

# Data Monitor KS 3002

Colour display, CompactFlash

Sampling rate 250 ms; shortest storage cycle 1s

Usable as point or line recorder

3 or 6 universal inputs with galvanic isolation

Vertical display format with selectable channel representation: numeric, scaled, bargraph

Programmable storage cycle and value for normal, event, or timed operating mode

Data analysis in the KS 3002 or with evaluation software in a PC and electronic archiving

Ethernet interface with integrated webservice (option) presentation of the current measurements on the PC

## PROFILE

The Data Monitor KS 3002 is a freely configurable, microprocessor-controlled device for measuring, storing, visualizing, monitoring, printing and evaluating process data. Fitted with 3 or 6 universal inputs, the KS 3002 accepts signals from direct current and voltage sources, thermocouples, and resistance thermometers.

The measured data are stored in a FLASH memory, where they are available for display on the colour screen. For long-term storage, the data are written onto a CompactFlash. By means of suitable software, the stored data can also be used for subsequent evaluation and analysis on a PC.

The data monitor KS 3002 is intended for use in industrial applications and is designed for panel mounting in a cut-out of 138 x 138 mm. The front panel has protection class IP 54 and measures 144 x 144 mm.

## DESCRIPTION

### Measurement and inputs

The KS 3002 has 3 or 6 universal analog inputs for direct current and voltage signals, thermocouples and resistance thermometers. Sensor type and measurement range are freely configurable.

Internal linearization is provided for thermocouple and resistance thermometer signals. The inputs are galvanically isolated by means of opto-couplers. The sampling rate is fixed at 250 ms (regardless of the number of inputs), enabling the unit to be used as a point or line recorder.

As an option, 4 digital inputs can be fitted in addition to the 3 or 6 analog inputs. With the „Mathematics“ option, one analog input is required per computation.

### Operation and configuration

Operation and configuration of the data monitor is menu-guided by means of 8 keys in the front panel. Five of the keys are „softkeys“ whose functions are context-dependent. This ensures confident operation, because the permitted functions are always displayed at the bottom of the screen as symbols. Unauthorized access to the configuration can be password-protected. Configuration data can be uploaded onto a CompactFlash from the KS 3002, or downloaded from a CompactFlash into the KS 3002.

By means of an Engineering Tool (see Accessories), the unit can be configured via a PC, with Windows 95/98 or NT/2000/XP. Subsequently, the configuration data can be uploaded into the KS 3002 and changed, if necessary. The „copy“ function enables the same parameters to be downloaded into other units. Furthermore, the configuration data can be stored on a data carrier for archiving or printing. Before the KS 3002 is mounted in the panel, the configuration data can be loaded directly from the PC via an interface cable (→ Accessories).

The operating language is selectable on-screen for English, German, French, Dutch, Spanish, Portuguese, Italian, Czech, Hungarian, Polish, Swedish, Danish, Russian or Finnish. The Engineering Tool provides a choice of English, German or French.

### PC-based evaluation software

This software package (see Accessories) runs under Windows 95/98 or NT/2000/XP and is used for visualization, evaluation, administration, and archiving of measurement data stored by the KS 3002.

The available functions are as follows:

- The data from differently-configured monitors is recognized and stored in a database. The entire data administration is executed automatically, whereby the user only has to enter an identifier.
- The user has direct access to data that has been specified by means of the identifier. Furthermore, the periods to be evaluated can be limited.
- New display groups can be configured at any time by assigning the required analog and digital inputs.
- An export filter enables the data to be transferred to other programs, e.g. Excel, for further calculations.

- The evaluation program supports networking, i.e. several users have independent access to the same data.
- By means of an accessory device, the PCA communication server, the data stored in the FLASH memory of the KS 3002 can be read via the serial RS 232/RS 485 interface or a modem. Readout can be triggered manually or with a timed function.

