**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.

**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.

**Clear operating concept and lockable parameter adjustment**

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

**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).

**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.
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 °C/min), and LED W2 blinks. With Gr = ——, 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 °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 °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. ≤ 55 °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 Tt, and the max. rate of change Vmax 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...999,9 s.

Thermocouples
For ranges, see Ordering data.
Input resistance: ≥ 1MΩ
Display: in °C or °F
With linearization (temperature-linear)
Display error: ≤ 3K ± 1 digit (±1K ± 1 digit typically for types L, J, and K up to ±700 °C, and type B above 400 °C)
TC break monitor:
Sensor current \( \leq 1 \, \mu A \), 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: \( \leq 1 \, K/10 \, K \) change of terminal temperature

Resistance thermometer
Pt 100Ω to DIN IEC 751
Range: \(-200.0...850.0 \, ^\circ C \) or \(-99.9...250.0 \, ^\circ C \)
(display in °F selectable)
With linearization (temperature-linear)
Display error: \( \leq 1 \, K \pm 1 \) digit
Sensor current: \( \leq 1.5 \, mA \)
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 x \( R_{\text{lead}} \)
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 \( \Omega \)
Display error: \( \leq 0.1\% \)
Measurement limits: selectable within –999...9999
Decimal point: adjustable, with one or two digits behind the decimal point.
Input circuit monitor for 4...20 mA:
Triggered, if input signal \( \leq 2 \, mA \).
Output action configurable.

Direct voltage
0...10 V, linear
Input resistance: \( \geq 110 \, k\Omega \)
Display error: \( \leq 0.1\% \)
Measurement limits: selectable within –999...9999
Decimal point: adjustable, with one or two digits behind the decimal point.

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...0...+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“:
\( \geq 10 \, V \) 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: \( \leq 250 \, VAC, \leq 1 \, A, \leq 500 \, VA \), 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: \( \leq 0.1 \, mA \)
Load: \( \leq 500 \, \Omega \)
Working point \( y_0 \) (P-control): 0%
Output limiting \( y_{\text{min}} \) and \( y_{\text{max}} \) adjustable.
The continuous output is configurable as a logic output for direct connection of solid-state relays:

- Logic "1": ≥ 10 V with a load ≥ 500 Ω or 20 mA with a load ≤ 500 Ω
- Logic "0": 0 V

Optional measured output value x: scaled as SPL...SPH for 0/4...20 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 y2.

**POWER SUPPLY**

Voltage: 230/115 VAC or 24 VAC, depending on version
Tolerance: –15...+20%
Frequency: 48...62 Hz
Power consumption: approx. 6,5 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:
- signaler 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 signaler is adjustable in the range 1...9999.

**Three-point stepping controller**
Configurable as above, and additionally:
- three-point stepping output with DPI behaviour and 1 alarm.

**Continuous controller**
Configurable as:
- signaler 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 W0...W100 are selectable within the measuring range limits X0...X100.

**DISPLAYS**
Two red 4-digit LED displays.
Digit height: 10 mm for process value x
7,6 mm for set-point w
Display range: –999...9999

**LEDs for status display**
Yellow W2: for set-point W2 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 Wext 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 interface.
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: ≤75% yearly average, no condensation

Shock and vibration
Vibration test Fc
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 Ea
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 kV

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 V0
Front dimensions: 48 x 96 mm
Depth behind panel: 111 mm

Protection mode
DIN VDE 0470 / EN 60525
Front: IP 54 (vertical mounting ±15°)
Housing: IP 20
Terminals: IP 00

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

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 1x6 , 3mm or 2x2 , 8mm

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

Weight: approx. 0,45 kg

ACCESSORY EQUIPMENT

Interface module/interface cable
Up to four controllers can be connected to the interface module; also in combination 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).

ORDERING DATA FOR ACCESSORY EQUIPMENT

<table>
<thead>
<tr>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface module</td>
<td>9404 429 98001</td>
</tr>
<tr>
<td>230 VAC</td>
<td>9404 429 98001</td>
</tr>
<tr>
<td>115 VAC</td>
<td>9404 429 98011</td>
</tr>
<tr>
<td>24 VAC</td>
<td>9404 429 98021</td>
</tr>
<tr>
<td>Interface cable</td>
<td>9404 407 50011</td>
</tr>
<tr>
<td>Length 1m, one per controller</td>
<td>9404 407 50011</td>
</tr>
</tbody>
</table>

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: ≥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

ACCESSORY EQUIPMENT

Interface module/interface cable
Up to four controllers can be connected to the interface module; also in combination 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).
### Configuration word Con1

