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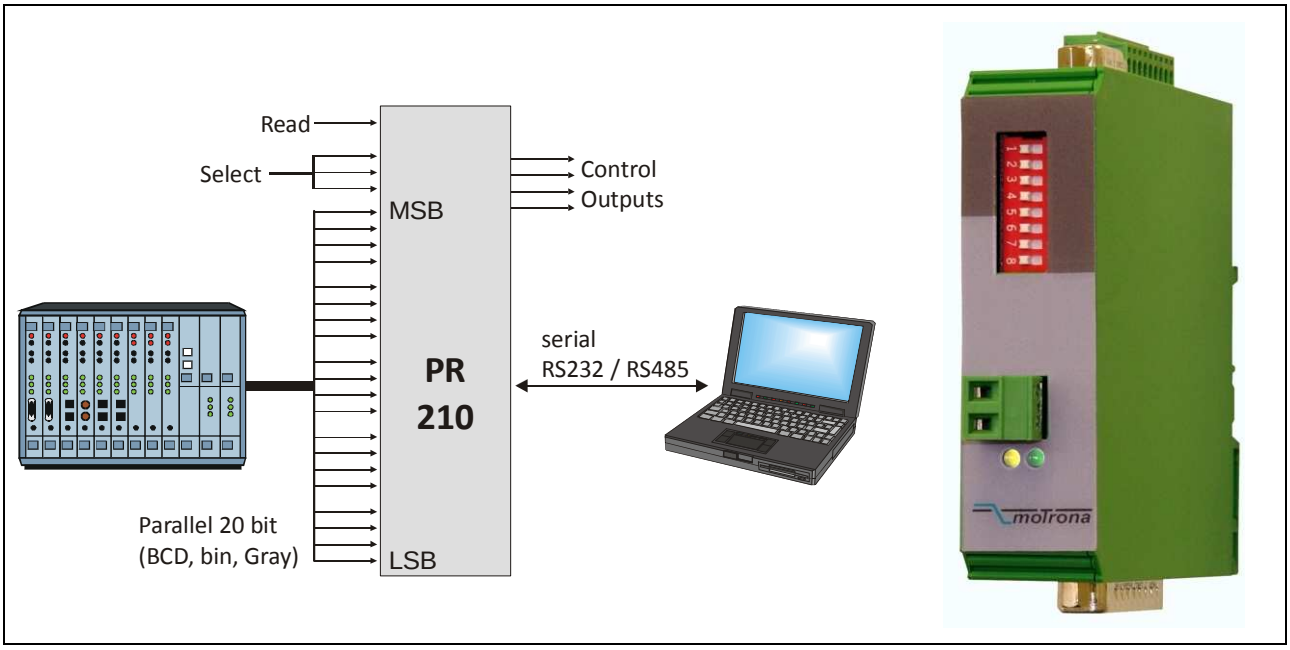
control – motion – interface

PR 210

Signal Converter
Parallel Data ⇨ Serial Data



- Parallel input 20 bits for data with BCD or binary or Gray code
- Select inputs for serial transmissions to eight different target units
- Serial RS232 and RS484 interface operating at rates from 4800 to 38 400 bauds
- Four status outputs for transmission control and error indication
- 10 - 30 VDC power supply, compact and slim housing for DIN rail mounting

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
PR21001a_Juli 2010/af/hk	First edition
PR21002a_Juli 2011/kk/pp	Gray code as standard implemented
PR21002b_May 2012/pp	Correction in Chapter 4.1 and 5.3.4; Parameter "Store Value"

Table of Contents

1. Application

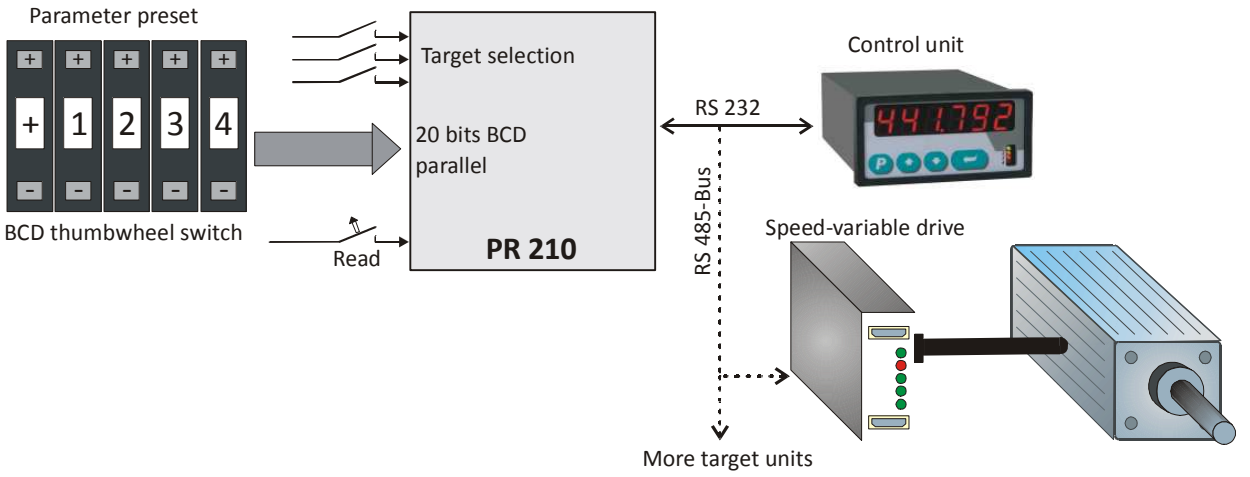
The PR210 signal converter is used for conversion of parallel data from encoders, sensors, thumbwheel switches or PLC into serial information. One of the major applications refers to replacement of obsolete control products using parallel data interface against new products providing serial interface only. With use of the PR210 converter the customer can keep all the parallel structure and cabling of an existing machine and still use modern controllers with serial interface. Besides this typical application the converter can also be used for many other technical solutions.

