



KS 90

Compact industrial controller

- Simplest operation and bright LED displays
- Precise control behaviour and self-tuning
- Plug-in controller module
- Switching or continuous output with two alarms
- Signaller/two-point controller with measurement value output
- KS 90 TPS with transmitter power supply
- Two digital opto-coupler inputs for freely-selectable functions
- Programmer with 10 segments
- 2nd analog input for external set-point, ratio control, or position feedback
- Potentiometer input for position control with three-point stepping controller
- Type-tested to DIN 3440

PROFILE

The KS 90 compact controllers feature microcomputer operation for precise, cost-effective temperature control. Functions like „programmer“, „2nd analog input“ and „digital control inputs“ enable applications to be implemented without supplementary equipment.

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 90 controllers meet European Standards EN 50 081-1 and EN 50 081-2, and have therefore qualified for CE-marking. Furthermore, they conform to IEC 348 safety regulations (VDE 0411). Each unit is tested with 3 kV before shipment.

DESCRIPTION

Plug-in controller modules

KS 90 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

The version with 3 relays and a logic output is configurable as a 2-point controller with alarm, 3-point controller with alarm, or as a 3-point stepping controller.

The version with continuous output, 2 relays and a logic output is configurable as a continuous controller with 2 alarms, or as a 3-point controller for „heating/cooling“ with 2 alarms. Heating and cooling can be allocated to the continuous output and to the logic output.

Input, control function and alarms are freely configurable.

All versions feature self-tuning, a 2nd set-point with ramp function, a programmer with 10 segments, and a 115/230 V power supply as standard. The bumpless auto/manual switch-over is done via a key in the front panel or by means of an external signal.

Simple operation

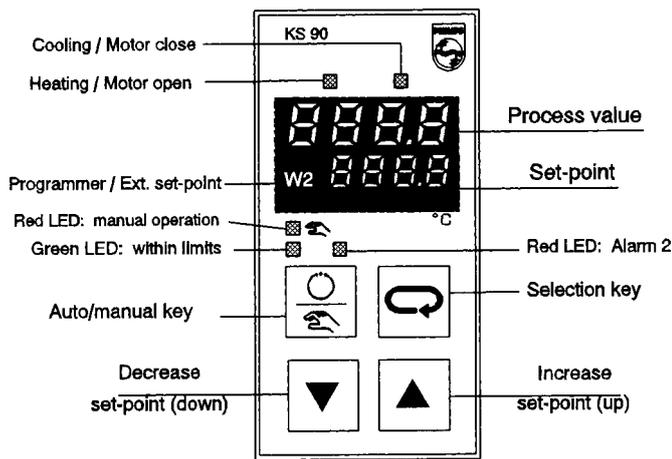
Only four robust keys are used for all settings and adjustments. Tactile feedback from the keys and an automatic increase in rate of change when a key is pressed for a longer period ensure fast and safe settings.

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 during automatic operation changes the lower display to output signal y (display only, no alteration possible). Pressing the key again switches the display back to process value x.

Fig. 1 Display and operation



Pressing the Auto/manual key switches the KS 90 to manual control, which is indicated by a red LED. The lower display shows the output signal y in % (e.g. Y 45). By means of the up/down keys, it is possible to change the output signal. Pressing the selector key during manual operation changes the lower display to set-point w , which can be changed with the up/down keys. After pressing the selector key again, the display changes back to process 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 operating functions

The set-point adjustment can be disabled. In addition, the set-point adjustment limits can be defined in the Parameter Level.

Furthermore, the digital control inputs can be used to disable set-point adjustment, and to prevent changes in the Parameter and Configuration Levels (remote switch-over).

Input circuit monitoring

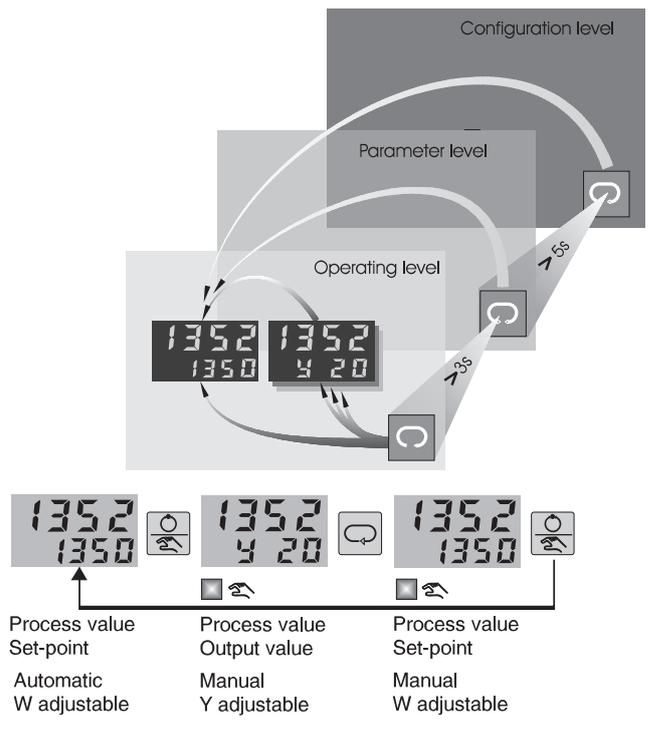
In case of a fault in sensor or leads, the built-in monitor provides increased operational safety. The controller output action after monitor triggering can be configured for:

- upscale
- downscale
- outputs switched off
- switch-over to a preset 2nd set-point

Thermocouple input

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

Fig. 2 Operating concept



Resistive input

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

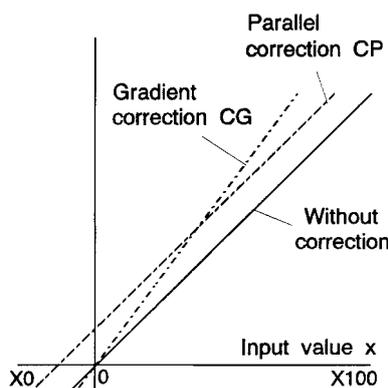
4...20 mA input

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

Measurement value correction for thermocouples and Pt 100 (Option)

The correcting function changes the measurement value by a preset amount, and is effective for the relevant measurement value or with open input. Two correction types are selectable for thermocouple and Pt 100 input: Gradient correction CG or parallel correction CP (see Fig. 3).

Fig. 3 Measurement value correction



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. The 0/4...20 mA output of the continuous controller is configurable as measured value output x .

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). The alarm is disabled while start-up set-point SPA is active.
- 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) **End of program cycle** signal from programmer.

Alarms a), b), c), and d) can be combined.

Fig. 4 Set-point gradient function

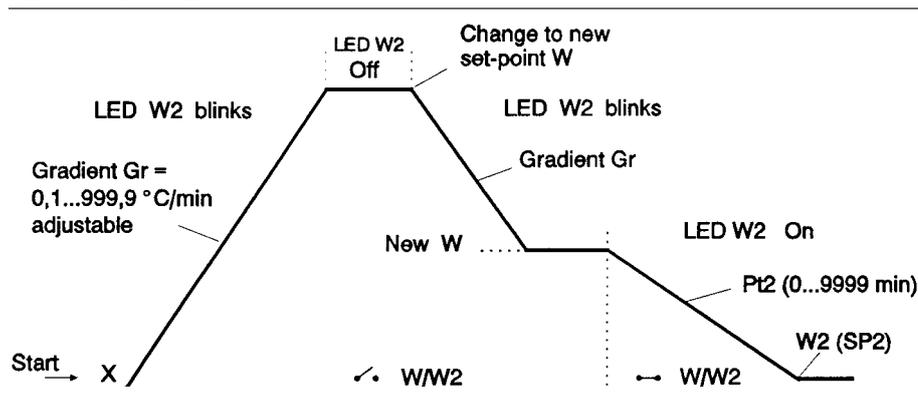
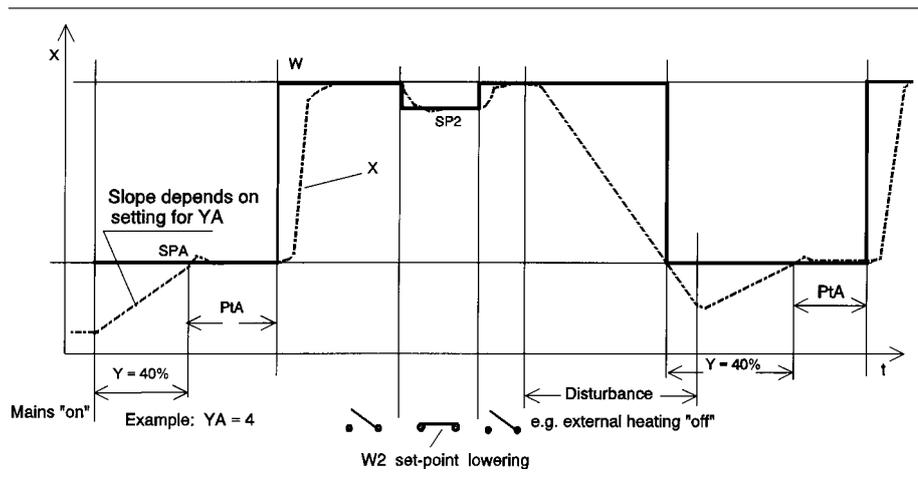


Fig. 5 Start-up circuit



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 also be used when starting after mains recovery). The second set-point becomes effective after an adjustable time has elapsed and is then adjustable in the operating level.

Programmer

10 set-points with corresponding segment times can be used for program control. Unused set-points and segments can be switched off. After mains failure, start or re-start is from the actual process value x (see Fig. 6).

When the program time has elapsed, the controller continues with set-point $W11$ (or the last active set-point), and the signal "program end" can be routed to alarm output 1 or 2.

Second analog input

This input is used for ratio control, for an external set-point, or as position feedback with three-point stepping controllers.

Configurable digital inputs

The KS 90 offers a number of extra functions which can be combined with other equipment, or respond to certain events in the plant. Two digital inputs are available, e.g. for:

- switch-over to 2nd set-point $W2$
- starting the programmer
- switch-over to external set-point
- disable all outputs
- switch-over to preset output $Y2$
- switch-over to manual operation
- switch-over to remote operation
- disabling the display of parameters and configuration data after entry of last programmer parameter
- disabling the auto/manual key.

