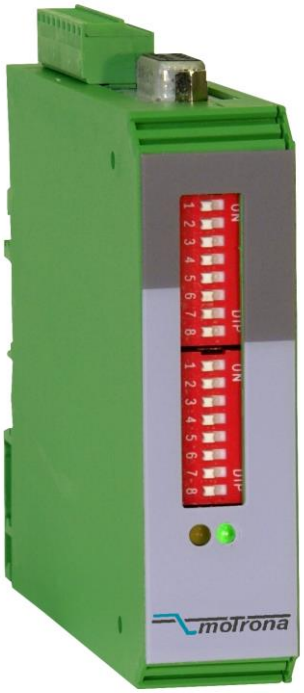
safety - control - motion - interface

CONNECTRIC SYSTEMS INC.
28-207 Edgeley Blvd., Concord, Ontario, L4K 4B5
Ph: 905-669-0080 Fax: 905-669-0082
www.connectric.com info@connectric.com

Operation Manual

PU 210

Level Converter, Potential Separator and Direction Signal Decoder for Incremental Encoder Signals



- Signal inputs A, B, Z and /A, /B, /Z, adjustable to either RS422 format or TTL level or HTL (10-30V) level
- Signal outputs A, B, Z and /A, /B, /Z, likewise adjustable to either RS422 format or TTL level or HTL (10-30V) level
- Potential separation between input and output
- Conversion of a A/B quadrature direction signal to a static direction output and vice-versa
- Encoder connection alternatively via SUB-D-connectors or parallel screw terminal strips

Version:	Description:
PU21001d/af/hk/Aug.05	Original Edition
PU21001d/af/hk/Feb.06	Edition A5 GER/ENG/FRA
PU21002a/kk/hk/Feb.08	Corrections: HTL output level, switch assignments A/B/Z
PU21003a/af/hk/Feb.11	Supplement: processing of single-ended TTL signals
Pu21003b_oi/ag/Apr.15	Safety Instructions, Technical Specifications and Design updates

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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). 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.

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

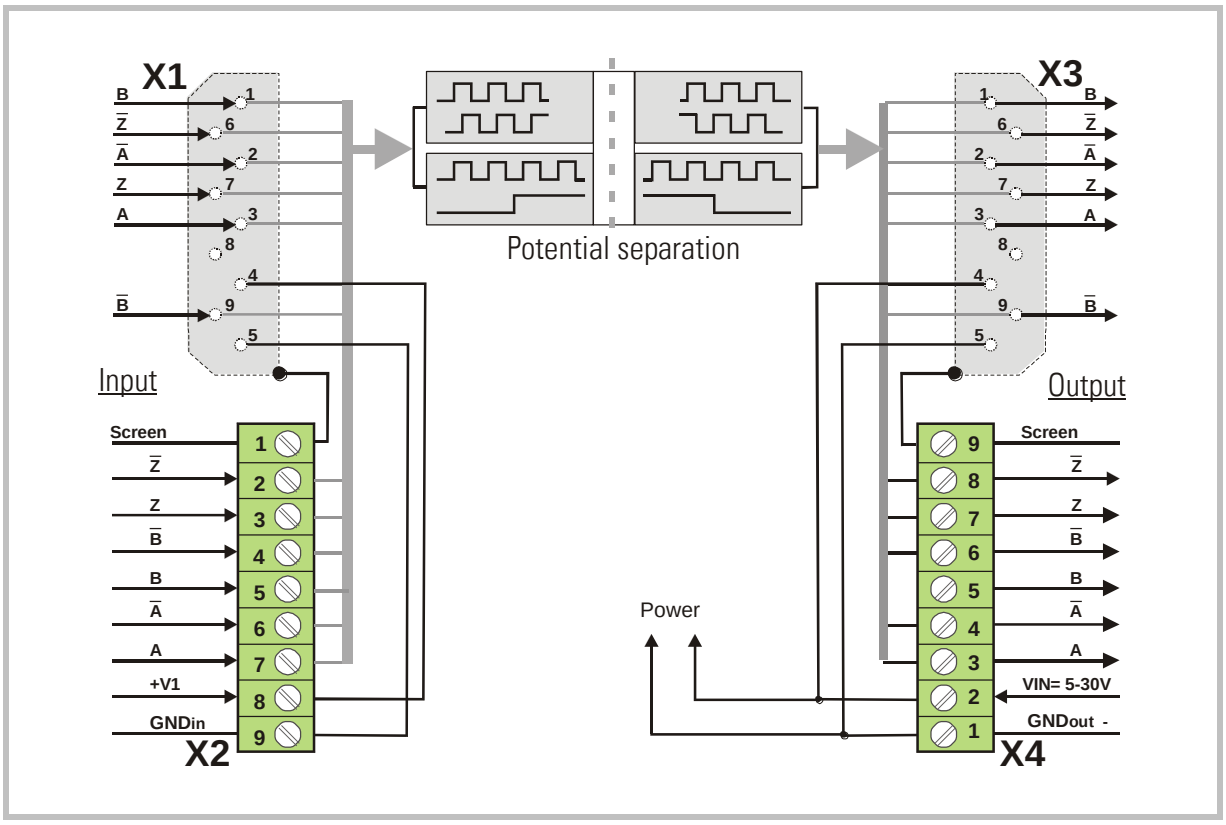
This universal level converter, on the input side, can accept single channel and quadrature encoder signals with either RS422 format or TTL level or HTL (10-30V) level. Where the signal provides direction information, the direction may be defined by either an A/B-90° phase displacement, or by a static direction signal.

