



CNC1 (with M401) and CNC2X Installation Manual

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1 Disclaimer of Liability and Limitation of Warranty

Where the CNC box is supplied as a component and not as part of a complete control system it is assumed that the purchaser has sufficient electrical and electronic knowledge to handle the component competently.

It is further assumed that the purchaser has sufficient knowledge of safe working practices and the relevant Health & Safety regulations which apply to working with electrical and electronic systems to work safely with the component.

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2 Introduction to the CNC1 and CNC2X boxes



The CNC1 and CNC2X boxes have been designed to control CNC lathes, milling machines, PCB drills, routers, etc. In fact any machine which has 1, 2, 3 or 4 axes with a CNC1 and up to 6 axes with a CNC2X. With a CNC2X the stepper motors can also, optionally, be controlled in a closed-loop mode with the addition of standard quadrature encoders in either strip or rotary form.

The CNC2X can operate without a computer if a VGA monitor and PS2 keyboard are plugged in. Please see the X661 manual for full details of the stand-alone mode.

The CNC box has a built in power supply which can output 36 volts @ 10 Amps.

2.1 Front panel controls



The front panel controls are (from left to right) the axis jog buttons for the X and Y axis (arranged in a cross around the green 'Enter'/BTN1 button), the Z axis jog buttons, 3 status LEDs, the electronic hand-wheel and the power switch.

When in manual mode the jog buttons can be used to rapidly position an axis and then the hand-wheel can be used to control the precise position. The hand-wheel automatically switches to operate the last axis that was moved with one of the jog-buttons. The electronic hand-wheel is rotated clockwise to move the axis in the positive direction and counter-clockwise to move the axis in the negative direction.

2.2 Rear Panel Connections

CNC1 rear panel

The rear panel of a CNC1 box contains plugs for the mains supply, the computer ([serial](#)), an [AC/DC spindle motor](#) (or any 10 Amp load) and coolant pump, the [stepper motors](#) and the [feed-back/encoder/limit-switch](#) plug.



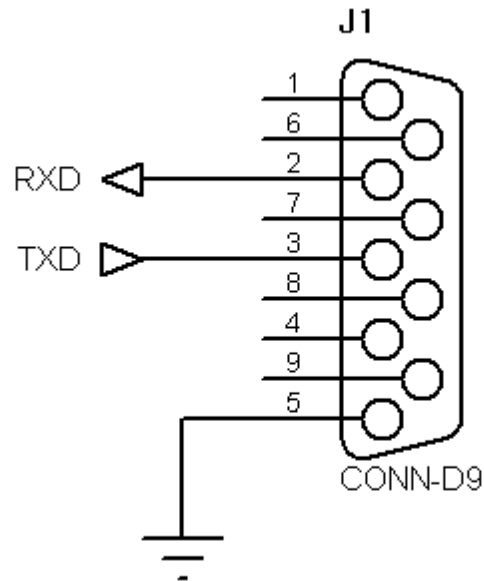
CNC2X rear panel

The rear panel of a CNC2X contains the plugs for: the mains supply, [the computer](#), [an AC/DC spindle motor](#) (or any 10 Amp load) and coolant pump, a VGA monitor, a PS2 keyboard, the [stepper motors](#) and the [feed-back/encoder/limit-switch](#) plug.

AC Mains Inlet

The AC mains connector is a standard 'kettle' type plug (an IEC plug). The socket includes a 4 Amp fuse - do not use a higher rated fuse... it will reduce the level of protection!

2.2.1 RS232 Serial Interface



Pin	Signal
2	Receive Data (RXD)
3	Transmit Data (TXD)
5	Ground

The serial port is configured as a standard PC AT 9-pin port. A standard PC-AT to PC-AT serial cable (a cross-over cable) can be used.

The default protocols are 115,200 baud, 8 data bits, no parity and 1 stop bit.

The board will use XON/XOFF flow controls by default.

2.2.2 Spindle Motor control plug

Pin	Signal
1	Emergency stop
2	Emergency stop
3	Spindle speed control +
4	Spindle speed control reference
5	Spindle speed control -
6	Coolant relay ^{note 2}
7	Coolant relay ^{note 2}
8	Spindle relay ^{note 1}
9	Spindle relay ^{note 1}

The emergency stop circuit can be connected through any safety switches, cover switches, etc. Provided it is unbroken the spindle, coolant and programmes can be run. If the emergency stop circuit is broken then the spindle and coolant are forced off and any programme running will be stopped... the machine can still be moved in manual mode. **The plug supplied has a link shorting pins 1 and 2. Do NOT connect the spindle circuit to any active components!**

The spindle speed control circuit is designed to emulate a potentiometer control and can be used with most 3rd party spindle motor control cards.

