

KS 40-1 burner
Universal Burner Controller

BluePort interface and BlueControl software

Maintenance Manager and error list

Modulating, two or three stage regulation

Automatic/manual and function key

External setpoint and external correction

Extended limit function with latch

Type tested to EN 14597 (replaces DIN 3440) and cULus

universal line

- 100 ms cycle time, i.e. also suitable for fast control loops
- Customer-specific linearization for all sensors
- Settings can be blocked via password and internal switch for high security
- Extended temperature range up to 60 °C allows mounting close to the process
- Easy 2-point or offset measurement correction
- Logical combination of digital outputs, e.g. for general alarm
- Built-in transmitter power supply
- Splash-water proof front (IP 65)

APPLICATIONS

- Modulating burners
- Two-stage burners
- Three-stage burners
- Position control
- Synchronisation control
- Boiler pressure control
- Weather-compensation
- 2- and 3-point control

DESCRIPTION

The universal temperature controller KS 40-1 *burner* are intended for universal, precise, and cost-effective control tasks of modulating, two- and three-stage burners. It can be switched between the simple on/off control of 2-stage burners and motorized control for modulating burners during operation. Thus different fuels are optimally applicable.
The process value signal is connected via a universal input. Thus thermocouples and Pt100 can be used for temperature control. 2-wire, 3-wire or 50/30/50 Ω pressure transmitters can be used for boiler pressure control. The additional input INP2 can be used eg. for external setpoint or weather-compensation.

Plug-in module

KS 40-1 controllers are built as plug-in modules. This enables them to be replaced very quickly without tools, and without disturbing the wiring.

Self-tuning

During start-up, the self-tuning function determines the optimum settings for fast line-out without overshoot.

Display and operation

Clear informations are given by ten indicator LED's in the front panel that display operating mode, I/O states, and errors. The auto/manual key switches the controller into the manual mode directly, without lengthy operating sequences. If required, the direct switch over can be disabled or the key can be configured e.g. switch off the controller. This results in a level of operational safety that is usually found only in controllers of a higher price category.

Front interface and Engineering Tools

Via the BlueControl software incl. its simulation functions, and especially the convenient BluePort front panel interface, the required set-up for a specific control task can be determined without a detailed study of the operating instructions.
Off cause almost all adjustments can be done comfortably over the instrument front. (see page 5, BlueControl)

Password protection

If required, access to the various operating levels can be protected with a password. Similarly, access to a complete level can be blocked.

TECHNICAL DATA

INPUTS

SURVEY OF THE INPUTS

Input	Used for:
INP1	x (process value)
INP2	SP.E (external set-point or external correction)
di2 (option)	Control mode selection modulating/stage
di3 (option)	Operation disabled, switch-over to second set-point SP.2, external set-point SP.E, fixed output signal Y2, manual operation, controller off, disabled auto/manual function, reset stored alarms

PROCESS VALUE INPUT INP1

Resolution: > 14 bits
Decimal point: 0 to 3 decimals
Limiting frequency: 2 Hz
Digital input filter: adjustable 0,000...9999 s
Scanning cycle: 100 ms
Measured value correction: 2-point or offset correction

Thermocouples (a)

Input impedance: ≥ 1 MΩ
Effect of source resistance: 1 µV/Ω

Cold junction compensation

Max. additional error ± 0,5 K

Sensor break monitoring

Sensor current: ≤ 1 µA
Operating sense configurable (see page 3)

Resistance thermometer (b)

Connection: 3-wire
Lead resistance: max. 30 Ω
Input circuit monitor: Break and short circuit

Special measuring range

The BlueControl software can be used to match the input to the sensor KTY 11-6 (characteristic is stored in the controller).

Physical measuring range: 0...4500 Ω
Linearization segments 16

Potentiometer (c)

Connection of eg 50-30-50 Ω .

