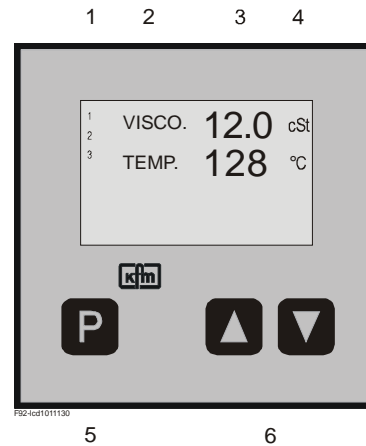


- 1 Display for relay function
- 2 Descriptive text for displayed values
- 3 Digital value displays
- 4 Unit of display
- 5 Key for setpoint and parameter mode
- 6 Setpoint adjustment

**certifications: DIN, GL, BV, DNV**



**General:**

The universal controllers 93AM20 / 21 consist of a control part with 4 resp. 2 preadjusted selectable functions. After reconfiguration to another function the stored parameters for each function are preadjusted automatically.

93AM20: Three-point-step with 1 signal output and 1 or 2 additional contacts according to the types VC 211 / 221.

Double three-point-step switchable depending on the state of a binary input with 0 or 2 information signal outputs and 2 additional contacts according to the types VC 320 / 322.

93AM21: Three-point-step with 1 or 2 additional contacts according to the types VC 210 / 220.

The high contrast plain- text indication with white background lighting is easy to read in both light and dark environments. In operating mode up to 4 values (actual values, setpoint values, etc...) can be displayed including freely adjustable description text and unit of display. Additional displays for operating and malfunction messages, including the corresponding hardware are optionally available.

Controller types 93AM20 / 21 with option ..re can be remotely operated with remote devices 903A50., i.e. all operations can take place at the controller as well as at the remote control device resp. all indications are visible on both.

**Measuring inputs / ranges:**

- ai1: Pt100 or standard signal, range 0...400°C resp. adjustable, preadjustment 4-20 mA / 0-50,
- ai2: Pt100 or standard signal, range 0...400°C resp. adjustable, preadjustment 4-20 mA / 0-200, setpoint range limitable by menu

**Displays:**

Max. 4-four-digit value displays with selectable decimal point, each including adjustable descriptive text and unit of display, 2 automatically faded in message texts, up to 4 displays for relay functions.

**Binary input**

- b1\*: 1 binary input, external voltage 0/24VDC or potential free contact  
0V resp. contact open: status = 0; 24V resp. contact closed: status = 1  
b1 (only with conf. = VC320 or 322): 0 = control channel 1 active; 1 = control channel 2 active

**Outputs:**

- K1,K2: relay with potential-free changeover contacts incl. spark extinction, switching power 250V 2A for control function three-point-step.
- K3: relay with potential-free changeover contact incl. spark extinction, switching power 250V 2A, for additional contact 3, limit comparator assigned to actual value 1 (preadjustment).
- K4: relay with potential-free changeover contact incl. spark extinction, switching power 250V 2A, for additional contact 4, limit comparator assigned to actual value 2 (preadjustment). (only conf = VC220 / 221 / 320 / 322)

S1/S2\*: Signal output 0/4..20 mA, galvanically isolated, freely configurable, preadjustment S1: actual value 1 (only conf = VC211 / 221 / 322), preadjustment S2: actual value 2 (only conf = VC322)

\* = type 93AM20 only

### 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 (if available) will light up according to the setpoint after some seconds. If nothing happens check the fine-wire fuse (if available) on the back panel of the controller and the electrical wiring. Adjust set value and check other adjustments.

### Maintenance:

*All electronic controllers in the product range of the manufacturer 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  |
| Err 58    | Binary inputs out of function (status = 0), remit controller for repair   |
| Err 59    | Digital outputs out of function (switched off), remit controller for repair   |
| Err 60    | Relay outputs out of function (switched off), remit controller for repair   |
| Err 61    | Analogue outputs out of function (0 %), 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:**

1	ACT.VAL.1	2	3	5.	8	°C
2	ACT.VAL.2	2	3	1.	2	°C
3	SETPOINT	2	3	6.	0	°C

ACT.VAL.1	2	3	5.	8	°C
ACT.VAL.2	2	3	1.	2	°C
12:09	TEMPERATURE		HIGH		
12:26	LEVEL		LOW		

BIN. MESSAGES P1 / 2					
WATER LEVEL LOW					
*SMOKE GAS TEMP HIGH					
*STEAM TEMP HIGH					
*PRESSURE LIMITTER					
BURNER OPERATION					
BURNER MAX LOAD					
CIRC. PUMP STEP 1					
CIRC. PUMP STEP 2					

**Analog values:** Depending on the configuration, up to three values in 10 mm size or two values in 10 mm and two values in 3 mm size can be displayed. A dedicated unit for each value can be configured if desired. The corresponding descriptive texts are changeable by means of the PKS PC software.

