



# Operating Instructions Electronic Tachometer PCD43

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## General Information

In the following you will find the explanations of the symbols used in this operating manual.

*Explanation of symbols*

➔ This symbol indicates activities to be carried out.

● This symbol stands for additional technical information.



This symbol is located before texts to which particular attention is to be paid to ensure proper use of the products.



This symbol is located before texts that provide important additional information.

*Italics*

Important terms in the left text column are printed in italics to help you find information more quickly.

## 1 Safety Instructions

### 1.1 General information

The unit has been developed and built in accordance with the recognized rules of technology. The units have left the manufacturing plant ready to operate and in safe condition. To keep the units in this condition, it is necessary that the units be installed and operated

- properly,
- in a safety and hazard-conscious manner,
- under observance of this operating manual and in particular of these safety precautions!

Make sure that the personnel has read and understood the operating manual, and in particular the "Safety Instructions" chapter. In addition to the operating manual, the generally applicable legal and other binding regulations for accident prevention and environmental protection must be observed and ensured.

### 1.2 Proper use

The application of the units consists of controlling and monitoring industrial processes in the metal, wood, plastics, paper, glass and textile industry etc.

The units may only be operated

- in the properly installed state and
- in accordance with the specifications of the technical data!



Operation not covered by the specified descriptions/parameters is improper and can lead to

- fatal injuries,
- serious damage to health,
- property damage or
- damage to the units

in conjunction with the systems/machines/processes to be controlled/monitored!

The overvoltages to which the units are subjected at the connection terminals must be limited to the value of the overvoltage category II (see Technical Data)!

The units may not be operated

- in hazardous areas,
- as medical units,
- in applications expressly named in EN 61010!



If the units are used to control/monitor machines or processes with which, as the result of a failure/malfunction or incorrect operation of the units

- a life-threatening danger,
- health risks or
- a danger of property or environmental damage

could result, then appropriate safety precautions must be taken!

Do not open the housing of the units or make any changes to it! Tampering with the units can have a negative affect on their operating safety, resulting in dangers! Do not make repairs on the units! Return defective units to the manufacturer!

### 1.3 Installation/commissioning

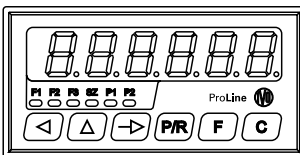
In case of changes (including in the operating behavior) that impair safety, shut-down the units immediately. Installation may only be carried out in accordance with the procedure described in Chapter 3 "PCD43 connection". During installation work on the units, the power supply must always be disconnected. Installation work may only be carried out by appropriately trained experts. Max. voltage 250V terminal - terminal, ground - terminal. Following proper assembly and installation, the units are ready for operation. Following commissioning, familiarize yourself with the use of the units in Chapter 4 "PCD43 operation".

### 1.4 Maintenance/repairs

Always disconnect the power supply of all units involved. Maintenance and repair work may only be carried out by appropriately trained experts. If troubleshooting is unsuccessful, do not continue to use the units. Please contact the manufacturer in this case.

## 2 Get to know your PCD43

### 2.1 PCD43 components



It comprises

- 2 separate tachometer units, tacho 1 with internal phase evaluation
- programmable calculation functions
- maximum memory "maximum point SZ"
- adjustable limit values

#### Control panel

- Shift key for display of functions
- Key for decade function
- Key to set decade values
- Key to shift between programming/operator level
- Function key
- Reset

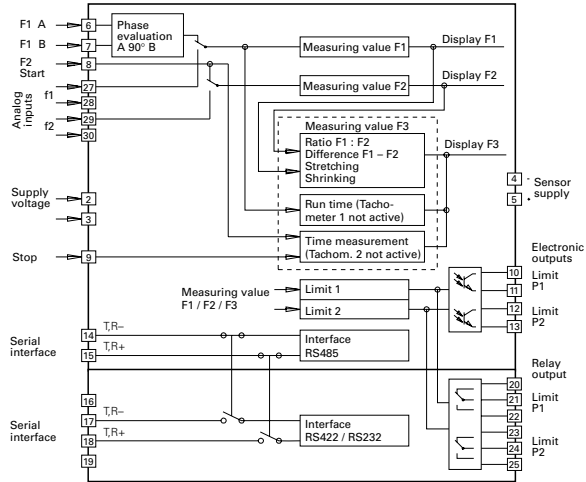
#### LED-display

- F1 Display Tachometer 1
- F2 Display Tachometer 2
- F3 Display of calculation selection
- SZ Display "maximum point SZ"
- P1 Limit value 1
- P2 Limit value 2



### 2.2 Block diagram

The block diagram shows the components together with its contacts and connections.



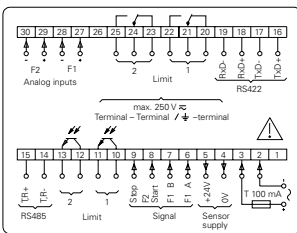
### 3 PCD43 connection

This chapter will explain how the contacts are assigned and give you some examples of connection.

