HENGSTLER

Technical Manual

Absolute Shaft Encoder

ACURO® industry with SSI programmable

Item no.: 2 565 269, Version: 3 270911 TH

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Contents

1 Definitions

This technical manual describes the software, parameter setting and initial operation of the shaft encoder.

Explanation of symbols:

Passages to which special attention should be paid in order to ensure the correct use and to avoid **dangers** are marked by this symbol.

This Symbol indicates important directions for the **proper use** of the shaft encoder.
The non-observance of these instructions may lead to malfunctions in the shaft encoder or its surrounding parts.

Abbreviations used

ccw	counterclockwise
cw	clockwise
Dt	data transmission
AV	actual value
CP	configuration parameter
LSB	least significant bit/ byte
MB	middle byte
MF	monoflop
MSB	most significant byte
MT	Multiturn
S/rev	steps per revolution
SCF	scaling factor
ST	Singleturn
t_m	monoflop period
T_p	Clock pause
rev	revolution
S	sign
xxx	undefined
µP	microprocessor

Numerical data

Unless indicated explicitly, decimal values are represented as figures without additional features (e.g. 1408), binary values are marked **b** (e.g. 1101b) hexadecimal values **h** (e.g. 680h) at the end of the figures.

2 Safety and Operating Instructions

The ACURO® model series' absolute shaft encoders are quality products that have been manufactured according to recognized electrical engineering regulations. The devices have left the manufacturing company's premises meeting all relevant safety requirements.

Therefore:

- In order to preserve this condition and to ensure an interference-free Operation of the encoders, the technical specifications presented in this documentation must be observed.
- Electrical appliances may only be installed by skilled electricians!
- The devices may only be operated within the limits defined in the technical data.
- The maximum operating voltages must not be exceeded!!
  The devices have been constructed according to DIN EN 61010 Part 1, protection class III.
  In order to avoid dangerous electric shocks, the devices have to be operated with safety extra-low voltage (SELV) and be situated in a field with equipotential bonding.
- For better protection use an external fuse Field of application: industrial processes and control systems.
  Over voltages at the connection terminals have to be restricted to over voltage category II values.
- Shock effects on the housing, especially on the encoder shaft, as well as axial and radial overloading of the encoder shaft should be avoided.
- Only in case an appropriate coupling is used can the maximum precision and life time be guaranteed.
- The proper electromagnetic compatibility values (EMC) are only valid for standard cables and plugs. In the case of screened cables, the screen has to be connected on both sides as well as on large surface to ground. The lines for power supply should also be entirely screened. If this is not possible, appropriate filter methods should be applied.
- The neighbouring parts as well as the installation of the cable system have got a significant influence on the electromagnetic compatibility of the shaft encoder. As a consequence, the electrician has to ensure the EMC of the entire system (device).
- In regions endangered by electrostatic discharges, a good ESD protection for the plugs and the cable to be connected should be provided when installing the shaft encoder..

3 Introduction

Absolute angle encoders supply an absolutely encoded value for any possible angular position. All such values are stored in the form of a code pattern on one or several encoder disks. The encoder disks are scanned opto-electronically. The bit patterns obtained in this procedure are amplified and fed to a microprocessor (μP). The processed values can be enquired at the SSI interface.

The absolute angle encoder AC58 resolves one encoder revolution into 4096 measuring steps (= 12 bits). The number of revolutions is 4096 (= 12 bits) of a Multiturn encoder. This results in an encoder range 2^{24} of measuring steps.

The result of 12 bits + 12 bits is output together with an additional status byte as a 4 byte value. Data output is optionally possible in binary or Gray code.

The angle encoder AC58 is available in various mechanical versions (see chapter Dimensioned drawings).

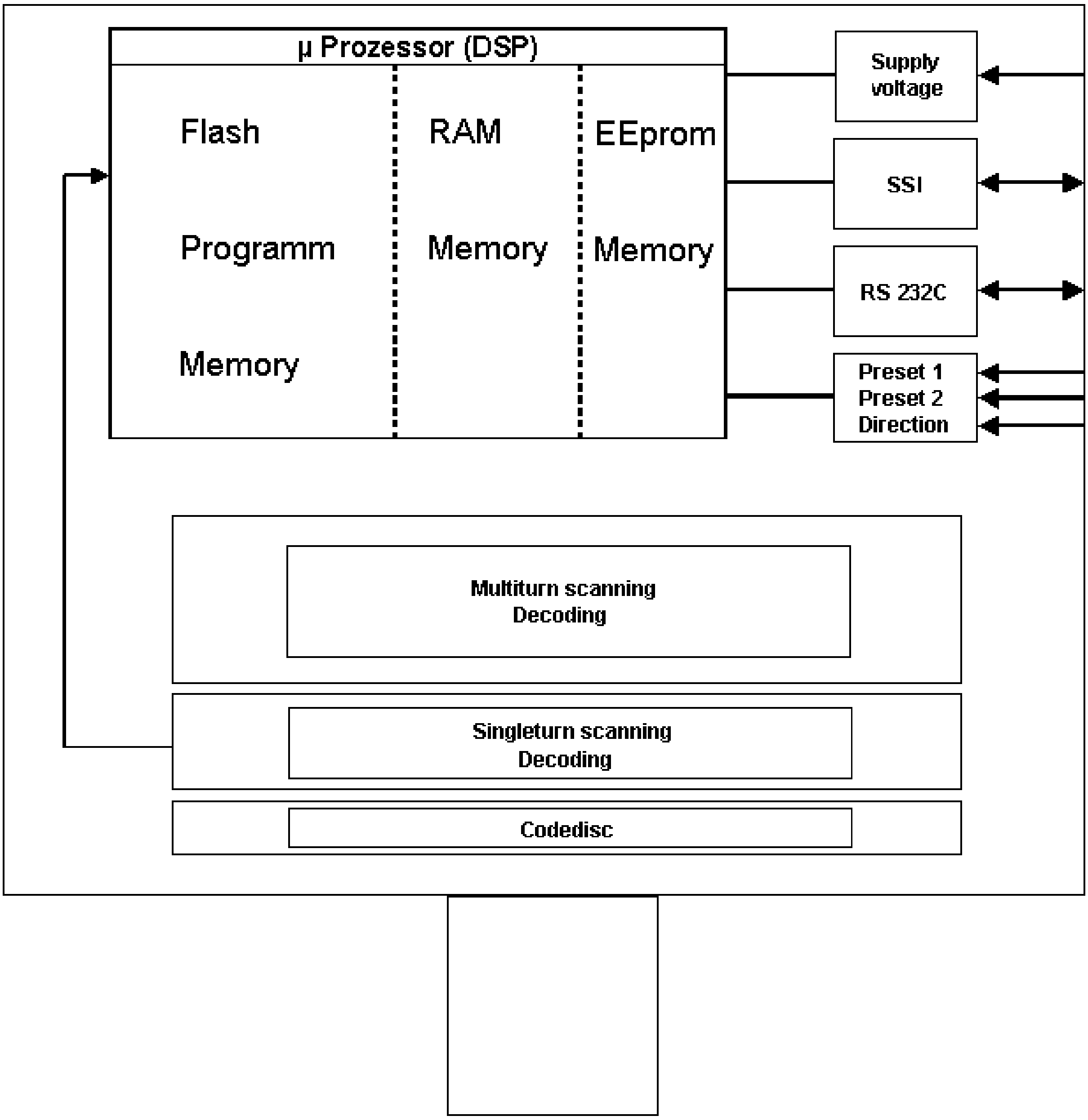
The angle encoder AC58 can be programmed via RS232 interface. With this function the encoder can be used universally. Thus, a lot of computing time can be saved and additional processing can reduced in the automatic control systems.

For permanent storage of parameters the AC58 is equipped with an EEPROM. When the device is switched on, parameters are automatically loaded into the working memory.

The AC58 is programmed by means of a commercial Windows PC via serial interface RS232. For this purpose a PC program including an adaptor cable is available. The program is menu controlled and enables convenient entry and transmission of parameters.

4 Description of the blocs of function

4.1 Schematic layout diagram AC58-P with SSI interface



4.2 Memory

The AC58 includes two different types of data memory:

- A volatile memory (RAM) which is used as a working memory into which the CP are entered after receipt from the programming device. Data stored in the volatile memory are lost when the supply voltage is switched off.

- A non-volatile memory (EEPROM) which retains its data independent of the power supply.

When the CP are transmitted from the programming device to the AC58, they are initially entered only into the working memory. After all required CP have been sent and when the encoder supplies the values in conformance with system configurations, the working memory contents can be transferred to the non-volatile memory with the command “Save into EEPROM“.

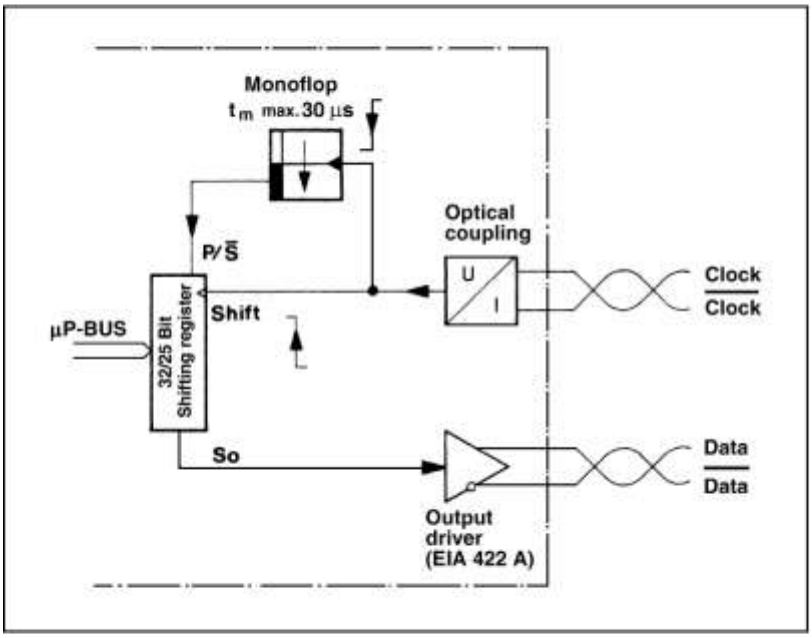
When switching on power supply the AC58 will automatically copy the contents of the non-volatile memory into the working memory, and the encoder then works with the data specified by the control system.

With the command »RAM Default Values« all parameters in the working memory are reset to default values. In this case the encoder will transmit the original encoder steps as actual values to the control system. The originally set parameters can be retrieved with the command Load from EEPROM.

The command sequence RAM Default Values, Save into EEPROM resets the non-volatile memory; consequently the encoder will work with an SCF of "1", a zero shift of "0" and code characteristic "cw".

4.3 The SSI Interface

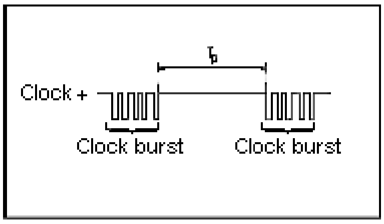
4.3.1 Layout



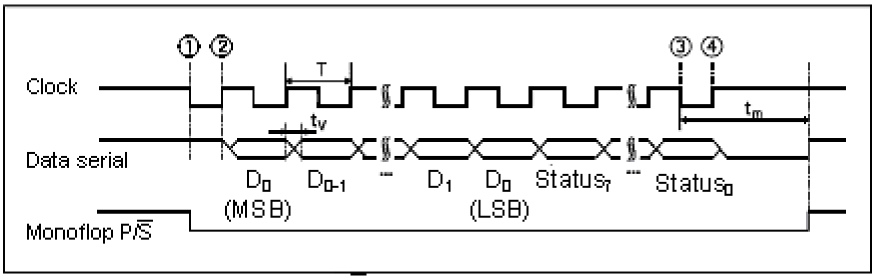
Picture: Block diagram of SSI interface

The shift clock is supplied externally by the control system. Electrical insulation from the AC58 is provided by an optocoupler. Encoder data and status bits are loaded into a 32-bit shift register by the microprocessor. Data are output synchronously with the external shift clock via an RS422 driver (refer to "SSI clock diagram" below).

