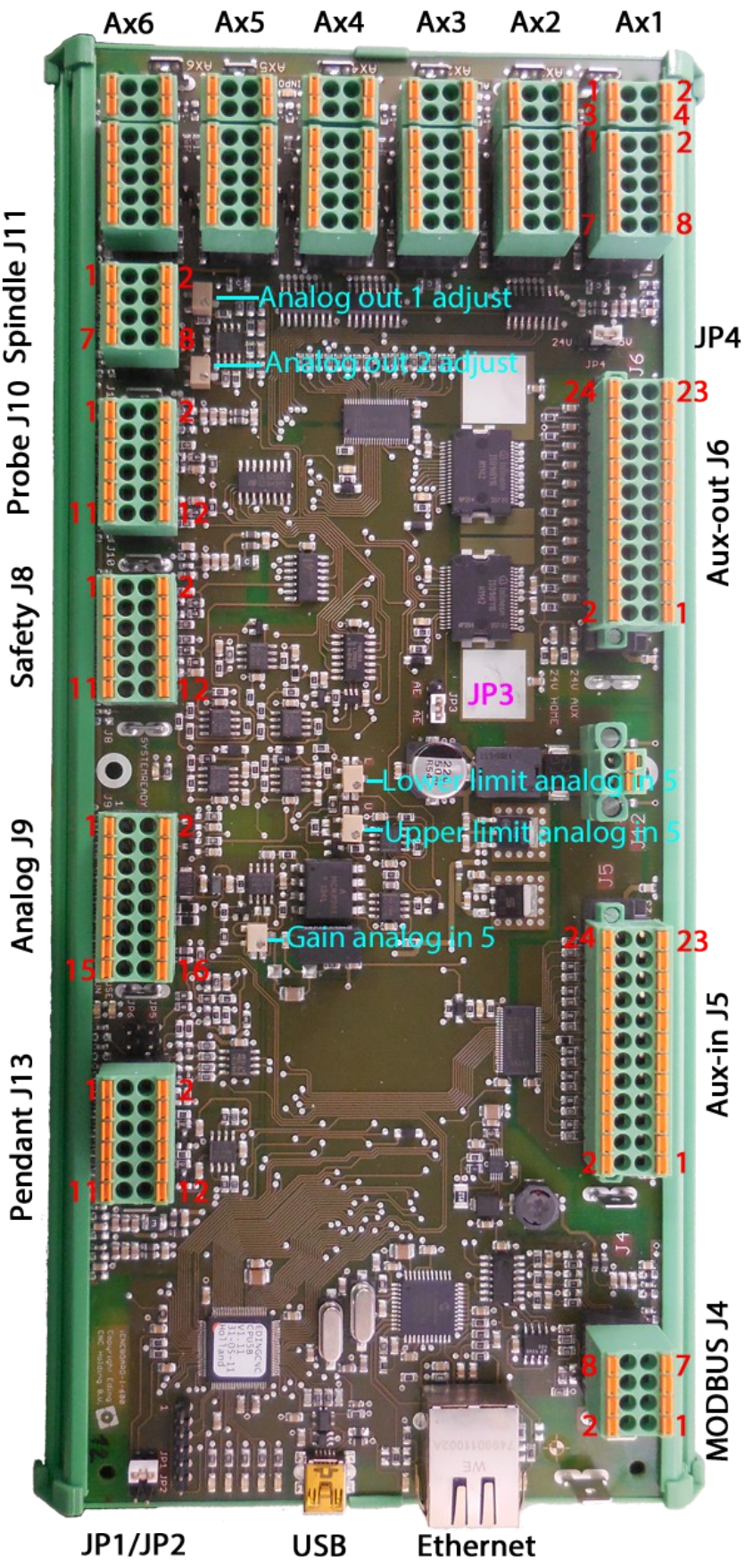
Installation manual iCNC600 board


Ax6
Ax5
Ax4
Ax3
Ax2
Ax1
Spindle J11
Probe J10
Safety J8
Analog J9
Pendant J13
Analog out 1 adjust
Analog out 2 adjust
JP4
Aux-out J6
JP3
Lower limit analog in 5
Upper limit analog in 5
Gain analog in 5
Aux-in J5
MODBUS J4
JP1/JP2
USB
Ethernet

