



IV 251

Signal converter SSI - analog / serial

Product features:

- Suitable for operation with all sensors and encoders using SSI interface
- Serial RS232 and RS485 interface for serial readout of the encoder data
- Scalable analog output, usable for voltage or current operation
- Additional facilities as bit-blanking, round-loop-operation etc.
- Linearization facilities by freely programmable input-output curves
- Easy to set up by teach function or by PC
- 5 VDC encoder supply output
- 18 to 30 VDC power supply

Version:	Description:
IV25101a/af/kk/hk/Feb.08	Version A5-motrona
IV25102a/kk/nw/Sept. 13	Added Printer mode
lv251_02b_oi/ag/Sep-15	Safety instructions, legal notices and actualized design added. Analog output note: only mA or V, but not both together.

Legal notices:

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1. Safety Instructions and Responsibility

1.1 General Safety Instructions

This operation manual is a significant component of the unit and includes important rules and hints about the installation, function and usage. Non-observance can result in damage and/or impairment of the functions to the unit or the machine or even in injury to persons using the equipment!

Please read the following instructions carefully before operating the device and observe all safety and warning instructions! Keep the manual for later use.

A pertinent qualification of the respective staff is a fundamental requirement in order to use these manual. The unit must be installed, connected and put into operation by a qualified electrician.

Liability exclusion: The manufacturer is not liable for personal injury and/or damage to property and for consequential damage, due to incorrect handling, installation and operation. Further claims, due to errors in the operation manual as well as misinterpretations are excluded from liability.

In addition the manufacturer reserve the right to modify the hardware, software or operation manual at any time and without prior notice. Therefore, there might be minor differences between the unit and the descriptions in operation manual.

The raiser respectively positioner is exclusively responsible for the safety of the system and equipment where the unit will be integrated.

During installation or maintenance all general and also all country- and application-specific safety rules and standards must be observed.

If the device is used in processes, where a failure or faulty operation could damage the system or injure persons, appropriate precautions to avoid such consequences must be taken.

1.2 Use according to the intended purpose

The unit is intended exclusively for use in industrial machines, constructions and systems. Non-conforming usage does not correspond to the provisions and lies within the sole responsibility of the user. The manufacturer is not liable for damages which has arisen through unsuitable and improper use.

Please note that device may only be installed in proper form and used in a technically perfect condition - in accordance to the "Technical Specifications" (see chapter [11](#)). The device is not suitable for operation in explosion-proof areas or areas which are excluded by the EN 61010-1 standard.

1.3 Installation

The device is only allowed to be installed and operated within the permissible temperature range. Please ensure an adequate ventilation and avoid all direct contact between the device and hot or aggressive gases and liquids.

Before installation or maintenance, the unit must be disconnected from all voltage-sources. Further it must be ensured that no danger can arise by touching the disconnected voltage-sources.

Devices which are supplied by AC-voltages, must be connected exclusively by switches, respectively circuit-breakers with the low voltage network. The switch or circuit-breaker must be placed as near as possible to the device and further indicated as separator.

Incoming as well as outgoing wires and wires for extra low voltages (ELV) must be separated from dangerous electrical cables (SELV circuits) by using a double resp. increased isolation.

All selected wires and isolations must be conform to the provided voltage- and temperature-ranges. Further all country- and application-specific standards, which are relevant for structure, form and quality of the wires, must be ensured. Indications about the permissible wire cross-sections for wiring are described in the Technical Specifications (see chapter [11](#)).

Before first start-up it must be ensured that all connections and wires are firmly seated and secured in the screw terminals. All (inclusively unused) terminals must be fastened by turning the relevant screws clockwise up to the stop.

Overvoltages at the connections must be limited to values in accordance to the overvoltage category II.

For placement, wiring, environmental conditions as well as shielding and earthing/grounding of the supply lines the general standards of industrial automation industry and the specific shielding instructions of the manufacturer are valid. Please find all respective hints and rules on www.motrona.com/download.html --> "[General EMC Rules for Wiring, Screening and Earthing]".

1.4 Cleaning, Maintenance and Service Notes

To clean the front of the unit please use only a slightly damp (not wet!), soft cloth. For the rear no cleaning is necessary. For an unscheduled, individual cleaning of the rear the maintenance staff or assembler is self-responsible.

During normal operation no maintenance is necessary. In case of unexpected problems, failures or malfunctions the device must be shipped for back to the manufacturer for checking, adjustment and reparation (if necessary). Unauthorized opening and repairing can have negative effects or failures to the protection-measures of the unit.

2. Introduction

IV251 is a small and low-cost, but highly performing converter for industrial applications, where the information of a sensor or encoder with SSI interface needs to be converted to an analog signal or to a serial RS232/485 data format. The unit has been designed as a compact module with 12 screw terminals and a 9-position SUB-D connector (female). The housing is suitable for standard DIN rail mounting.

Applicable encoders and sensors:

Single-turn or multi-turn absolute encoders and all similar sensors using a standard SSI interface (6 to 25 bits of resolution with binary or Gray code). The unit can operate in either master mode (clock signal generated by the IV251 unit), or in slave mode (clock signal generated by a remote device)

Remark to the encoder resolution:

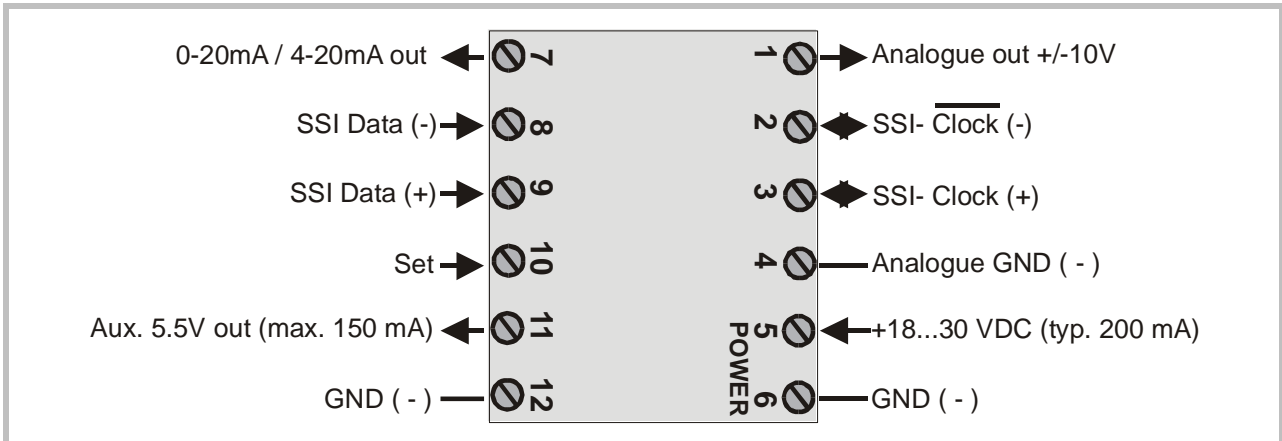
The unit provides settings for the standard resolutions of 13 bits, 21 bits and 25 bits. In general, for sensors with other resolutions you can use the next higher setting (i.e. set the unit to 21 bits with a sensor of 16 bits).

Depending on brand and specification of the encoder, in some cases it may be necessary to blank out the surplus bits by using the bit blanking function described later. In general however, the unit should work perfectly also without special bit blanking.

3. Terminal Assignments and Connections

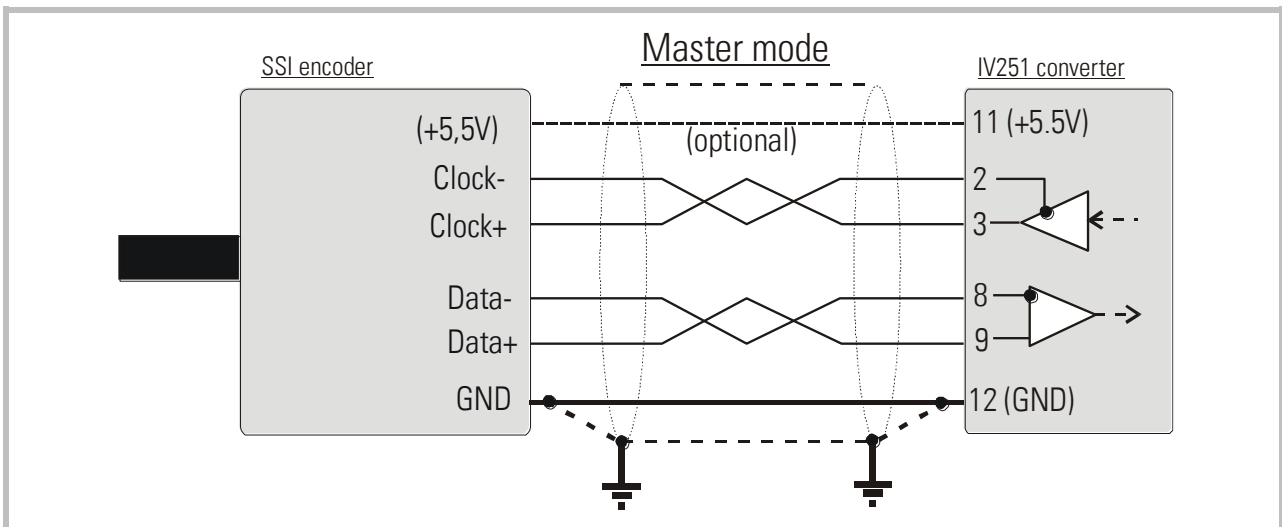
The subsequent diagram shows the assignment of the screw terminals.

We recommend to connect the Minus wire of the power supply to earth potential. GND terminals 4, 6 and 12 are connected internally. Depending on input voltage and load of the auxiliary voltage output, the total power consumption of the unit is about 200 mA.