4.3.2 Process of the transmission



Picture: clock burst



Picture: SSI clock diagram

Correct data transmission requires that a defined number of pulses (i.e. a clock burst) is supplied to the shaft encoder input. Then a pause T_p is required.
As soon as a clock burst is present at the clock input, the current angle information is stored.
With the first transition of the clock signal from High to Low ① the retriggerable monoflop integrated in the shaft encoder is set. Its monoflop period t_m must be longer than the period T of the clock signal. With each additional falling edge the active status of the monoflop is prolonged by t_m (for the last time at ③). The monoflop output controls the shift register via connector P/S.
With the first transition of the clock signal from Low to High ②, the most significant bit (MSB) of the angle information is supplied to the serial data output of the shaft encoder.
With each additional rising edge the next less significant bit will be shifted to the data output.

Independent of the SSI-configuration (25/ 32 bit) data can be read twice (double read).
Condition: among first and second reading t_m mustn't be elapsed.
With a data length of 32 bit 7 status bits are displayed when transmitting LSB of the position value.

With a data single length of 25 bits follows the status bit 7 and separating bit after output of the 24 data bits.

If you clock after second reading (without t_m elapsed) a zero will be displayed with all further clocks.

The next data transmission with a new value can only be started when the data line switches back to high ④ and Tp (= t_m + 1µs) is awaited.

At the end of a clock burst the data line remains on log. 0 (busy) for the duration of the monoflop period.

After the monoflop period has elapsed, the data line will be set to log. 1 (ready).
When the next clock burst begins, the shift register will again be loaded with the current actual value supplied by the µP.

Technical data of the SSI interface

Clock frequency: 70kHz...1MHz
Monoflop period t_m: 20µs $\leq t_m \leq$ 30µs
Clock burst: 32 or 25 clock pulses
Multiple transmission 64 or 51 clock pulses
Delay time t_v: <100 ns (without cable)
Data refresh: every 150 µs

4.4 RS232 interface

Function: **Transmission of encoder parameters to AC58**

Reading of stored encoder parameters and actual values from AC58

Baud rate (fixed): 2400 Baud.

Byte format: 1 start bit, 8 data bits, no parity, 1 stop bit.

Protocol: DK3964R (Siemens)

Protocol length: 4 Byte to AC58
4 Byte from AC58 (without protocol frame)

Signals: RxD, TxD, signal ground

Das **DK3964R**-Protokoll:

PC	STX		CP no.	MSB	MB	LSB	DLE	ETX	BCC	
AC58		DLE								ACK
			User ➔ AC 58-P							

AC58	STX		MSB	MB	LSB	XXX[1)]	DLE	ETX	BCC	
PC		DLE								ACK
			User data ➔ PC				1) or status byte			

The "transmitter" starts data transmission with "STX". The "receiver" confirms its ready-to-receive state with "DLE". The "transmitter" then begins to transfer the useful data. The end of the protocol is triggered by the transmitter with "DLE". In order to clearly mark the end of the telegram, the useful data byte is transmitted twice if its value is "10H" (="DLE"). Then follow the characters "ETX" and "BCC" (checksum). The "receiver" acknowledges the proper receipt of the telegram with "ACK" (acknowledge). If the telegram has not been received properly, the "receiver" will answer with the character "NAK" (not acknowledged). The transmitter then repeats the entire telegram.

4.4.1 Data transmission to AC58 via RS232

In the DK3964 protocol frame 4 bytes of data are transferred to the RA58-P unit. The AC58 unit will, in return, answer with an equal set of 4 bytes of data if required. In the first byte transmitted the parameter number (CP no.) is encoded. Then the corresponding data bytes follow. These data bytes are stored in the working memory of the AC58 unit after data transfer is completed. All data entries are made in the hexadecimal number system (H). Data which will not be evaluated are designated with "XXX"

The scheme below will be used when describing the parameters:

Parametername	KP-Nr.	Daten MSB	Daten MB	Daten LSB

4.5 Control line

Encoder has three encoder lines:

- Preset1
- Preset2
- direction (cw/ ccw)

For every control line a debouncing time can be set (KP 17).
It is also possible to enable or disable every control line.
The polarity of the active state is programmable.

4.6 Power supply

AC58 encoder can be run from +10 to +30 VDC (incl. ripple).

The current consumption contains max. 300mA.

5 Variable parameters

5.1 Overview configuration parameters

CP no.	Description	Writing to AC58 (w) Read from AC58 (r)
01	internal Preset (over RS232)	wr
02	external Preset 1 (over control line)	wr
03	external Preset 2 (over control line)	wr
04	offset	wr
08	scaling factor	wr
09	number of revolution	wr
0A	steps	wr
0B	number of measuring steps	wr
0E	(Opto ASIC register configuration)	r
0F	(Opto ASIC register configuration)	r
10	limit values 1	wr
11	limit values 3	wr
12	limit values 2	wr
13	limit values 4	wr
14	Number of bits in tannenbaum format	wr
15	Number of bits in standard format	wr
16	over speed	wr
17	debouncing time for control line	wr
1A	parameter load from RAM to EEPROM	w
1B	parameter load from EEPROM to RAM	w
1C	Load RAM with default parameter	w
1D	32 / 25 bit mode	wr
1E	tannenbaum-shift-function	wr
1F	read SW-version	r
20	external Preset 1 enable/ disable	wr
21	external Preset 2 enable / disable	wr
22	external direction enable/ disable	wr
23	gray code/ binary code shift	wr
24	Number representation of the position value	wr
25	tannenbaum-/standard representation	wr
26	Internal direction change (over RS232)	wr
27	measurement of length on / off	wr
28	bit position in status byte of limit value 1	wr
29	bit position in status byte of limit value 2	wr
2A	bit position in status byte of limit value 3	wr
2B	bit position in status byte of limit value 4	wr
2C	bit position in status byte of over speed	wr
2D	bit position in status byte of encoder shutdown	wr
2E	bit position in status byte of parity bit	wr
2F	bit position in status byte of encoder error	wr
30	bit position in status byte of direction of rotation	wr
80	read position value of encoder or parameter	see 5.1.10

5.1.1 Preset

int. Preset	01 H	MSB	MB	LSB

The internal preset is an absolute preset value. After transmission of this parameter the actual values change to the set values.

ext_preset1	02 H	MSB	MB	LSB

The external preset 1 is an absolute preset value. By supplying a voltage pulse > debouncing time to external preset input 1 the actual value change to the received parameter value (the external activated preset value is automatically stored to EEPROM). External preset 1 can be disabled of enabled (see chapter switch functions).

ext_preset2	03 H	MSB	MB	LSB

The external preset 2 is an absolute preset value. By supplying a voltage pulse > debouncing time to external preset input 2 the actual value change to the received parameter value (the external activated preset value is automatically stored to EEPROM). External preset 2 can be disabled of enabled (see chapter switch functions).

5.1.2 Offset

Offset	04 H	MSB	MB	LSB

The offset value effects a relative shifting of the actual values. After transmission of the offset value the current actual value will be shifted by the amount of the offset value. Presets delete the set offset value.

5.1.3 Resolution

A change in the physical encoder resolution by entering a scaling factor only has an effect in the data format „Standard-P". In the data format "Tree" and "Standard-S" the resolution remains always equal 1 regardless of entering a scaling factor or not!

There are three possibilities to modify the resolution of encoder in the format „Standard-P":

1. direct entry of a scaling factor (SCF): CP no. 08H.

2. entry of number of revolutions and (required) number of steps: CP no. 09H and 0AH

3. entry of the number of measuring steps and (required): CP no. 0BH and 0AH

Scaling factor	08 H	MSB	MB	LSB

SCF is used for modifying the encoder resolution. Actual values are multiplied with the SCF. The SCF is interpreted as a number < 1. SCF is transmitted as an unsigned 3-byte number. Its maximum value is FF FF FFH (≈ 1 Decimal).
If, for example, resolution is to be halved, the SCF must be 80 00 00H (= 0.5 in decimal notation). An SCF of 40 00 00H corresponds to a decimal factor of 0.25, etc.

⇒ **Formula for converting the desired decimal (<1) into the corresponding hexadecimal value:**
1. multiply the decimal value with 2^{24}
2. round this value to a decimal integer number
3. convert the rounded number into a hexadecimal number

Number of revolutions	09 H	XXX	MB	LSB

A desired number of steps can be assigned to a certain number of revolutions (measuring distance) (CP no. 0AH). The range of values for the number of revolutions is 1...FFFH. The number of revolutions is an unsigned integer value. After the number of revolutions and the required number of steps have been entered, the AC58 unit will calculate the SCF automatically.

Steps	0A H	MSB	MB	LSB

Entry of required number of steps to be output for a measuring distance. The value range for the number of steps is 0...FF FF FFH..

Number of measuring steps	0B H	MSB	MB	LSB

The required number of steps (CP no. 0AH) can be assigned to a number of measuring steps (measuring distance). The range of values for the number of measuring steps is 1...FF FF FFH. The number of measuring steps is an unsigned integer value. After the number of measuring steps **and** the required number of steps have been entered, the AC58 unit will calculate the SCF automatically.

5.1.4 Internal encoder functions

Save to EEPROM	1AH	XXX	XXX	XXX

The parameters stored in the working memory (RAM) are saved in the EEPROM for permanent storage. After a reset (when switching on the power supply) the parameters will be loaded into the working memory automatically.

load EEPROM	1BH	XXX	XXX	XXX

The parameters held in permanent storage in the EEPROM are reloaded into the working memory.

RAM Default values	1CH	XXX	XXX	XXX

The working memory is deleted. All parameters are reset to default (see chapter 8.2).

32/25 bit mode	1DH	XXX	XXX	LSB=0/1

With this function the physical length of the SSI register can be switched.
LSB = 0: length = 32 Bit
LSB = 1: length = 25 Bit
(see chapter 4.3)

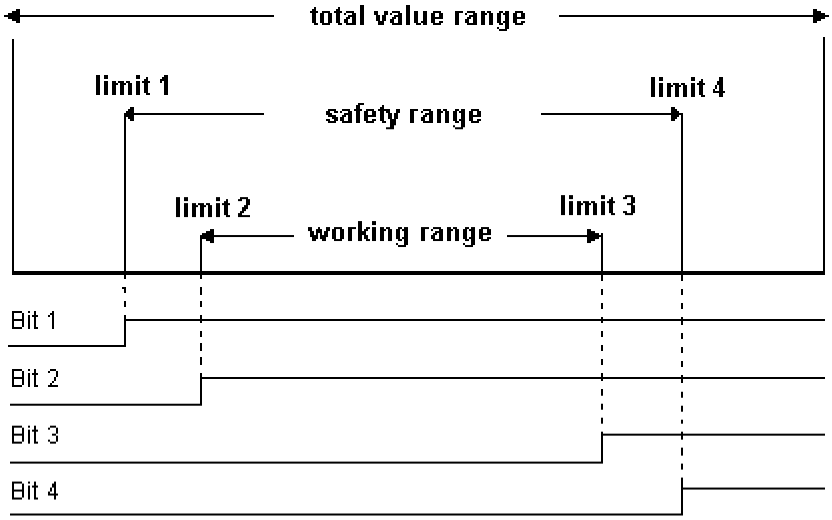
5.1.5 Limit positions

All limit positions (soft limits) are set as 3-byte values. They can be freely adjusted within the value range of the encoder. A status bit is set when the corresponding limit position has been reached. This bit can be output as a status bit at the SSI interface (see chapter 5.1.9).

Limit 1	10H	MSB	MB	LSB
Limit 2	12H	MSB	MB	LSB
Limit 3	11H	MSB	MB	LSB
Limit 4	13H	MSB	MB	LSB

Example of an application of these limit positions:

A safety range (from limit value 1 to limit value 4) and a working range (from limit value 2 to limit value 3) should be defined.



Upon reaching the respective limit values, the related status bit is set and remains set as long as the condition „ current position $\geq$ limit value“ is fulfilled.

A following control can thus evaluate these limit value status bits directly and does not need to compare each position value with the limit values any longer. This reduces the control's workload meaning that it becomes faster and the programming effort is reduced.

Evaluation of the control:

Current position lies within the **safety range** when **bit 1 is set and bit 4 is not set**.
Current position lies within the **working range** when **bit 2 is set and bit 3 is not set**.