Under chapters 3.1 to 3.5, you will find actual tips and technical data for the various connections.

The electric inputs and outputs are found on two plug-in screw terminals. Both screw terminals with 15 pins are coded as loss-free.

#### Examples of connection Assignment



Contact	Function
1	not connected
2	Supply voltage
3	Supply voltage
4	Encoder supply 0 Volt
5	Encoder supply + 24 V
6	Signal f1/A (track A)
7	Signal f1/B (track B)
8	Signal f2/Start
9	Signal Stop
10	Limit 1 (Collector)
11	Limit 1 (Emitter)
12	Limit 2 (Collector)
13	Limit 2 (Emitter)
14	reserved for Option RS 485 T,R-
15	reserved for Option RS 485 T,R+
16-19	reserved for Option RS 232 or RS 422
20-22	reserved for Option Relay output Limit 1 (P1)
23-25	reserved for Option Relay output Limit 2 (P2)
27	+f1 Analog input
28	-f1 Analog input
29	+f2 Analog input
30	-f2 Analog input



Litz contact only by means of connector sleeves with insulating enclosures for reasons of shock protection according to VDE 0411, Section 100. Do not otherwise assign contacts that have been left unassigned ex factory. We recommend to screen all encoder terminal leads and to ground the shield on one side. Shields on both sides are recommended in case of RF interference or in case of equipotential bonding over long distances. The encoder leads should not be in the same phase winding as the MAINS supply and the output contact leads.

### 3.1 Supply voltage connection

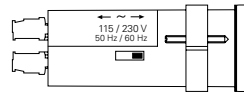
#### AC connection

Supply voltage	Recommended external protection
24 V $\pm 10\%$ 50/60 Hz	T 400 mA
48 V $\pm 10\%$ 50/60 Hz	T 400 mA
115 V $\pm 10\%$ 50/60 Hz	T 100 mA
230 V 6%-10% 50/60 Hz	T 100 mA

It is possible to choose two different AC voltages (please refer to adjacent table) by using the selector on the side. The respectively higher voltage (48 VAC or 230 V) is preset at the factory.

→ Switch to the required AC voltage using the selector.

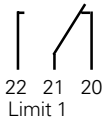
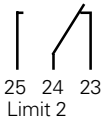
→ Connect AC to contacts 2 and 3 according to the terminal diagram.



Fire protection: Operate instrument on the MAINS with external fuse recommended on the rating plate. In case of disturbance, make sure that 8 A / 150 VA (W) are never exceeded - as defined per VDE 0411.

### 3.2 Assignment of signal outputs (Relay contacts) Option

Contacts 20, 21 and 22 as well as 23, 24 and 25 are floating changeover contacts. The signal outputs can be assigned as per adjacent terminal diagram. The limit values are assigned on programming lines 33 and 34.



Max. rating	Max. voltage	Max. current
150 VA / 30 W	250 V	1 A



The user must take care that, in case of disturbance, the contact rating of 8 A / 150 VA (W) is not exceeded. Internal spark suppression with zinc-oxide varistor (275 V).

→ Assign contacts 20, 21 and 22 as well as 23, 24 and 25 accordingly.

### 3.3 Assignment of signal inputs

Contacts 6 to 9 are signal inputs. The contacts 6 (f1/A) and 7 (f1/B) are inputs for the tachometer display F1. Type and logic of signal are programmed on lines 23 and 24.

Contact 8 (f2/Start) may be used, depending on its setting in line 21,

- as signal input for tachometer display F2
- or as start input for time measurement.

Contact 9 (Stop) is used as stop input for time measurement.

Input resistance	ca. 3 kOhm
Max. input level	+/- 40 V
Max. frequency F1	10 kHz
Max. frequency F2	40 kHz

→ Assign contacts 6 to 9 accordingly.

For suitable encoders, please refer to encoder catalog.

### 3.3.1 Analog inputs

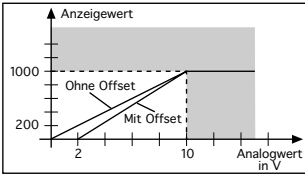


Illustration 1 shows the display value in dependence of the analog value for one analog input. The input is shown as voltage input with and without offset (line 64).

Maximum analog value = 1000 (line 62 or 63)

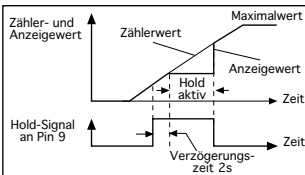


Illustration 2 shows the behavior of the Hold signal with regard to the display value.

The delay period (line 43) has been adjusted to 2 seconds for this example.