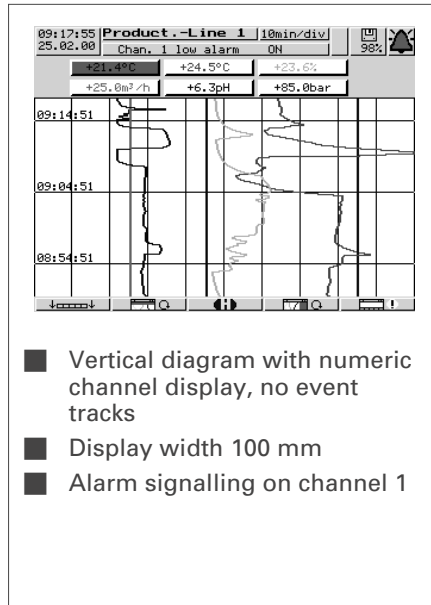
**Visualization**

For visualization, the KS 3002 is fitted with a 5-inch (126 mm) STN colour graphics display with a resolution of 320 x 240 pixels. 27 colours ensure brilliant displays. Measured data are displayed vertically, as with conventional chart recorders. By means of a key in the front panel, various display formats are possible for the channels: numeric, scaled, bargraph, or no display.

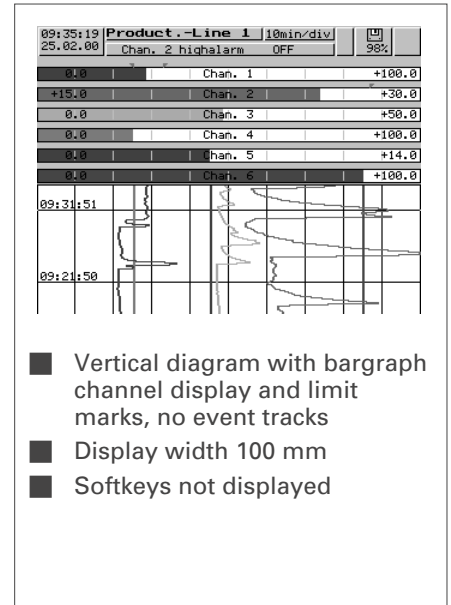
Furthermore, it is possible to select a large numeric display instead of the normal (vertical) chart display. Another front key enables six event tracks to be activated for the chart display. This reduces the normal 100 mm display width to 72 mm. If „Perforation“ has been selected during parameter adjustment, the chart display shows perforations, which reduces the chart width to 94 mm. Vertical movement of the chart display depends on the selected storage cycle, and can be adjusted for mm/h, time/grid or storage cycle during parameter adjustment.

Another front key selects the display or analysis of historic data. This enables all the data stored in the ring buffer to be displayed with various zoom settings. The required data for zooming are selected with a cursor line.

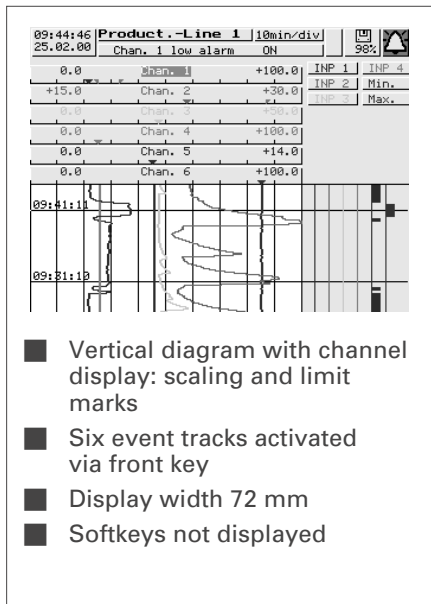
Various messages in plain text can be triggered by certain events, and are stored in the events' list. Such events can be alarms, digital inputs (option) or system messages (e.g. mains supply on/off). The events' list is stored in the ring buffer and on the CompactFlash. The list can also be displayed at the push of a front key on the KS 3002.