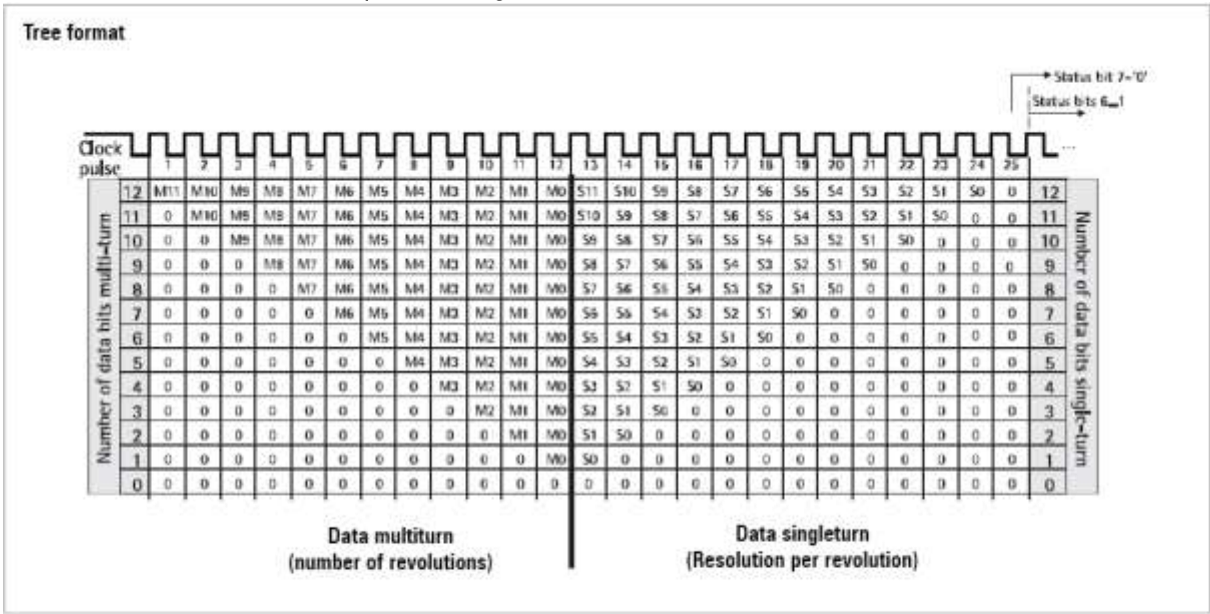
5.1.6 SSI output formats

5.1.6.1 Tree Format

Number of bits in Tree-Format	14 H	XXX	XXX	S/rev	rev
				LSB	

In the tree-format (see chapter „Switch functions“) bit 12 and bit 13 are always located in the same bit position, independent of the selected resolution. The number of significant bits can be set separately for S/rev and rev. The numbers are 0...12 in decimal notation (= 0...CH) for the steps per revolution and 0...12 in decimal notation (= 0...CH) for the number of revolutions. Both values are encoded in the upper/lower tetrade of the LSB.

If the LSB value is, for example, 9BH, 9 bits of steps per revolution (= 512 S/rev) and 11 bits of revolutions (= 2048 rev) are output. Missing bits are filled with zero.



Picture: Data bit arrangement in the tree format

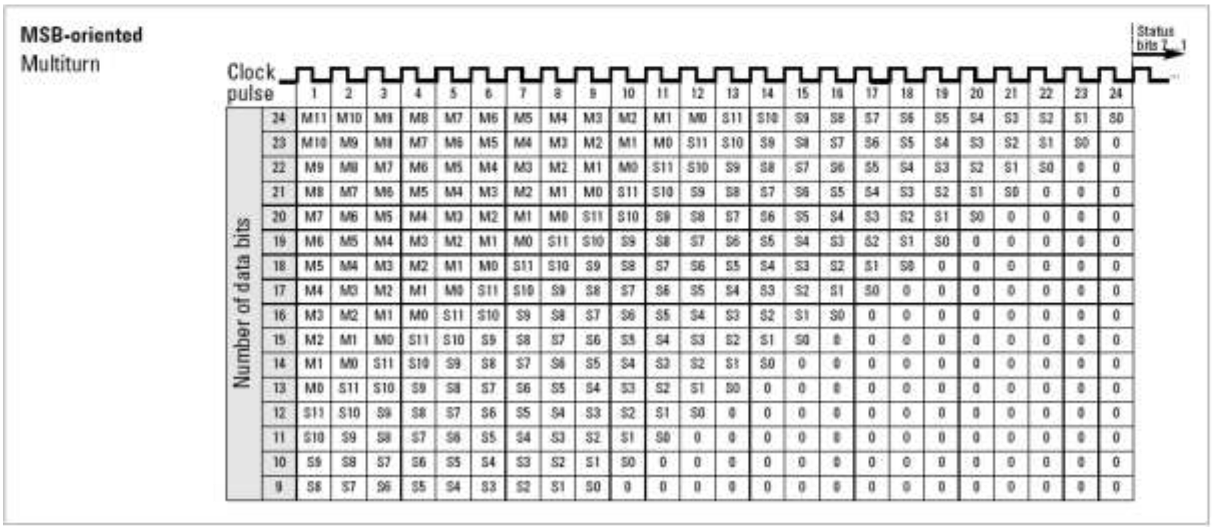
1. The Tree-format is designed for an encoder with a resolution of up to 13 bits singleturn data. The Encoder AC58-P however delivers 12 bit single turn data (clock pulse 13...24) and the first status bit with the bit position 7 in clock pulse 25. Therefore, the bit position 7 may not be used as a status bit in the tree format.

2. In the Tree-format the number system must be set to integer.

5.1.6.2 Format Standard-P

No. of bits in Standard-P-Format	15 H	XXX	XXX	LSB

In the Standard-P-format (please refer also to "Switch functions") the number of significant bits can be set between 9...24 decimal (= 10H...18H). Data are shifted towards the MSB by 24 minus the number of bit positions. The remaining LS-bits are filled up with zero.



Picture: Arrangement of data bit in the Standard-P-format

With the scheme below the data bits of the output formats "Tree" and "Standard-P" can be shifted to the right or to the left.

Shift right/ left	1E H	XXX	MB 0/1	LSB

MB : 0 = shift to the right; 1 = shift to the left (default = 0)

LSB: no. of shift position 0...12 (default = 0)

5.1.6.3 Format Standard-S

No. of bits in Standard-S-Format	15 H	XXX	XXX	LSB

The Standard-S-Format is used for resolutions >14 Bit because of the high holding time of a standard-SSI-encoder for resolutions > 14 Bit.
The reason for this holding time is a SAR-Interpolator that is used for such high resolutions.
Compared to a standard-SSI-encoder the SSI-P saves the read data and then releases the data via a SPI-Port without a holding time.

The standard-S-format is only possible with the version singleturn.

MSB-oriented

Multiturn (not scaleable)

Number of data bits \ Clock pulse	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
32	M11	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
32	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
32	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
31	M8	M7	M6	M5	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0
30	M7	M6	M5	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0
29	M6	M5	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0
28	M5	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0
27	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0
26	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0
25	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0
24	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0
23	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0
22	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0
21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0
20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0
19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Picture: Arrangement of data bit in the Standard-S-Format

5.1.7 Over speed

Over speed	16 H	XXX	XXX	LSB

When the set over speed is reached or exceeded a marker bit is set. The input format is "multiples of 100 rpm". The value range for the input is 0...255 in decimal notation
(= 0...FFH). If, for example, the LSB value is 47 in decimal notation (= 2FH), the marker bit will be set at a rotational speed of 4700 rpm. Accuracy of measurement is approx. ± 5%.

5.1.8 Switch functions

Switch functions are used for enable or disable or modifying certain encoder functions. When using easy switch functions (only ON/ OFF) the LS bit of the last byte is always used. If
LSB = 1 the functions is switched on. If LSB = 0 the function is switched off.
Further bits can be used if they are required.

ext. Preset1 On/ Off	20 H	XXX	XXX	LSB=3/2/1/0

ext. Preset2 On/ Off	21 H	XXX	XXX	LSB=3/2/1/0

ext. switching forw./ rev. On/ Off	22 H	XXX	XXX	LSB=3/2/1/0

Description of possible parameter values 3....0 of the 3 control signals
LSB Bit 0: On (enable) = 1; off (disable) = 0
LSB Bit 1: Determining of the polarity of the active state, see chart below

control line	parameter value (LSB Bit 1)	function
on PS or open	0 (active 0 = default)	switched off
on GND	0 (active 0 = default)	switched on (active)
on PS or open	1 (active 1)	switched on (active)
on GND	1 (active 1)	switched off

(PS = + Power supply, GND = 0V)

For the control signals ext. Preset 1, ext. Preset 2 and ext. ext. switching forw./ rev. a debouncing time of 1...255ms is programmable (default 255ms).

debouncing time [ms]	17 H	XXX	XXX	LSB

Gray/ binary code switch	23 H	XXX	XXX	LSB=1 /0

Binary code output: LSB = 0
Gray code output: LSB = 1

Two's complement/ integer/ separate sign	24 H	XXX	XXX	LSB=0/1 /2

Two's complement notation: LSB = 0
Integer notation: LSB = 2
Separate sign: LSB = 2

Two's complement notation:

- max/2 -3, -2, -1	0	1, 2, 3 + max. value/2-1

In two's complement notation (values signed) the zero point is located in the middle of the value range: (800000H...FFFFFFH, 0, 000001 H...7FFFFFH)

Integer notation:

0..... max. value/ 2 max. value

In integer notation (values unsigned) the zero point is located at the beginning of the value range: (000000H...FFFFFFH)

Separate sign:

VZ	+ max. value/2-1 3, 2, 1	0	1, 2, 3 + max. value/2-1

In the notation with separate sign the zero point is located in the middle of the value range: (FFFFFFH...800001, 0, 000001H...7FFFFFH with SCF=1). The sign is encoded separately in the MSB. In the range below zero the sign is 1, in the range above zero the sign is 0.

Tree /standard-P/S format	25 H	XXX	XXX	LSB=0/1/2

Standard-P format: LSB=0
Tree format: LSB=1
Standard-S format: LSB=2

Standard-P format: LSB = 0

In the standard-P format the number of significant bits can be set to values between 9...24 in decimal numbers. Data are shifted towards the MSB by 24 minus the number of bit positions (the encoder data are output at the SSI in MSB-justified form) The remaining LS-bits are filled with zeros (See CP no. 15H for description).
The length of the shift register can optionally be set to 32 bits or to 25 bits (CP no.1DH).

Tree format: LSB = 1

In Tree format bit 12 and bit 13 are always located in the same bit position, independent from the selected resolution setting (see CP no. 14H for description)
The length of the shift register can optionally be set to 32 bits or to 25 bits.

Standard-S format: LSB = 2

In the standard-S format the number of significant bits can be set to values between 9...24 in decimal numbers. Data are shifted towards the MSB by 32 minus the number of bit positions. The remaining LS-bits are filled with zeros (See CP no. 15H for description).
The length of the shift register is equal to the sum of the set Bits (MT +ST). The maximum is 32 Bit including the separating bit for double read.

Example: MT = 12 Bit; ST = 20 Bit
MT = 10 Bit; ST = 22 Bit

Internal switch forw. / rev.	26H	XXX	XXX	LSB=0 /1

Counter sense forward: LSB=0

Counter sense reversed: LSB=1

When external direction switching function is activated, LSB = 1 will reverse the counter sense selected by the external control.

ext. length measurement On/Off	27H	XXX	XXX	LSB=0/1

External preset inputs are used for starting and stopping length measurements.
Requirement: The external presets 1 and 2 are both set to »On«. (CP no. 20 and 21 H).
For starting a measurement the external preset 1 is triggered with a positive pulse. The encoder value jumps to the preset value. After that the Preset 1 must be deactivated again. After pacing off the measuring distance a positive pulse at external preset 2 stops the measurement for the duration of the pulse. During this period the measurement result can be read out.

5.1.9 Reverse reading of encoder values and set parameters

PC → AC58

CP no. 80H is reserved for the "reverse reading" function. In the LSB the CP no. to be read in reverse is set.

Exception: Encoder actual values incl. status byte can be read with CP no. 00H.

Encoder actual values	80H	XXX	XXX	00H

Read parameters	80H	XXX	XXX	CP no.

AC58 → PC

The reply message also comprises 4 byte of data.

Transmit encoder actual values	MSB	MB	LSB	Status byte
	Current encoder actual values			

Transmit parameters	MSB	MB	LSB	XXX
	set parameter			

Special case encoder> 24 bits (eg 12/13): Actual value is KP-No. 31H read.

