

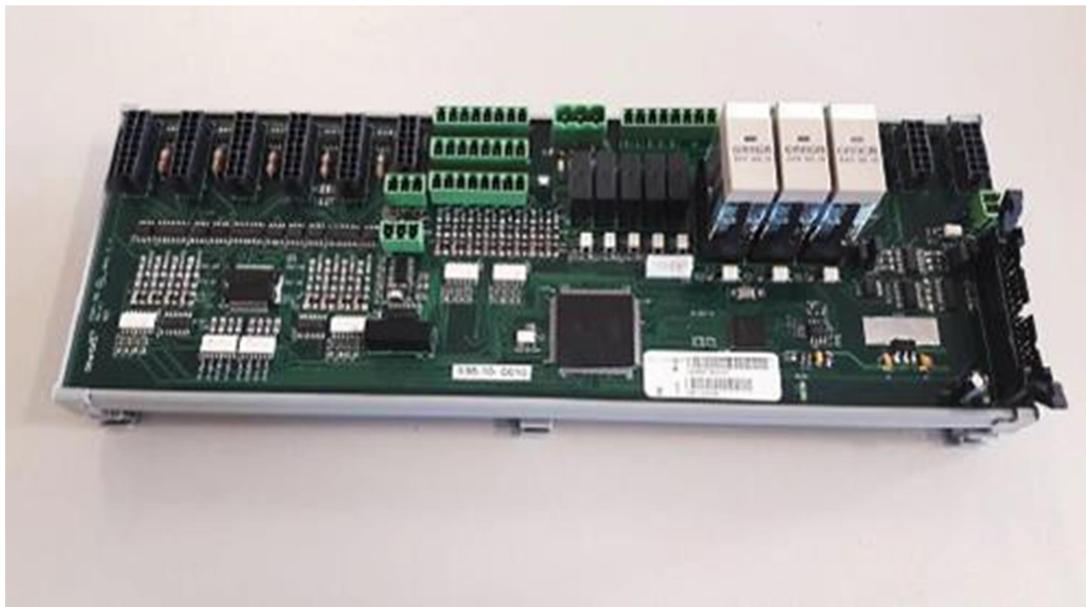
PI-EMI

EtherCAT MULTIFUNCTIONAL PERIPHERAL MODULE

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INTRODUCTION



Step-dir connection (16-pole Molex MicroFit):

- STEP-DIR motor output – 5 pcs
- 24V input – 1 pc
- 24V output – 1 pc
- EnDat/SSI connection – 5 pcs (EnDat only on Channel 5 is possible)

Analog spindle connection (12-pole Molex MicroFit):

- +/-10 V analog output – 1 pc
- 24V input – 3 pcs
- 24V output – 2 pcs

24V I/O:

- 8 pcs input
- 5 pcs relay (5 A)
- 3 pcs relay (10 A)

Other interface signals:

- Analog input (0-5 V) – 2 pcs
- CAN BUS for handwheel – 1 pc
- Touch Probe – 2 pcs (12-pole Molex MicroFit)
- LED line drive – 1 pc (24V / 1 kohm)
- Connection to the EtherCAT LVDS bus

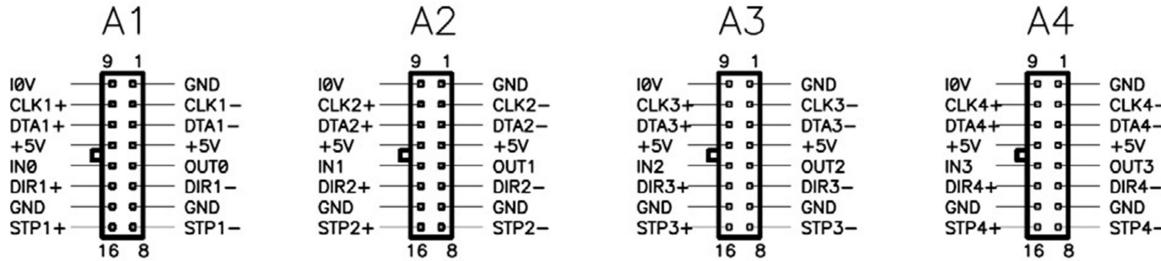
IDENTIFICATION

Type of the module:	PI-EMI
	5 V
	520 mA without load
Mechanical dimensions:	300×108×56 mm
Weight:	350 g

1 SSI INPUTS

Their purpose is to receive signals from encoders with an SSI interface.

