

# Operating Instructions

## Electronic preselection counter CM03xx40

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Contents	Page
<b>1 Safety instructions</b>	<b>2</b>
<b>2 Getting to know the counter</b>	<b>4</b>
<b>3 Counter connection</b>	<b>4</b>
3.1 Connecting the power supply	5
3.2 Assignment signal output „relays contact“	5
3.3 Assignment electronic output	6
3.4 Assignment signal input	6
3.4.1 Typical connections	8
3.5 Connecting the sensor supply	8
3.6 Establishing basic settings	9
3.6.1 Settings operating modes	9
3.6.2 Setting the counting frequency	9
3.7 Executing the test routine	10
<b>4 Operating mode</b>	<b>10</b>
<b>5 Programming mode</b>	<b>12</b>
5.1 Counting modes (Input modes)	15
5.2 Output responses (Output modes)	19
5.3 Counter overrun response	19
<b>6 Technical data</b>	<b>20</b>
6.1 Dimensions	21
6.2 Default settings	22
6.3 Error messages	22
<b>7 Order designations</b>	<b>22</b>

## 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 indicates supplementary technical information.



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



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

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*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 products 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!



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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!

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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!



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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 "Counter connecting".

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 250 V 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 "Operating mode".

### **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 Getting to know the counter





The counter is an electronic, microprocessor-based presetting counter. It can also be programmed to function as a:

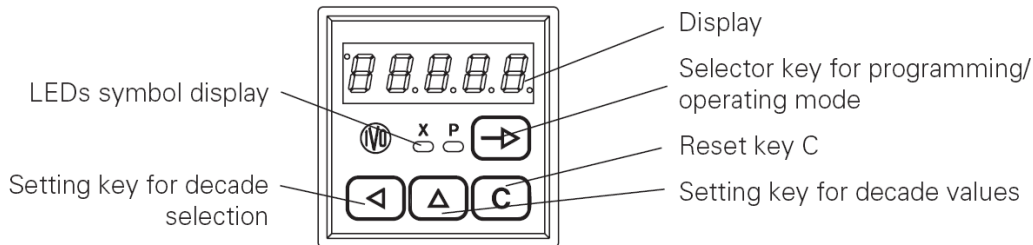
- Time counter with various timescale options
- Time delay relay with four operating modes

### Parameters/LED display

-  Current main counter
-  Preset value
-  Scaling factor

### Control panel

-  Selector key for programming/operating mode
-  Reset key C
-  Setting key for decade values
-  Setting key for decade selection

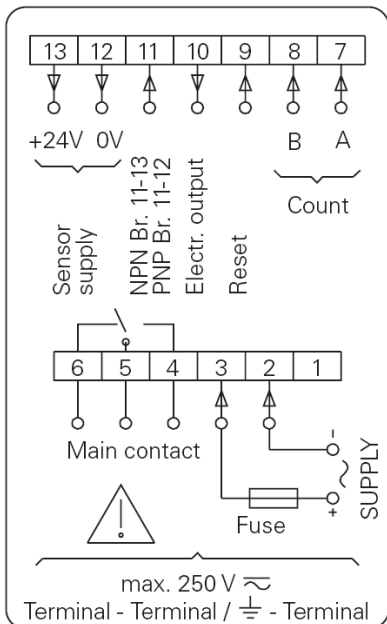


## 3 Counter connection

This section describes the terminal assignments, accompanied by an example of a typical connection.

Sections 3.1 to 3.5 contain specific instructions and technical data relating to the individual terminals.

Connection example



Terminal	Function
1	Not assigned
2	Power supply
3	Power supply
4	1 Signal output - relay contact
5	
6	
7	Track A
8	Track B
9	Reset by external signal
10	Electronic output (choice of PNP or NPN logic)
11	Coding input for input logic
12	Sensor supply (0 V)
13	Sensor supply (+24 V)



For protection against shock hazards as specified in VDE 0411 part 100, stranded conductors may only be connected using wire end ferrules with insulating caps. Terminals which are not assigned in the factory must not be otherwise assigned by the user. We recommend shielding all encoder connecting leads and earthing the shield at one end. Earthing at both ends is recommended to avoid RF interference or if equipotential bonding conductors are installed over long distances. Encoder connecting leads should not be laid in the same trunking as the mains power supply cable and output contact leads.