Encoder actual values	31H	XXX	XXX	31H

The reply message also 4 byte of data.

Transmit encoder values Transmit	MSB	MB	LSB	LSB
	Current encoder actual values			

5.1.10 Software-Version

read software Version:

command to the encoder:

Software Version	80H	XXX	XXX	1FH

reply from the encoder:

Software Version	VK 10	VK 1	NK1	NK 10

Example Version 1.00 VK 10 = 30H (before comma, 10's digit)
VK 1 = 31H (before comma, 1's digit)
NK 1 = 30H (after comma, 0.1's digit)
NK 10 = 30H (after comma, 0.01's digit)

6 Connection

The maximum data transmission rate depends on the length of cable.
For Clock/ $\overline{\text{Clock}}$ and Data/ $\overline{\text{Data}}$ respectively use twisted wire pairs. Use shielded cable.

Cable length	clock rate
< 50 m	< 400 kHz
< 100 m	< 300 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz

Pin assignment:

Signal	Pin	Colour
$\overline{\text{Clock}}$	1	green
Clock	2	yellow
Data	3	pink
$\overline{\text{Data}}$	4	gray
RS 232 TxD	5	brown
RS 232 RxD	6	white
0 V signal output	7	black
$\overline{\text{Direction}}$	8	blue
Preset1	9	red
Preset2	10	violet
10...30 VDC	11	white[1]
0 V (supply voltage)	12	brown[1]

[1] Ø = 0,5 mm^2

7 Control and display elements

7.1 Preset button (set position value to zero)

⇒ Remove rubber plug. Thus you will get a free view on the preset button!
⇒ Push the button .

If the red LEDs light up shortly then the position value is set to zero.

Warning !

Encoder can become leak, if rubber plug is inserted wrong or is damaged

- IP Protection is not guaranteed!
- A total failure of the encoder is possible!

⇒ pay attention when removing rubber plug!
⇒ push the rubber plug several times for a tight fit in the bore
⇒ damaged rubber plugs have to be replaced (Art. no. 2565007)

7.2 LED display

There are four LEDs shining through the rubber plug. Two of the LEDs shine green, the other two LEDs shine red.

Meaning of the LEDs:

	LEDs	Meaning
Power (green)	OFF	No Power supply
	ON	Power supply OK
Error (red)	OFF	No error
	once blinking	Communication error RS232 interface
	twice blinking	Writing-/ reading error of EEPROM
	three times blinking	Reading error of the position data

If a error takes a long time blinking repeats every 0.5 seconds.

8 Transmission sequence

When programming the AC58 some parameters require that certain transmission sequence is observed.

8.1 Sequence of parameter entries

1. RAM Default Values
2. Encoding characteristic
3. Scaling factor
4. Preset value
5. remaining functions (data formats, status bit function, etc.)
6. Save to EEPROM (remnant data storage)

8.2 Parameter default setting

The AC58 is preset to the following parameter default values:

Internal Preset:	0
Offset:	0
Scaling factor:	1 (encoder resolution 2^{24} steps)
Encoding characteristic:	cw
Binary data output format, two's complement notation, standard format 24 data bit + 7 status bits	
Status bits:	0; all status bit functions disabled
Control line (ext. inputs):	off
Limit position	0
Over speed:	0
Debouncing time:	255ms
Shift function	off
Length measurement	off

8.3 Initial operation

No special procedures are required for taking the device into operation. Power supply, clock and data lines must be laid and connected to the control system as specified in chapter 6 “connection”. The easiest way of programming the encoder is to use the software Win SSI (see chapter 9 “programming over software Win SSI”).
For programming via programming unit the signals RxD, TxD and signal ground must be connected.

9 Parameterization over software Win SSI

Requirements: right connection and initial operation

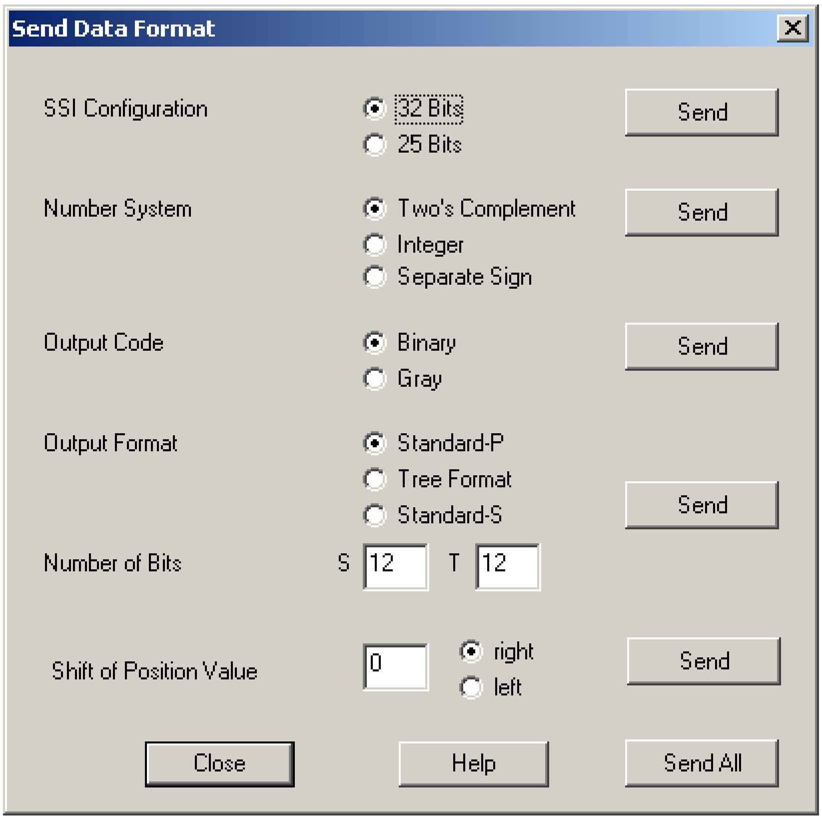
In the following chapters all possible settings are described.

Overview

Send parameters	Page	Read parameters	Page	Configuration	Page
Data format	31	Data format	40	PC interface	45
Presets	35	Presets	41	RAM default value	45
Scaling factor	36	Scaling factor	42	Load EEPROM	45
Limit position	37	Limit position	43	Save to EEPROM	45
Status bits	38	Status bits	43		
Counter sense	39	Counter sense	44		
Send all	39	Actual value	44		
		Read all	44		

9.1 Send parameter

9.1.1 Data format



All numbers can also be entered as hexadecimal numbers in that dialog.
Therefore you have to put a "$" in front of the number.
Example: $7FF $-123.

SSI Configuration:

The length of the shift register can optionally be set to 32 bits or to 25 bits.

Number System:

In **two's complement notation** (values signed) the zero point is located in the middle of the value range.
In **integer notation** (values unsigned) the zero point is located at the beginning of the value range.
In the notation with **separate sign** the zero point is located in the middle of the value range. The sign is encoded separately in the MSB. In the range below zero the sign is 1, in the range above zero the sign is 0.

Output code:

You can choose among binary or gray code.

Shift of position value

Before output the position value can be shifted to the right or to the left.

9.1.1.1 Standard-P format

In the **Standard-P format** the number of significant bits can be set to values between 9...24 in decimal numbers. Data are shifted towards the MSB by 24 minus the number of bit positions (the encoder data are output at the SSI in MSB-justified form). The remaining are filled with zeros.

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Status-bits 1...1

Anzahl Datenbits \ Takt	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
24	M11	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
23	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0
22	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0
21	M8	M7	M6	M5	M4	M3	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0
20	M7	M6	M5	M4	M3	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0
19	M6	M5	M4	M3	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0
18	M5	M4	M3	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0
17	M4	M3	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0
16	M3	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0
15	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0
14	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0
13	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0
12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0
11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Picture: Arrangement of data bit in the Standard-S-Format

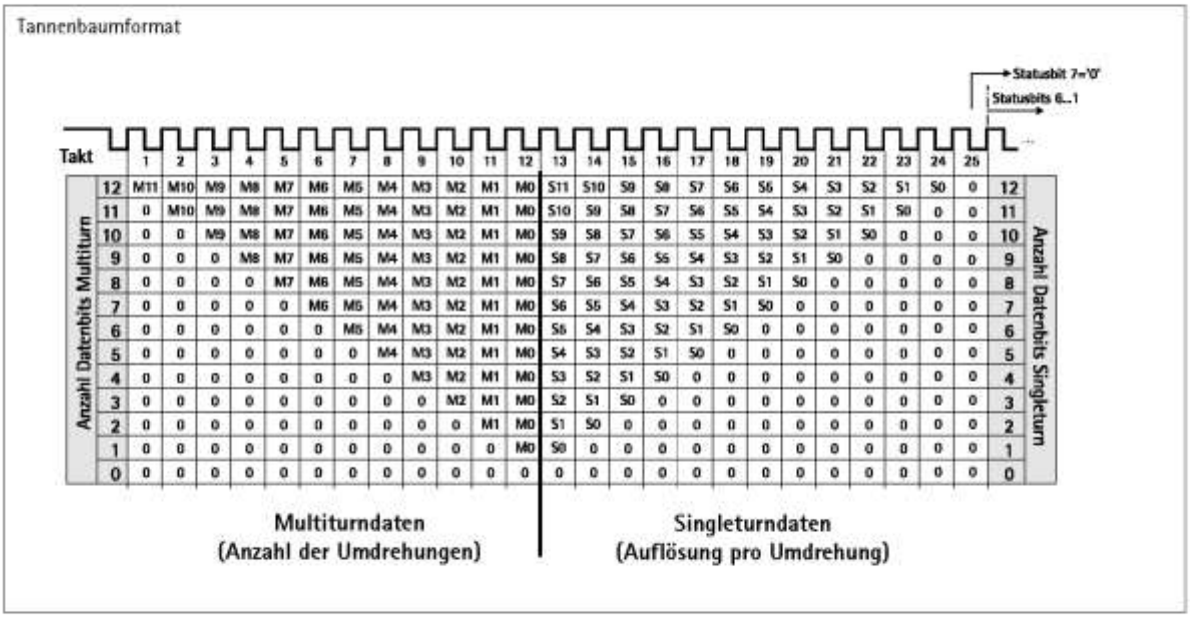
9.1.1.2 Tree format

In the tree-format bit 12 and bit 13 are always located in the same bit position, independent of the selected resolution. The number of significant bits can be set separately for S/rev and rev. The numbers are 0...12 in decimal notation for the steps per revolution and 0...12 in decimal notation for the number of revolutions. Both values are encoded in the upper/lower tetrade of the LSB.

If the LSB value is, for example, 9BH, 9 bits of steps per revolution (= 512 S/rev) and 11 bits of revolutions (= 2048 rev) are output. Missing bits are filled with zero.

1. The Tree-format is designed for an encoder with a resolution of up to 13 bits singleturn data. The Encoder AC58-P however delivers 12 bit single turn data (clock pulse 13...24) and the first status bit with the bit position 7 in clock pulse 25. Therefore, the bit position 7 may not be used as a status bit in the tree format.

2. In the Tree-format the number system must be set to integer.



Takt	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
12	M11	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	12
11	0	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	11
10	0	0	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	10
9	0	0	0	M8	M7	M6	M5	M4	M3	M2	M1	M0	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	9
8	0	0	0	0	M7	M6	M5	M4	M3	M2	M1	M0	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	8
7	0	0	0	0	0	M6	M5	M4	M3	M2	M1	M0	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	7
6	0	0	0	0	0	0	M5	M4	M3	M2	M1	M0	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	6
5	0	0	0	0	0	0	0	M4	M3	M2	M1	M0	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	5
4	0	0	0	0	0	0	0	0	M3	M2	M1	M0	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	4
3	0	0	0	0	0	0	0	0	0	M2	M1	M0	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	3
2	0	0	0	0	0	0	0	0	0	0	M1	M0	S1	S0	0	0	0	0	0	0	0	0	0	0	0	2
1	0	0	0	0	0	0	0	0	0	0	0	M0	S0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Picture: Data bit arrangement in the tree format

9.1.1.3 Standard-S format

The Standard-S-Format is used for resolutions >14 Bit because of the high holding time of a standard-SSI-encoder for resolutions > 14 Bit.
The reason for this holding time is a SAR-Interpolator that is used for such high resolutions.
Compared to a standard-SSI-encoder the SSI-P saves the read data and then releases the data via a SPI-Port without a holding time.