The PR210 parallel input accepts data with BDC, binary or Gray code.
The input data will be packed into a serial protocol and transmitted to one or several target units via RS232 / RS485 interface. A transmission cycle can be triggered by either external control command or automatically in a cycle by an adjustable timer. In both cases the PR210 converter acts as a serial master unit.

Conversion and transmission can be controlled at any time by means of the digital status output signals.

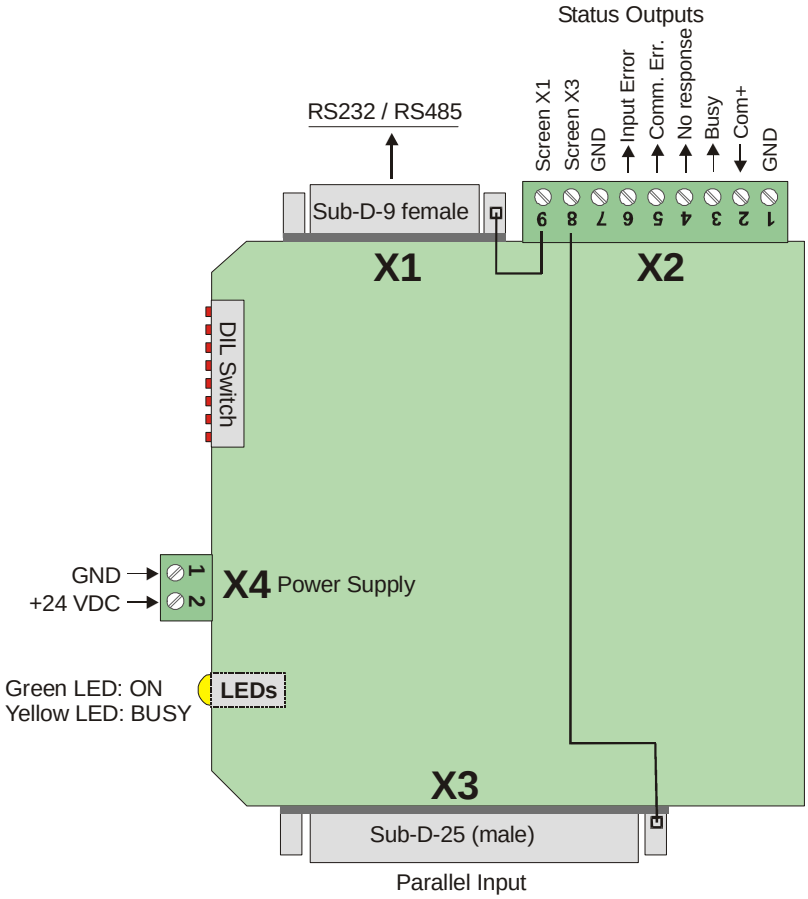
An 8-position DIL switch located at the front side provides all basic settings. Some essential parameters for the serial transmission require a PC with the operator software OS32 installed (for initial setup only).

