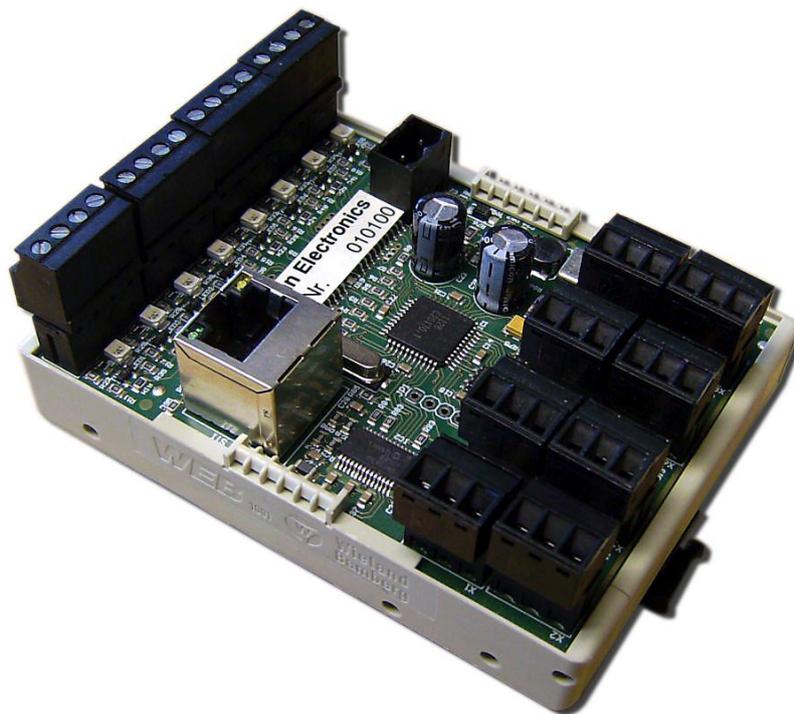# Beamicon2 IoExt1

Input/output extension for
CNC control with Ethernet interface

Installation manual
Version 1

Brief product description

The IO Expansion provides additional digital inputs and outputs for the Beamicon2 CNC control. This means that the number of available inputs and outputs is not limited to the limited number on the NetBOB or the CncPod, but can be expanded practically at will.

The module has eight outputs and eight inputs with 24V level. Unused outputs can also be used as inputs, so that up to 16 inputs are available alternatively. A normal network connection with RJ45 cable is used for data transfer from the PC. A network switch is required to connect several modules to one PC. All signals are galvanically isolated from the PC. All outputs and inputs are equipped with filters and protected against short-circuit and polarity reversal, so that a maximum of interference immunity is achieved.

Safety Instructions

The interface board may only be installed and put into operation by qualified personnel. Please read the operating instructions carefully and follow all instructions exactly. Improper installation or operation of the device can cause damage to the electronics or the machine and can result in dangers to the health of the operating personnel.

Depending on the hazard potential of the machine, additional safety measures may be required, such as door interlocks and standstill monitoring. As a rule, such safety functions must be implemented purely electromechanically with external circuits (not included in the scope of delivery) and must not depend solely on software and PC hardware. The system manufacturer, who assembles the interface board and other components to form the overall system, and the system operator are responsible for compliance with the legal regulations.

Connections

(All pins of the terminals are numbered from left to right or from top to bottom)
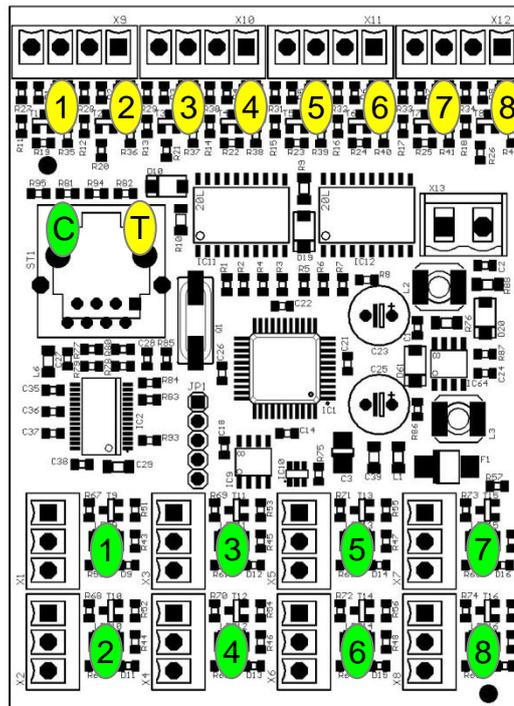
Status LEDs

LED No.	Description
1 - 8	Outputs (X9 to X12, top)
1 - 8	Inputs (X1 to X8, bottom)
T	Network traffic
C	Network Carrier (connected)

Outputs (terminals above)

Pin No.	Assignment
1	0V Ground
2	Signal output (max. 250mA)
3	0V Ground
4	Signal output (max. 250mA)

Supply voltage(terminal X13 right above)

Pin No.	Assignment
1	+24V output (max. 100mA)
2	Signal input
3	0V signal ground

Inputs (terminals below)

No.	Description
1	Signal ground
2	+24V input (10..30V)

Functional description

PC / network connection

The data transfer from the PC software to the CncPod is done via an Ethernet network connection (IEEE802.3 10BASE-T). The connection can be made with standard patch cables to the RJ45 socket ST1.