The standard-S-format is only possible with the version singleturn.

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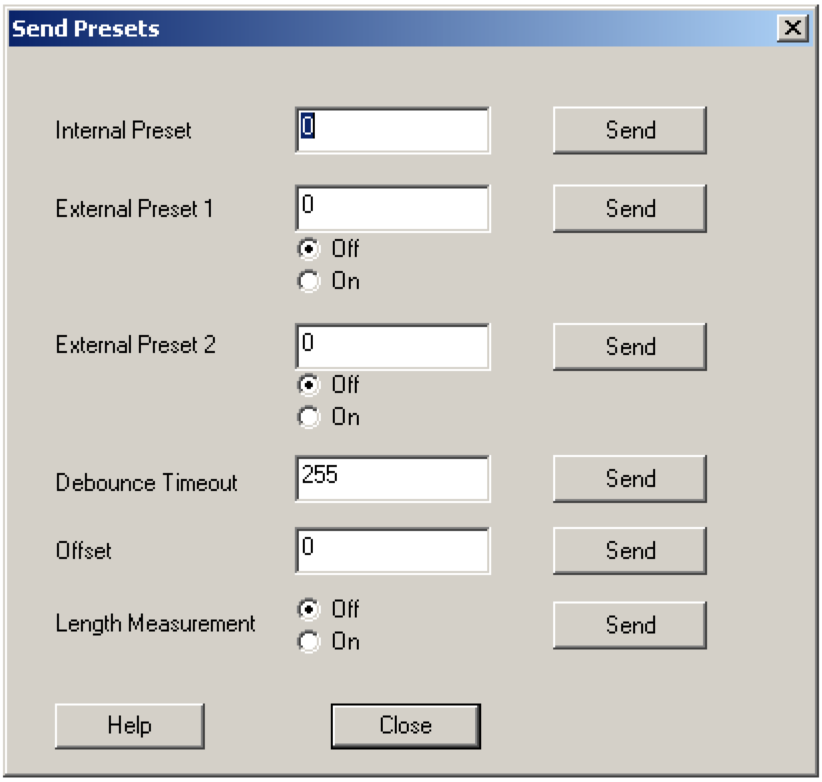
Anzahl Datenbits / Takt	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
32	M11	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
32	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
32	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
31	M8	M7	M6	M5	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0
30	M7	M6	M5	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0
29	M6	M5	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0
28	M5	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0
27	M4	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0
26	M3	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0
25	M2	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0
24	M1	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0
23	M0	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0
22	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0
21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0
20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0
19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Picture: Arrangement of data bit in the Standard-S-Format

9.1.2 Presets



All numbers can also be entered as hexadecimal numbers in that dialog.
Therefore you have to put a "$" in front of the number.
Example: $7FF $-123.

The **internal preset** is an absolute preset value. After transmission of this parameter the actual values change to the set values.

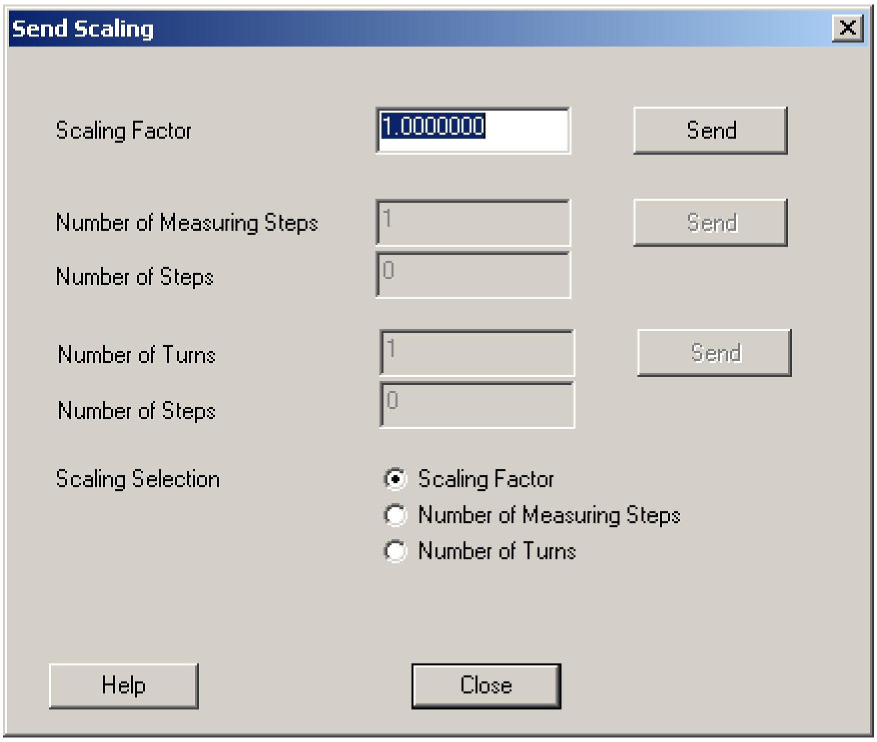
The **external presets 1 and 2** are absolute preset value. By supplying
a voltage pulse > debouncing time to external preset input 1 or 2 the actual value change to the received parameter value (the external activated preset value is automatically stored to EEPROM).
External preset 1 or 2 can be disabled of enabled (see chapter switch functions).

For the external Presets 1 or 2 a **debouncing time** of 1...255ms is programmable (default 255ms).

The **offset value** effects a relative shifting of the actual values. After transmission of the offset value the current actual value will be shifted by the amount of the offset value. Presets delete the set offset value.

External preset inputs are used for starting and stopping **length measurements**.
For starting a measurement the external preset 1 is triggered with a positive pulse. The encoder value jumps to the preset value. After pacing off the measuring distance a positive pulse at external preset 2 stops the measurement for the duration of the pulse. During this period the measurement result can be read out.

9.1.3 Scaling



All numbers can also be entered as hexadecimal numbers in that dialog (apart from the internal scaling factor). Therefore you have to put a "$" in front of the number.
Example: $7FF $-123.

There are three possibilities to modify the resolution of a Standard-P encoder:

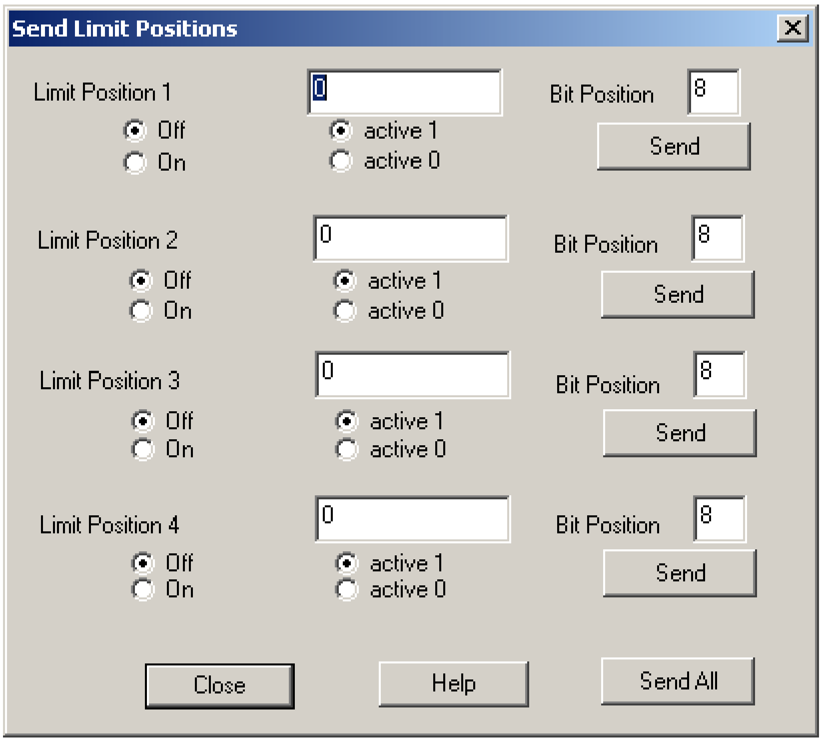
1. Direct entry of a scaling factor (SCF)
2. Entry of number of revolutions and (required) number of step
3. Entry of the number of measuring steps and (required) number of steps

The **scaling factor (SCF)** is used for modifying the encoder resolution. Actual values are multiplied with the SCF. The SCF is interpreted as a number < 1. SCF is transmitted as an unsigned 3-byte number. Its maximum value is 1 (Input: 0.99999999).
If, for example, resolution is to be halved, the SCF must be 0.5.

A desired number of steps can be assigned to a certain **number of turns** (measuring distance). The range of values for the number of revolutions is 1...FFFH. The number of revolutions is an unsigned integer value. After the number of revolutions and the required number of steps have been entered, the AC58 unit will calculate the SCF automatically. The value range for the number of steps is 0...FF FF FFH.

The required number of steps can be assigned to a **number of measuring steps** (measuring distance). The range of values for the number of measuring steps is 1...FF FF FFH. The number of measuring steps is an unsigned integer value. After the number of measuring steps and the required number of steps have been entered, the AC58 unit will calculate the SCF automatically.

9.1.4 Limiting Position



All numbers can also be entered as hexadecimal numbers in that dialog.
Therefore you have to put a "$" in front of the number.
Example: $7FF $-123.

In that menu you can

- set the amount of limiting values
- set the position of the marker bit in the status byte
- choose between 0 and 1 for the marker bit
- switch on or off the limiting values

All limit positions (soft limits) are set as 3-byte values. They can be freely adjusted within the value range of the encoder. A marker bit is set when the corresponding limit position has been reached. This bit can be output as a status bit via the SSI interface.

The default value for the bit position is 8, i.e. no bit position is assigned. The default value is used for a plausibility check. The program controls the bit positions, which were assigned to the status bits. This excludes a double use. This means that unused status bits have to be set to 8.

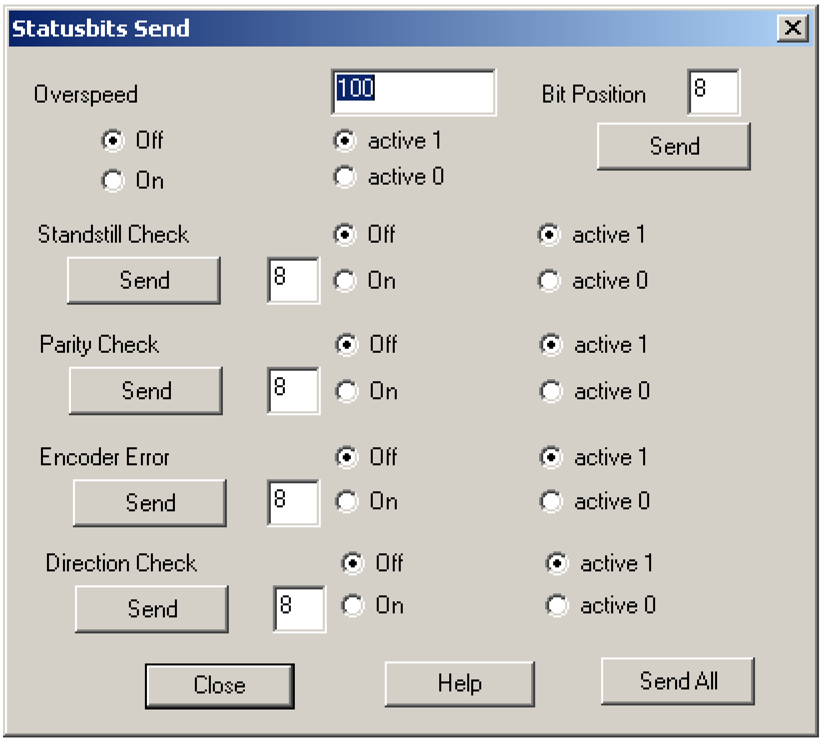
Example:

Settings: Limit position 1
Bit position 5
Active 1

➔ If the limiting value is reached than there will be a 1 on position 5 of the status byte.

Position:	7	6	5	4	3	2	1	0
Status byte:	0	0	**1**	0	0	0	0	0

9.1.5 Status bits



All numbers can also be entered as hexadecimal numbers in that dialog.
Therefore you have to put a "$" in front of the number.
Example: $7FF $-123.