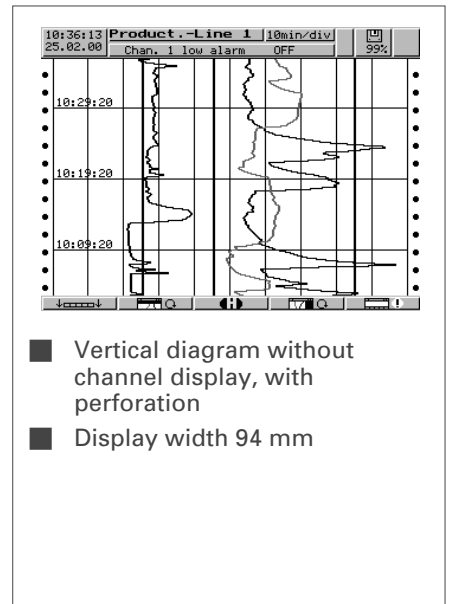
- Vertical diagram with numeric channel display, no event tracks
- Display width 100 mm
- Alarm signalling on channel 1



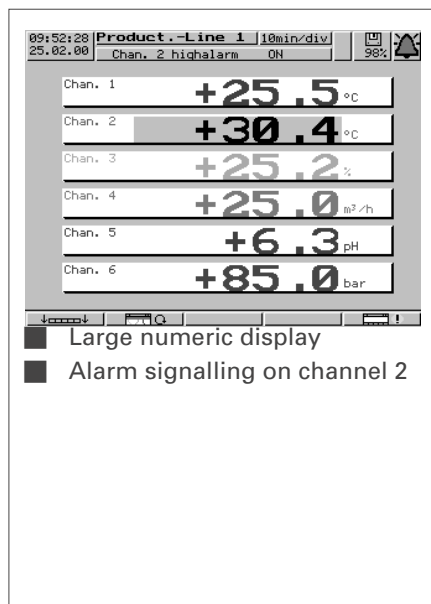
- Vertical diagram with bargraph channel display and limit marks, no event tracks
- Display width 100 mm
- Softkeys not displayed



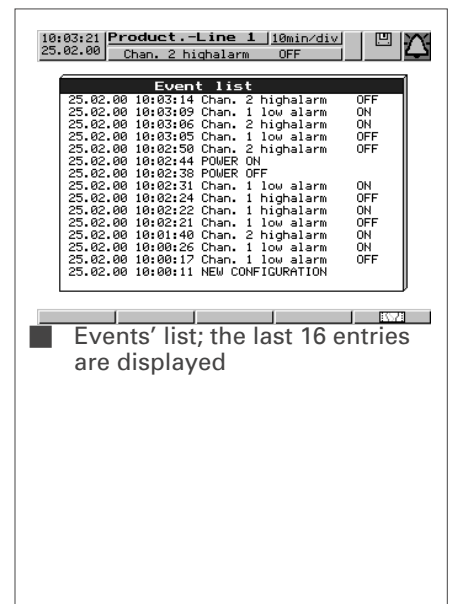
- Vertical diagram with channel display: scaling and limit marks
- Six event tracks activated via front key
- Display width 72 mm
- Softkeys not displayed



- Vertical diagram without channel display, with perforation
- Display width 94 mm



- Large numeric display
- Alarm signalling on channel 2



- Events' list; the last 16 entries are displayed

## Data processing

Analog input values are sampled cyclically at fixed intervals of 250 ms, and are stored in a buffer memory. The stored data is checked for exceeded limits.

Depending on the configuration for storage cycle, storage mode and storage data (min, max, mean, current or min+max value), the measurement results are then passed to a ring buffer (FLASH). There are three operating modes, each of which can be configured for storage cycle and storage data:

- **Normal mode:**  
This is the default setting, and is used as long as there is no alarm, and timed mode has not been selected.
- **Event mode:**  
This is triggered by an external signal (digital input, group alarm, etc.) and remains active as long as the trigger signal is present.
- **Timed mode:**  
This mode is executed once a day during a pre-defined time.

The event mode has highest priority, followed by timed mode and normal mode.

