**PROFILE**

With their compact dimensions, these mini-controllers can be mounted even in the smallest machines. They have one control output and two alarm outputs. Depending on configuration, they can be used as signalers or two-point controllers. By configuring one of the alarm outputs accordingly, they are also suitable for three-point control, i.e. all heating, cooling or heating/cooling applications.

High-resolution input circuit, fast scanning cycle, and self-tuning result in precise control behaviour.

**SAFE OPERATION**

Operation is done by means of 3 front-panel keys in the Operating, Parameter and Configuration Levels. Easily remembered mnemonics are displayed for every adjusted parameter, thus simplifying the unit’s configuration. Alarm and control parameters can be selected for adjustment in the Operating Level. Two DIP switches enable the adjustment of set-point and parameters to be disabled.

**HIGH-PRECISION UNIVERSAL INPUT INP1**

The measurement input is configurable for all conventional applications. With thermocouple and Pt 100 input, resolution is 0,1°C. Optionally, the display can be in °F or in a linear engineering unit of your choice. Measurement value correction is fitted as standard. Current/voltage input signals are scalable in the range of -19999...+45536. Set-point limits are adjustable within the measurement range. In case of sensor break, the output goes to a pre-defined state.

**SUPPLEMENTARY INPUT INP2**

for heating current monitor, external set-point, or difference control Heating current is switched on by the two-point controller is monitored with an external current transformer, and compared with a preset limit. Alternatively, the supplementary input can be used for an external set-point, or for difference control.

**ADDITIONAL DISPLAY MODE**

Apart from the standard display of set-point and process value, it is possible to select a display mode for previous min/max process values together with their gradients. Heating current and output value can also be displayed in this way.

**CONTROL OUTPUTS**

with PID + Fuzzy behaviour plus self-tuning

Depending on version, control output OUT1 is either a relay, a logic signal, or a continuous 0/4...20 mA or 0...10 V signal. Due to the fast scanning time of 100 ms and the high input resolution, the controller is also suitable for fast control loops (e.g. air heating, pressure, and flow). At the push of a button, the autotuning function determines the optimum parameters for fast line-out without overshoot. For this step changes of the output are used for the calculation. Selftune is as well possible: The controller determines automatically the optimum parameters without producing a detectable disturbance to the process. By means of the alarm relay OUT 2, the unit can be configured as a three-point controller, e.g. for „heating/cooling” applications.

**TWO UNIVERSAL, CONFIGURABLE ALARM OUTPUTS**

Both alarm outputs operate on the working current principle; when triggered by an alarm, the relays are energized (logic output goes „High” with KS 10-I), and the front-panel LED lights. The switching difference is individually adjustable. Configurable alarm modes are: Absolute or relative measurement value alarm, min/max alarm, tolerance band alarm, or control loop monitoring. The absolute alarm is selectable for INP1 or INP2. Furthermore, alarm behaviour is configurable: Alarm suppression after power-up, alarm „latch” or alarm „on/off” in case of a fault, e.g. sensor break. Latched alarms can be reset via an external contact.

**2ND SET-POINT and 2nd set of parameters**

By means of an external contact „WWW2”, a 2nd set-point can be activated. If required, a separate parameter set can be assigned to the 2nd set-point.
**SET-POINT RAMP FUNCTION / TIMER RELAY**

The ramp function is initiated after power-up, whereby the set-point starts from the actual process value and increases at a defined rate (°C/min or °C/h) to the final value. If one of the alarm relays is used for timing functions, the timer is started as soon as the process value reaches the set-point value. When the preset time has elapsed, the relay can be used e.g. to switch off a heater.

**SLEEP FUNCTION**

This function is used to disable the control outputs.

**OPTION: INTERFACE OR MEASUREMENT VALUE OUTPUT**

The RS 485 interface with Modbus RTU protocol can be used for remote access to all the parameters. The high-precision 0/4...20 mA measurement value output is galvanically isolated and configurable to represent the process value, the control deviation, or the isolated and configurable to represent the controller output.