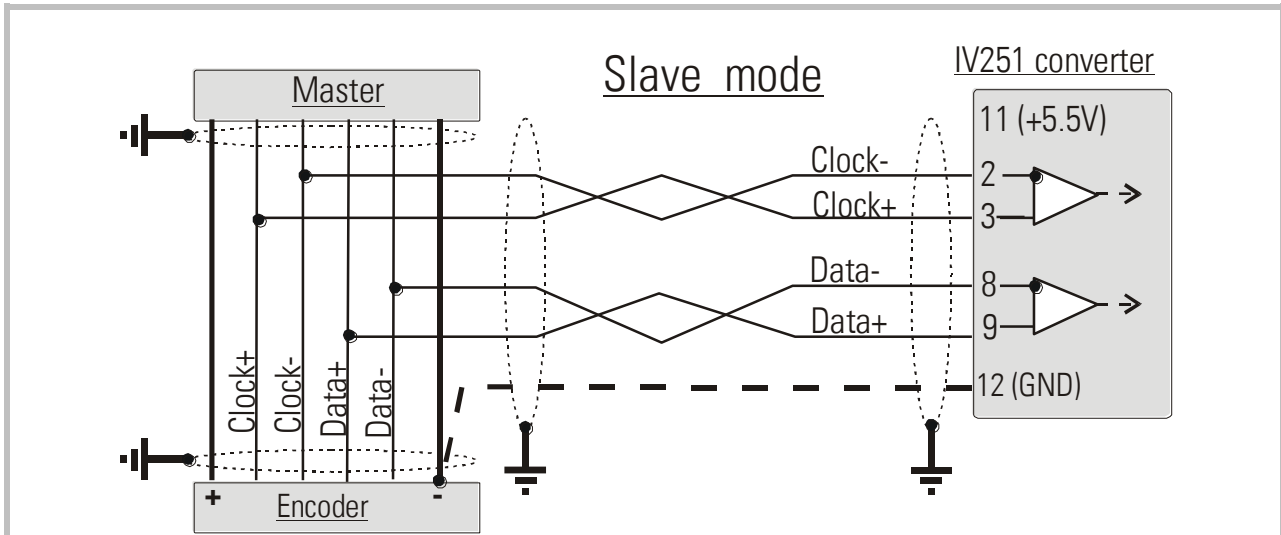
3.1. Encoder connections with Master operation

We recommend to connect the screen to the Minus wire of the encoder supply voltage on both sides.



3.2. Encoder connections with Slave operation

With this mode, the IV251 converter operates in parallel to another unit, acting as a „listener“ to the existing data communication. Quite according to need, the common potential of the master can be connected to terminal 12 (GND), or remain open for fully differential operation.

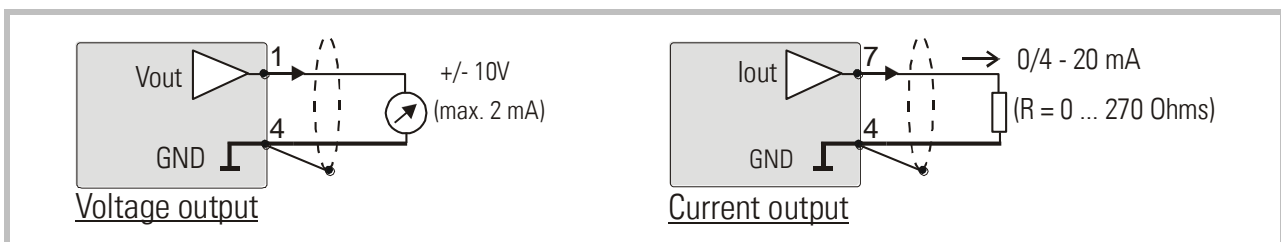


3.3. Analog outputs

The unit provides one +/-10V voltage output and one 0 ... 20 mA / 4 ... 20 mA current output at a resolution of 14 Bits (i.e. the voltage output operates in steps of 1.25 mV).

The nominal load of the voltage output is 2 mA; the current output accepts loads between 0 and 270 Ohms.

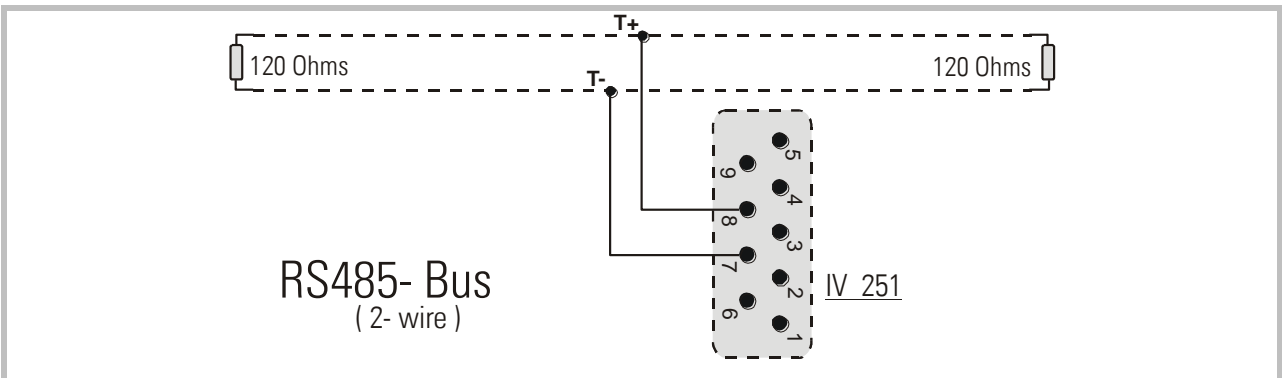
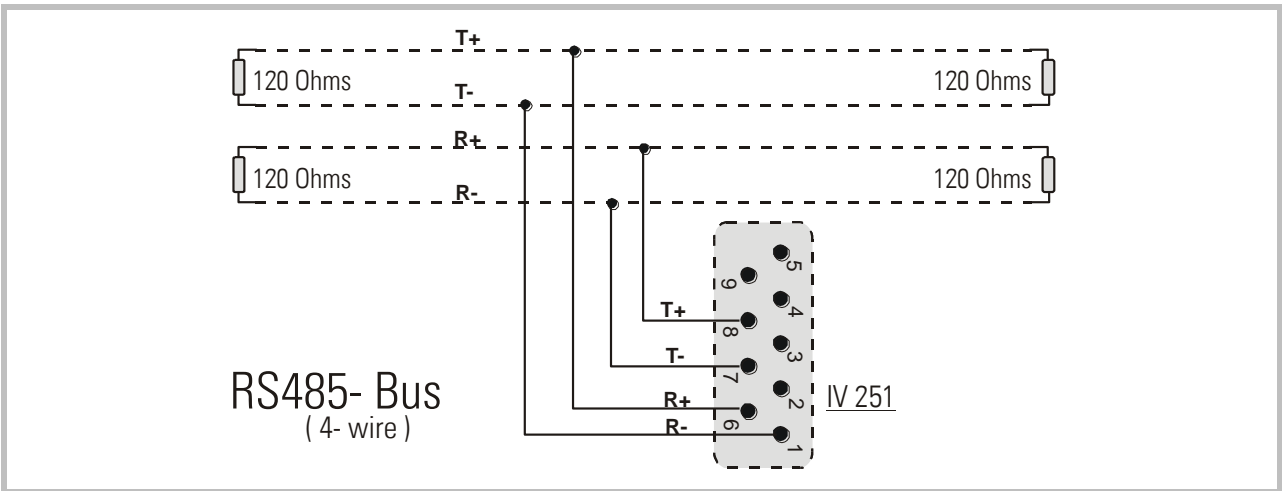
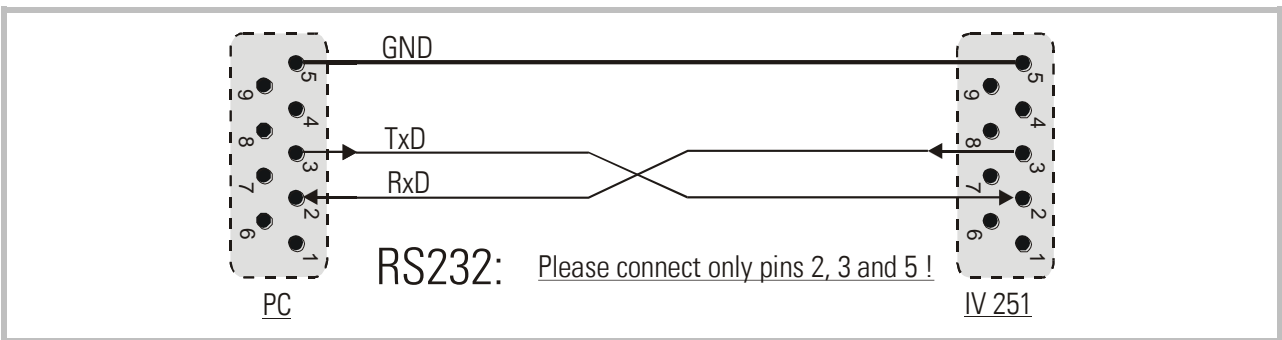
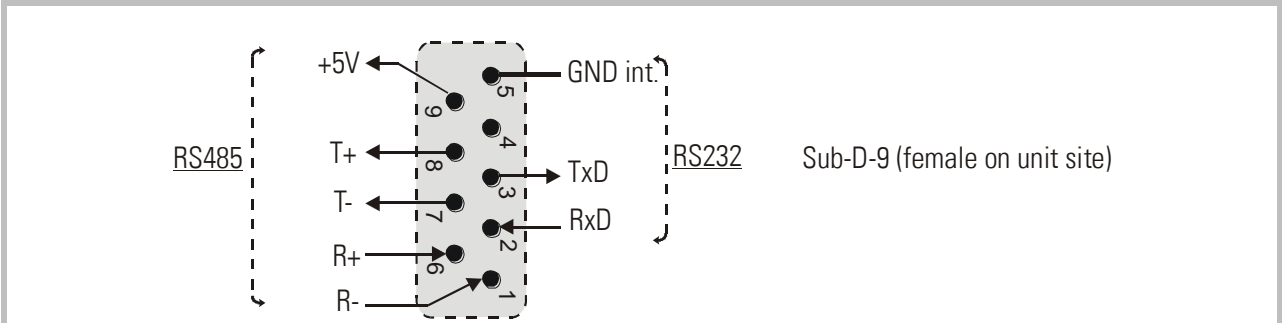
There is a separate analog ground terminal, which internally is connected to the GND potential of the power supply



Important note: "Voltage out" and "Current out" cannot be used together. Please do never connect mA and V simultaneously!