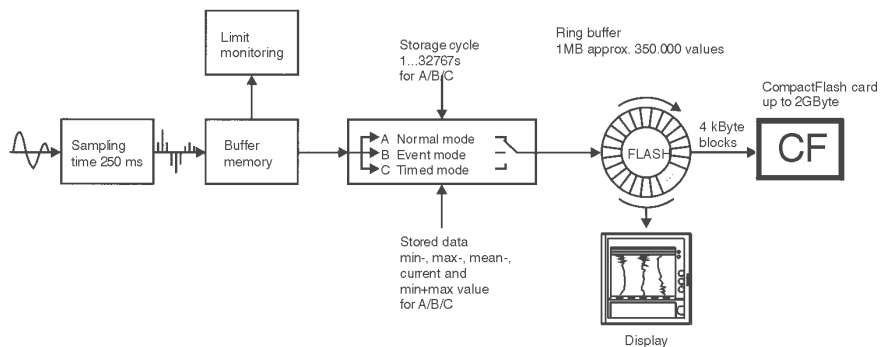
The internal Flash memory is operated as a ring buffer, and has a capacity for about 350.000 measurement values with 1MB, with 2MB it has about 850.00. When the memory is full, the oldest data are overwritten (first in, first out). At regular intervals, the data stored in the memory is copied onto a CompactFlash in 4 kbyte blocks.

The CompactFlash is a memory card with a capacity of 32MBytes until 2GB (industrial grade). Because every write process is verified, memory faults are recognized immediately.

The unit also monitors the remaining CompactFlash capacity and generates an alarm as soon as a configurable „CompactFlash change“ capacity is reached. The alarm signal can be used to trigger a relay (option). With the „CompactFlash update“ function, the CompactFlash manager copies any data from the Flash memory that has not yet been stored, before a CompactFlash is removed.

Measurement data are stored on the CompactFlash in a special encryption code. If the CompactFlash is removed from the unit, there is no immediate loss of data, because operation of the Flash memory is not affected. Only when the memory is full, and there is no CompactFlash in the drive, data will be overwritten.

The period required until the storage capacity of the ring buffer and the CompactFlash is exhausted, depends on the unit's configuration, and is variable



within wide limits: from a few days up to several years.

- **Example:**  
If the KS 3002 with 6 channels has been adjusted to 60s in normal operating mode, the event and timed modes have been disabled, and only min, max, mean and current values are to be stored, the result is a recording period of about 5 years for the CompactFlash, and approx. 35 days with 1MB for the ring buffer. It is assumed that no limit signals occur.

Behaviour when separating the unit from the power supply

- Configuration and measurement data are maintained also after separating the KS 3002 from the power supply.
- When the on-board lithium battery (10 years) or the buffer capacitor (typically 2 weeks) is exhausted, any data in the Flash memory is lost, and the internal clock stops. Because the assignment of measured values to the time will no longer be correct, a new CompactFlash must be inserted and the internal clock readjusted.

If a limit value is exceeded, an alarm is triggered. This alarm can be routed to an output relay (option), or it can be used to switch the unit to a different operating mode (normal, event, or timed). The delay function enables short-term alarms (e.g. during commissioning) to be ignored, so that no alarm is triggered.

Furthermore, the alarm's switching hysteresis is adjustable.

### Interface

Current process data as well as special monitor data can be output via the optional RS 232 or RS 485 interface.

Switchover between RS 232 and RS 485 is done via software. With the RS 232 interface, up to 15 m of cable are allowed. With RS 485, the cable can be up to 1200 m long.

The interface port is a 9-pin D-type female connector at the rear of the unit.

Transmission protocols for Modbus and J-bus are available. The transmission mode is RTU (Remote Terminal Unit).

By means of the PCC communication server (see Accessories), it is possible to read the data stored in the Flash ring buffer of the KS 3002 via the RS 232/485 interface at timed intervals.

The switch over between RS232 and RS485-interface is handled in the configuration-program.

An Ethernet connection with integrated webserver for the KS 3002 can be ordered (option)

## TECHNICAL DATA

### INPUT

#### Analog inputs

Configurable for sensor type and measuring range.  
Galvanic isolation between inputs: up to 30 VAC or 50 VDC by means of opto-couplers.

