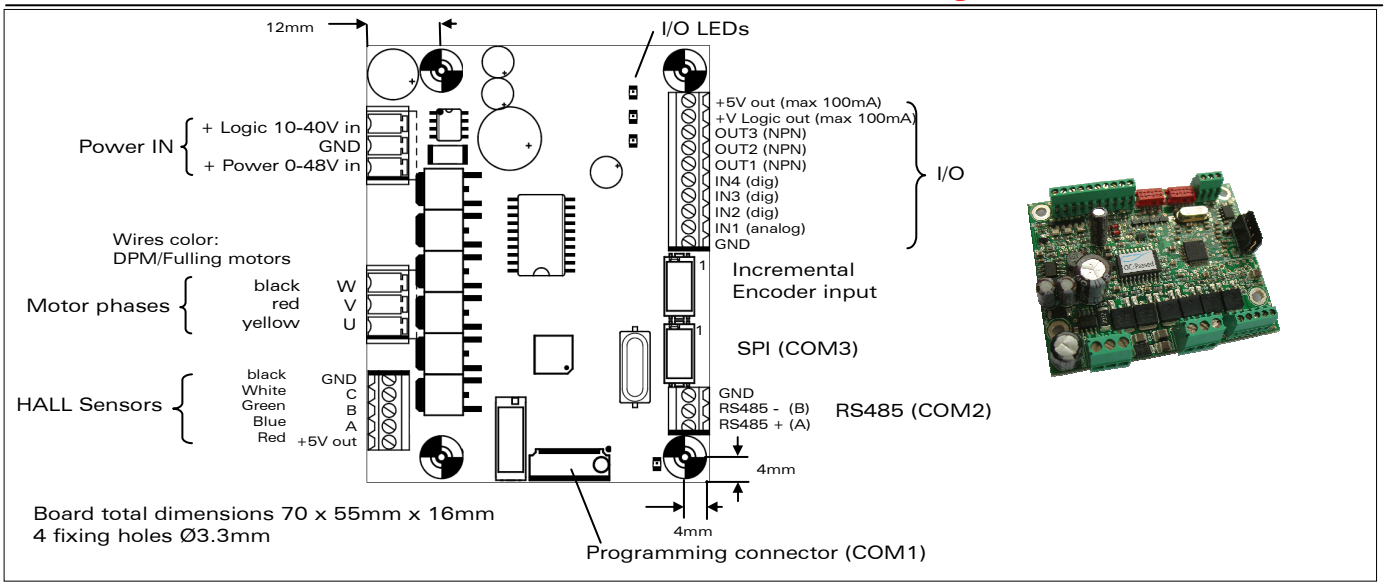
INTELLIGENT BLDC electronic Programmable in BASIC



Overview

The **Tinaxis BL120 INTELLIGENT controller** is a powerful motor driver, programmable in **BASIC, includes 32bit ARM processor**

40V– 5A continuous, up to 8 A peak (200W / 360W)

- PWM amplifier: 2, 4 quadrants, block commutation, with brake
- High performance multiple PID controllers, predictive module
- Speed 0 to 100'000 RPM
- Rotor detection: Hall sensors
- Programmable in BASIC (12kB program flash), configuration wizard for easy use
- 50 MHz, 32 bit microcontroller (ARM)
- 4 inputs (1 analog, 3 digital, with time counting capability: 20ns resolution)
- 3 outputs Open collector NPN, 100mA 35V
- 3 serial connectors: RS232 (TTL levels), RS485, SPI
- Encoder input: A/B + Index (SSI possible on SPI)
- Can drive 1 BLDC or 2 DC motors or 3 solenoids or 1DC and 1 solenoid

