Operating Instructions

VOLUME CORRECTOR

Type ERZ 9004 T
ERZ 9104 T

Status: 06/01
Subject to change

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1 Introduction

The operating concept:
The operating concept has been chosen in such a way that the operator can easily use the device without wasting too much time reading a manual

The function keys:
The most important data for the operator can be directly selected via function keys. There are function keys

Pressure
Temperature
Analysis values
Flow rates
Totalizer readings
Density
Standard density
Superior calorific value
Outputs (currents, dispatcher, interfaces)
Identification / device data
Storing measured values (freeze) / calibration during operation.

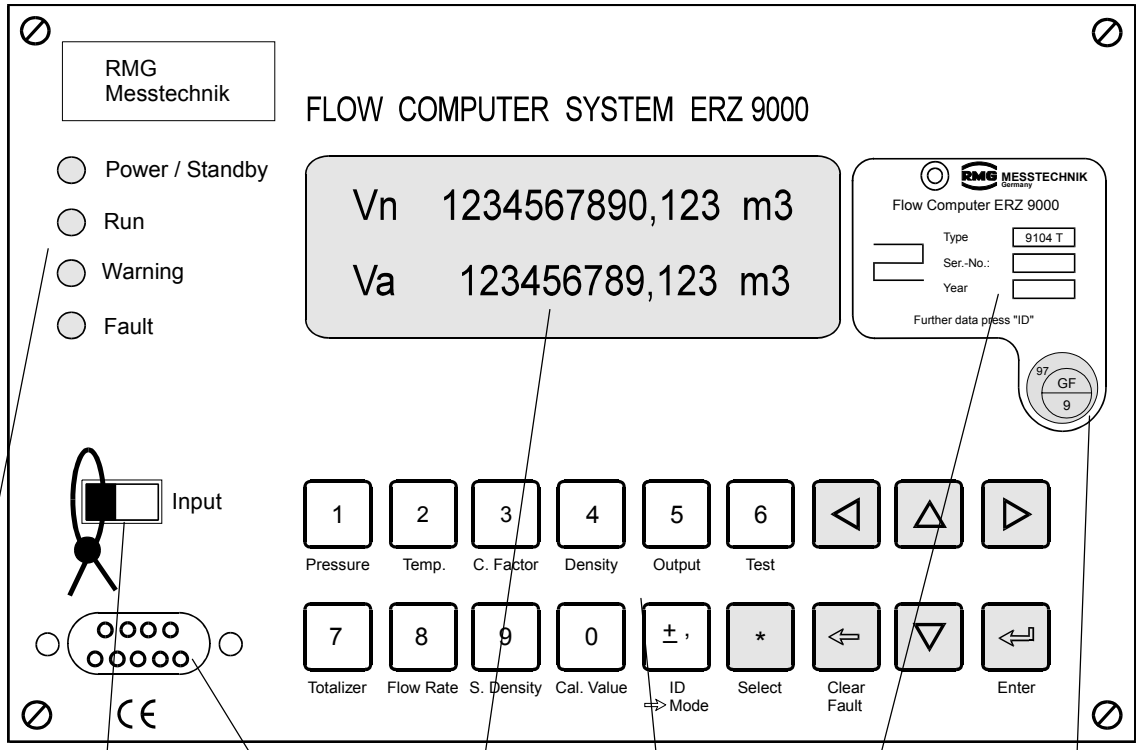
The system of coordinates:
A system of coordinates makes it easy for the operator to access all configuration data, measured values and operands by means of a table.
The system of coordinates is based on 27 columns and 46 lines. Columns are marked **A** to **ZB**, and include **46** lines each. The operator can reach every value in this system of coordinates via cursor keys (arrows).

The display field:
An alphanumeric 2-line display with 20 characters per line enables data and measured values to be indicated together with their short designations and units. The luminescent display field in blue is easily readable even from a distance.

The types of devices:

		Active columns of the system of coordinates												
Type of device	**Description**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M-ZB**
ERZ 9004 T	Volume corrector with calculation of GERG 88 S via measured values for Hs, ρ_n and CO_2.	X	X	X		X	X			X	X	X	X	X
ERZ 9104 T	Superior calorific value corrector (state) with calculation of GERG 88 S via measured values for Hs, ρ_n and CO_2.	X	X	X		X	X			X	X	X	X	X

2 Front Panel



LED's

Sealable slide switch

RS 232 C port

2-line display with 20 characters per line

Keypad for directly accessing the various device functions

ID plate with basic data; all other data can be accessed via the **ID** function key

Main stamp

3 Operation

Description of function keys

Pressure	Indication of the PRESSURE and when pressing the ↑ ↓ keys all pressure-related values.
Temp.	Indication of the TEMPERATURE and when pressing the ↑ ↓ keys all temperature-related values.
C. Factor	Indication of the COMPRESSIBILITY FACTOR and the VOLUME CORRECTION FACTOR and when pressing the ↑↓ keys all the other gas-analysis values.
Density	Indication of the DENSITY and when pressing the ↑↓ keys all density-related values.
Output	Indication of all outputs of the device: ANALOG, DIGITAL or DATA INTERFACES.
Test	Activation of the FREEZE and CALIBRATION DURING OPERATION functions. This key initiates a dual function (see Chapter 6).
Totalizer	Indication of V_a and V_n totalizers.
Flow Rate	Indication of the VOLUME AT ACTUAL CONDITIONS and when pressing the ↑↓ keys all values related to the volume at actual conditions.
S. Density	Indication of the STANDARD DENSITY and when pressing the ↑↓ keys all values related to the standard density.
Cal. Value	Indication of the SUPERIOR CALORIFIC VALUE and when pressing the ↑↓ keys all values related to the superior calorific value.
ID ⇒ Mode	Indication of DEVICE DATA and OPERATING MODES.

Special function keys

↑ ↓ ← → **Clear** **Enter** **Select**

Arrow up / down

↑ ↓

To scroll up or down by lines within a column. If you press ↑ at the beginning of a line of a column, you jump to the freeze table, namely to the last value of this table. Now you can select the fourth, third or second value by pressing ↑. If you press ↓ at the end of the freeze table, the display returns to the standard indication of the function key.

Arrow to the right / left

→ ←

To scroll to the right or left by columns within a line. If you press ←, you can jump via the first column to the last column. If you press →, you can jump via the last column to the first column.

The following applies to cursor keys in general: Unoccupied line fields within a column and unoccupied columns within a line are automatically skipped. If the column jumped to is occupied but the line field is empty, the line number is automatically increased until an occupied field is found. When you jump to the next column, the initial line number is selected again.

Clear / Fault

⇐

a) To clear incorrect inputs in the programming mode. The state prior to inputting the first digit is restored.

b) To indicate and clear fault messages.

c) To close user inputs (locking by means of the code number).

Enter

To initiate and complete a data input. All data inputted are accepted.

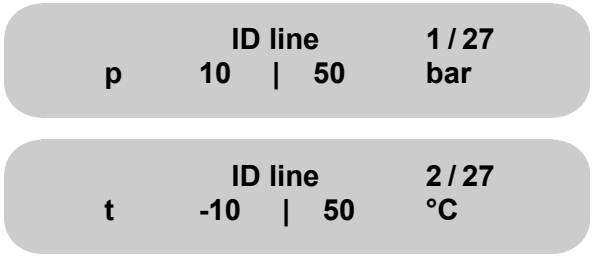
Select

*****

To switch over from short designations to coordinates and vice versa. Switching over is possible in almost all fields (also in the programming mode).

4 ID Display / Device Data

Press the **ID / MODE** key. (Example: ERZ 9104 T)



The ID display comprises a field with a maximum of 30 data lines, a header line and a bottom line. The number of data lines depends on the chosen model. When you press the **ID / MODE** key, the header line overlays the upper part of the display field. The header line will always remain in the upper part of the display field as long as the ID mode is active. The first data line of the ID data field is shown in the lower part of the display field. You can now scroll in the ID data lines by pressing the ↓ or ↑ key. The bottom line appears at the end of the data field. The ID display of the ERZ 9104T includes the following data, for example:

Header line →	ID line				n / 27
	p	10.0	I	80	bar
	t	-10	I	50	°C
	Hs	7	I	14	kWh/m3
	rn	0.65	|	1.30	kg/m3
	CO2	0	|	30	Mol %
	Meter G	6500			
	q	500	|	10000	m3/h
	M-Kv	600.315			P/m3
	ECL	None			
ID contents →	M-type	TM			
	M-No.	22523			
	qamin-HP	200			m3/h
	ramin-HP	40			kg/m3
	ramax-HP	80			kg/m3
	Gas-type:	Natural gas			
	p-type	3051 C			
	p-No	632345			
	t-type	AGG Ex			
	t-No	662345			
	Hs-type	PGC			
	Hs-No	652345			
	rn-type	NDG08			
	rn-No	682345			
	CO2-type	CO2x			
	CO2-No	692345			
	Comp-No	602345			
Bottom line →	**	End of ID	**		

Programming the ID display
Set the switch to "Input", select ID and press the → key four times. The ZB column will appear with the heading "ID input". The size of the ZB column depends on the chosen model. Make your changes here, while the input switch is open. Data inputted are automatically transferred to the ID display.
Note: The input column (ZB) will only appear if the switch is in its "Input" position!

5 Display Fault / Clear Fault Function

Display fault

The occurrence of a fault is indicated by the **Fault** LED on the front panel of the device or by an isolated contact at the terminal block. The LED flashes if faults are pending. If faults are no longer pending, the LED turns to steady light.

To display fault texts, you must press the **CLEAR** / **FAULT** key. After you have pressed this key, the display field shows ***Fault indication*** and the bottom line shows the fault texts at 3-second intervals. All messages are consecutively shown in the display field. As long as the Fault LED flashes, there is still at least one fault pending. If the Fault LED shows steady light, all indicated fault messages are no longer valid and the device has returned to fault-free operation.

Clear fault

There are two operating modes for clearing fault messages: ***DIRECT CLEARING*** and ***INDIRECT CLEARING***. You can select the desired operating mode under **FAULT-MOD** in the field Y 17.

a) Direct clearing
In the fault indication mode you can clear fault messages directly via the **CLEAR** / **FAULT** key.

b) Indirect clearing
You cannot clear fault messages unless you have selected the ***CLEAR FAULT ?*** field (Y5) using the **ENTER** key.

The time and date of the fault occurred are shown in the fields Y3 and Y4. If there is more than one fault pending, the time and date of the first fault occurred are shown.

The time and date of the last fault acknowledgment are shown in the field Y6.

Note on the SELECT key [*] in connection with the fault indication mode:

You are in the coordinate field and as soon as a fault message occurs you want to quickly switch over to the fault indication mode and then return to the same location in the coordinate field. To do this, you must press the **SELECT** key in the fault indication mode

6 "TEST" Key Special Function: Freeze / Calibration During Operation

The **TEST** key comprises two functions:
1. Freeze function (storage of measured values and operands)
2. Calibration during operation (start / stop function of totalizers)

Freeze function

Manual freezing
If the freeze mode is set to manual, a freeze operation is performed every time you press the **TEST** key. The frozen values can be read in the columns A ... V 43, 44, 45, 46.

Example:
Press the **TEST** key. The display will show the totalizers for calibration during operation. At the same time, all freeze coordinates are written with the current values at this moment. Press the **FLOW RATE** key and the display will show the frozen value for the volume at actual conditions. The following is displayed for example:

current value	**qa**	**1622.74**	**m3/h**
current value	**fm**	**450.34**	**Hz**

Press ↑ three times.

current value	**qa**	**1622.74**	**m3/h**
frozen value	**Fqa**	**1621.45**	**m3/h**

If you press the **TEST** key again, this will result in repeated freezing of current values.

Automatic freezing
In the automatic freeze mode, the desired parameters are preselected in the "Mode" column.

Example:
You want to freeze current values daily at 06:00:00 a.m. First input the code number to enable the change option for the appropriate fields.

Press the **MODE** key.
Press → once.

	Mode	
Current time	**Time:**	**13-25-43**

press ↓ 4 times

Manual freezing

Mode
F-mod: Manual

Set the “F-mod“ mode to daily freezing [Day(s)]:

Press the **ENTER** key.
Press the **MODE** key 3 times.

Daily freezing

Mode
F-mod: Day(s)

Press ↓ once

Start time

Mode
F-time: hh:mm:ss

Input the desired time for the first freeze operation.

Press ↓ once

Start date

Mode
F-date: dd:mm:yy

Input the desired date (no days of the past) for the first freeze operation.

Press ↓ once

Repetition rate

Mode
F-rep: xx

Input the desired repetition rate. For daily repetition, input “1“

Calibration during operation
Parallel to the totalizers for custody transfer metering, separate totalizers can be started or stopped via the **TEST** key. At the same time the totalizers are started, they are set to zero. In the coordinate field V5 a stopwatch is operated at the same time the **TEST** key is pressed. Designation: C-duration (duration of calibration during operation).
Attention! Each time the totalizers are started or stopped, a freeze operation of the appropriate fields is performed in the manual freeze mode. If the freeze mode is not set to "manual", pressing the **TEST** key will not have any effect on freezing.

7 Summary of Coordinates

7.1 Coordinates from A-F

	Active	**9004 T**	**9004 T**	**9004 T**		**9004 T**	**9004 T**
	Active	**9104 T**	**9104 T**	**9104 T**		**9104 T**	**9104 T**

		Pressure	**Sup. Cal. Val.**	**S. Density**		**Temperature**	**CO2**
		A / 01	**B / 02**	**C / 03**	**D / 04**	**E / 05**	**F / 06**
1	**Meas. value 1**	p	Hsnc	rnc		t	CO2
2	**Meas. value 2**		Hsn	rn			
3	**In / Out 1**	mA	mA	mA		Ohm	mA
4	**In / Out 2**						
5	**Min. range**	*p-min*	*Hsn-min*	*rn-min*		*t-min*	*CO2-min*
6	**Max. range**	*p-max*	*Hsn-max*	*rn-max*		*t-max*	*CO2-max*
7	**Min. limit**						
8	**Max. limit**						
9	**Default value**	*p-default*	*Hsn-default*	*rn-default*		*t-default*	*CO2-default*
10	**Jump**	*delta (%)*	*delta (%)*	*delta (%)*		*delta (%)*	*delta (%)*
11	**Reference**	p-*standard*				t-*standard*	
12	**Corr. factor**	*Input*	*Input*	*Input*		*Input*	*Input*
13	**Averaging**						
14	**Min. contact**	*p<*	*Hsn<*	*rn<*		*t<*	*CO2<*
15	**Max. contact**	*p>*	*Hsn>*	*rn>*		*t>*	*CO2>*
16							
17	**Mode 1**	*off / 0- / 4-*	*off / 0- / 4-*	*off / 0- / 4-*		*off / on*	*off / 0- / 4-*
18	**Mode 2**	*Meas. / DF val.*	*Meas. / DF val.*	*Meas. / DF val.*		*Meas. / DF val.*	*Meas. / DF val.*
19	**Mode 3**	pabs/pgauge					
20	**Last meas. val**		Hsn-h	rn-h			
21	**Specif. value**		*Hsn-s*	*rn-s*			
22	**Delta limit**		*delta (%) max*	*delta (%) max*			
23	**Delta act. val.**		delta (%)	delta (%)			
24	**Meas. value**		Hsn calib.	rn calib.			
25	**Cor. meas. val**						
26	**Corr. factor**		*Corr. val. abs*	*Corr. val. abs*			
27	**Constants**						
28	**Constants**						
29	**Constants**						
30	**Constants**						
31	**Constants**						
32	**Constants**						
33	**Constants**						
34	**Constants**						
35	**Constants**						
36	**Constants**						
37	**Special**						
38	**Special**						
39	**Special**						
40	**Special**						
41	**Special**						
42	**Special**						
43	**Freeze / CDO**	1st value	1st value	1st value		1st value	1st value
44	**Freeze / CDO**		2nd value	2nd value			
45	**Freeze / CDO**	3rd value	3rd value	3rd value		3rd value	3rd value
46	**Freeze / CDO**						

Locked via calibration switch (E)
Locked via code number (B)
No locking (A)

Italic
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7.2 Coordinates from G - L

