

7186.5024 / 7186.5028

7184.5022 / 7184.5024 / 7184.5028

Pulse splitters for incremental encoders with and without potential separation

Product features:

- Power supply from 10 up to 30 VDC
- 1 encoder input for channels A, /A, B, /B, Z, /Z
- Input levels selectable between RS422, TTL and HTL
- Optionally types with 2, 4 or 8 outputs with or without potential separation available (see below)
- Output levels are specified by external power supply
- Short-circuit proof +5VDC and +24VDC encoder supply

Available devices:

- **7186.5024:** Pulse splitter with 1 encoder input and 4 outputs
- **7186.5028:** Pulse splitter with 1 encoder input and 8 outputs
- **7184.5022:** Pulse splitter with 1 encoder input and 2 potential separated outputs
- **7184.5024:** Pulse splitter with 1 encoder input and 4 potential separated outputs
- **7184.5028:** Pulse splitter with 1 encoder input and 8 potential separated outputs

Version:	Description:
7186.5024_01a/March 22/tgo/mbo	First edition 7186.502x/ 7184.502x

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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 [5](#)). 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 [5](#)).

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.

1.4. EMC Guidelines

All motrona devices are designed to provide high protection against electromagnetic interference. Nevertheless you must minimize the influence of electromagnetic noise to the device and all connected cables.

Therefore the following measures are mandatory for a successful installation and operation:

- **Use shielded cables for all signal and control input and output lines.**
- **Cables for digital controls (digital I/O, relay outputs) must not exceed a length of 30 m and are allowed for in building operation only**
- Use shield connection clamps to connect the cable shields properly to earth
- The wiring of the common ground lines must be star-shaped and common ground must be connected to earth at only one single point
- The device should be mounted in a metal enclosure with sufficient distance to sources of electromagnetic noise.
- Run signal and control cables apart from power lines and other cables emitting electromagnetic noise.

Please also refer to motrona manual “General Rules for Cabling, Grounding, Cabinet Assembly”. You can download that manual by the link

<https://www.motrona.com/en/support/general-certificates.html>

1.5. 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. Compatibility Hint

The 7186.502x and 7184.502x series are the successor models of the 7186.526x and 7186.528x family of pulse splitters, which have proven themselves thousand times. The new pulse splitters are able to largely replace the previous models functionally. However, there are minor differences in the wiring, the DIL switch setting and the potential separating.

The main differences between the new products and their previous models are listed below.

Differences of the 7186.502x and 7184.502x series compared to their previous models:

	7186.502x/ 7184.502x	7186.526x/7186.528x
Incremental input:	<p><u>Possible configurations:</u></p> <p>RS422 (TTL), HTL Differential, HTL PNP (asymmetrical) und TTL PNP (asymmetrical)</p> <p>The set signal level and the set signal format at the input always applies to all channels (A, B and Z) and cannot be set individually.</p>	<p><u>Possible configurations:</u></p> <p>RS422 (TTL), HTL Differential, HTL PNP (asymmetrical)</p> <p>The desired signal level and the desired signal format can be set separately for all channels (A, B and Z) using the corresponding DIL switches.</p>
Signal level:	<p><u>RS422 / TTL:</u> Differential voltage > 0,5 V</p> <p><u>HTL Differential:</u> Differential voltage > 2 V</p> <p><u>HTL (asymmetrical):</u> LOW 0 ... 6 V, HIGH 8 ... 40 V</p> <p><u>TTL (asymmetrical):</u> LOW < 0,8 V, HIGH >2,0 V</p>	<p><u>RS422 / TTL:</u> Differential voltage > 0,5 V</p> <p><u>HTL (symmetrical):</u> 10 ... 30V</p> <p><u>HTL (asymmetrical):</u> LOW 0 ... 10 V, HIGH 15 ... 30 V</p>
Max. frequencies:	<p>max. 1 MHz at RS422 / TTL</p> <p>max. 500 kHz at HTL Differential</p> <p>max. 250kHz at SE TTL / SE HTL</p>	<p>max. 500 kHz at RS422 / TTL</p> <p>max. 200 kHz at HTL Differential</p> <p>max. 200kHz at HTL (asymmetrical)</p>
Encoder supply:	<p>Output voltage: 5VDC / 24VDC</p> <p>Output current: max. 500 mA / 250 mA</p>	<p>Output voltage: 5VDC</p> <p>Output current: max. 200 mA</p>
Incremental outputs: Signal level:	<p><u>7186.502x/ 7184.502x:</u></p> <p>At terminal "ext. COM+" the desired output voltage (5V / 24V) must be supplied externally.</p>	<p><u>7186.526x:</u> 5,5V (or applied voltage (5...30V) at terminal „+Lev.“)</p> <p><u>7186.528x:</u> 5 ... 30V</p> <p>At terminal „+Lev.“ the desired output voltage (5V / 24V) must be supplied externally.</p>
Signal delay time:		approx. 400 ns