#### Sampling rate

250 ms for 3 or 6 inputs.  
Resolution: >14 bits

#### Thermocouples

Type	Max. meas. range
Fe-CuNi „L“	-200 ... +900 °C
Fe-CuNi „J“	-210 ... +1200 °C
Cu-CuNi „T“	-270 ... +400 °C
Cu-CuNi „U“	-200 ... +600 °C
NiCr-CuNi „E“	-270 ... +1000 °C
NiCr-Ni „K“	-270 ... +1372 °C
NiCrSi-NiSi „N“	-270 ... +1300 °C

Smallest span: 100 K

#### Measurement error:

±0,1% referred to max. measuring range (only guaranteed above -100 °C with Type J, above -150 °C with Types U and T, and above -80 °C with Types K, E, and N).

Type	Max. meas. range
Pt10Rh-Pt „S“	-50... +1768 °C
Pt13Rh-Pt „R“	-50... +1768 °C
Pt30Rh-Pt6Rh „B“	0... +1820 °C
W3Re/W25Re „D“	0... +2400 °C
W5Re/W26Re „C“	0... +2320 °C

Smallest span: 500 K

#### Measurement error:

±0,15% referred to max. measuring range (only guaranteed above 400 °C with Type B, and above 0 °C with Types S and R). Span start and end of span can be configured freely in steps of 0,1 K within the specified max. measuring ranges.

#### Cold junction

Internal: Pt 100

Error of internal cold junction: ±1,0 K

External: with reference thermostat

The cold junction temperature is configured for a constant value in the range -50...+100 °C.

#### Resistance thermometers (two, three or four-wire connection)

Type	Max. meas. range	Linearization
Pt 100	-200 ... +850 °C	DIN EN 60751
Pt 100	-200 ... +650 °C	JIS
Pt 500	-200 ... +850 °C	DIN EN 60751
Pt 1000	-200 ... +850 °C	DIN EN 60751
Ni 100	-60 ... +180 °C	
Pt50	-200... +1100°C	
Cu50	-50... +200°C	

Smallest span: 15 K

Measurement error referred to max. measuring range:

Sensortype	2&3-wire	4-wire
Pt100, Pt500, Pt1000, Pt100 JIS,	± 0,8 K	± 0,5 K
Pt50, Cu50	± 0,9 K	± 0,6 K
Ni100	± 0,4 K	± 0,4 K

Span start and end of span can be configured freely in steps of 0,1 K within the specified max. measuring ranges.

#### Lead resistances

- With 3 and 4-wire connection: ≤30 Ω per lead
- With 2-wire connection: ≤10 Ω per lead
- Current through sensor: 0,5 or 0,25 mA, depending on sensor type

#### Direct voltage

Voltage signals with the following max. ranges can be measured:

Max. meas. range	Measurement error
-20 ... +70 mV	± 80 μV
-3 ... +105 mV	± 100 μV
-10 ... +210 mV	± 240 μV
-0,5 ... +12 mV	± 6 mV
-0,05 ... +1,2 V	± 1 mV
-1,2 ... +1,2 V	± 2 mV
-10 ... +12 V	± 12 mV

Smallest span: 5 mV

Within the specified max. measuring ranges, span start and end of span can be configured freely in steps of 0,0 mV.

#### Input impedance:

≥1 MΩ for input signals ≤100 mV  
≥470 kΩ for input signals >100 mV

#### Direct current

Current signals with the following max. ranges can be measured:

Max. meas. range	Measurement error
- 2 ... +22 mA	± 20 μA
-22 ... +22 mA	± 44 μA

Smallest span: 0,5 mA

Span start and end of span can be configured freely in steps of 0,01 mA within the specified max. measuring ranges.

Voltage drop across input: <1 V

#### Input circuit monitoring

Sensor type	Break	Short circuit
Thermocouple	x	-
Resistance thermometer	x	x
Voltage ≤210 mV	x	-
Voltage >210 mV	-	-
Current	-	-

X = monitored; - = not monitored

#### Digital inputs (option)

4 digital inputs to DIN 19 240;  
max. 1 Hz, max. 32 V,  
Logic „Low“ (0): -3... +5 V,  
Logic „High“ (1): 12...30 V  
Sampling rate: min. 1s

#### ALARM MONITORING

Min and max limits are monitored for each channel; freely adjustable hysteresis and alarm delay.

