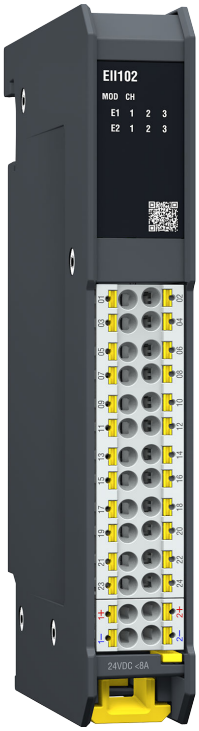

EII102

Counter / Time Measurement / Incremental Encoder Interface Module

Incremental encoder and counter evaluations at the highest signal input frequencies are managed in automation tasks by modules of the EII100 series. The digital sensor signals to be acquired are configurable, thus enabling the connection of a wide range of sensors.

The module allows the counting of pulse edges as well as the measurement of period and pulse duration. The module offers the evaluation of incremental encoders up to 32 MHz for demanding motion and handling applications. Immediate reactions such as latch, reset or counter enable are triggerable via digital inputs on the module. If the actual position is reaching a configured comparison value, module-to-module communication enables a digital output to be switched at the adjacent module without any time loss. Thus function initiate a machine response. Integrated sensor power supply units for 5 V and 24 V directly in the terminal panel simplify wiring.

Part type designation	Part number
EII102	00029503-00
EII102 EC	00038772-00

Features

- Up to 2 incremental encoder interfaces:
  - A, B, Z + inverted
  - 1-wire connection: TTL, HTL
  - Differential transmission: RS-422, HTL
  - Calculation of the speed at the module
- Up to 6 channels as counters / for time measurement
- 6 DI for latch / homing / counter enable
- 2x 5 V DC / 24 V DC / GND encoder supply
- Oversampling
- Synchronous clocks
- Direct module-to-module communication:
  - Switching of DO at the adjacent module when the target position / the comparison value is reached

Common properties	
Basic function	2x incremental encoder evaluation A/B/Z + inverted + velocity calculation 6x edge counting 6x cycle time measurement, pulse duration measurement 2x oversampling 2x difference time measurement Input level HTL / TTL / HTL differential / RS-422 (TTL differential)
System	Bachmann system M100
Digital Inputs – 24 V	
Number of digital inputs	4 to 6 configurable
Signal standard	IEC 61131-2 type 1 / type 3 sink (P-reading)
Voltage category, nominal	24 V DC
Signals per supply group	6 (1 group)
Connections per input	1 (LATCH / HOME / EN)
Signal supply voltage range	18 V DC to 32 V DC
Operating voltage range (high/on)	11 V DC to 32 V DC
Off-state voltage (low/off)	-15 V DC to 5 V DC
Overvoltage protection	-32 V DC to 32 V DC
Input current, on-state, nominal	2.5 mA
Input current, off-state, max.	0.1 mA
Signal on delay, max.	5 µs + digital spike filter setting value
Signal off delay, max.	5 µs + digital spike filter setting value
Digital spike filter	0 µs, 10 µs to 500 ms in increments of 15 (6x)
Internal scan rate, max.	No internal cycle
Maximum input frequency	20 kHz
Signal inversion	No
Impulse extension	No
Oversampling	No
Time stamps	Homing time (HOME) Triggered value transfer (LATCH)
Signal state indication	Yes, green numeric LED per channel
Signal cable length, shielded, max.	1000 m
Signal cable length, unshielded, max.	30 m
Digital inputs – HTL	
Number of digital inputs	0 to 6 configurable
Signal standard	HTL (sink)
Voltage category, nominal	24 V DC
Connections per input	1 (signal)
Signal supply voltage range	18 V DC to 32 V DC
Operating voltage range (high/on)	11 V DC to 32 V DC
Off-state voltage (low/off)	-15 V DC to 5 V DC
Overvoltage protection	-32 V DC to 32 V DC
Input current, on-state, nominal	0.55 mA
Input current, off-state, max.	0.21 mA
Maximum input frequency	300 kHz
Digital spike filter	0 ns, 200 ns to 5 ms in 15 increments (6x)
Time stamps	New counter value / position value / measured time value

