control – motion – interface

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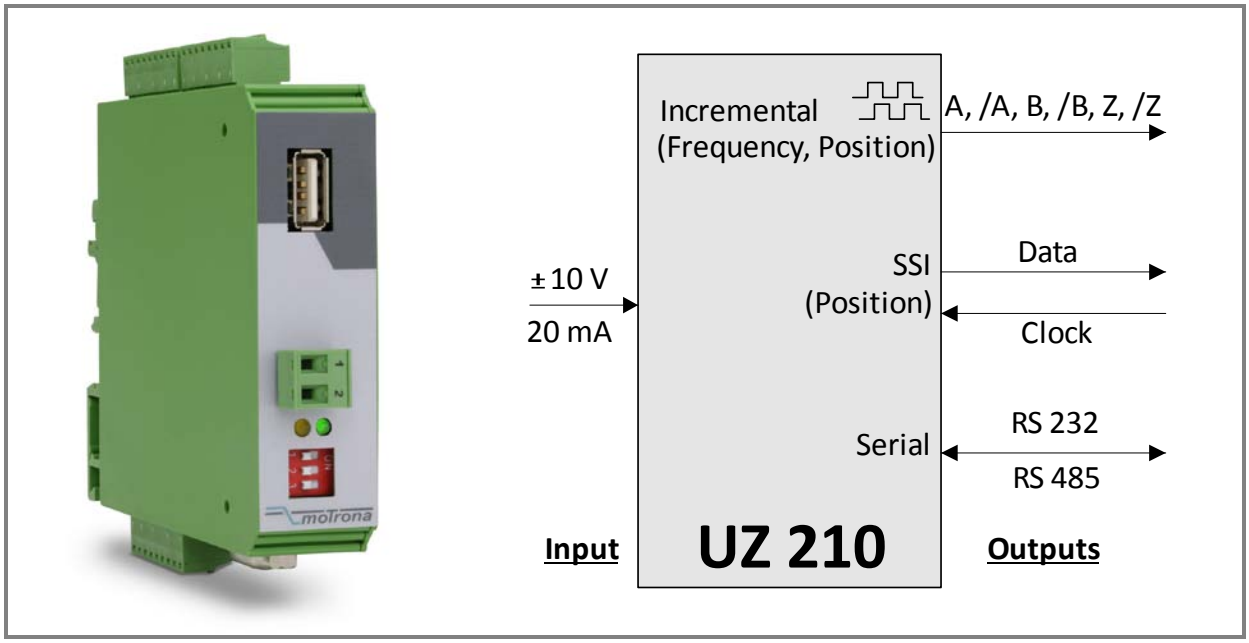
UZ 210

Universal Converter for Analogue Input Signals

Output Formats:
- Position (incremental or SSI)
- Frequency (incremental)
- Serial RS232/RS485



- Signal inputs ±10 V or 0/4 – 20 mA
- Frequency output proportional to the input (HTL or TTL level, max. 1 MHz)
- Incremental encoder output and SSI interface, for digital expression of linear or angular positions as a result of analogue inputs
- Incremental direction signal A/B under control of input signal and parameter settings
- Programmable marker impulse output (Z, /Z)
- Programmable curves with optionally repeating curve cycles, additional control functions similar to a "motorized potentiometer"
- USB port and serial RS232/RS485 interface

Operating Instructions

Safety Instructions

- This manual is an essential part of the unit and contains important hints about function, correct handling and commissioning. Non-observance can result in damage to the unit or the machine or even in injury to persons using the equipment!
- The unit must only be installed, connected and activated by a qualified electrician
- It is a must to observe all general and also all country-specific and application-specific safety standards
- When this unit is used with applications where failure or maloperation could cause damage to a machine or hazard to the operating staff, it is indispensable to meet effective precautions in order to avoid such consequences
- Regarding installation, wiring, environmental conditions, screening of cables and earthing, you must follow the general standards of industrial automation industry
- - Errors and omissions excepted –

General instructions for cabling, screening and grounding can be found in the SUPPORT section of our website http://www.motrona.com

Version:	Description
ZU21001a_af_hk/Feb12	First edition

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1. Introduction

UZ 210 is a versatile and competitive signal converter and frequency generator for use with industrial applications in drive and automation technology. The unit accepts analogue input signals (0 - ±10 V, 0 - 20 mA or 4 - 20 mA) for conversion to digital output signals. Due to an inbuilt reference voltage source it is also easy to connect potentiometers or similar analogue transducer systems to the input of the unit.

The front USB port shown in this manual will be available from version UZ210.02 on only.

1.1. Operation as Signal Converter

The conversion output generated from the analogue input is available with following formats:

- Frequency
  The unit converts the analogue input into a proportional output frequency with a free programmable range between 0,01 Hz and 1 MHz. A full set of impulse channels A, /A, B, /B, Z, /Z is available and the direction information (A, B, 90°) automatically considers the actual state and course of the analogue input with regard to the related parameter settings. An external voltage connected to terminal [Com+] defines the output voltage level (range 5 - 30 V). Where no remote voltage has been applied (Com+ unconnected), the unit automatically provides a 4 volts output (TTL compatible).
- Linear or angular position with incremental representation
  The unit converts the analogue input into a positional or angular information similar to an incremental encoder. This means that e.g. the rotation angle of an analogue potentiometer shaft converts to real incremental encoder information. The unit provides a full set of output channels A, /A, B, /B, Z /Z, and the directional information (A, B, 90°) fully follows the mechanical motion of the potentiometer. The impulse level on the incremental output is determined by the remote voltage applied to terminal [Com+] (range 5 - 30 V). When no external voltage is applied (i.e. terminal Com+ unconnected) the unit automatically generates a 4 volts signal swing (TTL compatible).
- Linear or angular position with absolute SSI output
  The unit converts the analogue input into a positional or angular information similar to an absolute encoder with SSI interface. This means that e.g. the rotation angle of an analogue potentiometer shaft converts to real SSI encoder information. Similar to a real SSI encoder the UZ 210 converter always acts as a "Slave" responding to the clock signal of a remote SSI master unit. All SSI signal levels are in line with the common SSI standard (TTL-differential or RS422 respectively).
- Serial and USB
  At any time and with all modes of operation the conversion result of the unit is accessible by PC or PLC, via the serial interface or by the converter's USB port

1.2. Operation as Frequency or Position Generator (Motorized Potentiometer Mode)

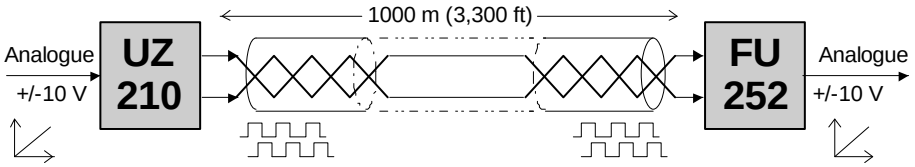
With this mode of operation the unit functions similar to a motorized potentiometer or to a digital positioning axis.

