



KS 40-1 lab Universal laboratory controller



Including data acquisition software

Controller output via maintenance-free solid-state relays

BluePort front interface and BlueControl software

Maintenance manager and error list

Auto/manual key

Heating current monitor and input circuit alarm

Timer and programmer

Extended limit signalling function with memory

expert line

- ⊕ 100 ms cycle time, i.e. also suitable for fast control loops
- ⊕ Customer-specific linearization
- ⊕ Measurement value correction as offset or 2-point
- ⊕ Emergency operation on sensor break by acceptance of the mean output value
- ⊕ Logical interlock of the digital outputs, e.g. for common alarm
- ⊕ Program controller with 4 segments and „End“ signal

APPLICATIONS

- Heating plates
- Heating bands
- Cartridge heaters
- Tempering baths
- Heating ovens

DESCRIPTION

The universal controller KS 40-1lab is intended for precise and cost-effective control tasks in laboratories and manufacturing. Hereby, it is possible to choose between simple on/off control and PID control. The supplementary analog input can be used for an external setpoint.

Self-tuning function

During start-up, the self-tuning function determines the optimum parameters for the control loop quickly and safely, thus ensuring fast lineout without overshoot.

Display and operation

Ten indicator LEDs in the front panel provide a reliable indication of I/O states, operating mode, and fault conditions. An Auto/manual key switches the controller into the manual mode directly, without having to follow confusing operating sequences.

If necessary, the key can be disabled or it can be configured to start the internal timer. This provides a degree of operational safety that previously could only be expected from equipment with a considerably higher price tag.

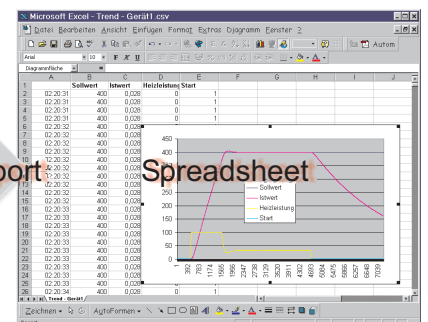
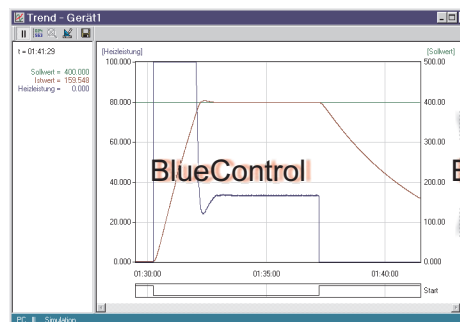
Front interface and Engineering Tools

Controller tuning within seconds is now also possible with controllers of the KS 40 range.

By means of the standard BlueControl software (including controller and loop simulation) and especially the very convenient connection via the BluePort front interface, it is possible to find the best control solution quickly, without lengthy study of the operating instructions. Of course practically all the settings are also possible via the front panel keys (see page 4, BlueControl). Furthermore, the software contains a data acquisition feature, complete with a data export function.

Password protection

If required, the various operating levels can be protected against unauthorized access by means of a password, or an entire level can be disabled.



TECHNICAL DATA

INPUTS

SURVEY OF INPUTS

Input	Used for
INP1	x (process value)
INP2	external setpoint
di1	Disabling operation, switch-over to second setpoint SP.2, external setpoint SP.E, fixed output signal Y2, manual operation, controller off, disabling of Auto/manual key, reset of stored alarms, timer start (= Y.2)

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
Measurement value correction:	2-point or offset correction

Thermocouples (Table 1)

Input impedance:	$\geq 1 \text{ M}\Omega$
Source resistance effect:	$1 \mu\text{V}/\Omega$

Cold junction compensation

Max. additional error:	$\pm 0,5 \text{ K}$
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Sensor break monitor

Sensor current:	$\leq 1 \mu\text{A}$
Operating sense configurable (see page 3)	