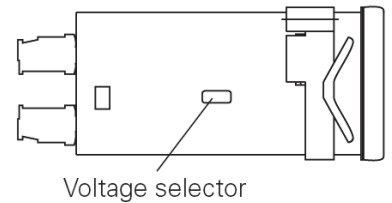
*AC voltage connection*

Power supply AC voltage	Recommended external fusing
24V ± 10% 50/60 Hz	M 400 mA
48V ± 10% 50/60 Hz	M 400 mA
115V ± 10% 50/60 Hz	M 125 mA
230V +6/ -10 % 50/60 Hz	M 125 mA

**3.1 Connecting the power supply**

It is possible to switch between two different alternating voltage ratings (see adjoining table) by means of the voltage selector switch at the side of the unit. The higher of the two alternating voltage ratings (48V or 230V) is preset by the factory.

- ➔ Set the required alternating voltage with the voltage selector switch.
- ➔ Connect the alternating voltage supply to terminals 2 and 3 in accordance with the counter wiring diagram.



*DC voltage connection*

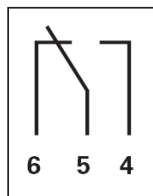
Power supply AC voltage	Recommended external fusing
24 V ± 10 % approx. 5 % RW	M 400 mA

Connect an interference-free power supply, i.e. do not use it for the parallel connection of drive systems, contactors, solenoid valves, etc.

- ➔ Connect the DC voltage in accordance with the counter wiring diagram.



Fire protection: Operate the instrument using the recommended external fusing indicated in the terminal diagram. VDE 0411 specifies that 8A/150 VA(W) must never be exceeded in the event of a fault.



**3.2 Assignment signal output „relay contact“**

Terminals 4, 5 and 6 form a no-potential changeover contact, which can be assigned as a pulse or continuous contact in accordance with the adjoining wiring diagram.

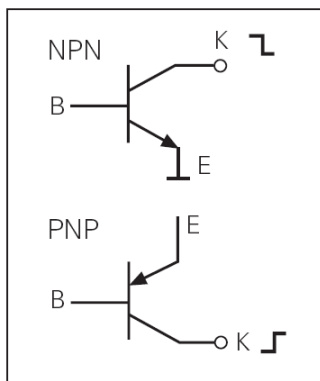
Implementation as a pulse or continuous signal is effected via DIP-switch 2 and in the programming mode, line 12 (see 3.6). The pulse time is programmed in the programming mode, line 2.

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



The user is responsible for ensuring that a switching load of 8A/150 VA (W) is not exceeded in the event of a fault. Internal spark suppression by means of two zinc oxide varistors (275 V). The output relays of the instrument (1 relay or several) may only be disengaged in total 5 x per minute at the most. Admissible clicks according to interference suppression standard EN 55011 EN 50081-2 for the industrial sector. In case of a higher switching rate, the operator must take care of interference suppression on the spot and under his own responsibility by observing the load to be switched.

➔ Assign terminals 4, 5 and 6 (relay contact outputs) accordingly.



**3.3 Assignment electronic output**

The electronic output (terminal 10) is pre-programmed by the factory as an NPN or PNP switching transistor (open collector) in accordance with the purchase order specification. The output is coded as a pulse or continuous signal at DIP-switch 2.

Output logic	Max. switching voltage	Max. switching current
NPN	+35 V	50 mA
PNP	+12...+24 VDC with AC power supply load-dependend	10 mA with AC power 50 mA with DC power



The electronic output is not short-circuit proof.

➔ Assign terminal 10 accordingly.

**3.4 Assignment signal input**

Terminals 7, 8 and 9 are AC optocoupler inputs. Terminals 7 (track A) and 8 (track B) are pulse inputs for the counting function. Terminal 9 is the external reset input.

Terminal	Input resistance	Starting current	Breaking current
7, 8	1.65 kΩ	> 9 mA, < 16 mA	< 0.5 mA
9	3.3 kΩ	> 5 mA, < 8 mA	< 0.5 mA

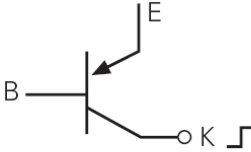
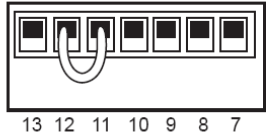
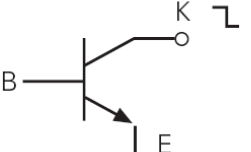
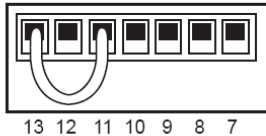
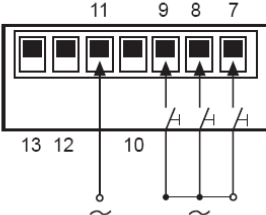


The counter is reset by applying an external signal (signal width ≥30 ms) at terminal 9 (see part 5, programming line 7).

