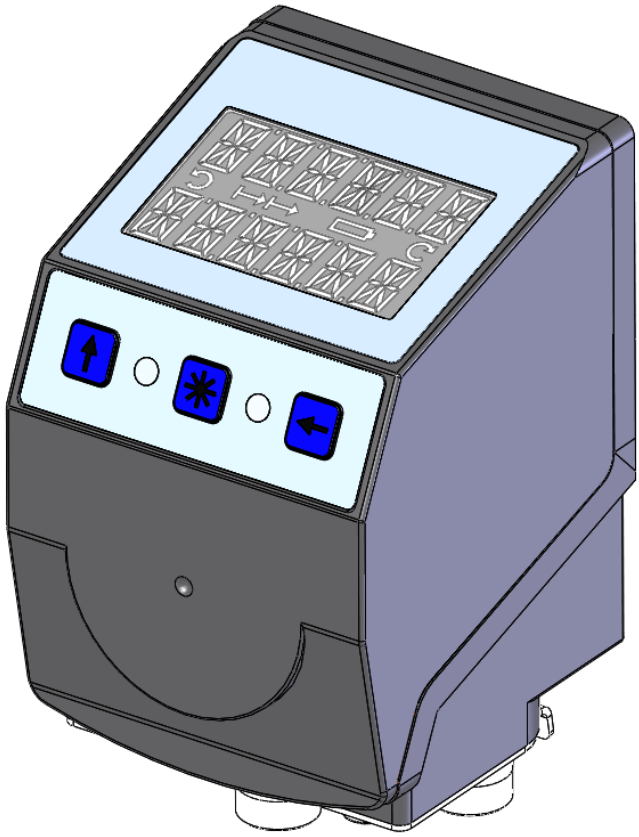
AP10S

Absolute / Electronic Position Indicator with plug connector for magnetic sensor and RS485 / SIKONETZ5 interface

User manual



183/18

Table of contents

1 General Informaton

1.1 Dokumentation

The following documents describe this product:

- The data sheet describes the technical data, the dimensions, the pin assignments, the accessories and the order key.
- The installation instructions describe the mechanical and electrical installation including all safety-relevant requirements and the associated technical specification.
- The user manual for commissioning and integrating the position indicator into a fieldbus system.

These documents can also be downloaded at **http://www.siko-global.com/p/ap10s**.

Additional information and support for this device can also be found there.

1.2 Definitions

If not explicitly indicated otherwise, decimal values are given as figures without addition (e. g. 1234), binary values are labeled with b (e. g. 1011b), hexadecimal values are identified by h (e. g. 280h) after the figures.

2 Intended use

The device is an absolute position indicator with a plug-in connection for MS500H magnetic sensor for direct linear distance measurement (combined with MB500 magnetic tape) or a supported GS04 magnetic sensor for direct shaft mounting. Actual and target values are indicated via the backlit two-row LC display. A direction indicator (arrow) is blended in if the actual value deviates from the target value including the adjustable target window. The direction of the arrow indicates the direction of shaft movement necessary to reach the target. Additionally, various visualization tasks can be realized by means of two bi-color LEDs.

The device parameters can be adjusted by means of 3 keys. You can change the set point, output the position value and adjust all device parameters via the integrated bus interface.

Scanning is magnetically-incremental. In the currentless state, scanning and saving of changes of the position value are battery-supported.

The state of charge of the replaceable battery is monitored and signified.

If no sensor is connected or the MS500H sensor lifted off the tape, an error will be detected and the position value displayed red with a flashing "Error" message. This condition survives a power failure. The error must be remedied by way of calibration after checking the sensor connection or sensor position, respectively.

Display and interface are active with external power supply only.

2.1 Switching on the supply voltage

The AP10S will be initialized after switching on the supply voltage. A display test is executed during initialization, the LEDs are lighted consecutively and the configutation parameters are loaded from the non-volative memory into the RAM of the controller.
With the display still unconfigured all parameters are set to their default values. See to it that the bus will be connected only after correct adjustment of baud rate and ID (see chapter 4.3: Parameterization of the position indicator and 6.8: Auto-ID). The AP10S functions with the data last parameterized.
AP10S is in the normal operating state. According to the requirements of the application, the display can be parameterized via the SIKONETZ5 interface in this state.

3 Display and control keys

3.1 General

The position indicator has a two-line display with special characters and three control keys. The keys serve for position indicator parameterization and control. Two LEDs (1) serve for monitoring positioning.

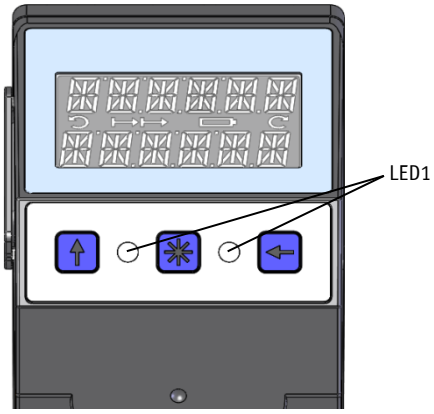


Fig. 1: Control elements

3.2 LCD display

NOTICE	The display range is limited to -19999 ... 99999. Values outside this range are displayed with "FULL".

With supply voltage applied to the position indicator with factory settings, the actual value will be displayed in the 1st row and the set point in the 2nd row. If there is no valid set point, "---" will be displayed in the 2nd row. The values displayed are determined by the operating mode.

Direction indicators (arrows) support positioning.

The battery symbol ▭ is shown with a critical or insufficient battery status.
With incremental measurement function activated, the incremental measurement symbol ⟼⟼ is shown.

If battery voltage drops to a critical value, the battery symbol on the display will flash. If it falls below the minimum value, the symbol will glow permanently.

Errors are signified by red characters.

3.2.1 Extended display range

Values up to -999999 can be displayed by means of the control word. If the relevant bit has been set and the value to be displayed is between -199999 and -999999, then the negative sign and the digit of the highest order will flash alternately. If the value range drops below -999999, "FULL" will be displayed.

3.3 LED display

In its basic state (factory setting) the LED display has different meanings depending on the operating mode (see chapter 4.1: Operating modes).
With the basic function of the LEDs inactivated, every LED can be controlled independently via the control word (see chapters 6.9.8 to 6.9.10 and 6.9.31: LEDs and chapter 6.3.4: Control word).

3.4 Keys

Pressing the ↑ key enables or disables the incremental measurement function. With the Auto-ID function, the new ID is adopted by actuating this key (see chapter 6.8: Auto-ID).

Pressing the ✱ key starts calibration (see chapter 4.6.2: Calibration) and acknowledges a pending error (see chapter 4.5.2: Errors).

Pressing the ← key starts the parameterization mode (see chapter 4.3: Parameterization of the position indicator).

4 Functional Description

4.1 Operating modes

The following position-dependent operating modes are differentiated: **Absolute Position**, **Differential Value**, **Modulo** and the position-independent operating mode **Alpha-numeric Display**.

Operating mode	Absolute position	Differential value	Modulo	Alpha-numeric Display
Line 1	Actual position	Actual position	Actual position	Set point1
Line 2	Set point2	Differential value	Set point2	Set point2

Table 1: Display with different operating modes

Absolute position:

Linear absolute position values are displayed.

Differential value display:

With factory setting: Differential value = actual position - set point2

Modulo display:

Position values ranging from 0° to 360° are displayed.

Using the parameter 0Ah: Decimal places the resolution and the modulo point of the displayed values are set.

Decimal places	Display resolution	Value range
0	1°	0° ... 360°
1	1/10°	0.0° ... 360.0°
2	1/100°	0.00° ... 360.00°
3	1/1000°	0.000° ... 360.000°
4	1/10000°	0.0000° ... 360.0000°

Table 2: Modulo display

Alpha-numeric display:

Both rows can be written freely. Set point1 is received via the SIKONETZ5 parameter FBh "set point1", set point2 via parameter FFh "set point2". The data identifier must be correctly set in the relevant control word. The data identifier differentiates whether the data is interpreted and displayed as figures or alpha-numeric characters (ASCII) (see chapter 6.3.4: Control word).

4.1.1 Position-bound operating modes

4.1.1.1 Positioning

(see chapter 4.1.1.2: Loop positioning)

Arrows: (see parameter 0Ch: Direction indicators (CW, CCW))

Arrows are displayed to support the user with positioning as long as the current actual position value is outside (see parameter 20h: Target window1 (near field)) target window1. The direction of the arrow indicates the direction of shaft rotation in order to arrive at the set point.