Resistance thermometer

Connection:	3-wire
Lead resistance:	max. 30 Ohm
Input circuit monitor:	break and short circuit

Special measuring range

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

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

Current and voltage signals

Span start, end of span:	anywhere within the measurement 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 measurement range

Thermocouple type*		Measuring range		Accuracy	Resolution (\emptyset)
K	NiCr-Ni	-100...1350°C	-148...2462°F	$\leq 2 \text{ K}$	0,2 K

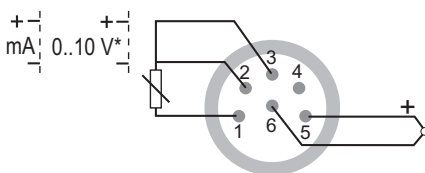
* The controller KS40-1 is configurable for all thermocouple types. If a different type is used, the corresponding equalizing lead must be fitted in the tabletop housing.

Table 2: Resistance thermometers

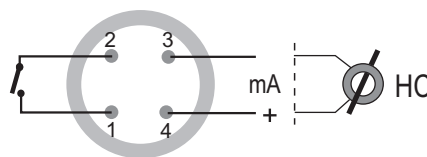
Type	Sensor current	Measuring range		Accuracy	Resolution (\emptyset)
Pt100	0,2 mA	-200...850°C	-328...1562°F	$\leq 1 \text{ K}$	0,1 K
Pt1000		-200...850°C	-328...1562°F	$\leq 2 \text{ K}$	0,1 K
KTY 11-6*		-50...150 °C	-58...302 °F	$\leq 2 \text{ K}$	0,05 K

* or special measuring range

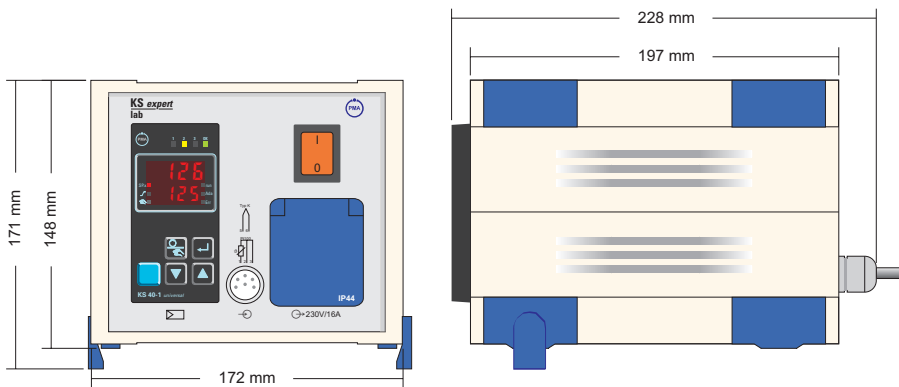
Pin-out of the process value sensor



Pin-out of the supplementary inputs di1, INP2



Measures:



SUPPLEMENTARY INPUT INP2

Resolution:	> 14 bits
Scanning cycle:	100 ms
Error:	within 0,1 %

Current measurement

Input resistance:	approx. 120 Ω
Span start, end of span:	anywhere between 0 and 20 mA
Scaling:	selectable -1999...9999
Input circuit monitor:	12,5% below span start (4...20 mA, 2 mA)

Heating current measurement

via current transformer	
Measuring range:	0...50 mA AC
Scaling:	selectable -1999...0,000...9999 A

CONTROL INPUT DI1

Configurable as direct / inverse switch or push-button!	
Connection of a potential-free contact suitable for switching „dry“ circuits.	
Switched voltage:	2,5 V
Switched current:	50 μA

CONTROL OUTPUT

Solid-state relay 3600 VA, 250 V, 16 A	
Operating life: unlimited.	

FUNCTIONS

Control behaviour

- Signaller with adjustable switching differential (On/Off controller)
- PID controller (2-point)

Control parameters self-tuning or manually adjustable via front panel keys or BlueControl software.


