PMA

KS 10-I/KS 20-I
Mini-controller

economy line

High-precision universal input

Precise control behaviour with short scanning cycle of 100 ms,

Hardware switch for disabling operation

Two freely configurable alarm outputs for suppression, latch, and timer function

Monitoring of heating current and control loop

External contact for 2nd set-point and 2nd set of parameters

Precise, galvanically isolated measurement value output

RS 485 interface with Modbus RTU protocol

Front panel protection IP 65

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 signallers 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.

The max. effec- tive output value is individually adjust- able for heating and cooling, whereby PID, PD, PI, or P control behaviour is selectable. With P or PID behaviour, permanent offset can be prevented by shifting the working point.

Output response in the case of sensor break is adjustable 0...100%. Alternatively, the „hold" function maintains the output at its previous mean value. The input for an external contact can be used to activate a second set of parameters.

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 „W/W2", 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 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
Thermocouple and Pt 100 break protection

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

Sensor/signal	Type	Measuring range		Error*
Fe-CuNi	J	-120...1000 °C	-184...1832 °F	2 K
Fe-CuNi	L	-200...900 °C	-328...1625 °F	2 K
NiCr-Ni	K	-200...1370 °C	-328...2498 °F	2 K
PtRh-Pt 10%	S	0...1767 °C	32...3214 °F	2 K
PtRh-Pt 13%	R	0...1767°C	32...3214 °F	2 K
PtRh-Pt 6%	B	0...1820°C	32...3308°F	2 K**
Cu-CuNi	T	-250...400°C	-418...752°F	2 K
Nicrosil/Nisil	N	-250...1300 °C	-418...2372 °F	2 K
NiCr-CuNi	E	-100...900 °C	-148...1652 °F	2 K
Pt 100		-210...700 °C	-346...1292 °F	0,1 K
Linear		4-20 mA	-19999...45536	0,05 %
Linear		0-20 mA	-19999...45536	0,05 %
Linear		0-1 V	-19999...45536	0,05 %
Linear		0-5 V	-19999...45536	0,05 %
Linear		1-5 V	-19999...45536	0,05 %
Linear		0-10 V	-19999...45536	0,05 %

* Error includes linearity, temperature compensation, lead resistance, and offset drift

* *For range 200...1820 °C

Current 0/4...20 mA
Input resistance: 70,5 Ω

Voltage
Input resistance: 302 κΩ

Lead resistance
Max. 100 Ω

Temperature compensation
Additional error: typically 0,1 K /10 K

Effect of compensating lead
Additional error: 0,1 μV / Ω

Resistance thermometer connection
2 or 3-wire connection

Measurement value correction
-200,0...200,0 °C

Decimal point adjustment
0 or 1 for thermocouple, Pt 100 ranges
0, 1, 2 or 3 for mA, V ranges

Interference suppression
Series mode rejection: 40 dB
Common mode rejection: 120 dB

INPUT INP2

Scanning cycle
500 ms
Alternatively for:

External current transformer type 9407 998 00051
Range: 0...50,0 A
Error: ±2% of indication ± 0,2 A or:

External set-point
0...1 V, 0...5 V, 1...5 V, 0...10 V
Input resistance: 302 κΩ
0/4...20 mA (only with KS 20-I)
Input resistance: 70,5Ω +0,8 V /1 mA

Digital input (external switch)
Configurable action:

Display	Description
NONE	No function
SP2	Second set-point W2
PID2	Second parameter set
SP.P2	Second W2 parameter set
RS.A1	Reset alarm 1 output
RS.A2	Reset alarm 2 output
R.A1.2	Reset Alarm 1&2
D.01	Output 1 disabled
D.02	Output 2 disabled
D.01.2	Output 1&2 disabled
LOCK	All parameters disabled

OUTPUTS

Relay contacts
Rating: 240 VAC, 2 A, resistive load

Logic output
Rating: >4V with R_L > 400Ω
max. 30 mA with R_L < 400Ω

Continuous output
Galvanically isolated, resolution < 0,1 %
0/4...20 mA (3,8...21 mA), load 500 Ω
0...10 V, load > 10 κΩ konfigurable 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
(0...9000 units)
Integral action time ti:: 0...3600 s
Working point (Offset): 0...100,0 %
Derivative action time td: 0...900,0s
Hysteresis of signaller
(Pb1 = 0): 0,1...55,6 °C
Duty cycle: 0,1...100,0 s
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: 0,1...100,0 s
Proportional band cooling CPb: 1...255 % of proportional band Pb1 „heating" Trigger point separation: >4V at R_L > 400Ω, max 30 mA at R_1 < 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 &2:0...6553,5 min (timer function independent of the ramp function)
Alarms 1 &2configurable 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