The controller encompasses 2 digital and 2 analog inputs. Either the digital or the analog inputs may be used. They are selected on line 61. On lines 62 and 63 it is possible to adjust the display range to the analog range. The programmed value corresponds to the display value at the 10 V and/or 20 mA analog value. The display value 0 is fixed for 0 V and/or 0 mA (without offset). When operating with offset, 0 will always be displayed in the range of 0 - 2 V / 0 - 4 mA.

**The necessary parameters for both analog inputs are contained in programming lines 61 to 64.**

### 3.3.2 Extended hold input

Input "Signal Stop" (Pin 9) of the controller offers the extended "Hold" function. This function acts on the displays F1, F2 and F3 (lines 1 - 3) when the input is activated with a delay of 0 - 9 seconds as programmed in line 43. After the Hold signal has been removed, the current value is displayed with the next Update cycle. The digital outputs (limit values) react to the memorized value and are thus also affected by the Hold function. It is also possible to read the memorized value of F1, F2 or F3 via the serial interface.

### 3.4 Encoder supply connection



Connect encoder supply to contacts 4 and 5. However, do not use encoder supply for unearthed inductors or capacitive loads.



The encoder supply is not short-circuit-proof.

Contact	Voltage	Max. resid. ripple	Max. admissi. current
12	0 V	-	-
13	+12...+26VDC	dependent of load	80 mA

### 3.5 Interface connections (Option)

The serial interface can perform the following functions:

- Retrieve data
- Program and retrieve parameters.

Interface parameters are:

- Transmission speed (Baud rate),
- Parity bit,
- Number of stop bits,
- Address of controller.

The interface parameters can be set on the programming level (Line 51 to 54).

The following standard interfaces can be connected (option):




- RS 232
- RS 422
- RS 485.

### Interface characteristics

- RS 232* Full - duplex transmission with the following features:
- Asymmetrical
  - 3 lines
  - Point-to-point connection - 1 emitter and 1 receiver
  - Maximum distance of data transfer: max. 30 m
- RS 422* Full - duplex transmission with the following features:
- Symmetrical
  - 4 lines
  - Multi-point connection - 1 emitter and 32 receivers
  - Maximum distance of data transfer: max. 1500 m
- RS 485* Half - duplex transmission with the following features:
- Symmetrical
  - 2 lines
  - Multi-point connection - Emitter and receiver (max. 32 units)
  - Maximum distance of data transfer: max. 1500 m
- ➔ Assign proper interfaces to contacts 14 and 15 and possibly 16, 17, 18 and 19.

### 3.6 Test routine

The test routine is described below:

- Test start* ➔ Simultaneously press the keys  and .
- ➔ Switch on (keep above key pressed until device is ON).
- All display segments will automatically be shown one after the other, their function thus being checked.
- Test extension* ➔ Subsequently check keyboard, inputs, outputs and interface using the  key.



No machine function is to be connected when testing the outputs.



Test keyboard.






Test inputs

- The inputs can be triggered simultaneously or individually. Their display is active if triggered.



Test outputs

- ➔ Push keys  and .

Outputs are activated. The outputs are reset using the key .



Test analog inputs

Display: F1 Analog input



Display: F2 Analog input

- Output of input voltage to F1/F2 analog input in value : 1 bit value  
V: 2.442 mV      I: 4.884  $\mu$ A



### Test interface

Display: Interface (output of transmitted data)

➔ End of test: „F“ for error; „P“ for Pass

Display: Program number and model number

Display: Program date

Test of different input levels (thresholds), signal forms and of phase discriminator (test of number 1 to 9)

*End of test* The test routine can only be terminated by switching off device. When the supply voltage is turned on again, the controller will be on the operator level.

### 3.7 Service routine

The test routine is described below:

*Test program version* Push key , turn on (keep key pressed until device is ON).

Display: Program number and version number

Display: Program date

## 4 PCD43 operation

The following chapter will inform you on the operation.

- The controller is automatically on the operator level after the supply voltage has been turned on.

*Operator level* On the operator level it is possible to

- to read the tachometer display F1, e.g. feeding speed;
- to read the tachometer display F2, e.g. rotational speed;
- to read the calculation value F3, e.g. ratio F1:F2;
- to read and clear the "maximum point" display SZ, e.g. F2 max;
- to read and modify the limit values P1 and P2.

It is possible to disable all operation parameters on the programming level. (Please also refer to chapter 5, programming field 2.)

### Tachometer display F1

*Read* ➔ Read current value.

### Tachometer display F2



*Read* ➔ Push key .  
➔ Read current value.

### Calculation function F3

*Read* ➔ Push key .  
➔ Read current value.








### “Maximum point” SZ

- Read* → Push key  .  
 → Read “maximum point”
- Reset* → Push key  .








