LineMaster 300

Continuous-line recorder

Parameter setting instructions

42/43-33 EN

Rev. 02

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Important instructions for your safety! Read and observe!

Safe and proper operation of the recorder requires proper transportation and storage, installation and commissioning by qualified personnel, proper use and careful maintenance.

Only qualified personnel who are familiar with the installation, commissioning, operation and maintenance of similar instruments are authorized to work on the recorder.

Observe the present operating instructions and the warnings and cautions attached to the device.

The regulations, standards and directives referred to in these operating instructions are applicable in Germany. When using the recorder outside the German jurisdiction, the relevant regulations, standards and directives applicable in the country where the device is used must be observed.

The device has been designed, produced and tested in accordance with DIN EN 61 010-1 “Safety Requirements for Electronic Measuring, Control and Laboratory Apparatus” and has been supplied in a safe condition. The present operating instructions contain warnings marked accordingly which must be followed by the user to retain the device in a safe condition and to ensure safe operation. Otherwise, persons may be injured or the device itself or other devices or installations may be damaged or fail.

If you should need information which is not contained in the present operating instructions please contact our service department.

Writing Conventions

Keys to be actuated are written in	**< >** brackets.
Displayed texts are written in	{ } brackets.
Printed texts are written in	**[ ]** brackets.

Usually, all possible parameters are shown. However, the number of parameters actually provided depends upon the recorder model and may be different from what is written in this manual.

The recorder automatically identifies its hardware.

Brief Description

This microprocessor-controlled continuous line recorder has 1...4 line channels, or 1...3 line channels and 1 printer channel.

It is designed to be connected to transmitters and sensors like thermocouples or resistance thermometers. Standard temperature sensor curves are stored in the recorder firmware, and are linearized with high accuracy.

The recorder is adapted to the measuring task by configuring its software either with the internal keypad or externally via the RS 485 interface.

Introduction

The recorder is configured either by using the operating keypad or remotely from a PC via the RS-485 interface.

A configuration program is needed for configuring the recorder via the RS-485 interface.

Description of Keys / Operation

Fig. 1 Front panel operating elements
R-17079*

The operating keypad with eight keys can be accessed by opening the recorder front door.Note that the functions printed on the keys are active when the recorder is in operating mode. The functions printed above the keys are active in configuration mode.

Key functions

Operating mode	**Configuration mode**
<Para> Change over to configuration mode	<Esc> Exit configuration mode or return to next higher menu level
<Print> Print channel code, measured value, time, ...	<Help> Call up online-help for parameters (context-sensitive)
<→| > Increment measured value display by one channel number	<▸•> Shift decimal point to the right by one digit
<Stop> Stop recording or standby mode (can be activated or de-activated in configuration mode)	<▲> Select menu item Set number
<○¯○> Stop rewinding	<▼> Select menu item Set number
<⇓> Adjust baseline (high chart speed)	<◂> Editing function: Cursor left
<⏲> Display date and time	<▸> Editing function: Cursor right
<| =⊗> Acknowledge error messages	<↵> Select menu item Select parameter Take over parameter value

The parameters and parameter values are shown in a 16-digit dot matrix display as plain text messages.

Starting Configuration

Note
The recording function and the alarm monitoring function are active in configuration mode.

1. Press <Para> to access the recorder's configuration mode.

The red LED at the <Para> key lights up. The firmware revision number is displayed for 2 seconds.

If no password has been defined (password "0000") or the password jumper has been set on the CPU board, the main menu item **{System data}** is displayed.

If a password has been defined, the recorder prompts you to enter the password:

{Password? 0000} (last digit is flashing):

Entering the Password

2. Press <▸> to move the cursor to the desired position, press <▴> to change the relevant digit (cursor position), press <↵> to complete password entry.

When entering password "9999" you can only read, but not edit the parameters. Neither main menu item **{Service}** nor the password is displayed.

With all other passwords ("0001" to "9998") you can edit the parameter definitions, provided that the entries are valid.

If an invalid password is entered, the message

{Invalid password!}

pops up and flashes in the display.

3. Press <↵> to acknowledge this message.

The recorder then returns to operating mode.

Main Menu

Pressing the <▴> key will call up the main menu items listed below one after the other:

{System data ■}	Definition of drive/display parameters
{Meas. chan. ■}	Parameters of measuring channels 1 ... 4
{Math. chan. ■}	Parameters of math. channels 1 ... 4
{Pulse chan. ■}	Parameters of pulse channels 1 ... 4
{Acc. chan. ■}	Parameters of accounting channels 1 ... 4
{Output chan. ■}	Parameters of violet, blue, red and green output channels
{Text lines ■}	Entry of text lines
{Print intervals ■}	Interval-controlled print functions
{Sync. times ■}	Time-controlled print functions
{DI assignment ■}	Assignment of inputs to functions
{Service ■}	Tests and balancing

{System data ■}

..

Menu item **{DI assignment ■}** is only displayed if the recorder is provided with the "Digital inputs/outputs" option.

Main menu items are marked with ("■") at the end of the line.

Channel menu items are marked with ("□") at the end of the line.

Submenu items are marked with ("▮") at the end of the line.

Configuration Principle

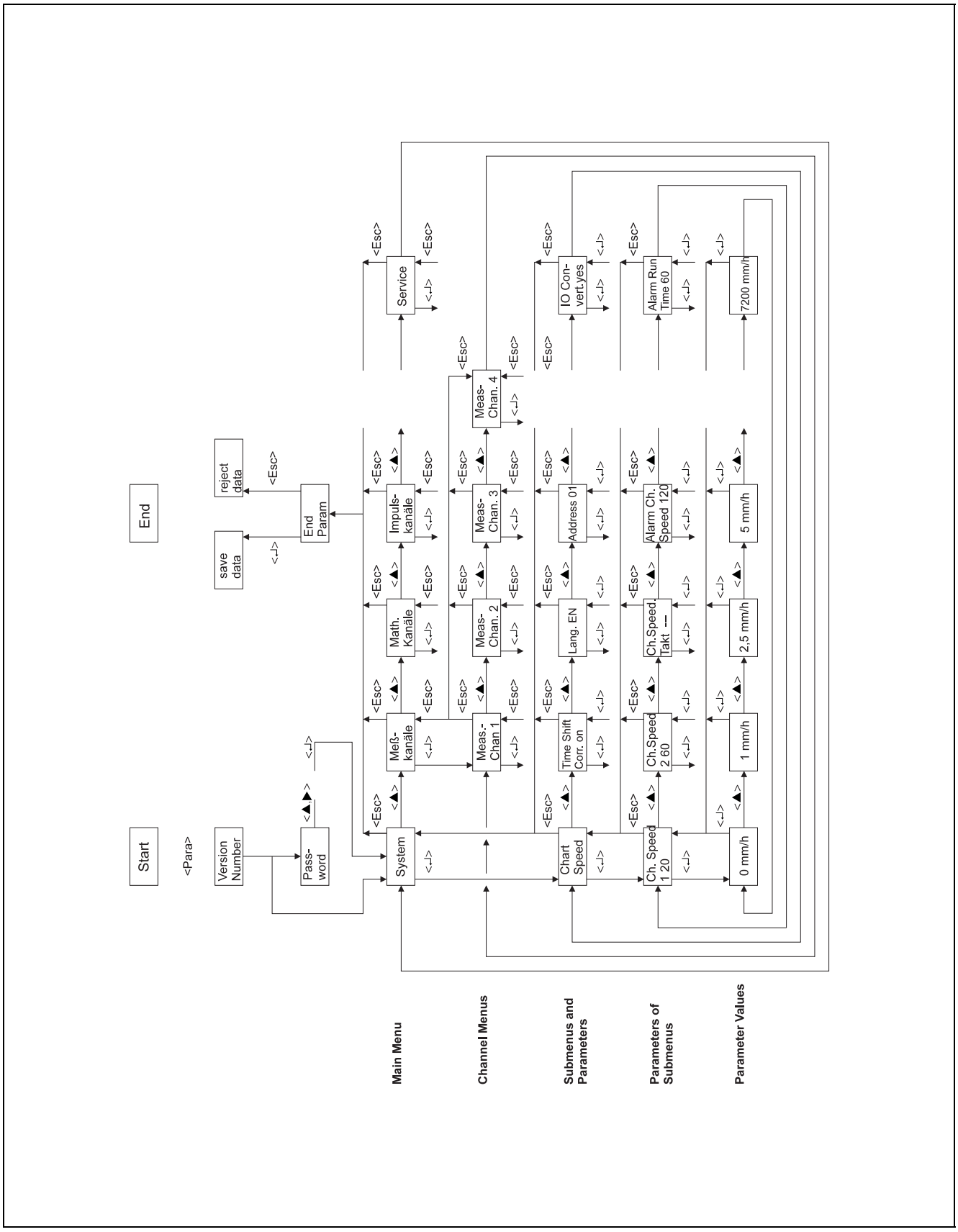

Fig. 2 Configuration principle
Z-18885

Selecting a Parameter

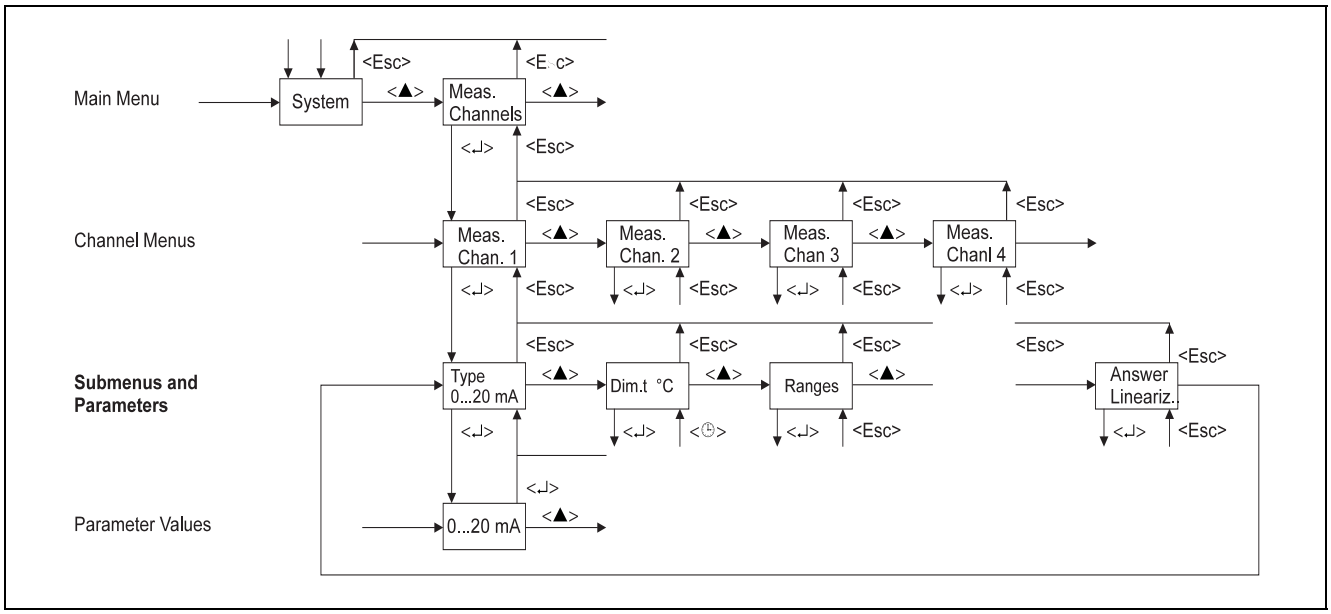

Fig. 3 Selecting a parameter

Z-18886

1. Press <↵> to confirm the selection of the main menu item (or channel menu item or submenu item, respectively). The first parameter of the menu item is then displayed.
2. Press <▲> to display the parameters of the main menu item one after the other.
3. Press <Esc> to return to the main menu item.

Setting a Parameter Value

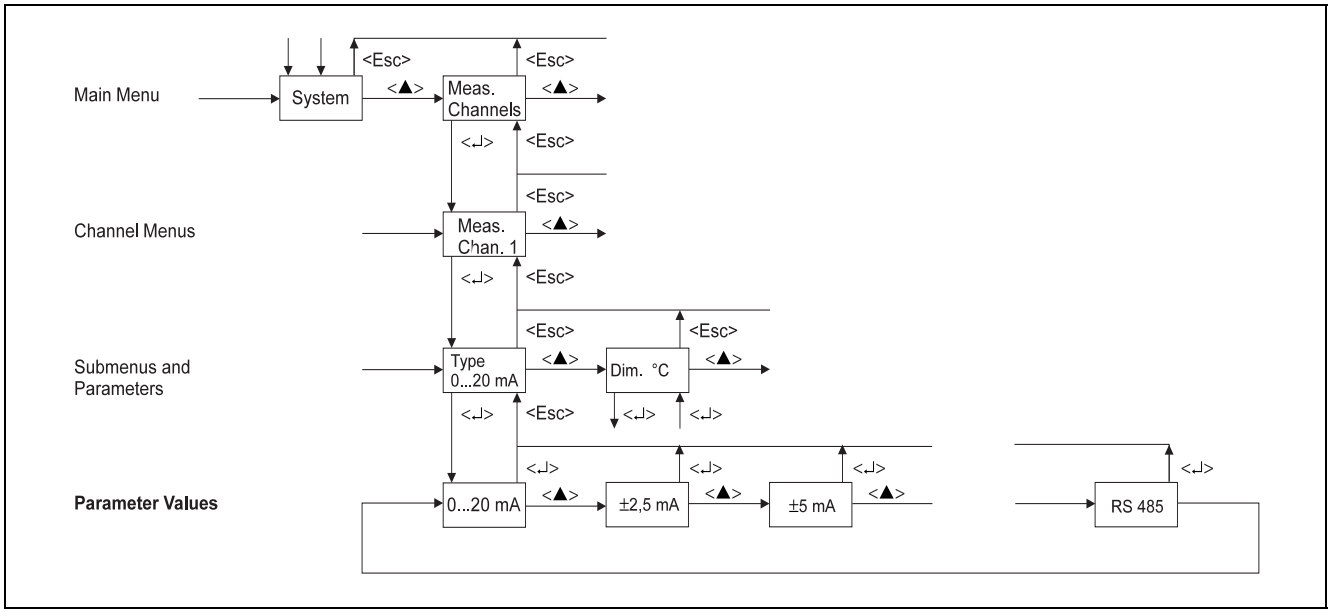

Fig. 4 Setting a parameter value

Z-18887

1. Press <↵> to confirm the selection of the parameter. The predefined setting of the selected parameter value starts flashing.

There are 2 ways in which parameter values can be set:

Selecting a Parameter Value ...

... from n predefined values.

Example: Selecting a chart speed from the series 0 / 2.5 / 5 / 20 / ... mm/h.

1. Press <▲> to display the parameter values of the selected parameter one after the other.
2. Press <↵> to confirm the selected parameter value. The parameter is then displayed.

Entering a Parameter Value

... between a lower and upper limit (any value).

Example: Entering the lower and upper measuring range value.

Note

The positive (“+”) and negative (“−”) signs are only displayed for selection when entering real numbers. They are not displayed when entering integers (e.g. password).

Press <▸•> to move the decimal point.

1. Press <▸> to select digits 1...5 of the parameter value, one after the other. The currently selected position is flashing.
2. Press <▲> to display
   0 / 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9
   one after the other.
3. Press <↵> to confirm the 4-digit number (with sign). The parameter is displayed then.
4. Press <Esc> to return to the main menu item.

