Precision in Motion

User manual

Electronic display

MA10/4 Software S

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1 General Information

1.1 Documentation

The following documents describe this product:

- The product data sheet describes the technical data, the dimensions, the pin assignments, the accessories and the order key.
- The mounting instructions describe the mechanical and electrical installation including all safety-relevant requirements and the associated technical specifications.
- The user manual of commissioning the electronic display.

These documents can also be downloaded at *http://www.siko-global.com/en-de/service-downloads*.

2 Key functions

The display is operated and programmed by means of the four keys of the membrane keyboard. Depending on the operating mode the keys may have additional functions (see 'Programming mode' and 'Input mode'). The keys are actuated individually or combined (each two of them) and time-dependent.

1) Programming
2) Select 'value'
3) Select 'digit'
4) Store value

Fig. 1: Key functions

2.1 Operating modes

There are two operating modes:

1. Programming mode: Single set-up of the display for the intended application.
2. Input mode: Functions required during normal application (not speed).

3 Display description

The MA10/4 has a backlighted 12-digit LC display. The display as well as the meaning of the individual symbols is explained in the tables below.

3.1 Incremental and SSI versions

1	2	3	4	5	6	7	8	9	10	11	12	Digit
R	-		1	2	3	4	.	9		m	m	Position value

Digit	Symbol	Description
1	R	Incremental measure is active.
1	>	Upper limiting value exceeded (only for output circuit option). If incremental measure as well as exceeding of the limiting value is active, this will be displayed alternately.
1	<	Lower limiting value exceeded (only for output circuit option). If incremental measure as well as exceeding of the limiting value is active, this will be displayed alternately.
2-9		Measured value; negative values are displayed by "-" on position 2.
11-12		Unit of measure (programmable)

3.2 Rototional speed version

1	2	3	4	5	6	7	8	9	10	11	12	Digit
	1	2	3	.	2		U	/	M	i	n	Position value

Digit	Symbol	Description
1	>	Upper limiting value exceeded (only for output circuit option). If incremental measure as well as exceeding of the limiting value is active, this will be displayed alternately.
1	<	Lower limiting value exceeded (only for output circuit option). If incremental measure as well as exceeding of the limiting value is active, this will be displayed alternately.
2-6		Measured value
8-12		Unit of measure (programmable)

3.3 Number of pieces version

1	2	3	4	5	6	7	8	9	10	11	12	Digit
R	-		1	2	3	4	5		S	t	k	Position value

Digit	Symbol	Description
1	R	Incremental measure is active.
1	>	Upper limiting value exceeded (only for output circuit option). If

Digit	Symbol	Description
		incremental measure as well as exceeding of the limiting value is active, this will be displayed alternately.
1	<	Lower limiting value exceeded (only for output circuit option). If incremental measure as well as exceeding of the limiting value is active, this will be displayed alternately.
2-8		Measured value; negative values are displayed by "-" on position 2.
10-12		Unit of measure (programmable)

4 Programming mode

The display is delivered ex factory with default settings. Normally programming is only necessary at initial installation. Parameters can be modified and checked at any time. They are stored in a non-volatile memory. For designation, function and selectable values see chapter 5.

To change and control parameters

For parameter modification enter into programming mode.

To enter into the programming mode

Press key P for at least 5 s (pre-programmed) or for the period programmed under P-KEY delay.

To leave programming mode

Automatically, if no key has been pressed during approx. 30 s, or press key P until the end of the parameter list is reached.

To scroll parameter information

Use key P.

Input of numerical values

For numerical values the smallest decade flashes first. The numerical value of the flashing digit can be updated by pressing the ▲ key. The next digit can be accessed by pressing the ◀ key.

Changing given selection

By means of the ▲ key.

Accepting/ saving the changed value

By pressing the ✱ key, the message "speichern..." will be displayed for a short while.

5 Parameter description

At chapter 12 you will find a detailed parameter list showing all programmable parameters and offering space for customer-specific programming values.

(in English, parameter LANGUAGE = "eng")

After entering the programming mode (see chapter 4) the parameters described below can be configured. Depending on the settings selected, only the menu items that are relevant for the application will be displayed.

5.1 Incremental version

Display	Value range	Description
LANGUAGE:	ger or deu (German) eng (English)	Language To choose the language in which the menu items are to be displayed. Attention! The term "SPRACHE" will be displayed first in German.
DEC:	0., 0.0, 0.00, 0.000, 0.0000	Positions after the comma
DPR:	0 ... 59999	Display after 1 revolution Value by which the display increases/decreases after 1 revolution of the encoder. If DPR: = 0, quadruple evaluation of the encoder signal will take place automatically.
DIVISOR:	1, 10, 100, 1000	Display divisor Divisor by which the display accuracy is reduced compared to the measuring accuracy. Example: Due to an integer value ratio, the measuring resolution is programmed to 1/1000 mm. The display, however, needs a resolution of 1/10 mm only. -> The display divisor is programmed to '100'.
INCR:	0 ... 59999	Encoder pulses per revolution If INCR: = 0, quadruple evaluation of the encoder signal will take place automatically.
DIRECTION:	i, e	Counting direction 'i' clockwise increasing values 'e' anti-clockwise increasing values
INDEX:	I-lang, 0-lang, I-kurz, 0-kurz	Input of logic and length of the encoder's reference signal The encoder reference signal is output only once per revolution. 'lang' index signal is wider than one increment; index is linked with A and B signals. 'kurz' index signal is exactly as wide as one increment '0' index signal with positive logic 'I' index signal with negative logic