In frequency mode the unit generates a scalable frequency output where the frequency can be adjusted via remote commands „UP" (increase) and „DOWN" (decrease). In positioning mode the unit generates quadrature counting impulses in forward or reverse direction, under control of the „UP" and „DOWN" commands (virtual positioning axis).

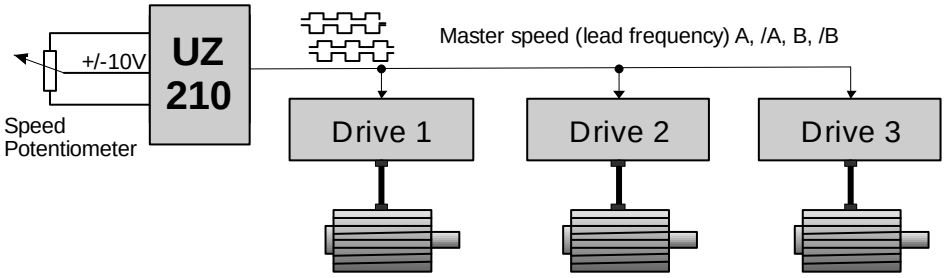
Moreover the unit provides a „Repeat"-Function for cyclic execution of frequency or position curves within programmable limits.

2. Typical Examples of Application

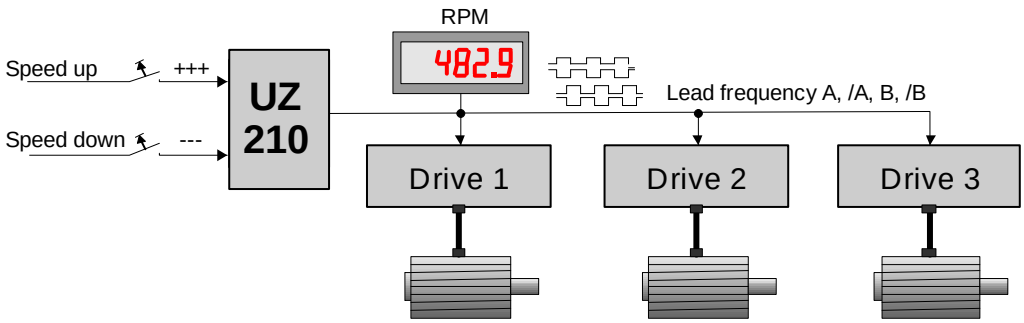
2.1. UZ 210 as Analogue-to-Frequency Converter or Generator



Secure digital transmission of sensitive analogue signals over long distances

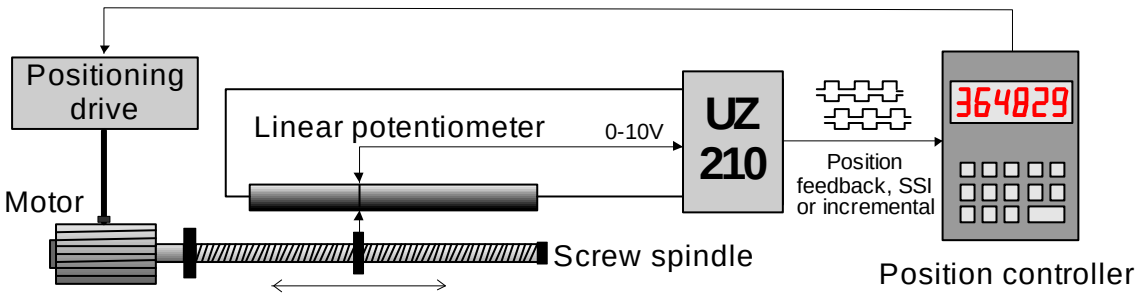


Generation of a digital set speed reference with use of a simple potentiometer



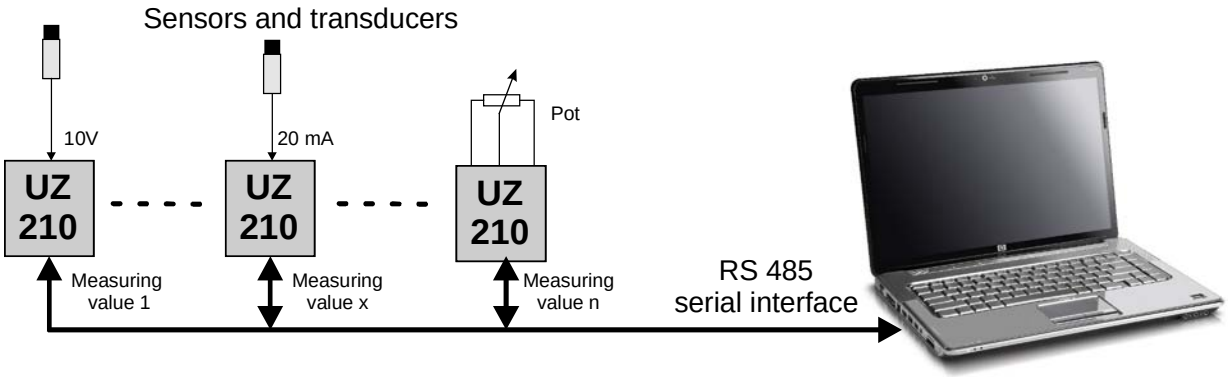
Digital RPM setting with a drive network by simple commands „UP“ or „DOWN“

2.2. UZ 210 as Positional or Angular Encoder with Analogue Input



Operation of a digital position controller with use of an analogue feedback system