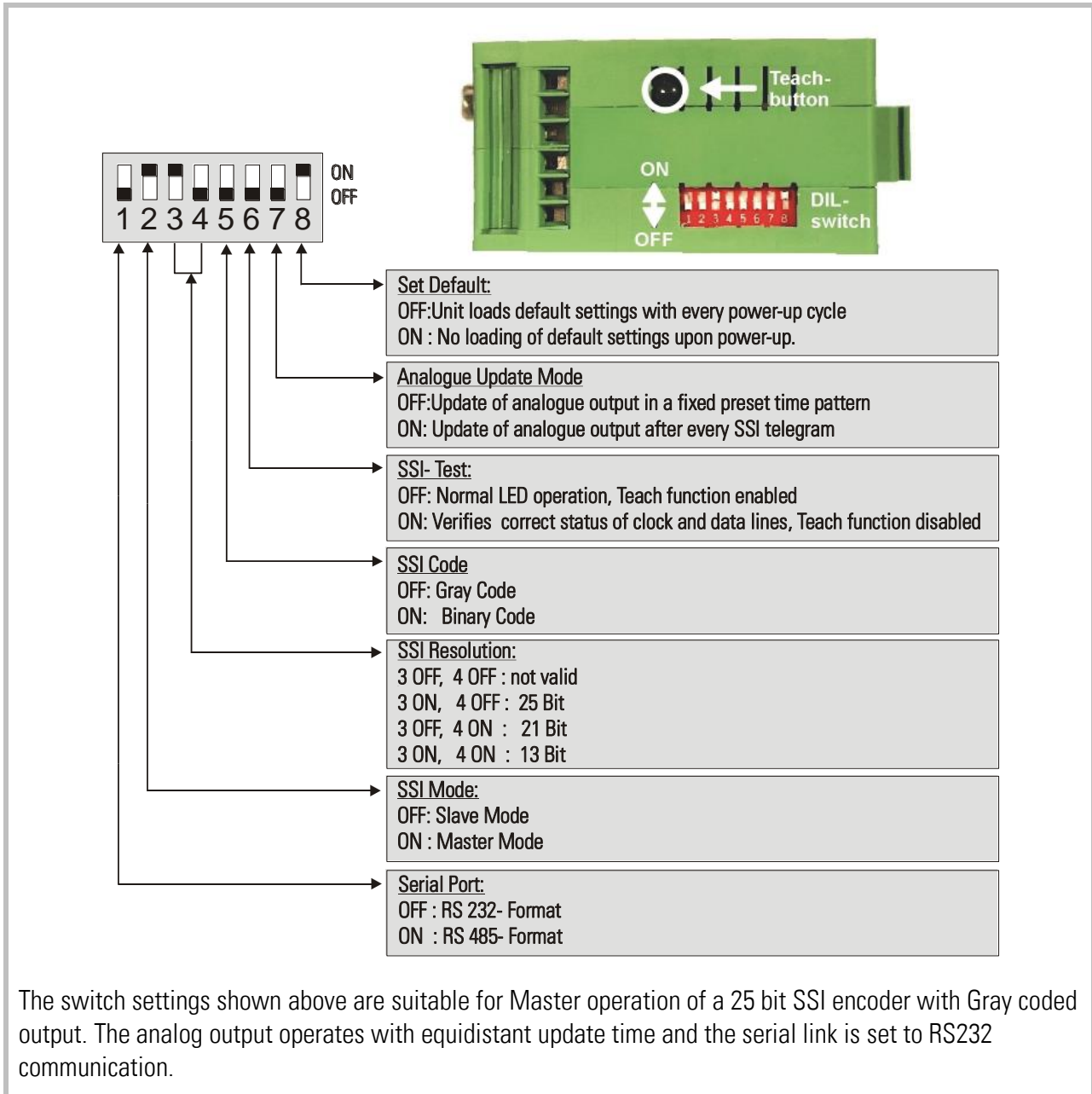
3.4. Serial interface

The unit provides a RS232 interface and a RS485 interface, however only one of the two can be used at a time. Serial communication allows to read out the encoder position and to set parameters and variables by PC, according to need.



4. DIL switch settings

The DIL switch located on the top site of the unit provides customer-specific settings of desired operation modes.



- Changes of the switch settings will become active only after the next power-up cycle!
- After setup and commissioning, please set DIL switch position 6 to ON. If set to OFF, any inadvertently touch of the „Teach“ button would overwrite your previous scaling input!

5. Commissioning

With basic applications, you can use the Teach procedure for commissioning of the unit. Extended functions need a PC for setup and are described later.

5.1. Self-test:

Set all DIL switches according to your application and connect encoder and power supply to the unit. Set switch position No. 6 to ON first (test mode) and power the unit up. The green LED (power) and the yellow LED (status) must light both. After a successful self-test, the yellow LED must switch off again (approx. 1 sec.)

5.2. SSI signal test:

Push the Teach button one time now. This will verify the SSI Data lines. The yellow LED must switch on. Where it remains off, you need to cross the input lines "Data+" (9) and "Data-" (8).

The second actuation of the Teach button will test the SSI Clock lines in the same manner.

Again, the LED must be lit, otherwise you need to cross the lines "Clock+" (3) and "Clock-" (2).*)

The third actuation of the Teach button will switch the LED off and conclude the test cycle.

Where you find your status LED lit after the first and the second actuation of the button, your wiring of the encoder is o.k. Please power the unit down and set DIL position 6 to OFF for Teach operation. With use of a PC and the OS32 operator software, you can check the status also from the indicator boxes „Status SSI clock“ and „Status SSI data“ (red = status o.k.)

*) Testing the clock lines is primarily useful with Slave operation. Though the test works also in Master mode, the result says only that the internal generation of the clock works fine. However, with Master mode, this test cannot indicate faulty clock drivers or bad wiring of the clock lines.

5.3. Scaling of the analog output with use of the Teach function:

Power the unit up again, with DIL position 6 set to OFF. Press the Teach button one time.

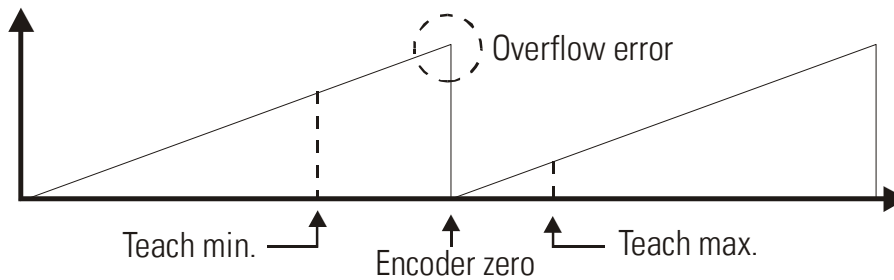
The status LED will blink in a slow sequence now while the unit waits for the zero position. Move your encoder to where you like zero output and press the button again.

This stores your zero definition and the LED will blink in a fast sequence now while the unit waits for the full scale position. Move your encoder to where you desire full scale output and press the button once more.

This stores your full scale definition and the LED will switch off. Your analog output is now set to the desired operating range, as selected by the output mode setting.



- Your full scale position is allowed to be higher or lower than the zero position
- More scaling facilities and linearization functions are available with PC setup.
- Teach min" always refers to the initial output value defined by „Output mode", i.e. 0 volts or 0 mA or 4 mA.
- When, after setting of the full scale position, the status LED does not switch off, this indicates an overflow error where the mechanical zero position of your encoder lies between your two teach settings. In this case you need to change the zero position of the encoder (mechanically or by corresponding programming of the encoder). With PC setup, the converter itself provides also an electronic suppression of the overflow jump.
- The only way to reset an overflow error state is to cycle the power supply.
- The LED overflow check may fail with encoders providing a resolution lower than 13 bits.



5.4. The Set Input:

With a HIGH signal on the Set input (terminal 10), the unit temporarily substitutes the SSI encoder data by a set value as entered to the "SSI Set Value" register, and the analog output as well as the serial readout will follow correspondingly. This means, independent of the actual mechanical position of the encoder, the unit internally uses the register data instead of the encoder SSI data. It turns back to normal encoder reading as soon as the Set signal goes LOW again.

This function can be very useful for testing and commissioning purpose.

The Set input uses PNP / HTL characteristics (LOW = open or 0 – 3 V, HIGH = 10 – 30 V)

6. Serial Readout of the Actual Encoder Position

You can read out the actual SSI position of the encoder at any time from the serial link. For setting of communication parameters, a PC is required.

