PMA Prozeß- und Maschinen-Automation GmbH

PMA

Multi-Temperature-Controller
KS 800
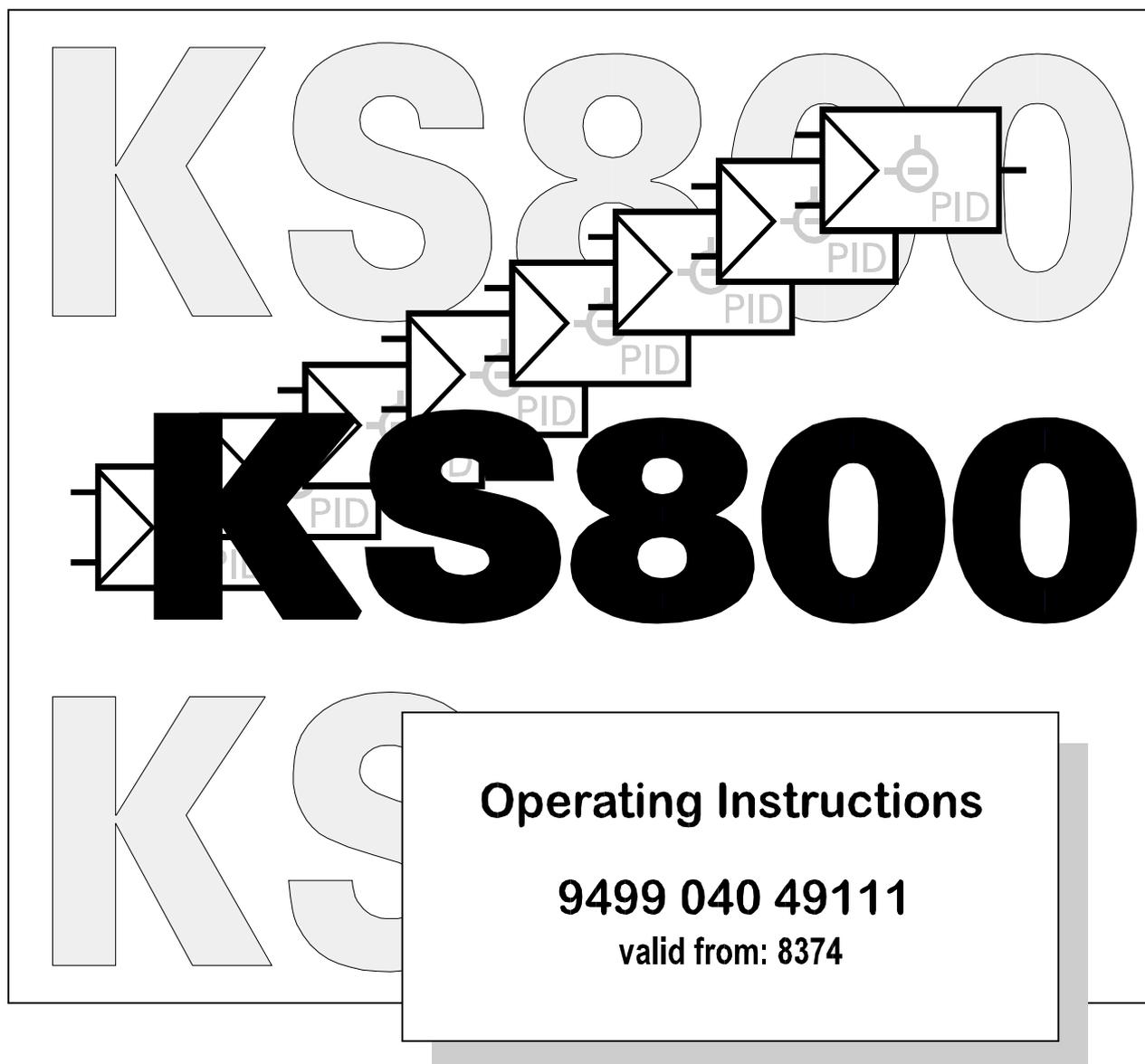
KS800

Operating Instructions

9499 040 49111
valid from: 8374

Restriction of warranty:

No warranty is given for the complete correctness of this manual, since errors can never avoided completely despite utmost care. Any hints are welcome and gratefully accepted.

Contents

1 Safety hints

Following the enclosed safety hints 9499 047 07101 is indispensable!

For hints on the power supply to be used, see section **4.3 Supply voltage**

1.1 Electromagnetic compatibility

The unit conforms to European guideline 89/336/EEC and is provided with the CE marking. The following European generic standards are met: **Electromagnetic radiation:** EN 50081-1 and **electromagnetic immunity:** EN 50082-2
For compliance with EN 50082-2, the analog input leads must be screened.

The unit is suitable for use in industrial areas (there may be radio interference in residential areas). Electromagnetic radiation can be reduced considerably, if the instrument is installed in a grounded metal control cabinet.
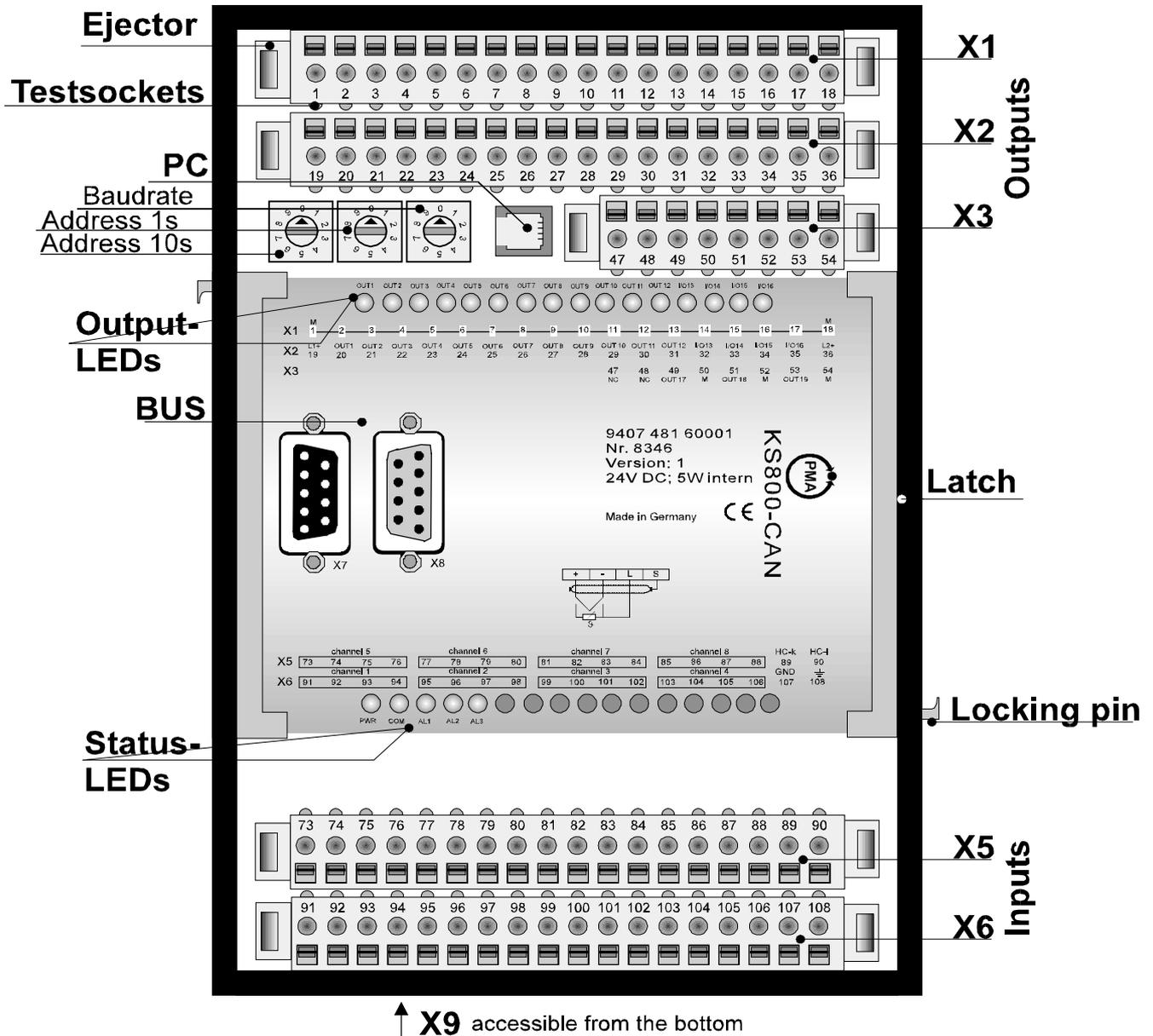
2 General

KS 800 is a microcomputer-based multi-loop temperature controller. Functions "set-point lowering" and "heating/cooling with four alarms" make it ideally suited for temperature control of plastics 20 processing machinery, moulds, packaging machinery, tempering units and similar thermal processes. Furthermore, with high-power heating elements (e.g. in hot runner moulds), the selectable functions "start-up circuit" and "output hold" in case of sensor break ensure increased element life and prevent interruptions during production. The self-tuning feature guarantees very short start-up times.

