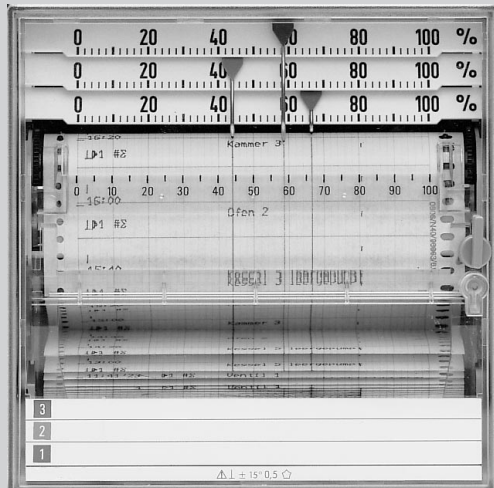




# Point recorder KS 3960 A KS 3960 B



Six galvanically isolated input channels

Measuring and recording range freely configurable

Maintenance-free recording system

Universal cassette for roll or Z-fold chart paper

6 limit values with free channel allocation

Optional:

– isolated 24 VDC output

– digital inputs & outputs

*Additionally with KS 3960 A:*

Alpha-numeric printing system for recording date, time, texts, and other information

## PROFILE

The KS 3960 is an industrial point recorder with microprocessor control and max. 6 channels. Its front dimensions are 144 x 144 mm. There are two basic versions:

### KS 3960 B

This is a low-cost recorder with two different input circuits:

- a) Standard  
For DC input (e.g. 0/4...20 mA or 0...10V signals).
- b) Universal  
Extended measurement value table for DC signals (mA, mV, V), thermocouples, resistance thermometers, and potentiometric transducers.

### KS 3960 A

This version offers the same functions and input circuits as the KS 3960 B, additionally fitted with:

- an alpha-numeric printing system for recording date, time, texts, event marking, measurement value table, etc.

Both basic versions are freely programmable without any accessory equipment. Alternatively, the recorders can be configured remotely from a PC which is connected via a front-panel interface socket. A suitable Engineering Tool is available as a software package.

With numerous functions and robust construction, the KS 3960 A/B point recorders are ideal for universal industrial applications.

## OPERATING PRINCIPLE

The input channels are polled by a wear-free semiconductor scanner which also provides galvanic isolation. The A/D converter works with high resolution, so that even small measuring spans can be processed accurately.

Non-linear input signals, e.g. from thermocouples and resistance thermometers, are corrected, so that display and recording are temperature-linear.

The microprocessor controls the stepping motors for chart drive and recording system. Digital technology eliminates wear-prone components such as DC motors, cord drives, and feedback potentiometers, making the recorders practically maintenance-free.

## CONSTRUCTION

The recorder is fitted in a sheet-steel housing for panel mounting. The front door gives protection type IP 54 (splash water).

The chassis is retained in the housing by means of a locking lever. After unlocking, the chassis can be drawn forwards, e.g. for convenient replacement of the printing head. For servicing, the chassis can be removed completely.

A ribbon cable with plug connects the recording chassis with the CPU. The power supply unit is fitted to the housing rear, thus ensuring good heat convection and minimum self-heating of the recorder.

A universal chart cassette enables roll or Z-fold charts to be used. For roll charts, a take-up spool is supplied as an accessory. The front edge of the chart is caught and wound up automatically.

## TECHNICAL DATA

### INPUT

#### Measurement inputs

No. of channels: 6, galvanically isolated via semiconductor switches.  
Max. voltage against protective earth: 24 VDC  
Excess voltage protection is provided by Varistors.

#### Measurement principle

A/D conversion according to the dual-slope method  
Resolution: 14 1/2 bits  
Channel scan time: 40 ms with 50 Hz

#### Permissible continuous overload

Max. 24V, max. 40 mA

#### Interference suppression

Common mode: 90 dB with 50 Hz  
Series mode: 60 dB with 50 Hz

#### Signal attenuation

1st-order low-pass filter adjustable  
0-1-3-10-30-100 s or with automatic matching to chart speed.

#### Reference conditions

Ambient temperature: 21...25 °C  
Relative humidity: 50...60 %  
Source resistance: < 1 kΩ  
Potential difference: < 1 V

### STANDARD INPUT (U / I)

#### Measurement cycle

Normal: 240 ms  
Fast: 150 ms

#### Input resistance

Direct voltage: 100 kΩ  
Direct current: 50 Ω

#### Measurement ranges

Separately configurable for each channel.