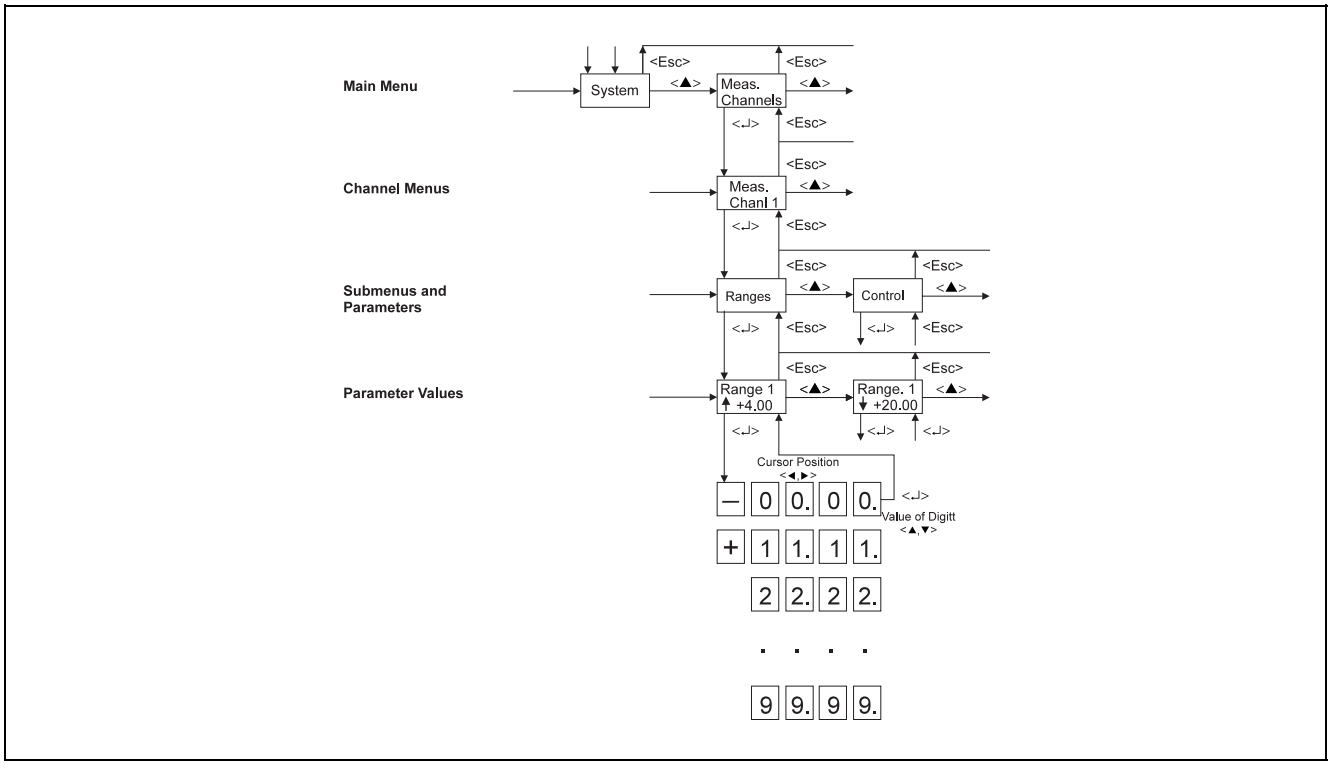

Fig. 5 Entering a parameter value
Z-18888

Completing Configuration

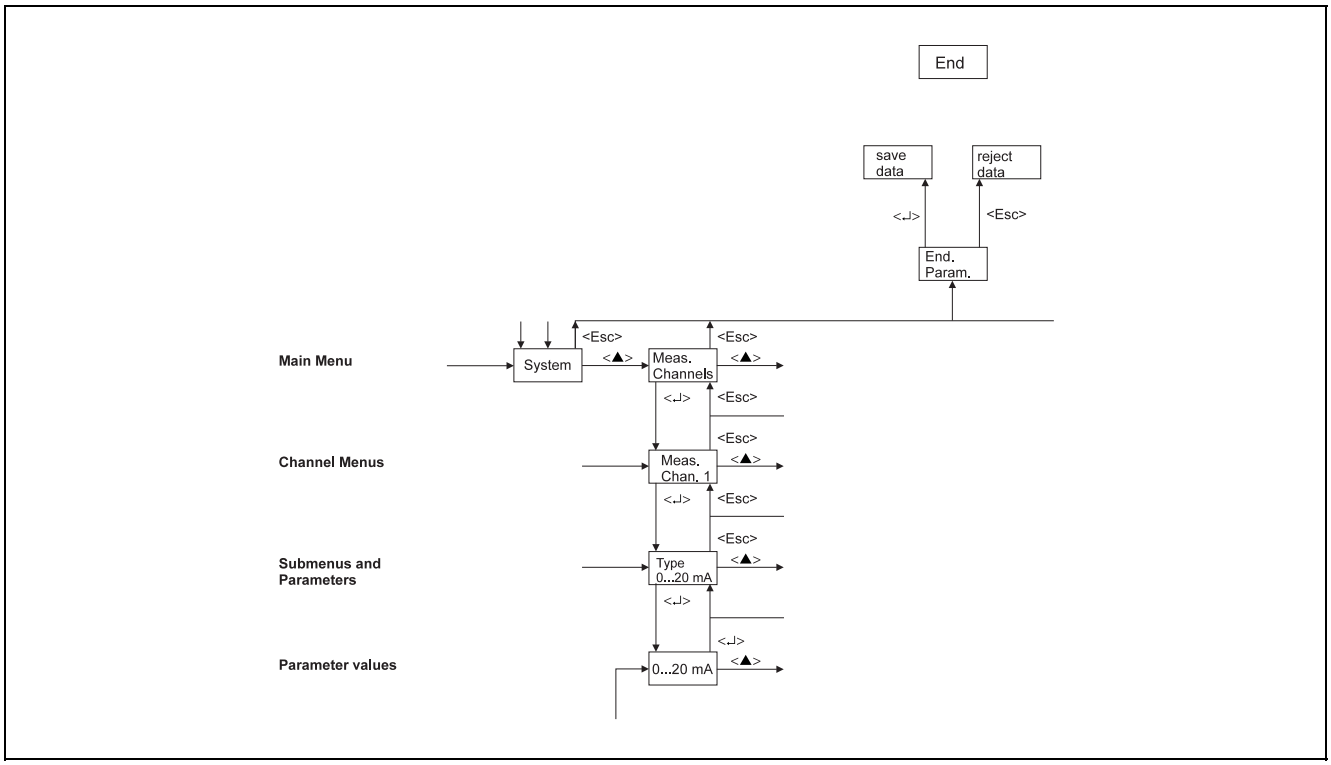

Fig. 6 Completing configuration
Z-18889

When pressing <Esc> again, the prompt
{Save data ?}
is displayed.

There are two ways to exit the configuration mode:

- Pressing <↵> saves the modified parameter settings in the EEPROM.
- Pressing <Esc> rejects the modified parameter settings.

Notes on Configuration

Editing Channel Parameter Values

The following section describes the procedure for selecting a new type of measurement, a new nominal range, the measuring range or the engineering unit.

Changing the Type of Measurement or the Nominal Range

The lower and upper range value are adjusted to the limits of the nominal range.

The display range is adjusted to the limits of the nominal range.

The alarm values are set to the lower (with min. function) or upper value (with max. function) of the display range.

The input limits for the measuring range are equal to the nominal range.

The input limits for the display range depend upon the selected display format.

The engineering unit is set to the unit of the type of measurement (e.g. type = 0...10 V: units = “V”).

If measurement by a thermocouple or a Pt 100 resistance thermometer is selected, the following menu items are reset:
- User linearization
- Square rooting
- Recording direction

The temperature unit is set to °C.

Changing the Lower or Upper Range Value

With thermocouple or Pt 100 measurement the display range is automatically tracked.

The alarm values are checked for compliance with the new display range. If the range is exceeded or fallen below, the alarm values are set to the limits of the measuring range.

With current or voltage measurement the display range and the alarm values remain unchanged.

The alarm values are always referred to the display range.

Changing the Display Range

The alarm values are checked for compliance with the new display range. It the range is exceeded or fallen below, the alarm values are set to the limits of the new display range.

Changing the Temperature Unit

Both the measuring range and the display range are reset to the nominal range. The input limits are given according to the nominal range. If °F has been selected as the temperature unit, the input limits of the measuring range are converted to °F (°F = 9/5 × °C + 32).

Defining the Measuring Range

When defining the measuring ranges, it is checked whether or not the minimum span of 20 % is observed. If the span is too small, the following error message appears on the screen:
{Span < 20%}

Reaction when the Measuring Range is Exceeded / Fallen Below-

The display and recording actions are proportional within the range of −0.25 % ... 100.25 %, referred to the measuring range. If the measured value exceeds or falls below the defined proportional range, this special operating condition is indicated as described below.

Display

If the measured value exceeds or falls below the selected measuring range by more than 0.25 %, the following message is shown in the display for the respective channel (channel 1 in the example below) after around 2 s:

{C 1 ↑} if the measuring range is exceeded
{C 1 ↓} if the value is below the measuring range

The channel code and the "↑" and "↓" symbols are flashing.

When the measured value is within the permissible range again, the display returns to the measured value after 2 seconds.

Printout

If the measured value exceeds or falls below the selected measuring range by more than 0.25 %, the measuring section is set to around −1 % or +101 % of the recording width. The changeover takes place in steps, with a delay of around 2 s.

System Data

The following parameters can be called up under main menu item “System data”:

Key	Display	Parameter
	{System data ■}	System data (main menu item)
<↵>	**{Chart speeds ■}**	Submenu item chart speeds
<▲>	**{TimeShiftComp. off}**	Time shift compensation
<▲>	**{TimeShiftInd. off}**	Cyclic printing of the symbol indicating active time shift compensation
<▲>	**{Language GB}**	Menu language
<▲>	**{Address 01}**	Address of the bus node
<▲>	**{Baud rate 9600}**	Data transmission rate
<▲>	**{Display cycle 03}**	Measured value display time
<▲>	**{AlarmAck. off}**	Type of alarm acknowledgement
<▲>	**{Stop button off}**	Stop button function
<▲>	**{Alarm annunciator DO1}**	Alarm annunciator output
<▲>	**{EndOfPaper DO1}**	End of paper alarm output
<▲>	**{Password 0000}**	Password entry
<▲>	**{Date/time ■}**	Date/time submenu
<▲>	**{Print functions ■}**	Print functions submenu
<▲>	**{History ■}**	History submenu
<▲>	**{Invert DI 000}**	Inversion of the assigned function
<▲>	**{Invert DO 000}**	Switching of the alarm relays
<▲>	**{IO-Convert. no}**	Extension unit for digital inputs and alarm relays

Chart Speeds

Key	Display	Parameter
	{Chart speeds ■}	
<↵>	**{Chart speed 1 20}**	Standard chart speed
<▲>	**{Chart speed 2 120}**	Second chart speed (triggered externally)
<▲>	**{Ch.Sp.ClockPulse ---}**	Pulse-control (max. 80 Hz) of the chart speed
<▲>	**{Clck.Pls.Divider off}**	Divider for a max. pulse frequency of 256 Hz
<▲>	**{AV mask 0000}**	Selecting the alarm value for chart speed changeover
<▲>	**{Alm.ChartSpeed 600}**	Chart speed upon alarm value violation
<▲>	**{Alm.ChartSpeedDur. 60}**	Duration of the alarm chart speed upon alarm value violation
<▲>	**{AlmChartSpeed yes}**	Behavior of alarm chart speed
<▲>	**{Rec.Stop yes}**	Measuring section stop upon chart drive stop

Chart speed 1

Defines the standard chart speed of the recorder. This chart speed is used when no chart speed changeover function is active.The default value is 20 mm/h.

Parameter
{Chart speed 1 20}

Parameter value mm/h
0 / 1 / 2.5 / 5 / 10 / 20 / 30 / 40 / 60 / 120 / 240 / 300 / 600 / 1200 / 1800 / 3600 / 7200

Chart speed 2

Defines the chart speed to be used with active chart speed changeover function. Chart speed 2 can have the same value as chart speed 1. The default value is 120 mm/h. If a 24 V DC voltage is applied to terminals +902 and −901, the recorder automatically changes over to the second chart speed.

Note
The recorder must be equipped wit the “Alarm monitoring and digital input” option.

Parameter
{Chart speed 2 120}

Parameter value mm/h
0 / 1 / 2.5 / 5 / 10 / 20 / 30 / 40 / 60 / 120 / 240 / 300 / 600 / 1200 / 1800 / 3600 / 7200

External Chart Speed Control, Switching off the Chart Drive

When external chart speed control is active, the chart drive is controlled by an external clock generator. This parameter is used to define the paper length transported during each clock pulse.The max. clock frequency on the input is 80 Hz. The max. possible chart speed is 7200 mm/h. The 24 V DC pulses must be applied to terminals +904 and −903.

Note
The recorder must be equipped wit the “Alarm monitoring and digital input” option.

Parameter
{Ch.Sp.ClockPulse ---}

Parameter value

---	off
0.025	mm / clock pulse
0.05	mm / clock pulse
0.1	mm / clock pulse
0.2	mm / clock pulse

Note

The chart speed is calculated using the following formula:
Chart speed= clock frequency × step length / 3600 (mm/h)

With parameter value “---” one of the internally triggered chart speeds is used. Selecting any other value will automatically change the recorder over to external chart speed control.In this case, the internally triggered chart speeds will have no effect on the chart drive.

Pulse Frequency Divider

When the pulse frequency divider is activated, the maximum pulse frequency for chart speed control must not exceed 256 Hz.

Parameter
{Clck.Pls.Divider off}

Parameter value
off
on

The chart speed is calculated using the following formula:
Chart speed= clock frequency × step length / 11520 (mm/h)

Chart Drive Stop

When the **{Ch.Sp.ClockPulse}** parameter is set to "---", the chart drive running at the currently active chart speed can be switched off by applying a 24 V DC voltage to terminals +904 and −903.

The "Chart Drive Stop" status can be linked with the "Measuring Section Stop" function.The measuring sections will then stop at the measured value that was displayed before the chart drive was switched off. Note that the parameter **{Rec.Stop}** must be activated for this.

Alarm Values for Chart Speed Changeover

Defines the alarm values for triggering the alarm chart speed.

The parameter value to be entered is the sum of the code numbers of the alarm values that trigger the alarm chart speed.

Parameter
{AV mask 00001}

Parameter value
0...65535

Code	Alarm value	Output channel
1	1	blue
2	2	blue
4	3	blue
8	4	blue
16	1	red
32	2	red
64	3	red
128	4	red
256	1	green
512	2	green
1024	3	green
2048	4	green
4096	1	violet
8192	2	violet
16384	3	violet
32768	4	violet

Chart Speed Changeover upon Alarm Value Violation

Defines the chart speed that is activated upon alarm value violation.

Parameter
{Alm.ChartSpeed 600}

Parameter value mm/h
0 / 1 / 2.5 / 5 / 10 / 20 / 30 / 40 / 60 / 120 / 240 / 300 / 600 / 1200 / 1800 / 3600 / 7200

Duration of Alarm Chart Speed

Defines the duration or after-running time of the alarm chart speed.

Parameter
{Alm.ChartSpeedDur. 00}

Parameter value
00...255 s

After-Running of Alarm Chart Speed

There are two options for controlling the duration of the alarm chart speed: Upon alarm limit violation

- the recorder changes over to alarm chart speed for a pre-selected **duration**. Other alarm value violations that may occur during this time period have no further effect and are ignored.
- the recorder changes over to alarm chart speed. If the alarm value is no longer exceeded or fallen below, the recorder continues to work at alarm chart speed for the specified **after-running time**.If another alarm limit violation occurs during this time period, the after-running time is restarted.

Parameter
{AlmChartSpeed}

Parameter value

no	Duration
yes	After-running time

Recording Stop

Defines whether or not the measuring sections are stopped at the measured value that was displayed before the chart drive was stopped (triggered via digital inputs +904 and −903).

Parameter
{Rec.Stop}

Parameter value
no
yes

Time Shift Compensation

Switches time shift compensation on or off.

The respective reference channel (real-time channel) can be seen in the following table:

Version	Reference channel
4 line channels	violet
3 line channels	blue
2 line channels	blue
3 line channels + printer channel	printer channel
2 line channels + printer channel	printer channel
1 line channel + printer channel	printer channel

If the reference channel (line channel or printer channel) is deactivated for the measurement, the next active channel takes over the reference position. The order is: violet (printer channel), blue, red.

If the recorder is provided with a printer channel, the following text line is printed upon switch-on of the time shift compensation:

“Time shift compensation on (time/date)”

The character string “--τ--” is printed cyclically at a spacing of 12 cm on the chart, to indicate that time shift compensation is on.Active time shift compensation is also indicated in the display with “τ”.

Example:
{BL τ 560 °C}

Note
With the reference channel the sign “τ” is not shown in the display.

When time shift compensation is deactivated, the recorder prints the following text line:

“Time shift compensation off (time/date)”

Parameter
{TimeShiftComp. on}

Parameter value
off
on

Disable Message Lines

Defines if printing of the lines

“Time shift compensation on (time/date)”
and
“Time shift compensation off (time/date)”
and
cyclic printing of “--τ--”

is to be suppressed.

Note
This parameter is only displayed when time shift compensation is on.-

Parameter
{TimeShiftInd. on}

Parameter value
off
on

Language

This parameter defines the language to be used. You can select **D** for German, **GB** for English and **F** for French. Upon selection of the desired language the menu display is changed over to this language.

Parameter
{Language GB}

Parameter value
D
GB
F

Bus Node Address

This parameter defines the bus address of the recorder for communication.

Parameter
{Address 01}

Parameter value
0....127 (= bus node addresses)

Note
Address 133 is the recorder's broadcast address.

Baud Rate

This parameter defines the transmission rate for the RS-485 interface The standard transmission rates are used.

Parameter
{Baud rate 9600}

Parameter value
1200
2400
4800
9600
19200

Display Cycle

Defines the automatic display changeover of the active channels during recording operation. The setting is made in second intervals.

The following displays are shown:

c1...c4	= measuring channels
m1...m4	= math channels
i1...i4	= pulse channel sum display
s1...s4	= accounting channel sum display
bl, rd, gn, vi (pr)	= output channels

Manual changeover is started with the first active measuring channel.

When switching over the channels manually by pressing <→| >, upper case characters are displayed instead of lower case ones.

Parameter
{Display cycle 00}

Parameter value
0...10 s

Alarm Acknowledgement

Defines how the display of alarms is to be handled. The parameter can be set to “off”, “auto” or “man”.

Selecting the “off” option disables the display of alarms.

With “auto” the alarm message is indicated as long as the alarm value is active. Manual acknowledgement is possible in this case. The alarm message is erased automatically as soon as the alarm value violation does no longer persist.

With setting “man” every single alarm has to be acknowledged manually.

These settings are not valid for selftest messages. Selftest messages are always displayed and always have to be acknowledged.

Parameter
{AlarmAck. auto}

Parameter value
off
auto
man

Stop Button

Defines the stop button function.

If the default function is selected for the stop button, the measuring section is set to the home position upon actuation of the button. The home position allows you to easily replace the print inserts. Note that measured value monitoring is interrupted when the measuring section is in the home position.