Display	Value range	Description
TRS:	n.open, n.closed, hand	Reference switch Type of reference value transmitter; can either be a mechanical contact or a proximity switch. 'n.open' closing contact, which is normally open 'n.closed' opening contact, which is normally closed 'hand' Referencing arbitrarily via callipers independent of A and B, index signal). The input is current-sinking and edge-triggered.
REF:	-999999 ... +999999	Reference point for the measuring system Absolute datum point of the measuring system. This value is set after system reference accord. to chapter 7.
OFF:	-999999 ... +999999	Offset (displacement) An be any value; used to influence the value displayed, e. g. tool correction value.
RESET:	off, on, del.1s, del.3s	Reset via keyboard enable 'off' reset function off 'on' reset function enabled 'del.1s' reset function enabled (press key ✱ for at least 1 sec.) 'del.3s' reset function enagled (press key ✱ for at least 3 sec.)
ABS/REL:	off, on	Incremental measurement enable To switch from absolute measurement and zero-zetting to relative measurement. 'off' function off 'on' function on
RE/OF.EN:	off, on	Reference/ offset value input enable 'off' reference/offset value correction off 'on' reference/offset value correction enabled
STO:	off, on	Actual value store When switched off, the last displayed value is stored in a non-volatile memory. 'off' Actual value memory off: when switched on, the display must be calibrated (zeroed) (Display value is flashing). 'on' Actual value memory on: when switched on, the last measured value is displayed.
P-KEY:	3s, 5s, 10s, 20s, 30s	Programming keys delay Delay of key P when switching from input to programming mode.
BAUD:	2400, 4800, 9600, 19200, SIKON.3, SCHALT	Interface's baud rate 'SCHALT' must be programmed for switching outputs, 'SIKON.3' for SIKONETZ3.
ADR:	1 ... 31	Adress setting for SIKONETZ3 Menu item will be displayed only if 'SIKON.3' is programmed for 'BAUD:'.
UPL:	-999999 ... +999999	For switching output: Input of the upper switching point Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'.
LOL:	-999999 ... +999999	For switching output: Input of the lower switching point Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'.

Display	Value range	Description
LIMIT.EN:	off, on	Enabling of modification of the limiting value Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'. Possibility of input/modification of the upper and lower limiting values in the input mode. 'off' Modification of limiting values disabled in input mode. 'on' Modification of limiting values enabled in input mode.
UNITS:	--, mm, cm, m, km, in (inch), °	Unit of measure Choice of the measurement unit to be displayed on positions 11, 12 (see chapter 3 Display description).
DIS.ANGLE:	-5 ... +4	Display angle Here, the contrast of the LC display can be set.
CODE:	00000	Code input: for service only
CONTROL:	off, on	Code input: for service only

5.2 SSI version

Display	Value range	Description
LANGUAGE:	ger or deu (German) eng (English)	Language To choose the language in which the menu items are to be displayed. Attention! The term "SPRACHE" will be displayed first in German.
E-TYP:	multi, single, linear	Encoder type Determines the encoder type connected 'multi' multi-turn encoder 'single' single-turn encoder 'linear' linear measuring system
FORMAT:	no, Tree	Data format Menu item will be displayed only if "multi" is programmed for 'E-TYP:' 'no' Encoder data leftjustified (MSB first) 'tree' pine-tree (12 multiturn + 13 singleturn bits data format)
S-BITS:	5 ... 19	Input of single-turn bits for multi-turn encoder Menu item will be displayed only if "multi" is programmed for 'E-TYP:'.
ENCOD.BIT:	5 ... 25	Input of the total encoder bit number
DEC:	0., 0.0, 0.00, 0.000, 0.0000	Positions after the comma
DPR:	0 ... 59999	Display after 1 revolution Menu item will be displayed only if "multi" is programmed for 'E-TYP:' Value by which the display increases/decreases after 1 revolution of the encoder. The maximum possible encoder resolution is displayed if DPR: = 0. For 10 bit single-turn: 0 ... 1023

Display	Value range	Description
DIVISOR:	1, 10, 100, 1000	Display divisor Menu item will be displayed only if 'single' or 'multi' is programmed for 'E-TYP:' Divisor by which the display accuracy is reduced compared to the measuring accuracy. Example: Due to an integer value ratio, the measuring resolution is programmed to 1/1000 mm. The display, however, needs a resolution of 1/10 mm only. -> The display divisor is programmed to '100'.
FAC:	00.0001 ... 99.9999	Calculating faktor Freely selectable value, which influences the display. Menu item will be displayed only if "linear" is programmed for 'E-TYP:'.
DIRECTION:	i, e	Counting direction 'i' clockwise increasing values 'e' anti-clockwise increasing values
DIRECT:	up (upwards) down (downwards)	Counting direction Menu item will be displayed only if 'linear' is programmed for 'E-TYP:'.
CAL:	-999999 ... +999999	Calibration value for the measuring system Absolute datum point of the measuring system. This value is set after system calibrated accord. to chapter 7.
OFF:	-999999 ... +999999	Offset (displacement) Can be any value; used to influence the value displayed, e. g. tool correction value.
RESET:	off, on, del.1s, del.3s	Reset via keyboard enable 'off' reset function off 'on' reset function enabled 'del.1s' reset function enabled (press key ✱ for at least 1 sec.) 'del.3s' reset function enagled (press key ✱ for at least 3 sec.)
ABS/REL:	off, on	Incremental measurement enable To switch from absolute measurement and zero-zetting to relative measurement. 'off' function off 'on' function on
CA/OF.EN:	off, on	Calibration/offset value input enable 'off' calibration/offset value correction off 'on' calibration/offset value correction enabled
OUTPUT:	gray, bin	Output code 'gray' Encoder's data in Gray code 'bin' Encoder's data in binary code
TIMEOUT:	off, on	Time-out function 'off' Cable break recognition off 'on' Cable break recognition off
P-KEY:	3s, 5s, 10s, 20s, 30s	Programming keys delay Delay of key P when switching from input to programming mode.
BAUD:	2400, 4800, 9600, 19200, SIKON.3, SCHALT	Interface's baud rate 'SCHALT' must be programmed for switching outputs, 'SIKON.3' for SIKONETZ3.