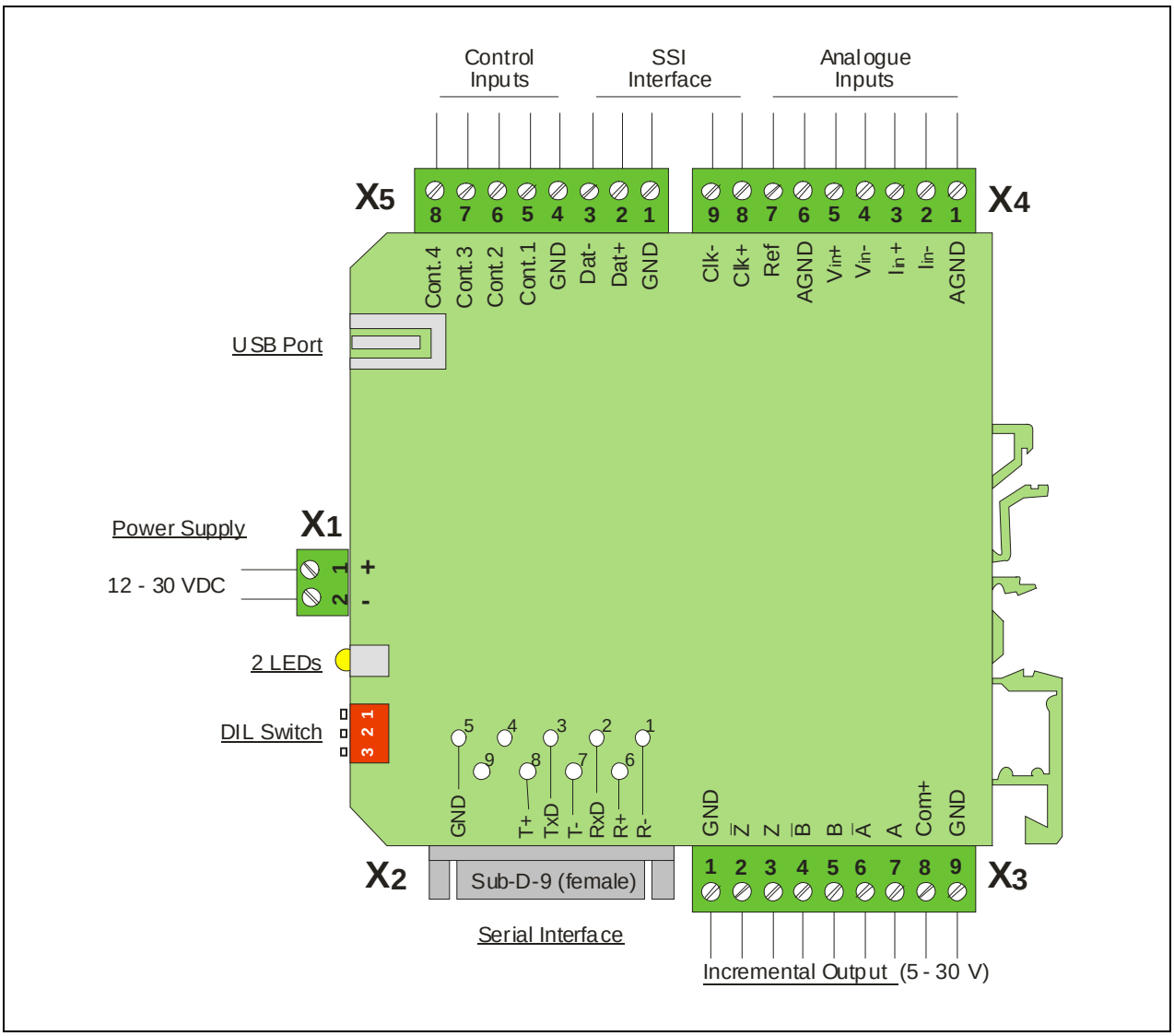
2.3. UZ 210 for PC Applications (Data Logging)



Evaluation of several sensor data via RS485 bus and PC

3. Connections and Control Elements

For electrical connection the unit provides four plug-in terminal strips X1, X3, X4 and X5, with mechanical codification against accidental misconnection. The 9-position Sub-D-connector X2 and the front USB port (mini format) allow serial communication and setup of the unit.

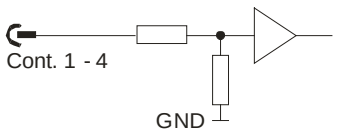


3.1. Power Supply

The UZ 210 converter requires a DC supply from 12 to 30 VDC applied to the screw terminals X1 [1] (+) and X1 [2] (-) (residual ripple $\leq$ 0,5 V). In idle state the typical consumption is approx. 50 mA (24 VDC input). The green front LED indicates that power is applied to the unit.

3.2. Control Inputs Control1 - Control4

Four control inputs with programmable function are accessible via terminals **X5 [5, 6, 7, 8]**. The desired function can be assigned by the parameters [Input Config.] and [Input Function] of the „Command Setting" menu.[a]
All control inputs are designed as PNP inputs, i.e. a positive voltage must be applied with reference to GND. The switching thresholds are LOW $\leq$ 3 V and HIGH $\geq$ 10 V, and the input impedance is about 15 kΩ.

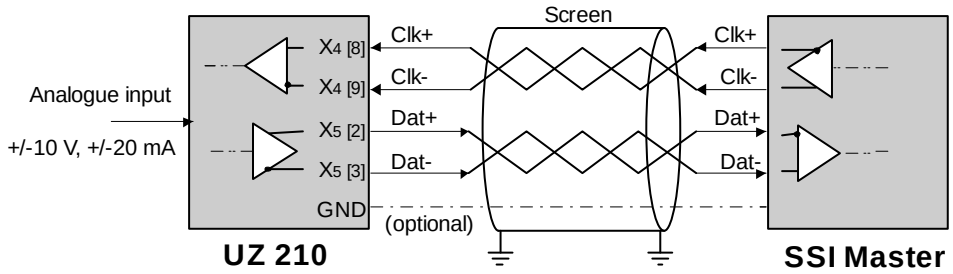


Principal of a control input circuit

3.3. The SSI Interface

A synchronous serial interface according to the industrial SSI standard is available on terminal strips **X4** and **X5**, for absolute signal transmission of positions or angles. In SSI operating mode the converter acts exactly like an SSI absolute encoder, i.e. it receives a clock signal from a remote Master via lines **X4 [8]** (Clk+) and **X4 [9]** (Clk-), and it sends the corresponding data via lines **X5 [2]** (Dat+) and **X5 [3]** (Dat-).

Please note that the unit will not provide any internal termination resistors. [b]

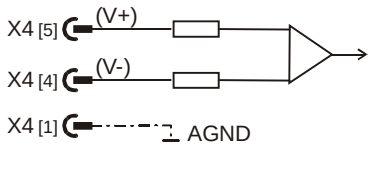


Connection of the SSI interface to a remote SSI Master (position controller, PLC or similar)

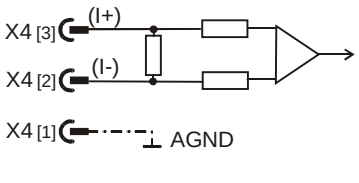
[a] See chapter 4.5
[b] For recommendations about screening and signal termination please refer to the document "General Rules for Wiring, Screening and Earthing" available under the Support section of our website.

3.4. Analogue Inputs

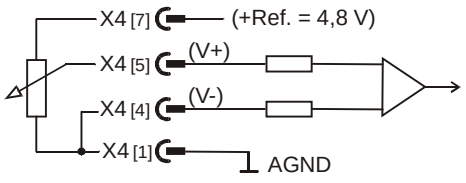
The differential inputs on the input side of the converter accept standard voltages (± 10 V), standard currents (0/4 - 20 mA) and also potentiometer connection. The drawings below explain the principle of the input circuits with each of the input connection modes.