Depending on equipment, the status of the relays is shown at the left side of the display via the respective number (K) 1, 2, ..

In conjunction with the option of binary input messages, the corresponding texts are shown in the two lower 3 mm display lines if the binary inputs are activated. The corresponding value displays are hidden during this time.

**Message list:** Briefly press the **▲** - button (*do not hold*)

The display now shows a list of message texts for all activated binary inputs in the order of their occurrence. Additionally, messages which are configured to the collective relay are marked with a circle symbol. This flashes until the message has been confirmed by means of binary input 1.

**Setpoint value setting:**

1	ACT.VAL.1	2	3	5.	8	°C
2	ACT.VAL.2	2	3	1.	2	°C
SP = 236.0						
SETPOINT CHANNEL 1						

Briefly press the **P** - button (*do not hold*)

A flashing frame with the description SP shows the activated setpoint level. The *upper text display* shows the parameter name "SP=" and the adjusted value, the *lower text display* optionally shows a description text.

The displayed value can now be changed using the **▼** (smaller) and **▲** (larger) buttons.

A setpoint change is effective *immediately*, without any further operational steps.

'Arrow' button *acceleration effect:*  
*longer pressing causes faster changing.*

*return to operating mode:*  
*briefly press the P - button (or automatic after > 30 sec)*

optional:

\*SPB

\*SP

SP2 / 3 / ..

SPE

SP-F

Briefly press the **P** - button again each time:

Bus setpoint, forced by an external bus adapter (e.g. 99spde..)

setpoints of additional control loops (\*=no)

additional setpoints for the control loops

external setpoint (display only);

*flashing* description signifies for this version:

value is presently *not* active.

Switch over menu SP / SPE (only in case of adjustment SP-F=MENU (Conf-level))

**Manual operation:** (*optional*)

Press and hold the **▼** -button, then additionally press the **▲** - button, then release both. (Option: *Switch on and off using the extra button* **Ⓢ**)

(For multi-channel controllers, first select the channel number CH..

using the **▼**...**▲** buttons and continue with the **P** -button, after which:)

**MAN.**

The *upper text display* shows "MAN. \*", plus the setting variable, if it exists.

The control function is switched off.

Manual control is now possible using the **▼**...**▲** buttons

**return** to operating mode: *only* with **P** -button (or. **Ⓢ**),

*no* automatic switching back from manual operation!

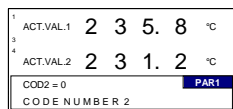
*Optional:* Start self-optimisation (see chapter Optimisation):

press the **P** -button >5 sec whilst in manual control function;

the lower display jumps to "-Ad-".

*Abort:* press the **P** -button again >5 sec

**Access** from the operating level



After *polling* (see instructions for level PARA 1 / 2), a flashing frame with the description PAR1 / PAR2 shows the activated parameter level.  
The *upper text display* shows the first parameter name and the adjusted value, the *lower text display* optionally shows a description text.

*continue* to the next parameter and/or *confirm* entry:  
briefly press each time the **P** - button

To *change* the setting displayed: Press the **▼...▲** buttons

**Settings in detail:**

(existence depends on version and type):

<b>PARA 1</b>		<i>Factory setting</i>	<i>Notes</i>
	Polling: press and hold the <b>P</b> - button >5 sec, release it after the display reacts.		
<b>COD2</b>	Code number 2 (password) for parameter levels (1...9999)	1	___
<b>CH..</b>	(only) for multi-channel controllers: Selection of desired channel (no.)		___
<b>P</b>	Proportional range Xp (%) (for more details, see "Optimisation")	25.0	___
<b>I</b>	Integral action time Tn (min) (for more details, see "Optimisation")	7.0	___
<b>D</b>	Rate time Tv (min) (for more details, see "Optimisation")	0.2	___
<b>SH</b>	Response sensitivity ("dead zone") Xsh (%)	0.1	___
<b>SA.</b>	Setpoint distance (absolute) for following switching contact no.	5.0*	___
<b>SP.</b>	Independent setpoint for switching contact no.	0.0	___
<b>SD.</b>	Hysteresis (switching difference on/off) for switching contact no.	3.0	___
		(*..201,701/SA3 :10.0)	