2.1 Versions

These operating notes are valid for the three versions, which are only different in the communication interface:

Multiple temperature controller with RS485 / RS422 interface and ISO 1745 protocol.

9407 480 00001 KS 800-RS:	Without analog outputs
9407 480 00101 KS 800-RS:	With analog outputs, standard current signal 0/4...20mA
9407 480 00201 KS 800-RS:	With analog outputs, standard voltage signal 0...10V
9407 480 00301 KS 800-RS:	With 10V= constant-voltage

Multiple temperature controller with Profibus DP interface and Profibus DP protocol.

9407 480 30001 KS 800-DP:	Without analog outputs
9407 480 30101 KS 800-DP:	With analog outputs, standard current signal 0/4...20mA
9407 480 30201 KS 800-DP:	With analog outputs, standard voltage signal 0...10V
9407 480 30301 KS 800-DP:	With 10V= constant-voltage

Multiple temperature controller with CANbus interface and CANopen protocol.

9407 480 60001 KS 800-CAN:	Without analog outputs
9407 480 60101 KS 800-CAN:	With analog outputs, standard current signal 0/4...20mA
9407 480 60201 KS 800-CAN:	With analog outputs, standard voltage signal 0...10V
9407 480 60301 KS 800-CAN:	With 10V= constant-voltage

Multiple temperature controller with CANbus interface and Device-Net protocol.

9407 480 70001 KS 800-DN:	Without analog outputs
9407 480 70101 KS 800-DN:	With analog outputs, standard current signal 0/4...20mA
9407 480 70201 KS 800-DN:	With analog outputs, standard voltage signal 0...10V
9407 480 70301 KS 800-DN:	With 10V= constant-voltage

The differences between the KS 800 versions are only in the field bus / serial interface.

2.1.1 Possible output configurations

Provided that other criteria are taken into account, the following controller configurations are possible:

Signaller with one output
Signaller with two outputs
Two-point controller (heating switching)
Three-point controller (heating switching, cooling switching)
Three-point controller (heating continuous, cooling switching)
Three-point controller (heating switching, cooling continuous)
Three-point stepping controller (without position feedback)
Continuous controller
Split-range controller (heating and cooling continuous, 0...100% each; max. 4 controllers)
Three-point controller with watercooling (water vaporization)
Limitter with latch function

When configuring a controller output as a continuous output, the relevant switching output is firmly assigned to 0% duty cycle.

With unused analog outputs, the output variable is 0V or 0mA.

3 Installation

3.1 Mounting
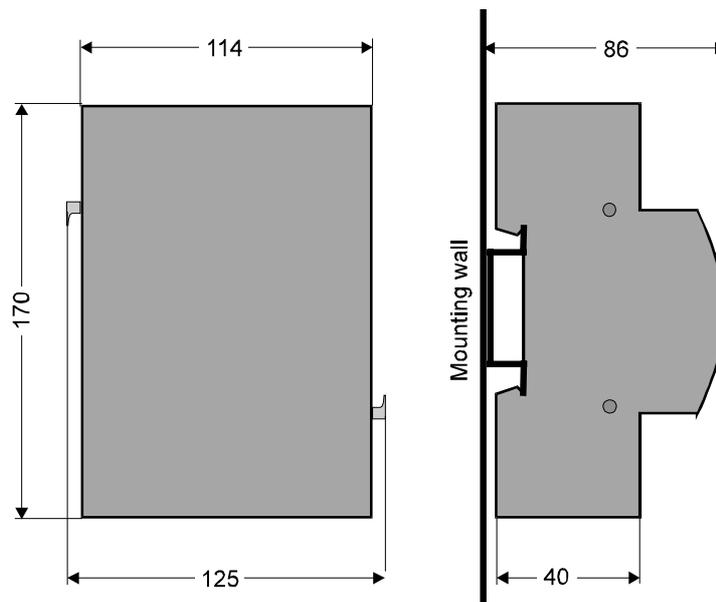
Overall dimensions of KS 800

KS 800 is provided for fast clip-on mounting to "top hat" standard rails 35 x 7,5 to EN 50 022, EN 50 035 and EN 50 045.
KS 800 earthing is via a spring to the "top hat" rail. Therefore, this rail must have a good, conducting connection with the grounded mounting wall (layer of lacquer, non-conducting mounting wall, Eloxal, ...). If necessary, the "top hat" rail must be earthed using a separate connection.

Single unit: For mounting, pull the two latches on the sides upwards by approx. 5 mm via a click point and snap on the unit to the mounting rail. Press these latches down to lock the unit in position on the rail.

Several units: For mounting several units side by side, snap on the first unit to the rail and lock only the side on which <u>no</u> other unit shall be mounted. Snap on the second unit like the first one, approx. 2 cm beside the first unit and shift it sideways to connect it to the first unit (locking pins click into position). Press down the second latch of the first unit only now.
The connectors on the instrumentside (board-toboard connector; type: AMP champ-050-connection) are used <u>only</u> for CANBUS through-connection, i.e. one CANbus connection is sufficient for several units mounted side by side.

Bus connectors: These connectors are <u>not</u> used with the KS 800 Profibus and RS485 versions. In this case, each unit must be connected to the bus separately via the 9-pin sub-D-connectors.
If the KS 800 units are operated together with other P-Open components in a CANbus system, the KS 800 units must be connected as <u>last</u> instruments at the left or the right end of the modules side by side on a rail. Otherwise, the individual component cannot be addressed. (The "addressing line" is interrupted by KS 800.)

3.2   Dismounting

For dismounting, the leads need not be disconnected.
Before removing, mark the upper parts of the connectors and the corresponding lower parts, because the terminals are protected by design against distortion but not against wrong polarity.
For releasing the upper part of a terminal, press the two red ejectors in a terminal row towards the circuit board by means of a screwdriver, if necessary.
For releasing the unit from the mounting rail, draw the two side latches (1) forwards by approx. 5mm (latch released) and remove the unit from the mounting rail by tipping it down or up.
For replacing an "inner" one of several units mounted side by side, start releasing the latch (and the latch of the following unit!) at the end of the row and shift the unit sideways. Repeat this procedure until reaching the unit which must be replaced. When its locking pins are free on both sides, the unit can be tipped down or up out of the mounting rail.

4 Electrical connection

• Measurement and signal leads may carry max. 50 V rms against earth.

• Mains cables must be kept separate from signal and measurement cables.

• For protection of the outputs and avoiding interference, connected final elements must be fitted with protective circuits according to manufacturer specification.

4.1 Terminals

All terminals leading to the process are designed as (plug-in) screw terminals or spring clamps.

The terminals are not included in the scope of delivery and must be ordered separately.

Type: **PHOENIX COMBICON**
Two types are available:

Screw terminal	4 x FRONT-MSTB 2,5/18-ST-5,08	1 x FRONTMSTB 2,5/8-ST-5,08
PMA Order-No.	9407 799 00001	9407 799 00011
Spring clamp	4 x FK-MSTBP 1,5/18-ST-5,08	8-pole not suitable
PMA Order-No.	-----	-----

For units with analog outputs,
    2 x 8-pole terminal, order no. 231-308/026-000, resp. 9407 799 00011
is required additionally.

Note: The screwless spring clamps are shown in the KS 800 figures. These clamps have a separate test socket. With the screw terminals, the screw heads are used for test measurements.

