

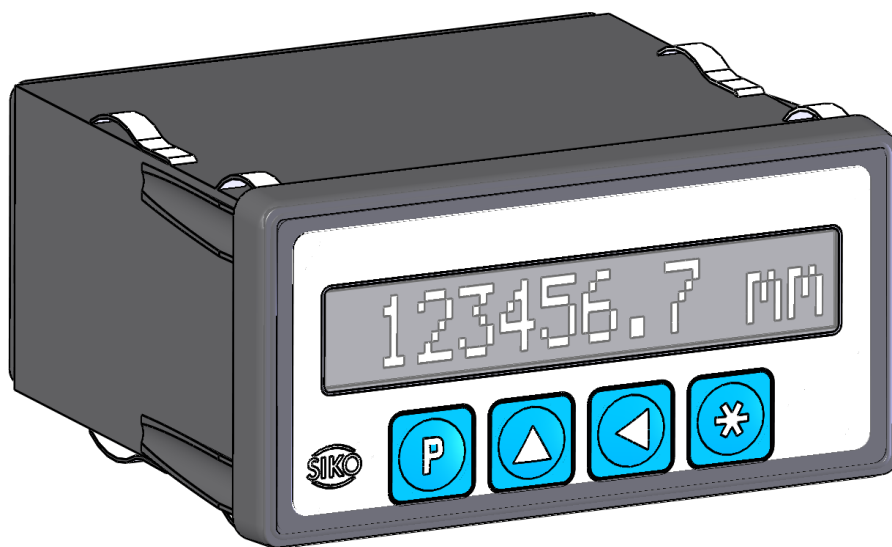
---

# User manual

---

Electronic display

## MA10/4 Software SW02



## Table of contents

<b>1</b>	<b>General Information .....</b>	<b>3</b>
1.1	Documentation .....	3
1.2	Short Description .....	3
<b>2</b>	<b>Key functions.....</b>	<b>3</b>
2.1	Operating modes.....	4
<b>3</b>	<b>Display description .....</b>	<b>4</b>
3.1	Display mode Modulo.....	4
3.2	Display mode 0-90-0 .....	4
<b>4</b>	<b>Programming mode .....</b>	<b>5</b>
<b>5</b>	<b>Parameter description .....</b>	<b>5</b>
5.1	Incremental version .....	6
5.2	SSI version .....	8
<b>6</b>	<b>Input mode .....</b>	<b>11</b>
6.1	Reset function .....	11
6.2	Incremental measurement .....	11
6.3	Direct alteration of reference/offset value or calibration/offset value .....	12
6.4	Direct input of limiting value .....	12
<b>7</b>	<b>0-90-0 Angle display.....</b>	<b>13</b>
7.1	Input of limit with switching output option.....	13
<b>8</b>	<b>Referencing / Calibration.....</b>	<b>13</b>
8.1	Manual referencing / calibration .....	14
8.2	Automatic referencing .....	14
<b>9</b>	<b>Serial Interface.....</b>	<b>16</b>
9.1	Standard protocol .....	16
9.2	SIKONETZ3 Protocol description .....	18
<b>10</b>	<b>Application examples .....</b>	<b>21</b>
10.1	Example of Modulo display mode .....	21
10.2	Example: Mitre-box saw (Display mode 0-90-0) .....	21
10.3	MA10/4 combined with an MSK magnetic sensor and the MR magnetic ring.....	21
<b>11</b>	<b>Trouble shooting .....</b>	<b>22</b>
<b>12</b>	<b>Parameter list.....</b>	<b>22</b>
12.1	Incremental version .....	22
12.2	SSI version .....	23