Digital inputs – HTL	
Signal state indication	No
Digital inputs – TTL	
Number of digital inputs	0 to 6 configurable
Signal standard	TTL (sink)
Voltage category, nominal	5 V DC
Connections per input	1 (signal)
Signal supply voltage range	18 V DC to 32 V DC
Operating voltage range (high/on)	2 V DC to 15 V DC
Off-state voltage (low/off)	-15 V DC to 0.8 V DC
Overvoltage protection	-32 V DC to 32 V DC
Input current, on-state, nominal	85 µA
Input current, off-state, max.	-50 µA
Maximum input frequency	400 kHz
Digital spike filter	0 ns, 200 ns to 5 ms in 15 increments (6x)
Time stamps	New counter value / position value / measured time value
Signal state indication	No
Digital inputs – 5 V/24 V pull up	
Number of digital inputs	0 to 2 configurable
Signal standard	5 V sourcing input
Voltage category, nominal	5 V DC
Connections per input	1 (ERR)
Signal supply voltage range	18 V DC to 32 V DC
Operating voltage range (high/on)	2.5 V DC to 32 V DC
Off-state voltage (low/off)	0 V DC to 0.5 V DC
Nominal threshold	0 → 1: 1.3 V 1 → 0: 0.7 V
Overvoltage protection	-32 V DC to 32 V DC
Input current, on-state, nominal	85 µA
Maximum input frequency	20 kHz
Digital spike filter	0 µs, 10 µs to 500 ms in increments of 15 (2x)
Time stamps	No
Signal state indication	Yes, green numeric LED per channel
Digital inputs – HTL differential	
Number of digital inputs	0 to 6 configurable
Signal standard	HTL differential (sink)
Voltage category, nominal	24 V DC differential
Connections per input	2 (signal+, signal-)
Signal supply voltage range	18 V DC to 32 V DC
Operating voltage range (high/on)	2 V DC to 32 V DC
Off-state voltage (low/off)	-32 V DC to -2 V DC
Overvoltage protection	-32 V DC to 32 V DC
Input current, on-state, nominal	2.7 mA
Maximum input frequency	300 kHz
Time stamps	New counter value / position value / measured time value
Digital spike filter	0 ns, 200 ns to 5 ms in 15 increments (6x)
Signal state indication	No

Digital inputs – RS-422 (TTL differential)	
Number of digital inputs	0 to 6 configurable
Signal standard	RS-422
Voltage category, nominal	5 V DC differential
Connections per input	2 (signal+, signal-)
Signal supply voltage range	18 V DC to 32 V DC
Operating voltage range (high/on)	0.45 V DC to 15 V DC
Off-state voltage (low/off)	-15 V DC to -0.45 V DC
Overvoltage protection	-32 V DC to 32 V DC
Input current, on-state, nominal	0.6 mA
Maximum input frequency	8 MHz [1)]
Digital spike filter	0 ns, 200 ns to 5 ms in 15 increments (6x) [1)]
Time stamps	New counter value / position value / measured time value
Signal state indication	No

[1)] *At input signal frequencies > 1 MHz, disable the signal filter (parameter value "Off").*

Time measurement	
Number of time measurements	0 to 6 configurable
Selectable input interfaces	Digital inputs - HTL Digital inputs - TTL Digital inputs - HTL differential Digital inputs - RS-422 (TTL differential)
Edge evaluation	6x
Cycle time measurement	6x
Pulse duration measurement	6x
Difference time measurement between edges of different channels	2x
Maximum input frequency	HTL: 300 kHz TTL: 400 kHz HTL differential: 300 kHz RS-422 (TTL differential): 8 MHz
Time resolution	10 ns
Time source accuracy	50 ppm

Counter	
Number of counters	0 to 6 configurable
Selectable input interfaces	Digital inputs - HTL Digital inputs - TTL Digital inputs - HTL differential Digital inputs - RS-422 (TTL differential)
Edge evaluation	6x
Edge counter including frequency reduction	2x
Counter latch	Via DI (2x)
Conditional counting (gate)	Via DI (2x) Via software (6x)
Selectable counting direction	Via software (6x)
Frequency measurement	No
Set/reset counter	Via DI (2x) Via software (6x)