### Limit value P1

- Read* → Push key  .  
 → Read set value of limit P1.
- Modify* → Enter P1 via  and  .  
 Plus/Minus sign, 6<sup>th</sup> decade after digit 9  
 (Sign only possible if line 21 = 1 or 2)
- Push key  .
-  End of modification



### Limit value P2

- Read* → Push key  .  
 Read set value of limit P2.
- Modify* → Enter P2 via  and  .  
 Plus/Minus sign, 6<sup>th</sup> decade after digit 9  
 (Sign only possible if line 21 = 1 or 2)
- Push key  .
-  End of modification




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The previous limit value will automatically be displayed again after 15 seconds if no keys have been operated.

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## 5 PCD43 programming

This chapter will inform you on how to program your controller.

*Programming level* Operation parameters are set on the programming level. The programming level consists of 3 programming fields.

*1<sup>st</sup> programming field* Here it is possible to select and modify all operation parameters. The operation parameters that are disabled for the operator are also displayed. The first programming field consists of 6 lines. (Lines 1 - 4 are not programming lines.)

*2<sup>nd</sup> programming field* The individual operation parameters for operator access on the operator level are disabled or enabled here. It is possible to access these disabled operation parameters in the first programming field.

*3<sup>rd</sup> programming field* All functions and values conditioned by the machinery as well as interface parameters are programmed here.

*Key operation* The key functions are the same for all programming fields, they may however differ on the operator / programming level. That is why all functions are described in the following.

### Key

*Function on operator and programming level* Shift to the following operation parameter on operator and programming level.  
Keep key pressed for quick sweep.

### Key

*Function on operator and programming level* Switch between operator and programming level.

### Key

*Function on operator and programming level* Select first or next decade desired. The chosen decade starts blinking.

### Key

*Function on operator level* Display is cleared.

*Function on programming level* Display is cleared. Reset to zero. Reset of the possible programmed operation parameters.

### Key

*Function on operator level* Shift from any display to a parameter as selected on line 41.

*Function on programming level* In connection with key  , shift to programming level.

### Key

*Function on operator level* When this key is pushed, the pertaining decade position jumps to the next value.

*Function on operator and programming level* When this key is pushed, the pertaining decade position jumps to the maximum setting.

The programming and the three programming fields are now described in the sequence of their use.

- Turn on programming*
- Push key **PR**.
  - The instrument shifts from operator to programming level.
  - Push key **F**.
  - **Code** is displayed.

The code exists for programming fields 1 - 3.

- Enter code: **◀** and **▶**.
- Push key **→**.




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No code is entered when instrument is delivered.

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*Wrong code* Wrong code entered:

- **Code** is displayed after key has been pushed.
- After 15 seconds, the instrument switches automatically to the operator level.
- Push key **PR**.
- Push key **F**.
- Enter correct code.

*Correct code unknown* If the correct code is not known:

- Return the controller to factory (for general reset).

*Correct code* → In case of correct code, push key **→**.

- The programming fields are now called one after the other.

### **Programming field 1**

Please refer to chapter 4 for more information on display and modification of particular values.

- Repeatedly push key **→**.
- The operation parameters are selected. Their corresponding LED starts blinking.

*Modify operation parameters* → Enter modified value via keys **◀** and **▶**.

- |                      |                      |   |
|----------------------|----------------------|---|
| 1 <sup>st</sup> line | <input type="text"/> | F1 - display Tachometer 1                           |
| 2 <sup>nd</sup> line | <input type="text"/> | F2 - display Tachometer 2                           |
| 3 <sup>rd</sup> line | <input type="text"/> | F3 - display of calculation function                |
| 4 <sup>th</sup> line | <input type="text"/> | SZ - display of "maximum point SZ" (maximum memory) |
| 5 <sup>th</sup> line | <input type="text"/> | P1 - Limit value 1                                  |
| 6 <sup>th</sup> line | <input type="text"/> | P2 - Limit value 2                                  |



- At the end of the first programming field, a dash line is displayed.



**Programming field 2** In the second programming field, S t A t e 0 is displayed to select status.

- S t A t e is displayed. The corresponding LED of operation parameter starts blinking.

*Meaning of status numbers*

0	Operation parameter can be selected, read, and in case of P1, P2 and SZ modified and/or cleared without the P/R key.
1	As with status 0, however modification only possible after having pushed the P/R key.
2	Operation parameter is fully disabled on the operator level. When this operation parameter is selected, it will not be displayed on the operator level but skipped. Its corresponding function remains.

*Modify status*



- ➔ Enter desired status number.
- Modified status number is automatically stored if instrument switches to operator level.
- ➔ Repeatedly push key.
- The status of each particular operation parameter is selected in sequence.