Display	Value range	Description
ADR:	1 ... 31	Address setting for SIKONETZ3 Menu item will be displayed only if 'SIKON.3' is programmed for 'BAUD:'.
UPL:	-999999 ... +999999	For switching output: Input of the upper switching point Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'.
LOL:	-999999 ... +999999	For switching output: Input of the lower switching point Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'.
LIMIT.EN:	off, on	Enabling of modification of the limiting value Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'. Possibility of input/ modification of the upper and lower limiting values in the input mode. 'off' Modification of limiting values disabled in input mode. 'on' Modification of limiting values enabled in input mode.
UNITS:	--, mm, cm, m, km, in (inch), °	Unit of measure Choice of the measurement unit to be displayed on positions 11, 12 (see chapter 3 Display description).
DIS.ANGLE:	-5 ... +4	Display angle Here, the contrast of the LC display can be set.
SET:		Encoder zeroing Zeroing of the encoder (+ offset + calibration value) in programming mode via ✱ key.
GDAT:		Position value of the encoder Display of the actual encoder position.
CODE:	00000	Code input: for special functions
CONTROL:	off, on	Code input: for special functions

5.3 Speed version

(see chapter 9 for programming examples)

Display	Value range	Description
LANGUAGE:	ger or deu (German) eng (English)	Language To choose the language in which the menu items are to be displayed. Attention! The term "SPRACHE" will be displayed first in German.
INCR:	0 ... 59999	Encoder pulses per revolution
DEC:	0., 0.0, 0.00, 0.000, 0.0000	Positions after the comma
FAC:	00.0001 ... 99.9999	Calculating faktor Freely selectable value, which influences the display.
CYCLUS:	0.1s, 0.5s, 1s, 1.5s, 2s, 3s, 5s, 10s	Cycle time The display is refreshed after the programmed cycle time. If short cycle times have been programmed (recommended for high speed applications and high pulse counts), modifications are quickly displayed. Increase cycle time if display is irregular.

Display	Value range	Description
P-KEY:	3s, 5s, 10s, 20s, 30s	Programming keys delay Delay of key P when switching from input to programming mode.
BAUD:	2400, 4800, 9600, 19200, SIKON.3, SCHALT	Interface's baud rate 'SCHALT' must be programmed for switching outputs, 'SIKON.3' for SIKONETZ3.
ADR:	1 ... 31	Address setting for SIKONETZ3 Menu item will be displayed only if 'SIKON.3' is programmed for 'BAUD:'.
UPL:	0 ... +999999	For switching output: Input of the upper switching point Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'.
LOL:	0 ... +999999	For switching output: Input of the lower switching point Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'.
LIMIT.EN:	off, on	Enabling of modification of the limiting value Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'. Possibility of input/ modification of the upper and lower limiting values in the input mode. 'off' Modification of limiting values disabled in input mode. 'on' Modification of limiting values enabled in input mode.
UNITS:	--, U/Sek, U/Min, m/Sek, mm/S, m/Min; mm/M	Unit of measure Choice of the measurement unit to be displayed on positions 8-12 (see chapter 3 Display description).
DIS.ANGLE:	-5 ... +4	Display angle Here, the contrast of the LC display can be set.
CODE:	00000	Code input: for service only
CONTROL:	off, on	Code input: for service only

5.4 Number of pieces version

Display	Value range	Description
LANGUAGE:	ger or deu (German) eng (English)	Language To choose the language in which the menu items are to be displayed. Attention! The term "SPRACHE" will be displayed first in German.
DIRECT:	up (upwards) down (downwards)	Counting direction of the number of pieces.
FAC:	00.0001 ... 99.9999	Calculating faktor Freely selectable value, which influences the display.
REF:	-999999 ... +999999	Reference point for the measuring system Absolute datum point of the measuring system. This value is set after system reference accord. to chapter 7. Thus, the count of the counter can be set to a desired value.

Display	Value range	Description
OFF:	-999999 ... +999999	Offset value Freely programmable value; used to influence the displayed value. The offset is added to the reference value.
RESET:	off, on, del.1s, del.3s	Reset via keyboard enable 'off' reset function off 'on' reset function enabled 'del.1s' reset function enabled (press key ✱ for at least 1 sec.) 'del.3s' reset function enagled (press key ✱ for at least 3 sec.)
ABS/REL:	off, on	Incremental measurement enable To switch from absolute measurement and zero-zetting to relative measurement. 'off' function locked 'on' function enabled
RE/OF.EN:	off, on	Reference/offset value input enable 'off' reference/offset value correction off 'on' reference/offset value correction enabled
STO:	off, on	Actual value store When switched off, the last displayed value is stored in a non-volatile memory. 'off' Actual value memory off: when switched on, the display must be calibrated (zeroed). (Display value is flashing) 'on' Actual value memory on: when switched on, the last measured value is displayed.
P-KEY:	3s, 5s, 10s, 20s, 30s	Programming keys delay Delay of key P when switching from input to programming mode.
BAUD:	2400, 4800, 9600, 19200, SIKON.3, SCHALT	Interface's baud rate 'SCHALT' must be programmed for switching outputs, 'SIKON.3' for SIKONETZ3.
ADR:	1 ... 31	Address setting for SIKONETZ3 Menu item will be displayed only if 'SIKON.3' is programmed for 'BAUD:'.
UPL:	-999999 ... +999999	For switching output: Input of the upper switching point Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'.
LOL:	-999999 ... +999999	For switching output: Input of the lower switching point Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'.
LIMIT.EN:	off, on	Enabling of modification of the limiting value Menu item will be displayed only if 'SCHALT' is programmed for 'BAUD:'. Possibility of input/modification of the upper and lower limiting values in the input mode. 'off' Modification of limiting values disabled in input mode. 'on' Modification of limiting values enabled in input mode.
UNITS:	--, Stk, Bat	Unit of measure Choice of the measurement unit to be displayed on positions 11, 12 (see chapter 3 Display description).

Display	Value range	Description
DIS.ANGLE:	-5 ... +4	Display angle Here, the contrast of the LC display can be set.
CODE:	00000	Code input: for service only
CONTROL:	off, on	Code input: for service only

6 Input mode

6.1 Reset function

(Not speed!)

NOTICE	Precondition: Parameter 'Reset enable' (RESET:) in programming mode must be programmed to "on", "del.1s" or "del.3s" but unit must not be left in programming mode (see chapter 4 'To leave programming mode').

- Press key ✱ to set the display to reference/calibration + offset value.

6.2 Incremental measurement

(Not speed!)