Counter	
Automatic compare function	Upper/lower comparison value (2x) Incrementing comparison value (2x)
Maximum input frequency	HTL: 300 kHz TTL: 400 kHz HTL differential: 300 kHz RS-422 (TTL differential): 8 MHz
Incremental position encoder	
Number of encoders	0 to 2 configurable
Selectable input interfaces	Digital inputs - HTL Digital inputs - TTL Digital inputs - HTL differential Digital inputs - RS-422 (TTL differential)
2-phase quadrature encoding (A/B track)	Single, double, quad edge evaluation (2x)
2-phase quadrature encoding with reference (A/B/Z track)	Single, double, quad edge evaluation (2x)
Edge counting modes	Single, double, quad edge evaluation, pulse/direction (2x)
Edge counter including frequency reduction	2x
Counter latch	Via DI (2x)
Velocity measurement	2x
Set/reset encoder	Via DI (2x) Via track Z (2x) Via DI + track Z (2x) Via software (2x) Automated (for comparison value) (2x)
Automatic compare function	Upper/lower comparison value (2x) Incrementing comparison value (2x)
Maximum count frequency	HTL: 1.2 MHz (quad edge evaluation) TTL: 1.6 MHz (quad edge evaluation) HTL differenziell: 1.2 MHz (quad edge evaluation) RS-422: 32 MHz (quad edge evaluation)
Sensor supply 24 V DC	
Number of supply points 24 V DC	2
Output current per channel, nominal, continuous	300 mA
Short-circuit protected, supply	Yes, self-healing fuse
Overvoltage protection	-32 V DC to +32 V DC
Sensor supply 5 V DC	
Number of supply points 5 V DC	2
Output current per channel, nominal, continuous	250 mA
Short-circuit protected, supply	Yes, current limit
Overvoltage protection	No
Sensor supply GND	
Number of supply points GND	2
Module-to-module communication	
Signal propagation to neighbour	Upper comparison value reached (2x) Lower comparison value reached (2x)
Signal receiver from neighbor modules	No

Module bus interface	
System	M100
Slot type	IO (1/E, 2, 3, 4, ...31)
Module data rate	Typ.: 0 Mbit/s to 33.6 Mbit/s depending on the configuration
Bus cycle time, min.	4.5 µs [1]

[1] *Depending on the fieldbus used and the respective configuration, lower data rates and longer cycle times can be expected.*

Synchronization/clocks	
Distributed clocks	Yes
Time stamp format	64 bit in ns
Time resolution	10 ns
Time precision	25 ns within the station 100 ns via network (typ.) 1 µs via network (max.)
Synchronization functions	INC CNT TM DIFF
Latch input	Yes
Field bus cycle time, min.	100 µs [1]

[1] *Depending on the fieldbus used and the respective configuration, lower data rates and longer cycle times can be expected.*

Diagnostics	
Electronic type plate	Yes (application interface and in the engineering tool)
Machine readable type plate	Yes (QR code with type and part information and internet link)
Environmental conditions sensor	Integrated (temperature)
Operational indications	LED "MOD" (red/green) module status LED "CH" (red/green) channel status summary Numeric LED per digital input (green) level of the digital input
Error indications	Module supply Sensor supply 24 V Sensor supply 5 V Level of counting signals Sensor error (via DI) Sequence error A/B (incremental encoder) Encoder resolution monitoring Warning in the event of faults close to filter limit Module temperature
Powerfail, logic supply	No
Powerfail, signal supply	Undervoltage < 16.1 V (fallback > 17 V)
Open circuit	Yes, for differential input signal
Mismatch output readback	No

Energy supply	
Supply voltage, nominal	24 V DC
Supply voltage, range	18 V DC to 32 V DC
Supply voltage, short-term overload	40 V for 100 ms
Power consumption from 24 V signal supply	0.7 W plus sensor supply
Maximum residual ripple 24 V signal supply	±2.4 V
Overcurrent protection required	No internal protection External protection with circuit breaker characteristic: B, C, D, Z or K Max. nominal current 8 A DC