Parameter
{Stop button on}

Parameter value
off Stop button function is disabled
on Stop button function is enabled

Standby

The stop button can be configured in the “History” submenu by using the “Standby” function. The **{Button}** parameter in the “History” submenu has a higher priority than the **{Stop button}** parameter.

Alarm Annunciator

Defines, which relay output is to be activated if a selftest error or any other alarm occurs.The alarm annunciator relay uses the NC contact operation principle. If no alarm is present, the output is closed.-

Parameter
{Alarm annunciator DO 1}

Parameter value

---	Alarm annunciator off
DO 1	Digital output 1
DO 2	Digital output 2
.	.
DO 6	Digital output 6
DO 7	Digital output 7 via IO converter
.	.
DO 20	Digital output 20 via IO converter

End-of-Paper Signal

Defines which relay output is activated when the end of the paper chart is reached.

Parameter
{End-of-Pap. DO1}

Parameter value

---	No message
DO 1	Digital output 1
DO 2	Digital output 2
.	.
DO 6	Digital output 6
DO 7	Digital output 7 via IO converter
.	.
DO 20	Digital output 20 via IO converter

Password

Defines, which numbers have to be entered to be authorized to access the parameter data.

If “0000” is defined here as the password, the user will not be prompted to enter a password. If this parameter is set to “9999”, all parameters (except for the password itself) can be read.In this case, the parameters cannot be edited.

Parameter
{Password 0000}

Parameter value
0001....9998

Date / Time

Key	Display	Parameter
	{Date / time }	
<↵>	**{Time 12:15}**	Time
<▲>	**{Date 26.08.1997}**	Day, month, year
<▲>	**{DateFormat EURO}**	Time and date format
<▲>	**{Clock.Sync. 12:00}**	External clock synchronization
<▲>	**{ClockChange auto}**	Changeover between daylight saving time / normal time
<▲>	**{Sum.Date 30.03}**	Date on which the clock is to be changed over to daylight saving time.
<▲>	**{Sum.Time 02.00}**	Time at which the clock is to be changed to daylight saving time.
<▲>	**{Win.Date 29.10}**	Date on which the clock is to be changed back to normal time.
<▲>	**{Win.Time 03.00}**	Time at which the clock is to be changed back to normal time.
<▲>	**{CEST 1}**	Status indicator (0 = CET active, 1= CEST active)

Time

Defines the time, which is immediately written into the clock module upon each change.

Parameter
{Time 11:33}

Parameter value
00:00 to 23:59

The factory setting for date and time is:
01.01.97 00:00 o’clock.

Date

Defines the date, which is immediately written into the clock module upon each change.

Parameter
{Date 02.10.}

Parameter value
01.01. to 31.12.

The factory setting for date and time is:
01.01.97 00:00 o'clock.

Date Format

Defines the format for date and time data. This format is valid for all printed and displayed date and time data (input and output data).

Parameter
{DateFormat EURO}

Parameter value
EURO
US

Time for External Clock Synchronization

Defines the time to which the clock module is set when the input assigned to it is closed.

Parameter
{ClockSync. 00:00}

Parameter value
00:00 to 23:59

Changeover between Daylight Saving Time / Normal Time

Defines the way in which the clock is changed over from daylight saving time to normal time and vice versa.

The parameter can be set to "off", "man" and "auto".

With "auto" setting the date and time for changeover are taken from an internal table.The table includes all dates up to the year 2022.

With setting "man" you have to specify the time and date for changeover in the next four parameters.

When "off" is selected, changeover is not active.

Parameter
{ClockChange man}

Parameter value
off
man
auto

Parameter
{Sum.Date 30.03}

Parameter value
01.01. to 31.12.

Parameter
{Sum.Time 02:00}

Parameter value
00:00 to 23:59

Parameter
{Win.Date 30.03}

Parameter value
01.01. to 31.12.

Parameter
{Win.Time 02:00}

Parameter value
00:00 to 23:59

Print Functions

(Printing of text only possible with chart speeds ≤300 mm/h)

Key	Display	Parameter
	{Print functions }	
<↵>	**{Scal.Print yes}**	Printing of double lines is active
<▲>	**{Scal.Spac. 060}**	Spacing (in mm) between two double lines
<▲>	**{PrintChrt.Sp. yes}**	Printing of chart speed date / time upon changeover
<▲>	**{AV text print yes}**	Printing of text lines with measured values upon alarm value violation
<▲>	**{CounterValue 00000000}**	Entry of counter value
<▲>	**{Incr./Decr. +1000}**	Entry of counter increment or decrement / pulse
<▲>	**{CounterTextLin. 10}**	Number of text line with counter
<▲>	**{Counter DI DI 10}**	Digital input for resetting the counter
<▲>	**{Messg.Blk. 1 0049}**	Printing message block 1
<▲>	**{MessgBlk 2 0082}**	Printing message block 2
<▲>	**{MessgBlk 3 0148}**	Printing message block 3
<▲>	**{MessgBlk 4 0280}**	Printing message block 4

Print Double Lines (Scaling Lines and Text Lines)

Enables or disables printing of scaling lines and text lines.

Parameter
{Scal.Print yes}

Parameter value
yes
no

Spacing between Double Lines

Defines the spacing between the double lines (scaling line and text line) of the channels.

Parameter
{Scal.Spac. 60}

Parameter value
40...500 (in mm steps)

Print Chart Speed

When the recorder is switched on or when the chart speed is changed, a text line containing the current chart speed, date and time is printed.This parameter enables printing of this line.

Parameter
{PrintChrtSpd on}

Parameter value
off
on

Print Text Lines Upon Alarm Value Violation

Limit values can be assigned to text lines. In case of alarm value violation these lines are shown in the display and are printed with the date and time. In this parameter you can also add the currently measured value (= alarm value) to the text line printout. Note that the prerequisite for adding the alarm value is that the text line does not contain more than 16 characters.

If this parameter is set to “on”, the text line will be printed in the following format (example):

[Text line > −23.00 mV 12.02.99 9:45]

Parameter
{AV text printon

Parameter value
off
on

Batch Counter

The following parameters are used to create an 8-digit counter for batch coding.

The batch counter is assigned to a text line. Printing of the text line is triggered either
- externally via a digital input,
- internally upon alarm value violation or
- cyclically

Counter Value

This parameter is used for entering the counter value for the 8-digit counter.

Parameter
{CounterValue 00000000}

Parameter value
0...99999999

Counter Increment / Decrement

Defines the amount and the direction by which the counter value is changed with each activation.

Parameter
{Incr./Decr. +1000}

Parameter value
0...±1000

Text Line with Counter

Defines the assignment of the counter to a text line.The count is added to the line text, separated by a space. The time is no longer added to the selected text line.

Parameter
{CounterTextLin. 10}

Parameter value
0...10

Reset Batch Counter

When the batch counter is assigned to a digital input, the batch counter can be reset to the initial count.

Parameter
{Counter DI 04}

Parameter value
DI 1 ... DI 4
additionally DI 7 ... DI 14 via IO converter

Print Message Blocks

The individual text lines, the measured value lines, and the date/time line can be grouped to form text blocks. A maximum of four text blocks is possible. The text blocks are triggered via the digital inputs DI 1...DI 4 assigned to them.

A code number is assigned to each text line. Enter the total of all code numbers of the text lines grouped in a text line as the parameter value.

Code number

0	No blocks
1	Measured value of blue output channel (measured value printing must be enabled in the output channel)
2	Measured value of red output channel (measured value printing must be enabled in the output channel)
4	Measured value of green output channel (measured value printing must be enabled in the output channel)
8	Measured value of violet output channel (measured value printing must be enabled in the output channel)
16	All measured values for which printing is enabled
32	Date / time
64	Text line 1
128	Text line 2
256	Text line 3
512	Text line 4
1024	Text line 5
2048	Text line 6
4096	Text line 7
8192	Text line 8
16384	Text line 9
32768	Text line 10

Parameter
{Messg.Blk. 1 0049}
{Messg.Blk. 2 0082}
{Messg.Blk. 3 0148}
{Messg.Blk. 4 0000}

Parameter value
0...65535

History

Key	Display	Parameter
	{History }	
<↵>	**{STBY Mode}**	Standby with/without history function
<▲>	**{Retent.Tim 1h}**	Retention time with history function
<▲>	**{AfterRunTime 1h}**	Time for delayed switch-on of the standby function
<▲>	**{Input DI 1}**	Input for activating the standby/history function
<▲>	**{SystemPos. 0}**	System stop at last measured value or start of scale
<▲>	**{AlarmValue 3}**	Alarm values for standby stop
<▲>	**{Button on}**	Standby triggered with stop button
<▲>	**{Chart speed 10}**	Chart speed during standby
<▲>	**{ChartSp.Prior. 0}**	Priority of standby chart speed over chart speed stop.
<▲>	**{DirectStart off}**	Recorder defaults to standby mode directly upon switch-on.

Operating Mode

Activates standby mode with or without history function. The history function is only possible with an existing printer channel, and for line channels blue, red and green.

The standby mode is triggered either
(a) by applying a 24 V DC voltage to an assigned digital input or
(b) by actuating the stop button, if configured accordingly (parameter **{Button}**) or
(c) by switching on the recorder, if configured accordingly (parameter {**DirectStart**}).

The recorder will exit from the standby mode in case
(a) if an alarm value violation occurs or the voltage applied to the configured input (DI 1...DI 4) is switched off.
(b) if an alarm value violation occurs or the stop button is actuated
(c) if an alarm value violation occurs.

In standby mode the measured value processing and alarm monitoring functions are active.The measuring sections are positioned at the start of the scale or stay in the last position they had when the standby mode was triggered. The chart speed can be selected as required in standby mode (usually 0 or 1 mm/h).

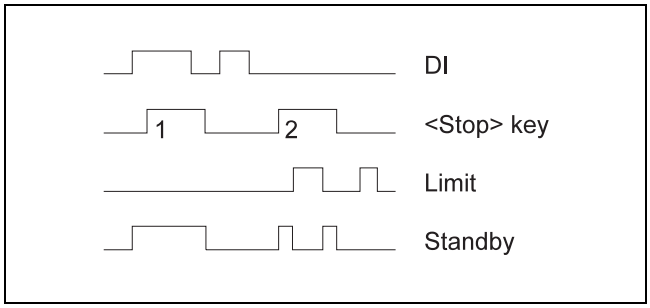

Fig. 7 Functional diagram of standby mode
Z-18890 1 First key actuated
2 Second key actuated

The functional diagram shows what happens if you configure this parameter in such a way that standby triggering by both digital input and stop button is possible.

In this scenario, the standby mode is triggered by applying a voltage to the digital input.When actuating the first key (1), the stop button takes over standby control.

When selecting parameter value “MEMO” the recorder will behave as described above.Additionally, the measured values are written into the FIFO memory. When the standby mode is terminated, the data is read from the memory and then written at maximum chart speed. When the entire memory contents has been read and printed, the recorder returns to normal chart speed. The start of the writing action and the end of the standby mode are marked accordingly.

The following data is written upon start of the recording action:

1. [MEMO: date time -- date time]
2. [V = 20 mm/h (1) t = 10 min]
3. [Text line > -23.00mV 9:45]

The retention time used by the recorder is printed as retention time t. If an invalid time has been entered (i.e. value is greater than max. permissible value for selected chart speed), the maximum value (see table) is printed. Line 3 is only written if the standby mode is terminated by alarm value violation.

Parameter
{STBY mode}

Parameter value
off
STBY
MEMO

Retention Time

Defines the retention time for “MEMO” mode. The max. possible retention time depends on the selected operating chart speed (operating chart speed = chart speed after standby mode). The following table includes the max. retention times with the respective chart speeds. It is possible to select shorter retention times. The shortest selectable retention time is 1 minute.

Chart speed (mm/h)	Retention time
1	--
2.5	2880 min = 48 h
5	1440 min = 24 h
10	720 min = 12 h
20	360 min = 6 h
30	240 min = 4 h
40	180 min = 3 h
60	120 min = 2 h
120	60 min
240	30 min
300	24 min
600	12 min
1200	6 min
1800	4 min
3600	2 min

Parameter
{Retent.Time 30}

Parameter value
1...2880 (enter in steps of 1 minute)

Delay Changeover to Standby Mode

Defines the time by which the activation of the standby mode is delayed. If, for example, a text is to be written when a standby criterion is fulfilled, the chart drive must not be switched off immediately. Instead, the chart must be further transported by another text line (2.8 mm). This parameter is not active with standby control via the stop button.

Parameter
{AfterRunTime 200}

Parameter value
0...200 minutes

Digital Input for Triggering Standby Mode

Defines the digital input with which the recorder is changed over to standby mode.

Parameter
{Input DI 1}

Parameter value
off, DI 1 ... DI 4
additionally DI 7 ... DI 14 via IO converter

Position of the Measuring Section

Defines the position of the measuring section in standby mode.

Parameter
{SystemPos. 0}

Parameter value
0 Measuring sections at start of scale
1 Measuring section stays at last value measured before standby has been triggered.

Exit Standby Mode

Defines alarm values. If these alarm values are exceeded or fallen below, the standby mode is terminated.

Enter the code number of the respective alarm value at which standby mode is to be exited.If you want to define several alarm values, sum up the appropriate code numbers using the table below and then enter the total as the parameter value.

Code	Limit value	Output channel
1	1	blue
2	2	blue
4	3	blue
8	4	blue
16	1	red
32	2	red
64	3	red
128	4	red
256	1	green
512	2	green
1024	3	green
2048	4	green
4096	1	violet
8192	2	violet
16384	3	violet
32768	4	violet

Parameter
{Alarm value 00003}

Parameter value
0...65535

Stop Button Function

Activates the stop button for terminating standby operation.

Parameter
{Button on}

Parameter value
off
on

Chart Speed in Standby Mode

Defines the chart speed to be used in standby mode.

Parameter
{Chart speed 1}

Parameter value mm/h
0 / 1 / 2.5 / 5 / 10 / 20 / 30 / 40 / 60 / 120 / 240 / 300 / 600 / 1200 / 1800 / 3600 / 7200

Chart Speed Priority

Defines whether or not the standby chart speed has a higher priority than a chart drive stop (triggered by applying a 24 V DC voltage to terminals +904 and −903).

Parameter
{ChartSp.Prior.}

Parameter value
0 Chart drive stop has higher priority
1 Standby chart speed has higher priority

Standby Operation Directly upon Recorder Switch-On

Defines whether or not the recorder defaults to standby mode directly upon switch-on.

Parameter
{DirectStart on}

Parameter value
off Recorder starts normal recording operation upon switch-on
on Recorder defaults to standby mode directly upon switch-on

Invert Digital Input

Defines that the function assigned to the digital input is triggered by either applying (normal) or switching off the 24 V DC voltage.

Enter the code number of the digital input to be inverted as the parameter value.If you want to invert several digital inputs, sum up the appropriate code numbers using the table below and then enter the total as the parameter value.

Parameter
{Invert DI 000}

Parameter value
0...127

Code	Digital input
1	DI 1
2	DI 2
4	DI 3
8	DI 4
16	Change over chart speed
32	Switch off chart drive
64	All digital inputs of the IO converter

Relay Action

Defines if the output relays are to work as NO or NC contacts.This also includes the contact action in case of an alarm.

NO contact = no
NC contact = yes

Parameter
{Invert DO no}

Parameter value
no
yes

IO Converter

4 digital inputs and 6 contact outputs are available if the recorder is provided with the “Alarm monitoring and digital inputs” option. The IO converter adds another 8 digital inputs and another 14 contact inputs to the the standard hardware configuration of the recorder. The contact outputs are electrically isolated. The parameter can be set to “off” or “on”. With parameter setting “on” the IO converter can be connected to a recorder that is not provided with the “Alarm monitoring and digital inputs” option.

Parameter
{IO converter off}

Parameter value
no
yes

Main Menu Item Measuring Channels

Up to four measuring channels can be used and configured, depending on the recorder model. The measuring channels can be assigned to the output channels (measuring sections) as required.Measuring channels 1...4 are channel menu items.

The channel parameters can be set individually and independently for each channel.

{Channel 1 ❑}
{Channel 2 ❑}
{Channel 3 ❑}
{Channel 4 ❑}

Key	Display	Parameter
<↵>	**{Type 4...20mA}**	Type of measurement with nominal range
<▲>	**{Unit mA}**	Select unit for first display range
<▲>	**{Text unit 1 bq}**	Freely configurable measuring unit for the first display range
<▲>	**{Text unit 2 bq}**	Freely configurable measuring unit for the second display range
<▲>	**{Temp.Unit °C}**	Select temperature unit for the first measuring/display range
<▲>	**{Ranges }**	Ranges submenu
<▲>	**{Control }**	Accounting submenu
<▲>	**{Usr.Linear. }**	User linearization submenu

Signal Type (Type of Measurement and Nominal Range)

This parameter defines the type of measurement and the nominal range for the respective channel. The “RS 485” signal type switches the channel over from measured value processing to the reception of measured values via the serial interface. The last value received from the interface is recorded until a new value is received. The measured value received via the interface must be a standard value in the range 0 .. 1000. The permissible scale for signal type “RS 485” lies within the max. input range limits.

Press <↵> to select the desired signal type and, thus, the corresponding nominal range. Note that the display range for current and voltage measurement is independent of the measuring range. If the engineering unit for temperature measurement through Pt 100 or thermocouple is set to °F, the permissible range limits are automatically adapted to this setting.

The following formula is used for conversion:
°F = (9/5) × °C + 32.