Set-point gradient functions (Option)

This function (Fig. 4) 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. $5\text{ }^\circ\text{C}/\text{min}$), and LED $W2$ blinks. With $Gr = \text{---}$, the function is switched off.

Start-up circuit

For temperature control, e.g. with hot runners (Fig. 5). 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 temperature (e.g. 40%) until reaching the start-up set-point (e.g. $95\text{ }^\circ\text{C}$). For protection of the heating elements, the duty cycle is reduced to $1/4$ during start-up.

The start-up set-point (e.g. $95\text{ }^\circ\text{C}$) is maintained during the selected start-up holding time. Subsequently, the controller uses main set-point W .

The start-up circuit is activated, when the process temperature is more than 40 K below the start-up set-point (e.g. $\leq 55\text{ }^\circ\text{C}$).

Self-tuning

The function is fitted as standard for automatic determination of the best control parameters. Self-tuning is started at the push of a button and uses the delay time T_u and the max. rate of change V_{max} of the temperature control loop to calculate the optimum settings for fast line-out without overshoot.

With three-point controller configuration, the „cooling“ parameters are determined separately.

KS 90 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 .

TECHNICAL DATA

INPUTS

ANALOG INPUT 1

Analog input 1 is fitted with a filter. The filter's time constant is adjustable in the Parameter Level in the range $0,5\text{...}999,9\text{ s}$.

Thermocouples

Types L, J, K, N, S, R, T, W, B and E to DIN IEC 584. For ranges, see Ordering data. Input resistance: $\geq 1\text{ M}\Omega$

Display: in $^\circ\text{C}$ or $^\circ\text{F}$
 With linearization (temperature-linear)
 Display error: $\leq 3\text{K} \pm 1\text{ digit}$
 ($\leq 1\text{K} \pm 1\text{ digit}$ typically for types L, J, and K up to $\leq 700\text{ }^\circ\text{C}$, and type B above $400\text{ }^\circ\text{C}$)

TC break monitor:

Sensor current $\leq 1 \mu\text{A}$, configurable output action

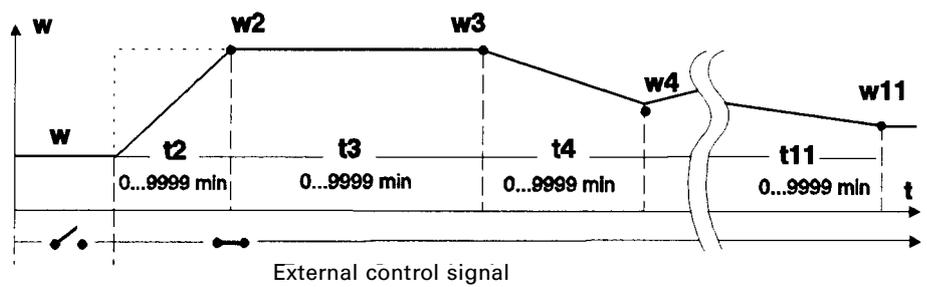
Polarity monitoring:

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: $\leq 1 \text{ K}/10 \text{ K}$ change of terminal temperature

Fig. 6 Set-point w2 with ramp and program controller



Resistance thermometer

Pt 100 Ω to DIN IEC 751

Range: $-200,0 \dots 850,0 \text{ }^\circ\text{C}$ or $-99,9 \dots 250,0 \text{ }^\circ\text{C}$

(display in $^\circ\text{F}$ selectable)

With linearization (temperature-linear)

Display error: $\leq 1 \text{ K} \pm 1$ digit

Sensor current: $\leq 1,5 \text{ mA}$

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: $\leq 30 \Omega$

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

Configurable output action.

Potentiometric transducer

Resistance-linear

$R_{\text{total}} \leq 500 \Omega$ including $2 \times R_{\text{lead}}$

Measuring span: $\geq 30 \Omega$

Sensor current: approx. 0,3 mA

Matching and scaling is done with transducer connected.

(For transducers $\leq 1000 \Omega$, a suitable parallel resistor must be fitted.

Linearity is not affected.)

Direct current

0/4...20 mA, linear

Input resistance: 15 Ω

Display error: $\leq 0,1\%$

Measurement limits:

selectable within $-999 \dots 9999$

Decimal point:

adjustable, with one or two digits behind the decimal point.

Input circuit monitor for 4...20 mA:

Triggered, if input signal $\leq 2 \text{ mA}$.

Output action configurable.

Direct voltage

0...10 V, linear

Input resistance: $\geq 110 \text{ k}\Omega$

Display error: $\leq 0,1\%$

Measurement limits:

selectable within $-999 \dots 9999$

Decimal point:

Adjustable, with one or two digits behind the decimal point.

Ratio input

$2 \times 0/4 \dots 20 \text{ mA}$ connected to analog inputs 1 and 2 (x1 and x2 respectively)

$\lambda = (x1 \pm x0)/x2 = 0,01 \dots 9,99$

Analog inputs 1 and 2 are galvanically connected.

