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Three-Axis Counter for Incremental Measuring Systems

Hardware version: MC23102

Software version: MC23102

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6. List of Illustrations 40

Changes to software version 01:

Parameter P36 in the parameter level All can now be set to 3, maximum difference between axis 1 and axis 2.

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1. Safety

This operating guide contains instructions for ensuring safe and proper installation and operation. If you have any difficulties which cannot be resolved by consulting this guide, please check with the machine manufacturer or vendor for additional information.

hejm GmbH is not liable for any personal injury or equipment damage resulting from improper commissioning, incorrect operation, misunderstandings or errors contained in this guide or on the display.

hejm GmbH reserves the right to make technical changes to the equipment or operating guide without prior notice. Therefore, deviations in the agreement between the device and the device description cannot be precluded.

Pay particular attention to hazard notices in this operating guide.

This equipment description should be carefully read in full before commissioning.

Use of the operating guide presumes corresponding user qualifications.

1.1 Personnel Qualifications

Startup, installation and operation are intended only for appropriately qualified personnel. The personnel must have qualifications which are appropriate to their function and activity, e.g.

- Instruction and obligation to observe all application-related, regional and in-house regulations and requirements.
- Training in accordance with the standards of safety engineering in the use and maintaining of appropriate safety and occupational health and safety equipment.
- Courses in first aid, etc.

1.2 Proper use

This position display has been developed solely for use on industrial machinery.

Any further use is considered improper. The manufacturer

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assumes no liability for damages resulting from such misuse. This risk is assumed solely by the user.

1.3 Safety Notes

The following symbols are used for hazards and other important notes:

The **Hazard** symbol warns of errors and hazards in commissioning and operation of the controller. This warning notice means a directly threatening hazard to the health of persons and contains special specifications and instructions as well as imperatives and prohibitions for preventing personal injury and damage to equipment.

The **Attention** symbol means a possible hazardous situation and contains special specifications and instructions as well as imperatives and prohibitions for preventing personal injury and damage to equipment.

The **Note** symbol indicates important and useful information and provides application tips.

1.4 Safety Precautions

The device is powered with 24V and must be fused according to prevailing regulations.