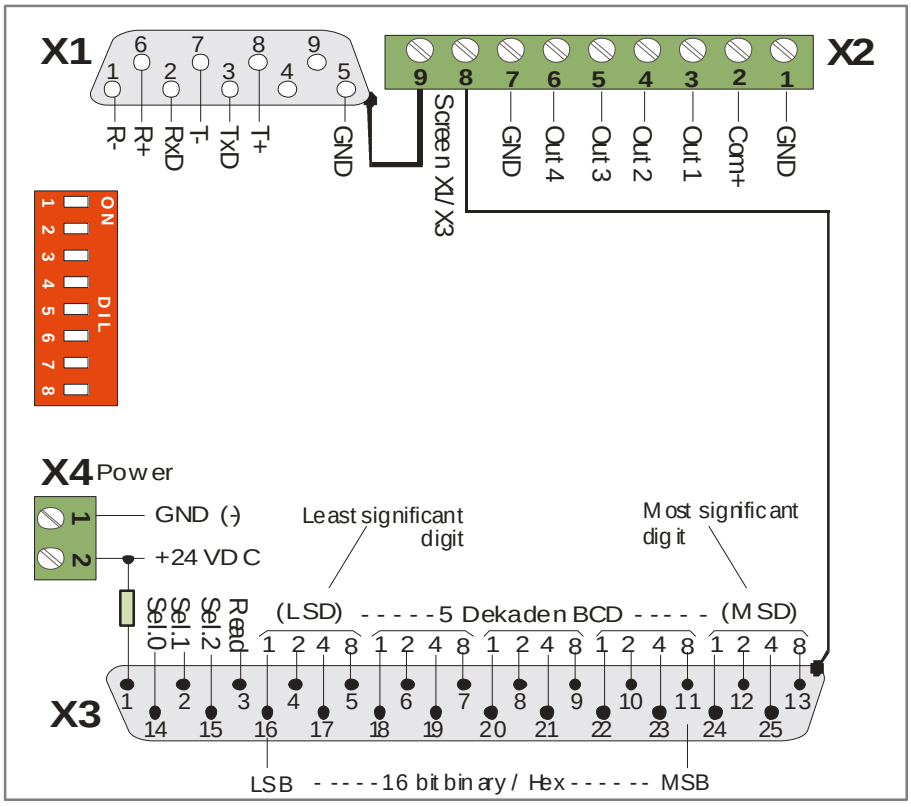
Typical application example of the PR210 converter:



Remote setting of operational parameters via simple BCD thumbwheel switch set

2. Construction and Terminal Assignments





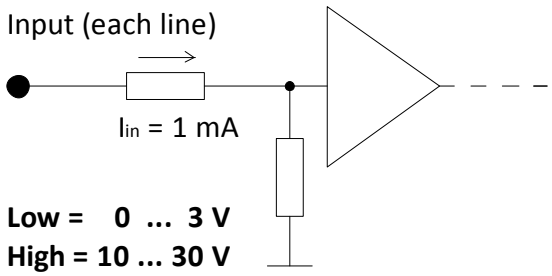
2.1. Power Supply (X4)

The unit requires a 24 V DC power (range 10 ... 30 V DC) which must be applied to screw terminal strip X4 (X4/1 = minus, X4/2 = plus). The current consumption is about 20 mA

2.2. Connection of the Parallel Input (X3)

Parallel input data must be applied to the Sub-D-25 (male) connector X3 on the bottom side of the unit. Terminal position 8 of the screw terminal strip X2 allows connecting the metal housing of the Sub-D connector to any external potential *)

Parallel input signals must match with the following specifications:

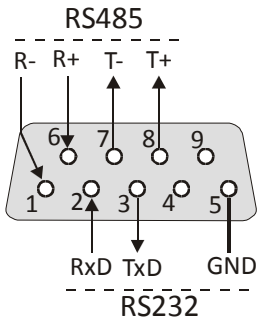


Principle of input circuit for parallel data (each line)

Unconnected input lines will always be evaluated as a "LOW" signal. The line current with HIGH state is quasi constant and independent of the input level, due to internal current control circuits. (Data lines approx. 1 mA, Read input approx. 6 mA).

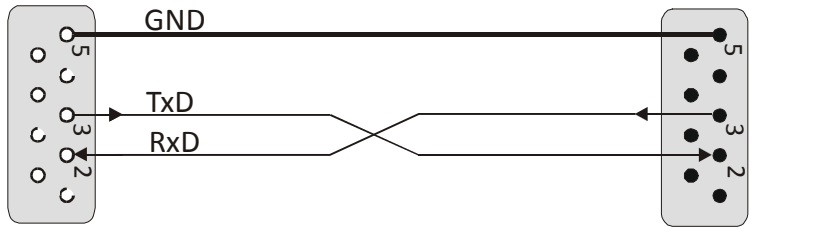
2.3. The Serial Interface (X1)

RS232 and RS485 interfaces are accessible via the X1 Sub-D-9 connector (female) on the top side of the unit. It is acceptable to connect both interfaces at a time, but you can communicate only by one at a time (while the other one must be idle). Terminal position 9 of the screw terminal strip X2 allows connecting the metal housing of the Sub-D connector to any external potential *)

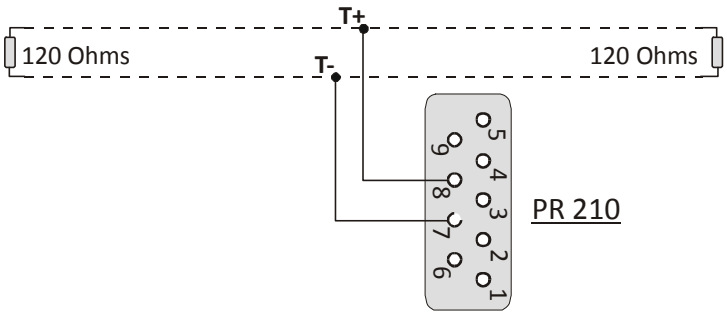


Sub-D-9 (female on unit side)

