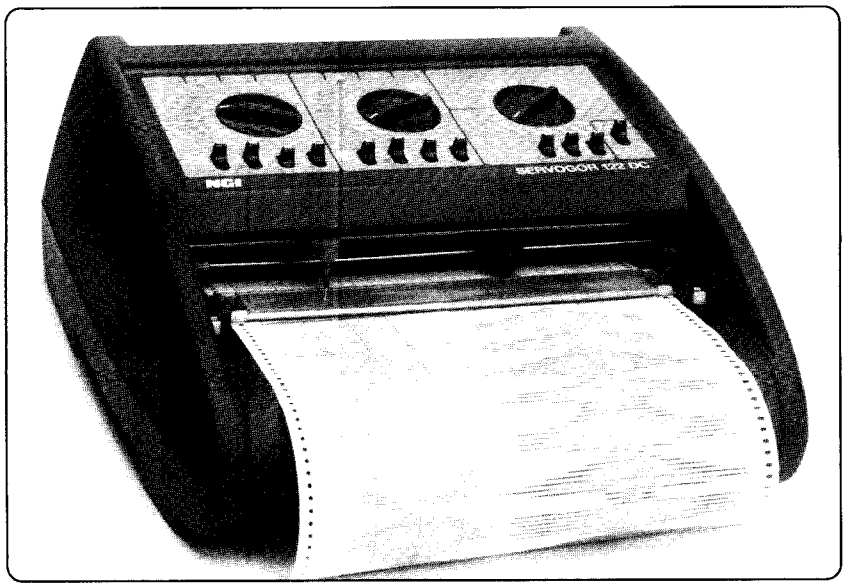
FLATBED RECORDER
SERVOGOR 122 AC
SERVOGOR 122 DC

Operating Instructions



RS 196-9089 = SE122DC SINGLE CHANNEL
RS 196-9102 = SE122DC DUAL CHANNEL
RS 196-9118 = SE122AC SINGLE CHANNEL
RS 196-9124 = SE122AC DUAL CHANNEL

NGI
NORMA GOERZ INSTRUMENTS

Order Reference — Order No.

SERVOGOR 122 AC - 1 channel instrument	A 2510 31000 00
SERVOGOR 122 AC - 2 channel instrument	A 2510 32000 00
SERVOGOR 122 DC - 1 channel instrument	A 2510 21000 00
SERVOGOR 122 DC - 2 channel instrument	A 2510 22000 00

Supplied Accessories

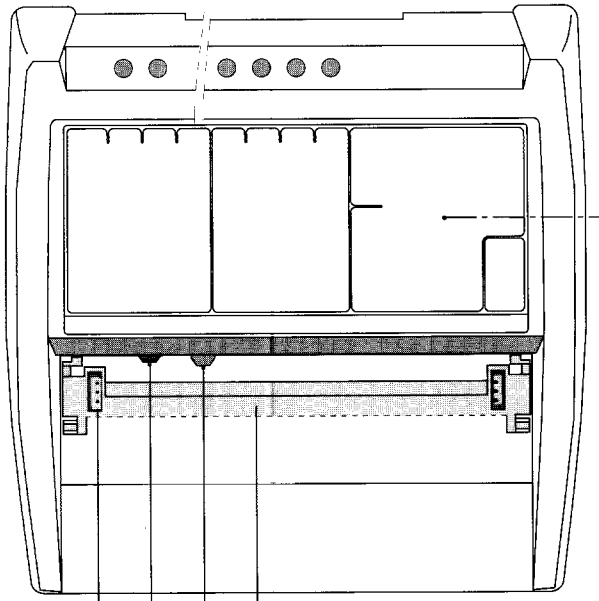
1 Mains adapter country specific (one of the following)	
230 V/CEE-7 VII/SEV 1011	
(Europa (except U.K.) and all not seperately stated countries	A 6403 92002 03
120 V/NEMA 5-15 P	
USA, Canada, Japan, Mexiko, Taiwan, Latin America	A 6403 92001 03
240 V/BS 1363 A	
U.K., Commonwealth, (except Canada, Australia, New Zealand)	A 6403 94001 03
240 V/AS C 112	
Australia, New Zealand	A 6403 94002 03
1 Chart paper; 200mm wide, numbered 0 to 100	195 2710 00
1 disposable red felt-pen for 1 channel instrument or for channel 1 of the 2 channel instrument	195 5360 74
1 disposable blue felt-pen for channel 2 of the 2 channel instrument	195 5360 75
1 Operating instructions country specific (one of the following)	
German	A 2510 11 GA 1D
English	A 2510 11 GA 1E
French	A 2510 11 GA 1F
1 Cartboard box	Z 2510 29101 00
1 Moulded PE inlays for cartboard box	Z 2510 29201 00
1 Transport case (optional)	A 2510 99002 00
1 Paper take-up unit (optional)	A 2510 00010 00

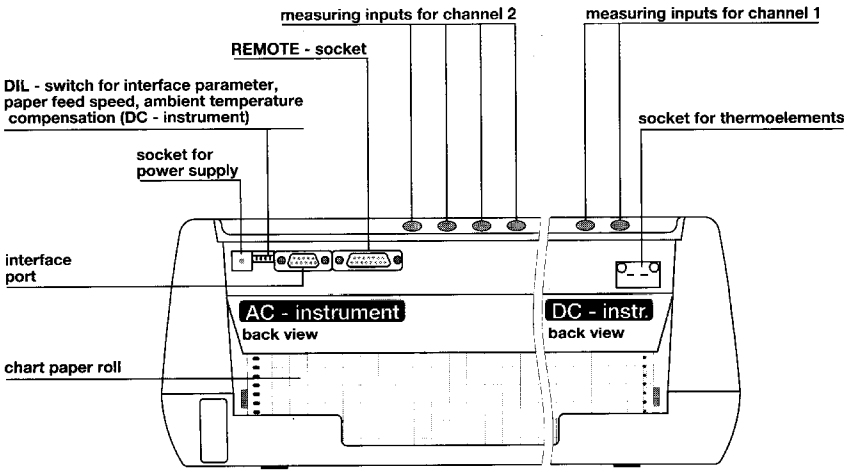
Accessories

Refillable red ink pen set for 1 channel instrument or for channel 1 of the 2 channel instrument	195 7070 00
Refillable blue ink pen set for channel 2 of the 2 channel instrument	195 7070 74
Chart paper	
Chart paper; 200mm wide, numbered 0 to 30	A 6212 93080 03
Chart paper; 210mm wide, numbered 0 to 100	195 2710 74
Chart paper; 210mm wide, numbered 0 to 30	A 6212 93090 03
Shunt resistors	
1 to 10 A / 100 mV	999 2015 00
2 to 20 A / 200 mV	A 6802 00501
10 to 20 mA	999 2016 00
Measuring cable / interface cable	
Safety measuring cable set with test probe (PVC)	A 6003 14204
Safety measuring cable set with test probe (silicon)	A 6003 14205
measuring cable set banana plug/ safety plug incl. alligator clip	A 6045 10211
Serial interface cable (RS232) 1.5 m long 9pin / 9pin .	A 6417 20022
Serial interface cable (RS232) 1.5 m long 9pin . / 25pin	A 6417 20023
Adapter cable for 12 V DC power supply	(on request)
Application software for SE 122 (one of the following)	
German	A 2510 80100 01
English	A 2510 80100 02
French	A 2510 80100 03

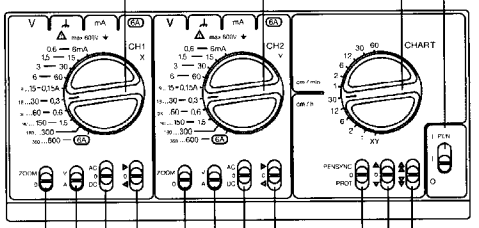
In the operating instruction the instruments are referred to the following types:
SERVOGOR 122 AC as **AC - Instrument**
SERVOGOR 122 DC as **DC - Instrument**

Thank you for buying an NGI product.
For safety reasons and optimum use of this instrument
read through the operating instructions very carefully.



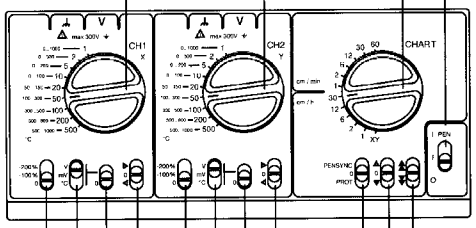


AC - 2 channel instruments

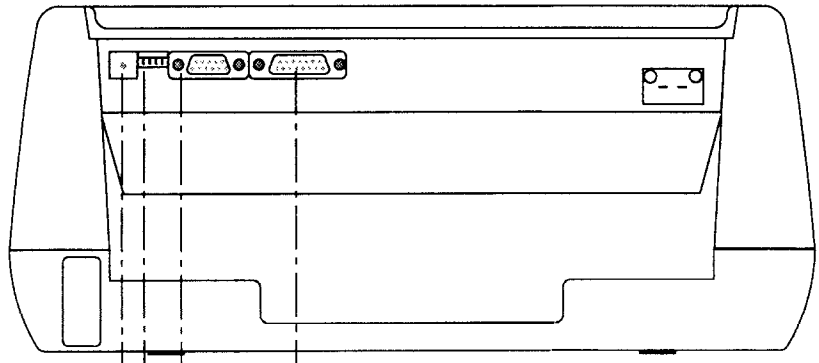


selector for the measuring ranges of channel 2
selector for chart paper feed speed
selector for the measuring ranges of channel 1
main switch for power supply and lowering of the recording pens
progressive paper positioning
ZOOM - function for channel 1
chart paper transport ON/OFF
selection of measuring quantity of channel 1
PENSYNC; electronic compensation of the mechanical recording pen offset and protocol printout
AC/DC input selector or selector for zero point display 1
zero setting for the measured value recording 2
zero setting for the measured value recording 1
AC/DC input selector or selector for zero point display 2
selection of measuring quantity of channel 2
ZOOM - function for channel 2

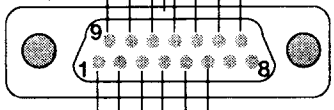
DC - 2 channel instruments



selector for the measuring ranges of channel 2
selector for chart paper feed speed
selector for the measuring ranges of channel 1
main switch for power supply and lowering of the recording pens
progressive paper positioning
zero suppression for channel 1
chart paper transport ON/OFF
selection of measuring quantity of channel 1
PENSYNC; electronic compensation of the mechanical recording pen offset and protocol printout
selector for signal display or zero point display for channel 1
zero setting for the measured value recording 2
zero setting for the measured value recording 1
selector for signal display or zero point display f. channel 2
selection of measuring quantity of channel 2
zero suppression for channel 2

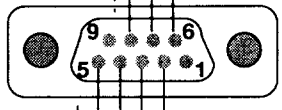


lowering the recording pens
switch to 2 nd paper feed speed
stop paper feed
reverse direction of paper feed
paper transport by external pulses
switch internal paper transport to external pulses
ground



MAX - alarm output channel 2
MIN - alarm output channel 2
MAX - alarm output channel 1
MIN - alarm output channel 1
event recording (eventmarker) channel 2
event recording (eventmarker) channel 1

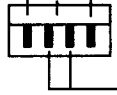
Clear to Send (CTS)
Request to Send (RTS)
Data Set Ready (DSR)



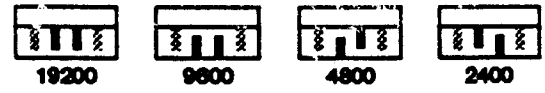
Received Data (RXD)
Transmitted Data (TXD)
Data Terminal Ready (DTR)
Signal Ground

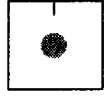
additional 11 paper feed speeds
DIL switch in the upper position

ambiente temperature compensation for temperature measurement
"ON" DIL switch in the upper position



baud rate - settings for interface





power supply 12 V DC / 0,5 A

Programming the second paper feed speed

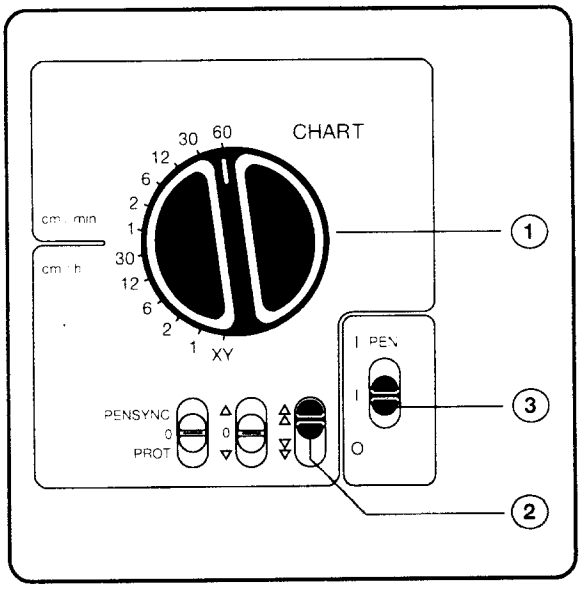
(1) Turn rotary selector to 60 cm/min

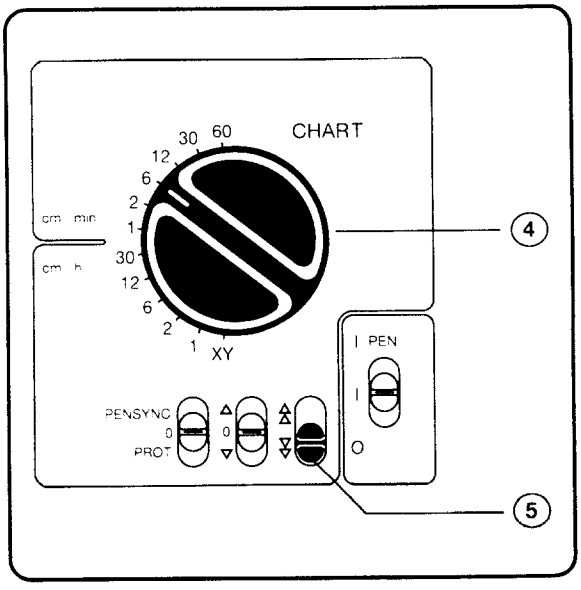
(2) Move shift switch to position rewind

(3) and switch the instrument on at the same time

(4) Turn rotary switch to the desired 2nd paper feed speed

(5) Move shift switch for a short moment to position forward





Programming limit values

(1) Turn rotary selector to 30 cm/min

(2) Move shift switch to position rewind

(3) and switch the instrument on at the same time

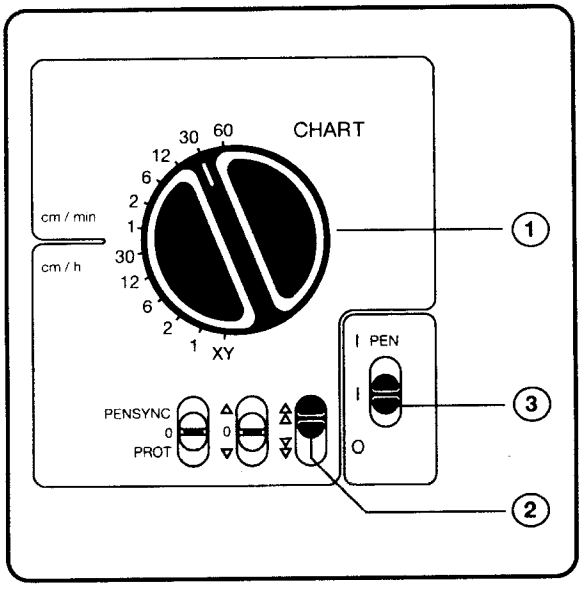
(4) Set shift switch to position "0" (channel 1 & 2)

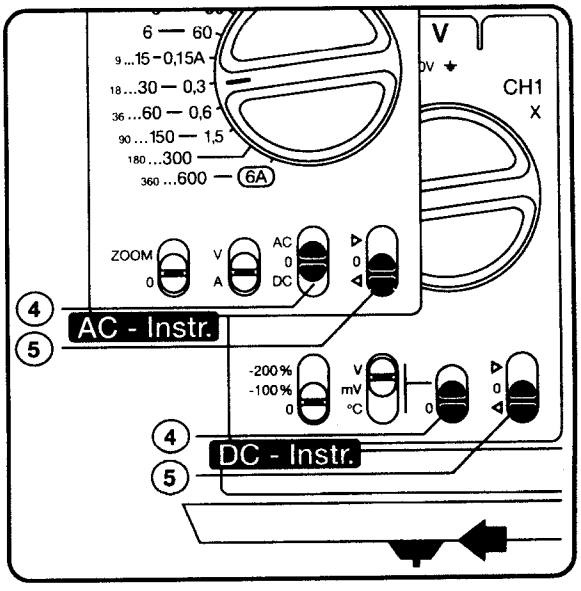
(5) Set zero point to MIN-limit value (channel 1 & 2)

(2) Move shift switch for a short moment to position forward

(5) Set zero point to MAX-limit value (channel 1 & 2)

(2) Move shift switch for a short moment to position forward





interface Commands

Command	Parameter	Function
A	<YY>,<MM>,<DD>,<hh>,<mm>,<ss><ez>	set date/time
B	<YY>,<MM>,<DD>,<hh>,<mm><te>	query date/time
D	none	move rec. paper one step backwards
E	<ThCH1>,<ThCH2>,<CJ><te>	query configuration for temperature measurement
F	<xxx><te>	query error code
G	<d><ez> d=0... OFF d=1... ON	switch servo on/off
H	none	lift rec. pens from chart paper
I	none	lower rec. pens to chart paper
J	none	page feed in the XY-operation mode
L	<WertCH1><se><WertCH2><tx>	updating of measuring data
O	<WertCH1><te> <WertCH1>,<WertCH2><te>	output of measuring data
P	<d><ez> d=0... OFF d=1... ACTIVE	switch to 2nd feed speed
Q	<SP><ez>	enter 2nd feed speed
R0<ez>	<SP>,<PP>,<VV>,<WW>,<DL><te>	query switch position from time unit
R1<ez>	<BER>,<NZ>,<MA>,<REC>,<NL><te>	query switch positions of channel 1
R3<ez>	<CH1min>,<CH1max><te>	query Min-Max-limit values of channel 1
R4<ez>	<CH2min>,<CH2max><te>	query Min-Max-limit values of channel 2
R5<ez>	<SP2>,<SP2akt><te>	query 2nd feed speed
S	<d><ez> Parameter d=0... OFF d=1... ON	measuring data jabber ON/OFF
T	"<AsciiString>"<ez>	print text line
U	none	move rec. paper one step forward
V	<Ident>,<KZ>,<VS>,<VH>,<YY>, <MM>,<DD><te>	query identstring
W	<d><ez> d=0... active d=1... STOP	stop chart paper feed
X	CH1min,CH1max<ez>	set Min-Max-limit values of channel 1
Y	CH2min,CH2max<ez>	set Min-Max-limit values of channel 2
Z	<d><ez> d=0... LF d=1... CR	switch over Output-Block-Terminator
ZZ<ez>	none	hardware reset

Symbol	Significance	Charact.
<...>	the symbols of input and output parameters are put between angle brackets.	
<ez>	command end character	;
<se>	output separator (string-terminator) is used as a seperator between the parameters.	,
<te>	output-terminator (record terminator)	<ETB>
<tx>	output-block-terminator	<LF>

<ETB>... 23decimal <CR>... 13decimal <LF>... 10decimal

interface Commands

Command	Parameter	Function
A	<YY>,<MM>,<DD>,<hh>,<mm>,<ss><ez>	set date/time
B	<YY>,<MM>,<DD>,<hh>,<mm><te>	query date/time
D	none	move rec. paper one step backwards
E	<ThCH1>,<ThCH2>,<CJ><te>	query configuration for temperature measurement
F	<xxx><te>	query error code
G	<d><ez> d=0... OFF d=1... ON	switch servo on/off
H	none	lift rec. pens from chart paper
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P	<d><ez> d=0... OFF d=1... ACTIVE	switch to 2nd feed speed
Q	<SP><ez>	enter 2nd feed speed
R0<ez>	<SP>,<PP>,<VV>,<WW>,<DL><te>	query switch position from time unit
R1<ez>	<BER>,<NZ>,<MA>,<REC>,<NL><te>	query switch positions of channel 1
R3<ez>	<CH1min>,<CH1max><te>	query Min-Max-limit values of channel 1
R4<ez>	<CH2min>,<CH2max><te>	query Min-Max-limit values of channel 2
R5<ez>	<SP2>,<SP2akt><te>	query 2nd feed speed
S	<d><ez> Parameter d=0... OFF d=1... ON	measuring data jabber ON/OFF
T	"<AsciiString>"<ez>	print text line
U	none	move rec. paper one step forward
V	<Ident>,<KZ>,<VS>,<VH>,<YY>, <MM>,<DD><te>	query identstring
W	<d><ez> d=0... active d=1... STOP	stop chart paper feed
X	CH1min,CH1max<ez>	set Min-Max-limit values of channel 1
Y	CH2min,CH2max<ez>	set Min-Max-limit values of channel 2
Z	<d><ez> d=0... LF d=1... CR	switch over Output-Block-Terminator
ZZ<ez>	none	hardware reset

Symbol	Significance	Charact.
<...>	the symbols of input and output parameters are put between angle brackets.	
<ez>	command end character	;
<se>	output separator (string-terminator) is used as a seperator between the parameters.	,
<te>	output-terminator (record terminator)	<ETB>
<tx>	output-block-terminator	<LF>

<ETB>... 23decimal <CR>... 13decimal <LF>... 10decimal

ATTENTION: printer's error!

page 18 **2.2 Test Voltages**
all Test Voltages 2,3 kV AC

page 22 Interference Voltage Rejection:
AC CMRR: ≥70 dB at 50 / 60 Hz

page 36 Warning notice: The **measuring voltage must not exceed 300 V towards earth.**

page 49 Warning notice: A **possible voltage** at the thermo element plug must not exceed **30 V_{eff} (42 V_{peak})** to earth.

page 125 **5.5 Programming example**
2nd line: **CD 0** instead of CD 2000

Table of Contents

Safety Regulations

This measuring device is only to be installed and operated by **qualified personnel** and according to the technical data in compliance with the safety precautions and regulations set forth below. Additionally, the use of this equipment requires compliance with all legal and safety regulations pertaining to each specific application. Similar regulations apply to the use of accessories.

Operating electrical devices implies that parts of the device carry dangerous voltages. Disregarding warning notices may lead to serious physical injury and material damage.

Fault-free and safe operation of this device requires suitable transport and storage, setting up and assembly as well as careful operation and maintenance.

If there is reason to believe that safe operation is no longer possible, the device has to be put out of operation immediately and must be protected against accidental restarting.

It can be assumed assumed that safe operation is no longer possible if the device

* shows visible damage,
* has been exposed to unfavourable conditions (e.g. storage beyond the permissable climatic limits without adaption to the ambient climate, dewing etc.) or to
* has been exposed to major strain during transport (e.g. been dropped from some height without visible external damage etc.).

No measurements must be performed on unprotected measuring circuits.

Qualified Personnel are persons familiar with the setting up, installation, starting off and operation of the device and possesses a formal qualification required for such activities, such as

* training, instruction or authorization to switch on and off, isolate, earth/ground or label electric circuits and instruments/systems according to the safety engeneering standards
* training or instruction in maintenance and use of adequate safety equipment according to the safety engeneering standards
* training in rendering first aid

Summary of Warning Notices

Upper Side of Instrument AC - Instrument

In all voltage ranges the applied measured voltage **must not exceed 600 V towards earth**.

Upper Side of Instrument DC - Instrument

In all voltage ranges (also in the yellow marked range **500 V**) the applied measured voltage **must not exceed 300 V towards earth**.

Bottom Side of Instrument

WARNING - TO AVOID ELECTRIC SHOCK
DISCONNECT POWER PLUG AND MEASURING TERMINALS BEFORE SERVICING.
INSTRUMENT TO BE SERVICED BY QUALIFIED PERSONNEL ONLY.

FOR CONTINUED PROTECTION AGAINST FIRE, REPLACE ONLY WITH FUSE OF THE SPECIFIED VOLTAGE AND CURRENT RATINGS.

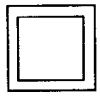
Rear Side of Instrument

POWER 12V ⎓ 0,5 A

Power Supply

12 V DC / 0.5 A (jack plug see chapter 2.5)

Mains Adapter



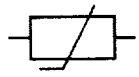
protective insulation as per DIN 40014 and IEC 117.

to be operated in closed rooms only !

υ 130 °C

encapsulated transformer;
company;
thermal protection+ 130 °C.

+ υ



short circuit proof PTC.

Notes on the Operating Instructions

These operating instructions have been written in compliance with DIN 43750.

This sign indicates that special attention has to be given to certain text passages.

* This sign always preceeds an enumeration.

• **After this sign a certain action is required.**

Short Description

This compact flat bed recorder has been manufactured and tested according to the latest technology complying with Ouality Assurance System **DIN ISO 9001**.

The compliance with the currently applicable **EMC** (electromagnetic compatibillity) is documented by the **CE** sign attached to the instrument.

Thanks to the **10 to 18 V DC voltage supply** this flatbed recorder can be used stationary or as a portable instrument.

AC - Instrument

The recorder **records AC and DC voltages up to 600 V and AC and DC currents up to 6A** in dependence on time, as well as all physical quantities that can be converted with measuring transducers.

DC - Instrument

The recorder **records DC voltages up to 300 V** in dependence on time, as well as all physical quantities that can be converted with measuring transducers

Additionally **temperatures can be displayed directly by means of a thermoelement.**

1 Installation

1.1 Unpacking

While unpacking check instrument for any damage that might have occurred during transport. In case of damage keep packing material till complaint has been settled.

For a possible later transport keep the packing material.

1.2 Checking Delivery

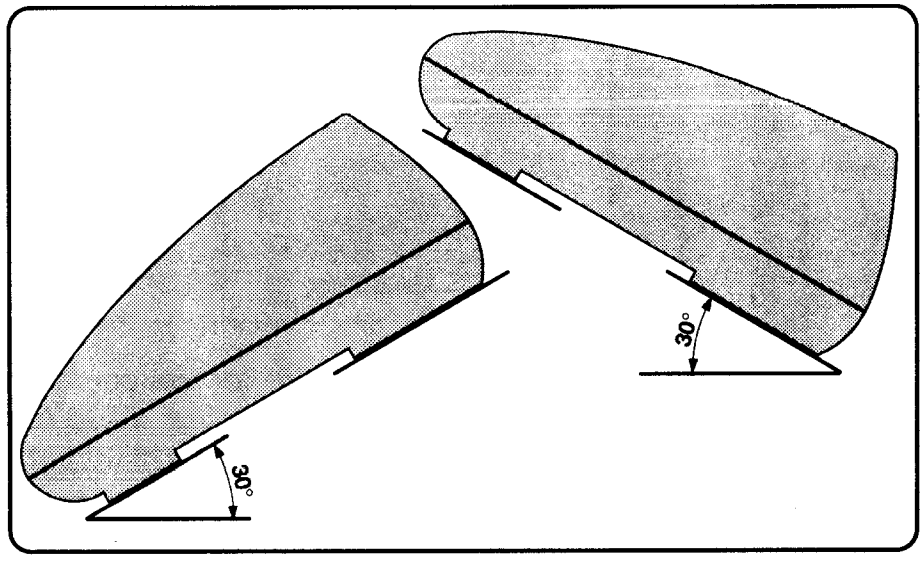
Check accessories for missing parts immediately after unpacking. A list of supplied accessories can be found on front inside cover.

1.3 Operating Conditions

The instrument should only be put into operation in places where the ambient conditions remain within the stated specifications (see chapter 2 "Technical Data").

1.4 Operating Position

Possible Operating Position +30° to -30° maximum



1.5 Power Supply

(Specifications for power supply see chapter 2.5)

To ensure fault-free operation of the instrument the **supply voltage range of 10V to 18V** has to be strictly observed

power input of the instruments:

AC - Device

One channel instrument	approx. **350 mA** / 12 V;
Two channel instrument	approx. **500 mA** / 12 V.

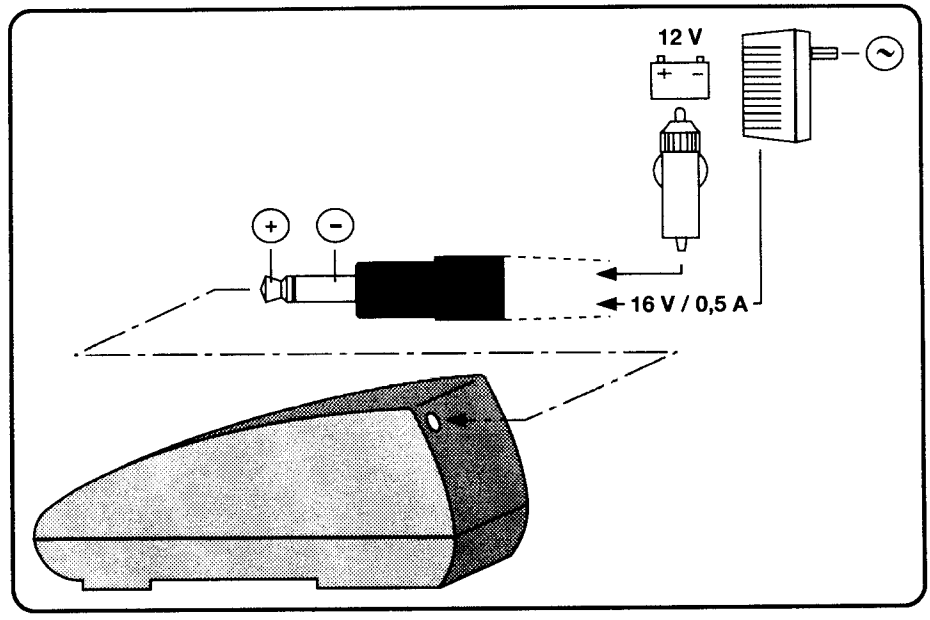
DC - Device

One channel instrument	approx. **350 mA** / 12 V;
Two channel instrument	approx. **500 mA** / 12 V.

Power supply on the connection socket for 3.5 mm Ø jack alternatively
- with country specific mains adaptor from the mains or
- with any batteries.