	Active			**9004 T**	**9004 T**	**9004 T**	**9004 T**
	Active			**9104 T**	**9104 T**	**9104 T**	**9104 T**

				S. Density	Flow Rate 1	Flow Rate 2	Analysis
		G / 07	H / 08	I / 09	J / 10	K / 11	L / 12
1	**Meas. value 1**			rnc	qa	qQ	VCF
2	**Meas. value 2**			rn	qac	qn	K
3	**In / Out 1**			f1 (Hz)	fm (Hz)		Hsn corr.
4	**In / Out 2**			f2 (Hz)	fr (Hz)		rd corr.
5	**Min. range**			*rn-min*	*qa-min*		
6	**Max. range**			*rn-max*	*qa-max*		
7	**Min. limit**						
8	**Max. limit**						
9	**Default value**			*rn-default*	*Difference (%)*		*K-default*
10	**Jump**			*delta (%)*	*delta (%)*		
11	**Reference**						*T comb.*
12	**Corr.-factor**						
13	**Averaging**				*Input*		*Input*
14	**Min. contact**			*rn<*	*qa<*	*qn<*	
15	**Max. contact**			*rn>*	*qa>*	*qn>*	
16						*qQ<*	
17	**Mode 1**			*off / 1f / 2f*	*off / on*	*qQ>*	*GERG / K=c*
18	**Mode 2**			*Meas. / DF val.*	*1/ 1:1 / x:y*		
19	**Mode 3**				*off / corr.*		
20	**Last meas. val**			rn-h			
21	**Specif. value**			*rn-s*			H2calc
22	**Delta limit**			*delta (%)*	*delta Kvc (%)*		
23	**Delta act. val.**			delta (%)	Kvc (%)		
24	**Meas. value**			rn calib.			rbcalc
25	**Cor meas. val**				Kvc		
26	**Corr. factor**			*Corr. val. abs*	*Kv*		
27	**Constants**			*KK*	*Meas. wheel*		
28	**Constants**			*KM*	*Ref. wheel*		*H2-2*
29	**Constants**			*KR*	*Missing puls.*		
30	**Constants**			*KC*	*Ref. pulses*		
31	**Constants**				*Startup puls.*		
32	**Constants**				*f<L*		*H2-1*
33	**Constants**				*t<qa-min*		
34	**Constants**				*A -2*		
35	**Constants**				*A -1*		
36	**Constants**				*A 0*		
37	**Special**				*A 1*		
38	**Special**				*A 2*		
39	**Special**				qa peak	qn peak	
40	**Special**				Date / Time	Date / Time	Zn
41	**Special**					qQ peak	Z
42	**Special**					Date / Time	
43	**Freeze / CDO**			1st value	1st value	1st value	1st value
44	**Freeze / CDO**			2nd value	2nd value	2nd value	2nd value
45	**Freeze / CDO**			3rd value	3rd value		
46	**Freeze / CDO**			4th value	4th value		

Locked via calibration switch (E)
Locked via code number (B)
No locking (A)

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7.3 Coordinates from M-S

	Active	9004 T	9004 T	9004 T	9004 T	9004 T	9004 T	9004 T
	Active	9104 T	9104 T	9104 T	9104 T	9104 T	9104 T	9104 T

		Analog 1	Analog 2	Analog 3	Analog 4	Digital 1	Digital 2	Data A
		M / 13	N / 14	O / 15	P / 16	Q / 17	R / 18	S / 19
1	Special	Phys. value	Phys. value	Phys. value	Phys. value	Designation	Designation	Data 1 / Front
2	Special							*Mode 1*
3	On / Off 1	I 1 (mA)	I 2 (mA)	I 3 (mA)	I 4 (mA)			*Mode 2*
4	On / Off 2							*Baud rate*
5	Min. range	*Phys. value*	*Phys. value*	*Phys. value*	*Phys. value*			
6	Max. range	*Phys. value*	*Phys. value*	*Phys. value*	*Phys. value*			
7	Special							
8	Special							
9	Special	*Calib curr.*	*Calib curr.*	*Calib curr.*	*Calib curr.*	*50...300 ms*	*50...300 ms*	Data 2 / C1
10	Special							*Mode 1*
11	Special	*Selection*	*Selection*	*Selection*	*Selection*	*Selection*	*Selection*	*Mode 2*
12	Special	*Input*	*Input*	*Input*	*Input*			*Baud rate*
13	Special	*Input*	*Input*	*Input*	*Input*			
14	Special							
15	Special							
16	Special							
17	Special	*off / 0- /4-/ CC*	*off / 0- /4-/ CC*	*off / 0- /4-/ CC*	*off / 0- /4-/ CC*	*off / on*	*off / on*	Data 3 / C3
18	Special							*Mode 1*
19	Special							*Mode 2*
20	Special							*Baud rate*
21	Special							*Stop bit*
22	Special							*Parity*
23	Special							
24	Special							
25	Special							Data 4 / C4
26	Special							*Mode 1*
27	Special					*Pulse val. 1*	*Pulse val. 2*	*Mode 2*
28	Special							*Baud rate*
29	Special							*Stop bit*
30	Special							*Parity*
31	Special							RBS
32	Special							
33	Special							
34	Special							Data 5 / C5
35	Special							*Mode 1*
36	Special							*Mode 2*
37	Special							*Baud rate*
38	Special							*Stop bit*
39	Special							*Parity*
40	Special							
41	Special							
42	Special							
43	Freeze / CDO							
44	Freeze / CDO							
45	Freeze / CDO							
46	Freeze / CDO							

Locked via calibration switch (E)
Locked via code number (B)
No locking (A)

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7.4 Coordinates from T - ZB

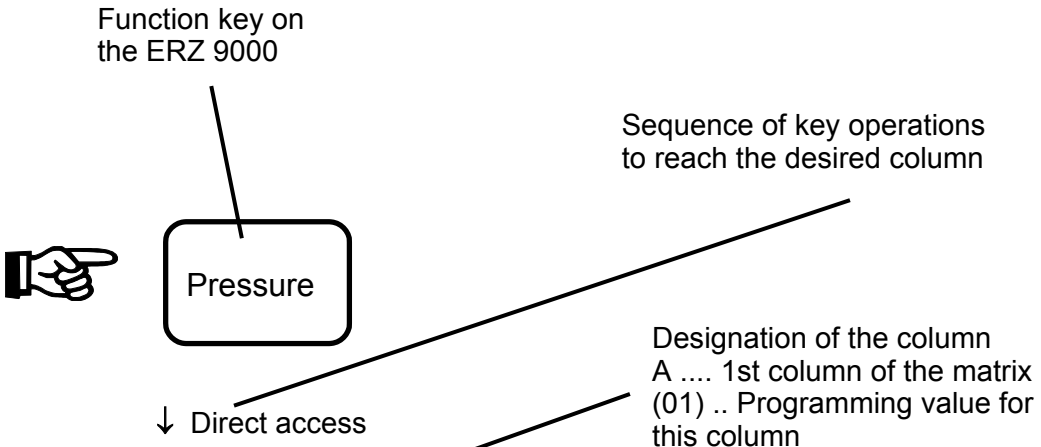
	Active	9004 T	9004 T	9004 T	9004 T	9004 T	9004 T	9004 T	9004 T	9004 T
	Active	9104 T	9104 T	9104 T	9104 T	9104 T	9104 T	9104 T	9104 T	9104 T
		Data B	Totalizer	Test	ID	Mode	Fault	Load Point	ID	Backup
		T / 20	U / 21	V / 22	W / 23	X / 24	Y / 25	ZA / 26	ZB / 27	ZC / 28
1	Special	Data 6 / C2	Vn/Q	CVn / CQ	The length of the ID display column depends of the chosen model (maximum length: 30 fields)	Designation	Designation	Heading	Heading	I1-In
2	Special	*Mode 1*	Vac	CVac		*Time*	Status	*LP 1*	The length of the ID input column depends on the chosen model	I2-In
3	Special		Va	CVa		*Date*	Fault time	*E-LP 1*		I3-In
4	Special	*Baud rate*	Vn	CQ / CVn		*Code No.*	Fault date	*LP 2*		I4-In
5	Special	*Stop bit*	Vn/Q dist..	C-duration		Operating hrs.	clear ?	*E-LP 2*		T1-In
6	Special	*Parity*	Vac dist.			*Freeze mode*	last clearing	*LP 3*		I5-In
7	Special	*DSfG addr. U:*	Va dist.			*Freeze time*	Def.wr:	*E-LP 3*		f1-In
8	Special	*Preset U:*	Vn dist.			*Freeze date*		*LP 4*		f2-In
9	Special	*S-addr.:*				*Freeze repeat.*		*E-LP 4*		f3-In
10	Special	*S-preset:*				last freeze		*LP 5*		f4-In
11	Special	*DSfG addr. U:*				*Print mode 1*		*E-LP 5*		fm-In
12	Special	*Preset U:*				*Print mode 2*		*LP 6*		fv-In
13	Special	Event 1				*Print mode 3*		*E-LP 6*		DP-Ram
14	Special	Time 1				*Print start*		*LP 7*		110
15	Special	Event 2				*Print interval*		*E-LP 7*		2
16	Special	Time 2				*Revis. interval*		*LP 8*		Vac
17	Special	Event 3	*Tot. mode*			last print out	*Clearing mode*	*E-LP 8*		Vn
18	Special	Time 3	*Tot. 1 select*			*Limit contacts*		*LP 9*		Q
19	Special	Event 4	*Tot. 2 select*			*Display mode*		*E-LP 9*		Va
20	Special	Time 4	*Tot. 1 sf*			Comp. type	*rn mode*	*LP 10*		PGC 0
21	Special	Event 5	*Tot. 2 sf*			Version	*External mode*	*E-LP 10*		PGC 1
22	Special	Time 5				*Comp. No.*	*A/D corr.*	*LP 11*		PGC 2
23	Special	Event 6				*Comp. mode*	*2-Way?*	*E-LP 11*		PGC 3
24	Special	Time 6				*RTC corr*		*LP 12*		PGC 4
25	Special	Event 7	*Vac set*			*System freq. f-Vol*		*E-LP 12*		PGC 5
26	Special	Time 7	*Vn set*			*System freq. f-den*				PGC 6
27	Special	Event 8	*Q set*			Lamp test bott.				PGC 7
28	Special	Time 8	*Va set*			Lamp test top				PGC 8
29	Special	Event 9	*VacD set*				*PGC Timeout*			PGC 9
30	Special	Time 9	*VnD set*							PGC 10
31	Special	Event 10	*QD set*			*Day print*				PGC 11
32	Special	Time 10	*VaD set*			*t-DayPrint*				PGC 12
33	Special					*Page length*				PGC 13
34	Special	print format				*Station*				PGC 14
35	Special	*Print Sel. 1*				*Customer*				PGC 15
36	Special	*Print Sel. 2*				*Meas. point*				PGC 16
37	Special	*Print Sel. 3*				*Product*				PGC 17
38	Special	*Print Sel. 4*								PGC 18
39	Special	*Print Sel. 5*								PGC 19
40	Special	*Print Sel. 6*								PGC 20
41	Special	*Print Sel. 7*								PGC 21
42	Special	*Print Sel. 8*								PGC 22
43	Frz / CDO		FVn / FQ	FCVn/Q dist.						PGC 23
44	Frz / CDO		FVac	FCVac dist.						PGC 24
45	Frz / CDO		FVa	FCVa dist.						PGC 25
46	Frz / CDO		FVn	FCQ/Vn dist.						PGC 26
47										PGC 27

Locked via calibration switch (E)
Locked via code number (B)
No locking (A)

Italic
Italic

8. Summary of Device Functions to Be Called up with Function Keys

8.1 Column Structur



		A (01)	Description of coordinates	Unit	Comment(s)
1	A	P	Measured value for pressure (absolute pressure)	bar a	
3	A	I	Measured value for input current	mA	
5	E	P min	Lower adjusting value and fault limiting value	bar a/g	2)
6	E	P max	Upper adjusting value and fault limiting value	bar a/g	3)
9	B	Pdef	Default value (replacement value if a fault occurs)	bar a	

Short description
of the coordinate

Abbreviation of the coordinate
(Display of the ERZ 9000)

Unit of the value displayed or
programmed

Data protection level:
A ... Display value
B ... Data which the user can be modify using a code number
E ... Data which can be modified via the slide switch (sealable)

Designation of the line
9 ... 9th line column A

Explanatory notes
on the coordinate

8.2 Device-specific functions

8.2.1 Pressure at measuring conditions

Pressure

↓ Direct access

		A (01)	Description of coordinates	Unit	Comment(s)
1	**A**	p	Measured value for pressure (absolute pressure)	bara	
3	**A**	I	Measured value for input current	mA	
5	**E**	Pmin	Lower adjusting value and fault limiting value	bar a / g	2)
6	**E**	Pmax	Upper adjusting value and fault limiting value	bar a / g	3)
9	**B**	PDF	Default value (replacement value if a fault occurs)	bar a	
10	**B**	P-JP	Max. permissible jump from measured value to measured value	%	
11	**E**	Pn	Standard pressure (reference quantity)	bar	4)
12	**E**	P-C	Correction factor: balancing A/D converter offset		
14	**B**	P<	Contact: lower limit	bara	
15	**B**	P>	Contact: upper limit	bara	
17	**E**	P-mod1	Mode 1: current input = off (default value) / 0-20mA / 4-20mA		1)
18	**E**	P-mod2	Mode 2: if a fault occurs = default / measured value (last measurement)		1)
19	**E**	P-mod3	Mode 3: pressure transmitter = P-abs / P-gauge		1)
43	**A**	FP	Freeze: pressure (bar)	bara	
45	**A**	FI	Freeze: input current	mA	

1) Rolling texts! Press the **MODE** key to make your changes.
2) Assigning 0 mA or 4 mA to the lower adjusting value.
3) Assigning 20 mA to the upper adjusting value.
4) Reference quantity for standard conditions of the country concerned.

8.2.2 Superior calorific value

Cal. Value

↓ Direct access

		B (02)	Description of coordinates	Unit	Comment(s)
1	**A**	GCVc	Corrected superior calorific value, calculated	MJ/m3	
2	**A**	GCV	Measured value for the superior calorific value	MJ/m3	
3	**A**	I	Measured value for input current	mA	
5	**E**	GCVmin	Lower adjusting value and fault limiting value	MJ/m3	2)
6	**E**	GCVmax	Upper adjusting value and fault limiting value	MJ/m3	3)
9	**B**	GCV-DF	Default value (replacement value if a fault occurs)		
10	**B**	GCV-JP	Max. permissible jump from measured value to measured value	%	
12	**E**	GCV-C	Correction factor: balancing A/D converter offset		
14	**B**	GCV<	Contact: lower limit	MJ/m3	
15	**B**	GCV>	Contact: upper limit	MJ/m3	
17	**E**	GCV-mod1	Mode 1: current input = off (default value) / 0-20mA / 4-20mA / Databus		1)
18	**E**	GCV-mod2	Mode 2: if a fault occurs = default / measured value (last measurement)		1)
20	**A**	GCV-h	Hold value of the process gas for external calibration	MJ/m3	
21	**E**	GCV-s	Specified value of the test gas for external calibration	MJ/m3	
22	**E**	dGCV>L	Max. spec. / act. value deviation for external calibration	%	
23	**A**	dGCV	Spec. / act. value deviation for external calibration	%	
24	**A**	GCV-E	Measured value for the test gas for external calibration	MJ/m3	
26	**E**	CorrF	Correction value for the superior calorific value after external calibration	MJ/m3	
43	**A**	FGCVc	Freeze: corrected superior calorific value	MJ/m3	
44	**A**	FGCV	Freeze: superior calorific value	MJ/m3	
45	**A**	FGCVI	Freeze: input current	mA	

1) Rolling texts! Press the **MODE** key to make your changes.
2) Assigning 0 mA or 4 mA to the lower adjusting value.
3) Assigning 20 mA to the upper adjusting value.

8.2.3 Standard density (current input)

Temp.

