User manual

PLCM-B1
Breakout board for PLCM-E3/E3p controller

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1. GENERAL INFORMATION

PLCM-B1 is a breakout board for CNC Ethernet/USB PLCM controller. It allows to involve optimal all inputs and outputs. Sockets are mounted on board for connection of 6 step/servo motor drivers, 15 optoisolated inputs, 16 optoisolated outputs, 6 high-current relays and frequency converter for electric spindle control.

PLCM-B1 module allows to control up to 6 step/servo motor drivers (any with STEP/DIR/ENABLE interface). The module can be used for creation of such various X-Y-Z coordinate systems as the CNC machines, the label equipment, engraving, laser cutting, pick and place machines.

The module supports operating with any step motor drivers and servo motor drivers of Purelogic R&D production, drivers of other manufactures.

2. DELIVERY SET

- PLCM-B1 breakout board – 1 pcs.
- PLCM-B1 User manual - 1 pcs.

3. TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>12V</td>
</tr>
<tr>
<td>Maximum consumption current</td>
<td>400 mA</td>
</tr>
<tr>
<td>Control interface</td>
<td>Ethernet/USB compatibility with CNC programs (for example MACH3)</td>
</tr>
<tr>
<td>Quantity of inputs</td>
<td>15, optoisolated inputs (optocouple, 1 KOhm, 30V MAX)</td>
</tr>
<tr>
<td>Quantity of outputs</td>
<td>16, optoisolated outputs (optocouple, 40 mA, 40V MAX)</td>
</tr>
<tr>
<td>Quantity of power outputs, relay</td>
<td>6, toggle, 6A/250V relay</td>
</tr>
<tr>
<td>PWM → voltage converter</td>
<td>U output = 0...9,5 V [at on-off time ratio change Q=0...1], 10 V supply voltage by frequency converter</td>
</tr>
<tr>
<td>Isolation resistance</td>
<td>500 MOhm</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0…50 °C</td>
</tr>
<tr>
<td>Net weight</td>
<td>0.3 kg</td>
</tr>
<tr>
<td>Overall dimensions (Width x Height x Depth)</td>
<td>188 x 25 x 173 mm</td>
</tr>
</tbody>
</table>

TURN OFF POWER DEVICE BEFORE MAKING ANY CONNECTIONS
POWER SUPPLY NEGATIVE WIRE CONNECTION WITH GROUND (GND), HOUSING AND ETC. IS FORBIDDEN

Check wiki.purelogic.ru for more detailed information
4. KEY FEATURES

- Operation with any LPT CNC program (STEP/DIR – MACH, TurboCNC and ETC.).

- Single power supply can be used for power supply of entire circuit, smooth launching system.

- Simultaneous control up to 6 step/servo motors drivers. Drivers are connected via special sockets (terminal sockets or RG-45 type sockets). Control signals states are indicated by LEDs.

- 15 optoisolated inputs for connection of limit switches and E-STOP button. Connection of optoisolated inputs operation external backup LEDs is provided.

- 16 optoisolated outputs (open collector). States of outputs are indicated by LEDs.

- Frequency converter support [adjustment of spindle rotations, PWM voltage converter] from control program [MACH] PWM signal.

- Control of six high-current relays 6A/220V for commutation of supplementary CNC machine devices (spindles, coolant system pump or electric fan). Relay states are indicated by LEDs.

Fig. 1. PLCM-B1 dimensions
5. SOCKETS PURPOSE AND INDICATION

P1/p12

“P” - port notation  
“1” - port number  
“p” - pin notation  
“12” - pin number

XP20 (X) | XP21 (Y) | XP22 (Z)  
---|---|---  
XP1 | XP4 | XP7  
XP2 | XP5 | XP8  
XP3 | XP6 | XP9  
ENB | ENB | ENB  
DIR | DIR | DIR  
STEP | STEP | STEP  
P3/p1 | P3/p1 | P3/p1  
P2/p9 | P2/p8 | P2/p7  
P2/p6 | P2/p7 | P2/p8

XP23 (A) | XP24 (B) | XP25 (C)  
---|---|---  
XP10 | XP13 | XP16  
XP11 | XP14 | XP17  
XP12 | XP15 | XP18  
ENB | ENB | ENB  
DIR | DIR | DIR  
STEP | STEP | STEP  
P3/p1 | P3/p1 | P3/p1  
P3/p3 | P3/p4 | P3/p5  
P3/p7 | P3/p8 | P3/p9

XP1-XP18 (terminal socket) or XP20-XP25 (RG-45 type) - step/servo motor drivers connectors.  
XP19 (terminal socket) - module supply voltage connectors.  
XP26-XP40 (terminal socket) - external sensors connection and E-STOP button connectors, optoisolated inputs  
XP41-XP55 (pin connector) - external LED of optoisolated input operation, connection polarity is specified on the connection diagram («+» anode, «-» cathode).  
XP56-XP61 (terminal socket) - K1-K6 relay load connectors.  
XP62-XP77 (terminal socket) - optoisolated outputs [open collector].  
XP78 (terminal socket) - XP6 socket backup of PLCM-E3/E3p module.  
XP79 (terminal socket) - frequency converter connector.  