## 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>.

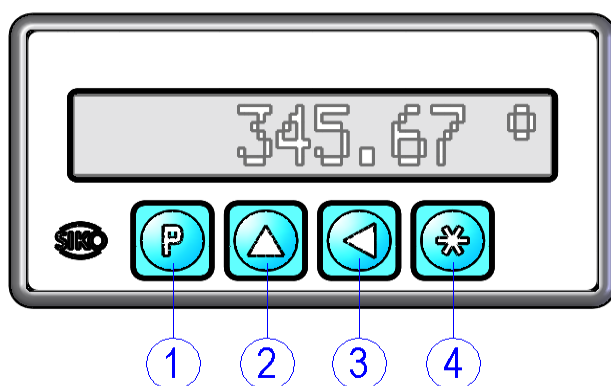
### 1.2 Short Description

In combination with an incremental/SSI encoder the MA10/4 SW02 can be used for measuring angles in three ranges of resolution (1°, 0.1°, 0.01°). After reaching the respective maximum value, e. g., 359 (programmable modulo value), the display jumps to 0. With opposite sense of rotation of the encoder the display jumps back from 0 to 359.

Furthermore, the MA10/4 SW02 may be used as an angle display for mitre-box saws. With the saw blade swinging, the measured value decreases from 90° into the 0° direction.

## 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.



## 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. The display differs depending on the application mode (modulo or 0-90-0):

### 3.1 Display mode Modulo



The display is in the input mode.






1	2	3	4	5	6	7	8	9	10	11	12	Digit
R				1	5	9	.	9			°	Angle value

Digit	Symbol	Description
1	R	Incremental measure is active.
3		Upper limiting value exceeded (only for output circuit option).
3		Lower limiting value exceeded (only for output circuit option).
5-10		Measured value
12		Unit of measure (programmable)

### 3.2 Display mode 0-90-0

The display is in the input mode.

1	2	3	4	5	6	7	8	9	10	11	12	Digit
				3	5	.	9	0			°	Angle value

Digit	Symbol	Description
1		Position value is in the 0 quadrant.
1		Position value is at 90°.
1		Position value is in the 1 quadrant (symbol flashes).
3		Upper limiting value exceeded (only for output circuit option).
3		Lower limiting value exceeded (only for output circuit option).
4-10		Position value
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.
WINK:	modulo, 0-90-0	Angle mode 'modulo' angle measurement, e. g., 0-360° '0-90-0' angle measurement for mitre-box saws
DEC:	0., 0.0, 0.00	Positions after the comma '0.' : 1° resolution '0.0' : 0.1° resolution '0.00' : 0.01° resolution
MOD.W:	0 ... 59999	Modulo value: Number of possible steps Menu item is displayed only if 'WINK:' is programmed with 'modulo' Example: Angle measurement 0° ... 359° corresponds to a number of 360 steps -> MOD.W: = 00360; after reaching the maximum value (359) the display jumps back to 0. With opposite rotational direction of the encoder, the display jumps back from 0 to 359.
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:	l-lang, 0-lang, l- 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 'l' 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 8. value range modulo: -999999...+999999 value range 0 0-90-0: -999999...+90 (resolution 1°) -999999...+900 (resolution 0.1°) -999999...+9000 (resolution 0.01°)
OFF:	-999999 ... +999999	Offset (displacement) Menu item appears only if 'WINK:' has been programmed with 'modulo'. Freely selectable value that influences the display. The offset value can be used as tool correction or offset measure for instance.
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 enabled (press key  for at least 3 sec.)
ABS/REL:	off, on	Incremental measurement enable Menu item will be displayed only if 'modulo' is programmed for 'WINK:'. 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 Menu item will be displayed only if 'modulo' is programmed for 'WINK:'. 'off' reference/offset value correction off 'on' reference/offset value correction enabled
RE/EN:	off, on	Reference value input enable Menu item will be displayed only if '0-90-0' is programmed for 'WINK:'. 'off' reference value correction off 'on' reference 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.