#### COUNTER, MATHEMATICS (OPTION)

Since instrument software no. 133.03.xx, the KS 3002 can be fitted as well as retro-fitted with the following software functions:

#### Counter/ Integrator / Operating time counter

Six additional channels are available, which can be configured as counter, integrator, or operating time counter. The numeric display has max. 9 digits, and all six channels are shown on a separate counter page. Counting periods can be defined as periodic, external, daily, weekly, monthly, yearly, total, or daily from/to. An external, periodic reset or a reset via the front panel keys .

- **Counter inputs:** binary (digital) inputs, alarms, logic channels, disturbance, Modbus flag.  
**Counter frequency:** max. 30 Hz

**Evaluation factor:** ± 0,0001 up to 99999

- **Integrator inputs:** analog inputs  
**Integrator time base:** s, min, h, d

**Evaluation factor:** ± 0,0001 up to 99999

**Threshold value:** adjustable

- **Operating time counter input:** alarms, logic channels, disturbance, Modbus flag.

**Time base:** s, min, h, d

#### Mathematics / Logic

Six mathematics channels and six logic channels are available. Whilst the logic channels operate virtually, a mathematics channel requires a corresponding analog input channel for computation. Configuration is only possible with the Engineering Tool.

- **Mathematical variables:** analog inputs, counter/ integrator channels, binary (digital) inputs, alarms, logic channels, disturbance, Modbus flag.

**Mathematical operators/functions:** +, -, \*, /, SQRT, MIN, MAX, SIN, COS, TAN, \*\*, EXP, ABS, INT, FRC, LOG, LN

- **Logic variables:** binary (digital) inputs, alarms, logic channels, disturbance, Modbus flag  
**Logic functions:** AND, NOT, OR, XOR  
**Logic actions:** event track, event-triggered operation, display switch-off, clock synchronization, counter, integrator, or operating time counter, reset for counter/integrator, disabling of front panel keys, relay output

#### DISPLAY AND OPERATION

STN colour display  
Screen size: 126 mm (5 inches)  
Resolution: 320 x 240 pixels, 27 colours

Operation and configuration from the front by means of 8 keys, 5 of which are softkeys. Alternatively via Engineering Tool and a PC interface cable (→ Accessories) or by downloading from a CompactFlash.

#### OUTPUTS

##### Relay (option)

3 signalling relay, Change-over contacts: 3A, 230 VAC. Combined switching of safe low voltages (SELV) and mains voltages is not allowed.

##### Voltage source (optional)

Output: 24 VDC, 30 mA, short-circuit proof

## POWER SUPPLY

### Supply voltage

AC 110...240 V +10%-15%; 48...63 Hz  
AC/DC 20...53 V; 0/48...63 Hz

### Supply voltage effect

<0,1% of max. measuring range

### Power consumption

approx. 25 VA

## ENVIRONMENTAL CONDITIONS

### Operating temperature

0 ... 45 °C

### Temperature effect

0,03 % / K

### Storage temperature

-20 ... +60 °C

### Relative humidity

≤75%, no condensation

## CONFORMITY TESTS

### CE marking

The unit meets the relevant European Standards.

### Electrical safety

According to DIN EN 61 010, Part 1 (March 1994)

Over-voltage category II  
Contamination degree 2

### Electromagnetic compatibility

Meets EN 61 326 class A industrie.  
NAMUR recommendation NE21.

## GENERAL

### Housing

Panel-mounting to DIN 43 700.  
Material: galvanized sheet steel  
Front dimensions: 144 x 144 mm  
Depth behind panel: 214 mm  
Panel cut-out: 138<sup>+1,0</sup> x 138<sup>+1,0</sup> mm  
Panel thickness: 2...40 mm  
Fixing clamps to DIN 43 834.