Always **connect the mains adaptor** to the **recorder first** and only **thereafter** to the **mains socket**.

Polarity and Position of Jack Plug



Note

The ordering reference for the country specific mains adaptor can be found on the inside of the front cover. The adapter cable for NiCad operation can be supplied upon request.

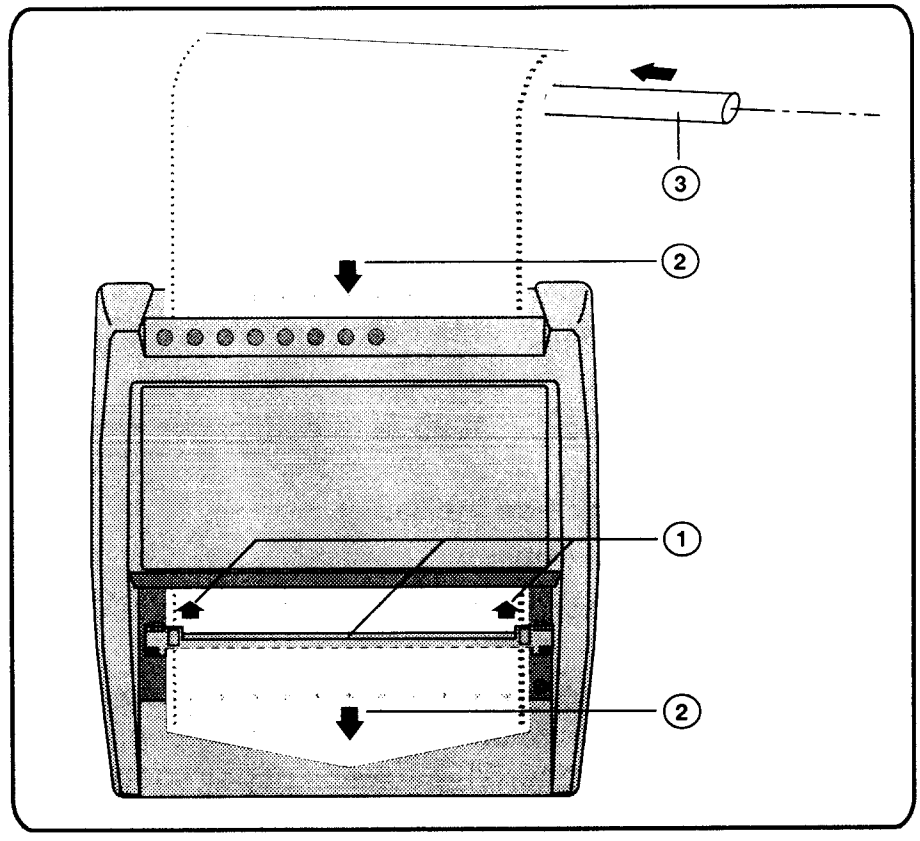
1.6 Insertion of Chart Paper

The ordering reference can be found on the inside of the front cover.

Technical specifications of the chart paper: see chapter 2 "Technical Data".

- **Open the paper guide lid** (1).
- **Insert the chart paper** (direction of arrow (2)) **into the instrument.**
  It has to be observed that paper is adjusted to the pin feed drum so that pins match the perforation.
- **Close the paper guide lid** (1).
- **Attach the chart take-up rod** (3) **to the chart paper.**
- **Click the take-up tube** (3) **into the snap lock mechanism at the rear side of the instrument.**

Insertion of Chart Paper



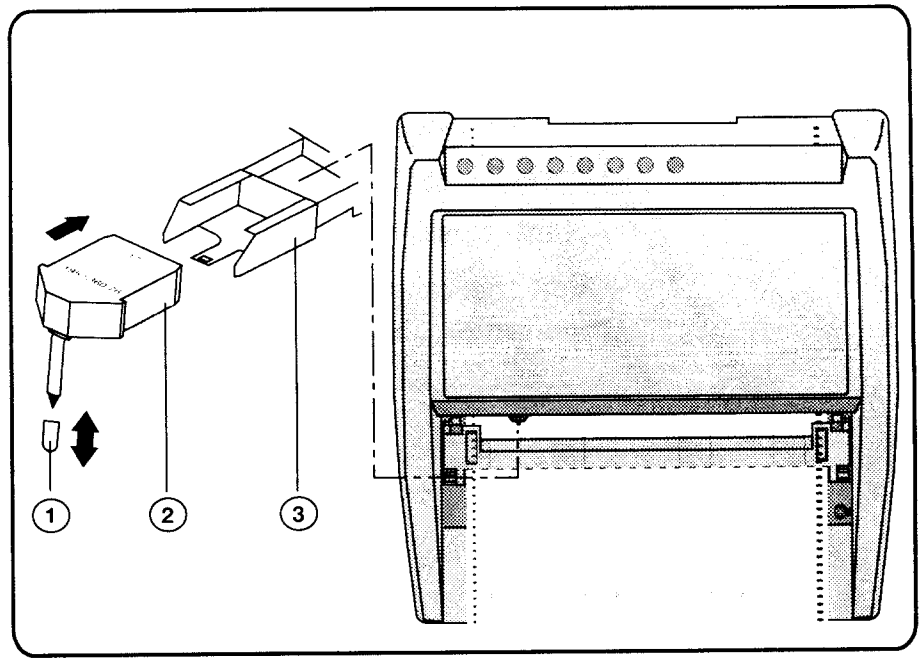
Note 1.5 meters before the end, the paper carries a red signal line.

1.7 Mounting of the Recording Pens

The ordering reference can be found on the inside of the front cover.

- **Remove pen cap (1) from the recording pen (2) and keep it in a save place.**
- **Insert pen into pen holder (3) until limit stop is reached.**

Insertion of Pens



Disposable Felt Pen (already filled)

Advantage: no ink clotting

Recording Expectancy: approx. **1000 m** in continuous recording.

Ink Pen (refillable)

Advantage: refillable

Recording Expectancy: approx. **1500 m** in continuous recording.

The recording expectancy depends on
- **humidity** (alters the absorbent capacity of the paper)
- **recording speed / paper speed** and
- **duration of recording sequence.**

Note: To prevent pens from drying-out **cap the pens** immediately **if recording is paused** for a longer period.

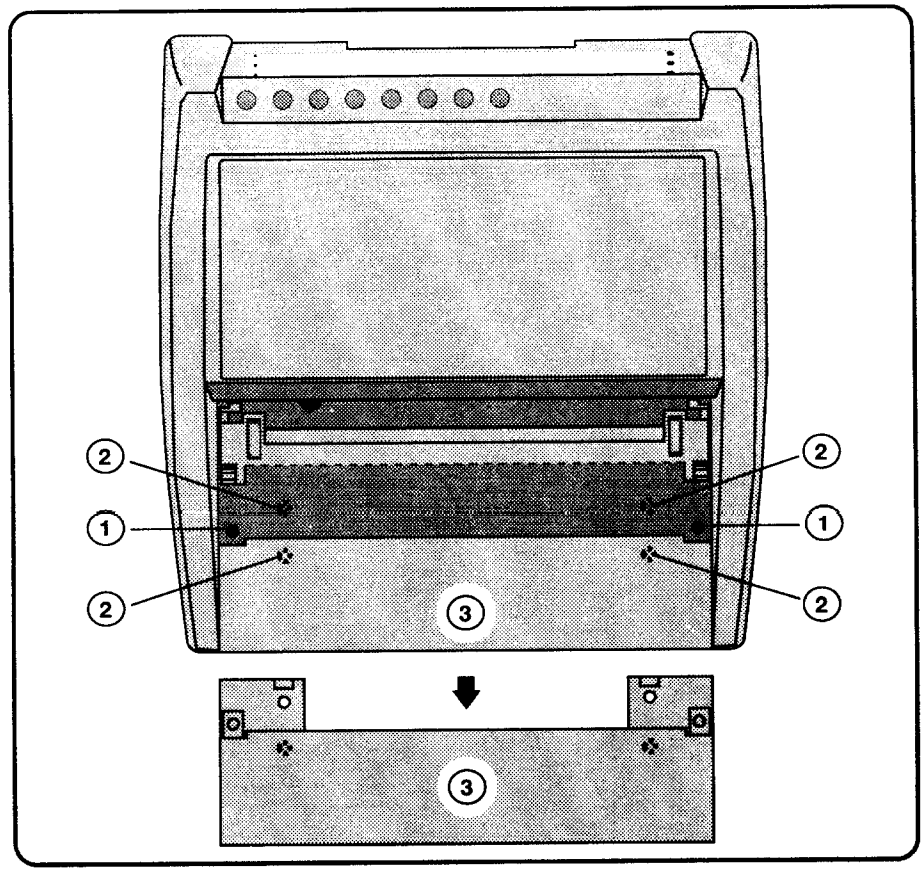
1.8 Mounting the Paper Take-Up Unit and Inserting the Chart Paper

The paper take-up unit is optionally available.

The order reference and the order number can be found on the inside of the front cover.

- **Remove the 2 fastening screws (1) on the upper side of the instrument.**
- **Remove the 4 fastening screws (2) on the bottom side of the instrument.**
- **Pull the cover (3) from the instrument.**

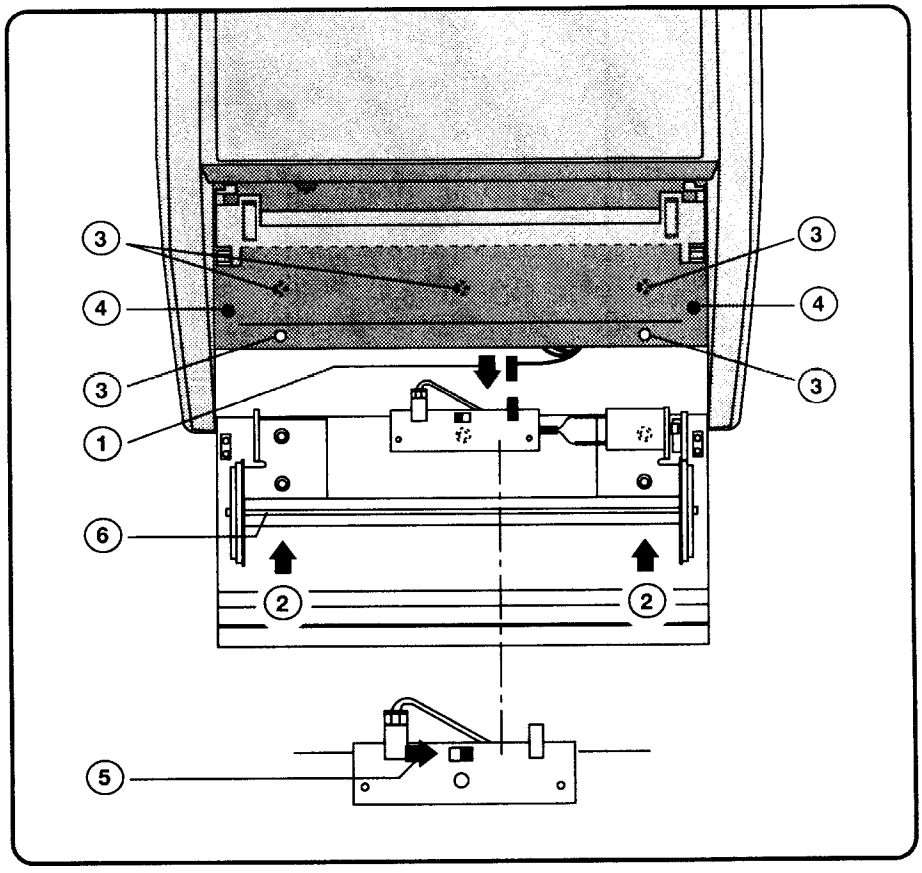
Removing the cover



- **Plug the connecting cable (1) to the take-up unit.**
- **Push the take-up unit (2) into the instrument until limit stop is reached.**
- **Fasten the take-up unit with the 5 fastening screws (3) at the bottom side of the instrument.**
- **Fasten the take-up unit with the 2 fastening screws (4) at the upper side of the instrument.**
- **Move the shift switch (5) of the take-up unit to the right (ON - Position).**

  The take-up unit is switched ON and OFF with the instruments main switch. If the take-up unit shall not be used the shift switch (5) has to be moved to the left (OFF-position).
- **Insert the chart paper into the aperture (6) of the take-up reel and close the take-up unit.**

Mounting the paper take-up unit



2 Technical Data

2.1 Standards and Regulations Applied

IEC654-1 as per Climatic Class B3	Operating regulations for electrical equipment and systems.
IEC359	Storage and transport condition.
IEC68-2-6	mechanical strain: vibration, shock, permanent shock.
IEC1010-1, UL244, CSA C22 No.231	Saftety standards for electronic measuring instruments.
VDE 0411 Part 1 DIN/IEC66E	Protection Class II. Overvoltage Category II. Soiling Index II.
DIN 41662/UL198G	Specification and standards for fuse-links.
IEC 801 Part 1-5	elecromagnetic susceptability.
VDE 0871/6.78	Stipulation for radio interference suppression on electrical equipment and systems.
FCC CLASS B	radio interference suppression B.
Quality Standard	developed, constructed and manufactured to comply with DIN ISO 9001.

2.2 Test Voltages

AC - Instrument

4 kV AC	measuring input channel 1 against casing measuring input channel 2 against casing
4 kV AC	measuring input channel 1 against measuring input channel 2

DC - Instrument

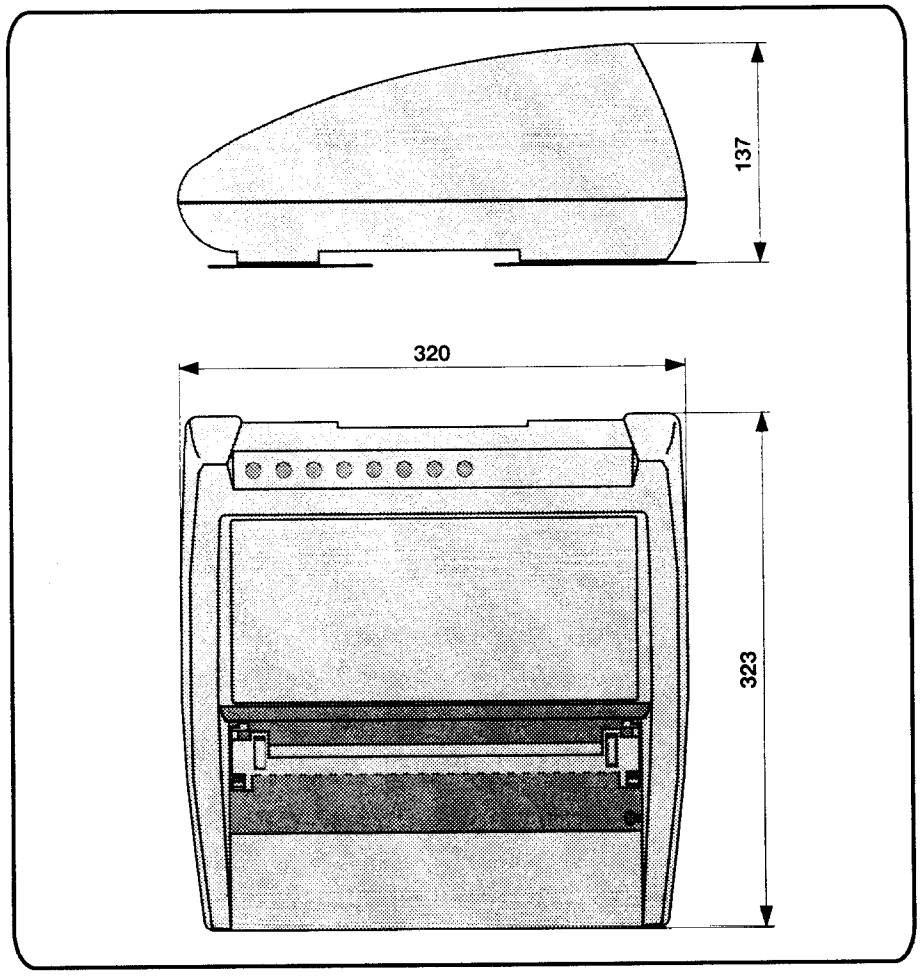
3 kV AC	measuring input channel 1 against casing measuring input channel 2 against casing
3 kV AC	measuring input channel 1 against measuring input channel 2

2.3 Operating-, Transport- and Storage Specifications

Operating Position	horizontally up to ±30° tilted
Climatic Class	B3 according to IEC 654-1
Reference Temp. Range	23 ±2° C
Operating Temp. Range	0 to +50° C
Storage and Transport-Temperature Range	-20 to +70° C
rel. Humidity	10 to 95%
abs. Humidity	1 to 15 g/m^3

2.4 Physical Dimensions, Package and Weight Specifications

Physical-Dimensions



Mass	AC - DC 1 channel instrument without accessories and package	2585 grams
	AC - DC 2 channel instrument without accessories and package	2735 grams
	Accessories for AC - DC 1 channel instrument	770 grams
	Accessories for AC - DC 2 channel instrument	780 grams
Original Wrapping	for AC - DC 1 and 2 channel instrument 470 (L) x 270 (D) x 490 (W) mm	1200 grams
Transport Case	for AC - DC 1 and 2 channel instrument 405 (L) x 365 (D) x 165 (W) mm	2620 grams

Wrapping material and plastic parts are labeled with the corresponding disposal instructions. During manufacturing of all parts special attention was directed to environmentallly friendly production cycles.

2.5 Power Supply Specifications

Mains Adaptor	primary voltage and mains plug according to country; frequency 50 / 60 Hz; secondary 16 V / 0.5 A (open circuit voltage 26 V) jack connector DIN 45318 SG 3.5 power consumption approx. 15 W
External Supply	10 to 18 V DC

2.6 Instrument Specifications

Design	Flatbed
Channels	1 or 2 depending on type in 2 channel instruments switchable to XY - operation mode.
Interface	RS 232
Recording Width	200 mm (standard) 210 mm (possible if instrument is recalibrated)
Recording Paper	Roll, width 230 mm, length 25 m; for normal climate 23° C / 50% rel. humidity - 0.5 class DIN 50 014
Graph Grid on Paper	Recording width alternatively 200 mm or 210 mm Y- division for DC instruments: 100 subdivisions, numbered 0 to 100 Y- division for AC instruments: 60 subdivisions, numbered 0 to 30 t - division in cm
Recording Pens	disposable felt pen, channel dependent, recording length approx. 1000 m ink pen, channel dependent , recording length approx. 1500 m mechanical pen offset from channel 1 to channel 2 approx. 2.5 mm.
Pen Lift	with shift switch or controlling via "REMOTE" - socket
Dead Zone	0.3% of full scale value
Linearity	0.2% of full scale value
Response Time	< 0.5 s
Damping	as per DIN 43 782, overshoot and rounding ≤1% of recording width
Recording Speed	40 cm/s (by servo system)
Cut-off Frequency	≥1.5 Hz (-3dB)

2.7 Time Unit Specifications and Paper Feed

Paper Feed	quartz-clocked
Paper Positioning	progressive motor control with switch activated forward and reverse feed.
Feed Speeds	11 chart feed speeds to be selected with switch 1 - 2 - 6 - 12 - 30 cm/h and 1 - 2 - 6 - 12 - 30 - 60 cm/m. inbuilt reverse feed selectable with shift switch.
Step Width	0.078 mm (128 steps/cm)
Feed Accuracy	0.01%
Temp. Influence	0.01% / 10° C
External Control	"REMOTE" socket:

* external feed (128 pulses = 1 cm feed);
* lowering of rec. pens to chart paper;
* switching to second feed speed;
* reversal of recording feed direction;
* sounding of alarmsignal if limit value is exceeded;
* stopping oof recording feed;
* writing of an event marker.

2.8 Measuring Unit Specifications AC - Instrument

Zero Point	progressive zero point setting (continuously variable)
V - Meas. Ranges (calibrated)	0.6 - 1,5 - 3 - 6 - 15 - 30 - 60 - 150 - 300 - 600 V AC / DC 6 - 15 - 30 - 60 - 150 - 300 - 600 - 1500 mA AC / DC 6 A AC / DC.
ZOOM - Ranges	9 to 15, 18 to 30, 36 to 60, 90 to 150, 180 to 300, 360 to 600 V AC / DC.
Accuracy	V DC: 1% of full scale value V AC (50 Hz to 500 Hz): 1.5% of full scale value V AC (>500 Hz to 2 kHz): 3% of full scale value A DC 1.5% of full scale value A AC (50 Hz to 500 Hz): 2% of full scale value A AC (>500 Hz to 2kHz): 3.5% of full scale value
Temp. Influence	0.5% / 10° C
Interference of External Field	< 0.5% (0.5 mT bei 50 / 60 Hz)
Measuring Input	floating, asymmetrical; 4 mm Ø safety jacks
Difference of Potentials between Input and Earth	600 V max.
Overloading (max.)	380 V for all measuring ranges to 300 V 600 V for the 600 V measuring range.
Input Resistance	1 MΩ
Source Resistance	100 Ω max. 1 kΩ
Interference Voltage Rejection	AC SMRR: ≥ 60 dB from 50 Hz upwards AC CMRR: ≥ 100 dB at 50 / 60 Hz DC CMRR: ≥ 120 dB

2.9 Measuring Unit Specifications DC - Instrument

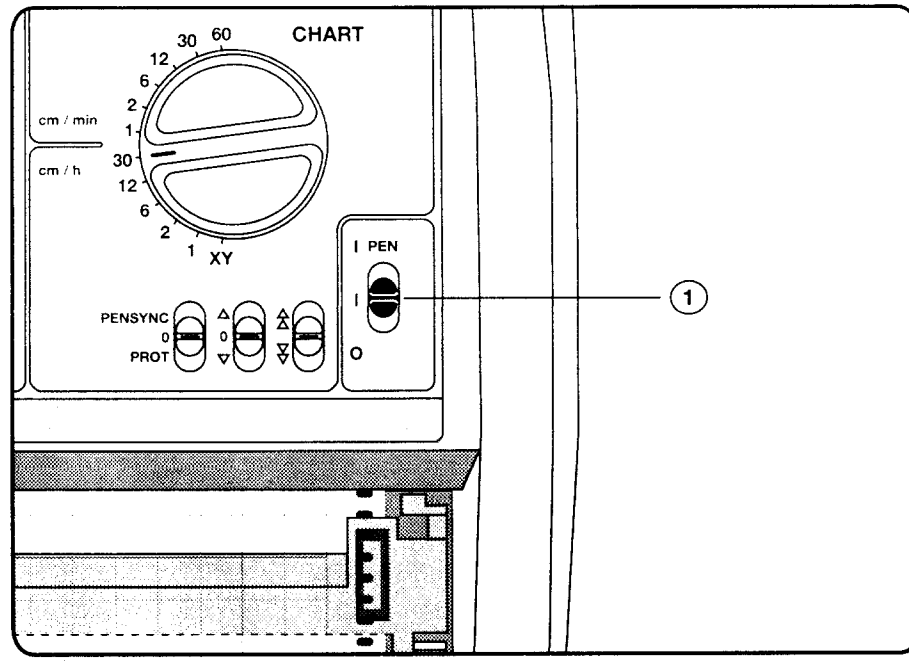
Zero Point	progressive zero point setting (continuously variable
V - Meas. Ranges (calibrated	1 - 2 - 5 - 10 - 20 - 50 - 100 - 200 - 500 mV DC 1 - 2 - 5 - 10 - 20 - 50 - 100 - 200 - 500 V DC (max. 300 V)
Accuracy	0.5% of the full scale value + 5 µV (i.e. the 1mV - measuring range has an accuracy of 1%)
Temperature Influence	0.2% / 10° C + 5µV / 10° C (the higher value is applicable)
Zero Suppression (calibrated)	-100% and -200%.
Interference of External Field (0.5 mT, Mains Frequ.)	< 0.5%
Measuring Input	floating, asymmetrical; 4 mm Ø safety jacks
Dif. of Potentials between Input and Earth	300 V max.
Max. Overloading	300 V for all measuring ranges
Input Resistance	1 MΩ
Source Resistance	100 Ω max. 1 kΩ
Interference Voltage Rejection	AC SMRR: ≥ 60 dB from 50 Hz upwards AC CMRR: ≥ 90 dB at 50 / 60 Hz DC CMRR: ≥ 120 dB
T - Meas. Ranges (calibrated)	0 to 1000° C, 0 to 500° C, 0 to 200° C, 0 to 100° C, -50 to 150° C, 100 to 300° C, 300 to 500° C, 300 to 800° C, 500 to 1000° C,
Compensation of Ambient Temp.	switchable with DIL - switch on the rear side of the instrument
Thermo Elements	K - standard element; J and T - elementsif ordered
Accuracy	2% of full scale value + 5 µV
Input	floating, asymmetrical; thermo plug
Dif. of Potentials between Input and Earth	50 V max.
Interference Voltage Rejection	AC SMRR: ≥ 60 dB from 50 Hz upwards AC CMRR: ≥ 90 dB at 50 / 60 Hz DC CMRR: ≥ 120 dB

3 Operation

3.1 Switching On the Instrument

- **Move the main switch (1) to position I (mid-position).**

Switching the Instrument On and Off



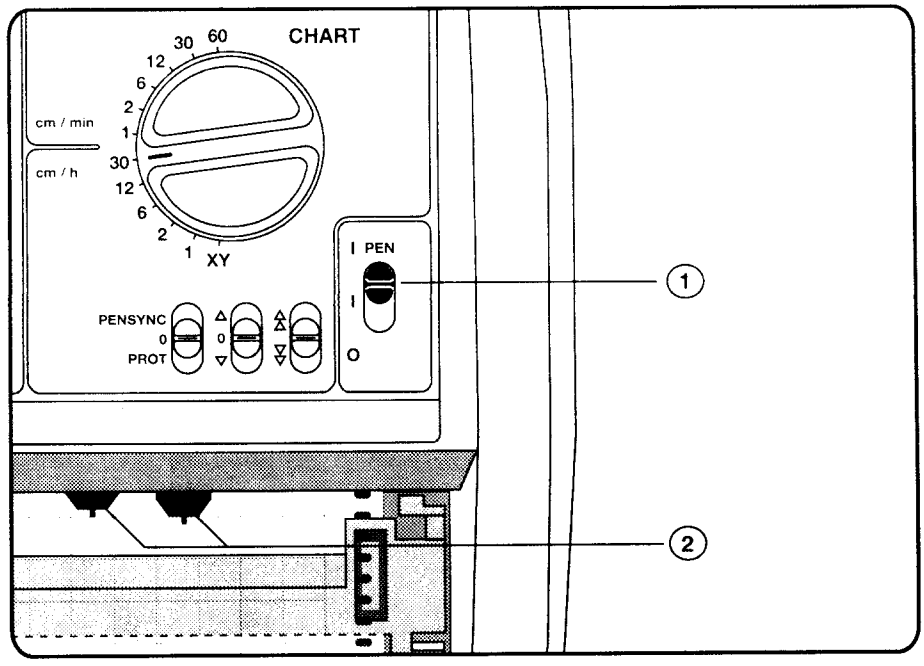
Additional information referring to	Can be found in
Power supply	chapter 1.5
Power supply specifications	chapter 2.5

3.2 Lowering the Recording Pen to the Chart Paper

- **Move the main switch (1) to position I PEN.**

The recording pen(s) (2) is (are) lowered to the chart paper by a lifting magnet.

Lowering the Recording Pen to the Chart Paper



Note

If the **recording is paused lift the recording pen(s) from the recording paper** with main switch (1) to avoid ink bleeding.

If the recording is paused for a longer periods cap the recording pen(s) to prevent them from drying out.

In case of a power failure the recording pen(s) is (are) automatically lifted.

Additional information referring to	**Can be found in**
mounting of the recording pens	chapter 1.7

3.3 Lowering the Recording Pen to the Chart Paper by Controlling via the "REMOTE" - Socket

- **Connect the positive control signal with "PIN 9" and the reference point of the control signal with "PIN 15"** (earth) **of the "REMOTE" - socket.**

Connection "PIN 9"

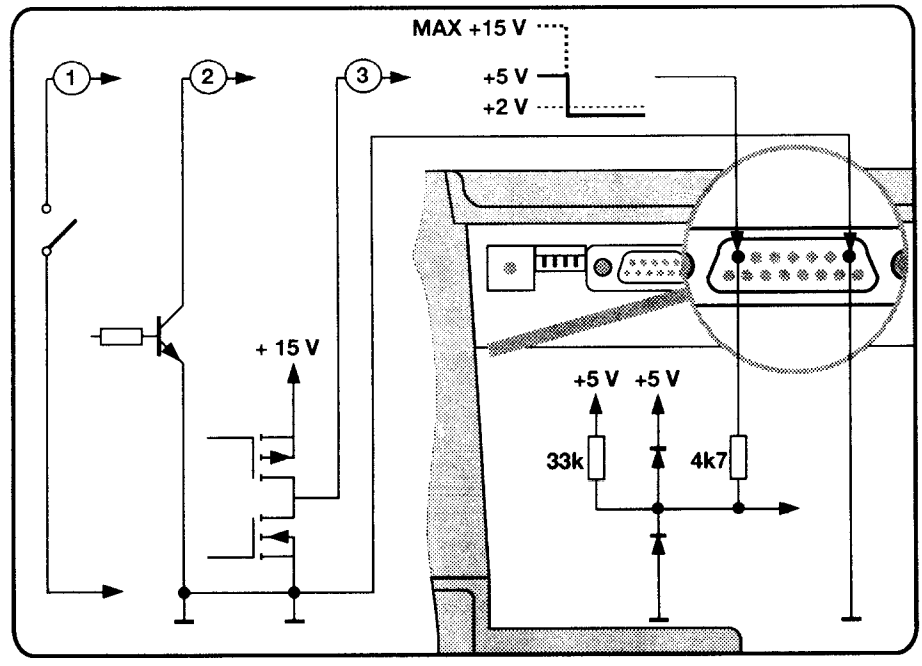
aktiv e"LOW"; switch threshold approx. 2 V; max. input voltage ±15 V.

for the period of time in which "PIN 9" is connected to earth, the recording pen(s) is (are) lowered to the chart paper.

Preconditions

mains switch is in position "I"; recording pen(s) is (are) not lowered to the chart paper.