➔ Assign terminals 7, 8 and 9 accordingly.

The maximum counting frequency is set via DIP-switch 3 (see 3.6). For suitable pulse generators, see the encoder Catalogue.

*Programming input logic* The signal input logic can be programmed by means of a bridge between terminals 11, 12 and 13, in accordance with the table below.

To be used	Encoder signals	Terminal assignments
<ul style="list-style-type: none"> <li>- If the pulse generator is not supplied by the encoder power supply from the counter.</li> <li>- If the pulse generator has a push-pull or PNP output stage.</li> <li>- If several counters are triggered in parallel by a single pulse generator.</li> </ul>	<p>PNP, triggered by a plus signal.</p> 	<p>11 and 12</p> 
<ul style="list-style-type: none"> <li>- If the pulse generator has an NPN output stage.</li> <li>- If a NAMUR encoder is connected.</li> </ul>	<p>NPN, triggered by a minus signal.</p> 	<p>11 and 13</p> 
<ul style="list-style-type: none"> <li>- In conjunction with a max. 24 VAC power supply.</li> </ul>	<p>Alternating voltage input; 7, 8 and 9, triggered by max. 24 VAC.</p>	



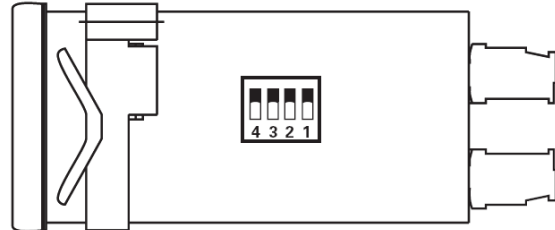
Electrical isolation is provided for instruments with an AC power supply and a relay output without electronic signal output in the case of an external sensor supply.

**3.4.1 Typical connections**

DIP	Position	Effect
1	OFF	Adding mode
1	ON	Subtracting mode
2	OFF	Automatic reset with pulse signal
2	ON	External reset with cont. signal
3	OFF	Counting frequency 10 kHz
3	ON	Counting frequency 15 Hz
4	OFF	Programming disabled (for operating mode see part 4)
4	ON	Programming enabled (for programming mode see part 5)

**3.6 Establishing basic settings (DIP-switches)**

The basic settings are established by means of DIP-switches, the positions and effects of which are described below. The DIP-switches are located on one side of the counter housing, together with a setting diagram.



- Dip-switch:  
 1 Count mode  
 2 Reset  
 3 Count speed  
 4 Programming

- ➔ Set DIP-switches as required before installing the unit.
- All switches are set to OFF by the factory before delivery.

**3.6.1 Setting operating modes (DIP-switch 1)**

**Adding mode**



The counter adds from zero to the preselected number. An external, manual or automatic reset causes the counter to revert to zero or to the programmed start count value.



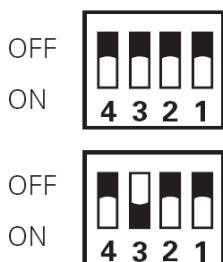
**Subtracting mode**

The counter subtracts from a preselected number to zero or to the programmed start count value. An external, manual or automatic reset causes the counter to revert to the preselected number.



For details of totalizing, up/down and differential counting, see 5.1.

**3.6.2 Setting the counting frequency (DIP-switch 3)**



Application	Max. counting setting	DIP-switch 3 setting
Sensor with electronic output	10 kHz	OFF
Triggering via contacts; microswitches AC voltages	15 kHz	ON








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In the case of two counting signals, phase offset by 90° and with fourfold evaluation, the maximum counting frequency reduces to 5 kHz.


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### 3.7 Executing the test routine

The test routine is described below.

- To start test*
- ➔ Press the  and  keys simultaneously.
  - ➔ Switch the counter on.
  - All the display segments will be displayed automatically in sequence and are thereby tested for functional capability.

*Test repeat* If you wish to repeat the test:

- ➔ Press the  key.

*Test extension* Other counter functions can be tested:

- ➔ Press the  key again.




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No machine functions may be connected when the outputs are tested.

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Testing of inputs A and B and reset input R.