### Protection mode

(to EN 60 529, Category 2)  
Front: IP 54, Rear: IP 20

### Data back-up

The internal clock is buffered for at least 10 years by means of a lithium battery. If the buffer capacitor is used, the data are retained for 2 weeks (ambient temperature 15...25 °C)

Configuration and measurement data are stored in a non-volatile Flash memory. In addition, measurement data are saved to a CompactFlash.

### Electrical connections

From the rear, via plug-in screw terminals for leads with max. 2,5 mm<sup>2</sup> (does not apply for RS 232 / RS 485 interfaces).

### Mounting position

user-defined, in consideration of the viewing angle of the screen horizontal +/-50°Vertical ±30° .

**Weight:** approx. 3,5 kg

### Accessories

- 1 operating instructions (English, German, French) with basic unit
- 2 fixing clamps
- 1 set of screw terminals (without 9-pin D-type connector) Only with optional RS 232/RS 485 interfaces:
- 1 operating instructions (English, German, French) with interface option.

## ORDERING DATA

Order-No:	KS3002-	x	x	x	-	x	x	x	x	-	x	x		
<b>Inputs</b>		↑	↑	↑		↑	↑	↑	↑		↑	↑		
3 analog inputs (U, I, TC, RTD) <sup>1)</sup>		3												
6 analog inputs (U, I, TC, RTD) <sup>1)</sup>		6												
<b>Supply voltage</b>														
AC 110...240V +10/-15%, 48...63 Hz				1										
AC/DC 20...30V, 0/48...63 Hz				2										
<b>Memory</b>														
Recorder with CF card drive for CF cards 32MBytes until 2 Gbytes but														
Without CompactFlash card (→ optional accessories)								9						
<b>Options</b>														
Without Ethernet port									0					
With Ethernet port and integrated webserver									1					
Without I/O and interface										0				
4 digital inputs, 3 output relays, voltage source 24VDC, RS 232/RS 485 interface											1			
Without mathematics												0		
With mathematics ( <sup>2)</sup> )												1		
Lithium battery for real-time clock													1	
Buffer capacitor for real-time clock													2	
<b>Housing</b>														
Door non lockable													0	
Door lockable													1	
Door non lockable + IP65 (not for portable housing)													2	
Housing for panel mounting														1
Portable housing with KS 3002														2

## OPTIONAL ACCESSORIES (to be ordered separately)

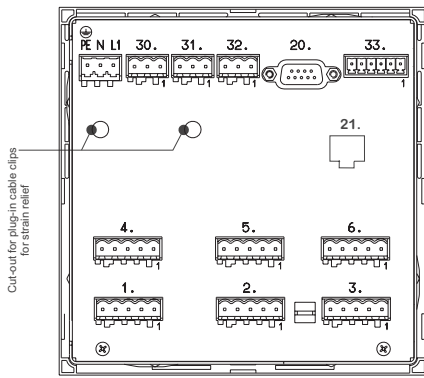
## Order no.

<b>PCA 3000 evaluation software</b> , CD-ROM (D,GB,F)	<b>9407-301-90201</b>
<b>PCCcommunication server</b> , CD-ROM (D,GB,F)	<b>9407-301-90211</b>
<b>Engineering Tool</b> , PC setup software, CD-ROM (D,GB,F)	<b>KS3002-90221</b>
<b>PC interface cable</b> with adapter for Engineering Tool RS232	<b>9407-301-90111</b>
<b>PC interface cable</b> with adapter for Engineering Tool with USB	<b>9407-301-90121</b>
<b>CompactFlash Card 64 MB</b>	<b>9407-301-90321</b>
<b>CompactFlash Card 128 MB</b>	<b>9407-301-90331</b>
<b>CompactFlash Card 256 MB</b>	<b>9407-301-90341</b>
<b>Counter, Mathematics</b> , Software-Module for retrofitting Data Monitor KS 3002	<b>KS3002-90301</b>
<b>Operating instructions for basic unit</b> English (XX=11) / German (XX=18)/French (XX=32)	<b>9499-040-799XX</b>
<b>Operating instructions for interfaces</b> English (XX=11) / German (XX=18)/French (XX=32)	<b>9499-040-768XX</b>