Line 11	<div style="border: 1px solid black; padding: 2px; display: inline-block;">S t A t e 0</div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px; text-align: center;">2</div>	F1 - display Tachometer 1
Line 12	<div style="border: 1px solid black; padding: 2px; display: inline-block;">S t A t e 0</div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px; text-align: center;">2</div>	F2 - display Tachometer 2
Line 13	<div style="border: 1px solid black; padding: 2px; display: inline-block;">S t A t e 0</div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px; text-align: center;">2</div>	F3 - display of calculation function
Line 14	<div style="border: 1px solid black; padding: 2px; display: inline-block;">S t A t e 0</div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px; text-align: center;">2</div>	SZ - display of "maximum point SZ" (maximum memory)
Line 15	<div style="border: 1px solid black; padding: 2px; display: inline-block;">S t A t e 0</div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px; text-align: center;">2</div>	P1 - Limit value 1
Line 16	<div style="border: 1px solid black; padding: 2px; display: inline-block;">S t A t e 0</div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 2px; text-align: center;">2</div>	P2 - Limit value 2
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">-----</div>	● At the end of these programming lines, a dash line is displayed, indicating the end of the second programming field.



The status of the operation parameters is set to zero ex factory.

**Programming field 3** The third programming field starts with programming line 21. The programming lines are shown one after the other in this programming field. The factory setting is displayed as *italics*.

- ➔ Repeatedly push key  ; for quick sweep, keep key pressed.
- The programming lines are selected one after the other. To skip back within programming lines, keep key  pressed as well.

The entry is stored when the instrument shifts back to the operator level from the programming level.

#### Calculation functions (Display on F3)

Line 21	21 0	<ul style="list-style-type: none"> <li>0 <i>Ratio F1 : F2</i></li> <li>1 Difference F1 - F2 (with plus/minus sign)</li> <li>2 Stretching/Shrinking (with plus/minus sign)</li> <li>3 Run time of a predefined distance</li> <li>4 Time measurement via Start and Stop signal</li> <li>5 Time measurement of length of period</li> <li>6 Time measurement of pulse duration</li> </ul>
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#### Calculation function 0, 1 and 2

Line 22	22 0	<ul style="list-style-type: none"> <li>0 <i>Calculation function as in line 21</i></li> <li>1 F1 - F2 exchanged</li> </ul>
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#### Type of signal of F1 and max. frequency of F2

Line 23	23 0	<ul style="list-style-type: none"> <li>0 <i>F1 Track A, possibly Up/Down, F2 40 kHz</i></li> <li>1 F1 Track A 90°, Track B, F2 40 kHz</li> <li>2 F1 Track A possibly Up/Down, F2 25 kHz (Contact triggering)</li> <li>3 F1 Track A 90°, Track B, F2 25 kHz (Contact triggering)</li> </ul>
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#### Input logic and thresholds of signal inputs

Line 24	24 0	<ul style="list-style-type: none"> <li>0 <i>PNP, Threshold at ca. 11 V</i></li> <li>1 NPN, Threshold at ca. 11 V</li> <li>2 PNP, Threshold at ca. 5 V or Namur with 8 V external supply</li> <li>3 NPN, Threshold at ca. 5 V or for Namur w/o explosion protec.</li> <li>4 PNP, Threshold at ca. 2.5 V</li> <li>5 NPN, Threshold at ca. 2.5 V</li> </ul>
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#### Evaluation F1 (Divisor)

Line 25	25 6F1	<ul style="list-style-type: none"> <li><i>1,0000</i></li> <li>0,0001</li> <li>9999,99</li> </ul>
	0000	

#### Evaluation F2 (Divisor), for speed measurement: Pulses/rev.

Line 26	26 6F2	<ul style="list-style-type: none"> <li><i>1,0000</i></li> <li>0,0001</li> <li>9999,99</li> </ul>
	0000	


**Evaluation F3 (Multiplier)**, e.g. to 100.000 with percentage

Line 27      27 bF3 display of stretching and/or shrinking  
10000 1,0000  
0,0001  
9999,99

**Update time** (repeated display)

Line 28      28 0 0 0.5 s  
1 1 s  
2 2 s  
3 3 s  
4 5 s  
5 10 s  
6 20 s  
7 30 s  
8 60 s

**Time-out F1 - F3**

If instrument is at rest, a reset to zero is effected after this interval.

Line 29      29 0 0 1 s  
1 2 s  
2 3 s  
3 5 s  
4 10 s  
5 20 s  
6 30 s  
7 60 s  
8 Time-out not in operation  
9 Time-out not in operation, with memorization of F1, F2 and F3 in case of power failure.

