

Universal controller KS40-1

Application and function

The universal temperature controller KS40-1 is intended for universal, precise, and cost-effective control tasks in all branches of industry. For this, the unit provides simple 2-point (on/off) control, continuous PID control, or 3-point stepping control. The process value signal is connected via a universal input. A supplementary analog input can be used for heating current measurement or as an external set-point input.

Every KS 40-1 has three process outputs that can be 3 relays or 2 relays plus a universal output. This universal output can be used for operating a solid-state relay, a continuous current/voltage output or to energize a two-wire transmitter.

Plug-in module

The KS 40-1 controller is built as plug-in module. This enables it 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 information 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. to start the internal timer. 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

Quick control parameter adjustment is implemented in the KS 40 class of instruments. Via 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. Of course almost all adjustments can be done comfortably over the instrument front. (see page 6 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.



Edition 02/2020
Subject to change without a note.

Technical data

Inputs

Survey of the inputs

Input	Used for
INP1	X (process values)
INP2	Heating current, ext. set-point
di1	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 key, reset stored alarms, timer start (complete with Y2)
di2 (option)	
di3 (option)	
Process value input INP1	
Resolution	>14 Bit
Decimal point	0 to 3 decimals
Digital input filter	adjustable 0,000...9999s
Scanning cycle	100 ms
Measured value correction	2-point or offset correction
Thermocouples (table 1)	
Input resistance	≤ MΩ
Effect of source resistance	μV/Ω
Cold junction compensation	
Max. additional error	±0,5K
Sensor break monitoring	
Sensor current	≤1μA
Operating sense configurable	→ (Page 5)
Resistance thermometer	
Connection	3-Leiter
Lead resistance	max. 30 Ω
Input circuit monitor	Break and short circuit
Resistance measuring range	
The blue control software can be used to match the input to the sensor KTY 11-6 (characteristic is stored in the controller)	
Physical measuring range	0 bis 4500 Ω
Linearization segments	16

Table 1

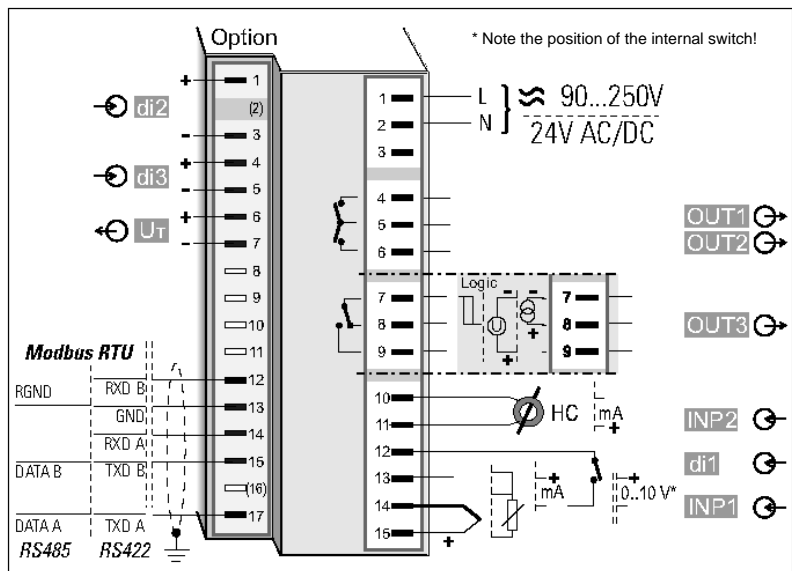
Thermocouple		Range		Accuracy	Resolution (ø)
L	Fe-CuNi (DIN)	-100..900°C	-148..1652°F	≤ 2K	0,1 K
J	Fe-CuNi	-100..1200°C	-148..2192°F	≤ 2K	0,1 K
K	NiCr-Ni	-100..1350°C	-148..2462°F	≤ 2K	0,2 K
N	Nicrosil/Nisil	-100..1300°C	-148..2372°F	≤ 2K	0,2 K
S	PtRh-Pt 10%	0..1760°C	32..3200°F	≤ 2K	0,2 K
R	PtRh-Pt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

Table 2 Resistance transducer

Type	Sensor current	Range		Accuracy	Resolution (ø)
Pt100	0,2mA	-200..100 (150)°C	-328..212 (302)°F	≤ 1K	0,1 K
Pt100		-200..850°C	-328..1562°F		
Pt1000		-800..850°C	-328..1562°F	≤ 2K	0,1 K
Resistance		4500 Ω		≤ 0,1%	0,01%