LED display: (see e. g. parameter 09h: LED1 (green left))

With factory setting, the LED glows green as long as the actual position is within the programmed window1. When leaving target window1, the LED glows red. The sensor must be adjusted in the direction of the glowing LED in order to arrive at the set point2. The red glowing LED on the right means: clockwise (cw) rotation required. Red glowing LED on the left: counter-clockwise (ccw) rotation required.

An additional target window (target window2) and an associated visualization can also be configured (see parameter 31h: Target window2 (extended)).

With factory settings, the LED display has the following meaning:

Operating state	LED	Status	Meaning
There is no valid set point2.	both	off	Positioning disabled.
There is a valid set point2.	LED left	off	Target window not reached! The sensor must be moved in positive counting direction in order to reach the target.
		red	Target window not reached! The sensor must be moved in negative counting direction in order to reach the target.
		green	Target window reached
	LED right	off	Target window not reached! The sensor must be moved in negative counting direction in order to reach the target.
		red	Target window not reached! The sensor must be moved in positive counting direction in order to reach the target.
		green	Target window reached

Table 3: LED display

Control word (see chapter 6.3.4: Control word):

The set point is not displayed and positioning not monitored unless the set point2 is marked as valid in the control word.

Status word (see chapter 6.3.5: Status word):

Upon reaching target window1, the static and dynamic target-window-reached bits are set in the status word. The dynamic bit is deleted when leaving target window1. The user must acknowledge the static bit.

Example Position monitoring:
Parameterization: Factory setting
Additionally: Set point2 = 100

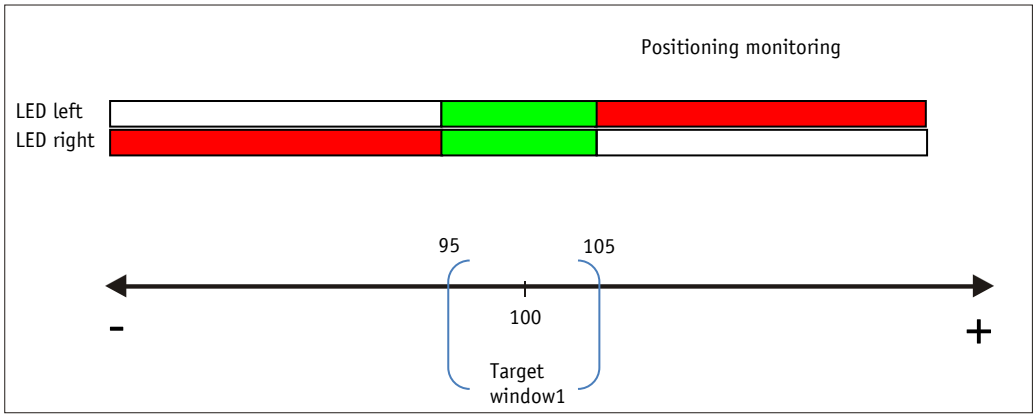


Fig. 2: Positioning monitoring

Example of position monitoring with additionally activated target window2 parameter:

Parameterization:	Factory setting	
Additionally:	Target window 2	= 15
	Visualization target window 2	= 1
	Set point	= 100

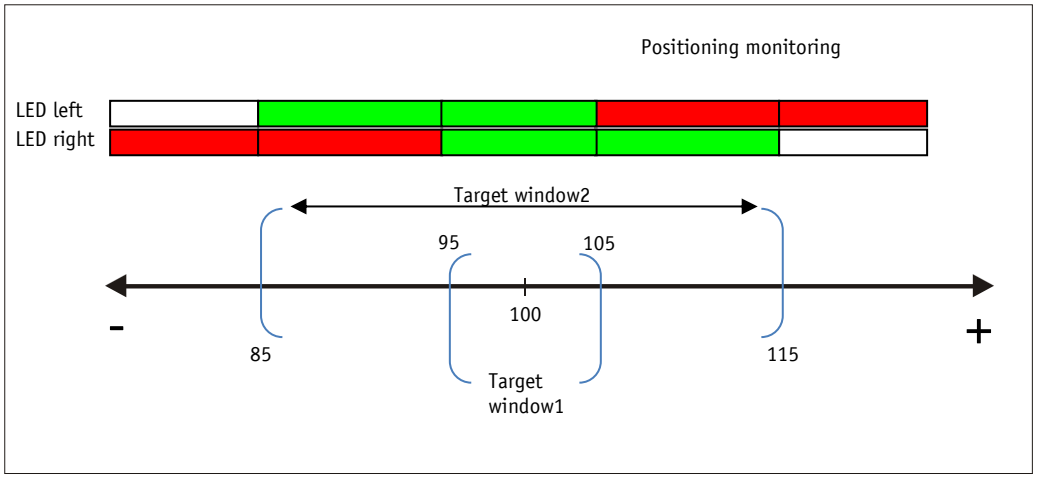


Fig. 3: Positioning monitoring with target window2

4.1.1.2 Loop positioning

NOTICE	Target window1 is also applied to the loop length.

If the position indicator is operated on a spindle or an additional gear, the spindle or external gear backlash can be compensated by means of loop positioning. Therefore, movement towards the set point is always in the same direction. This direction of approach can be defined.

Example:

The direction from which every target position shall be driven to is positive.

- Case 1 ⇒ the new position is greater than actual position:

Direct travel to the target position.

- Case 2 ⇒ the new position is smaller than actual position:

The position indicator's arrows show that the set point is to be overrun by the loop length. Afterwards, the set point is approached in positive direction.

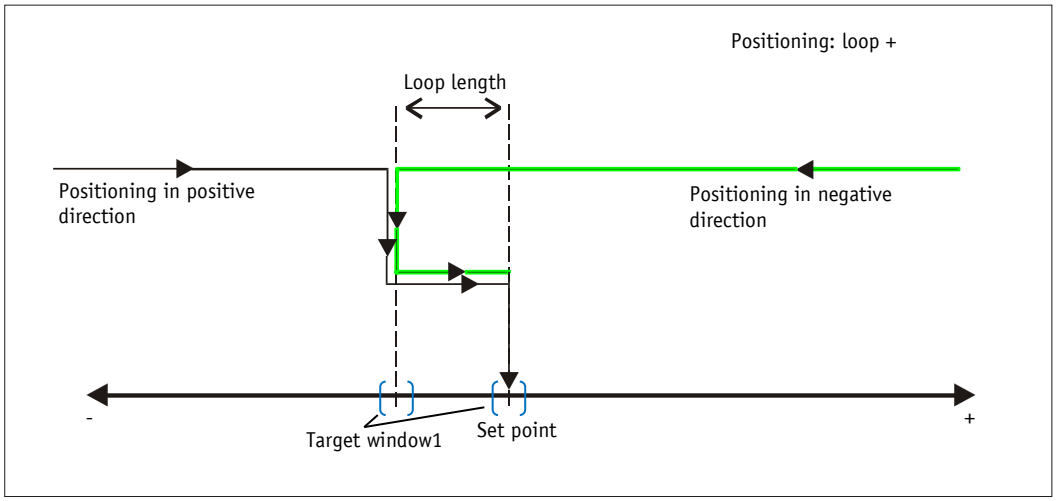


Fig. 4: Positioning Loop+

4.1.2 Alpha-numeric display operating mode

Two 6-digit set points can be displayed in this operating mode. With factory settings, the set points are acknowledged by pressing the asterisk key (see chapter 3.4: Keys).

LCD display:

In the absence of a valid set point, the 1st row is displayed empty (blank). "---" appears in the 2nd row.
A valid set point is displayed flashing until its receipt is acknowledged.

LED display:

With factory settings, the LED display works according to the following table.

Operating state	LED	Status	Meaning
There is no valid set point.	both	off	
There is a valid set point.	LED left	red	Set point1 not acknowledged
		green	Set point1 acknowledged
	LED right	red	Set point2 not acknowledged
		green	Set point2 acknowledged

Table 4: LED display in the alpha-numeric display operating mode

Control word:

In the control word, the relevant type (number or character string) and the validity of the set point is transmitted to the display. As an additional option, the set point can be acknowledged via the control word.

Status word:

Type, validity and acknowledgement status of the set points are fed back in the status word.