**return** to operating mode:

briefly press the **P** - button (or automatic after > 30 sec)

<b>PARA 2</b>			<i>Notes</i>
	Polling: <i>press and hold the P - button, additionally press the ▼ - button, hold both buttons for &gt;5 sec, release them after the display reacts:</i>		
<b>COD2</b>	Code number 2 (password) for parameter levels (1...9999)	1	___
<b>Unit</b>	Switches the unit of display (°C / °F)	C	___
<b>*BLO/*BHI</b>	(only) for voltage / current input: start / end of display range	#	___
<b>*ELO/*EHI</b>	(only) for external setpoint: start / end of setpoint range	#	___
<b>*SLO/*SHI</b>	(only) for information signal output: start / end of range	#	___
<b>NST</b>	Number of decimal places of the display (0 / 1 / 2, depending on range)	0	___
<b>*Lo / *HI</b>	Setpoint setting range, lower / upper limit	#	___
<b>CRST</b>	Contrast setting for display (0...20)	32	___
<b>BRGH</b>	Brightness display (30 ... 100)	50	___
<b>DSP1</b>	Variable shown in first display line (10mm) (OFF / SP / Y / IST..)	IST1	___
<b>DSP2</b>	Variable shown in second display line (10mm) (OFF / SP / Y / IST..)	IST2	___
<b>DSP3</b>	Variable shown in third display line (10mm if DSP4=OFF, otherwise 3mm) (OFF / SP / Y / IST..)	SP	___
<b>DSP4</b>	Variable shown in fourth display line (3mm) (OFF / SP / Y / IST..)	OFF	___
	(SP = setpoint, Y=setting variable, Ist * = Actual value channel / measuring input*)		
<b>EIN1..4</b>	Unit of measurement for corresponding display line(°C / °F / % / bar / mbar / mPas / cSt / Kgm3 / mm / KPa / L / m3/h) Note: no conversion!	C	___
<b>Text1/2/3/4</b>	Description text for corresponding display line1..4: choose from a predefined list (ACT.VAL...,SETPOINT, SUPPLY,RETURN), resp. 1 additionally editable text..*,changeable by PKS-software	1= ACT.VAL1 2= ACT.VAL1 3= SETPOINT	___ ___ ___

**return** to operating mode:

briefly press the **P** - button (or automatic after > 30 sec)

\* = ID number in case of several measuring inputs or control loops. # = *corresp. 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 (if available) 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

1	ACT.VAL.1	2	3	5.	8	°C
3						
4	ACT.VAL.2	2	3	1.	2	°C
	CODE = 1					<b>CONF</b>
	CODE NUMBER					

**Access** from the operating level

*Polling: press and hold the **P** - button, additionally press the **A** - button, hold both buttons for >5 sec, release them after the display reacts:*  
 A flashing frame with the description CONF shows the activated parameter level. The *upper text display* shows the first parameter name and the adjusted value, the *lower text display* optionally shows a description text.  
*continue* to the next parameter and/or *confirm* entry:  
 briefly press each time the **P** - button  
 To *change* the setting displayed:  
 Number values: Press the **▼**...**▲** buttons, text values:press the **A** - button

**Settings in detail:**

(existence depends on version and type):

*Factory setting*

*Notes*

<b>CODE</b>	Code number for configuration level (1...9999), Alternatively: Hold the <b>P</b> button for more than 10 sec after code entry:	1	___
<b>COD1</b>	Possibility of setting the code number for the configuration level(option).1		___
<b>COD2</b>	Possibility of setting the code number for the parameter levels(option). 1		___
<b>LNG</b>	Language selection of the menu text(Deutsch,English,User def, Off)Deutsch		___
<b>CONF</b>	Selection of the configured controller function ( <i>if existent</i> )		___

**return** to operating mode: *Briefly* press the **P** - button

or: **continue** to the following settings: press the **P** -button and *hold it* > 5 sec:

*Note: when continuing after changing a function, the display first flashes for a few seconds, only then does the desired switching over or back take place*

<b>SPEF</b>	Configuration external/second setpoint "BIN" (activation by binary input) / "MENU" (activation from the setpoint level) / "SP2" / "AUS"=OFF	MENU	___
<b>AIN*</b>	Input type for input no.*: "RTD / 0-20 / 4-20(mA) / 0-10 / 2-10(V) / AUS=OFF" (note different terminals for I/U)**	RTD	___
<b>IST*</b>	Correction value for changing the controller display (+/-)	0.0	___
<b>SP 2/E</b>	Type of effect of second / external setpoint: "Add/ Sub/ AbS" (adding / subtracting / absolute value)	AbS	___
<b>*YM</b>	Setting time of the controlled drive "6...600" (sec)	60 sec	___
<b>*CY' '</b>	Switching frequency in two-point controllers: "2...120" (sec.)	20 sec	___
<b>*OUT</b>	Setting output signal "0...20 / 4...20" (mA) / 0...10 / 2...10 (V)"	4...20 mA	___
<b>*OUT</b>	Setting output characteristic: direct / inverse "di / in" (with 2 outputs: "in in / in di / di in / di di")	in	___
<b>*td</b>	For 2 outputs: dead zone between outputs 1 and 2 "0...10%"	0	___
<b>*AP</b>	Output signal working point (-100...+100)	50	___
<b>FG A/E</b>	Automatic adjustment of remote transmitter input (see extra sheet 99ar)		___
<b>Sou*</b>	Assignment of inform. output signal(s)* (act. value/setp., setting var..) <i>Ist1</i>		___
<b>Sou*</b>	Type of information output signal(s)* "0..20/4..20(mA)/0..10/2..10(V)" (* Sout= Signal 1; Sou2 = Signal 2)	4...20 mA	___
<b>*Y_S</b>	Behaviour of the setting output in the event of measurement line error: Relay position: "rel1 / rel2 / OFF"	<i>rel2(70.),rel1(20.)</i>	___
	Continuous output: "0...100" (%)	0	___

**bin. Eing** Sub-menu for binary input configurations

Polling: press the **P** -button and *hold it* > 5 sec:

<b>BIN*</b>	Direction of control action binary input* direct / inverse (di/in)	di	___
<b>BIN*</b>	Assignment of collective relay: Stat=none, SREL= collective relay	stat	___
<b>BIN*</b>	Switch-on delay (0...300 sec)	0	___
<b>REL*</b>	Function mode of additional contact (relay no.)	SoA(701),StA(201)	___
<b>REL*</b>	Measuring input / control loop assigned to additional contact	<i>Ist 1</i>	___
<b>REL*</b>	Add. contact – relay pos. in event of meas. line error "SiE/SiA"(on/off) <i>Si A</i>		___
<b>DSPL</b>	Display representation: NORM (grey / black), INV (black / white)	NORM	___
<b>Adr</b>	if equipped with interface: bus address (number)	5	___
<b>BAUD</b>	if equipped with interface: baudrate (9600/19200/38400)	38400	___

**return** to operating mode: briefly press the **P** - button *again*

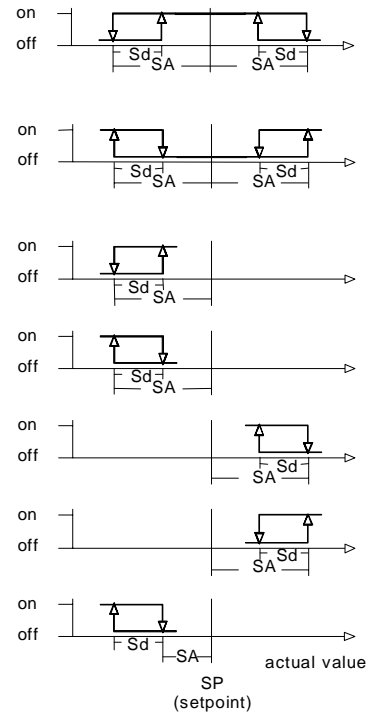
\* = ID number in case of several inputs / outputs or control loops.

\*\*= Rtd input of ain2 is additionally usable if equipped with ext. setpoint and activation using SP-F.