**Time unit F1**

Line 30      30 0 0 1/min.  
1 1/s  
2 1/h

**Time unit F2**

Line 31      31 0 0 1/min.  
1 1/s  
2 1/h

**Assignment of maximum point SZ**

Line 32      32 0 0 F1  
1 F2  
2 F3

**Assignment Limit value P1**

Line 33	<input type="text" value="33"/> <input type="text" value="0"/>	0	Maximum limit of F1
		1	Minimum limit of F1
		2	Maximum limit of F2
		3	Minimum limit of F2
		4	Maximum limit of F3
		5	Minimum limit of F3

**Assignment Limit value P2**

Line 34	<input type="text" value="34"/> <input type="text" value="0"/>	0	Maximum limit of F1
		1	Minimum limit of F1
		2	Maximum limit of F2
		3	Minimum limit of F2
		4	Maximum limit of F3
		5	Minimum limit of F3

**Output logic for digital output**

Line 35	<input type="text" value="35"/> <input type="text" value="0"/>	0	Both outputs as normally open
		1	P1 normally closed, P2 normally open
		2	P1 normally open, P2 normally closed
		3	Both outputs as normally closed

**Decimal point for F1**

Line 36	<input type="text" value="36"/> <input type="text" value="0"/>	0	No decimal point
		1	0,0
		2	0,00
		3	0,000

**Decimal point for F2**

Line 37	<input type="text" value="37"/> <input type="text" value="0"/>	0	No decimal point
		1	0,0
		2	0,00
		3	0,000

**Decimal point for F3** (Please refer to line 21)

for calculation factor 0, 1 or 2 for calculation factor 3, 4, 5 or 6

Line 38	<input type="text" value="38"/> <input type="text" value="0"/>	0	No decimal point	59.59.99 min.
		1	0,0	99.59.59 h
		2	0,00	99.59.59 h
		3	0,000	99.59.59 h


**Assignment of basic display** (back to previous setting after 15 s)

Line 39	<input type="text" value="39"/> <input type="text" value="0"/>	0	No switch to basic display
		1	F1
		2	F2
		3	F3
		4	SZ
		5	P1
		6	P2

**Code setting**

Line 40	<input type="text" value="40"/> <input type="text" value="Cod"/>		
	<input type="text" value=""/> <input type="text" value="0"/>	0	No code
		1 - 9999	

**Assignment of function key** (quick display switching)

Line 41	<input type="text" value="41"/> <input type="text" value="0"/>	0	No assignment of function key
		1	F1
		2	F2
		3	F3
		4	SZ
		5	P1
		6	P2

**Output behavior of minimum limit**

Line 42	<input type="text" value="42"/> <input type="text" value="0"/>	0	With starting lockout	(switches after power supply ON or PGM/RUN shift only if below value)
		1	Without starting lockout	

**Hold delay period**

Line 43	<input type="text" value="43"/> <input type="text" value="0"/>	0	No delay
		1	Delay of 1 s
		2	Delay of 2 s
		3	Delay of 3 s
		4	Delay of 4 s
		5	Delay of 5 s
		6	Delay of 6 s
		7	Delay of 7 s
		8	Delay of 8 s
		9	Delay of 9 s

**Baud rate**

Line 51	<input type="text" value="51"/> <input type="text" value="0"/>	0	4800 Baud
		1	2400 Baud
		2	1200 Baud
		3	600 Baud





## 5.1 Rotational speed and speed measurement

If used to measure speed in rpm, the time unit for F1 (Tachometer 1) is set on line 30, for F2 (Tachometer 2) on line 31 to 1/min. The number of pulses/revolution (evaluation) is effected for F1 on line 25, for F2 on line 26.

*Decimal positions* If decimals are to be displayed, please take this into account when setting the evaluation and the decimal point:

1 decimal point	Evaluation x 0.1	Decimal point 0.0
2 decimal points	Evaluation x 0.01	Decimal point 0.00
3 decimal points	Evaluation x 0.001	Decimal point 0.000

*Rotational speed measurement* A rotational speed of 9999 rpm is assumed for the 4 following examples:

<b>Pulses/rev</b>	<b>Evaluation</b>	<b>Decimal point</b>	<b>Example of displ.</b>
	Line 25/26	Line 36,37	

<i>Example</i> 1 rev=1 pulse	1	none	9999 (1/min)
1 rev=1 pulse	0.1	0.0	9999.9 (1/min)
1 rev=10 pulses	10	none	9999 (1/min)
1 rev=10 pulses	1	0.0	9999.9 (1/min)

*Speed measurement* If used to measure speed in m/min, the time unit for F1 and F2 is set in lines 30 and 31 (1/min), the number of pulses/meter (evaluation) is effected for F1 in line 25, for F2 in line 26.

Calculation formula of evaluation factor:  $\frac{\text{Pulses/rev.}}{\text{Circumference}}$

*Example* A speed of 9999 m/min is assumed for the following two examples:

<b>Circumf.</b>	<b>Pulses/rev</b>	<b>Evaluation</b>	<b>Dec. point</b>	<b>Display</b>
(Meas. w.)	(Emitter)	(Line 25, 26)	(Line 36,37)	
0.5 m	1	$\frac{1}{0.5} = 2$	None	9999 (1/min)
0.5 m	50	$\frac{50}{0.5} = 100$	None	9999 (1/min)

## 5.2 Calculation functions

The calculation functions are described in the following.

To control two rotational speeds or speeds and/or one rotational speed and one speed that are to be displayed as ratio, difference or stretching/shrinking (percentage deviation).