ANALOG INPUT 2

Standard signal for external set-point

$W_{\text{ext}} = 0/4 \dots 20 \text{ mA}$

Input resistance: approx. 170 Ω

W_{ext} is referred to the adjusted set-point range:

$0/4 \text{ mA} \triangleq W_0$

$20 \text{ mA} \triangleq W_{100}$

Input circuit monitor for 4...20 mA:

Triggered, if input signal $\leq 2 \text{ mA}$.

Output action configurable.

Standard signal for position feedback

$Y_p = 0/4 \dots 20 \text{ mA}$

Input resistance: approx. 170 Ω

With three-point stepping controllers, this corresponds to a display range of

0...100%.

DIGITAL INPUTS 1 AND 2

Opto-coupler isolated

Rated voltage 24 VDC external

Current sink (IEC 1131 type 1)

Logic „0“ = $-3 \dots 5 \text{ V}$

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.

Functions of digital inputs

The control function of the digital inputs is configurable with Con4.

Depending on configuration, a logic „1“ triggers one of the following:

Control outputs disabled

All output relays are de-energized.

Other outputs are at 0 mA or 0V.

Switch-over to output value y_2

The controller output y goes to a preset value which is defined in the Parameter Level in the range 0...100% or $-100 \dots 0 \dots +100\%$.

The alarm functions remain active.

The preset output y_2 has priority, also during manual operation, i.e. it cannot be altered manually.

By setting W to „----“, the outputs are disabled, and y_2 cannot be activated.

OUTPUTS

Logic output

For direct connection of solid-state relays.

Logic „1“:

$\geq 10 \text{ V}$ with a load $\geq 500 \Omega$

or 20 mA with a load $\leq 500 \Omega$

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: $\leq 250 \text{ VAC}$, $\leq 1 \text{ A}$,

$\leq 500 \text{ VA}$, resistive load

Minimum load: 10 VDC, 50 mA, 1 VA

Continuous output (output 2)

(optional measured value output x)

Output signal y:

0/4...20 mA, configurable

Resolution: $\leq 0,1 \text{ mA}$

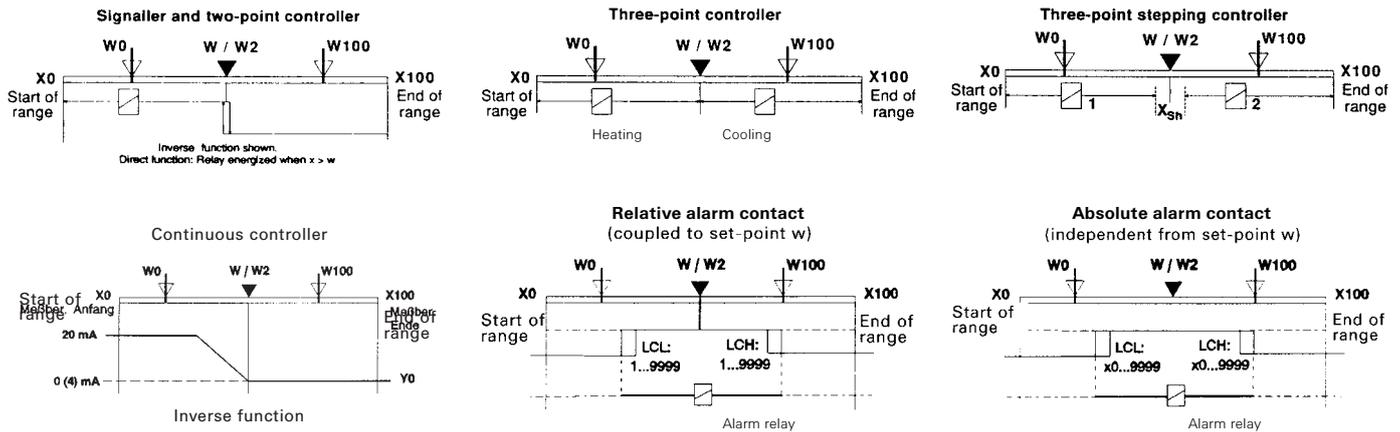
Load: $\leq 500 \Omega$

Working point y_0 (P-control): 0%

Output limiting y_{min} and y_{max}

adjustable.

Fig. 7 Controller functions and alarm functions



All relays are shown in energized state (or logic 1). Alarm relays are de-energized when a limit is exceeded. Upper and lower alarm can be disabled, and switching difference X_{sd} is adjustable.

The continuous output is configurable as a logic output for direct connection of solid-state relays:

Logic „1“:

$\geq 10\text{ V}$ with a load $\geq 500\ \Omega$

or 20 mA with a load $\leq 500\ \Omega$

Logic „0“: 0 V

Optional measured output value x :

scaled as SPL...SPH for $0/4\text{...}20\text{ mA}$

For number and type of outputs, see Ordering Data.

The output functions are configurable (see Con 1).

By setting W to „----“, all outputs are switched off.

Switch-off has higher priority than preset output y_2 .