	approx. 160 ns	
Housing:	<p><u>Dimensions (BxHxT):</u> 7186.5024/7184.5022/7184.5024: 34 x 100 x 131 mm / 1,34 x 3,94 x 5,16 inches (w x h x d) (without connectors) 34 x 118 x 140 mm / 1,34 x 4,65 x 5,51 inches (w x h x d) (inclusive connectors) Weigh: approx.. 160 g</p> <p><u>Dimensions (BxHxT):</u> 7186.5028/7184.5028: 54 x 100 x 131 mm / 2,13 x 3,94 x 5,16 inches (w x h x d) (without connectors)) 54 x 118 x 140 mm / 2,13 x 4,65 x 5,51 inches (w x h x d) (inclusive connectors) Weight: approx.. 240 g</p>	<p><u>Dimensions (BxHxT):</u> 72 x 144 x 60,5 mm 2,86 x 4,89 x 2,38 inches (w x h x d) (without connectors & mounting kit) 72 x 144 x 90,5 mm / 2,83 x 5,67 x 2,38 inches (w x h x d) (inclusive connectors & mounting kit)</p> <p>Weight: approx.. 400 g</p>
Device parameterization:	Over 3-position DIL switch	Über 8-position. DIL switch
electrical pin assignment:	Different pin assignments of input, outputs and supply compared to previous model series!	Different pin assignments of input, outputs and supply compared to successor model series!
Potential separation:	<p><u>7184.502x:</u> Potential separation between input and all outputs, as well as all outputs among each other.</p> <p>No galvanic isolation between input and the device supply.</p>	<p><u>7186.526x:</u> Potential separation between input and the outputs.</p> <p><u>7186.528x:</u> Complete electrical isolation between input, all outputs among each other and the device supply.</p>

3. Introduction and Block Diagram

7186.5024 and 7186.5028 as well as 7184.5022, 7184.5024 and 7184.5028 represent a series of incremental encoder splitters with a most compact, space-saving design and with most versatile technical features. All models are fully identical except for the number of output channels and any potential separation between input and output.