Span	Resolution	Max. error
<b>Direct voltage (DC U)</b>		
-1...+1V	0,1mV	1mV
0... 1V	0,1mV	1mV
0,2...1V	0,1mV	1mV
-10...+10V <sup>1)</sup>	1mV	11mV
0... 10V	1mV	11mV
2... 10V	1mV	11mV
<b>Direct current (DC I)</b>		
-20...+20mA	2μA	22μA
0... 20mA	2μA	22μA
4... 20mA	2μA	22μA

<sup>1)</sup> -20...+20V configurable

#### Recording range

Freely configurable within the selected input span, for example:  
Input span -20...+20 mA  
Recording range -2,5...+15,0 mA

### UNIVERSAL INPUT (U / I / TC / RTD / R)

#### Measurement cycle

Normal: 640 ms  
Fast: 400 ms

#### Input signals

##### Direct voltage (U)

For input signals ≤ 100mV:  
Input resistance > 10MΩ  
Source resistance < 10kΩ  
For input signals ≥ 1V:  
Input resistance 100kΩ

##### Direct current (I)

Input resistance 50Ω

##### Thermocouples (TC)

Input resistance > 10MΩ  
Internal or external cold-junction compensation configurable.  
Error of internal CJC: approx. 0,5 K

#### Measurement ranges

Separately configurable for each channel.

Input signal	Span	Resolution	Max. error
<b>Direct voltage (DC U)</b>			
- 40... 40mV		4μV	36μV
- 100... 100mV		10μV	80μV
- 400... 400mV		40μV	320μV
-1000... 1000mV		100μV	800μV
- 1... +1V		0,1mV	1mV
0... 1V		0,1mV	1mV
0,2... 1V		0,1mV	1mV
- 10... +10V <sup>1)</sup>		1mV	11mV
0... 10V		1mV	11mV
2... 10V		1mV	11mV
<b>Direct current (DC I)</b>			
- 20... +20mA		2μA	22μA
0... 20mA		2μA	22μA
4... 20mA		2μA	22μA
<b>Thermocouples (TC) to DIN IEC 348<sup>2)</sup></b>			
Type J Fe-CuNi	(-210) -100...1200°C	0,2K	1,3K
Type K NiCr-Ni	(-270) -100...1370°C	0,3K	1,6K
Type R Pt13Rh-Pt	(- 50) 100...1760°C	0,5K	1,8K
Type T Cu-CuNi	(-270) -100... 400°C	0,2K	0,9K
Type S Pt10Rh-Pt	(- 50) 100...1760°C	0,5K	1,8K
Type N NiCrSi-NiSi	(-200) -100...1300°C	0,4K	1,7K
Type E NiCr-CuNi	(-270) -100...1000°C	0,2K	1,1K
Type B Pt30Rh-Pt6Rh	( 100) 600...1820°C	0,6K	2,0K
<b>Thermocouples (TC) to DIN 43 710<sup>2)</sup></b>			
Type L FeCu-Ni	(-200) -100... 900°C	0,2K	1,1K
Type U CuCu-Ni	(-200) -100... 560°C	0,2K	1,0K
<b>Resistance thermometer (RTD)</b>			
Pt100 DIN IEC 751	-200... 850°C	0,05K	0,9K
Ni100 DIN 43710	- 60... 180°C	0,05K	0,4K
<b>Potentiometric transducer (R)</b>			
0... 300Ω		0,03Ω	0,4Ω
0...1000Ω		0,1Ω	1,2Ω

<sup>1)</sup> -20...+20V configurable

<sup>2)</sup> Slightly higher errors apply for the ranges in brackets.

Reference temperature of external CJC: configurable for 0, 20, 50, or 70 °C via reference channel.

Action on sensor break: configurable for < 0 or > 100% of recording range

#### Resistance thermometer (RTD) and potentiometric transducer (R)

Connection with 3 or 2 leads configurable.  
With 2-lead connection, lead resistance must be adjusted to 10Ω.

#### Recording range

Freely configurable within the selected input span, for example:  
Pt 100, input span -200...850 °C  
Recording range -50...80 °C

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## DISPLAY AND RECORDING

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### Display and recording range

Freely configurable within the selected input span by means of „Value left“ and „Value right“, for example:

Input span Pt 100 -200...850 °C

Recording range -50...180 °C

### Recording mode

- Dots or connected dots configurable, with dot spacing selectable for 3, 6, 12, 24, 48 seconds, or matched automatically to the chart speed.
- 2 event channels for recording ON/OFF signals, triggered by an alarm or an external signal.

### Scale

Max. 4 scale graduations 0...100% or to specification (see Ordering Data, Options).

Length: 100 mm

### Drive for recording system

Program-controlled stepping motor.

Resolution: 0,125 mm

Slewing speed: max. 125 mm/s

Recording width: 100 mm

### Mechanical recording error

≤ 0,3% of recording width

### Printing head

Replaceable, with 6 felt tips.

Automatic head lift when recording stops.

Colours: violet, red, black, green, blue, brown

Trace length: appr. 1800 m per colour

Head life: approx. 6 months

Storage life: approx. 2 years

### Chart drive

Program-controlled stepping motor.

Step length: 0,02 mm

Chart speed: 0-1-1,25-2,5-5-10-20-

60- 120 mm/h, configurable

### Chart paper

Universal cassette for Z-fold or roll charts to DIN 16 230

Chart width: 120 mm

Recording width: 100 mm

### Z-fold charts

Length 16m, fold depth 40 mm, visible chart 30...80 mm

### Roll charts

Length 31 m, visible chart 70...80 mm, automatic chart take-up

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## ONLY WITH VERSION KS 3960 A

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### Alpha-numeric printing system

With printing head, colour violet.

Character height: approx. 2,2 mm

The following are printed:

- Date, time, chart speed.
- One recorder text (max. 20 characs.)
- Six event texts (max. 16 characters per text). Printing is cyclical or triggered by an alarm or external signal.
- Measurement value table, cyclical every 1, 2, 3, 4 or 12 hours, or triggered by an alarm or an external signal.
- Alarm marks along the recorded trace.
- Channel no.
- Configuration data.
- Scale graduation every 20 mm, divisions configurable from 1/1 to 1/7.

### Real-time clock

For printing of date/time in 12 or 24-hour mode, summer/winter time switch-over.

Clock is buffered with built-in CR2032 lithium battery, useful life > 3 years with recorder switched off.

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## OPERATION

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By means of built-in keys and display elements.

### Operating level

Start/Stop of recorder

Fast chart speed

### Programming level

Measurement and recording ranges

Alarm settings

Chart speed

and other functions.

### Testing level

Test functions

Service functions

Program blocking

and other functions.

### PC interface

For remote configuration and polling of measurement values via a PC.

The interface socket is accessible from the front. The necessary adapter cable and Engineering Tool software must be ordered separately, see „Accessories“.

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## ALARMS

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6 limit values, configurable for MIN or MAX operation, free allocation to the recording channels.

Switching hysteresis of alarm output: 2 % of recording range

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## OPTIONS

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### Digital inputs/outputs

Control inputs:

Quantity: 4 (DI1...DI4), passive, galvanically isolated via opto-coupler.

Switching levels:

Low: -3...+5 V

High: +8...+30 V

Input resistance: > 5 kΩ

Signal duration: > 0,5 seconds

Max. 4 of the following functions can be selected and allocated to the inputs:

Chart-speed switch-over A/B

Start/Stop of recording

1...6 event texts, 1 recorder text

2 event channels, measurement value table

Fast/slow recording

Chart feed 10 to 100 mm

Summer time, and other functions.

### Alarm outputs

6 output relays with potential-free switch-over contacts.

Contact rating: max. 50 V, 1 A, 30 W or 60 VA

### Voltage output

24 VDC, ± 15%, max. 75 mA, short-circuit proof, galvanically isolated, max. capacitive load 33 μF.

Used e.g. for:

Two-wire transmitter supply or for energizing the control inputs.

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## POWER SUPPLY

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### AC voltage

230V, 115V or 24V, 47...64 Hz

Tolerance range: -20...+15%

Power consumption: approx. 20 VA

### DC voltage

24 VDC, -20...+15%, approx. 13 W

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## ENVIRONMENTAL CONDITIONS

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### Permissible temperatures

For operation: 0...50 °C

For storage: -25...70 °C

### Climatic category

KWF to DIN 40 040

Relative humidity ≤ 75% yearly average, no condensation

### Vibration test

To IEC 68-2-6

### Mounting position

Front vertical with max. ± 15° inclination to DIN 16 257.

## CONFORMITY TESTS

The instrument has CE-marking.

### Electrical safety

Meets EN 61 010-1.  
Excess voltage category II  
Contamination degree 2  
Protective class I (protective earth connection) to VDE 0411, Part 1

### Electromagnetic compatibility

Complies with EN 50 081-1 and EN50 082-2.  
Meets NAMUR recommendation NE 21.