Energy supply	
Power dissipation, typ./max.	1.0 W / 3.2 W
Reverse polarity protection signal supply	Yes, continuously (up to -32 V)
Power consumption from backplane	660 mW
Supply terminal block bridge	Yes, internal connection from 1+ to 2+, and 1- to 2-
Product safety	
Galvanic isolation	850 V AC
Galvanic isolation between inputs	No
Permitted potential difference between digital channels	40 V
Degree of protection acc. IEC 60529	IP40, terminal block IP30
Protection class acc. IEC 61010-1, IEC 61010-2-201	III
Overvoltage category acc. IEC 61010-1	II
Rated impulse withstand voltage acc. IEC 61000-4-5	Supply DC: • 500 V DM • 1000 V CM
Keying of terminal block	Yes (6-fold per 4 contacts)
Environmental conditions	
Temperature range, operating	-30 °C to +70 °C
Temperature range, transport and storage	-40 °C to +85 °C
Installation altitude, max.	Up to 2000 m without temperature derating 2000 m to 4500 m: Reduction of the max. ambient temperature by 0.1 °C per 100 m elevation
Air pressure	106 kPa to 58 kPa (0 m to 4500 m)
Relative humidity, operation	Standard: 0 % to 100 % noncondensing Extended Climate: 0 % to 100 % with temporary condensation
Pollution degree acc. IEC 61010-1	Standard: 2, noncondensing Extended Climate: 2
Vibration	6 g (14.1 Hz to 500 Hz) 7.5 mm amplitude (2 Hz to 14.1 Hz) Test duration: 15 h
Shock	45 g max. (test scope 18 shocks) 20 g permanently (test scope 6000 shocks)
Approvals/certificates	
Product safety	CE, UKCA cULus (NRAQ, NRAQ7)
Hazard area operation	ATEX: Ex II 3G Ex ec IIC Gc
Maritime	ABS, BV, DNV, KR, LR, NK, RINA: in preparation
Hazardous substances and waste treatment	RoHS, RoHS China, REACH, WEEE
Quality management	ISO 9001 for development and production
Engineering	
Configuration tool	SolutionCenter (≥ V2.75)
Firmware package update	Yes (via SolutionCenter or console interface on the head module)
Mounting/installation	
Mounting type	Inserting and screwing onto the backplane with integrated M4 screw
Ground connection for protection class I	No

Dimensions	
Number of slots	1
Size unpacked W × H × D	23.3 mm × 152.5 mm × 95.7 mm
Mass unpacked	268 g

Order data

Part type designation	Part number	Description
EII102	00029503-00	Counter / time measurement / incremental encoder module system M100 0 to 6 counters/time measurements; 0 to 2 incremental encoders A/B/Z+ inverted, max. count frequency 32 MHz, configurable input signal types; integrated sensor supply; 6x DI 24 V DC for latch, homing, counter enable, 1 group; comparison value monitoring, module-to-module communication provider; synchronization, 2 oversampling, time stamping; isolated from system, without terminal block
EII102 EC	00038772-00	Like EII102 with Extended Climate Range

Accessories

Part type designation	Part number	Description
BPR1nn	00039235-nn	Backplane for DIN-rail mounting Active backplane system M100: BPR1nn with nn = 04 to 16 slots in increments of 1, as well as 20, 24, 28, 32 slots, for DIN-rail mounting; delivery without backplane slot covers and without mounting rail
BPR1nn EC	00039236-nn	Like BPR1nn; Extended Climate Range
BPS1nn	00039237-nn	Backplane for direct screw mounting Active backplane system M100: BPS1nn with nn = 04 to 16 slots in increments of 1, as well as 20, 24, 28, 32 slots, for direct screw mounting; delivery without backplane slot covers and without screws
BPS1nn EC	00039238-nn	Like BPS1nn; Extended Climate Range
TPI100_W24_P5.0_Cgy_L1to24		Signal terminal block Completely removable terminal block, push-in spring connector for system M100, 24-way/contacts, pitch 5.0 mm, female, conductors flexible 0.2 mm² to 2.5 mm² (24 to 14 AWG), solid 0.2 mm² to 1.5 mm² (24 to 16 AWG), with wire end ferrules 0.25 mm² to 1.5 mm² (24 to 16 AWG), stripping length: 10 mm, rating: 300 V / 8 A per contact, connector color: gray, push-release: yellow, labeling: 1 to 24
TPI100_W4_P5.0_Cgy_Lsup		Supply terminal block Completely removable terminal block, push-in spring connector for system M100, 4-way/contacts, pitch 5.0 mm, female, conductors flexible 0.2 mm² to 2.5 mm² (24 to 14 AWG), solid 0.2 mm² to 1.5 mm² (24 to 16 AWG), with wire end ferrules 0.25 mm² to 1.5 mm² (24 to 16 AWG), stripping length: 10 mm, rating: 300 V / 8 A per contact, connector color: gray, push-release: yellow, labeling: 1+/1-/2+/2-
TKP106		Keying element Keying element for signal terminal blocks and supply terminal blocks TPI100 for system M100, plastic ring with 6 keying elements
TPI100_W24_W4_Set [1)]	00042412-00	Terminal block set for M100 standard modules: • 1x TPI100_W24_P5.0_Cgy_L1to24 • 1x TPI100_W4_P5.0_Cgy_Lsup • 2x TKP106

[1)] *All components of the set are also available in bulk packages.*