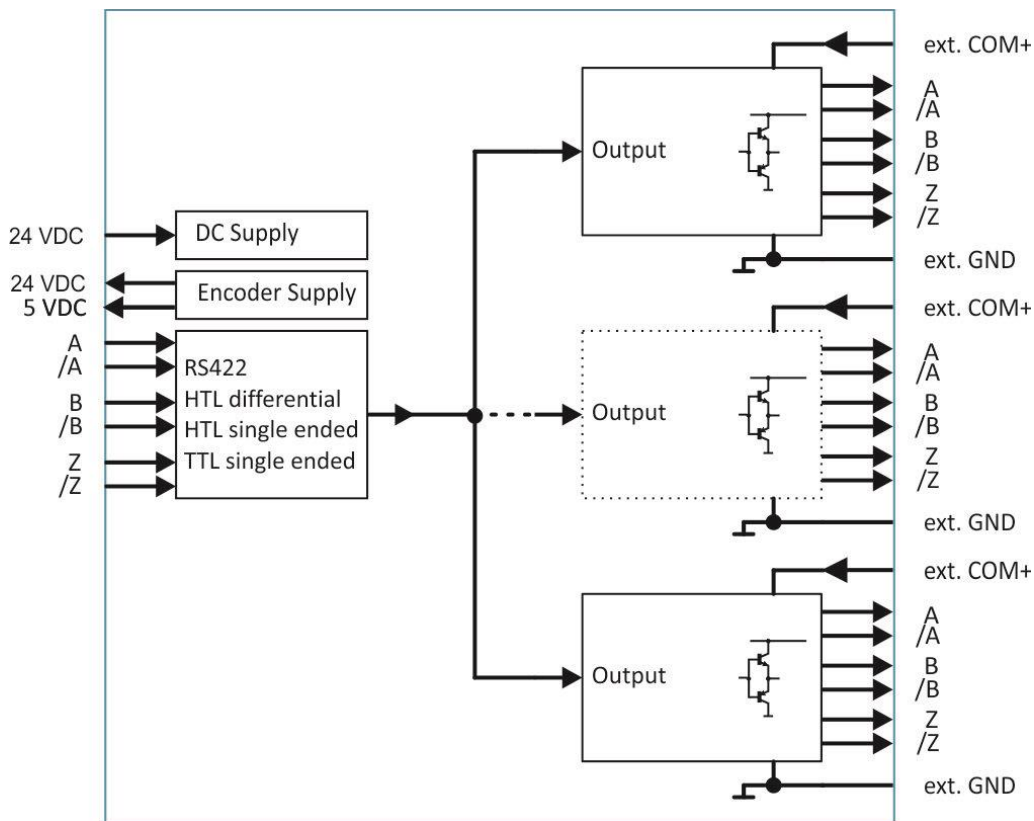
Models 7184.5022, 7184.5024 and 7184.5028 have a potential separation between input and output circuit as well as between the output circuits among each other. There is no galvanic separation between input and device supply. This feature, in general, can be most advantageous with impulse distribution among expanded production lines with adverse conditions of EMC / grounding / potential shift.

The encoder input is switch-selectable for operation with either standard RS422 signals, with differential TTL or HTL signals or with single-ended HTL encoder signals. All encoder outputs provide push-pull drivers. The output level can be individually specified accordingly about an external voltage.

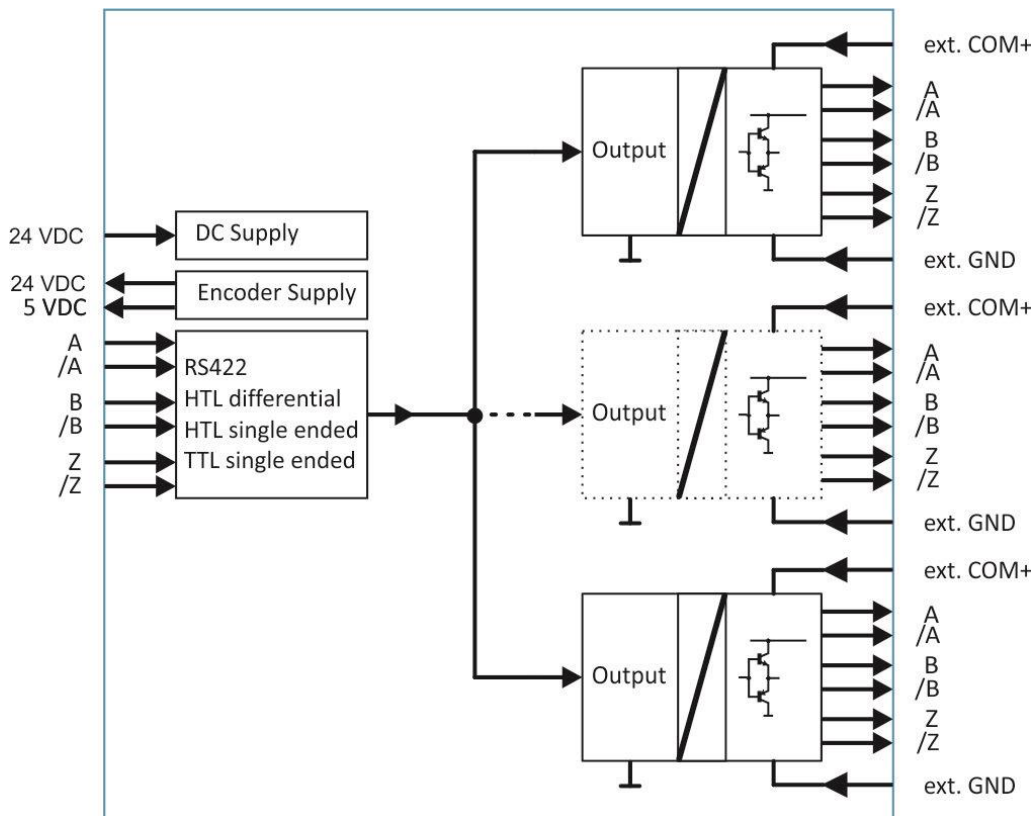
The adjoining block diagrams clearly explain the principle of operation and the potential conditions between all circuits. For simplification the illustrations show only two of the outputs, since all other outputs are fully identical.