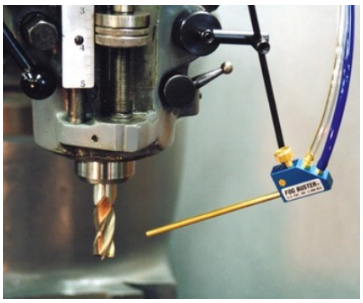
Highlights

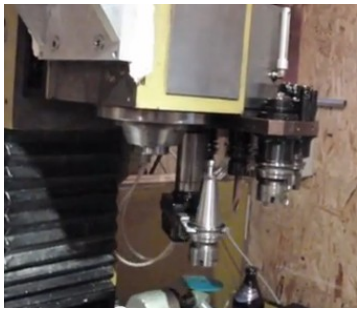
- Designed for the Industry, EMC and Safety
- All I/O 24V and short circuit protected, galvanic isolation where applicable
- Drive error inputs, stops all drives if one has an error.
- Drive warning inputs, action configurable.
- PT100 temperature sensor inputs.
- Isolated analog input for Plasma THC.
- System Ready / Estop input for connection with Safety relay.
- Easy Phoenix connectors, no break-out board needed.
- 6 Axes simultaneous control, fully interpolated.
- 6 Home inputs
- 6 Drive error inputs
- 6 Drive Warning inputs
- 2 touch probe inputs
- 5 analog inputs
- Spindle sync input for thread cutting
- Flood coolant output
- Mist coolant output
- Spindle on/off output
- Spindle direction output
- Spindle 0-10V output
- Spindle PWM output
- 2nd Analog output
- 2nd PWM output
- 3rd PWM output
- 8 General purpose outputs
- 8 General purpose inputs
- MODBUS interface for additional I/O boards
- Ethernet connection for CNC operation
- USB connection for firmware upgrade
- Pendant connection with RUN/PAUSE/Hand wheel connection
- Size 270mm x 125mm
- DIN rail mount.

Connectors

Connector	
AX1-AX6   	**Home Sensor or Micro switch** 24V-HOME 1 2 GND-IO IN-HOME 3 4 NC **Open collector outputs 24V or 5V** ENA+ 1 2 ENA- STEP+ 3 4 STEP- DIR+ 5 6 DIR- ALARM+ 7 8 ALARM- INPOS+ 9 10 INPOS- The home inputs can be used with micro-switches or with proximity sensors NPN or PNP, 24V. For micro-switches use PIN 1 and 3. For sensors use the 24V supply, PIN 1 and 2 and PIN 3 for the sensor output. These inputs are galvanic isolated. The drive ENA, STEP, DIR outputs to the drive are designed for common supply at 5V or 24V, this voltage is selected by jumper JP4. The ENA+, STEP+ and DIR+ are 5V or 24V depending on JP4. The ENA+, STEP-, DIR- are pulled to ground for action. These outputs are poly-fuse protected, max current together is 0.2 Amp. The ALARM+ input is connected to the open collector + output of the drive. The ALARM – input is connected to the – alarm input of the drive. The action (ESTOP) can be configured in the software. This is used to stop all axes if one drive gets an error. The INPOS input can also be used the same way, and can be configured for ESTOP or SMOOTHSTOP in the software. Using shielded cable is recommended, the shield can be connected to the FASTON connector besides the connector.