Setpoint functions

- Adjustable setpoint gradient 0,01...9999 °C/min
- Setpoint controller
- Setpoint / cascade controller
- Program controller with 4 segments (setpoint / segment time)
- Timer

Timer

Time t_{SP} adjustable from 0,1 to 9999 minutes

Timer start:

- Power On
- Control input
-  key (= Y.2 switch-over)
- Direct presetting of the timer

Behaviour with sensor break or short circuit

- Controller outputs switched off
- Switch-over to a pre-defined safe output value
- Switch-over to the mean output value (PID controller)

LIMIT SIGNALLING FUNCTIONS

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

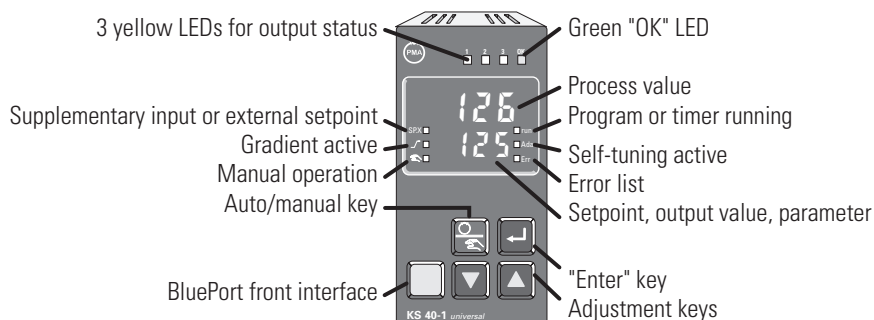
Signals that can be monitored

- Process value
- Control deviation
- Control deviation with suppression during start-up or setpoint changes
- Effective setpoint
- Output value Y

Signalling functions

- Input circuit monitor

Display and operating elements



- Input circuit monitor with storage (reset via front key or digital input)

ALARMS

Open control loop

Automatic detection if process value does not react to a change of output value.

Sensor break or short circuit

Depending on selected sensor type, the input signal is monitored for break and short circuit. In case of an open control loop, thermocouple short circuit, sensor break, etc., the control signal to the heater is switched off.

MAINTENANCE MANAGER

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

Possible signals in the error list:

Sensor break, short circuit, reversed polarity
Control loop alarm
Fault during self-tuning
Stored limit values
e.g. recalibration warning (if an adjustable operating time is exceeded, a warning is given)
e.g. maintenance interval for an actuator (if an adjustable number of actuator operations is exceeded, a warning is given)
Internal faults (RAM, EEPROM, ...)