1) The basic configuration for all inputs is 4...20 mA, scaled 0...100%

2) The mathematics-logic function can only be configured with the engineering tool

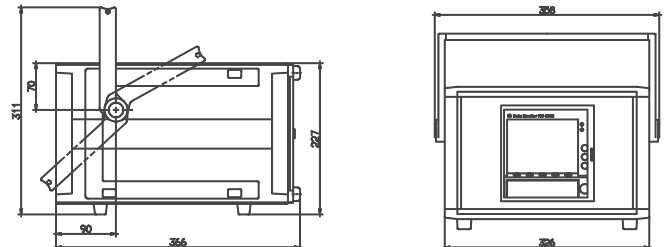
## Connecting diagram



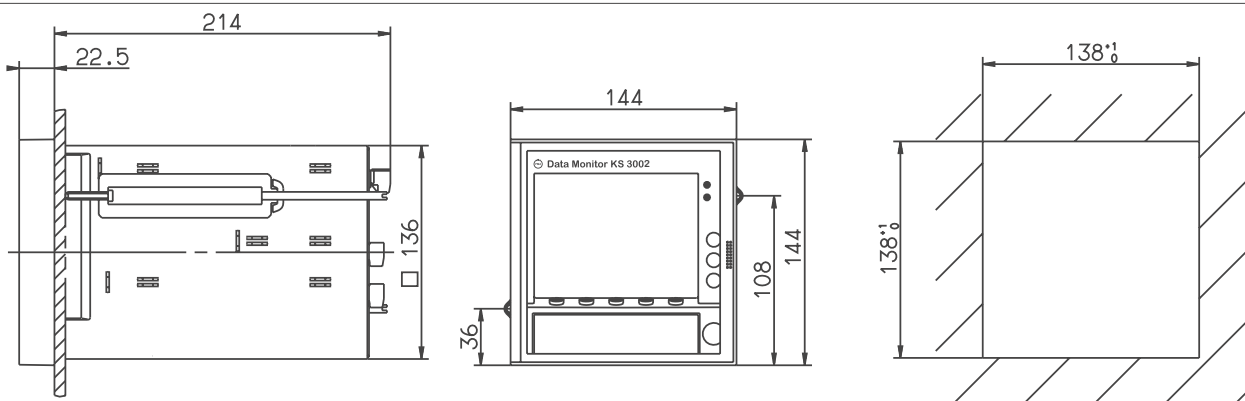
Input/output connections for 3/6 channels	Connector	Connecting symbol
<b>Analog Inputs</b>		
Voltage input $\leq 210$ mV	1. to 6.	
Voltage input $> 210$ mV	1. to 6.	
Current input	1. to 6.	
Thermocouples	1. to 6.	
Resistance thermometer in two-wire connection	1. to 6.	
Resistance thermometer in three-wire connection	1. to 6.	
Resistance thermometer in four-wire connection	1. to 6.	

Supply voltage		
Supply voltage	Connector PE N (L-) L1 (L+)	
Relay outputs (optional)		
Relay K1, K2, K3 change-over contacts	Connector 30., 31., 32.	
Interface (option)		
(selection of the active interface is done by configuration in the unit)		
RS 232 C 9pin. SUB-D	Connector 20.	2 RxD 3 TxD 5 GND 8 CTS Received Data Transmitted Data Ground
RS 485 9pin. SUB-D	Connector 20.	3 TxD+/RxD+ 5 GND 8 TxD-/RxD- Received/Transm. data Ground Receive/Transm. data
Ethernet (Option)(in prep)	Connector 21.	RJ 45
Digital inputs (optional)		
Supply voltage 24V / 30mA	Connector 33. 6 +24V Aux. supply 5 GND	
Digital inputs Voltage controlled LOW = DC -3...5V HIGH = DC 12...30V	4 digital input 1 3 digital input 2 2 digital input 3 1 digital input 4	Example: BE4, controlled by internal voltage supply
Setup interface		
The Setup interface is located on the front behind the lower cover.		

## Overall dimensions of portable housing



## Overall dimensions



### PMA

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### Your local representative