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

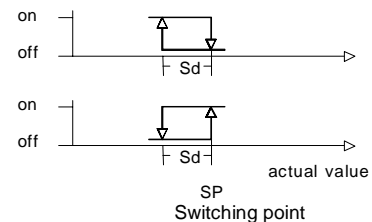
**Switching functions for trailing contacts:**

- 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

*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**

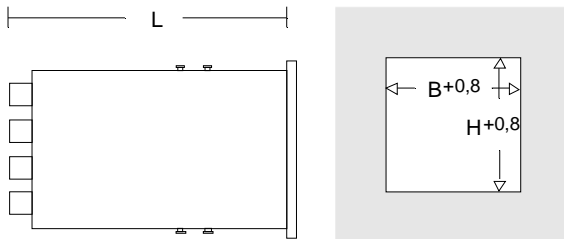
**Characteristics:** (parameters dep. on sub type:)

Adjustment on parameter level, code locked,  
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

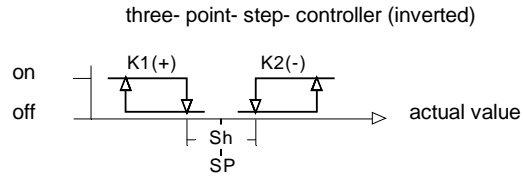
**Additional contact functions:**

As switching interval above and below setpoint or independent adjustable with own setpoint and measuring input, switching function adjustable

**Installation dimensions:**



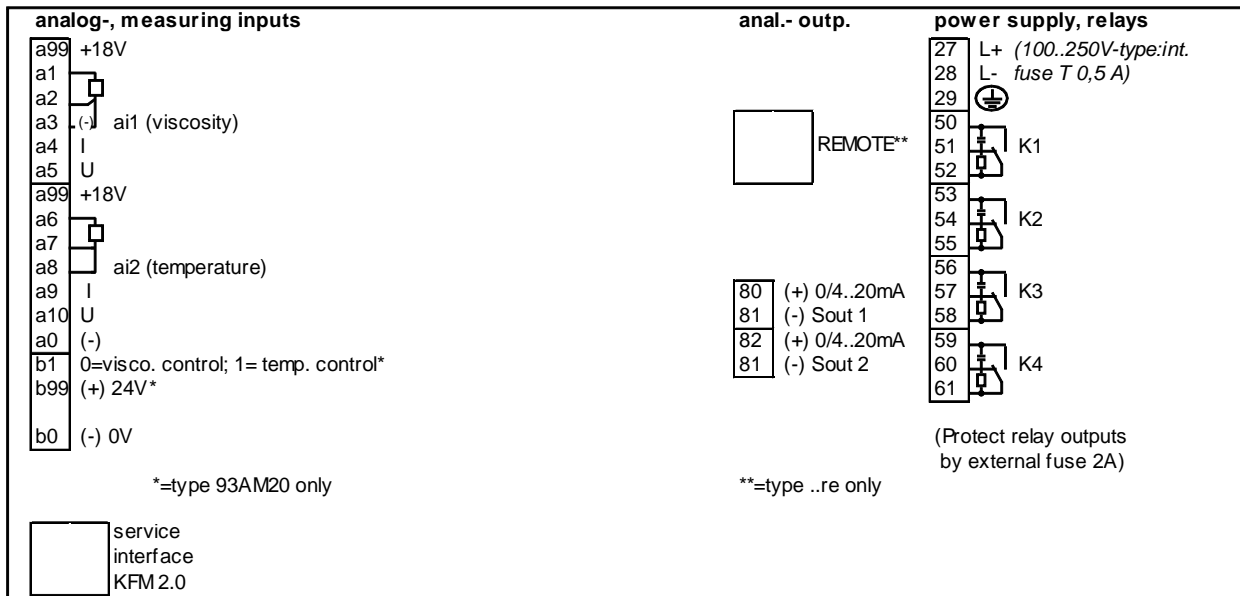
Form 96x96: L=150mm, B=92mm, H=92mm



**Other data:**

Housing for panel mounting, 96 x 96 mm  
Installation orientation: optional  
Power supply: 100..250 VAC, about 14 VA  
alternative 24 V AC / DC  
Protective system EN 60529: IP54 (terminals IP20)  
Permissible ambient temperature: 0...60°C  
Nominal temperature: 20°C  
Climatic category: KWF to EN 60529  
Relative humidity <= 75 % yearly average, no condensation  
EMC: referring to EN 61326

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



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