XP80 (terminal socket) - socket backup of PLCM-E3/E3p module Analog-to-Digital convertors (ADC). It isn’t used in the current software versions.  
XS1-XS5 (pin connector) - sockets for PLCM-E3/E3p module connectors.  
LED1, LED3, LED5, LED7, LED9, LED11 - indication LED of 1-6 axes STEP signal.  
LED2, LED4, LED6, LED8, LED10, LED12 - indication LED of 1-6 axes DIR signal  
LED13 - indication LED of ENABLE signal  
LED14-LED28 - indication LEDs of optoisolated inputs operation.
PLCM-B1 Breakout board for PLCM-E3/E3p controller

Fig. 2. General CNC control system diagram
6. CONNECTION

**Connection to PLCM-E3/E3p**

It is necessary to close JP3 jumper. PLCM-E3/E3p board is connected with PLCM-B1 module by XS1-XS5 pin connectors. It is necessary to connect two boards same as shown in drawing and to fix PLCM-E3/E3p board by using M3 screws.

**Step motor drivers connection**

Step motor drivers are connected to the module by XP1-XP18 terminal sockets or XP20-XP25 (RG-45 type) according to fig.3. Drivers are connected to the module according to a circuit with "+" common. In this case it is +5V.

**K1-K6 relay loads connection**

PLCM-B1 supports control of six high-current K1-K6 relays for CNC additional devices commutation (spindles, coolant pump or electric fan). Relay states are indicated by LED29-LED34 according to fig.3. Relay loads are connected to XP56...XP61 pins.

**Limit switches connection**

PLCM-B1 has 15 inputs for XP-26-XP40 switches connection. Physically each input is optocouple with built-in transition resistor (1 KΩ, depending on sensor type and sensor supply voltage the increase in resistance is probably required). This construction of optoisolated inputs allows to connect any sensors to module and provides driver optoisolation from sensors.

Optoisolated inputs states are translated to CNC MACH3 program and are indicated by LED14-LED28 according to fig.3. External LEDs connection is provided by XP41-XP55.

Simple contact switches (buttons) and non-contact sensors (inductive, capacitive) of PLL01 type (inductive non-contact sensor) can be connected to the module. Connection is accomplished...
according to fig. 2. Separate power supply unit with necessary voltage is strongly recommended to use for sensors supply. 12V module supply can be used in an extreme case (in this case opto-isolation will not be).

**Optoisolated outputs loads connection**

PLCM-B1 has 16 optoisolated outputs, in which loads are connected to XP62-XP77. Physically each output is an optocouple, open collector type output. This optoisolated outputs construction provides module opto-isolation from loads circuits.

**Power supply connection**

PLCM-B1 needs to be supplied from separate 12V power supply voltage unit (DC, for example, S-15-12 or power line of 12V PC power supply). Power supply is connected to XP19 socket (according to fig. 2). Connection polarity is important.

JP3 jumper can be closed on PLCM-E3/E3p board to join controller power supply and PLCM-B1. In that case it is necessary to apply voltage only to one of devices. Power supply of PLCM-B1 and power supply of PLCM-E3 by USB or PoE is possibly, but in this case relays will not work.

7. **PWM → VOLTAGE CONVERTER**

PLCM-B1 has built-in PWM → voltage convertor, which transforms PWM control signal to voltage - on-off time ratio Q=0...1 → voltage U=0...9.5V.

Convertor is used for frequency transformer control (FT, inverter), to which is connected spindle (it allows to change spindle rotations by CNC control program using electronic method).

The convertor is optoisolated from module and is supplied from FT (frequency transformer). In standard FT has 3 pins of convertor connection - 10V supply voltage, GROUND and voltage 0...10V output FIV (in proportion to which spindle rotation frequency is changing). FT PWM control signal is generated by MACH3 CNC control program.

Frequency convertor is connected to XP79 according to fig. 3.
Pay attention that documentation can be changed due to constant technical upgrading of production. You can download last versions from www.purelogic.ru