Controlling via the "REMOTE" - socket; Rear side of instrument



Possibilities of Controlling

① floating contact,
② TTL open - collector,
③ output of CMOS gates

Additional information referring to	**Can be found in**
lowering the recording pen to the paper	chapter 3.2 chart

3.4 Zero Setting

On 2 channel instruments the procedure described below has to be carried out for the second channel similarly.

- **Set the shift selector (1) to position 0.**

  Internally the measuring input is connected to earth and one side of the measuring signal is disconnected.
  Only the zero setting is displayed without influence by the connected measuring signal.

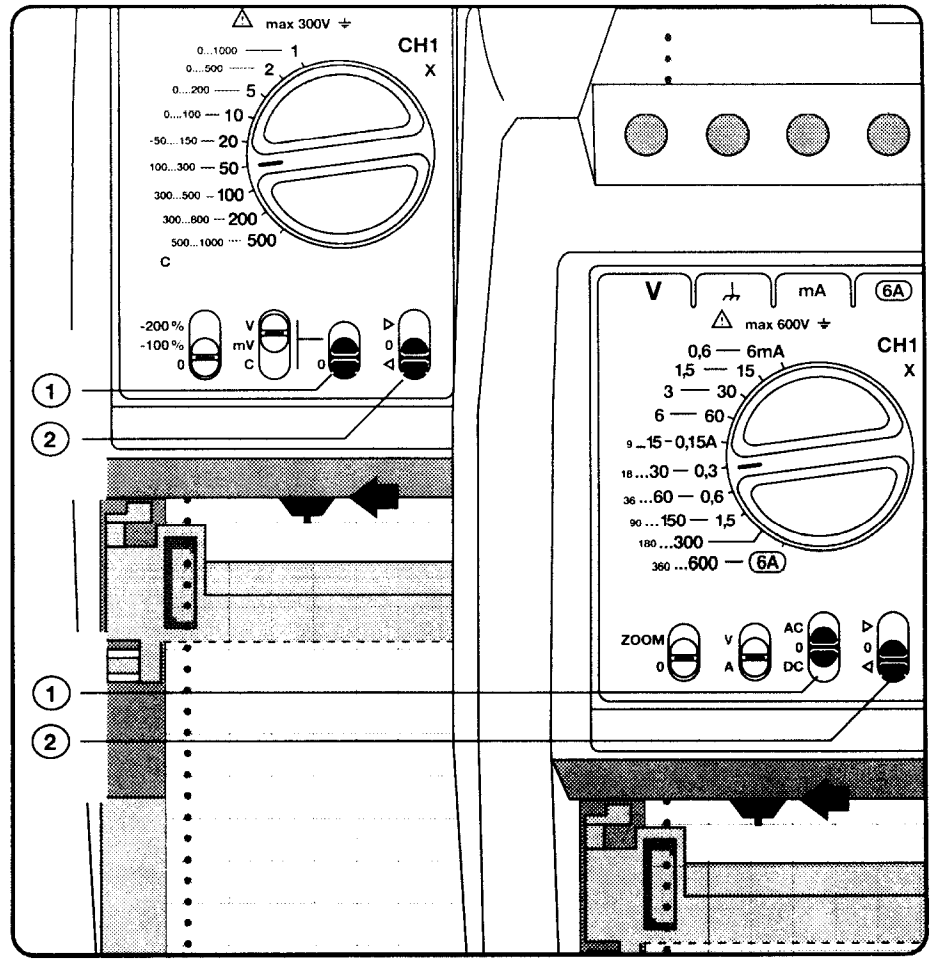
- **Press the shift selector (2) in the desired direction.**

  The corresponding recording pen moves in the selected direction with a progressive speed.

Zero Setting

DC - Instrument

AC - Instrument

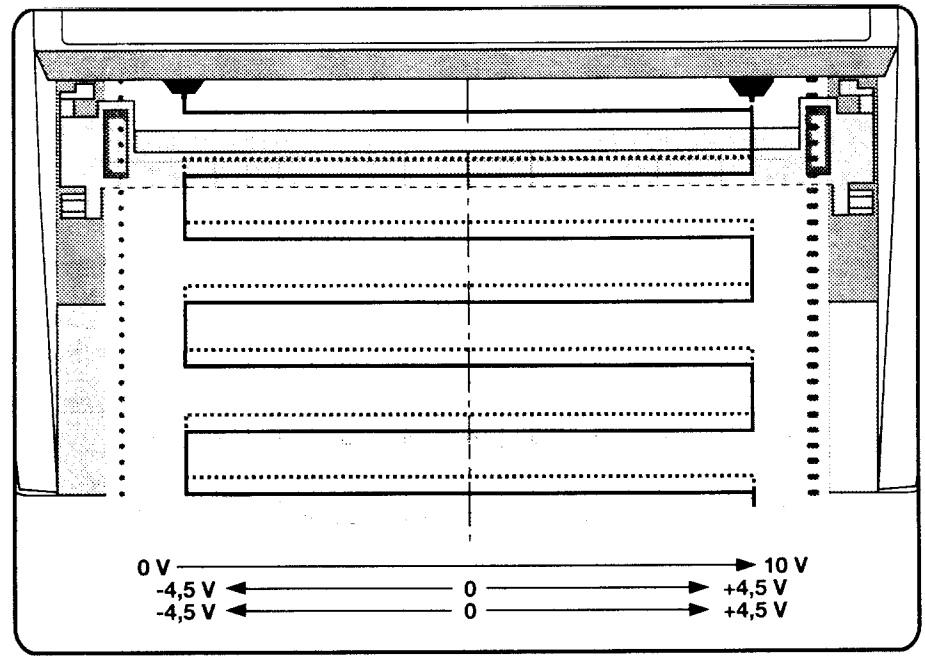


3.4.1 Setting of Different Formats with the Zero Point in 2 - Channel Instruments

Example — Two square wave signal with ±4.5 V each shall be printed.

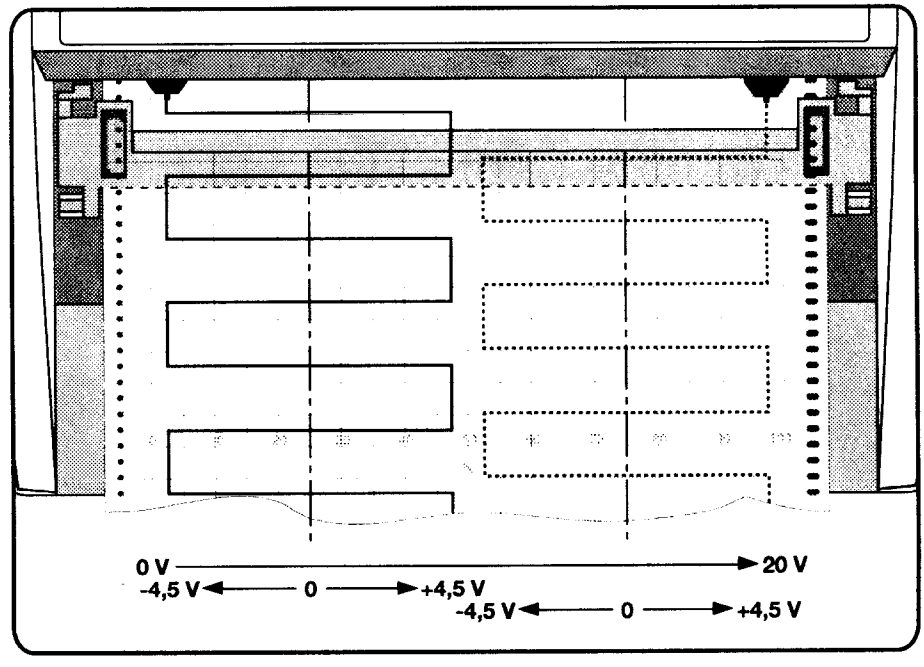
Meas. Range 10V — Zero setting of channel 1 and 2 to 50%.

Format **2 x 100 %**



Meas. Range 20V — Zero setting of channel 1 to 25%; of channel 2 to 75%.

Format **2 x 50 %**



3.5 Setting of DC Voltage Measuring Ranges and Connection of Measuring Voltages in DC - Instruments

The following measuring ranges can be selected:

1 - 2 - 5 - 10 - 20 - 50 - 100 - 200 - 500 mV
1 - 2 - 5 - 10 - 20 - 50 - 100 - 200 - 500 V.

All measuring ranges are calibrated. That means that the value of the selected measuring range corresponds to 100% of the upper range limit at a zero setting of 0% on the recording paper.

Decide upon the following questions before selecting the measuring range:

* does the measured signal exceed 300 V to earth ?
* which signal amplitude can be expected ?

Note If the dimension of the measuring signal is not known exactly, **select the highest measuring range.**

After the measuring signal has been applied to the measuring input the measuring range can be gradually decreased until the desired resolution is reached.

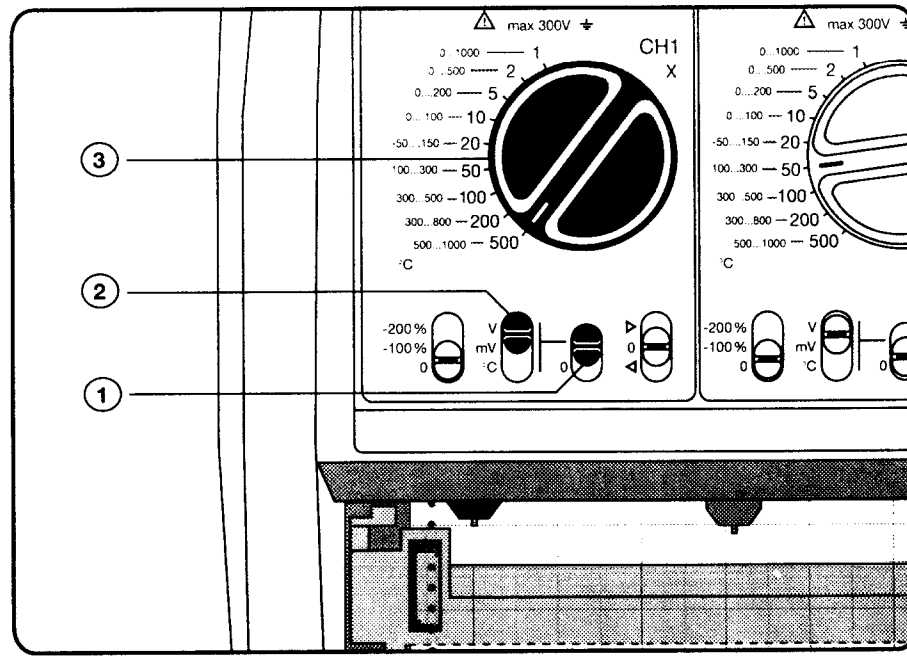
On 2 channel instruments the procedure described below has to be carried out for the second channel similarly.

To protect against dangerous shock-hazard voltages:
The measuring voltage must not exceed 300V towards earth.

Overload protection of the measuring ranges:
All measuring ranges from 1 mV to 500 V are protected against destruction by high voltages up to 300 V.

- **Set the shift selector (1) to the position shown in the figur.**
- **Set the shift selector (2) to position "mV" or position"V".**
- **Set the dial selector (3) to the desired measuring range.**

Setting of the Measuring Range(s)



Make sure that no thermo element is connected to the same channel.

For your own safety always connect the measuring cable to the instrument first and only then to the signal source.

Note

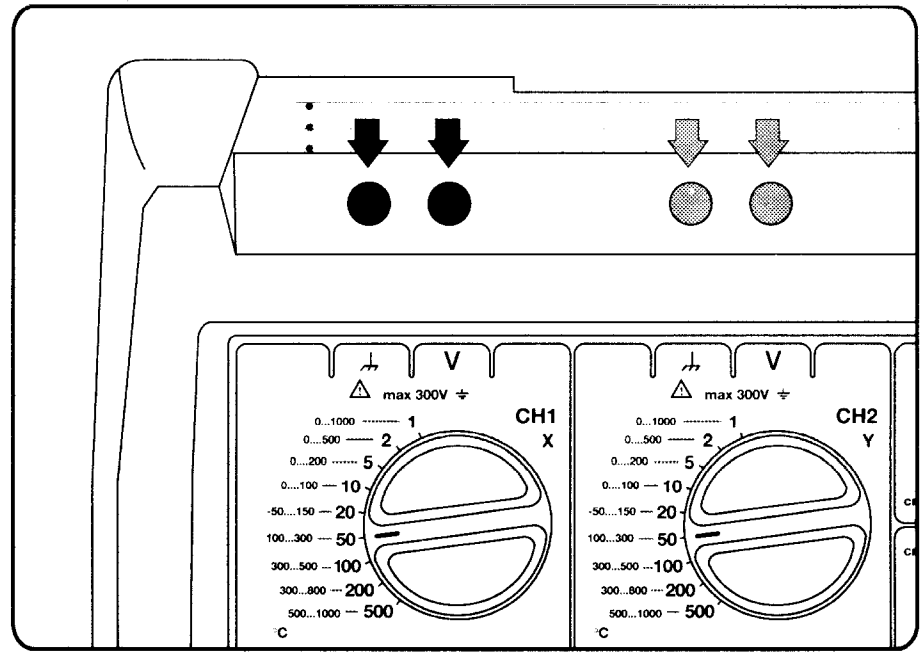
The **measuring input "⏚" is nearer to earth** and should therefore be connected **with that measuring signal's potential which is nearer to earth.**

Design of the Measuring Inputs

The measuring inputs have 4 mm safety sockets. They are floating and asymetrical.
In 2 - channel instruments the measuring inputs are isolated from each other.

- **Connect the measuring cable to the measuring input.**

Connection of Measuring Signal(s)



Additional information referring to	**Can be found in**
Instrument Specifications	chapter 2.6
Measuring Unit Specifications DC-Instr.	chapter 2.9
Earthing and Interference Voltage	chapter 4.1
Dependance of Accuracy on Source Resistance	chapter 4.2
Dynamic Behaviour	chapter 4.3
Expansion of Measuring Capabilities	chapter 4.4

3.6 Working with Zero Suppression

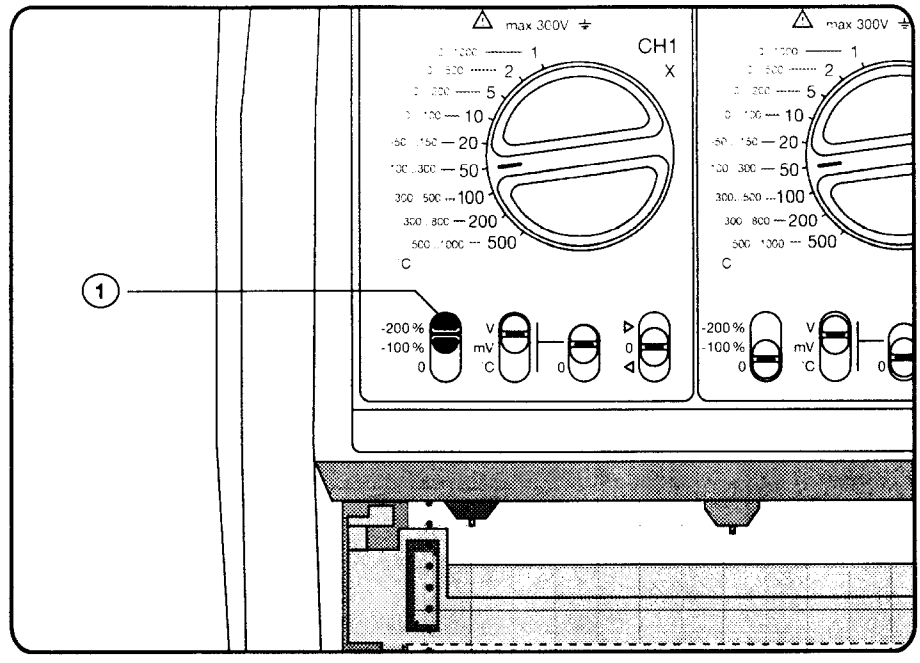
On 2 channel instruments the procedure described below has to be carried out for the second channel similarly.

- **Move the shift selector (1) to position "-100%" or "-200%".**

The zero point of the corresponding channel is suppressed by 100% or 200%.

Thereby, relatively small changes of a signal with a high basic level can be enlarged up to 3 times.

Switching On the Zero Suppression



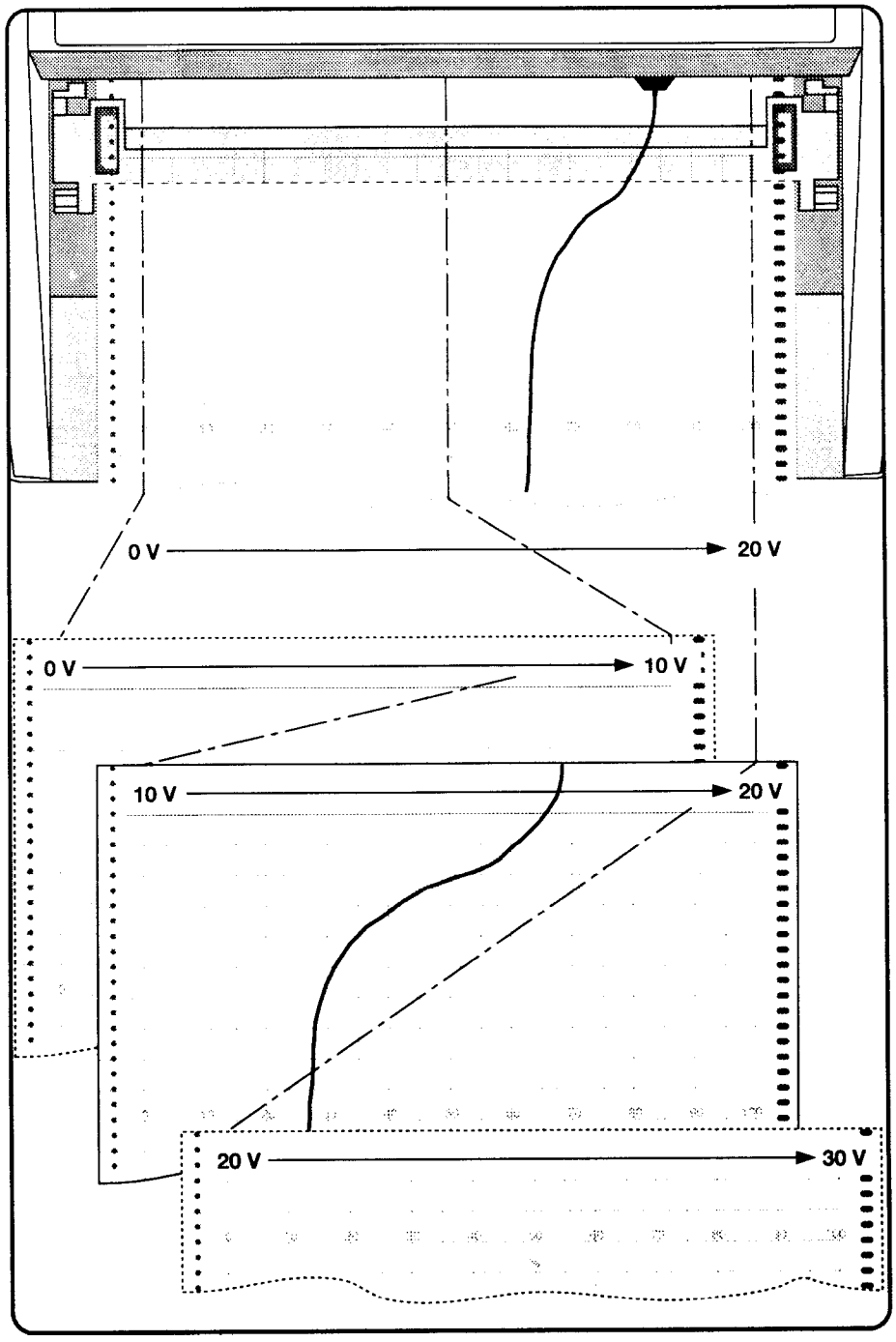
In the following example the terminal voltage of a 12V lead-acid battery is recorded.
During the charging sequence the terminal voltages rises from 12.6 V to 16.8 V (depending on the discharge condition).

Meas. Range 20 V
Zero Suppression
0 %

Meas. Range 10 V
Zero Suppression
0 %

Zero Suppression
100 %

Zero Suppression
200 %



3.7 Setting of AC - DC Voltage Measuring Ranges and Connection of Measuring Voltages in AC - Instruments

The following measuring ranges can be selected:

0.6 - 1,5 - 3 - 6 - 15 - 30 - 60 - 150 - 300 - 600 V

All measuring ranges are calibrated. That means that the value of the selected measuring range corresponds to 100% of the upper range limit at a zero setting of 0% on the recording paper.

Decide upon the following questions before selecting the measuring range:

* Does the measured signal exceed 600 V to earth ?
* Which measuring quantity am I dealing with (voltage, current and type of signal AC / DC) ?
* Which signal amplitude can be expected ?

Note If the dimension of the measuring signal is not known exactly, **select the highest measuring range.**

After the measuring signal has been applied to the measuring input the measuring range can be gradually decreased until the desired resolution is reached.

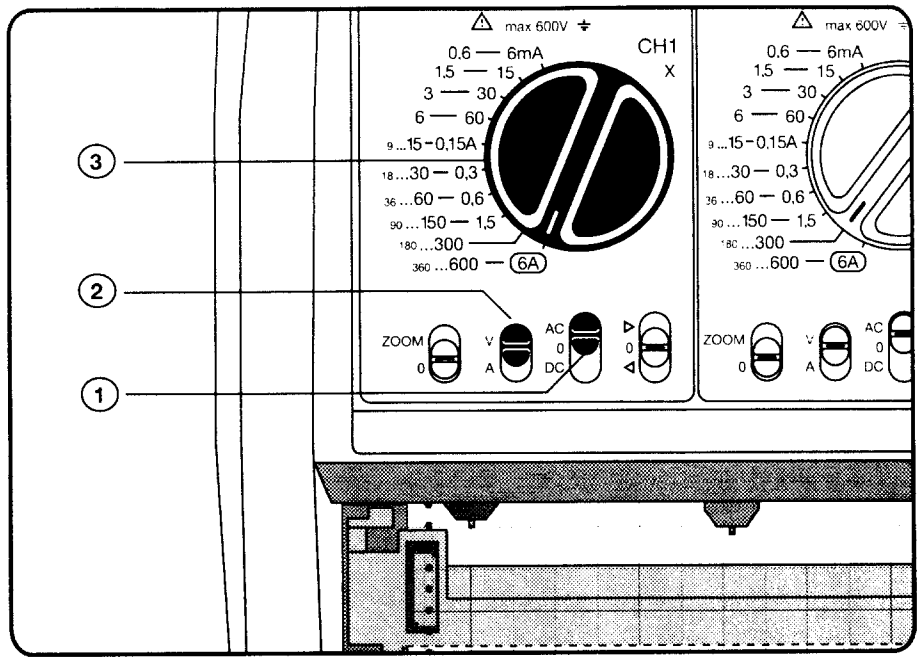
On 2 channel instruments the procedure described below has to be carried out for the second channel similarly.

To protect against dangerous shock-hazard voltages:
The measuring voltage must not exceed 600 V towards earth.

Overload protection of the measuring ranges:
All measuring ranges from 0.6 mV to 600 V are protected against destruction by high voltages up to 600 V.
Additionally all measuring ranges are protected by an **internal 6.3 A measuring circuit fuse (semi -time lag).**

- **Set the shift selector (1) to the "AC" or the "DC" position.**
- **Set the shift selector (2) to the "V" position.**
- **Set the dial selector (3) to the desired measuring range.**

Setting of the Meas. Range(s)



For your own safety always connect the measuring cable to the instrument first and only then to the signal source.

Note

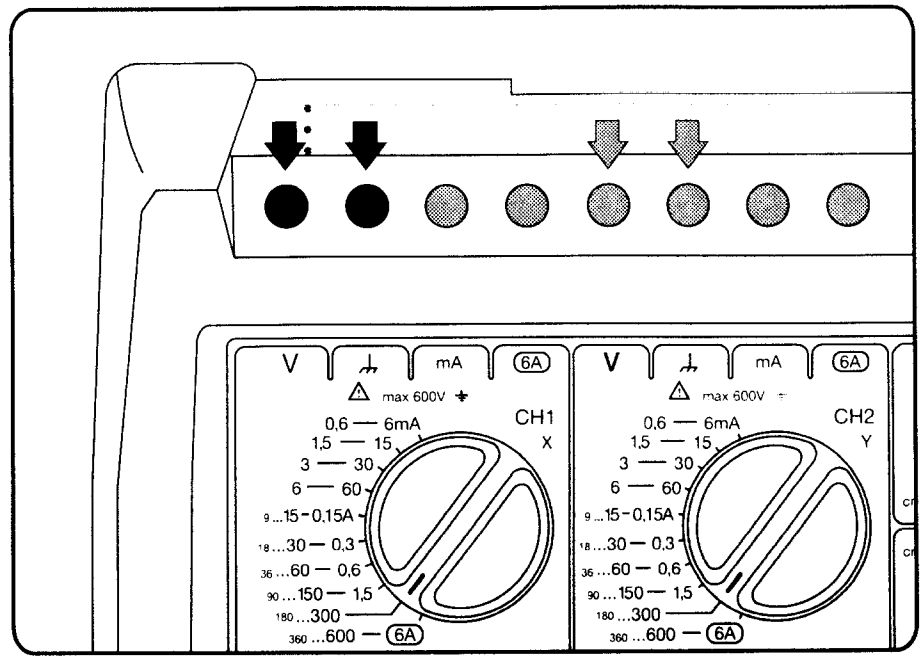
The **measuring input "⏚" is nearer to earth** and should therefore be connected **with that measuring signal's potential which is nearer to earth.**

Design of the Measuring Inputs

the measuring inputs have 4 mm safety sockets . They are floating and asymetrical.
In 2 - channel instruments the measuring inputs are isolated from each other.

- **Connect the measuring cable to the measuring input.**

Connection of Measuring Signal(s)



Note to the AC - Ranges

The **measured signal will be rectified in the measuring amplifier** (rectification value) and calibrated to r.m.s. values with a form factor of 1.11. When measuring **sinus-shaped AC-voltages** the **recorder output corresponds to the r.m.s. value**.

R.m.s. measuring starts at a signal frequency of approx. 30 Hz. Frequencies in ranges up to 20 Hz result in an increased line width.

If in the AC ranges an AC voltage with a DC voltage component is measured the DC voltage is dropped.

Additional information referring to	**Can be found in**
Instrument Specifications	chapter 2.6
Measuring Unit Specifications AC-Instr.	chapter 2.8
Earthing and Interference Voltage	chapter 4.1
Dependance of Accuracy on Source Resistance	chapter 4.2
Dynamic Behaviour	chapter 4.3
Expansion of Measuring Capabilities	chapter 4.4

3.8 Working with the Zoom Function

On 2 channel instruments the procedure described below has to be carried out for the second channel similarly.

- **Set the shift selector ① to position "ZOOM".**

The following ZOOM - ranges can be selected:

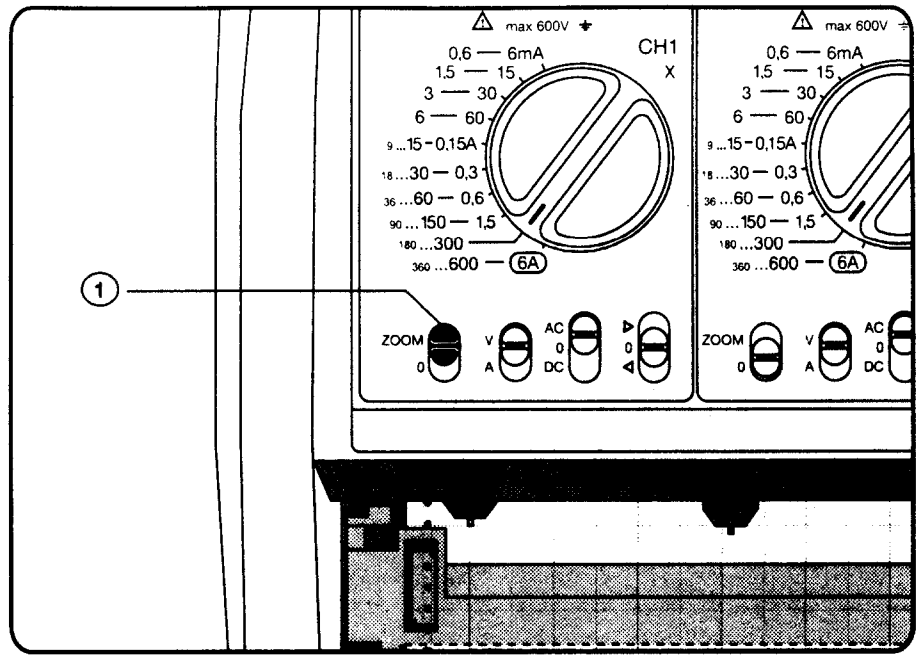
9 to 15 V
18 to 30 V
36 to 60 V
90 to 150 V
180 to 300 V
360 to 600 V

All ZOOM - measuring ranges are calibrated.

For the zero setting to 0% on the recording paper this means:
The **smaller value corresponds to 0%** on the paper;
the **higher value corresponds to 100%** full scale value.