Parameter
{Type 0...20 mA}

Parameter value

0...20 mA	
4...20 mA	
±2.5 mA	
±5 mA	
±20 mA	
0...25 mV	
±25 mV	
±100 mV	
0...2.5 V	
±2.5 V	
0...10 V	
±20 V	
PT100-I	−50...150 °C
PT100-II	−200...850 °C
THERMO-B	0...1820 °C
THERMO-E	−270...1000 °C
THERMO-J	−210...1200 °C
THERMO-K	−270...1372 °C
THERMO-L	−200...900 °C
THERMO-N	−270...1300 °C
THERMO-R	−50...1769 °C
THERMO-S	−50...1769 °C
THERMO-T	−270...400 °C
THERMO-U	−200...600 °C
USER	Special measuring ranges (see section “Special Measuring Range Configuration”)
RS 485	Measured value received via RS-485 interface

Measuring Unit

The measuring unit can be selected individually for every channel. The recorder makes a distinction between
- temperature unit,
- standard unit and
- freely configurable unit

If the range changeover function has been enabled, the “Freely Configurable Measuring Unit” must be selected for the second display range.

Temperature Unit

The temperature unit is to be defined by the user if a thermocouple or a Pt 100 resistance thermometer is connected to the measuring input. You can select either °C or °F.

Parameter
{Temp. Unit °C}

Parameter value
°C
°F

Standard Unit

You can select the standard unit from a list.This menu item is available for standard signals (current, voltage).

Parameter
{Unit bar}

Parameter value

mA	°F
A	K
mV	m^3/h
V	l/s
bar	%
mbar	‰
psi	MW
Pa	1/min
kPa	-TEXT-
°C	

Freely Configurable Measuring Unit

This measuring unit consists of up to 7 user-configured characters.It is available for standard signals (current, voltage), only.

Parameter
{Text unit 1??????}

Parameter value
Character set from section “Character Set Table”. The text marked with 1?????? can be edited using the cursor keys (see section “Main Menu Item Text Lines), e.g. in **{Text unit mV/MW}**.

Ranges

Key	Display	Parameter
	{Ranges }	
<↵>	**{Meas.Ran.1↓ +4.000}**	Lower range value
<▲>	**{Meas.Ran.1↑ +20.00}**	Upper range value
<▲>	**{Displ.1 ↓ +50.00}**	Start of display range
<▲>	**{Displ.1 ↑ +300.0}**	End of display range
<▲>	**{Changeover off}**	Digital input for measuring range changeover
<▲>	**{Meas.Ran.2↓ +4.000}**	Lower range value
<▲>	**{Meas.Ran.2↑ +20.00}**	Upper range value
<▲>	**{Displ.2 ↓ +50.00}**	Start of display range
<▲>	**{Displ.2 ↑ +300.0}**	End of display range
<▲>	**{x1 −5}**	Measuring range value for 1st salient point
<▲>	**{x2 10}**	Measuring range value for 2nd salient point
<▲>	**{y1 100}**	Display range value for 1st salient point
<▲>	**{y2 800}**	Display range value for 2nd salient point
<▲>	**{OffsetCorr. →}**	Possible correction of display range

Measuring ranges

This parameter defines which range within the nominal range is to be used for measurement. Note that the span must be at least 20 % of the nominal range. The input limits for these values are set to the lower and upper range value of the selected nominal range. The upper range value may be between 20 and 100 % of the nominal range, the lower range value between 0 and 80 %.

Two measuring ranges with the corresponding display ranges can be defined and changed over externally via a digital input.

Parameter

{Meas.Ran.1 ↓ -50.00}	Measuring range 1, lower range value
{Meas.Ran.1 ↑ +150.0}	..., upper range value
{Meas.Ran.2 ↓ 100.00}	Measuring range 2, lower range value
{Meas.Ran.2 ↑ +150.0}	..., upper range value

Parameter value

Lower range value of nominal range to
upper range value of nominal range
The values are entered in the measuring unit of the measuring range.

Example:
With **{Type 0..20mA}** nominal range 0...20 mA and setting **{Meas.Ran.1↓ +4.500}** and **{Meas.Ran.1↑ +19.00}** the measuring range is 4.5...19 mA (with the accuracy reduced correspondingly).

Display Measured Values

The start/end of display range parameters define to which physical range (maximum reading) the selected measuring range (e.g. 0..20 mA → 3..9 bar) is to be mapped.

Parameter

{Displ.Ran.1 ↓ 0.000}
{Displ.Ran.1 ↑ 9000.}
{Displ.Ran.2 ↓ 0.000}
{Displ.Ran.2 ↑ 5000.}

Parameter value

−999....+9999 for decimal display
−9.990E9...+9.990E9 for exponential display

Range Changeover

Defines the digital input which is used for external changeover of the range.

Note

Only the linear display range is possible for measuring range 2.

For recorders with printer channel the following line (example) is printed upon changeover of the measuring range:

```
C1 = 1; C2 = 1; C3 = 2; C4 = 0
```

Explanation:

C1...C4	Measuring channels
0	No changeover of measuring range configured
1	Measuring range 1 active
2	Measuring range 2 active

Parameter

{Changeover DI 1}

Parameter value

off
DI 1 ... DI 4
additionally DI 7 ... DI 14 via IO converter

Salient Points for Linear Display Range

Linear display ranges can be configured with one or two salient points.This option is used to create magnifying ranges within the measuring range (e.g. compressed starting range or end range). This parameter defines the coordinates of the salient points. If the display range is hyperbolic, the point of discontinuity is entered with the x1 value.

Parameters

{x1 4.000}	1st salient point measuring range 1
{x2 100.0}	2nd salient point measuring range 1
{y1 12.00}	1st salient point display range 1
{y2 200.0}	2nd salient point display range 1

Parameter value

for x1, x2 = lower to upper meas. range value
for y1, y2 = lower to upper display range value

Offset

Shifts the measured value by a constant amount. Used, for example, to compensate dissymetries of Pt 100 feed cables.

Parameters

{Offset →}

<↵>

{11.75 0000} (left measured value, right offset)

Parameter value

<▲>	increments the measured value
<▼>	decrements the measured value

Control

Key	Display	Parameter
	{Control }	
<↵>	**{Meas.V.Displ. yes}**	Display measured value
<▲>	**{Meas.V.Print yes}**	Print measured value upon actuation of the key <Print>
<▲>	**{Mapp.Funct. 02}**	Display format
<▲>	**{Exp.Format no}**	Number format
<▲>	**{Dec.Points 0}**	Number of digits to the right of the decimal point
<▲>	**{Ref.Temp. 0°C}**	Reference point temperature for TC
<▲>	**{Pt100Conn. 2L}**	Select type of connection for Pt 100
<▲>	**{LineRes. int}**	Select input of line resistance for Pt100 in 2-wire connection
<▲>	**{RL-Measmt. ffff}**	Measure line resistance for Pt100 in 2-wire connection
<▲>	**{BreakMonitor off}**	Switch on sensor break monitoring
<▲>	**{BreakPos. ◂0}**	Define print head position in case of sensor break
<▲>	**{FilterTime 00}**	Filtering time constant
<▲>	**{Action 0 ◂100}**	Define the direction of action
<▲>	**{SquareRooting off}**	Square rooting of measured value
<▲>	**{SystemHold off}**	Switch off system via digital inputs

Enable Measured Value Display

Enables the measured value display of the measuring channel.

Parameter
{Meas.V.Displ. yes}

Parameter value
yes
no

Enable Measured Value Printout

Enables printing of the measured value in the instantaneous value table.

Parameter
{Meas.V.Print yes}

Parameter value
yes
no

Mapping Function

Allows to select a mapping function for the display range.

The following functions are available:

Linear
Linear with one salient point
Linear with two salient points
Logarithmic
Cosine
Hyperbolic

Note
For measuring range 2 only the linear display range is possible.

Parameter
{Mapp.Funct. 4}

Parameter value
0 Linear
1 Linear with one salient point
2 Linear with two salient points
3 Logarithmic
4 Cosine
5 Hyperbolic

Explanations For Non-linear Mapping Functions

Linear with one salient point
Linear with two salient points

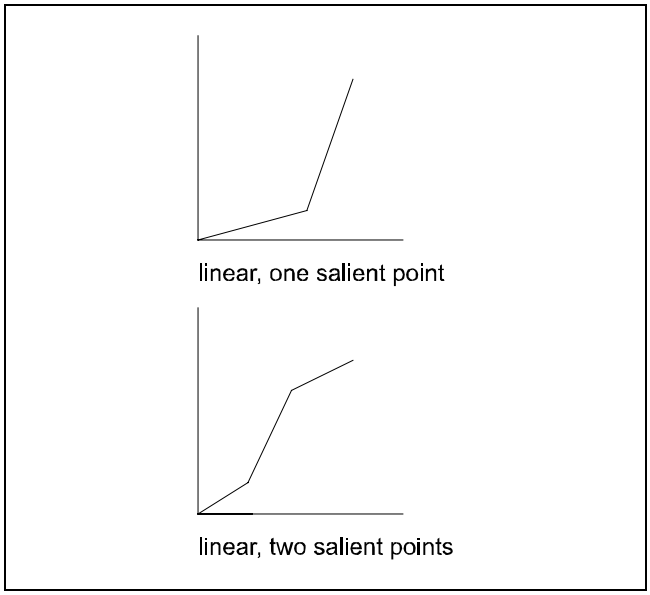

Fig. 8
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With this mapping function the display range can be adapted to transmitters which have a characteristic with salient point(s). Examples are ”Volt magnifying transmitters“ with compressed starting and end range.

Logarithmic

With this mapping function only positive values can be entered for the display range. If negative values are entered, error messages will appear in the display.The following messages are indicated, depending on the magnitude of the measured value:

”±INF Measuring unit“
”NaN Measuring unit“
”0,000 10^{+0} Measuring unit

To be able to enter the display range in a logarithmic format, first set the **{Exp.Format}** parameters in the **{Control}** submenu to “yes”.The display will then indicate “Displ.1↓ +2.000E+3”, for example.

Cosine

This mapping function allows to connect cos-φ-transmitters with the following characteristic curves:

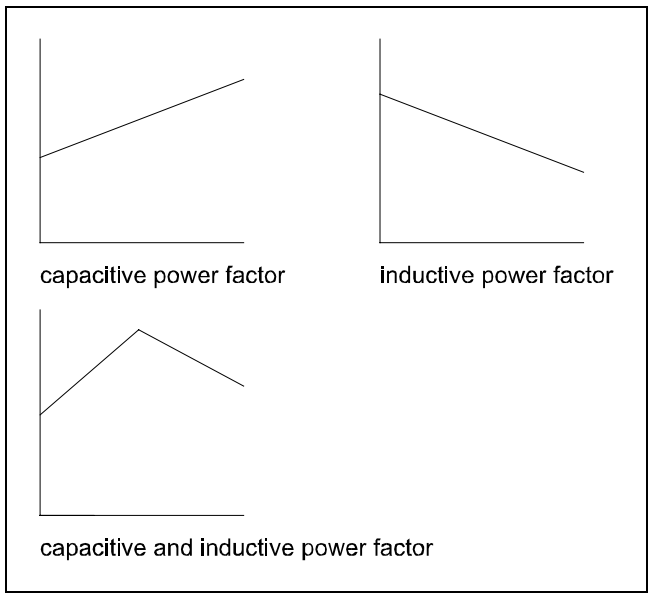

Fig. 9
Z-20127

The type of power factor is indicated in the display with “i” for inductive loads and “c” for capacitive loads. “cos-φ-transmitters” of which the output signal is proportional with the phase shift angle between current and voltage are adapted to the recorder as seen in the following example:

Measuring range 0...20 mA corresponds to c 0.5 ... i 0.5 cosφ.

1. The display range is converted to rad and then configured in measuring channel 1, for example: c 0.5 ... i 0.5 corresponds to −1.047... +1.047 rad
2. Math channel 1 is configured with sig(c1) × cos(c1).
3. The blue output channel is assigned to math channel 1, and **{Mapp.Funct. cos}** is activated.-

Hyperbolic

With this function only the upper value of the display range is entered. The curve is clearly defined by entering the discontinuity points in values of the measuring range in parameter **{x1}**.

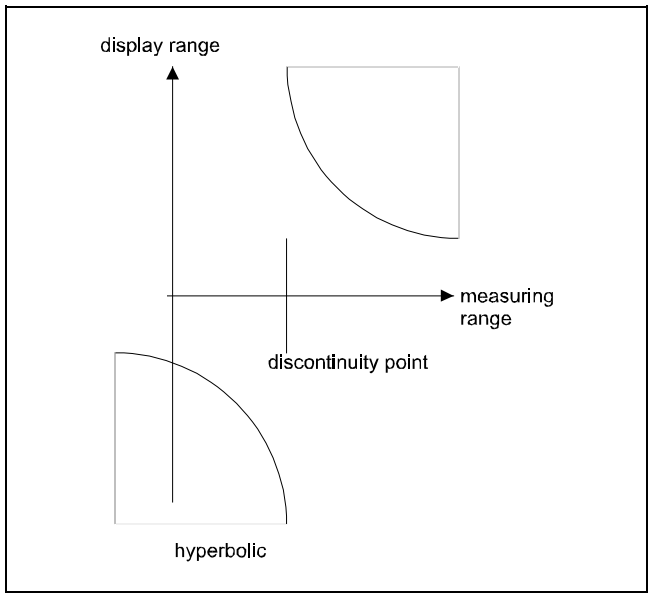

Fig. 10
Z-20125

Exponential Format

Defines the number format for measured value indication in the display. Values up to 9.99E9 = ±9 990 000 000 can be displayed due to the exponential function.

Parameter
{Exp.Format no}

Parameter value
no
yes

Decimal Points

This parameter defines the number of digits to the right of the decimal point for measured value display and printout. The parameter can be set to “0”, “1”, “2”, “3” and “auto”. With setting “auto” the number of digits to the right of the decimal point is determined by the recorder. The configured display range is used as the basis for this. With logarithmic display control the values are always displayed in exponential format, independent of the setting of this parameter.

Parameter
{Dec.Points auto}

Parameter values
0
1
2
3
auto

Reference Point Compensation

This parameter defines the temperature to be used for calculating the reference point when connecting a thermocouple. The parameter can be set to “0”, “20”, “50”, “60”, “70”, “int”. If this parameter is set to “int”, the terminal temperature measured by the recorder is used for compensation.

Parameter
{Ref.Temp. 0°C}

Parameter value

0°C	External compensation
20°C	External compensation
50°C	External compensation
60°C	External compensation
70°C	External compensation
int.	Use of internal compensation circuitry

Type of Pt 100 Connection

Defines if the Pt 100 sensor is connected to the recorder in 2-wire or 3-wire circuitry.

Parameter
{Pt100Conn. 2W}

Parameter value

3W	3-wire connection
2W	2-wire connection

Line Resistance of Pt 100 in 2-wire Circuitry

Defines the line resistance to be used for measured value correction with Pt 100 measurement. The parameter can be set to “0”, “10”, “20”, “40” and “int”.When “int” is selected, the recorder performs resistance measurement. Refer to section “Line Resistance Measurement” for details.

Parameter
{LineRes. int.}

Parameter value
0
10
20
40
int

Line Resistance Measurement

This parameter is needed for measuring the line resistance. First set the **{LineRes }** parameter to “int.l”.Then shorten the Pt 100 sensor at its connection point. When this menu item is selected, the measured resistance of the Pt 100 feed line is shown in the display. Upon actuation of <↵> the measured value is taken over and saved in the EEPROM of the channel board. The value determined here will then be used for measured value correction.

Parameter
{RL-Measmt. 03d2}

Parameter value
{RL = 1.15 Ω}

Sensor Break Monitoring

Switches on or off the sensor break monitoring function for thermocouples and Pt 100 resistance thermometers.If sensor break monitoring is disabled, it is ensured that the recorder will not influence any instruments connected in parallel with it.

Parameter
{SensorBreak on}

Parameter value
on
off

Response to Sensor Break

Defines the direction in which the measuring section is moved if a sensor break occurs.

Parameter
{SensorBreak ◂—0}

Parameter value

◂—0	Pointer moves to zero in case of sensor break
100—▸	Pointer moves to end of scale in case of sensor break

Measured Value Damping

Defines the time constant of the digital filter for input signal damping.The filter acts as a first degree low pass filter.

Parameter
{FilterTime 00}

Parameter value

0...60	in second steps

Recording Direction

Defines whether or not the input signal is to be inverted when being recorded.

Note
Not possible with directly connected temperature sensor.

Parameter
{Action 0 ▸ 100}

Parameter value
0 ▸ 100
100 ◂ 0

With setting “100 ▸ 0” the pointer moves from the right side to the left with increasing measured value (normally from the left to the right).

Square Rooting

Defines whether or not the input signal is square-rooted.

Parameter
{SquareRooting off}

Parameter value
off
on

System Hold

Holds the last measured value when triggered externally.

Parameter
{SystemHold DI 1}

Parameter value
off
DI 1 ... DI 4
additionally DI 7 ... DI 14 via IO converter

User Linearization

Key	Display	Parameter
	{Usr.Linear. }	
<↵>	**{Enable 1}**	Enable and assign the linearization table
<▲>	**{Lin.Pt.x1 1000}**	1st reference point, input value
<▲>	**{Lin.Pt.y1 1000}**	1st reference point, output value
...		
<▲>	**{Lin.Pt.x16 1000}**	16th reference point, input value
<▲>	**{Lin.Pt.y16 1000}**	16th reference point, output value

Enable User Linearization

This parameter is only accessible with current and voltage measuring ranges, “USER” measurement, and measured value reception via RS-485 interface. It is used to assign the linearization table to the nominal range, measuring range or display range. Making this assignment will activate the linearization table. The assignment of the linearization table to the display range is used for delinearization.Thermocouples and Pt 100 resistance thermometers (in accordance with the “signal type” table) are always processed using the internal linearization of the recorder.