J6 AUX OUTPUTS
COOLANTS
AMP-ENABLE





ISO CHIP OUTPUTS J6 AUX OUT, COOLANTS, AMP-ENABLE			
GND-IO	24	23	AUX-OUT-8
GND-IO	22	21	AUX-OUT-7
GND-IO	20	19	AUX-OUT-6
GND-IO	18	17	AUX-OUT-5
GND-IO	16	15	AUX-OUT-4
GND-IO	14	13	AUX-OUT-3
GND-IO	12	11	AUX-OUT-2
GND-IO	10	9	AUX-OUT-1
GND-IO	8	7	COOL2
GND-IO	6	5	COOL1
GND-IO	4	3	OUT-AMPEN
GND-IO	2	1	OUT-AMPEN

AUX_OUT_1 – AUX_OUT_8 are general-purpose outputs, then can be used to switch on/off additional devices and to control e.g. an automatic tool changer.

COOL2 is the MIST coolant output.
COOL1 is the FLOOD coolant output.

OUT_AMPEN (2x) are switched on when the amplifier enable is activated in the software. The polarity of this output can be configured by jumper JP3.

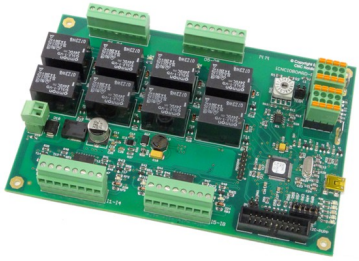
These outputs are galvanic isolated and short circuit proof.

J5 AUX IN

ISO CHIP INPUTS J5 AUX IN			
GND-IO	24	23	GND-IO
AUX-IN-8	22	21	AUX-IN-7
24V-AUX	20	19	24V-AUX
GND-IO	18	17	GND-IO
AUX-IN-6	16	15	AUX-IN-5
24V-AUX	14	13	24V-AUX
GND-IO	12	11	GND-IO
AUX-IN-4	10	9	AUX-IN-3
24V-AUX	8	7	24V-AUX
GND-IO	6	5	GND-IO
AUX-IN-2	4	3	AUX-IN-1
24V-AUX	2	1	24V-AUX

AUX-IN-1 – AUX-IN-8 are general purpose digital inputs. The can be used for reading additional sensors/switches etc. These are galvanic isolated 24V. Each input as a 24V and GND terminal, this allows the supply of 24V sensors.

J4 MODBUS



J4-MODBUS			
COMMON_MODBUS	8	7	IO_ESTOP
COMMON_MODBUS	6	5	IO_SSTOP
COMMON_MODBUS	4	3	IO_WARN
RS485-B	2	1	RS485-A

This interface is there to connect external MODBUS (RS485) compatible I/O boards. Currently only the RLY8 I/O card of Eding CNC is supported. This connector connects 1:1 to the MODBUS (RS485) connector on the I/O board. A 4x twisted pair shielded cable is recommended.

J11 SPINDLE

J11 SPINDLE			
TOOL OUT (24V)	1	2	GND
TOOLDIR OUT (24V)	3	4	GND
0-10V-OUT	5	6	GND-0-10V
24V	7	8	PWM1-OUT (OC)

The TOOL OUT output switches the spindle ON/OFF (M3/M4/M5 in g-code). The TOOLDIR OUT sets the spindle direction (M3/M4 in g-code) . The 0-10V-OUT is for controlling the spindle RPM if there is a VFD controlled spindle. Use this signal always in combination with THE associated GND-0-10V. PWM1-OUT is the PWM signal that can also be used to control the power of the spindle (or laser).

These outputs are galvanic isolated and short circuit proof.

J10 PROBE

J10 PROBE			
24V	1	2	GND
IN-SYNC (spindle pulse)	3	4	NC
24V	5	6	GND
PROBE	7	8	NC
24V	9	10	GND-24V
PROBE	11	12	NC
(Use NPN or Normally open switch in case 2 probes/tool setters are used) (Probe inputs are parallel)			

IN-SYNC is connected (if applicable) to a sensor that gives 1 pulse/revolution of the spindle, it is used to measure the spindle speed and perform thread cutting on a lathe, the minimum pulse width is 1 ms.