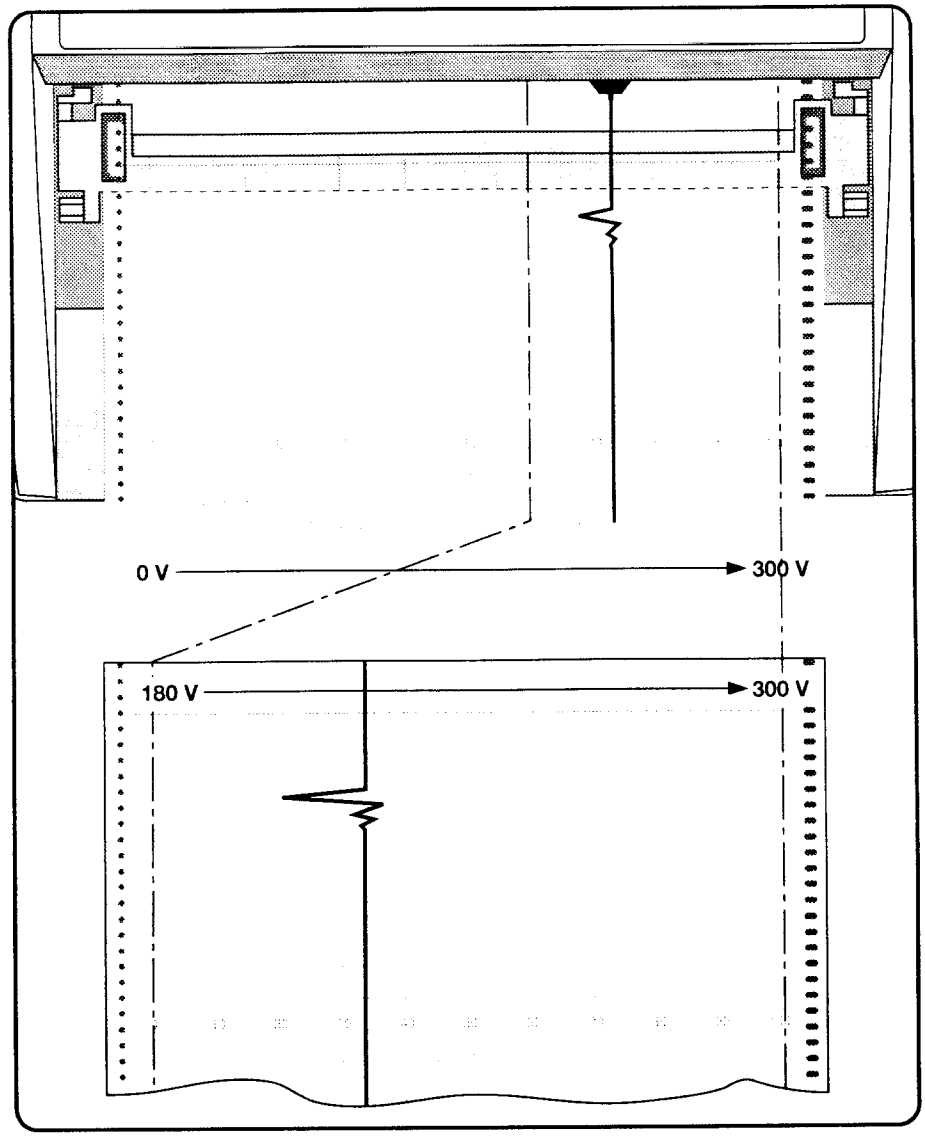
Thereby, relatively small changes of a signal with a high basic level can be enlarged.

Switching On the Zoom Function



In the following example the output voltage of a UPS (uninterruptible power system) with a connected electronic data processing unit is monitored.
The transient reaction occurs when the connected data processing unit is switched on.

Meas. Range
from 0 to 300 V



Zoom Range
from 180 to 300 V

3.9 Setting of AC - DC Current Measuring Ranges and Connection of the Measuring Current

The following measuring ranges can be selected:

6 - 15 - 30 - 60 mA
0.15 - 0.3 - 0.6 - 1.5 - 6 A.

All measuring ranges are calibrated. That means that the value of the selected measuring range corresponds to 100% of the upper range limit at a zero setting of 0% on the recording paper.

Decide upon the following questions before selecting the measuring range:

* Does the voltage at the measuring terminals exceed 600 V to earth ?
* Which measuring quantity am I dealing with (type of signal AC / DC) ?
* Which signal amplitude can be expected ?

Note If the dimension of the measuring signal is not known exactly, **select the highest measuring range.**

After the measuring signal has been applied to the measuring input the measuring range can be gradually decreased until the desired resolution is reached.
The current path is not interrupted.

On 2 channel instruments the procedure described below has to be carried out for the second channel similarly.

To protect against dangerous shock-hazard voltages:

The voltage at the measuring terminals must not exceed 600V towards earth:

Overload protection of the measuring ranges:

All measuring ranges from 6 mA to 1.5 A are protected against unintentional overloading by a **2 A measuring circuit fuse (fast-blow)** which can be reached from the rear side of the instrument.

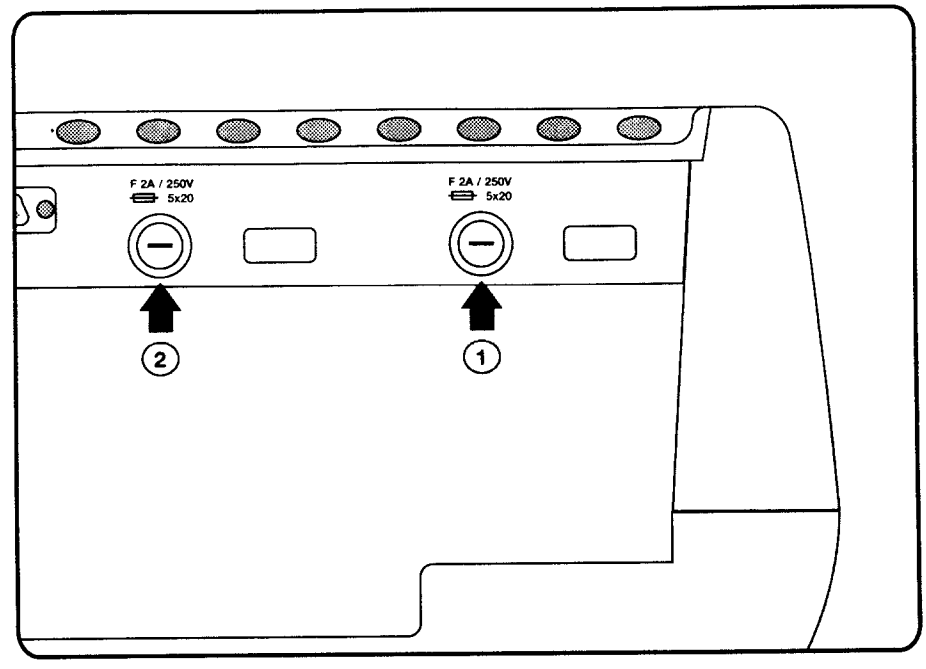
Additionally all measuring ranges are protected by an **internal 6.3 A measuring circuit fuse (semi -time lag).**

The measuring ranges can be permanently overloaded up to a maximum of 1.5times of the nominal current.

To protect the measuring current transformer:

In measurements with the current transformer it has to be ensured under any circumstances that the **maximum induced current does not exceed the nominal current of the selected measuring range by more than 1.5 times.**

2 A measuring circuit fuse; Rear side of instrument

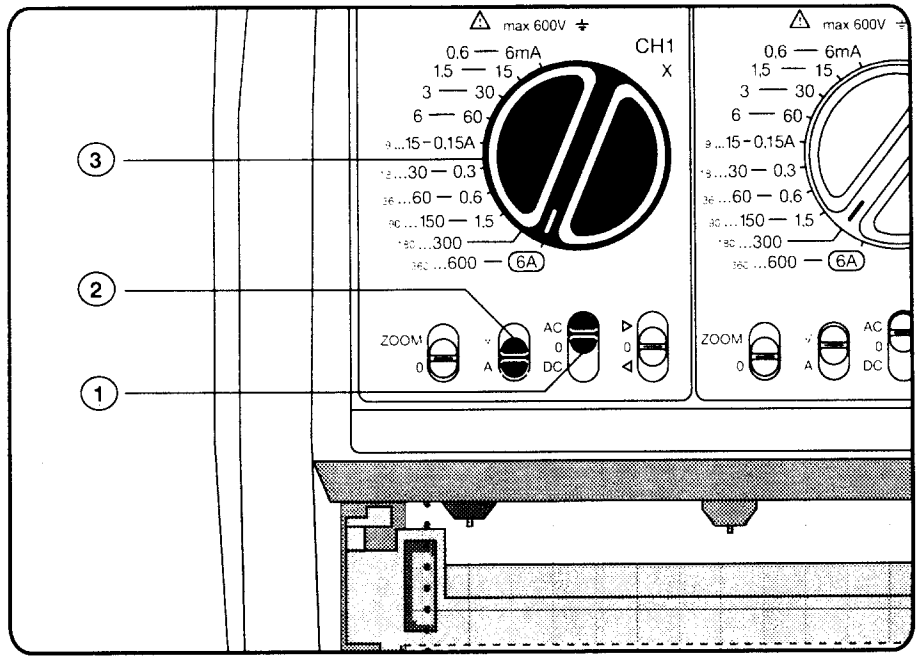


(1) Fuse for the 1st channel.

(2) Fuse for the 2nd channel.

- **Set the shift selector (1) to the "AC" or "DC" position.**
- **Set the shift selector (2) to the "A" position.**
- **Set the dial selector (3) to the desired measuring range.**

Setting of the Meas. Range(s)



For your own safety always connect the measuring cable to the instrument first and only then to the signal source.

Note

The **measuring input "⏚" is nearer to earth** and should therefore be connected **with that measuring signal's potential which is nearer to earth.**

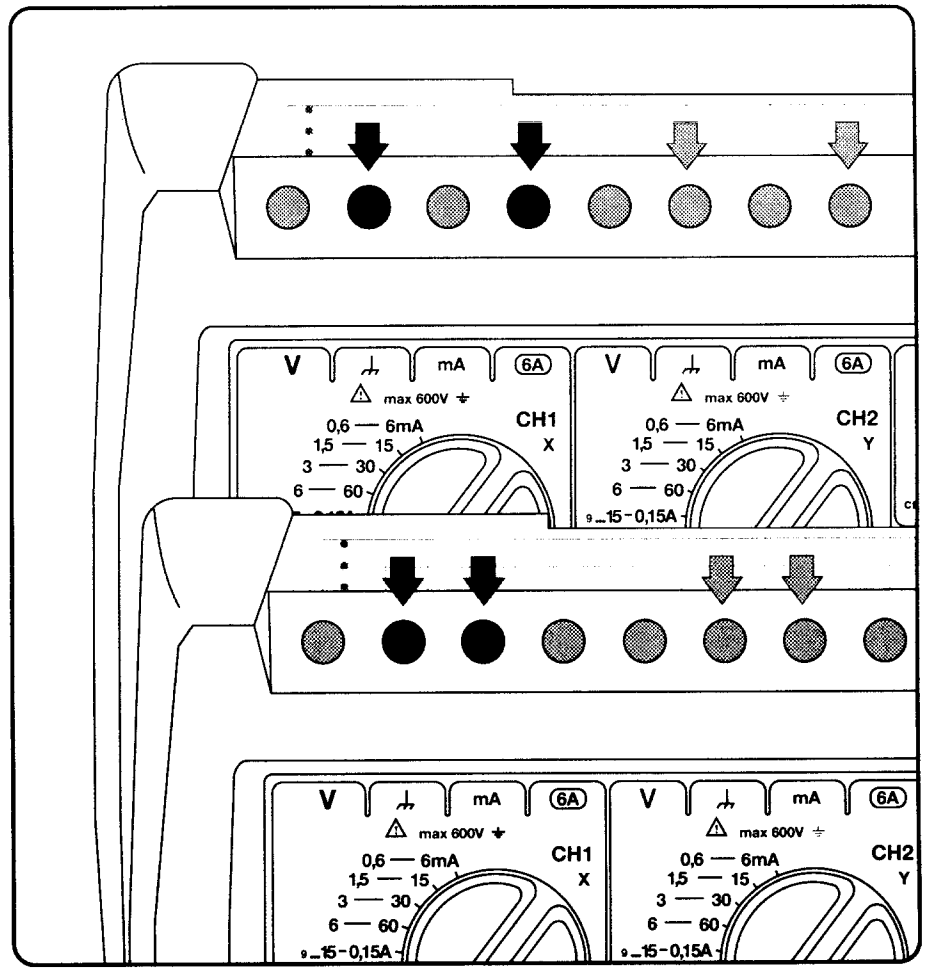
Design of the Measuring Inputs

The measuring inputs have 4 mm safety sockets . They are floating and asymetrical.
In 2 - channel instruments the measuring inputs are isolated from each other.

- **Connect the measuring cable to the measuring input.**

Connection of the 6A Measuring Signal(s)

Connection of the 6mA to 1.5A Measuring Signal(s)



Note to the AC - Ranges

The **measured signal will be rectified in the measuring amplifier** (rectification value) and calibrated to r.m.s. values with a form factor of 1.11. When measuring **sinus-shaped AC-voltages** the **recorder output corresponds to the r.m.s. value**.

R.m.s. measuring starts at a signal frequency of approx. 30 Hz. Frequencies in ranges up to 20Hz result in an increased line width.

If in the AC ranges an AC current with a DC current component is measured the DC current is dropped.

Additional information referring to	**Can be found in**
Instrument Specifications	chapter 2.6
Measuring Unit Specifications AC-Instr.	chapter 2.8
Earthing and Interference Voltage	chapter 4.1
Dependance of Accuracy on Source Resistance	chapter 4.2
Dynamic Behaviour	chapter 4.3
Expansion of Measuring Capabilities	chapter 4.4

3.10 Setting of Temperature Measuring Ranges

The following temperature measuring ranges can be selected:

0 to 1000 C	0 to 500 C	0 to 200 C
0 to 100 C	-50 to 150 C	100 to 300 C
300 to 500 C	300 to 800 C	500 to 1000 C

All temperature measuring ranges are calibrated.

For the zero setting to 0% on the recording paper this means:
The **smaller value corresponds to 0%** on the paper; the **higher value corresponds to 100%** of the full scale value.

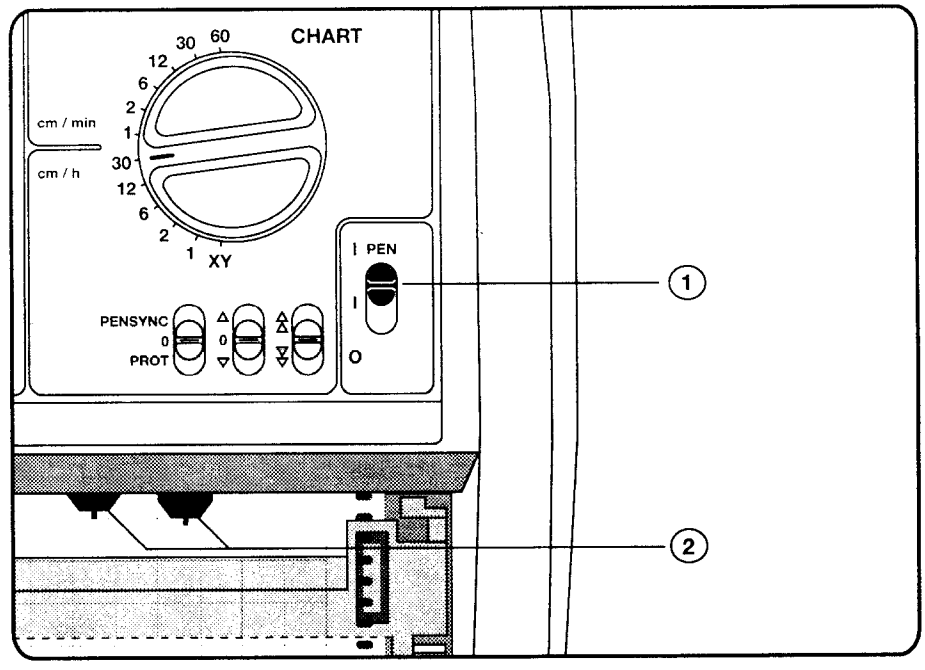
Decide upon the following questions before selecting the measuring range:

* Does a possible voltage at the thermoelement plug exceed 50 V to earth ?
* Which temperature can be expected ?

On 2 channel instruments the procedure described below has to be carried out for the second channel similarly.

- **Set the shift selector (1) to the "0" position.**
  The zero suppression must not be used in temperature measuremnets.
- **Set the shift selector (2) to the position shown in the picture.**
- **Set the shift selector (3) to the " C" position.**
- **Set the dial selector (4) to the desired temperature measuring range.**

Setting the Temperature Measuring Ranges



Note Depending on the type of thermo element some temperature measuring ranges are only used partly.

e.g.: thermo element T: -100 to +400 C
temperature measuring range: 0 to +500 C.

A recording is possible in the range from 0 to 400 C.

For a zero setting to 0% on the recording paper this means a deflection from 0 to 80% of the recording width.

- **Switch the ambient temperature compensation with the DIL - switch** (1)
  ON (DIL - switch in the upper position) **or**
  OFF (DIL - switch in the lower position).

  ambient temperature compensation switched on:
  The temperature to be measured is recorded as absolute (referring to 0 °C).

  ambient temperature compensation switched off:
  The temperature to be measured is recorded relative to the temperature of the thermo element plug.

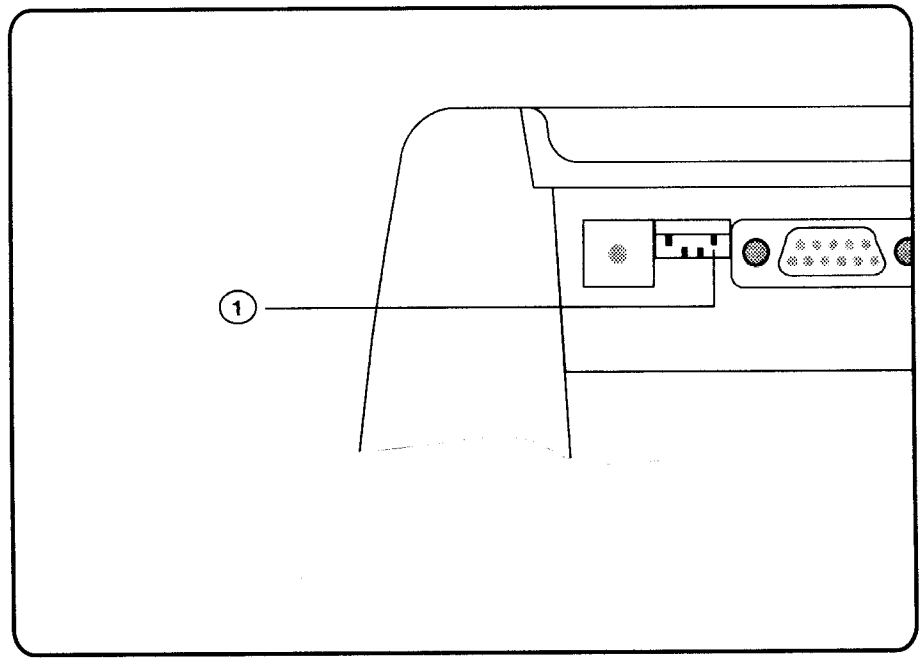
Note

Relative temperature measurtement
Normally, the temperature of the thermo-element plug corresponds to the ambient temperature.

The temperature of the thermo-element plug is not necessarily the same as the ambient temperature if the instrument was shortly moved to an environment with a different temperature.

In such a case the warming up time has to be taken into account. The warming up time depends on the actual temperature difference between thermo-element plug and ambient temperature.

Switch-On the Ambient Temperature Compensation; Rear Side of Instrument



To protect against dangerous shock-hazard voltages:
A **possible voltage** at the thermo element plug **must not exceed 300 V to earth..**

Make sure that no measuring signal is connected to the voltage measuring input of the same channel.

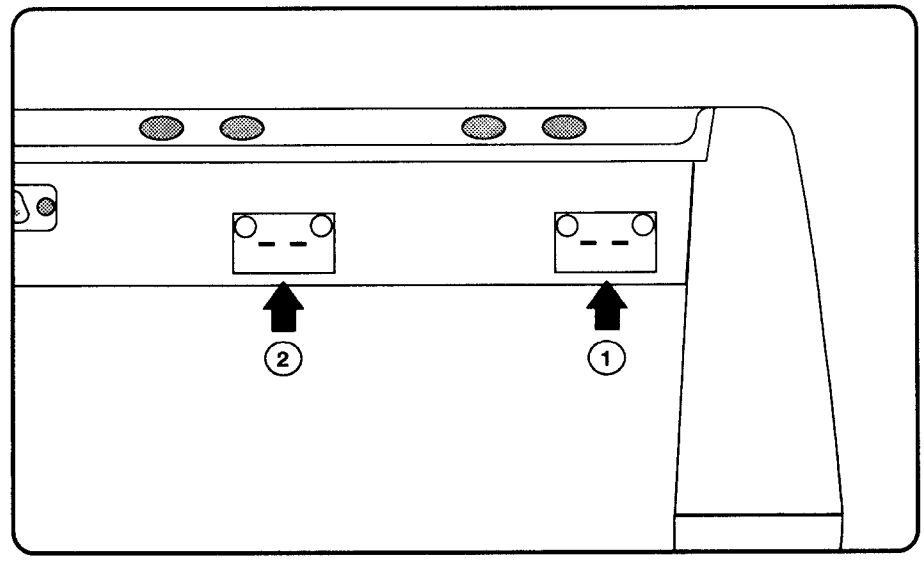
- **Connect the thermoelements to the instrument**

Depending on the type of instrument only one of three possible thermo-elements (J, K and T) can be connected to a channel.

Note In an authorized service facility the instrument can be retrofitted for the use with another thermo-element at any time.

type of thermo-element	J (Fe/Cu-Ni)	K (Ni-Cr/Ni-Al)	T (Cu/Cu-Ni)
thermo-element plug	colour / black	colour / yellow	colour / blue
temperature range of the thermo-element	-100 to 1200 °C	-100 to 1300 °C	-100 to 400 °C

Connection Of the Thermo-Element; Rear Side of Instrument



(1) thermo-element - plug for the 1st channel.

(2) thermo-element - plug for the 2nd channel.

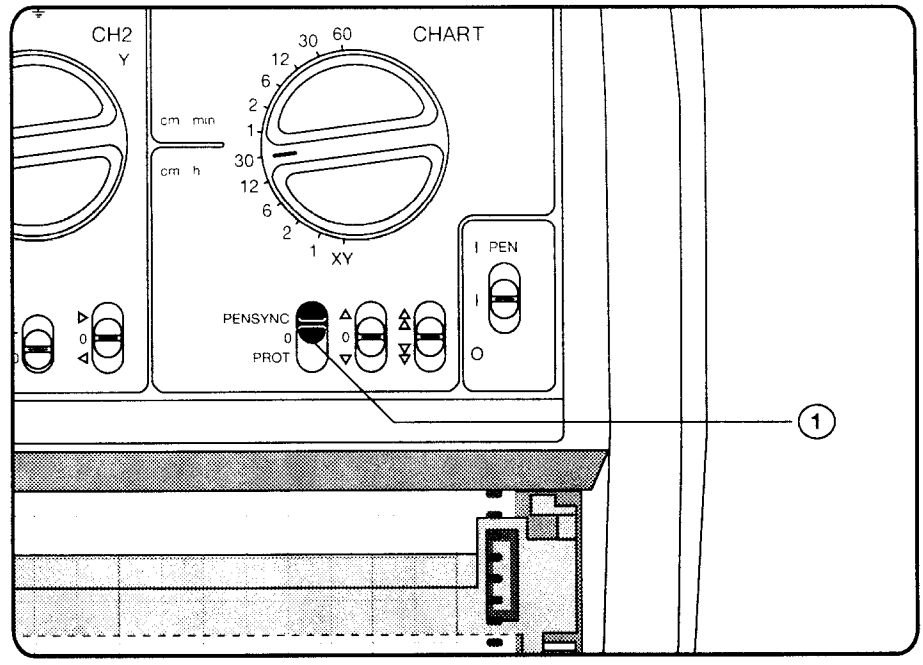
3.11 Working with PENSYNC

In the **2 - channel instrument** the recording pens are staggered (offset) by 2.5mm on the time axis (chart paper feed direction). This allows them to pass each other.

The PENSYNC compensates this mechanically staggered arrangement of the recording pens, in effect "time aligning" the two inputs on the chart. With that, synchronous sequences are represented sychronously.

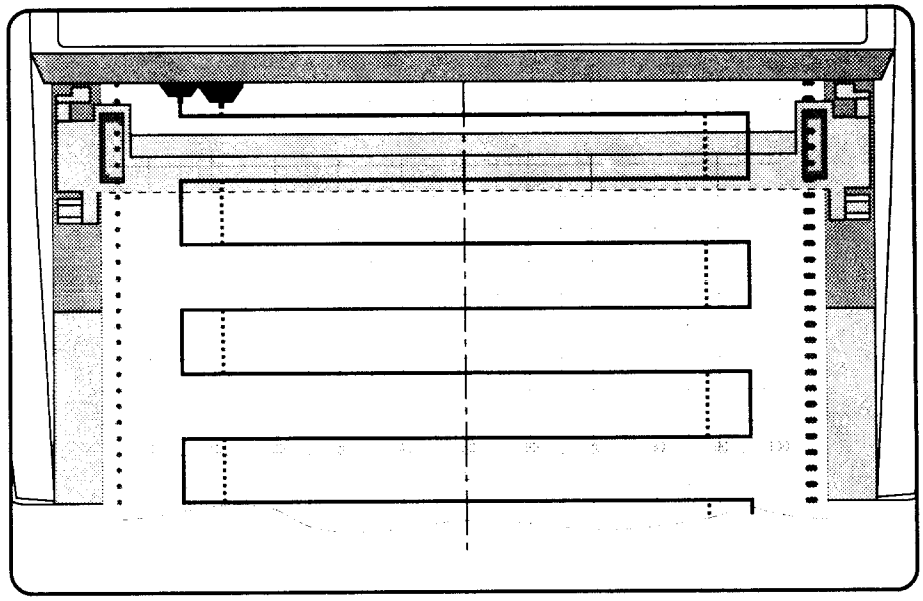
- **Set the shift selector (1) to position PENSYNC.**

Switch On PENSYNC



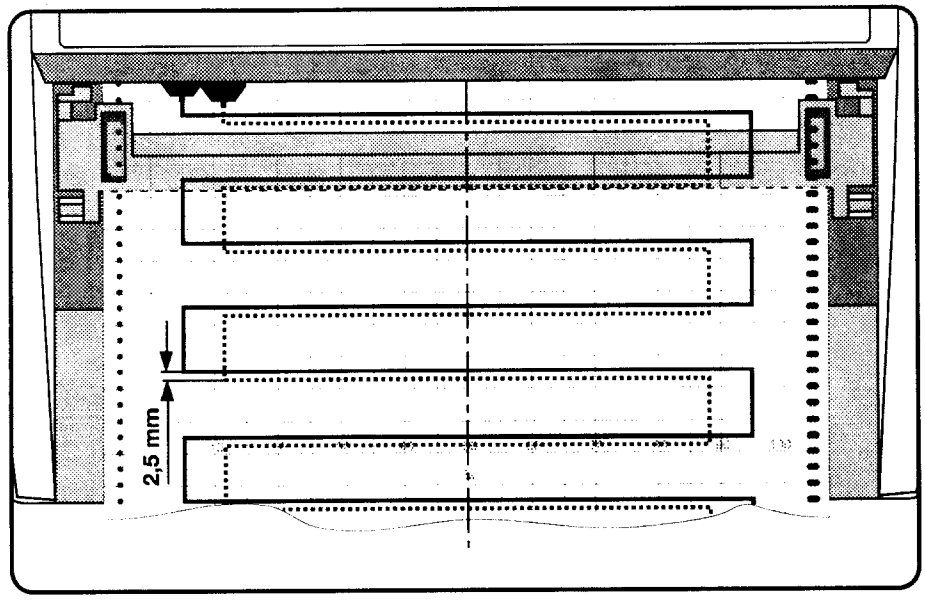
Note Channel 1 records without delay. The measured value of channel 2 is delayed to align with channel 1. Channel 2 only starts after the paper has advanced by 2.5 mm.

PENSYNC
Switched On



With PENSYNC switched on, synchronous sequences are recorded fully synchronized.

PENSYNC
Switched Off



With PENSYNC switched off synchronous sequences are recorded as staggered curves.

2.5 mm mechanicallstaggering (offset) corresponds to a to a delay in the second recording pen dependent on the chart paper feed speed:

0.25 seconds
at an advance speed of **60 cm/min;**

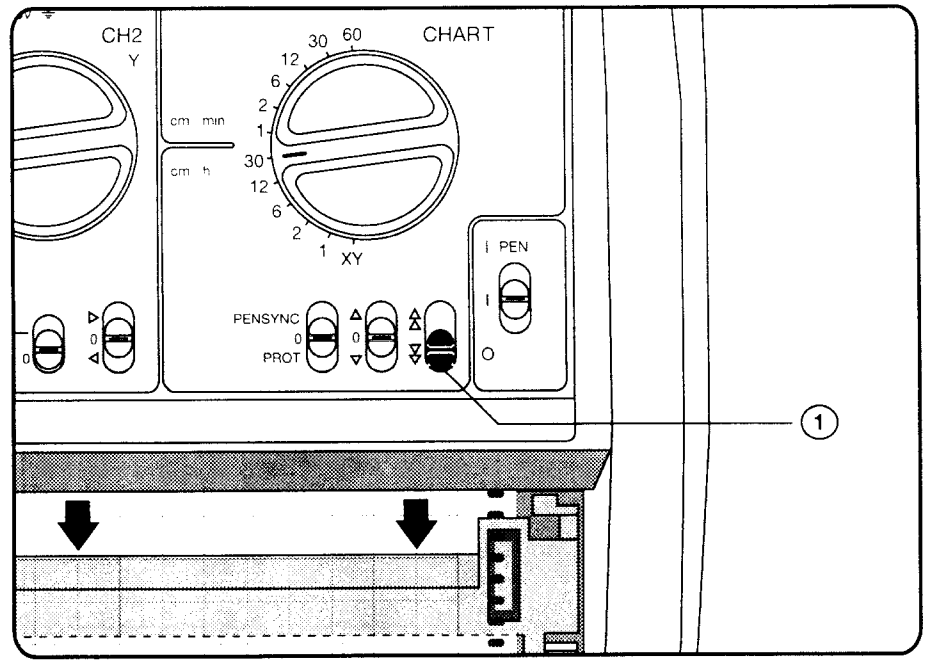
15 minutes
at an advance speed of **1 cm/h.**

3.12 Positioning of Chart Paper

- **Move the shift switch (1) to the desired paper feed direction.**
- **Hold the shift switch (1) until the desired paper position is reached.**

  For approx. 3 s the recording paper advances at a speed of 2 cm/min and after that with a speed of 60 cm/min.