Parameter
{Usr.Linear. off}

Parameter value
off
1 Nominal range is linearized
2 Measuring range is linearized
3 Display range is delinearized

Reference Points of User Linearization

The user can define 16 reference points for special linearizations. The values are entered in per mil. The reference points must be monotonously rising. After the values have been entered, they are sorted by the recorder. As a result, no manual rearrangement of the table is required after adding new values. The reference points for 0 % and 100 % are automatically added by the recorder.

Parameters
{Lin.Pt.x1 100} 1st reference point, input value
{Lin.Pkt.y1 120} 1st reference point, output value
...
{Lin.Pt.x16 900} 16th reference point, input value
{Lin.Pkt.y16 980} 16th reference point, output value

Parameter value
0.....1000 ‰

Main Menu Item Math Channels

Up to four math channels can be used and configured. The math channels can be assigned to the output channels (measuring sections) as required.Math channels 1...4 are channel menu items.

The channel parameters can be set individually and independently for each channel.

{Channel 1 ☐}
{Channel 2 ☐}
{Channel 3 ☐}
{Channel 4 ☐}

Key	Display	Parameter
<↵>	**{Function int}**	Enter string
<▲>	**{Unit mA}**	Enter measuring unit
<▲>	**{Displ. ↓ +50.00}**	Start of display range
<▲>	**{Displ. ↑ +300.00}**	End of display range
<▲>	**{Meas.V.Displ yes}**	Display measured values
<▲>	**{Meas.V.Print yes}**	Print measured values
<▲>	**{Exp.Format yes}**	Display and print measured values in exponential format
<▲>	**{Dec.Points 3}**	Number of digits to the right of the decimal point
<▲>	**{C 1 20.00}**	Constant C 1
<▲>	**{C 2 30.00}**	Constant C 2
<▲>	**{C 3 40.00}**	Constant C 3
<▲>	**{C 4 50.00}**	Constant C 4

Calculating Functions

The math channels allow to create mathematical links between the input channels and logical operations. With this, status corrections and the creation of compound measuring variables are possible. The max. string length is limited to 32 characters.

Parameter
{Function int((c1*c2)^0.5)}

Parameter values

1. Caclulating rules	+; −; ×; /
2. Functions	x↑a = x^a; a↑x = a^x; √x
	log x; cos x; sgn x; int x
3. Variables	c1 ... c4
	m1 ... m4
	i1 ... i4
	s1 ... s4
4. Predefined constant	C1 ... C4 and π
5. Numbers	0 ... 9
6. Point	,; .
7. Brackets	(;)
8. Special characters	√; ↑ (Exponent)

Press <▲> and <▼> to create the links and functions for each string item.

Explanation:

c1...c4	Measuring channels 1...4
m1...m4	Math channels 1...4
i1...i4	Pulse channels 1....4
s1...s4	Accounting channels 1...4

When using the exponential function x^a, the exponent a can be any real number.The square rooting function can be realized by setting the exponent a to 0.5.

Measuring Unit

The measuring unit can be defined with 7 user-configurable characters. It is available for standard signals only.

Parameter
{Text unit ???????}

Parameter value
Character set from “Character Set Table”. The text marked with ?????? can be edited by using the cursor keys (see section “Main Menu Item Text Lines”), e.g. in **{Text unit mV/MW}**.

Display Measured Values

The start/end of display range parameters define to which physical range (maximum reading) the selected measuring range (e.g. 0..20 mA → 3..9 bar) is to be mapped.

Notes on special result calculations

Three different curves are possible, depending on the selected result range.

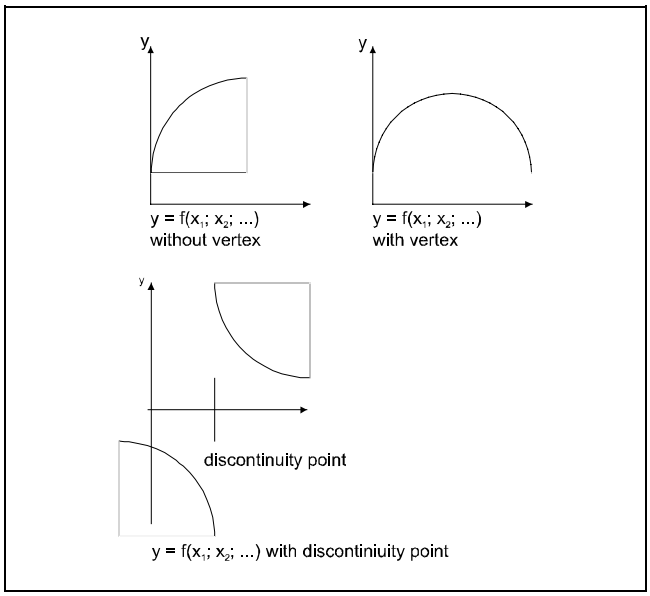

Fig. 11
Z-20131

In order to permit analog writing of the result value, the recorder has to be configured accordingly. This can be defined for the output channels by setting parameter **{Mapp.Funct.}** for cases with and without vertex. For the case with discontinuity point, parameter **{C2}** must be set additionally.

Note
The graduated scales can be non-linear, depending on the calculating function. In the display, the calculated values are always shown linearly.

Parameters
{Displ. ↓ 0.000}
{Displ. ↑ 0.000}

Parameter value
−999....+9999 for decimal display
−9.990E9...+9.990E9 for exponential display

Enable Measured Value Display

Enables result display for the math channel.

Parameter
{Meas.V.Display yes}

Parameter value
yes
no

Enable Measured Value Printout

Enables printing of the calculating result in the instantaneous value table.

Parameter
{Meas.V.Print yes}

Parameter value
yes
no

Exponential Format

Defines the number format for measured value indication in the display. Values up to 9.99E9 = ±9 990 000 000 can be displayed due to the exponential function.

Parameter
{Exp.Format no}

Parameter value
no
yes

Decimal Points

Defines the number of digits to the right of the decimal point for measured value display and printout. The parameter can be set to “0”, “1”, “2”, “3” and “auto”. With setting “auto” the number of digits to the right of the decimal point is determined by the recorder. The configured display range is used as the basis for this. This parameter is also active when selecting the exponential format.

Parameter
{Dec.Points auto}

Parameter values
0
1
2
3
auto

Constants

The following four parameters are used to define space-saving constants for the creation of calculating functions. If more than four constants are needed in a string, they have to be created directly in the string.

Parameters
{C 1 +5.340}
{C 2 −7.540}
{C 3 +860.0}
{C 4 +1543}

Parameter values
−999....+9999 for decimal display
−9.990E9...+9.990E9 for exponential display

Main Menu Item Pulse Channels

Up to four pulse channels can be used and configured. The results of pulse integration are output on the printer as a table. The integrated value can also be recorded as an analog value. In this case, the output channel can be selected as required. Pulse channels 1...4 are channel menu items.

The channel parameters can be set individually and independently for each channel.

{Channel 1 ❑}
{Channel 2 ❑}
{Channel 3 ❑}
{Channel 4 ❑}

Key	Display	Parameter
<↵>	**{Operating mode Σx}**	Enter operating mode
<▲>	**{Contr.Inp. DI 1}**	Digital input for interval control
<▲>	**{Interval 1h}**	Enter integration interval
<▲>	**{Sync.Day 00}**	Enter calendar day for start/stop interval
<▲>	**{Sync.Time 00:00}**	Enter time for start/stop interval
<▲>	**{DigitNum 6}**	Enter number of decimals to the right of the point for counter
<▲>	**{Start 10000000}**	Enter counter count
<▲>	**{End 00010000}**	Enter counter count
<▲>	**{Value 25}**	Enter pulse value
<▲>	**{Alm.Val 00006000}**	Enter the alarm value
<▲>	**{Alm.Val.DO DO 1}**	Assign alarm value to contact
<▲>	**{Meas.V.Disp. yes}**	Enable measured value display
<▲>	**{Display format 1}**	Enter the counter reading to be displayed
<▲>	**{Print format 015}**	Select contents of balance sheet
<▲>	**{Meas.V.Print yes}**	Assign totalizer to instantaneous value table.
<▲>	**{Unit mA}**	Enter measuring unit
<▲>	**{Add.Text 01}**	Select comment line
<▲>	**{ClockPulse-DI DI 2}**	Select pulse input
<▲>	**{Recordng.ΣI yes}**	Analog sum recording as analog enveloping curve

Operating Mode

Defines the operating mode.

Operating modeΣx

In this mode the sum is calculated without alarm monitoring.

Operating mode Δx

In this mode summation takes place with alarm monitoring. The alarm value set is used for for absolute value monitoring of the total value.As soon as the total value reaches the alarm value, this event is signaled for three seconds (contact output). At the same time the summator of the alarm value is set to 0. The alarm value cycle is restarted. The alarm value can be reached several times within one and the same interval.

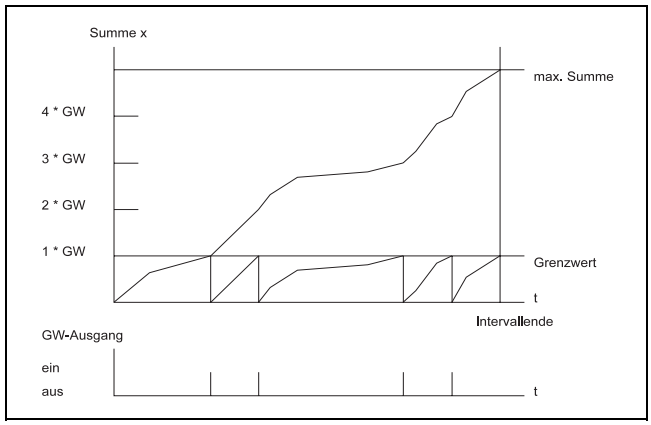

Fig. 12 Operating mode Δx (contact time around 3 s)
Z-18965

Operating mode ΔΣx (Tangent function)

The set alarm value is referred to the end of the interval. It is specified in the following measuring units:

Measuring unit of display range × time (e.g. kW × h = kWh).

Based on the current total value it is checked whether or not the alarm value will be exceeded when the current pulse frequency is constant (see floating alarm monitoring, fig. 13).

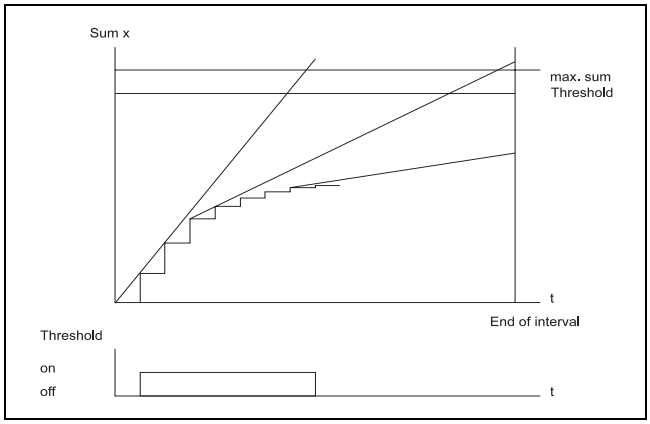

Fig. 13 Operating mode ΔΣx
Z-18786

Parameter
Operating modeΣx

Parameter value
off
Σx
Δx
ΔΣx

Interval Control

The accounting interval can be controlled internally by the built-in real-time clock. External control via a digital input of the recorder is also possible.

Note
Even with external interval control the interval time must be configured.

External Interval Control

Parameter
{Contr.Input DI 1}

Parameter value
--- (off)
DI 1 ... DI 4
additionally DI 7 ... DI 14 via IO converter

Internal Interval Control

Parameter
{Interval 1h}

Parameter value
1 min / 2 min / 3 min / 5 min / 8 min
10 min / 12 min / 15 min / 30 min
1 h / 2 h / 3 h / 6 h / 8 h / 12 h
1 day / 7 days / 1 month

Sync. Day for Internal Interval Control

Note
This parameter is only needed with monthly intervals.

Parameter
{Sync.Day 25}
Reference time day of month

Parameter value
00...31

Sync. Time for Internal Interval Control

Parameter
{Sync.Time 06:00}
Reference time for interval

Parameter value
hh:mm

Set Counter

Three summators are available for each pulse channel.

Totalizer

The totalizer works without a reset function. When changing the measuring task, follow the instructions below to reset the counter:

1. Enter new count.
2. Deactivate the **{ClockPulse DI}** parameter (parameter value "---").
3. Exit from the configuration mode.
4. Access the configuration mode again.
5. Activate the **{ClockPulse DI}** parameter (set parameter value according to the wanted clock input).

The current totalizer reading can be shown in the display or printed as a line of the balance sheet, depending on the parameter definition. A counter overflow or underflow trigger printing of the balance sheet. If a pulse channel is selected for permanent display in the recorder operating mode, the current totalizer value is printed after a "double-click" on the <Print> button (provided that a printer channel exists).

Parameter
{Start 00000000}

Parameter value
0...99999999

Totalizer Pulse Value

Defines the pulse value. Graduation is possible in small steps. The smallest value can be entered with ±0.001.The sign defines the totalizer counting direction. An absolute sum is calculated with interval and alarm value summators.

Parameter
{Value +1000}

Parameter value
−9999...9999

Interval Summator

The interval summator works with a reset to 00000. The reset is triggered by interval control (either internally at the end of an interval or externally upon contact making). At the same time printing of the balance sheet is triggered. The max. possible total value must be set in the **{End}** parameter, for standardization of the interval sum. It is needed for analog recording of the interval sum. The value is the upper value of the recording range. There are two methods of analog recording:

Parameter
{End 00000000}

Parameter value
0...99999999

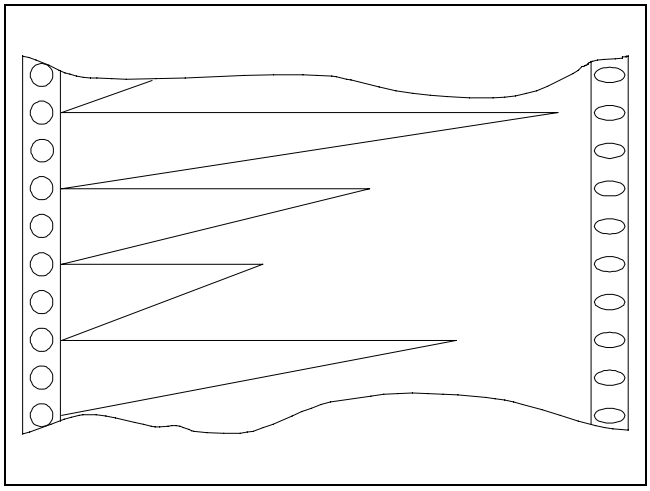

Fig. 14 Saw-tooth shaped recording curve
Z-20008

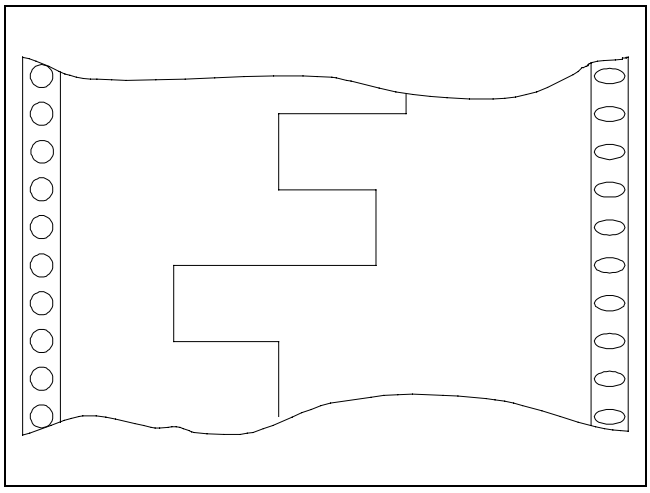

Fig. 15 Envelope curve recording
Z-20009

It is recommended to use envelope curve recording for short intervals and slow chart speeds, since the curve is clearer then (set (**{Recordng. -- ΣI}** to “yes”).

Alarm Value Summator

The alarm value summator works with a reset to 00000. The reset depends upon the operating mode. In mode "Δx" the alarm value summator is reset when the alarm value is reached. In mode "ΔΣx" it is reset at the end of the interval. In mode "Δx" the values are entered in the measuring units of the display range. In mode "ΔΣx" the values are entered in the measuring units of the display range multiplied with the time (e.g. kW → kWh, m^3/h → m^3).

Parameter
{Alm.Val. 800000}

Parameter value
0...99999999

Assign Alarm Values to Relay Outputs

Parameter
{Alm.Val. DO DO 6}

Parameter value
off
DO 1 ... DO 6
additionally DO 7 ... DO 20 via IO converter

Enable Measured Value Display

Enables measured value display of the measuring channel.

Parameter
{Meas.V.Display yes}

Parameter value
yes
no

Display Format

Three different types of measured value display can be selected:

- Instantaneous sum of the interval summator
- Instantaneous sum of the totalizer
- Residual value display

Note
The residual value can only be displayed in mode "δΣx". The values are indicated in the measuring unit of the pulse / time. From this reading it can be derived by which amount a flow or a power must be reduced to avoid that the alarm value is exceeded at the end of the interval. If the displayed value has a negative sign, this indicates the power that still can be added.