## GENERAL

### Housing

For mounting in a panel cut-out.  
Material: sheet steel, grey finish  
Transparent plastic door with catch.  
For dimensions, see Fig. 1  
Mounting to DIN 43 834-A-230.

### Protection mode

According to IEC 529 (EN 60 529)  
Front with door: IP 54  
Terminals: IP 20

### Electrical connections

#### Signal inputs:

Screw terminals for max. 2,5 mm<sup>2</sup> solid or 1,5 mm<sup>2</sup> flexible with sleeve

#### Digital inputs and outputs:

Via 25-pin D-type connector socket (plug is provided with recorder)

#### 230/115 VAC supply:

Appliance connector to IEC 320 (plug is provided with recorder)

#### 24V AC/DC supply:

Screw terminals

### Weight

approx. 4 kg  
(5,5 kg packed weight)

### Packaging dimensions

Overall: 490 x 290 x 290 mm

### Statistical article code

HS-Code 90308390

### Accessories

- 2 Fixing clamps
- 1 Z-fold chart
- 1 Printing head
- 1 Chart-reading rule per graduation
- 1 Mains connector with 230/115 VAC supply
- 2 Fuses
- 1 Take-up spool for roll charts
- 1 Installation instruction (GB, D, F, E, I)
- 1 Manual „Operation, quick reference“ 1 x GB, 1 x D, 1 x F
- 1 Manual „Parameter setting, quick reference“ (1 x GB, 1 x D, 1 x F)

Fig. 1 Overall dimensions (in mm)

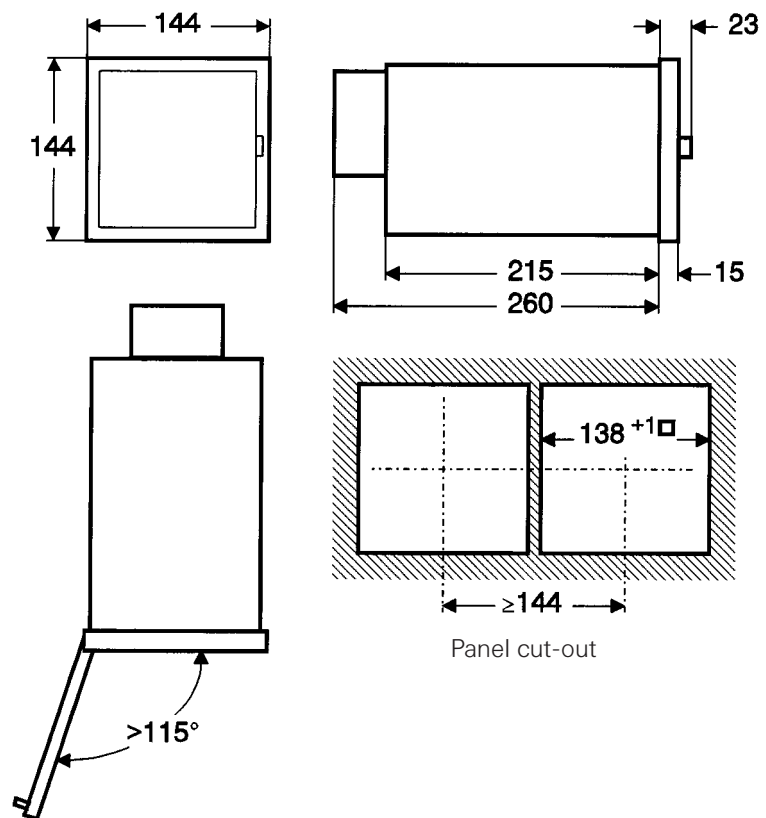
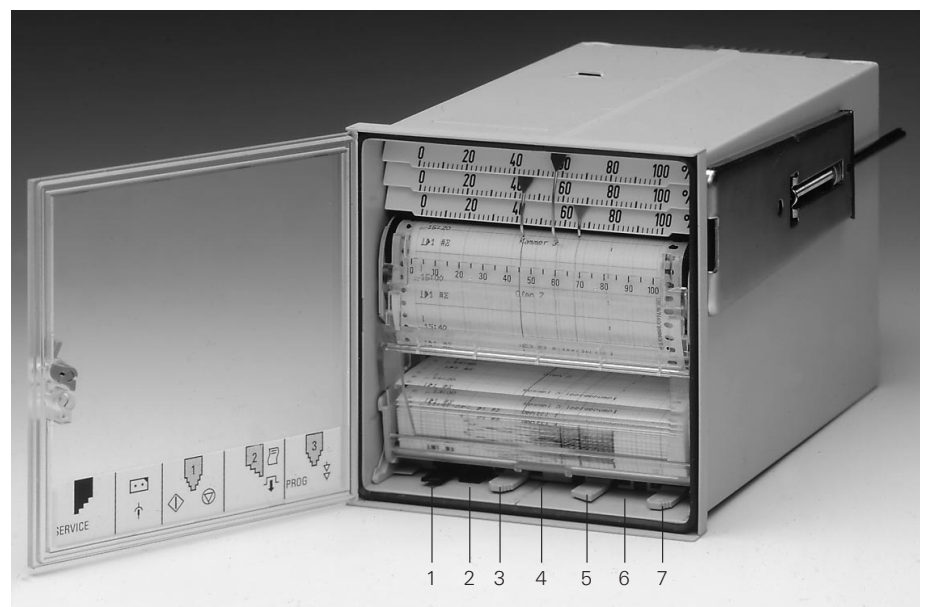