NOTICE	Precondition: Menu item 'Incremental measurement enable' (ABS/REL:) in programming mode must be programmed to "on", but unit must not be left in programming mode (see chapter 4 'To leave programming mode').

- Switching on by pressing the ▲ key.
- The display is zeroed and an "R" is displayed on position 1.
- Switchin off by pressing the ▲ key once more. The absolute measuring value is displayed again.
- While in the incremental measurement mode the display can also be set to zero by pressing key ✱. This does not change the absolute measurement in the background.

6.3 Direct alteration of reference/offset value or calibration/offset value

(Not speed!)

NOTICE	Precondition: In programming mode menu item 'reference/offset value input enable' (RE/OF.EN:) or 'calibration/offset value input enable' (CA/OF.EN:) must be programmed to "on", but unit must not be left in programming mode (see chapter 4 'To leave programming mode').

- Change of reference/offset value or calibration/offset value is enabled by pressing the P key, with subsequent pressing of the ▲ key (within 1 sec.).
- The display then shows the reference/calibration value, which can be changed via the two arrow keys. By pressing the ✱ key, the value is saved and directly taken over in the display.

- Change of offset value is enabled by pressing the P key once again. The display then shows the offset value, which can be changed via the two arrow keys. By pressing the ✱ key, the value is saved and directly taken over in the display.
- If no key has been pressed for approx. 30 s or if you press again key P, MA10/4 will return to display mode.

6.4 Direct input of limiting value

(Only for switching output option!)

NOTICE	Precondition: In programming mode menu item enabling of modification of the limiting value (LIMIT.EN:) must be programmed to "on", but unit must not be left in programming mode (see chapter 4 'To leave programming mode').

- If the limiting values must be chanded frequently in the application, there is the possibility to directly call up the input of limiting values in the input mode.
- Change of the limit values is enabled by pressing the P key, with subsequent pressing of the ◀ key (within 1 sec.).
- The display then shows the upper limit value, which can be changed via the two arrow keys. By pressing the ✱ key, the changed value is saved.
- After pressing key P once again, the display shows the lower limit value, which also can be changed via the two arrow keys. By pressing the ✱ key, the changed value is saved.
- If no key has been pressed for approx. 30 s or if you press again key P, MA10/4 will return to display mode.

7 Referencing / Calibration

(Not speed!)

The display must always be referenced/ calibrated:

- before the first use of the measuring system.
- if the actual value memory (STO:) was programmed to 'off' (not SSI).
- in case of a displacement during power failure (not SSI).

During reference/calibration the counter is set to the programmed reference/calibration value (+ offset value). The display can thus be zeroed, if reference/calibration and offset value were previously programmed to 0.

7.1 Manual referencing / calibration

Manual reference/calibration can either be made by:

- activating a reference/calibration switch according to its function, i. e. RFS/CAL to ground. Menu item 'TRS:' must be programmed to "hand".
- or by pressing key ✱. Therefore menu item 'RESET:' must be programmed to "on", "del.1s" or "del.3s".

7.2 Automatic referencing

(Only incremental!)

Automatic referencing is always made via a reference point transmitter, which is automatically approached at a defined position (reference value). Suitable reference point transmitters are:

- mechanical cam switches.
- proximity switches with NPN-output (connected to earth).

Referencing condition: (for opening/ closing contact)

Index "lang": Signal_A + signal_B + index signal + reference switch

Index "kurz": Index signal + reference switch

General information on automatic reference

Electronic linking of the signals from a reference point transmitter (e. g. cam switch or limit switch) with the index pulse (index marker) of the connected encoder will calibrate the measuring display, ie. a start position is defined. During mounting of the reference point transmitter, please adjust the incremental encoder in such a way that the index pulse appears when the reference point switch is activated.

The contact of the reference point transmitter must only be active for less than one revolution of the encoder (see Fig. 2).

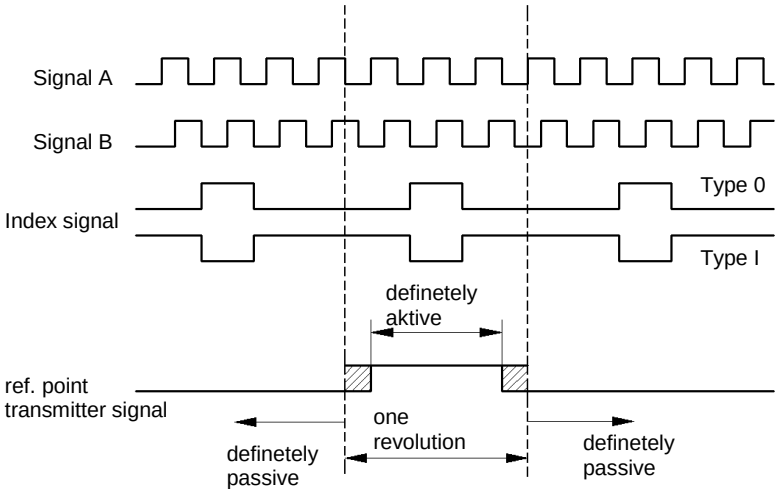

Fig. 2: Signal types for referencing

Information concerning the setting of the reference point

Move the spindle exactly to the position which corresponds to the reference value programmed before accord. to chapter 6. The mechanically mounted reference point transmitter must now be definitely active (see Fig. 2).

The encoder can be turned without causing any movement of the driving spindle, if you untighten the clamping ring or coupling. You can now search the index signal of the encoder (voltage change) by using for example a voltmeter and carry out the adjustment of the reference point. When the index and reference point transmitter signals are positioned as described in Fig. 3, the clamping ring and the coupling of the incremental encoder are retightened.