	Parameter (summary)	unit	value
1	Supply voltage POWER and LOGIC separated	V	Power: 0-48V / Logic 8-36V
2	Driver current (continuous / peak) (On high values, be careful of temperature elevation)	A	5 / 8
3	Input current when motor OFF	mA	30 to 100 (depend on voltage)
4	General purpose inputs: 1 analog input, 0-25V with 25mV resolution, impedance to GND: ~30kOhm 3 digital. In timer mode, time resolution of 20ns An input not connected is low levelled (<100mV or logical 0). Compatible to PNP 24V logic.		
5	General purpose outputs: 3 digital outputs, open collector to GND, max 100mA 35V, visualized by LEDs		
8	PWM frequency	kHz	1 to 60
9	Ambient temperature range for 100% of max power*	°C	-10 to 50
10	Ambient temperature range for 50% of max power*	°C	-10 to 75
11	Response time on input change	ms	<2.5
12	Embedded safety protections: Over temperature, over current (software), low current polarity inversion, ESD in wires, short circuited outputs		
13	Safety precautions: be sure to avoid these parameters during storage and use: Water or metallic particles projections, shocks, over voltage, reversed voltage		
14	Start-up initialisation time (system boot): < 300 ms		
15	Communication, hardware description: COM1 (UART TTL, to USB or RS232 via adapter) 100 to >500000 bps COM2 RS485 with fail safe, no terminal resistor. 100 to >500000 bps COM3 SPI (accessories connector) Optional MODBUS ASCII or RTU (binary)		
15	Communication, software description: COM1 and COM2: DM-Remote, DM-binary (slave or master), optional ModbusRTU (s or m), optional DMX (s or m) COM3: to connect SSI encoder(s), I/O module, display module		
16	Movement: Open loop voltage mode – closed loop speed control with ramps – closed loop positioning with trajectory generation – cam generation (optional) - brake mode – free wheel mode		
	* depend on the cooling conditions		

This specification is subject to change without prior notice

Dynamic Motion SA
105, rue Fritz Courvoisier
2300 La Chaux-de-Fonds
Switzerland

welcome@dynamicmotion.ch
www.dynamicmotion.ch
Phone: +41 32 968 64 50
Fax: +41 32 968 64 51

Software

Custom motion software can be written by the user and download to the unit from a user friendly Windows software available at Dynamic Motion, through a RS232 or USB cable provided by Dynamic Motion, or through a long distance RS485.
Thanks to the BASIC programming, any kind of sequence and behaviour can be programmed with a minimum effort, ensuring a reliable operation and fast engineering.
The user can access to the motion parameters, I/O, communication parameters and various other parameters like temperature or timers.
Tinaxis BL120 offers the extended parametric motion calculator.

Driver detailed electrical characteristics

Power connector

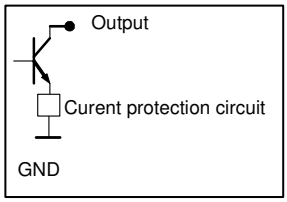
Pin	*Function*	*Range*
1	Logic +	8-36V
2	GND	
3	Power +	0-48V

GND = negative voltage, common to Power, Logic, I/O
V + Power = Supply of the amplifier bridge that power the motor phases. Note: V+ power works from 0V
V + Logic = Supply of the internal circuits (microprocessor, LCD, IO, ...)
Both V+ can be connected together, or separate. Therefore it is possible to connect the power through a safety relay, without affecting the software execution.
Connector type: 3.5mm pitch, terminal block, for up to 1.5 mm2

I/O connector (Inputs – Outputs)

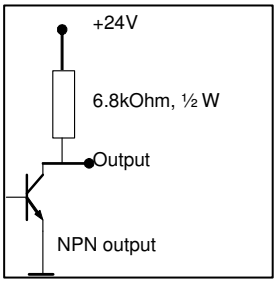
Pin	*Function*	*Description*
1	+5V out	Max 100mA, usage: only to supply low current devices, as switchs, leds, potentiometers, ...
2	+V Logic out	Voltage to connect external low power devices that are connected to the board. This output is not protected, not short-circuit tolerant. Max current: 100mA.
3	Out3	NPN output (see below)
4	Out2	NPN output
5	Ou1	NPN output
6	IN4	Digital
7	IN3	Digital
8	IN2	Digital
9	IN1	Analog input: 10 bits with oversampling
10	GND	Use it to reference the I/O. Do not supply from this pin. Internally connected to power GND

The outputs are "Open collector" NPN transistors, with over-current protection circuitry. In software, a level 0 makes the transistor not conducting, and a level 1 makes them conducting up to 100mA in total for the 4 channels. When an over-current is detected, the outputs are disabled up to the next reset (power off of logic supply). The state of the outputs are shown with the LED



Tips: how to make it compatible with PNP logic?

Answer: use a pull-up resistor, to force the voltage to a higher value when the transistor is not avtive. The value of that resistor can be between 4.7k and 10k.



Programming connector

The 5 pin connector may be used for downloading the BASIC software and for remotely control the electronic.

Encoder connector

6 PIN Micromatch type
Pinout:

1. GND
2. A
3. B

Dynamic Motion SA
105, rue Fritz Courvoisier
2300 La Chaux-de-Fonds
Switzerland
welcome@dynamicmotion.ch
www.dynamicmotion.ch
Phone: +41 32 968 64 50
Fax: +41 32 968 64 51

4. Index
5. Chip Select (not used with incremental encoders, only for SSI encoders)
6. +5V (max. 40mA)

SPI connector

6 PIN Micromatch type
Pinout:

1. GND
2. CLK
3. RX
4. TX
5. Chip Select
6. +5V (max. 40mA)

Driver software characteristics

For a complete documentation, please refer to the Software manual 3.x. This section is a summary of the most used options

Programming environment

The minimum requirement is:
A computer with a serial connexion, a text editor, a terminal software for downloading and a cable to connect the motor to the computer.

Dynamic Motion provides the following components:

- Free (GNU) text editor with special syntax coloration add-on for Dynamic Motion BASIC language
- Free Dynamic Motion Communication Software that works under Windows XP
- 9 pin RS232 adaptor to the 5 pin communication connector, with 1.8m prolongation cable
- USB – RS232 converter cable (needed if your computer does not have RS232 connector)

Programming language

- The software that runs inside the controller is **Dynamic Motion BASIC**.
- To remotely control the motor, a set of **REMOTE commands** is available.

Dynamic Motion BASIC summary

Instructions	Expression operators	Comparison operators
IF-THEN-ELSE	(form: variable = expression)	=
FOR-TO-NEXT	+	<
GOSUB-RETURN	-	>
GOTO	*	<> *(not equal)*
PRINT	/	<= *(smaller or equal)*
PAUSE	^ *(power)*	>= *(bigger or equal)*
END	% *(remaining of a division)*	
	( )	

Variables, registres	Special	Numbers
user variables: A, B, ...Y, Z *Predefined variables: see Dynamic Motion BASIC detailed description* *Example:* SPEED	' *(line comment)* " *(text string descriptor)* , ; *(argument separators)*	*Line labels:* 0 to 9999999 Numbers: *signed integer in decimal notation, 32bit (range: from -2'147'483'648 to + 2'147'483'647)*

Remote language

Motion Instructions	System Instructions	Programming tools
JG *(jog, set speed)*	SB *(Stop Basic execution)*	PR *(Print the BASIC software currently in Flash memory)*
MT *(move to, absolute position)*	TB *(Start Basic execution)*	PC *(Print configuration)*
MB *(move by, relative move)*	RB *(RESET Basic execution)*	UL (*Upload BASIC software)*
MD *(mode: brake, speed, ...)*	VA *(variable get or change)*	
DS *(Disable motor)*	RV *(reset all variables to default)*	
BR *(Brake)*		

Usage example: jg 1200enter: set the jog speed to 1200RPM

Most used variables

Motion variables	Usage
MODE	0: auto; 1: brake; 2: not powered; 4: open loop; 6: speed regulation; 8: positioning
JOG	Set the speed regulation value (unit: RPM)
TARGET	Set the position to reach in positioning mode (unit: encoder increment, 1024 =1 rev.)
MOT_V	Motor voltage: can be read in any modes. Set voltage in open loop. (Unit: mV)
ACC, DEC	Acceleration and deceleration value that regulation must follow
M_SP_P, M_SP_N	Max speed in positive and negative direction in positioning mode
SPEED, POS_HAL	Value of the measured speed and position (unit: RPM and HALL sensor increment)
IN1, IN2, ...IN4	Value of the voltage measured on the 5 inputs (unit: mV)
OUT1, ... OUT3	Set the state of the outputs (0 = not conducting, 1 = conducting)
V_POW, I_MOT	Measured voltage of power supply, measured motor current (unit: mV and mA)
TEMPER	Temperature of the board (unit: 1/1000 °Celsus)
TIME	Time in seconds since last power-up (68 year counting)

Dynamic Motion SA
105, rue Fritz Courvoisier
2300 La Chaux-de-Fonds
Switzerland
welcome@dynamicmotion.ch
www.dynamicmotion.ch
Phone: +41 32 968 64 50
Fax: +41 32 968 64 51

TIME_U1, TIME_U2	Timer counting up from 0 to ~$2 \cdot 10^9$, stopped when value is neg. (Unit: millisecond)
TIME_D1, TIME_D2	Timer counting down to 0, from any positive value (Unit: millisecond)
PID1_P, PID1_I, PID1_D	PID regulator factors (used in any closed loop modes)
...	*See the detailed documentation for complete description*

Software example

```
100                 'line label of infinite loop
       if in1 > 2000 then gosub 200 'jump to subroutine at label 200 if voltage on IN1 is > 2.0V
       else jog = 0   'stop motor
goto 100            'back to the beginning if infinite loop
200    jog = 2500     'set speed to 2500RPM
       pause 10000    'wait 10.0 second
return              'come back from subroutine
```

Commutation table

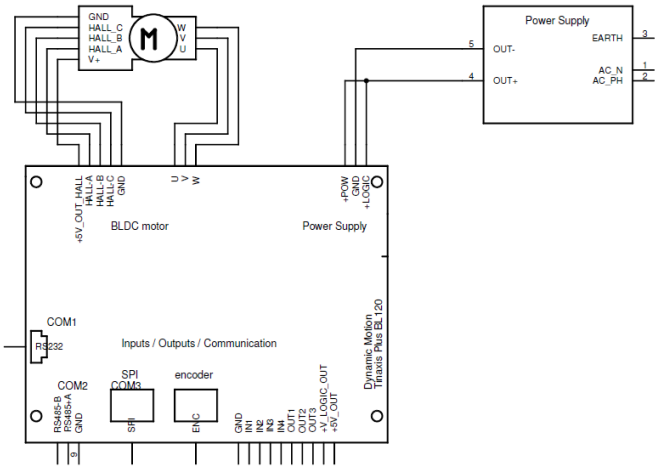
In the case that the HALL sensor polarity is positive:

Step nr (register HALL_N)	0	1	2	3	4	5
Hall sensor A	0	0	0	1	1	1
Hall sensor B	0	1	1	1	0	0
Hall sensor C	1	1	0	0	0	1
Phases voltage CW						
U	hZ	GND	GND	hZ	+	+
V	GND	hZ	+	+	hZ	GND
W	+	+	hZ	GND	GND	hZ
Phases voltage CCW						
U	hZ	+	+	hZ	GND	GND
V	+	hZ	GND	GND	hZ	+
W	GND	GND	hZ	+	+	hZ

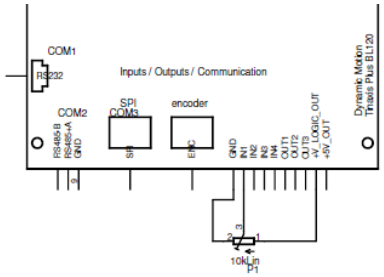
Legend:
0= low voltage level (0V), 1= level high (5V)
hZ = high impedance, + = PWM variable voltage, GND= connected to GND

Typical connections

The example below shows the minimum connections if the Tinaxis board has been programmed before (using onboard connector COM1, an adaptor cable P000-034, and the free software "Dynamic Motion Programming Suite").



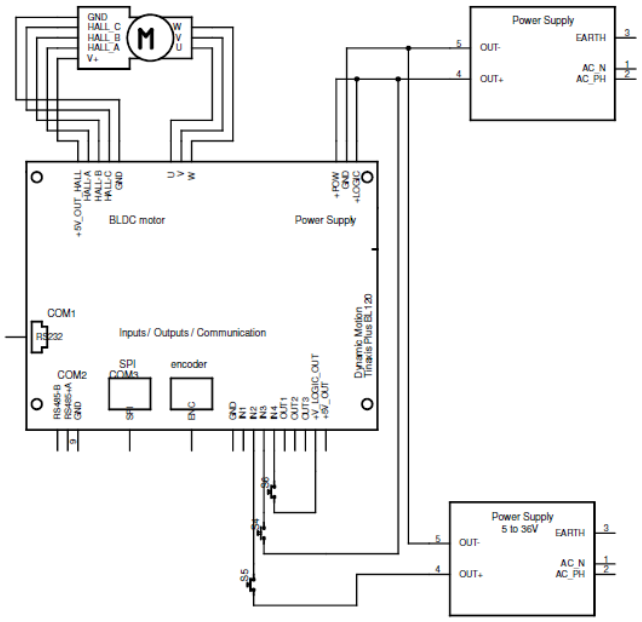
The following examples illustrates how to connects inputs. NEVER connect together GND from power side and I/O side, it already connected inside the board.



Using a potentiometer as analog signal to analog input IN1

Dynamic Motion SA
105, rue Fritz Courvoisier
2300 La Chaux-de-Fonds
Switzerland

welcome@dynamicmotion.ch
www.dynamicmotion.ch
Phone: +41 32 968 64 50
Fax: +41 32 968 64 51



3 examples of wiring digital inputs: Using connection to the same power supply, separate power supply and 24V I/O connector output V_Logic

Ordering information

	Désignation	Article
1	Tinaxis Plus BL120.01	P010-E260

Custom versions possible

Contact person: Bernard Vaucher / direct phone +41 32 968 64 54

Dynamic Motion SA
105, rue Fritz Courvoisier
2300 La Chaux-de-Fonds
Switzerland

welcome@dynamicmotion.ch
www.dynamicmotion.ch
Phone: +41 32 968 64 50
Fax: +41 32 968 64 51