Independent of the input level and the mode of direction information, the output provides A, /A, B, /B und Z, /Z signals, and again the direction may be selected as quadrature A/B format or as a static direction signal. The outputs provide push-pull characteristics and the output level is about 1.5 volts lower than the power supply voltage (+5 to +30 volts DC).

Inputs and outputs are isolated via inductive high-speed couplers. All signals can be connected alternatively via SUB-D-connectors or by parallel screw terminal strips.

PU210 uses a slim and space-saving plastic housing for DIN rail mounting.

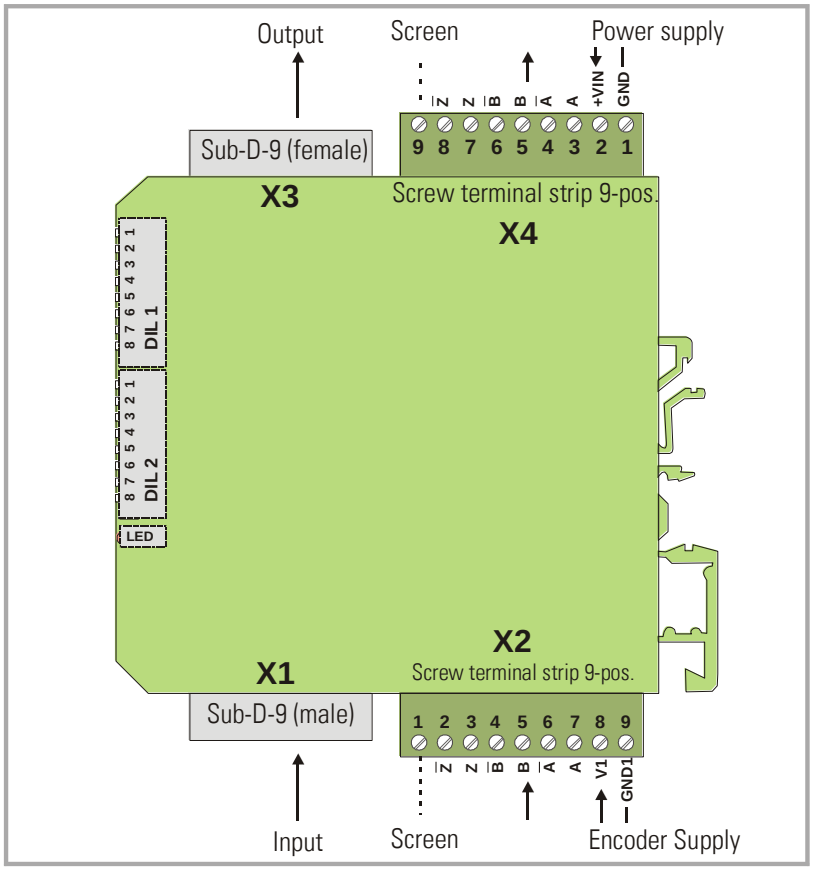
The subsequent block diagram explains all essential details:



Even with differential operation on the input side it may be advantageous to connect the signal common to GNDin (terminal 9 of X2 or pin 5 of X1).

This may result in better signal quality and will not affect at all the potential separation between input and output

3. Construction and Electrical Connections



3.1. Power supply

The unit requires a DC supply between 5 and 30 volts.
The level of the supply voltage will at the same time determine the output swing
(voltage drop approx. 1.5 volts, i.e. 24 VDC power supply will result in a 22.5 V output swing)

The supply voltage can either be applied to the screw terminals marked “GND” and “+VIN” on terminal strip X4, or also to the female SUB-D-9 output connector X3, using pin 5 (GND) and pin 4 (+VIN).

3.2. Encoder supply

On the input side, pin 4 (+) and pin 5 (-) of the SUB-D-connector X1 can be used for encoder supply, provided that a corresponding supply voltage is applied to the parallel screw terminals V1 and GND1 of terminal strip X2. The unit itself does not provide any internal encoder supply.