Table 3 Current and voltage

Range	Input resistance	Accuracy	Resolution (ø)
0 – 10V	~ 110kΩ	≤ 0,1%	0,6mV
0 – 20mA	49 Ω (voltage requirement ≤ 2,5V)	≤ 0,1%	1,5μA

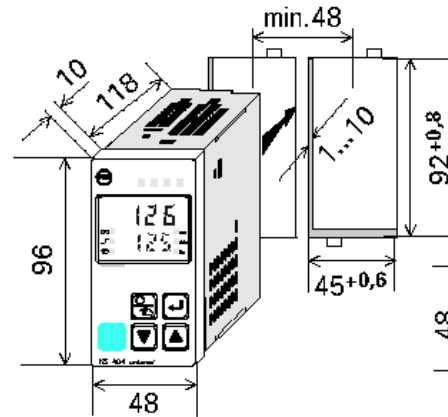


Current and voltage signals

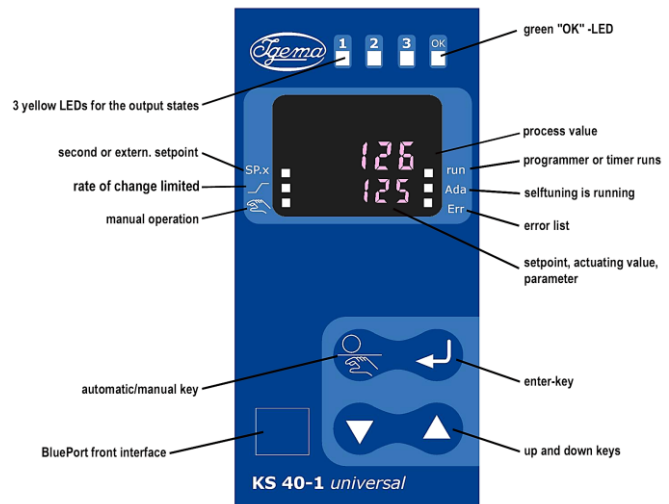
Span start, end of span	anywhere within the measuring range
Scaling	selectable -1999 .. 9999
Linearization	16 segments, adaptable with BlueControl
Decimal point	adjustable
Input circuit monitor	12,5% below span start (2mA, 1V)
Supplementary INP2	
Resolution	>14 Bit
Scanning cycle	100ms
Accuracy	Better than 0,4%
Heating current measurement	
Measuring range	0 .. 50mA AC
Scaling	selectable -1999 .. 9999A
Current measuring range	
Input resistance	approx. 120Ω
Scan:	configurable within 0 – 20mA
Scaling	selectable -1999 .. 9999
Input circuit monitor	12,5% below span start (4 .. 20mA → 2mA)
Control input DI1	
Configurable as direct or invers switch or push-button Connection of a potential-free contact suitable for switching „dry“ circuits	
Switched voltage	2,5V
Switched current	50μA
Control inputs DI2, DI3 (Option)	
Configurable as switch or push-button! Optocoupler input for active triggering	
Nominal voltage	24Vdc external
Current sink (IEC 1131 Type 1)	
Logic „0“	-3 .. 5V
Logic „1“	15 .. 30V
Current requirement	approx. 5mA
Transmitter supply UT (Option)	
Output	22mA/~ 18V

If the universal output OUT3 is used there may be no external galvanic connection between measuring and output circuits

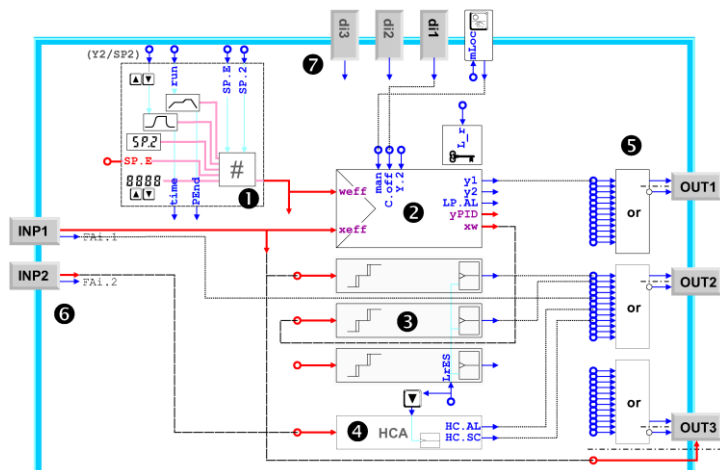
Dimensions



Display and operating



Example of the linkage of the internal functions



- ① setpoint processing with programmer and timer
- ② controller function with loop monitoring
- ③ limit monitoring, configurable with latch and suppression
- ④ heating current monitoring
- ⑤ output processing with logic or-combination and inverting
- ⑥ analog inputs with logical sensor fail signal
- ⑦ digital inputs and -key with lock function