Connecting capacity

	FRONT-MTSB 2,5/...-ST		FK-MSTBP 1,5/...-ST	
	rigid	flexible [1])	rigid	flexible [1])
One wire [mm²]	0,2 - 2,5	0,25 - 2,5	0,2 - 1,5	0,25 - 1,5
Multiple-wire connection [mm²] [2])	0,2 - 1,5	0,25 - 1,0	0,2 - 1,0	0,5 - 0,75 [3])

[1]) with end crimps
[2]) 2 wires of equal cross section
[3]) with TWIN end crimps

Type : **WAGO Multi-Connection-System MIDI**

Spring-clamp	4 x female connector with CAGE CLAMP order no. 231-318/026-000
PMA Order-No.	9463 000 05341
	1 x female connector with CAGE CLAMP order no. 231-308/026-000
PMA Order-No.	9463 000 05321

Connecting capacity
    Only one wire: 0,08 - 2,5 mm², single-wire, multiple-wire, fine-wire, end crimp, pin cable shoe

For units with analog outputs,
    2 x 8-pole terminal, order no. 231-308/026-000, resp. 9463 000 05321 is required additionally.

4.2   Bus-Stecker

For connecting KS 800 to the fieldbus system, the connectors listed in the table must be used:

Profibus	Canbus; RS422/485	DeviceNet
z.B. Siemens *) 6ES7 972-0BA10-0XA0 6ES7 972-0BA10-0BB0 6ES7 972-0BA10-0BA0 6GK1 500-0EA00	Sub-D-connector/socket; prefer commercially available metal/metalized versions	Special adaptor PMA order no. 9407 799 00301

*)These connectors are not available from PMA.
Specification of the order number is not binding, as these numbers can always be changed by Siemens.

Note! For pin allocation see chapters **8.2.1** und **8.2.2**

4.3   Galvanic isolations

The galvanic isolations of KS 800 are shown in the following diagram.

Identical block shading means that blocks are galvanically connected.
I.e. all outputs are galvanically connected, but isolated from inputs and microcontroller (controller).

All inputs are also galvanically connected.

An exception are the digital inputs/outputs, which are connected with controller outputs (and supply voltage) independent of their configuration.
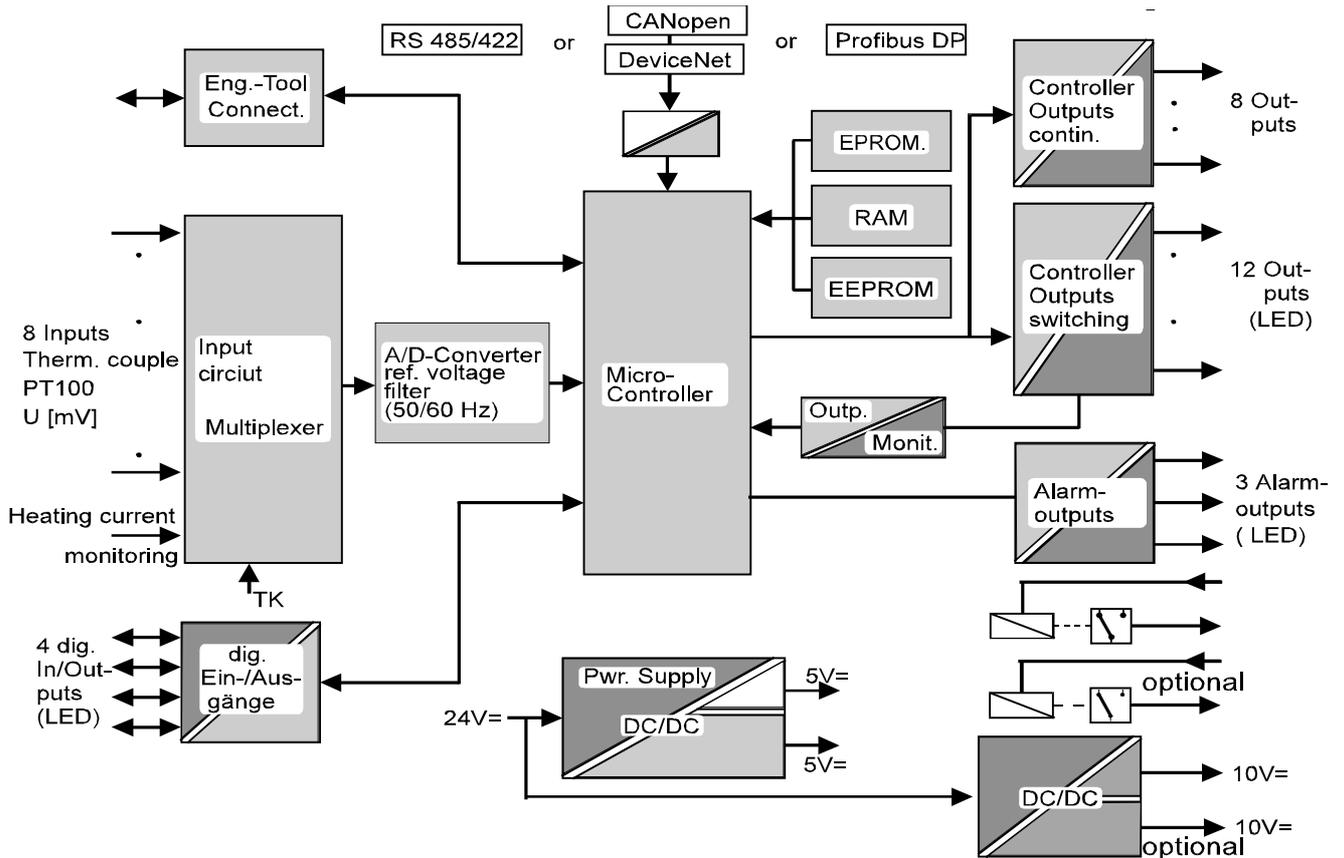
KS 800 block diagram and galvanic isolation

4.4   Supply voltage

KS 800 is designed for a supply voltage rating of 24V DC, range 18V to 30V, residual ripple 5%.
The supply voltage must comply with the conditions of protective low voltage (SELV) according to
IEC 364-4-41 [VDE 0100-410].
Power supply load by <u>one</u> KS 800:

8 controller outputs + 4 alarm outputs each with 0,07A	20,16W
plus controller consumption	5,50W
results in a max. overall load (at 24V) of approx.	25,60W
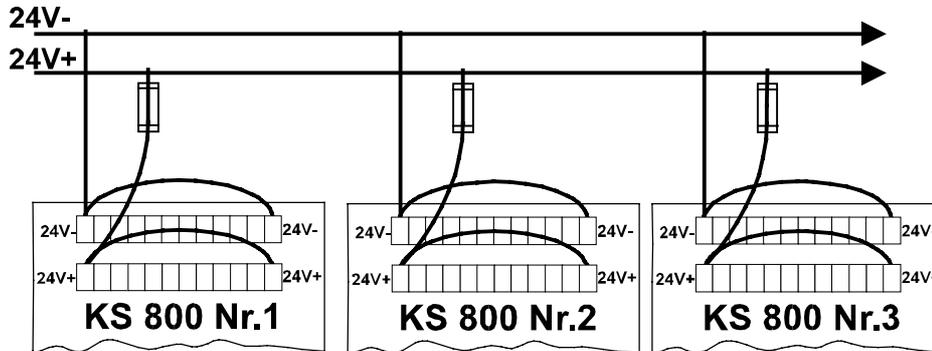
Correct supply voltage connection
with several KS 800 units

The supply voltage minus pole is connected via the two external terminals (1 and 18) of
connector J1.

The plus pole is connected via terminals 19 and 36 of connector J2.

The supply voltage must always be connected from both sides, in order to prevent overload of
the circuit tracks.

We recommend using rail-mounted terminals with built-in fuse.

**When mounting several units side by side, supply from one side and subsequent passing on
to the following unit must be avoided!**

Faulty supply voltage connection
with several KS800 units

4.5   Fuses

Each unit must be protected with a separate fuse (in rail-mounted terminal) 2A, medium-fast.
Unless the "PWR" LED is lit with the supply voltage applied (check external fuse and polarity!), the
unit is defective and must be returned to the manufacturer.