OPERATION AND DISPLAY

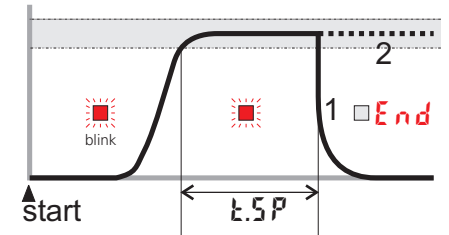
Display

Process value	7-segment LED, 10,5 mm
Lower display line	7-segment LED, 7,8 mm

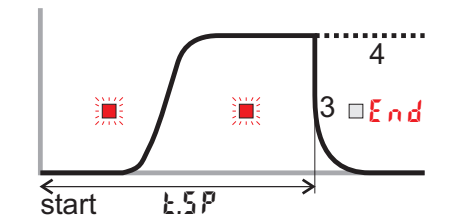
Mains switch

Interrupts the controller's supply voltage

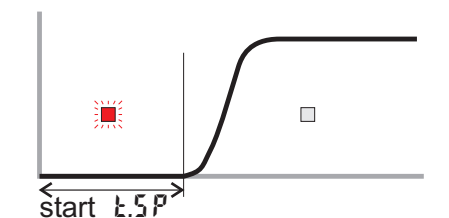
Timer modes 1 and 2



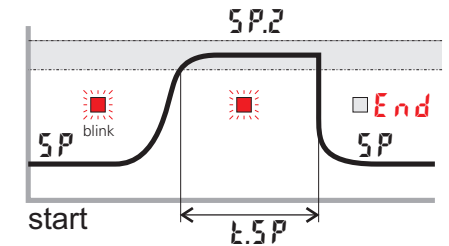
Timer modes 3 and 4



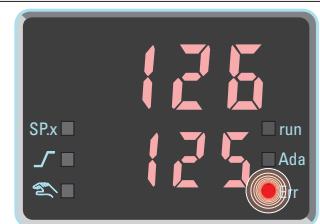
Timer mode 5



Timer mode 6



Maintenance manager: Blinking error LED indicates an active alarm in the error list



Galvanic isolation

- Safety isolation
- Functional isolation

Mains supply terminals	Process value input INP1 Supplementary input INP2 Digital input di1
	Universal output OUT3 (control of the solid-state relay)

POWER SUPPLY

AC supply

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

BEHAVIOUR WITH POWER FAILURE

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

BLUEPORT FRONT INTERFACE

The RS 232 interface of the PC is connected via a PC adapter (see "Accessories supplied"). The BlueControl software can be used to configure, set parameters, and operate the KS 40-1 *lab*.

Galvanically isolated
(isolation provided by the PC adapter)
Protocol: Modbus RTU
Transmission speed: 9600 bits/sec
Address: fixed at 0

ENVIRONMENTAL CONDITIONS

Protection mode: IP 50

Permissible temperatures

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

Humidity

75 % yearly average, no condensation

Electromagnetic compatibility

Complies with EN 61 326-1

- Meets the interference immunity regulations for continuous, unattended operation.
- Meets the interference radiation regulations of Class B for residential areas.
- Increased measurement errors must be expected in case of surge-type interference.

GENERAL

Tabletop housing

Material: ABS housing with folding feet

Safety tests

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

Electrical connections

Mains supply: 1,5 m cable with mains plug
Controller output: built-in power socket
Sensor: DIN connector
Supplementary inputs: DIN connectors

Accessories supplied

- Operating instructions
- BlueControl Expert software
- PC adapter for connection to a PC

ORDERING DATA

Description	Order no.
Laboratory controller KS 40-1 <i>lab</i> including BlueControl data acquisition software	9407-998-00071
Mineral-insulated thermocouple Type K, 3 mm dia., 200 mm length, 3 m connecting lead	9404-103-13211
Mineral-insulated thermocouple Type K, 1 mm dia., 200 mm length, 3 m connecting lead	9404-103-10211
Mineral-insulated Pt 100/B sensor, 3 mm dia., 200 mm length, 3 m connecting lead	9404-105-13211

BlueControl functions

Adjustment of parameters and configuration data
Controller and control loop simulation
Download: Transfer of an engineering to the controller
Online mode / visualization
Generation of an application-specific linearization
Configuration of the extended Operating Level
Upload: Read-out of the engineering from the controller
Basic diagnostic function
Saving of files and the engineering
Printer function
Online documentation / Help
Implementation of a measurement value correction
Program editor
Data acquisition and trend recording with data export
Network and multi-user license
Assistant function
Extended Simulation
Extended Diagnosis and Service

- One connector each for sensor and supplementary inputs

BlueControl (Engineering Tool)

PC-based program for configuration, parameter setting, and operation (commissioning) of the KS 40-1 controller. Moreover, a powerful data acquisition module with trend graphics is available.

Required software platform Windows 95/98/NT/2000. The built-in simulation serves to test the controller settings, but can also be used for general training and observation of the interaction between controller and control loop.

Required hardware platform

A special PC adapter (see Accessories) is required for connecting the controller to a PC.

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



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