Current and voltage signals (d, g)

Span start, end of span: anywhere within measuring range
Scaling: selectable -1999...9999
Linearization: 16 segments, adaptable with BlueControl
Decimal point: adjustable
Input circuit monitor: 12,5% below span start (2mA, 1V)

Table 1 Thermocouple ranges (INP1)

Thermocouple		Range		Accuracy	Resolution (∅)
L	Fe-CuNi (DIN)	-100...900°C	-148...1652°F	≤ 2K	0,1 K
J	Fe-CuNi	-100...1200°C	-148...2192°F	≤ 2K	0,1 K
K	NiCr-Ni	-100...1350°C	-148...2462°F	≤ 2K	0,2 K
N	Nicrosil/Nisil	-100...1300°C	-148...2372°F	≤ 2K	0,2 K
S	PtRh-Pt 10%	0...1760°C	32...3200°F	≤ 2K	0,2 K
R	PtRh-Pt 13%	0...1760°C	32...3200°F	≤ 2K	0,2 K
	special	-25 ...75 mV		≤ 0,1 %	0,01 %

Table 2 Resistance transducers (INP1)

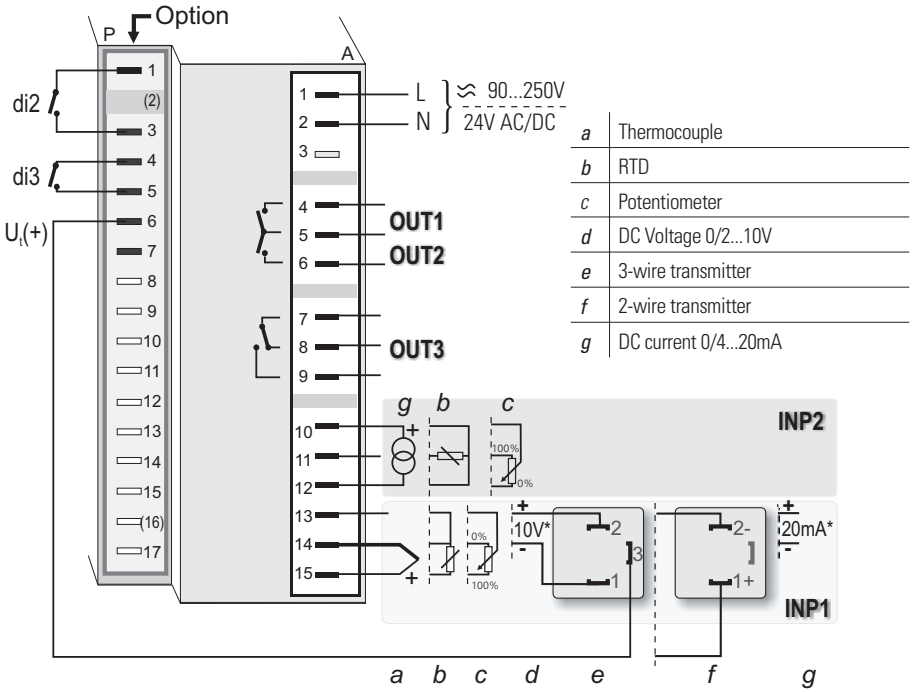
Type	Sensor current	Range		Accuracy	Resolution (∅)
Pt100	0,2 mA	-200...850°C	-328...1562°F	≤ 1 K	0,1 K
Pt1000		-200...200°C	-328...392°F	≤ 2 K	0,1 K
KTY 11-6*		-50...150 °C	-58...302 °F	≤ 2 K	0,05 K
Potentiometer		160/450/1600 Ω		≤ 0,1 %	0,01 %

** or special 0...4500 Ω*

Table 3 Current and voltage (INP1)

Range	Input resistance	Accuracy	Resolution (∅)
0-10 Volt	≈ 110 kΩ	≤ 0,1 %	0,6 mV
0-20 mA	49 Ω (voltage requirement≤ 2,5 V)	≤ 0,1 %	1,5 µA

Electrical connections:



a	Thermocouple
b	RTD
c	Potentiometer
d	DC Voltage 0/2...10V
e	3-wire transmitter
f	2-wire transmitter
g	DC current 0/4...20mA

