Operating instructions

GOSSEN METRAWATT CAMILLE BAUER

Digem f 96x48CK/EK

Programmable digital panel meter and MESSCONTACTER

3-348-835-02
3/3.98

Contents Page

Notes and Warnings

This instrument has been shipped from the factory in proper condition for safe operation. In order to maintain this condition and to assure safe operation, the user must observe all notes and warnings included in these operating instructions. If damage to the instrument causes any doubt concerning safe operation, it must be taken out of service. Visible damage always represents cause for such doubt. Prior to initial start-up it must be determined, whether or not the measuring instrument is equipped for the proposed application (correct supply voltage, inputs and outputs). The model of the instrument and possible options are identified on the serial plate. When covers are opened or components are removed, voltage conducting parts may be exposed. Balancing, maintenance or repair of an open, live instrument may only be carried out by trained personnel who are familiar with the dangers involved.

1 Applications

This measuring instrument is suited for applications in which the monitoring and evaluation of measurement values are required, which, if applicable, must also be transmitted via analog outputs or a serial interface.

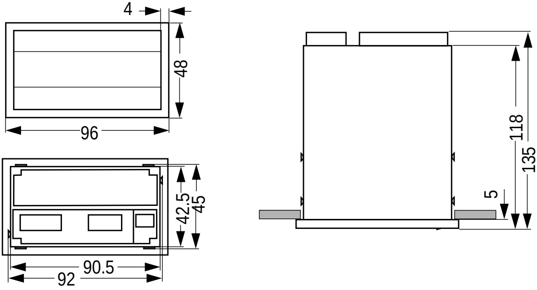
2 Installation

First push the instrument into the switch panel without screw clips. The screw clips are then set into the cone-head rivets at the side panels. The instrument can then be tightened to the switch panel with the screws. For installation into a grid mounting system, the fastening elements designed especially for the grid system in use are set into the cone-head rivets . The complete instrument can then be inserted into the grid system.

Attention!

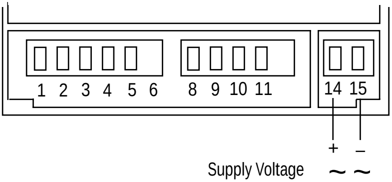
If several devices are installed with maximum component density it must be observed, that the allowable operating temperature of 50 ˚C is not exceeded despite specific heat.

Dimensional drawing with switch panel opening: $45^{+0.6}$ x $92^{+0.8}$ mm

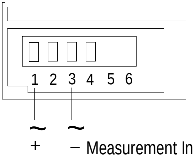
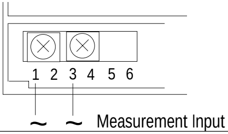
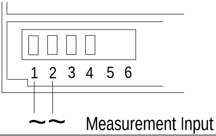
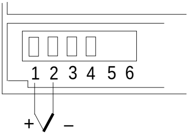


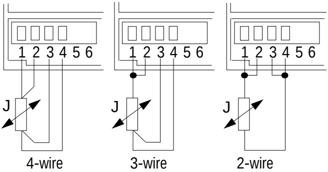
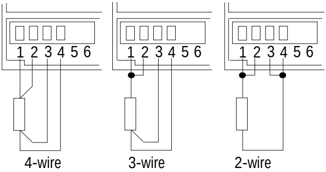
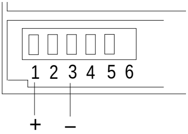
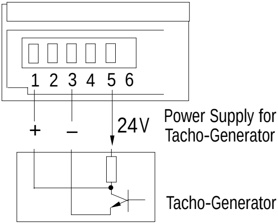
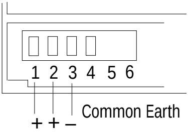
3 Connection

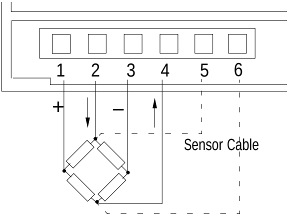
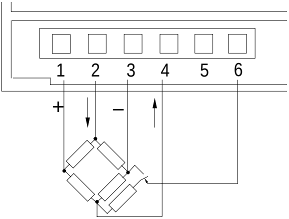
3.1 Supply Voltage



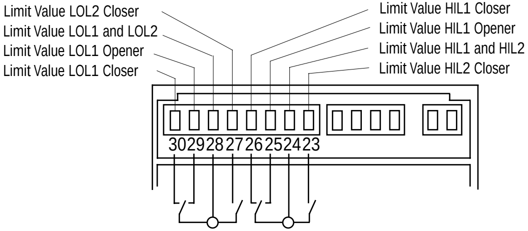
3.2 Measurement Input (per Model)

Model	Ranges	Connector Pin Assignment
DC	V, mV, mA	
AC	V, mA	
AC True RMS	200 V, 700 V	
Line Frequency	for AC-V (80 V-500 V)	
DC with power supply for 2-wire transducer	mA	
AC	A	
AC True RMS	A mA	
AC True RMS	200 mV –20 V	
Temperature Measurement with Thermocouples	all	

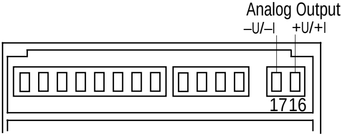
Model	Ranges	Connector Pin Assignment
Temperature Measurement with PT100	all	
Resistance Measurement	all	
Frequency Measurement, Counter	all	
R.P.M. Measurement	all	
DC with 2 Measurement Inputs		

Model	Ranges	Connector Pin Assignment
Pressure Measurement	all	
Pressure Measurement with Automatic Calibration	all	

3.3 Limit Value Outputs (Option)



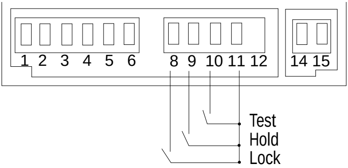
3.4 Analog Output (Option)



3.5 External Control Inputs

Attention!
Terminals 8, 9 10 and 11 are electrically connected to the measurement input. Isolation of external circuit elements must be executed in a fashion suitable for the prevailing measurement input potential.