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2. Technical Data

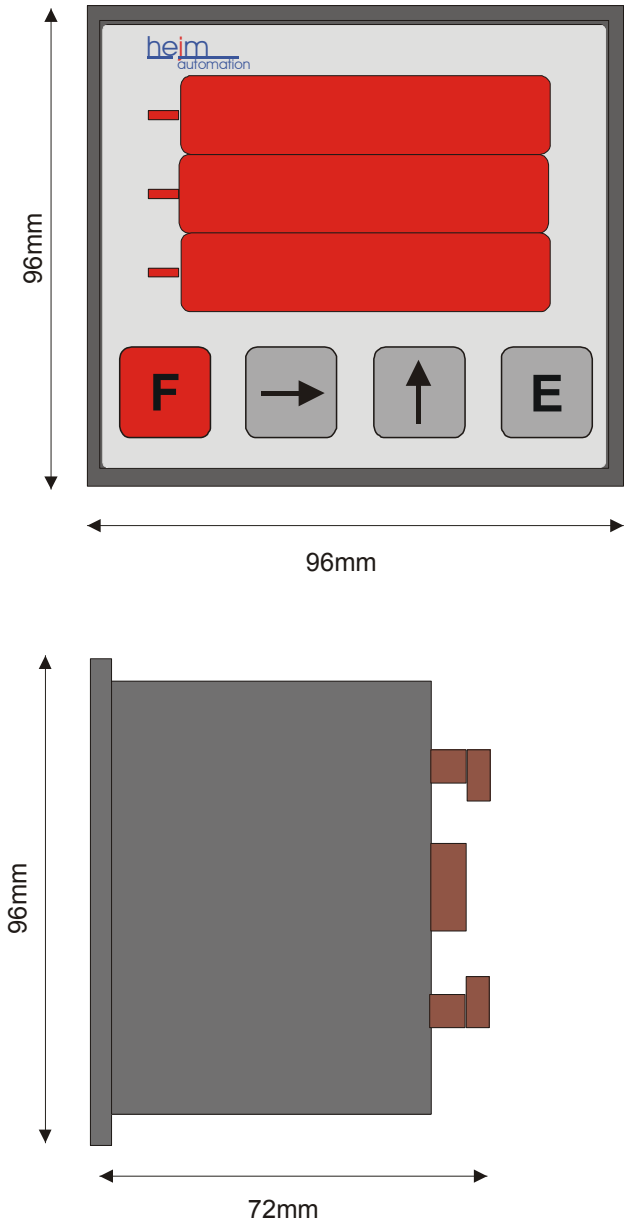

Fig. 1 **Dimensions** (illustration reduced)

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Supply voltage	24 V DC
Current draw	Max. 200 mA when not connected to a measuring system
Indicator	3 x 6 decade LED display digit height 10 mm 3 LEDs for sign
Input signals	0 – 5 V low active 10 - 30 V high active
Measuring system	Incremental measuring system A, A/, B, B/, Z, Z/ or A, B, Z Supply voltage 5V or 24V for 24V BDD supply voltage Current draw per channel: < 3mA at 5V < 20mA at 24V Max. 110 mA per measuring system Max. input frequency for RS422 Signal A or B: 1 MHz Min. edge separation for 4x inter-polation: 250 ns. Max. input frequency for HTL Signal A or B: 500 kHz Min. edge separation for 4x inter-polation: 500 ns.
Output signals	2 output drivers 24V, 600 mA
Interface	N/A
Operating temperature	0 – 40 °C
Storage temperature	-20 - + 65 °C
Relative humidity	max. 90 % non-condensing
Installation orientation	any
Enclosure rating	IP42 front side

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Dimensions	96 x 96 x 72 mm^3 (W x H x D) Installation depth including connector

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3. Commissioning

Most damage to the device is a result of faulty cabling and incorrect parameter values. Therefore commissioning is to be performed only by trained and expert personnel.

3.1 Installation

The device is supplied in a plastic housing and may be attached to a machine frame as desired.

3.2 Connection

The device is powered with 24V DC.

Before connecting, compare the part label on the back of the device with the desired connection voltage.

Electrical cables are to be routed in accordance with the respective national regulations (e.g. VDE). Route measuring, signal and power cables separately.

We recommend using only shielded cable connected to GND on the device.

Ensure that no ground loops are created.

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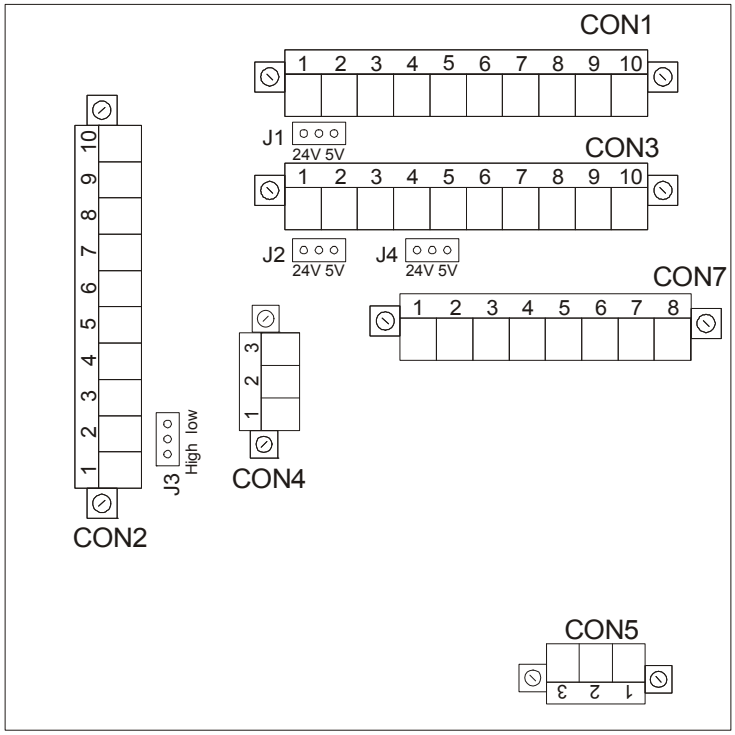
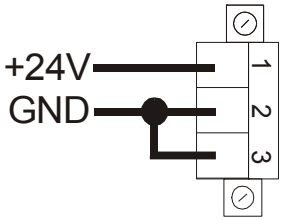


Fig. 2 Wiring diagram

Connector and pinouts

Connect supply voltage to the device only as specified on the part label!