Display	Value range	Description
P-KEY:	3s, 5s, 10s, 20s, 30s	Programming keys delay Delay of key <b>P</b> 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 point 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:	--, °	Unit of measure Choice of the measurement unit to be displayed on positions 11, 12 (see chapter 3 <a href="#">Display description</a> ).
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.
WINK:	Modulo, 0-90-0	Angle mode 'modulo' angle measurement, e. g., 0-360° '0-90-0' angle measurement for mitre-box saws
DEC:	0., 0.0, 0.00	Positions after the comma '0.' : 1° resolution '0.0' : 0.1° resolution '0.00' : 0.01° resolution



Display	Value range	Description
MOD.W:	0 ... 59999	Modulo value: Number of possible steps Menu items displayed only if 'WINK:' is programmed with 'modulo'. Example: Angle measurement 0° ... 359° corresponds to a number of 360 steps -> MOD.W: = 00360; after reaching the maximum value (359) the display jumps back to 0. With opposite rotational direction of the encoder, the display jumps back from 0 to 359.
E-TYP:	multi, single	Encoder type Determines the encoder type connected 'multi' multi-turn encoder 'single' single-turn encoder
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
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
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'.
DIRECTION:	i, e	Counting direction 'i' clockwise increasing values 'e' anti-clockwise increasing values
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 8. value range modulo: -999999 ... +999999 value range 0-90-0: -999999 ... +90 (resolution 1°) -999999 ... +900 (resolution 0.1°) -999999 ... +9000 (resolution 0.01°)
OFF:	-999999 ... +999999	Offset (displacement) Can be any value; used to influence the value displayed, e. g. tool correction value.

Display	Value range	Description
RESET:	off, on, del.1s, del.3s	Reset via keyboard enable key  'off' reset function off 'on' reset function enabled 'del.1s' reset function enabled (press key  for at least 1 sec.) 'del.3s' reset function enabled (press key  for at least 3 sec.)
ABS/REL:	off, on	Incremental measurement enable Menu item will be displayed only if 'modulo' is programmed for 'WINK:'. 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 Menu item will be displayed only if 'modulo' is programmed for 'WINK:'. 'off' calibration/offset value correction off 'on' calibration/offset value correction enabled
CA/EN:	off, on	Calibration value input enable Menu item will be displayed only if '0-90-0' is programmed for 'WINK:'. 'off' calibration value correction off 'on' calibration 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 on
P-KEY:	3s, 5s, 10s, 20s, 30s	Programming keys delay Delay of key  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.


Display	Value range	Description
UNITS:	--, °	Unit of measure Choice of the measurement unit to be displayed on positions 11, 12 (see chapter 3 <a href="#">Display description</a> ).
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

## 6 Input mode

### 6.1 Reset function

<b>NOTICE</b>	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').
---------------	---

#### For "modulo" display mode

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




#### For "0-90-0" display mode

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

### 6.2 Incremental measurement

(Not 0-90-0 display mode!)

<b>NOTICE</b>	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

<b>NOTICE</b>	Precondition: In programming mode menu item 'Reference/offset value input enable' (RE/OF.EN:) or 'calibration/offset value input enable' (CA/OF.EN:) in display mode 'modulo', resp. reference/calibration value input enable (RE.EN:/CA.EN:) in display mode '0-90-0' must be programmed to "on", but unit must not be left in programming mode (see chapter 4 'To leave programming mode').
---------------	---

If frequent changes to the reference/calibration value or offset value are required in the application, then you can call and alter these values directly in the input mode.

#### Input reference/calibration value

- Change of reference/calibration 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.

#### Input offset value (not at '0-90-0')

- 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.

#### Finishing direct input of reference/calibration/offset value

- 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!)

<b>NOTICE</b>	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 changed 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 0-90-0 Angle display

If the encoder value is smaller than 90 (or 90.0 or 90.00, resp.), it is immediately displayed. However, if it exceeds the above limits, it is calculated according to the following formula:

Displayed value = 180-encoder value

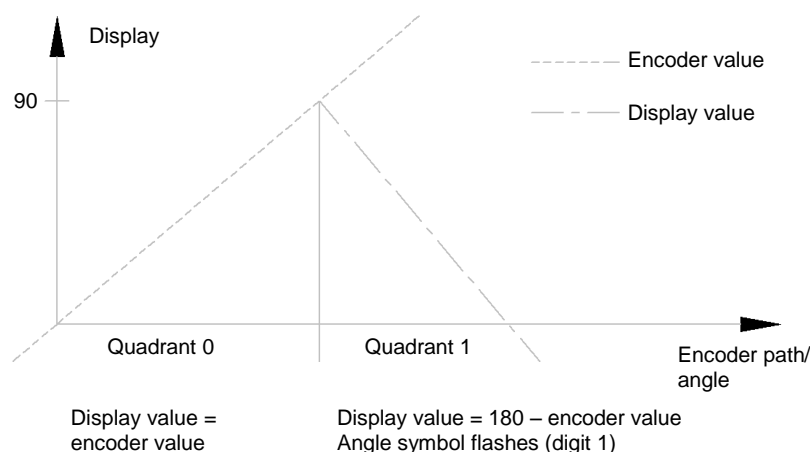


Fig. 2: Angle display

A flashing angle sign (display position 1) symbolises, that one is in the first quadrant. In this position no referencing/calibration must be conducted. If, however, referencing/calibration is required on this position (angle symbol flashes), it can be done by inverting the sense of rotation.

### 7.1 Input of limit with switching output option

When entering the limits that are in the quadrant 1, please note that they cannot be entered directly as with quadrant 0, but must be calculated according to the following formula:

Limiting value = 180 - display value

#### Example:

The lower limit is in quadrant 0 at 40°, the upper limit in quadrant 1 at 40°.

-> LOL: = 40

Calculation of the input value for the upper limit:

Upper limit = 180 - 40 = 140

-> UPL: = 140

## 8 Referencing / Calibration


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'.
- in case of a displacement during power failure.

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

## 8.1 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".
- During reference/calibration the counter is set to the programmed reference/calibration value (+ offset value when display mode modulo) The display can thus be zeroed, if reference/calibration and offset value were previously programmed to 0.

## 8.2 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. 3](#)).

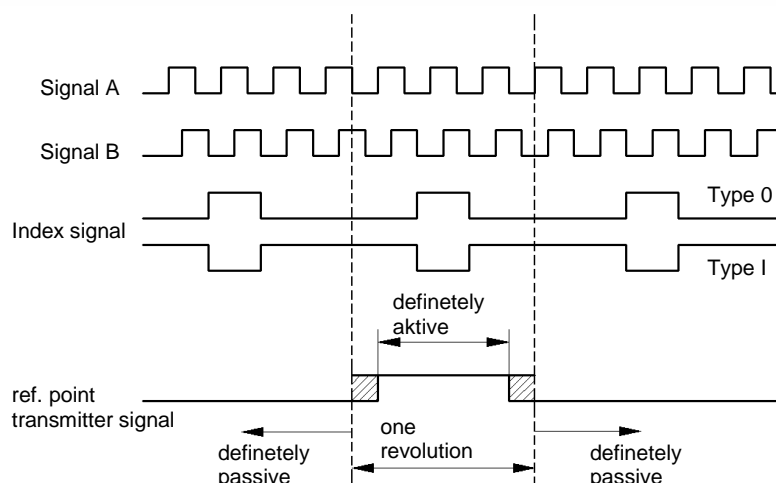


Fig. 3: Signal types for referencing

### 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. 3).

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. 4, the clamping ring and the coupling of the incremental encoder are retightened.

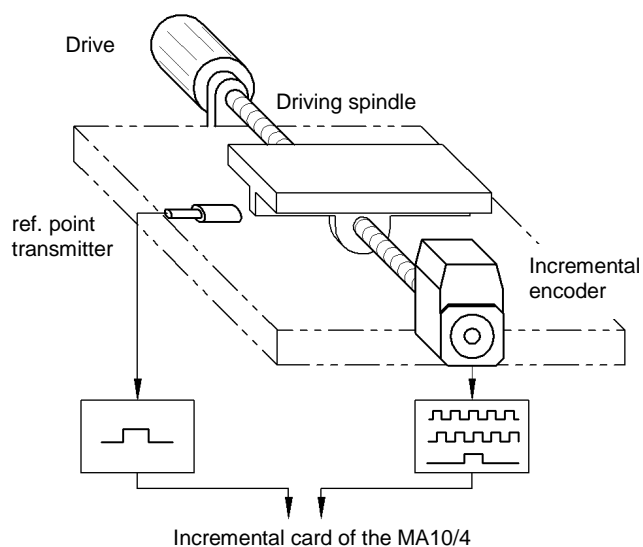


Fig. 4: Referencing setup

## 9 Serial Interface

(Only 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).