Indirect access by
pressing the ← key

		C (03)	Description of coordinates	Unit	Comment(s)
1	**A**	rnk	Corrected standard density, calculated	kg/m3	
2	**A**	rn	Measured value for standard density	kg/m3	
3	**A**	I	Measured value for input current	mA	
5	**E**	rnmin	Lower adjusting value and fault limiting value	kg/m3	2)
6	**E**	rnmax	Upper adjusting value and fault limiting value	kg/m3	3)
9	**B**	rn-DF	Default value (replacement value if a fault occurs)		
10	**B**	rn-JP	Max. permissible jump from measured value to measured value	%	
12	**E**	rn-C	Correction factor: balancing A/D converter offset		
14	**B**	rn<	Contact: lower limit	kg/m3	
15	**B**	rn>	Contact: upper limit	kg/m3	
17	**E**	rn-mod1	Mode 1: current input = off (default value) / 0-20mA / 4-20mA / Databus		1)
18	**E**	rn-mod2	Mode 2: if a fault occurs = default / measured value (last measurement)		1)
20	**A**	rn-H	Hold value of the process gas for external calibration	kg/m3	
21	**E**	rn-S	Specified value of the test gas for external calibration	kg/m3	
22	**E**	drn>L	Max. spec. / act. value deviation for external calibration	%	
23	**A**	drn	Spec. / act. value deviation for external calibration	%	
24	**A**	rn-E	Measured value for the test gas for external calibration	kg/m3	
26	**E**	KorrW	Correction value for standard density after external calibration	kg/m3	
43	**A**	Frnk	Freeze: corrected standard density	kg/m3	
44	**A**	Frn	Freeze: standard density	kg/m3	
45	**A**	FI	Freeze: input current	mA	

Depending on the set mode (standard density either as frequency or as current), you will be referred to the C column or the I column after selecting the standard density.

1) Rolling texts! Press the **MODE** key to make your changes.
2) Assigning to the lower limiting value.
3) Assigning to the upper limiting value.

8.2.4 Temperature at measuring conditions (PT100)

Temp.

↓ Direct access

		E (05)	Description of coordinates	Unit	Comment(s)
1	**A**	T	Measured value for gas temperature	°C	
3	**A**	R	Measured value for input resistance	Ohm	
5	**E**	T-min	Lower fault limiting value	°C	2)
6	**E**	T-max	Upper fault limiting value	°C	3)
9	**B**	TDF	Default value (replacement value if a fault occurs)	°C	
10	**B**	TJP	Max. permissible jump from measured value to measured value	%	
11	**E**	tn	Standard temperature = 0 / 15 (reference quantity)	°C	1) 4)
12	**E**	T-C	Correction factor : balancing A/D converter offset		
14	**B**	T<	Contact: lower limit	°C	
15	**B**	T>	Contact: upper limit	°C	
17	**E**	T-mod1	Mode 1: resistance measurement off / on (PT 100)		1)
18	**E**	T-mod2	Mode 2: if a fault occurs = default / measured value (last measurement)		1)
43	**A**	FT	Freeze: gas temperature	°C	
45	**A**	FRT	Freeze: input resistance	Ohm	

1) Rolling texts! Press the **MODE** key to make your changes.
2) Assigning 0 mA or 4 mA to the lower adjusting value.
3) Assigning 20 mA to the upper adjusting value.
4) Reference quantity for standard conditions of the country concerned.

8.2.5 CO_2

Temp.

Indirect access by
pressing the [→] key

		F (06)	Description of coordinates	Unit	Comment(s)
1	**A**	CO2	Measured value for CO_2	%	
3	**A**	I	Measured value for input current	mA	
5	**E**	CO2min	Lower adjusting value and fault limiting value	%	2)
6	**E**	CO2max	Upper adjusting value and fault limiting value	%	3)
9	**B**	CO2-DF	Default value (replacement value if a fault occurs)	%	4)
10	**B**	CO2-JP	Max. permissible jump from measured value to measured value	%	
12	**E**	CO2-C	Correction factor : balancing A/D converter offset		
14	**B**	CO2<	Contact: lower limit	%	
15	**B**	CO2>	Contact: upper limit	%	
17	**E**	CO2-mod1	Mode 1: Current = Off (default value) / 0-20mA / 4-20mA / Databus		1)
18	**E**	CO2-mod2	Mode 2: if a fault occurs = default / measured value (last measurem.)		1)
43	**A**	FCO2	Freeze: Measured CO_2 value	%	
45	**A**	FI	Freeze: input current	mA	

1) Rolling texts! Press the **MODE** key to make your changes.
2) Assigning to the lower limiting value.
3) Assigning to the upper limiting value.
4) Inputs must be made in mol %. If values are only available in vol %, you must convert them to mol %. Conversion:
   $\text{mol \%}_{CO2} = \text{vol \%}_{CO2} * 1.0037$

8.2.6 Standard density (frequency input)

S. density

↓ Direct access

		I (09)	Description of coordinates	Unit	Comment(s)
1	**A**	rnk	Corrected standard density, calculated	kg/m3	
2	**A**	rn	Measured value for standard density	kg/m3	
3	**A**	f1	Measured value for input frequency (measuring channel)	Hz	
4	**A**	f2	Measured value for input frequency (reference channel)	Hz	
5	**E**	rnmin	Lower adjusting value and fault limiting value	kg/m3	2)
6	**E**	rnmax	Upper adjusting value and fault limiting value	kg/m3	3)
9	**B**	rn-DF	Default value (replacement value if a fault occurs)	kg/m3	
10	**B**	rn-JP	Max. permissible jump from measured value to measured value	%	
14	**B**	rn<	Contact: lower limit	kg/m3	
15	**B**	rn>	Contact: upper limit	kg/m3	
17	**E**	rn-mod1	Mode 1: frequency = 2f / off / 1f		1)
18	**E**	rn-mod2	Mode 2: if a fault occurs = default / measured value (last measurement)		1)
20	**A**	rn-H	Hold value of the process gas for external calibration	kg/m3	
21	**E**	rn-S	Specified value of the test gas for external calibration	kg/m3	
22	**E**	drn>L	Maximum deviation for external calibration	%	
23	**A**	drn	Current deviation for ext. calib. (specified / actual-value comparison)	%	
24	**A**	rn-E	Measured value of the test gas for external calibration	kg/m3	
26	**E**	KW-rn	Standard density correction value after external calibration	kg/m3	
27	**E**	KK	Tuning fork constant KK		
28	**E**	KM	Tuning fork constant KM		
29	**E**	KR	Tuning fork constant KR		
30	**E**	KC	Tuning fork constant KC		
43	**A**	Frnk	Freeze: corrected standard density	kg/m3	
44	**A**	Frn	Freeze: standard density	kg/m3	
45	**A**	Ff1	Freeze: input frequency (measuring channel)	Hz	
46	**A**	Ff2	Freeze: input frequency (reference channel)	Hz	

Depending on the set mode (standard density either as frequency or as current), you will be referred to the C column or the I column after selecting the standard density.

1) Rolling texts! Press the **MODE** key to make your changes.
2) Assigning to the lower limiting value.
3) Assigning to the upper limiting value.

8.2.7 Volume flow rate at actual conditions

Flow Rate

↓ Direct access

		J (10)	Description of coordinates	Unit	Comment(s)
1	**A**	qa	Calculated volume flow rate at actual conditions	m3/h	
2	**A**	qac	Calculated corrected volume flow rate at actual conditions	m3/h	5)
3	**A**	fm	Measuring channel input frequency	Hz	
4	**A**	fr	Reference channel input frequency	Hz	
5	**E**	qamin	Lower fault limiting value of the volume meter	m3/h	
6	**E**	qamax	Upper fault limiting value of the volume meter	m3/h	
9	**B**	q-D%	Max. permissible difference between qam and qar	%	2)
10	**B**	qa-JP	Max. permissible jump from measured value to measured value	%	
13	**B**	q-A	Averaging factor for flow rate calculation and display		
14	**B**	qa<	Contact: lower limit	m3/h	
15	**B**	qa>	Contact: upper limit	m3/h	
17	**E**	Va-mod1	Mode 1: volume measurement = on / off		1) 3)
18	**E**	Va-mod2	Mode 2: operating mode = 1-c. / 1:1 (2-chan.) / x:y (2- chan.)		1) 4)
19	**E**	fault corr.	Mode: error curve linearization: none / polynominal / load points		1) 9)
22	**E**	d-Kvc>L	Limiting value for max. deviation due to error curve linearization	%	5)
23	**A**	d-Kvc	Deviation of corrected pulse value (Kvc) from pulse value (Kv)	%	5)
25	**A**	Kvc	Corrected pulse value of the volume meter	l/m3	5)
26	**E**	Kv	Volume meter pulse value	l/m3	
27	**E**	MWP	Number of blades of the measuring wheel * 10	l	
28	**E**	RWP	Number of blades of the reference wheel * 10	l	
29	**E**	DP	Limiting value for the number of missing pulses (official value 10)	l	6)
30	**E**	RP	Limiting value for the number of reference pulses (off. val. 10000)	l	6)
31	**E**	P Start	Suppression of fault messages during startup of volume meter	l	
32	**E**	f<L	Min. volume meter frequency	Hz	7)
33	**E**	t<q-min	Max. operating time for qa < qa-min	S	8)
34	**E**	A-2	Polynominal coefficient for error curve linearization		5)
35	**E**	A-1	Polynominal coefficient for error curve linearization		5)
36	**E**	A0	Polynominal coefficient for error curve linearization		5)
37	**E**	A1	Polynominal coefficient for error curve linearization		5)
38	**E**	A2	Polynominal coefficient for error curve linearization		5)
39	**A**	>qa	Max. qa value (peak value)	m3/h	
40	**A**	>	Time of max. value (date / time)		
43	**A**	Fqa	Freeze: volume flow rate at actual conditions	m3/h	
44	**A**	Fqac	Freeze: corrected volume flow rate at actual conditions	m3/h	5)
45	**A**	Ffm	Freeze: measuring channel frequency	Hz	
46	**A**	Ffr	Freeze: reference channel frequency	Hz	

Comments: See next page.

8.2.8 Energy flow rate, standard volume flow rate

Flow Rate

Indirect access by
pressing the → key

		K (11)	Description of coordinates	Unit	Comment(s)
1	**A**	qQ	Calculated energy flow rate	kW	1)
2	**A**	qn	Calculated standard volume flow rate	m3/h	
14	**B**	qn<	Contact: lower limit	m3/h	
15	**B**	qn>	Contact: upper limit	m3/h	
16	**B**	qQ<	Contact: lower limit	MJ/h	1)
17	**B**	qQ>	Contact: upper limit	MJ/h	1)
39	**A**	>qn	Max. qn value (peak value)	m3/h	
40	**A**	>	Time of max. value (date / time)		
41	**A**	>qQ	Max. qe value (peak value)	MJ/h	1)
42	**A**	>	Time of max. value (date / time)		1)
43	**A**	Fqn	Freeze: standard volume flow rate	m3/h	
44	**A**	FqQ	Freeze: energy flow rate	kW	1)

Comments on the column for the volume flow rate at actual conditions

1) This line is not available in the mode ERZ 9004 T

Standard volume flow rate

1) Rolling texts! Press the **MODE** key to make your changes.
2) If the percentage deviation between the qa measuring channel (qam) and the qa reference channel (qar) is smaller than the preset value, the arithmetic mean is used to display the qa flow rate and the qa current output. If the deviation is greater, the greater one of the two flow rates is used.
   Attention! The calculation or display of flow rates does not have any effect on the calculation and monitoring of totalizers.
3) Va-mod1 = off — The Flow Computer operates in the pulse counting mode without monitoring volume limits including f<L.
4) Va-mod2 = 1-chan. — J/9, J/27 - J/31 not active
   Va-mod2 = 1:1 — J/27, J/28 not active
   Va-mod2 = x:y — J/29, J/30, J/31 not active
5) ECL = none — The field is not displayed.
6) Number of permissible missing pulses for a quantity of reference pulses before an alarm is tripped.
7) Lower limiting frequency of the volume meter. When the frequency drops below the lower limiting frequency, correction is no longer carried out.
8) Time in seconds during which the volume meter can be operated below qa-min before an alarm is tripped.
9) The volume at actual conditions can be corrected via a polynominal or via load points. Please also refer to the annex "Survey of Equations Used".

8.2.9 Analysis

C. Factor

↓ Direct access

		L (12)	Description of coordinates	Unit	Comment(s)
1	**A**	VCF	Reference volume correct. factor via press., temp.and compressibility		
2	**A**	K	Compressibility factor calculated per GERG88-S or default value		
3	**A**	GCV,G	Via L11 corrected calorific value for GERG88-S		
4	**A**	rd,G	Via L11 corrected relative density for GERG88-S		
9	**B**	K-DF	Compressibility factor default value		
11	**E**	TB	Gas temperature before combustion	°C	1)
13	**B**	VCF-A	Averaging factor for VCF (from p, t and K)		
17	**B**	K-mod	Mode: K calculation = GERG88-S / K=const(ant)		1)
21	**A**	H2Calc	Display of the hydrogen content received by bus	%	
24	**A**	rbcalc	Calculated density at actual conditions	kg/m3	
28	**B**	H2-2	Hydrogen content of the gas (contact for analysis switching = open)	%	2)
32	**B**	H2-1	Hydrogen content of the gas (contact for analysis switching = closed)	%	2)
40	**A**	Zn	Real gas factor at standard conditions		
41	**A**	Z	Real gas factor at actual conditions		
43	**A**	FVCF	Freeze: volume correction factor		
44	**A**	FK	Freeze: compressibility factor		

1) Rolling texts! Press the **MODE** key to make your changes.
2) Inputs must be made in mol %. If values are only available in vol %, you must convert them to mol %. Conversion:
   $\text{mol \%}_{H2} = \text{vol \%}_{H2} * 0.9964$

8.3 Outputs

8.3.1 Current outputs

Output

↓ Direct access

→ → →

		Analog 1	Analog 2	Analog 3	Analog 4			
		M (13)	**N (14)**	**O (15)**	**P (16)**	**Description of coordinates**	**Unit**	**Comment(s)**
1	**A**	I1O	I2O	I3O	I4O	Physical value for output n	variable	
3	**A**	I	I	I	I	Current for output n	mA	
5	**B**	O1min	O2min	O3min	O4min	Lower limiting value for output n	variable	2)
6	**B**	O1max	O2max	O3max	O4max	Upper limiting value for output n	variable	2)
9	**B**	I1CC	I2CC	I3CC	I4CC	Calibration current default value	mA	3)
11	**B**	O1CS	O2CS	O3CS	O4CS	Selection of coordinate		4)
12	**B**	I1-c	I2-c	I3-c	I4-c	Correct. Factor (D/A converter offset)		
13	**B**	I1-A	I2-A	I3-A	I4-A	Averaging factor (damping)		
17	**B**	I1-mod	I2-mod	I3-mod	I4-mod	Mode: operating mode = off / 0-20 mA / 4-20 mA / calib. C.		1)

1) Rolling texts! Press the **MODE** key to make your changes.
2) Assigning physical limits to 0/4 mA or 20 mA.
3) If the "calibration current" mode is selected under I(n)-mod, the corresponding output (n) operates as current transmitter. The current value preselected in this field will be outputted.
4) Selection of measured value to be outputted as current. Preselected the value via ist coordinate. Example: See Annex B.

8.3.2 Dispatcher outputs

Output

Indirect access by pressing the → key 4 times →

		Digital 1	Digital 2			
		Q (17)	**R (18)**	**Description of coordinates**	**Unit**	**Comment(s)**
1	**A**	Dispatcher 1	Dispatcher 2	Designation of the selected dispatcher		
9	**B**	P Width	P Width	Setting the dispatcher pulse width (50 - 300)	ms	
11	**B**	D1CS	D2CS	Assignment of the dispatcher = Va / Vn / Vac / Ve		1)
17	**B**	D1-mod	D2-mod	Mode: dispatcher = off / on		1)
27	**B**	Df1	Df2	Pulse value (0.001 to 10000)	X/p	

1) Rolling texts! Press the **MODE** key to make your changes.

