



Documentation for
Universal Stepper Motor Interface II

Last change: 11.7.2015

Technical data

Power supply: 15-45V=

Current consumption (typical): 100mA

Minimum frequency of safety signal: approx. 250Hz

Minimum frequency of PWM signal: 200Hz

Maximum frequency for frequency variable input: approx. 2kHz

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Functional description

The universal stepper motor interface is a breakout board to condition and distribute I/O signals from a PC parallel port or a USB/LAN stepper motor controller to interface with stepper or servo motor drivers, especially those with optocoupler inputs. Signals are decoupled from the PC in a way that voltages up to approx. 50V cannot harm the PC even in case of a short circuit. The signals are then amplified to feed inputs with high current demand (e.g. optocoupler inputs). To connect to motor drivers from other brands, all signals are distributed to screw terminals to allow easy wiring. The internally required logic voltages (+5V/+12V) are generated from the supply voltage. For 24V I/O operation the board must be supplied from an external +24V power supply, in all other applications 15V to 45V is allowed.

To increase the operational safety the board can be configured in a way that drivers and relays are enabled only when pin 8 or pin 16 of the parallel ports carries a clock signal of at least 2.2 kHz. Another clock signal (PWM or variable frequency) may be used to generate an analogue output signal with 0-10V or 0-5V to act as a set value for a frequency converter for the main spindle motor.

New: The output signals are internally pulled to +5V. They can switch signal voltages up to 24V to ground, so that motor drivers with 5V logic inputs can be used as well as drivers with optocoupler inputs with different input sensitivities, without changing components on the interface board.

New: Inductive switches can be used as limit switches, no matter if they have NPN type outputs or PNP type outputs (switching to +12V). Mixing PNP and NPN type switches is not possible. Mixing NPN type inductive switches with mechanical switches contacting to ground is allowed.

New: Case for DIN rail mounting is available as an option.

We can also supply this board with pluggable connectors type Phoenix Combicon / Mini-Combicon starting in relative low volumes. Please send us your request if you have demand!

Disclaimer, EMC-compliance

Even though all parts of the circuitry have been thoroughly checked and tested, mecha-pro® does not give any warranty or other assurance as to the operation or functionality of the circuitry or the documentation. To the full extent permissible by law we disclaim all responsibility for any damages or losses (including, without limitation, financial loss, damages for loss in business projects, loss of profits or other consequential losses) arising from the use and/or operation of the presented circuitry.

The universal stepper motor interface II card is an OEM-product for further processing by industry or other, in electronics specialized, personal. In line with §5 of the EMC-regulation the universal stepper motor interface II does not have to carry a CE-Label. Wiring and the individual components being used as well as the complete environment in which the interface card is operated will influence its EMC behaviour. Therefore, if CE-compliance is required, a system in which one or more interface cards have been installed for operation has to be evaluated as a whole unit. Of course, when developing the circuitry for the universal interface II all possible aspects for an EMC-suitable design have been taken into account.

Initial operation

Before using the board, set all jumpers to the desired settings according to this manual. Afterwards the board can be mounted in a case or cabinet and get wired to the machine and the PC. When all connections are done, the board is ready to operate.

Connectors

The following section gives you a short overview about the functions of the different connectors. The detailed pinout is explained afterwards.

- The connections X1 resp. SV1 are the connections to a PC parallel port or an optocoupler board. The pin assignment is optimised for WinPCNC, other software may require an adaptor cable. Most windows CNC applications allow changing the pin assignment in software.

- X2 resp. the terminals X7 and X8 are the inputs for limit switches. The emergency off switch (EMO) must be a normally closed contact to ground; limit switches may be either normally open or normally closed. When the EMO contact is open, motor drivers and relays are deactivated.
- SV2 is a connector for options which are not yet available. Please do not connect anything here.
- SV3-SV6 and X3-X6 are the connections to the motor drivers. SV3-SV6 also supply +5 Volt for the logic supply of the motor drivers. The pin assignment is compatible to our single axis drivers (Tiny-Step, HP-Step.pro, HEM-545 and DS10 with adaptor board). At X3-X6 supply output can be selected from +5V, +12V or input voltage V_{in} .
- The switch contacts from the relays are available on screw terminals X11 (Relay 1) and X12 (Relay 2). Maximum voltage level and current load: 250V~/8A. Only trained personnel are allowed to work with voltages > 50 Volt!
- X13 is the connection for the supply of the board. Supply range is 15-45V=. Observe the polarity marking printed on the board ($V_{in}=+$)! Please note:: If the board is supplied from the same power supply than the motor drivers, the galvanic isolation from optocoupler inputs is shorted. We recommend using a separate, small +24V power supply if a galvanic isolation is required.
- Internal switching regulators generate 12V for the relays and 5V for the logic from the input supply voltage (15 to 45 Volts). This 12V can also be used to supply fans and other small loads (up to 250mA external load). These voltages are available at X9 as well as on FAN connector (+12V).
- The board generates an analogue output voltage (0-10V or 0-5V) from a PWM input signal to control the main spindle speed with a frequency converter. This outputs voltage is available on terminal X10.

All contacts at screw terminals are numbered from right to left. If pin 1 is not specially marked, the terminal designation is placed on pin 1 (e.g. for X3).