	CON5	Supply voltage (24V DC)
		Terminal strip, 3-pin
	Pin 1	+24V, max. 550 mA
	Pin 2	GND jumper on Pin 3
	Pin 3	GND jumper on Pin 2

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CON1	Measuring system Axis 1
	Terminal strip, 10-pin
Pin 1	GND
Pin 2	+24V, if jumper J1 at left is tied to 24V
	+5V, if jumper J1 at left is tied to 5V
Pin 3	Signal A
Pin 4	Signal A/ (only for RS422)
Pin 5	Signal B
Pin 6	Signal B/ (only for RS422)
Pin 7	Signal Z
Pin 8	Signal Z/ (only for RS422)
Pin 9	Shield
Pin 10	Shield

CON3	Measuring system Axis 2
	Terminal strip, 10-pin
Pin 1	GND
Pin 2	+24V, if jumper J2 at left is tied to 24V
	+5V, if jumper J2 at right is tied to 5V
Pin 3	Signal A
Pin 4	Signal A/ (only for RS422)
Pin 5	Signal B
Pin 6	Signal B/ (only for RS422)
Pin 7	Signal Z
Pin 8	Signal Z/ (only for RS422)
Pin 9	Shield
Pin 10	Shield

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CON7	Measuring system Axis 3
	Terminal strip, 8-pin
Pin 1	GND
Pin 2	+24V, if jumper J4 at left is tied to 24V
	+5V, if jumper J4 at right is tied to 5V
Pin 3	Signal A
Pin 4	Signal A/ (only for RS422)
Pin 5	Signal B
Pin 6	Signal B/ (only for RS422)
Pin 7	Shield
Pin 8	Shield

CON2	In-/outputs (unused in-/outputs can be left unconnected)
Pin 1	Supply for driver output 2
Pin 2	Output for driver output 2
Pin 3	Supply for driver output 1
Pin 4	Output for driver output 1
Pin 5	Switching input 4, input voltage 0 – 24 V
	Offset dimension/actual value output via RS232
Pin 6	Switching input 3, input voltage 0 – 24 V
	Freeze/Stop,/Absolute-Incremental
Pin 7	Switching input 2, input voltage 0 – 24 V
	Set
Pin 8	Switching input 1, input voltage 0 – 24 V
	Reset
Pin 9	GND for switching inputs
Pin 10	+24V for switching inputs

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CON4	RS232 interface (Option)
	Terminal strip, 3-pin
Pin 1	RxD
Pin 2	TxD
Pin 3	GND

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3.3 Measuring system supply voltage

To set the supply voltage to the desired level, the respective voltage must be selected by using Jumper J1 or J2 and J4. (Observe data sheet for measuring system!)

Jumper in left position 24V, for 24V measuring system power.

Jumper in right position 5V, for 5V measuring system power.

3.4 Switching Output Logic

To set the logic of the switching inputs, use Jumper J3.

The switching states are printed on the circuit board.

Lower jumper low, inputs switch to GND.

Upper jumper high, inputs switch to +24V.