Parameter
{Display format 1}

Parameter value
0 Interval sum
1 Total sum
2 Residual value display of instantaneous sum

Print Format

Defines the values that are to be printed at the end of the interval (triggered externally or internally).

Example for table print

```
[/   I 1 [Comment line]                  ]
[/   15.09.98 11:51 - 15.09.98 17:15  [x] ]
[/   ΣT = 568000 m³                      ]
[/   ΣI = 008000 m³                      ]
```

The code [x] represent the reason why the printout was triggered:

0 = Interval control (normal)
1 = Recorder switch-on/switch-off
2 = Totalizer overflow
3 = Totalizer underflow
4 = Interval summator overflow

Enter the code number of the text element that is to be printed as the parameter value.If you want to print several text elements, sum up the appropriate code numbers using the table below and then enter the total as the parameter value.

Code	Digital input
0	No printing
1	Print interval sum
2	Print total sum
4	Print interval time
8	Print comment line
128	Print table after power failure

Parameter
{Print format 015}

Parameter value
0...255

Enable Measured Value Printout

Enables printing of the current totalizer reading in the instantaneous value table.

Parameter
{Meas.V.Print yes}

Parameter value
yes
no

Measuring Unit

The measuring unit can be selected individually for every channel. The freely configurable measuring unit can be defined by the user with 7 characters.

Parameter
{Unit ???????}

Parameter value
Character set from “Character Set Table”. The text marked with ?????? can be edited by using the cursor keys (see section “Main Menu Item Text Lines”), e.g. in **{Text unit mV/MW}**.

Comment Line

One of the 10 freely configurable text lines can be used as the comment line in the balance sheet (first line).

Parameter
{Add.Text 2}

Parameter value
00 None
01 Text line 1
02 Text line 2
...
10 Text line 10

Pulse Input

Defines the digital input through which the pulses for the respective pulse channel are fed in.

Parameter
{ClockPulse DI DI2}

Parameter value
--- (off)
DI 1 ... DI 4

Analog Sum Recording

Defines if analog recording of the interval sum is to be performed as a saw tooth curve or as an envelope curve (see also **{Interval summator}**.

Parameter
{Recordng.ΣI yes}

Parameter value
yes Envelope curve recording
no Saw tooth curve recording

Main Menu Item Accounting Channels

Up to four accounting channels can be used and configured. Both measuring channels and math channels can be accounted. The accounting results are output on the printer as a table. The integrated value can be recorded as an analog value. The output channel can be selected as required. Measuring channels 1...4 are channel menu items.

The channel parameters can be set individually and independently for each channel.

{Channel 1 ❑}
{Channel 2 ❑}
{Channel 3 ❑}
{Channel 4 ❑}

Key	Display	Parameter
<↵>	**{SourceChan. C1}**	Channel for which accounting will be performed
<▲>	**{Operating mode Σx}**	Select the operating mode
<▲>	**{Contr.Inp. DI }**	Digital input for interval control
<▲>	**{Interval 1h}**	Enter integration interval
<▲>	**{Sync.Time 2:30}**	Enter time for start/stop interval
<▲>	**{Sync.Day 02}**	Enter calendar day for start/stop interval
<▲>	**{Add.Text 3}**	Comment line
<▲>	**{Alm.Val 5000}**	Enter alarm value
<▲>	**{Alm.Val.DO DO6}**	Assign alarm value to contact
<▲>	**{Meas.V.Disp. yes}**	Enable measured value display
<▲>	**{Meas.V.Print yes}**	Assign average to instantaneous value table
<▲>	**{Print format 063}**	Select contents of balance sheet
<▲>	**{Sum printing yes}**	Print sum in case of alarm value violation
<▲>	**{Res.Val.Displ. yes}**	Indicate residual power that still can be added (in mode δΣx)
<▲>	**{Recordng.ΣI yes}**	Analog sum recording as analog enveloping curve

The accounting function allows you to print the following table in selectable time intervals:

1. Channel code with comment
2. Sum of power fail times
3. Time/date of interval start and time/date of interval end
4. Smallest value measured during interval, with time and date
5. Greatest value measured during interval, with time and date
6. Average value over interval period
7. Sum value over interval period

Example for table print

```
[ x S1 [C1]: [Comment line]              ]
[ x -PF- 0 min >= 2 min                  ]
[ x 15.09.98 13:24 - 15.09.98 17:15      ]
[ x MIN: 13:35 AV 15.09.98 16:28         ]
[ x MAX: 17:14 AV 15.09.98 16:02         ]
[ x   x̄: 14.40 AV                        ]
[ x  Σx: 7.200E0 MWh                     ]
```

The code [x] represent the reason why the printout was triggered:

$ = Interval control (external or internal)
= = Manual
= Power failure with reset
& = Power failure / accounting is continued
  = Interval summator overflow

For interval times of less than 1 h the values of the current interval are erased in case of a power failure. The residual interval is restarted. For interval times equal to or greater than 1 h the accounting values calculated up to the time when the power failure occurred are recorded, provided that the minimum accounting time has already been reached. Accounting is continued or restarted, depending on the duration of the power failure.

Interval time	Minimum accounting time after interval start	Power failure time	
		Code „&“	Code „#“
1 h	15 min	≤2 min	≤15 min
2 h	15 min	≤2 min	≤15 min
3 h	15 min	≤3 min	≤15 min
6 h	15 min	≤3 min	≤15 min
8 h	15 min	≤4 min	≤15 min
12 h	30 min	≤6 min	≤30 min
24 h	60 min	≤12 min	≤60 min
7 days	480 min	≤90 min	≤480 min
1 month	2280 min	≤1440 min	≤2280 min

Tab. 1

In the case of a power failure within the minimum power failure time the already calculated accounting results are erased, and the interval is restarted. The following line is printed:

```
[ % -PF- 13:31 14:26                                    ]
```
(first time: power failure, second time: power recovery)

The table with 7 lines has a length of around 24 mm (around 21 mm with 6 lines). The minimum chart speed for accounting with one measuring channel can be calculated using the following inequation:

Chart speed [mm/h] > 24 (21) [mm] / interval time [h]
or
Chart speed [mm/h] > 24 (21) [mm] × 60 / interval time [min]

If several channels are considered for accounting, the result for one channel must be multiplied with the number of channels for which accounting is performed. The max. possible chart speed for text printing is 300 mm/h.

Source Channel

Defines the channel to be accounted. Measuring channels 1...4 or math channels 1...4 are used as source channels.

The measured values are saved in the time intervals listed below, depending on the selected accounting interval, and are used for averaging or summation.

Interval time	Scanning rate
1...30 min	100 ms
1 h	200 ms
2 h and 3 h	500 ms
6 h and 8 h	1 s
12 h	2 s
24 h	5 s
7 days	1 min
1 month	2 min

The scanning rate of the measuring inputs is 100 ms. Every measured value is considered for measurement, even if the interval time is quite long. With interval times equal to or greater than 1 h the measured values recorded every 100 ms are submitted to averaging. The average value resulting from this is saved.

Example

With a 1 month interval 1200 measured values occur within 2 minutes. The average of the 1200 measured values is considered for summation and for calculating the monthly average. The minimum and maximum values are verified every 100 milliseconds.

Parameter
{SourceChan. C1}

Parameter value

---	off
C1...C4	Measuring channels
M1...M4	Math channels

Operating Mode

Defines the operating mode.

Operating mode $\bar{x}$

In this mode lines 1...6 (see example) are written in the balance sheet. No sum is calculated.

Operating mode Σx

In this mode the sum is calculated. Lines 1...7 are written in the balance sheet.

The following is valid for the measuring ranges of the sum: The upper value of the selected channel measuring range multiplied with the time of the accounting interval (in h) yields the maximum value of the total (measuring unit × h). This value can be displayed in an arbitrary display range, provided that the max. displayable value (= max. count) of 9.9E9 (9 990 000 000) is not exceeded.

Example:

Measuring range	0...20 mA
Display range	0...300 m^3/h
Interval time	1 month = 24 h × 31 = 744

End value Σx = 20 × 744 h = 14880 mAh

When analog sum recording is selected, a pointer deflection of 100 % is achieved with 14880 mAh.

Max display value Σx = 744 × 300 = 223200 m^3 = 2.232E5 m^3

Operating mode ΔΣx (Tangent function)

In this mode the sum is calculated. Limit value monitoring is possible.

The set alarm value is referred to the end of the accounting interval.It is specified in the following measuring units:

Measuring unit of display range × time (e.g. kW × h = kWh).

Based on the current total value it is checked whether or not the alarm value will be exceeded when the current pulse frequency is constant (see floating alarm monitoring, fig. 16).

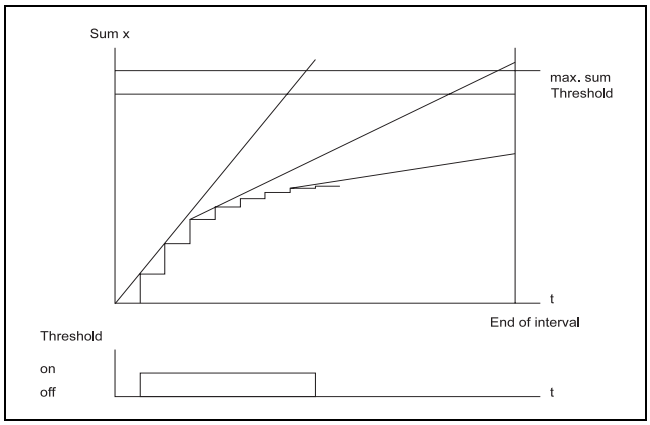

Fig. 16 Operating mode ΔΣx
Z-18786

Operating mode Δx

In this mode the sum is calculated. Alarm monitoring is possible.

The alarm value set is used for absolute value monitoring of the total value. As soon as the total value reaches the alarm value, this event is signaled for three seconds (contact output). At the same time the summator of the alarm value is set to 0. The alarm value cycle starts again. Note that the alarm value may be reached several times within one and the same interval (see fig. 17).

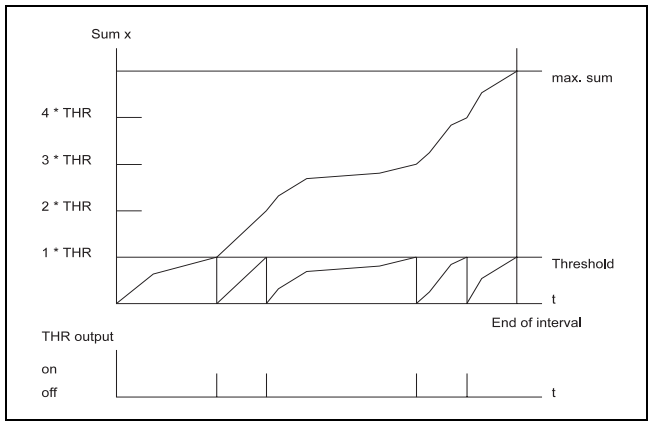

Fig. 17 Operating mode Δx
Z-18965

Parameter
{Operating mode Σx}

Parameter value

$\bar{x}$
Σx
ΔΣx
Δx

External Interval Control

The accounting interval can not only be controlled internally by the built-in real-time clock. External control via a digital input of the recorder is also possible.

Parameter
{Contr.Input DI 1}

Parameter value
off
DI 1 ... DI 4
additionally DI 7 ... DI 14 via IO converter

Interval

Parameter
{Interval 1h}

Parameter value
1 min / 2 min / 3 min / 5 min / 8 min
10 min / 12 min / 15 min / 30 min
1 h / 2 h / 3 h / 6 h / 8 h / 12 h
1 day / 7 days
1 month

Sync. Time for Internal Interval Control

Parameter
{Sync.Time 08:30}
Reference time for interval

Parameter value
00:00 Time

Parameter
{Sync.Day 25}
Reference time day of month

Parameter value
00...31

Comment Line

One of the 10 freely configurable text lines can be used as the comment line in the balance sheet (first line).

Parameter
{Add.Text 2}

Parameter value
00 None
01 Text line 1
02 Text line 2
...
10 Text line 10

Alarm Value Entry

The alarm value is entered in the units of the display range multiplied with the time.

Examples:
kW → kWh
$m^3/h \rightarrow m^3$

Parameter
{Max.Value 5.0E2}

Parameter value
1...7.500E6

Assign Alarm Value to Relay Output

Parameter
{Max.-DO DO 2}

Parameter value
None
DO 1 ... DO 6
additionally DO 7 ... DO 20 via IO converter

Enable Measured Value Display

Enables the sum display of the accounting channel.

Parameter
{Meas.V.Display yes}

Parameter value
yes
no

Enable Measured Value Printout

Enables printing of the average value in the instantaneous value table.

Parameter
{Meas.V.Print yes}

Parameter value
yes
no

Print Format

Defines the values that are to be printed on the balance sheet after termination of the interval.

Parameter
{Print format 000}

Parameter value
0 No printing
1 Channel code
2 Interval start and stop time
4 Min. value
8 Max. value
16 Average value
32 Total value

Print Total

Defines whether or not the total is to be printed together with the channel code upon alarm limit violation (static alarm value).

Parameter
{Sum printing yes}

Parameter value
no
yes

Residual Value Display

Defines whether or not the difference between the interval alarm value and the interval instantaneous value is to be displayed instead of the total value in mode $\Delta\Sigma x$. The values are entered in the measuring unit of the measured value. From this reading it can be derived by which amount a flow or a power must be reduces to avoid that the alarm value is exceeded at the end of the interval. If the displayed value has a negative sign, this indicates the power that still can be added.

Parameter
{Res.Val.Displ. no}

Parameter value
no
yes

Analog Sum Recording

Defines if analog recording of the interval sum is to be performed as a saw tooth curve or as an envelope curve (see also section “Pulse Channels”, “Interval Summator” parameter).

Parameter
{Recordng.ΣI yes}

Parameter value

yes	Envelope curve recording
no	Saw tooth curve recording

Main Menu Item Output Channels

Up to four output channels (measuring sections) are available, depending on the recorder model. Output channels 1...4 are channel menu items.

The channel parameters can be set individually and independently for each channel.

{Channel 1 blue ☐}
{Channel 2 red ☐}
{Channel 3 green ☐}
{Channel 4 violet ☐}

Key	Display	Parameter
<↵>	**{SourceChan. C1}**	Select the channel to be recorded
<▲>	**{Scal.Format 1}**	Format of the scaling line
<▲>	**{Scal.Text Temper}**	Enter text line for scaling line
<▲>	**{Rec.Ran. ↓ 00}**	Lower value of recording range
<▲>	**{Rec.Ran. ↑ 75}**	Upper value of recording range
<▲>	**{C2 +0.000}**	Discontinuity point of math channel
<▲>	**{AlarmValue }**	Alarm value submenu
<▲>	**{Mapp.Funct. lin}**	Mapping function of math channel
<▲>	**{Meas.V.Print yes}**	Assign measured value to instantaneous value table.

Source Channel

Defines the channel to be recorded. Measuring channels 1...4, math channels 1...4, pulse channels 1...4, and accounting channels 1...4 are used as source channels. The interval sum is written for the pulse and accounting channels.

Parameter
{SourceChan. PHY 1}

Parameter value

C1...C4	Measuring channels
M1...M4	Math channels
I1...I4	Pulse channels
S1...S4	Accounting channels

Print Double Lines

A double line can be assigned to each output channel and written. The first line of the double line is printed as a scaling line.The second one is a text line which can contain data specific to the measuring point, e.g. AKZ-No. and so on.

With scaling module 2 for the scaling line the engineering unit is printed between the 0 % and the 50 % value. The channel code is printed between the 50 % value and the 100 % value.

With scaling module 3 the engineering unit is printed between the 33 % value and the 66 % value. The channel code is printed between the 66 % value and the 100 % value.

With scaling module 5 no unit and no channel code is printed in the scaling line.

With setting “Freely configurable” the user can define the scale as required.

If the recorder is set to logarithmic scaling format, the scaling line is always printed with module 2. Other settings configured are ignored. The engineering unit is printed between the 0 % value and the 50 % value. The channel code is printed between the 50 % value and the 100 % value.

With hyperbolic curve the scale is also printed with module 2, with the character “∞” printed at the discontinuity point.

Scaling line examples:

Module 2:

```
0.00       mA           50.00           CH1      100.0
```

Module 3:

```
0.00         33.33 V    66.66           CH4      100.0
```

Module 5:

```
0.00     20.00     40.00     60.00     80.00     100.0
```

Scaling Line Format

Defines the format of the scaling line.

Note
With a recording range of less than 100 mm the scaling line must be set to “Freely configurable”.

Parameter
{Scal.-Format 1}

Parameter value
0 Scaling line and text line “off”
1 Scaling module 2
2 Scaling module 3
3 Scaling module 5
4 Scaling module 2 with offset at 20 %
5 Logarithmic
6 Hyperbolic
7 Freely configurable (max. 48 characters)
8 Scaling according to display format

Text Line for the Scaling Line

The scaling text line is printed as the second line of the scale, if scaling line printing has been enabled.Printing of this line is suppressed if the first character of the line is 20 H (“spaces”). The scaling text line can have up to 48 characters. The spacing between the double lines can be defined under main menu item **{System}**, subitem **{Print functions}**.

Parameter
{Scal.Text xxxxxx}

You can edit the text parts marked with t xxxxx.... by using the cursor keys (see section “Main Menu Item Text Lines”, starting on page 61).

Parameter value
Character set from the “Character Set Table”.