**Input type**
- Type L 0...900 °C
- Type J 0...900 °C
- Type K 0...1350 °C
- Type N 0...1300 °C
- Type S 0...1760 °C
- Type R 0...1760 °C
- Type T 0...400 °C
- Type W 0...2300 °C
- Type E 0...900 °C
- Type B 0...1820 °C
- Pt 100 DIN/IEC –99.9...250.0 °C
- Pt 100 DIN/IEC –200...850 °C

**Output allocation**

#### Switching controller, 3 relays, 1 logic output
- Signaller, direct
- Signaller, inverse
- Two-point DPID, direct
- Two-point DPID, inverse

#### Three-point DPID/DPID

#### Continuous 0(4)...20 mA, 2 relays, 1 logic output
- Signaller, direct (+ meas. value output x)
- Signaller, inverse (+ meas. value output x)
- Two-point DPID, direct (+ meas. val. outp. x)
- Two-point DPID, inverse (+ meas. val. outp. x)

#### Three-point DPID/DPID

#### Continuous controller, direct
- Continuous controller, inverse

---

### Output allocation

<table>
<thead>
<tr>
<th>Logic</th>
<th>Relay 1</th>
<th>Relay 2</th>
<th>Relay 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Heating</td>
<td>Alarm 2</td>
<td>Alarm 1</td>
</tr>
<tr>
<td>1</td>
<td>Heating</td>
<td>Alarm 2</td>
<td>-----</td>
</tr>
<tr>
<td>2</td>
<td>Heating</td>
<td>Alarm 2</td>
<td>Cooling</td>
</tr>
<tr>
<td>3</td>
<td>Heating</td>
<td>Alarm 2</td>
<td>Cooling</td>
</tr>
<tr>
<td>0</td>
<td>Heating</td>
<td>Alarm 2</td>
<td>-----</td>
</tr>
<tr>
<td>1</td>
<td>Heating</td>
<td>Alarm 2</td>
<td>-----</td>
</tr>
<tr>
<td>2</td>
<td>Heating</td>
<td>Alarm 2</td>
<td>Cooling</td>
</tr>
<tr>
<td>3</td>
<td>Heating</td>
<td>Alarm 2</td>
<td>Cooling</td>
</tr>
<tr>
<td>2</td>
<td>Open</td>
<td>Close</td>
<td>-----</td>
</tr>
</tbody>
</table>

---

### Fig. 8 Overall dimensions (mm)

- Minimum dimension: 48 mm
- Maximum dimension: 92 ± 0.8 mm
Configuration word Con2

**Alarm 1**
- No alarm function (0)
- Sensor fault (1)
- Sensor fault or measured value alarm (2)
- End of program (3)

**Alarm 2**
- 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)
- 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)

**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) (0)
- Programmer with 10 segments (1)
- Ramp (1 segment) and start-up circuit (2)

**Configuration word Con4**

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

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

**Auto/manual key**
- Auto/manual (0)
- Auto/preset value y2 (1)
- Only auto function (2)
- Only manual function (3)

**Analog input 2**
- Not used/ratio control (0)
- Ext. set-point W_{ext} 0...20 mA (1)
- Ext. set-point W_{ext} 4...20 mA (2)
- Position feedback y_{p} 0...20 mA (3)
- Position feedback y_{p} 4...20 mA (4)