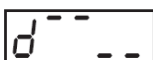
- Inputs can be triggered simultaneously or individually. A display is only provided when a signal is applied.



Output test



The output is now activated. Reset the output with the  key.



Testing of DIP-switches in accordance with ON/OFF settings. The settings and functions of the DIP-switches can be changed while the test is in progress.

*End of test* The test routine is now terminated.

## 4 Operating mode

The operation and use of the counter are described in this section.

- As soon as the power supply has been switched on, the counter is automatically set to the operating mode.

*Operating mode* In the operating mode:

- the current counter status can be read and reset;
- the input preset value can be read and changed, provided this is enabled in the programming mode (line 5);
- the scaling factor can be read and changed, provided this is enabled in the programming mode (line 5);

All the parameters can be disabled in the programming mode.

**Counter status**



The current counter status is displayed in the operating mode; no keying is necessary.



➔ Read the counter status display.

*To reset*

Resetting must be enabled in the programming mode (line 6).

➔ Press the **[C]** key.

**Preset value**



Functions relating to the preset value must be enabled in the programming mode (line 5).



➔ Press the **[→]** key.

➔ Read of preset value.

*To change*

➔ Hold down the **[←]** key until the decade position you require to change flashes.

➔ Hold down the **[△]** key until the required number within the flashing decade is reached.




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If a key is not operated within 15 seconds, the current counter status will automatically be re-displayed.

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*To store*

➔ Press the **[→]** key.




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The preset value can be changed during counting. This function must be enabled in the programming mode (line 4).

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- If a value is disabled in the operating mode, it will be skipped and the next value displayed.

**Scaling factor**



Scaling factor functions must be enabled in the programming mode (line 5).



➔ Press the **[→]** key.



➔ Read off the scaling factor.




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The scaling factor is an adjustable multiplier, whereby the ingoing counting pulses are multiplied. The scaling factor can be adjusted within the range from 0.001 to 99.999. The result of the multiplication is shown in the display. Only whole-number values are displayed. The remainder of the value is added to the next calculation in each case.

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- To change* → Hold down the  key until the decade position you require to change flashes.
- Hold down the  key until the required number within the flashing decade is reached.



---

If a key is not operated within 15 seconds, the current counter status will automatically be re-displayed.

---

- To store* → Press the  key.

## 5 Programming mode

This section describes the procedure for programming the counter.

*Programming mode* Operating parameters are set in the programming mode, which is subdivided into two programming segments, i.e. PRO 0 and PRO 1. Both segments are described below in their actual order.

- To access programming* → Set DIP-switch 4 to „ON“.
- Programming of the desired operating parameter is now enabled.

### Keying

Key operation is the same in both the PRO 0 and PRO 1 programming segments.

#### Key

*Function 1* Transfer to the next operating parameter in the programming segment.

*Function 2* Accept and acknowledge new value.

#### Key

*Function* Select first or next decade position.  
This will now be displayed flashing.

#### Key

*Function* When this key is pressed, the display for the decade position concerned runs from 0 to 9 or to the maximum setting value. When the required number is reached, release the key.

#### Key

*Function* In the case of the preset value, pulse time and start count value, the display is reset to zero when this key is pressed.

**Programming segment PRO 0**

Line 5

5 0

Information on changing the counter status, preset value and scaling



**Function enabled in operating mode**

- 0 \* Changing of preset value only enabled
- 1 Changing of scaling factor only enabled
- 2 Changing of preset value and scaling factor enabled
- 3 Changing of preset value and scaling factor disabled

Line 6

6 0

**Reset key  , function enabled in operating mode**

- 0 \* Reset key  activated
- 1 Reset key  disabled

Line 7

7 0

**Reset input function**

- 0 \* Counting stop activated during external reset signal.
- 1 Differentiating reset signal effective with signal edge, no counting stop.

Line 8

8 0

**Start count value 0-999**

- 0 \* Start count value 0
- 999 Any start count value from 0 - 999
- DIP-switch 1 OFF: output set to preset value
- DIP-switch 1 ON: output set to start count value

Li  
Line 9

9 0

**Time scale and resolution**

- 0 \* 999 s 99/100 s
- 1 99 min 59 s 9/10 s
- 2 999 min 59 s
- 3 999 h 59 min
- Only applicable to use as a time counter or time delay relay.