In contrast to similar products from competitors (e.g. Smoothstepper or Eding-CNC) no exclusive interface has to be reserved on the PC, but the infrastructure of an existing network with switches can be used. There is also no need to change IP addresses or otherwise interfere with the Windows Control Panel. The Beamicon2 software automatically detects all modules, even if it is connected "somewhere" in the network. Several modules can be connected to a PC at the same time and can also be used simultaneously. To ensure reliable operation, however, the following rules must be observed:

- All modules must either be connected to the first switch after the PC, or a further switch may be added if only devices of the machine are connected to the second switch, e.g. within the control cabinet of the machine. All devices not involved in machine control (Internet router, printer, NAS, etc.) must be connected to the first switch or to additional switches behind the first.

- The transmission speed between the PC and the first switch must be higher than the maximum data rate of any existing Internet routers (DSL modem etc.). For home networks with few PCs 100MBit is recommended, for larger networks Gigabit-Ethernet.

- Since no TCP/IP is used but a separate protocol, this cannot be forwarded by routers, external firewalls, proxies, etc. Therefore only so-called "unmanaged switches" may be used between the control PC and the CNC pod.

- Switches must support Fast Forward and Store-and-Forward (virtually all modern switches meet this criterion)

- Hubs are also allowed for test purposes (listening with diagnostic tools on taps), but are not recommended.

- The data traffic of the machine controller must not be routed via slow (DSL modem) or unreliable (wireless) connections (WLAN). All wireless interfaces are therefore intentionally hidden.

The network interface is galvanically isolated from the PC. Power-over-Ethernet (PoE) is not supported.

Power supply

The expansion module can be supplied with an operating voltage of 10 to 30V DC. The input is protected against accidental reverse polarity. It is recommended to use a switching power supply with 24V, as most industrial contactors, pneumatic valves and sensors are designed for this and can therefore be connected directly.

Connection of actuators

A total of 16 terminals (4 pluggable contact blocks with 4 connections each) are provided at the top of the module for the connection of consumers. The connections with odd numbers 1, 3, 5 etc. are permanently connected to ground. The actual outputs are the connections with even number 2, 4, 6 etc. The outputs are of the PNP type, i.e. an activated output is connected to the supply voltage (24V), a deactivated one is high-impedance. The outputs are protected against overvoltage by switching inductive loads and against short circuit. The corresponding LED lights up when more than about 6V are applied to the output, i.e. when the output is either switched on or a voltage is applied externally.

Connection of sensors

Each input has its own 3-pin terminal, where the supply voltage, the signal input and a ground connection is available. This also allows a direct connection of inductive proximity switches without additional distribution terminals. The inputs are intended for mechanical switches (normally closed or normally open) or for PNP type sensors (switching to +). The corresponding LED lights up when more than about 6V are applied to the input.

Mechanical switches are connected with two wires to pin 1 (top) and pin 2 (middle). Inductive switches or other electronic sensors are connected with three wires (brown=1, black=2, blue=3). If NPN types are to be used (not recommended), an additional pull-down resistor of approx. 2.2kΩ must be connected between pins 1 and 2.

If the eight available inputs are not sufficient and not all outputs are used, outputs can also be used as inputs. Thus, a total of up to 16 inputs are available. Since there are only two pins per input/output on the output terminals, the supply voltage must be connected to a distribution terminal or directly to the power supply unit in this case.

Configuration

The assignment of the inputs and outputs is done in the Beamicon2 software. The installation and operation of the software as well as the adjustment of the machine parameters is described in detail in the Beamicon2 software manuals. Therefore, only the special features of the expansion module will be discussed here.

After the first start, the module must first be connected. Open the hardware dialog by selecting this in the menu under "Configuration -> Hardware". If several identical modules are connected, you may assign the desired module with "Identify". In this case you should remember the number of the module (8-digit hexadecimal number, usually starting with "A3"), because otherwise confusion could occur later when assigning the individual inputs and outputs. Finally, select the module and then click on "connect" and "save".

To assign the signals, switch to the configuration dialog (Menu -> Configuration -> Machine), and then to the "Inputs/Outputs" page. You can now assign existing signals (e.g. limit switches), or define new ones (with "Add"), e.g. for your own macros.

The signals of the expansion module can be used for (almost) any purpose, e.g

- Relays or contactors for switching loads,
- Pneumatic or hydraulic valves
- Limit value/limit switches at the ends of the travel range of positioning axes,
- "End position reached" switch on pneumatic cylinders
- other sensors

However, there are the following restrictions:

- The emergency stop input is assigned to a fixed input on the primary axis controller module (NetBob, CncPod or TripleBeast)
- Reference switches and tool length sensors, which have to achieve high precision in connection with axis movements, cannot be placed on expansion modules because the propagation delay via the network would result in a position deviation. These must be connected directly to the primary module.
- Some outputs with special functions (PWM or analog output) can also only be assigned to certain pins on the primary module.

Technical data

Absolute limit values

The following parameters must not be exceeded under any circumstances to prevent damage to the device:

Parameters	min.	max.	Unit
Operating voltage	-40	+40	V
Storage temperature	-40	+70	°C
Operating temperature	0	+70	°C
Voltage at digital inputs	-40	+40	V
Voltage at digital outputs	-0.5	+40	V

Electrical connection values:

Parameters	min.	max.	Unit
Operating voltage (Vcc, nominal 24V)	+10	+30	V
Power consumption (without external consumers)	0.1	2	W
Ambient temperature	0	+50	°C
Level for logical 0 at inputs	-0.5	+5	V
Level for logical 1 at inputs	8.0	30	V
Current consumption at inputs at 24V	3	5	mA
Level for logical 0 at outputs	0	0.5	V
Level for logic 1 at outputs	Vcc-2	Vcc	V
Load current at outputs	0	250	mA
Switch-off energy with inductive load	0	3	mJ

Dimensions:

Description	Width	Length	Height	Unit
Dimension of the board without connector	56	62	8	mm
Dimensions with plug	56	82	22	mm