Instrument Test (Test)



When terminals 10 and 11 are bridged, the entire display is darkened.
Attention: This connection causes resetting of the microprocessor. All stored min. and max. values, as well as automatic tare values, are lost.
After this connection is interrupted, a segment test is conducted for about 1 second.
Thereafter, the instrument returns to normal operation.

Display Storage (Hold)

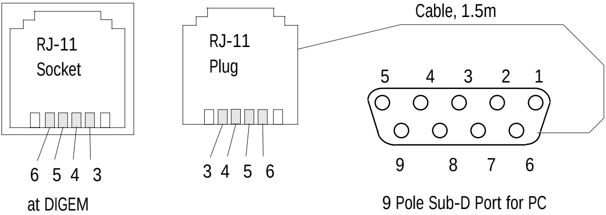
When terminals 9 and 11 are bridged in the normal display mode, the currently displayed value is stored. This has no influence on the measuring sequence.
In the counter mode, this causes setting of the counter to zero. In the tare mode the tare zero-value is set.

Program Protection (Lock)

When terminals 8 and 11 are bridged, the limit values selected before adjustment are protected and the programming of important parameters is disabled. If an attempt is made to change the protected limit values selected prior to adjustment, the message "Loc" appears in the display.

3.6 Serial Interface (only for DIGEM f 96 x 48 CK)

Connector Pin Assignment



A connector cable is included with measuring instruments with serial interface.

DIGEM RJ11 Socket			DIGEM Cable, 9 Pole Sub-D		PC Configuration, 9 Pole	
	RS232	RS485	RS232		RS232	
Pin 3	RxD	B (low)	Pin 3	RxD	Pin 3	TxD
Pin 4	TxD	A (high)	Pin 2	TxD	Pin 2	RxD
Pin 5	+5V	+5V	Pin 7	blank	Pin 7	
Pin 6	Ground	Ground	Pin 5	Ground	Pin 5	Ground

4 Operation

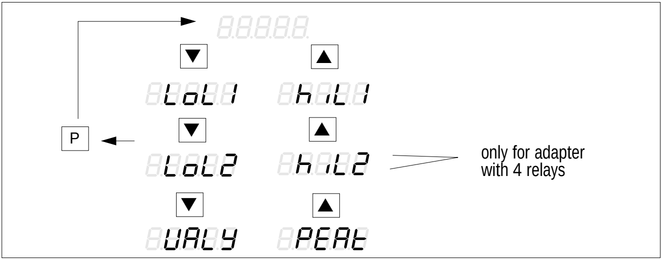
The measuring instrument displays the current measurement value. The display blinks if values fall below, or exceed the measuring range. Zeros which precede the decimal point are not displayed. Depending upon instrument configuration, one or another of the parameters is removed. The following are a few of the important instrument configurations:

- Limit value relays: 2 or 4 relays, each with min-min, max-max or min-max contacts
- Minimum value panel meter
- Maximum value Panel meter
- Min. max. value storage
- Alarm storage

4.1 Limit Values (Option)

The instrument can be used as a CONTACTING INSTRUMENT, if limit value relays are used (option).

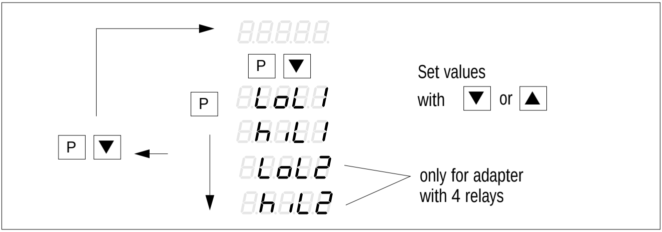
For programming of parameters see table on page 12.



Read-out of selected limit values and minimum and maximum measurement values

Depending on the model, either 2 or 4 limit values can be digitally selected. The limit values LOL1, LOL2 and HIL1, and HIL2 function either as min-max, min-min or max-max contacts, depending upon the selected function.

Depending upon the selected function, the relays work either according to the principle of bias current or load current. If no special particulars are included concerning the type of contacts, and if these are not indicated on the serial plate, the measuring instrument has been laid out at the factory with min-max contacts for load current. Instrument settings cannot be changed when it is installed. Corresponding instructions are described in programming for cod2 (see table on page 13).



Setting limit values

Attention: If the Loc message blinks at the beginning of limit value setting, the limit values are protected against change.

Each limit value is stored with P, and the preset value for the subsequent limit value is then displayed in blinking fashion.

Saving Limit Values

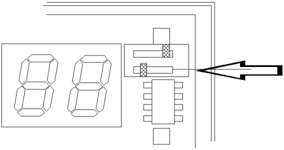
The limit values can be protected against change in two ways.

Attention!

This work may only be carried out by a trained electrician. The pc board accessed during this work is live.

- By bridging terminals 8 and 11 at the rear of the instrument (see chap. 3.5 page 7).
- With a coding switch in the instrument.

To this end remove the front frame, the front plate and the front panel. Two coding switches are located at the right of the display. In order to lock in the limit values, push the lower switch to the left. The limit values are thus protected against change.