Li

Line 10

10 0

**Time delay relay cycle**

- 0 \* Operating mode 1: ON delay
- 1 Operating mode 2: Hold time without stop (can be re-triggered)
- 2 Operating mode 3: Decay delay
- 3 Operating mode 4: Hold time with stop

Li

Line 11

11 0

**Output signal logic**

- 0 \* Normal output signal logic
- 1 Inverted output signal logic
- In the inverted output logic mode, the outputs are activated when the power supply is switched on and drop out on preset.

Line 12



12 0

**Output signal function**

- 0 \* As DIP - switch 2
- 1 External reset but without pulse signal

Li

To leave the programming mode  
To reprogram the counter to the default settings

- ➔ Set DIP-switch 4 to „OFF“ .
- ➔ Press an hold the  and  keys before switching the instrument on.

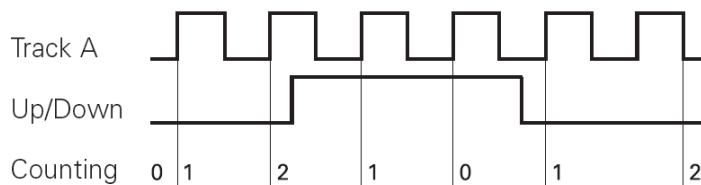
**Programming lines**

Line	Default settings	Customer's program	Description
	Pro 0		Separating line
	0		Current counter status
	100		Preset value
	1000		Scaling factor
	Pro 1		Separating line
01	1 0	1	Decimal point
02	2 0.25	2	Pulse signal time
03	3 0	3	Counting mode
04	4 0	4	Accept preset value
05	5 0	5	Function enabled in operating mode
06	6 0	6	Reset key, function enabled in operating mode
07	7 0	7	Reset input function
08	8 0	8	Start count value 0-999
09	9 0	9	Timescale and resolution
10	10 0	10	Time delay relay cycle
11	11 0	11	Output signal logic
12	12 0	12	Output signal function

**5.1 Counting modes (Input modes)**

This counter is able to count in either direction. The counting direction is independent of the selected adding or subtracting operating mode. The exceptions to this are counting with one counting track A, counting stop input on track B, and totalizing.

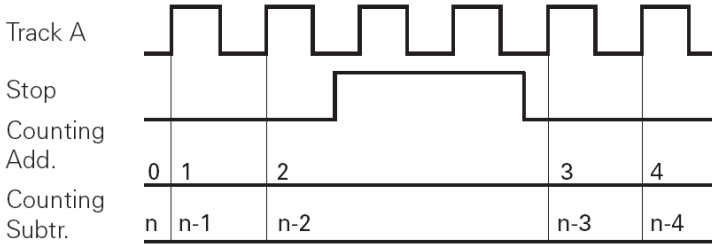
**Up/down counting with one counting track A and an external up/down signal on track B**





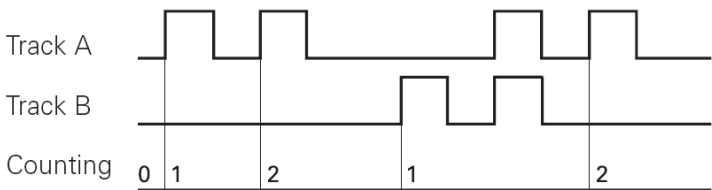
**Counting with one counting track A and counting stop input on track B**

The operating mode and consequent counting direction are selected with DIP-switch 1.



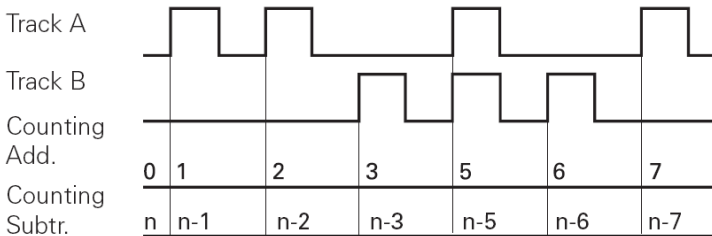
**Differential counting, track A adding, track B subtracting (A-B)**

Any signal duration and time.



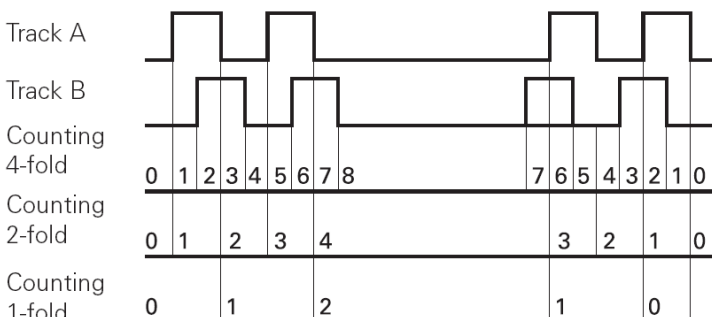
**Totalizing, tracks A and B adding (A+B)**

The operating mode and consequent counting direction are selected with DIP-switch 1.