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3.5 Keypad and Front Panel

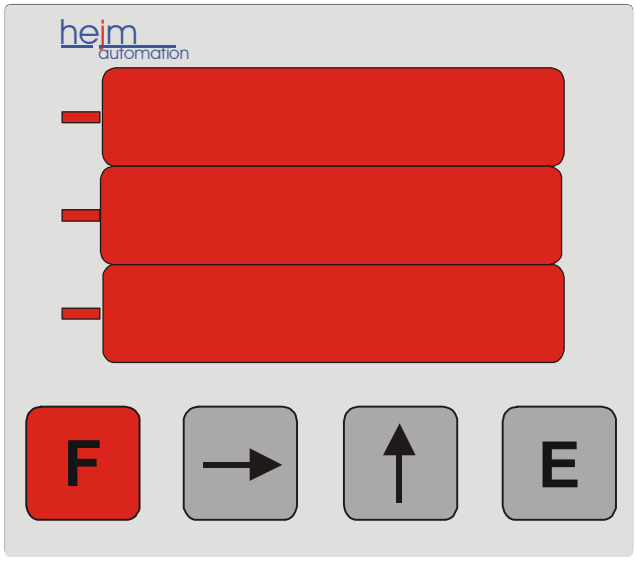

Fig. 3 Front panel

3.5.1 Display

The displays are used for visualizing the actual position and for displaying the parameter values in the parameter levels.

3.5.2 Key functions

1. The **F** switches from the display level to the calibration and parameter levels and back.
2. The → key is used to select a decade within the function level (flashing) which can then be edited in one of the function levels using the ↑ key.

   It is also used to change the parameter numbers in one of the function levels.

   In normal operation this key can be used to change the displayed actual value between absolute and incremental measurement.

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3. The ↑ key is used for editing the flashing decade in one of the function levels.

   When not in one of the function levels, this key is used to select an axis.

   The selected axis is indicated by a flashing LED.

4. The **E** key is used for confirming an edited value in the function levels.

   This key must always be pressed after entering a parameter or calibration value in order to save it.

   In normal operation this key can be used to set an axis to the stored calibration value or set the value to zero.

   The E and → keys may be assigned special functions.

   (see function level All P06)

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3.6 Parameter and Functon Levels

3.6.1 Entering parameters, changing the device functions

When changing control and calibration parameters, always take into account the effects on the overall system:

The parameters may be protected against unintended changes by using a security code.

This may be selected by the machine manufacturer himself.

The device provides two levels, one for entering parameters and one for entering the set value (calibration function).

1. Calibration value function level
2. General parameter level
3. Axis 1 parameter level
4. Axis 2 parameter level
5. Axis 3 parameter level

The **F** key is sued to activate and exit function and parameter entry.

Switch between the levels using the → key.

To open a level use the **E** (Enter) key, which also serves to confirm an input value.

Changes in the parameter setting can result in malfunction, stopping or failure. Changes to the parameter settings should therefore be made only by knowledgeable personnel.

Example:

Changing Parameter P 06 in the All level (parameter level):

1. Press the **F** key (display Cal)
2. Press the → key (display All)
3. Press the **E** key (display P 00)
4. Press the → key 4 times (display P 06)
5. Press the **E** key (display e.g. 0)

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6. Shift the flashing decade using the →

   key and increase the value using the ↑ key.

7. Confirm the value by pressing the **E** key. (display P 07)

8. Exit parameter entry by pressing the **F** key twice. (display shows actual value)

If the parameter level is code protected, then you must first press **E** after Step 1, then enter the appropriate code and confirm using the **E** key.

3.6.2 Parameter functions

The parameters shown in the following are all shown according to the pattern

Parameter number Name [Unit/ Minimum/Maximum value]
Parameter description.

Parameters in which P00 is entered as the unit refer to the unit specified in parameter P00 (function level 2).

Parameters which are filled with index ro can only be read.

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Calibration level (Cal):

P00 *Set value [P00/ -99999,999999]*

In the calibration level you can calibrate all axes to a particular value. When this level is opened, the device suggests the value stored in Parameter P02 in levels Axis1, Axis2 and Axis3.
If the desired axis is selected by pressing **E** key, then
Pressing the **E** key sets the value.

The **E** key must be held down until a flashing decade is no longer displayed.

Parameter level All:

P00 *Number of axes displayed [qty./ 1,3]*

Contains the number of axes to display.

P01 *Device ID [ro/------,-------]*

Contains the device MC2XX

P02 *Software version [ro/------,-------]*

Current software version of the device.