5   Inputs
(A complete KS 800 connecting diagram is given in section 7.)

Examples for connection are given in section 5.7.
The following rules are applicable to all analog inputs:
>   **Unused analog inputs must be short-circuited!**
>   **Thermocouple and DC voltage:**
>>   **Connect + and - terminal of each input.**
>   **Resistance thermometer:**
>>   **Unused inputs for resistance thermometers must be configured as mV or ther mocouple input. In this case, the + and - terminal of an input must also be**

connected.

5.1   Analog inputs IN1...IN8

These analog inputs are the process value inputs of control loops 1 - 8. These inputs can be confi-gured for thermocouple, resistance thermometer or voltage. Within a controller, "mixed operation" of inputs is possible.

5.1.1   Thermocouple inputs (IN1+/IN1- ... IN8+/IN8-)

The following thermocouple types according to DIN/EN 60584 can be connected:

Thermocouple type	Old description	Ident. colour neg. wire	Range
L	Fe/CuNi	blue	0... 900°C
J	Fe/CuNi	black	0... 900°C
K	Ni-Cr/Ni	green	0...1350°C
N	Nicrosil/Nisil	pink	0...1300°C
S	Pt-10/Rh/Pt	orange	0...1760°C
R	Pt-13/Rh/Pt	white	0...1760°C
T	Cu/Cu-Ni	brown	0... 400°C
W[*])	W5Re/W26Re	not defined	0...2300°C
E	Ni-Cr/Cu-Ni	violett	0...1000°C

[*])not according to DIN/EN
The upper KS 800 measuring limit is the upper limit for operation of the relevant thermocouple type.
The thermocouples are monitored for polarity error and break and the action (upscale/downscale) is configurable.

All thermocouples must be connected with correct polarity at terminals INx+ and INx-.
With thermocouples to DIN 43710, the plus arm is red and the colour of the minus arm corresponds to the identifying colour of the thermocouple type.
According to DIN/IEC 584, the colour of the plus arm corresponds to the identifying colour of the thermocouple type and the minus arm is white.

Terminals IPTx remain free.

The controller inputs are not galvanically isolated. Therefore, measurement errors may occur with thermocouple measurements above approx. 700°C and unsuitable thermocouples. This effect is due to a decrease of the insulation value between protective tube and thermocouple to values of a few kOhm from these temperatures dependent of construction type and insulation material. Additionally, potential differences between the individual thermocouples due to hot gas ionization may cause measurement errors or troubles due to compensating currents.
For the same reason, there may be problems when using grounded and isolated thermocouples in mixed applications. The potential differences between thermocouples must not exceed 7Vss.

We urgently recommend avoiding mixed operation.

If using grounded and isolated thermocouples in an installation should be indispensable for other reasons, the negative arm of the isolated thermocouple must be grounded at KS 800.

Already grounded thermocouples must not be grounded for a second time!

When replacing isolated thermocouples by non-isolated ones, removal of the negative arm grounding at KS 800 is indispensable.

5.1.2 Cold-junction temperature compensation

There are four possibilities of temperature compensation:

> 1. The temperature compensation is ineffective (for PT 100 or mV inputs)

> 2. Internal temperature compensation. Compensating lead must be used up to KS 800.

> 3. External temperature compensation. Compensating lead must be used only up to the cold-junction reference, leads between reference and KS 800 can be of copper.

> 4. Remote measurement of a cold-junction reference. Input IN8 can be configured so that it functions as input of the temperature sensor of a remote cold-junction reference.
> The thermocouples of each individual measuring point are connected to a common cold-junction reference by means of compensating lead. The leads between cold-junction reference and KS 800 can be of copper. The 8th input is used for measuring the temperature of this cold-junction reference and correcting the input voltage accordingly. For maintaining the specified accuracy, the sensor should be a resistance thermometer. When using this temperature compensation method in an installation containing several KS 800 controllers, this method must be used with each individual unit.

5.2 DC voltage (<100mV) IN1+/IN1- ... In8+/IN8-

DC voltages up to 100 mV instead of thermocouples can also be connected. Scaling of these values is possible via software adjustments.
The input resistance is approx. 100 kΩ.

5.3   Resistance thermometer (IN1+/IN1-/IPT1 ... IN8+/IN8-/IPT8)

Pt 100, 2 or 3-wire connection

Resistance thermometer type PT 100 to DIN/IEC 751 can be connected in 2 or 3-wire circuit. The max. measuring range is -100,0 ... 850,0°C, temperature-linear.
Connection in 3-wire circuit is possible without lead resistance adjustment, provided that the cross-section of the individual wires is identical.
With 2-wire connection, a compensating resistor corresponding to the lead resistance must be fitted. Using 2-wire connection is not recommendable.
The sensor is monitored for short circuit or break. The action (upscale/downscale) is configurable.

Resistance

wInstead of Pt10, a linearly variable resistor can be connected as a signal source in 3-wire circuit (for connection, see section 7.1), 2-wire connection is not possible.
The max. resistance can be 400 Ω. The measuring range starts at 0Ω to the final resistance value (max. 400Ω) The output action is reversible by connecting the wiper either to IN+ or IN- .
Monitoring is only for lead break.

5.4   Screening

For compliance with the regulations on electromagnetic compatibility to EN 50082-2, the connecting cables must be screened. The 2 screening possibilities are:

1. Each input is provided with a grounded screen connecting terminal to which the cable screening must be connected. These interconnected screenings must be connected to the ground potential (protective earth) via terminal 108 by means of the shortest possible cable (approx. 20 cm).

2. Use a commercially available screen connecting system.

5.5   Heating current measurement and heating current alarm

KS 800 has an input for connection of an external current transformer. All heating loads connected to a controller module are taken through a current transformer. Further processing and evaluation of the transformer signal are in the multi-controller module.

Measurement principle: a KS 800 "control cycle" takes approx. 600 ms for all 8 controllers. Heating current monitoring for a controller is possible after each 4th cycle, i.e. at intervals of 2,25 s. Via software, this interval can be increased by a factor between 0 and 99 in common for all controllers, whereby 0 means no monitoring.
E.g. factor 10: heating current monitoring for controller 1 is done after 22,5 s. After another 22,5 s, the heating current of controller 2 is monitored, etc., i.e. controller 1 is monitored again after 9 x 22,5 s = 202,5 s ≈ 3,5 min. Monitoring switch-off for individual controllers does not affect the cycle time.
As all controllers except the one to be monitored are **switched off** during monitoring (which is **switched on** independently of its control status), the control accuracy can be affected negatively. Therefore, heating current monitoring should be done only as frequently as necessary rather than as frequently as possible.

The current transformer input is **not** a measurement input in the sense of a calibrated measuring instrument. The software for display calculation is designed for a single-phase 1000:1 current transformer (30A = 30mA). When applying other values to this input, there will be an error (3-phase transformers, wave-form factor due to rectification and internal resistance outside KS 800...). Nevertheless, applying other variables to this input, e.g. 3-phase transformer with subsequent rectification and totalizing is possible. In this case, scaling is not correct any more.

Therefore, the KS 800 current input must be matched to the relevant conditions:
Allow the current to be monitored of one heating loop to flow through the transformer. The relevant controller measurement value is in a fixed ratio to the current, as long as the linearity limits are not exceeded. E.g. the KS 800 display with 27A heating current is 19(A) (by additional external rectification with a higher internal resistance). For monitoring a 10% current decrease, a limit of 17,1 (A) must be adjusted.

However, the absolute measurement limits of transformer and KS 800 must not be exceeded:

1. The maximum current through the transformer(s). (When heating up the machine, all heatings are switched on and the total of all heating currents flows through the transformer(s). This current must be below the max. value permissible for this transformer, otherwise, the transformer can be destroyed. For our transformers 9404 407 500x1, the current limit is 100 A.

2. The maximum KS 800 input current must not exceed 100 mA (thermal limits).

3. Measurement is linear within 0 and approx. 35 mA.

When detecting an exceeded limit, this information is available at one of the alarm outputs or can be read via the field bus.

Monitoring is done for exceeded min. and max. heating current limit.

Exceeded min. heating current limit: with the controller output switched off, an (adjustable) heating current min. value is monitored, i.e. interruptions of the heating loop are detected.

Exceeded max. heating current limit: with the output switched off, monitoring is done for an exceeded heating current limit of 3% of the heating current span (HC 100), which indicates leakage currents.

The dyn. input resistance is approx. 170 Ω
Heating current monitoring is omitted, if a control loop is switched off.