8.3.3 Data interface A

Output

Indirect access by
pressing the → key 6 times

		S (19)	Description of coordinates	Unit	Comment(s)
1	**A**	Data 1/ Front	Designation of the RS 232 C data interface Data 1: front panel for service laptop computer		2)
2	**B**	D-mod1	Mode 1: interface = off / on		1)
3	**B**	D-mod2	Mode 2: Data (for PC) / HP DeskJet / EPSON / Reverse		1)
4	**B**	Baudr.	Bit rate = 300 / 600 / 1200 / 2400 / 4800 / 9600		1)
9	**A**	Data 2 / C1	Designation of the RS 232 C data interface Data 2: rear panel for printer connection		2)
10	**B**	D-mod1	Mode 1: interface = off / on		1)
11	**B**	D-mod2	Mode 2: Data (for PC) / HP DeskJet / EPSON / Reverse		1)
12	**B**	Baudr.	Bit rate = 2400 / 4800 / 9600 / 19200		1)
17	**A**	Data 3 / C3	Designation of the RS 232 C data interface Data 3: rear panel for FE-06		2)
18	**B**	D-mod1	Mode 1: interface = off / on		1)
19	**B**	D-mod2	Fixed setting for FE-06 (data)		
20	**B**	Baudr.	Bit rate = 1200 / 2400 / 4800 / 9600 / 19200		1)
21	**B**	Stopbit	Stop bit setting = 1 / 2		1)
22	**B**	Parity	Parity bit setting = off / even / odd		1)
25	**A**	Data 4 / C4	Designation of the RS 232 C data interface Data 4: rear panel		2)
26	**B**	D-mod1	Mode 1: interface = off / on		1)
27	**B**	D-mod2	Mode 2: Selection of bus type = Reserved / EGO / RMG-Bus		3)
28	**B**	Baudr.	Bit rate = 1200 / 2400 / 4800 / 9600 / 19200		1)
29	**B**	Stopbit	Stop bit setting = 1 / 2		1)
30	**B**	Parity	Parity bit setting = off / even / odd		1)
31	**A**	RBS:	RMG Bus status indications		
34	**A**	Data 5 / C5	Designation of the RS 232 C data interface Data 5: rear panel		2)
35	**B**	D-mod1	Mode 1: interface = off / on		1)
36	**B**	D-mod2	Reserved		
37	**B**	Baudr.	Bit rate = 1200 / 2400 / 4800 / 9600 / 19200		1)
38	**B**	Stopbit	Stop bit setting = 1 / 2		1)
39	**B**	Parity	Parity bit setting = off / even / odd		1)

1) Rolling texts! Press the **MODE** key to make your changes.
2) Heading, no writing into this data field.
3) EGO = special message for Erdgas Ostschweiz

8.3.4 Data interface B

Output

Indirect access by
pressing the → key 7 times

		T (20)	Description of coordinates	Unit	Comment(s)
1	**A**	Data 6 / C2	Designation of the RS 485 data interface Data 6: rear panel for DSfG applications		2)
2	**E**	D-mod1	Mode 1: interface = off / on		1)
4	**B**	Baud-rate	Data 6: bit rate = 1200 / 2400 / 4800 / 9600 / 19200		1)
5	**B**	Stop-bit	Stop bit setting = 1 / 2		1)
6	**B**	Parity	Parity bit setting = off / even / odd		1)
7	**E**	DSFG-Addr U:	Address on DSfG bus (1 to 31)		
8	**E**	Preset U:	Identification for PTB stamp		
9	**E**	Source-Addr	Address of the device sending data		
10	**E**	Source-Preset	Identification of the device sending data		
11	**E**	DSFG-Addr R:	Address of data logger ET 9000		
12	**E**	Preset R:	Identification of data logger ET 9000		
13	**A**	E-1	Log for remote adjustments via the DSfG interface		3)
14	**A**	T-1	Log for remote adjustments via the DSfG interface		3)
15	**A**	E-2	Log for remote adjustments via the DSfG interface		3)
16	**A**	T-2	Log for remote adjustments via the DSfG interface		3)
17	**A**	E-3	Log for remote adjustments via the DSfG interface		3)
18	**A**	T-3	Log for remote adjustments via the DSfG interface		3)
19	**A**	E-4	Log for remote adjustments via the DSfG interface		3)
20	**A**	T-4	Log for remote adjustments via the DSfG interface		3)
21	**A**	E-5	Log for remote adjustments via the DSfG interface		3)
22	**A**	T-5	Log for remote adjustments via the DSfG interface		3)
23	**A**	E-6	Log for remote adjustments via the DSfG interface		3)
24	**A**	T-6	Log for remote adjustments via the DSfG interface		3)
25	**A**	E-7	Log for remote adjustments via the DSfG interface		3)
26	**A**	T-7	Log for remote adjustments via the DSfG interface		3)
27	**A**	E-8	Log for remote adjustments via the DSfG interface		3)
28	**A**	T-8	Log for remote adjustments via the DSfG interface		3)
29	**A**	E-9	Log for remote adjustments via the DSfG interface		3)
30	**A**	T-9	Log for remote adjustments via the DSfG interface		3)
31	**A**	E-10	Log for remote adjustments via the DSfG interface		3)
32	**A**	T-10	Log for remote adjustments via the DSfG interface		3)
34	**A**	print format	Heading		2)
35	**B**	P-CH1	Selection of the measured value for column 1 of the print format		1) 4)
36	**B**	P-CH2	Selection of the measured value for column 2 of the print format		1) 4)
37	**B**	P-CH3	Selection of the measured value for column 3 of the print format		1) 4)
38	**B**	P-CH4	Selection of the measured value for column 4 of the print format		1) 4)
39	**B**	P-CH5	Selection of the measured value for column 5 of the print format		1) 4)
40	**B**	P-CH6	Selection of the measured value for column 6 of the print format		1) 4)
41	**B**	P-CH7	Selection of the measured value for column 7 of the print format		1) 4)
42	**B**	P-CH8	Selection of the measured value for column 8 of the print format		1) 4)

1) Rolling texts! Press the **MODE** key to make your changes.
2) Heading, no writing into this data field.
3) Log for remote adjustment via data transmission when using the DSfG interface.
4) Free assembly of the print format.

8.4 Totalizers

Totalizer

↓ Direct access

		U (21)	Description of coordinates	Unit	Comment(s)
1	**A**	Vn / Q	Main totalizer for standard volume / energy	kWh	6)
2	**A**	Vac	Main totalizer for corrected volume at actual conditions	m3	2)
3	**A**	Va	Main totalizer for uncorrected volume at actual conditions	m3	
4	**A**	Vn	Main totalizer for standard volume	m3	5)
9	**A**	VnD / QD	Disturbing quantity totalizer for standard volume / energy	m3	6)
10	**A**	VcD	Disturbing quantity totalizer for corrected volume at actual cond.		2)
11	**A**	VaD	Disturbing quantity totalizer for uncorrected volume at actual cond.	m3	
12	**A**	VnD	Disturbing quantity totalizer for standard volume		5)
17	**E**	INDX-mod	Mode: main totalizers = alarm stop / alarm run(ning)		1) 3)
18	**B**	INDX-S1	Assigning output contact 1 = Va, Vac, Ve, Vn		1)
19	**B**	INDX-S2	Assigning output contact 2 = Va, Vac, Ve, Vn		1)
20	**B**	If1	Totalizer factor output contact 1 = 1 / 10 / 100 / 1.000 / 10.000		1)
21	**B**	If2	Totalizer factor output contact 2 = 1 / 10 / 100 / 1.000 / 10.000		1)
25	**E**	Vac-set	Setting: main totalizer for corrected volume at actual conditions	m3	2) 4)
26	**E**	Vn-set	Setting: main totalizer for standard volume	m3	4)
27	**E**	Q-set	Setting: main totalizer for energy	kWh	4) 5)
28	**E**	Va-set	Setting: main totalizer for uncorrected volume at actual conditions	m3	4)
29	**E**	VacD-set	Setting: dist. quantity totalizer for corr. volume at actual conditions	m3	2) 4)
30	**E**	VnD-set	Setting: disturbing quantity totalizer for standard volume	m3	4)
31	**E**	QD-set	Setting: disturbing quantity totalizer for energy	kWh	4) 5)
32	**E**	VaD-set	Setting: dist. quantity totalizer for uncorr. volume at actual conditions	m3	4)
43	**A**	FVn / FQ	Freeze: standard volume / energy	kWh	6)
44	**A**	FVac	Freeze: corrected volume at actual conditions	m3	2)
45	**A**	FVa	Freeze: uncorrected volume at actual conditions	m3	
46	**A**	FVn	Freeze: standard volume	m3	5)

The number of digit positions preceding or following a decimal point depends on the size of the flow meter preset in the ID data field.

	Size <= G 2500		**Size > G 2500**	
	Digit positions preceding / following a decimal point		Digit positions preceding / following a decimal point	
Vn	10	3	11	2
Va	9	3	10	2
Vac	9	3	10	2

1) Rolling texts! Press the **MODE** key to make your changes.
2) ECL (J19) = no: The field is not displayed.
3) Tot-mod = alarm stop: In the event of an alarm (Annex D) the main totalizers stop and the disturbing quantity totalizers start to run.
   Tot-mod = alarm run: In the event of an alarm (Annex D) the main totalizers continue to run and in addition to this, the disturbing quantity totalizers start to run.
4) To set the totalizer, you must first input the code number and then set the calibration switch to "Input". Example: see Annex D.
   Attention! Observe the sequence of operations.
5) This line is only available in the ERZ 9104 T mode.
6) Vn in the ERZ 9004 T mode, Q in the ERZ 9104 T mode

8.5 Test

Test

↓ Direct access

		V (22)	Description of coordinates	Unit	Comment(s)
1	**A**	CVn / CQ	Calibration during operation: totalizer for energy	kWh	2) 4)
2	**A**	CVc	Calibration during operation: totalizer for corr. volume at actual cond.	m3	1) 2)
3	**A**	CVa	Calibration during operation: totalizer for uncorr. volume at actual cond.	m3	2)
4	**A**	CQ / CVn	Calibration during operation: totalizer for standard volume	m3	2) 4)
5	**A**	t CDO	Duration of calibration during operation	s	3)
43	**A**	FVnD / FQD	Freeze: Vn / Q disturbing quantity	kWh	4)
44	**A**	FVcD	Freeze: Va disturbing quantity, corrected	m3	1)
45	**A**	FVaD	Freeze: Va disturbing quantity, uncorrected	m3	
46	**A**	FQD / FVnD	Freeze: Q / Vn disturbing quantity	m3	4)

1) ECL (J19) = "none": The field is not displayed.
2) The totalizer can be started and stopped independently of the main totalizer via the **TEST** key. See also Chapter '"TEST Key Special Function".
3) Indication of running time of the totalizers for calibration during operation.
4) It depends on the mode whether Q or Vn is displayed (the first for ERZ 9004 T, the second for ERZ 9104 T).

8.6 ID display

ID

↓ Direct access

	W (23)	Description of coordinates	Unit	Comment(s)
1	Heading	ID line 1 / n		
2	ID	ID lines 2 to n-1		1)
3	Bottom line	** End of ID **		

1) Display of ID data. The contents and the length of the ID data field depend on the chosen model. Make your inputs in the ZB column.

8.7 Mode

ID

Indirect access by
pressing the [→] key

		X (24)	Description of coordinates	Unit	Comment(s)
1	**A**	Modes	Heading		
2	**A**	time	Current time		
3	**B**	date	Current date		
4	**E**	code	User code (can only be defined if slide switch is set to "Input")		
5	**A**	op.h.	Indication of operating hours	hours	
6	**B**	F mod	Freeze mode = manual or automatic (min / hour / day / week / month)		1) 2)
7	**B**	F time	Time: freeze start		
8	**B**	F date	Date: freeze start		
9	**B**	F repeat	Repetition rate for automatic freezing		2)
10	**A**	F	Indication of time / date of last freeze operation		
11	**B**	Pr mod1	Print initiation via internal clock or external contact		1)
12	**B**	Pr mod2	Switching over between automatic and revision print		1) 3)
13	**B**	Pr mod3	Manual printout or channel data report		1) 6)
14	**B**	Pr start	Start time for automatic printout		
15	**B**	Auto rep:	Repetition time for automatic printout (0, 1, 2, 3, 4, 6, 12, 24)	hours	5)
16	**B**	Rev. rep:	Repetition time for revision printout (1 to 99)	minutes	
17	**A**	LPr	Time of last printout		
18	**B**	><Cont.	Limit contacts: definition of coordinate (assignm. to a meas. value)		1) 4)
19	**B**	Display-mod	Active display time (30 min / 6h - 18h / continuous duty)		1)
20	**A**	Comp. type	9000Turbo		
21	**A**	Version	Software version: version No. / date		
22	**B**	Comp. No.	Serial number		
23	**E**	Comp. mod:	Mode: 9002T / 9002/4T / 9102T / 9102/4T / 9104T / 9004T / 9102/4L / 9004 / 9002TM		1)
24	**B**	RTC-corr.	Correction factor for real-time clock		
25	**E**	f Vol	Internal clock frequency (quartz divided by 12) for volume frequencies	Hz	
26	**E**	f Den	Internal clock frequency (quartz divided by 12) for density frequencies	Hz	
27	**A**	Lamp test bottom	Lamp test of bottom line of display		
28	**A**	Lamp test top	Lamp test of top line of display		
31	**B**	Day print	on / off; printing the sum of the day (ethylene)		
32	**B**	t-DayPrint	hh-mm-ss; time for starting the day print		
33	**B**	Page length	Number of lines per page (e.g. 62)		
34	**B**	St.:	Name of station; input via PC, 15 characters		
35	**B**	Del.:	Name of customer; input via PC, 15 characters		
36	**B**	MS.:	Measuring point; input via PC, 15 characters		
37	**B**	Pr.:	Product (gas type); input via PC, 15 characters		

1) Rolling texts! Press the **MODE** key to make your changes.
2) If F-mod = "manual" is selected, the F-rep mode is not active.
   If F-mod = "minute, hour, day, week, or month" is selected, the freeze operation is carried out periodically in connection with the field X9. See also Chapter "'Test" Key Special Function.
3) Printing is automatically carried out in connection with the field X15 or as revision printing in connection with the field X16
4) Select the measured value whose < and > limit contacts should be available as output contacts.
5) Repetition time = 0: printing is carried out only once a day at the set start time.
6) The manual print out is **not** possible at a full hour plus/minus 10 minutes (only from hh:11:00 to hh:49:00). Otherwise there might be a conflict with the automatic print.

8.8 Clear / Fault

Clear Fault

↓ Direct access

		Y (25)	Description of coordinates	Unit	Comment(s)
1	**A**	Heading	Indication of faults		
2	**A**	Status	Fault No. / text or "no error" for undisturbed operation		
3	**A**	time	Time of the first fault message		
4	**A**	date	Date of the first fault message		
5	**A**	clear fault(s) ?	Indirect clearing function		
6	**A**	CF	Indication of the time of clearing the last faults		
7	**A**	Def.Wr:	Coordinate where a default value is written		
17	**B**	Fault-mod	Fault clearing mode = direct / indirect		1)
20	**E**	rn mod	Mode for standard density = rhon[f] / rhon[l]		1)
21	**B**	External	Mode for J 8 input (pins 1 & 2) = freeze / print		1)
22	**E**	AD corr.	Input of A/D converter correction value		
23	**E**	2-Way?	normal / 2-Way		
29	**E**	PGC-Timeout	Input of PGC monitoring time		2)

For more information, please refer to Chapter 5.

1) Rolling texts! Press the **MODE** key to make your changes
2) The Flow Computer monitors the measuring internals of the PGC, settable in minutes. Special case: monitoring is switched off at 999. This is of importance if a revision of the PGC is to be made.

8.9 Error curve linearization via load points

ID

Indirect access by
pressing the ⇒ key 3 times

		ZA (26)	Description of coordinates	Unit	Comment(s)
1	**A**	Heading	KV corr. parameters		
2	**E**	LP-n	Input of load points 1 - 12: percentage load of the meter	%	1)
3	**E**	E-LP-n	Input of the error at load point 1-12: error	%	1)

1) Load point data input fields
   LP : Load point = percentage load of the gas meter related to qa_{max}
   E-LP : Error at the load point = percentage error of the meter at the selected load point with regard to the zero line

   You can input a maximum of 12 load points. If less than 12 load points are required, you must program the next unused load point LP to carry the value 0. The value 0 serves the flow computer as an abort condition.