** Pay attention to the internal switch!*

Direct cConnection of transmitters (Option)

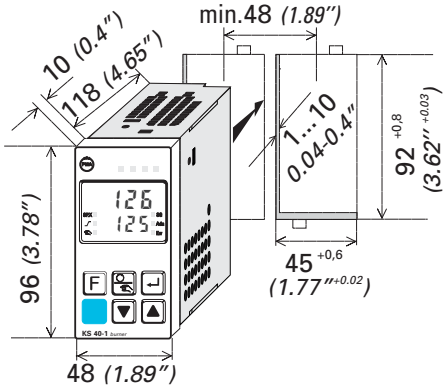
3-wire transmitters (c)

Supply voltage ≥ 18 V/22 mA
measuring range 0...10V

2-wire transmitters (f)

Supply voltage ≥ 18 V/22 mA
measuring range 4...20mA

Dimensions (mm)::



SUPPLEMENTARY INPUT INP2

Resolution:	> 14 bit
Scanning cycle:	100 ms
Accuracy:	≤ 0,5%

Current measurement

Input resistance	approx. 15 Ω
Span:	configurable within 0 to 20mA
Scaling:	adjustable -1999...9999
Input circuit monitor:	12,5% below span start (4..20mA → 2mA)

Potentiometer

Connection:	3-wire
Ranges:	160/450/1600 Ω
Scaling:	beliebig -1999...9999
Input circuit monitor:	Break and short circuit

Resistance thermometer

Connection:	3-Leiter
Ranges:	Pt100, Pt1000
Input circuit monitor:	Break and short circuit

CONTROL INPUTS (OPTION)

Connection of a potential-free contact suitable for switching „dry" circuits.

Switched voltage:	5 V
Switched current:	160 µA

TRANSMITTER SUPPLY U_T (OPTION)

Output:	22 mA / ≥ 18 V

OUTPUTS

SURVEY OF THE OUTPUTS

Output	Used for:	Optional
OUT1	Control output Y1	Control outputs Y1, Y2, limit contacts, alarms*
OUT2	Control output Y2	
OUT3	Limit contact 1	

** All logic signals can be OR-linked !*

Galvanic isolations:

▬ Safety isolation
═ Functional isolation

Mains supply	Process value input INP1 Supplementary input INP2
Relay outputs OUT1,2	Digitaleingänge
Relay output OUT3	Transmitterspeisung U_T

RELAY OUTPUTS OUT1, OUT2

Contacts:	2 NO contacts with common connection
Max. contact rating:	500 VA, 250 VAC, 2A at 48...62 Hz, resistive load
Min. contact rating:	6 V, 1 mA DC
Duty cycle electric	for I = 1A/2A: ≥ 800,000 / 500,000 (at ~ 250V / (resistive load))

RELAY OUTPUT OUT3

Contacts:	Potential-free changeover contact
Max. contact rating:	500 VA, 250 VAC, 2A at 48...62 Hz, resistive load
Min. contact rating:	5 V, 10 mA AC/DC
Duty cycle electric	for I = 1A/2A: ≥ 1,000,000 / 600,000 (at ~ 250V / (resistive load))

Note:
If the relays OUT1...OUT3 operate external contactors, these must be fitted with RC snubber circuits to manufacturer specifications to prevent excessive switch-off voltage peaks.

FUNCTIONS

Control behaviour

- Signaler with adjustable switching differential (ON/OFF controller)
- 3-point signaller (3-stage)
- PID controller (2-point)
- Delta / Star / Off or 2-point controller with switch over from partial to full load
- 2 x PID (heating/cooling)
- 3-point stepping controller (modulating)
- 3-point stepping controller switch-over to signaller (2-stage)
- 3-point stepping controller switch-over to 3-point signaller (3-stage)

Self-tuning control parameters or adjustable manually via front keys or BlueControl software.