In addition to the limiting values further parameters can be set to the status byte. These are over speed, stand still check, parity check, encoder error and direction check.

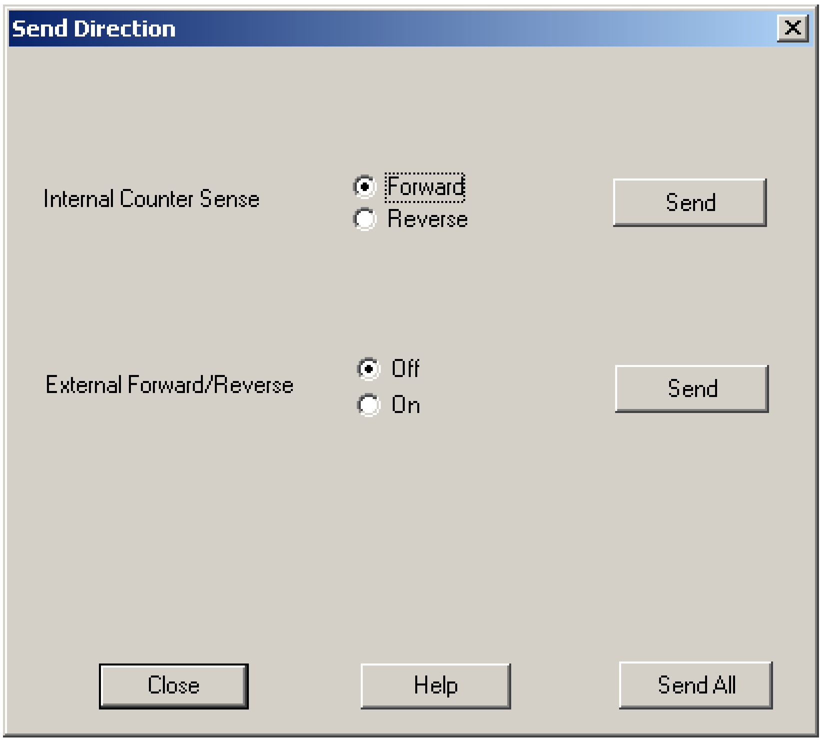
The possible settings for over speed are:
- the amount of over speed
- the position of the marker bit in the status byte
- choose between 0 and 1 for the marker bit
- switch on or off the over speed

When the set over speed is reached a marker bit is set. The input format is multiples of 100 rpm. The value range for the input is 0…255. If, for example, the LSB value is 47 in decimal notation the marker bit will be set at a rotational speed of 4700 rpm. Accuracy of measurement is approx. ± 5 %.

The possible settings for standstill check, parity check, encoder error and direction check are:
- the position of the marker bit in the status byte
- choose between 0 and 1 for the marker bit
- switch on or off the over speed

The default value for the bit position is 8, i.e. no bit position is assigned. The default value is used for a plausibility check. The program controls the bit positions, which were assigned to the status bits. This excludes a double use. This means that unused status bits have to be set to 8.

9.1.6 Counter sense



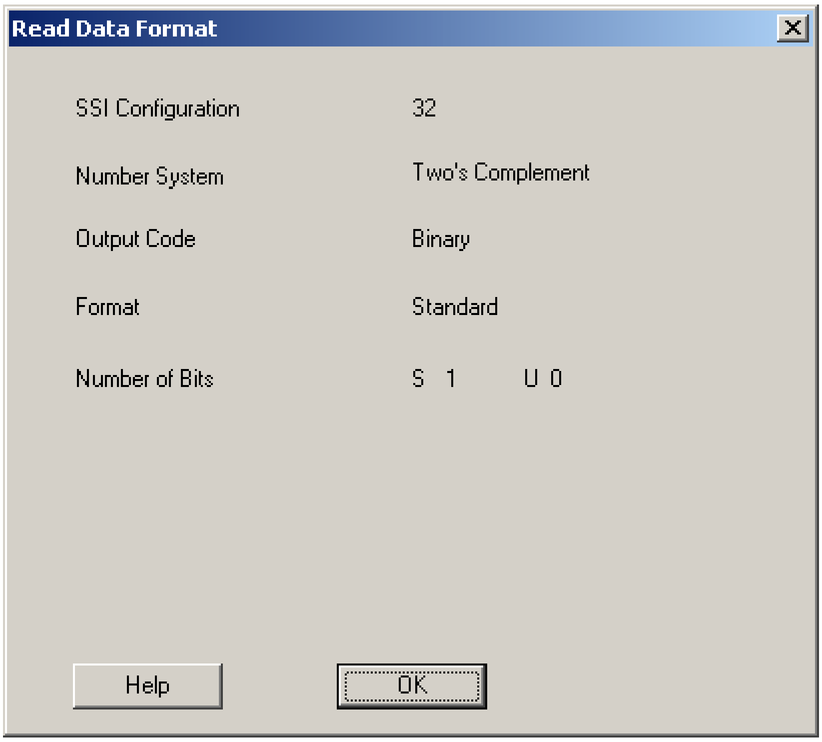
Set of internal counter sense and external forward/ reverse switching.

9.1.7 Send all

With this button the actual parameters are sent to the encoder.

9.2 Read parameters

9.2.1 Data format



SSI Configuration:
The selected length of the shift register, 32 bits or to 25 bits.

In **two's complement notation** (values signed) the zero point is located in the middle of the value range. In **integer notation** (values unsigned) the zero point is located at the beginning of the value range. In the notation with **separate sign** the zero point is located in the middle of the value range. The sign is encoded separately in the MSB. In the range below zero the sign is 1, in the range above zero the sign is 0.

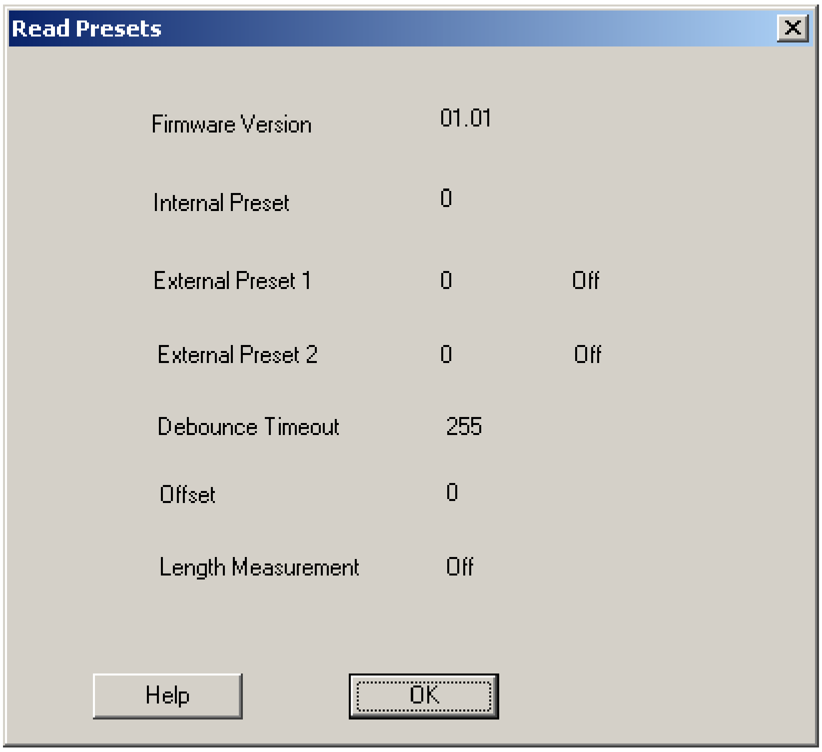
The selected **output code**, binary or gray.

In the **Standard-P Format** the number of significant bits can be set to values between 9...24 in decimal numbers. Data are shifted towards the MSB by 24 minus the number of bit positions (the encoder data are output at the SSI in MSB-justified form). The remaining are filled with zeros.

In the **Tree Format** bit 12 and bit 13 are always located in the same bit position, independent of the selected resolution. The number of significant bits can be set separately for S/rev and rev. The numbers are 0...12 in decimal notation for the steps per revolution and 0...12 in decimal notation for the number of revolutions. Both values are encoded in the upper/lower tetrade of the LSB.

The **Standard-S Format** is used for resolutions >14 Bit because of the high holding time of a standard-SSI-encoder for resolutions > 14 Bit.
The reason for this holding time is a SAR-Interpolator that is used for such high resolutions.
Compared to a standard-SSI-encoder the SSI-P saves the read data and then releases the data via a SPI-Port without a holding time.

9.2.2 Presets



The **internal preset** is an absolute preset value. After transmission of this parameter the actual values change to the set values.

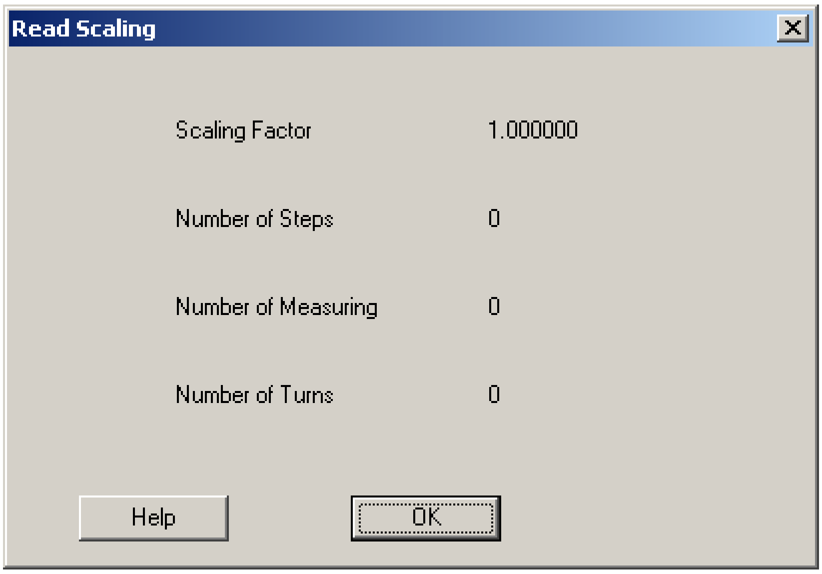
The **external presets 1 and 2** are absolute preset value. By supplying a voltage pulse > debouncing time to external preset input 1 or 2 the actual value change to the received parameter value (the external activated preset value is automatically stored to EEPROM). External preset 1 or 2 can be disabled of enabled (see chapter switch functions).

For the external Presets 1 or 2 a **debouncing time** of 1...255ms is programmable (default 255ms).

The **offset value** effects a relative shifting of the actual values. After transmission of the offset value the current actual value will be shifted by the amount of the offset value. Presets delete the set offset value.

External preset inputs are used for starting and stopping **length measurements**.
For starting a measurement the external preset 1 is triggered with a positive pulse. The encoder value jumps to the preset value. After pacing off the measuring distance a positive pulse at external preset 2 stops the measurement for the duration of the pulse. During this period the measurement result can be read out.

9.2.3 Scaling

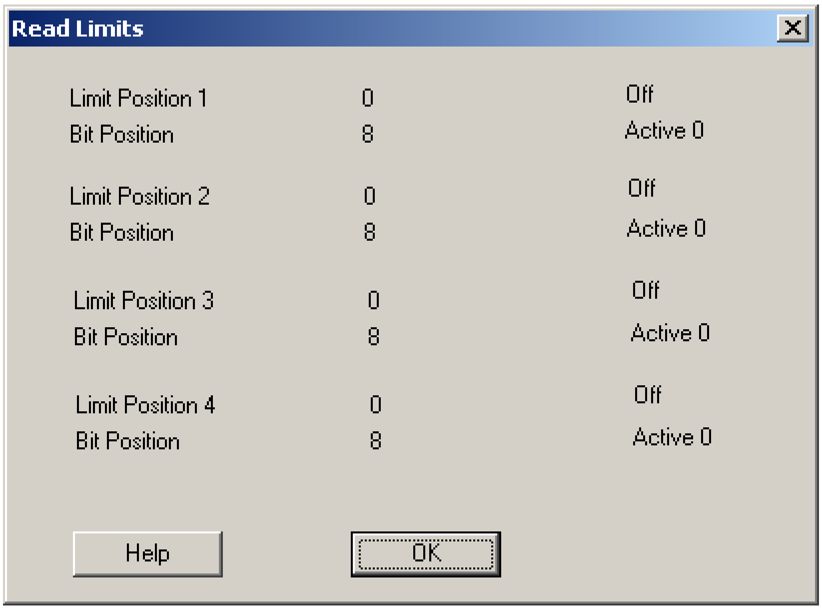


The **scaling factor (SCF)** is used for modifying the encoder resolution. Actual values are multiplied with the SCF. The SCF is interpreted as a number < 1. SCF is transmitted as an unsigned 3-byte number. Its maximum value is 1 (Input: 0.99999999).
If, for example, resolution is to be halved, the SCF must be 0.5.