8.10 ID input

ID

Indirect access by
pressing the [→] key 4 times

		ZB (27)	Description of coordinates	Unit	Comment(s)
1	**A**	Heading	ID input		
2	**E**	ID	Input fields for ID display		1)

1) ID data input fields.
The length of the column ZB and, therefore, the length of the ID display depend on the chosen model.

8.11 Backup data (only for service)

ID

Indirect access by
pressing the [→] key 5 times

		ZC (28)	Description of coordinates	Unit	Comment(s)
1	**A**	Heading	backup value		1)
...	**...**	...	...		
47	**A**	ID	backup value		1)

1) This column is only displayed if the calibration switch is set to "Input".

Annex A Survey of Equations Used

Equations for the ERZ 9004 T, ERZ 9104 T

Volume flow rate at actual conditions

q_a	=	Volume flow rate at actual cond.	(m^3/h)
f_V	=	Volume transmitter frequency	(Hz)
K_V	=	Meter factor	(pulses/m^3)

$$q_a = \frac{f_V}{K_V} \cdot 3600$$

Volume at actual conditions

V_a	=	Volume at actual conditions	(m^3)
p_V	=	Volume pulse	
K_V	=	Meter factor	(pulses/m^3)
K_{Z1}	=	V_a totalizer factor (output contact only)	

$$V_a = \frac{p_V}{K_V} \cdot \frac{1}{K_{Z1}}$$

Compressibility factor

K	=	Compressibility factor
Z	=	Real gas factor
Z_n	=	Real gas factor at standard conditions

$$K = \frac{Z}{Z_n}$$

Calculation is made in accordance with GERG 88 pursuant to G 9.

Volume correction factor

$VCF_{(p,t)}$	=	Volume correction factor	
p	=	Absolute pressure	(bar)
T	=	Temperature	(Kelvin)
T_n	=	Standard temperature	(Kelvin)
p_n	=	Standard pressure	(bar)

$$VCF_{(p,t)} = \frac{p \cdot T_n}{p_n \cdot T \cdot K}$$

Standard density

r_n	=	Standard density	(kg/m^3)
K_K	=	Transmitter / transducer constant	
K_M	=	Transmitter / transducer constant	
K_R	=	Transmitter / transducer constant	
K_C	=	Transmitter / transducer constant	

$$r_n = K_K \cdot \frac{K_M + \tau_M^{\,2}}{K_R + \tau_R^{\,2}} + K_C$$

$$\tau = \frac{1}{f} \cdot 10^4 = \text{period } (\mu s)$$

Standard volume

V_n	=	Standard volume	(m^3)
V_a	=	Volume at actual conditions	(m^3)
$VCF_{(p,t)}$	=	Volume correction factor	
K_{Z2}	=	V_n totalizer factor (output contact only)	

$$V_n = V_a \cdot VCF_{(p,t)} \cdot \frac{1}{K_{Z2}}$$

Standard volume flow rate

q_n	=	Standard volume flow rate	(m^3/h)
f_V	=	Volume transmitter frequency	(Hz)
K_V	=	Meter factor	(pulses/m^3)

$$q_n = \frac{f_V}{K_V} \cdot VCF \cdot 3600$$

Equations for the ERZ 9104 T

Energy

Q	=	Energy	(kWh) (MJ)
$H_{s,n}$	=	Superior calorific value	(kWh/m3)
K_{Z2}	=	V_e totalizer factor (output contact only)	

$$Q = V_n \cdot H_{s,n} \cdot \frac{1}{K_{Z2}}$$

Energy flow

q_e	=	Energy flow	(kW) (MJ/h)

$$q_e = V_n \cdot H_{s,n} \cdot 3600$$

Gas meter error curve linearization

Polynominal

Linearization is made using a quartic polynominal which simulates the error curve of the gas meter.

Error equation: $E = A_{-2} * q_a^{-2} + A_{-1} * q_a^{-1} + A_0 + A_1 * q_a + A_2 * q_a^2$

E	=	Deviation of the error curve	(%)
q_a	=	Volume flow rate at actual cond.	(m^3/h)
A_n	=	Constants	

The following values are permanently programmed in the computer: A_1: 10^{-4} A_2: 10^{-8}

The constants A_n (n = -2 to n = 2) are calculated from the measured value pairs error E_i and flow rate q_{ai}. Instead of the constant meter factor K_V, the corrected meter factor K_{Vc} is used for subsequent calculation or correction.

$$K_{Vc} = K_V \cdot \left(1 + \frac{f}{100}\right)$$

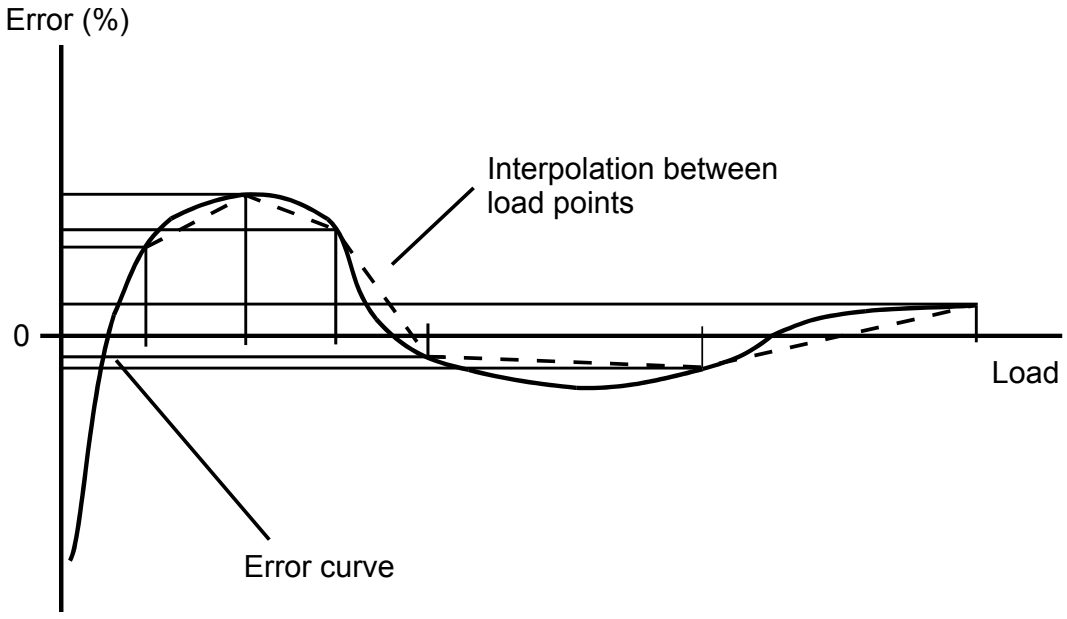
Load point method

The load point method includes up to 12 load points. The selected percentage loads related to qa_{max} are entered on the x-axis (parameters LP n). LP stands for "load point" and n for 1...12. For each load point, the deviation from the zero line is entered (parameters E-LP n). E-LP stands for "error at the load point". Make your inputs in the column ZA. If less than 12 load points are required, you must program the next unused load point to carry the value 0 as an abort condition for the linearization program.

Note: You must input the values in the min. to max. load sequence!

Thus, the volume flow rate at actual conditions q_a is calculated from the following equation:

f_V	=	Volume transmitter frequency	(Hz)	
K_{Vc}	=	Corrected meter factor	(pulses/m^3)	$q_{ac} = \frac{f_V}{K_{Vc}} \cdot 3600$



Annex B Operating Examples

Displaying measured values and constants

1. example

Press the **PRESSURE** key

P	**34,26**	**bar a**	
Ip	**13,50**	**mA**	

Press ↓

P	**34,26**	**bar a**	
P-min	**10,00**	**bar a**	P min

Press ↓

P	**34,26**	**bar a**	
P-max	**50,00**	**bar a**	P max

Press →

T	**10,57**	**bar a**	
T-max	**30,00**	**mA**	T max

Press →

qa	**734,26**	**m3/h**	
qa-max	**3600,00**	**m3/h**	qa max

2. example

Press the **C FACTOR** key

VCF	**55,41**	
K	**0,988**	

Press ↓ 6 times

VCF	**55,41**	
K-mod	**GERG**	

Press ↓ 3 times

VCF	**55,41**	
H2-2	**xx,xx**	**%**

Press ↓

VCF	**55,41**	
H2-1	**xx,xx**	**%**

Press ↓

VCF	**55,41**	
Zn	**x,xxx**	

Press ↓

VCF	**55,41**	
Z	**xx,xx**	

Programming a new constant

You want to change the p-max value to 41,50 bar.

Press the **Pressure** key

P	**34,26**	**bar a**
Ip	**13,50**	**mA**

Press ↓ twice

P	**34,26**	**bar a**
P-max	**50,00**	**bar a**

P max range

Set the **SWITCH** to “Input“

Press the **Enter** key. The bottom line of the display turns darker and the POWER / STANDBY LED flashes at one-second intervals to indicate the programming mode.

Press the “4“ key

P	**34,26**	**bar a**
P-max	**4....**	

Press the “1“, “±“, “5“ and “0“ keys consecutively.

P	**34,26**	**bar a**
P-max	**41,50**	

Press the **Enter** key

P	**34,26**	**bar a**
P-max	**41,50**	**bar a**

The display turns bright and the unit indicated again.

Lock the data inputted by means of the **SWITCH**.

Programming is completed!

General information about inputting new values:
If a value is locked with the code number (user data), you must first input the correct code number into the appropriate field (X4) in the **MODE** function (see example on Page 39). You can input values either in the short designation or coordinate display mode. Switching over is possible at any time by pressing the **SELECT** key.

Programming current / dispatcher outputs

Current outputs
You can select the desired values in the columns M11, N11, O11, P11 via the **OUTPUT** function key and the cursor keys. To input coordinates, you must input the appropriate digits (A = 01, B = 02, etc.) instead of the letters of the columns concerned (A, B, etc.). However, you can only connect the fields 1 and 2 of the columns A to L to one current output!

Example: You want to output the standard volume flow rate (coordinate K2) to current output 1. (Column K corresponds to the number 11; see Page 12 Flow Rate 2 column)

1) Press the **OUTPUT** key.
2) Press ↓ four times (e.g. "O1-CS K-1" is indicated on the bottom line of the display).
3) Press the **ENTER** key. (The display switches over to "O1-CS 11-1").
4) Input the key sequence "1" "1" "2" (for field K2) into the field M11. (The first two digits stand for the column and the third digit stands for the field.)
5) Press the **ENTER** key.

Dispatcher outputs
Programming dispatcher outputs is analogous to the procedure for programming current outputs.

Programming a new mode
You want to change the mode of the pressure transmitter from 0-20 mA to 4-20 mA

Press the **PRESSURE** key.

p	**34.26**	**bara**
Ip	**13.50**	**mA**

Press ↓ nine times.

p	**34.26**	**bara**
p-mod1	**0-20**	**mA**

Set the **SWITCH** to "Input".
The POWER / STANDBY LED flashes at one-second intervals to indicate the programming mode, and after you have pressed the **ENTER** key, the bottom line of the display turns darker.

Press the **MODE** key.

p	**34.26**	**bara**
p-mod1	**4-20**	**mA**

The setting changes from 0-20 mA to 4-20 mA.

Press the **ENTER** key and lock the data inputted by means of the "Input**" SWITCH**.

Setting main totalizers

You want to set the main totalizer V_a to 100000.

First input the code number and then set the **SWITCH** to "Input".
Press the **TOTALIZER** key.

Vn	**000004321.985**	**m3**
Va	**00000346.987**	**m3**

Press ↓ so many times until "Va-set" appears.

Vn	**000004321.985**	**m3**
Va-set	**0**	**m3**

Press the **ENTER** key. The bottom line of the display turns darker and the POWER / STANDBY LED flashes at one-second intervals to indicate the programming mode.

Press the keys "1" "0" "0" "0" "0" "0" consecutively.
Press the **ENTER** key.

Vn	**000004321.985**	**m3**
Va-set	**100000**	**m3**

After the data have been transferred, "Va-set" returns to "0".
Then lock the data inputted by means of the "Input" **SWITCH.**

Setting and resetting disturbing quantity totalizers is performed in the same way.

NOTE:
If you set the mode in the column J19 (ECL) to "polynominal" or "load points", the sequence of the totalizers changes, since additional totalizers are inserted for the corrected volume at actual conditions.

Enabling programming

Code number to enable user access

First press the **MODE** key and then the → key. The time is indicated.

Mode
Time: 12-48-10

Press ↓ twice.

Mode
Code ** - ******

Press the ENTER key and input the appropriate digits.

Mode
Code *

The digits inputted remain invisible. Each digit is marked with an asterisk.

Press the **ENTER** key to complete the data input.

Mode
Code ** - ******

If the code number is correct, the POWER / STANDBY LED on the front panel starts to flash at one- second intervals. If the code number is incorrect, the display returns to

Mode
Code ** - ******

Repeat the operation using the correct code number!

The computer enables you to access user data. To change data, you must select the desired coordinate on the bottom line of the display and press the **ENTER** key. The brightness of the bottom line is reduced to indicate that access to the coordinate field is enabled. If you want to lock the computer again after having completed your programming, press the **CLEAR / FAULT** key twice quickly. If you forget to do so, the computer itself disables access after approx. 30 minutes. It is possible to change the code number if the sealable slide switch is in its "Input" position.

Sealable switch for the Office of Weights and Measures

When the switch is operated, the POWER / STANDBY LED starts to flash at one-second intervals and access to the memories (incl. code number) is enabled. To change data, you must select the desired coordinate on the bottom line of the display and press the **ENTER** key. The brightness of the bottom line is reduced to indicate that access to the coordinate field is enabled.

Annex C Technical Data

Inputs

Analog inputs: 14½-bit resolution. Accuracy ± 1 bit, measuring period approx. 100 ms.

Volume frequency: 16-bit resolution. Range: 0.05 Hz to 20 kHz or metering from 0 Hz.

Frequency inputs: 23-bit resolution, range from 0.05 Hz to 25 kHz.

Digital inputs: Passive (relay or open collector); load 5 V 20 mA.

Status signals: td_{high} > 1 s td_{low} > 1 s

Outputs

Analog outputs: 14±1-bit resolution, load 800 ohms, electrically isolated.

Digital outputs: **Limiting value 24V 100mA**

Dispatcher
Minimum pulse width adjustable from 50 ms (10 Hz) to 300 ms (1.5 Hz).
Output frequency from 0 to 10 Hz, electrically isolated open collector.
Totalizer pulses
Pulse width approx. 150 ms (3 Hz), pulse width not adjustable.
Electrically isolated open collector.
Limit contacts
Electrically isolated open collector.
Fault / Warning
Relay contacts (closed-circuit principle).

Interfaces

Design:
Front panel - rack- / wall-mounting unit
1 9-pin subminiature Cannon connector
Rear panel - rack-mounting unit
5 9-pin subminiature Cannon connectors
Rear panel - wall-mounting unit
1 interface, screw terminals in the terminal compartment

Front panel: RS 232 C for personal computer or printer connection

Rear panel:
C1 interface
RS 232 C for personal computer or printer connection
C2 interface
RS 485 C for standard data communication applications (DSfG)
C3 interface
RS 232 C for FE-06 connection
C4 & C5 interfaces
RS 232 C - spare -

Power supply

Stand. power supply unit: 24 V DC (21 V to 27 V), power input approx. 35 W

Special version: 230 V AC (-10% to +6%), power input approx. 35 W

Option: The standby battery sustains the power supply of the ERZ 9000T including transducers / transmitters for approx. 30 minutes. After a discharge, the battery attains its full power after approx. 10 hours.