All units of this series provide an extended range of ambient temperatures for use under difficult environmental conditions (see chapter [5](#) “Technical Specifications”).

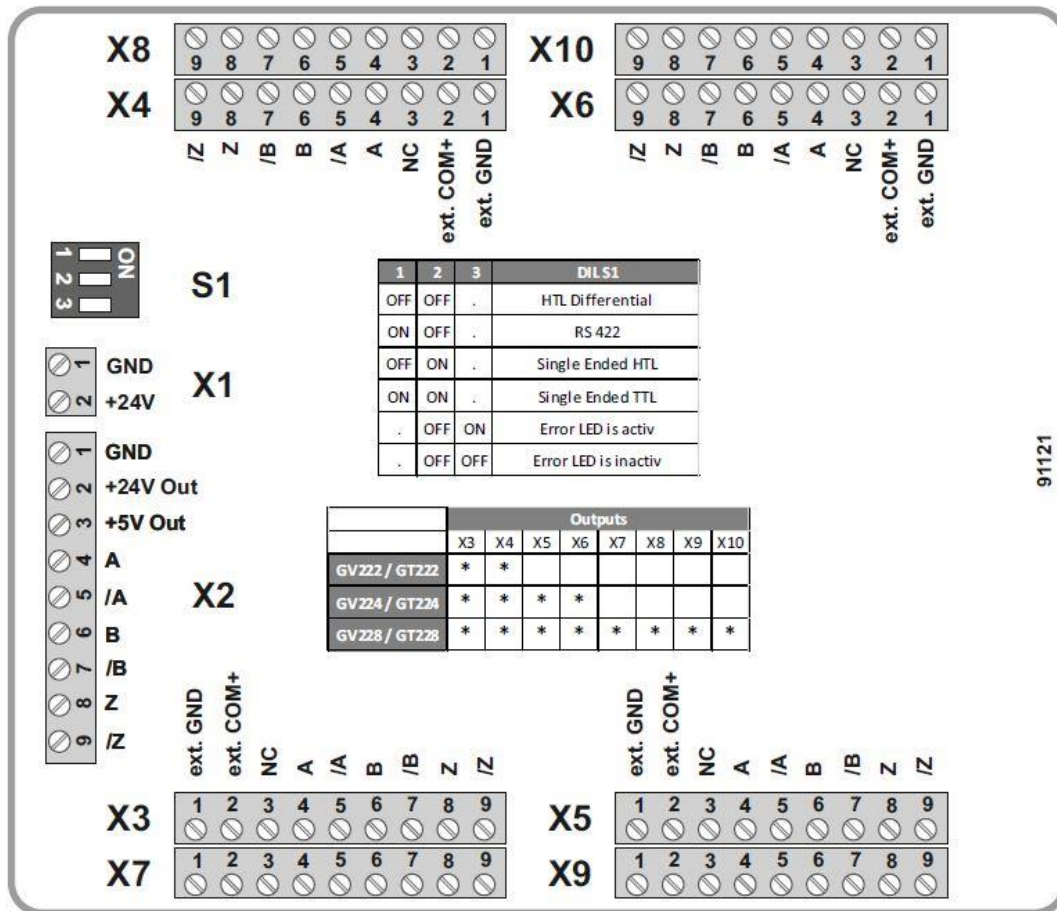
3.1. Block diagram 7186.5024 und 7186.5028