**TECHNICAL DATA**

**UNIVERSAL INPUT INP1**

**Scanning cycle**

100 ms

**Input filter**

Time constant adjustable: max. 60 s

**Display**

°C, °F or engineering unit selectable

**Sensor break monitoring**

Response time: approx. 1 s

**Lead break monitoring:**

- current <1 mA for 4...20 mA input; voltage <0,025 V for 1...5 V input
- Output response: adjustable 0...100.0 %
- Alarm output action: adjustable On / Off

**Sensor and signal types**

<table>
<thead>
<tr>
<th>Sensor/signal Type</th>
<th>Measuring range</th>
<th>Error*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe-CuNi J</td>
<td>-120...1000 °C</td>
<td>±184...1832 °F</td>
</tr>
<tr>
<td>Ni-CuNi K</td>
<td>-200...300 °C</td>
<td>±328...1652 °F</td>
</tr>
<tr>
<td>PtRh-Pt 10% S</td>
<td>0...1767 °C</td>
<td>±32...3214 °F</td>
</tr>
<tr>
<td>PtRh-Pt 13% R</td>
<td>0...1767 °C</td>
<td>±32...3214 °F</td>
</tr>
<tr>
<td>PtRh-Pt 6% B</td>
<td>0...1820 °C</td>
<td>±32...3298 °F</td>
</tr>
<tr>
<td>Cu-CuNi T</td>
<td>-250...400 °C</td>
<td>±418...752 °F</td>
</tr>
</tbody>
</table>

**OUTPUTS**

**Relay contacts**

Rating: 240 VAC, 2 A, resistive load

**Logic output**

- 4V with RL > 400Ω
- max. 30 mA with RL < 400Ω

**Continuous output**

Galvanically isolated, resolution < 0.1 %

- 0/4...20 mA (3,8...21 mA), load 500 Ω
- 0...10 V, load > 10 kΩ configurable for 0-1/5/10V, 1-5V

**POWER SUPPLY**

- AC supply: 90...264 VAC, 50/60 Hz
- Universal supply: 11-26 VUC
- Power consumption: Max15VA /7 W

**CONTROL BEHAVIOUR**

- **Two-point and continuous controllers**
  - Proportional band Pb1: 0...500,0 °C
  - Integral action time ti: 0...3600 s
  - Derivative action time td: 0...900,0 s
  - Duty cycle: 0...100,0 %
  - Control action: Inverse („Heating”) or direct („Cooling”)
  - Output limiting: 0...100 %
  - Output signal in case of sensor break: configurable 0...100 % or switch-over to last mean value of the output signal

- **Three-point controller**
  - Alarm relay 2 configurable for „cooling”: Duty cycle: 0...100,0 %
  - Proportional band cooling Cp: 1...255 % of proportional band Pb1
  - „heating” Trigger point separation: >4V at RL > 400Ω, max 30 mA at RL < 400Ω, db = -36,0 to +36,0 °C
  - Output limiting: 0...100 %
  - Output signal in case of sensor break: adjustable 0...100 %

- **Set-point ramp function / Timer function**
  - Gradient: 0...500,0 °C/min or 0...500,0 °C/hour. Dwell time at set-point for alarms 1 & 2: 6553,5 min
  - Alarms 1 & 2 configurable for „On / Off” respectively

**Sleep function**

Outputs can be disabled; display point blinks

**ALARM OUTPUTS 1 AND 2**

**KS 10-I**

- Alarm 1: Logic output 5 V /100mA
- Alarm 2: Relay output

**KS 20-I**

- Alarms 1 & 2: Relay output
- Contact rating: 240 VAC, 2 A, resistive load

**Configurable alarm action**

Alarm suppression on power up
- Alarm latch
- Alarm On / Off for sensor break
**Configurable alarm functions**
Min/max monitoring for process value (INP 1 and INP 2), control deviation or deviation band

**Output loop break alarm**
Detection time: 2 x integral action time, < 120 s

**Adjustment of alarm trigger points**
Absolute alarm: within measuring range
Relative alarm: -200,0...200,0 °C
Switching difference (hysteresis): 0,1...10,0 °C

**OPERATION**

**Extension of the operating level**
Additionally to the set-point, up to 5 alarm/control parameters can be selected for the adjustment in the operating level.

**Set-point adjustment**
Upper and lower limits of the set-point are selectable within the measuring range limits

**Disabling DIP switches**

<table>
<thead>
<tr>
<th>1</th>
<th>2 Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF OFF</td>
<td>All parameters adjustable</td>
</tr>
<tr>
<td>ON OFF</td>
<td>Only SP1 and selected parameters</td>
</tr>
<tr>
<td>OFF ON</td>
<td>Only SP1 adjustable</td>
</tr>
<tr>
<td>ON ON</td>
<td>All parameters disabled</td>
</tr>
</tbody>
</table>