4.2 Battery buffering

The battery makes possible the detection of currentless displacement. Battery life is approx. 5 years depending on the duration of battery operation (including storage) and frequency of currentless adjustments. Battery voltage is checked at intervals of approx. 5 min. If battery voltage drops below a specified value, the battery symbol will blink on the display. If the battery voltage continues to drop, will be displayed permanently. The battery should be replaced within approx. three months after the first appearance of the battery symbol. The battery can be replaced by the SIKO distribution partners or at the SIKO main factory. For battery replacement it is mandatory to follow the instructions of the installation instructions.

Status word:

The charge status of the battery is signified in the status word. Bit 11 is set when the charging voltage is critical and an error is signified with the additional bit 7 set when the battery is empty.

4.3 Parameterization of the position indicator

The position indicator can be fully parameterized via the bus interface. You can configure manually via keyboard the most significant bus parameters (node address, baud rate, protocol, bus timeout and reponse delay time).

4.3.1 Manual parameterization

4.3.1.1 Starting parameterization

After applying supply voltage and completion of initialization, the position indicator is on the uppermost level of the menu structure (default/Factory settings).
By actuating the key, the set node address and baud rate is displayed. Parameterization starts if it is actuated for the duration of the enable time (see parameter 04h: Keys enable time: Configuration start delay and 3Dh: Key function enable3: Configuration enable via keyboard).

4.3.1.2 Value input

Enter values via the key and the key. Confirm values entered by pressing the key.

- decimal place selection key

- value input key

4.3.1.3 Value selection

For some parameters you can select values from a list.

Direct value input is not possible there.

Pressing the ↑ key, the value can be selected from the list. By pressing the ✱ key, the selection is confirmed.

4.3.1.4 Adjustable parameters

The following parameters can be adjusted.

Display	Parameter	Options
ID	Node-ID	1 ... 127
KBAUD	Baud rate	19.2 kbaud
		57.6 kbaud
		115.2 kbaud
Protcl	Protocol	SIKONETZ5
		Service-standard
BUS TO	Bus-Timeout	0 ... 20
Inhibt	Response delay	0 ... 20
CODE	System commands	Reset factory settings (see chapter 4.6.3)
		Start diagnosis (see chapter 4.6.4)

Table 5: Manually adjustable parameters

4.3.2 Parameterization via interface

The position indicator can be completely parameterized in the RS485-SIKONETZ5 interface (see chapter 6: Communication via SIKONETZ 5).

4.4 Sensor

NOTICE	Alignment travel is required if a new sensor is connected (see chapter 4.6.1: Alignment travel).

Mounting of the sensors as well as installation of the sensor cable is explained in the documentation pertaining to the sensor MS500H or GS04. With supply voltage switched on, the display monitors the connected sensor. If no sensor is connected or if the sensor is lifted from the tape (MS500H), an error will be detected and the position value displayed red with flashing "Error". This status persists even with power supply failure. The error must be corrected after checking the sensor connection or sensor position with calibration (see chapter 3.4: Keys and chapter 4.6.2: Calibration). If both battery supply and power supply fail simultaneously (e. g. during a battery change), the absolute position value can get lost. For making the measuring system work again, calibration is required (see chapter 4.5.2: Errors and 4.6.2: Calibration).

4.5 Warnings / Errors

4.5.1 Warnings

Warnings do not influence the acquisition of the absolute position value.
Warnings are deleted after removing the cause.

Possible warnings:

- Battery voltage for absolute position detection is below limit ⇒ immediately exchange battery!
  This warning is displayed with a blinking battery symbol ▭. Warnings are issued through the interface via the status word (see chapter 6.3.5: Status word, and chapter 4.6.4: Read error memory).

Display	Bit assignment in the status word	Error
▭ blinking	11	Low battery voltage

4.5.2 Errors

Errors are signified via the display (written in red or ▭) and via the interface.
The cause of error must be removed to enable resumption of normal operation (see Table 7: Corrective actions). Afterwards you can acknowledge or delete the error message by pressing the ✳ key or via the interface (see chapter 6.3.4: Control word). If the currently determined position value is no longer reliable due to an error, the error can only be permanently deleted via calibration!

(For signaling see chapter 6.3.5: Status word and chapter 4.6.4: Read error memory)

Display	Error code SIKONETZ5	Bit assignment in the status word	Error
▭ permanent	0006h	11+7	Low battery voltage (empty)
SENBND	000Fh	12+7	Tape-sensor gap exceeded
noSENS	001Ah	12+7	No sensor connected
SPEED	0019h	12+7	Travel speed exceeded
CS bUS	0080h	7	Checksum SIKONETZ5
to bUS	0081h	7	Timeout SIKONETZ5

Table 6: Error messages

Display	Error	Possible effect	Corrective actions
▭ permanent	Battery empty	Position value not reliable	Battery change + calibration
SENBND	Tape-sensor gap exceeded	Position value not reliable	Check sensor position + calibration
			Alignment travel executed?

Display	Error	Possible effect	Corrective actions
noSENS	No sensor connected	Position value not reliable	Check sensor + calibration
			Alignment travel executed?
SPEED	Admissible travel speed exceeded (see installation instruction) Error may also occur during alignment travel.	Position value not reliable	Decelerate travel speed + calibration
			Alignment travel executed?

Table 7: Corrective actions

4.6 System commands

4.6.1 Alignment travel

The AP10S is fully functional as delivered. To adjust the display to the connected sensor and to achieve optimum measuring accuracy, alignment travel must be carried out whenever a new/different sensor is connected to the AP10S. For calibration, the sensor must have been mounted correctly (see documentation MS500H or GS04).

1. By entering the CODE 000100 or the SIKONETZ5 command "Encoder software alignment" AP10S is set to the alignment mode (see chapter 4.3.1: Manual parameterization and 6.9.48: C3h: Start sensor alignment).
   Display: 1st line. "ADJUST"
   2nd line. "100" this value may vary by ±1.
2. When connecting sensor MS500H, it must be moved by a few millimeters in the direction of the cable outlet (speed <1 cm/s).
   When connecting sensor GS04, the shaft must be rotated clockwise by a few millimeters (speed <<1 U/min).
   In the lower line, the value will change in positive direction up to "103".
3. The alignment process will be completed when this value is finally exceeded. AP10S has returned to normal operation and shows the corresponding display. If values above 103 are displayed during alignment, then travel speed must be slowed down during alignment.
4. It is not unusual that the position value cannot be displayed immediately after alignment travel and "FULL" is displayed instead of the value. The display should be calibrated in this case (see chapter 4.6.2: Calibration).

4.6.2 Calibration

Two steps are required for executing calibration:

1. Write calibration value (see object 1Fh: Calibration value)
2. Execute calibration (reset) (see chapter 3.4: Keys or object A0h: System commands with the data content 7 or object A7h: Calibration)

Since the measuring system is an absolute system, calibration is necessary only once with commissioning. With calibration, the calibration value is adopted for calculation of the position value. The following equation is applied in case of calibration:

Position value = 0 + calibration value + offset value

Calibration value (see object 1Fh: Calibration value)

Offset value (see object 1Eh: Offset value)

4.6.3 Restore factory settings

There are various options for restoring the factory settings of the device:

Access	Coding		Factory settings are restored
Manuell	CODE	11100	all parameters
		11102	all except bus parameters
		11105	only bus parameters
SIKONETZ5 (see parameter A0h: System commands)	A0h	1	all parameters
		2	all except bus parameters
		5	only bus parameters

Table 8: Access to factory settings

The bus parameters are:

Display	Parameter address	Parameter
ID	00h	Node-ID
KBAUD	01h	Baud rate
Protcl	-	Protocol
BUS TO	02h	Bus-Timeout
-	03h	Response parameter to target value write access
-	0Eh	Configuration programming mode
Inhibt	D0h	Response delay

Table 9: Bus parameters

4.6.4 Read error memory

To receive a list of device errors that occurred switch the device to the diagnosis mode. Enter CODE "200000" in parameterization (see chapter 4.3.1: Manual parameterization) and confirm by pressing the ✳ key. Any errors occurring are output indicating the error number and total of occurrences in the upper row. The type of error is shown in the lower row. Error number 1 contains the latest error. The oldest error is output with the highest error number.