Positioning of Chart paper



Note The positioning of the chart paper is possible with the paper feed switched **on** or **off**.

3.13 Activiation of Chart Paper Feed

11 chart feed speeds can be selected:

1 - 2 - 6 - 12 - 30 cm/h
1 - 2 - 6 - 12 - 30 - 60 cm/min.

Preconditions

For the below set paper feed to become active the "PIN 14" connection of the "REMOTE" - socket must not be connected to earth (active LOW).

The connection "PIN 14" switches the paper feed from internal operation over to external pulse at the "PIN 13" connection of the REMOTE" socket.

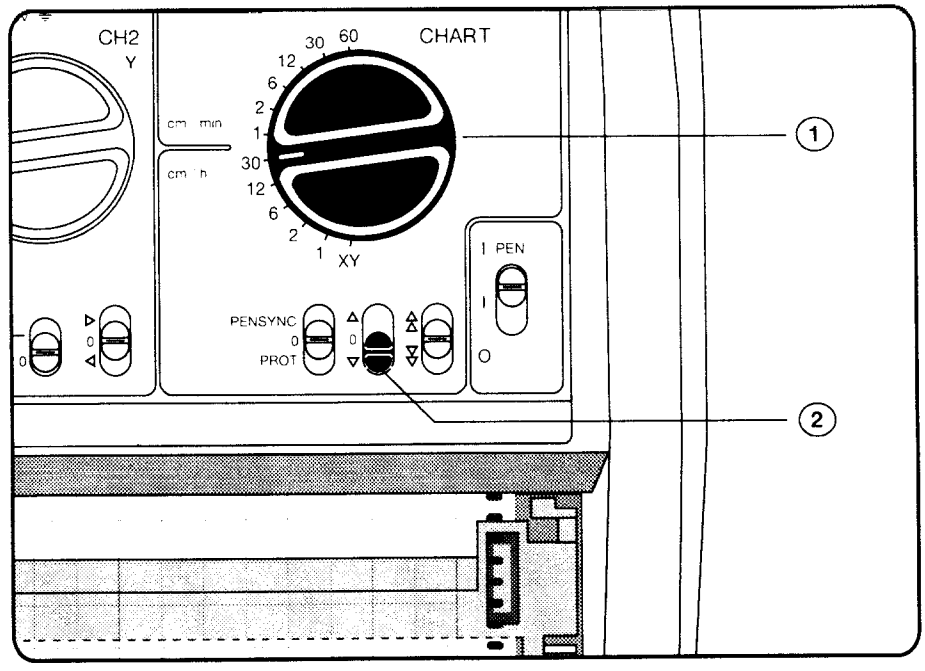
If there are no pulses at the "PIN 13" connection while the "PIN 14" connection (active LOW) is activated, paper feed does not ocurr.

Furthermore, the PIN 11" connection and the "PIN 10" connection of the "REMOTE" - socket (STOP and 2nd feed speed) **must not be connected to earth (active LOW).**

- **Set the dial selector (1) to the desired chart feed speed.**
- **Set the shift selector (2) to the desired feed direction.**

The chart paper is transported with the selected feed speed.

Selection of Chart-Feed Speed



Maximum recording time with a full 25 m chart paper roll at different chart feed speeds:

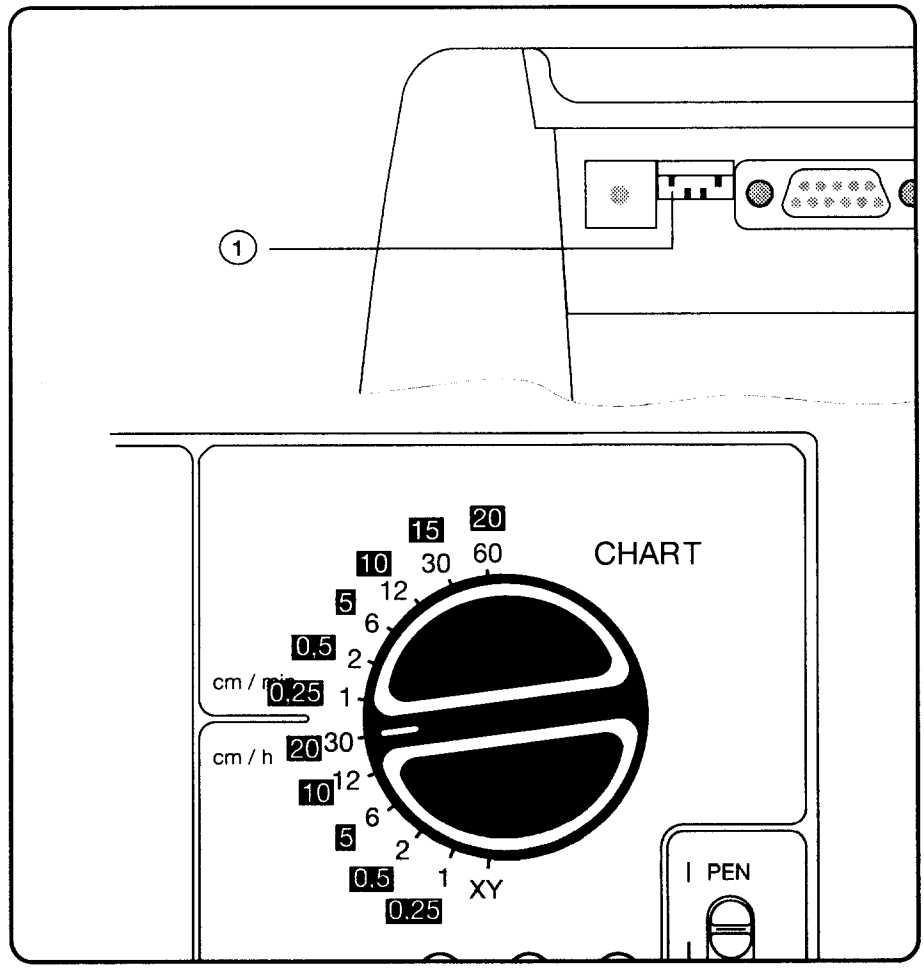
Chart feed speed	Max. recording time	Chart feed speed	Max. recording time
1 cm/h	104 days + 4 hrs.	1 cm/min	41 hrs. + 40 min
2 cm/h	52 days + 2 hrs.	2 cm/min	20 hrs. + 50 min
6 cm/h	17 days + approx. 8.5 hrs.	6 cm/min	6 hrs. + approx. 56 min
12 cm/h	8 days + approx. 16 hrs.	12 cm/min	3 hrs. + approx. 28 min
30 cm/h	3 days + approx. 11 hrs.	30 cm/min	1 hrs. + approx. 23 min
		60 cm/min	approx. 41 min

3.13.1 Switching to the Additional 11 Feed Speeds

- **Set the DIL - switch (1) to the upper position with the instrument switched off.**

After the switch on the dial selector is assigned to the white-on-black feed speed values. The other feed speeds are not valid anymore.

Switching to the Additional Feed Speeds; Rear Side of Instrument



Note These additional feed speeds can be changed up to a maximum of 1 cm/sec. by reprogramming with the application software at an authorized service facility or by the user itself.

Additional information referring to	Can be found in
Time Unit Specifications and Paper Feed	chapter 2.7
Operating the Chart Paper Transport by an External Signal at the "REMOTE" - Socket	chapter 3.17

3.14 Reversing the Chart Paper Feed Direction by Controlling via the "REMOTE" - Socket

- **Connect the positive control signal with "PIN 12" and the reference point of the control signal with "PIN 15"** (earth) **of the "REMOTE" - socket.**

"PIN 12" Connection

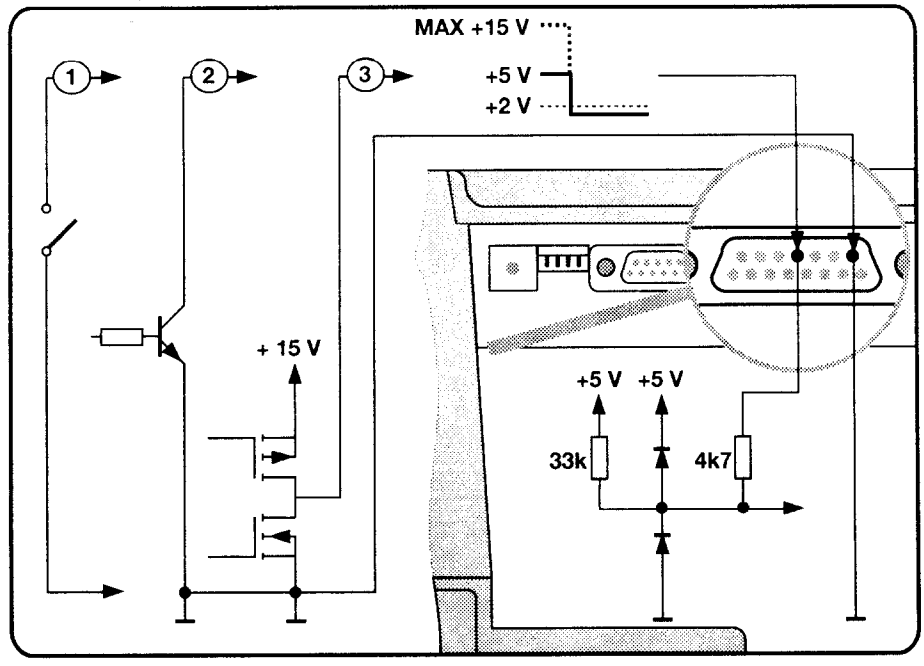
active "LOW"; switch threshold approx. 2 V; max. input voltage ±15 V.

For the time in which "PIN 12" is connected to earth, the recording feed direction is reversed.

Note

The reversal of the feed speed is also effective if the feed step-motor is controlled by external signals.

Controlling via the "REMOTE" - Socket; Rear Side of Instrument



Possibilities of Controlling

① floating contact,
② TTL open - collector,
③ output of CMOS gates

Additional information referring to	**Can be found in**
Operating the Chart Paper - Transport by External Signal to the " REMOTE" - Socket	chapter 3.17

3.15 Stopping the Chart Paper Feed by Controlling Via the "REMOTE" - Socket

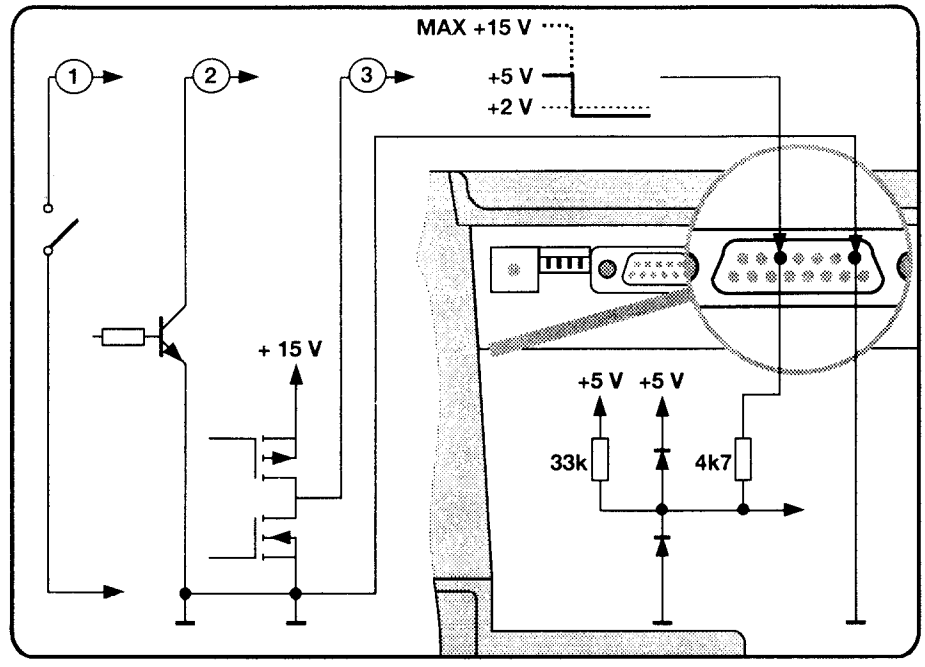
- **Connect the positive control signal with "PIN 11" and the reference point of the control signal with "PIN 15"** (earth) **of the "REMOTE" - socket.**

"PIN 11" Connection

active "LOW"; switch threshold approx. 2 V; max. input voltage ±15 V.

For the time in which "PIN 11" is connected to earth, the recording feed is stopped.

Controlling via the "REMOTE" - Socket; Rear Side of Instrument



Possibilities of Controlling

① floating contact,
② TTL open - collector,
③ output of CMOS gates

Note

If the **recording is paused lift the recording pen(s) from the recording paper** to avoid ink bleeding.

3.16 Programming and Switching Over to the Second Feed Speed

Calling the programming mode:

- **Set the dial selector (1) to 60 cm/min.**
- **Press the shift switch (2) to "Reverse" and switch the instrument on at the same time (3).**

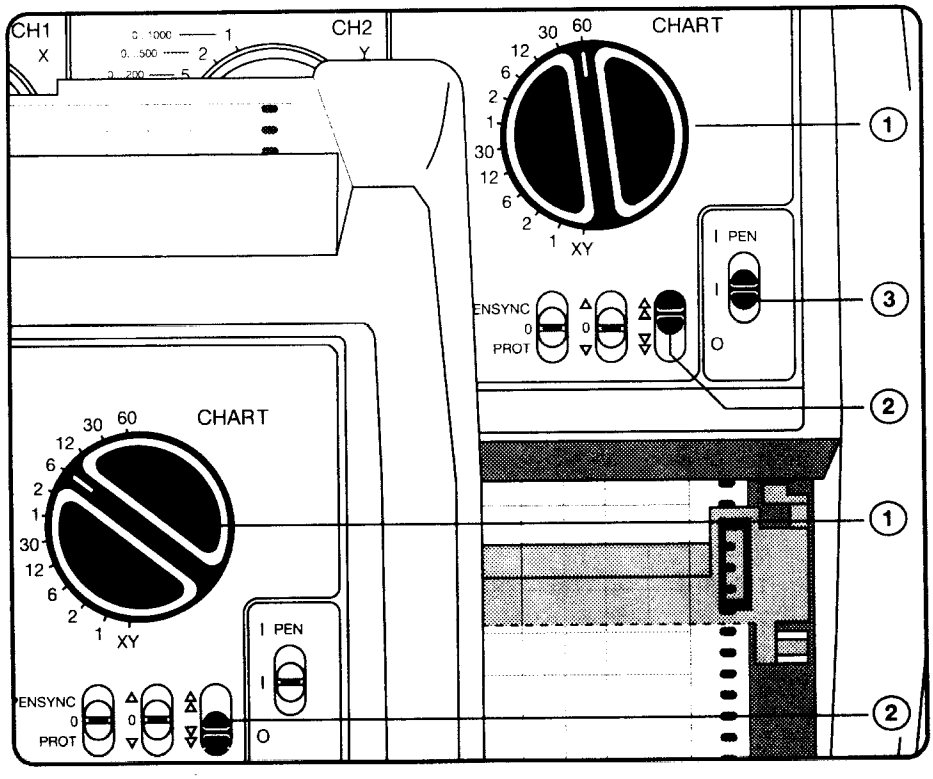
Programming of a second feed speed:

- **Set the dial selector (1) to the desired second feed speed**
  (e.g.: 6 cm/min).
- **For a short moment, press the shift switch (2) to "Forward" once.**

  The instrument has stored the second feed speed and is again ready for operation.

Note — The feed speed stays stored even after the instrument is switched on or off.

Programming the Feed Speed



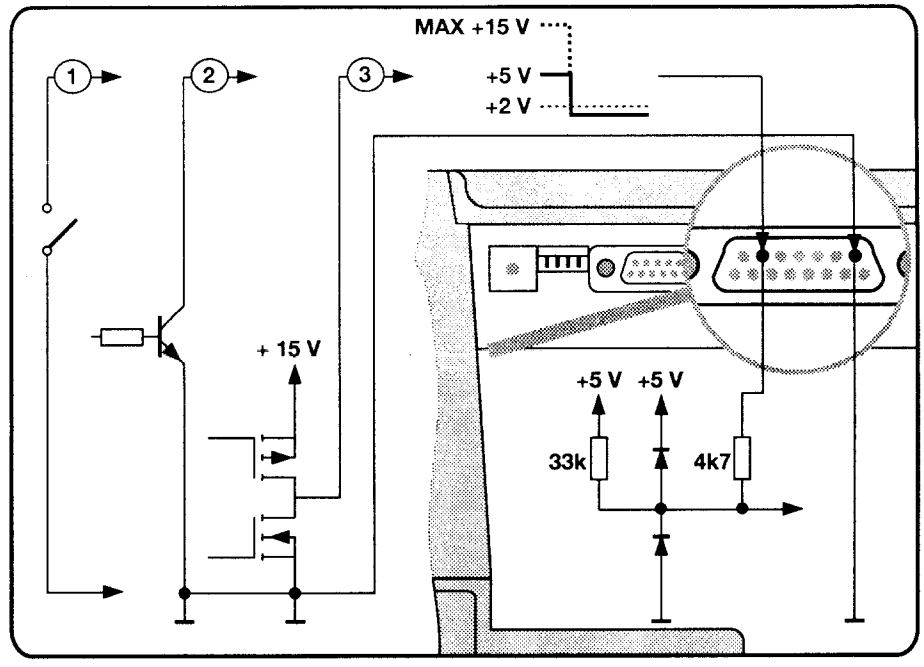
- **Connect the positive control signal with "PIN 10" and the reference point of the control signal with "PIN 15"** (earth) **of the "REMOTE" - socket.**

"PIN 10" Connection

active "LOW"; switch threshold approx. 2 V; max. input voltage ±15 V.

For the time in which "PIN 10" is connected to earth, the instrument switches to the programmed second feed speed.

Controlling via the "REMOTE" - Socket; Rear Side of Instrument



Possibilities of Controlling

① floating contact,
② TTL open - collector,
③ output of CMOS gates

3.17 Operating the Chart Paper - Transport by External Signals to the "REMOTE" - Socket

128 pulses / second at the step motor M result in a feed speed of 60 cm/min. If more pulses /second are sent the step motor stops.

- **Connect the positive control signal with "PIN 10" and the reference point of the control signal with "PIN 15"** (earth) **of the "REMOTE" - socket.**

"PIN 14" Connection

active "LOW"; switch threshold approx. 2 V; max. input voltage ±15 V.

- **Connect the positive wire of the external pulses with "PIN 13" and the reference point of the external pulses with "PIN 15"** (earth) **of the "REMOTE" - socket.**

"PIN 13" Connection

active "LOW"; switch threshold approx. 2 V; max. input voltage ±15 V.

The connection "PIN 14" switches the operation of the paper transport from internal operation over to external pulses on the "PIN 13" connection.

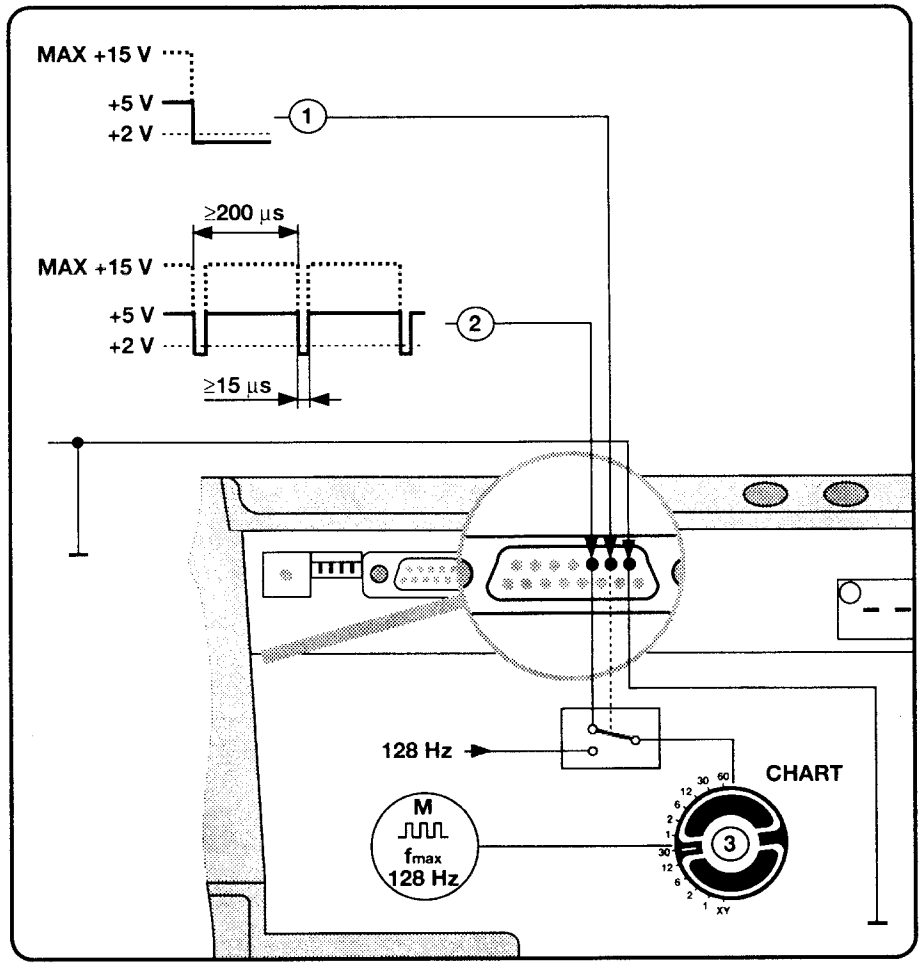
Preconditions

To enable the paper transport to be operated by external pulses the "PIN 14" connection has to be connected to earth.

If there are no pulses at the "PIN 13" connection while the "PIN 14" connection (active LOW) is activated, paper feed does not ocurr.

Controlling with External Pulses via the "REMOTE" - Socket; Rear Side of Instrument

Smallest Pulse-Duty Factor of the External Pulses



(1) "PIN 14" connection; switching over from internal operation to external pulses (active LOW).

(2) "PIN 13"connection; max. external frequency 128 Hz.

(3) Selector for chart paper feed speed-selector = divisor: 1:1 = 60 cm/min
1:3600 = 1 cm/h

Formula to find f_{ext} (Hz)

$$f_{ext}\ (Hz) = \frac{\text{desired feed speed [cm/min]}}{\text{selector setting [cm/min]}} \times 128\ Hz$$

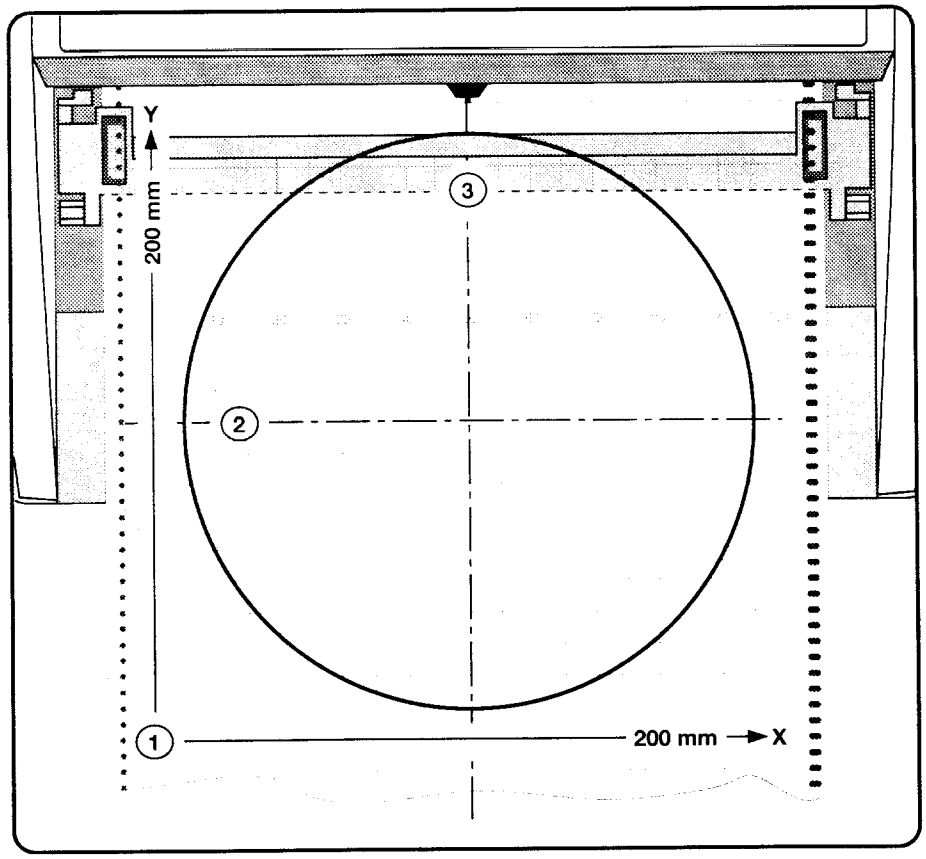
Note A value expressed as (cm/h) must be converted to cm/min before being inserted into the formula.

3.18 Working in the XY - Operational Mode

Example

Two slowly ascending sinus signals rotated by 90° shall be displayed on paper.

XY Representation

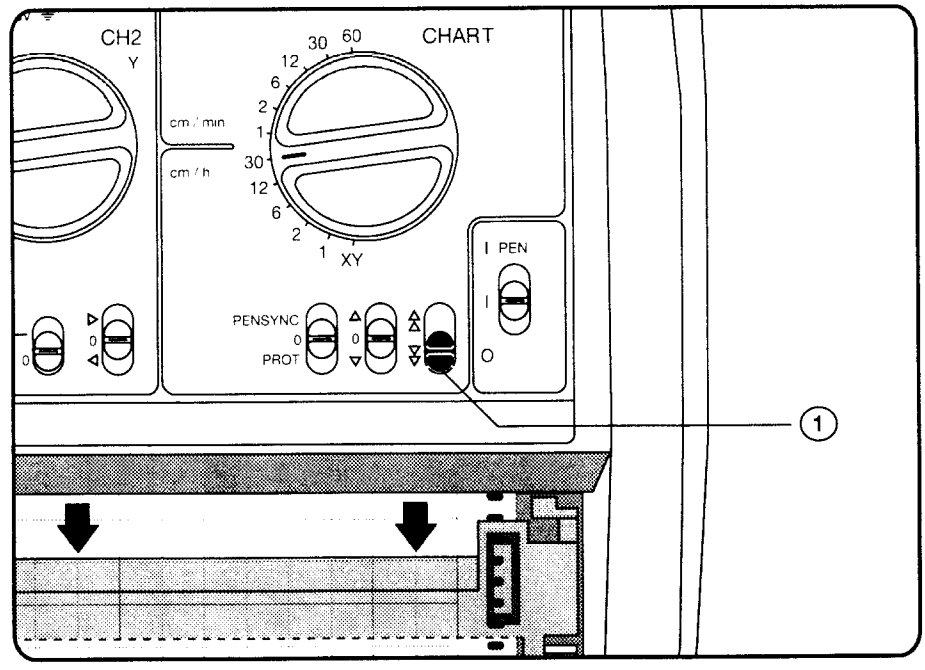


(1) set format zero point.
(2) set zero point of the Y - channel.
(3) set zero point of the X - channel.

Setting the Format Zero Point

- **Press the shift switch (1) to the desired feed direction.**
- **Hold the shift switch (1) until the desired paper position (= format zero point) is reached.**

Setting of the Format Zero Point



Setting the X - Zero Point

- **Set the shift selector (1) to position 0.**

  The currently valid zero point setting is displyed without being influenced by the connected measuring signal.

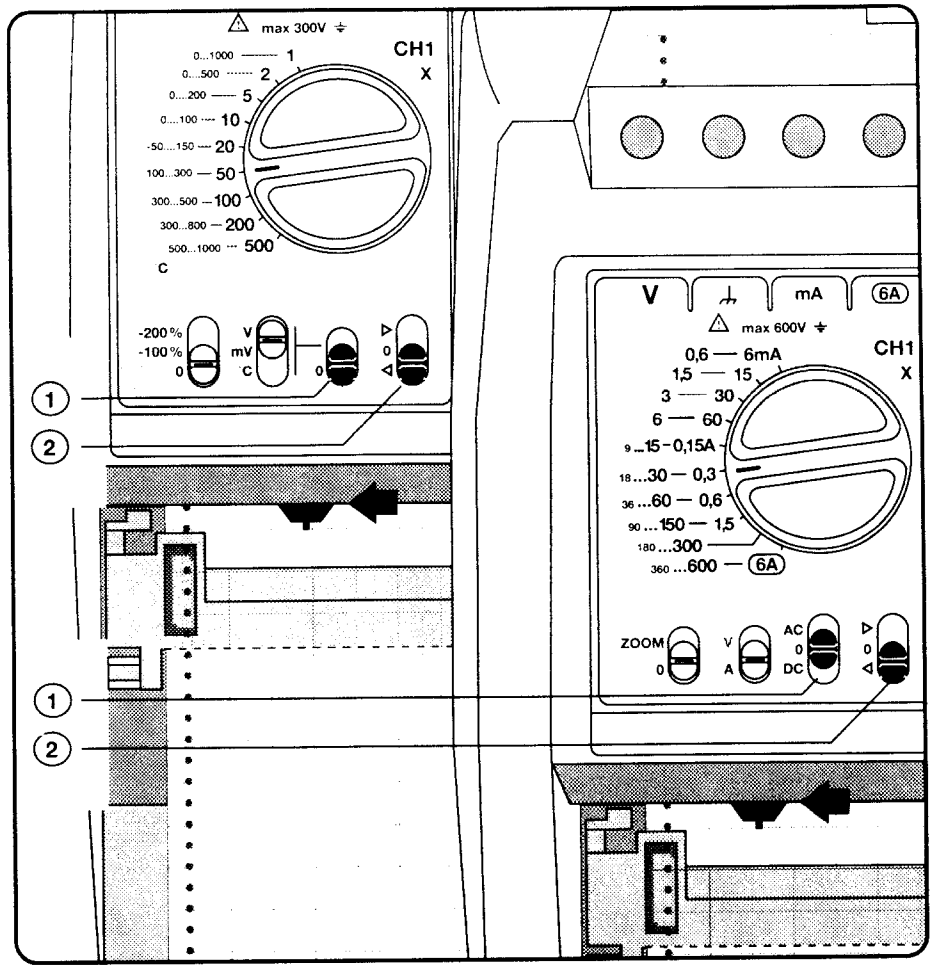
- **Press the shift switch (2) (of channel 1) to the desired direction.**

  The recording pen moves to the desired direction.