5.6 Input circuit examples
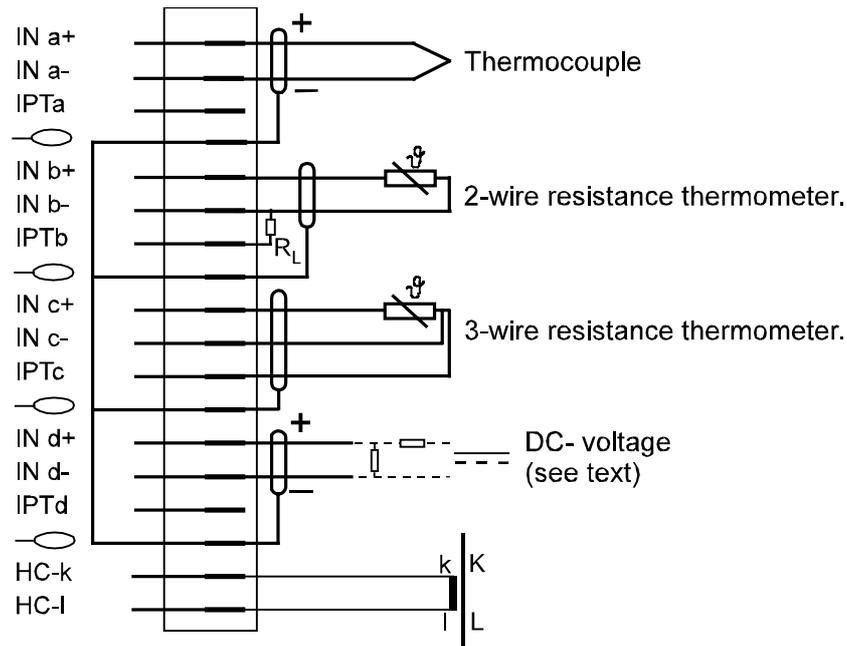
5.7 Digital inputs

KS 800 contains 4 digital inputs, which can also be configured individually as inputs, unless required as controller outputs (cooling output with three-point controllers or closed output with three-point stepping controllers).

The inputs are "high-active" and designed as current sink according to IEC 1131 type 1. The current requirement is approx. 5 mA.
Logic "0" = -3...5 V
Logic "1" = 15...30 V

With configuration as input, the following allocation is applicable:

IN/OUT13: control parameter set 1/2 switch-over
This input is used to activate the 2nd control parameter set in common with all controllers which are configured accordingly.

IN/OUT14: controller switch-off
This input is used for common switch-over of all controllers configured accordingly to manual mode and for setting the outputs to "0". All other configured functions continue operating normally.

See also hint on page 21.

IN/OUT15: Input for leakage current monitoring
The logic signal of an external leakage current monitor can be connected to this input.

IN/OUT16: W/W2 switch-over
This input is used for activating the 2nd setpoint (W2) with all controllers configured accordingly.

Unused digital inputs need not be connected.

5.8 Input/output forcing

Unless connections IN/OUT13...IN/OUT16 or OUT17...OUT19 are used for their actual tasks, they can be used as "free digital inputs/outputs" of a supervisory system. In this case, they cannot be influenced by KS 800, but only as a system component via the system bus.

Inputs/outputs IN/OUT13...IN/OUT16 can be configured as **digital inputs or outputs.**

Alarm outputs OUT17...OUT19 can be used as **digital outputs**, whereby the electrical specifications of these inputs and outputs remain unchanged.

6 Outputs

(For the complete connecting diagram, see section 7.2, 7.3)

6.1 Controller outputs:

Dependent of controller configuration, various output functions are possible:

	2-pnt. controller signaller 1 output [1]	3-pnt. controller signaller 2 outputs [2]	3-pnt. stepping controller
OUT 1	heating (contr. 1)	heating (contr. 1)	open (contr. 1)
OUT 2	heating (contr. 2)	heating (contr. 2)	open (contr. 2)
OUT 3	heating (contr. 3)	heating (contr. 3)	open (contr. 3)
OUT 4	heating (contr. 4)	heating (contr. 4)	open (contr. 4)
OUT 5	heating (contr. 5)	heating (contr. 5)	open (contr. 5)
OUT 6	heating (contr. 6)	heating (contr. 6)	open (contr. 6)
OUT 7	heating (contr. 7)	heating (contr. 7)	open (contr. 7)
OUT 8	heating (contr. 8)	heating (contr. 8)	open (contr. 8)
OUT 9	switched off	cooling (contr. 1)	closed (contr. 1)
OUT 10	switched off	cooling (contr. 2)	closed (contr. 2)
OUT 11	switched off	cooling (contr. 3)	closed (contr. 3)
OUT 12	switched off	cooling (contr. 4)	closed (contr. 4)
IN/OUT 13	input or unused	cooling (contr. 5)	closed (contr. 5)
IN/OUT 14	input or unused	cooling (contr. 6)	closed (contr. 6)
IN/OUT 15	input or unused	cooling (contr. 7)	closed (contr. 7)
IN/OUT 16	input or unused	cooling (contr. 8)	closed (contr. 8)

[1]) Outputs OUT1 to OUT8 are the "signal outputs".
[2]) Outputs OUT1 to OUT8 are the "signal outputs 1" and the outputs OUT9 to OUT16 are the "signal outputs 2".

KS 800 has max. 19 outputs with identical specification:
Transistor outputs, + switching (for loads with common minus connection).
Rated output current:< 70 mA, short-circuit proof
Voltage drop with full load: typ. 0,3 V, max. 1,0 V

OUT1...OUT12   12 fixed logic outputs (controller outputs). The controllers and controller output allocation are fixed. Reconfiguration is not possible.

IN/OUT13...IN/OUT16   4 variable inputs/outputs. They can be configured as controller outputs (logic outputs) or digital inputs.

OUT17...OUT19   3 outputs for alarms. The alarm allocation to the three outputs is confi-
                         gurable.

Unused outputs cannot be switched off individually. These outputs go to the status which is defined
in the KS 800 configuration. The inputs of these unused controllers must be short-circuited (see
also section 5).

Because of the variety of KS 800 configurations, note that:

The KS 800 options can be limited by the controller configuration.
With KS 800 configuration as two-point controller, all unused inputs/outputs are available for the
option.
With KS 800 configured as three-point controller (heating/cooling) or as three-point stepping control-
ler, 16 output are required with eight control loops, i.e. several options are not possible.

6.2   Controller outputs, continuous

The continuous controller terminals are accessible from the bottom through a cut-out in the
aluminium profile. Two 8-pin connectors must be used for connection.

The type of continuous outputs (voltage or current) is dependent of the KS 800 type (see section
2.1 Versions) and cannot be changed.
The current output, dead-zero (0mA) or live-zero (4mA), is adjustable via software.

	Current output 0/4...20mA	Voltage output 0...10V
Range	0...20mA / 4...20mA	0...10V
Accurcy	typ. ± 0,2% ±1 digit	typ. ± 2 digits
Resolution	9 bits	9 bits
Load	max. 470 Ω	min. 6 kΩ
Settling time	max. 625 ms	max. 625 ms
Overload pro-tection up to	----[1])	short circuit proof

[1]) With low load resistances, the most important part of the power is converted (into heat) in KS800
itself, which implies a risk of instrument overheating, especially with high ambient temperatures.
With all eight controllers configured as current outputs, the load resistances should not be lower
than 250 Ω.

6.2.1   Analog output allocation

There are 2 modes of analog output allocation to the hardware outputs:

1. Up to instrument number 8396 (Dec. 2001) operating version 4:

Continuous outputs cannot be allocated firmly to the controllers and thus to the terminals. The order
of allocation is as with controller configuration with analog outputs.

Starting with controller 1, the 1st controller, which has a continuous output, is allocated to analog output 1 (AO1).
E.g. controller 1 and 2 are two-point controllers (heating, switching), controller 3 is configured as a three-point controller (heating switching, cooling continuous): the first free analog output (AO1) is allocated to the cooling output of controller 3. (The output of the 3rd controller is connected with the 1st analog output (AO1).) Analog output 2 (AO2) is used by the following controller output which is configured as an analog output. Analog outputs which are added or removed subsequently shift the controller ⇔ analog output allocation.