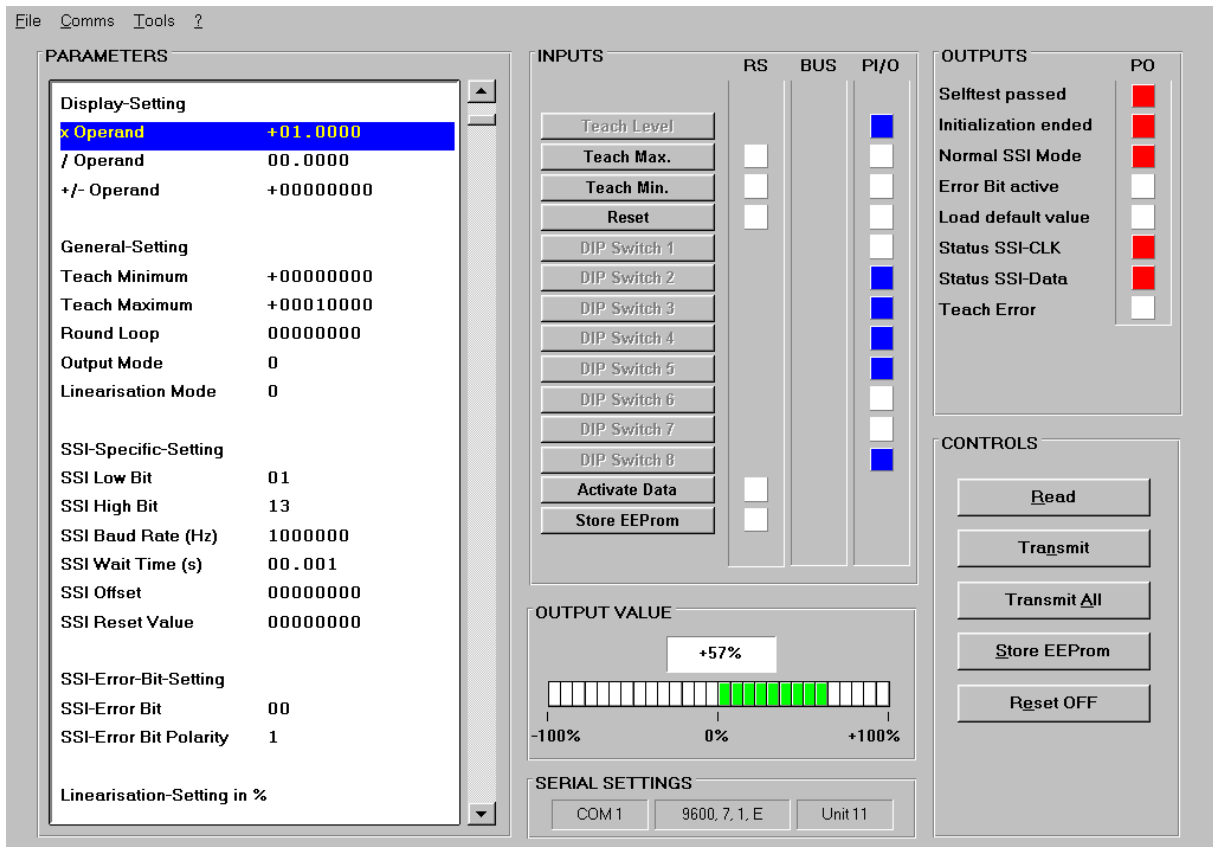
IV251 uses the DRIVECOM communication standard according to ISO 1745. Details about this protocol can be found in our file [Serpro1a.doc](#) which is available for download on the *motrona* homepage.

The serial access code for the actual encoder position is „ :8 „
(ASCII characters, colon and 8)

7. PC setup using the operator software OS32

You can apply the full set of functions when using a PC and our operator software OS32 for setup of the unit. You can download this software and full instructions, free of charge, from our homepage www.motrona.com.

- Connect your PC to the converter, using a serial RS232 cable like shown in section 3.4 of this manual. Make sure, the cable only connects pins 2, 3 and 5.
- Run the OS3.x software and you will find the following screen:



- In case your text and color fields remain empty and the headline says „OFFLINE“, you must verify your serial settings. To do this, select „Comms“ from the menu bar. Ex factory, all *motrona* units use the following serial standard settings:

Unit No. 11, Baud rate 9600, 1 start/ 7 data/ parity even/ 1 stop bit

- If the serial settings of the unit should be unknown, you can run the „SCAN“ function from the „TOOLS“ menu to find out.

8. Parameter Settings

8.1. Display Settings:

X Operand, / Operand, +/-Operand:

These operands serve for conversion of the position information transmitted by the encoder into other engineering units like millimeters or inches etc. This conversion only refers to the numeric readout value by serial link, but does not affect the scaling of the analog output.

With the settings $\frac{x \text{ Operand}}{/ \text{ Operand}} = \frac{1.0000}{1.0000}$ and $\frac{+/- \text{ Operand}}{0.0000}$

the serial readout value equals to the encoder value.

$$\text{Serial Readout} = \left[\text{SSI encoder data} \times \frac{x\text{Operand}}{/ \text{Operand}} \right] + \frac{+/- \text{Operand}}{0.0000}$$

8.2. General Settings:

Teach Minimum, Teach Maximum:

These two settings define the range of the encoder where the analog output should move between minimum and maximum output. At any time you can use the Teach button of the unit or the soft keys on the screen to set these registers*), but you are free to enter your settings directly by keyboard, without using the Teach function.

*) Click to Teach-Min (on) and again (off), then click to Teach-Max (on) and again (off). To activate your Teach results, click to "Activate Data", to read out and see your Teach results on the screen, click the "Read" key. All settings will be finally stored to the unit after clicking the "Store EEPROM" key.

Round Loop:

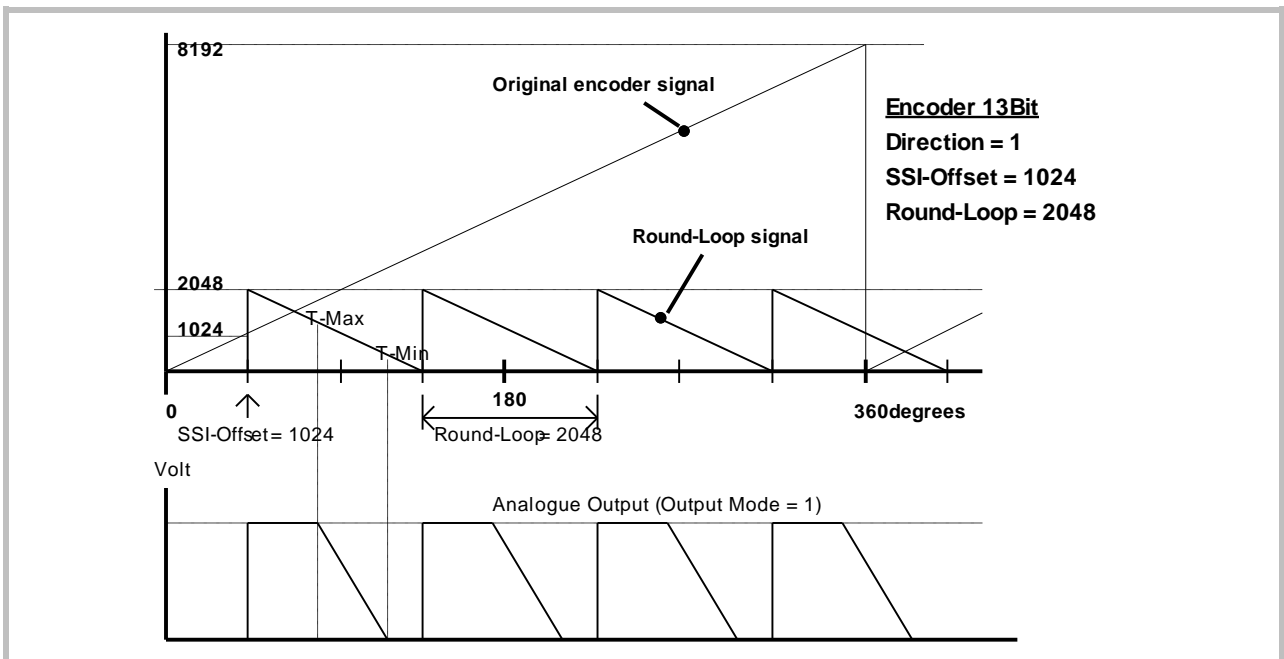
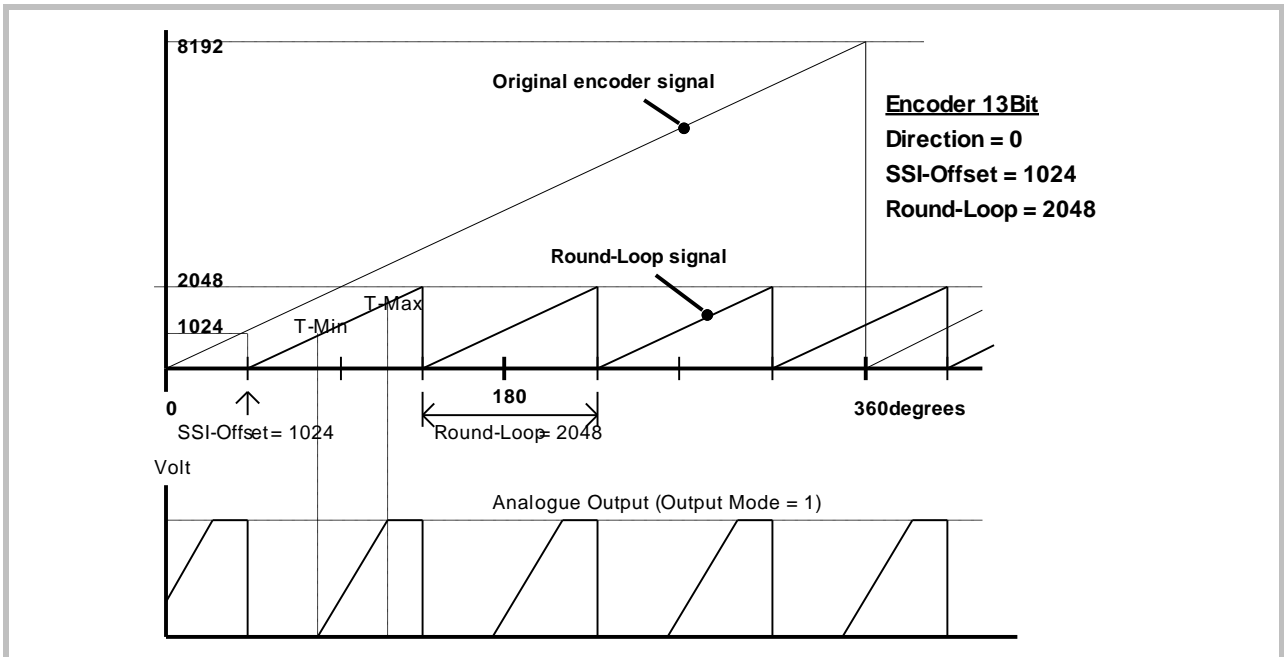
In general, this setting should be 00000. Any other settings will substitute the real encoder position by a repeating cycle count.