**Manual control mode**
Control output adjustable: 0,0...100 % „Heating“ / 0,0...100 % “Cooling”

**Display mode**
The following parameters can be displayed:

- PVHI: Maximum process value
- PVLO: Minimum process value
- H_ _ _: Percentage power „heating”
- C_ _ _: Percentage power “cooling”
- DV: Control deviation (x-w)
- PV1: Process value (INP 1)
- PV2: Process value (INP 2)/heating current
- PB: Proportional band value
- TI: Integral action time
- TD: Derivative action time
- CJCT: Cold junction temperature
- PVR: Process value rate
- PVRR: PVRL: Maximum process value rate
- PVRL: Minimum process value rate

**COMMUNICATION**

**RS 485 interface**
Data protocol: Modbus RTU
Interface address: 1...247
Transmission speed: max. 38.400 bits/s

**Measurement value output**
0/4...20 mA, load max 250 Ω
Galvanically isolated, scalable
Resolution: 0,025 %
Accuracy: ± 0,05 %
Configurable, scalable for representation of: Process value x, set-point w, control deviation x-w, correcting variable y

**ENVIRONMENTAL CONDITIONS**

**Operating temperature**
-10...+50 °C

**Storage temperature**
-40...+60 °C

**Relative humidity**
0...90 %, no condensation

**Shock and vibration**
Shock test: 20 g
Vibration test: 10...55 Hz, 1 mm

**CONFORMITY TESTS**

**CE marking**
The unit meets the relevant European Standards

**Electrical safety**
According to DIN EN 61 010-1
Over-voltage category II
Contamination degree 1
Working voltage range 300 V
Protection class II
UL approval (in preparation)
CSA approval (in preparation)

**Electromagnetic compatibility**
Meets EN 50 081-1, EN 50 082-2 and EN 61326

**GENERAL**

**Housing KS 10-I**
Front dimensions: 48 x 24 mm
Depth behind panel: 99 mm

**Housing KS 20-I**
Front dimensions: 48 x 48 mm
Depth behind panel: 75 mm

**Accessories**
Operating instructions (English, German)
Current transformer
Dimensions: 25 x 55 x 70,6 mm
Weight: 59 g
Ordering Number: 9407 998 00051

**Ordering Number:** 9407 998 00051

**Panel cut-out:** 45+0,5 x 22,2+0,3 mm (see dimension drawing)

**Housing KS 20-I**
Front dimensions: 48 x 48 mm
Depth behind panel: 75 mm
Panel cut-out: 45+0,5 x 45+0,5 mm (see dimension drawing)
Protection mode:
Front: IP 65 (NEMA 4X)

**Electrical connection**
Screw terminals for max. 2.5 mm²

**Weight**
KS 10-I: approx. 0,11 kg
KS 20-I: approx. 0,15 kg

**Accessories**
Operating instructions (English, German)
Current transformer
Dimensions: 25 x 55 x 70,6 mm
Weight: 59 g
Ordering Number: 9407 998 00051
### ORDERING DATA

<table>
<thead>
<tr>
<th>KS 10-I economy</th>
<th>9407 - 403 - x x x 1</th>
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</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>90-264 VAC</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>11-26 VUC</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Control output 1</td>
<td>Relay (2 A / 240 VAC)</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Logic (5 V / 30 mA)</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Continuous 0/4...20 mA</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Continuous 0...10 V</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Options</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>0</td>
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<tr>
<td></td>
<td>Digital interface RS 485</td>
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<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Meas. value output 0/4...20 mA</td>
</tr>
<tr>
<td></td>
<td>2</td>
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<tr>
<td></td>
<td>Config. to specification</td>
</tr>
<tr>
<td></td>
<td>9</td>
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<tr>
<td>Current transformer 0...50A</td>
<td>9407 - 998 - 0 0 0 5 1</td>
</tr>
<tr>
<td>Operating manual GB</td>
<td>9499 - 040 - 5 8 0 1 1</td>
</tr>
<tr>
<td>Operating manual D</td>
<td>9499 - 040 - 5 8 1 1 8</td>
</tr>
<tr>
<td>Operating manual F</td>
<td>9499 - 040 - 5 8 2 3 2</td>
</tr>
</tbody>
</table>

1) For two-point control „heating“ or „cooling“. Three-point controller uses the alarm relay ALM 2 for „cooling“.

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<tr>
<td>Operating manual F</td>
<td>9499 - 040 - 5 8 5 3 2</td>
</tr>
</tbody>
</table>

2) Basic configuration: Two-point controller, thermocouple input (type J), alarm outputs monitor the max. control deviation.

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**Your local representative**

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