4.2 Minimum Value Panel Meter

As a rule, the instrument always displays the minimum measurement value. Current and maximum measurement values are read as follows:

Display	Key Sequence
Min. Measurement Value	
Current Measurement Value	P
Max. Measurement Value	⇑
Delete Min. Measurement Value (re-enable)	first press ⇓ and then press⇑ and ⇓ simultaneously

4.3 Maximum Value Panel Meter

As a rule, the instrument always displays the maximum measurement value. Current and minimum measurement values are read as follows:

Display	Key Sequence
Max. Measurement Value	
Current Measurement Value	press P continuously
Min. Measurement Value	⇓
Delete Max. Measurement Value (re-enable)	first press ⇑ and then press ⇑ and ⇓ simultaneously

4.4 Resetting Min. and Max. Display Values

Press keys ⇑ and ⇓ simultaneously.

4.5 Min-Max Storage

The instrument always displays the current measurement value. Minimum and maximum measurement values are stored as follows:

Display	Key Sequence
Current Measurement Value	
Min. Measurement Value	⇓
Max. Measurement Value	⇑
Delete Min. or Max. Measurement Value (re-enable)	press ⇑ or ⇓ and then press ⇑ and ⇓ simultaneously
Return to Current Measurement Value	P (at each level)

4.6 Panel Meter with Automatic Tare

With this model the first measured value is stored. The measuring instrument determines the difference between the current measurement value and the stored value (tare value) for each subsequent measurement. The difference between these values is displayed. The right decimal point lights up.

Display	Key Sequence
Current Differential Value	
Store Tare Value	P
Delete Tare Value	press ⇑ and ⇓ simultaneously

The tare value is deleted after display storage is ended (pins 9 and 11 chap. 3.5 page 7). The right decimal point is no longer lit up if no tare value is in storage.

4.7 Switching Hysteresis and Delay Time (Option)

The measuring instrument can be programmed with either a switching hysteresis or a delay time for the alarm message or the relays. Switching hysteresis can be adjusted from ± 1 D to ± 127 D. A delay between 0 and 127 s can be selected. Instructions for programming can be found in chap. 5.7 page 19.

4.8 Alarm Storage (Option)

If the measurement value is within the alarm range, an alarm message is continuously displayed. When the measurement value is no longer within the alarm range, the alarm message is normally deactivated. If this is not desired, the instrument can be programmed for alarm storage. This function stores the alarm message until it is deleted with the ⇑ and ⇓ keys, or with an external signal at the hold input. Alarm storage programming is described in chap. 5.7 page 19.

4.9 Automatic Balancing for Pressure Measurements (Option)

If balancing of the zero point and the final value is frequently required during operation, the measuring instrument can be programmed for automatic balancing (see table on page 13, parameter cod 3, 1st digit).
If this function is activated, automatic balancing is activated by pressing and holding the P key for 2 seconds.
ZEro and a digit blink alternately at the measuring instrument. The input magnitude which corresponds to the value of the blinking digit must be applied to the measurement input. The measuring instrument automatically balances the input magnitude to the digit, which blinks alternately with ZEro. The value can be changed with the ⇑ and ⇓ keys, to which balancing is to be carried out.
If the P key is pressed repeatedly, SPAn and a digit blink alternately. The input magnitude which corresponds to the value of the blinking digit must be applied to the measuring instrument. When the P key is pressed again, the new values are stored and remain even in the event of power failure.

Pressure Measurement, Special Case

For pressure measurements with Autocal, automatic balancing is accomplished by pressing and holding the P key for approximately 8 seconds.

5 Instrument Settings

5.1 Significance of Parameters and Programming Instructions

Instrument settings include the following parameters:

Parameter	Function	Setting Range
bri	Display brightness	0 ... 7
hCA	Initialize Hardware Calibration	
ZEro	Measuring range, lower limit	–19,999 ... 32,765
SPAn	Measuring range, upper limit	–19,999 ... 32,765
PCA	Initialize Software Calibration	
OFSt	Offset adjustment	–19,999 ... 32,765
SCAL	Measurement value multiplier	–1.9999 ... 1.9999
Adr	Serial interface address	0 ... 255
bAud	Transmission speed	200 ... 19,200
cod 1 (display)	1st digit: LED limit values and indication of tendency 2nd digit: decimal point 3rd digit: rounding of the last place	0 ... 3 0 ... 7 0 ... 7
cod 2 (limit values)	1st digit: blinking display for alarm message 2nd digit: storage of min-max value, limit values function 3rd digit: switching hysteresis, delay time and alarm storage	0... 3 0... 7 0 ... 7
cod 3 (special display functions)	1st digit: cos φ function, automatic tare and automatic balancing 2nd digit: analog output balancing 3rd digit: determination of mean value	0 ... 3 0... 7 0 ... 7
cod 4 (measurement functions)	1st digit: measurement speed, analog or digital measurement input 2nd digit: linear/non-linear meas. input, remote display 3rd digit: arithmetic linking of two inputs, temp. sensor, frequency measurement range	0 ... 3 0 ... 7 0 ... 7

Functions can only be programmed, when the internal program switch is set to the corresponding position.

3rd digit means: the outside right hand display segment.