1	2	Function
OFF	OFF	All parameters adjustable
ON	OFF	Only SP1 and selected parameters
OFF	ON	Only SP1 adjustable
ON	ON	All parameters disabled

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
PVRH	Maximum process value rate
PVRL	PVRL Minimum process value rate

COMMUNICATION

RS 485 interface

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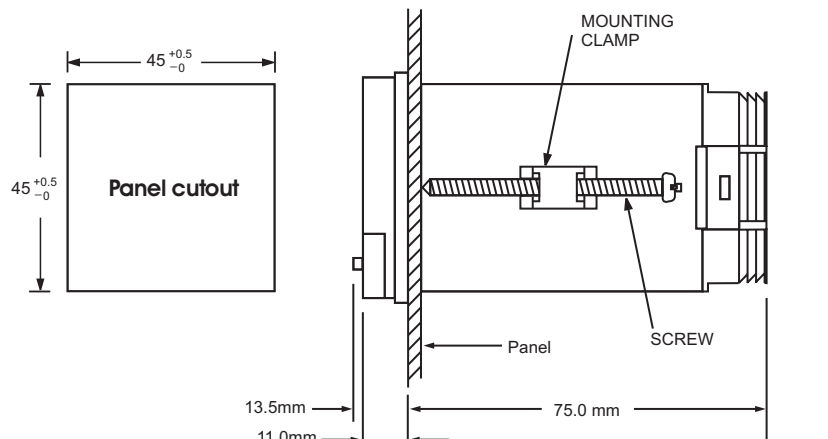Transmission speed: max. 38.400 bits/s

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

Overall dimensions of KS 10-I
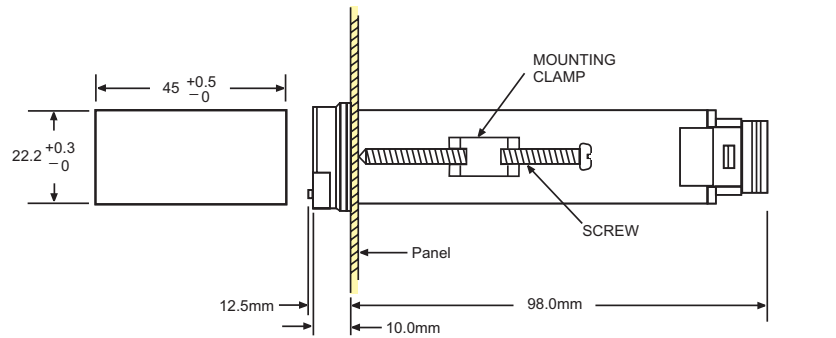
Overall dimensions of KS 20-I

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

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
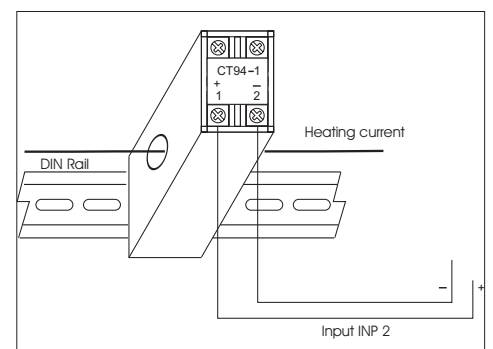KS 20-I: approx. 0,15 kg

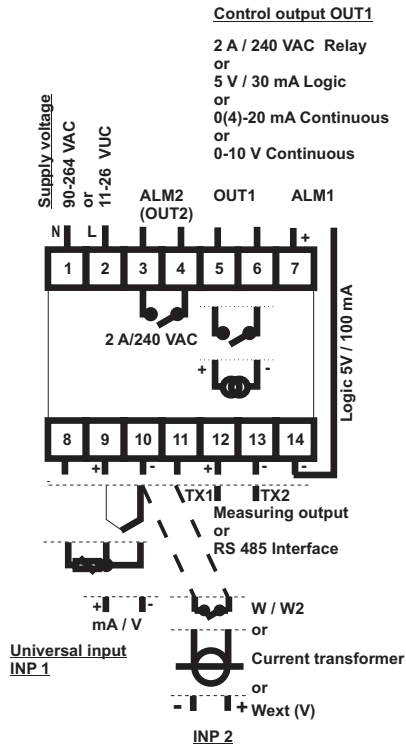## Accessories

Operating instructions (English, German)