4.6.5 Diagnosis of bus communication

By entering code CODE 300 00X, three different diagnostic modes can be called up:

Mode	Diagnostic parameters to be specified	Possible results of diagnosis
General communication	Baud rate Node address	• There is general bus communication. • Bus load • Addressed nodes • Connection or data quality, resp.
Data scan	Node address (ID) to be checked Access type (read/write) Parameter address	• The data content of the set telegram last received meets the expectation. • The set telegram is sent with the expected quantity and time.
Telegram scan	Node address to be checked Access type (read/write) Parameter address Data content	• The expected telegram is sent or received, resp.

Table 10: Diagnostic modes

LED status	Meaning
All OFF	No messages are received (no bus traffic).
red	General bus traffic is detected, but not with the set telegram properties.
green	The set node address is addressed, or the data contents correspond with the set value, resp.

Table 11: Meaning of the LED

4.6.5.1 General communication

Start via input "CODE 300.000".

Display	Adjustment	Meaning
	ID to be checked	Number of all telegrams received with this ID, per second. M/s = Message / second. here: to ID 31: 63 telegrams/s

Display	Adjustment	Meaning
	ID to be checked	Number of all telegrams received with this ID, per second. M/s = Message / second. here: to ID 31: 0 telegrams/s → no telegrams with this ID (0M/s) However, telegrams with a different ID are received (indicated by the red LED)
	ID to be checked	Number of all telegrams received with this ID, per second. M/s = Message / second. here: to ID 31: 0 telegrams/s → no telegrams with this ID (0M/s) → no telegrams with a different ID (no LED) Possible causes: wrong baud rate, disconnection, master does not send, defective device driver
	ID to be checked acknowledged by ✳ key	1st line "FE" = Parameter address in hex (here: actual value). ".0" = read command (see chapter 6.3.1) "Nxx" = number of telegrams received (here: 63)
		2nd line: The data content of the message last heard is displayed in decimal notation. (here: 0). Consequently, the data content, e.g. of the position value may alternate between "0" and "x". The master sends "0" in its request, the respective device responds with "x". Messages sent by the device itself cannot be displayed/recorded.
	ID to be checked acknowledged by ✳ key	If no telegram with this confirmed ID was received, "no COM" will be displayed.
	ID to be checked again acknowledged by ✳ key	1st line: Number of telegrams with checksum error (with valid ID) in one second. (here: 7)
		2nd line: Number of telegrams with CS error compared with number of all telegrams. Expressed as a percentage (here: 99.99 %)

4.6.5.2 Data scan

With the data scan, the data content of a specific telegram is output.
Start via input "CODE 300.001".

Display	Adjustment	Meaning
	ID to be checked	Telegrams directed to node address xx are examined below. (Annotation to the picture: LED off: no bus traffic!) Here: node address = 31
	Command to be checked (access type)	The command is input in decimal notation (lower line). The command is displayed in hexadecimal notation due to lack of space (upper line). Here "0" = read command
	Parameter to be checked	The parameter address is input in decimal notation (lower line). The parameter address is displayed in hexadecimal notation due to lack of space (upper line). Here parameter address = "0xFF" = set point
	The ID, the access type and the parameter address were input	The parameter address and the access type are displayed in the upper line. After the X, the number of these telegrams received is indicated. (The counter overruns at 0xFF) In the lower line, the data content of the message last received is displayed in decimal notation. Attention: The data content may alternate between 0 (= question of the master) and x (= response of the device).

4.6.5.3 Telegram scan

Start via input "CODE 300.002".
Here, node address, command, and parameter address aere set as is the case with the data scan. Additionally, the expected data content is set. If a telegram is received where all items match exactly, the Received counter is increased, and the LED switched to green.

5 Overview of parameters

Name	Description	see page
00h: Node address	Node address	29
01h: Baud rate	Baud rate of the RS485 interface	29
02h: Bus Timeout	Indication of bus timeout in x100 ms	29
03h: Response parameter to a set point write access	Defines the response to the command "Write set point"	30
04h: Keys enable time: Configuration start delay	Period of key actuation in order to start configuration.	30
05h: Key function enable1: Calibration enable	Enable calibration	30
06h: LED flashing	All LEDs flashing	31
07h: LED3 (green right)	LED green right (LED3)	31
08h: LED2 (red left)	LED red left (LED2)	31
09h: LED1 (green left)	LED green left (LED1)	32
0Ah: Decimal places	Number of decimal places	32
0Bh: Display divisor (ADI)	ADI display divisor	32
0Ch: Direction indicators (CW, CCW)	Visualization of direction indicators	33
0Dh: Display orientation	Display orientation	33
0Eh: Configuration programming mode	Basic setting of programming interlock	33
1Bh: Counting direction	Counting direction	34
1Ch: Resolution or measurement steps per revolution	Resolution of the measuring system	34
1Eh: Offset value	Offset value	35
1Fh: Calibration value	Calibration value	35
20h: Target window1 (near field)	The set point has been reached when the actual value is within the target window1	36
21h: Positioning type (loop type)	Travel towards set point in this direction	36
22h: Loop length	Loop length	36
28h: Operating mode	Operating mode	37
30h: Display in the 2nd row	Controls the display of the 2nd row of the display	37
31h: Target window2 (extended)	Extended target window for easier positioning	38
32h: Target window2 visualization	Visualization of target window2	38
33h: Application of the display divisor (ADI application)	ADI application	38
34h: Formation of the differential value	Formation of the differential value	39
35h: Key function enable2: Incremental measurement enable	Incremental measurement enable	39
38h: Sensor type	Selection of the sensor type	39
39h: LED4 (red right)	LED red right (LED4)	40

Name	Description	see page
3Ah: LCD backlight flashing	Flashing LCD backlight	40
3Bh: LCD backlight white	LCD backlight white	40
3Ch: LCD backlight red	LCD backlight red	41
3Dh: Key function enable3: Configuration enable via keyboard	Configuration enable	41
3Eh: Acknowledgement settings	Acknowledgment settings (alpha-numeric display)	41
3Fh: Display factor	Display factor (inch indication)	42
63h: Battery voltage	Battery state of charge	42
65h: Device identification	SIKONETZ5 device identification (AP10S = 9)	43
67h: Software version	Software version	43
80h: Number of errors	Number of error incidents	44
81h until 8Ah: Errors	Error list	44
96h: Input errors	Input error list	44
A0h: System commands	Various system commands	45
A7h: Calibration	Starting calibration	45
A8h: Programming mode	Programming disable	46
AAh: Freeze actual value	Freeze position value	46
C3h: Start sensor alignment	Execute alignment	46
C5h: ADC values of the sensor	Hardware analysis	47
CFh: Period counter	Hardware analysis	47
D0h: Response delay	Delay until a SIKONETZ5 bus telegram is answered.	47
D2h: Auto-ID assignment	Automated node address assignment	48
FAh: Status word	Device status	48
FBh: Set point1	Set point1 (alpha-numeric display)	48
FCh: Differential value	Deviation between actual and target positions	49
FDh: Error telegram	Error telegram	49
FEh: Position value	Actual position	49
FFh: Set point2	Target position	50

Table 12: Parameter description

6 Communication via SIKONETZ 5

6.1 Interface

RS485 interface
Available baud rates: 19.2 kBit / 57.6 kBit (factory setting) / 115.2 kBit

No parity, 8 data bits, 1 stop bit, no handshake

6.2 Data exchange

The protocol functions according to the master – slave principle.

The position indicator acts as a slave. Every instance of communication must be initiated by the master. When the master has sent a command telegram, the slave sends a reply telegram. Broadcast commands are an exception, they remain always unanswered by the slave.

The protocol is optimized for cyclical data exchange. The relevant data such as set point and actual value as well as control and status words can be transferred between master and slave by a single telegram exchange.

The parameter to be returned by the slave as a reply to the master's Write set point command can be defined via the "Write set point reply parameter".

6.3 Telegram setup

Control word (CW), status word (SW) and data are transferred in the Big-Endian format.

1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte	9th byte	10th byte
Command	Node address	Parameter address	high Byte	low Byte	MSB			LSB	Check sum
			CW		Data				

Table 13: Command telegram (from master)

1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte	9th byte	10th byte
Command	Node address	Parameter address	high Byte	low Byte	MSB			LSB	Check sum
			SW		Data				

Table 14: Reply telegram (from slave)

6.3.1 Command

The following access types are provided by SIKONETZ5.