P03 *Customer, for custom devices [ro/------,-------]*

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Parameter level All:

P06 *Function of the front-side buttons [Function/ 0,6]*

The front-side keys → and **E** may be assigned special functions outside of the function levels.

To select the desired axis, press the ↑ key.

The LED for the selected axis begins to flash.

Input value	Key function
0	Keys have no function
1	**E** sets selected display to 0
2	**E** sets selected display to the stored calibration value
3	Function 1 active
4	→ Toggles the selected display between absolute and incremental
5	Function 1 and 4 active
6	Function 2 and 4 active

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Parameter level All:

P07 *Function of switching input 1 [Function/ 0, 6]*

Switching input 1 affects Counter 1 as follows:

Setting	Function
0	Reset static
1	Reset edge-triggered
2	Set static
3	Set edge-triggered
4	Offset active
5	Counter Stop
6	Display frozen

P08 *Function of switching input 2 [Function/ 0, 6]*

See Parameter P07. But refers to Counter 2

P09 *Function of switching input 3 [Function/ 0, 6]*

See Parameter P07. But refers to Counter 3

P10 *Function of switching input 4[ ]*

Reserved for expansion.

In the current version the input can be used to activate the serial interface. See Parameter P92.

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Parameter level All:

P11 *Inch/mm toggle free [ ]*

Setting	Function
0	No Inch/mm toggling possible
1	Inch/mm toggle refers to Axis 1
2	Inch/mm toggle refers to Axis 2
3	Inch/mm toggle refers to Axis 1 and Axis 2
4	Inch/mm toggle refers to Axis 3
5	Inch/mm toggle refers to Axis 1 and Axis 3
6	Inch/mm toggle refers to Axis 2 and Axis 3
7	Inch/mm toggle refers to Axis 1, Axis 2 and Axis 3

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Parameter level All:

P29 *Switching input logic [binary code/ 0,15]*

In machine building both normally open and normally closed devices are used as electrical switches.

To be able to adapt the device quickly to any hardware, the switching behavior of the inputs must be determined using this parameter.

The respective settings can be found in the tables below.

1. Inputs switch to GND

Terminal 5	Terminal 6	Terminal 7	Terminal 8	P13
N.O.	N.O.	N.O.	N.O.	0
NC	N.O.	N.O.	N.O.	1
N.O.	NC	N.O.	N.O.	2
NC	NC	N.O.	N.O.	3
N.O.	N.O.	NC	N.O.	4
NC	N.O.	NC	N.O.	5
N.O.	NC	NC	N.O.	6
NC	NC	NC	N.O.	7
N.O.	N.O.	N.O.	NC	8
NC	N.O.	N.O.	NC	9
N.O.	NC	N.O.	NC	10
NC	NC	N.O.	NC	11
N.O.	N.O.	NC	NC	12
NC	N.O.	NC	NC	13
N.O.	NC	NC	NC	14
NC	NC	NC	NC	15

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Parameter level All:

2. Inputs switch to 24V

Terminal 5	Terminal 6	Terminal 7	Terminal 8	P13
NC	NC	NC	NC	0
N.O.	NC	NC	NC	1
NC	N.O.	NC	NC	2
N.O.	N.O.	NC	NC	3
NC	NC	N.O.	NC	4
N.O.	NC	N.O.	NC	5
NC	N.O.	N.O.	NC	6
N.O.	N.O.	N.O.	NC	7
NC	NC	NC	N.O.	8
N.O.	NC	NC	N.O.	9
NC	N.O.	NC	N.O.	10
N.O.	N.O.	NC	N.O.	11
NC	NC	N.O.	N.O.	12
N.O.	NC	N.O.	N.O.	13
NC	N.O.	N.O.	N.O.	14
N.O.	N.O.	N.O.	N.O.	15

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Parameter level All:

P30 *Actual value memory [on, off/0,1]*

On machines whose axes can be moved when power is off, the axis should be re-calibrated after turning on the axes.

By setting the parameter to 1, each time the machine is turned on the text **Cal** appears on the display to prompt the operator to recalibrate the axis.

