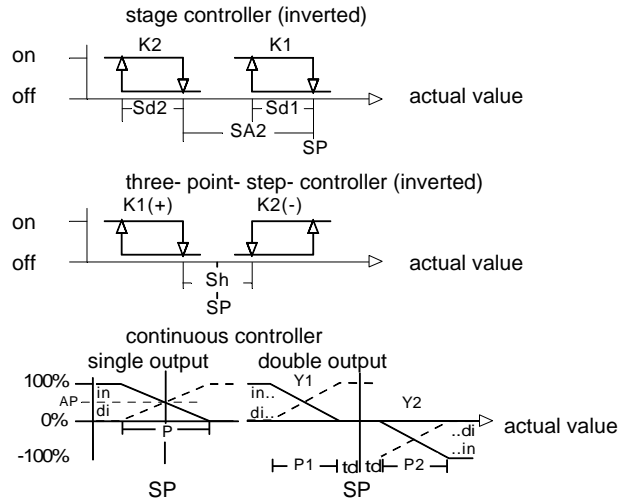
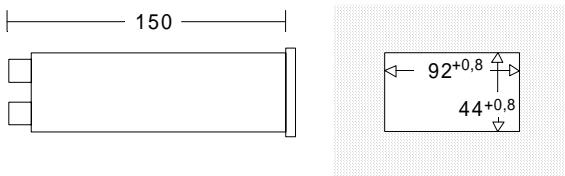
**Characteristics:** (parameters dep. on sub type:)

Adjustment on parameter level, with lock switch,  
 pre adjusted on customer's demand.  
 Proportional band Xp: 0,1...999,9 %  
 Integral action time Tn: 0,0...999,9 min  
 Rate time Tv: 0,0...99,9 min  
 Sensitivity of response Xsh: 0,1...1,0 %  
 Travel time of the actuator Tm: 6...600 sec  
 Switching frequency cy: 2...120 sec  
 Function characteristics: direct / inverted  
 Switching interval SA (add. contacts): 0..100,0 K  
 Switching difference Sd: 0,1...100,0 K

**Additional contact functions:**

As switching interval above and below setpoint or  
 independent adjustable with own setpoint and  
 measuring input, switching function adjustable  
 (ref. to chapter additional switching contacts)

**Installation dimensions:**

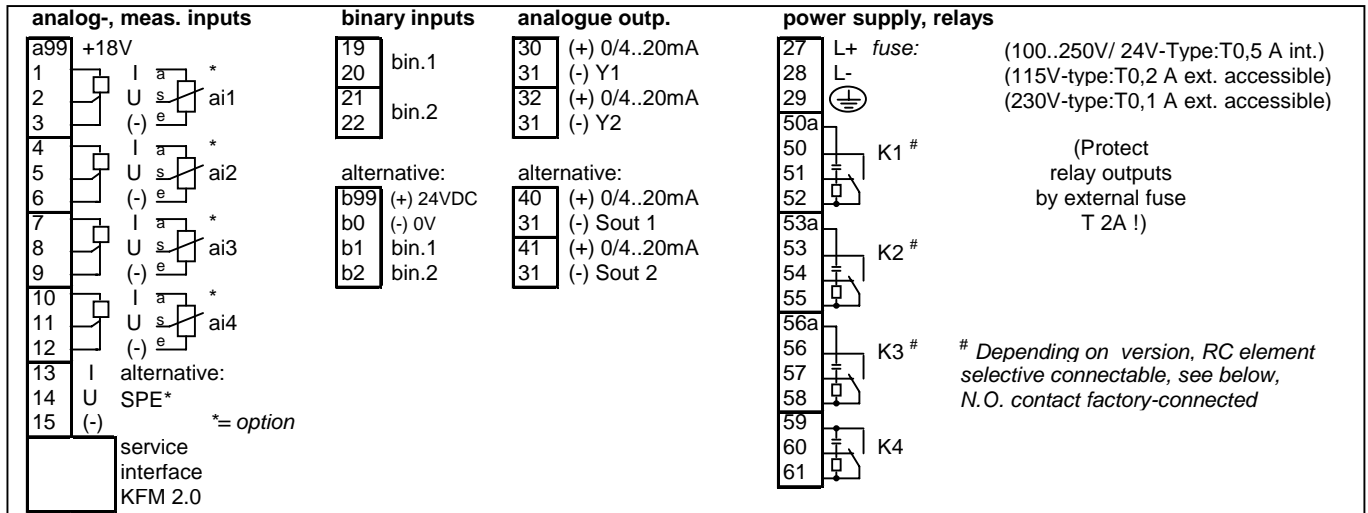


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**Other data:**

Housing for panel mounting, 48 x 96 mm  
 Power supply: 230VAC +/- 10 %, 48...62Hz  
 alternative 115 VAC, 48 VAC, 24 VAC, 24 VDC  
 Power consumption: approx. 14 VA  
 Protective system DIN 40050: IP54 (terminals IP20)  
 Permissible ambient temperature: 0...60°C  
 Nominal temperature: 20°C  
 Climatic category: Relative humidity <= 75 % yearly  
 average, no condensation, KWF to EN 60 529  
 EMC: refer to EN 61326

**Wiring diagram:** valid for each delivered controller is the wiring diagram on its casing only)



**Wiring, examples for input 1 and output 1 respectively:**