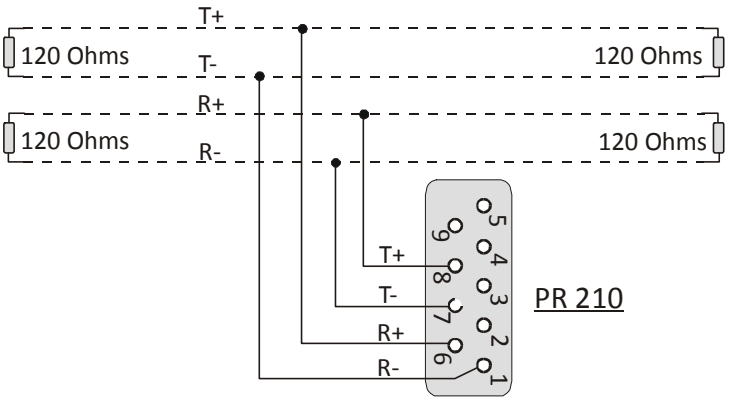
*) e.g. connection to protection earth (PE) for grounding of the shield of the data cable



RS232 communication with PC or serial target unit



Connecting the RS485 interface (2-wire mode)



Connecting the RS485 interface (4-wire mode)

Where you use the RS232 interface only, please make sure you have only wired pins 2, 3 and 5 (other pins should remain unconnected). As soon as one of the unused RS485 lines accidentally gets in touch with a remote potential (e.g. by a fully wired cable due to internal connections inside your PC), this may jam the RS232 communication.

2.4. Status Outputs (X2)

Four digital status outputs are available on the 9-position terminal strip X2. These outputs are switching to "+" (PNP) and require a remote switching voltage from 10 to 30 volts which must be applied to terminal 2 (Com+). The switching capacity of the outputs is 350 mA each. All outputs are permanently short-circuit-proof, however only one of them should be in a continuous short circuit situation at a time to avoid overheating of the drivers.

The following status signals are available:

Out1: Busy	Operates in parallel to the yellow front LED "Busy" and is switched ON while a serial communication is in progress in one or the other direction
Out2: No Response	Switches ON when, after transmission of date, the target unit would not respond at all (i.e. no ACK and no NAK response). *) The status resets automatically upon start of a new transmission.
Out3: Communication Error	Switches ON when the target unit refuses acceptance of transmit data and responds with a "NAK" character *) The status resets automatically upon start of a new transmission.
Out4: Input Error	Switches ON after faulty operation of the parallel input, i.e. upon overheating of the input circuit caused by out-of-range input levels etc. The status resets automatically after the input problem has been solved.

*) Since, by convention, collective addressing (Broadcast) does not allow the target unit to respond, this kind of addressing will disable the output after missing ACK/NAK characters. While the output is set, the unit will suppress all commands appended to the data string (no "Activate Data", no "Store EEProm").