Access code	Meaning	Description
00h	read	The master requests the addressed slave to output the relevant value in a response telegram.
01h	write	The master requests the addressed slave to accept the value transferred in the same telegram.
02h	broadcast	The master requests all connected slaves to execute the command transferred in the same telegram.

6.3.2 Node address

The device address can be freely set in the range of 0 to 127. The delivered devices are preset to node address 31 ex works and must be reset to the desired address to enable their operation with multiple slaves on the SIKONETZ5 fieldbus (see parameter 00h: Node address and chapter 6.8: Auto-ID).

Each address can be assigned in the fieldbus only once!

6.3.3 Parameter address

A distinct address is assigned to every parameter (e. g. calibration value) or functional value (e. g. set point) (see chapter 6.9: Parameter description).

6.3.4 Control word

The control word consists of 16 bits.

Control word															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB			High Byte					Low Byte							LSB

The following table lists the designations of the individual bits of the control word and their meanings.

Bit	Meaning	Value = 0	Value = 1
0	reserved	ever 0	-
1	reserved	ever 0	-
2	Validity of set point1	invalid	valid
3	Display range	standard	extended
4	Acknowledgment target window1 static	not acknowledged	acknowledged
5	Error	not acknowledged	acknowledged
6	With "Display" operating mode: Acknowledgement of set point2	not acknowledged	acknowledged
7	With "Display" operating mode: Data identifier	number	ASCII
8	reserved	ever 0	-
9	Validity of set point2	invalid	valid
10	With "Display" operating mode: Acknowledgement of set point1	not acknowledged	acknowledged
11	LED1 green left	Off	On
12	LED3 green right	Off	On
13	LED4 red right	Off	On
14	LED2 red left	Off	On
15	LED blinking	Off	On

Table 15: Control word

6.3.5 Status word

The status word indicates the current status of AP10S. It consists of 16 bits.

Status word															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB			High Byte					Low Byte							LSB

The following table lists the designations of the individual bits of the status word and their meanings.

Bit	Meaning	Value = 0	Value = 1
0	Direction indication CW	Off	On
1	Direction indication CCW	Off	On
2	Validity set point1	invalid	valid
3	Target window2 dynamic	not reached	reached
	With "Display" operating mode: Acknowledgement of set point2	not acknowledged	acknowledged
4	Target window1 static	never reached	reached
5	Target window1 dynamic	not reached	reached
	With "Display" operating mode: Acknowledgement of set point1	not acknowledged	acknowledged
6	Deviation	actual position <= set point	actual position > set point
7	General error	not present	is present
8	Output of position value	dynamic	freezed
9	Position value = incremental measurement	Off	On
	With "Display" operating mode: Data identifier	Zahl	ASCII-String
10	Validity set point2	invalid	valid
11	Battery status (critical or empty)	alright	critical or empty
12	Sensor error (Tape-Sensor or Lost-Sensor or Speed)	not present	is present
13	← key	not actuated	actuated
14	✱ key	not actuated	actuated
15	↑ key	not actuated	actuated

Table 16: Status word

6.3.6 Data

Range for data exchange. Size: 4 bytes.

6.3.7 Check sum

For checking error-free data transfer, a check sum is formed at the end of the telegram. The check sum is the exclusive-OR-link of bytes 1 ... 9:

Check sum [Byte10] =

[Byte1] XOR [Byte2] XOR [Byte3] XOR [Byte4] XOR [Byte5] XOR [Byte6] XOR [Byte7] XOR [Byte8] XOR [Byte9]

The following applies for checking the telegram received:

[Byte1] XOR [Byte2] XOR [Byte3] XOR [Byte4] XOR [Byte5] XOR [Byte6] XOR [Byte7] XOR [Byte8] XOR [Byte9] XOR [Byte 10] = 0

With a result unequal 0 a transmission error is to be assumed.

When a check sum error is detected, it is answered with an error telegram.
With three subsequent check sum errors, the check sum SIKONETZ5 error will be triggered.

6.4 Synchronization

NOTICE	Processing of the "Restore factory settings" system command may take up to 600 ms. Acknowledgment is reported only after proper updating of all parameters in the non-volatile memory.

Byte/telegram synchronization is via "Timeout". The intervals between the individual bytes of a telegram must not exceed the value of 10 ms. If an addressed device does not respond, the master must not send another telegram earlier than after 30 ms.

6.5 Error telegram

Illegal entries are replied with an error telegram.

An error telegram consists of parameter address FDh and an error code.

The error code is in the data section of the reply telegram. The error code is divided in two bytes. Code 1 describes the error proper, code 2 contains additional information if available.

In the following example an attempt was made at writing a value of 90 to the key enable time parameter address.

However, a maximum value of only 60 is admissible for this parameter.

1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte	9th byte	10th byte
Command	Node address	Parameter address	CW		Data				Check sum
01h	01h	04h	00h	00h	00h	00h	00h	5Ah	5Eh

Table 17: Telegram from master to slave

1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte	9th byte	10th byte
Command	Node address	Parameter address	SW		Data				Check sum
					-	-	Code 2	Code 1	
01h	01h	FDh	00h	81h	00h	00h	02h	82h	FCh

Table 18: Reply telegram from slave

6.5.1 SIKONETZ5 error codes

Code 2	Code 1	Description
00h	80h	Check sum SIKONETZ5
00h	81h	Timeout SIKONETZ5
00h	82h	Value rage exceeded / inadequate
01h		Value < MIN
02h		Value > MAX
00h	83h	Unknown parameter
00h	84h	Access is not supported
01h		write attempt to read only
02h		read attempt to write only
00h	85h	Error due to device status
03h		Programming locked

Table 19: SIKONETZ5 error codes

6.6 Communication errors

Error states of the slave are signified with the status word.7 = 1.

Every error must be acknowledged with control word.5 = 0/1 or by pressing the ✱ key. If the cause of the error has not been resolved at the time of acknowledgment, the error will not be reset or triggered anew, resp.

Errors that have not been acknowledged can be read via a read command on Parameter FDh: Error telegram. The error code will be output (see chapter 4.5.2: Errors and 6.5.1: SIKONETZ5 error codes).

A list of errors occurring is output in Diagnosis (see chapter 4.6.4).

6.7 Communication monitoring

6.7.1 Bus-Timeout

Bus timeout monitoring is activated by configuring a valid time value (>0) for timeout (see parameter 02h: Bus Timeout).

The first telegram received by the slave starts time monitoring.

Every new telegram recognized as valid by a slave (correct check sum) triggers time monitoring.

If timeout occurs, this will result in the Timeout SIKONETZ5 error.

After establishing cyclic communication between master and slave, this function can detect a broken cable of the connection line for instance and signal the defect.

6.7.2 Programming interlock

Programming interlock is controlled via parameter 0Eh: Configuration programming mode. This parameter being enabled, the interlock must be canceled prior to write access to a lockable parameter (see entry at the relevant parameter) by applying a write access to parameter A8h: Programming mode. Correspondingly, the interlock should be enabled again immediately after a write access.

This mechanism enhances protection against unintentional parameterization.

Write access to locked parameters is replied with "Error due to device state" (see chapter 6.5.1: SIKONETZ5 error codes).

6.8 Auto-ID

This function facilitates first commissioning of the devices in the plant. The node numbers can be assigned by the superordinate control or by pressing the relevant button on the device concerned. The functional principle is illustrated in Fig. 5: Auto-ID function.

The Node-ID 1Fh (31d) is factory-set. Now, the SIKONETZ5 master must send a write command on parameter D2h: Auto-ID assignment with the new Node ID to be set to the bus subscriber(s) with the current Node-ID 1Fh and wait for an SIKONETZ5 response. A write command on devices with a node ID different from 1Fh is responded to with an error message.

"New ID" will be displayed on all devices that have the current Node-ID 1Fh. The user must press the ↑ key on the device intended to adopt the new Node ID. Afterwards, this device sends a SIKONETZ5 response with the parameter D2h: Auto-ID assignment. The new Node-ID is taken over and stored in the EEPROM. The initialization phase is finally repeated so that the new Node ID applies henceforth. All other devices do not react. Afterwards, the control unit can execute a read command on a parameter for the node with the node ID 1Fh for instance in order to detect any other devices with node ID 1Fh present in the bus. If so, the procedure may be repeated until all devices have received the desired Node-ID. The Auto-ID function is aborted in the AP10S when an illegal value was sent for the new ID. Error messages will be returned in this case.