Detailed Representation of Parameter cod1 to cod4

cod 1	1		2		3
No additional	0	no decimal point	0	no rounding	0
LED		no decimal point	1	rounding in steps of 2	1
				rounding in steps of 5	2
With limit value LED /		external decimal point		rounding in steps of 10	3
bias current	1	(x.xxxx - xxxx.x)	2	additional zero	4
With limit value LED /		(xx.xxx - xxxxx)	3	additional zero + rounding to 20	5
load current	2	x. xxxx	4	additional zero + rounding to 50	6
		xx. xxx	5	additional zero + rounding to	7
LEDs for indication of	3	xxx. xx	6	100	
tendency		xxxx. x	7		
cod 2	1		2		3
Display does not	0	with min-max storage	0	--	0
blink		min. value panel meter	1	with hysteresis	1
		max. value panel meter	2	with delay time	2
Blinks for alarm		--	3	with alarm storage	3
LOL1/LOL2	1	min-max contact	4		
		HIL= min. / LOL= max. contact	5	with hysteresis and	
Blinks for alarm				alarm storage	4
HIL1/HIL2	2	LOL= min. / HIL= max. contact	6		
				with delay time and	
Blinks for alarm	3	max-min contact	7	alarm storage	5
cod 3	1		2		3
Direct meas. value	0	Remote control		no mean value	0
display in cos φ	1	for analog output	0		
		Analog output		mean value, 2 measurements	1
Automatic balancing		after linearization	1		
(via relay, pressure				mean value, 4 measurements	2
module only)	2	Analog output scaling	2	mean value, 8 measurements	3
		Analog output balancing	3		
Activate automatic				mean value, 16 measurements	4
tare	3	Analog output		mean value, 32 measurements	5
		before linearization	4		

cod 4	1		2		3
Analog Input = 16 Meas. / Sec.	0	Current / voltage / frequency temperature or resistance	0 1	Description of functions in next table	
Digital Input = Frequency/R.P.M./ Counter	1	Reciprocal value, current / voltage or frequency Recip. value, res. or temp.	2 3		
Analog Input = 3 Meas. / Sec.	2	Counter Display with linearization Program linearization	4 5 6		
Digital Input = Cycle Duration	3	Remote display	7		

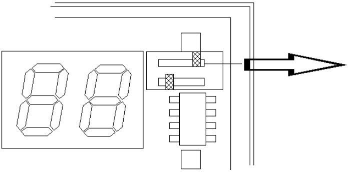
Function of 3rd digit in cod 4

1st D	2nd D	§3rd Digit		
0 or 2	0	for current or voltage:	one measurement input for U / I	0
			U1 = measurement input and U2 = limit value for U1	1
			2 meas. values, display U1	2
			2 meas. values, display U2	3
			U1 - U2	4
			U1 * 20,000) / U2	5
			U1 + U2	6
			U1 * U2 / 20,000	7
	1	for temperature:	thermocouple type R (Pt13 %Rh / Pt)	0
			thermocouple type J (Fe / CuNi)	1
			thermocouple type T (Cu / CuNi)	2
			thermocouple type K (NiCr / Ni)	3
			resistance, 2 or 4-wire	4
			Pt100, 2 or 4-wire	5
			resistance, 3-wire	6
			Pt100, 3-wire	7
1	0	frequency:	2 kHz (resolution, 0.1Hz)	1
			20 kHz (resolution, 1Hz)	3
			200 kHz (resolution, 10Hz)	5

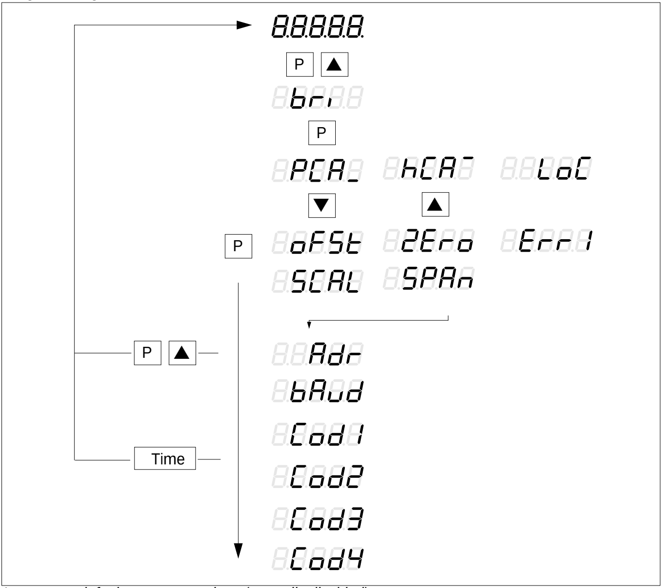
Enable Programming

Attention!
This work may only be carried out by a trained electrician. The pc board accessed during this work is live.

The front frame, the front plate and the front panel must be removed in order to enable programming. Two coding switches are located at the right of the display. Push the upper switch to the right to enable programming. If programming is not enabled, the Loc message is displayed when programming is initialized.



Programming Instructions



Instrument default program settings (normally disabled)

Measuring instruments are programmed at the factory as shown on the serial plate. If programming is enabled, instrument settings can be changed:
a) with the three keys at the front panel and
b) via the serial interface if included.
Press the keys P and ⇑ simultaneously to initialize programming. Parameter identification and the corresponding value blink alternately for menu commands. The longer the key remains pressed, the faster the value changes. Storage of the selected value only occurs after the subsequent parameter has been called up (P key).
If the programming sequence is to be interrupted prematurely, the keys P and ⇑ must be pressed simultaneously after storage with the P key has occurred.
If no activation of keys in the programming mode occurs for a period of 1.5 minutes, the measuring instrument automatically returns to the normal operating mode. This function is suppressed for pressure measuring instruments. Complete programming can be carried out via the serial interface, if available.