### 9.1 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	"±xxxxxxxx>"	Binary counter value
Ey	2/10	"±xxxxxxxx>"	Transmit 3-byte value y = address (1 ... 5) xxxxxxx = decimal value y=1: position value y=2: reference/calibration value y=3: offset value y=4: offset value of incremental measure y=5: disc value at the moment of zeroing (SSI only!)
Fy±xxxxxx	9/2	">"	Enter 3-byte value y = address (2 ... 6) xxxxxxx = decimal value y=2: reference/calibration value y=3: offset value y=4: offset value of incremental measure y=5: SSI zeroing value (SSI only!) y=6: factor (SSI only!)



Command	Length	Reply	Description
Gy	2/7	"xxxxx>"	Transmit 2-byte value y = address (0 ... 7) xxxxx = decimal value y=0: display value after 1 revolution y=1: number of pulses (incremental only!) y=2: positions after the comma y=3: baud rate y=4: encoder bits (SSI only!) y=5: singleturn bits (SSI only!) y=6: modulo value y=7: DIVISOR
Hyxxxxx	7/2	">"	Enter 2-byte-value y = address (0 ... 6) xxxxx = decimal value y=0: display value after 1 revolution y=1: number of pulses y=2: positions after the comma y=4: encoder bits (SSI only!) y=5: singleturn bits (SSI only!) y=6: modulo value
labc	4/2	">"	Release frontal keys a: reset via keyboard 0 = off 1 = on 2 = 1 sec. delay 3 = 3 secs. delay b: enable incremental measure (not 0-90-0!) 0 = off 1 = on c: input reference (calibration)/ offset value 0 = off 1 = on
Jy	2/2	">"	y: language 0 = German 1 = English
K	1/0	" "	Software RESET
L	1/1	">"	Zero-zetting (referencing/calibration)
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
N	1/4	"xx>"	Issue flag register xx: flag register 0 (HEX) yy: flag register 1 (HEX)
Ox	2/2	">"	Actual value store (incremental only!) x=0: actual value store off x=1: actual value store on

Command	Length	Reply	Description
Px	2/2	">"	Input encoder type (SSI only!) x=0: Multiturn encoder x=1: Singleturn encoder
S	1/2	">"	Reset device to standard programming (default values)
Tx	2/1	">"	Counting direction x=0: counting direction 'i' x=1: counting direction 'e'
Ux	2/1	">"	Input index type (incremental only!) x=0: Index I-lang x=1: Index O-lang x=2: Index I-kurz x=3: Index O-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
Xy	2/2	">"	Enter unit of measure y: number y=0: no y=1: " ° " (angle degree)
Yx	2/2	">"	Enter display divisor (incremental and SSI only!) x= number x=0: ADI = 1 x=1: ADI = 10 x=2: ADI = 100 x=3: ADI = 1000
Z	1/10	"±xxxxxxx>"	Issue position value

## 9.2 SIKONETZ3 Protocol description

(Only interface option!)