Set-point functions

- Adjustable set-point gradient 0,01...9999 °C/min
- Set-point control
- Set-point/cascade control
- Set-point with external correction (weather control)

Behaviour with sensor break or short circuit:

- Control outputs switched off
- Switch-over to a safe output value
- Switch-over to a mean output value (PID-controller only)

LIMIT SIGNALLING FUNCTIONS

Max., Min. or Max./Min. monitoring with adjustable hysteresis.

Signals which can be monitored:

- Process value
- Control deviation
- Control deviation with suppression during start-up or set-point changes
- Effective set-point
- Output signal Y

Functions

- Input signal monitoring
- Input signal monitoring with latch (reset via front key or digital input)

Several limit signals or alarms can be OR-linked before being output.
Applications: Release of a brake with motor actuators, general alarms, etc.

ALARMS

Sensor break or short circuit

Depending on selected input type, the input signal is monitored for break and short circuit.

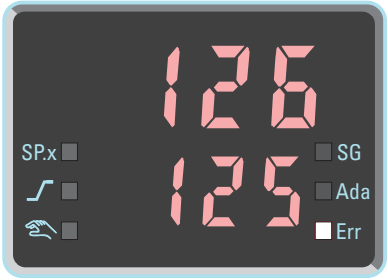
MAINTENANCE MANAGER

Display of error signals, warnings, and latched limit messages in the error list. Signals are latched, and can be reset manually.

Possible signals in the error list:

Sensor break, short circuit, reversed polarity
Heating current alarm
Control loop alarm
Fault during self-tuning
latched limit messages
e.g. re-calibration warning (If the adjusted operating hours are exceeded a message is displayed)
e.g. maintenance interval of actuator (If the adjusted switching cycles are exceeded a message is displayed)
Internal fault (RAM, EEPROM, ...)

Flashing Error LED indicates active alarm in the error list:



OPERATION AND DISPLAY

Display

Process value:	10,5 mm LED
Lower display:	7,8 mm LED

Function key

Available for the following functions:

- Control mode selection modulating/stage
- Operation blocked
- Switch-over to second setpoint SP.2
- Switch-over to exteral setpoint SP.E
- Switch-over to setpoint correction SP.E
- Switch-over to fixed output signal Y2
- Manual operation
- Controller off
- Disabled auto/manual function
- Reset of latched alarms

POWER SUPPLY

Depending on version:

AC SUPPLY

Voltage:	90...260 VAC
Frequency:	48...62 Hz
Power consumption	approx. 7 VA

UNIVERSAL SUPPLY 24 V UC

AC voltage:	20,4...26,4 VAC
Frequency:	48...62 Hz
DC voltage:	18...31 V DC class 2
Power consumption:	approx: 7 VA (W)

BEHAVIOUR WITH POWER FAILURE

Configuration, parameters, and adjusted set-points, control mode:
Non-volatile storage in EEPROM

BLUEPORT FRONT INTERFACE

Connection of PC via PC adapter (see „Accessories“). The BlueControl software is used to configure, set parameters, and operate the KS 40-1.

ENVIRONMENTAL CONDITIONS

Protection modes

Front panel:	IP 65
Housing:	IP 20
Terminals:	IP 00

Permissible temperatures

For specified accuracy:	0...60°C
Warm-up time:	< 15 minutes
Temperature effect:	< 100ppm/K
For operation:	-20...65°C
For storage:	-40...70°C

Humidity

75% yearly average, no condensation

Shock and vibration

Vibration test Fc (DIN 68-2-6)

Frequency:	10...150 Hz
Unit in operation:	1g or 0,075 mm
Unit not in operation:	2g or 0,15 mm

Shock test Ea (DIN IEC 68-2-27)

Shock:	15g
Duration:	11ms

Electromagnetic compatibility

Complies with EN 61 326-1
(for continuous, unattended operation

GENERAL

Housing

Material:	Makrolon 9415, flame-retardant
Flammability class:	UL 94 VO, self-extinguishing

Plug-in module, inserted from the front

Safety tests

Complies with EN 61010-1 (VDE 0411-1):
Over voltage category II
Contamination class 2
Working voltage range 300 VAC
Protection class II