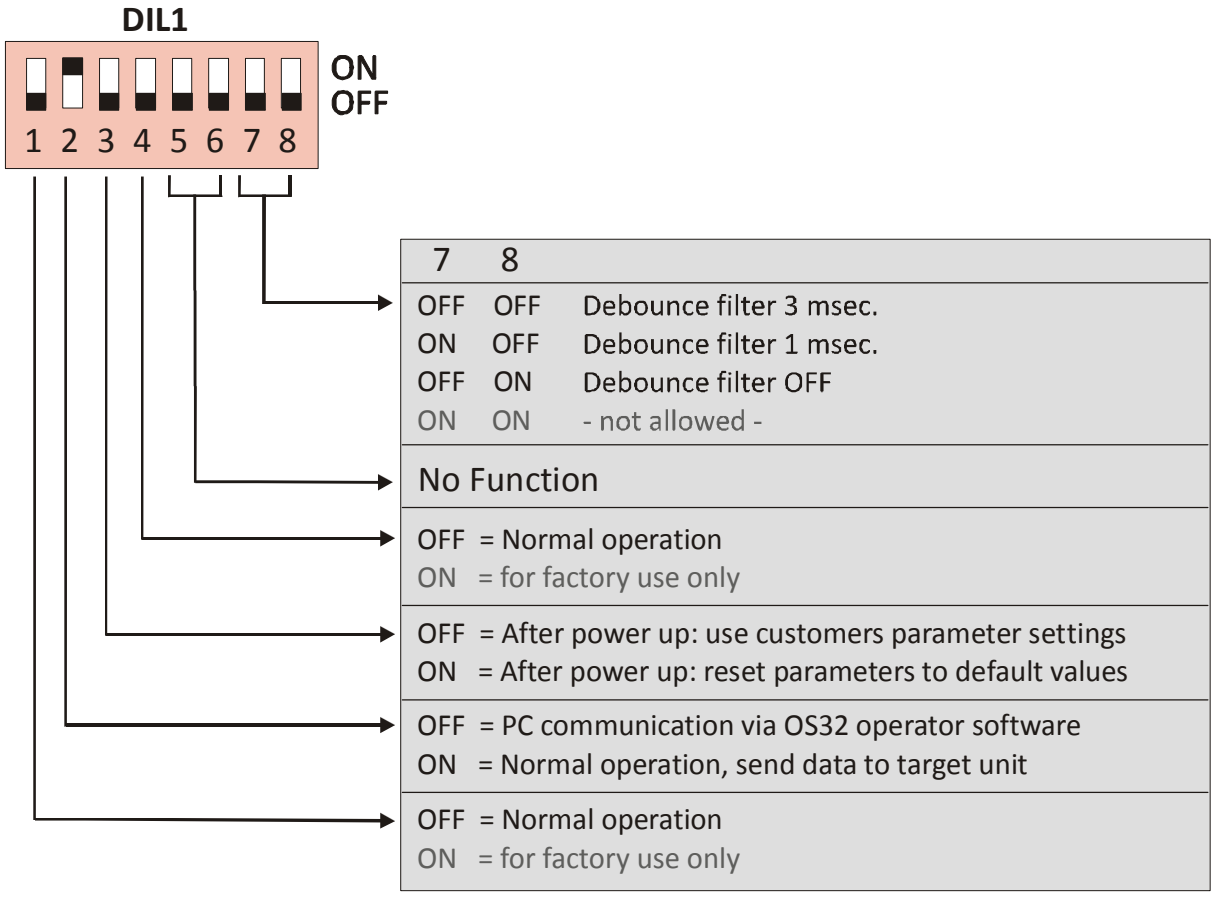
2.5. The Front LEDs

The green LED is ON as soon as power is applied to the power supply input.
The yellow LED signals the activity of the serial interface by blinking (communication in one or the other direction is in progress)

3. Basic DIL Switch Settings

Some general settings have to be done on the front side 8-position DIL switch.
Positions 1 and 4 are for factory use only and must otherwise be "OFF" at any time.

There is an adjustable debounce filter for elimination of possible noise and interference on the parallel data input and the READ input. All signal transitions faster than the filter time will be suppressed. It is recommended to always use the 3 msec. filter, except for special applications.