POWER SUPPLY

Voltage: $230/115\text{ VAC}$ or 24 VAC ,

depending on version

Tolerance: $-15\text{...}+20\%$

Frequency: $48\text{...}62\text{ Hz}$

Power consumption: approx. $6,5\text{ VA}$

Power supply effect

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

CONTROL CHARACTERISTICS

Switching controllers

Configurable as:

- signaller with 1 or 2 alarms
- two-point controller with DPID behaviour and 2 alarms
- three-point controller with DPID/DPID behaviour and 1 or 2 alarms

The switching differential of the signaller is adjustable in the range $1\text{...}9999$.

Three-point stepping controller

Configurable as above, and additionally

- three-point stepping output with DPI behaviour and 1 alarm.

Continuous controller

Configurable as:

- signaller with 1 alarm
- two-point controller with DPID behaviour and 1 alarm
- three-point controller with DPID/DPID behaviour and 1 or 2 alarms, and the functions:
 - „Heating/cooling“ via logic outputs
 - „Heating“ = logic output/„Cooling“ = current output
 - „Heating“ = current output/„Cooling“ = logic output.
- continuous controller with 1 or 2 alarms

Control parameters

Self-tuning or adjustable (see table „Parameter Adjustment“).

Limiting frequency: approx. 1 Hz .

Auto/manual operation

If auto/manual operation has been configured, switch-over is by means of the A/H key. In the manual mode, output signal y can be changed by means of the up/down keys. The actual output value is stored in an EEPROM, and is taken over after a power failure.

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.

The switching differential of the alarms is separately adjustable (see table „Parameter Adjustment“).

SET-POINT

Upper and lower limits of the set-point range $W_{0\text{...}W_{100}}$ are selectable within the measuring range limits $X_{0\text{...}X_{100}}$.

DISPLAYS

Two red 4-digit LED displays.

Digit height:

10 mm for process value x

$7,6\text{ mm}$ for set-point w

Display range: $-999\text{...}9999$

LEDs for status display

Yellow W_2 : for set-point W_2 or programmer „On“ or remote operation
Red „Hand“: for manual operation

LEDs for relay status

Yellow left: heating „On“ or motor „open“

Yellow right: cooling „On“ or motor „close“

LED for alarm 1: green, process value within limits

LED for alarm 2: red, limit value exceeded

Input circuit monitoring

(in upper display)

„FbF“ = sensor break

„POL“ = reversed polarity

(in lower display)

„FbF2“ = value of external set-point

W_{ext} below 2 mA

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

With remote operation, the output
signal y can be changed via the inter-
face.

With enabled auto/manual switch-over,
manual operation is possible.

ENVIRONMENTAL CONDITIONS

Permissible temperatures

For specified accuracy: 0...55 °C

For operation: 0...60 °C

Storage/transport: -20...70 °C

Climatic category

KUF to DIN 40 040

Relative humidity: $\leq 75\%$ yearly
average, no condensation

Shock and vibration

Vibration test F_c

to DIN IEC 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 E_a

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

ELECTROMAGNETIC COMPATIBILITY

*Complies with EN 50 081-1 and
EN 50 082-2 for unrestricted use
within rural and industrial areas, if
screened input leads are used.*

ELECTROMAGNETIC IMMUNITY EN 50082-2

Electrostatic discharge

Test to IEC 801-2

Voltage: 8 kV

Contact discharge: 4 kV

High-frequency interference

Test to IEC 801-3

Frequency: 80...1000 MHz, 10 V/m

Effect: ≤ 7 K

HF interference on leads

Test to IEC 801-6

Frequency: 0,15...80 MHz, 10 V

Low-frequency magnetic field

Test to IEC 1000-4-8

Frequency: 50 Hz

Field strength: 30 A/m

Fast pulse trains (burst)

Test to IEC 801-4

2 kV applied to leads for supply voltage
and signal leads

High-energy single pulses (surge)

Test to IEC 801-5

Test voltage applied to following leads:

Supply leads: 1 kV symmetric, 2 kV
asymmetric

Signal leads: 0,5 kV symmetric, 1 kV
asymmetric

ELECTROMAGNETIC RADIATION
complies with EN 50081-1

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

DIN VDE 0470 / EN 60525

Front: IP 54 (vertical mounting $\pm 15^\circ$)

Housing: IP 20

Terminals: IP 00

CE-marking

According to European Directive
93/44/EEC for electromagnetic compa-
tibility.

Electrical safety

Complies with EN 61 010-1.

Over-voltage category II

Contamination degree 2

Working voltage range 300 V

Protection class I

Safety test to DIN 3440

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

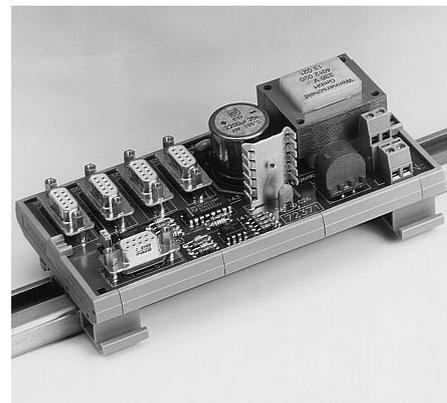
ACCESSORY EQUIPMENT

Interface module/interface cable

Up to four controllers can be connected
to the interface module; also in combi-
nation with other PMA products.