Setting of the (Recording) Zero Point

DC - Instrument

AC - Instrument



1. possibility

procedure as with the X - channel

Setting the Y - Zero Point in the none XY - Mode

After switching over to the XY mode, a pen deflection e.g. of 50% of channel 2 results in a paper feed of 10 cm.

2. possibility

procedure as with the X - channel

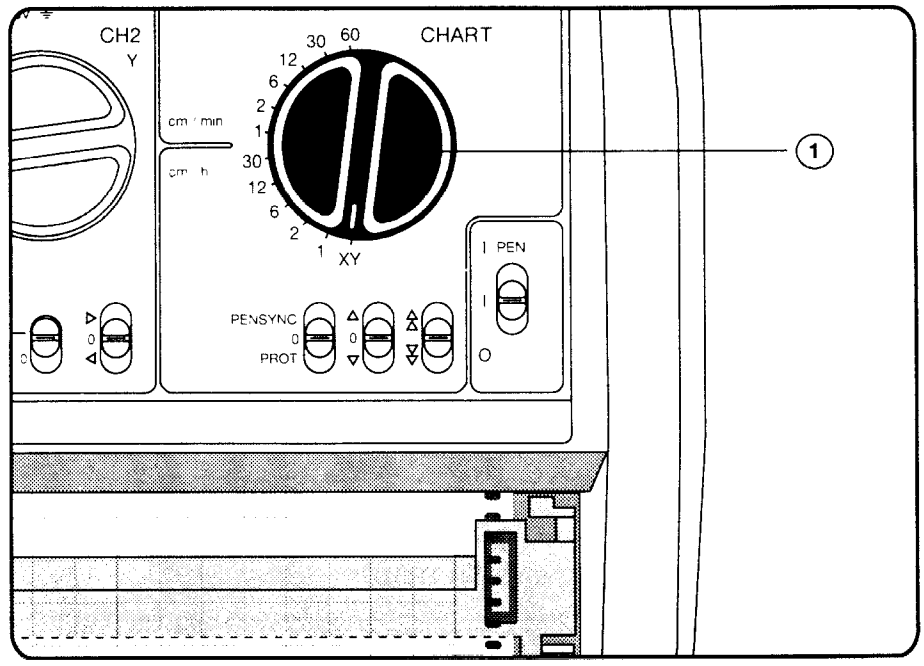
Setting the Y - Zero Point in the XY - Mode

Not the recording pen but the chart paper is transported.

- **Set the shift selector (1) to the desired measuring mode.**

- **Set the dial selector (1) to XY.**

Switching on the XY - Operational Mode



Deflection in the Y - direction:

Paper feed depends on the measuring signal.

If the format zero point coincides with the (recording) zero point , 100% of the set measuring range moves the paper in the forward direction by 200 mm.

Deflection in the X- direction:

Movement of the recording pen depends on the measuring signal.
If the zero point is set to 0% of the chart paper, 100% of the set measuring range moves the recording pen across the full recording width of 200 mm.

Note

The response speed in the Y - direction is 1 cm/s.
With rapidly changing measuring signals hysterisis effects and ensuing faulty measurments are inevitable.

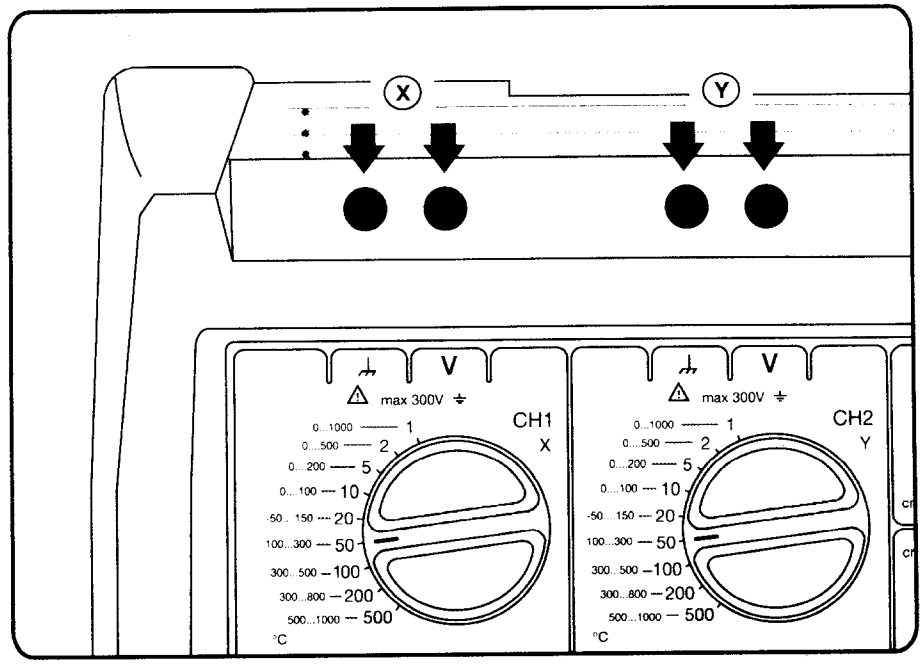
The warning notices **"To protect against dangerous shock-hazard voltages"** und **"Overload protection of the measuring ranges"** have to be complied with under any circumstances.
Further specifications about the instrument can be found in the chapters "Setting of Voltage- and Current Measuring Ranges."

- **Set the measuring ranges as described in chapter "Setting of Voltage- and Current Measuring Ranges."**

For your own safety always connect the measuring cable to the instrument first and only then to the signal source.

- **Connect the measuring cables to the measuring inputs as described in chapter "Setting of Voltage- and Current Measuring Ranges."**

Connection of the Measuring Signals



Additional information referring to	**Can be found in**
Instrument Specifications	chapter 2.6
Measuring Unit Specifications AC-Instr.	chapter 2.8
Measuring Unit Specifications DC-Instr.	chapter 2.9
Earthing and Interference Voltage	chapter 4.1
Dependance of Accuracy on Source Resistance	chapter 4.2
Dynamic Behaviour	chapter 4.3
Expansion of Measuring Capabilities	chapter 4.4

3.19 Printing a Measuring Protocol

- **Press the shift switch (1) to position PROT.**

1. Possibility — Printout of measuring protocol **before** the measurement:

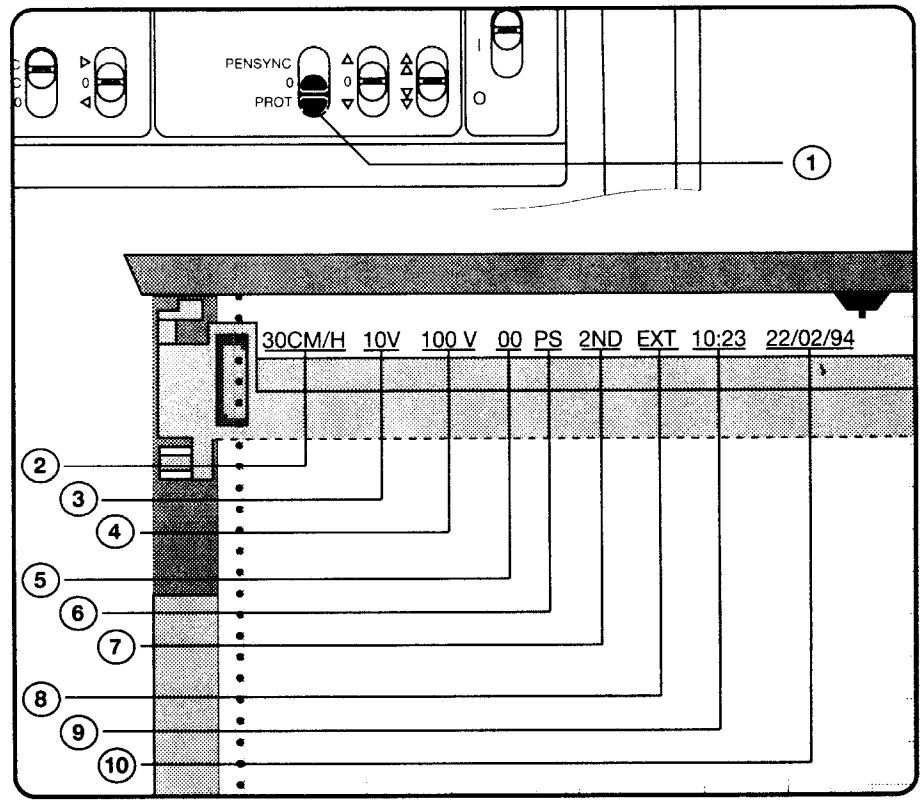
- **If the PENSYNC is used for the following measurement and if it should also be printed on the protocol set the shift switch (1) to PENSYNC immediately afterwards.**

2. Possibility — Printout of measuring protocol **after** the measurement:

- **If the PENSYNC has been used in the preceeding measurement and if it has also also be en printed on the protocol set the shift switch (1) to PENSYNC immediately afterwards.**

Note — Measurments and paper feed is interrupted for the duration of the measuring protocol printout.

Starting a Measuring Protocol



② Chart paper feed speed

③ Measuring range; channel 1

Measuring mode DC is not printed out.
e.g.: 10V

Measuring mode AC is not printed out.
e.g.: 600VAC

④ Measuring range; channel 2

Representation as described for channel 1.

⑤ Zero suppresssion (DC instrument only)

in the shown example:
0 . . . means: left character for chan.1
0 . . means: right character for chan. 2

coding:
0 . . . 0% suppression
1 . . . 100% suppression
2 . . . 200% suppression

⑥ PENSYNC activated

⑦ Second feed speed activated

⑧ Paper feed with exteranal pulses

⑨ Time

⑩ Date

3.20 Writing a Marker by Controlling via the "REMOTE" - Socket (Eventmarker)

For channel 1:

- **Connect the positive control signal with "PIN 1" and the reference point of the control signal with "PIN 15"** (earth) **of the "REMOTE" - socket.**

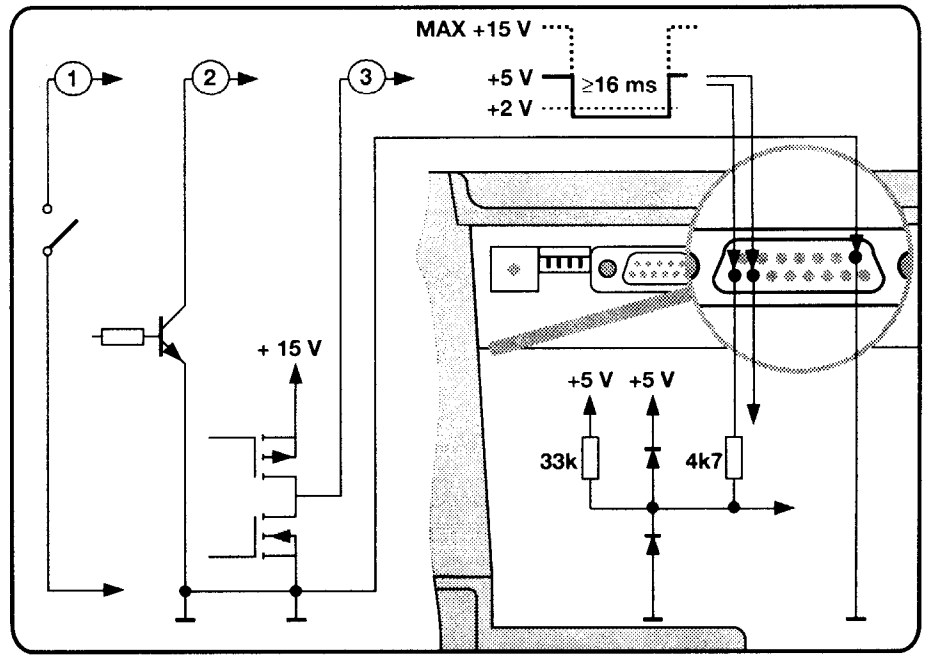
For channel 2:

- **Connect the positive control signal with "PIN 2" and the reference point of the control signal with "PIN 15"** (earth) **of the "REMOTE" - socket.**

Connection "PIN 1" or "PIN 2"

active "LOW"; switch threshold approx. 2 V; max. input voltage ±15 V.

Controlling via the "REMOTE" - Socket; Rear Side of Instrument

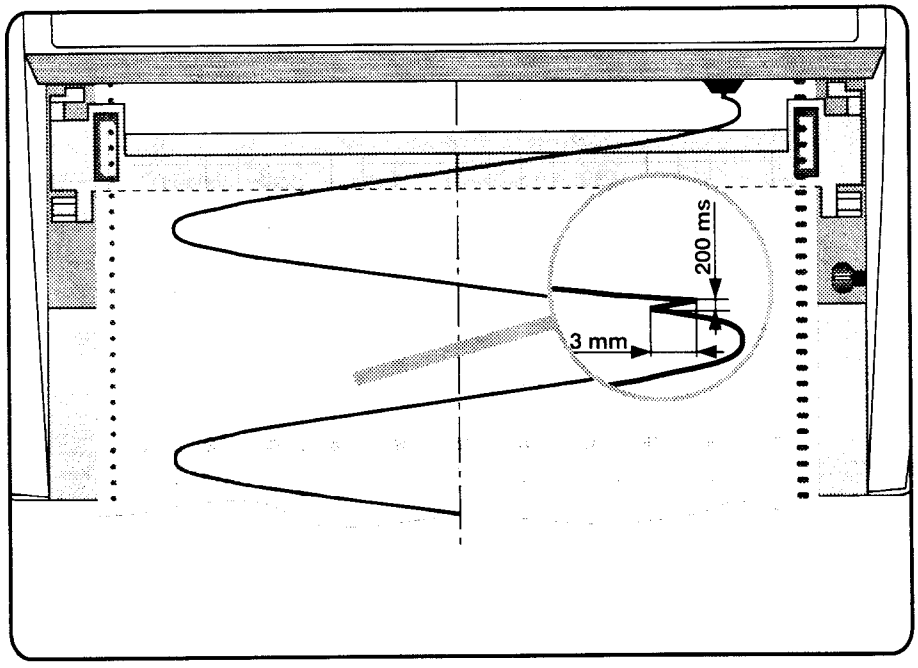


Possibilities of Controlling

① floating contact,
② TTL open - collector,
③ output of CMOS gates.

If "PIN 1" or "PIN 2" is connected to earth for ≥16 ms a positive needle pulse is superimposed by a deflection of approx. 3 mm and a pulse duration of approx. 200 ms of the recording (channel 1 or 2).

Marker Superimposed to Recording

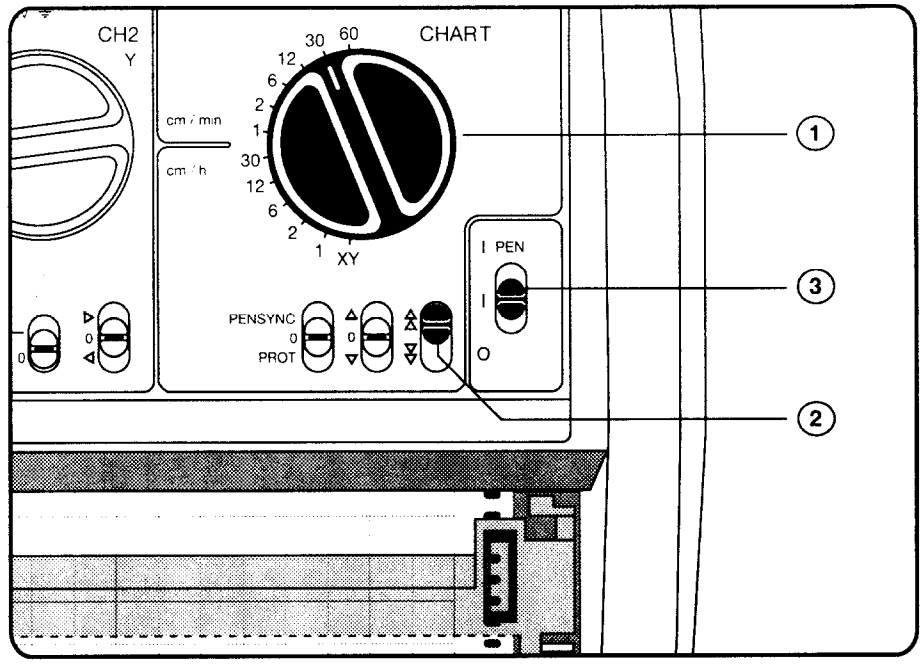


3.21 Programming of Limit Values and Sounding an Alarm Signal If a Limit Value is Exceeded

Calling the programming mode:

- **Set the dial selector (1) to 30 cm/min.**
- **Press the shift switch (2) to reverse feed and switch the instrument on at the same time (3).**

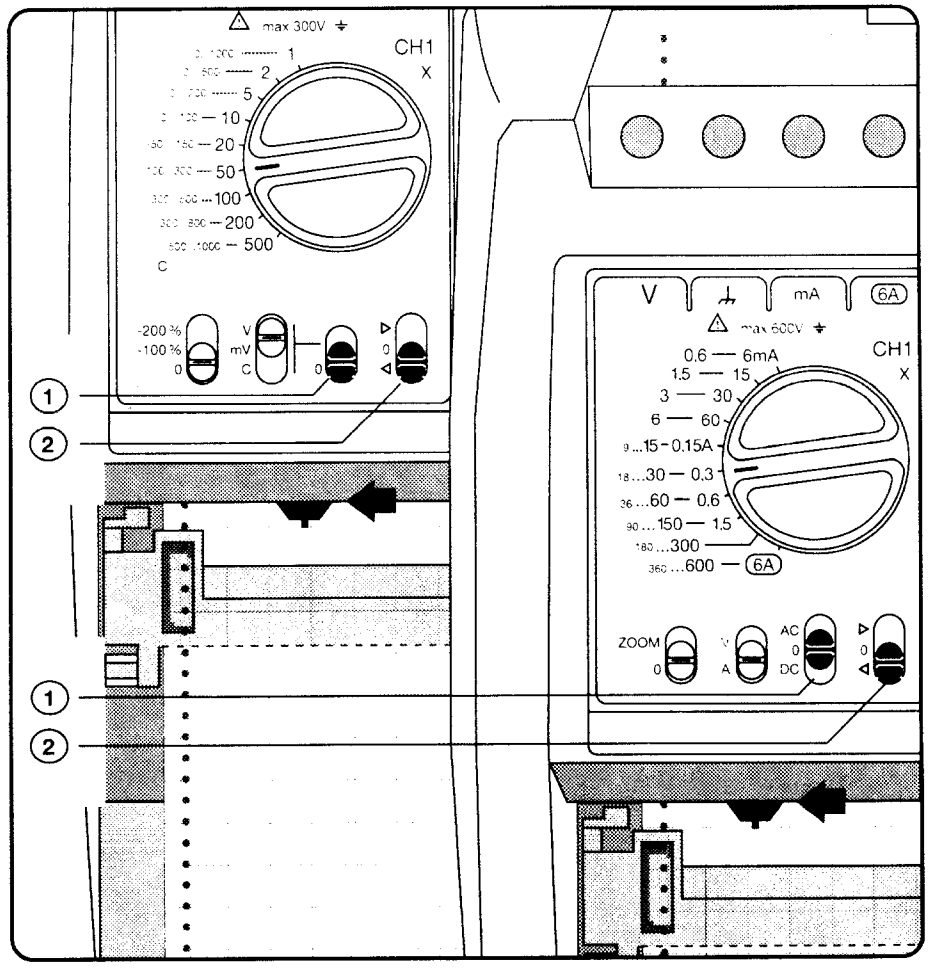
Calling the Programming Mode



Programming of MIN - limit vakues MIN1 and MIN2:

- **Set the shift selector (1) to position 0.**
- **With the shift switch (2) set the zero point of channel 1 to the desired MIN limit value.**
- **In 2 channel instruments this procedure also applies to the 2nd channel.**

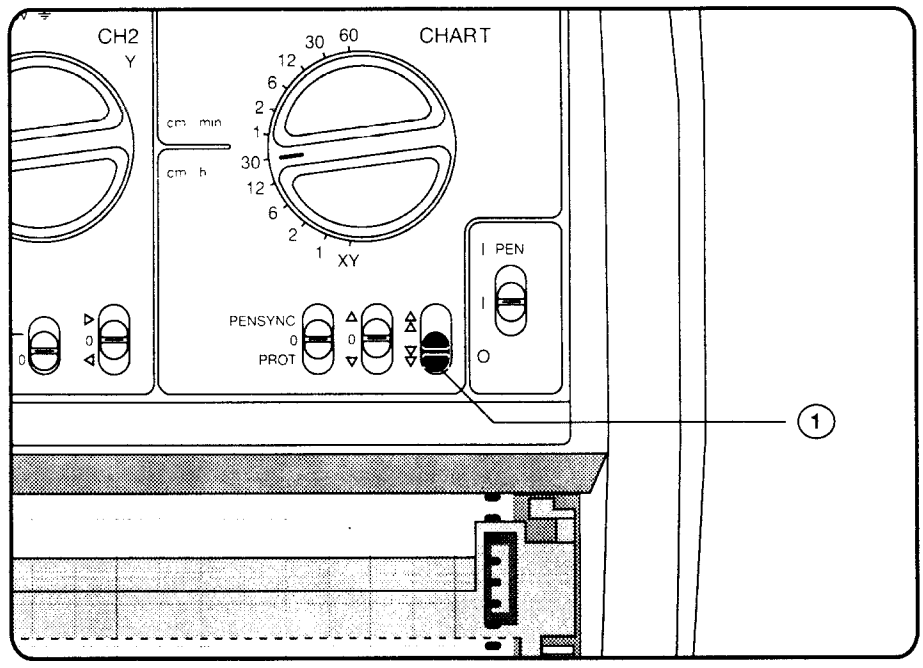
Programming MIN - MAX - Limit Values



- **Press the shift switch (1) shortly to forward feed once.**

  The instrument keeps the selected MIN limit values stored and shows the stored MAX limit values.

Programming MIN - MAX - Limit Values



The programming of MAX limit values MAX1 and MAX2 has to be done in the same way.

After the MAX - limit value programming procedure has been accomplished the instrument returns to the ready-for-operation state if the shift switch (1) is pressed to the forward feed position once.

Note The MIN - MAX - limit values remain stored even after the instrument has been switched off and on again.

Alarm Signals

Output Voltage
The voltage levels are TTL - compatible.

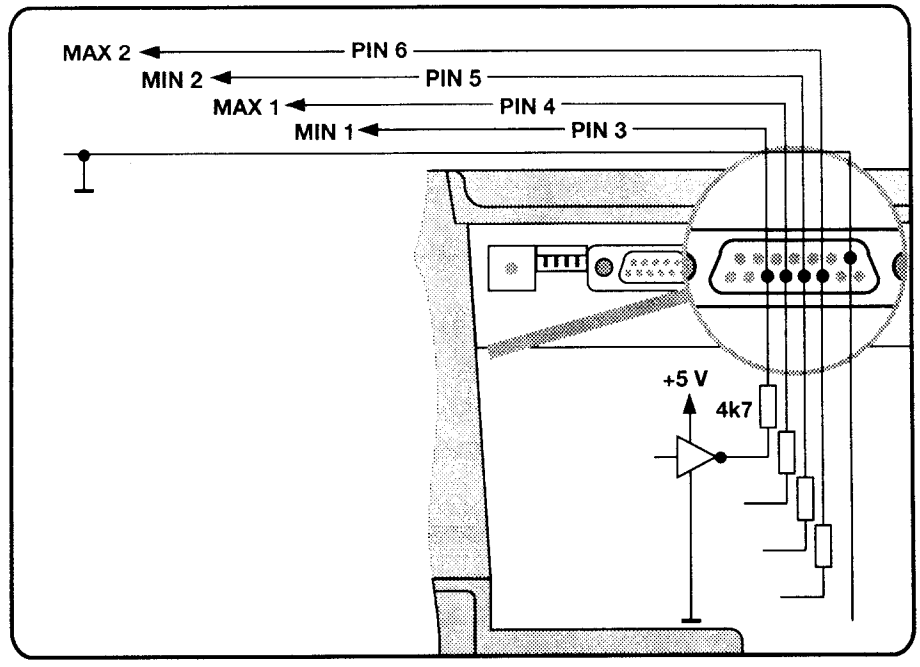
Output Current
The output current is limited by approx. 1mA by the 4k7 protective resisitor connected in series to the output.

Connection "PIN 3" or "PIN 5"
For the duration of a MIN - limit value - exceeding
"PIN 3" for channel 1 and
"PIN 5" for channel 2 becomes **LOW**.

Connection "PIN 4" or "PIN 6"
For the duration of a MAX - limit value - exceeding
"PIN 4" for channel 1 and
"PIN 6" for channel 2 becomes**LOW**.

"PIN 15" Connection
"PIN 15" is the reference point for the alarm outputs.

Alarm Outputs at the "Remote" Socket; Rear Side of Instrument



4 Measuring Directions

4.1 Earthing and Noise Voltages

When positive pole of measured voltage is connected to the "⏚" input nearer to earth, the zero reference of the instrument must be set to a full scale value of 100%. Then the upper range limit corresponds to the lower limit of scale of 0 %.

The appearance of noise voltage in the measuring circuit may cause wrong measuring results. Often these errors are not directly recognizable. In case of high amplitudes of a noise voltage signal, however, a jittering of the measured signal can be observed. The limits of the maximum amplitude of a noise voltage inbetween which tolerable errors are not exceeded can be found in chapter "Technical Data".

Unfavourable grounding of the measuring circuit may also cause noise voltages. Even if the inputs of the recorder are floating, the "⏚" terminal is nearer to the earth potential because of its connection to the shielding. This shielding protects the electronics against leakage currents and interferences. Therefore the "⏚" terminal of the recorder input should be connected to the pole of the measured signal which is nearer to earth and, if possible, should be connected to earth either directly or by means of a capacitor.

The **signal-to-noise ratio "A(dB)"** states the formula

$$A = 20 \lg \frac{\text{noise voltage [Vss] at the input terminals}}{\text{displayed noise voltage [Vss]}}$$

Example Determine the maximum allowed noise voltage at the input terminals in the 500 mV range at a series mode rejection (SMR A = 40dB at 50hz) so that the expansion of the recording width does not exceed 1 mm.

1 mm deflection in the 500 mV measuring range corresponds to a measured signal of 2.5 mVss (0,0025 Vss).

$$40\ dB = 20 \lg \frac{\text{noise voltage at the input terminals [Vss]}}{0.0025\ Vss}$$

$$\text{noise voltage} = 0.0025\ Vss \times 10^{40/20} = \underline{\mathbf{0.25\ Vss}}$$

4.2 Dependence of Accuracy on Source Resistance

The accuracy of the measuring result depends on the value of the source resistance (the higher the value the higher the error). To stay inside the tolerable accuracy the value of the source resistance must not be higher than indicated.

$$\left(\frac{R_S}{R_S + R_{in}}\right) \times 100\% = \text{error in } \%$$

R_S . . . source resistance
R_{in} . . .input resistance

4.4 Expansion of Measuring Capabilimes

Possible with accessories to be supplied.
A list of accessories can be found on the front inside cover.

5 Interface

5.1 Connecting the Interface

With the interface the instrument can accomplish the following tasks:

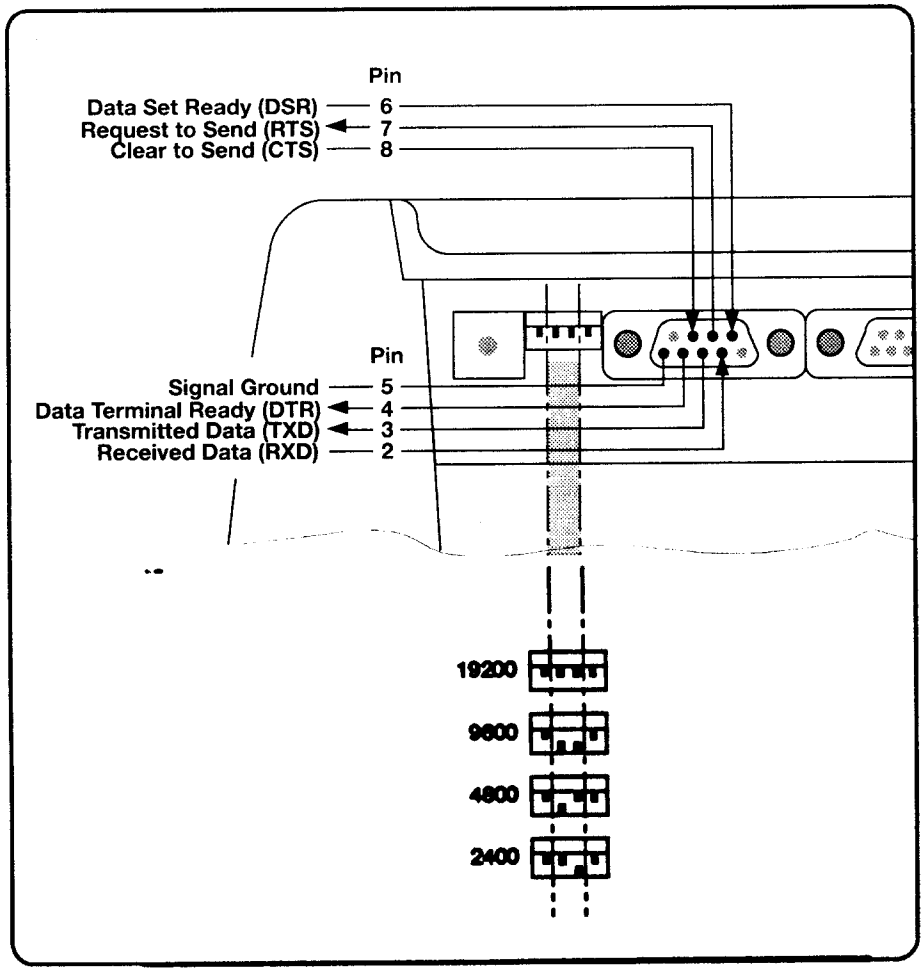
* Request all instrument settings,
* Transmitt measured values from or to the instrument and
* Controll functions of the instrument.