**Up/down counting with two counting signals, phase-offset by 90 degrees**

The counting direction is automatically identified from the leading/lagging 90° phase offset. The internal phase discriminator performs the necessary evaluation. Twofold or fourfold evaluation is possible. Automatic up or down counting can also be obtained with pulse generators which are not provided with evaluating electronics and do not deliver a counting signal with the related counting direction signal.



**Using the counter as a time counter with preset**

*Function* The time counter with reset is used to control maintenance intervals, mixing times, etc. Use of the counter as a time counter is established in programming line 3. The four timescales are selected in programming line 9. The decimal point is set automatically. The operating mode and consequent counting direction are selected with DIP-switch 1. Resetting with a pulse signal or continuous signal is effected with DIP-switch 2.

*Start input* Track A (terminal 7) in time counting mode

*Stop input* Track B (terminal 8) in time counting mode

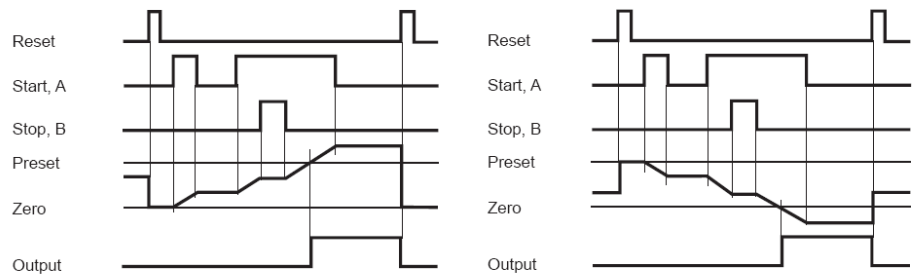


The value programmed in programming line 1 remains ineffective.

The diagrams below show the output responses as a function of the signal inputs.

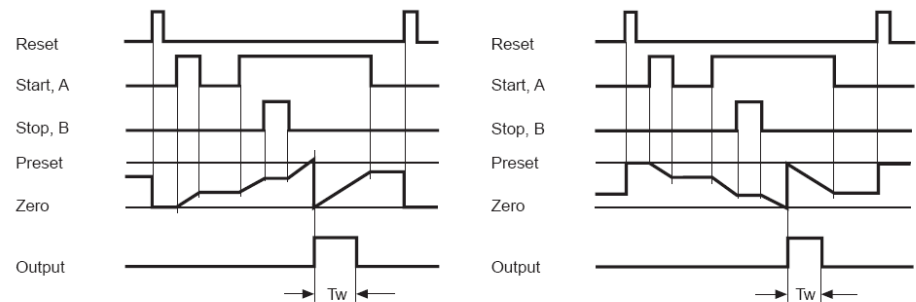
**External reset with continuous signal**

*DIP-switch 2 ON*



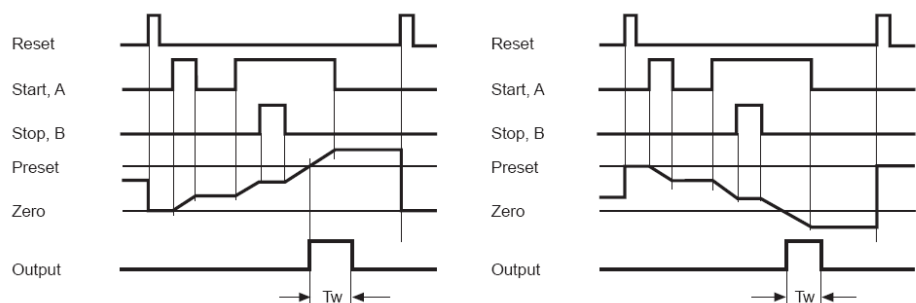
**Automatic reset with pulse signal**

*DIP-switch 2 OFF*



**External reset with pulse signal**

*DIP-switch 2 ON and Line 12 on 1*



**Using the counter as a time delay relay**

*Function* Use of the counter as a time delay relay is established in programming line 3. The four timescales are selected in programming line 9. The four operating modes are selected in programming line 10. The internal counting sequence takes place adding in all the operating modes, irrespective of the positions of the DIP-switches.