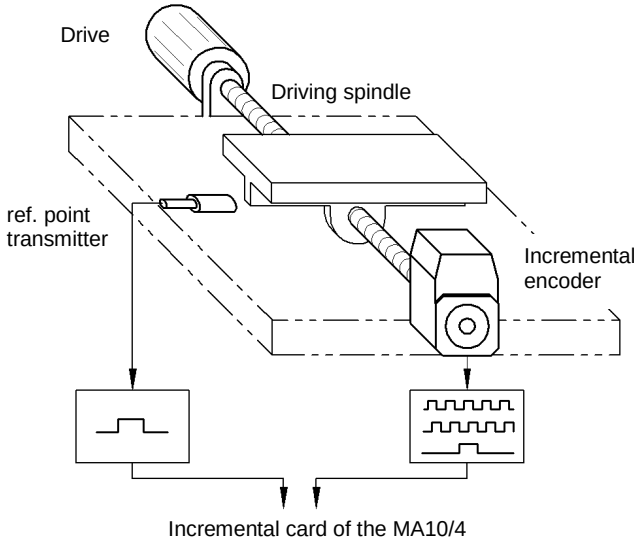

Fig. 3: Referencing setup

8 Serial Interface

(Only for interface option!)

Data can be exchanged with a PC via the serial interface of the MA10/4: Two different protocols are used depending on the MA10/4 version (standard protocol or SIKONETZ3).

8.1 Standard protocol

Menu item 'BAUD:' must be programmed on "2400", "4800", "9600" or "19200".

The MA10/4 can be operated directly on a PC or terminal via the serial interface.

Parameter: 2400 ... 19200 baud, no parity, 8 bits, 1 Stop bit, no handshake

Data code: ASCII

Value range: 2/3 Byte: 0 ... 65536 / 0 ... $\pm 2^{23}$

The transmission functions generally so, that the PC (or terminal) sends Capital Letters, if necessary with additional parameters. The MA10/4 transmits its answer with automatic Carriage Return <CR>.

Input: Lower and upper cases are accepted (ASCII).

Output: All response telegrams are completed with a CR (hex 13), except for the 'W' and "K" commands.

Command	Length	Reply	Description
Ax	 2/8 2/14 2/8	 "xxxxxx>" "xxxxxxxxxxxx>" "xxxxxx>"	Unit type/ software version x=0: hardware version x=1: software version x=2: unit type (INC, SSI...)
B	1/10	"±xxxxxxx>"	Binary counter value

Command	Length	Reply	Description
Ey	2/10	"±xxxxxxx>"	Transmit 3-byte value y = address (1 ... 6) xxxxxxx = decimal value y=1: position value/ number of pieces value y=2: reference/calibration value (not speed!) y=3: offset value (not speed!) y=4: offset value of incremental measure (not speed!) y=5: disc value at the moment of zeroing (SSI only!) y=6: factor (not inkremental!)
Fy±xxxxxx	9/2	">"	Enter 3-byte value y = address (2 ... 6) xxxxxxx = decimal value y=2: reference/calibration value (not speed!) y=3: offset value (not speed!) y=4: offset value of incremental measure (not speed!) y=5: SSI zeroing value (SSI only!) y=6: factor (not inkremental!)
Gy	2/7	"xxxxx>"	Transmit 2-byte value y = address (0 ... 7) xxxxx = decimal value y=0: display value after 1 revolution (incremental and SSI only!) y=1: number of pulses (incremental and speed only!) y=2: positions after the comma (not number of pieces!) y=3: baud rate y=4: encoder bits (SSI only!) y=5: singleturn bits (SSI only!) y=6: DIVISOR (incremental and SSI only!)
Hyxxxxx	7/2	">"	Enter 2-byte-value (not number of pieces!) y = address (0 ... 5) xxxxx = decimal value y=0: display value after 1 revolution (not speed!) y=1: number of pulses y=2: positions after the comma y=4: encoder bits (SSI only!) y=5: singleturn bits (SSI only!)
Iabc	4/2	">"	Release frontal keys (not speed!) a: reset via keyboard 0 = off 1 = on 2 = 1 sec. delay 3 = 3 secs. delay b: enable incremental measure 0 = off 1 = on c: input reference (calibration)/ offset value 0 = off
Jy	2/2	">"	y: language 0 = German 1 = English

Command	Length	Reply	Description
K	1/0	" "	Software RESET
L	1/1	">"	Zero-zetting (referencing/calibration) (not speed!)
Mabc	4/1	">"	Enter SSI format (SSI only!) a: Format 0 = no 1 = tree b: output 0 = gray 1 = binary c: Time-out 0 = off 1 = on
Mabc	4/1	">"	Enter cycle time (speed only!) a: 0 b: 0 c: 0 = 100 msec 1 = 500 msec 3 = 1.5 sec 4 = 2 sec 5 = 3 sec 6 = 5 sec 7 = 10 sec
N	1/4	"xx>"	Issue flag register xx: flag register 0 (HEX)
Ox	2/2	">"	Actual value store (incremental and number of pieces only!) x=0: actual value store off x=1: actual value store on
Px	2/2	">"	Input encoder type (SSI only!) x=0: Multiturn encoder x=1: Singleturn encoder x=3: Linear measurement system
S	1/2	">"	Reset device to standasrd programming (default values)
Tx	2/1	">"	Counting direction (not speed!) x=0: counting direction 'i' counting direction 'up' x=1: counting direction 'e' counting direction 'down'
Ux	2/1	">"	Input index type (incremental only!) x=0: Index I-lang x=1: Index 0-lang x=2: Index I-kurz x=3: Index 0-kurz
Vx	2/2	">"	Type of reference switch (incremental only!) x=0: reference switch 'closing contact' x=1: reference switch 'opening contact' x=2: manual reset
W	1/3	"xyz"	Binary position value xyz = 3 bytes in two's complement MSB ... LSB

Command	Length	Reply	Description
Xy	2/2	">"	Enter unit of measure y: number inkremental and SSI: y=0: no y=1: "mm" y=2: "cm" y=3: "m" y=4: "km" y=5: "in" (inch) y=6: " ° " (angle degree) speed: y=0: no y=1: "U/Sek" y=2: "U/Min" y=3: "m/Sek" y=4: "mm/S" y=5: "m/Min" y=6: "mm/M" number of pieces: y=0: no y=1: "Stk" y=2: "Bat"
Yx	2/2	">"	Enter display divisor (incremental and SSI only!) x=0: ADI = 1 x=1: ADI = 10 x=2: ADI = 100 x=3: ADI = 1000
Z	1/10	"±xxxxxxx>"	Issue position/measurement value

8.2 SIKONETZ3 Protocol description

(Only interface option!)