P36 *Count modes [Mode/ 0,2]*

Setting	Mode
0	Standard three-axis count mode All axes are counted independent of each other and displayed in the respective window.
1	Differential counter Count value = Count value of Axis 1 – Count value of Axis 2 The result is displayed in the bottom-most window.
2	Sum counter Count value = Count value of Axis 1 + Count value of Axis 2 The result is displayed in the bottom-most window.
3	Maximum difference The bottom-most window will show the maximum difference that appeared between the the counter of axis 1 and axis 2.

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Parameter level All:

P42 *Code for parameter levels [5-decade number/ 0,99999]*

Entering a code allows the parameter values in function levels All, Axis1 and Axis2 to be protected against overwriting.

Entering parameter values is then only possible after

entering this code.

P44 *Code for calibration level [5-decade number/ 0,99999]*

By entering a code you can protect the device from calibration in function level 1.

Then you are only able to calibrate to a new value after entering this code.

P80 *Switching characteristic of the outputs [static,pulse/ 0,3]*

Input value	Output switching behavior
0	Both outputs static
1	Output 1 pulse, Output 2 static
2	Output 1 static, Output 2 pulse
3	Both outputs pulse

If the value not equal to 0 is set pulse, then the respective pulse widths can be set in Parameters P85 and P86.

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Parameter level All:

P81 *Switching threshold for outputs 1 [P00/ -9999,99999]*

If the value stored here is exceeded by the display value, then the Driver Output 1 resp. Relay 1 is switched.

P82 *Switching threshold for outputs 2 [P00/ -9999,99999]*

If the value stored here is exceeded by the display value, then the Driver Output 2 resp. Relay 2 is switched.

P85 *Pulse width for switching output 1 [sec/ 0,2.50]*

The Pulse width of Output 1 can be selected within a range of 0 to 2.50 seconds.

P86 *Pulse width for switching output 2 [sec/ 0,2.50]*

The Pulse width of Output 2 can be selected within a range of 0 to 2.50 seconds.

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Parameter level All:

***P*87** *Reference for switching output 1 [Display/ 1, 3]*

Input value	Output function
1	Switching output 1 refers to the upper display.
2	Switching output 1 refers to the center display.
3	Switching output 1 refers to the lower display.

***P*88** *Reference for switching output [Display/ 1, 3]*

Input value	Output function
1	Switching output 2 refers to the upper display.
2	Switching output 2 refers to the center display.
3	Switching output 2 refers to the lower display.

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Parameter level All:

P89 *Switching output logic [Logic/ 0,3]*

The switching outputs can be programmed so that they switch whenever the set upper or lower limits are exceeded.

Input value	Output function
0	1 switches when overshot
	2 switches when overshot
1	1 switches when overshot
	2 switches when undershot
2	1 switches when undershot
	2 switches when overshot
3	1 switches when undershot
	2 switches when undershot

P90 *Device number [Address/ 11,99]*

If the device is equipped with an RS232 port, the device address can be set here for accessing the device.

Do not use addresses such as 20,30,40,..,90, since these addresses are considered collective addresses and the device would not respond to requests.

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Parameter level All:

P91 *Baud rate [Baud/ 0,4]*

The following baud rates are available.

Setting	Baud rate/Baud
0	2400
1	4800
2	9600
3	19200
4	38400

P92 *RS232 Mode [Mode/ 0,3]*

Various modes are available for the RS232 interface.

0 Standard RS232 protocol per DIN 66019. (See section

1 For printer connection, the actual value is sent at a fixed time interval as set in Parameter P93.

2 For printer connection, the actual value is sent when the **E** key is pressed.

3 For printer connection.

If Input 4 is activated, the device sends the

current display value for all axes.

P93 *Time for RS232 sending [Seconds/ 0.00, 650.00]*

If Parameter P93 is set to 1, you can set a time here after which the actual value is cyclically sent.

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Parameter level Axis 1, Axis 2, Axis 3:

P00 *Actual value [P05/ -9999,99999]*

Here the current actual value of the axis is stored.

P02 *Calibration value [P05/ -9999,99999]*

Value which the counter proposes when the calibration level is activated, or to which the axis is set when the Set function is activated.