Voltage input
(± 10 V, Ri = 100 kΩ)



Current input
(0/4 - 20 mA, Ri = 100Ω)



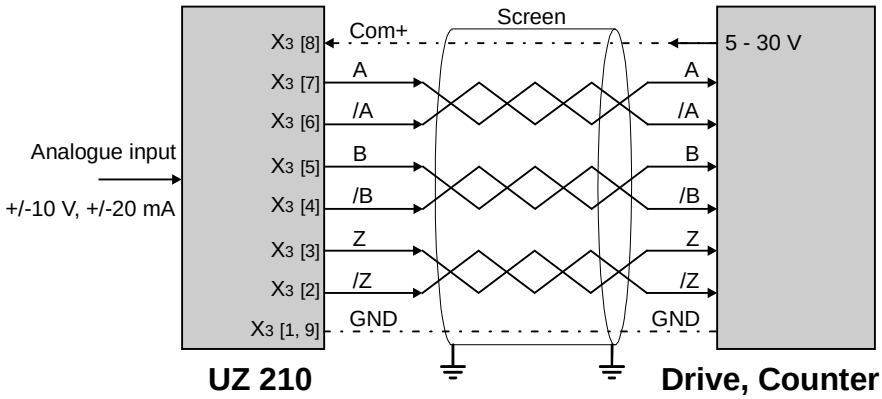
Potentiometer-input
(≥ 10 kΩ)

3.5. Incremental Outputs

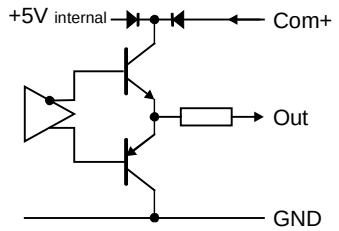
A complete set of incremental channels A, /A, B, /B, Z and /Z is available for incremental representation of the analogue input signal. Inverted channels are for optional use and may remain unconnected if not needed (e.g. for transmission at a 24 volts impulse level with use of channels A and B only). Likewise also the marker pulse outputs Z and /Z may remain open when the application does not provide zero pulse evaluation.

Dependent on the respective Mode of Operation of the converter the incremental output signals represent either a frequency proportional to the analogue input signal (i.e. straight analogue-to-frequency conversion), or a linear or angular position (i.e. for applications with analogue linear scales or analogue angular transducers).

All output lines are equipped with push-pull drivers (short-circuit-proof) and the output swing (signal level) results from the remote voltage applied to terminal **X3 [8].** Upon non-connection of this terminal the unit automatically generates a 4 volts TTL-compatible output.



Connection of the incremental output to a target unit *)
(e.g. drive, counter, position controller etc.)

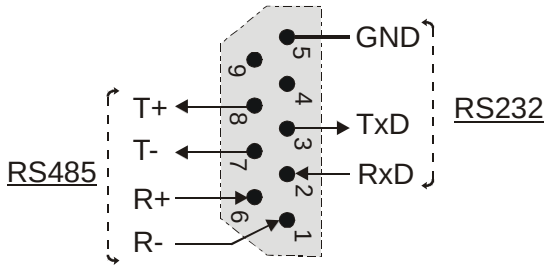


Output circuit
(principle)

*) For recommendations about screening and signal termination please refer to the document "General Rules for Wiring, Screening and Earthing" available under the Support section of our website.

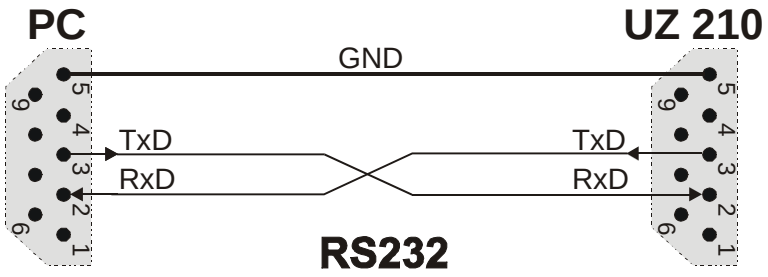
3.6. The Serial Interface

Both, a serial RS 232 interface and a RS 485 interface are available on the unit; however the converter can only communicate by one or by the other interface, but not by both at a time. Serial communication allows readout of internal measuring and conversion results and is also required for setup and commissioning of the unit.via PC.

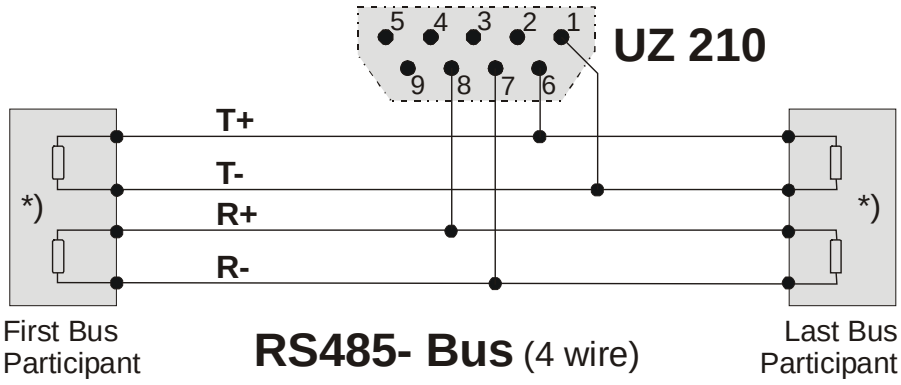


Sub-D-9 (female on unit site)

Pin assignment of the serial connector



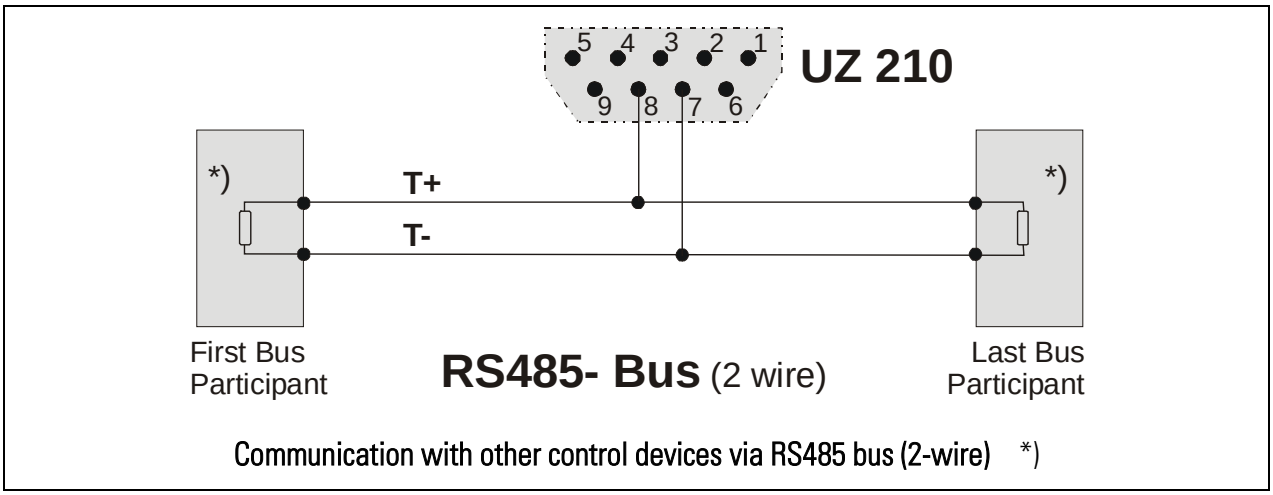
Connection of a PC to the RS 232 interface **)