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

Voltage 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 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: $\geq 75\%$ 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

ORDERING DATA FOR ACCESSORY EQUIP- MENT

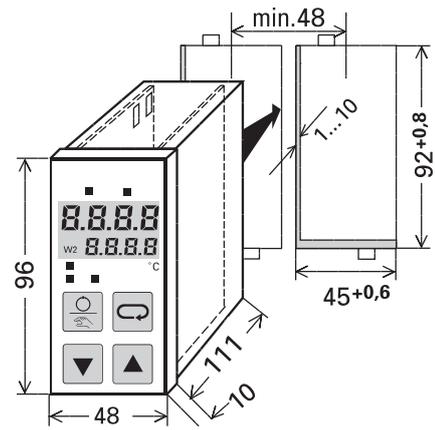
Description	Order no.
Interface module for max. 4 controllers	
230 VAC	9404 429 98001
115 VAC	9404 429 98011
24 VAC	9404 429 98021
Interface cable Length 1m, one per con- troller	9404 407 50011

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
Type T 0... 400 °C	0	6
Type W 0...2300 °C	0	7
Type E 0... 900 °C	0	8
Type B 0...1820 °C	0	9
Pt 100 DIN/IEC -99,9...250,0 °C	2	0
Pt 100 DIN/IEC -200...850 °C	2	1
0...20 mA, linear	3	0
4...20 mA, linear	3	1
0...10 V, linear	3	2
Potentiometric transducer	4	0
Ratio input 0...20 mA	5	0
Ratio input 4...20 mA	5	1

Fig. 8 Overall dimensions (mm)



Switching controller, 3 relays, 1 logic output		Output allocation			
		Logic	Relay 1	Relay 2	Relay 3
Signaller, direct Signaller, inverse Two-point DPID, direct Two-point DPID, inverse	0	-----	Heating	Alarm 2	Alarm 1
	1	Heating	Alarm 2	----	Alarm 1
	2	----	Heating	Cooling	Alarm 1
	3	Heating	Alarm 2	Cooling	Alarm 1
Three-point DPID/DPID	5				
Three-point stepping contr., 3 relays, 1 logic output	0	-----	Heating	Alarm 2	Alarm 1
	1	Heating	Alarm 2	----	Alarm 1
	2	----	Heating	Cooling	Alarm 1
	3	Heating	Alarm 2	Cooling	Alarm 1
Three-point DPID/DPID	5				
Three-point stepping control	7				
Continuous 0(4)...20 mA, 2 relays, 1 logic output	0	-----	Logic	0(4)...20mA/Logic	Relay 3
	1	heating	heating	x = 0...20 mA	Alarm 1
	2	heating	Alarm 2	x = 0...20 mA	Alarm 1
	3	Alarm 2	-----	x = 4...20 mA	Alarm 1
Three-point DPID/DPID	3	Heating	Alarm 2	Cooling: Logic	Alarm 1
	4	Heating	Alarm 2	Cooling: 0...20mA	Alarm 1
	5	Heating	Alarm 2	Cooling: 4...20mA	Alarm 1
	6	Cooling	Alarm 2	Heating: 0...20mA	Alarm 1
	7	Cooling	Alarm 2	Heating: 4...20mA	Alarm 1
Continuous controller, direct	8	----	Alarm 2	0...20mA	Alarm 1
Continuous controller, inverse	9	----	Alarm 2	4...20mA	Alarm 1

Configuration word Con2



Alarm 1 No alarm function Sensor fault Sensor fault or measured value alarm End of program	1 2 3	Alarm 2 <i>Relay de-energized on alarm</i> 0 Without measured value alarm 1 Relative measured value alarm 2 Rel. measured value alarm with alarm suppression 3 Absolute measured value alarm <i>Relay energized on alarm</i> 5 Without measured value alarm 6 Relative measured value alarm 7 Rel. measured value alarm with alarm suppression 8 Absolute measured value alarm
Alarm 1 <i>Relay de-energized on alarm</i> Without measured value alarm Relative measured value alarm Rel. measured value alarm with alarm suppression Absolute measured value alarm <i>Relay energized on alarm</i> Without measured value alarm Relative measured value alarm Rel. measured value alarm with alarm suppression Absolute measured value alarm	0 1 2 3 5 6 7 8	
Alarm 2 No alarm function Sensor fault Sensor fault or measured value alarm End of program	0 1 2 3	

Configuration word Con3



Interface / Baud rate Without interface 2 400 Bd 4 800 Bd 9 600 Bd 19 200 Bd	0 1 2 3 4	Display / input circuit monitor action 0 °C / upscale 1 °C / downscale 2 °C / controller outputs off 3 °C / output to preset value y2 4 °F / upscale 5 °F / downscale 6 °F / controller outputs off 7 °F / output to preset value y2
Programmer Ramp (1 segment) Programmer with 10 segments Ramp (1 segment) and start-up circuit	0 1 2	

Configuration word Con4



Digital input 1 Switch-over W/W2 Switch-over W/W _{ext} Outputs switched off Auto/manual Auto/preset value y2 Local/remote Disabling of display for parameters and configuration after entry of last parameter for programmer Switch-over to 2nd control parameter set (option) Disabling of auto/manual key	0 1 2 3 4 5 6 7 8	Auto/manual key 0 Auto/manual 1 Auto/preset value y2 2 Only auto function 3 Only manual function
Digital input 2 Switch-over W/W2 Switch-over W/W _{ext} Outputs switched off Auto/manual Auto/preset value y2 Local/remote Disabling of display for parameters and configuration after entry of last parameter for programmer Switch-over to 2nd control parameter set (option) Disabling of auto/manual key	0 1 2 3 4 5 6 7 8	

The switch-over from disabled manual or Y2 output to automatic operation is bumpless.