5.2 Measuring Range Adjustment

The measuring range can be adjusted in two different ways:

- By applying the measurement magnitudes for measuring range upper and lower limits, and storing these to the parameters ZerO and SPan (via hCA = hardware calibration).
- By defining an offset magnitude and a multiplier with the parameters OFSt and SCAL (via PCA = software calibration).

5.2.1 Measuring Range Adjustment with hCA

Apply the value to the measurement input, which corresponds to the measuring range lower limit.
Select parameter ZErO and set the value, which corresponds to the measuring range lower limit.
Apply the value to the measurement input, which corresponds to the measuring range upper limit.
Select parameter SPAn and set the value, which corresponds to the measuring range upper limit.
Store the values with the P key. The measuring instrument automatically determines offset and multiplier, and stores the corresponding values.
Attention: If, during calculation of offset or multiplier, values occur which do not lie within the setting range, the error message Err1 is displayed briefly and the measuring instrument immediately exits the programming mode (e.g. SCAL => 19,999).

5.2.2 Measuring Range Adjustment with PCA

Offset and multiplier are set digitally for measurement range adjustment with PCA.

Offset Calculation (OFSt)

The offset value is the number of digits, by which the display for the “normal” zero point is displaced. The offset value is calculated according to the following equation, without taking a decimal point into consideration:

$$\text{Offset} = MA - \frac{SA \times (ME - MA)}{SE - SA}$$

MA = Measuring range lower limit (display range lower limit)

ME = Measuring range upper limit (display range upper limit)

SA = Signal range lower limit (input range lower limit)

SE = Signal range upper limit (input range upper limit)

Example: 4 ... 20 mA = 0 ... 60.00

$$\text{OFSt} = 0 - \frac{4\text{ mA x}(6000 - 0)}{(20\text{ mA} - 4\text{ mA})} = -1500$$

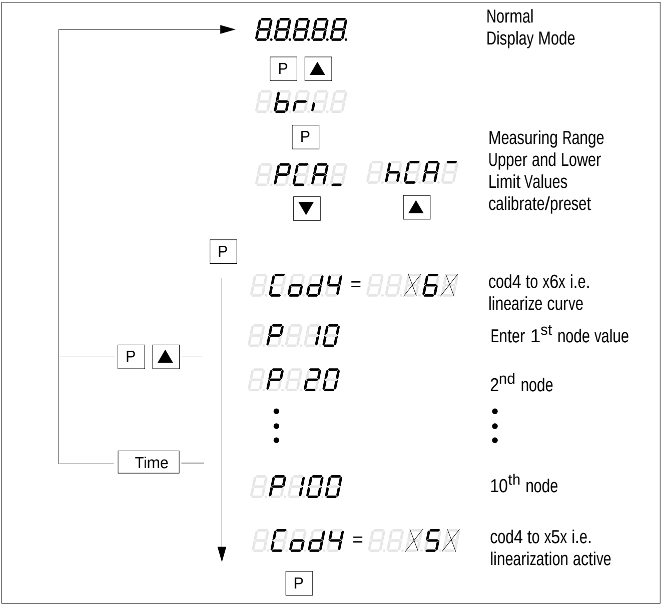
Multiplier Calculation (SCAL)

The display range is adapted to the signal range of the input signal with the SCAL multiplier. The multiplier is calculated with the following equation:

$$\text{SCAL} = \frac{\text{ME} - \text{MA}}{\text{SE} - \text{SA}}$$

5.3 Linearization of Non-Linear Measurement Values

For measurement of non-linear measurement values, linearization can be set at the instrument with the help of 10 nodes. The nodes are preset at steps of 10 % each of the measurement value. The procedure is as follows:



Programming instructions for linearization characteristic curve

First set the measuring range upper and lower limit values via PCA or hCA (software or hardware calibration). See chap. 5.2 page 16.
Then select linearization programming:
cod4 = x6x (set the second digit of the parameter cod4 to 6). Attention: The remaining cod4 digits must have the same values as before.
Enter the ten node values P10, P20, ... P100; store each with the P key. After entry of P100 the measuring instrument again displays parameter cod4.
Now activate linearization: cod4 = x5x (set the second digit of cod4 to 5; exit with the P key. The measuring instrument now displays the measurement value which corresponds to the selected linearization.

Example: Programming the non-linear characteristic curve for thermocouple type S (Pt10 %Rh/Pt)
Select the following values for offset and scaling factor:
OFSt = 0, SCAL = 1.0000 (see PCA, chap. 5.2 page 16).
Then proceed with linearization programming as described above and enter the following 10 node values:

P10 = 000	P40 = 828	P70 = 1319	
P20 = 255	P50 = 998	P80 = 1477	
P30 = 649	P60 = 1161	P90 = 1638	P100 = 1807

Next, activate linearization: cod4 = x5x (set the second digit of cod4 to 5. Attention: The remaining cod4 digits must have the same values as before. Exit with the P key. The measuring instrument now displays the measurement value which corresponds to the type S thermocouple characteristic curve.

5.4 Activation of Automatic Tare

Set the first digit of cod3 to 3 (cod3 = 3xx).
Attention: The remaining cod3 digits must have the same values as before. Press the P key repeatedly, until the instrument returns to the normal operating mode.

5.5 Programming and Activation of a Display per cos φ

First deactivate display of cos φ: cod3 = 0xx (set the first digit of parameter cod3 to 0 = dark). Attention: The remaining cod3 digits must have the same values as before. Press the P key repeatedly, until the instrument returns to the normal operating mode. Then select either hCA (hardware calibration) or PCA (software calibration).
Set the display range according to the angular degree of cos φ with a resolution of 0.01 degrees.