Fig. 2 Operating controls KS 3930 A/B and KS 3960 A/B



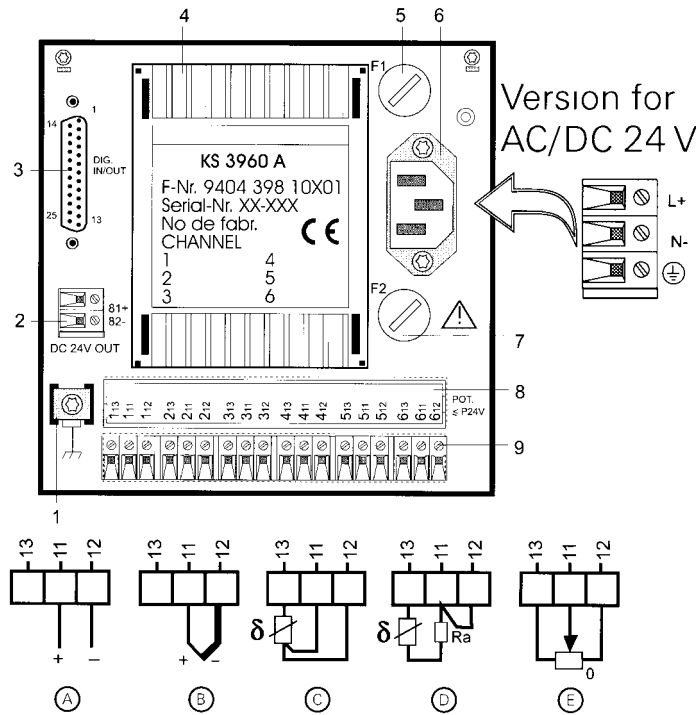
- 1 Chassis locking lever
- 2 PC interface connector socket
- 3 Recording start/stop
- 4 Red LED (programming status)
- 5 Catch for chart cassette
- 6 Green LED (power on)
- 7 Fast chart speed/program ON

Fig. 3 Electrical connections

Pin allocation for digital inputs/outputs (Pos. 3)

Pin	Alarm outputs
14	DO1 NO contact
2	Common
15	NC contact
3	DO2 NO contact
16	Common
4	NC contact
17	DO3 NO contact
5	Common
18	NC contact
6	DO4 NO contact
19	Common
7	NC contact
20	DO5 NO contact
8	Common
21	NC contact
9	DO6 NO contact
22	Common
10	NC contact

Pin	Control inputs
24	DI1
12	DI2
25	DI3
13	DI4
11	OV ref. potential



- 1) Earth terminal
- 2) Output 24 VDC (option)
- 3) Digital inputs/outputs (option)
- 4) Transformer with type label
- 5) Fuse F1
- 6) Power socket 230/115 VAC
- 7) Fuse F2
- 8) Window with channel identification for adjusting the input ranges
- 9) Input terminals for channels 1...6

- A Voltage/current
- B Thermocouples
- C Resistance thermometer in 3-wire connection
- D Resistance thermometer in 2-wire connection
- E Potentiometer

**ORDERING DATA**

The basic setting for all channels is: Input range 4... 20 mA, scale 0... 100%. Different settings must be specified as options.