Priorities of digital inputs

1. Outputs switched off
2. Auto/preset value y2
3. Auto/manual
4. Switch-over W/W2
5. Switch-over W/W_{ext}

Priorities of operating modes

1. Outputs switched off
2. Manual operation
3. Preset value y2 effective
4. Sensor error
5. Automatic operation

Parameter adjustment

Depending on configuration (Con1, Con2, Con3, Con4), 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 ¹⁾	w0...w100
Segment time t3	Pt3	0...9999min
↓	↓	↓
11th set-point w11	SP11 ¹⁾	w0...w100
Segment time t11	Pt11	0...9999 min
Start-up temperature	YA ⁶⁾	5...100%
Start-up set-point	SPA ⁶⁾	w0...w100
Start-up holding time	PtA ⁶⁾	0...9999 min
Low limit contact 1	LCL1 ¹⁾	Relative: 1...9999 Absolute: x0...9999
High limit contact 1	LCH1 ¹⁾	Relative: 1...9999 Absolute: x0...9999
Low limit contact 2	LCL2 ¹⁾	Relative: 1...9999 Absolute: x0...9999
High limit contact 2	LCH2 ¹⁾	Relative: 1...9999 Absolute: x0...9999
Alarm switch. differ. Xsd A1	SdA1	1...9999
Alarm switch. differ. Xsd A2	SdA2	1...9999
Signaller switch. diff. Xsd 1	SdS	1...9999
Operation blocking	Loc ³⁾	0...2 (table at right)
-----	-----	-----
Lower set-point limit w0	SPL	x0...x100
Upper set-point limit w100	SPH	x0...x100
Set-point gradient	Gr ¹⁾	0,1...999,9/min
Proport. band Xp1 (heating)	Pb1 ²⁾	0,1...999,9%
Proport. band Xp2 (cooling)	Pb2 ²⁾	0,1...999,9%
Integral action time Tn	ti	0...9999s (0 = no I-action)
Derivative action time Tv	td	0...9999s (0 = no D-action)
Motor actuator time Tm	tt	8...300s
Step (pulse) duration Tmp	ttP	0,1...2,0s
Trigger point separation	SH ²⁾	0,2...20,0%
Duty cycle for heating	t1	0,4...999,9s
Duty cycle for cooling	t2	0,4...999,9s
2nd output signal (preset)	Y2	Ymin...Ymax
Lower output limit Ymin	YLL	-100...YLH-10%
Upper output limit Ymax	YLH	YLL+10...100%
Time constant of input filter	tF	0,0...999,9s
Offset x0 for ratio control	OFFS ¹⁾	-99,9...99,9%
Transducer start	P0	0...470 (display/ matching)
Transducer end	P100	30...500 (display/ matching)
Decimal point ⁴⁾	dP ⁴⁾	0 or 1 or 2 (0=no decimal point)
Span start x0 ⁵⁾	InL ⁵⁾	-999...9999
End of span x100 ⁵⁾	InH ⁵⁾	-999...9999
Interface address	Adr	0...99

Blocking of display and operating functions

Symbol	Display	Permissible adjustments
Loc 0	X & W or X & Y	W, (Y), (W2), self-tuning
Loc 1	X & W or X & Y	W, (Y), (W2)
Loc 2	X & W or X & Y	(Y)
Loc 3	X	(Y)

¹⁾ Can be switched off via key  (display '----').

²⁾ Specifications in % refer to the measuring range x0...x100.

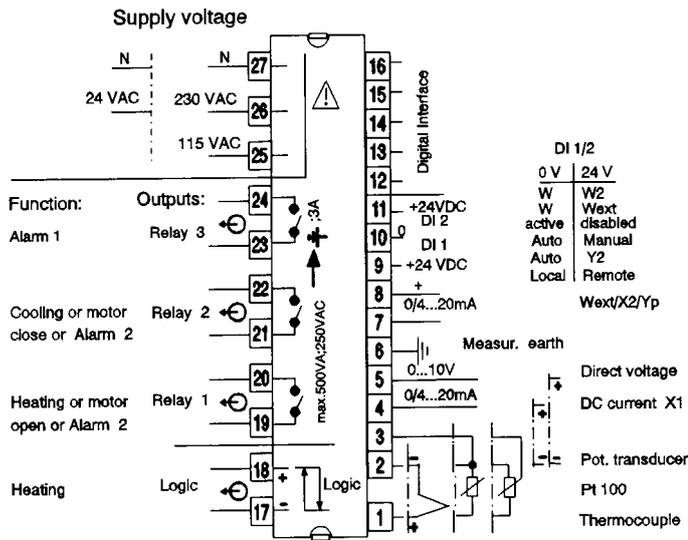
³⁾ After selecting Loc 1, 2 or 3, all subsequent parameters are not displayed.