Example: Range cos φ = – 0.5 ... 1 ... 0.5
Set display range = – 60.00 ... 00.00 ... 60.00

Now activate the display for cos φ: cod3 = 1xx (set the first digit of cod3 to 1). Attention: The remaining cod3 digits must have the same values as before.
Press the P key repeatedly, until the instrument returns to the normal operating mode. The measuring instrument now displays the measurement value per cos φ.

5.6 Setting and Balancing the Analog Output

Depending upon the model, the analog output delivers either a current or a voltage which is dependent upon the display (not the input signal).
The signal range, to which the analog output is balanced at the factory, can be found on the serial plate. Subsequent adaptation of the output signal to the display range is possible with simple means, and is described in chap. 5.6 on page 19.

The analog output is adjusted digitally with the help of the keys at the front panel and with a precision measuring instrument.

Setting the Analog Output Measuring Range

Select scaling for the analog output as follows:
cod3 = x2x (set the second digit of parameter cod3 to 2). Then set parameter ZEro to the display value, at which the analog output is to deliver 0 mA.

Example: for 0 ... 15000 = 0...20 mA, set ZErO to 0
or for 0 ... 15000 = 4 ... 20 mA, set ZErO to –3750

The F.S. parameter (full scale) is now made available with the P key, for which you will now set the display value at which the analog output is to deliver its maximum value. F.S. is to be set at 15,000 in the above example. The P key now returns you to the display: cod3 = x2x.

Balancing the Analog Output

Connect a measuring instrument with the required accuracy to the analog output. Now select balancing for the analog output: cod3 = x3x (set the second digit of parameter cod3 to 3. Pressing the P key calls up the zero-point parameter CAL_L for the analog output. Now adjust the value, until the measuring instrument connected to the analog output displays 0 mA. Pressing the P key stores the value and calls up the final value parameter CAL_H, which now must be adjusted, until the measuring instrument connected to the analog output displays the required maximum value.

Example: for 0... 20 mA, set to 20 mA.
Press the P key. cod3 is displayed again along with a number, whose middle digit is a 3 (x3x). Set the second digit of parameter cod3 to 1 (cod3 = x1x).

The same procedure is to be followed with an analog output for voltage.

5.7 Switching Hysteresis, Delay Time and Alarm Storage

Switching hysteresis, delay time and alarm storage are set with parameter cod2.

Switching Hysteresis

If a switching hysteresis is to be selected, the last digit of cod2 must be set to xx1. Press the P key. hYSt and a number (0 ... 127) blink alternately in the display. This number indicates switching hysteresis in ± digits. Select the desired digit for switching hysteresis with the keys ⇑ and ⇓. Press the P key. cod3 and a number blink alternately in the display.

Switching Hysteresis and Alarm Storage

If the measuring instrument requires switching hysteresis, and must also store alarm messages, the last digit of cod2 must be set to xx4. The above procedure is followed as described for switching hysteresis.

Delay Time

If the relays are not to respond immediately in the event of an alarm message, an integration time constant can be selected. Selection is made as with switching hysteresis with the last digit in cod2. Set the last digit of cod2 to xx2. Press the P key. dEL and a number blink alternately in the display. This number represents delay time in seconds. Selection can be made within a range of 0 to 127s. Select the desired time with the keys ⇑ and ⇓. Press the P key. cod3 and a number blink alternately in the display.

Delay Time and Alarm Storage

If the measuring instrument requires a delay time, and must also store alarm messages, the last digit of cod 2 must be set to xx5. The above procedure is followed as described for delay time.

Alarm Storage

If the storage of alarm messages is required without switching hysteresis or delay time, the last digit of cod2 must be set to xx3.

5.8 Display Brightness

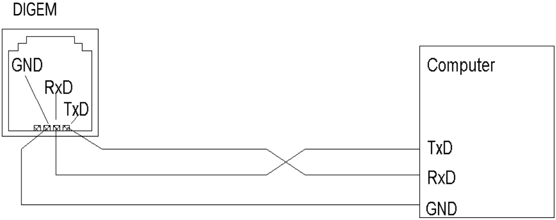
Display brightness can be adjusted with the “bri” parameter. The adjustment range runs from 0 to 7. Brightness is set to 5 at the factory.

5.9 Temperature Display in ˚C and ˚F

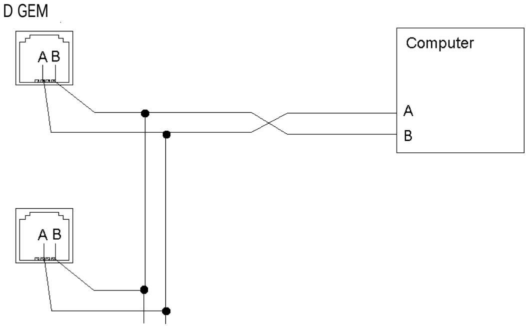
The measuring instrument displays temperatures in either ˚C or in ˚F, as is indicated on the serial plate. For display in ˚C, offset and scaling factor have the following values: offset = – 178, SCAL = 0.5556. For display in ˚F, offset and scaling factor have the following values: offset = 0, SCAL = 1.0000. Offset and scaling factor must be changed correspondingly, if display is changed from ˚C to ˚F, or vice versa.

6 Serial Interface for DIGEM f 96 x 48 CK (Option)

The instrument can be equipped with either an RS 232 or RS 485 interface (observe particulars on serial plate). Transmission is accomplished with a transmission protocol in accordance with DIN Draft no.19244.