Communication with other control devices via RS485 bus (4-wire) *)

*) For recommendations about screening and signal termination please refer to the document "General Rules for Wiring, Screening and Earthing" available under the Support section of our website

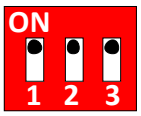
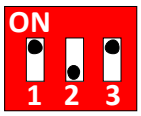
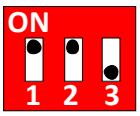
**) Please connect only pins 2, 3 and 5 as shown. Connection of the other pins (e.g. by using a fully occupied 9-conductor cable) will cause problems with communication



Communication with other control devices via RS485 bus (2-wire) *)

3.7. The Front DIL Switch and the Front LEDs

The 3-position DIL switch located on the front side provides the following settings:

		
Normal Operation For normal operation of the converter all positions of the switch must be ON at any time.	Reload Default Settings Upon next power-up all parameters will be overwritten by the factory default values.	Programming-Mode For factory use only, e.g.to download a new firmware version to the unit

DIL switch settings are read once upon power up of the unit only. It is therefore important to cycle the power supply after any change of DIL switch settings, in order to activate the corresponding function.

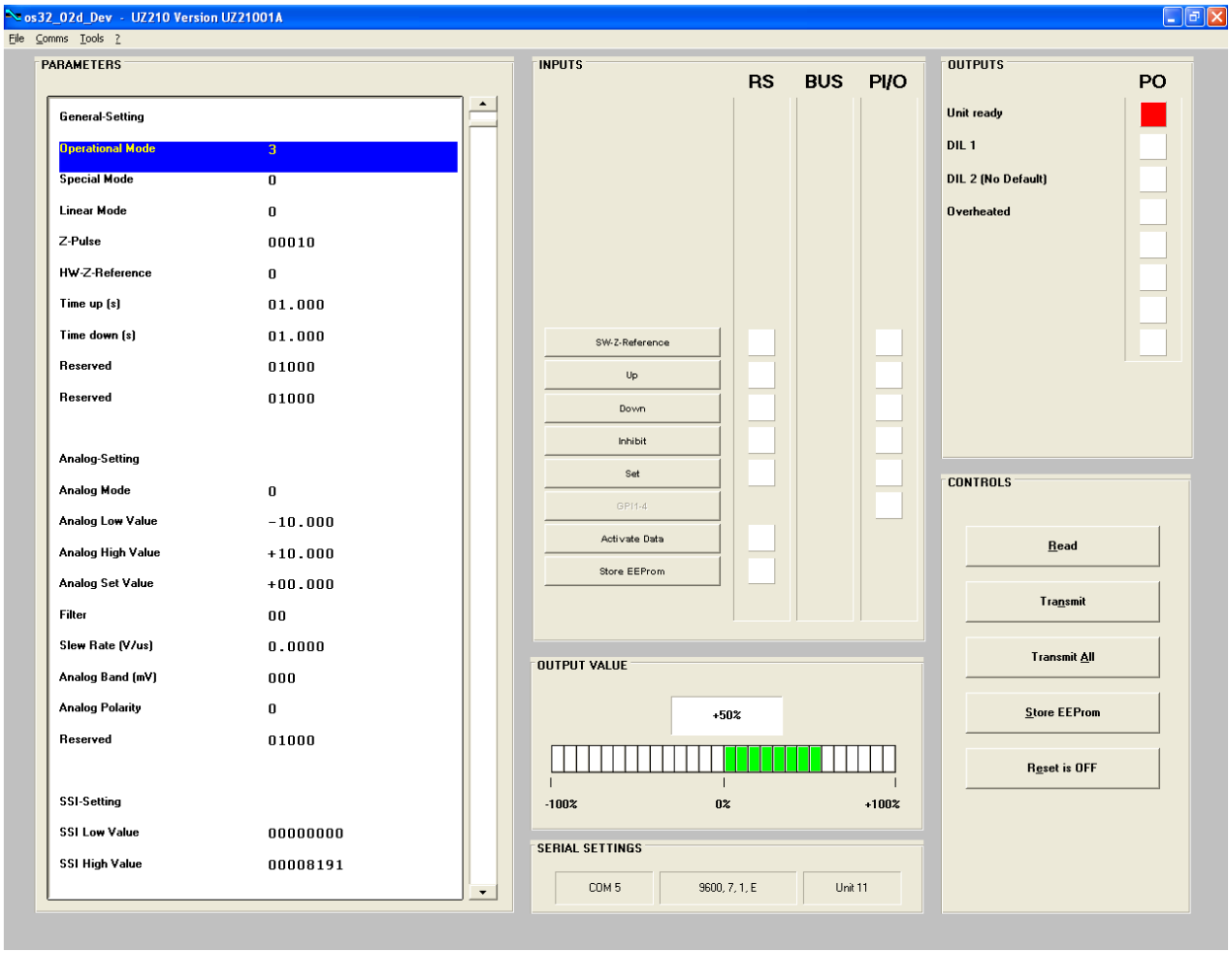
The green LED on the front indicates that DC power is applied to the unit.

The yellow LED remains OFF first after powering the unit up, then turns on after initialization of the processor, to indicate that the converter is ready for operation.

*) For recommendations about screening and signal termination please refer to the document "General Rules for Wiring, Screening and Earthing" available under the Support section of our website.

4. Parameter Settings

For setting of parameters and commissioning a PC with Operator Software OS32 is required. Please connect your PC to the unit via USB cable or by serial link as shown in chapter 3.6. After starting the OS32 software the following screen will appear:



Where you find the parameter field empty with the top line indicating “OFFLINE”, please click to the “Comms” menu in the head line to adapt the serial communication parameters of your PC correspondingly.

The parameter field allows to read and to edit all unit parameters according to need. The subsequent parameter tables explain the function and setting of each parameter in detail. The tables also inform about the factory default settings and the serial access codes of all parameters.

More information about serial communication can be found in chapter 5. of this manual.