NOTICE	Precondition: Menu item "BAUD:" must be programmed to "SIKON.3".

The SIKONETZ3 protocol is a bus-capable protocol based on RS485 interface.

Parameter: 19200 baud, 8 bits, no Parity, 1 Start bit, 1 Stop bit

The protocol setup follows the Master-Slave-System; the MA10/4 only has the slave function. There are 2 telegram lengths:

3 Byte:

Address Byte	Command	Check Byte

6 Byte:

Address Byte	Command	Data Byte Low	Data Byte Middle	Data Byte High	Check Byte

The address byte is composed as follows:

1	0	A0	A1	A2	A3	A4	0	RR	L	1
	Start									Stopp

The check byte results from an EXOR-interconnection of the remaining two or five bytes of the telegram.

A0 ... A4: binary coded address 1 ... 31, address 0 defined for master

RR: broadcast bit: 1 = command valid for all devices, devices do not reply

L: length bit: 1 = short telegram (3 bytes), 0 = long telegram (6 bytes)

List of commands SIKONETZ3 protocol

Parameter: 19200 baud, no Parity, 8 Bit, 1 Start bit, 1 Stop bit

Column	Signification
Hex	Hexadecimal value of the command
TX	Length of telegram from master to MA10/4
RX	Length of telegram from MA10/4 to master
S	Transmitted parameter is permanently stored in the sensor
P	For this command programming mode has to be activated (command 0x32; 0x33)
R	This command can be broadcasted

Hex	TX	RX	S	P	R	Function
0x16	3	6	-	-	-	Incremental and SSI: read out position value number of pieces: read out number of pieces value speed: read out measurement value
0x18	3	6	-	-	-	Read out reference/ calibration value (not speed!)
0x19	3	6	-	-	-	Read out offset value (not speed!)
0x1b	3	6	-	-	-	Read out device's characteristics Low Byte: identifier = 21 Middle Byte: software version High Byte: hardware version
0x1c	3	6	-	-	-	Read out address/ positions after the comma (not number of pieces!) Low Byte: address Middle Byte: positions after the comma
0x1d	3	6	-	-	-	Read out counting direction (not speed!) Low Byte = 0: counting direction i / counting direction up Low Byte = 1: counting direction e / counting direction down
0x1e	3	6	-	-	-	Read out display after 1 revolution (only incremental and SSI!)
0x1f	3	6	-	-	-	Read out encoder pulses per revolution (only incremental and speed!)
0x28	6	6	S	P	-	Program reference/ calibration value (not speed!)
0x29	6	6	S	P	-	Program offset value (not speed!)
0x2c	6	6	S	P	-	Program positions after the comma (not number of pieces!) Value must be in data byte Middle
0x2d	6	6	S	P	-	Program counting direction (not speed!) (see command 0x1d)
0x2e	6	6	S	P	-	Program display after 1 revolution (only incremental and SSI!) value range 0 ... 59999

Hex	TX	RX	S	P	R	Function
0x2f	6	6	S	P	-	Program encoder pulses per revolution (only incremental and speed!) value range 0 ... 59999
0x32	3	3	-	-	-	Programming mode "on"
0x33	3	3	-	-	-	Programming mode "off" default
0x38	3	6	-	-	-	Read out display divisor (only incremental and SSI!) Low Byte = 0: ADI 1 Low Byte = 1: ADI 10 Low Byte = 2: ADI 100 Low Byte = 3: ADI 1000
0x39	6	6	S	P	-	Program display divisor (only incremental and SSI!) (see command 0x38)
0x3a	3	6	-	-	-	Send system status
0x3b	3	3	-	-	-	Cancel system status
0x48	3	3	S	P	-	Zero-zetting Position value is set to reference/calibration value + offset value
0x4f	3	3	-	-	R	Freeze measured value (position, number of pieces number), measured value is frozen. Deactivated when positional value is read out. Used for synchronizing the read out of several devices.
0x6c	3	6	-	-	-	Output index type (only incremental!) Low Byte = 0: I-lang Low Byte = 1: 0-Lang Low Byte = 2: I-kurz Low Byte = 3: 0-kurz
0x6d	6	6	S	P	-	Program index type (only incremental!) (see command 0x6c)
0x72	3	6	-	-	-	Output configuration bits
0x73	6	6	S	P	-	Program configuration bits
0x7e	3	6	-	-	-	Send type of reference switch (only incremental!)
0x7f	6	6	S	P	-	Program type of reference switch (only incremental!)

Error messages

The slave (MA10/4) recognizes transmission or input errors and then issues the following error messages:

Hex	TX	RX	S	P	R	Function
82 Hex	-	3	-	-	-	Check sum data transmission error
83 Hex	-	3	-	-	-	Invalid or unknown command
85 Hex	-	3	-	-	-	Invalid value (parameter programming)

Synchronisation

Byte/ telegram synchronisation is made via "timeout": the distance between each byte of a telegram must not exceed 10 ms. If a device does not respond, the master may only send another telegram after 30 ms at the earliest.

Telegram example

Master requests position value from device 7

Master sends (hex): 87 16 91

Short telegram to address 7 (87h); read out position value (16h); check byte (91h)

MA10/4 replies (hex): 07 16 03 02 00 10

Long telegram from address 7 (07h); read out position value (16h); value 203h = 515 dec (03 02 00h); check byte (10h).

9 Application examples for speed

9.1 How to display revolutions/minute (rpm)

Precondition:

Value programmed under "Encoder pulses per rev." (_incr_), must be identical to the pulse number of the encoder.

Cycle time is to be adapted to the encoder's increments and the speed (encoder with few increments --> high cycle time; encoder with many increments --> low cycle time).

Resolution 1 U/rpm: Factor = 1.0000

Resolution 0.1 U/rpm: Factor = 10.0000

That means: with each decreasing power of 10 of the factor, the resolution decreases by 0.1 mm.