Example: when we set this register to 2048, the internal position register will only move in a range between 0 and 2047. When we underpass zero with reverse direction, again 2047 will appear. When we exceed 2047 with forward direction, we restart at 0 again.

The zero position of the round-loop counter can be set by register "SSI-Offset" which allows settings between 0 and the Round-Loop value. Register "Direction" allows to set the counting direction of the round loop counter (0 = up, 1 = down).

Within this new definition of a round-loop range, you are free to set the zero and full scale thresholds of your analog output again by means of Teach-Min. and Teach-Max. parameters.

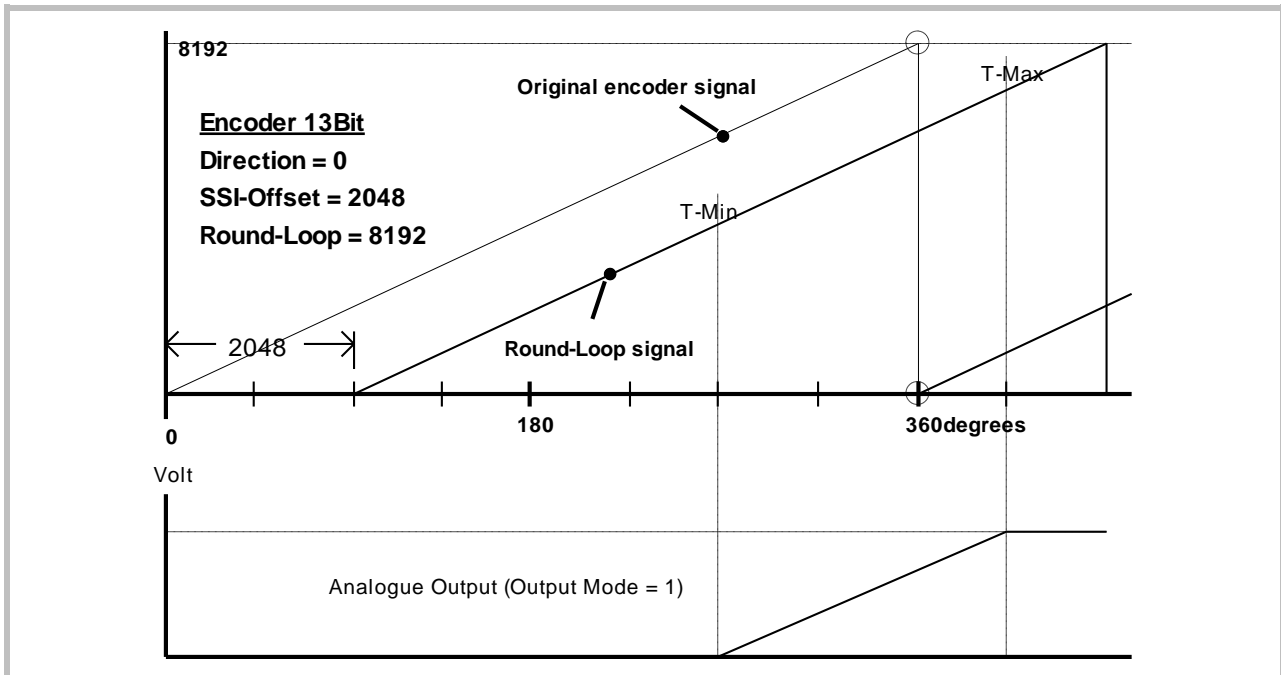
The following drawings explain the coherence between original encoder data, Round-Loop setting, SSI-Offset and Direction register.



The Round-Loop function is also suitable to suppress the encoder overflow, when the mechanical zero position of your encoder lies between your Teach-Min and Teach-Max values and you do not like to change the mechanical situation. As shown in the subsequent picture, you need to set the Round-Loop register to the full encoder resolution and then shift the zero transition by setting the SSI Offset correspondingly.

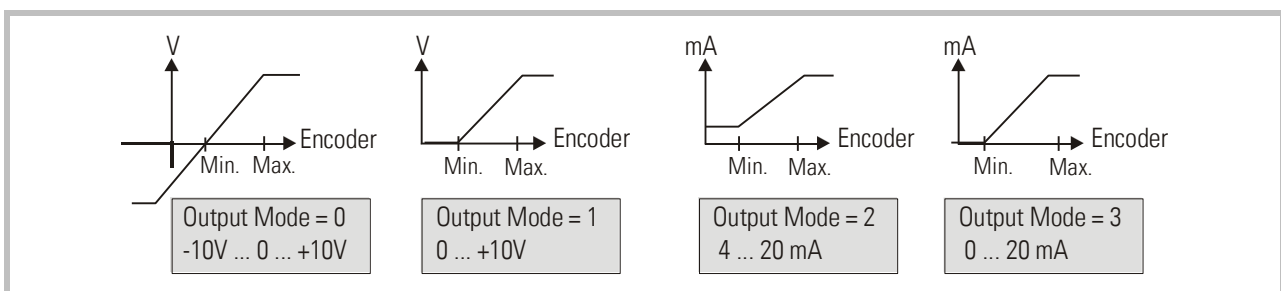


- Every change of the Round-Loop setting requires new entry of Teach-Min, Teach-Max and Offset values.
- With use of the Round-Loop function it is also possible to change the counting direction of the encoder, by setting the Direction bit correspondingly.
- After any action concerning the round-loop and direction settings, new entry of Teach-Min, Teach-Max and Offset becomes necessary.



Output Mode:

Selects the output format of the analog outputs like shown:



Linearisation Mode:

Sets the mode of linearisation:

- 0: Linearisation off, registers P1 to P16 do not affect the output characteristics.
- 1: Linearisation in a range of 0 – 100%
- 2: Linearisation over full range –100% to +100%

(See examples in section [9](#), "Free programmable Linearisation")

8.3. SSI Specific Settings:

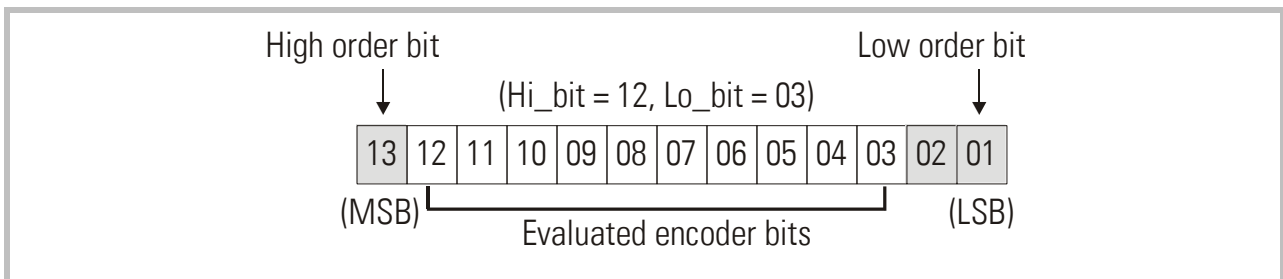
SSI Low Bit:

Defines the lowest bit (LSB) for evaluation, when the bit blanking function is used.
Must be set to "01" for evaluation of the full encoder range.

SSI High Bit:

Defines the highest bit (MSB) for evaluation, when the bit blanking function is used.
Must be set to the total number of encoder bits for evaluation of the full encoder range.

The following example uses a 13 bit encoder where High Bit is set to 12 and Low Bit is set to 03, resulting in evaluation of bits 03 to 12 only and blanking out positions 01, 02 and 13.



Hint for the use of the bit blanking function:

Bit blanking results in a different evaluation of the encoder information, and you should be fully aware of what happens with the resolution and the number of registered turns when you use this function.

The subsequent example uses a 13-bit single-turn encoder to explain two different results when blanking out one bit:

- Without blanking, a 13 bit encoder would provide a 0 – 8191 information with a 0 - 360° turn of the encoder shaft.
This would assume a setting of "High Bit = 13" and "Low Bit = 01".

It is easy to understand that there are two different ways how to use only 12 of the 13 bits available:

- When we set High Bit to 12 while Low Bit remains 01, we have blanked the high order bit. The result corresponds to an encoder providing information 0 – 4095 while we turn from 0 - 180°, and again the same 0 – 4095 information while we continue from 180° to 360°. The resolution remains unchanged with respect of the number of steps per revolution.
- We can also leave High Bit to 13 and set Low Bit to 02 instead. This means we blank the low order bit now. As a result, within one turn of 0 - 360°, we receive the encoder information 0 – 4095 one time only, but the total number of steps per revolution has been halved.

SSI Baud Rate:

Sets the communication speed of the SSI interface with SSI encoders.

Setting range: 100 Hz to 1MHz.

You are free to set any desired frequency between 0.1 kHz and 1000.0 kHz. For technical reasons however, in the upper frequency range with Master operation, the unit will only generate one of the following frequencies accurately:

1 000,0 kHz	888,0 kHz	800,0 kHz	727,0 kHz	666,0 kHz
615,0 kHz	571,0 kHz	533,0 kHz	500,0 kHz	470,0 kHz
444,0 kHz	421,0 kHz	400,0 kHz	380,0 kHz	363,0 kHz
347,0 kHz	333,0 kHz	320,0 kHz	307,0 kHz	296,0 kHz
285,0 kHz	275,0 kHz	266,0 kHz	258,0 kHz	250,0 kHz

With Master operation, other settings will result in generation of the next upper or lower value according to above list. With all settings < 250.0 kHz the error between set rate and generated rate becomes negligible.

It is mandatory to set the Baud rate also with Slave operation. In this case, however, the setting serves only to determine the pause time for correct synchronization (pause is detected after 4 clock cycles). The unit automatically synchronizes with every remote clock signal within the specified Baud rate range.