4.1. General Settings

No.	Parameter Description	Range	Default	Ser.
001	Operational Mode: 0: Analogue input => Frequency (incremental output) 1: Analogue input => Position (incremental output) [a] 2: Analogue input => Position (incremental output) [a] 3: Analogue input => Position (SSI interface)	0, 1, 2, 3	0	A0
002	Special Mode: 0: standard operation as a signal converter 1: Function as „Motorized Potentiometer" (frequency and position generator, keys „UP" and „DOWN") 2: Repeat-Function (cyclic course of frequency or position curves)	0, 1, 2	0	A1
003	Linear Mode: Programmable Linearization [b] 0: Linearization OFF 1: Linearization in the positive range only (negative input values appear as a mirror of positive values) 2: Full range linearization of positive and negative inputs	0, 1, 2	0	A2
004	Z-Pulse: Number of increments between 2 marker pulses When this parameter is set to a value "n", the converter generates an index output pulse after every n encoder impulses	5 - 60 000	10	A3
005	HW-Z-Reference: Hardware Reference for marker pulse Parameter to define the function of control input [Cont1] 0: Free function assignment to [Cont1] Parameter 032 [Input 1 Function] assigns the function to the control input [Cont1] 1: a static HIGH signal on input [Cont1] will reset the marker pulse counter to zero (re-initialization) [c] 2: a rising edge on input [Cont1] will reset the marker pulse counter to zero (re-initialization) [c] 3: a falling edge on input [Cont1] will reset the marker pulse counter to zero (re-initialization) [c]	0, 1, 2, 3	0	A4
006	Time up: Ramp time for UP commands (increase output with motorized potentiometer and repeat functions)	0,001 - 99,999 sec	1,000	A5
007	Time down: Ramp time for DOWN commands (decrease output with motorized potentiometer and repeat functions)	0,001 - 99,999 sec	1,000	A6
008	Reserved, no function			
009	Reserved, no function			

[a] Mode 1 uses a fixed time raster of 100 µsec. causing a possible minimum output frequency of 10 kHz. Mode 2 uses variable input sampling and therefore can also generate frequencies lower than 10 kHz with slow changes of the input position

[b] See chapter 4.8

[c] Input „Cont1" is now reserved for this function only and no more available for other assignments, i.e. it is mandatory to set parameter [Input1 Function] to "0".

4.2. Analogue Settings (Analogue Input)

No.	Parameter Description	Range	Default	Ser.
010	Analogue Mode: Input characteristics 0: Input signal = voltage (±10 V) 1: Input signal = current (0/4 - 20 mA)	0, 1	0	A9
011	Analogue Low Value: Beginning of the analogue range	± 10 000 mV	-10 000	B0
012	Analogue High Value: End of the analogue range	± 10 000 mV	+10 000	B1
013	Analogue Set Value: Preset value for the analogue input *)	± 10 000 mV	0	B2
014	Analogue Filter: Filter function for the analogue input (used for smoothing of unstable analogue input signals) 00: Filter OFF (immediate response) 01: Filter LOW, fast response (*T* ca. 50 µsec) --- 05: Filter MEDIUM. medium response (*T* ca. 800 µsec) --- 12: Filter HIGH, very slow response (*T* ca. 100 msec)	0 - 12	0	B3
015	Analogue Slew Rate: Limitation of the dynamic slope of analogue input signals to a maximum value according to setting	0 - 1,0000 V/µsec	0	B4
016	Analogue Band: Dead band for signal changes The output will only respond to changes of the analogue input if they are greater than the dead band setting	0 - 100 mV	0	B5
017	Analogue Polarity: positive or negative frequencies 0: The direction information A/B (90°) will change according to input signal and parameter setting 1: All impulse outputs are in forward direction only (A always leading B), no reverse frequencies (This setting is not relevant with „Operational Mode = 3“, SSI)	0, 1	0	B6
018	Reserved, no function			

4.3. SSI Setting (SSI Data Transmission)

No.	Parameter Description	Range	Default	Ser.
019	SSI Low Value: Beginning of the SSI output value where the analogue input equals to „Analogue Low Value“	1 - 33554431 (25 Bit)	0	B8
020	SSI High Value: End of the SSI output value where the analogue input equals to „Analogue High Value“	1 - 33554431 (25 Bit)	8191 (13 Bit)	B9
021	SSI Format: Coding ot the SSI signal 0: Output data is Gray coded 1: Output data is binary coded	0, 1	0	C0
022	SSI Baud Rate: SSI transmission speed	0,001 - 1,000 MHz	0,100	C1
023	SSI Bit: Resolution, total length of one SSI telegram	10 - 25 Bit	25	C2
024	Reserved, no function			

*) see parameter No. 032 [Input1 Function]

4.4. Encoder Setting (Incremental Output)

No.	Parameter Description	Range	Default	Ser.
025	POS Low Value: Beginning of the position count where the analogue input equals to „Analogue Low Value“	±100 000 000 (increments)	0	C4
026	POS High Value: End of the position count where the analogue input equals to „Analogue High Value“	±100 000 000 (increments)	10 000	C5
027	FRE Low Value: Start value of the frequency where the analogue input equals to „Analogue Low Value“	± 1 000 000.00 (Hz)	-1000.00	C6
028	FRE High Value: End value of the frequency where the analogue input equals to „Analogue High Value“	± 1 000 000.00 (Hz)	+1000.00	C7
029	Reserved, no function			
030	Reserved, no function			

4.5. Command Setting (Control Inputs)

No.	Parameter Description	Range	Default	Ser.
031	Input 1 Config: Switching characteristics of input „Cont1“ 0: Function active with static LOW level 1: Function active with static HIGH level	0, 1	0	D0
032	Input 1 Function: Function of input „Cont 1“ 0: no function assigned 1: Function „Set“. Forces the analogue input temporary to the fixed value according to the setting of [Analogue Set Value] (see parameter Nr. 013) 2: Function „Inhibit“. Disables temporary all impulses on the incremental encoder output 3: Function „DOWN“. Down-function (decrease value) with motorized potentiometer applications 4: Funktion „UP“. Up-function (increase value) with motorized potentiometer applications 5: Function „Z-Reference“. Assigns a static Reset function for the marker impulse counter *) 6: Function „Print“. The input will trigger a serial transmission of the specified measuring value.	0 - 6	0	D1
033	Input 2 Config: see „Input 1 Config“	0, 1	0	D2
034	Input 2 Function: see „Input 1 Function“	0 - 6	0	D3
035	Input 3 Config: see „Input 1 Config“	0, 1	0	D4
036	Input 3 Function: see „Input 1 Function“	0 - 6	0	D5
037	Input 4 Config: see „Input 1 Config“	0, 1	0	D6
038	Input 4 Function: see „Input 1 Function“	0 - 6	0	D7
039	Reserved, no function			
040	Reserved, no function			

*) Function only suitable for slow and purely static Reset (e.g. for index referencing in standstill).
For dynamic requirements please refer to parameter 005 [HW-Z-Reference]