Certifications

Type tested to EN 14597 (replaces DIN 3440)

With certified sensors applicable for:

- Heat generating plants with outflow temperatures up to 120°C to DIN 4751
- Hot-water plants with outflow temperatures above 110°C to DIN 4752
- Thermal transfer plants with organic transfer media to DIN 4754
- Oil-heated plants to DIN 4755

cULus-certification

(Type 1, indoor use)
File: E 208286

Electrical connections

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

Mounting

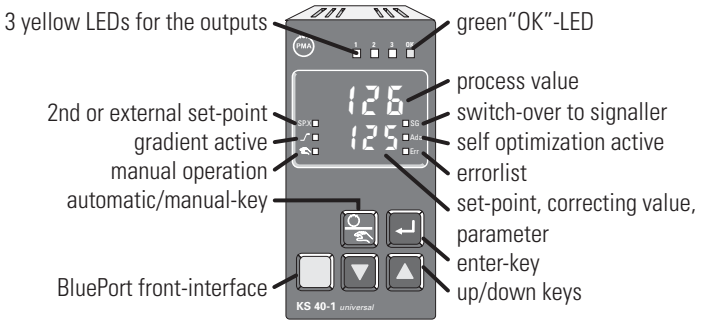
Panel mounting with two fixing clamps at top/bottom or left/right
Close mounting possible

Mounting position:	not critical
Weight:	0,27 kg (9.52 oz)

Accessories supplied with unit

Operating instructions
2 fixing clamps

Display and operation:



ACCESSORY EQUIPMENT

BlueControl (Engineering Tool)

PC-based program for configuring, setting parameters, and operating (commissioning) the KS 40-1 controller. Moreover, all the settings are saved, and can be printed on demand.
Depending on version, a powerful data acquisition module is available, complete with trend graphics.
Software requirements:
Windows 95/98/NT/2000.
The built-in simulation serves to test the controller settings, but can also be used for general training and observing the interaction between controller and control loop.

Configurations that can only be implemented via the BlueControl software (not via the front-panel keys):

- Customer-specific linearizations
- Enable „forcing" for inputs/outputs. Forcing allows to write the analog and digital inputs and outputs via Modbus interface.
- Adjustment of limits for operating hours and switching cycles
- Switch-over to 60 Hz mains frequency
- Disable operator actions and operating levels, plus password definition
- Prevent automatic optimization of cycle times T1, T2

Hardware requirements:

A PC adapter (see „Accessories") is required for connecting the controller.

Updates and demo software can be downloaded from:
www.pma-online.de

BlueControl, versions and functionality:

FUNCTIONALITY	MINI	BASIC	EXPERT
parameter and configuration setting	yes	yes	yes
controller and loop simulation	yes	yes	yes
download: trnsfer of an engineering to the controller	yes	yes	yes
online mode/ visualization	SIM only	yes	yes
defining an application specific linearization	yes	yes	yes
configuration in the extended operating level	yes	yes	yes
upload: reading an engineering from the controller	SIM only	yes	yes
basic diagnostic functions	no	no	yes
saving data file and engineering	no	yes	yes
printer function	no	yes	yes
online documentation, help	yes	yes	yes
implementation of measurement value correction	yes	yes	yes
data acquisition and trend display	SIM only	yes	yes
wizard function	yes	yes	yes
extended simulation	no	no	yes
programmeditor (KS 90-1prog only)	no	no	yes