Use of this function is optional. The node numbers can also be set via parameterization (see chapter 4.3: Parameterization of the position indicator).

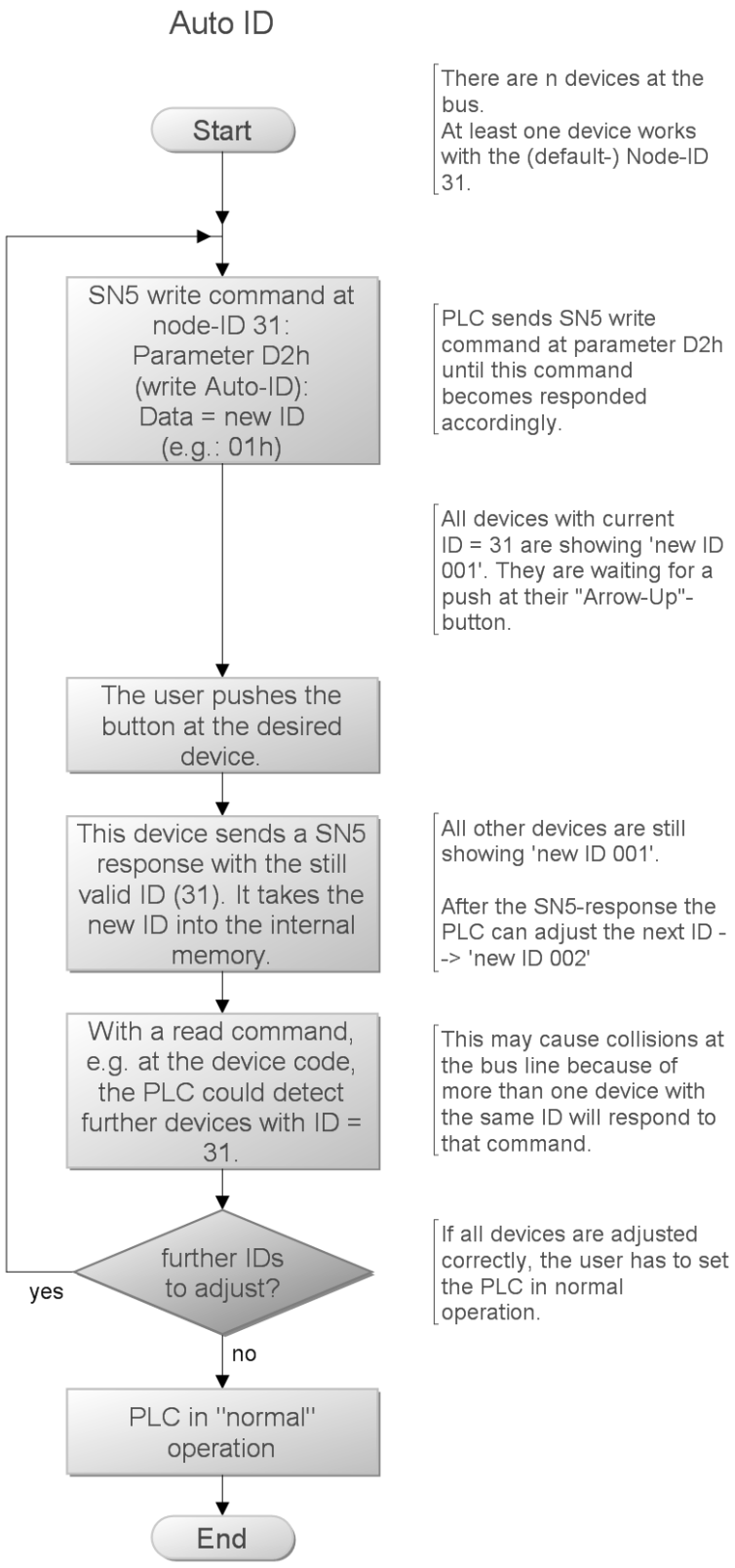


Fig. 5: Auto-ID function

6.9 Parameter description

6.9.1 00h: Node address

Setting of the SIKONETZ5 node address.
Changes become active only after restart of the device.

Parameter address	00h
Description	node address
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	31
Data content	1 ... 127

6.9.2 01h: Baud rate

Setting of the SIKONETZ5 baud rate.
Changes become active only after restart of the device.

Parameter address	01h
Description	Baud rate of the RS485 interface
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	57600 kBaud
Data content	0 = 19200 1 = 57600 2 = 115200

6.9.3 02h: Bus Timeout

See chapter 6.7.1: Bus-Timeout.

Parameter address	02h
Description	Indication of bus timeout in x100 ms
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 ... 20

6.9.4 03h: Response parameter to a set point write access

Parameter address	03h
Description	This parameter defines the response to the command "Write set point"
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 = set point 1 = actual value 2 = differential value

6.9.5 04h: Keys enable time: Configuration start delay

Configuration start delay (key enable time) is set via parameter 04h.

Parameter address	04h
Description	Duration of key actuation to start configuration.
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	5
Data content	1 ... 60 s

6.9.6 05h: Key function enable1: Calibration enable

The parameter 05h indicates whether calibration of the position value is enabled via key actuation.

Parameter address	05h
Description	Key enable
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	1
Data content	0: Calibration disabled 1: Calibration enabled

6.9.7 06h: LED flashing

Flashing of the LEDs can be set via parameter 06h (see chapter 3.3: LED display). This setting applies to all LEDs.

Parameter address	06h
Description	Flashing of all LEDs
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 = no flashing 1 = any glowing LED is flashing

6.9.8 07h: LED3 (green right)

LED3 (green, right) can be set via parameter 07h (see chapter 3.3: LED display). The control word can be freely accessed only if the LED is switched off here.

Parameter address	07h
Description	LED green right (LED3)
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	1
Data content	0 = Off 1 = position-dependent

6.9.9 08h: LED2 (red left)

LED2 (red, left) can be set via parameter 08h (see chapter 3.3: LED display). The control word can be freely accessed only if the LED is switched off here.

Parameter address	08h
Description	LED red left (LED2)
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	1
Data content	0 = Off 1 = position-dependent

6.9.10 09h: LED1 (green left)

LED1 (green, left) can be set via parameter 09h (see chapter 3.3: LED display). The control word can be freely accessed only if the LED is switched off here.

Parameter address	09h
Description	LED green left (LED1)
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	1
Data content	0 = Off 1 = position-dependent

6.9.11 0Ah: Decimal places

The parameter 0Ah indicates the number of decimal places.

Parameter address	0Ah
Description	number of decimal places
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 ... 4

6.9.12 0Bh: Display divisor (ADI)

The display divisor can be changed via parameter 0Bh.

Parameter address	0Bh
Description	display divisor ADI
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0: 1 1: 10 2: 100 3: 1000

6.9.13 0Ch: Direction indicators (CW, CCW)

The display of the direction arrows is set via parameter 0Ch.

Parameter address	0Ch
Description	Representation of the direction indicators
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 = On
	1 = inverted
	2 = Off

6.9.14 0Dh: Display orientation

Display orientation can be set via parameter 0Dh.

Parameter address	0Dh
Description	Display orientation
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 = 0° 1 = 180° rotated

6.9.15 0Eh: Configuration programming mode

Basic settings of programming interlock (see chapter 6.7.2: Programming interlock).

Parameter address	0Eh
Description	Configuration programming mode
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 = no active programming interlock 1 = active programming interlock

6.9.16 1Bh: Counting direction

The counting direction can be set via parameter 1Bh.

Parameter address	1Bh	
Description	counting direction	
Access	rw	
EEPROM	yes	
Programming mode	yes	
Data type	UNSIGNED 8	
Default	0	
Data content	MS500H	0: positive counting direction
		1: negative counting direction
	GS04 Bit 1	0: clockwise sense of rotation I (CW)
		1: counter-clockwise sense of rotation E (CCW)

MS500H:

Positive counting direction: ascending position values when sensor moves to the sensor cable

Negative counting direction: ascending position values when sensor moves away from the sensor cable

GS04:

I sense of rotation: ascending position values with clockwise shaft rotation (CW, view on the display)

E sense of rotation: ascending position values with counter clockwise shaft rotation (CCW, view on the display)

6.9.17 1Ch: Resolution or measurement steps per revolution

When using an MS500H, the resolution is set in nm (nanometer) via parameter 1Ch. When using a GS04, the number of measuring steps per revolution (display / revolution = APU) is set.