Outputs

Survey of the outputs

Output	Used for
OUT1 OUT2 (Relay)	Control output heating/cooling or Open/Close, limit contacts, alarms, timer or programmer End *
OUT3 (Relay or logic)	as OUT1 and OUT2
OUT3 (continuous)	Control output, process value, set-point, control deviation, transmitter supply 1 3V/22mA
* All logic signal can be OR-linked!	
Relay output OUT1, OUT2	
Contacts	2 NO contacts with common connection
Max. contact rating	500VA, 250V, 2A at 48 .. 62Hz resistive load
Min. contact rating	6V, 1mA DC
Duty cycle electric	for I = 1A/2A: ~ 800.00/500.00 (at ~ 250V resistive load)
OUT3 used as relay output	
Contacts	Potential-free change over contact
Max. contact rating	500VA, 250V, 2A at 48 .. 62Hz, resistive load
Min. contact rating	5V, 10mA AC/DC
Duty cycle electric	for I ≥ 1A/2A: ~ 1.000.000/600.000 (at 250V resistive load)
OUT3 used as relay output	
Galvanically isolated from the inputs	
Freely scalable	
Resolution	11 Bit
DA-converter limiting frequency T90	50ms
Limiting frequency of the complete continuous controller	> 2Hz

Current output

0/4 .. 20mA configurable	
Signal range	0 .. ca. 21,5 mA
Load	≤500 Ω
Load effect	0,02% / 100 Ω
Resolution	≤ 22 μA (01%)
Error	≤ 40 μA (0,2%)
Voltage output	
0/2 .. 10V configurable, short-circuit-proof	
Signal range	0 .. 11V
Load	≥ 2 k Ω
Load effect	no influence
Resolution	≤ 11mV (0,1%)
Error	≤ 20mV (0,2%)
OUT3 used as transmitter supply	
Output	22mA / ≤ 13V
OUT3 used as logic output	
Load ≤ 500 Ω	0 / ≤ 20mA
Load > 500 Ω	0 / > 13V

Note:

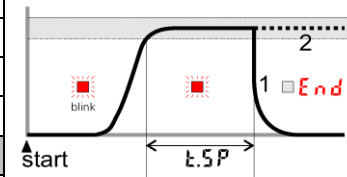
If the relays OUT1 ... OUT3 operate external contactors, these must be fitted with RC snubber circuits to manufacturer specifications to prevent excessive switch-off voltage peaks

Galvanic isolations

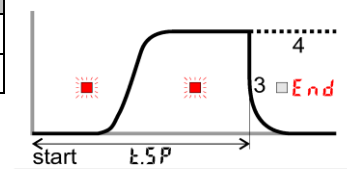
- Safety isolation
- Functional isolation

Mains supply	Process value input INP1 Supplementary input INP2 Digital input di1
Relay outputs OUT1,2	RS 422/485 interface
Relay output OUT3	Digital inputs di2, 3 Universal output OUT3 Transmitter supply UT

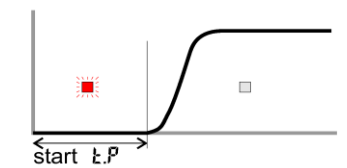
Timer modes 1 and 2



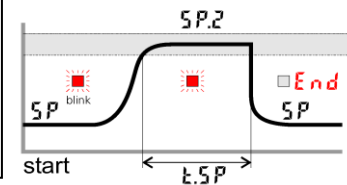
Timer modes 3 and 4



Timer mode 5



Timer mode 6



Control behaviour


- Signaller with adjustable switching differential (ON/OFF-controller)
- PID-controller (2-point and continuous)
- Delta/Star/Off or 2-point controller with switch over from partial to full load
- 2xPID (heating/cooling, 3-point and continuous)
- 3-point stepping controller

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
- Program controller with 4 segments (Set-point/section time)
- Timer

Timer

Time  adjustable 0,1 .. 9999 min

Timer Start

- Mains on
- Control input
- -key (complies with. Y.2 switch over)
- Direct adjustment of running time

Behaviour with sensor break or short circuit

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

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 brake with motor actuators, general alarms, etc.