6.1 Connector Pin Assignment



6.2 Transmission Speed and Address

All instruments which are connected to the same bus (RS485), or work with the same interface (RS232), must be set to the same transmission speed. Transmission speed is set to 9600 baud at the factory. Speed can be changed to 200, 300, 600, 1200, 2400, 4800, 9600 or 19200 baud with the bAUD parameter.

If several instruments are operated with the same interface, a different address must be selected at each instrument. Address 1 is selected for all instruments at the factory. Different addresses can be selected with the Adr parameter. See programming instruction in chap. 5.1 page 12.

6.3 Transmission Protocol and Message Formats

Protocols for serial interfaces RS232 and RS485 are the same and demonstrate the following characteristics:

Data bits: 8, parity: even parity check, stop bits: 1

Message Formats

Notes: The required waiting time between two messages is equal to max. 1 ms. The check sum ranges from the address, up to the last byte prior to the check sum.

- Status inquiry: With this message the computer can inquire as to whether or not a DIGEM is connected to this address, and whether or not it is functional.
- Reset: This message resets all stored values, and the tare value if one is selected. Other values remain unchanged.
- Parameters inquiry: see table below
- Setting parameters: see table below

Message Formats

Message	Meaning
Status Inquiry	
10H	Start Byte
Address	DIGEM Address
11H	Status Inquiry Code
Check Sum	Sum of all User Data
16H	Stop Byte
The DIGEM confirms status inquiry with:	
E5H	Acknowledgement
Setting Parameters	
68H	Start Byte
05H	Message Length
05H	Message Length
68H	Start
Address	DIGEM Address
69H	Inquiry Code
ASCII Code	Parameter Id. Letter
Check Sum	Sum of all User Data
16H	Stop Byte
The DIGEM confirms parameter setting:	
E5H	Acknowledgement
Reset	
10H	Start Byte
Address	DIGEM Address
01H	Reset Flag
Check Sum	Sum of all User Data
16H	Stop Byte

Message	Meaning
Parameters Inquiry	
68H	Start Byte
03H	Message Length
03H	Message Length
68H	Start
Address	DIGEM Address
89H	Inquiry Flag
ASCII Code	Parameter Id. Letter
Check Sum	Sum of all User Data
16H	Stop Byte
The DIGEM confirms parameter inquiry:	
68H	Start Byte
05H	Message Length
05H	Message Length
68H	Start
Address	DIGEM Address
80H	Function Code
ASCII Code	Parameter Id. Letter
Parameter LO	Low-Order Byte
Parameter HI	Higher-Order Byte
Check Sum	Sum of all User Data
16H	Stop Byte

- Parameter Identification Letters

Parameter	Identification Letter	
Offset	O	
Scaling Factor	S	see note
Tare Value	T	
Limit Value LO1	L	
Limit Value HI1	H	
Limit Value LO2	D	
Limit Value HI2	U	
cod1 and cod2	A	
cod3 and cod4	B	
Measurement Value	M	see note
Display Value	E	
Hysteresis	X	

Parameter	Identification Letter	
Delay Time	Y	
Minimum Value	I	
Maximum Value	J	
Set Relays	G	
Analog Output		
CAL Zero	K	
CAL Full Scale	N	
SCAL Zero	P	
SCAL F.S.	Q	
Linearization Nodes:		
0 %	a	
10 %	b	
20 %	c	
30 %	d	
40 %	e	
50 %	f	
60 %	g	
70 %	h	
80 %	i	
90 %	j	
100 %	k	

If several parameters are to be transmitted one after the other, a waiting time of at least 200 ms between messages must be observed.

Notes Concerning Parameters

- Adjustment to Scaling Factor (identification letter S)

The scaling factor which is prescribed by the serial interface is internally divided by 1.6384 (2^{14}) by the measuring instrument. This must be taken into consideration when setting the scaling factor via the serial interface.

Example: Scal reference value = 1,000; to be transmitted = 16384

- Scaling factor inquiry (identification letter S)

The measurement instrument transmits the value which has been multiplied by a factor of 1.6384. Example: transmitted scaling factor = 16384; actual scaling factor = 1.0000

- Measurement value inquiry (identification letter M)

The measuring instrument transmits the measurement values as a16 place binary code. Positive values are transmitted directly without polarity sign. For negative values the result of 65,536 minus the measurement value is transmitted. Example: display = –2000, transmitted value: 63,536.

- Operation as remote display (identification letter M)

If identification letter M is used in the protocol for the setting of parameters, the measuring instrument functions as a remote display. The analog-digital converter is deactivated with this command. If the instrument is to resume its measuring function thereafter, a reset must be carried out via the serial interface.

7 Technical Data

Display

Type	7 segment LED
Illumination Color	red, optionally green
Number of Digits	–19,999 to 32,765
Character Height	14 mm
Polarity	"–" is displayed automatically
Decimal Point	Programmable
Overflow Display	-----

Input

Module depending upon Model	see serial plate	
Voltage Module		
Input Resistance	> 1 MΩ for measurements > 2 V	
	> 70 kΩ for measurements < 2 V	
Voltage Module		
Voltage Drop	max. 2 V	
Resistance Module		
Current to Resistance Path	200.0 Ω range:	1.5 mA
	2.000 kΩ range:	150 μA
	20.00 kΩ range:	15 μA
Temperature Module Pt100		
Sensor Current	2 mA for Pt100	
Pressure Module		
Measurement Signal	2 / 3.3 / 20 mV/V	
Bridge Supply	10 V for 2 / 3.3 mV/V sensor	
	5 V for 20 mV/V sensor	
Min. Bridge Resistance	150 Ω for 2 / 3.3 mV/V sensor	
	100 Ω for 20 mV/V sensor	