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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Adjustment range</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd set-point w2 (ramp)</td>
<td>SP2</td>
<td>w0...w100</td>
</tr>
<tr>
<td>Segment time t2 (ramp)</td>
<td>Pt2</td>
<td>0...9999min</td>
</tr>
<tr>
<td>3rd set-point w3</td>
<td>SP3</td>
<td>w0...w100</td>
</tr>
<tr>
<td>Segment time t3</td>
<td>Pt3</td>
<td>0...9999min</td>
</tr>
<tr>
<td>11th set-point w11</td>
<td>SP11</td>
<td>w0...w100</td>
</tr>
<tr>
<td>Segment time t11</td>
<td>Pt1</td>
<td>0...9999min</td>
</tr>
<tr>
<td>Start-up temperature</td>
<td>YA</td>
<td>5...100%</td>
</tr>
<tr>
<td>Start-up set-point</td>
<td>SPA</td>
<td>w0...w100</td>
</tr>
<tr>
<td>Start-up holding time</td>
<td>PtA</td>
<td>0...9999min</td>
</tr>
<tr>
<td>Low limit contact 1</td>
<td>LCL1</td>
<td>Relative: 1...9999&lt;br&gt;Absolute: x0...9999</td>
</tr>
<tr>
<td>High limit contact 1</td>
<td>LCH1</td>
<td>Relative: 1...9999&lt;br&gt;Absolute: x0...9999</td>
</tr>
<tr>
<td>Low limit contact 2</td>
<td>LCL2</td>
<td>Relative: 1...9999&lt;br&gt;Absolute: x0...9999</td>
</tr>
<tr>
<td>High limit contact 2</td>
<td>LCH2</td>
<td>Relative: 1...9999&lt;br&gt;Absolute: x0...9999</td>
</tr>
<tr>
<td>Alarm switch. differ. Xsd A1</td>
<td>SdA1</td>
<td>1...9999</td>
</tr>
<tr>
<td>Alarm switch. differ. Xsd A2</td>
<td>SdA2</td>
<td>1...9999</td>
</tr>
<tr>
<td>Signaller switch. diff. Xsd 1</td>
<td>SdS</td>
<td>1...9999</td>
</tr>
<tr>
<td>Operation blocking</td>
<td>Loc</td>
<td>0...2 (table at right)</td>
</tr>
<tr>
<td>Lower set-point limit w0</td>
<td>SPL</td>
<td>x0..x100</td>
</tr>
<tr>
<td>Upper set-point limit w100</td>
<td>SPH</td>
<td>x0..x100</td>
</tr>
<tr>
<td>Set-point gradient</td>
<td>Gr</td>
<td>0,1...999,9/min</td>
</tr>
<tr>
<td>Proport. band Xp1 (heating)</td>
<td>Pb1</td>
<td>0,1...999,9%</td>
</tr>
<tr>
<td>Proport. band Xp2 (cooling)</td>
<td>Pb2</td>
<td>0,1...999,9%</td>
</tr>
<tr>
<td>Integral action time Tn</td>
<td>ti</td>
<td>0...9999s&lt;br&gt;(0 = no I-action)</td>
</tr>
<tr>
<td>Derivative action time Tv</td>
<td>td</td>
<td>0...9999s&lt;br&gt;(0 = no D-action)</td>
</tr>
<tr>
<td>Motor actuator time Tmp</td>
<td>tt</td>
<td>8...300s</td>
</tr>
<tr>
<td>Step (pulse) duration Tmp</td>
<td>ttP</td>
<td>0,1...2,0s</td>
</tr>
<tr>
<td>Trigger point separation</td>
<td>SH</td>
<td>0,2...20,0%</td>
</tr>
<tr>
<td>Duty cycle for heating</td>
<td>tt1</td>
<td>0,4...999,9s</td>
</tr>
<tr>
<td>Duty cycle for cooling</td>
<td>tt2</td>
<td>0,4...999,9s</td>
</tr>
<tr>
<td>2nd output signal (preset)</td>
<td>Y2</td>
<td>Ymin...Ymax</td>
</tr>
<tr>
<td>Lower output limit Ymin</td>
<td>YLL</td>
<td>–100...YLH-10%</td>
</tr>
<tr>
<td>Upper output limit Ymax</td>
<td>YLH</td>
<td>YLL+10...100%</td>
</tr>
<tr>
<td>Time constant of input filter</td>
<td>tF</td>
<td>0,0...999,9s&lt;br&gt;-99,9...99,9%</td>
</tr>
<tr>
<td>Offset x0 for ratio control</td>
<td>OFFS</td>
<td>0...470 (display/matching)</td>
</tr>
<tr>
<td>Transducer start</td>
<td>PO</td>
<td>30...500 (display/matching)</td>
</tr>
<tr>
<td>Transducer end</td>
<td>P100</td>
<td>dP</td>
</tr>
<tr>
<td>Decimal point</td>
<td>Ln</td>
<td>–999...9999</td>
</tr>
<tr>
<td>Span start x0</td>
<td>LnE</td>
<td>–999...9999</td>
</tr>
<tr>
<td>End of span x100</td>
<td>LnH</td>
<td>–999...9999</td>
</tr>
<tr>
<td>Interface address</td>
<td>Addr</td>
<td>0...99</td>
</tr>
</tbody>
</table>

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.
Industrial controller KS 90

![Diagram of industrial controller KS 90](image)

**Connections for switching controllers**

**Connections for continuous controller**

### 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

<table>
<thead>
<tr>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dummy panel</td>
<td>9404 723 11231</td>
</tr>
<tr>
<td>Labels for engineering unit (qty. 27)</td>
<td>4012 140 66041</td>
</tr>
</tbody>
</table>

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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