When planning or changing the installation, note that controller outputs and analog outputs must not have the same numbering.

2. From Instrument number 8397 (Jan. 2002), operating version 5

The analog output allocationto the hardware output is fixed: controller 1 -> analog output 1, controller 2 -> analog output 2, etc. Analog outputs which are not required for individual controllers can be used for analog output of other variables (Xeff, Weff, Ypid, Y1heating, Y2cooling of this channel, or for forcing.

6.3   Alarm outputs

The three alarm outputs of KS 800 are accessible at connector J3.

The alarms

> **HC alarm:** alarm is output with the heating current <u>below</u> the adjusted controller-specific limit value (to ensure the heating power; high impedance of heating elements develops slowly).

> **Leakage current alarm:** Alarm generated in case of differential current due to insulation error. Monitoring is done by an external unit for differential current monitoring with relay output. This relay provides error signalling to digital input IN/OUT15 configured for this purpose. The insulation error can be signalled via the fieldbus or via an alarm output (OUT17...19).

Caution!!! Never use this leakage current alarm message for monitoring of faulty currents which are inteded for safety against contact with high voltages.

> **Output monitoring alarm:** alarm is output if one of outputs OUT1...OUT8 does not go to the status determined instantaneous by the control algorithm.

can be allocated to each of alarm outputs OUT17...OUT19. The outputs are "open-collector outputs" and can be configured for normally closed or normally open operation.

For detailed information on the configuration, see **manual 9499 040 49211**.

With the unit configured accordingly, the alarm LEDs (AL1...AL3) are lit when an alarm is pending, independent of whether the output is or is not connected. The software evaluation of alarms is also independent of the hardware evaluation.

Note: Unless these alarm outputs are used as alarm outputs, they can also be used as digital outputs of a control system (see also section **5.8**).

6.4   Constant voltage and auxiliary relays

KS 800 version 9407 480 xx**3**xx is provided with a constant voltage source, which is galvanically isolated from all other KS 800 inputs and outputs.
This constant voltage source can be used for energizing a strain-gauge bridge (pressure sensor). Galvanic isolation permits direct connection of the bridge diagonal (bridge output) via a KS800 input configured as a mV-input.

$U = 10V \pm 0,2\%$; $Imax = 60mA$

The constant voltage source is protected against short circuit without being permanently short circuit proof.

Sensors used for pressure measurement are normally provided with a built-in resistor, which changes the bridge output signal by 80% if connected in parallel to a bridge arm.
Therefore, function checking is possible after de-pressurizing.

For connecting this resistor in parallel, this KS 800 version is fitted with an additional relay with change-over contact, which can be controlled by applying an external voltage (24V= from a digital system output card; current sink type1 to IEC 1131) or via the system bus.
The relay is designed for switching "dry circuits". For using the relay for this purpose, the switching current must not exceed 2mA, to prevent an increase of the contact resistance (burning off or oxydation due to spark formation), which leads to bridge output measurement errors.

7 Circuit diagrams

7.1 Input/output circuit diagram

For better understanding with complex connecting problems, the circuit diagrams of inputs and outputs are shown below.

Switching Outputs and Supply voltage

Aux. Relais (Rel.1 / Rel.2)

Continious Outputs (Voltage)

Continious Outputs (Current)
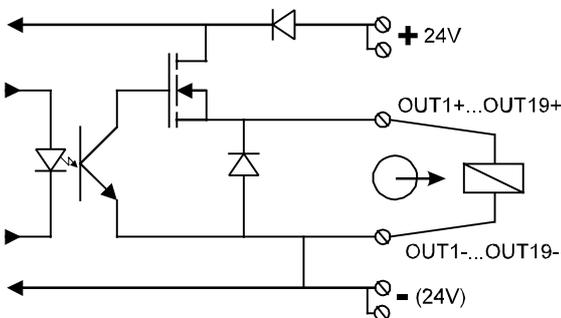
Resistance Thermometer
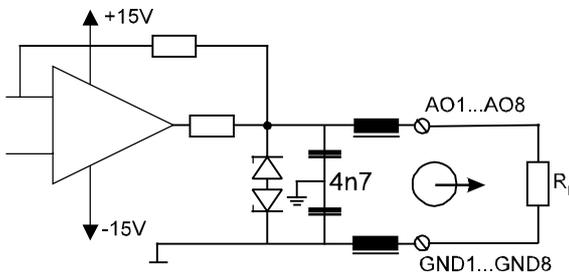
Resistance

Digital Inputs
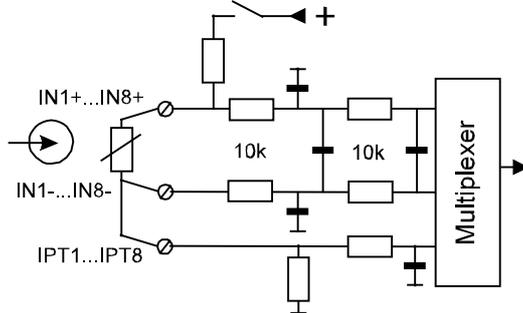
Heating Current Monitoring
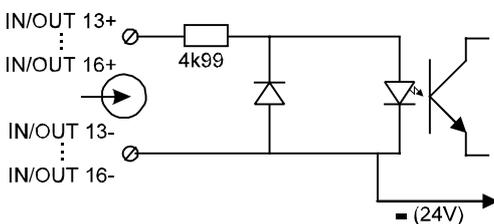
DC- or Thermocouple-Input
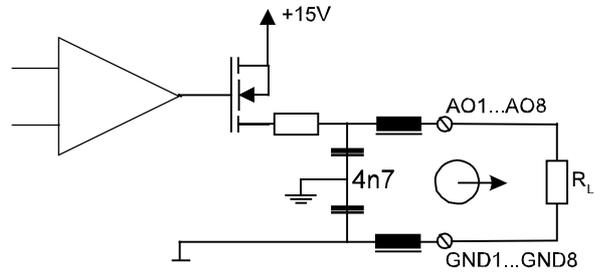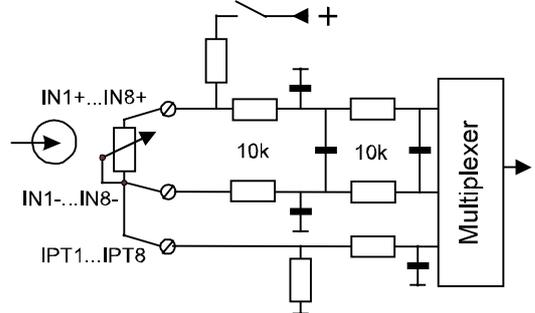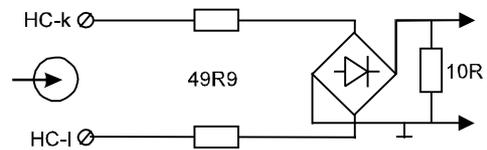
Constant Voltage 10V
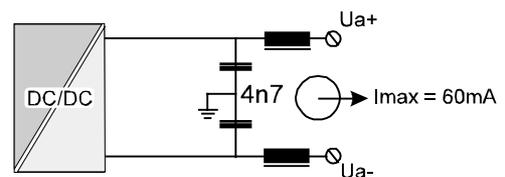
7.2   KS 800 overall connecting diagram with/without continious outputs