The percent display is adjusted by using the factor 100. For decimal points, please refer to above.

<i>Example</i>	<b>Formula</b>	<b>Rev/min</b>	<b>Evaluation</b>	<b>Dec. point</b>	<b>Display</b>
			(Line 27)	(Line 38)	
<i>Ratio</i>	F1 F2	F1 = 100 rpm F2 = 200 rpm	10	0.0	0.5
<i>Difference</i>	F1-F2	F1 = 200 rpm F2 = 100 rpm	1	none	100
<i>Stretching/Shrinking</i>	(F2-F1) F1	F1 = 100 rpm F2 = 200 rpm	100	none	100 (%)
		F1 = 200 rpm F2 = 100 rpm	1000	0.0	- 50.0 (%)

### 5.3 Time measurement

When used to measure time, the following functions are available that can also be programmed on line 21.

Time range and resolution are defined in line 38.

The result is displayed in F3.



In case of a time overflow, the display will start again at 00.00.00, and limit contacts that might have been set will drop out.

*Run time* Calculation of run time (e.g. of a transport belt) that is needed for a certain distance (from A to B) taking its speed under consideration. The calculation result is displayed under F3. The speed can be captured via an incremental encoder with two signal tracks "A 90° B" on tachometer 1.

The distance to be measured is to be programmed in line 27.



F1 is suppressed for this application, if selected "F1 OFF" will be displayed. F2 can be used to display rotational speed or speed.

<i>Example</i>	<b>Circumf.</b> (Meas. w.)	<b>Pulses/rev</b> (Emitter)	<b>Evaluation</b> (Line 25)	<b>Distance</b> (Line 27)	<b>Displ. range</b> (Line 38)
	0.5 m	50	$\frac{50}{0.5} = 100$	10.00 m	99.59.59 h 59.59.99 min

*Measurement via start and stop signal* Time measurement is initiated via an impulse at input "F2/Start" and terminated via an impulse at input "Stop". Both inputs react to the front pulse edge. F2 indicates a measurement in progress. (The final result is displayed under F3.)

*Length of period* Time measurement is initiated via the front pulse edge at input "F2/Start" and terminated by the subsequent front pulse edge. The measurement may be interrupted via the input "Stop" (gate function). F2 indicates a measurement in progress. (The final result is displayed under F3.)

*Length of pulse* Time measurement is initiated via the front pulse edge at input "F2/Start" and terminated by the trailing edge. The measurement may be interrupted via the input "Stop" (gate function). F2 indicates a measurement in progress. (The final result is displayed under F3.)

## 6. Technical data

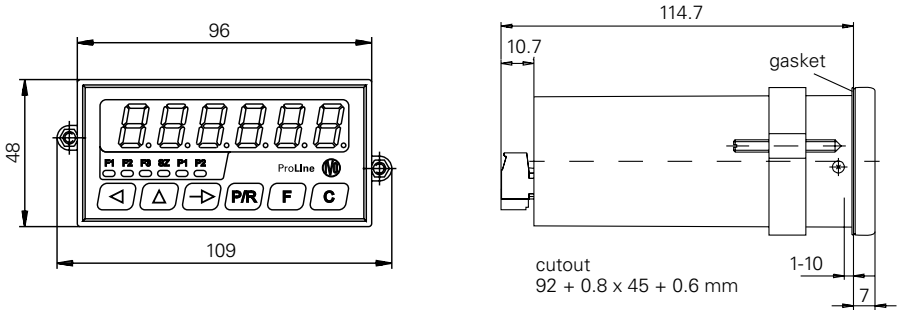
Display	7-segment LED-display 6-digit, red, with suppression of leading zero, - (minus) sign for negative values
Digit size	14 mm
Supply voltage	24 / 48 VAC ± 10 %, 115 VAC ± 10 % / 230 VAC + 6%, - 10 %
Power consumption	7 VA, 5 W
Encoder supply	12 ... 26 VDC, max. 80 mA
Signal inputs	To be programmed to PNP, NPN-Logic
Input resistance	ca. 3 kOhm
Max. input level	+/- 40 V
Max. input frequency F1, F2	10 kHz, 40 kHz
Accuracy	0.02 % of final value of particular range in general +/- 1 digit
Signal outputs	Optocoupler for limit value 1 and 2
Max. switching voltage	40 V
Max. switching current	15 mA
Max. residual voltage	< 1 V
Data storage	> 10 years via EEPROM
Fixing	Clamping frame
Dimensions	96 x 48 mm Casing for front-plate mounting
Mounting depth	ca. 115 mm
Connections	Plug-in screw terminals
Core cross-section	Max. 1.5 mm <sup>2</sup>
Casing material	Makrolon 6485
Front membrane	Polyester foil
Weight	ca. 350 g
Protection	Front IP 65 to DIN 40050
General rating	EN 61010 Part 1 - Protection class II - Overvoltage protection categ. II - Contamination factor 2
Interference immunity	EN 50082-2
Emitted interference	EN 50081-1
Ambient temperature	0...+50 °C
Storage temperature	-20...+70 °C
Humidity	Max. relative humidity 80%, non-conden.