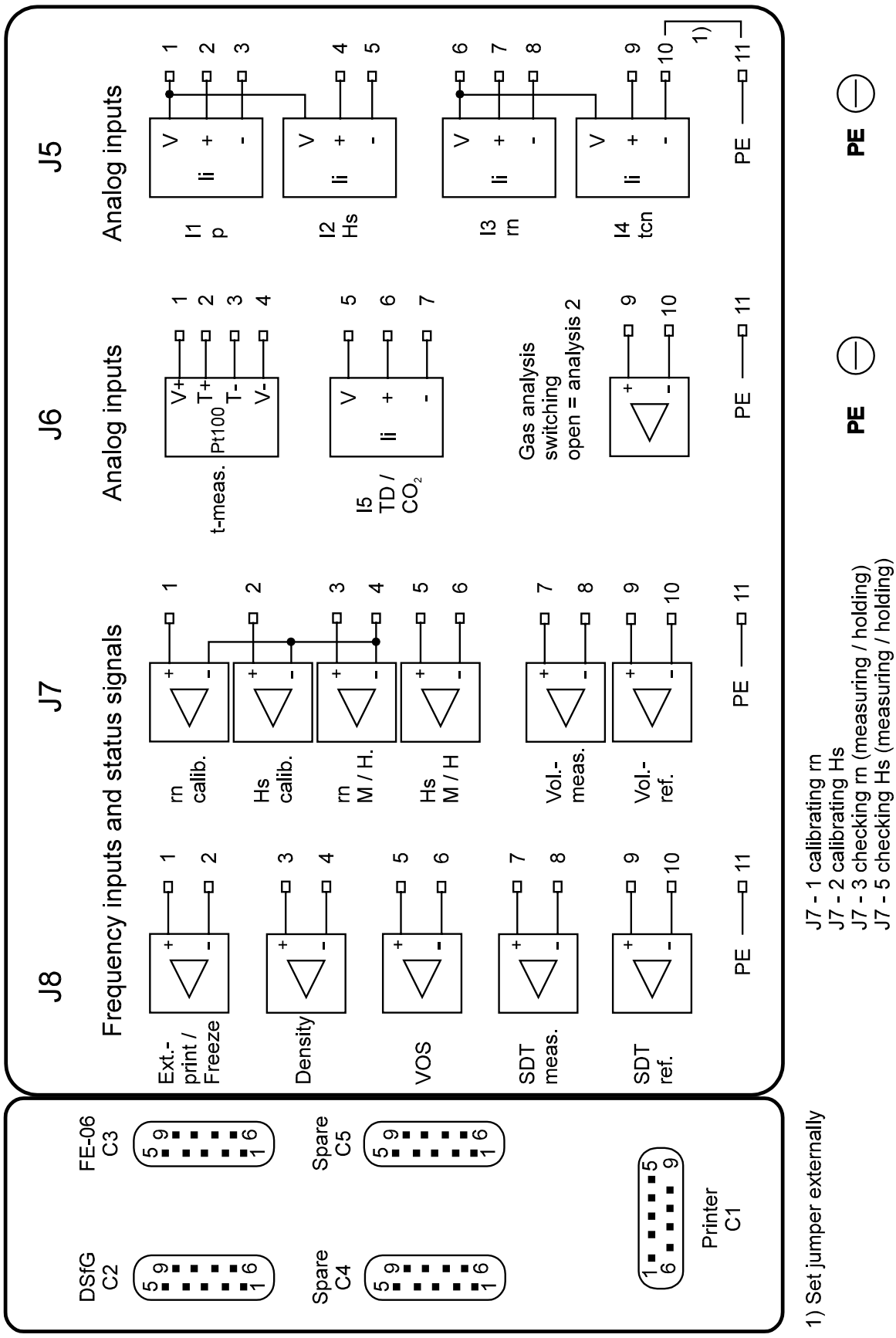
Weight & dimensions

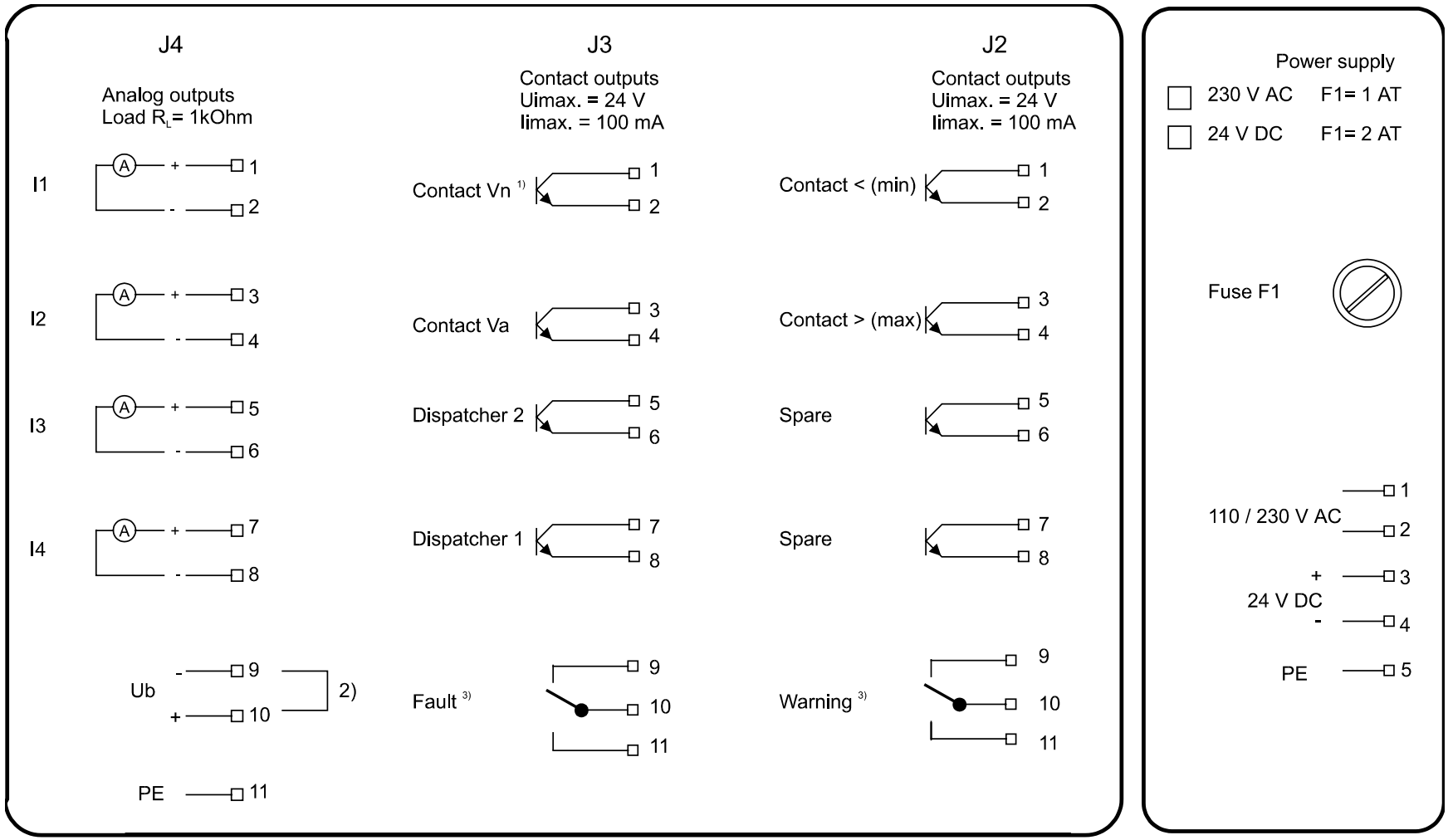
Rack-mounting unit: Height 3 units, width 213 mm, depth 310 mm
weight excl. battery approx. 3.2 kg, weight incl. battery approx. 4 kg

Wall-mounting unit: Height 245 mm, width 340 mm, depth 260 mm
weight excl. battery approx. 3.7 kg, weight incl. battery approx. 4.5 kg

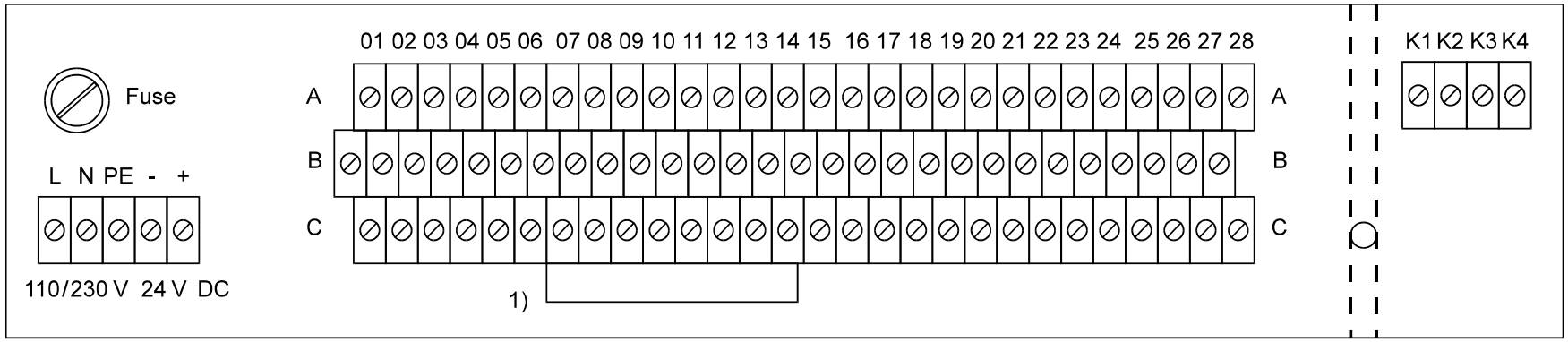
Annex D Pin Assignment Diagrams

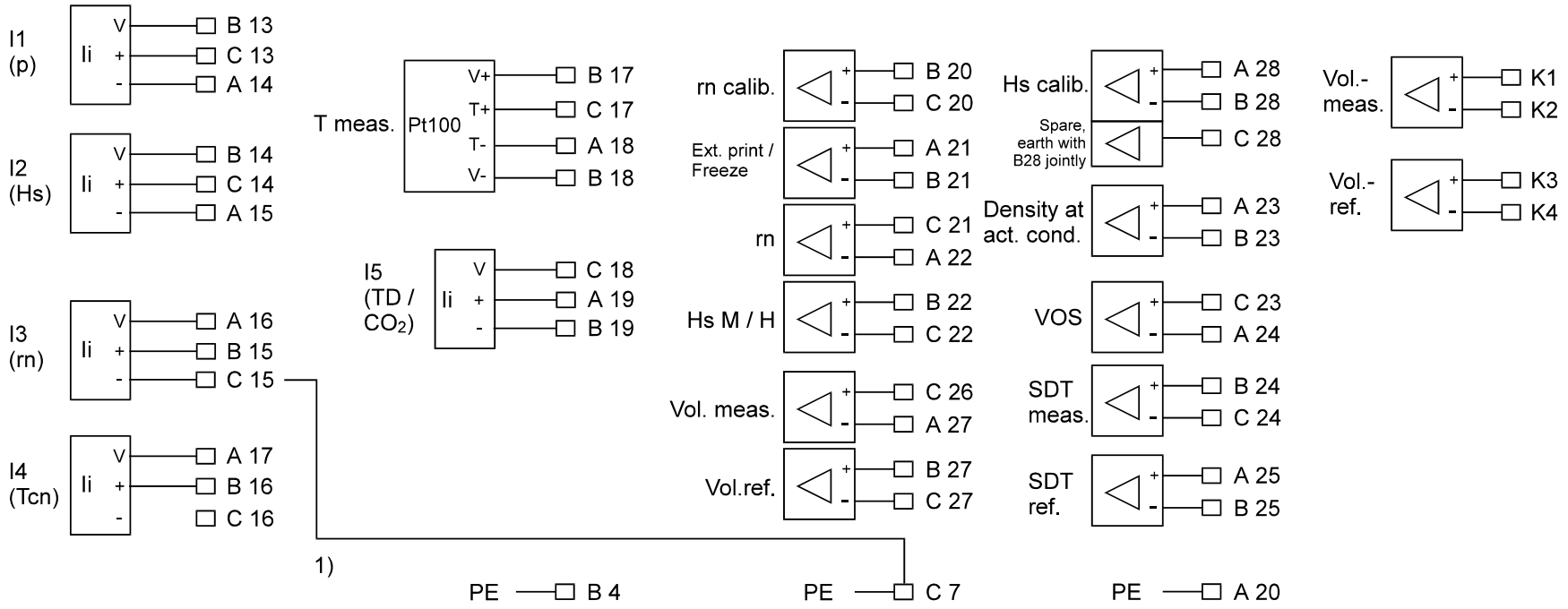
Inputs of the rack-mounting unit



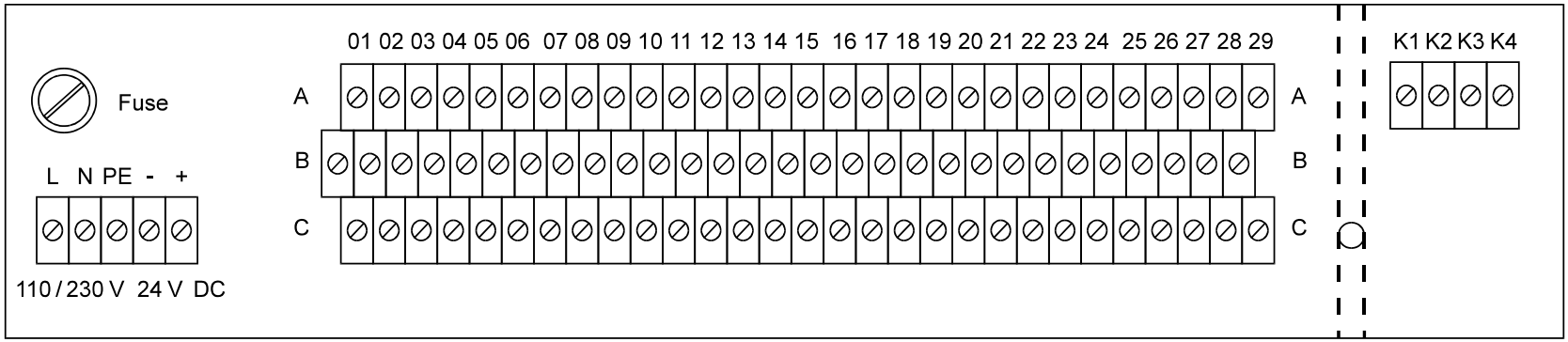


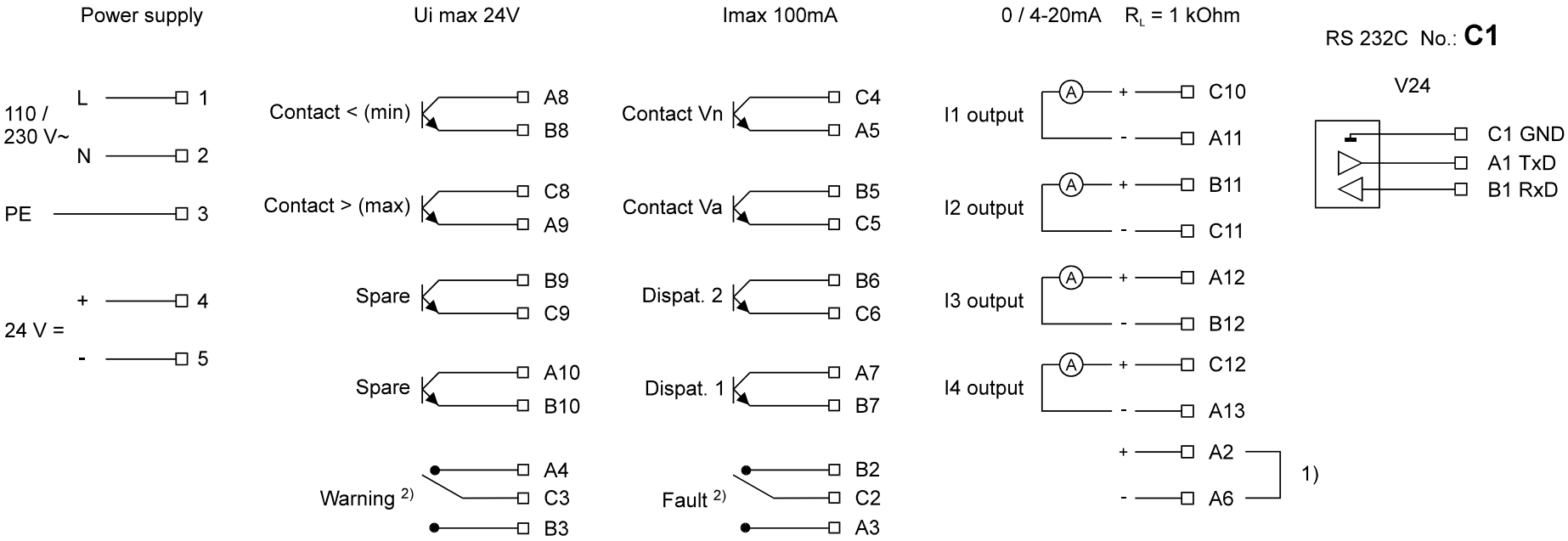
1) Model ERZ 9002TM: Contact E (earth).
2) When using an internal battery, set a jumper between the contact A9 and A10. When using an external battery, set the soldering jumper P14 in the ERZ 9000 (see "Technical Data").
3)In the event of fault-free operation, the fault / warning relays are picked up (contacts J3 / (9-10) and J2 / (9-10) are closed).
If a fault occurs and or if the device is diconnected from the power supply, the relays release (contacts J3 / (10-11) and J2 / (10-11).