Parameter address	1Ch
Description	MS500H: Resolution
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 32
Default	10000
Data content	310 ... 2114064575

Parameter address	1Ch
Description	Number of measurement steps per revolution (GS04)
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 16
Default	720
Data content	1 ... 65535

6.9.18 1Eh: Offset value

The offset value is determined via parameter 1Eh.

Parameter address	1Eh
Description	Offset enables the shifting of a scaled value range. The offset value is added to the position value in the encoder. Both positive and negative values are allowed. Position value = measured value + calibration value + offset value
Access	rw
EEPROM	yes
Programming mode	yes
Data type	SIGNED 16
Default	0
Data content	-29999 ... 29999

6.9.19 1Fh: Calibration value

Via parameter 1Fh, the encoder's position value can be set to a calibration value when calibrating.
To enable the execution of calibration, the "Calibration" system command must be executed (see chapter 4.6.2: Calibration).

Parameter address	1Fh
Description	calibration value (position value = measured value + calibration value + offset value)
Access	rw
EEPROM	yes
Programming mode	yes
Data type	SIGNED 32
Default	0
Data content	-999999 ... 999999

6.9.20 20h: Target window1 (near field)

The parameter 20h indicates the window within which the set point is considered reached (see chapter 4.1.1.1: Positioning).

Parameter address	20h
Description	The set point is reached when the actual value is within the target window.
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 16
Default	5
Data content	0 ... 9999

6.9.21 21h: Positioning type (loop type)

The positioning type, loop type is indicated via parameter 21h, thereby selecting the direction from which the set point shall be approached (see chapter 4.1.1.2: Loop positioning).

Parameter address	21h
Description	Set point is approached in this direction.
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0: no loop 1: loop + 2: loop -

6.9.22 22h: Loop length

Parameter 22h specifies the loop length by which the set point shall be moved over with loop travel (see chapter 4.1.1.2: Loop positioning).

Parameter address	22h
Description	loop length
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 16
Default	0
Data content	0 ... 9999

6.9.23 28h: Operating mode

The operating mode can be set via parameter 28h.

Parameter address	28h
Description	operating mode
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0: Absolute position
	1: Difference
	2: Modulo (360° angle display)
	3: Alpha-numeric display

6.9.24 30h: Display in the 2nd row

Via parameter 30h the display of the 2nd row of the display unit is controlled. The setting is not effective in the "Display" operating mode.

Parameter address	30h
Description	controls the display of the 2nd row of the display unit
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0: Set point or differential value (depending on mode, see chapter 4.1.1: Position-bound operating modes)
	1: Off

6.9.25 31h: Target window2 (extended)

Via parameter 31h, the size of target window2 can be set (see chapter 4.1.1.1: Positioning and parameter 32h: Target window2 visualization).

Parameter address	31h
Description	Extended target window to facilitate positioning at fast travel speed.
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 16
Default	0
Data content	0 ... 9999

6.9.26 32h: Target window2 visualization

Target window2 visualization can be set via parameter 32h (see chapter 4.1.1.1: Positioning and parameter 31h: Target window2 (extended)).

Parameter address	32h
Description	target window2 visualization
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 = Off
	1 = On

6.9.27 33h: Application of the display divisor (ADI application)

The ADI application can be set via parameter 33h.

Parameter address	33h
Description	ADI application
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0: on all values 1: only on display. Values transferred via the interface are not offset against the ADI.

6.9.28 34h: Formation of the differential value

Calculation of the differential value is set via parameter 34h.

Parameter address	34h
Description	formation of the differential value
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0: DIFF = ACT – SET 1: DIFF = SET - ACT

6.9.29 35h: Key function enable2: Incremental measurement enable

The parameter 35h indicates whether setting of the position value as incremental measurement is enabled via key actuation.

Parameter address	35h
Description	Key enable
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	1
Data content	0: Incremental measurement disabled 1: Incremental measurement enabled

6.9.30 38h: Sensor type

The sensor type can be set via parameter 38h.

Parameter address	38h
Description	sensor type
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0: MS500H
	1: GS04

6.9.31 39h: LED4 (red right)

The LED4 (red, right) can be set via parameter 39h (see chapter 3.3: LED display). Free access via the control word is only enabled if the LED is switched off here.

Parameter address	39h
Description	LED red right (LED4)
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	1
Data content	0 = Off 1 = position-dependent

6.9.32 3Ah: LCD backlight flashing

Flashing of the LCD backlight can be set via parameter 3Ah. This setting applies to either color.

Parameter address	3Ah
Description	Flashing of the LCD backlight
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 = no flashing 1 = the current backlight is flashing.

6.9.33 3Bh: LCD backlight white

The white LCD backlight can be set via parameter 3Bh.

Parameter address	3Bh
Description	LCD backlight white
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	1
Data content	0 = Off 1 = On

6.9.34 3Ch: LCD backlight red

The red LCD backlight can be set via parameter 3Ch.

Parameter address	3Ch
Description	LCD backlight red
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	1
Data content	0 = Off 1 = On

6.9.35 3Dh: Key function enable3: Configuration enable via keyboard

Parameter 3Dh indicates whether configuration via key actuation is enabled.

Parameter address	3Dh
Description	Key enable
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	1
Data content	0: configuration disabled 1: configuration enabled

6.9.36 3Eh: Acknowledgement settings

Parameter 3Eh serves for determining the key to be used as acknowledgement key.
The setting is only relevant in the alpha-numeric display mode. By pressing the relevant key, the previously received set points (set point1 and set point2) are acknowledged. If both values are unacknowledged, both values will be acknowledged via one keystroke.

Parameter address	3Eh
Description	acknowledgement settings
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0: ✳ key 2: Up and Left key

6.9.37 3Fh: Display factor

If a display factor> 0 is set, all values on the display are indicated in inch.
It should be noted that the transmission values from and to the interface are present in the metric system (depending on resolution and ADI). The control delivers target, calibration, and offset values as well as loop length and target window metrically as well. Device-internal position monitoring is metrical. Therefore, the superordinate control can only function in the metric system. The values for position, set point and the differential value if applicable are calculated by means of the following formula (for position value):

$$\text{Display value} = \text{position value} \times \text{calculation factor}$$

$$\text{Calculation factor} = \frac{1}{0.254} \times 10^{4-\text{Display factor}}$$

9 different calculation factors can be set (see Table 20). The number of decimal places is selected via parameter 0Ah: Decimal places.

Display factor	Calculation factor	Meaning	Examples of indication (APU = 400) Position after 1 revolution = 400
0	1	Metric indication after APU and ADI	400
1	$\frac{10^3}{0.254}$	Imperial indication (inch)	1574803
2	$\frac{10^2}{0.254}$		157480
3	$\frac{10^1}{0.254}$		15748
4	$\frac{10^0}{0.254}$		1575
5	$\frac{10^{-1}}{0.254}$		158
6	$\frac{10^{-2}}{0.254}$		16
7	$\frac{10^{-3}}{0.254}$		2
8	$\frac{10^{-4}}{0.254}$		0

Table 20: Value table of display factor

Parameter address	3Fh
Description	Display factor
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 … 8

6.9.38 63h: Battery voltage

Battery voltage can be read via parameter 63h. The voltage is indicated in 10 mV resolution.

Parameter address	63h
Description	battery voltage
Access	ro
EEPROM	no
Programming mode	no
Data type	UNSIGNED 16
Default	0
Data content	0 … 310 (0 V … 3.10 V)

6.9.39 65h: Device identification

Parameter address	65h
Description	Device identification
Access	ro
EEPROM	no
Programming mode	no
Data type	UNSIGNED 8
Default	9
Data content	9 = AP10S

6.9.40 67h: Software version

Parameter address	67h
Description	Software version number
Access	ro
EEPROM	no
Programming mode	no
Data type	UNSIGNED 32
Default	-
Data content	100 (= version 1.00) or higher

6.9.41 80h: Number of errors

See chapter 4.5: Warnings / Errors.

Parameter address	80h
Description	Number of errors recorded
Access	ro
EEPROM	yes
Programming mode	no
Data type	UNSIGNED 8
Default	0
Data content	0 … 10

6.9.42 81h until 8Ah: Errors

See chapter 4.5: Warnings / Errors. The oldest error is found under parameter address 81h, the most recent error is found under the highest address.