Interface-Parameters

2400 / 4800 / 9600 / 19200 baud, 8 data bit, no parity, 1 stop bit.

- **Set the baud rate with the DIL - switches at the rear side of the instrument.**

Pin Assignment of The 9pin Interface Terminal



Setting the Baud Rate

Pin	Signal Name	Function	Signal Direction
2	Received Data (RXD)	Data to Interface (Reception connection)	Input
3	Transmitted Data (TXD)	Data from the interface (send connection)	Output
4	Data Terminal Ready (DTR)	Interface ready to receive data > +5 V	Output
5	Signal Ground (GND)	Earth	
6	Data Set Ready (DSR)	Dataoutput from interface possible > +3 V	Input
7	Request to Send (RTS)	Data ready to be sent > +5 V	Output
8	Clear to Send (CTS)	Dataoutput from interface possible > +3 V	Input

Handshake

The Signal Connection RTS, DTR:
With the signal connection RTS and DTR the instrument controls the data transmission from the computer to the instrument. If the instrument is not ready to receive data RTS and DTR are set to logic "0". If the instrument is ready to receive data RTS and DTR are set to logic "1".

The Signal Connection CTS, DSR:
Via the signal connection CTS and DSR the communication partner is able to control the data transmission from the instrument to the PC. If CTS or DSR becomes logic "0" the instrument terminates the transmission immediately after having sent the character currently stored in the output buffer. If CTS and DSR become logic "1" the interrupted data transmission is resumed.

Electrical Properties

The interface uses voltage levels corresponding to the RS 232 C.standard. The following two voltage ranges are assigned to the two conditions of the binarily transmitted information:

* Condition "OFF" (logic "1", "Mark"): -15 to -3V
* Condition "ON" (logic "0", "Space"): +15 to +3V

Outside these voltage ranges the signal condition is undefined.

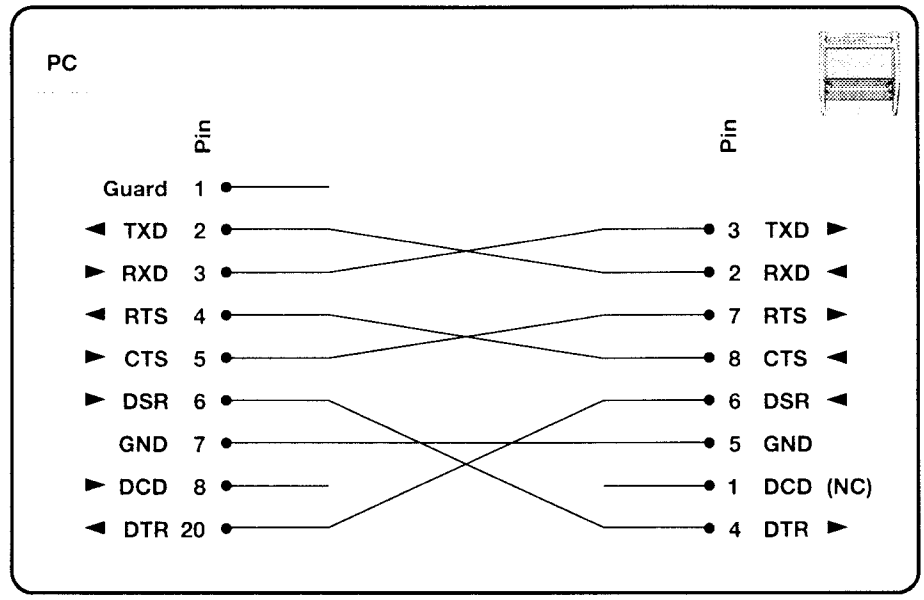
The sender is protected against short circuit.

The transmission line should not be longer than 15 m. If longer lines are used make sure the cable's capacity is not higher than 2500pF.

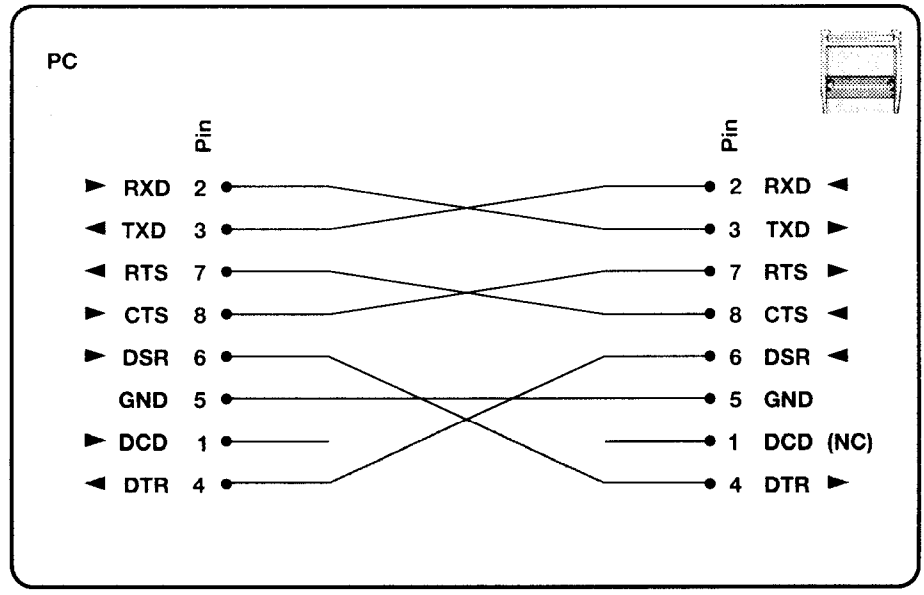
Interface Cable

The order reference and number can be found on the inside of the front cover page.

25 Pin Connector at the PC



9 Pin Connector at the PC



5.2 Summary of Commands

5.2.1 Reset Command

Comm.	Parameter	Function
ZZ<ez>	none	**Hardwarereset** Instrument is ready to receive only after DC1 has been sent off.

Note: The command has to be put in capitals.

5.2.2 Commands to Remote Control the Instrument

Comm.	Parameter	Function
W	<d><ez> d = 0 ... enable 1 ... stop	**Stop chart paper feed**
P	<d><ez> d = 0 ... off 1 ... active	**Switch over to 2nd feed speed**
Q	<SP><ez> SP = 00 ... XY-mode 01 ... 1 cm/h 02 ... 2 cm/h | 11 ... 60 cm/min Ranges are not valid if instrument is switched over to additional feed speed.	**Enter 2nd feed speed**
G	<d><ez> d = 0 ... off 1 ... on	**Switch servo off/on** (= pen movement)
U	none	**Move chart paper 1 step to forward** (approx. 0.078mm) 128 steps = 1cm
D	none	**Move chart paper 1 step to reverse** (approx. 0.078mm) 128 steps = 1cm
H	none	**Lift recording pens from chart paper**
I	none	**Lower recording pens to chart paper**
A	<YY>,<MM>,<DD>,<hh>,<mm>,<ss><ez>	**Set date/time**
J	none	**Page feed in XY-mode** (200mm)

continued **Commands to Remote Control the Instrument**

Comm.	Parameter	Function
T	"<AsciiString>"<ez> max. of 50 printable 8Bit-ASCII-characters quotation characters (") are not printable.	**Print text line** (including line feed) The command **T""**<ez> results in a line feed.
X	CH1min,CH1max<ez> CH1min/max = 0 ... 100 min-/max-limit value -position has to be entered in percent of the recording width.	**Set min-/max-limit value for channel 1**
Y	CH2min,CH2max<ez> CH1min/max = 0 ... 100 min-/max-limit value -position has to be entered in percent of the recording width.	**Set min-/max-limit value for channel 2**
Z	<d><ez> d = 0 ... <tx>=<LF> 1 ... <tx>=<CR>	**Switch over output-block-terminator**

5.2.3 Commands for the Measured Data Transmission

Comm.	Response	Function
O		**Measured data output**
1 channel	<valueCH1><te>	Single request (in XY- and Yt-mode)
2 channel	<valueCH1>,<valueCH2><te>	
	assignment in XY-mode	
	<valueCH1> = X-channel <valueCH2> = Y-channel	
S	<d><ez> parameter	**Measured data jabber ON/OFF**
	d = 0 ... off 1 ... on	
1 channel	<valueCH1><tx> <valueCH1><tx>	In the instrument both channels are read out at an interval of 16ms.
	<valueCH1><te>	128 measured values per second are transmitted.
2 channel	<valueCH1>,<valueCH2><tx> <valueCH1>,<valueCH2><tx>	
	<valueCH1>,<valueCH2><te>	

5.2.4 How to Bring the Measured Data from the Interafce to Paper (Reprint function)

Comm.	Parameter	Function
L		Reprint of measured data in the instrument's output format. The measured data are printed to paper in Yt- or in XY-format according to the instrument's operational mode.
1 channel	<valueCH1><tx> <valueCH1><tx> <valueCH1><te>	
2 channel	<valueCH1>,<valueCH2><tx> <valueCH1>,<valueCH2><tx> <valueCH1>,<valueCH2><te>	
	Value range in the Yt-mode: from 0 ... 1600 corresponding to 0 ... 100% of the rercording width	
	Value range in the XY-mode: from 0 ... 100% of the diagram length	

5.2.5 Commands to Query the Instrument Status

Comm.	Response	Function
F	<xxx><te> xxx = 000 to 023	**Query error code**
V	<Ident>,<KZ>,<VS>,<VH>,<YY>, <MM>,<DD><te> Ident = type of instrument KZ = number of meas. channels VS = no. of software version VH = no. of hardware version last calibration YY = year MM= month DD = day	**Query Ident-string**
E	<ThCH1>,<ThCH2>,<CJ><te> ThCHn = J I K I T I 0 J ... thermo element type J K ... thermo element type K T ... thermo element type T 0 ... channel does not exist CJ = 0 I 1 0 ... compensation off 1 ... compensation on	**Query configuration for temperature measurement**
B	<YY>,<MM>,<DD>,<hh>,<mm><te> (without seconds)	**Query date/time**

continued **Commands to Query the Instrument Status**

Comm.	Response	Function
R0<ez>	<SP>,<PP>,<VV>,<WW>,<DL><te> SP = 00 ... XY-mode 01 ... 1 cm/h 02 ... 2 cm/h . . 11 ... 60 cm/min PP = 0 ... PROT 1 ... 0 2 ... PENSYNC VV = 0 ... forward 1 ... stop 2 ... reverse WW = 0 ... progr. forward 1 ... stop 2 ... progr. reverse DL = 0 ... additional feed- speed (DIL - switch rear side of instrument) 1 ... feed speed- according to sign on front panel	**Query switch positions from the time unit**

continued Commands to Query the Instrument Status

Comm.	Response	Function
R1<ez>	<BER>,<NZ>,<MA>,<REC>,<NL> <te>	**Query switch positions of channel 1**
SE122DC	<BER> = 0 ... (500..1000°C I 500V) 1 ... (300.. 800°C I 200V) 2 ... (300.. 600°C I 100V) 3 ... (100.. 300°C I 50V) 4 ... (50.. . 150°C I 20V) 5 ... (0.. ... 100°C I 10V) 6 ... (0.. ... 200°C I 5V) 7 ... (0.. ... 500°C I 2V) 8 ... (0....1000°C I 1V) 9 ... (unbenutzt) NZ = 0 ... none 1 ... -100% 2 ... -200% MA = 0 ... °C 1 ... mV 2 ... V REC = 0 ... 0 1 ... REC	
SE122AC	0 ... (6A I 360..600V) 1 ... (-- I 180..300V) 2 ... (1.5A I 90..150V) 3 ... (0.6A I 36..60V) 4 ... (0.3A I 18..30V) 5 ... (0.15A I 9..15V) 6 ... (60mA I 6V) 7 ... (30mA I 3V) 8 ... (15mA I 1.5V) 9 ... (6mA I 0.6V) NZ = 0 ... position OFF 1 ... position ZOOM MA = 0 ... A 1 ... V REC = 0 ... DC 1 ... 0 2 ... AC NL = 0 ... < 1 ... 0 2 ... >	

continued Commands to Query the Instrument Status

Comm.	Response	Function
R3<ez>	<CH1min>,<CH1max><te> <CH1min = 0 to 100 <CH1max = 0 to 100 (value corresponds to min-/max-limit value - position in percent of the recording width)	**Query min-/max-limit value of chan.1**
R4<ez>	<CH2min>,<CH2max><te> <CH2min = 0 to 100 <CH2max = 0 to 100 (value corresponds to min-/max-limit value - position in percent of the recording width)	**Query min-/max-limit value of chan. 2**
R5<ez>	<SP2>,<SP2akt><te> SP2 = 00 ... XY-mode 01 ... 1 cm/h 02 ... 2 cm/h | 11 ... 60 cm/min Ranges are not valid if instrument is switched over to additional feed speed. SP2akt = 0 ... not active 1 ... active	**Query 2nd feed speed**

5.3 Command Syntax

The standard instruction set consists of 1-Byte commands or 1-Byte commands followed by a parameter by which the instrument can be controlled via a computer or a terminal.

5.3.1 Writing Conventions

Symbols Used

Symbol	Description	Char.
<...>	The symbols of the in-/output-parameters are put between angle brackets.	
<ez>	Command-end sign	;
<se>	Output separator (string-terminator) Is used as seperator between the parameters.	,
<te>	Output-terminator (record terminator)	<ETB>
<tx>	Output-block-terminator	<LF>

Note <tx> can be switched to <CR> with command Z1; .

<ETB>... 23decimal
<CR>... 13decimal
<LF>... 10decimal

5.3.2 Command Formats

Commands without Parameters

1 character.

e.g. command **B** (read date/time)

Commands with Parameters

1 character followed by (a) parameter(s) and command-end sign <ez>
The paramters are seperated by a comma ",".

e.g. command **A**<**Parameter**>,<**Parameter**>, ... <ez>
(set date/time)

5.3.3 Query Command

Fetching the Response

After the "query command" the provided response has to be fetched immediately. Only after that another command can be sent.

5.3.4 Output Format

According to IEC625/part 2 all responses of the instrument are ended with an output-terminator <te>.

5.3.5 Functional Conditions

Input Buffer

All incoming commands are stored in a 16 Byte input buffer with data flow control. After that the commands are processed one after the other.

Reset Function

Deviating from this rule the reset function (hardware reset) is processed immediately. With that the instrument can be reset after a system crash. After a hardware reset or a switch on the instrument is ready-to-receive only after DC1 (Xon) has been sent.

DC1 = Xon character
DC3 = Xoff character

Faulty Commands

Faulty commands are not executed and trashed up to the command-end sign <ez> (incl.).

Not Executable Data Query Commands

Not executable data query commands or other query commands with faulty parameters are answered with <te>. This prevents a program crash of the hostcmputer after such commands are sent off. Further information is available by querying the error code.

Error Code

An error code always contains the last recognized error and can be called up at any time.

5.3.6 Data Import

Data sent from the recorder can be stored into a file on the PC with a corresponding program. This file can be imported into other application like Exel. Lotus etc.

5.4 Programming

To be able to send the commands to the instrument and to receive the incoming data from the instrument an ASCII-terminal or a PC with a terminal emulation program (e.g. TERMINAL.EXE - delivered with MS-Windows, VTERM, or TELIX) is required.

To control the instrument in BASIC see chapt. 5.5 "Programming Example".

5.4.1 Differences between Terminal and PC

Terminal	Easy to operate but cannot store measured data
PC with Emulation Programm	Depending on the capabilities of the terminal emulation program it is able to store measuring data. Part-automatization possible with predefined functions (depending on the capabilities of the terminal emulation program).

5.4.2 Programming Preparations

Using the terminal

- **Connect terminal and instrument with a suitable cable** (see chapt. 5.1 "Connecting the Interface").
- **Set the same interface parameters on the recorder and the terminal (e.g. 9600Bd,N,8,1).**
- **Query the recorder's error code and status** chapt. 5.4.4 "Commands to Query the Instrument Status").

Using a PC with a terminal emulation program

- **Connect PC and instrument with a suitable cable** (see chapt. 5.1 "Connecting the Interface").
- **Start the installed terminal emulation program on the PC.**
- **Set the same interface parameters on the recorder and the terminal (e.g. 9600Bd,N,8,1).**
- **Query the recorder's error code and status** chapt. 5.4.4 "Commands to Query the Instrument Status").

5.4.3 Reset - Commands

Hardware - Reset

Syntax **ZZ**<ez>

Note Nur in Großbuchstaben eingeben!

Parameters none

Application With the hardware reset the instruments processor is newly initialized.

Note the Ready-To-Receive Condition After the hardware reset or after switch on the instruemtn is ready to receive only after DC1 has been sent off.

5.4.4 Commands to Query the Instrument Status

Sequence

After the "query command" the provided response has to be fetched immediately. Only after that another command can be sent.

Query Error Code

Syntax

F

Application

Aleays the last ocurred error code is displayed. An error code always contains the last recognized error and can be called up at any time.

Response

*<**xxx**> <te>*

Significance of the Error Code

000... OK (no error since last query)

001... instrument in the XY-mode - job not executable.

002... Text printout or protocol printout not possible - instrument is operated as data jabber.

004... Aborted after data loss in a measuring data transmission sequence (possible causes: baud rate to small , computing capacity too low, mass storage device too slow).

005... No valid measuring data available

006... Channel switch setting changed during data output

007... Other errors

010... Impossible command

continued **Query Error Code**

011... Parameter outside the range

012... Invalid character received

013... Wrong number of parameters

014... Text too long

015... I^2C-EEPROM not addressable I readable I writable

016... I^2C-clock not addressable I readable I writable

017... Commands not allowed with active measuring data jabber

018... Function not available in one-channel instrument

020... Wrong safety code

022... File format error (Reprint function)

023... Commands not allowed with active reprint mode

Query Instrument Type and Version Number

Syntax **V**

Application Query instrument type or version number

Response <**Ident**>,<**KZ**>,<**VS**>,<**VH**>,<**YY**>,<**MM**>,<**DD**><te>

Significance of the Parameters

Ident	= 122AC | 122DC	(instrument type)
KZ	= 1 | 2...	reports number of available measuring channels
VS	= Software version number	(2 ASCII-digits)
VH	= Hardware version number	(2 ASCII-digits)
YY	= year	of the last calibration
MM	= month	of the last calibration
DD	= day	of the last calibration

Note The version number of software and hardware as well as the date of calibration are important service references.

Example Response **122DC,2,01,01,94,01,25**
(randomly assumed values)

Query of the Configuration for Temperature Measurements

Syntax **E**

Application For the statur query in temperature measurements the type of thermo element as well as the DIL switch position for the selection of of the ambient temperature compensation is queried.

Response <**ThermoelemCH1**>,<**ThermoelemCH2**>,<**CJ**> <te>

ThermoelemCHn = J | K | T | 0

J ... Thermo-element type J
K ... Thermo-element type K
T ... Thermo-element type T
0 ... channel does not exist (or channel not bulit for temperature measurements)

CJ = 0 ... ambient temperature compensation **off**
1 ... ambient temperature compensation **on**

Example Measuring channel 1 and 2 are built for temperature measurements ; channel 1 is set to J and channel 2 is set to T. The ambient temperature compensation is switched off.

Response: J,T,0

Set Ambient Temperature Compensation The ambient temperature compensation is switched on with the DIL switch at the rear side of the instrument (see chapter 3.10 "Setting of Temperature Measuring Ranges").

Query Date/Time

Syntax **B**

Application Calling date and time from the instrument's system clock.

Response <**YY**>,<**MM**>,<**DD**>,<**hh**>,<**mm**><te>

Example **Response**: **94,03,18,08,35**
(randomly assumed values)

Note Seconds are not stated.

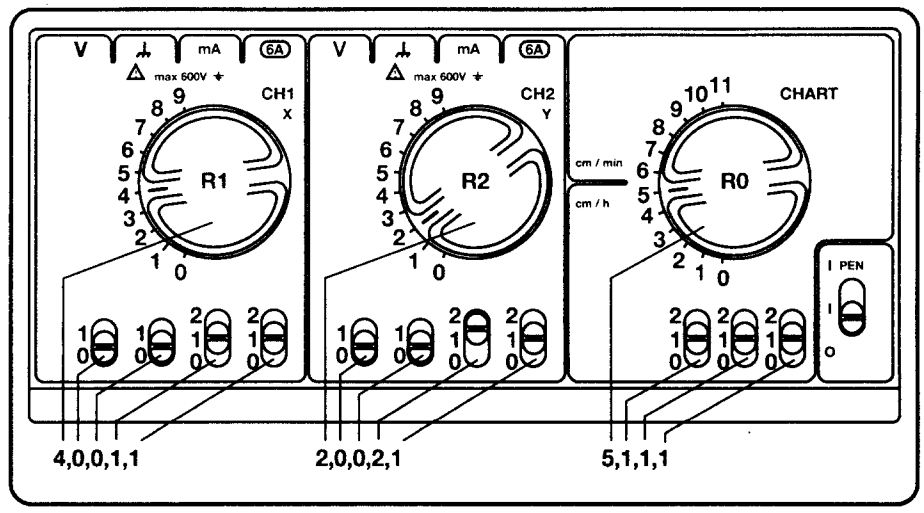
Generals about the Query of the Switch Positions

All switch positions are queried for the whole functional block (e.g. time unit, measuring unit channel 1/2 etc.) and are put out in string format.

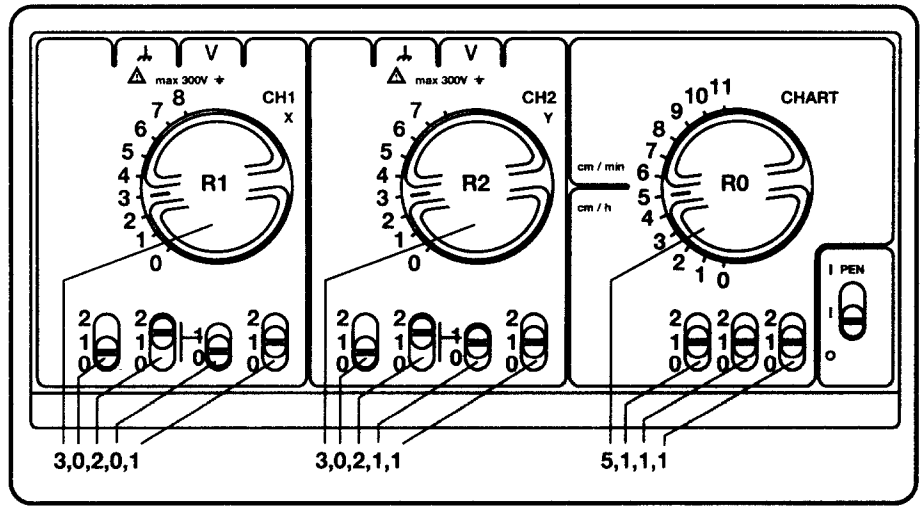
Abrufbare Functionsblöcke:

Comm.	Switches of Functional Block
R0 <ez>	time unit
R1 <ez>	measuring unit channel 1
R2 <ez>	measuring unit channel 2 (2 channel instruments only!)
R3 <ez>	MIN-MAX-limit values channel 1
R4 <ez>	MIN-MAX-limit values channel 2 (2 channel instruments only!)
R5 <ez>	additional feed speed

Functional Blocks AC - 2 Channel Instrument



Functional Blocks DC - 2 Channel Instrument



Query Switch Positions of the Time Unit

Syntax ***R0***<*ez*>

Application Staus query for time unit control.

Response <**SP**>,<**PP**>,<**VV**>,<**WW**> ,<**DL**> <te>

Paper Feed Switch <**SP**> =

00 ... XY-mode	I	XY-mode
01 ... 1cm/h	I	0,25 cm/h
02 ... 2cm/h	I	0,5 cm/h
03 ... 6cm/h	I	5 cm/h
04 ... 12cm/h	I	10 cm/h
05 ... 30cm/h	I	20 cm/h
06 ... 1cm/min	I	0,25 cm/min
07 ... 2cm/min	I	0,5 cm/min
08 ... 6cm/min	I	5 cm/min
09 ... 12cm/min	I	10 cm/min
10 ... 30cm/min	I	15 cm/min
11 ... 60cm/min	I	20 cm/min
Factory setting	I	Additional feed - speeds

Factory Setting The stated values correspond to the front panel imprint at the chart paper feed speed selector.

Additional Feed Speeds The front panel imprint is invalid. The instrument is switched to the **additional feed speeds** with the DIL switch at the rear side of the instrument. After that the instrument has to be newly initialized (see chapt. 3.13.1). The additional feed speeds can be programmed at an authorized service facility. Any range contained in 60 cm/min is possible.

continued **Query Switch Positions of the Time Unit**

Response <**SP**>,<**PP**>,<**VV**>,<**WW**> ,<**DL**> <te>

Switch PROT/PENSYNC
<**PP**> = 0 ... PROT
1 ... 0
2 ... PENSYNC

Paper Feed Switch
<**VV**> = 0 ... forward (>)
1 ... stop (0)
2 ... reverse (<)

Switch for Progressive Paper Feed
<**WW**> = 0 ... progr. forward (>>)
1 ... stop
2 ... progr. reverse (<<)

DIL-Switch TB2
<**DL**>= 0 ... additional feed speed
feed values are taken over by the EEPROM
(front panel imprint is invalid)

1 ... feed values correspond to the front panel imprint

Example The instrument is set to a feed speed of 30cm/h . The PenSyncis switched on. The paper feed is set to forward and the progressive paper feed is switched off.

Response 05,2,0,1,1

Query Switch Position of Measuring Channel 1 and 2

Syntax
R1<ez> measuring channel 1
R2<ez> measuring channel 2

Application
Status query for the scaling of the measuring data during the measuring data output.

Response
<**BER**> ,<**NZ**> ,<**MA**> ,<**REC**>,<**NL**> <te>

Measuring Range Switch only in DC Instruments

<**BER**> =			
0 ...	(500..1000°C	I 500V)
1 ...	(300.. 800°C	I 200V)
2 ...	(300.. 600°C	I 100V)
3 ...	(100.. 300°C	I 50V)
4 ...	(50.. . 150°C	I 20V)
5 ...	(0.. ... 100°C	I 10V)
6 ...	(0.. ... 200°C	I 5V)
7 ...	(0.. ... 500°C	I 2V)
8 ...	(0....1000°C	I 1V)

Measuring Range Switch only in AC Instruments

<***BER***> =			
0 ...	(6A	I 360..600V)
1 ...	(--	I 180..300V)
2 ...	(1.5A	I 90..150V)
3 ...	(0.6A	I 36..60V)
4 ...	(0.3A	I 18..30V)
5 ...	(0.15A	I 9..15V)
6 ...	(60mA	I 6V)
7 ...	(30mA	I 3V)
8 ...	(15mA	I 1.5V)
9 ...	(6mA	I 0.6V)

Switch for Cal. Zero Suppression only in DC Instruments

<**NZ**> =	
0 ...	no zero suppression
1 ...	-100%
2 ...	-200%

ZOOM-Switch only in AC Instruments

<**NZ**> =	
0 ...	position "OFF"
1 ...	position "ZOOM" (expanded measuring ranges are valid)

continued **Query Switch Position of Measuring Channel 1 and 2**

Response <**BER**> ,<**NZ**> ,<**MA**> ,<**REC**>,<**NL**> <te>

Measuring Mode Switch only in DC Instruments	<**MA**> =	0 ...	C	temperature measurements
		1 ... (mV-ranges)	mV	voltage measurement
		2 ...	V	voltage measurement (V-ranges)
Measuring Mode Switch only in AC Instruments	<**MA**> =	0 ...	A	current measurement (A-ranges)
		1 ...	V	voltage measurement (V-ranges)
REC-Switch only in DC Instruments	<**REC**>=	0 ...	0	channel switched off
		1 ...	REC	channel switched on
AC/DC-Switch only in AC Instruments	<**REC**>=	0 ...	DC	channel switched on
		1 ...	0	channel switched off
		2 ...	AC	channel switched on
Zero Position Key	<**NL**> =	0 ...	<	move zero point to the left
		1 ...	0	
		2 ...	>	move zero point to the right

Example The example refers to an AC instrument.
The measuring channel 2 is set to a calibrated voltage measuring range of 360 ... 600VAC, the zoom range is switched off, the recording is switched on and the key for the zero point setting is in position 0.

Response 0,0,1,2,1

Query MIN-MAX-Limit Values of Channel 1

Syntax **R3**<ez>

Application To control the programmed Min/Max limit values of channel 1.

Response <**Ch1min**>,<**Ch1max**> <te>

<**Ch1min**> = 0 to 100

<**Ch1max**> = 0 to 100

The stated value corresponds to limit value position in percent of the recording width.

Query MIN-MAX-Limit Values of Channel 2

Note **Only in 2 channel instrumenten möglich!**

Syntax **R4**<ez>

Application To control the programmed Min/Max limit values of channel 2.

Response <**Ch2min**>,<**Ch2max**> <te>

<**Ch2min**> = 0 to 100

<**Ch2max**> = 0 to 100

The stated value corresponds to limit value position in percent of the recording width.

Example The MIN-limit value is programmed to 10% of the recording width and the MAX-limit value is programmed to 90% of the recording width.

Response: **10,90**

Query 2nd Feed Speed

Syntax **R5**<ez>

Application Controlling of the 2nd feed speed. The programming can be made via the interface (Comm. "P") or via switch on the time unit (see chapt. 3.16).

Response <**SP2**> ,<**SP2akt**> <te>

2nd Feed Speed

<**SP2**> =	00 ... XY-mode	I XY-mode
	01 ... 1cm/h	I 0,25 cm/h
	02 ... 2cm/h	I 0,5 cm/h
	03 ... 6cm/h	I 5 cm/h
	04 ... 12cm/h	I 10 cm/h
	05 ... 30cm/h	I 20 cm/h
	06 ... 1cm/min	I 0,25 cm/min
	07 ... 2cm/min	I 0,5 cm/min
	08 ... 6cm/min	I 5 cm/min
	09 ... 12cm/min	I 10 cm/min
	10 ... 30cm/min	I 15 cm/min
	11 ... 60cm/min	I 20 cm/min
	Factory setting	I additional feed speeds

Status of 2nd Feed Speed

<**SP2akt**> =	0 ... not active [1]	
	1 ... active	

Example The 2nd feed speed is programmed to 60 cm/min and active.