Note 1 & 2 CNC1 - The spindle and coolant relays are both 5A/250V.

Note 1 CNC2X - The spindle relay connections can carry 10 Amps @ 240 VAC whichever control card is fitted (with an X641 a separate 10A relay is already fitted in the box). The circuit is closed when spindle run is selected.

Note 2 CNC2X - The coolant relay connections (pins 6 and 7) will depend upon which control card is fitted in the box (an X641 or an X661). If an X661 card is fitted then the connections are to a relay which can carry a 10 Amp load. If an X641 card is fitted then the connections are to a 12-volt 250 mA drive for a relay - a relay needs to be attached externally to control the load.

2.2.3 Stepper motor plug

Pin	Signal
1	A phase +
2	A phase -
3	B phase +
4	B phase -

N.B. As delivered the stepper motor outputs are configured for 1 Amp/phase and for half-stepping with power-save enabled. To change these settings please refer to the manual for the stepper motor drive card (either a STEP1 or STEP2).

*****WARNING** Never connect or disconnect a motor when the control box is powered up. Always turn off the control box and allow 2-3 minutes for the power-supply capacitors to discharge before connecting or disconnecting motors. Failing to observe this precaution could permanently damage your control box!***

This is for a standard CNC box fitted with STEP1 stepper motor drive cards. If the CNC box has been supplied to drive 3rd party cards then please see the next section.

2.2.3.1 Output plugs for 3rd party motor drives

If the box has been supplied to drive 3rd party drives which have TTL compatible inputs or 5-volt compatible opto-isolators (Geckodrives, Digiplan drives with the opto-isolator daughter board, etc) then the motor plugs are 5-pin DIN and are wired as...

Pin	Signal
1	+5V
2	Clock
3	Direction
4	Enable (active high)
5	GND/0V

If the box has been supplied to drive 3rd party drives that may not be on the same power supply then the motor plugs are 4-pin DIN and are wired as...

Pin	Signal
1	Clock/Step-pulse -
2	Clock/step-pulse +
3	Direction +
4	Direction -

...these are opto-isolated connections.

2.2.4 Feed-back/Encoder/Limit-switch plug

The pin-out for 25-pin D-connector is below - please note that D-connectors are numbered across the top row and then the bottom row...

DB25 pin	Function
1	+5V
14	X encoder channel A
2	X encoder channel B
15	0V/GND
3	X limit+
16	X limit-
4	FB1 - single slot encoder for threading
17	U encoder channel A
5	U encoder channel B
18	+5V
6	Y encoder channel A
19	Y encoder channel B
7	0V/GND
20	Y limit + (also FB 1 on CNC1)
8	Y limit - (also FB2 on CNC1)
21	FB2 - multi-slot encoder for threading
9	V encoder channel A
22	V encoder channel B
10	+5V
23	Z encoder channel A
11	Z encoder channel B
24	0V/GND
12	Z limit+
25	Z limit-
13	+12V

Cells highlighted in grey are not connected (N/C) in a CNC1 box

The power requirement of any encoder used should not exceed 100 milli-amps.

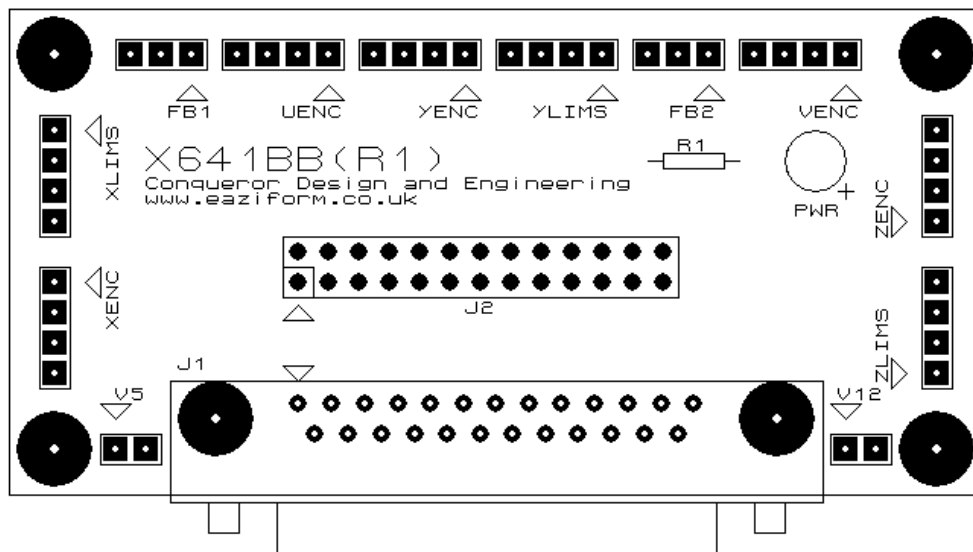
To connect a limit switch it should be connected between the limit switch input and the ground connection for the same section. For instance to connect an X-LIMIT+ switch the switch would be connected across pins 3 and 15.