Only valid for the option:
Continious outputs
I = 0/4...20mA
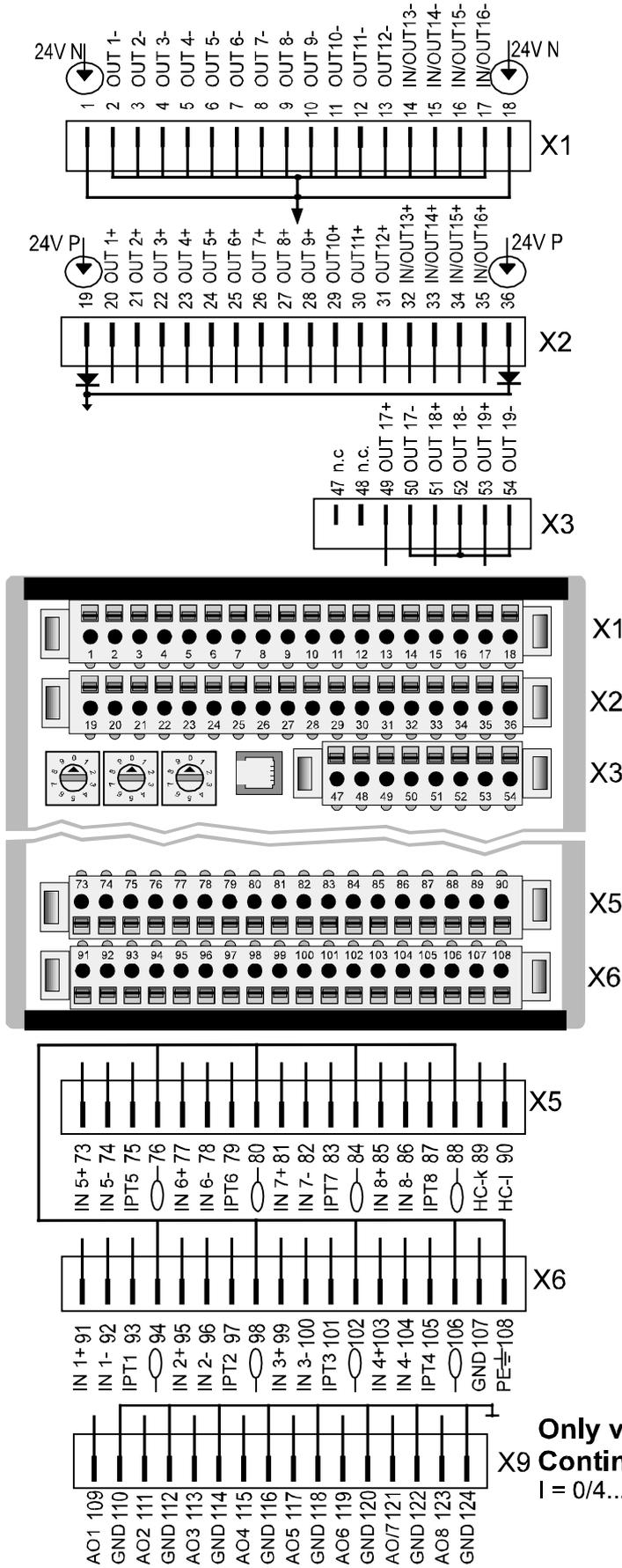
7.3 KS 800 overall connecting diagram with constant voltage 10V

Only valid for the option:
Constant-Voltage
U = 10V Imax = 60mA
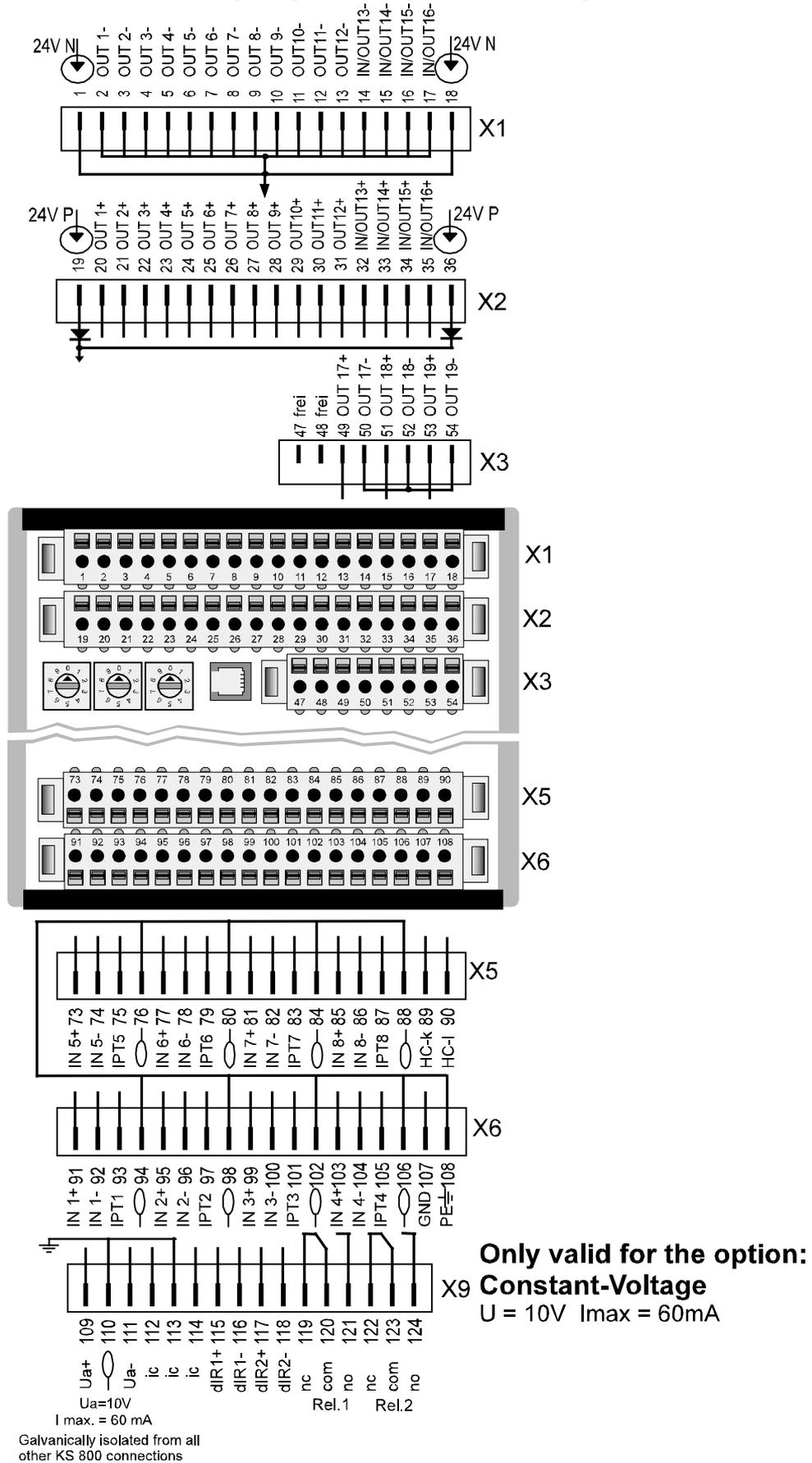
8 Digital interfaces

Communication with controller KS 800 is possible only via the digital interfaces. Reading process values, changing set-points or control parameters is always done via these interfaces.
There are two types of interfaces:

8.1 Engineering tool interface

The PC interface is provided on all controller versions. This interface is a special interface using the ISO 1745 protocol. Access to all controller values is possible using the relevant software, the engineering tool. E.g. for simple applications or test circuits, an individual unit can be configured and the control loops can be operated normally via this interface.
Connection is to the 4/4 FCC68 data connector (Western telephone connector) via a special PC adaptor, order no. 9407 998 00001.

8.2 BUS interfaces

This interface is used for connecting the KS 800 to a PLC, a PC or a visualization unit. Dependent of version, the interface is designed for CANbus, CANbus with DeviceNet-protocoll, Profibus or as RS 422/485 (see section 2.1). The 9-pole sub-D connector and socket are equivalent. They are used for "through-connecting" the bus with several connected controllers.
See also page 8: **Bus connectors**

8.2.1 BUS-Connector
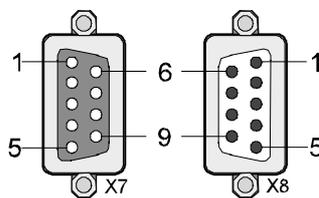
Connector sockets and pins with identical name are connected.

n.c.: Do not use these contacts!

Con-tact	Profibus	CANbus	RS422/485	DeviceNet
1	n.c.	n.c.	n.c.	
2	n.c	CAN-L	GND	
3	n.c.RxD/TxD-P	CAN-GND	TXD-B	
4	DGNC	n.c.	RXD-B	
5	n.c.	n.c.	RGND	See chapt. **8.2.2** "DeviceNet-Adaptor"
6	Vp(+5V)	CNA-GND	n.c.	
7	n.c.	CAN-H	GND	
8	RxD/TxD-N	n.c.	TXD-A	
9	n.c	n.c.	RXD-A	

8.2.2 DeviceNet adaptor

If KS 800 is operated with DeviceNet, an adapter is required for this bus system. This adaptor is available under order number 9407-799-00301.