Response 11,1

1 The feed speed corresponds to the time unit switch query - command "SP".

5.4.5 Commands to Remote Control the Recorder

Remote Controlable Time Unit Functions

All settings remain stored in the instrument until they are updated by manual input or by the interface.

After the instrument has been switched on the settings on the control panel are valid.

Chart Paper Feed Stop

Syntax **W**<**d**> <ez>

Parameter <**d**> = 0 ... enable
1 ... stop

Application The chart paper feed is stopped regardless to the start function.

External Remote Control The chart paper feed can also be stopped by an external signal to the REMOTE socket (see chapt. 3.15).

Note If the reprint mode (command "**L**") is active this command is locked (see also command "**F**").

Switching Over to the 2nd Feed Speed

Syntax **P<d><ez>**

Application Switching over to the 2nd feed speed.

Parameter <**d**> = 0 ... off
1 ... active

External Remote Control The switching over to the 2nd feed speed can also be made by an external signal to the REMOTE socket (see chapt. 3.16).

Enter 2nd Feed Speed

Syntax **Q**<SP><ez>

Application Entering the 2nd feed speed

Parameters

<SP> =	Feed speed*)	additional feed - speed s**) (default values)
01 ...	1 cm/h	0.25 cm/h
02 ...	2 cm/h	0.5 cm/h
03 ...	6 cm/h	5 cm/h
04 ...	12cm/h	10 cm/h
05 ...	30cm/h	20 cm/h
06 ...	1 cm/min	0.25 cm/min
07 ...	2 cm/min	0.5 cm/min
08 ...	6 cm/min	5 cm/min
09 ...	12cm/min	10 cm/min
10 ...	30cm/min	15 cm/min
11 ...	60cm/min	20 cm/min

*) Feed Speed The front panel imprint at the selector switch for the chart paper feed speeds is valid.

) Additional Feed Speeds The front panel imprint is invalid. The instrument is switched over from **standard feed speeds to the **additional feed speeds** with the DIL-switch at the rear side of the instrument (see chapt. 3.13.1).

2nd Feed Speed The 2nd feed speed can also be set with the control elements of the time unit (see chapt.3.16).

Activation of 2nd Feed Speed "PIN 10" of the "REMOTE - socket set to "LOW".

Switch Servo ON/OFF.

Syntax **G**<**d**><ez>

Application This command is used to switch off the recording pen movement if the instrument is used as data transmitter.

Parameters <**d**> = 0 ... off
1 ... active

Move Chart Paper 1 Step to the Reverse Direction

Syntax **U**

Application Individual feed control in steps.

Chart Feed Per Step With every command "U" the paper is transported by 0.078 mm.

Example To transport the paper by 1cm the command has to be sent 128 times.

Move Chart Paper 1 Step to the Forwrad Direction

Syntax **D**

The same conditions apply as have been layed out in the command "Move Chart Paper 1 Step to the Reverse Direction".

Lift Recording Pens from Chart Paper

Syntax **H**

Application The recording pens are lifted from the chart paper e.g. to avoid ink bleeding to the chart paper during recording pauses.

Note The command is without effect if the external input at the REMOTE socket for lowering the pen is active and/or if the PEN switch is in position PEN.

All 3 controls are "OR" linked and result in a lowering of the recording pen(s) to the chart paper.

- PEN-switch (in position **I PEN)**
- external input active (REMOTE-socket Pin 9 connected to earth)
- RS232-command. (command. "**I**")

Lower Recording Pens from Chart Paper

Syntax **I**

Application The recording pens are lowered to the chart paper to start recording.

Set Date / Time

Syntax **A** <**YY**>, <**MM**>, <**DD**>, <**hh**>, <**mm**>, <**ss**> <ez>

Application Set system clock

Parameters
<YY> year
<MM> month
<DD> day
<hh> hour
<mm> minute
<ss> second

Note Date and time always have to be entered completely.

Page Feed in XY-Mode

Syntax **J**

Application The page feed is 200mm. For further information see chapt. 3.18.

Note The recording zero point remains unchanged (see chapt. 3.18).

Print Text Line

Syntax **T"<ASCIIString>"** <ez>

Application A text line is printed out (incl. line feed) e.g. to letter a measuring protocol.

Parameters <**ASCIIString**> = 50 printable 8Bit-ASCII-characters maximum.

Notes The character sequence **T" "**<ez> results in a line feed
The character sequence **ZZ**<ez> is interpreted as a reset command.

Note Printing texts and recording data at the same time is not possible. If the jabber is switched on such a command is answered with error code **002** "*Text or protocol printout not possible - instrument is operated as data jabber*".

Unprintable characters between quotation marks "" are ignored.

Note Quotation marks (") cannot be printed.

Error Code 014 A missing end-sign results in a trashing of all following characters except for the quotation marks and subsequently up to <ez>. Afterwards the error code **014** "*Text too long*" is set.

Set MIN-MAX-Limit Values for Channel 1

Syntax **X** <**Ch1min**>, <**Ch1max**> <ez>

Application With the MIN-MAX-limit value a measured signal can be monitored for an upper or a lower limit value (see chapt. 3.21).

Parameters <**Ch1min**> = 0 to 100
Min-limit value position has to be entered in percent of the recording width.

<**Ch1max**> = 0 to 100
Max-limit value position has to be entered in percent of the recording width.

Set MIN-MAX-Limit Values for Channel 2

Note **Possible only in 2 channel instruments**

Syntax **Y** <**Ch2min**>, <**Ch2max**> <ez>

Application As in measuring channel 1.

Parameter <**Ch2min**> = 0 to 100
Min-limit value position has to be entered in percent of the recording width.

<**Ch2max**> = 0 to 100
Max-limit value position has to be entered in percent of the recording width.

Switch Over Output-Block-Terminator

Syntax **Z** <**d**> <ez>

Application Switch over output-block-terminator.

Parameters <**d**> = 0 ... <tx>=<LF>
1 ... <tx>=<CR>

Default Setting After a hardware reset or if the instrument is switched on the output-block-terminator is set to default setting <LF>.

5.4.6 Commands for the Transmission of Measuring Data

General

Scaling of Measuring Data

The transmitted measuring data are relative ASCII-integer numbers. Taking into account the position of the measuring range switch and the switch for the calibrated zero suppression "CAL_0", the physical measuring quantity (the voltage-, current- or temperature value at the input terminals) is determined the following way:

How to Avoid Measuring Errors

To avoid measuring errors the computer has to be informed in time of any changes made to the channel settings.

Proceed the following way:

The interface answers a data query command with <te> or aborts a running data transmission with <te>.

- **Request error code with command F.**

  Error code = 006 means that the measuring channel setting has been changed.

- **Request channel parameters in case of error code =006**

  With command **R1** <ez> measuring channel 1
  R2 <ez> measuring channel 2

Note

Send R1 (R2) before data read-out!

measured value =

$$(\text{value} - 2048 + \text{cal } 0 * 1600) * \frac{\text{RAEND} - \text{RABEG}}{1600} + \text{RABEG}$$

RABEG RAange BEGin = lower measuring range value

RAEND RAnge END = upper measuring range value

Measured Value Physical quantity , mV, V, K (the measured value is computed by the computer).

Value Digital measuring value .sent from the instrument

cal 0 0 . . . zero suppression switched off
1 . . . 100% zero suppression
2 . . . 200% zero suppression

Example word = 2848
cal 0 = 0 (always has to be 0 in temperature measurements).
RABEG = 100
RAEND = 300 C (temperature range 100 . . . 300 K given by the position of the measuring range switch and the measuring quantity switch (V, mV, C).

Measured value [K] =

$$[2848 - 2048 + 0 * 1600] * \frac{300 - 100}{1600} + 100 =$$

$$800 * \frac{200}{1600} + 100 = 200 \text{ K}$$

Note Normally, the user does not change the channel settings after the measurement has been started. The procedure described above prevents measuring errors brought about by unrecognized misadjustment of the channel switch.

Measured Data Output

Mind that the baud rate of a 2 channel instrument has to be set to a minimum of 9600 Baud . Otherwise only a <te> is sent instead of a measured value for channel 2 followed by error code 004.

Syntax	**O** Single query (in XY- and Yt-mode)
Application	Query one measured value each from channel 1 and channel 2.
Response (in SE122-1 Channel)	<value**CH1**> <te>
Response (in SE122-2 Channel)	<value**CH1**>,<value**CH2**> <te>
In XY-mode	X-channel = <value**CH1**>, Y-channel = <value**CH2**>
Value Range	ASCII-integer number with a maximum value range of 2048 ±1600 corresponds to zero point ±100% span.
Upper Value Range Exceeded	In case of measuring errors an exceeding of the maximumvalue range becomes possible. In this case **9999** is uniformly sent as an OVERFLOW-message. Further details can be found in chapter 5.4.6 "Commands for the Transmission of Measuring Data/General".
Note	After the command has been received the immediatly following value is sent from the ADC; a maximum response time of 16ms is possible.
Measured Value Output -Interval	In the instrument both channels are read out at an interval of 16ms.

Measuring data jabber ON/OFF

Set a minimum of 9600 Baud . Otherwise only a <te> is sent instead of a measured value for channel 2 followed by error code 004.

Before "S" R1 (R2) has to be sent.

Syntax **S** <**d**> <ez>

Parameters <**d**> = 0 | 1 (off | on)

Application From switch on to switch off the instrument continuously sends all data created in the instrument (in XY- and Yt-mode).

Note The **command S1**; switches the instrument from reprint mode back to the standard mode.

Response (in SE122-1 Channel)

<value**CH1**> <tx>
<value**CH1**> <tx>
|
<value**CH1**> <ez>

Response (in SE122-2 Channel)

<value**CH1**>,<value**CH2**> <tx>
<value**CH1**>,<value**CH2**> <tx>
| |
<value**CH1**>,<value**CH2**> <ez>

In XY-Mode X-channel = <value**CH1**>, Y-channel = <value**CH2**>

Value Range <value**CH1**>, <value**CH2**> see command "single query"

Sequence of Measured Value Query and -Transmission In the instrument both channels are read out at an interval of 16ms. In the main loop every 8ms a new measured value is scaled, sent to the servo and a new transmission request is made to the RS232.

Measured Values per Second 128 measured values per second(128*5 characters = 640 ASCII-characters per second).

Behaviour in Borderline Cases in Measuring Data Jabber Mode.

Demands on the Receiver

Behaviour in case the receiver is too slow (or baud rate set to < 9600):

The instrument cannot internally buffer measured values. If measured data cannot be sent quick enough the instrument aborts the jabber function. The instrument aborts the function only after the end of one measured value or a pair of values with <te>. Such a condition can be identified and eliminated by querying the error code. After that the jabber can be restarted again.

In Case the Channel Switch Setting has been Changed

Jabber aborted after the channel switch settings have been changed:

In such a case query the new switch positions with the application software and afterwards start the jabber again.

No measuring protocol

No measuring protocol can be be requested at the jabber (PROT-key is not operated).

With the jabber active only the S-command "measuring data jabber ON/OFF" is accepted.

All other commands are rejected and the error code is set to 017.

Print Measuring Data from the Interface to Paper (reprint function)

Syntax (in SE122-1 Channel)

L <value**CH1**> <tx>
<value**CH1**> <tx>

<value**CH1**> <te>

Syntax (in SE122-2 Channel)

L <value**CH1**>,<value**CH2**> <tx>
<value**CH1**>,<value**CH2**> <tx>

<value**CH1**>,<value**CH2**> <te>

Application — Update the measuring data in the instrument's output format. According to the operational mode the instrument is in the measuring data are printed to paper either in Yt- or in XY-representation.

Value range — <value**CH1**>, <value**CH2**> ASCII-integer number

In Yt-Mode — From 0...1600 corresponding to 0..100% of the recording width or

In Xy-Mode — From 0..100% of the diagram length.

Mind the different zero point levels of the measuring data:

0 when writing
2048 at output.

In Xy-Mode — The recording pen of measuring channel 2 goes to the park position.

In Yt-Mode — The interval between the 2 measured values is fixed with the time eqvivalent of two steps 1/128cm each.

Lower and Lift Recording Pen

Is effective on both channels. Therefore in the Yt-mode updating is only possible on both channels synchronuosly.

Protocol Printout

During the readback of a file the protocol printout cannot be called up (PROT-key is not operated).

The zero level switch is not effective if measuring data from the interface are printed to paper.

Instrument used as Output Unit of an Analysis Instrument

By means of the reprint function the instrument can be used as an output device for an analysis instrument under certain conditions. In such a case the output format of the analysis instrument in use has to be converted into the instrument format and can then be sent to the recorder.

Switch Back to Regukar Recorder Function

Is done with the data query command **S1,** or **0.** This enables the user to execute other important commands inbetween command blocks (pen up/down, page feed in XY-mode, etc.).

S1 switches from reprint mode to data jabber mode. With **0** reprint is switched off and 1 data element is sent to the interface.

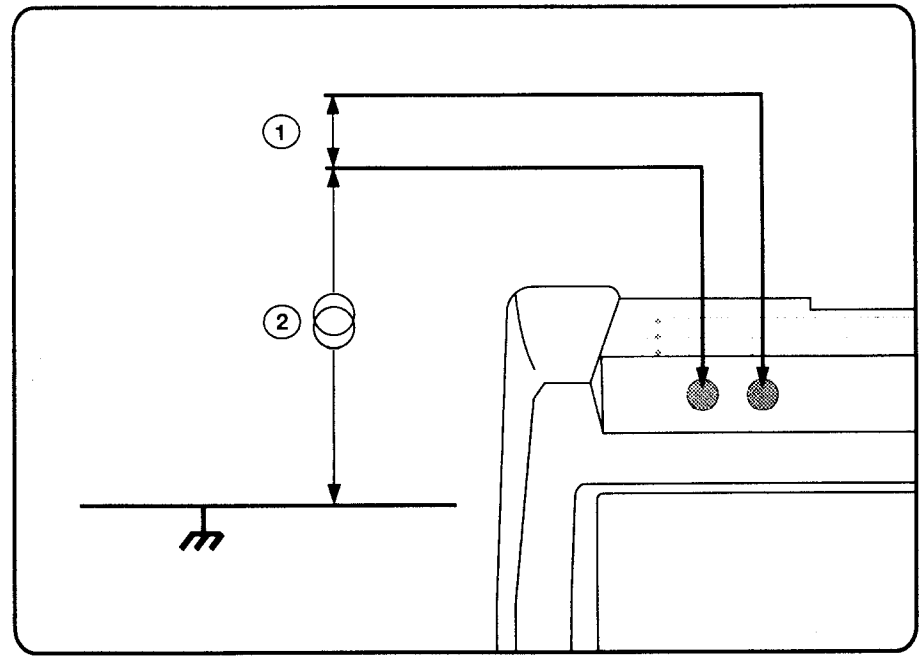
5.5 Programming Example

```
'*************************************************************************
' PROGRAMMING EXAMPLE
' Hardware        : PC-XT/AT
' Operating System  : MS-DOS 5.0
' Software        : Quick Basic 4.5
' Interfaces  : COM1
'*************************************************************************

CLS                                              delete screen

OPEN "COM1:9600,n,8,1,cd2000,cs2000,ds2000,rb2048" FOR RANDOM AS #1
     'open COM1 for in- output
     '9600 baud, 8 data bit, no parity, 1 stop bit
     'control connections DCD, CTS, DSR  (Time Out to 2sec)

w$ = "ZZ;": GOSUB SerOut                         'Reset Recorder
SLEEP 3                                          'Wait for 3sec
GOSUB SerIn: PRINT r$                            'Read-in Response (etb)

w$ = "V": GOSUB SerOut                           'Read-in Idn.String
GOSUB SerIn: PRINT r$                            '

w$ = "A 94,01,01,12,30,00;": GOSUB SerOut        Date to 01.01.1994
                                                 'Time to 12:30:00
w$ = "B": GOSUB SerOut                           'Read out Date/Time
GOSUB SerIn: PRINT r$                            '

FOR x = 1 TO 5                                   '5x
  w$ = "NK;": GOSUB SerOut                       'Read out Measured values CH1/CH2
  GOSUB SerIn: PRINT r$                          '
NEXT                                             '

CLOSE #1                                         'close COM1

END                                              'Program End

'------------------------------------------------------------------------
SerOut:                                          'Write Data to COM1
  PRINT #1, w$;                                  '
RETURN                                           '
'------------------------------------------------------------------------
SerIn:                                           ' Read in Data from COM1
  t! = TIMER
  r$ = ""
  DO
    h% = LOC(1)                                  'Number of received characters.
    FOR x% = 1 TO h%
      rx$ = INPUT$(1, #1)                        'Read in characters
      IF rx$ = CHR$(23) THEN EXIT DO             'Exit if (etb)
      r$ = r$ + rx$
    NEXT
  LOOP UNTIL t! + 2 < TIMER                      'Abort if no Data for 2sec
RETURN
'------------------------------------------------------------------------
```

6 Terminology and Explanatory Notes

AC (V AC) — alternating current (AC voltage).

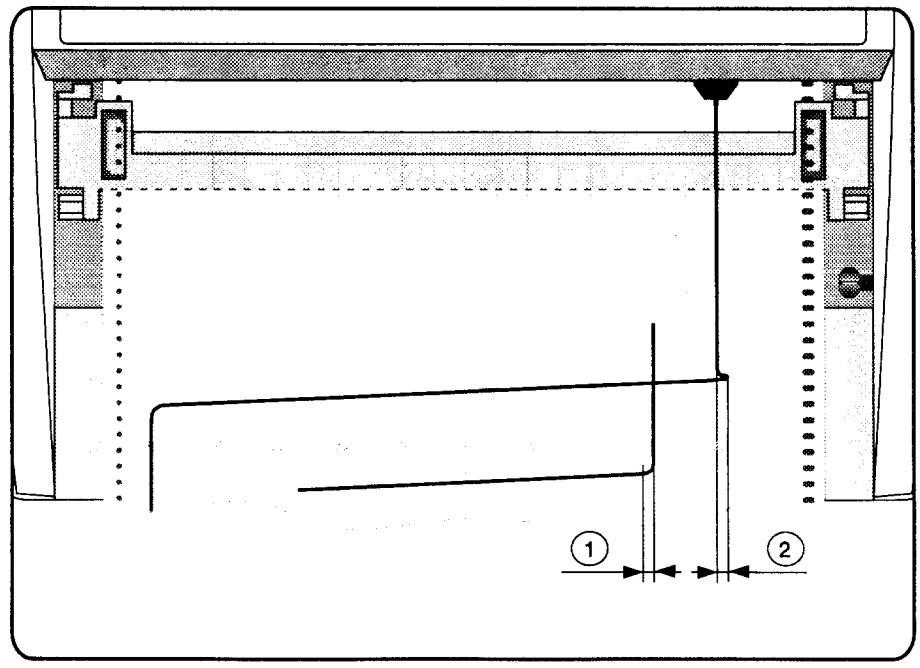
CMRR — common mode rejection ratio.



① measured signal (measured voltage).

② noise voltage.

damping

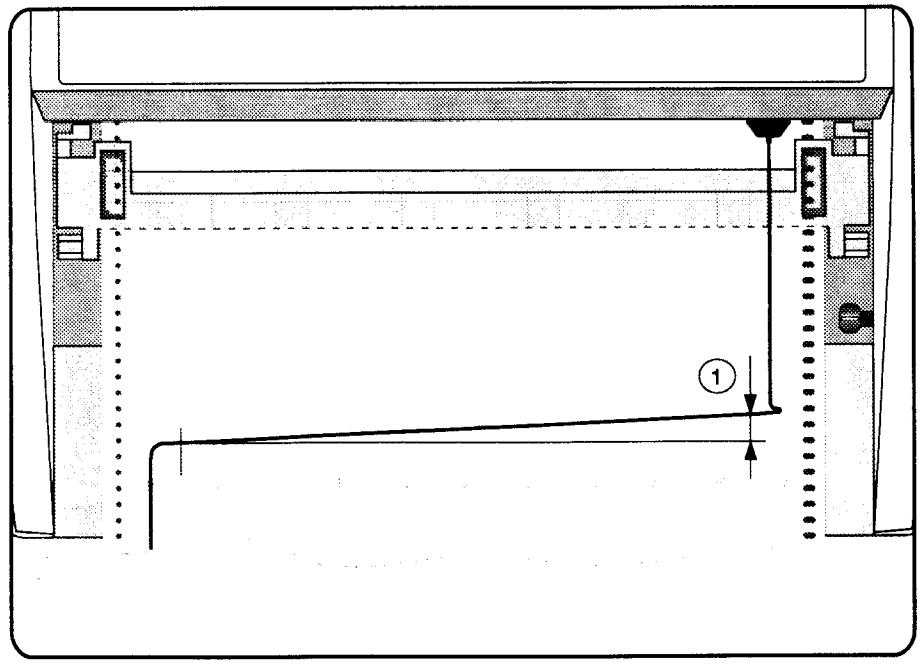


① rounding
② overshoot

DC (VDC) direct current (DC voltage).

Response time

The time the servosystem (the recording pen) needs to switch from 5% to 95% recording width at a immediate change of the measured signal.



(1) response time

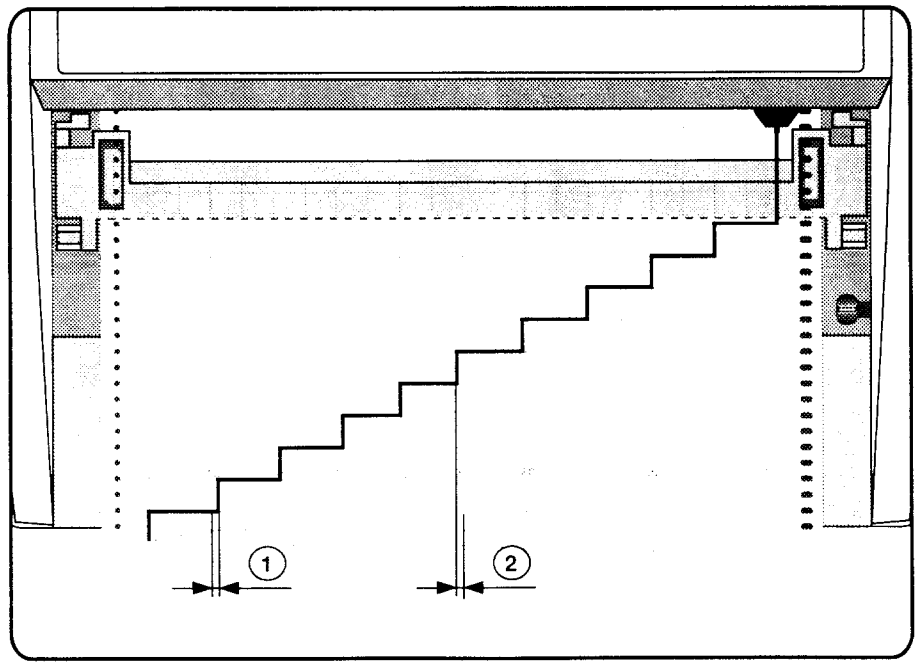
Accuracy

deviation from the desired value in percent of the full scale value (to determine the total error the dead zone error and the linearity error have to be added to the accurracy of the measuring unit).

Cut-Off Frequency

If with sinusoidal measured signals the cut-off frequency of the instrument is reached the recording amplitude is reduced by 3 dB.

Linearity



① positive linearity error

② negative linearity error

Protection Class II — protection insulated - no connection to earth.

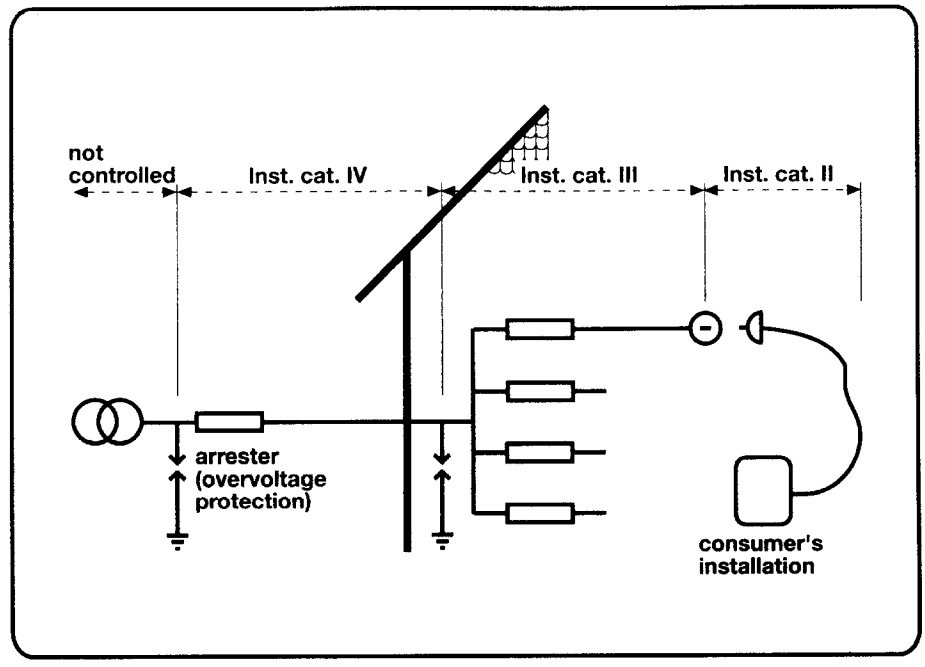
SMRR — serial mode rejection ratio;
If an AC voltage is superimposed to a measured signal an error inside the stated limits occurs.

Dead Zone — the range inbetween which the measured signal can be changed without causing a movement of the servosystem (the recording pens).

Overvoltage Category

(Installation category):
Installation categories state the peak voltages of voltage pulses which can be superimposed to the nominal voltage rating of each mains voltage or more generally of each voltage source. The pulse cycle can be statically distributed but can also be periodical.
Structural components and safety air paths of electrical equipment operated with mains voltage might be exposed to extraordinary strain by these voltage pulses. For this reason, every instrument that has to be connected to voltage sources for reasons of power supply or measuring must be defined and specified in accordance to an installation category. **For reasons of safety, operations on mains supplies with a higher category than the one stated are therefore not allowed.**

The figure shows the typical distribution of categories in a house installation.



The category is reduced with overvoltage conductors Inside the distributor installation reaching up to the socket area category 3 must be assumed.
The socket **with a switched on electrical device connected is grouped into category 2.**

Pollution level (dirt collection resistance):

The environmental conditions strongly influence the electrical behaviour of an instrument. Soiling by moisture and dust is able to make safety determining leakage paths ineffective and can therefore jeopardize faultless functioning. To avoid such conditions the casing of an instrument must be designed and constructed according to the expected operational cases; vital areas inside the instrument have to be additionally protected. According to the IEC regulations 664 the soiling degrees are divided into classes:

Pollution level1:
Non-conductive negligible soiling which has no influence on the functioning and the safety determining parameters of the instrument. Examples are laboratories, climatized rooms, instruments are not moved.

Pollution level2:
The dust to be found in such environments is non-conductive either; it is nevertheless possible that these dust deposits develop a temporary conductivity in case of dewing. Examples for such environments are testing fields, workshops for electrical devices, clean workshops and the transport of instruments with the unavoidable temperature changes.

The higher degrees 3 and 4 already deal with conductive dust deposits as for instance can be found in electromotors. This kind of soiling is not included into the considerations of the safety regulations for electronic measuring- and controlling instruments IEC 1010 for operation inside closed rooms.

7 Upkeep and Maintenance

If the instrument is operated and handled properly it does not need specific maintenance and service. To clean the instrument always use a slightly moistened cloth and some rinsing agent . Avoid aggressive cleaning detergents and solvents (Tri, Chlorothene etc.). Do not allow liquid to get inside the instrument.

Maintenance work must only be undertaken by trained and qualified staff. In all repair and reconditioning works it has to be observered that the instrument's design parameters are not modified to the detriment of safety, that assembled parts correspond to the original spares and that these parts are reassembled properly (factory state).

Before any maintenance, repair or replacement of parts the instrument must be disconnected from all voltage sources.

8 Service

Dear customer,

This instrument has been manufactured and tested according to the latest technological innovations and in compliance with the **quality assurance system DIN ISO 9001**.

If there should still be reason for complaint please refer to your nearest service centre, giving a **detailed description of the defect** and including a copy of the invoice or the delivery note.

Packing

Use for shipping the original packing only. If the original packing is no longer available, our service centre will advise you with pleasure.

The manufacturer doesn't accept any granting security for damage that might have been formed by an inappropriate packing.

Note

For reasons of clarity this manual does not contain every detailed information about all models of this product and therefore cannot comprise every imaginable way of use, operation or maintenance.

For additional information or if any problems should be evolving which have not been dealt with extensively enough in the manual, ask for the required information at your local agent's.

Please also note that the contents of this manual neither constitutes part of nor modifies any earlier or existing agreement, promise or contract. All obligations result from the pertinent contract of purchase which also contains the sole and comprehensive warranty regulations. These contractual warranty regulations are neither extended nor limited by compliance with this manual.

CE

Certificate of Conformity

according to EC guideline 89/336/EWG 73/23/EWG

Manufacturer: NGI Norma Goerz Instruments

Address: A-2351 Wr.Neudorf - Palmersstraße 2

Product: **SERVOGOR 122 AC and 122 DC**

meet the following standards

EMC:

Emissions		
EN 55011		**Class B**
Imissions		
EN 50082-1	**Groupstandard**	
pr EN 60 1000-4-2	**IEC 801-2**	**8 kV**
pr EN 60 1000-4-3	**IEC 801-3**	**3V/m**
pr EN 60 1000-4-4	**IEC 801-4**	**0,5 kV**
pr EN 60 1000-4-5	**IEC 801-5**	**1 kV**

Safety standard:

IEC 1010-1

Signature:

NGI Norma Goerz Instruments
A-2351 Wr.Neudorf-Palmersstraße 2
Research Development