### Analog input

Type of transformer	Successive approximation
Resolution	12 bits (4096 steps)
Input range	
At voltage input	0...10 V 2...10 V (to be programmed via keypad)
1 bit value	2442 mV
Input resistance	20 kOhm
At current input	0...20 mA 4...20 mA (to be programmed via keypad)
1 bit value	4884 µA
Input resistance	250 kOhm
Accuracy	± 0.1 % per final value

Non-linearity	Max. $\pm 2$ LSB
Temperature coefficient	typ.. $\pm 20$ ppm / °C
Offset error	typ. $\pm 1$ LSB
Isolation	250 VRMS Min. input to tachometer logic Electrical isolation to all other functions
Miscellaneous	Overvolt. protect. of all inputs up to $\pm 30$ V

**6.1 Dimensions and cutout measures**



**6.2 Factory settings**

The following parameters are set ex factory:

P1 Limit value 1 to	1000
P2 Limit value 2 to	2000
Calculation function	Ratio F1 : F2
Counting mode of F1* (* F1 and F2 digital input)	One track (possibly Up/Down)
Input logic	PNP
Evaluation F1, F2, F3	1.0000
Repeated display	every second
Time-out	1 s
Time unit F1, F2	1/min
Assignment of max. point SZ	to F1
Assignment of Limit value 1	1 <sup>st</sup> maximum value of F1
Assignment of Limit value 2	2 <sup>nd</sup> maximum value of F1
Output logic for digital output	both outputs as normally open
Decimal point F1, F2, F3	No decimal point
Assignment of basic display	No return after 15 s
Program protection code	No code set
Assignment of function key	No assignment of function key
Output behavior	Switches only if minimum limit is exceeded
<i>Option</i>	Baudrate 4800 Baud
Parity	Even parity
Stop bit	1 stop bit
Instrument address	0



### 6.3 Error messages

*Error messages*

Err 1      Err 2      Hardware mistake, must be repaired at factory.  
Err 4

Err 6      Input frequency of Tachometer F1 too high, error message can be cleared via key C.

999999      Range overflow of display F1, F2, F3.

*blinking*      Can also appear for lower frequencies in case of unfavorable parameter settings.

**Example:**

F1 = 100 Hz, bF1 = 0.01, Unit = 1 /h

$100/0.01 \times 3600 = \mathbf{3600000}$

The blinking of the digits 999999 will be automatically stopped if parameters are corrected or frequency is reduced.

### 6.4 Programming lines

Line	Default Settings	Customer Program	Description Outline
01	0		F1 - Tacho display F1
02	0		F2 - Tacho display F2
03	0		F3 - Tacho display F3
04	0		SZ - Dragging value
05	1000		P1 - Limit value 1
06	2000		P2 - Limit value 2
10	-----		Separating line
11	StArE 0	StArE	F1 - Status for Tacho display F1
12	StArE 0	StArE	F2 - Status for Tacho display F2
13	StArE 0	StArE	F3 - Status for Tacho display F3
14	StArE 0	StArE	SZ - Status for Dragging value
15	StArE 0	StArE	P1 - Status for Limit value 1
16	StArE 0	StArE	P2 - Status for Limit value 2
20	-----		Separating line
21	21 0	21	Calculating function
22	22 0	22	Inversion of Calculating function
23	23 0	23	Counting mode Tacho 1
24	24 0	24	Input logic

Line	Default Settings	Customer Program	Description Outline
25	25 bF1 10000	25	Evaluation Tacho F1
26	26 bF2 10000	26	Evaluation Tacho F2
27	27 bF3 10000	27	Factor for Calculating function F3
28	28 0	28	Update time F1, F2, F3
29	29 0	29	Time-out F1, F2, F3
30	30 0	30	Time unit Tacho F1
31	31 0	31	Time unit Tacho F2
32	32 0	32	Assignment Dragging value
33	33 0	33	Assignment digital output 1
34	34 0	34	Assignment digital output 2
35	35 0	35	Output logic of digital outputs
36	36 0	36	Decimal point F1
37	37 0	37	Decimal point F2
38	38 0	38	Decimal point F3
39	39 0	39	Selection Basic display
40	40 Cod 0	40	Code
41	41 0	41	Assignment Function display
42	42 0	42	Output reaction lower limit value
43	43 0	43	Hold Delay time
51	51 0	51	Baudrate
52	52 0	52	Parity
53	53 0	53	Stop bits
54	54 0	54	Address
61	61 0	61	Selection Analoge Input
62	62 aR1 4095	62	Upper analog value input 1
63	63 aR2	63	Upper analog value input 2
64	64 0	64	Offset
65	-----		Separating line



## 7 Order Designation