Current transformer

Dimensions: 25 x 55 x 70,6 mm
Weight: 59 g

Ordering Number: 9407 998 00051

CONNECTION DIAGRAM KS 10-I

Control output OUT1

2 A / 240 VAC Relay
or
5 V / 30 mA Logic
or
0(4)-20 mA Continuous
or
0-10 V Continuous

Supply voltage
90-264 VAC or 11-26 VUC

ALM2 (OUT2)   OUT1   ALM1

N   L
1 2 3 4 5 6 7

2 A/240 VAC

Logic 5V / 100 mA

8 9 10 11 12 13 14
+   -   +   -   -

TX1   TX2
Measuring output
or
RS 485 Interface

W / W2
or
Current transformer
or
Wext (V)

mA / V
Universal input INP 1

INP 2

CONNECTION DIAGRAM KS 20-I

Control output OUT1

2 A / 240 VAC Relay
or
5 V / 30 mA Logic
or
0(4)-20 mA Continuous
or
0-10 V Continuous

Supply voltage
90-264 VAC or 11-26 VUC

ALM2 (OUT2)   OUT1   ALM1

N   L
1 2 3 4 5 6 7 8

9 10 11 12 13 14 15 16
+   -   -   +

TX1   TX2
Measuring output
or
RS 485 Interface

W / W2

Wext (mA / V)

Current transformer

+   mA   -
V
Universal input

ORDERING DATA

KS 10-I economy 9407 - 403 - x x x x 1

Power supply	
90-264 VAC	**0**
11-26 VUC	**1**
Control output 1)	
Relay (2 A / 240 VAC)	**0**
Logic (5 V / 30 mA)	**1**
Continuous 0/4...20 mA	**2**
Continuous 0...10 V	**3**
Options	
None	**0**
Digital interface RS 485	**1**
Meas. value output 0/4...20 mA	**2**
Configuration 2)	
Basic configuration	**0**
Configuration to specification	**9**

Current transformer 0...50A	**9407 - 998 - 0 0 0 5 1**
Operating manual GB	**9499 - 040 - 5 80 1 1**
Operating manual D	**9499 - 040 - 5 8 1 1 8**
Operating manual F	**9499 - 040 - 5 8 2 3 2**

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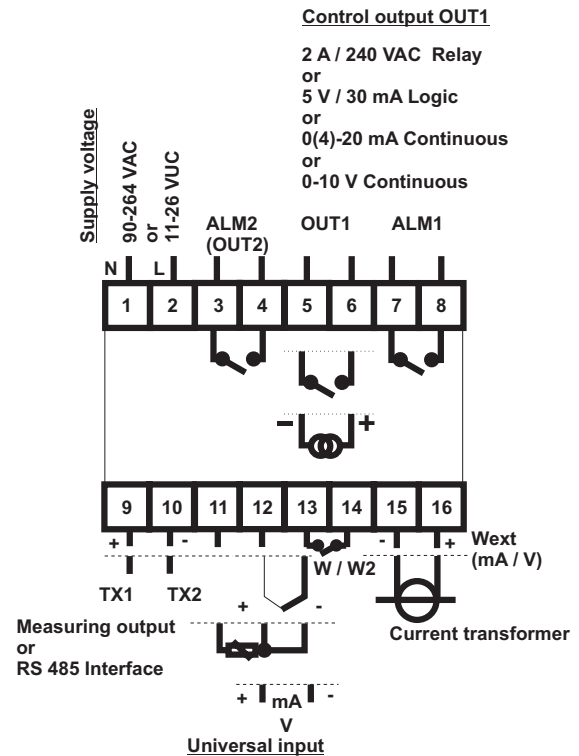
ORDERING DATA

KS 20-I economy 9407 - 404 - x x x x 1

Power supply	
90-264 VAC	**0**
11-26 VUC	**1**
Control output 1)	
Relay (2 A / 240 VAC)	**0**
Logic (5 V / 30 mA)	**1**
Continuous 0/4...20 mA	**2**
Continuous 0...10 V	**3**
Options	
None	**0**
Digital interface RS 485	**1**
Meas. value output 0/4...20 mA	**2**
Configuration 2)	
Basic configuration	**0**
Configuration to specification	**9**

Current transformer 0...50A	**9407 - 998 - 0 0 0 5 1**
Operating manual GB	**9499 - 040 - 5 8 3 1 1**
Operating manual D	**9499 - 040 - 5 8 4 1 8**
Operating manual F	**9499 - 040 - 5 8 5 3 2**

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

Your local representative