Freely Configurable Scale

This parameter is used to define a scale which is graduated as required.The parameter can only be defined if parameter **{Scal. Format}** has been set to parameter value 7.

Parameter
{Scal.Val 30}

Parameter value
Character set from the “Character Set Table”.

Recording Range

Defines the part of the chart that is to be used for recording the respective channel.The start value is 0 %... 90 %, the end value is 10 %...100 %. It is to be entered in steps of 1 %. Note that there is no function for checking invalid entries (e.g. start value greater than end value)!

Parameters
{Rec.Range↓ 00}
{Rec.Range↑ 75}

Parameter values
00...90 for start value
10...100 for end value

Constant C2

Needed for entering the discontinuity point for:

- the scaling line, if hyperbolic format has been configured for the measuring channel (C1...C4) assigned to it. The constant is entered in values of the measuring range.
- for the recording section, if the display range (result range) of the assigned math channel contains a discontinuity point. The constant is entered as a percentage of the recording range. In this case, the output channel only uses the parameter **{Displ. ↑ 50}** (= 100 % recording range) of the math channel. The start value of the recording section results from:

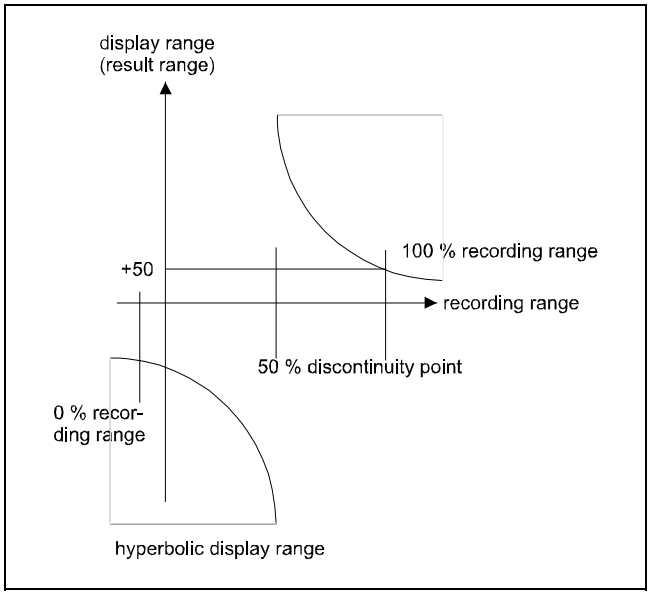

Fig. 18
Z-20126

Parameter
{C 2 80,75}

Parameter value
Start... end of measuring range for measuring channels or
Start... end of display range for math channels

Alarm Values

Three different alarm value functions with two alarm values, each, can be configured for every output channel:

- Absolute value monitoring (min. value, max. value)
- Gradient monitoring (with direction recognition)
- Band monitoring (floating alarm values)

Alarm value violations are indicated in the display. When using a recorder with printer channel, they can be logged additionally in a text line. Six outputs are available as potential-free contacts fro external signal processing. The alarm values can be assigned to the outputs as required. When connecting an IO converter to the recorder's lateral interface, 14 additional contact outputs are provided.

The "Absolute value monitoring" functions is realized for alarm value 1 and 2..

The "Gradient monitoring" and "Band monitoring" functions are realized with alarm values 3 and 4. Note that either the gradient monitoring or the band monitoring function can be used, not both of them at the same time.

With band monitoring the time average of the measured value itself or the average of several measuring inputs is used as the setpoint. The low and high alarm value are selected as a deviation from the setpoint. The time average is calculated for a selectable time period.

Key	Display	Parameter
	{Alarm values }	
<↵>	**{AV1 Funct. min}**	Alarm value function
<▲>	**{AV1 100}**	Value entry in units of the display range
<▲>	**{AV1 DO No. DO2}**	Assigned contact
<▲>	**{AV1 Text-No. 09}**	Assigned text line
<▲>	**{AV2 Funct. min}**	Alarm value function
<▲>	**{AV2 100}**	Value entry in units of the display range
<▲>	**{AV2 DO No. DO2}**	Assigned contact
<▲>	**{AV2 text-No. 10}**	Assigned text line
<▲>	**{AV3 Funct. +∆x}**	Alarm value function
<▲>	**{AV3 Grad 000}**	Value entry in s
<▲>	**{AV3 DO No. DO3}**	Assigned contact
<▲>	**{AV3 text-No. 10}**	Assigned text line
<▲>	**{AV4 Funct. −∆x}**	Alarm value function
<▲>	**{AV4 Grad 000}**	Value entry in s
<▲>	**{AV4 DO No. DO2}**	Assigned contact
<▲>	**{AV4 Text-No. 08}**	Assigned text line
<▲>	**{Pos. Band 30}**	Value entry in units of the display range
<▲>	**{Neg. Band 30}**	Value entry in units of the display range
<▲>	**{Interval 100}**	Integration time for measured value averaging
<▲>	**{Channel code 15}**	Channels for which the arithmetic average has to be calculated

Function of Alarm Values 1 and 2

Defines the effective direction of the alarm values.

Parameters

{AV1 Funct. min}
{AV2 Funct. max}

Parameter value

--- no alarm value processing
min.
max.

Values for Alarm Value 1 and 2

The values are entered in the measuring unit of the display range of the assigned source channel.

Parameters
{AV1 +4.000}
{AV2 +6.000}

Parameter value
Lower to upper value of source channel display range

Relay Output for Alarm Values 1 and 2

Assigns the alarm value to a relay output.

Parameters
{AV1 DO No. DO3}
{AV2 DO No. DO5}

Parameter value
--- (off)
DO 1 ... DO 6
additionally DO 7 ... DO 20 via IO converter

Text Lines for Alarm Values 1 and 2

Assigns a text line to the alarm value. The text line is printed if an alarm value violation occurs.

If the parameter **{AV text print}** in submenu item **{Print Functions}** (main menu item **{System data}**) is set to “on”, the alarm value is added to the text and printed with it.

If the parameter values “man” or “auto” are selected under menu item **{AlarmAck}**, the text line is also shown in the display as a flashing line (first 16 digits, only). With parameter value 0 there is no text output.

Parameters
{AV1 text No. 0}
{AV2 text No. 1}

Parameter value
0...10

Function of Alarm Values 3 and 4

Alarm values 3 and 4 are used for the “Gradient monitoring” and “Band monitoring” alarm functions.This parameter defines the function of the alarm values.

Parameters
{AV3 Funct. +Δx}
{AV4 Funct. -Δx}

Parameter value

+Δx	Positive gradient
−Δx	Negative gradient
Δx	Absolute gradient
+| |	Positive hysteresis
−| |	Negative hysteresis
| |	Absolute hysteresis

Gradient for Alarm Values 3 and 4

Defines the time period within which an alarm is generated when the measured value changes by more than 3 %.

Example

A temperature change of less than 10 K/min is to be monitored in a measuring range of 0...600 °C.

3 % of 600 °C are 18 °C or a temperature change of 18 K .

The parameter to be entered is calculated using the formula:

$$x = \frac{18\ K \times 1\ \text{min}}{10\ K} = 1{,}8\ \text{min} = 108\ s$$

Parameters
{AV 3 Gradient 0010}
{AV 4 Gradient 0100}

Parameter value
3...3600 s

Relay Output for Alarm Values 3 and 4

Assigns the alarm value to an output relay.

Parameters
{AV3 DO No. DO19}
{AV4 DO No. DO20}

Parameter value
--- (off)
DO 1 ... DO 6
additionally DO 7 ... DO 20 via IO converter

Text Lines for Alarm Values 3 and 4

Assigns a text line to the alarm value. The text line is printed if an alarm value violation occurs.

If the parameter values “man” or “auto” are selected under menu item **{AlarmAck}**, the text line is also shown in the display as a flashing line (first 16 digits, only). With parameter value 0 there is no text output.

Parameters
{AV3 text No. 0}
{AV4 text No. 1}

Parameter value
0...10

Alarm Value Hysteresis

Defines the hysteresis for all alarm values. The value is entered in per mil of the display range.

Parameter
{AV hysteresis 05}

Parameter value
5...99 %

Band Monitoring

Defines the setpoint bandwidth by entering the positive and negative hysteresis. The value is entered in values of the display range.

Parameters
{Pos.Band 120}
{Neg.Band 100}

Parameter values
Lower to upper value of display range

Time Average

The time average of the source channel is calculated to enable setpoint calculation for band monitoring.This parameter defines the time period over which the time average is calculated.

Parameter
{Interval 300}

Parameter values
0...3600 s

Group Average

The arithmetic average is calculated from the actual value of several channels to enable setpoint calculation for band monitoring. Measuring channels 1...4 or math channels 1...4 can be used as source channels. This function can be configured for the blue output channel, only. With this parameter you can select the channels to be used for averaging. The individual channels are encoded. Sum up all code numbers of the channels for which the average is to be calculated and enter the total as the parameter value.

Parameter
{Channel code 200}

Parameter values
0...255

Code	for
0	Not active
1	Measuring channel 1
2	Measuring channel 2
4	Measuring channel 3
8	Measuring channel 4
16	Math channel 1
32	Math channel 2
64	Math channel 3
128	Math channel 4

Mapping Function

Defines the mapping function to be used when a math channel assigned to the recording section has a curve with a vertex in the display range (result range):

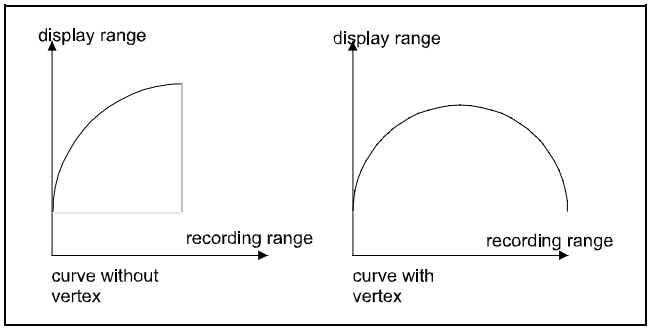

Fig. 19
Z-20129

A vertex also has to be assumed for the following curve form:

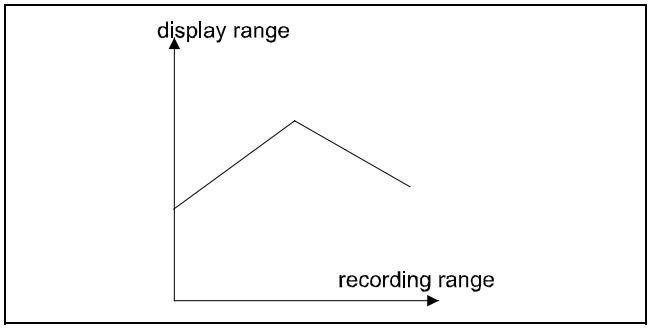

Fig. 20
Z-20130

Parameter
{Mapp.Funct. lin}

Parameter value

lin	Curve without vertex
cos	Curve with vertex

Enable Measured Value Printout

Enables printing of the measured value in the instantaneous value table.

Parameter
{Meas.V.Print yes}

Parameter value
yes
no

Main Menu Item Text Lines

Ten different text lines with a maximum length of 32 characters can be defined by the user for text outputs. Unused spaces at the end of a text line must be filled with (20H) representing a space.

Text lines written cyclically upon internal trigger (selected print interval and sync. time) also contain the time. The time print can be suppressed by entering the character “$” in position 32. The “$” character is hidden text which is not printed.

The date and time is added to event-dependent text lines. Date printing can be suppressed by entering the character “$” in position 32. Date and time printing can be suppressed by entering the character “@” in position 32. The characters “$” and “@” are hidden text which is not printed with the line.

The entire text of 32 characters can be moved and positioned in the display as required by using the cursor keys.

Parameters

Key	Display
<↵>	**{Text lines}**
<▲>	**{Text 1}**
<▲>	**{Text 2}**
...	
<▲>	**{Text 10}**

Parameter value

Any character from the character set table can be entered by using the <▲> key.

Main Menu Item Print Intervals

The text printing functions are defined under main menu items **{Print intervals}**, **{Sync. times}** and**{DI assignment}**.

Cyclic time printing according to DIN for chart speeds 20, 60 and 120 mm/h is achieved by selecting the appropriate print intervals. The time is printed in the format "_12:00". The underscore is the reference line for time data. Cyclic time printing is only possible if the printer queue is empty. Otherwise, the respective time printing action is canceled since the printed time does no longer match with the current time.

Time printing is also suppressed if the current chart speed is set to "0 mm/h".

Ten text lines of 32 characters are available to the user. Depending on the number of characters configured for the respective line, the time or the date and time is added to the line. The date and time is added to text lines of 24 characters. Text lines of up to 30 characters are extended with the time, only. Longer text lines are printed without date and time.

Print interval control permits cyclic printing of
- text lines 1...10,
- the measured values of the active channels,
- the date and time and
- the time

Parameters

Key	Display	Parameter
<↵>	**{Print intervals ☐}**	
<▲>	**{Text 1 10 min}**	Print text line 1
<▲>	**{Text 2 20 min}**	Print text line 2
...		
<▲>	**{Text 10 6 h}**	Print text line 10
<▲>	**{Meas. val. 12 h}**	Print measured values of active channels
<▲>	**{Dat./tim 24 h}**	Print date and time
<▲>	**{Time 20 min}**	Print time

Parameter value

--- (off)
10 min / 20 min
1 h / 2 h / 3 h / 4 h / 6 h / 8 h / 12 h / 24 h

The values can be configured independently for every single print function.The print function is printed cyclically at the selected intervals.The intervals are synchronized to the time specified under main menu item **{Sync.Times}** (Default value 0:00 o'clock).

Main Menu Item Sync. Times

This main menu item is used to synchronize the print interval (and with this printing) to an arbitrary time.

Parameters

Key	Display	Parameter
<↵>	**{Print intervals □}**	
<▲>	**{Text 1 00:00}**	Print text line 1
<▲>	**{Text 2 00:00}**	Print text line 2
...		
<▲>	**{Text 10 00:00}**	Print text line 10
<▲>	**{Meas. val. 00:00}**	Print measured values of active channels
<▲>	**{Dat./tim00:00}**	Print date and time
<▲>	**{Time 00:00}**	Print time

Parameter value

00:00 ... 23:59

Main Menu Item DI Assignment

Four internal and eight external digital inputs can be used for externally triggered functions.Under this main menu item the functions can be assigned to the digital inputs.The respective function is activated when the input is switched on.

Parameters

Key	Display	Parameter
<↵>	**{DI assignment □}**	
<▲>	**{Ev.Marker1 DI 2}**	Trigger event marker 1
<▲>	**{Ev.Marker2 off}**	Trigger event marker 2
<▲>	**{Ev.Marker3 off}**	Trigger event marker 3
<▲>	**{Ev.Marker4 off}**	Trigger event marker 4
<▲>	**{Text 1 DI 1}**	Trigger text line 1
<▲>	**{Text 2 ---}**	Trigger text line 2
...		
<▲>	**{Text 10 off}**	Trigger text line 10
<▲>	**{Meas. val. DI 3}**	Trigger measured value sheet
<▲>	**{Date/time DI 4}**	Trigger date/time line
<▲>	**{EnableConf. DI 1}**	Enable configuration
<▲>	**{Clock sync. DI 4}**	Synchronize recorder clock with external clock
<▲>	**{Empty PQ DI 1}**	Empty printer queue
<▲>	**{Scal.BL DI 1}**	Trigger scaling line of blue channel
<▲>	**{Scal.RD DI 2}**	Trigger scaling line of red channel
<▲>	**{Scal.GN DI 3}**	Trigger scaling line of green channel
<▲>	**{Scal.VI DI 4}**	Trigger scaling line of violet channel

Parameter value

off
DI 1 ... DI 4
additionally DI 7 ... DI via IO converter

Main Menu Item Service

Main menu item Service contains test and adjustment functions.

Key	Display	Parameter
<↵>	**{Service}**	
<▲>	**{BLUE channel }**	Submenu for line channel adjustment
<▲>	**{RED channel }**	Submenu for line channel adjustment
<▲>	**{GREEN channel }**	Submenu for line channel adjustment
<▲>	**{VIOLET channel }**	Submenu for line channel adjustment
<▲>	**{Copy channel →}**	Copy parameter values from channel x to channel y.
<▲>	**{Displ.Ref.Temp. →}**	Display the internal reference point temperature
<▲>	**{Display test →}**	Show test characters in the display
<▲>	**{Brightness 3}**	Display brightness
<▲>	**{Sys.Alarms 00000}**	Hide selftest error messages
<▲>	**{Initialize →}**	Load factory setting
<▲>	**{Listing →}**	Print configuration of the recorder
<▲>	**{Sim.Type sine}**	Output different test curves. The signals are then handled as analog input signals.
<▲>	**{Sim.Period 1200}**	Time period of a test curve in s
<▲>	**{Print head ←0008}**	Adjust print head 0 %
<▲>	**{Print head 0246}**	Adjust print head 100 %
<▲>	**{Installation →}**	Display hardware

Adjusting the Channels

Key	Display	Parameter
<↵>	**{Channel }**	
<▲>	**{Chart |← 0064}**	Adjust chart 0 % to system 0 %
<▲>	**{Chart →| 0F4E}**	Adjust chart 100 % to system 100 %

Adjusting the Recording Sections

Use the cursor keys <◂> and <▸> to match the channel zero and end with the chart zero and end.

Parameters

{Chart |← 0036} Adjust the channel zero
<↵>

{Chart |← 0036} The digits are flashing and can be adjusted using the cursor keys.