1) Set jumper externally





1) When using an internal battery, set a jumper between the contacts A2 and A6. When using an external battery, set the soldering jumper P14 in the ERZ 9000 (see "Technical data").
2) In the event of fault-free operation, the fault / warning relays are picked up (contacts B2-C2 and A4-C3 are closed).
If a fault occurs or if the device is disconnected from the power supply, the relays release (contacts C2-A3 and C3-B3 are closed).

Annex E Fault List

F A U L T M E S S A G E S

No.:	Text displayed	Explanation
	General	
02	Power failure	Power failure.
03	Defective clock	Clock component in the ERZ 9000 (CPU 1) is defective.
04	RAM fault	Fault detected when checking the RAM or EEPROM.
05	A/D hardw. 517	Hardware fault A/D measurement 517 on the controller chip.
06	A/D hardw. 7135	Hardware fault A/D measurement 7135 on the A/D converter.
07	Watchdog	Program runtime exceeded / restart of the program.
08	GERG error	GERG iteration (faulty abort).
09	GERG limit.	GERG limiting values were violated
10	8279 fault	Fault occurred when display was outputted or keypad fault.
11	CPU 2 timeout	CPU 2 does not respond to CPU 1.
12	DP receive	Transmission fault in the DUAL-PORT RAM between CPU 1 and CPU 2.
13	DP timeout	Transmission fault in the DUAL-PORT RAM between CPU 1 and CPU 2.
14	Default: Coordinate	When starting the program, an invalid value was found in the memory which was overwritten with a default value.
	Volume measurement	
15	Pulse comp. 1:1	Pulse comparison 1:1; checking "10 per 10000“ with 2-channel measurement.
16	Pulse comp. x:y	Pulse comparison x:y; checking for 4% deviation with 2-channel measurement.
17	Miss.pulse meas.	Missing pulses of the measuring channel.
18	Miss.pulse ref.	Missing pulses of the reference channel.
19	qa min range	Min. range of volume flow rate at actual conditions violated downwards.
20	qa max range	Max. range of volume flow rate at actual conditions exceeded.
21	Delta qa	Delta fault of volume flow rate at act. cond. / Meas.-value jump betw. 2 cycles.
22	Delta Kvc max	Kvc delta fault / Corrected Kv value is greater than permitted.
	Analog inputs	
23	p hardware	Pressure hardware, e.g. open circuit.
24	p min range	Min. pressure range violated downwards.
25	p max range	Max. pressure range exceeded.
26	p delta	Pressure delta fault / Meas.-value jump between 2 cycles > specified value.
27	Hs,n hardware	Superior calorific value hardware, e.g. open circuit.
28	Hs,n min range	Min. range of superior calorific value violated downwards.
29	Hs,n max range	Max. range of superior calorific value exceeded.
30	Hs,n delta	Superior cal. val. delta fault / Meas.-value jump betw. 2 cycles > specified value.
31	rn hardware	rn hardware, e.g. open circuit.
32	rn min range	Min. rn range violated.
33	rn max range	Max. rn range exceeded.
34	rn delta	rn delta fault / Meas.-value jump between 2 cycles > specified value.
35	I4-in hardware	I4-input tcn hardware, e.g. open circuit.
36	I4-in min range	I4-input min. range of tcn violated downwards.
37	I4-in max range	I4-input max. range of tcn exceeded.
38	I4-in delta	I4-input tcn delta fault / Meas.-value jump between 2 cycles > specified value
39	I5-in hardware	I5-input CO_2 hardware, e.g. open circuit.
40	I5-in min range	I5-input min. CO_2 range violated downwards.
41	I5-in max range	I5-input max. CO_2 range exceeded.
42	I5-in delta	I5-input CO_2 delta fault / Meas.-value jump between 2 cycles > specified value.

43	t hardware	Temperature hardware, e.g. open circuit.
44	t min range	Min. temperature range violated downwards.
45	t max range	Max. temperature range exceeded.
46	t delta	Temperature delta fault / Meas.-value jump between 2 cycles > specified value.

Totalizers

51	1 out of 3 Va	1-out-of-3 comparison volume at actual conditions.
52	1 out of 3 Vn	1-out-of-3 comparison standard volume.
53	1 out of 3 Vac	1-out-of-3 comparison corrected volume at actual conditions.
54	1 out of 3 Ve	1-out-of-3 comparison energy.
55	1 out of 3 VaD	1-out-of-3 comparison disturbance of volume at actual conditions.
56	1 out of 3 VnD	1-out-of-3 comparison disturbance of standard volume.
57	1 out of 3 VacD	1-out-of-3 comparison disturbance of corrected volume at actual conditions.
58	1 out of 3 VeD	1-out-of-3 comparison disturbance of energy.
59	1 out of 3 NOV-TOT	1-out-of-3 comparison NOVRAM.

Frequency inputs

60	ra failure	ra hardware, e.g. open circuit.
61	ra min range	Min. ra range violated downwards.
62	ra max range	Max. ra range exceeded.
63	ra delta	ra delta fault / Meas.-value jump between 2 cycles > specified value.
64	cn failure	VOS hardware, e.g. open circuit.
65	cn min range	Min. VOS range violated downwards.
66	cn max range	Max. VOS range exceeded.
67	cn delta	VOS delta fault / Meas.-value jump between 2 cycles > specified value.
68	rn 1 failure	Failure of standard density transmitter frequency 1.
69	rn 2 failure	Failure of standard density transmitter frequency 2.

PGC (via Databus)

116	PGC-Timeout	No analysis results from PGC for specified period of time
117	PGC-Fault	Fault occurred in PGC

HART transmission

126	Sensor-Alarm	In HART mode: a transmitter has set alarm bit

W A R N I N G S

No.:	Text displayed	Explanation
	Current inputs	
47	tra hardware	Temperature of density transmitter hardware, e.g. open circuit.
48	tra min range	Min. temperature range of density transmitter violated downwards.
49	tra max range	Max. temperature range of density transmitter exceeded.
50	tra delta	Temp. density delta fault /Meas.-value jump betw. 2 cycles > specified value.
	Totalizers and flow rate	
70	r / r corr. max	Permissible deviation exceeded.
71	VCF1 / VCF2 max	Permissible deviation exceeded.
72	Dispatcher 1	Dispatcher output 1 / Pulse buffer overflow.
73	Dispatcher 2	Dispatcher output 2 / Pulse buffer overflow.
74	el.mech. TOT1	Output contacts of totalizer V_a / Pulse buffer overflow.
75	el.mech. TOT2	Output contacts of totalizer V_n / Pulse buffer overflow.
76	Buffer data	Data buffer overflow for printer interface.
77	qa min limit	Min. limit of volume flow rate at actual conditions violated downwards.
78	qa max limit	Max. limit of volume flow rate at actual conditions exceeded.
79	qn min limit	Min. limit of standard volume flow rate violated downwards.
80	qn max limit	Max. limit of standard volume flow rate exceeded.
81	qe min limit	Min. limit of energy flow violated downwards.
82	qe max limit	Max. limit of energy flow exceeded.
83	cn min limit	Min. VOS limit violated downwards.
84	cn max limit	Max. VOS limit exceeded.
85	Hsn min limit	Min. limit of superior calorific value violated downwards.
86	Hsn max limit	Max. limit of superior calorific value exceeded.
87	Hsn calibration	Error during on-line correction of superior calorific value.
88	rn calibration	Error during on-line correction of standard density as current.
89	rn (f) calibration	Error during on-line correction of standard density as frequency.
	Current outputs	
90	I1 out min	Current output 1 min. violated downwards.
91	I2 out min	Current output 2 min. violated downwards.
92	I3 out min	Current output 3 min. violated downwards.
93	I4 out min	Current output 4 min. violated downwards.
94	I1 out max	Current output 1 max. exceeded.
95	I2 out max	Current output 2 max. exceeded.
96	I3 out max	Current output 3 max. exceeded.
97	I4 out max	Current output 4 max. exceeded.
	Limit contacts	
98	p min limit	Min. limit of pressure violated downwards.
99	p max limit	Max. limit of pressure exceeded.
100	Hsn min limit	Min. limit of superior calorific value violated downwards.
101	Hsn max limit	Max. limit of superior calorific value exceeded.
102	CO2 min limit	Min. CO_2 limit violated downwards.
103	CO2 max limit	Max. CO_2 limit exceeded.
104	rn min limit	Min. limit of standard density (current) violated downwards.
105	rn max limit	Max. limit of standard density (current) exceeded.
106	rnf min limit	Min. limit of standard density (frequency) violated downwards.
107	rnf max limit	Max. limit of standard density (frequency) exceeded.
108	ra min limit	Min. limit of density at actual conditions violated downwards.
109	ra max limit	Max. limit of density at actual conditions exceeded.
110	I4-in min limit	Min. limit of I4 input violated downwards (tcn or CO_2).
111	I4-in max limit	Max. limit of I4 input exceeded (tcn or CO_2).

112	t min limit	Min. limit of temperature at measuring conditions violated downwards.
113	t max limit	Max. limit of temperature at measuring conditions exceeded.
114	tra min limit	Min. temperature limit of density transmitter violated downwards.
115	tra max limit	Max. temperature limit of density transmitter exceeded.
118	Power Valid	Internal power supply: max. deviation exceeded.

EZD at interface C3

119	C3 Checksum	Checksum, related to interface C3, also for HART.
120	C3 Protocol	Protocol fault, related to interface C3, also for HART.
121	EZD Timeout	No data transmission.
122	EZD Delta	Totalizer change bigger than according to HF/NF.
125	EZD Value	HF pulses measured but there is no totalizer change.

HART transmission

123	Hart Timeout	Fault in data transmission between HART card and CPU card.
124	Param. change	HART transmitter parameters have been changed by handheld device.

Transmission of Measured Values or Data for Custody Transfer Metering between the GC 9000 Process Gas Chromatograph and the RMG ERZ 9000 T Flow Computer via the RMG-BUS

This digital interface is an RS 485-based bus connection designed in accordance with the MODBUS. The GC 9000 process gas chromatograph (PGC) operates as master and sends measured values and status signals cyclically via the broadcasting feature at address 0 to the correctors connected (slaves).

Data interface on the GC 9000:
RS 485 bus interface with master function

Data interface on the ERZ 9000 T:
RS 485 bus interface with slave function

Data transmission:
Data transmission between the GC 9000 and the ERZ 9000 T operates in such a way that similar to a current output, there is a permanent connection between the devices. On the receiver side, digital data are handled in the same way as measured values of current inputs (min./max. monitoring, timeout and plausibility checks).

Data security:
In order to secure data, the element (unit encryption) specified in the PTB Regulations 50.31 is used for encryption and authenticity checks.
Checksums are formed using all measured values and status signals.
The checksum is attached as last value to the message and accompanies the data,during transmission.

Description of message:
The MODBUS function 16 "write request" is used with address 0 (broadcasting).
:kk102222nnnnbb<Data>BCC<CRLF>

Signification:

:	Start of characters
kk	User address, here particularly 0 for broadcasting
10H	MODBUS function 16 (hexadecimal number)
ssss	Start of address of the registers to be used (0 ... 65535)
nnnn	Number of registers to be used (1 ... 63)
bb	Number of bytes to be transmitted
BCC	CRC12 checksum procedure (see annex)
CRLF	End of characters (carriage return, line feed)

Data Address

7001	methane
7002	ethane
7003	propane
7004	iso-butane
7005	n-butane
7006	neo-pentane
7007	iso-pentane
7008	n-pentane
7009	hexane
7010 – 7014	not assigned
7015	nitrogen
7016	CO_2
7017 - 7032	not assigned
7033	superior calorific value
7034	inferior calorific value
7035	relative density
7036	standard density
7037	Wobbe index
7038	Zn compressibility factor
7039	not assigned
7040	status

PGC Status

Calibration status / internal connection of test gas

While test gas is being connected internally, the last measured values are sent.

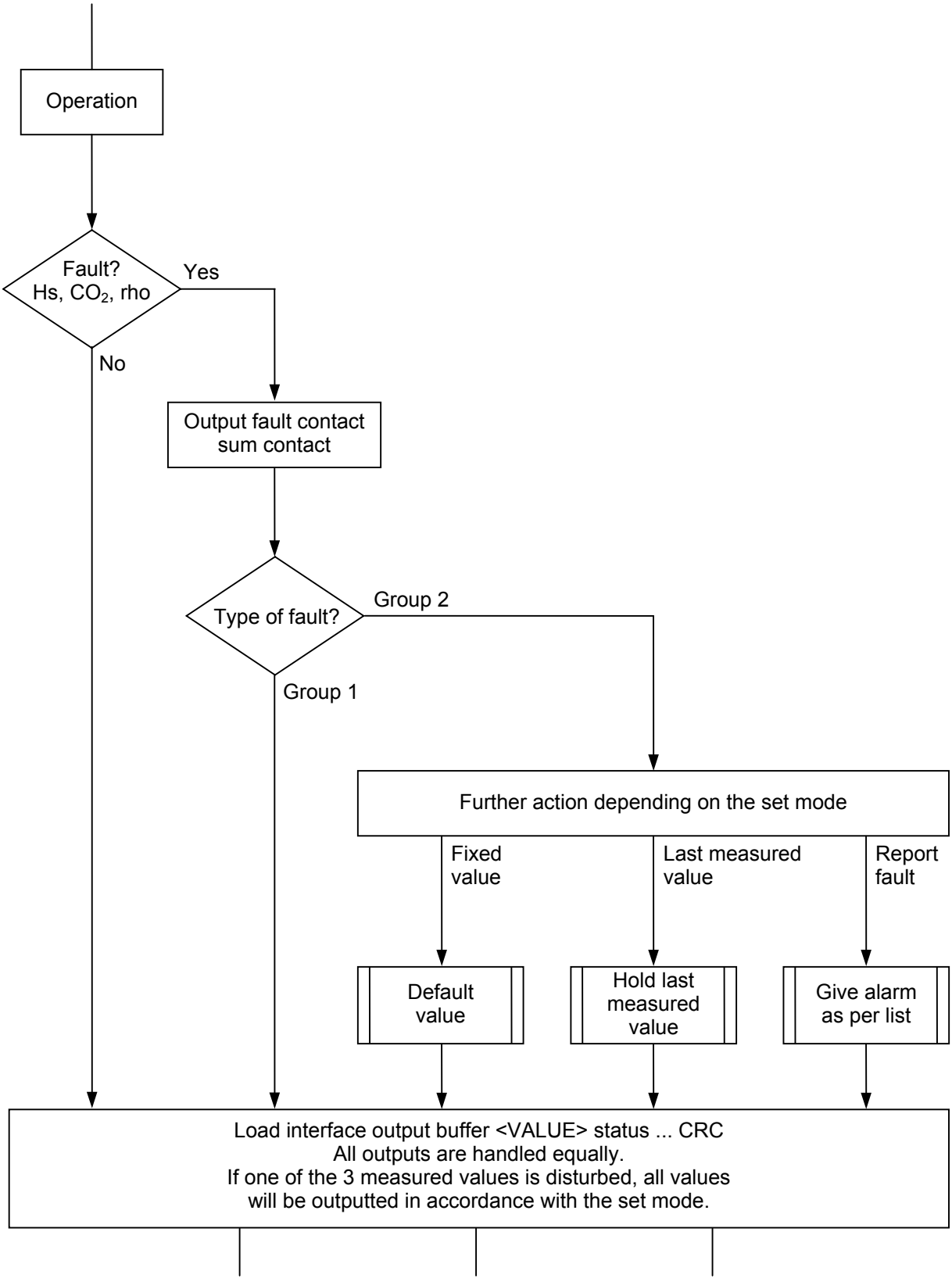
Revision status / external connection of test gas

While test gas is being connected externally, the last measured values are sent.
External connection of test gas must be communicated to the PGC (contact, etc.).