9.2 How to display Hz (s^{-1})

Precondition:

Parameter 'Encoder pulses per rev.' must be programmed to "0"; display interpretes incoming values 1:1.

Resolution 10 Hz : cycle time = 0.1 s

Resolution 1 Hz : cycle time = 1 s

Resolution 0.1 Hz: cycle time = 10 s

9.3 Some practise application examples

The following three application examples show programming / application of the MA10/4 'Speed'. Please study these application examples; this will facilitate and clarify the display's handling.

Example 1:

Use of the MA10/4 on a plate saw together with an incremental encoder with 16 pulses. A measuring wheel with 200 mm circumference is fixed on the encoder's shaft. Via encoder and measuring wheel the plate's feed rate is to be displayed in m/min. A resolution of 10 cm/min (corresponds to one position after the comma) is required.

1. Calculation of the factor:

Circumference measuring wheel = p * diameter = 3.141593 * 200 mm = 628.32 mm = 0.62832 m. As resolution is to be 10 cm/min (0.1 m/min), a 10-times higher factor must be chosen.

Factor = 10 * 0.62832 = 6.2832

2. Parameter programming:

Parameter	Value	Examination
INCR:	16	Enter 'Encoder pulses per revolution'.
DEC:	0.0	Positions after the comma (one for this application).
FAC:	6.2832	Enter calculated factor.
CYCLUS:	10	Connected encoder has a low pulse count; therefore, it is absolutely necessary to program a higher cycle time; otherwise an unstable display will result. The display becomes more sluggish, but also more precise.

Example 2:

Use of the MA10/4 on a paper-working machine to capture the speed of a paper web. An incremental encoder with 500 pulses is fixed on a shaft deflecting the paper web. The shaft has a circumference of 500 mm and m/s are to be displayed via the MA10/4. Required resolution = 1 mm/s (corresponds to 3 positions after the comma).

1. Calculation of the factor:

Factor = 0.5 m/60 s = 0.00833 m/s (Divisor 60 is necessary, because the MA10/4's standard programming is turns/minute).

As resolution is to be 1 mm/s, a 1000-times higher factor must be chosen.

Factor = 0.00833 * 1000 = 8.3333

2. Parameter programming:

Parameter	Value	Examination
INCR:	500	Enter 'Encoder pulses per revolution'.
DEC:	0.000	Three positions after the comma.
FAC:	8.3333	Enter calculated factor.
CYCLUS:	0.1 ... 1	Since the encoder has a high number of lines and the paper web is transported with high speed as a rule, it is recommended that you set a cycle time of 0.1 s to 1 s.

Example 3:

Speed of a motor on a machine is to be determined. During operation at normal rating the motor has a speed of 3000 rpm. An incremental encoder with 275 pulses is fixed on the motor's shaft. Speed is to be controlled by two independent stations using MA10/4 'Speed'.

For one station turns/minute without a position after the comma are to be displayed; for the other station turns/second and one position after the comma.

For the first station:

1. Calculation of the factor:

Factor = rpm = 1.000

Factor = 1.0000 (preprogrammed standard unit = rpm)

2. Parameter programming:

Parameter	Value	Examination
INCR:	275	Enter 'Encoder pulses per revolution'.
DEC:	0.	No positions after the comma
FAC:	.0000	Enter calculated factor.
CYCLUS:	0.1 ... 1	Depends on speed and desired display sensivity.

For the second station:

1. Calculation of the factor:

Factor = 1 rpm = 1 U/60 s = 0.0166

As the value is to be displayed with one position after the comma, a 10-time higher factor must be chosen.

Factor = 10 * 0.0166 = 0.1666

2. Parameter programming:

Parameter	Value	Examination
INCR:	275	Enter 'Encoder pulses per revolution'.
DEC:	0.0	Enter one position after the comma.
FAC:	0.1666	Enter calculated factor.
CYCLUS:	0.1 ... 1	Depends on speed and desired display sensivity.

9.4 Cycle times recom. for certain pulse counts

Cycle times should be programmed according to speed and individual requirements. Standard values can be seen from the following table:

Encoder pulses INCR:	Cycle time CYCLUS:
1 - 30	10
30 - 80	5
80 - 150	3
150 - 300	2
300 - 400	1.5
400 - 600	1
600 - 1000	0.5
>1000	0.1

10 MA10/4 in combination with MSK magnetic sensor

NOTICE	The parameters of the following table are intended for displaying the maximum resolution of the relevant sensor. Therefore, all sensor resolutions that are unequal 0.1, 1, 10, 100 cause jumps in the lowest decimal position. The resolution of the MA10/4 may be decreased by programming an DIVISOR: = "10" if this is not desired. The DEC: decimal point must be adjusted correspondingly.

If the MA10/4 is to be operated with an MSK type magnetic sensor, some parameters must be fixed.

Parameter DIVISOR: = "1"

Parameter INDEX: = "0-kurz"

Sensor	Resolution sensor	Resolution display	Parameter MA10/4		
			DPR:	INCR:	DEC:
MSK210	25 µm 50 µm 100 µm 125 µm 500 µm	10 µm 10 µm 100 µm 100 µm 100 µm	10 20 4 5 20	1 1 1 1 1	0.00 0.00 0.0 0.0 0.0
MSK320	0.04 mm 0.05 mm 0.08 mm 0.1 mm 0.16 mm 0.2 mm 0.8 mm	0.01 mm 0.01 mm 0.01 mm 0.1 mm 0.1 mm 0.1 mm 0.1 mm	16 20 32 4 64 8 32	1 1 1 1 10 1 1	0.00 0.00 0.00 0.0 0.0 0.0 0.0
MSK400/1	1 mm	1 mm	4	1	0.
MSK100 MSK1000	1 µm 2 µm 5 µm	1 µm 1 µm 1 µm	4 8 10	1 1 1	0.000 0.000 0.000
MSK200/1	2 µm 4 µm 5 µm 10 µm	1 µm 1 µm 1 µm 10 µm	8 16 20 4	1 1 1 1	0.000 0.000 0.000 0.00
MSK500/1 MSK5000	5 µm 10 µm 12.5 µm 20 µm 25 µm 50 µm	1 µm 10 µm 10 µm 10 µm 10 µm 10 µm	20 4 50 8 10 20	1 1 10 1 1 1	0.000 0.00 0.00 0.00 0.00 0.00