**KS 3960 A with alpha-numeric printing system**

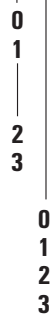
Standard input circuit (U/I)  
Universal input circuit (U/I / TC / RTD / R)

**KS 3960 B without alpha-numeric printing system**

Standard input circuit (U/I)  
Universal input circuit (U/I / TC / RTD / R)

Supply voltage	AC 230V
	AC 115V
	AC 24V
	DC 24V

Order no. 9404 398 . 0 . 01



**Ordering example:**

Pos.	Qty	Description
1.0	1	KS 3960 A 6-channel point recorder Mains supply 230 VAC Order no. 9404 398 10001
1.1	1	Option S1, fitted in Pos. 1.0 range and scale to specification: Chan. 1: 4...20mA, scale 0...100% Chan. 2: 4...20mA, scale 0...16 bar Chan. 3: Pt 100, scale -5...50 °C Chan. 4: TC type K, scale 0...800°C Chan. 5: 4...20 mA, scale 0...100% Chan. 6: 0...10V, scale 0...100% Order no. 9404 398 00011
1.2	1	Option Q1, fitted in Pos. 1.0 Built-in 24 VDC voltage source Order no. 9404 398 00041

**OPTIONS**

Must be ordered as separate items, will be fitted in recorder

Description	Order no.
<b>Recorder features, different from the basic version</b>	
Measuring range and scale to specification per recorder <sup>1)</sup>	Type S1 <b>9404 398 00011</b>
Non-reflecting door with lock	Type T1 <b>9404 398 00021</b>
Digital inputs/outputs	Type D1 <b>9404 398 00031</b>
24 VDC voltage source	Type Q1 <b>9404 398 00041</b>

<sup>1)</sup> Please specify range and scale for each channel, max. 4 scale graduation possible.

## CONSUMABLES

Description	Order no.
<b>Printing head</b>	<b>4012 027 45522</b>
<b>Z-fold chart</b> <sup>1)</sup>	
with 0...100 linear graduation	
no time marks	<b>4012 027 45517</b>
with time marks for chart speed	
10 mm/h	<b>4012 142 91451</b>
20 mm/h	<b>4012 142 91461</b>
60 mm/h	<b>4012 142 91471</b>
blank chart	<b>4012 027 45538</b>
<b>Roll chart</b> <sup>1)</sup>	
with 0...100 linear graduation	
no time marks	<b>4012 027 45516</b>
with time marks for chart speed	
10 mm/h	<b>4012 027 45523</b>
20 mm/h	<b>4012 027 45524</b>
60 mm/h	<b>4012 027 45525</b>
blank chart	<b>4012 027 45539</b>

<sup>1)</sup> For the recorder KS 3960 A we recommend the chart without time marks, because the alpha-numeric printing system records the time regularly. Similarly, graduation lines can be printed, so that blank charts can also be used as an alternative.

## ACCESSORIES

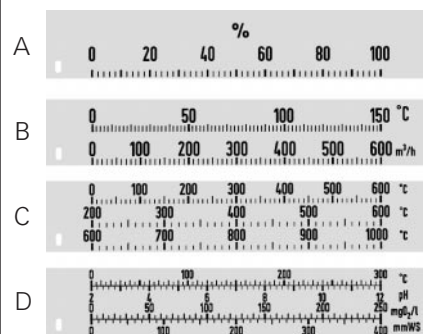
Description	Order no.
<b>Certificate</b> with calibration protocol (first calibration)	<b>9404 397 00201</b>
<b>Engineering Tool</b> (English, German)	<b>9404 397 00111</b>
<b>Adapter cable</b> for PC interface	<b>4012 027 45542</b>
<b>Recorder manual</b>	
English	<b>9499 040 44711</b>
German	<b>9499 040 44718</b>
French	<b>9499 040 44732</b>

## PARTS FOR RETRO-FITTING

for subsequent changes to a recorder

Description	Order no.
<b>Scale strip</b>	
blank	<b>4012 027 45528</b>
with one graduation to specification	<b>4012 027 45529</b>
with two graduations to specification	<b>4012 027 45531</b>
with three graduations to specification	<b>4012 027 45532</b>
with four graduations to specification	<b>4012 027 45533</b>
<b>Chart-reading rule</b> with one graduation to specification	<b>4012 027 45535</b>
<b>Digital inputs/outputs</b> , mounting kit with instructions	<b>4012 027 45543</b>
<b>Voltage source 24 VDC</b> , mounting kit with instructions	<b>4012 027 45544</b>

### Scale versions:



A scale plate with one, two, three or four scale graduations is required per recorder. (A, B, C, D). Scale sequence from 1 at bottom to 4 at top according to sequence of order codes 1 to 4.

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