DeviceNet Adaptor   DeviceNet Connector
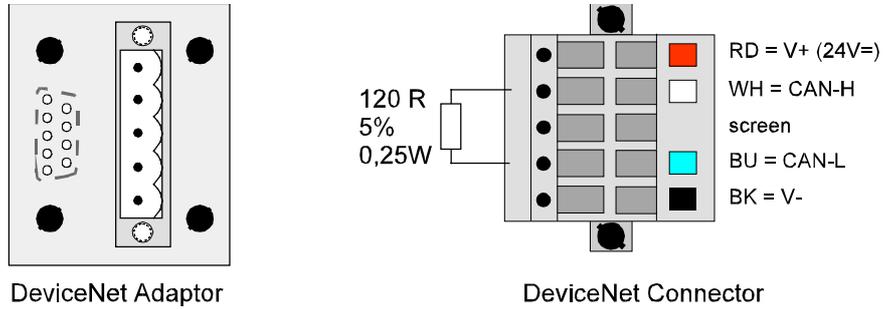
Pin allocation DeviceNet adaptor

Mounting the adaptor on the KS 800 sub-D-connectors is done as shown in the following drawing:
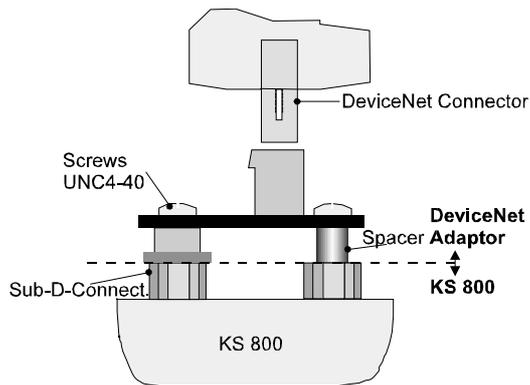
DeviceNet adaptor mounting

8.2.3 COM2 interface

Address and Baudrate for the COM2 interface can be adjusted via hardware or software for each KS 800.
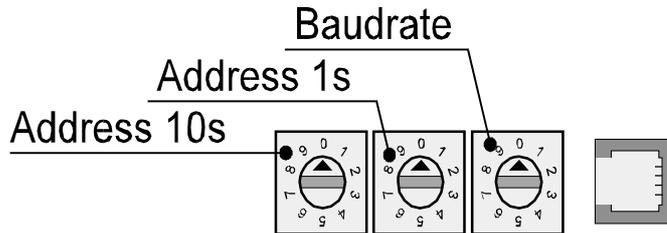
Via hardware, the **address** is adjustable within "01" and "99". In position "00", the address stored in EEPROM which can be changed via software will be used when switching on. Priority is given to the address adjusted via switch position. This address and baudrate cannot be readout or changed via software.

The same applies to the **Baudrate**: in Position "0", the EEPROM Baudrate is effective at first. This address can be changed via software. The digits on the switch correspond to the values used for determination of the Baudrate during configuration in C902.

Switch position	RS485	CANbus
0	from EEPROM or via software	from EEPROM or via software
1	2400 Bd	20 kBd
2	4800 Bd	125 kBd [*]
3	9600 Bd	500 kBd [*]
4	19200 Bd	1 Mbd
5	invalid setting	10 kBd
6	invalid setting	50 kBd
7	invalid setting	250 kBd [*]
8	invalid setting	800 kBd
9	invalid setting	invalid setting

As the baudrate is adjusted automatically with the **PROFIBUS DP**-version, manual adjustment is omitted.

[*] Only these Baudrates are available for DeviceNet. With faulty switch position 125 kBd is set automatically.

8.3   Terminating resistors

Hints related to baudrates, bus lengths, properties of electrical cables and mutual effects are given in the relevant interface descriptions.

All KS 800 versions are delivered without terminating resistors at the bus connectors which must be plugged into the free bus connector of the last unit.
The resistors required for each bus must be added externally to the last unit at both ends of the bus cable. Eihter in the last connector (socket) or in a separate terminating connector (socket), which must be plugged into the free bus connector of the last unit.
The standards or standard drafts of the relevant bus system are applicable

RS485/422: Unlike the other bus cables, these cables are not standardized. Therefore, no general data on terminating resistors can be provided. The wave resistance is dependent of cable type and length. Follow the guidelines provided by the cable manufacturers and connect the terminating resistors across lines A and B of the relevant conductor pairs TXD and RXD (values approx. 100...200 Ω).

CAN bus (Canopen and DeviceNet): 9-pole sub-D socket with terminating resistor. Only terminating resistor, not suitable for connecting a cable. PMA order no. 9407 800 90021

DeviceNet: The 120 Ω; 5%; 0,25W terminating resistor must be connected to the unused terminals of the DeviceNet connector across connections blue (BU) and white (WH) (see also drawing, section **8.2.2**).

PROFIBUS: e.g. Siemens, bus connector, types 6ES7972-OBB10-OXAO or 6ES7972-OBB20-OXAO, or 6GK1 500-OEAOO. This connector is not available from PMA.

9   Indicator LEDs

9.1   Outputs

Below the outputs, 16 indicator LEDs indicate the output status, provided that a definition is given for all outputs.
If inputs 13 ... 16 are defined as inputs, the indicator LEDs are lit with a high signal applied to the inputs.

9.2   PWR, COM and alarm indicator LED

Above the input terminals, five other LEDs with the following signification are fitted:

PWR	This LED is lit with the supply voltage applied.
COM	With CAN_BUS (CANopen and DeviceNet) and RS422/485, this LED indicates data transmission between KS800 and control system (PC or visualization) by blinking.
	With PROFIBUS, this Led indicates the bus statuses. **LED off:** error signalling for "no bus access" (so far not addressed by master)

LED on: O.K., cyclic data exchange busy
LED blinks: (2 Hz) data communication interrupted
LED blinks: (4 Hz) PROFIBUS parameter or configuration error

AL1...AL3   With KS 800 configured for alarm functions, these LEDs are lit in case of the relevant alarm.

10 Maintenance and measures in case of trouble

The KS 800 multiple controller needs no particular maintenance. There are no parts in the unit which need preventive maintenance or care.

10.1 Cleaning

If necessary, the aluminium and plastics components must be cleaned carefully with spirit. Do not use solvents or scouring agents.

10.2 Trouble shooting

To start with, all possibilities of error in other equipment and connections (input leads, electrical connections, equipment in the output circuit) should be examined. If the error cannot be located with the hints given in this section, we recommend returning the controller to the manufacturer:

PMA Prozeß- und Maschinen- Automation GmbH
Service
Miramstraße 87
D 34123 Kassel

If the trouble was found to be due to failure of an external fuse, the trouble cause must be located and removed. The spare fuse must be of the same type and current rating as the original one.
If the PWR LED does not light up despite correctly functioning fuse and correct polarity of the supply voltage, controller KS 800 is defective and must be returned to the manufacturer for repair.

10.3 Shut-down

Before disconnecting the unit, disconnect the installation completely from the mains and check that other equipment connected in the overall installation is not affected.

WARNING!   **WARNING!**
When safe controller operation seems not possible any more, the unit must be shut down and protected against accidental switch-on.

For removal of the unit, see section 3.2

10.4 Customer Support Hotline

For further questions beyond the scope of the KS 800 operating manual, please, contact one of the following telephone numbers from Monday to Friday, between 8 a.m. and 16 p.m.

Tel. Custumer Support:	**49 561 505 3091**
Tel. Repair:	**49 561 505 1257**
Tel. Sales Dept.:	**49 561 505 1307**
e-mail:	**mailbox@pma-online.de**

PMA Prozeß- und Maschinen-Automation GmbH

PMA

UL-Zulassung

Damit das Gerät die Anforderungen der
UL-Zulassung erfüllt, sind folgende Punkte
zu beachten:

.

☐ Nur Leiter aus 60 / 75 oder 75°C Kupfer
(Cu) verwenden..

☐ Die Klemmenschrauben sind mit einem
Drehmoment von 0,5 - 0,6 Nm anzu-
ziehen.

UL certification

For compliance with UL certificate,
the following information must be
taken into account:

☐ Use only 60 / 75 or 75°C copper
(Cu) wire.

☐ Tighten the terminal-screws
with a torque of 0,5 - 0,6 Nm