MA10/4 combined with an MSK magnetic sensor and the MR magnetic ring

If an MSK magnetic sensor with an MR magnetic ring is used instead of an incremental encoder, then the "encoder pulses per revolution" of the magnetic ring must be determined in order to enable parameterization of the magnetic display. The "encoder pulses per revolution" is calculated from the pose number of the magnetic ring and the scaling factor of the MSK sensor according ro the following formula:

Encoder pulses per revolution = number of poles of magnetic ring x scaling factor of sensor

Example:

Magnetic ring MR500: Pole number = 64

Magnetic sensor MSK500: Scaling factor = 125

-> Encoder pulses per revolution = 64 x 125 = 8000

11 Trouble shooting

Error states are recognized and shown in the display.

Messange	Description	Action
FULL	Display overrun	Control parameters and adjust them if necessary; reference/calibration display.
Flashing display	Device was switched on with actual value store programmed to 'off'.	Carry out reference/calibration.
TIME-OUT (only SSI)	No data transmission from encoder to display.	Check wiring.

12 Parameter list

12.1 Incremental version

Display	Selection/value	Default value	Your own programming use		
			1	2	3
LANGUAGE:	deu, eng	deu			
DEC:	0., 0.0, 0.00, 0.000, 0.0000	0.0			
DPR:	0 ... 59999	0000.0			
DIVISOR:	1, 10, 100, 1000	1			
INCR:	0 ... 59999	00000			
DIRECTION:	i, e	i			
INDEX:	I-lang, 0-lang, I-kurz, 0-kurz	I-lang			
TRS:	n.open, n.closed, hand	n.open			
REF:	-999999 ... +999999	+00000.0			
OFF:	-999999 ... +999999	+00000.0			
RESET:	off, on, del.1s, del.3s	off			
ABS/REL:	off, on	off			
RE/OF.EN:	off, on	off			
STO:	off, on	off			
P-KEY:	3s, 5s, 10s, 20s, 30s	5s			
BAUD:	2400, 4800, 9600, 19200, SIKON.3, SCHALT	4800			
ADR:	1 ... 31	31			
UPL:	-999999 ... +999999	+00000.0			

Display	Selection/value	Default value	Your own programming use		
			1	2	3
LOL:	-999999 ... +999999	+00000.0			
LIMIT.EN:	off, on	off			
UNITS:	--, mm, cm, m, km, in, °	mm			
DIS.ANGLE:	-5 ... +4	0			

12.2 SSI version

Display	Selection/value	Default value	Your own programming use		
			1	2	3
LANGUAGE:	deu, eng	deu			
E-TYP:	multi, single, linear	multi			
FORMAT:	no, Tree	no			
S-BITS:	5 ... 19	10			
ENCOD.BIT:	5 ... 25	22			
DEC:	0., 0.0, 0.00, 0.000, 0.0000	0.0			
DPR:	0 ... 59999	0000.0			
DIVISOR:	1, 10, 100, 1000	1			
FAC:	00.0001 ... 99.9999	01.0000			
DIRECTION:	i, e	i			
DIRECT:	up, down	up			
CAL:	-999999 ... +999999	+00000.0			
OFF:	-999999 ... +999999	+00000.0			
RESET:	off, on, del.1s, del.3s	off			
ABS/REL:	off, on	off			
CA/OF.EN:	off, on	off			
OUTPUT:	gray, bin	gray			
TIMEOUT:	off, on	aus			
P-KEY:	3s, 5s, 10s, 20s, 30s	5s			
BAUD:	2400, 4800, 9600, 19200, SIKON.3, SCHALT	4800			
ADR:	1 ... 31	31			
UPL:	-999999 ... +999999	+00000.0			
LOL:	-999999 ... +999999	+00000.0			
LIMIT.EN:	off, on	off			
UNITS:	--, mm, cm, m, km, in, °	mm			
DIS.ANGLE:	-5 ... +4	0			

12.3 Speed

Display	Selection/value	Default value	Your own programming use		
			1	2	3
LANGUAGE:	deu, eng	deu			
INCR:	0 ... 59999	00000			
DEC:	0., 0.0, 0.00, 0.000, 0.0000	0.0			
FAC:	00.0001 ... 99.9999	01.0000			
CYCLUS:	0.1s, 0.5s, 1s, 1.5s, 2s, 5s, 10s	1s			
P-KEY:	3s, 5s, 10s, 20s, 30s	5s			
BAUD:	2400, 4800, 9600, 19200, SIKON.3, SCHALT	4800			
ADR:	1 ... 31	31			
UPL:	-999999 ... +999999	+00000.0			
LOL:	-999999 ... +999999	+00000.0			
LIMIT.EN:	off, on	off			
UNITS:	--, U/Sek, U/Min, m/Sek, mm/S, m/Min; mm/M	U/Sek			
DIS.ANGLE:	-5 ... +4	0			

12.4 Number of pieces version

Display	Selection/value	Default value	Your own programming use		
			1	2	3
LANGUAGE:	deu, eng	deu			
DIRECT:	up, down	up			
FAC:	00.0001 ... 99.9999	01.0000			
REF:	-999999 ... +999999	+00000.0			
OFF:	-999999 ... +999999	+00000.0			
RESET:	off, on, del.1s, del.3s	off			
ABS/REL:	off, on	off			
RE/OF.EN:	off, on	off			
STO:	off, on	off			
P-KEY:	3s, 5s, 10s, 20s, 30s	5s			
BAUD:	2400, 4800, 9600, 19200, SIKON.3, SCHALT	4800			
ADR:	1 ... 31	31			
UPL:	-999999 ... +999999	+00000.0			
LOL:	-999999 ... +999999	+00000.0			
LIMIT.EN:	off, on	off			
UNITS:	--, Stk, Bat	Stk			
DIS.ANGLE:	-5 ... +4	0			