The Probe inputs are used to connect a Touch-Probe or tool setter.
NPN and PNP or switches sensors can be used, the 2 probe inputs are internally connected together. If a switch is used, connect it to PIN5 and PIN 7 or PIN 9 and PIN 11. If a proximity sensor is used, use PIN 5 and PIN 6 or Pin9 and PIN 10 for the supply of the sensor, use PIN 7 or PIN11 for the output of the sensor.

These inputs are not galvanic isolated, because it are high speed inputs. They are 24V inputs filtered and protected against transient voltages.

J8 SAFETY

J8 SAFETY			
24V	1	2	EXTERR-IN
ESTOP_K1_IN (24V)	3	4	ESTOP-K1-OUT
ESTOP-K2-IN	5	6	IN-ESTOP-K2-OUT
24V-SPINDLE	7	8	OUT_ SYSTEM_READY1 (OC)
24V-SPINDLE	9	10	OUT_ SYSTEM_READY2 (OC)
24V-SPINDLE	11	12	GND-24V-SPINDLE
(Use pin 3-6 if you have 1 ESTOP contact, 3-4 and 5-6 for 2 ESTOP contacts)			

External Error, is a 24V input that can be used as extra error input with action ESTOP or SMOOTHSTOP configurable in the software.

The ESTOP inputs are for informing the software that the safety relay is in safe or estop state. The ESTOP buttons and possible Machine limit switches are connected to the system safety relay. The safety relay switches on the Power of the Machine moving parts (usually spindle and drives). 1 or 2 output contacts of the safety relay are connected to the ESTOP input(s) of the J8 connector.
So the machine safety responsibility is the safety relay and not the iCNC600 board.
A possible Safety relay is e.g. the PNOZ S3 of company PILZ.
If one contact is used, connect it between PIN3 and PIN6.
If 2 contact is used, connect one contact to PIN3 and PIN4 and connect the second contact to PIN5 and PIN6.
For more info on using a safety relay, please refer to the documentation of the safety relay supplier,

The system ready output (2x), tells the safety relay that the iCNC600 and software is ready to switch on. The safety relay will switch on only if the ESTOP buttons connected to it are in safe state.

J9 ANALOG

J9 ANALOG			
AIN-1 PT100	1	2	GND-A
AIN-2 PT100	3	4	GND-A
24V	5	6	GND-IO
Isolated AIN-5 0-10V	7	8	Isolated AIN-5-GND
Isolated AIN-5 4-20mA	9	10	GND-IO
24V	11	12	PWM2 (OC)
24V	13	14	PWM3 (OC)
Analog Out-2 (Vacuum)	15	16	GND-AOUT
Isolated analog in 5 can be used for PLASMA THC			

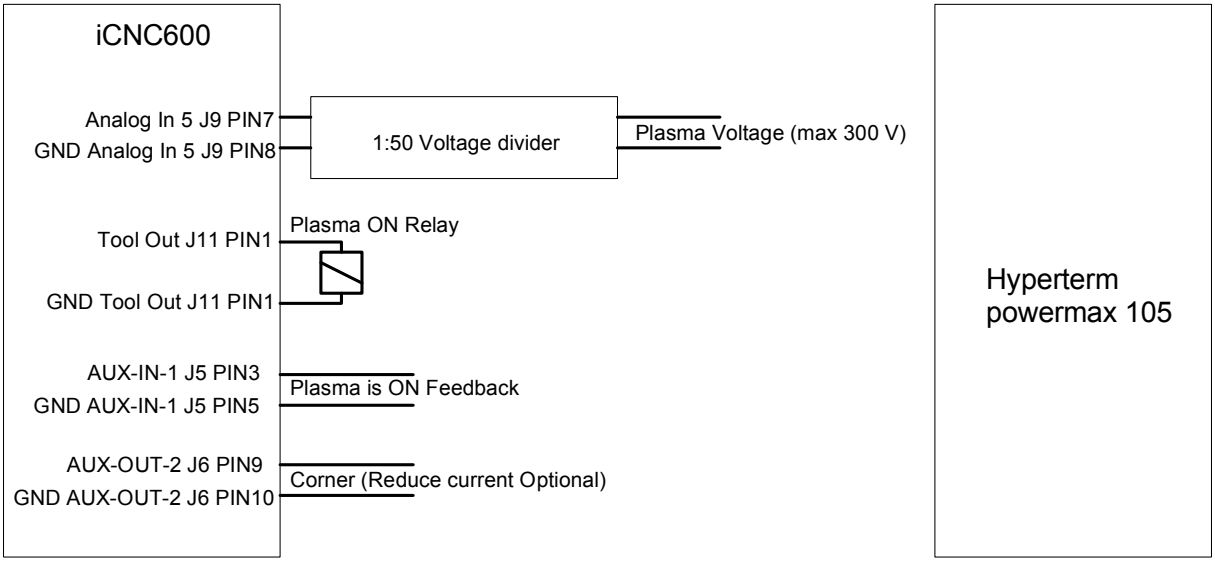
Analog 1 can be used to connect a PT100 temperature sensor, connect between PIN1 and PIN2.
Analog in 2 can also be used for a PT100 temperature sensor, connect to PIN3 and PIN4.