P05 *Travel distance for factor calculation [any desired unit of length/ 1, 10000]*

Contains any desired travel distance.

The device requires these two parameters in order to be set for various mechanical variations such as drives, spindle travel, etc.

1. Any desired travel distance in the desired unit and resolution (P05).
2. The number of pulses sent from the measuring system to the controller when traveling this distance (P06).

The controller can position without error over the entire range only if these data are entered in P05 and P06 without rounding error.

Therefore you should always select a travel distance for which a whole-number of pulses is sent by the measuring system.

P06 *Pulses / Travel distance [resolution of the measuring system/ 1, 65000]*

Number of pulses per travel distance specified in P05 (the factor is automatically calculated from P05 and P06).

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Parameter level Axis 1, Axis 2, Axis 3:

Example 1: The measuring system in use sends 100 pulses to the controller over a distance of 1.00 mm. Setpoints, actual values, etc. should be send in increments of 1/100 mm. This means each pulse arriving from the measuring system must be offset against the actual value. Therefore P05 and P06 should be set to the same value (e.g. 1, 1 or 10,10 resp. 100, 100).

Example 2: The system again has a resolution of 1/100 mm. Setpoints and actual values should resolve however only to one decimal place, i.e. in 1/10 mm. This means that over a distance of 1 (0.1 mm) 10 pulses are sent from the measuring system to the controller. Therefore set P05 to a factor of 10 less than P06 (e.g. 1, 10 or 10,100 resp. 100, 1000).

Example 3: A machine with spindle drive has the following benchmark data: Spindle pitch 5.0 mm / Encoder with a resolution of 20 pulses per revolution. You want setpoints and actual values to be resolved to one decimal place, i.e. in 1/10 mm. This means that over a distance of 50 (5.0 mm) 20 pulses are sent from the measuring system to the controller. Therefore you should set P05 to 50 and P06 to 20.

For settings in inches, enter P05 in inches.

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Parameter level Axis 1, Axis 2, Axis 3:

P22 *Measuring system selection [standard, with inverted / 0.1]*

Only for Axis1 and Axis2!

When using as a 3-axis counter, the settings in Axis1 and Axis2 should be the same, since these also affect Axis 3.

The device can operate with measuring systems whose supply voltage and signal level is 5V or 10-30V.

The measuring system supply voltage can be set using jumpers on the rear side.

When using 5V systems, always make sure that tracks A, B Z and their inversions are connected in order to prevent problems.

Setting	Measuring system
0	Only tracks A, B and Z are evaluated.
1	Tracks A, A/, B, B/ and Z, Z/ are processed.

P25 *Pulse processing[Edge processing/ 4, 4]*

Currently always 4 = 4-edge processing

P26 *Reverse count direction [Direction/ 0, 1]*

Changing this value from 0 to 1 or 1 to 0 causes the count direction to be reversed.

0 = forward
1 = backward

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Parameter level Axis 1, Axis 2, Axis 3:

P40 *Decimal point[Decimal place/ 0, 6]*

This parameter is used to set the decimal place within the display.

0 = Turn off decimal place

1 = One decimal place, etc.

Setting the decimal place has no effect on the display resolution.

This is done only using parameters P05 and P06.

P70 *Offset [P00/ -10000, 10000]*

Enter the offset dimension in units of length, such as xx.x mm or x.xx inches.

This value is subtracted from the display value when the offset measurement contact is activated.

When the input is deactivated the value is added again.

This function can also be set using the front-panel keys.

This disables the function using an external input however.

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Parameter level Axis 1, Axis 2, Axis 3:

P71 *Saw blade correction [P00/ -10000,+10000]*

Here a value can be stored which is subtracted from the display value when the Set or Reset function is activated in incremental mode.

P72 *Angle display in special function [off, on/0,1]*

If this function is activated, the axis displays angles from 0° to 90° and then from –89.9° to 0°.

This function automatically adjusts itself to the set decimal point of the display.

The decimal point may not however be set to a number greater than 2.

This enables display values down to 1/100 degree.

Calibrating the display is possible in this mode only in the positive range from 0° to 90°.