<b>NOTICE</b>	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:

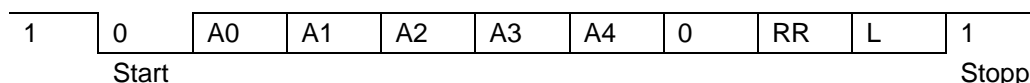
3 Byte:

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:



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	-	-	-	Read out position value
0x18	3	6	-	-	-	Read out reference/calibration value
0x19	3	6	-	-	-	Read out offset value
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 Low Byte: address Middle Byte: positions after the comma
0x1d	3	6	-	-	-	Read out counting direction Low Byte = 0: counting direction i Low Byte = 1: counting direction e
0x1e	3	6	-	-	-	Read out display after 1 revolution
0x1f	3	6	-	-	-	Read out encoder pulses per revolution
0x28	6	6	S	P	-	Program reference/ calibration value
0x29	6	6	S	P	-	Program offset value
0x2c	6	6	S	P	-	Program positions after the comma Value must be in data byte Middle
0x2d	6	6	S	P	-	Program counting direction (see command 0x1d)
0x2e	6	6	S	P	-	Program display after 1 revolution Value range 0 ... 59999
0x2f	6	6	S	P	-	Program encoder pulses per revolution Value range 0 ... 59999
0x32	3	3	-	-	-	Programming mode "on"

Hex	TX	RX	S	P	R	Function
0x33	3	3	-	-	-	Programming mode "off"
0x38	3	6	-	-	-	Read out display divisor 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 (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).

## 10 Application examples

### 10.1 Example of Modulo display mode

The position of the motor shaft on a motor is to be recorded ( $0^\circ \dots 359^\circ$ ) with a resolution of  $0.1^\circ$ . An incremental encoder with 1000 pulses per revolution is attached to the motor shaft. Thus, the display should count from 0.0 ... 359.9 and then jump back to 0.0.

#### Parameter programming:

Parameter	Input	Explanation
WINK:	modulo	Set modulo display mode.
DEC:	0.0	Enter positions after the comma.
MOD.W:	360.0	Enter modulo value.
DRP:	360.0	Enter display after one revolution.
DIVISOR:	1	Enter display divisor.
INCR:	1000	Enter pulses per revolution.

### 10.2 Example: Mitre-box saw (Display mode 0-90-0)

An MA10/4 as an angle display is to be installed on a mitre-box saw. While the saw blade is swinging, the measured value shall decrease from  $90^\circ$  in the direction of  $0^\circ$  on both sides. An incremental encoder with 100 pulses per revolution is available, the resolution shall be  $1^\circ$ .

#### Parameter programming:

Parameter	Input	Explanation
WINK:	0-90-0	Set display mode 0-90-0.
DEC:	0.	Enter positions after the comma.
DRP:	360	Enter display after one revolution.
DIVISOR:	1	Enter display divisor.
INCR:	100	Enter pulses per revolution.

### 10.3 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 pole number of the magnetic ring and the scaling factor of the MSK sensor according to 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.

Message	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.

## 12 Parameter list

### 12.1 Incremental version

Display	Selection/value	Default value	Your own programming use		
			1	2	3
LANGUAGE:	deu, eng	deu			
WINK:	modulo, 0-90-0	modulo			
DEC:	0., 0.0, 0.00	0.0			
MOD.W:	0 ... 59999	360.0			
DPR:	0 ... 59999	0000.0			
DIVISOR:	1, 10, 100, 1000	1			
INCR:	0 ... 59999	00000			
DIRECTION:	i, e	i			
INDEX:	l-lang, 0-lang, l-kurz, 0-kurz	l-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			
RE.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			

Display	Selection/value	Default value	Your own programming use		
			1	2	3
UPL:	-999999 ... +999999	+00000.0			
LOL:	-999999 ... +999999	+00000.0			
LIMIT.EN:	off, on	off			
UNITS:	--, °	°			
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			
WINK:	modulo, 0-90-0	modulo			
DEC:	0., 0.0, 0.00	0.0			
MOD.W:	0 ... 59999	360.0			
E-TYP:	multi, single	multi			
FORMAT:	no, Tree	no			
S-BITS:	5 ... 19	10			
ENCOD.BIT:	5 ... 25	22			
DPR:	0 ... 59999	0000.0			
DIVISOR:	1, 10, 100, 1000	1			
DIRECTION:	i, e	i			
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			
CA.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			
DIS.ANGLE:	-5 ... +4	0			