Threading sensors (FB1 and FB2) should be connected to the Y+ and Y- limits on a CNC1 box - the power supply for the encoders can be drawn from pins 1 and 7. A CNC1 box does

not have connections for the feedback encoders.

N.B. With a CNC2X it is possible to use encoders which require a higher voltage than 5 volts by using the 12-volt supply from the plug and inserting a diode into the A and B lines. For details please contact technical support.

2.2.4.1 X641BB break-out board



There is an optional X641BB break-out board.

The break-out board can be used with the X641 card using a 26-pin ribbon cable or with CNCX control boxes using a 25-pin extension cable.



X641BB connector pin-outs

In all cases the marked pin is pin #1.

XENC, YENC, ZENC and UENC connector

Pin	Signal
1	+5 volts
2	A signal
3	B signal
4	GND

XLIMS, YLIMS and ZLIMS connector

Pin	Signal
1	+ Limitswitch
2	GND
3	- Limitswitch
4	GND

(To connect a limit switch connect it across 1 & 2 or 3 & 4)

FB1 and FB2 connector

Pin	Signal
1	+5 volts
2	Encoder signal
3	GND

2.3 Spare and replacement plugs

Replacement plugs for the stepper motor connectors (earlier models - screw locking connectors) can be obtained from Maplin Electronics at <http://www.maplin.co.uk>.

*Stepper motor plug is... 4-pin cable socket, code FK24B, 'LKG Line Socket 4-way' (*earlier models)*

Replacement plugs for the stepper motors (current model - latching DIN) can be obtained from RS Components and JPR Electronics...

DIN 590 series 4-pin locking plug, RS 476-160, JPR 700-452

A replacement/spare plug for the feed-back/limit-switch connector, relay connector and DC motor/10-Amp-relay/Emergency-Stop connector can be obtained from RS Components (<http://www.rswww.com>) or Farnell Electronics (<http://www.farnell.co.uk>).

Feed-back/limit switch plug is... 25-pin male D-connector (plug)... various types are suitable.

Relay connector is... 9-pin male D-connector (plug)... various types are suitable.

RS Components code # 372-254, "Connector, circular, CPC, cable plug, 9 way, 13 shell".

Farnell Electronics code # 3195545, "RECEPTACLE, STD SLD CPC1 9 WAY".

3 Operation

For the specifics of operating the CNC box please refer to the EaziCNC software manual and to the M401 manual for the CNC1 box or the X661 manual for the CNC2X.

4 Appendices

4.1 Compatible Motors

The following motors have been tested with the CNC1 and CNC2 box...

Motor Size (W x H x L)	Voltage	Current (Amps.)	Holding Torque (mNM)	Holding Torque (Oz-In)
23 Standard 57 x 57 x 40	11.2	0.33	320	45
	3.4	1.0	340	48
	2.3	1.5	330	47
	1.5	2.2	310	44
23 Standard 57 x 57 x 52	10.1	0.44	650	91
	5.0	1.0	690	98
	2.3	2.1	640	91
23 Standard 57 x 57 x 67	4.2	1.6	1,090	154
	3.4	1.9	1,130	160
	2.8	2.5	1,140	161
23 Standard 57 x 57 x 103	3.5	2.9	1,480	210
23 High Perf. 57 x 57 x 41	4.6	1.0	470	67
	2.1	2.1	480	68
23 High Perf. 57 x 57 x 55	6.2	1.0	980	138
	2.9	2.1	980	138
	2.1	3.0	980	138
23 High Perf. 57 x 57 x 79	4.2	2.1	1,610	228
	3.3	3.0	1,630	231
34 Standard 82 x 82 x 62	5.8	1.3	1,820	258
	3.0	1.7	1,500	212
	2.8	3.1	1,820	258
34 High Perf. 82 x 82 x 67	7.0	1.4	2,800	396
	3.6	2.8	2,800	396
34 High Perf. 82 x 82 x 94	4.8	2.8	4,800	680
42 Standard 108 x 108 x 179	3.7	3.4	9,900	1,400

Torques quoted are for bi-polar drive.

Other motors with similar voltages and current requirements will also be compatible

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