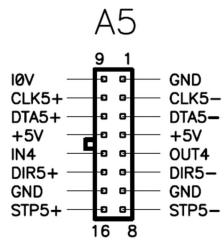
Maximum clock frequency:



2 ENDAT BEMENET

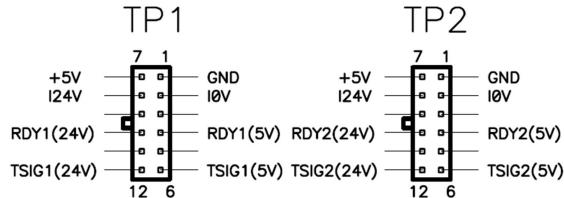
Their purpose is to receive signals from encoder with an EnDat interface.

Maximum clock frequency:



3 TOUCH PROBE INPUTS

Input for receiving touch probes acting with 5 V or 24 V signals.



The probes can also have a signal level of 5 V or 24 V. The signal level of the touch probe can be set by using the jumpers **JP18** (touch probe 1) and **JP20** (touch probe 2) (5 V and 24 V, respectively).

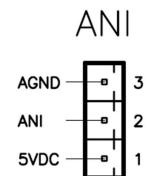
The jumper **JP17** (touch probe 1) and the jumper **JP19** (touch probe 2) can be used to select between the leading and trailing edges of the touch probe signal (TSIG).

The card has one RDY input per a channel for both the 5 V and 24 V signals. (It can also be used for battery, touch probe is connected, readiness and other functions.)

Using a resistor, a high level for the RDY signal can be reached by using the jumpers **JP18** (touch probe 1) and **JP20** (touch probe 2).

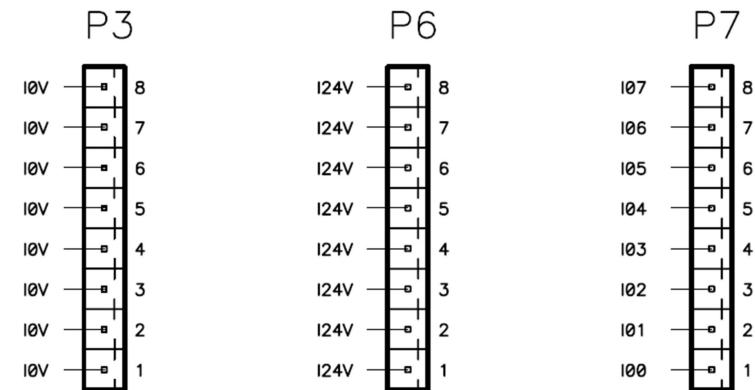
4 ANALOG INPUT

It is an input with a 12-bit A/D converter capable for receiving analog signals being within the range of 0~5 V.



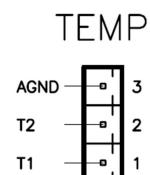
5 DIGITAL INPUTS

Inputs used for receiving digital signals of 24 V, sensors and other devices.



6 INPUT FOR TEMPERATURE SENSOR

The purpose of this input is to receive signals from a temperature sensor with rated resistance of 10 kohm; for example, B57703M0103G040 EPCOS.

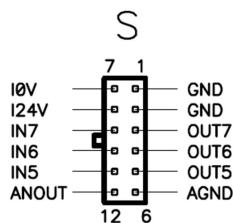


7 OUTPUT FOR STEPPER MOTOR CONTROL

It is a pulse (STP) and direction (DIR) output for a stepper motor, in ponated and negated forms. The signals are issued through a drive with open collector.