*Start input* Track A in time delay relay mode

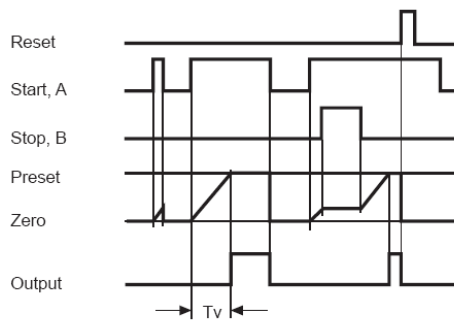
*Stop output* Track B in time delay relay mode



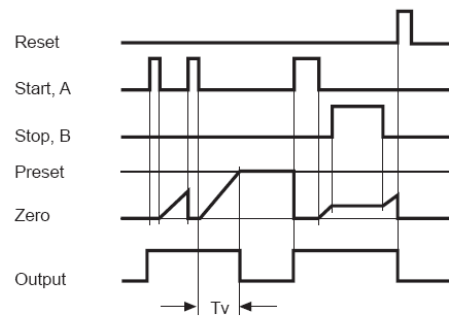
The values programmed in lines 1, 2 and 8 remain ineffective.

The diagrams below depict the output responses as a function of the signal input.

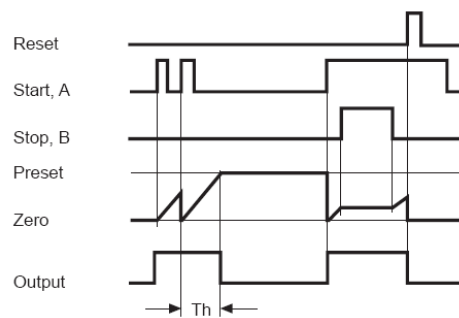
**Operating mode 1: ON delay**



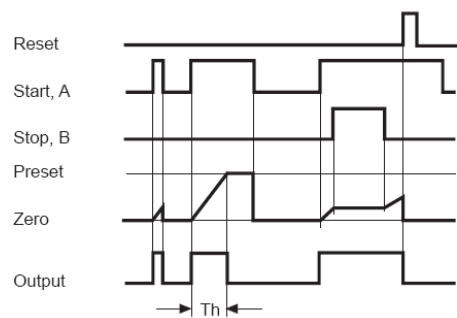
**Operating mode 3: Hold time without discontinuation**



**Operating mode 2: Drop-out delay**



**Operating mode 4: Hold time with discontinuation**



All the diagram patterns begin when the counter is switched on. The reset signal completely resets a time delay relay cycle in progress.

**5.2 Output responses (output mode)**

Signal output response is determined by the following:

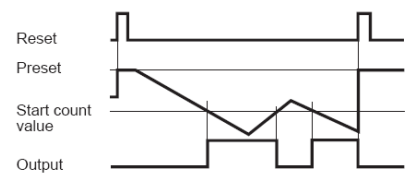
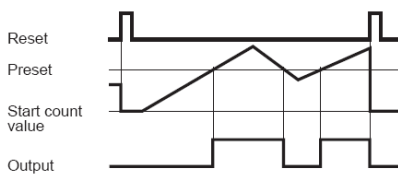
- Operating mode selected on DIP-switch 1
- Reset mode selected on DIP-switch 2
- Programming of the preset value, start count value, output time, output signal logic and output signal function;
- External resetting;
- External counting direction control.

The diagrams below show the output signal responses.

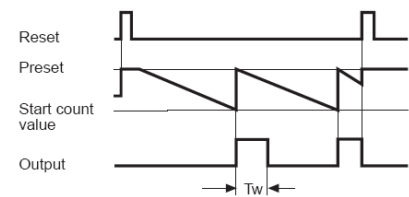
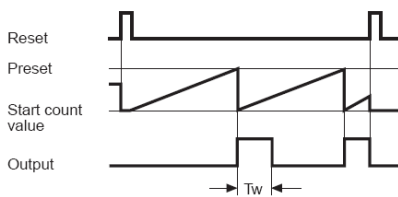
**Adding operating mode**

**Subtracting operating mode**

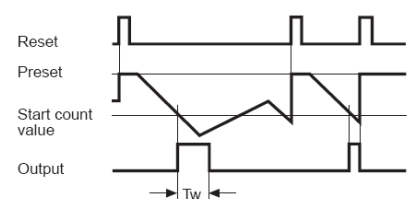
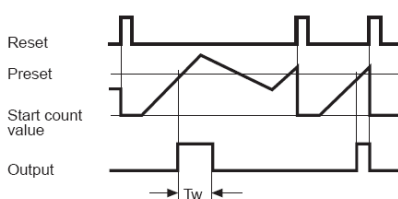
**External reset with continuous signal**



**Automatic reset with pulse signal**



**External reset with pulse signal**



**5.3 Counter overrun response**

*Counter overrun in minus range*

The minus counting range is 0 to -9999. If -9999 is exceeded, the counter is automatically reset to zero.

*Counter overrun in plus range*

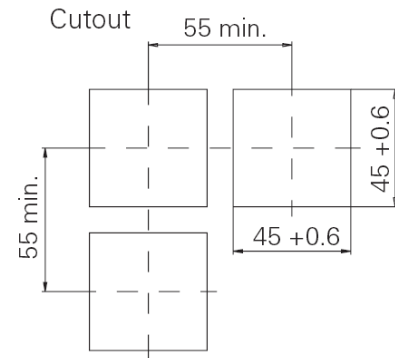
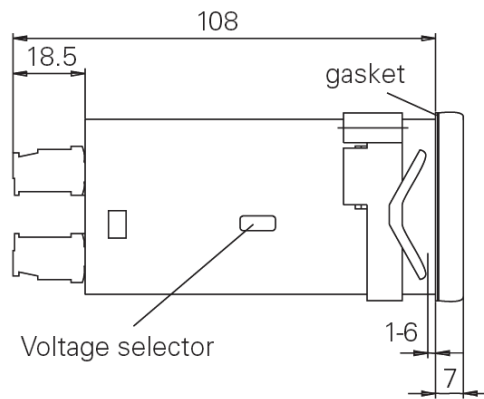
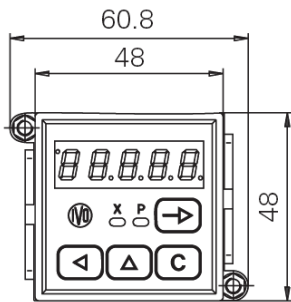
The plus counting range is 0 to 199999. If 100000 is exceeded, prefix zero suppression is cut out and the LED X flashes, indicating the overrun. If 199999 is exceeded, the counter is automatically reset to 100000.

## 6 Technical data

### Ambient conditions

Ambient temperature	0...+50 °C
Storage temperature	-20...+70 °C
Relative humidity	Max. relative humidity 80 %, at 25 °C, non-condensing
Protection	Front IP 65 to DIN 40050
General rating	EN 61010 Part 1 - Protection standard II - Overvolt. protection categ. II - Contamination factor 2
Interference immunity	DIN EN 61000-6-2
Emitted interference	DIN EN 61000-6-3
Approvals	UL-/cUL-Approvals

### 6.1 Dimensions



Reset  
Data storage  
Operation modes

- max. swit. power 10 mA, 10 V AC  
Manual, electr. or automatically  
> 10 years via EEPROM  
Adding or subtracting via DIP-switch

### Mechanical data

Display	7-segment LED-display 5-digit display of real value, 7.6 mm high Programmable decimal point Display suppression of preceding zeroes - Minus sign for negative values
Operation, keypad	Front membrane with short-stroke keys
Front dimensions	DIN housing 48 x 48 mm
Mounting	Front panel with clip frame
Weight	AC: approx. 260 g DC: approx. 140 g
Connection	Plug-in screw terminals Grid 5.08 mm
Core cross-section	Max. 1.5 mm <sup>2</sup>
Housing material	Macrolon 6485 (PC) black, UL 94V-0
Keypad membrane material	Polyester



## 6.2 Default settings


The following parameters are programmed into the counter by the factory prior to delivery:

Preset value	01000
Pulse contact time	0.25 s
Scaling factor	01.000
Start count value	00000
Display	No decimal point
Inputs	Track A and UP/DOWN
Change of preset	Enabled
Change of preset	Effective after reset
C-key	Activated

## 6.3 Error messages

 and : Fault must be rectified by the factory.

: Counting frequency above 10 kHz.

: After a power cut; the counter status display may be erroneous.

- Error messages  and  can be cleared with the  key.

## 7 Order designation

Voltage 24V DC: **CM 03 01 40**

Voltage 115/230V AC: **CM 03 44 40**