4.6. Serial Setting (RS232/RS485 Interface)

No.	Parameter Description	Range	Default	Ser.
041	**Unit Number** (serial device address)	11 … 99	11	90
042	**Serial Baud Rate** (communication speed) **0 =** 9600 Bauds **1 =** 4800 Bauds **2 =** 2400 Bauds **3 =** 1200 Bauds **4 =** 600 Bauds **5 =** 19 200 Bauds **6 =** 38 400 Bauds **7=** 56 000 Bauds **8=** 57 600 Bauds **9=** 76 800 Bauds **10=** 115 200 Bauds	0 - 10	0	91
043	**Serial Format** (byte format of serial data) **0 =** 7 Data, Parity even, 1 Stop **1 =** 7 Data, Parity even, 2 Stop **2 =** 7 Data, Parity odd, 1 Stop **3 =** 7 Data, Parity odd, 2 Stop **4 =** 7 Data, no Parity, 1 Stop **5 =** 7 Data, no Parity, 2 Stop **6 =** 8 Data, Parity even, 1 Stop **7 =** 8 Data, Parity odd, 1 Stop **8 =** 8 Data, no Parity, 1 Stop **9 =** 8 Data, no Parity, 2 Stop	0 … 9	0	92
044	**Serial Protocol** (transmit protocol with Printer-Mode *) **0 =** Transmission = Unit No. – Data, LF, CR **1 =** Transmission = Data, LF, CR	0 … 1	0	E0
045	**Serial Timer** (setting for timed transmissions (sec.) *)	0.000 … 9.999	0	E1
046	**Register Code** (serial register code of the transmit value *)	0 … 19	16	E2
047	**Reserved**, no function			
048	**Reserved**, no function			
049	**Reserved**, no function			

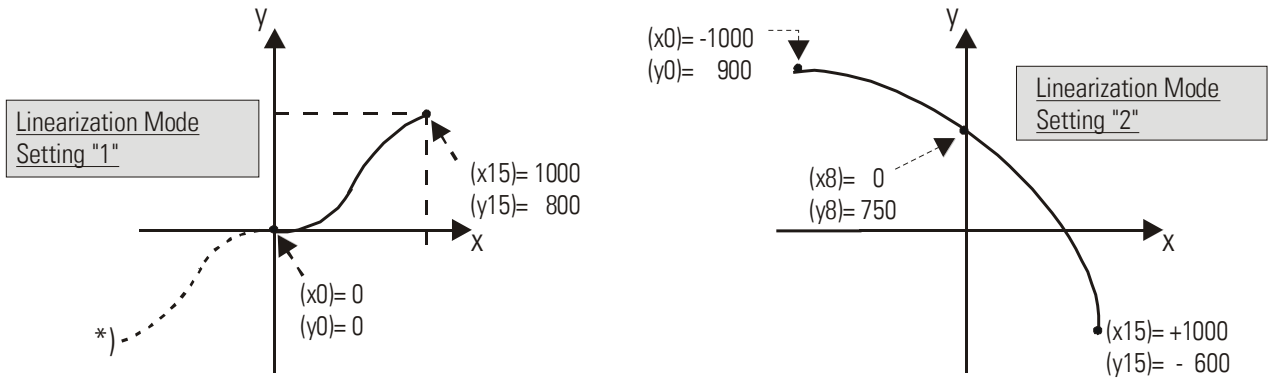
*) More information about serial operation of the unit can be found in chapter 5.

4.7. Linearization Setting

No.	Linearization Table	Range	Default	Ser.
050	First interpolation point (x0, original value)	-10 000 … +10 000	0	E6
051	First interpolation point (y0 as substitution for x0)			…
052	Second interpolation point (x1, original value)			…
053	Second interpolation point (y1 as substitution for x1)			…
	etc. ---->			…
080	Last interpolation point (x15, original value)			…
081	Last interpolation point (y15 as substitution for x15)			H7

4.8. Hints for Use oft the Linearization Function

The drawings below explain the difference between the settings
„Linear Mode“ = 1 and „Linear Mode“ = 2:



- The x-values are to determine which originally measured input value should be substituted by another value
- The corresponding y value defines a new value for replacement of the previous x value (e.g. the value x3 will be modified into y3)
- Values between two interpolation points will be reproduced by straight lines (linear interpolation)
- x-registers must use continuously increasing settings, i.e. P0(x) must have the lowest and P15(x) must have the highest setting
- Independent of all other settings the acceptable range for x values and y values is always from -10 000 to +10 000.
- For measuring values outside of the defined linearization range, please note:
  - if a measuring value is lower than x0, the linearization result will always be y0.
  - if a measuring value is higher than x15, the linearization result will always be y15.

5. Hints for Serial Communication

Serial communication with the UZ210 converter is intended to be used for

- Setup and programming of the unit by PC with operator software OS32
  (see chapter 4.)
- Automatic and cyclic transmission of converter data to a PC or PLC or data logger
- Free communication with PC or PLC using the communication protocol

This chapter describes the most essential communication functions only. For more detailed and general information please refer to the special document "SERPRO".

5.1. Automatic and Cyclic Data Transmission

Set any cycle time unequal to zero to parameter [Serial Timer]. Set the serial access code of the register you would like to transmit to parameter [Register Code]. In theory you could transmit any of all available internal register values by serial link, however in the current case only the following register makes really sense:

Parameter „Register Code"	Code internal	Value for transmission
16	; 6	Analogue input value, scaled in millivolts

Depending on the setting of parameter [Serial Protocol] the unit transmits one of the following two strings (xxxx = Converter Data, LF = Line Feed [hex. 0A], CR = Carriage Return [hex 0D])
(Leading zeros will not be transmitted)

	(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

5.2. Communication Protocol

When communicating with the unit via protocol, you have full read/write access to all internal parameters, states and actual values. The protocol uses the DRIVECOM standard according to DIN ISO 1745.

To request data from the unit, the following request string must be sent:

EOT		AD1	AD2	C1	C2	ENQ
EOT = control character (Hex 04) AD1 = unit address, High Byte AD2 = unit address, Low Byte C1 = register code to read, High Byte C2 = register code to read, Low Byte ENQ = control character (Hex 05)						

The table below shows how to request the actual analogue input data (register code ;6) from a converter with the serial unit number 11:

ASCII-Code:	EOT	1	1	;	6	ENQ
Hexadecimal:	04	31	31	3B	36	05
Binary:	0000 0100	0011 0001	0011 0001	0011 1011	0011 0100	0000 0101

Upon correct receipt of the request string the unit will respond:

STX	C1	C2	x x x x x x	ETX	BCC
STX = control character (Hex 02) C1 = register code to read, High Byte C2 = register code to read, Low Byte xxxxx = data (measuring value) ETX = control character (Hex 03) BCC = block check character					

Leading zeros will not be transmitted. The block check character BCC is composed by an EXCLUSIVE-OR function of all characters from C1 up to and including ETX.

To write parameter data to the unit the following data string must be sent:

EOT	AD1	AD2	STX	C1	C2	x x x x x x	ETX	BCC
EOT = control character (Hex 04) AD1 = unit address, High Byte AD2 = unit address, Low Byte STX = control character (Hex 02) C1 = register code to write data, High Byte C2 = register code to write data, Low Byte xxxxx = data, new parameter value ETX = control character (Hex 03) BCC = Block check character								

Upon correct receipt the unit will respond by ACK, otherwise by NAK.
Every new parameter sent will first wait in a buffer memory, without affecting the actual converter function. This feature enables the user, during normal converter operation, to prepare a complete new parameter set in the background.
To activate transmitted parameters you must write the numeric value "1" to the [Activate Data] register. This immediately activates all changed settings at the same time.
Where you like the new parameters to remain valid also after the next power up of the unit, you still have to write the numeric value "1" to the [Store EEProm] register. This will store all new data to the EEProm of the unit. Otherwise, after power down the unit would return with the previous parameter settings.

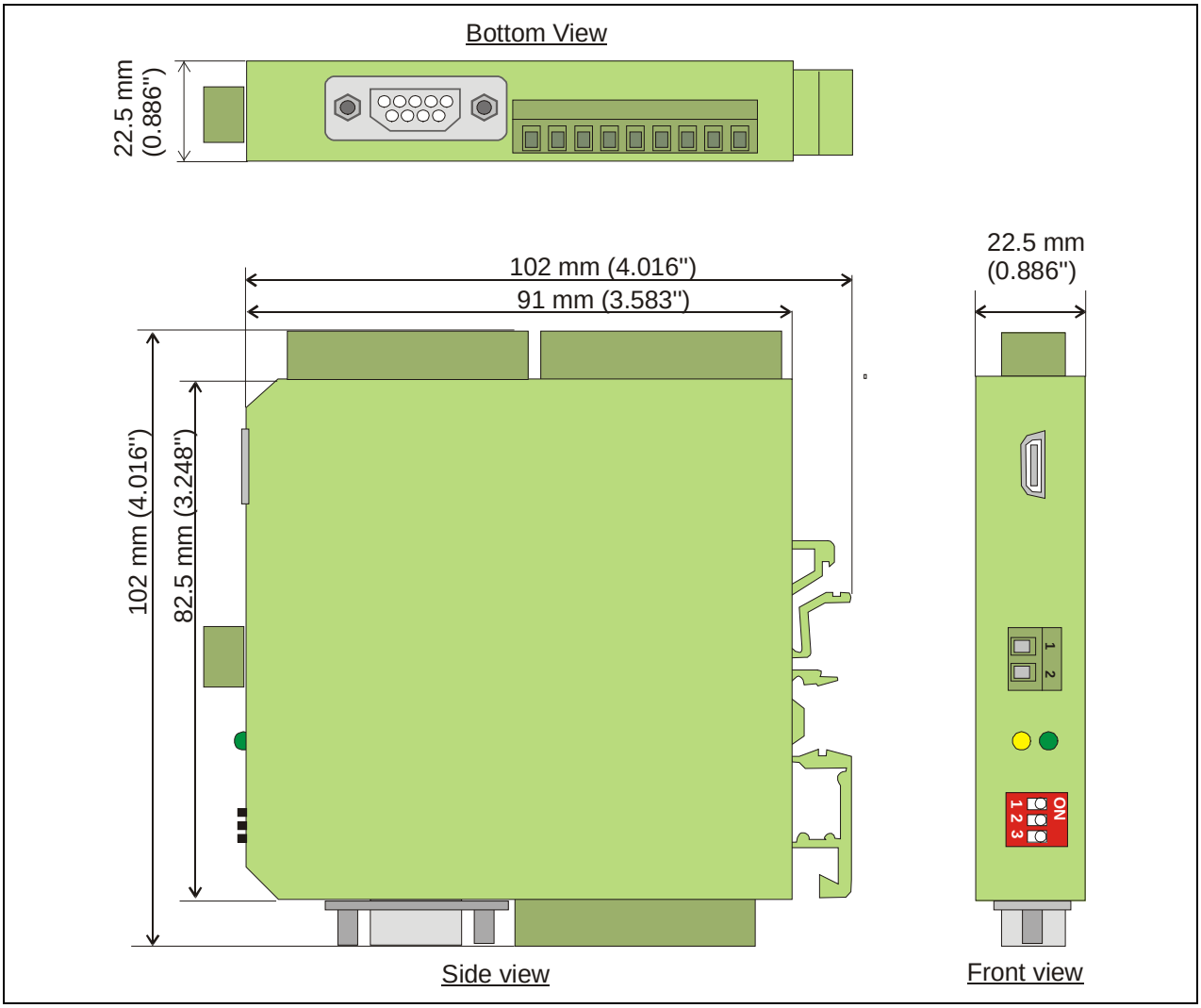
Function	Code
Activate Data	67
Store EEProm	68

Both commands provide dynamic operation, i.e. it is enough to just send "1" to the corresponding location. After execution the command will reset to zero automatically.

Example: send [Activate Data] to the converter with unit number 11:

ASCII	EOT	1	1	STX	6	7	1	ETX	BCC
Hex	0 4	3 1	3 1	0 2	3 6	3 7	3 1	0 3	3 3

6. Dimensions



7. Technical Specifications

Power supply	:	12 - 30 VDC, residual ripple ≤ 0,5 V
Current consumption (all lines idle)	:	ca. 50 mA with 24 V supply
Analogue input (voltage)	:	± 10 V (Ri = 120 kΩ)
Analogue input (current)	:	± 20 mA (Ri = 100 Ω)
Analogue resolution	:	± 13 Bit corresponding to 1,3 mV or 2,5 µA
Analogue overall accuracy	:	0,1 %
Update time of analogue inputs	:	100 µsec corresponding to 10 000 samples/sec.
Maximum analogue input frequency	:	1 kHz (with 10 sampling points)
Auxiliary reference voltage output (for remote potentiometers ≥ 10 kΩ)	:	ca. 4,8 V ± 0,1%, Ri = 240 Ω
Control inputs (Control 1 - 4)	:	4 inputs, PNP (switching to +)
Switching thresholds	:	LOW ≤ 3 V, HIGH ≥ 10 V (max. 30 V)
Input currents	:	ca. 2 mA (Ri = 15 kΩ)
Minimum pulse duration	:	1 msec (5 µsec on Cont.1 when [HW-Z-Reference] ≠ 0)
Incremental impulse outputs	:	Push-pull circuits A, /A, B, /B, Z, /Z
Output level	:	5 - 30 V according to remote supply (TTL level when no remote voltage is applied)
Output current	:	max. 30 mA per channel (short circuit proof)
Output frequency range	:	0,01 Hz - 1 MHz
Response time (to jumps on the input)	:	< 260 µsec
Fastest possible change of positions	:	1 Increment/µsec
SSI Interface (Simulation of an SSI absolute encoder)	:	according to SSI-Standard, 10 - 25 Bit, binary or Gray
Clock (input) (termination resistor not built-in)	:	TTL-differential / RS485 [Clk+], [Clk-]
Data (output)	:	TTL-differential / RS485 [Dat+], [Dat-]
SSI baud rate		max. 1 MHz
Serial Interface	:	RS232 und RS485 (2-wire or 4-wire), max. 115,2 kBauds
Ambient temperature (with non-condensing humidity)	:	Operation: -20°C…+60°C (-4°F…+140°F) Storage: -30°C…+70°C (-22°F…+158°F)
Weight	:	ca. 100 g
Conformity and standards	:	EMC 2004/108/EC: EN 61000-6-2 EN 61000-6-3