Error Limits

DC Module	
Intrinsic Error	± (0.05 % + 1 D)
Temperature Coefficient	< 80 ppm/K
SMRR	> 35 dB at 50 Hz
CMRR	> 120 dB as related to MB 200.00 mV at 50 Hz
AC Module (arithmetic)	
Intrinsic Error at 45 ... 65 Hz	± (0.2 % MW[1] + 0.2 % MB[2])
30 ... 100 Hz	additional ± (0.2 % MW + 0.2 % MB)
100 ... 1 kHz	additional ± (0.5 % MW + 0.2 % MB)
Temperature Coefficient	± (0.01 % + 0.01 mV) / K

1) MW = of measurement value

2) MB = of measuring range

TRUE RMS Module

Intrinsic Error at 45 ... 65 Hz	± (0.2 % + 0.2 % MB)
20 Hz ... 1 kHz	additional ± (0.2 % + 0.2 % MB)
Crest Factor	6 (additional 0.5 %)
Temperature Coefficient	± (0.01 % + 0.01 mV) / K

Temperature Module PT100

Max. Error	< 0.5 °C
Temperature Coefficient	< 150 ppm/K
Offset Drift	< 0.1 digit/K

Temperature Module Thermocouple

Linearization Error	< 1°C
Temperature Coefficient	< 150 ppm/K except for type S
Temperature Coefficient Type S	as of 20 % of MB < 2 °C
Offset Drift	< 0.1 digit/K
Cold Spot Compensation	
Error (10 ... 50 °C)	≤ 1 K
Broken Cable Display	"- - - - - "

Resistance Module

Measurement within range:	Error up to:
200,0 Ω	≤ 0.1 %
2,000 kΩ	≤ 0.1 %
20,000 kΩ	≤ 0.3 %

Frequency and R.P.M. Module

for ranges up to 500.0 Hz	Cycle Duration Measurement
Max. Resolution	0.1 Hz
Error Limits	± 1 D
Time Base	± 50 ppm
Temperature Coefficient	± 1.5 ppm / K
Frequency up to:	Error up to:
5,0 ... 100,0 Hz	± (0,1 Hz + 1 Digit)
100,0 ... 200,0 Hz	± (0,4 % + 2 Digit)
200,0 ... 300,0 Hz	± (0,6 % + 2 Digit)
300,0 ... 400,0 Hz	± (0,8 % + 2 Digit)
400,0 ... 500,0 Hz	± (1,0 % + 2 Digit)
for ranges > 500 Hz	Frequency Measurement
Frequency in:	Measuring Time:
200.00 kHz range	max. 0.3 sec.
20.000 kHz range	max. 2.0 sec.
2.0000 kHz range	max. 20 sec.

Pressure Measurement Module

Intrinsic Error	± (0.05 % + 1 digit)
Temperature Coefficient	< 80 ppm/K
SMRR	> 35 dB at 50 Hz
CMRR	> 120 dB as related to MB 200.00 mV at 50 Hz

Control Inputs

Instrument Test (Test)	by means of floating contact
Display Storage (Hold)	by means of floating contact
Program Protection (Lock)	by means of floating contact

Outputs

Relay Contacts

for LOL1 and HIL1	1 switching contact each
for LOL2 and HIL2	1 normally open contact each
Switching Time	max. 400 ms
Switching Hysteresis	adjustable from ±1 to ±127 D
Integration Time Constant	adjustable from 1s to 127s
Switching Capability	5 A / 240 V

Serial Interface	DIGEM f 96x48CK only
Interface Type	RS232 or RS485
Transmission Protocol	DIN Draft no. 19 244
Electrical Isolation	isolated from all other circuits

Analog Output

Resolution	12 bit, however max. resolution for digital display
Ranges	0 ... 20 mA; 4 ... 20 mA/500 Ω or 0 ... 10 V
Balancing	digital via front panel keys
Electrical Isolation	DIGEM f 96x48CK only

Supply Voltage

	depending upon model:
DIGEM f 96x48CK	230/115 V AC and 90 ... 260 V DC or 24/12 V AC and 10 V ... 50 V DC
DIGEM f 96x48EK	230 V AC or 115 V AC
Power Consumption	max. 5 VA

Electrical Safety

Models	IEC 1010-1: 1.91/ EN 61010-1: 3.94
Protection Class	I
Overvoltage Class	II
Contamination Level	2

Protection	EN 60529/ VDE 0470-1
Housing Front	IP40
Connections	IP00
EMC	
Interference Immunity	EN 50082-2
Interference Emission	EN 50081-2
Max. Allowable Voltage to Earth	
DC Voltage Module	300 V
AC Voltage Module 100/700V	1000 V
DC/AC Current Module	300 V
Temp./Pressure Modules	50 V
Frequency/R.P.M. Modules	90 ... 300 V

Ambient Conditions

Operating Temperature	0 ... 50 ˚C
Storage Temperature	– 20 ... 70 ˚C
Relative Atmospheric Humidity	max. 85 %
Applications Class	DIN 40040: KWG
Vibration Resistance	IEC 1010-1/ EN 61010-1: 3.94

Housing

Design	Metal Half-Shells
Front Panel Dimensions	96 x 48 mm
Switch Panel Opening	$45^{+0.6} \times 92^{+0.8}$ mm
Front Frame Height	5 mm
Front Frame Color	black, optionally gray, light gray, pebble gray or dark beige
Installation Depth	max. 140 mm
Weight	approx. 500 gr.
Connection Type	screw terminal blocks
Fastening	DIN screw clips

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