ORDERING INFORMATION

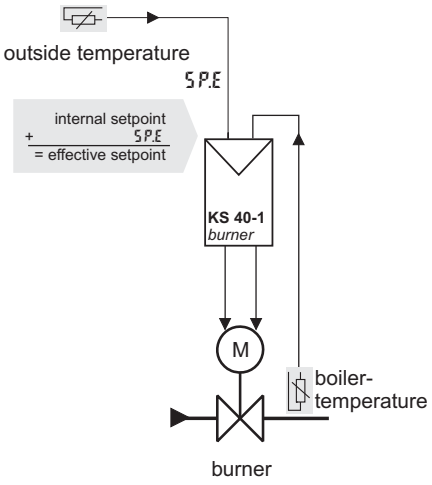
KS40-1 - 0 9 - 00

Flat-pin connectors	**0**
Screw terminals	**1**
90..250V AC, 3 relays	**8**
24VAC / 18..30VDC, 3 relays	**9**
no option	**0**
2 digital inputs and transmitter power supply	**9**
Standard configuration	**0**
Configuration to specification	**9**
no manual	**0**
German manual	**D**
Engish manual	**E**
French manual	**F**
Standard (CE-certified)	**0**
cULus-certified (with screw terminals only)	**U**
EN 14597 (reclaces DIN 3440) certified	**D**
GL (German Lloyd)-certified	**G**

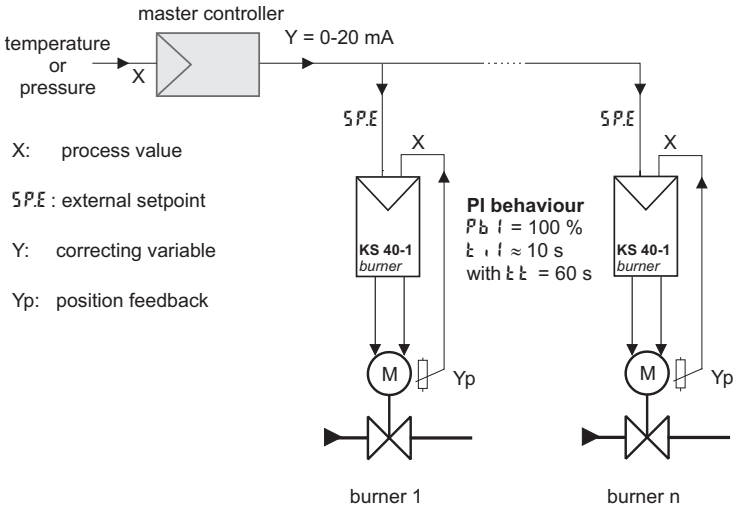
ACCESSORIES

Beschreibung		Bestell-Nr.
PC adapter, for connecting BlueControl software to the BluePort		9407-998-00001
Standard rail adapter		9407-998-00061
Operating manual	German	9499-040-___18
Operating manual	English	9499-040-___11
Operating manual	French	9499-040-___32
BlueControl Mini	German/English/french	www.pma-online.de
BlueControl Basic	German/English/french	9407-999-11001
BlueControl Expert	German/English/french	9407-999-11011

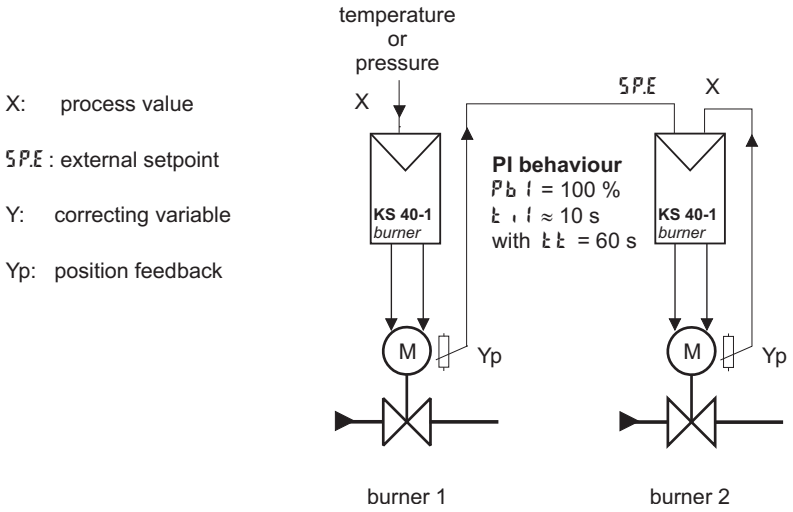
Application example for weather-control:



Application example for synchronisation control with additional master controller:



Application example for synchronisation control for two burners:



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