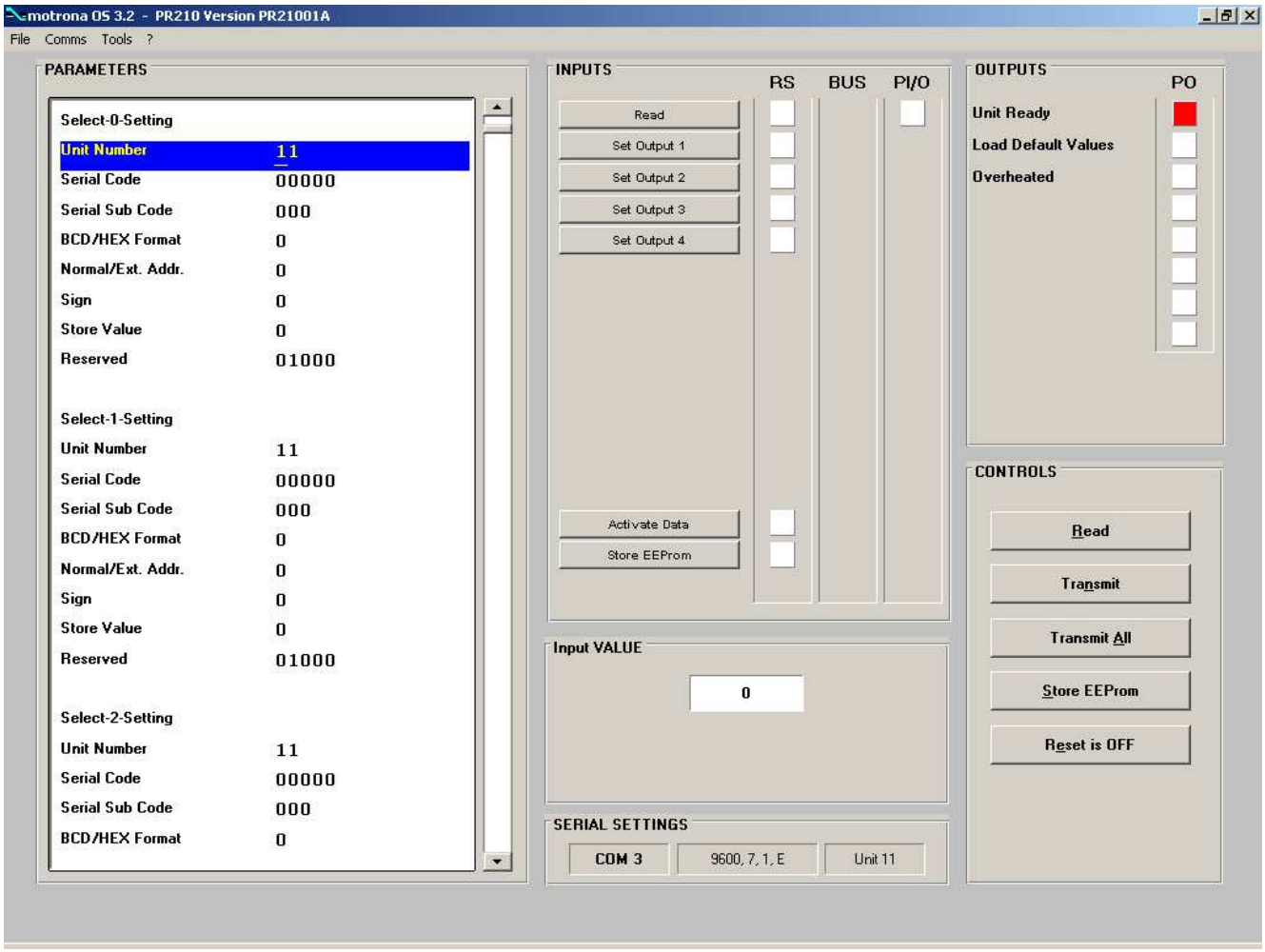


The example above shows the typical switch settings for transmission of parallel input data to a serial target unit.

4. Setup by PC and Operator Software

For setting of operational parameters and assignment of serial target addresses a PC with Operator Software OS32 is used. Connect your PC with the PR210 unit as explained under chapter 2.3, and then start the OS32 software.

The software allows setting of all parameters and also indicates all relevant actual values of the PR210 unit (parallel input data, logical state of the select lines, output states etc.)



Where after starting the software the text fields remain empty and the head line says „OFFLINE“ please click to the „Comms“ menu in the top line to adjust the serial settings of your PC to the signal converter.

4.1. Parameter Range "Selection Settings"

The selection lines Sel.0 - Sel.2 of the parallel input connector allow selection of totally 8 different target addresses or destination codes for serial transmit data (Select0 to Select7). For any of these 8 destinations the parameters shown below can be set individually.

Sel.2	Sel.1	Sel.0	Target specification according to parameter setting
0	0	0	Select-0
0	0	1	Select-1
0	1	0	Select-2
0	1	1	Select-3
1	0	0	Select-4
1	0	1	Select-5
1	1	0	Select-6
1	1	1	Select-7

Parameter (Select 0 - 7)	Range	Default
Unit Nr. Serial device address of the target unit. Addresses containing a "0" are reserved for collective addressing. Setting "00" will address all units (broadcast address). Setting "10" will address all units from 11 to 19 etc.	00 - 99	11
Serial Code Serial code of the register location inside the addressed unit (decimal representation) Example: to address the register code "A0" (hexadecimal) this parameter must be set to "160" (decimal)	0 - 65535 0000 - FFFF (hex)	
Serial Sub Code (only applicable with units using extended addressing) Serial Sub Code, sub division of the Serial Code. Must be set to 0 with all units using standard addressing (e.g. BY340)	0 - 255 00 - FF (hex)	
Format BCD / Hex Code of data used on the parallel input 0 = data use BCD 1-2-4-8 code 1 = data use binary or hexadecimal code 2 = data use Gray code	0 - 2	
Normal / Extend Addr. Protocol selection (standard or extended protocol) 0 = Standard protocol (used for most units, e.g. BY340) 1 = Extended Protocol (used for MC700 controllers and many drives)	0, 1	

Parameter (Select 0 - 7)	Range	Default
Sign (with BCD data only i.e. when parameter "Format BCD/Hex" = 0) Signed or unsigned data 0 = data are without a sign 1 = most significant bit is a sign (MSD8 = Pin 13) (MSD8 = 0 means "+" and MSD8 = 1 means "-")	0, 1	0
Store Value Parameter for automatic EEProm storage 0 = "Store EEProm" command will be added automatically 1 = no "Store EEProm" command will be added (see clarification under 5.3.4)	0, 1	0

4.2. Parameter Range "General Settings"

General Setting	Range	Default
Read In Config. Function of the "Read" input (pin 3) 0 = A rising edge will transfer the parallel data 1 = A falling edge will transfer the parallel data	0, 1	0
Output Polarity Switching polarity of the 4 Status outputs (binary setting) 1 = Out1 (Busy) 2 = Out2 (no Communication.) 4 = Out3 (Communication Error) 8 = Out4 (Input Error.) Bit = 0 means: the corresponding output operates straight (no inversion) Bit = 1 means: the corresponding output will be inverted	0 - 15 Example: with setting "9" the signals on Out 1 and Out 4 will be inverted	0
Input Polarity *) Polarity of the parallel input data 0 = input data are straight (Low = log.0 and High = log.1) 1 = input data are inverted (High = log.0 and Low = Log.1)	0, 1	0
Unit Nr. Serial device address of the PR210 converter itself for communication and setup by PC. (this address must never contain a "0")	11 - 99	11

*) Valid for all inputs on terminal X3 including Select lines and Read input

General Setting	Range	Default
<u>Serial Baud Rate</u> Baud rate for direct PC communication with the converter 0 = 9600 1 = 4800 2= 2400 3 = 1200 4 = 600 5 = 19200 6 = 38400	0 - 6	0
<u>Serial Format</u> Data format for direct PC communication with the converter 0 = 7 Data bits, Parity even, 1 Stop bit 1 = 7 Data bits, Parity even, 2 Stop bits 2 = 7 Data bits, Parity odd, 1 Stop bit 3 = 7 Data bits, Parity odd, 2 Stop bits 4 = 7 Data bits, no Parity, 1 Stop bit 5 = 7 Data bits , no Parity, 2 Stop bits 6 = 8 Data bits, Parity even, 1 Stop bit 7 = 8 Data bits, Parity odd, 1 Stop bit 8 = 8 Data bits, no Parity, 1 Stop bit 9 = 8 Data bits, no Parity, 2 Stop bits	0 - 9	0
<u>Read-In Filter</u> Minimum signal duration for acceptance of data on the parallel input 0 = immediate acceptance 1 = minimum signal duration 0.45 µsec. 2 = minimum signal duration 3.6 µsec 3 = minimum signal duration 14.4 µsec.	0 - 3	0
<u>Serial Timer</u> Programmable timer for automatic and cyclic reading and transmission of parallel data With setting "0" the timer is disabled and data transmission occurs only upon a remote signal on the "Read" input. With all other settings the data will be read an transmitted automatically according to the timer setting	0 - 99.99 (sec.)	

5. Data Formats and Data Transmission

5.1. Numeric format on the parallel input

5.1.1. BCD coded input data (Parameter "Format BCD/Hex" = 0)

The following numeric range will be evaluated:

Unsigned data (Parameter "Sign" = 0):
The numeric range is defined from 0 to 99 999

Signed data (Parameter "Sign" = 1)
The numeric range is defined from -79 999 to + 79 999

5.1.2. Binary and hexadecimal data (Parameter "Format BCD/Hex" = 1)

Only the lower 16 bits will be evaluated (pin 16 = least significant bit, pin 11 = most significant bit)
Binary data will be considered as unsigned at any time.

5.2. Serial Data Representation

- On the serial site numbers will always be expressed in ASCII format.
- Leading zeros will never be transmitted
- Positive signs will not be transmitted.

Example with BCD data: when the parallel input reads the BCD data 15724, the ASCII result in the data field of the serial string will appear as 31 35 37 32 34 (hex)

Example with binary or hex data: when the parallel input reads the binary data
0001 0011 1001 1100 (hex 139C), this is equal to a decimal value of 5020. Accordingly the ASCII result in the data field of the serial string will appear as 35 30 32 30 (hex)

5.3. Serial Transmission Protocol

(Subsequent indications use standard addressing *)

5.3.1. Transmit data

After triggering the "Read" command (remotely or by serial timer) the PR210 converter will transmit the data according to the following protocol:

EOT	AD1	AD2	STX	C1	C2	x x x x x x	ETX	BCC

EOT = Control character (Hex 04)
AD1 = Device address of target unit, High Byte
AD2 = Device address of target unit, Low Byte
STX = Control character (Hex 02)
C1 = register code of destination, High Byte
C2 = register code of destination, Low Byte
xxxxx = numeric data field (numbers use ASCII format)
ETX = Control character (Hex 03)
BCC = Block check character

*) For details about extended addressing please refer to the special document "SERPRO2a"

- No leading zeros will be transmitted.
- The Block-Check-Character (BCC) is generated by the EXCLUSIV-OR function of all characters from C1 thru ETX
- Positive values always appear without a sign. Only negative BCD values appear with a negative sign on top (ASCII "-" corresponding to 2D (hex))

5.3.2. Acknowledgement by the target unit (valid for all motrona units)

When the target unit has received the data string correctly, the response will be "ACK" (Acknowledge, control character 06 hex.) Where an error has been detected during transmission, the response will be "NAK" (Negative acknowledge, control character 15 hex)

5.3.3. Activation of transmit data (valid for all motrona units)

After the target unit has received and stored new data, they have still to be activated by means of the special command "Activate Data". Hence, after the target unit has sent back a positive acknowledge "ACK" to the PR210 converter, the converter must send the "Activate" command after. This command consists of the data value "1" sent to the register code "67". In an example with a serial device address of "11" the full activation string is:

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
		Address			Activation		Data		