3.2. Block diagram 7184.5022 / 7184.5024 und 7184.5028



4. Electrical Connections und LED Function



4.1. Power Supply and LEDs

The device is supplied with 10 to 30 VDC about the 2-pin screw terminal strip (X1) on the front of the device. The current consumption is approx. 25 mA (no-load operation).

The upper LED (green) signals that power is applied to the unit.

The lower LED (yellow) signals a possible error (e.g. wire break) at the input channels A, /A, B, /B and/or Z, /Z in case of differential input signals, switched on error evaluation (DIL 3 = ON) and corresponding terminated wires.

More detailed information about the error evaluation can be found in the chapter "Error evaluation".

4.2. Auxiliary Encoder Supply

The 9-pin input terminal on the front panel (X2) provides a short-circuit proof +5VDC and a +24VDC encoder supply. There is no electrical separation between encoder supply and device supply.

4.3. Impuls Inputs

The encoder signal to be distributed is applied to the 9-pin input terminal on the front panel (X2). The desired input level as well as the desired signal format of the pulse inputs can be set accordingly at the front DIL switch and always apply to all channels A, B and Z. An individual setting of the individual channels is not possible. The individual DIL switch positions and their meaning are listed below.

4.3.1. Encoders with differential output (Output level: HTL Differential / 10 - 30 V)

DIL switch:

DIL1: OFF DIL2: OFF

4.3.2. Encoders with differential output (Output level: RS422/ 5V)

DIL switch:

DIL1: ON DIL2: OFF

4.3.3. Encoders with single-ended output, without inverted signals (Output level: HTL)

DIL switch:

DIL1: OFF DIL2: ON

4.3.4. Encoders with single-ended output, without inverted signals (Output level: TTL)

DIL switch:

DIL1: ON DIL2: ON



For differential input signals "HTL Differential" and "RS422", in addition to the A, B and Z channels, the associated inverted channels /A, /B and /Z must also always be connected to terminal X2. For single-channel "Single Ended HTL" or "Single Ended TTL" signals only the used channels A, B and Z have to be connected. The corresponding cross channels remain unoccupied in these two cases.

4.4. Impuls Outputs

All outputs provide the non-inverted and the inverted signals at any time, even when on the input side the inverted signals are not available.

The potential situation between the outputs and other circuits is clearly explained by the block diagrams in chapter 3.

An external voltage must be supplied to the respective output terminals (terminal ext. COM+) of the outputs, which determines the level of the output signal *). The permitted output range is from 5 to 30 volts and the signal levels will be approx. 0.7 volts less than the remote voltage applied. All output lines are permanently short-circuit proof and the maximum output current is 30 mA per line.

The terminal assignment can be found in the block diagram and is also printed on the connection sticker. All output terminal strips have the same codification, since it is fully unimportant to which of the outputs a terminal strip is connected (only the external voltage applied to the (ext. Com+) input of the mating connector is responsible for the output level).