X1 / Printer port connector

Pin number	function
Pin 1	relay 1, e.g. main spindle on/off
Pin 2	direction Motor X
Pin 3	/clock Motor X
Pin 4	direction Motor Y
Pin 5	/clock Motor Y
Pin 6	direction Motor Z
Pin 7	/clock Motor Z
Pin 8	direction Motor 4 or Toggle signal
Pin 9	/clock Motor 4 or PWM signal
Pin 10, 12, 13, 15	outputs for signals from end and limit switches
Pin 14	current reduction, toggle signal, PWM signal or relay 2, e.g. coolant pump on/off
Pin 11	output for drives ready signal
Pin 16	toggle signal or PWM signal
Pin 17	current reduction (low active) or relay 2
Pin 18-25	signal ground (0V, GND)

X2 / Connector for end and limit switches

Pin number	function
Pin 1	limit switch X (forwarded to pin X1.13)
Pin 2	limit switch Y (forwarded to pin X1.12)
Pin 3	limit switch Z (forwarded to pin X1.10)
Pin 4	limit switch axis 4 (forwarded to pin X1.15)
Pin 5	emergency switch
Pin 6	+5V (VCC)
Pin7-9	ground (GND)

Please note: The inputs on pin 1-4 may be used or configured for other functions, according to the software that is used. End or limit switches may get connected in series (NC contacts) or in parallel (NO contacts), so safe inputs for other functions. But in this case it can't be distinguished which switch was operated!

SV3-SV6 / Connectors for stepper drivers

Pin number	function
Pin 1	(not used)
Pin 2	/clock, (each rising flank triggers a step)
Pin 3	/error, open collector error signal from power driver
Pin 4	dir, direction of motor movement
Pin 5	enable, enable signal to the power driver
Pin 6	/sleep, current reduction output
Pin 7-8	+5V (VCC), logic supply for the power driver
Pin 9-10	ground (GND)

X3-X6 / Connectors for stepper drivers

Pin number	function
Pin 1	positive supply voltage, adjustable by JP15
Pin 2	/clock, (each rising flank triggers a step)
Pin 3	dir, direction of motor movement
Pin 4	/sleep, current reduction output
Pin 5	/error, open collector error signal from power driver (tied to +5V by internal pull up resistor)
Pin 6	enable, enable signal to the power driver
Pin 7	ground (GND, not assembled on version with screw terminals)

X7 / Connector for end and limit switches 1

Pin number	function
Pin 1	limit switch X, at Pin X1.13
Pin 2	limit switch Y, at Pin X1.12
Pin 3	limit switch Z, at Pin X1.10
Pin 4	ground (GND)

X8 / Connector for end and limit switches 2

Pin number	function
Pin 1	limit switch C, at Pin X1.15
Pin 2	emergency off, disables motor drivers and relays. Signaling to PC on X1.11
Pin 3	positive supply voltage, adjustable by JP14
Pin 4	ground (GND)

X9 / Voltage outputs

Pin number	function
Pin 1	+5V=
Pin 2	+12V=
Pin 3	ground (GND)

X10 / Analoge outut signal for spindle control

Pin number	function
Pin 1	analogue signal, 0-5V or 0-10V, adjustable by JP11
Pin 2	ground (GND)

X11, X12 / Relay contacts Relay 1, Relay 2

Pin number	function
Pin 1	normally closed contact 1 (NC)
Pin 2	input contact 1 (COM)
Pin 3	normally open contact 1 (NO)
Pin 4	normally open contact 2 (NO)
Pin 5	input contact 2 (COM)
Pin 6	normally closed contact 2 (NC)

X13 / Supply input

Pin number	function
Pin 1	+24V= (15-45V)
Pin 2	ground (GND)

Jumper settings

JP1	Activate 5V on pin 26 of SV1 (for optocoupler board)
JP	Disable the monitoring of the emergency switch (recommended for testing purposes only)
JP3	Toggle signal from Pin14 (1-2) or Pin16 (2-3)
JP4	PWM signal from Pin16 (1-2) or Pin14 (2-3)
JP5	Use Toggle signal from Pin8 (1-2) or from JP3 (2-3)
JP6	Use PWM signal from Pin9 (1-2) or from JP4 (2-3)
JP7	Use current reduction signal (Sleep) (1-2) or don't (2-3)
JP8	Sleep from Pin14 (1-2) or Pin17 (2-3)
JP9	Control Relay 2 with Pin17 (1-2) or with Pin14 (2-3)
JP10	Use Toggle signal (charge pump safety function) (1-2) or don't (2-3)
JP11	Output range of analog output signal 0-10V (1-2) or 0-5V (2-3)
JP12	Input signal for analog output is frequency variable (1-2) or a pulse width modulated (PWM) signal (2-3)
JP13	Limit switches act to ground (1-2) or to positive supply voltage (2-3)
JP14	Supply voltage limit switches +5V (1-2) or +12V (2-3)
JP15	Positive supply voltage for stepper driver I/Os at X3-X6 +5V (1-2), +12V (3-4) or +Vin (5-6)
JP21-24	Polarity of current reduction signal (for each driver) is low active (1-2) or high active (2-3)
JP25-28	Polarity of enable signal (for each driver) is high active (1-2) or low active (2-3)

Remarks on jumper settings:

- Default settings on delivery are underlined
- When using inductive switches, set JP14 to +12V (2-3), for switches with PNP type outputs JP13 to „switch to positive supply voltage“ (2-3) in addition.
- Stepper drivers with optocoupler inputs need to be wired with positive input tied to supply voltage and negative input to signal output of the interface.
- If the drives are not enabled (no holding torque on motor) when EMO contact (or JP2) is closed, but when switch or jumper is open, change setting of JP25-JP28.

LEDs

LED1	Logic supply (5V) ready
LED2	Relay supply (12V) ready
LED3	ready is signaled to PC (no emergency stop, no error from the drivers)
LED4	Toggle signal is valid. If monitoring of Toggle is activated, both LED3 and LED4 must be lit to enable the drives and relays!

Notes:

Layout diagram:

