KS 50
Compact industrial controller

Temperature control of electrically heated machinery, moulds and thermal processes

Simplest operation and bright LED displays

Precise control behaviour and self-tuning

Heating (with logic output), cooling and two alarms

Automatic start-up function for protection of heating elements

„Hold" function for output in case of sensor break prevents downtime

Monitoring of heating current and actuator (SSR)

Opto-coupler inputs for set-point lowering

Low price and fast delivery

CE-marking

PROFILE

The new generation of KS 50 compact controllers features microcomputer operation for precise, cost-effective temperature control. Functions like „set-point lowering" and „heating/ cooling with two alarms" make the units particularly suitable for use in plastics processing machinery, heated moulds, packing machines, tempering equipment, and similar thermal processes.

The selectable functions „start-up" and „hold of output with sensor break" ensure increased lifetime, and prevent downtimes with high-performance electrical heating elements (e.g. hot runner moulds).

A digital interface permits communication with computers and PLCs.

Consistent application of modern technology (microcontroller, ASIC, SMD) reduces the controller's volume to a minimum, which also means low internal temperatures. Efficient production methods ensure highest quality and reliability, plus short delivery times.

KS 50 controllers meet European Standards EN 50 081-2 and EN 50 082-2, and have therefore qualified for CE-marking. Furthermore, they conform to safety regulations IEC 348 (VDE 0411). Each unit is tested with 3 kV before shipment.

DESCRIPTION

Plug-in controller modules

KS 50 controllers are plug-in modules, which ensures fast replacement without any tools. Electrical connections are made via rear flat-pin terminals.

Two hardware versions, freely configurable

All KS 50 versions are switching controllers with 3 relays and an optional digital interface. Input types, controller and alarm functions are configurable.

Self-tuning, a second set-point with ramp function, an additional input for heating current monitoring, a logic output for heating, and a 115/230 V power supply are provided as standard.

Simple operation

Only three robust keys are used for all settings and adjustments. Tactile feedback from the keys and an automatic increase in rate of change when a key is pressed for a longer period ensure fast and safe settings.

Clear operating concept and lockable parameter adjustment

All operating functions are user-friendly and clearly structured as follows:

Operating Level for process value display and set-point adjustment. Briefly pressing the selector key changes to display of heating current, and permits adjustment of the limiting current value.

Parameter Level for adjusting the required control parameters, limit values, etc.

Configuration Level for adjusting the controller functions.

An internal switch prevents unauthorized access to the Parameter and Configuration levels.

Disabling the display and operating functions
Disabling of set-point adjustment and display switch-over at Operating Level is possible. Moreover, the adjustment limits ($w_0 \ldots w_{100}$) for set-point can be defined at Parameter Level.
The digital input R/L enables any changes to set-point and in the Parameter/Configuration levels to be disabled (remote switch-over).

Input circuit monitoring
In case of a fault in sensor or leads, the built-in monitor provides increased operational safety. The controller output action after monitor triggering can be configured for:
– upscale
– downscale
– outputs switched off
– „hold" of average output value

Thermocouple input
The monitor is triggered by wrong sensor polarity or TC break.

Resistive input
The input is monitored for a break or a short circuit in the sensor and leads.

4 . . . 20 mA input
The monitor is triggered if the current falls below 2 mA.

Measurement value correction for thermocouples and Pt 100
The correction type is selectable for thermocouple and Pt 100 input: Gradient correction CG or parallel correction CP (see Fig. 2). Correction is at the relevant measurement value or with open input. With parallel correction, all display values are shifted in parallel by the positive or negative correcting value. With gradient correction, the display value characteristic is rotated at 0 °C or 32 °F. The display values increase or decrease proportionally to the measured value.

Fig. 2 Measurement value correction

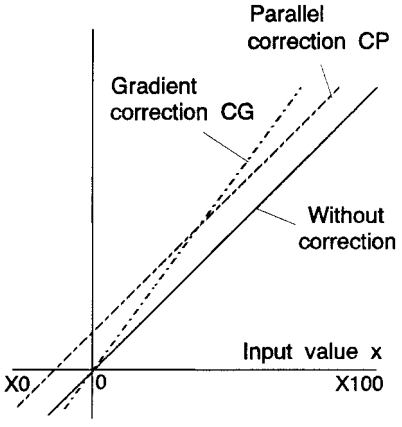
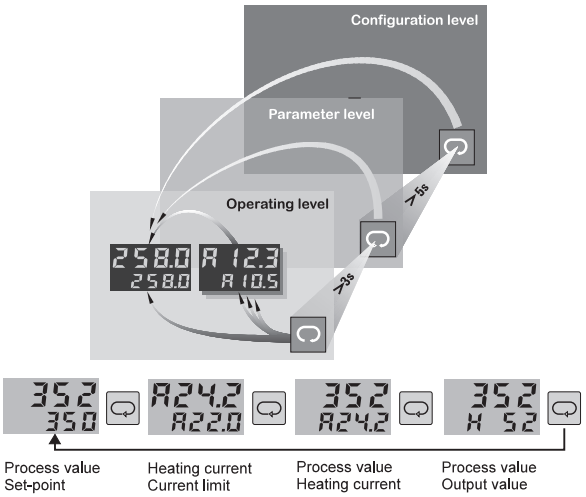


Fig. 1 Operating concept



Heating current display and alarm
The controllers are fitted with an input for connecting an external current transformer. The heating current and its adjustable limit value are displayed as parameters and (if required) at the Operating Level.
Heating current alarm signalling is provided by a red LED and via alarm relay 1 or 2.

Configuration „Monitoring for low current and actuator short circuit"
An alarm is signalled if the heating current falls below the limit value while relay 1 is energized or the logic output is active.
With relay 1 de-energized or logic output inactive, monitoring for heating current > 0,4 A is provided.

Configuration „Excess current monitoring"
An alarm is signalled if the heating current limit value is exceeded while relay 1 is energized or the logic output is active.

Configuration „Monitoring for low current and actuator short circuit, no alarm with set-point ––––"
If the function „relay de-energized on alarm" has been selected, and the controller has been switched off with set-point „––––", the alarm relay remains energized.
In plants comprising several controllers, this feature enables a controller to be switched off deliberately, without generating an alarm (e.g. when changing to a mould with a lower number of measuring points).

Controller and positioner functions
KS 50 is configurable as a signaller, as a two-point controller or as a three-point controller. When configured as a positioner, the output has an adjustable duty cycle of 0 . . . 100%.

Disabled outputs
The controller outputs can be disabled by adjusting the set-point to a value below the lower limit W_0 (all outputs de-energized).

Alarm functions
Alarms 1 and 2 are configurable as follows:

a) *Relative alarm* for monitoring the control deviation (relative to set-point)

b) *Absolute alarm* for limit monitoring (independent of set-point)

c) *Relative alarm* with alarm suppression
The alarm is not triggered during start-up or after set-point changes.

d) *Sensor fault alarm*

e) *Heating current alarm*

All alarm types can be combined.

Second set-point with ramp function
The external control signal W/W2 is used to activate a second set-point (e.g. safe set-point, which can be used when starting after mains recovery). The second set-point becomes effective after an adjustable time has elapsed.

Programmer
Four set-points with the relevant segment times can be used for program control. After mains failure, start or re-start is from the actual process value x (see Fig. 7).

Set-point gradient functions
This function (Fig. 3) can be adjusted by means of parameter Gr with the corresponding controller version. In case of set-point adjustment, after re-start, or switch-over from W2 to W, the set-point starts changing from process value x at the adjusted speed (e.g. 5 °C/min), and LED W2 blinks. With Gr = ----, the function is switched off.

Boost function
The boost function provides a short-term increase of set-point temperature, e.g. with hotrunner control, in order to clear nozzles of "frozen" rests of material during machine start-up.

The function is only possible with disabled interface, i. e. the front panel keys can no longer be disabled via the L/R remote input.

The boost function also works with the start-up function and the set-point gradient.

Start-up circuit
For temperature control, e.g. with hot runners (Fig. 4).
High-performance heating elements with magnesium oxide insulation must be heated slowly, to remove any humidity and to prevent destruction.

With activated start-up circuit, the controller uses the adjusted start-up correcting variable (e.g. 40%) until reaching the start-up set-point (e.g. 95 °C). For protection of the heating elements, the duty cycle is reduced to ¼ during start-up.

The start-up set-point (e.g. 95 °C) is maintained during the selected start-up holding time. Subsequently, the controller uses main set-point W.
The start-up circuit is triggered again automatically, if the process value falls more than 40 K below the start-up value (e.g. 55 °C).

„Hold" function for output signal
In order to continue with production in case of sensor break, the temperature must be maintained by means of the last mean value of the output signal.

On sensor break, the KS 50 process value display indicates „FbF", and the lower display shows the „hold" output signal, which can be changed by the operator, if necessary.

The „hold" value is determined from the mean output value at intervals of 1 minute , provided that the process value is within a response threshold LYH (e.g. $X_w = \pm$ 2K).

To prevent excessively high output values, i.e. overheating with TC break, the „hold" output value (YH) can be limited.

Fig. 3 Set-point gradient function

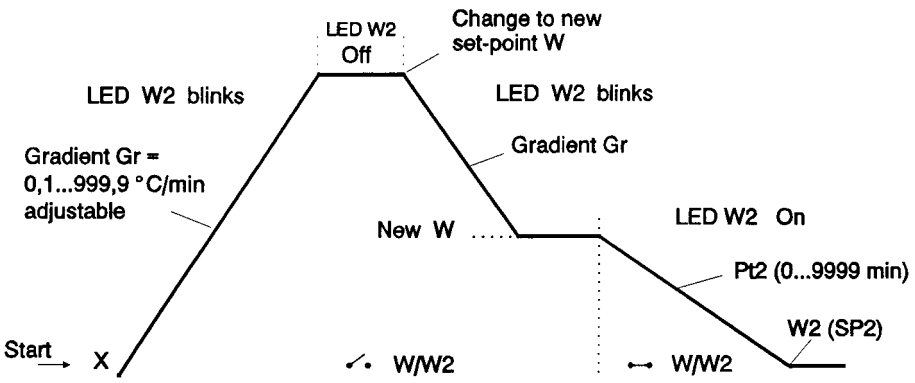


Fig. 4 Start-up circuit

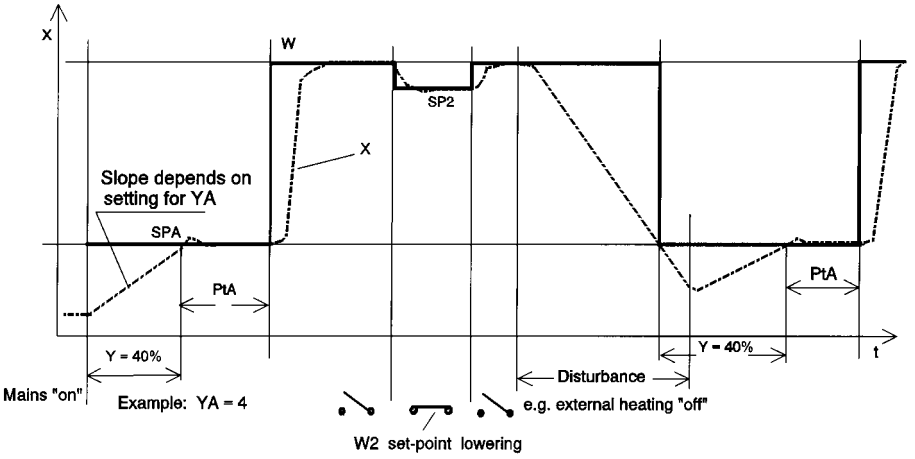
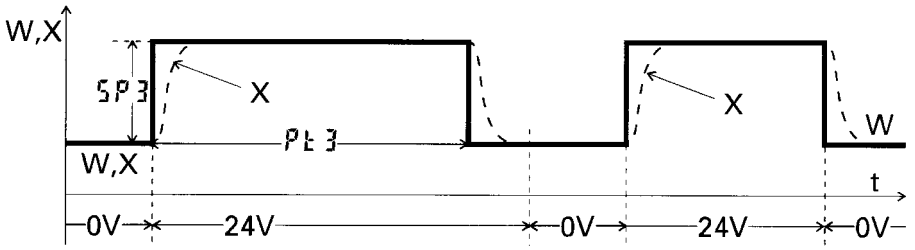


Fig. 5 Start-up function with boost (Con 3 = 03..)



Remote control input L/R

Sensor break signalling is provided via alarm 1 or 2 so that the sensor can be replaced. As soon as the KS 50 detects a valid input value after replacement, controller operation is continued automatically.

After switching on the supply voltage again or after re-configuration, the "hold" output value is set to 0% and re-determined.

Self-tuning
The self-tuning function is fitted as standard, and determines the best control parameters automatically. Self-tuning is started either at the push of button, or automatically (if the parameter AAdA = 1 has been set). Automatic tuning is triggered when the power supply is switched on, and after a control deviation exceeding ±5 K.

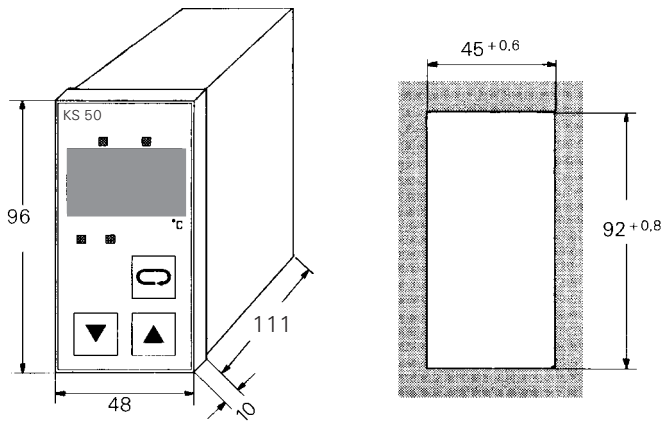
a) Adaptation during start-up
After detecting the step change of the output signal, the controller uses the delay time T_u and the max. rate of change V_{max} of the control loop to calculate the optimum settings for Xp1, ti1, td1, and t1 (if the logic output is used, the duty cycle t1 is not changed). With three-point controller configuration, the "cooling" parameters (Xp2, ti2, td2, t2) are determined separately. For fast control loops, e.g. hot runners, the pulsed method can be selected to prevent overshoot (AdAP = 1).

b) Adaptation to set-point
This new procedure avoids the time-consuming changes to control parameters when changing to a different mould or material, or with an altered throughput on an

extruder. At the touch of a button (or automatically in case of a large deviation from set-point), the controller uses a pulsed method to determine the optimum control parameters for the heating zone (Xp1, ti1, td1, t1) as well as for the cooling zone (Xp2, ti2, td2, t2).

KS 50 with digital interface
A separate RS 422/485 interface module is available, making the controllers bussable. Up to 4 controllers can be connected to the module using one interface cable (1m long). The max. transmission speed is 19.200 bits/s.

Fig. 6 Overall dimensions (mm)



TECHNICAL DATA

INPUTS

Thermocouples
Types L, J, K, N, S, and R to DIN IEC 584.
For ranges, see Ordering data.
Input resistance: ≧ 1 MΩ

Display: in °C or °F (temperature-linear)
Display error: ≦ 3K ± 1 digit
(≦ 1K ± 1 digit for types L, J, and K up to ≦ 700 °C)

TC break monitor:
Sensor current ≦ 1 mA, configurable output action

Polarity monitoring:
Responds when input signal is 30 K below span start

Temperature compensation: built in
Sensor or compensating lead must be taken up to the controller terminals.
Additional error: ≦ 1 K/10 K change of terminal temperature

Resistance thermometer
Pt 100Ω to DIN IEC 751
Range: –99,9 . . . 500,0 °C (temperature-linear)
Display error: ≦ 1 K ± 1 digit
Sensor current: ≦ 0,4 mA

Connection in three-wire technique without lead adjustment.
With two-wire connection, a calibrating resistor equal to the lead resistance must be fitted.
Lead resistance: ≦ 30 Ω

Input circuit monitoring for break in sensor or lead, or short circuit.
Configurable output action.

Direct current
0/4...20 mA, linear
Input resistance: 15 Ω
Display error: ≦ 0,1%
Measurement limits:
selectable within –999 . . . 9999

Decimal point:
adjustable, with one digit behind the decimal point.

Input circuit monitor for 4...20 mA: with I ≦ 2 mA, configurable output action.

Direct voltage
0...10 V, linear
Input resistance: ≧ 110 kΩ
Display error: ≦ 0,1%
Measurement limits:
selectable within –999 . . . 9999
Decimal point:
Adjustable, with one digit behind the decimal point.

Current transformer
Current range: 0...30 A/0...30 mA AC, (see Accessory equipment).
Input resistance: approx. 170 Ω
Analog inputs 1 and 2 are galvanically connected.

Digital inputs L/R and W/W2

Opto-coupler
Rated voltage 24 VDC external
Current sink (IEC 1131 type 1)
Logic „0" = –3... 5 V
Logic „1" = 15...30 V
Current requirement: approx. 5 mA

The digital inputs are galvanically isolated from the other inputs/outputs and from the supply voltage.

Digital interface
Via a separate interface module:
RS 422 or RS 485 (see Accessory equipment).
Controller address: 0...99
Transmission speed: 2400, 4800, 9600, or 19.200 bits/s

OUTPUTS

Logic output
For direct connection of solid-state relays.
Logic „1":
≧ 13 V with a load ≧ 500 Ω
or 10 mA with a load ≦ 500 Ω
Logic „0": 0 V

The logic output is galvanically connected with the input and the electronics. Up to 3 solid-state relays (with logic „1" = 3...4 V) can be connected in series.

Relay contacts (relays 1, 2 and 3)
Potential-free, open when de-energized.
Contact rating: ≦ 250 VAC, ≦ 1 A, ≦ 500 VA, resistive load
Minimum load: 10 VDC, 0,05 A, 1 VA

The output functions are configurable (see Con 1).
By setting W to „––––", all outputs are switched off (exception Con 3: xx2x).

POWER SUPPLY

Voltage: 230/115 VAC, –15...+20%
Frequency: 48...62 Hz
Power consumption: approx. 5 VA

CONTROL CHARACTERISTICS

Configurable as:
- signaller with 1 or 2 alarms
- two-point controller with DPID behaviour and 2 alarms
- positioner „heating"
- three-point controller with DPID/DPID behaviour and 1 or 2 alarms
- positioner „heating/cooling"

Control parameters
Self-tuning or adjustable (see parameter table).
Switching differential of signaller: 0,2%

ALARM FUNCTIONS

Alarms 1 and 2 configurable as:
- relative or absolute alarm
- relative alarm with alarm suppression
- sensor break alarm
- heating current alarm

Output action: relay de-energized or energized on alarm.

HEATING CURRENT MONITOR

Heating current is monitored with an external transformer (see Accessories).
Transformer rating: 0...30A / 30mA AC
For smaller heating currents, the load cable can be looped through the transformer several times for higher display accuracy, e.g. 2 x 15A / 30mA AC.

Display range selectable 1,0...99,0 A, so that other current transformers can be used.
Display error: ± 5% of display range

Heating current limit:
adjustable within selected display range, acting on alarm output 1 or 2.
Alarm indication via red LED.

Monitoring for undercurrent or short-circuited actuator (SSR)
Red LED lights up, if heating current is below limit value or with short-circuited actuator.
Trigger value for short-circuit monitor: ≧ 1,3% of selected range (e.g. ≧ 0,4 A with range 0...30 A).

Excess current monitoring
Red LED lights up, if heating current is above limit value.

SET-POINT

Upper and lower limits of the set-point range $W_0 \ldots W_{100}$ are selectable within the measuring range limits $X_0 \ldots X_{100}$.

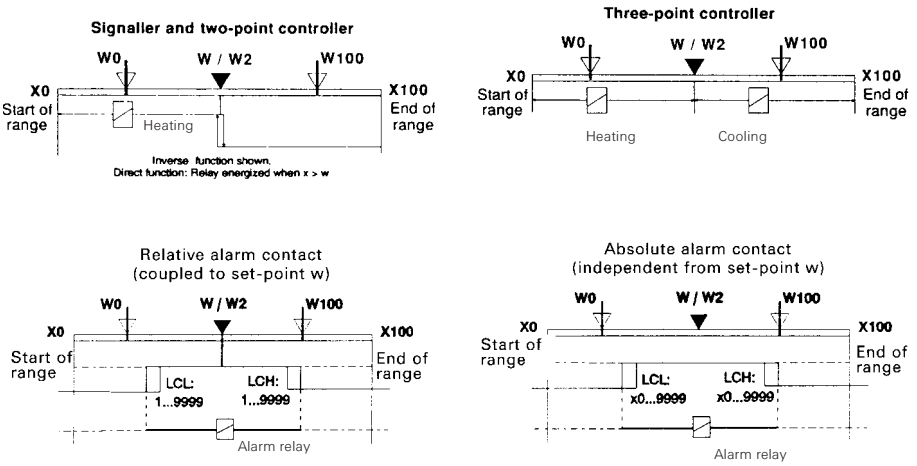
DISPLAYS

Multi-function display
Two red 4-digit LED displays.
Digit height:
Process value X = 10 mm
Set-point W = 7,6 mm
Display range: –999...9999

LEDs for status display
Yellow W2: for set-point W2 or programmer „On" or remote operation

LEDs for relay status
Yellow left: heating „On"
Yellow right: cooling „On"
LED for alarm 1: green, process value within limits
LED for heating current: red, limit value exceeded

Fig. 7 Controller functions and alarm functions



Upper and lower alarm can be disabled, and switching difference Sd is adjustable.
On alarm, relay is energized (as shown), and logic output = 1.
Functions are valid for relays 1 and 2.

Input circuit monitoring
(in upper display)
„FbF" = sensor break
„POL" = reversed polarity

ENVIRONMENTAL CONDITIONS

Permissible temperatures
For specified accuracy: 0...55 °C
Operation: 0...60 °C
Storage/transport: –20...70 °C

Climatic category
KUF to DIN 40 040
Relative humidity: ≦ 75% yearly average, no condensation

INFLUENCING FACTORS

Power supply effect
None. In case of mains failure, the configuration data are stored in a non-volatile EEPROM.

Shock and vibration

Vibration test Fc
to DIN 68-2-6 (10...150 Hz)
Unit in operation: 1g or 0,075 mm
Unit not in operation: 2g or 0,15 mm

Shock test Ea
to DIN IEC 68-2-27 (15g, 11 ms)

ELECTROMAGNETIC COMPATIBILITY

Complies with EN 50 081-2 and EN 50 082-2 for unlimited use within industrial areas.

Electrostatic discharge
Test to EN 61 000-4-2
Voltage: 8 kV
Contact discharge: 4 kV

High-frequency interference
Test to EN 61 000-4-3
Frequency: 80...1000 MHz, 10 V/m
Effect: ≦ 7 K

HF interference on leads
Test to EN 61 000-4-6
Frequency: 0,15...80 MHz, 10 V

Low-frequency magnetic field
Test to EN 61 000-4-8
Frequency: 50 Hz
Field strength: 30 A/m

Fast pulse trains (burst)
Test to EN 61 000-4-4
2 kV applied to leads for supply voltage and signal leads

High-energy single pulses (surge)
Test to EN 61 000-4-5
Test voltage applied to following leads:
Supply leads: 1 kV symmetric, 2 kV asymmetric
Signal leads: 0,5 kV symmetric, 1 kV asymmetric

GENERAL

Housing
Plug-in module, inserted from front.
Material: Makrolon 9415 flame-retardant, self-extinguishing.
Flammability class: UL 94 VO
Front dimensions: 48 x 96 mm
Depth behind panel: 111 mm

Protection mode
(to EN 60 529)
Front: IP 54 (vertical mounting ± 15 °)
Housing: IP 20
Terminals: IP 00

CE-marking
According to European Directive 93/44/EWG for electromagnetic compatibility.

Electrical safety
Tested to IEC 348 (VDE 0411)

Electrical connections
Flat-pin connectors to DIN 46 244 for 1 x 6,3 mm or 2 x 2,8 mm

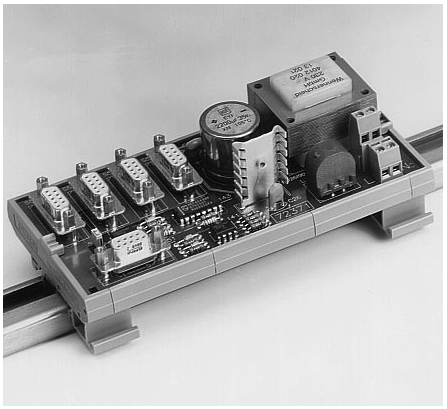
Mounting method
Panel-mounting with two fixing clamps at top/bottom

Weight: approx. 0,45 kg

Accessories
Operating instructions
2 fixing clamps

ACCESSORY EQUIPMENT

Interface module/interface cable



Interface module/interface cable
Up to four controllers can be connected to the interface module; also in combination with other PMA equipment. Connection is by means of the separately-ordered interface cable (1 m long). Via the RS 422/485 interface (D-type connectors), the data are transmitted up to a distance of 1 km. The data protocol conforms to ISO 1745 (fast select mode).

Supply voltage
230 VAC / 115 VAC, depending on version
Votage tolerance: + 10 . . . – 15 %
Frequency: 48 . . . 62 Hz
Power consumption: approx. 5 VA

Electrical connection
Screw terminals: 2,5 mm² solid or 1,5 mm² flexible

Mounting
To standard DIN rail, e.g. type NS 35 (U-rail) or type NS 32 (C-rail)

Protection mode
Type IP 00 (mounting in enclosure)

Permissible temperatures
For operation: 0 . . . 60 °C
For storage: – 20 . . . + 70 °C
Relative humidity: ≦ 75 % yearly average, no condensation

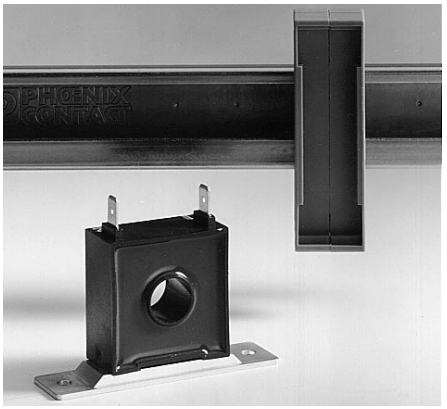
Mounting position: Not critical

Dimensions
158 x 78 x 60 mm (L x W x H)

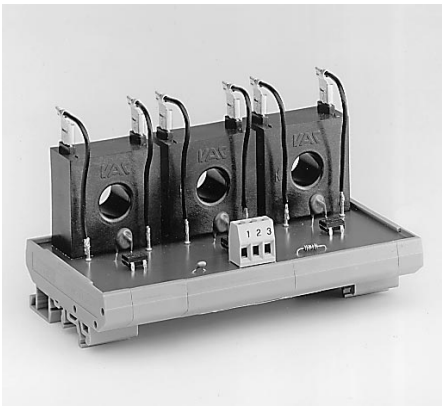
Weight: approx. 0,45 kg

Accessories
Operating leaflet

Current transformers



Current transformers are available in single-phase and three-phase versions. All versions are suitable for mounting to standard rails. The mounting clip for the single-phase version (above) must be ordered separately (e.g. Phoenix).



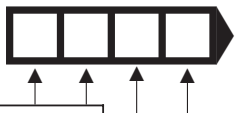
Dimensions
Single-phase: 38 x 38 x 20 mm
Three-phase: 137 x 77 x 86 mm

Weight
Single-phase: 70 g
Three-phase: 310 g

ORDERING DATA FOR ACCESSORY EQUIPMENT

Description	Order no.
Single-phase transformer	
0...30 A, complete with mounting plate for wall mounting	**9404 407 50001**
Three-phase transformer	
3 x 10 A or 3 x 30 A depending on connection	**9404 407 50021**
Interface module	
for max. 4 controllers	
230 VAC	**9404 429 98001**
115 VAC	**9404 429 98011**
for max. 24 controllers	
115 / 230 VAC	**9404 407 50041**
Interface cable	
Length 1m, one per controller	**9404 407 50011**

Configuration word Con1



Input type		
Type L 0... 900 °C	0	0
Type J 0... 900 °C	0	1
Type K 0...1350 °C	0	2
Type N 0...1300 °C	0	3
Type S 0...1760 °C	0	4
Type R 0...1760 °C	0	5
Pt 100 DIN/IEC –99,9...500,0 °C	2	0
Pt 100 DIN/IEC –200...850,0 °C	2	1
0...20 mA, linear	3	0
4...20 mA, linear	3	1
0...10 V, linear	3	2

Controller function	
Signaller, direct	0
Signaller, inverse	1
Two-point DPID, direct	2
Two-point DPID, inverse	3
Positioner "heating"	4
Three-point DPID/DPID	5
Positioner "heating/cooling"	6

Output allocation

	Logic	Relay 1	Relay 2	Relay 3
0	–––––	Heating	Alarm 2	Alarm 1
1	Heating	Alarm 2	–––––	Alarm 1
2	–––––	Heating	Cooling	Alarm 1
3	Heating	Alarm 2	Cooling	Alarm 1

Configuration word Con2

Alarm 1	
No alarm function	0
Sensor fault	1
Sensor fault or measured value alarm	2
Sensor fault, meas. value or htg. current alarm	3
Sensor fault or heating current alarm	4
Heating current alarm	5
Actuator (SSR) short circuit	6

Alarm 1	
Relay de-energized on alarm	
Without measured value alarm	0
Relative measured value alarm	1
Rel. measured value alarm with alarm suppression	2
Absolute measured value alarm	3
Relative measured value alarm referred to W1	4
Relay energized on alarm	
Without measured value alarm	5
Relative measured value alarm	6
Rel. measured value alarm with alarm suppression	7
Absolute measured value alarm	8
Relative measured value alarm referred to W1	9

Alarm 2	
Relay de-energized on alarm	
0	Without measured value alarm
1	Relative measured value alarm
2	Rel. measured value alarm with alarm suppression
3	Absolute measured value alarm
4	Relative measured value alarm referred to W1
Relay energized on alarm	
5	Without measured value alarm
6	Relative measured value alarm
7	Rel. measured value alarm with alarm suppression
8	Absolute measured value alarm
9	Relative measured value alarm referred to W1

Alarm 2	
0	No alarm function
1	Sensor fault
2	Sensor fault or measured value alarm
3	Sensor fault, meas. value or htg. current alarm
4	Sensor fault or heating current alarm
5	Heating current alarm
6	Actuator (SSR) short circuit

Configuration word Con3

Interface / Baud rate	
Without interface	0
2 400 Bd	1
4 800 Bd	2
9 600 Bd	3
19 200 Bd	4

Programmer	
Ramp (1 segment) [1]	0
Programmer with 4 segments	1
Ramp (1 segment) and start-up circuit	2
Start-up circuit and boost function	3

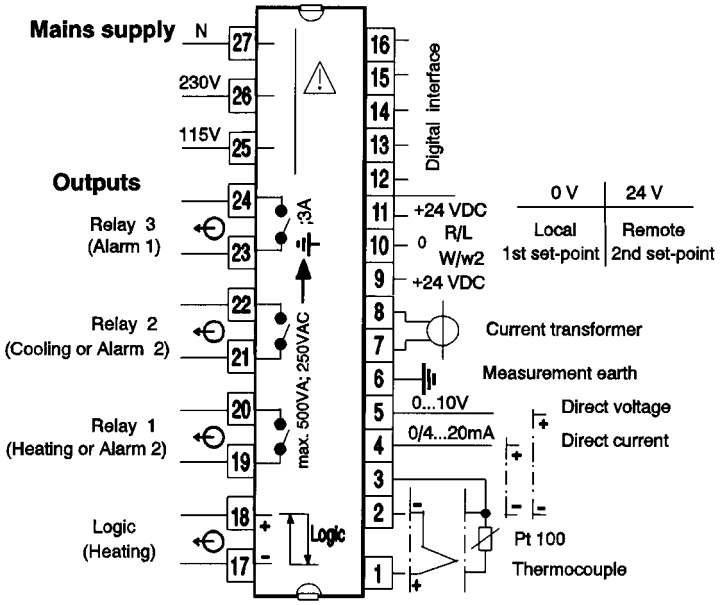
1) And gradient function for version 9404 407 8....

Display/Input circuit monitoring	
0	°C / upscale
1	°C / downscale
2	°C / controller outputs off
3	°C / output signal "hold"
4	°F / upscale
5	°F / downscale
6	°F / controller outputs off
7	°F / output signal "hold"

Current monitoring	
0	Undercurrent alarm/SSR short-circuit (no alarm function with set-point „––––")
1	Excess current alarm (no alarm function with set-point „––––")
2	Undercurrent alarm/SSR short-circuit (alarm relay is energized with set-point „––––")[2]

2) Only applies if "relay de-energized on alarm" was configured in Con2.

Fig. 8 Connecting diagram



Industrial controller KS 50

9	4	0	4		4	0	7					1

Without measured value correction	7
With measured value corr. and gradient	8
Switching contr. with 1 logic output and 3 relays	2
Switching contr. with 1 logic output, 3 relays and digital interface	3
Basic configuration[1)]	00
Configuration to specification[2)]	99

[1)] See ordering information
[2)] See configuration data at left

ORDERING INFORMATION

An order for KS 50 consists of the 12-digit Order no., completed with "00" or "99".
If "99" is used, the three configuration codes Con1, Con2 and Con3 must also be specified.
The basic configuration "00" is supplied with Con1 = 0053, Con2 = 2150 and Con3 = 0002, and must be changed by the user as required.

ORDERING EXAMPLE

Required is a three-point DPID/DPID controller with input for thermocouple type J, logic output "heating", relay 2 "cooling", alarm 1 for relative measured value, alarm 2 for heating current, start-up circuit and measured value correction.

Pos.	Description	Order no
1	KS 50 Contr. Con1: 0153 Con2: 2150 Con3: 0200	**9404 407 82991**
2	Curr. transform.	**9404 407 50001**

ACCESSORIES

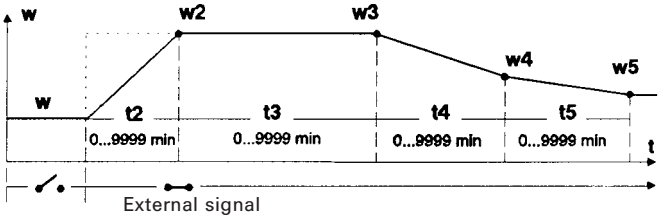
Description	Order no.
Dummy panel, black, 48 x 96 mm	**9404 723 11231**
Labels for engineering unit (qty. 27)	**4012 140 66041**

Parameter adjustment

Depending on configuration (Con1, Con2, Con3), unused parameters are not displayed

Parameter	Symbol	Adjustment range
2nd set-point w2 (ramp)	**SP2**[1]	w0...w100
Segment time t2 (ramp)	**Pt2**	0...9999min
3rd set-point w3	**SP3**	w0...w100
Segment time t3	**Pt3**	0...9999min
4th set-point w4	**SP4**	w0...w100
Segment time t4	**Pt4**	0...9999min
5th set-point w5	**SP5**	w0...w100
Segment time t5	**Pt5**	0...9999min
Correcting variable for start-up	**YA**	5...100%[2]
Start-up set-point	**SPA**	w0...w100
Start-up holding time	**PtA**	0...9999 min
Low limit contact 1	**LCL1**	Relat.: 1...9999 Absol.: x0...9999[1]
High limit contact 1	**LCH1**	Relat.: 1...9999 Absol.: x0...9999[1]
Low limit contact 2	**LCL2**	Relat.: 1...9999 Absol.: x0...9999[1]
High limit contact 2	**LCH2**	Relat.: 1...9999 Absol.: x0...9999[1]
Alarm switching differ. Xsd	**Sd**	1...9999
Heating current	**HC**	only display
Heating current limit	**HCA**[1]	0 < (1,5 · HCA) < 99,9 A
Operation blocking[3]	**Loc**	0...4 (table at right)
Range heating current limit	**HCH**	1,0...99,9 A
Lower set-point limit w0	**SPL**	x0...x100
Upper set-point limit w100	**SPH**	x0...x100
Filter time constant	**tF**	0,0...999,9 s
Set-point gradient	**Gr**[1]	0,1...999,9/min
Pulsed adaptation during start-up	**AdAP**	0/1
Automatic adaptation	**AADA**	0/1
Proport. band Xp1 (heating)	**Pb1**	0,1...999,9%[2]
Proport. band Xp2 (cooling)	**Pb2**	0,1...999,9%[2]
Integral action Tn1 (heating)	**ti1**	0...9999s
Integral action Tn2 (cooling)	**ti2**	0...9999s (0 = no I-action)
Derivative action Tv1 (heating)	**td1**	0...9999s
Derivative action Tv2 (cooling)	**td2**	0...9999s (0 = no D-action)
Duty cycle for heating	**t1**	0,4...999,9s
Duty cycle for cooling	**t2**	0,4...999,9s
Lower switch-point separation	**SH1**	0,0...999,9
Upper switch-point separation	**SH2**	0,0...999,9
Output signal (corr. variable)	**Y**	only display
Limit for „hold" value of output signal	**YH**	5...100%[2]
Threshold for determining mean output value	**LYH**	0,1...10,0
Decimal point[4]	**dP**	0 or 1 (0=no dec. point)
Span start x0[5]	**InL**	–999...9999
End of span x100[5]	**InH**	–999...9999
Interface address	**Adr**	0...99

Fig. 9 Set-point w2 with ramp and program controller



Blocking of display and operating functions

Symbol	Display	Permissible adjustments
Loc 0	X, W / HC, HCA	W, HCA, (W2) self-tuning
Loc 1	X, W / HC, HCA	W, HCA, (W2)
Loc 2	X, W / HC, HCA	none
Loc 3	X	none
Loc 4	X, W / HC, HCA	W
Loc 5	X, W / HC, HCA / X, HC / X, Y	W, HCA, (W2), self-tuning
Loc 6	X, W / HC, HCA / H, HC, X, Y	W, HCA, self-tuning

1) Can be switched off via key ▼ (display '----').
2) Specifications in % refer to the measuring range x0...x100.
3) After selecting Loc 1, 2, 3 or 4, all subsequent parameters are not displayed.
4) Only with input 0/4...20 mA, 0...10V, Pt 100.
5) Only with input 0/4...20 mA, 0...10V.

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