***) For the types with potential separation (GT22x), in addition to "ext. COM+" and also the corresponding "ext. GND" connection of the corresponding output must also be connected. For the types without potential separation (GV22x) all "ext. GND's" of the outputs are internally connected with the device supply - "GND".**

4.5. Error Evaluation

With DIL switch 3 = ON the yellow error LED can be activated for differential input signals (RS422 or HTL differential). This lights up as soon as one (or more) of the channels A, B and Z detects an error between the lines (e.g. wire break). For this error detection, the individual channels must be locked accordingly. (e.g. by means of 120 Ohm resistors)



If a channel (e.g. Z and /Z) is not used and consequently not connected and the error evaluation has been activated by DIL 3, then depending on the signal level set (TTL or HTL) the non-connected channel must be connected accordingly to this signal level (5V for TTL or 24V for HTL) and the associated non-connected inverted channel must be connected accordingly to GND. Otherwise the error detection would always be triggered incorrectly due to the non-connected channel.

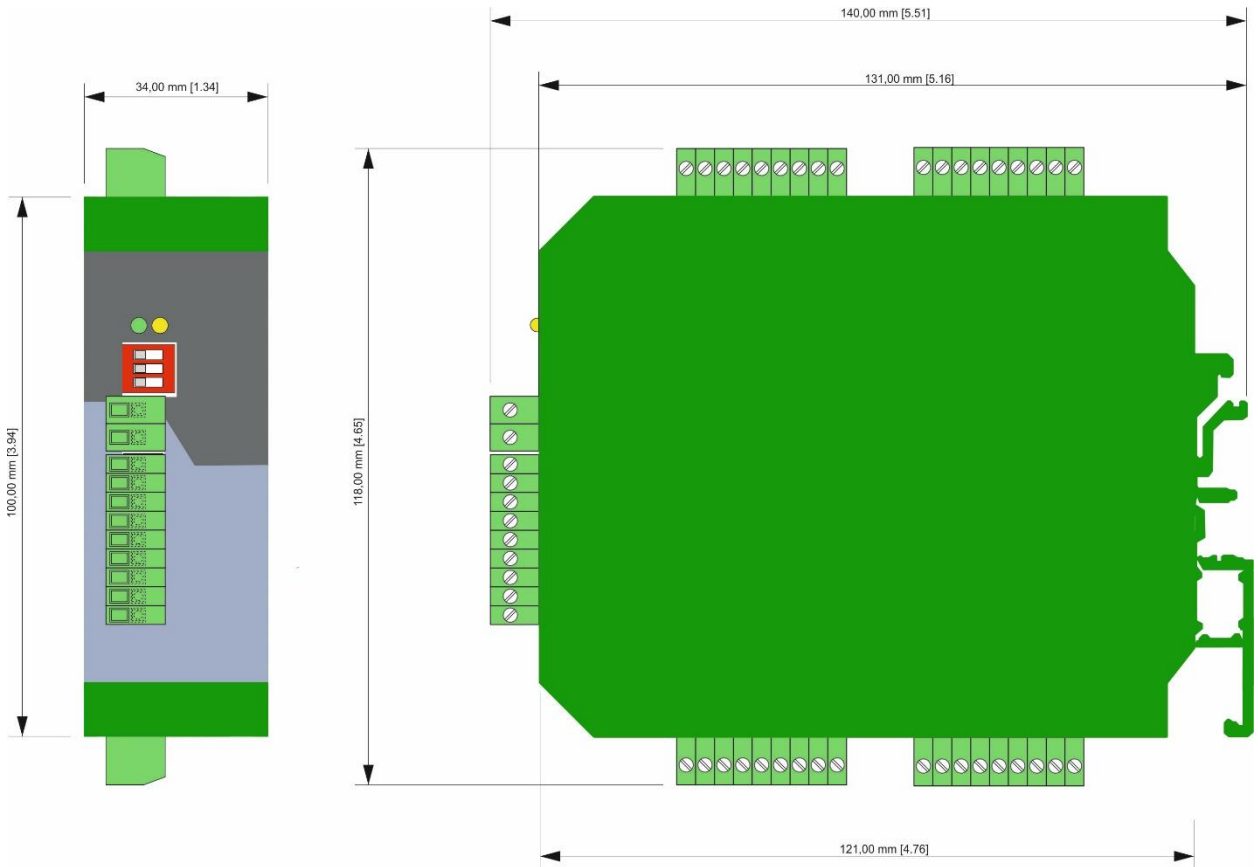
5. Technical Specifications

Technical Specifications		
Power supply:	Input voltage: Protection circuit: Ripple: Consumption: Connections:	10 ... 30 VDC Reverse polarity protection ≤ 10 % at 24 VDC approx. 25 mA, with an unloaded encoder supply screw terminal, 1,5 mm ² / AWG16
Encoder supply:	Output voltage 1: Output current: Output voltage 2: Output current: Protection: Connections: Further possibilities:	24 VDC (ca. 0,8 V less than supply voltage) max. 250 mA, (galvanically connected with the power supply) 5 VDC max. 500 mA, (galvanically connected with the power supply) short circuit proof screw terminal, 1,5 mm ² / AWG16, 9-pin a) Externally by a separate source b) By the same source that supplies the splitter (10...30V)
Incremental input:	Signal levels (selectable): Channels: Frequency: Connections:	RS422 / TTL (differential voltage > 0,5 V), HTL Differential (differential voltage > 2 V), HTL (asymmetrical): LOW 0 ... 6 V, HIGH 8 ... 40 V TTL (asymmetrical): LOW < 0,8 V, HIGH >2,0 V asymmetrical: A, B, Z or symmetrical: A, /A, B, /B, Z, /Z max. 1 MHz at RS422 / TTL max. 500 kHz at HTL Differential max. 250kHz at SE TTL / SE HTL screw terminal, 1,5 mm ² / AWG16
Incremental outputs:	Number of outputs: Output logic: Signal levels: Signal delay time: Output current: Protection: Connections:	2 (7184.5022), 4 (7184.5024/7186.5024) resp. 8 (7184.5028/7186.5028), push-pull 5 ... 30 V (can be supplied by respective ext. COM+ terminal) approx. 160 ns max. 30 mA short-circuit proof screw terminal, 1,5 mm ² / AWG16
Potential separation:	7184.5022 / 7184.5024 7184.5028	Potential separation between input and the outputs as well as all outputs among each other.
Indicators:	Number of indicators: Function:	2 LEDs 1 x green for "ready for operate" state 1 x yellow for error detection at the inputs A, B, Z

Housing:	<p>Material: plastic</p> <p>Mounting: mounting rail (EN 60715, 35mm C-Profile)</p> <p>Dimensions (B x H x T): 7186.5024/7184.5022/7184.5024: 34 x 100 x 131 mm / 1.34 x 3.94 x 5.16 inches (w x h x d) (without connectors) 34 x 118 x 140 mm / 1.34 x 4.65 x 5.51 inches (w x h x d)</p> <p>Weight: (inclusive connectors) approx. 160 g</p> <p>Dimensions (B x H x T): 7186.5028/7184.5028: 54 x 100 x 131 mm / 2.13 x 3.94 x 5.16 inches (w x h x d) (without connectors)</p> <p>Weight: (without connectors)</p> <p>Protection: 54 x 118 x 140 mm / 2.13 x 4.65 x 5.51 inches (w x h x d) (inclusive connectors) approx. 240 g IP20</p>
Ambient temperature:	<p>Operation: -20 °C ... +60 °C / -4 °F ... +140 °F (not condensing)</p> <p>Storage: -30 °C ... +75 °C / -22 °F ... +167 °F (not condensing)</p>
Failure rate:	<p>MTBF in years: 7184.5022: 131,7 a</p> <p>(continuous operation at 60 °C / 140 °F) 7186.5024: 120,9 a / 7184.5024: 102,0 a 7186.5028: 85,4 a / 7184.5028: 67,7 a</p>
Conformity & standards:	<p>EMC 2014/30/EU: EN 61326-1: 2013 for industrial location EN 55011: 2016 + A1: 2017 + A11: 2020 Class A</p> <p>RoHS (II) 2011/65/EU EN IEC 63000: 2018</p> <p>RoHS (III) 2015/863:</p>

6. Dimensions

7186.5024 / 7184.5022 / 7184.5024



7186.5028 / 7184.5028