Parameter value

To facilitate the adjustment the other recording pens move to the center position. If adjustment is required, press <▸> until the recording pens are within the recording range. Then press the <◂> key to make the zero adjustment. The four-digit number represents internal values of the recorder.

Confirm with <↵> to take over the newly set value.

Press <▴> to call up the next parameter:

{Chart →| 076C}

Adjust the end value following the instructions above.

If <⇓> is pressed during adjustment, the chart will be conveyed in the normal direction.

Copy Channel

Allows the user to copy the parameter values from one channel to another channel of the same type.

Parameter

{Copy channel →} <↵> **{Source channel C1}**

Parameter value

C1 ... C4
M1 ... M4
I1 ... I4
S1 ... S4
01 ... 04 = Output channels BL, RD, GN, VT
<↵>

Parameter

{Target channel C1}

Parameter value

see above

Display Reference Point Temperature

Displays the temperature of the internal reference point.

Parameter

{Displ.Ref.Temp. }

Parameter value

Temperature xx.x °C

Press <Esc> to exit this parameter.

Display Test

Checks whether or not all dots of the dot matrix display light up.

Parameter
{Display Test}

Parameter value
Start <↵>
Cancel <Esc>

Brightness

Defines the display brightness.

Parameter
{Brightness 2}

Parameter value
0
1
2
3

Skip Error Messages

Permits to skip error messages shown on the display.

Enter the code number of the error message to be skipped as the parameter value.If you want to skip several error messages, sum up the appropriate code numbers using the table below and then enter the total as the parameter value.

Parameter
{Sys.Alarms 00000}

Parameter value
00000...88665

Code	Error message
00001	Calibrating data checksum
00002	Configuration checksum
00004	Channel board EEPROM write error
00008	CPU board EEPROM write error
00010	Watchdog
00020	Printer queue overflow
00040	Print head time-out
00080	Clock module power failure
00100	Chart speed too high for text printing
00200	Invalid channel board input type
00400	CPU clock generation error
00800	FRAM checksum
01000	IO converter communication
02000	Invalid DI reference
04000	Invalid DO reference

Initialize

Loads the factory setting

Upon actuation of <↵> the factory setting is taken over.
Pressing <Esc> will cancel the procedure.

The parameter values of the factory setting are saved in the EEPROM, if <???> is actuated to answer the “Save data” prompt when terminating the configuration.

If, however, the <Esc> key is pressed to answer the prompt, the parameter values of the the factory setting are rejected. The recorder will then continue to use the previously valid parameter values.

Parameter
{Initialize}

Parameter value
<↵> = yes
<Esc> = no

Listing

Defines the extent of the listing and starts printing. Note that the recorder needs to remain in configuration mode as long as the listing is being printed.As soon as printing is terminated, the recorder automatically returns to the operating mode. Printing can be stopped by actuating <Esc>.

The extent is defined by summing up and entering the code numbers of the wanted information.

Code	for
1	Measuring channel data
2	Math channel data
4	Pulse channel data
8	Accounting channel data
16	Output channel data
32	System data
64	Printer data
128	Text lines

Parameters

{Listing →}

<↵>

{Control 000}

Parameter value
0...255

Press <↵> to start printing.

Simulation

In simulation mode the recorder generates test signals without requiring that a generator is connected to the input terminals. These signals are processed and then output on the display and via the recording section.

Note
Simulation only has an effect on measuring channels C1...C4.

Parameter
{SIM.Type ---}

Parameter value

RAMP
SINE
STEP (in steps of 10 %)

Select Period

Defines the duration of the function.

Parameter
{Sim.Period 1300}

Parameter value
20...2000 s

The chart speed has to be set in accordance with the simulation period.

Adjust the Printer Section

The printer channel zero and end can be matched with the chart zero and end by using the cursor keys <◂> and <▴>.

Parameters

{Print head ← 0036} <↵>	Adjust printer channel zero
{Print head ← 0036}	The digits are flashing and can be adjusted by using the cursor keys.

The print head is moved to the adjusted zero for testing. At the same time, a dotted line (5 dots) is printed, with the chart drive being on. To enable better checking, the other measuring sections are moved to the center position.

If zero adjustment is correct:

Press <Esc>

or

If zero adjustment is not correct

Press <↵>
The print head is moved to a chart width of around 3 %.
Press <◂>
The print head is moved to the chart zero, with recording being on.
As soon as the zero line is reached,
press <↵>.
Zero setting is saved.

Adjust the end value following the instructions above.

Installation

Outputs the recorder's hardware configuration.

Parameter
{Installation }

Parameter value
xS/PRT/IO/zzz

with

1S...3S	1..3 line channels
PRT	Printer channel
IO	with digital inputs and outputs
UNI	with universal board
STD	with standard board

Special Measuring Range Configuration

Special measuring ranges can be configured for the recorder when selecting “USER”. Please note that the procedure is quite complicated and should only be used exceptionally if no acceptable results can be achieved with the standard configuration.

Examples:
1. Thermoelectric voltage measurement with internal correction for thermocouples not contained in the list on page 30.
2. Resistance measurement with teletransmitters
3. Temperature measurement using Ni..Pt..,Cu.., etc., resistance thermometers.

The following measurements can be performed:

Type of measurement	Code
Voltage measurement < 1000 mV	0
Current measurement	8
Voltage measurement > 1000 mV	16
Resistance measurement, 2-wire circuitry	32
Thermocouple measurement	64
Resistance measurement, 3-wire circuitry -	160

Table 2

The required gain is calculated. The code of the gain is added to the code of the type of measurement.

The following gains can be selected:

Gain factor	Code
1	0
2	1
4	2
8	3
16	4
32	5
64	6

Table 3

The required gain is calculated as a function of the type of measurement, using the following inequations:

Type	Range	Calculation	Lower limit
Voltage measurement ranges < 1000 mV	$600 / V_{max} < G < 1200 / V_{max}$	$G \leq 1200 / V_{max}$	$600 \leq G \times V_{max}$
Current measurement ranges	$22 / I_{max} < G < 43 / I_{max}$	$G \leq 43 / I_{max}$	$22 \leq G \times I_{max}$
Voltage measurement ranges < 1000 mV	$12605 / V_{max} < G < 25210 / V_{max}$	$G \leq 25210 / V_{max}$	$12605 \leq G \times V_{max}$
Resistance measurement, 2-wire and 3-wire	$2858 / R_{max} < G < 5714 / R_{max}$	$G \leq 5714 / R_{max}$	$2858 \leq G \times R_{max}$
Thermocouple measurement	$600 / V_{max} < G < 1200 / V_{max}$	$G \leq 1200 / V_{max}$	$600 \leq G \times V_{max}$

Table 4 G = Gain
I_{max} = $|I_{max}|$ = greatest absolute value; I in mA
R_{max} = $|R_{max}|$ = greatest absolute value; R in Ω
V_{max} = $|V_{max}|$ = greatest absolute value; V in mV

The value resulting from calculation of the gain factor must be rounded down to the next smaller value shown in table 2. The value resulting from gain factor calculation must not fall below the lower limit.

The respective code numbers from table 1 and table 2 must be added.

The total code number is entered as the parameter value in parameter ADC-control (**A**na-log-**D**igital-**C**onverter).

Parameter
{ADC-Control 0000}

Parameter value
0...165

Measurement of Thermoelectric Voltage with Internal Reference Point (Constant 1)

The constant C1 permits to use the internal reference point compensation function of the recorder for thermocouples that are not available in parameter “Type” (see page 30).

The value for constant C is determined as described below: The curve of the thermocouple must be linearly approximated in the range of 0...70 °C. Zero is fixed. The slope of the straight line is entered in µV/10 K in the “Const. 1” parameter.

Parameter
{Const. 1 1234}

Parameter value
0000 no compensation
0001....9999

Constant C2

Constant C2 is needed for resistance measurement and for thermoelectric voltage measurement.

Resistance measurement:

$C2 = (R_{max} - R_{min}) \times 10$

Thermoelectric voltage measurement:

Enter | V_{max} | [µV]

Parameter
{Const. 2 01234}

Parameter value
0000...65535

Calibrating the Measuring Range

A current, voltage or resistance source has to be connected to the appropriate terminals of the measuring channel for which a special range is to be created. Use a source of class 0.1 or better.

Calibrating the Lower Range Value

Adjust the source to the lower range value.

On the recorder, select the following:

Parameter
{Cal.Lo.Val. 0000}

Parameter value

Press <↵> key. The lower range value is measured.

Press <↵> again to save the lower range value in the EEPROM.

Calibrating the Upper Range Value

Adjust the source to the upper range value.

On the recorder, select the following:

Parameter
{Cal.Up.Val FFFF}

Parameter value

Press <↵>. The upper range value is measured.

Press <↵> again to save the upper range value in the EEPROM.

In submenu item **{Ranges}** the parameter **{Meas.Ran. ↓}** must be set to 0 %, and parameter **{Meas.Ran. ↑}** must be set to 100%. The calibrated measuring range can be handled like a standard range. This means, the lower range value can be selected in parameter **{Meas.Ran. ↓}** between 0...80 % (referred to the calibrated measuring range). The upper range value can be selected in parameter **{Meas.Ran. ↓}** between 20...100 % (referred to the calibrated measuring range).

The further configuration procedure is the same as for the standard nominal ranges.

Special Measuring Ranges, Example

Current Measurement

Wanted measuring range	−1..+1 mA			Check of lower limit
Type of measmt. selected from Tab. 2		Code	8	$22 \leq G \times I_{max}$ $22 \leq 32 \times 1$
$\lvert I_{max} \rvert = 1$ mA				The desired range is possible. Parameter value “0013” can be entered in parameter **{ADC-control}**-. Make the calibration following the instructions above.-
$G \leq 43 / I_{max}$				
$G \leq 43 / 1 = 43$				
Gain selected from Tab. 3	32			
		Resulting code	5	
Total of code numbers			13	

Voltage Measurement

Wanted measuring range	−3..+11 mA			Check of lower limit
Type of measmt. selected from Tab. 2		Code	16	$12605 \leq G \times V_{max}$ $12605 \leq 2 \times 11\,000 = 22000$
$\lvert V_{max} \rvert = 11$ V				The desired range is possible.
$G \leq 25210 / V_{max}$				
$G \leq 25210 / 11\,000 = 2.29$				
Gain selected from Tab. 3	2			
		Resulting code	1	
Total of code numbers			17	

Voltage Measurement

Wanted range	−123..+46 mV			Check of lower limit
Type of measmt selected from Tab. 2		Code	0	$600 \leq G \times V_{max}$ $600 \leq 8 \times 123 = 984$
$\lvert V_{max} \rvert = 123$ mV				The desired range is possible.
$G \leq 1200 / V_{max}$				
$G \leq 1200 / 123 = 9.75$				
Gain selected from Tab. 3	8			
		Resulting code	3	
Total of code numbers			3	

Resistance Measurement, 3-Wire Circuitry

Wanted range	10...1000 Ω		
Type of measmt. selected from Tab. 2		Code	160
$\lvert R_{max} \rvert$ = 1000 Ω			
$G \leq 5714 / R_{max}$			
G ≤ 5714 / 1000 = 5.714			
Gain selected from Tab. 3	4		
	Resulting code		2
Total of code numbers			162

Check of lower limit

$2858 \leq G \times R_{max}$
$2858 \leq 4 \times 1000 = 4000$

The desired range is possible.

Determining Constant C 2

C 2 = (1000 - 10) x 10 = 9900

Thermoelectric Voltage Measurement

Wanted range	0...200 °C Pallaplat with internal reference point compensation mV range 0...6.50 mV		
Type of measmt. selected from Tab. 2		Code	64
$\lvert U_{max} \rvert$ = 6.5 mV			
$G \leq 1200 / V_{max}$			
G ≤ 1200 / 6.5 = 184.62			
Gain selected from Tab. 3	64		
	Resulting code		6
Total of code numbers			70

Check of lower limit

$600 \leq G \times V_{max}$
$600 \leq 64 \times 6.5 = 416$

The desired range is **not possible**. A new measuring range is selected: 0...399 °C. The mV range is 0...10.60 mV.

G ≤ 1200 / 10.60 = 113.2

Check of lower limit

$600 \leq G \times V_{max}$
$600 \leq 64 \times 10{,}60 = 678.4$

The new range can be realized when using a gain factor of 32.

Determining Constant C 1

The µV-difference between 0...70 °C is 1900 µV.

C 1 = 1900 µV / 70 °C = 27.143 µV / °C

C 1 = 271.43 µV / 10°C

Selected: C1 = 271 µV

Determining Constant C 2

C 2 = $\lvert V_{max} \rvert$ [µV] = 10600 µV

Error messages

Error Messages During Selftest

Display	Error
Self Test 00:	CPU error
Self Test 01:	Internal RAM error
Self Test 02:	External RAM error
Self Test 03:	No clock module response
Self Test 04:	No response from AV relay
Self Test 05:	
Self Test 06:	Meas. channel 1 of channel board: selftest error
Self Test 07:	Meas. channel 2 of channel board: selftest error
Self Test 08:	Meas. channel 3 of channel board: selftest error
Self Test 09:	Meas. channel 4 of channel board: self-test error
Self Test 10:	No response from CPU EEPROM 1 on read command
Self Test 11:	No response from CPU EEPROM 2 on read command
Self Test 12:	No response from CPU FRAM 1 on read command
Self Test 13:	No response from CPU FRAM 2 on read command
Self Test 14:	No response from channel board EEPROM on read command

Error Messages During Operation

The error messages are shown in the display.

Display	Error
F: CPU clock gen.	Clock generator error
F: Time	Clock module has lost time
F: Checks.Param.	Checksum error in parameter data
F: Write.Param.	Write error, cannot write in EEPROM on CPU board
F: Checks.Calibr.	Checksum error of calibration data
F: Write.Calib.	Write error, cannot write in EEPROM on channel board
F: Watchdog	Watchdog reset
F: Buffer overflow	Printer queue is full
F: Print head	Print head cannot move
F: Chrt.Sp.Prnt.	Chart speed too high for text printing
F: Input type	Invalid input type for channel board, has been reset to 4...20 mA.
F: I/O-Conv.Comm.	Interface error to IO converter
F: I/O-Conv.Ref.DI	Configuration refers to DI of I/O converter, although communication to I/O converter is disabled.
F: I/O-Conv.Ref.DI	Parameter refers to DO of I/O converter, although communication to I/O converter is disabled.
F: Channel 1	Communic. troubles with meas. channel 1
F: Channel 2	Communic. troubles with meas. channel 2
F: Channel 3	Communic. troubles with meas. channel 3
F: Channel 4	Communic. troubles with meas. channel 4

Messages During Configuration

Display	Error
Invalid password	The entered password is not identical with the configured password, access to the configuration data is denied.
x < nn.nn	The entered value is inferior to the minimum value.
x > nn.nn	The entered value is superior to the maximum value.
Span <20%	The configured measuring range is smaller than 20 % of the nominal range.
Invalid entry	The entered value is invalid (with date / time).
Key locked	The desired key function has not been enabled.
No access	Access to configuration data denied (locked via DI) or password = 9999

Character Set Table

Character	Code [dec]	[hexadec]
x̄	02	2
N	03	3
n̄	04	4
α	05	5
β	06	6
δ	07	7
Δ	08	8
η	09	9
Θ	10	A
λ	11	B
μ	12	C
π	13	D
σ	14	E
Σ	15	F
τ	16	10
Φ	17	11
Ω	18	12
Ä	19	13
å	20	14
Ä	21	15
ä	22	16
Ö	23	17
ö	24	18
Ü	25	19
ü	26	1A
→	27	1B
√	28	1C
²	29	1D
£	30	1E
¥	31	1F
	32	20
!	33	21
"	34	22
#	35	23
$	36	24
%	37	25
&	38	26
’	39	27
(	40	28
)	41	29
*	42	2A
+	43	2B
,	44	2C
-	45	2D
.	46	2E
/	47	2F
0	48	30
1	49	31
2	50	32
3	51	33
4	52	34

Character	Code [dec]	[hexadec]
5	53	35
6	54	36
7	55	37
8	56	38
9	57	39
:	58	3A
;	59	3B
<	60	3C
=	61	3D
>	62	3E
?	63	3F
@	64	40
A	65	41
B	66	42
C	67	43
D	68	44
E	69	45
F	70	46
G	71	47
H	72	48
I	73	49
J	74	4A
K	75	4B
L	76	4C
M	77	4D
N	78	4E
O	79	4F
P	80	50
Q	81	51
R	82	52
S	83	53
T	84	54
U	85	55
V	86	56
W	87	57
X	88	58
Y	89	59
Z	90	5A
[	91	5B
\	92	5C
]	93	5D
↑	94	5E
_	95	5F
’	96	60
a	97	61
b	98	62
c	99	63
d	100	64
e	101	65
f	102	66
g	103	67

Character	Code [dec]	[hexadec]
h	104	68
i	105	69
j	106	6A
k	107	6B
l	108	6C
m	109	6D
n	110	6E
o	111	6F
p	112	70
q	113	71
r	114	72
s	115	73
t	116	74
u	117	75
v	118	76
w	119	77
x	120	78
y	121	79
z	122	7A
{	123	7B

Character	Code [dec]	[hexadec]
|	124	7C
}	125	7D
~	126	7E
▌	127	7F
³	128	80
‰	129	81
⁰	130	82
↓	131	83
←	132	84
¹⁰	138	8A
□	139	8B
∞	140	8C
◘	141	8D
▌	142	8E
↵	143	8F

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