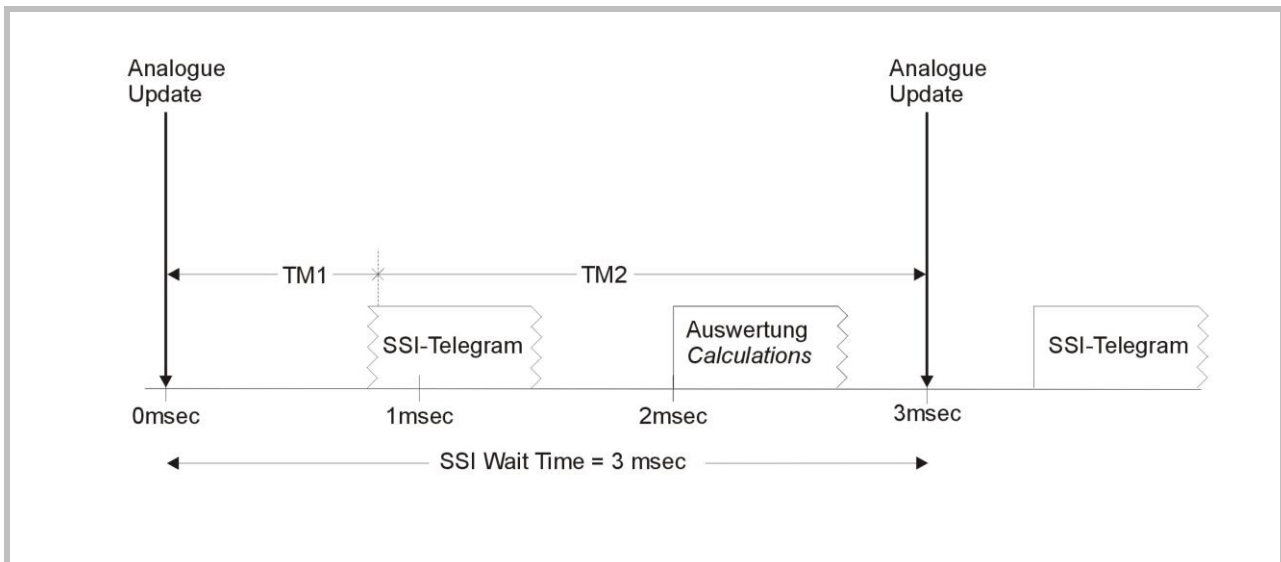
SSI Wait Time:

This register sets the waiting time between two SSI telegrams in a range from 0.001 to 99.999 sec. In normal operation, due to processor cycle times, the real time may vary by 512 μ sec. with respect to the preset time: The fastest sequence possible is 1.3 μ sec with a setting of 0.000.

With Slave operation mode, the distance of the SSI protocols depends on the remote Master and the SSI Wait Time specifies the distance of evaluation data strings. Setting to 100 msec results in evaluation of one telegram only every 100 msec, even though the Master may have transmitted many telegrams more.

Especially with applications of closed-loop control loops, it may be of advantage to have equidistant updating of the analog output (DIL switch 7 = OFF). This is possible with Master mode only, and the Wait Time setting (must be >0) directly corresponds to the time pattern of updates.

The subsequent drawing explains the timing with use of equidistant update mode with a SSI Wait Time setting of 3 msec.



- The shortest possible time for equidistant updating is 1.3 msec, due to internal processing times (SSi Wait Time set to 0.001).
- The time marks TM1 and TM2 shown in above diagram can be displayed with the Monitor function of the PC operator software. It is easy to understand that the sum of both times must be equal to the Wait Time setting; other-wise you must increase the Baud rate or choose a longer update cycle. (The serial access codes are :3 for TM1 and :5 for TM2).
- In critical cases you can reduce the internal processing times of the unit, by omitting the conversion of serial RS232 encoder data. For this, just set parameter "/Operand" to 00000.

SSi Offset:

Defines the electrical zero position of the encoder with respect to the mechanical zero position. When the Round-Loop function is not active (Round-Loop = 0), the SSi Offset is subtracted from the SSi position reading, which can also cause negative results. When the Round-Loop is active, SSi Offset displaces the mechanical zero position, but always with only positive results.

SSi Set Value:

Applying a remote Set signal to the Set input (terminal 10) results in a temporary substitution of the SSi position value by the SSi Set Value entered here. This function allows easy testing and simulation of fixed analog output values while commissioning.

8.4. SSI Error Settings:

SSI Error Bit:

Defines the position of the error bit, if available with the encoder you use. Errors indicated by the encoder can be read out via serial code `;9` (semicolon nine, error indication = 2000hex). In case of an error, on your PC screen, the "Error Bit active" box will appear red and the front LED will blink at a 1:4 On/Off ratio.

- 00: no error bit available
- 13: bit 13 represents the error bit
- 25: bit 25 represents the error bit etc.

SSI Error Bit Polarity:

Defines the polarity of the Error Bit

- 0: Bit is LOW in case of error
- 1: Bit is HIGH in case of error

8.5. Linearisation Settings in %:

P01 (x), P01 (y) etc:

Linearisation registers as shown in section [9](#).

8.6. Setup Settings:

Analogue Offset:

This register can adjust the analog zero output in a range of approx. +/- 100mV (respectively +/- 200 μ A), if necessary.

Analogue Gain:

Sets the maximum output swing of the analog output.

Setting of 1000 results in a 10 volts respectively 20 milliamps output swing.

Direction:

This parameter changes the internal direction of counting (0 or 1), provided the unit operates in the Round Loop mode.

Any changes of the Round Loop or Direction registers require a new Teach procedure.

8.7. RS232 / RS485 Parameter Settings

Parameter	Description																																												
Unit Number :	<p>It is necessary to attach a specific address to each unit, since up to 32 units can be connected to the same bus with RS485 systems. You can choose any address number between 11 and 99.</p> <p>Factory setting = 11</p> <p>The address must <u>not</u> contain a "0" because these numbers are reserved for collective addressing.</p>																																												
Serial Baud Rate:	<table border="1"> <thead> <tr> <th>Setting</th> <th>Baud-Rate</th> </tr> </thead> <tbody> <tr> <td>0*</td> <td>9600</td> </tr> <tr> <td>1</td> <td>4800</td> </tr> <tr> <td>2</td> <td>2400</td> </tr> <tr> <td>3</td> <td>1200</td> </tr> <tr> <td>4</td> <td>600</td> </tr> <tr> <td>5</td> <td>19 200</td> </tr> <tr> <td>6</td> <td>38 400</td> </tr> </tbody> </table> <p style="text-align: center;">* = Factory setting</p>	Setting	Baud-Rate	0*	9600	1	4800	2	2400	3	1200	4	600	5	19 200	6	38 400																												
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Serial Format:	<table border="1"> <thead> <tr> <th>Setting</th> <th>Data bits</th> <th>Parity</th> <th>Stop bits</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>7</td> <td>even</td> <td>1</td> </tr> <tr> <td>1</td> <td>7</td> <td>even</td> <td>2</td> </tr> <tr> <td>2</td> <td>7</td> <td>odd</td> <td>1</td> </tr> <tr> <td>3</td> <td>7</td> <td>odd</td> <td>2</td> </tr> <tr> <td>4</td> <td>7</td> <td>none</td> <td>1</td> </tr> <tr> <td>5</td> <td>7</td> <td>none</td> <td>2</td> </tr> <tr> <td>6</td> <td>8</td> <td>even</td> <td>1</td> </tr> <tr> <td>7</td> <td>8</td> <td>odd</td> <td>1</td> </tr> <tr> <td>8</td> <td>8</td> <td>none</td> <td>1</td> </tr> <tr> <td>9</td> <td>8</td> <td>none</td> <td>2</td> </tr> </tbody> </table> <p style="text-align: center;">* = Factory setting</p>	Setting	Data bits	Parity	Stop bits	0	7	even	1	1	7	even	2	2	7	odd	1	3	7	odd	2	4	7	none	1	5	7	none	2	6	8	even	1	7	8	odd	1	8	8	none	1	9	8	none	2
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6	8	even	1																																										
7	8	odd	1																																										
8	8	none	1																																										
9	8	none	2																																										
Serial Protocol:	<p>Determines the sequence of characters sent, when you use the serial output for cyclic data transmission under timer control (xxxxxxx is the measuring value transmitted). The length of the transmitted value is dependent on its current value.</p> <p>Both print formats are shown in the following table:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th colspan="10">Unit No.</th> </tr> </thead> <tbody> <tr> <td>Serial Protocol = 0*:</td> <td>1</td> <td>1</td> <td>+/-</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>LF</td> <td>CR</td> </tr> <tr> <td>Serial Protocol = 1 :</td> <td></td> <td></td> <td>+/-</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>LF</td> <td>CR</td> </tr> </tbody> </table> <p style="text-align: center;">* = Factory setting</p>		Unit No.										Serial Protocol = 0*:	1	1	+/-	X	X	X	X	X	X	LF	CR	Serial Protocol = 1 :			+/-	X	X	X	X	X	X	LF	CR									
	Unit No.																																												
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Serial Protocol = 1 :			+/-	X	X	X	X	X	X	LF	CR																																		