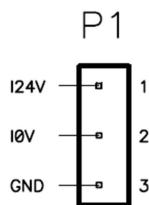
8 ANALOG OUTPUT

It is a speed reference signal of +/- 10 VDC (with 2^{15} resolution) for analog drives.



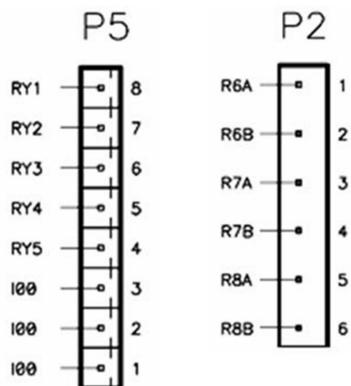
9 DIGITAL OUTPUTS

It is a 24 V digital output with 8 FET-switches. The maximum load current is 500 mA.



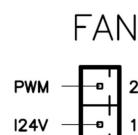
10 RELAY OUTPUTS

These outputs are 5 pieces of lower-current (5 A) outputs with normally-open contact and 3 pieces of higher-current (10 A) outputs with Morse contact.



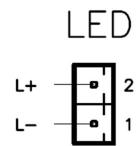
11 OUTPUT FOR FAN

It is an output of DC voltage adjustable within the range of 0~24 V. It is an output with PWM used, in general, for driving fans.



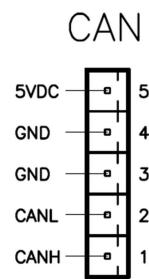
12 OUTPUT FOR LED

It is a 24 V DC output for LED lighting with current adjustable by using series rheostat.



13 CAN INTERFACE

It is a CAN interface for external handwheel. Through CAN bus, it receives the value of the handwheel angular displacement, the selected axis and the incremental step size. The speed of the CAN communication is 500 kbit/s. When cabling, termination resistors have to be provided.



14 ETHERCAT INTERFACE

The module communicates with the control system through an EtherCAT-LVDS bus. The module has to be connected, through the LVDS input, to the EPU unit or to a module connected to the EPU already. To the LVDS output connector, a next module can be connected to.

LEDs on the card and their functions are the following:

Link/Act In: EtherCAT input port works

Link/Act Out: EtherCAT output port works

Run: It does not give light: the unit is in INIT status

It is flashing: the unit is in PRE-OPERATIONAL status

It flashes: the unit is in SAFE-OPERATIONAL status

It gives light continuously: the unit is in OPERATIONAL status

15 ETHERCAT PDO DATA

15.1 SPEEDSETVALUE1..6 (OUT)

Data type: INT32

31	30	29	28	27	26	25	24
SSV_31	SSV_30	SSV_29	SSV_28	SSV_27	SSV_26	SSV_25	SSV_24
23	22	21	20	19	18	17	16
SSV_23	SSV_22	SSV_21	SSV_20	SSV_19	SSV_18	SSV_17	SSV_16
15	14	13	12	11	10	9	8
SSV_15	SSV_14	SSV_13	SSV_12	SSV_11	SSV_10	SSV_9	SSV_8
7	6	5	4	3	2	1	0
SSV_7	SSV_6	SSV_5	SSV_4	SSV_3	SSV_2	SSV_1	SSV_0

Bit31..0 – SSV31..SSV0: signed speed reference signal

maximum value: 0x200000

minimum value: 0xffe00000

In NC Ready state (EtherCAT OP mode), the value of SpeedSetValue on the output of the module will be valid promptly.

15.2 CONTROLWORD1..6 (OUT)

Data type: UINT32

31	30	29	28	27	26	25	24
23	22	21	20	19	18	17	16
15	14	13	12	11	10	9	8
				ZPulseRequest		ErrorClear	
7	6	5	4	3	2	1	0

Bit 9 – Error Clear Deleting the errors

When 1 is set for the value of the ErrorClear bit, the content of the ErrorDword will be deleted if the value of the ErrClearAck bit is 0 in the StatusDword.