Fault status / startup after POWER ON / internal faults

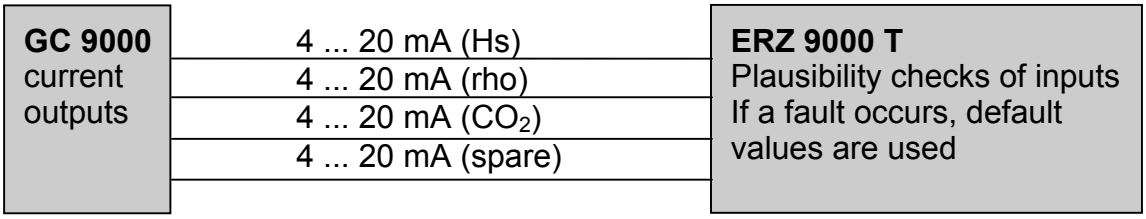
During the startup phase (warming-up, calibration, etc.), the PGC provides no measured values, but default values (fixed values).

Handling of faults occurring on the RMG-BUS digital interface for:
superior calorific value, standard density / relative density, carbon dioxide, nitrogen

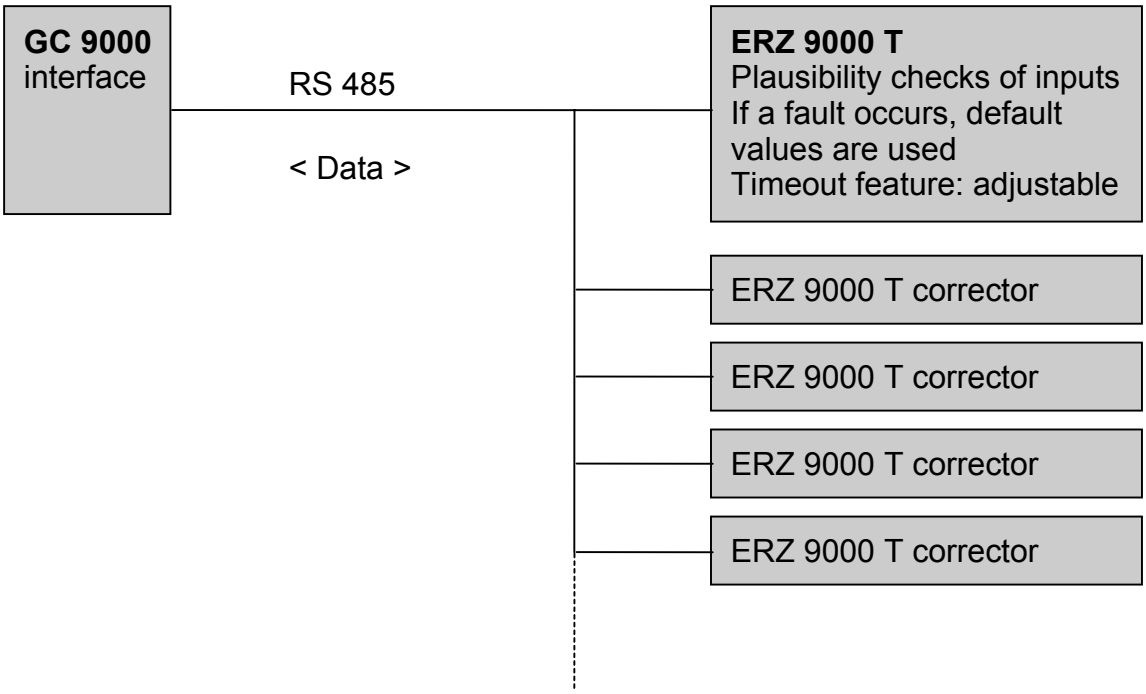


Connecting a PGC Type GC 9000 together with an ERZ 9000 T corrector

1. Analog interface



2. RMG-BUS digital interface
   Transmission of measured data is secured by
   a. BCC (CRC procedure) to secure the transmission route
   b. plausibilitychecks to monitor limits and verify contents
   c. timeout feature to monitor the transmission cycle



A maximum of 30 ERZ 9000 T Flow Computers can be connected to a PGC Type GC 9000. Wiring is to be made in the form of a bus network, while cable specifications must be observed.

Additional features of the GC 9000 process gas chromatograph

To activate the RMG-BUS mode
Set the mode to RMG-BUS in coordinate J 19.

Status indications
The status is indicated in coordinate J 20:

"Revision running"	Information indicated during revision
"Calibration running"	Information indicated during calibration
"Analysis running"	Information indicated during analysis
"Fault"	Information indicated while fault is pending

The status indicated flashes at 2-second intervals, but at the time the message is sent, the flashing stops for a few seconds. In this way, the time of transmission can be detected easily without any auxiliary equipment.

Additional features of the ERZ 9000 T corrector

To activate the RMG-BUS mode
Set the mode to RMG-BUS in column S under coordinate S 27. Set the baud rate, etc., in coordinates S 28 ... 30.

Status indications
The status is indicated in coordinate S 31.

"Revision running"	Information indicated during revision
"Calibration running"	Information indicated during calibration
"Analysis running"	Information indicated during analysis
"Fault"	Information indicated while fault is pending
"No connection"	Information indicated while fault is pending

The status indicated flashes at 2-second intervals, but at the time the message is received, the flashing stops for a few seconds. In this way, the time of transmission can be detected easily without any auxiliary equipment.

Data transmission / Timeout feature

Data transmission is carried out cyclically at intervals of approx. 30 seconds. Therefore, a change of status will be indicated after 30 seconds at the latest and causes a reaction with all users. The timeout feature can be adjusted by time reference (minutes), i.e. 2, 3, 4, 5, 6, ... x 30 seconds.

Electrical characteristics of the RMG-BUS

As to its electrical characteristics, the RMG measuring bus is based on the EIA RS 485 standard (differential voltage signals via a twisted pair of wires). The bus network with its regular-bus topology makes it possible to connect up to 31 users. The length of the bus may be up to 500 meters. All users are electrically isolated from each other, each interface has its own power supply unit to power the bus.

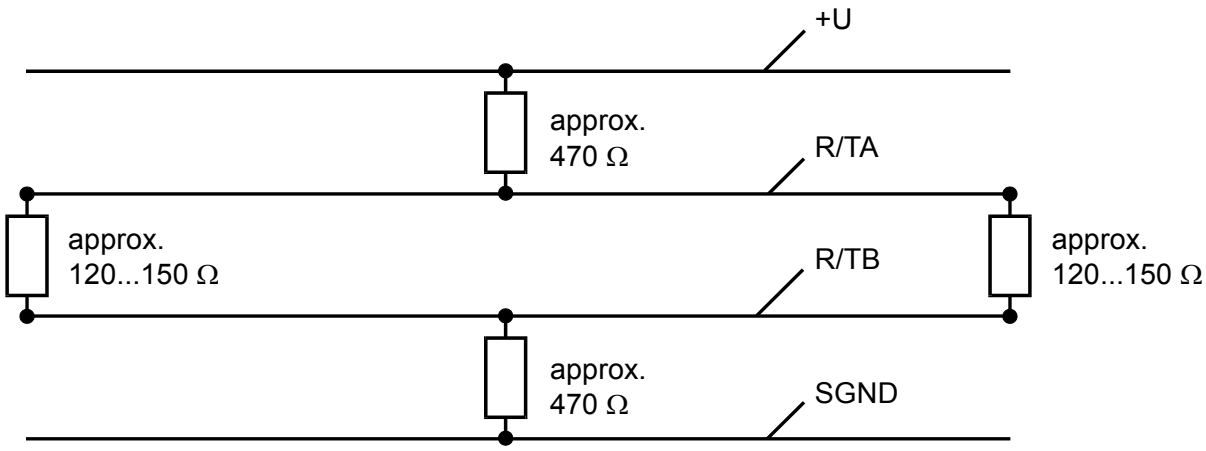
Connector pin assignment
The RMG-BUS interface has been designed as a 9-pin male Cannon connector. Refer to the following table for contact assignments.

Pin No.	Signal	Description
1	+U	Power supply (+5 VDC)
2	GND	Reference potential. Electrical isolation from the device is mandatory.
3	R/TA	Wire A of the pair of wires of the data line
4	...	not assigned
5	SGND	Reference potential, identical to GND
6	-U	Reference potenfial, identical to GND
7	GND	Reference potential, identical to GND
8	R/TB	Wire B of the pair of wires of the data line
9	...	not assigned

Bus termination and generation of open-circuit potential
In order to prevent distortion and reflection of signals, terminating resistors must be connected on both sides of the bus cable. These terminating resistors should correspond more or less to the wave impedance of the line with typical values between 120 and 150 ohms. In addition to the terminating resistors, there is one network necessary for the generation of open-circuit potential at least at one location (anywhere) to secure defined levels. It is to be specified that the supply of the bus will be taken over by the GC 9000 (set DIL switch) and that the terminating resistors on both sides of the bus cable will be switched on.

Cable specification
The cable comprises two pairs of wires which are twisted together and shielded in each case. The nominal cross section per wire must be at least 0.25 mm^2, while the effective capacitance must be below 150 pF/m. The shield is to be connected at one location, preferably at the end, to an equipotential bonding strip.

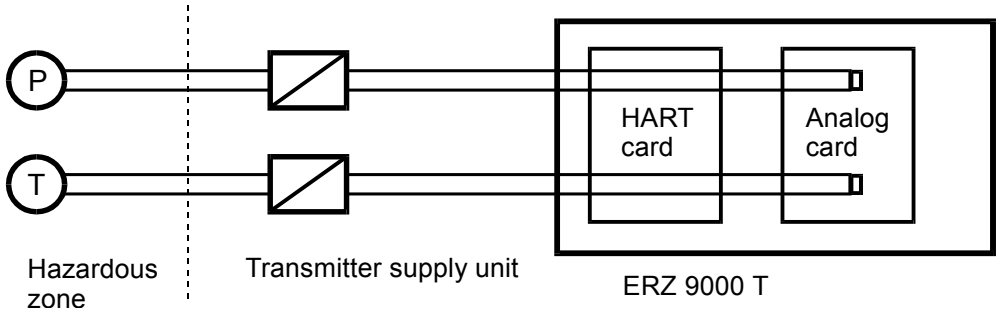
Example:



Annex G HART master card in the ERZ 9000 T

Transmitters: Pressure, temperature
Manufacturer: e.g. Rosemount
Degree of protection: Intrinsically safe with an external transmitter supply unit

Block diagram



Function
The analog signals are connected to the usual terminals on the rear panel of the ERZ 9000 T. The signals are looped through the HART master card and are additionally connected to the analog card. Therefore, both measuring facilities are available.
The HART master card comprises 2 HART modems with separate functions and is always connected to the transmitters (no multiplex operation).

No operator action has to be taken via the display of the corrector, since all card functions are performed automatically. Therefore, no HART functionality is integrated into the coordinate structure of the ERZ 9000 T. Transmitter parameterization is always to be performed using the external handheld device.

The master card in the ERZ 9000 T cyclically calls the HART function 03 and expects the following measured values:

- primary variable
- secondary variable
- tertiary variable
- 4th variable
- pv current

If there is no response or another response to this inquiry, the transmitter(s) must be parameterized appropriately using the handheld device. The master card expects the device address 0.

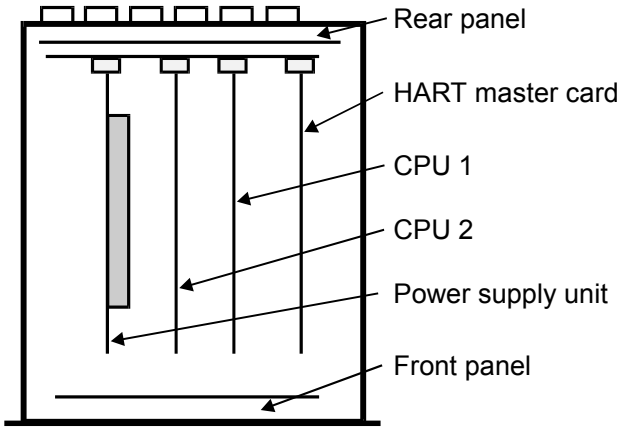
The data acquired by both transmitters are combined and sent to the ERZ 9000 T via an internal interface link. The protocol used is based on existing solutions and is described separately.

Configuring a transmitter using the external handheld device
During or after a change in the configuration of a transmitter, it adds what is called a configuration flag to the data sent for each inquiry. This flag is recognized by the master card which signals it to the corrector and immediately gives the command to erase it in the transmitter. The corrector then initiates the "***Parameter change"*** warning. After the flag has been erased in the transmitter, this message will turn to steady light if no other change is made through the handheld device.

Hardware design
Plug-in card for the ERZ 9000 T. This card is to be inserted into the free slot of the explosion-protected isolating card in the ERZ 9000 T. Coupling is made via an internal interface link (formerly FE-06).
The circuitry has been designed for P and T, but can optionally be expanded so that three or four inputs can be processed in multiplexing.

The 250 Ω resistor required for the modulation and demodulation of the digital signals is located on the master card. A relevant note should be made on the device and in its documentation, e.g. RL = 250 Ω inside.

Depiction of the mounting situation (19" rack-mounting unit, top view without cover):



Effects on the corrector

Pressure transmitter
In column A ***Pressure,*** the **P-mod 1** mode in coordinate A 17 is supplemented:
OFF / 0- 20 / 4- 20 / HART.

The pressure transmitter is to be connected to the corrector as usual, i.e. either as an (Ex) d 2-wire transmitter directly supplied by the corrector or as an (Ex) i active transmitter supplied by a supply unit.

If HART mode is selected, the digital measured value, which is also used for calculation, is displayed in A 01. In addition, I ..... (mA) is still displayed in A 03 for monitoring purposes. If the digital value fails, an alarm is tripped and the default value is used. There is no automatic changeover to the analog value. A changeover must be performed manually by changing the mode.

Resistance thermometer

In column E ***Temperature***, the **T-mod 1** mode in coordinate E 17 is supplemented:
OFF / PT100 / 0- 20 / 4- 20 / HART.

If a temperature sensor is used which is either directly supplied by the corrector as an (Ex) d 2-wire transmitter or supplies 0/4 ... 20mA or HART measured values as an (Ex) i active transmitter, it must be connected to the input J 5, pins 9, 10 (I 4).

The PT 100 input at J6, pins 1,2,3,4 must be terminated with 100 Ω resistors, so that the hardware-triggered open-circuit detection feature is not operated.

If HART mode is selected, the digital measured value, which is also used for calculation, is displayed in E 01. In addition, I ..... (mA) is still displayed in E 03 for monitoring purposes. If the digital value fails, an alarm is tripped and the default value is used. There is no automatic changeover to the analog value. A changeover must be made manually by changing the mode. Here, this means changing over to the 4-wire PT 100 input J 6.

Interfaces

In column S, coordinate S 19, the **D-mod 2** mode for the C3 interface is supplemented by HART. If the device is prepared for HART, the C3 interface at the 9-pin connector on the rear panel of the ERZ 9000 T can no longer be used. Then the data link is to be established inside the device using a ribbon cable.

Fault messages displayed by the corrector in HART mode

Warning 123:	HART Timeout	Cause: No data link
Warning 124:	Parameter change	Cause: Intervention via handheld device
Fault message 126:	Sensor-Alarm	One transmitter has set alarm bit