A desired number of steps can be assigned to a certain **number of revolutions** (measuring distance). The range of values for the number of revolutions is 1...FFFH. The number of revolutions is an unsigned integer value. After the number of revolutions and the required number of steps have been entered, the AC58 unit will calculate the SCF automatically. The value range for the number of steps is 0...FF FF FFH.

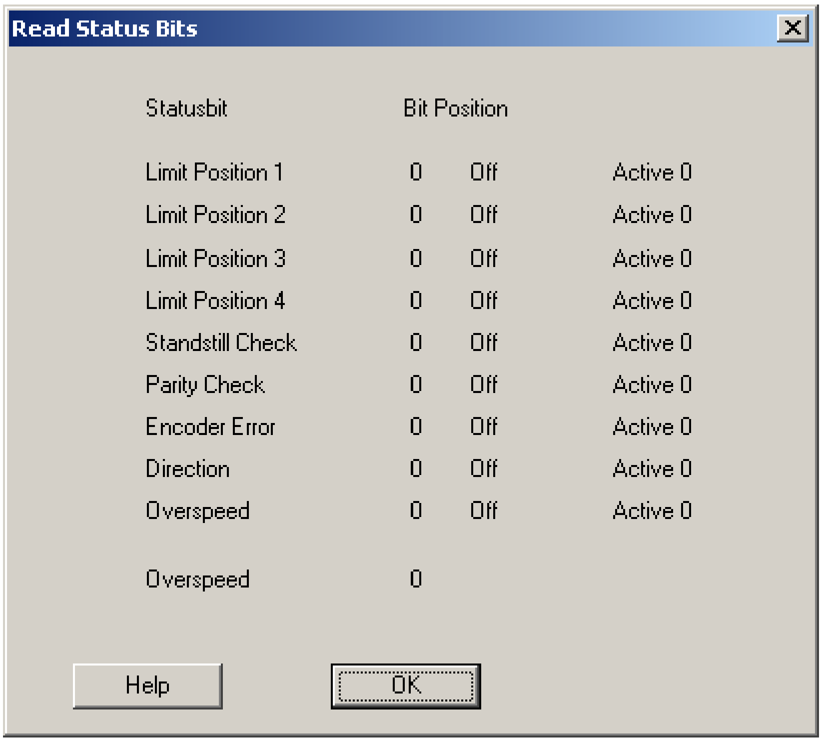
The required number of steps can be assigned to a **number of measuring steps** (measuring distance). The range of values for the number of measuring steps is 1...FF FF FFH. The number of measuring steps is an unsigned integer value. After the number of measuring steps and the required number of steps have been entered, the AC58 unit will calculate the SCF automatically.

9.2.4 Limit position



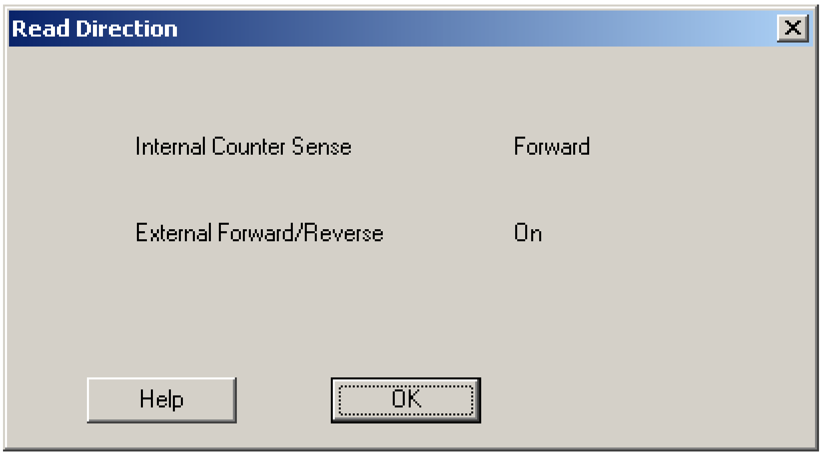
All limit positions (soft limits) are set as 3-byte values. They can be freely adjusted within the value range of the encoder. A status bit is set when the corresponding limit position has been reached. This bit can be output as a status bit at the SSI interface.

9.2.5 Status bits



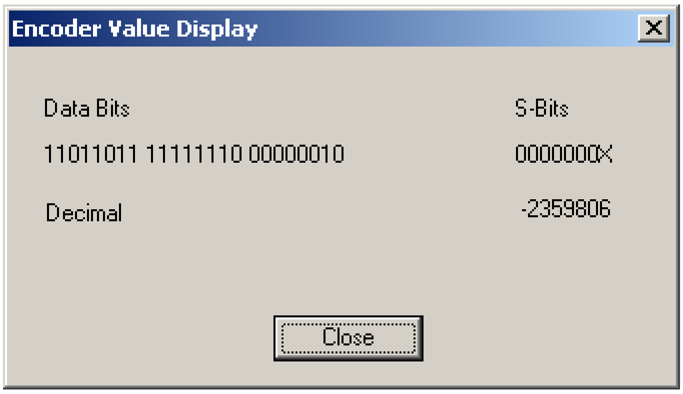
In addition to the limiting values further parameters can be set to the status byte. These are over speed, stand still check, parity check, encoder error and direction check.

9.2.6 Counter sense



Reading of internal counter sense and external forward/ reverse.

9.2.7 Actual value



This window displays all latest encoder values and the status of the status bit.

9.2.8 Read all

This command reads all parameters from the encoder and write it into the internal data structure. Existing values are overwritten.

9.3 Configuration

This menu item is used for setting general parameters in connection with the PC and the AC58.

9.3.1 PC Interface

The communication interface used with the encoder is set here. This setting is essential. Pay attention that you have set the used interface correctly. If not the functionality of the program can't be guaranteed.

9.3.2 RAM default values

The entire working memory of the AC58 is deleted. All encoder parameters are reset to default.

9.3.3 Load from EEPROM

The parameters held in permanent storage in the EEPROM are loaded back into the working memory.

9.3.4 Save to EEPROM

The parameters stored in the working memory (RAM) are saved in the EEPROM for permanent storage. After resetting (when switching on the power supply) the parameters will be loaded into the working memory automatically.

10 Technical data

10.1 Mechanical

Housing diameter	58 mm
Protection class shaft input	IP 64 or IP 67
Protection class housing	IP 64 (IP 67 optional)
Flange	Synchro flange, clamping flange, hub shaft with tether, square flange
Shaft diameter	Solid shaft 6 mm, 10 mm; hub shaft 10 mm, 12 mm
Max. speed	12000 min^{-1} (short term), 10000 min^{-1} (continuous)
Starting torque	$\leq$ 0,01 Ncm
Moment of inertia	3,8 x 10^{-6} kgm^2
Max. shaft load	axial 40 N, radial 60 N
Hub shaft with tether	
Tolerance axial	± 1.5 mm
Tolerance radial	± 0.2 mm
Shock resistance DIN EN 60068-2-27	1000 m/s^2 (6ms)
Vibration resistance DIN EN 60068-2-6	100 m/s^2 (10 - 2000Hz)
Operating temperature	-40 ... +70 °C
Storage temperature	-40 ... +85 °C
Material shaft	Stainless steel
Material housing	Aluminium
Weight approx. ST/ MT	260g/ 310g

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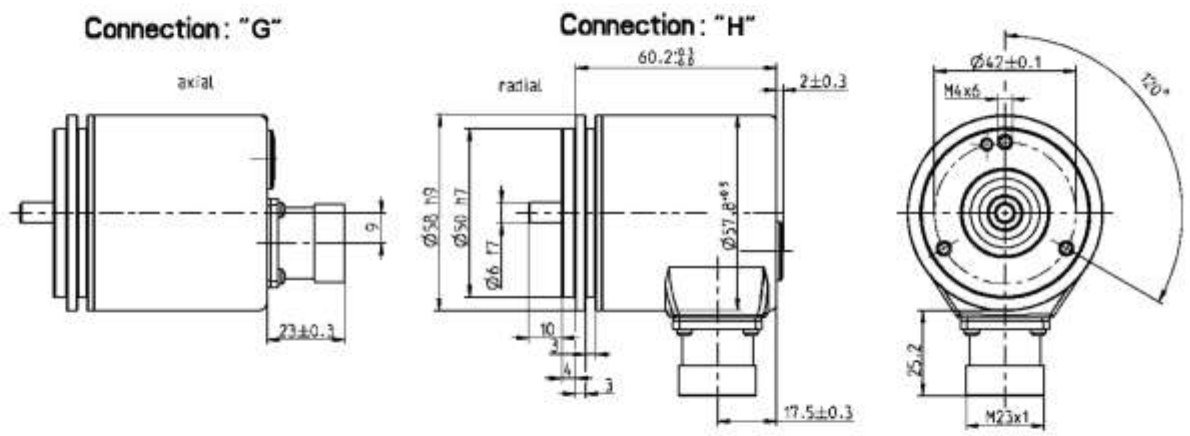
10.2 Electrical

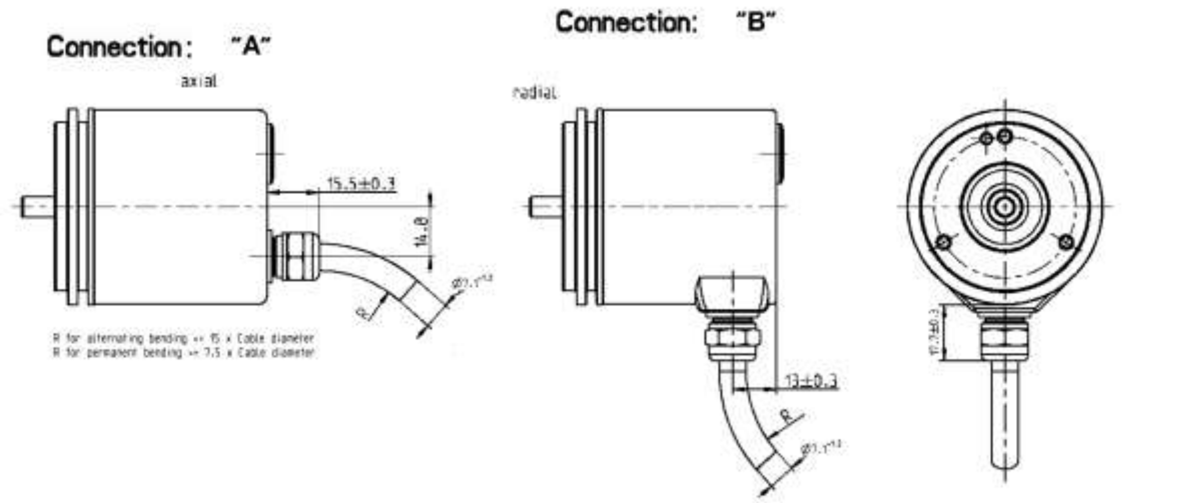
Supply voltage	DC 10 - 30 V
Max. current w/o load ST/MT	250 mA
Interface	SSI programmable
Lines/ Drivers	Clock and data / RS422
Output code	Binary or Gray
Resolution Singleturn	10 - 17 Bit
Resolution Multiturn	12 Bit
Parameterization	Resolution, code type, direction, output format, warning, alarm
Control input	Direction, Preset 1, Preset 2
Alarm output	Alarmbit
Status LED	Green = OK, red = alarm
Connection	Cable radial or axial Conin radial or axial, ccw

11 Dimensions drawings

11.1 Synchro flange

A Cable, axial
B Cable, radial
G Conin connector, 12 pole, axial ccw
H Conin connector, 12 pole, radial ccw