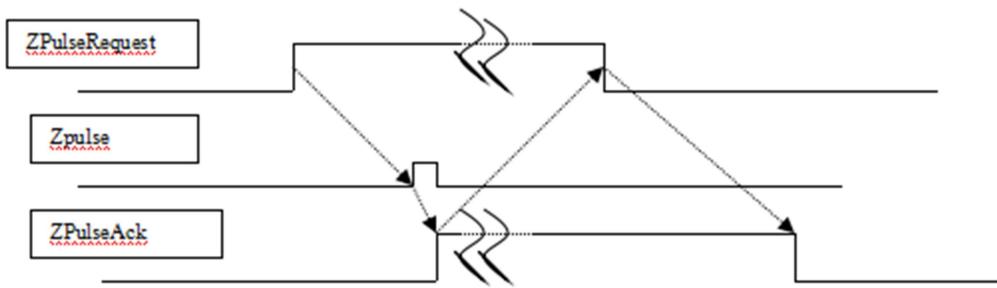
Bit 11 – ZpulseRequest Starting the search for reference pulse

The ZpulseRequest bit starts searching for reference pulse of the incremental encoder. When the measuring system of the drive finds reference pulse, it will indicate it by using the ZpulseAck flag bit. At the same time, it also indicates that the position (or angular position) of the reference pulse is available already and can be read out on the ReferencePosition data field. Having found each further reference pulse, the actual position of the reference pulse will be written in the ReferencePosition data field automatically, independently of the state of the ZpulseRequest and ZpulseAck.

Short description of the process

When ZpulseRequest=1, search for reference pulse begins. When the measuring system finds reference pulse, it will be indicated by the ZPulseAck=1. After this, the position of the reference pulse can be found on the ReferencePosition data field. Setting the ZpulseRequest bit into 0, the controller acknowledges existence of the position of the reference pulse. When ZpulseRequest=0, the value of the ZpulseAck will also be 0.

The flowchart below illustrates the process of the reference point return. Refer also to ZPulseAck.



15.3 OUTPUTBYTE0 (OUT)

Data type: UINT8

7	6	5	4	3	2	1	0
OUT_7	OUT_6	OUT_5	OUT_4	OUT_3	OUT_2	OUT_1	OUT_0

Bit7..0 – OUT7..OUT0: 24V DC FET digital outputs

15.4 OUTPUTBYTE1 (OUT)

Data type: UINT8

7	6	5	4	3	2	1	0
OUT_15	OUT_14	OUT_13	OUT_12	OUT_11	OUT_10	OUT_9	OUT_8

Bit7..0 – OUT15..OUT8: relay digital outputs

15.5 TP-MASK1..2 (OUT)

Data type: BIT

Bit – : it is the enable bit of the given touch probe channel

15.6 DUMMY (OUT)

Data type: BIT, UINT8

Data areas that are not in use.

15.7 FANSPEED (OUT)

Data type: UINT16

Bit15..0: fan voltage

0x0000: V

0xFFFF: V

15.8 ACTUALPOSITION1..5 (IN)

Data type: UINT64

31	30	29	28	27	26	25	24
POS_31	POS_30	POS_29	POS_28	POS_27	POS_26	POS_25	POS_24
23	22	21	20	19	18	17	16
POS_23	POS_22	POS_21	POS_20	POS_19	POS_18	POS_17	POS_16
15	14	13	12	11	10	9	8
POS_15	POS_14	POS_13	POS_12	POS_11	POS_10	POS_9	POS_8
7	6	5	4	3	2	1	0
POS_7	POS_6	POS_5	POS_4	POS_3	POS_2	POS_1	POS_0

Bit 31..0 - POS_31..POS_0: actual position

15.9 STATUSDWORD1..5 (IN)

Data type: UINT32

31	30	29	28	27	26	25	24
POS_31	POS_30	POS_29	POS_28	POS_27	POS_26	POS_25	POS_24
23	22	21	20	19	18	17	16
POS_23	POS_22	POS_21	POS_20	POS_19	POS_18	POS_17	POS_16
15	14	13	12	11	10	9	8
POS_15	POS_14	POS_13	POS_12	POS_11	POS_10	POS_9	POS_8
7	6	5	4	3	2	1	0
POS_7	POS_6	POS_5	ErrClearAck	ZpulseAck	Abs/Incr	POS_1	POS_0

Bit 2 - Abs/Incr Absolute or incremental encoder.