⁴⁾ Only with 0/4...20 mA, 0...10V, and resistive input (only 0 or 1 with Pt 100).

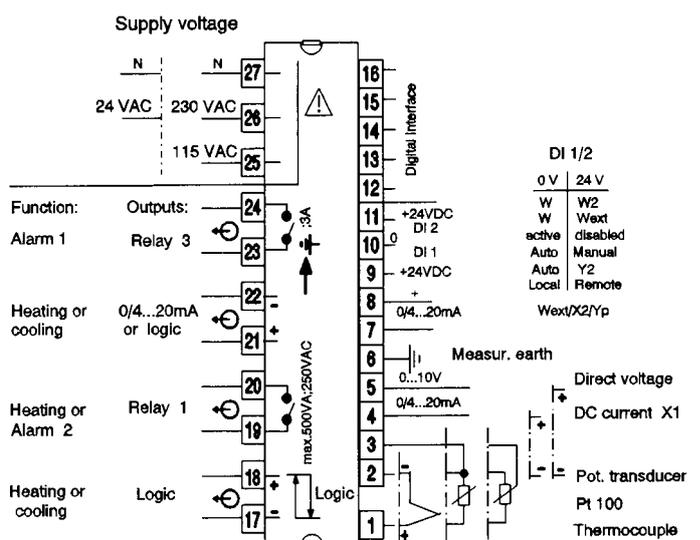
⁵⁾ Only with 0/4...20 mA, 0...10V, and pot. transducer input.

⁶⁾ Not for three-point stepping controller.

Fig. 9 Connecting diagrams

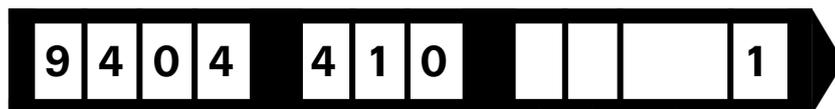


Connections for switching controllers



Connections for continuous controller

Industrial controller KS 90



230/115 VAC, without options ¹⁾	3
230/115 VAC, with options ¹⁾	4
24 VAC, without options ¹⁾	5
24 VAC, with options ¹⁾	6
Switching controllers	
with 3 relays and 1 logic output	0
with 3 relays, 1 logic output & digital interface	1
Three-point stepping controllers	
with 3 relays and 1 logic output	2
with 3 relays, 1 logic output & digital interface	3
Continuous controllers	
0(4)...20 mA, 2 relays and 1 logic output	4
0(4)...20 mA, 2 relays, 1 logic output & digital interface	5
Basic configuration	00
Configuration to specification ²⁾	99

ORDERING INFORMATION

An order for KS 90 consists of the 12-digit Order no., completed with "00" or "99".

If "99" is used, the four configuration codes Con1, Con2, Con3, and Con4 must also be specified.

The basic configuration "00" is supplied with Con1 = 0053, Con2 = 2100, Con3 = 0002, and Con4 = 0000. these settings must be changed by the user as required.

ACCESSORIES

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

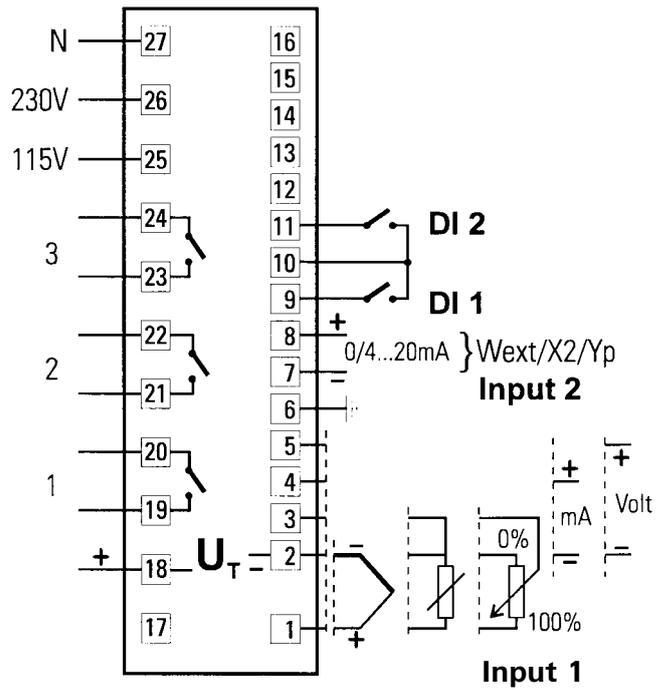
1) Options package with the functions measurement value correction, gradient, 2nd control parameter set.
 2) See configuration tables Con1 to Con4.

KS 90 TPS with transmitter supply

Order no. **9404 410 42101**

The industrial controller KS 90 TPS can be delivered in the basic version three-point stepping controller with a built-in transmitter supply voltage $U_T > 13\text{ V} / \leq 20\text{ mA}$. Different from the standard version, the control inputs di1 and di2 are contacts and the input 2 has a lower input resistance of $30\ \Omega$.

Fig. 10 Connecting diagram KS 90 TPS



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