Parameter	Description										
Serial Timer:	<p>This register determines the cycle time in seconds for cyclic transmission when the Printer Mode is switched on. Range 0.001 to 99.999 seconds. With setting "0" all cyclic transmission is switched off and the unit will only send data upon request (PC mode *).</p>										
Serial Value:	<p>Sets the code of the register of which the content should be sent with cyclic transmission. Setting range 00** – 09 (corresponds to register codes ;0 to ;9) and 10 - 19 (corresponds to register codes ;0 to ;9). For clarification of register codes see the following figure. The most important register codes are:</p> <table border="1" data-bbox="427 719 986 945"> <thead> <tr> <th>Register</th> <th>ASCII</th> </tr> </thead> <tbody> <tr> <td>Analog Voltage</td> <td>:1</td> </tr> <tr> <td>Calculation (Display)</td> <td>:8</td> </tr> <tr> <td>SSI Value</td> <td>:9</td> </tr> <tr> <td>SSI Value (HW)</td> <td>;0</td> </tr> </tbody> </table> <div data-bbox="443 981 1423 1886" data-label="Diagram"> <pre> graph TD subgraph IV251_Overview [IV251 Overview] direction TB HW1[Hardware] --> SSI_HW[SSI Value (HW) (Code ;0)] SSI_HW --> Eval_HW[Evaluation of the Hardware Value] Eval_HW --> SSI_Val[SSI-Value (Code ;9)] SSI_Val --> Eval_SSI[Evaluation of the SSI Value] Eval_SSI --> Display_Val[Display-Value (Code ;8)] Eval_SSI --> Analog_Volt[Analog Voltage (Code ;1)] Analog_Volt --> HW2[Hardware] HW1 --- C1["- SSI Format (13,21,25 bit)"] Eval_HW --- C2["- Bin/Gray Code - Bit Blanking - SSI Error Bit"] Eval_SSI --- C3["- Calculate Display Value - Round_Loop - ... - Calculate Analog Value"] end </pre> <p>** = Factory Setting</p> </div>	Register	ASCII	Analog Voltage	:1	Calculation (Display)	:8	SSI Value	:9	SSI Value (HW)	;0
Register	ASCII										
Analog Voltage	:1										
Calculation (Display)	:8										
SSI Value	:9										
SSI Value (HW)	;0										



*) The serial port of the unit can operate in either "PC-Mode" or in "Printer Mode".

With "PC-Mode", the unit receives a request string and responds with a corresponding data string. For details of the protocol see separate description "SERPRO".

With "Printer Mode" the unit sends data without any request and under Timer control as described subsequently. As soon as the unit receives a character, it automatically switches over to PC Mode and operates according to protocol. When for a period of 20 sec. no character has been received, the unit switches automatically back to "Printer Mode" and starts cyclic data transmission again.

9. Free programmable Linearisation

This programmable feature allows the user to convert a linear motion to a non-linear analog output and vice-versa. There are 16 programmable interpolation points available, which can be set in any desired distance over the full conversion range. Between two points, the unit uses linear interpolation. Therefore it is advisable to use more points in a range with strong curves and only a few points where the curvature is less.

To specify your desired linearization curve, you must first set the „Linearisation Mode“ register to either 1 or 2.

Use registers **P1(x)** to **P16(x)** to specify the coordinates on the x-axis. These are the analog output values that the unit normally would generate according to the actual encoder position. These settings must be in % of full scale.

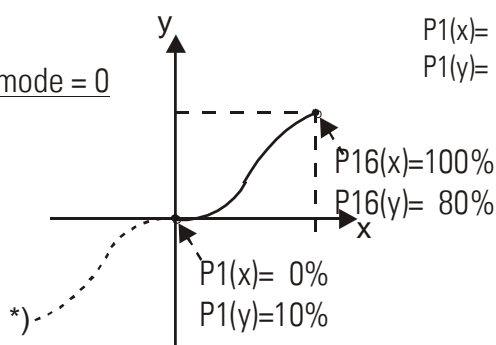
Now enter the attached values to registers **P1(y)** to **P16(y)**. These are the values that the analog output will generate instead of the x- values.

As an example, the value of P2(y) will substitute the encoder value P2(x) etc.

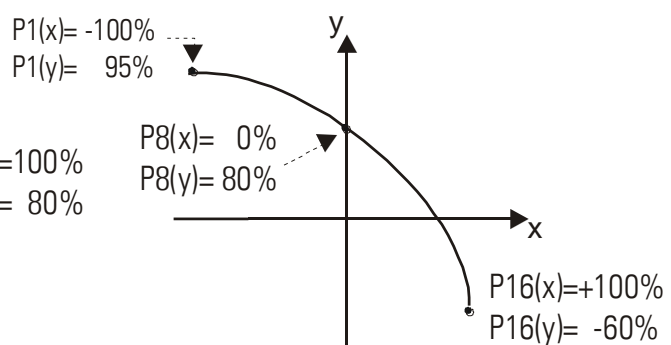


- x-registers must use continuously increasing settings, i.e. P1(x) must have the lowest setting and P16(x) must have the highest setting
- All entries use a percentage format of xx.xxx% full scale. Setting 0.000% means zero output and setting 100.000% means full scale output.
- With Linearisation Mode set to 1, it is a must to set P1(x) to 0% and P16(x) to 100%. Linearization is defined in the positive range only and the negative range will be a mirror image of the positive range with reference to zero
- With Linearisation Mode set to 2, it is a must to set P1(x) to -100% and P16(x) to +100%. This enables the user to set curves which are not symmetric to the zero position.

*) Output mode = 0

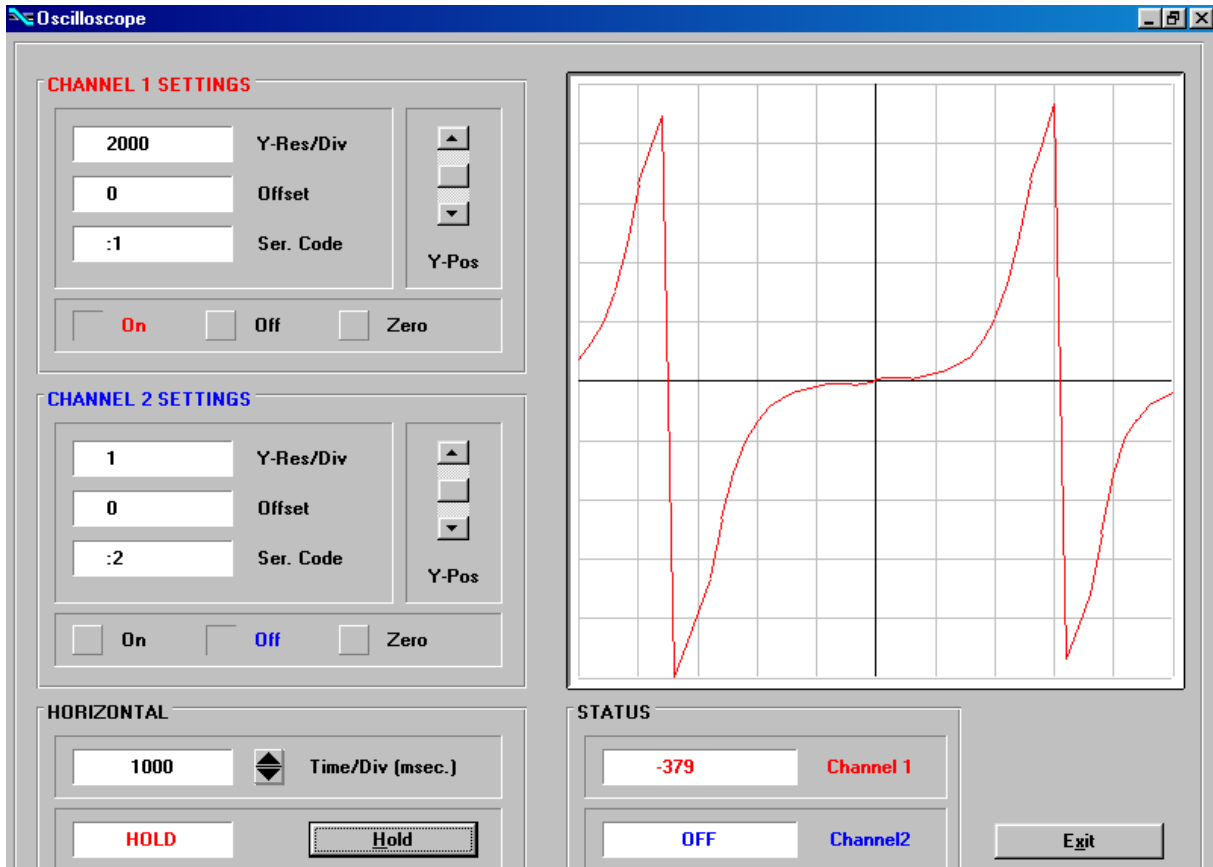


Linearisation Mode = 1



Linearisation Mode = 2

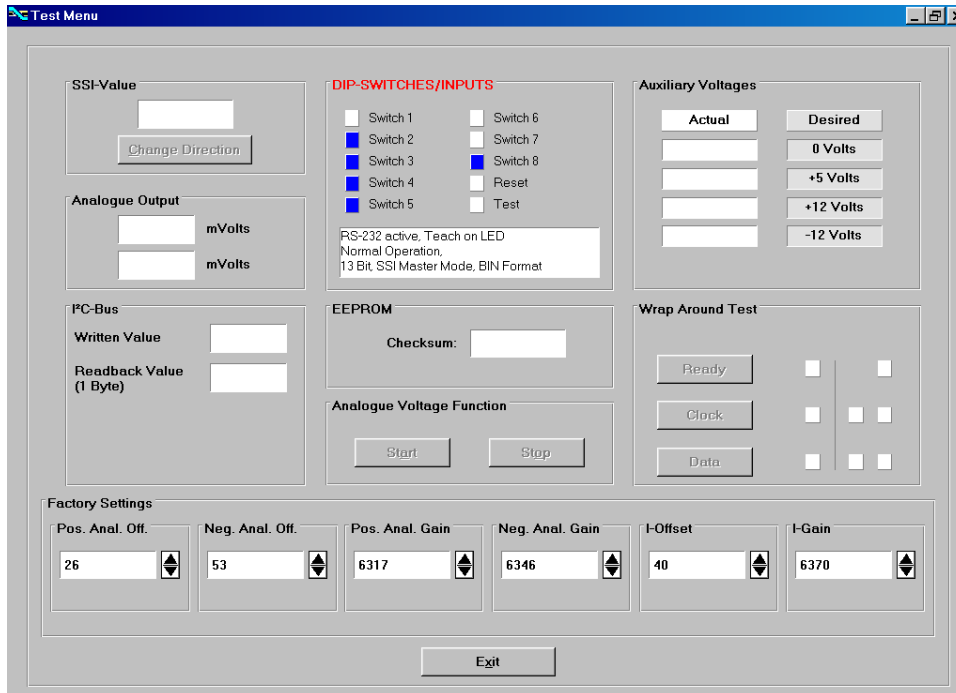
You can visualize your curve on the PC screen or by means of an external oscilloscope. For this, select TOOLS, then TEST and there „Analogue Voltage Function“. The unit will now simulate a repeating motion of the encoder over the full range and generate the analog signal accordingly. When you use the Scope function of the operator software, you must set the serial code „:1 „ to record the analog output.



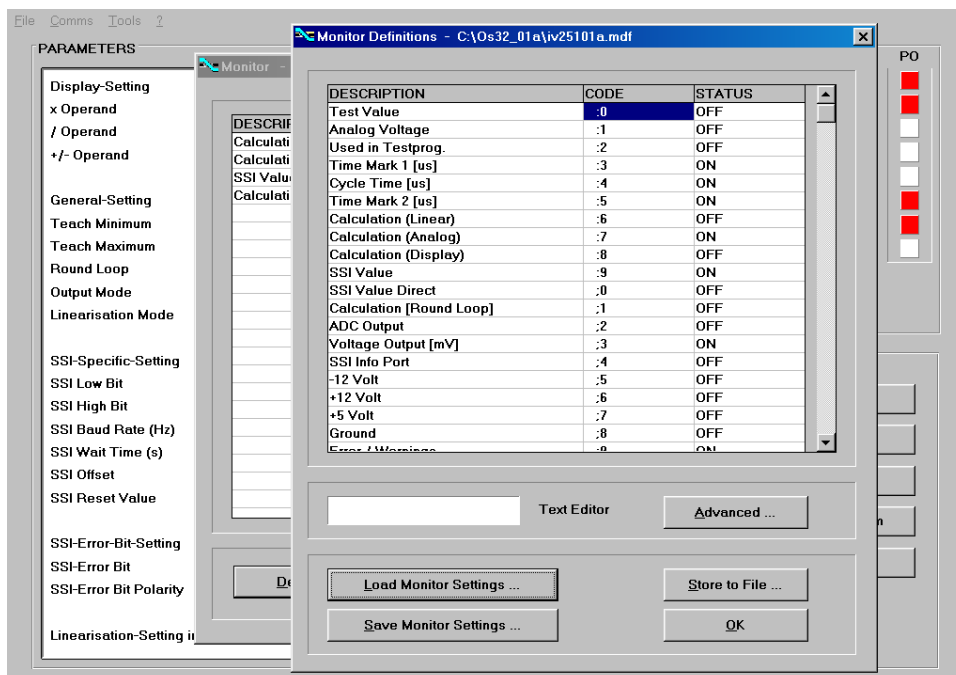
10. Testing Functions

When you select TEST from the TOOLS menu, you are able to verify the following data, by clicking to the corresponding field:

- Actual encoder position
- DIL switch settings
- Internal supply voltages
- Analog output state



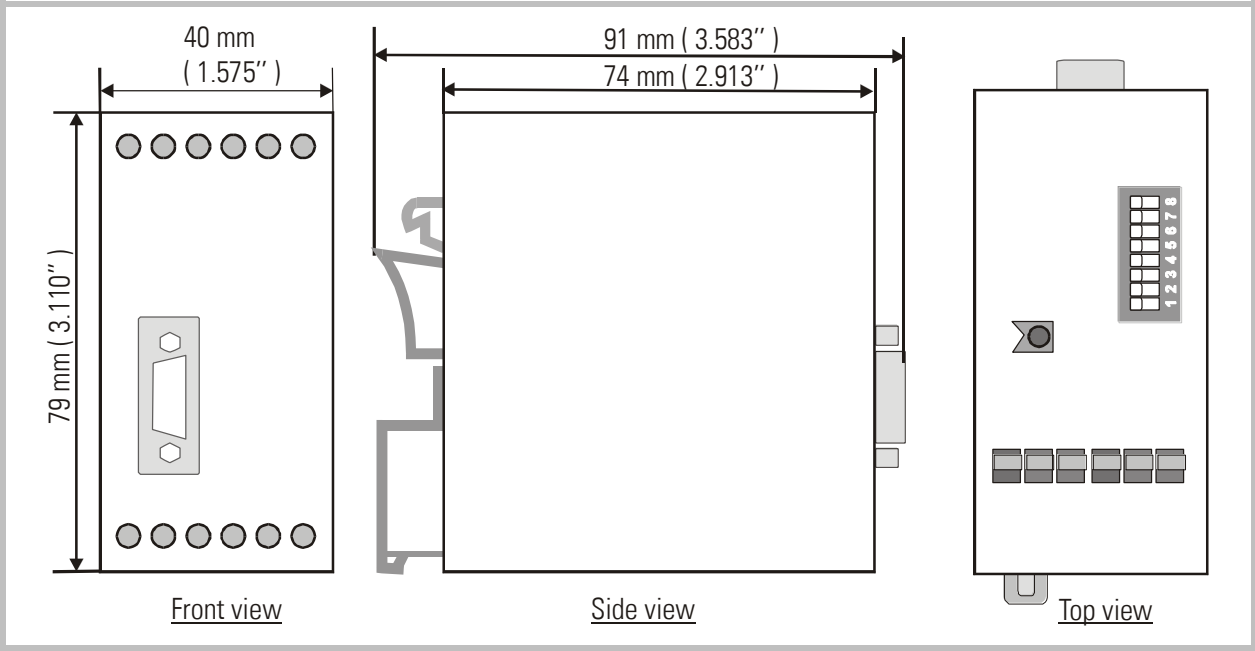
Furthermore, the following registers can be recorded by using the monitor function:



11. Technical Specifications

Power supply:	Input voltage: 18 ... 30 VDC Protection circuit: reverse polarity protection Ripple: $\leq 10\%$ at 24 VDC Consumption: approx. 170 mA (unloaded) Connections: screw terminal, 1.5 mm ² / AWG 14
Sensor supply:	Output voltage: + 5.5 VDC Output current: max. 150 mA Connections: screw terminal, 1.5 mm ² / AWG 14
SSI interface:	Inputs (SSI, TTL): TTL differential, RS422 Frequency range: 100 Hz ... 1 MHz Resolution: 13, 21 or 25 Bit SSI interval time: min. 4 x clock Connections: screw terminal, 1.5 mm ² / AWG 14
Control input:	Input logic: PNP, active high Signal levels: HTL: LOW: 0 ... 3 V, HIGH: 10 ... 30 V Function: set/preset Pulse time (Set): min. 10 ms Internal resistance: $R_i \approx 5\text{ k}\Omega$ Connections: screw terminal, 1.5 mm ² / AWG 14
Analog output:	Voltage output: -10 ... +10 V / 0 ... 10 V (max. 2 mA) Current output: 0 ... 20 mA / 4 ... 20 mA (burden: max. 270 Ω) Resolution: 14 Bit (± 13 Bit) Accuracy: 0.1 % Stabilization time: 2 ms Connections: screw terminal, 1.5 mm ² / AWG 14
Serial interface:	Format: RS232 or RS485 (selectable) Baud rate (selectable): 600, 1200, 2400, 4800, 9600 (default), 19200, 38400 baud Operation modes: PC or printer mode Connections: SUB-D connector (female), 9-pin
Housing:	Material: plastic Mounting: 35 mm top hat rail (according to EN 60715) Dimensions (w x h x d): 40 x 79 x 91 mm / 1.5748 x 3.1102 x 3.5827 inch Protection class: IP20 Weight: approx. 190 g
Ambient temperature:	Operation: 0 °C ... +45 °C / +32 ... +113 °F (not condensing) Storage: -25 °C ... +70 °C / -13 ... +158 °F (not condensing)
Failure rate:	MTBF in years: 65.6 a (long-term usage at 60 °C / 140 °F)
Conformity & standards:	EMC 2004/108/EC: EN 61000-6-2, EN 61000-6-3, EN 61000-6-4 RoHS 2011/65/EU: EN 50581

12. Dimensions



13. Parameter-List

Parameter	Min. value	Max. value	Default	Positions	Char.	Serial Code
X Operand	-10.0000	+10.0000	1.0000	+/- 6	4	00
/ Operand	0	10.0000	1.0000	6	4	01
+/- Operand	-99999999	99999999	0	+/- 8	0	02
Teach Minimum	-99999999	+99999999	0	+/- 8	0	03
Teach Maximum	-99999999	+99999999	10000	+/- 8	0	04
Round Loop	0	99999999	0	8	0	05
Output Mode	0	3	0	1	0	06
Linearisation Mode	0	2	0	1	0	07
SSI Low Bit	0	25	1	2	0	08
SSI High Bit	1	25	25	2	0	09
SSI Baud rate	100	1000000	100000	7	0	10
SSI Wait Time	0	10.000	0	5	3	11
SSI Offset	0	99999999	0	8	0	12
SSI Reset Value	0	99999999	0	8	0	13
SSI Error Bit	0	25	0	2	0	14
SSI Error Bit Polarity	0	1	0	1	0	15
P1(x)	-100.000	+100.000	100000	+/- 6	3	A0
P1(y).....	-100.000	+100.000	100000	+/- 6	3	A1
P16(x)	-100.000	+100.000	100000	+/- 6	3	D0
P16(y)	-100.000	+100.000	100000	+/- 6	3	D1
Direction	0	1	0	1	0	46
Analog Offset	-99	+99	0	+/-2	0	47
Analog Gain	0	10000	1000	5	0	48
Unit Number	0	99	11	2	0	90
Serial Baud Rate	0	6	0	1	0	91
Serial Format	0	9	0	1	0	92
Serial Protocol	0	1	0	1	0	30
Serial Timer	0	99.999	0	5	3	31
Serial Value	0	19	0	2	0	32
Reserve	0	10000	0	5	0	33