3.3. Function of the LEDs

The green LED on the front side is to indicate „power on“.
The yellow LED indicates directly the input impulses from input channel A.

4. Switch settings

The front DIL switches require a few settings depending on the signal levels and the mode of indicating the direction on inputs and outputs

4.1. Input characteristics

You can set the desired input characteristics by switch DIL2, positions 6, 7 and 8

0=OFF 1=ON								DIL2
8	7	6	5	4	3	2	1	
1 (Z)	1 (B)	1 (A)						**Single-ended input:** Only signals A, B and Z are connected, the inverted inputs /A, /B, /Z remain unconnected. Acceptable input level: HTL, 10 - 30 V *) (PNP only, must switch to +)
0 (Z)	0 (B)	0 (A)						**Differential input (RS422):** with every signal, also the corresponding inverted signal must be connected (A, /A, B, /B, Z, /Z). Acceptable input level of differential signals: 3 – 30 volts
								• Setting of the input format is separately for each of the encoder channels, according to above indications (A), (B), (Z) • With RS422 setting, the corresponding input will accept RS422 signals as well as differential TTL signals and also 10 - 30 V HTL levels. However, a minimum differential voltage of 1 volt is required. • Single-ended signals with standard applications need HTL level (10 - 30 volts) *)

*) Where exceptionally single-ended TTL signals have to be processed (i.e. TTL signals with no inverted channels), a special DIL switch hidden behind the front plate provides corresponding setting facilities.
To access this switch, please slightly lift up the front plate on its bottom side as shown on next page.



Position 1 affects input channel A
Position 2 affects input channel B
Position 3 affects input channel Z (marker pulse)

OFF = Single-ended operation using HTL Level

ON = Single-ended operation using TTL Level

Ex factory all positions are set to OFF,
i.e. HTL level is required for all single-ended operation

Single-ended TTL levels are most prone to interference (EMC) and are only conditionally suitable for signal transmissions under industrial EMC environment

With standard applications please never touch the DIL switch hidden behind the front plate!

4.2. Output level

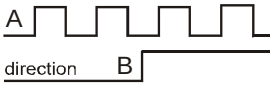
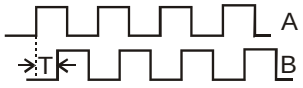
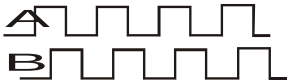
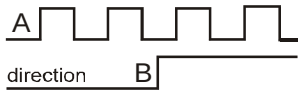
The output level depends directly on the power supply level applied to VIN. However, for best edge steepness and short-circuit-proof, switch DIL1, positions 1 to 6 must be set with regard to the level used.

The output always provides the inverted signals, even when these are not available on the input side.

0=OFF 1=ON								DIL1
8	7	6	5	4	3	2	1	Output
		0	0	0	0	0	0	HTL (VIN > 8 V)
		1	1	1	1	1	1	TTL / RS422 (VIN < 8V)

4.3. Definition of the direction of rotation

The unit is designed to evaluate quadrature direction information (A/B, 2x90°) and static direction information as well. Furthermore it can convert the direction information from one format to the respective other format. Positions 3, 4 and 5 of switch DIL2 provide individual selection for input and output.

0=OFF 1=ON								DIL2	
8	7	6	5	4	3	2	1		
			0	0	1			 Input: static direction	 Output: quadrature direction
			0	1	0			 Input: quadrature direction	 Output: static direction
			1	0	0			Output format = input format	

4.4. Phase displacement A/B

These settings are only relevant with single channel input signals (input A alone or A with B as a static direction information), when this information needs to be converted into a quadrature A/B format at the output.

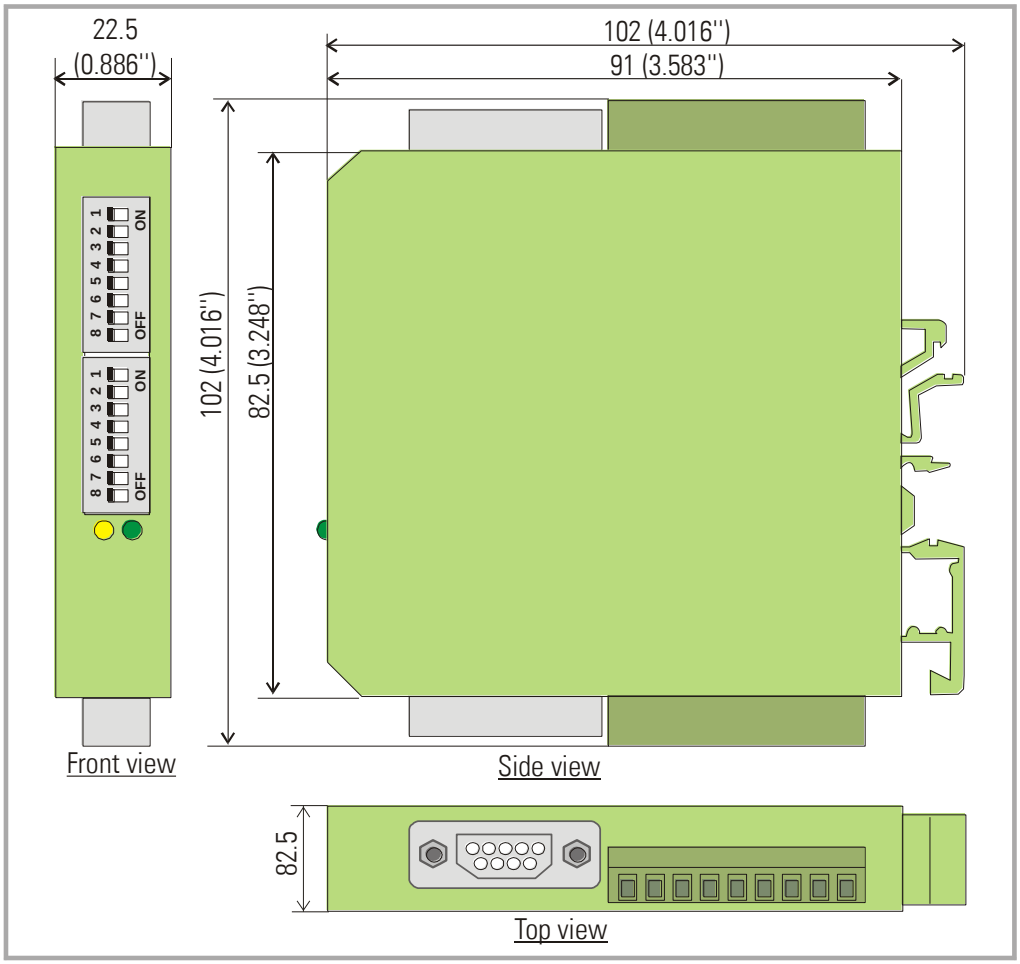
In this case the unit will generate a time-constant phase displacement "T". This displacement can of course correspond to 90° at a specific frequency only, which however will not be a disadvantage with most of the target units available on the market. Please select the time of A/B displacement according to the maximum frequency indications given in the setting table.

Displacement times will add up when several positions are switched on at the same time.

0=OFF 1=ON								DIL1	
8	7	6	5	4	3	2	1		
	1							T = +22us (12 kHz)	Time displacement A/B
1								T = +5us (50 kHz)	

0=OFF 1=ON								DIL2	
8	7	6	5	4	3	2	1		
							1	T = +2.5us (100 kHz)	Time displacement A/B
						1		T = +1us (250 kHz)	

5. Dimensions



6. Technical Specifications

Power supply:	Input voltage: Protection circuit: Ripple: Consumption: Connections:	5 … 30 VDC reverse polarity protection ≤ 10 % at 24 VDC approx. 50 mA (unloaded) screw terminal, 1.5 mm² / AWG 16
Encoder supply	Only external:	see chapter 3.2
Incremental inputs:	Number of inputs: Signal level: Channels: Frequency: Internal resistance: Connections:	1 selectable: RS422 (differential voltage > 1 V), TTL or HTL (10 … 30 V) symmetrical: A, /A, B, /B, Z, /Z asymmetrical: A, B, Z symmetrical: max. 500 kHz asymmetrical: max. 300 kHz (HTL) Ri ≈ 10 kOhm screw terminal, 1.5 mm² / AWG 16 or SUB-D (male), 9-pin
Incremental outputs:	Number of outputs: Signal level: Channels: Output current: Output circuit: Signal propagation delay: Connections:	1 3.5 … 28.5 V A, /A, B, /B, Z, /Z max. 30 mA (per output) Push-Pull approx. 600 ns screw terminal, 1.5 mm² / AWG 16' or SUB-D (female), 9-pin
Housing:	Material: Mounting: Dimensions: Protection class: Weight:	plastic mounting rail (DIN, 35 mm C-Profile) 22.5 x 102 x 102 mm (w x h x d) IP20 approx. 100 g
Ambient temperature: (not condensing)	Operation: Storage:	0 °C … +45 °C / +32 … +113 °F -25 °C … +70 °C / -13 … +158 °F
Failure rate:	MTBF in years:	71.8 a (long-term usage at 60 °C / 140 °F)
Conformity & standards:	EMC 2004/108/EC: Guideline 2011/65/EU:	EN 61000-6-2, EN 61000-6-3, EN 61000-6-4 RoHs-conform