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3.6.3 Parameter List

For service purposes it is advisable to document the stored parameters stored in the controller when the machine was shipped. You can use the following table for this.

Parameter	Specific machine setting
Calibration level	---
P00 set value (calibration value)	
Parameter level All	---
P00 Number of axes	
P01 Device ID	231
P02 Software version	01
P03 Customer number	0
P06 Key logic	
P07 Function of switching input 1	
P08 Function of switching input 2	
P29 Switching output logic	
P30 Power down memory	
P36 Count modes	
P42 Code for parameter level	
P44 Code for calibration level	
P80 Switching characteristic of outputs	
P81 Switching threshold output 1	
P82 Switching threshold output 2	
P85 Pulse width output 1	
P86 Pulse width output 2	
P87 Reference for switching output 1	

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P88 Reference for switching output 2	
P89 Switching output logic	
P90 Device number	
P91 Baud rate	
P92 RS232 mode	
P93 Time for RS232 sending	

Parameter level Axis1, Axis2, Axis3	**Axis 1**	**Axis 2**	**Axis 3**
P00 Current display value			
P02 Calibration value			
P05 Travel distance for factor calculation			
P06 Pulses per travel distance for factor calculation			
P22 Selects the measuring system			
P25 Edge evaluation			
P26 Reverse count direction			
P40 Decimal point			
P70 Offset			
P71 Saw blade correction			
P72 Angle display in special function			

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4. Operation

4.1 Display and function keys

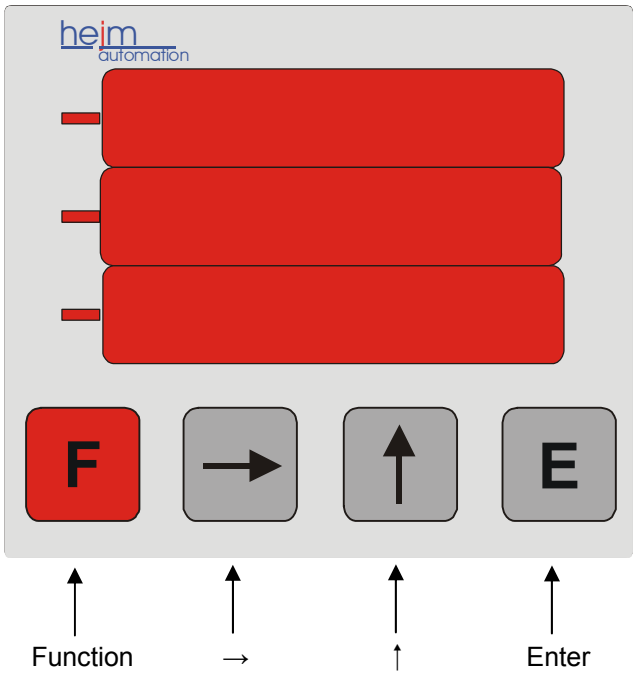

Fig. 4 Function keys, displays

4.2 Key functions within the function levels

4.2.1 F key

Switches from display mode to the function levels and back.

4.2.2 → Key

Goes to the next parameter numbers, or shifts the changeable flashing decade.

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4.2.3 ↑ Key

Increments the count within the flashing decade by 1 or selects an axis (outside the function levels).

4.2.4 E-key

This can be edited using key combinations.

In the Calibration function level, holding the key down for 2 seconds sets the selected axis (the calibration value is in the display for the selected axis). Once calibration is finished, the active decade stops flashing.

Briefly pressing the **E** key switches between axes.

Special key functions and combinations are described in Parameter P6, in the All menu level.

4.2.5 Clearing the EEPROM

Should it happen that a unit can no longer be initialized after powering up, there could be non-permitted values in the EEPROM memory.

This memory can be cleared and the parameters set to their initialization values.

To do this, the key combination Function, → and Enter must be pressed while the device is powering up.

5. Part Numbering

In series MC231 the following version is available:

Supply voltage 24V DC

2 digital outputs (transistor output), PNP sourcing

4 digital inputs

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6. List of Illustrations