Alarms

Heating current alarm
Overload and short circuit
Open circuit and short circuit
Limit value adjustable 0 .. 9999A

Control loop alarm

Automatic detection if there is no response of the process to a change of output value.

Sensor break or short circuit

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

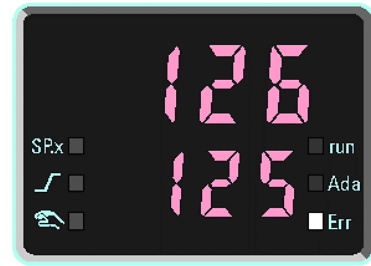
Maintenance manager

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, ..)

Maintenance manager: Flashing error active alarm in the error list



Operating and display

	KS40-1
Process value	10,5 mm LED
Lower display	7,8 mm LED

Power supply
Depending on version
AC supply

AC voltage	90 .. 260 V AC
Frequency	18 .. 62Hz
DC-voltage	18 .. 31 V DC
Power consumpt.	ca. 7VA(W)

Universal supply 24 V UC

AC voltage	20,4 .. 16,4V AC
Frequency	48 .. 62Hz
DC-voltage	18 .. 31V DC
Power consumpt.	ca. 7VA(W)

Behaviour with power failure

Configuration, parameters and adjustable 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 KS40-1
Bus interface (option)
Galvanically separated

Physical	RS 422/485
Protocol	Modbus RTU
Transmission speed	2400, 4800, 9600 19.200 Bit/s
Address range	1 .. 247
Number of controllers per bus	32
Repeaters must be used to connect more controller	

Environmental conditions

Protection	
Front panel	IP65
Housing	IP20
Terminals	IP00

Allowable temperatures	
Operation	0 .. 60°C
Warm up time	< 15 minutes
Temperature effect	< 100 ppm/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 .. 150Hz
Unit in operation	1g resp. 0,075 mm
Unit not in operation	2g resp. 0,15 mm

Shock test Ea (DIN IEC 68-2-2-7)	
Shock	1 5g
Duration	11ms

Electromagnetic compatibility
Complies with EN 61326-1

- Complies with the immunity requirements for continuous, unattended operation
- Complies with the emission requirements class B for rural areas
- Surge disturbances may increase the measurement error

General

Housing	
Material	Macrolon 9415 flame resistance
Flammability class	ULK94 VO, self-extinguishing
Plug-in module	inserted from front

Safety test

Complies with EN 611010-1 (VDE 0411-1)
Over voltage category II
Contamination class 2
Working voltage range 300V AC
Protection class II

Certifications

Type test to DIN 3440
With the certified sensors it can be used in:

- Heat generating plants with outflow temperature 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

cUL-certification
(Type 4x, indoor use)
File: E 208286

In order for the unit to meet the requirements of UL approval, the following points must be observed:
Only use conductors made of 60/75 or 75°C copper (Cu).
Tighten the terminal screws with a torque of 0.5 - 0.6 Nm.

Electrical connection
Depending on version

- Flat-pin connectors 1 x 6,3 mm or 2 x 2,8 mm to DIN 46244
- Screw terminals for conductor cross-section from 0,5 to 2,5 mm²

Mounting

Panel mounting with two fixing clamps at top/bottom or left/right (Top-hat rail mounting)

Mounting position: not critical
Weight : 0,27 kg

Accessories supplied with unit:

Operating instruction
2 fixing clamps

Accessories equipment:

BlueControl (Engineering Tool)
PC-based program for configuring, setting parameters, and operating (commissioning) the KS40-1 controller. Moreover, all settings are saved and can be printed on demand.
Depending on version a powerful data acquisition module is available, complete with trend graphics.

Visibility masks

With the BlueControl software, any number of parameters and configuration parameters can be hidden in the unit. This ensures that only authorised parameters can be changed on site. Safety-relevant parameters remain invisible.

Two parameters have been hidden

Kürzel	Bezeichnung	Sichtbar
Setp	Sollwert	<input checked="" type="checkbox"/>
SP.LQ	untere Sollwertgrenze	<input type="checkbox"/>
SP.Hi	obere Sollwertgrenze	<input type="checkbox"/>
SP.2	Zweiter Sollwert	<input checked="" type="checkbox"/>
r.SP	Sollwertgradient [1/min]	<input checked="" type="checkbox"/>
t.SP	Timer-Haltezeit [min]	<input checked="" type="checkbox"/>

Simulation

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.

Software requirements

Windows 95/98/NT/2000

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

- Customer-specific linearization's
- 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 (⇒"Accessories") is required for connecting the controller.

Digital Documentation