In the case of the TTLAC module, its value is always 1, i.e. it is incremental encoder.

Bit 3 - ZpulseAck Acknowledgement of valid reference pulse.

The value of this flag bit will be 1, when the first reference pulse is found after starting search for reference pulse (ZpulseRequest). Using ZpulseAck flag bit, the measuring system of the drive indicates finding a reference pulse; at the same time it indicates that the value of the ReferencePosition is valid and can be read out.

Bit 4 - ErrClearAck Locking of deleting the error

When the value of the ControlDword ErrClear bit is 1, the value of this ErrClearAck bit will be 1 and it remains 1 until the value of the ControlDword ErrClear bit changes into 0.

15.10 ERRORDWORD1..5 (IN)

Data type: UINT32

31	30	29	28	27	26	25	24
23	22	21	20	19	18	17	16
15	14	13	12	11	10	9	8
7	6	5	4	3	2	1	0
						EncoderErr	UnitErrors

Bit 0 - UnitErrors Global error indication.

The value of the UnitErrors bit will be 1 if any kind of error occurs at the unit.

The possible cause of the error can be explored by examination of further error bits.

Bit 1 - EncoderErr Encoder error at the encoder connected.

15.11 DIGITALINPUTBYTE0 (IN)

Data type: UINT8

7	6	5	4	3	2	1	0
IN_7	IN_6	IN_5	IN_4	IN_3	IN_2	IN_1	IN_0

Bit7..0 – IN7..IN0: 24 V digital inputs

15.12 DIGITALINPUTBYTE1 (IN)

Data type: UINT8

7	6	5	4	3	2	1	0
IN_15	IN_14	IN_13	IN_12	IN_11	IN_10	IN_9	IN_8

Bit7..0 – IN15..IN8: 24 V digital inputs

15.13 ANALOGINPUT (IN)

Data type: UINT16

15	14	13	12	11	10	9	8
0	0	0	0	DATA_11	DATA_10	DATA_9	DATA_8
7	6	5	4	3	2	1	0
DATA_7	DATA_6	DATA_5	DATA_4	DATA_3	DATA_2	DATA_1	DATA_0

Bit11..0 – DATA11..DATA0: 12-bit analog value

15.14 TP_STATUS1..2_ (IN)

Data type: BIT

The status of the touch probe signal (TSIG) at the touch probe 1 and touch probe 2.

15.15 TP_READY1..2_ (IN)

Data type: BIT

The status of the signal RDY at the touch probe 1 and touch probe 2.

15.16 DUMMY (IN)

Data type: BIT, UINT8

Data areas that are not in use.

15.17 TEMPERATURE (IN)

Data type: UINT16

15	14	13	12	11	10	9	8
0	0	0	0	DATA_11	DATA_10	DATA_9	DATA_8
7	6	5	4	3	2	1	0
DATA_7	DATA_6	DATA_5	DATA_4	DATA_3	DATA_2	DATA_1	DATA_0

Bit11..0 – DATA11..DATA0: 12-bit analog value proportional to the temperature

15.18 HANDWHEELMOVE (IN)

Data type: UINT8

Value of the handwheel movement between two queries.

15.19 HANDWHEELAXIS (IN)

Data type: UINT8

Data indicating the axis selected on the handwheel.

15.20 HANDWHEELINCR (IN)

Data type: UINT8

Data indicating the step size selected on the handwheel.

15.21 TEST (IN)

Data type: UINT8

Data used for development purpose.