Additional there is Analog out 2, for if there is a second device in the system that needs analog control e.g. a Vacuum pomp with frequency inverter. Use Analog out 2 PIN 15 (0-10V) together with PIN 16 to control such device.

PWM2 is a PWM signal with the same function as Analog out 2,
This is a poly-fuse protected open collector output on PIN12 with PIN11.
PWM3 is a third signal to control an analog function, this is only a PWM output, it is also ply-fuse protected against short circuit, at PIN 14 together with PIN 13.

Analog in 5 is designed for PLASMA THC control, to measure the plasma voltage. An external voltage divider 1:50 is used to convert the high voltage 300V to 6Volt. To have maximum control resolution of this input there are 3 potential-meters on the board to set a window to the interesting work voltage. Usually the working voltage for THC is between 80-180 volts, these potentiometers allow the map this range to the full range (0-1023) of the analog to digital converter on the iCNC600 board. See the description below how the adjust the analog input voltage level for analogue input 5.

Plasma THC interface connections



The plasma arc signal is used to control the height of the Z axis.
The signal is high voltage (approx. 300V and during ignition even several 1000 volts), it is brought back to a safe voltage using 1 1:50 plasma voltage divider. This divider is already build in into the plasma current source or can be obtained separately from the plasma current source supplier.
The signal from the 1:50 voltage divider is connected to analog input 5, see drawing above.
The plasma is started using M3, this switches to tool output ON, this can be connected with a relay to the plasma current source.
The plasma is on is an output from the plasma source to an input of the CPU indicating that the plasma is ON. This input is optional.
The corner output from the CPU is a signal that becomes active when the CNC is reducing velocity in corners. This signal can be used by the plasma source if supported to reduce the plasma current.

With 1:50 the voltage is brought back from 300V to approx. 6 volt.
The interesting work area for the THC lies between 60 and 200 volts.
The input of the CPU in handle max 10V.
The processor can read values for 0-1000 increments, 10 bit.
To make full usage of the 10 bit resolution the range can be adjusted to the working area for the THC.
The 60-200 volts are reduced to 1.2 – 4 volts.
So we want that the processor reads 0 when the input is 1.2 Volt and read approx. 1000 when the input is 4 Volts. This can be achieved by adjusting the 3 potentiometers on the iCNV600 board:

GAIN Analog in 5
This potentiometer defines the range of the input voltage, it can be set such theta the max processor read out is approx. 1000 from about 4V to 10V. For the plasma we want a range of approx. 200V

Lower Limit analog in 5
This sets the low voltage where the processor reads 0.

Upper limit analog in 5
This sets the voltage where the processor reads the maximum value, approx. 1000.

For the adjustment an variable voltage supply is needed.
The Eding CNC software is started and the IO page is selected to view the analog value.

Step1:
Apply 4 volt to the analog input 5.

Step 2:
Turn lower (marked with L) limit potentiometer counter clockwise until the value read does no longer change. Now the lower limit is set to 0Volt.

Step3:
Turn the upper limit potentiometer (marked wit U) counter clockwise until the analog value read no longer changes. Now the upper limit is disabled.

Step 4:
Adjust the gain potentiometer until the analog 5 value read is just at is max (approx 1000) and does not change anymore. When varying the input now between 0-4V you should see the value in the screen vary between 0 and 1000.
So now input=0 ==> analog value 5 on IO screen = 0.
And when input = 2V ==> analog value 5 is about 500
With 4V input ==> analog value 5 shows about 1000 (can be a bit more than 1000, up-to 1023)

Step 5:
Apply 1.2 volt after 1:50 divider is our lower arc voltage working value and resembles 60V plasma voltage. Turn the lower limit potentiometer clockwise until the value reads 0 volt.

Step 6:
Apply 4 V to the input, this is our max working voltage and resembles 200V plasma voltage.
Turn the upper limit potentiometer such that the value reaches near 1000.

This is all about the calibration of the analog input with the potentiometers on the board.
We have now mapped a plasma voltage from 60-200V after the 1:50 divider 1.2-4V to the full scale of the processor analog input (0-1023). This will give the optimum THC performance.

The software also must know the mapping of the 0-1023 input to arc-voltage.
The software uses an offset and multiplication factor to transform the analog 5 value read to a representation of the plasma arc voltage.

VoltPlasmaOnDisplay = voltInput * adcMulFactor + adcOffset

The adcOffset = 60, because at 60V the ADC input value is zero.
The adcMulfactor = VoltPlasmaOnDisplayRange / InputRange = (200 - 60) /1000 = 0.14

If your requirement of working arc voltage is different from 60-200V, apply the steps above with your values.

Step 7:
Read the plasma manual for setting up the plasma THC related parameters in the software.

J13 PENDANT

J13 Pendant			
IN-RUN	1	2	IN-PAUSE
IN-HW1-A	3	4	IN-HW1-A/
IN-HW1-B	5	6	IN-HW1-B/
AIN-3	7	8	AGND-PENDANT
AIN-4	9	10	AGND-PENDANT
5,2V-EXT	11	12	GND-5V
For RUN/PAUSE connect switch to input and GND-5V			

A pendant is a handheld device with a hand-wheel for jogging, a RUN and Pause Button and optionally rotation switches with voltage divider resistors to the analog inputs AIN-3 and AIN-4 to select the hand wheel axes and hand-wheel multiplication factor. Optionally because this can also be selected by the graphical user interface of the software.

The RUN button can be connected to PIN1 and PIN12.
The PAUSE button van be connected to PIN2 and PIN12.
The hand-wheel count signals (A B, /A/B is connected to PINS 3-6).
The hand-wheel +5V supply is connected to PIN11 AND pin12

Analog in 3 (use switch with voltage divider as explained in the software manual) can be used to set the axis used with the hand-wheel.

Analog in 5 (use with voltage divider as explained in the software manual) can be used to select the hand wheel multiplication factor.

Note that the pause button can also be used to select the axis when in hand wheel mode. The RUN button I hand-wheel mode will zero the axis position.

Note that these inputs are 5V and will be damaged when 24V is applied.

General EMC tips:

- USE Shielded cables for all cables, especially the hi noise cables from VFD to spindle and from Drive to motor.
- Keep these cables as far as possible away from the iCNC600 board. Route these cables close to the metal of the cabinet.
- Use a metal plate, preferably steel, not aluminum as GND/Earth plate for the whole cabinet.
- Connect the shield of the iCNC600 cabling to the FASTON connector available at each connector of the CPU. Even better would be to apply an GND/Earth rail besides the iCNC600 at both sides in you cabinets and connect the shield there with special EMC shield clamps. This way the noise will not reach the iCNC600 board.