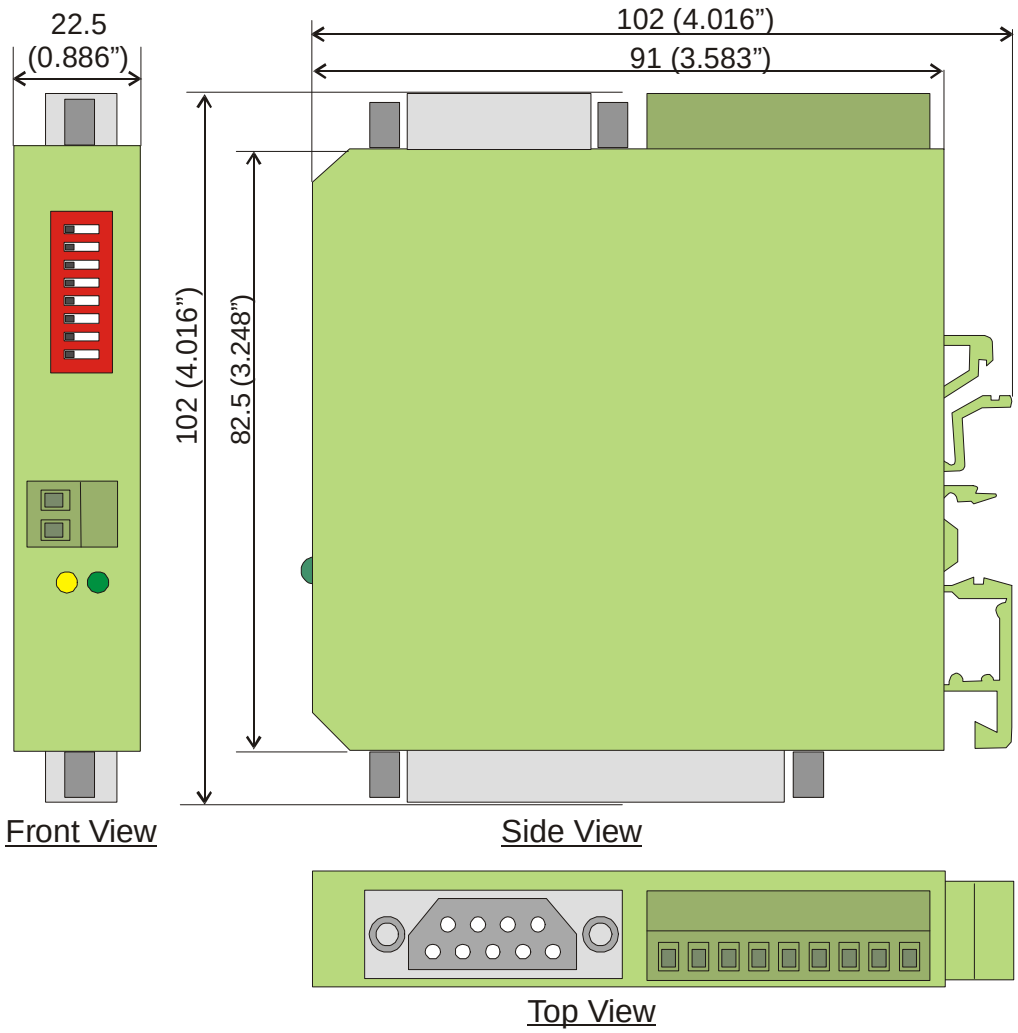
5.3.4. Data storage in the EEProm memory

With all motrona units the data is first transferred to the random access memory (RAM). This means the data are available and active until to the next power down only. After next power up the previous data stored in the EEProm will be reloaded.

If the data sent by the PR210 should be stored permanently in the non-volatile EEProm memory, this may be achieved by setting parameter "Store Value" correspondingly. When set to "0", the data string and the activation string will be automatically followed by a Store command. This command consists of the data value "1" sent to the register code "68". In an example with a serial device address of "11" the full string for EEProm storage is:

ASCII	EOT	1	1	STX	6	7	1	ETX	BCC
Hex	0 4	3 1	3 1	0 2	3 6	3 8	3 1	0 3	3 0
		Address			Store		Data		

6. Dimensions



7. Technical Specifications

Power supply V_{in}	:	10 V - 30 V DC
Current consumption	:	ca. 20 mA (with 24 V)
Aux. voltage output on the parallel input (X3/1)	:	V_{in} - 1,5 V, max. 100 mA
Parallel input	:	20bits BCD or 16 bits binary, Low <3 V, High >10 V Input current approx. 1 mA per line
Read input	:	Low <3 V, High >10 V Input current approx. 6 mA
Status outputs	:	4 outputs, short-circuit-proof *) (PNP, switching to Com+) Switching voltage 7 - 30 V Max. switching current 350 mA each output
Serial interface	:	RS232 and RS485 600 - 38400 bauds
Ambient temperature	:	Operation: 0° – 45 °C (32 – 113°F) Storage: -25° - + 75°C (-13 - 158°F)
Weight	:	approx. 100 g
Conformity and standards	:	EMC 2004/108/EC: EN 61000-6-2 EN 61000-6-3

*) Permanent short circuit is acceptable for one output only at a time