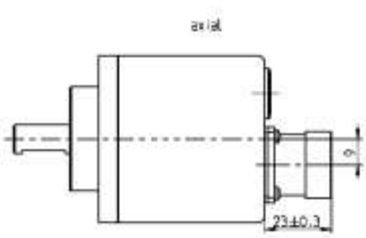




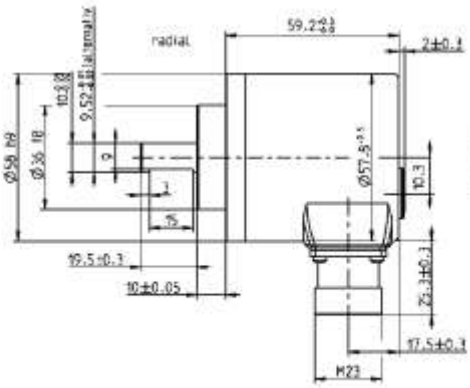
11.2 Clamping flange

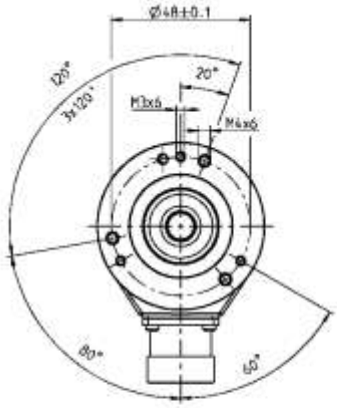
A Cable, axial
B Cable, radial
G Conin connector, 12 pole, axial ccw
H Conin connector, 12 pole, radial ccw

Connection: "G"

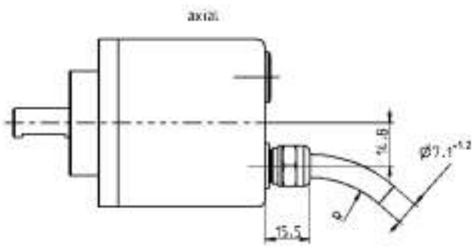


Connection: "H"



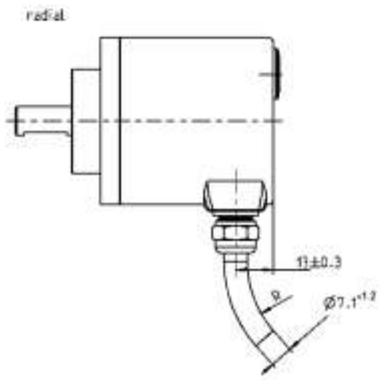


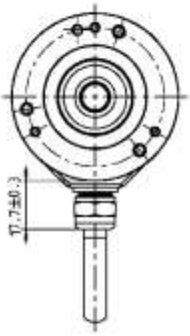
Connection: "A"



R for alternating bending => 15 x Cable diameter
R for permanent bending => 7.5 x Cable diameter

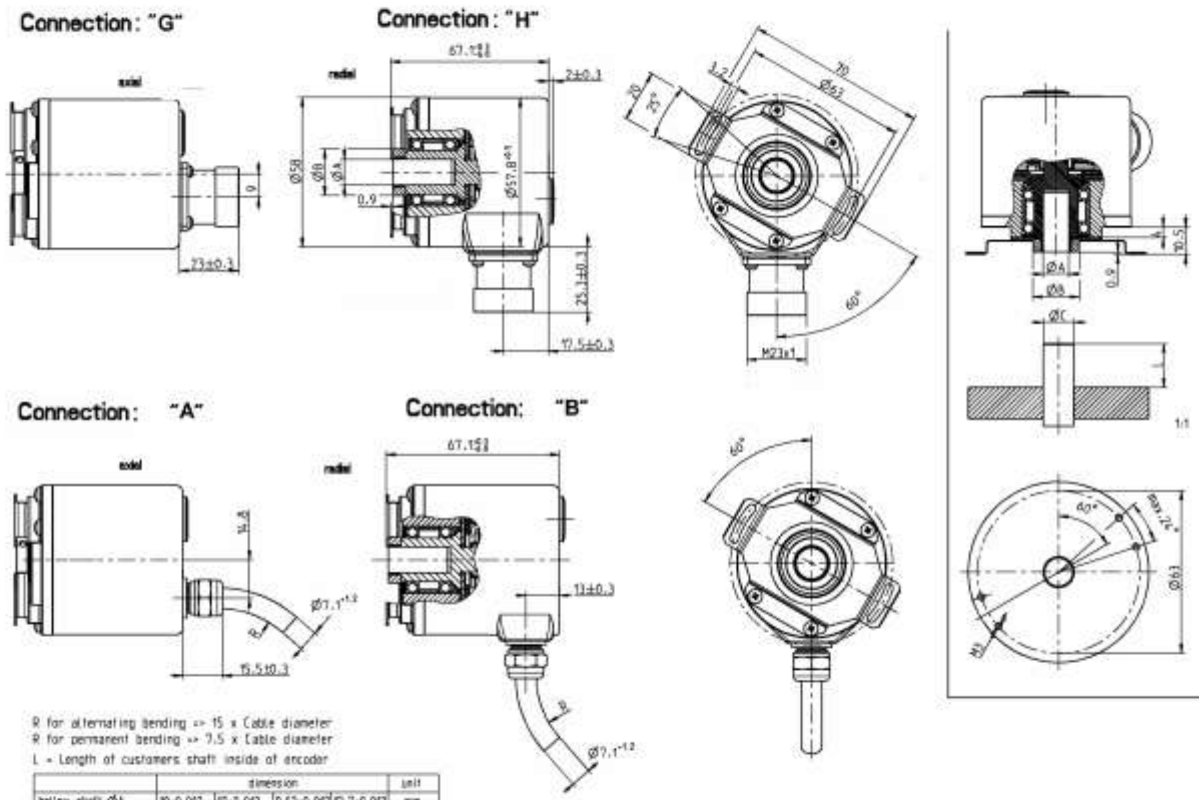
Connection: "B"





11.3 Hub shaft with tether

A Cable, axial
B Cable, radial
G Conin connector, 12 pole, axial ccw
H Conin connector, 12 pole, radial ccw



R for alternating bending => 15 x Cable diameter
R for permanent bending => 7.5 x Cable diameter
L = Length of customers shaft inside of encoder

	dimension				unit
hollow shaft-ØA	10+0.012	12+0.012	9.52+0.012	12.7+0.012	mm
connecting shaft-ØC	10 g7	12 g7	9.52 g7	12.7 g7	mm
clamping ring-ØB	18	20	18	22	mm
L min.	15	18	15	18	mm
L max.	20	20	20	20	mm
shaft code	"2"	"T"	"6"	"E"	

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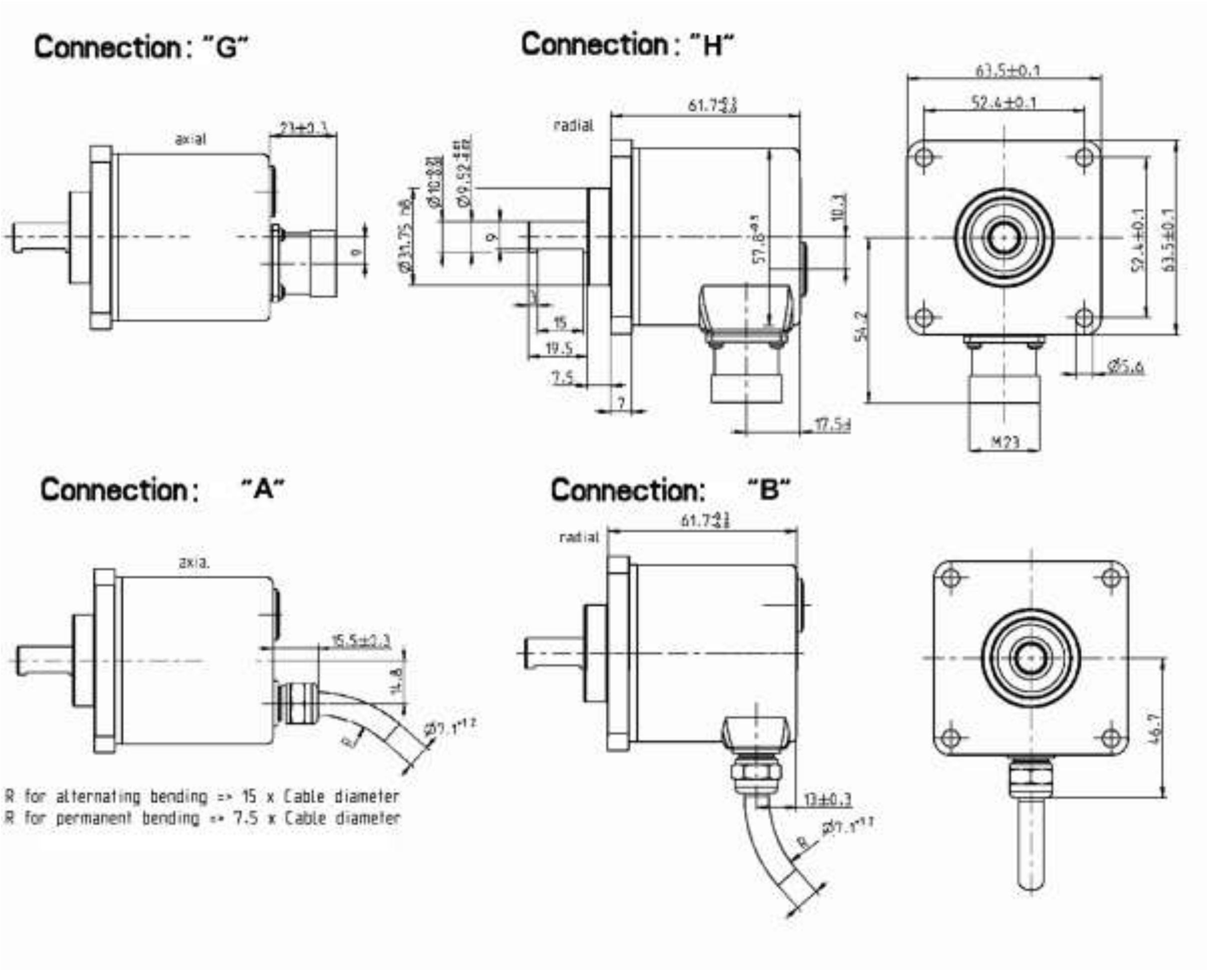
11.4 Square flange

- **A** Cable, axial
- **B** Cable, radial
- **G** Conin connector, 12 pole, axial ccw
- **H** Conin connector, 12 pole, radial ccw



12 Ordering Data

Type	Resolution	Supply voltage	Flange, Protection, Shaft	Interface	Connection
AC 58	**0010** 10 Bit ST **0012** 12 Bit ST **0013** 13 Bit ST **0014** 14 Bit ST **0017** 17 Bit ST **1212** 12 Bit MT +12 Bit ST **1213** 12 Bit MT +13 Bit ST **1214** 12 Bit MT +14 Bit ST **1217** 12 Bit MT +17 Bit ST *	**E** DC 10-30V	**S.41 Synchro, IP64, 6x10mm** **S.71 Synchro, IP67[1], 6x10mm** **K.42 Clamping, IP64, 10x19,5mm** **K.72 Clamping, IP67[1], 10x19,5mm** **K.46** Clamping, IP64, 9,52x19,5mm **K.76** Clamping, IP67[1], 9,52x19,5mm **F.42 Hub shaft with tether, IP64,10x19,5mm** **F.47 Hub shaft with tether, IP64, 12x19,5mm** **F.46** Hub shaft with tether, IP64, 9,52x19,5mm **Q.42** Square, IP64, 10x19,5mm **Q.72** Square, IP67[1], 10x19,5mm **Q.46** Square, IP64, 9,52x19,5mm **Q.76** Square, IP67[1], 9,52x19,5mm	**SP** SSI programmable	**A** Cable, axial **B** Cable, radial **G** Conin, 12-pol., axial, ccw **H** Conin, 12-pol., radial, ccw

Note:

[1] Protection class IP67 not available in combination with preset key and LED display
* higher resolution on request
Preferable available versions are printed in bold type

Accessories:

- Position indication Signo-SSI — www.hengstler.com
- Clamping eccentric for synchro flange — 0 070 655
- Diaphragm coupling (hub 6/6 mm) — 3 520 081
- Diaphragm coupling (hub 10/10 mm) — 3 520 088
- Software Win SSI as download from our homepage — www.hengstler.com
- Win SSI PC connecting cable, incl. power pack 230 VA, for Conin 12 pole, CCW (suited for supply voltage E and connection G or H) — 1 543 010

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