Parameter address	81h until 8Ah
Description	error
Access	ro
EEPROM	yes
Programming mode	no
Data type	UNSIGNED 16
Default	0
Data content	see chapter 4.5.2: Errors

6.9.43 96h: Input errors

Output of a list (10 entries) of input errors (see chapter 6.5.1: SIKONETZ5 error codes).
The list is deleted with initialization of the device at program start (reset or power-on).
The error number must be transferred in data byte 3 of the telegram.
Data byte 3 with the request = 0 → number of errors occurring is reported.
Data byte 3 with the request = 1 → error number 1 (latest error) is reported.

Example:
Telegram structure of master: latest error (= no. 1) shall be read:

Command	ID	Parameter	ZSW		Error number				CS
00h	1Fh	96h	XX	YY	01h	00h	00h	00h	NNh

Telegram structure of slave: latest error (1) is output:

Command	ID	Parameter	ZSW		Error number	Error code			CS
00h	1Fh	96h	XX	YY	01h	00h	00h	83h	NNh

Parameter address	96h
Description	error
Access	ro
EEPROM	yes
Programming mode	no
Data type	UNSIGNED 16
Default	0
Data content	see chapter 6.5.1: SIKONETZ5 error codes

6.9.44 A0h: System commands

Various system commands can be executed via parameter A0h (see chapter 4.6.3).

Parameter address	A0h
Description	System commands
Access	wo
EEPROM	no
Programming mode	no
Data type	UNSIGNED 32
Default	0
Data content	1: Reset all parameters to factory settings
	2: Reset all parameters to factory settings, except the bus parameters
	5: Reset only the bus parameters to factory settings
	7: Calibrate
	8: Delete error memory
	9: Software reset (warm start)

6.9.45 A7h: Calibration

Calibration can be executed via parameter A7h.

Parameter address	A7h
Description	Execute calibration (see chapter 4.6.2: Calibration)
Access	wo
EEPROM	no
Programming mode	no
Data type	UNSIGNED 32
Default	0
Data content	1

6.9.46 A8h: Programming mode

Programming interlock (see chapter 6.7.2: Programming interlock).

Parameter address	A8h
Description	Programming mode
Access	wo
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 = parameter programming disabled 1 = parameter programming enabled

6.9.47 AAh: Freeze actual value

The actual position value can be freezed via this parameter. So, synchronized recording of all position values in the unit can be generated. The status word signifies whether the position value treansmitted is updated or freezed (see chapter 6.3.5: Status word). Updating of the position value will be reenabled with the next readout operation.

Parameter address	AAh
Description	The current actual position value is cached (freezed) until the next readout operation of the actual position.
Access	wo
EEPROM	no
Programming mode	no
Data type	UNSIGNED 8
Default	0
Data content	1 = freeze actual position

6.9.48 C3h: Start sensor alignment

Alignment can be started via parameter C3h (see chapter 4.6.1: Alignment travel).

Parameter address	C3h
Description	Start sensor alignment
Access	wo
EEPROM	no
Programming mode	no
Data type	UNSIGNED 8
Default	0
Data content	1 = Start sensor alignment

6.9.49 C5h: ADC values of the sensor

The current ADC values of the sensor can be retrieved via parameter C5h.

Parameter address	C5h			
Description	ADC values of the sensor			
Access	ro			
EEPROM	no			
Programming mode	no			
Data type	UNSIGNED 32			
Default	0			
Data content	Byte 0	Data content	Byte 0	Data content
	ADC_SIN			

6.9.50 CFh: Period counter

The current values of the period counter can be retrieved via parameter CFh.

Parameter address	CFh			
Description	values of the period counter			
Access	ro			
EEPROM	no			
Programming mode	no			
Data type	UNSIGNED 32			
Default	0			
Data content	Byte 0	Byte 1	Byte 2	Byte 3
	Quadrant	Period counter		

6.9.51 D0h: Response delay

Number of internal program cycles deferred before responding to a SIKONETZ5 bus telegram. The response to a telegram can be delayed until the master is ready to receive. The value 10 corresponds to a delay of approx. 5 ms.

Parameter address	D0h
Description	Response delay
Access	rw
EEPROM	yes
Programming mode	yes
Data type	UNSIGNED 8
Default	0
Data content	0 ... 20

6.9.52 D2h: Auto-ID assignment

See chapter 6.8: Auto-ID.

Parameter address	D2h
Description	Automated assignment of a node address
Access	wo
EEPROM	yes, the node number is stored with its adoption
Programming mode	no
Data type	UNSIGNED 8
Default	-
Data content	1 ... 31

6.9.53 FAh: Status word

The status word can be read via this parameter. Bit 4: "Target window1 static" is deleted in the status word with this operation. With this function, it can be detected whether the actual position was ever in the target window even if this is not the case at present (see chapter 6.3.5: Status word)

Parameter address	FAh
Description	Read status word and delete "Target window1 static"
Access	ro
EEPROM	no
Programming mode	no
Data type	UNSIGNED 16
Default	-
Data content	0

6.9.54 FBh: Set point1

The current set point1 (**alpha-numeric display** operating mode) can be written and read via address FBh (see chapter 4.1.2).

Parameter address	FBh
Description	Set point1
Access	rw
EEPROM	no
Programming mode	no
Data type	UNSIGNED 32
Default	-
Data content	0h ... FFFFFFFFh

6.9.55 FCh: Differential value

The differential value can be read via parameter FCh. Formation of the differential value is set via parameter 34h: Formation of the differential value.

Parameter address	FCh
Description	Differential value: Deviation between actual and target positions
Access	ro
EEPROM	no
Programming mode	no
Data type	SIGNED 32
Default	-
Data content	MS500H: -65536000 ... 65536000 GS04: -5242880 ... 5242880

6.9.56 FDh: Error telegram

Illegal entries are answered with an error telegram.
An error telegram consists of the parameter address FDh and an error code (see chapter 6.5: Error telegram).

Parameter address	FDh
Description	Error telegram
Access	-
EEPROM	no
Programming mode	no
Data type	UNSIGNED 32
Default	-
Data content	see chapter 6.5: Error telegram

6.9.57 FEh: Position value

The current position value of the device is output under FEh.

Parameter address	FEh
Description	Actual position (see chapter 4.1: Operating modes)
Access	ro
EEPROM	no
Programming mode	no
Data type	SIGNED 32
Default	-
Data content	MS500H: -65536000 ... 65536000 GS04: -5242880 ... 5242880

Position value = measured value + calibration value + offset value

6.9.58 FFh: Set point2

The current set point2 can be written and read via address FFh.

Parameter address	FFh
Description	Set point2
Access	rw
EEPROM	no
Programming mode	no
Data type	SIGNED / UNSIGNED 32 (depending on the operating mode)
Default	-
Data content	0h ... FFFFFFFFh

7 Communication via Service Standard Protocol

7.1 General

The service protocol enables the control of the position indicator via ASCII commands. No additional devices must be connected to the RS485 interface since this protocol is not bus-compatible.

An ASCII terminal sends a letter and additional parameters if required (ASCII).
Subsequently, the position indicator sends a reply with a concluding <CR>.

Available baud rates: 19.2 kBit / 57.6 kBit (factory setting) / 115.2 kBit
Additional settings: No parity, 8 data bits, 1 stop bit, no handshake

7.2 Error number encoding

The following error messages are returned in case of wrong input.

Error number	Description
?1	input of illegal parameter number
?2	illegal value range

Table 21: Error number encoding

7.3 Service protocol commands list

Command	Length	Reply	Description
Ay	2/17	"AP10 SN5 zW xxxx>"	Device type / software version
			y=0: hardware version; z = H y=1: software version; z = S
L	1/2	">"	Calibration (see chapter 4.6.2: Calibration)

Command	Length	Reply	Description
Sxxxxx	6/2	">"	System commands
			x=00100: start alignment (see chapter 4.6.1: Alignment travel)
			x=11100: all parameters into basic state After restart, the factory settings will be active, this applies to bus protocol and baud rate as well.
			x=11101: reset all to factory settings, except bus parameters
			x=11102: only bus parameters into basic state
			x=11105: activate bootloader
Z	1/11	"±xxxxxxxx>"	Output actual position

Table 22: Service protocol commands list