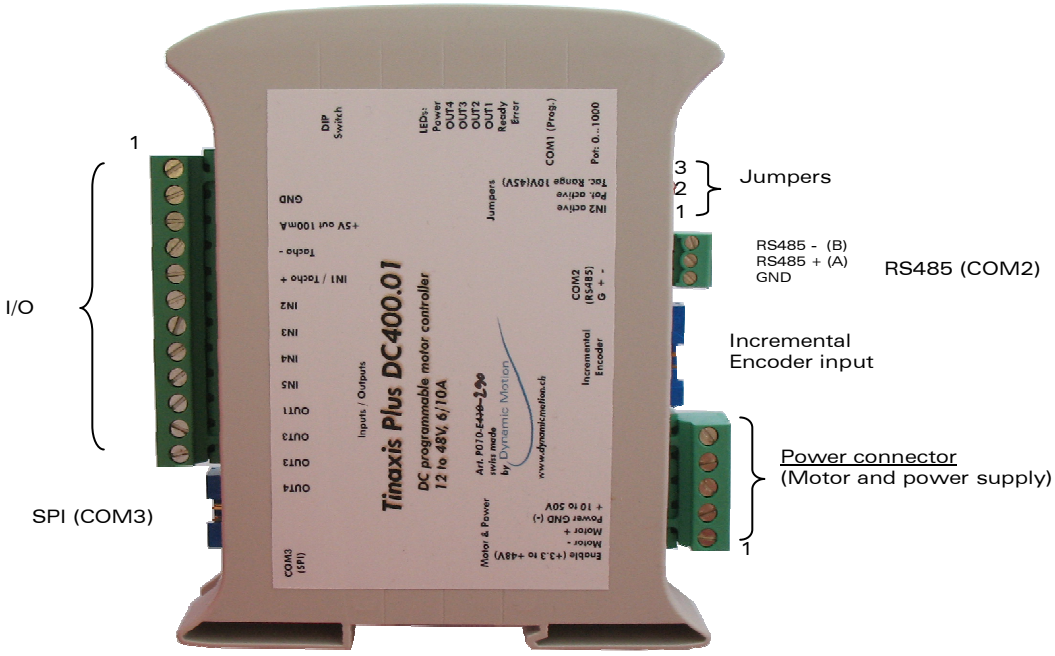
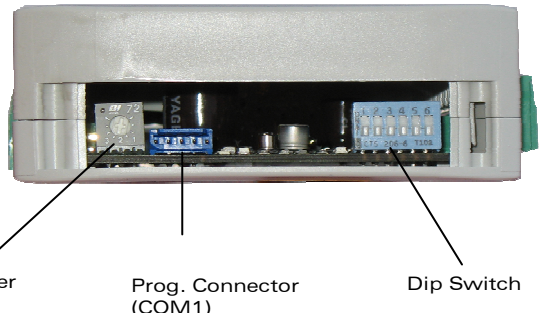
INTELLIGENT DC motor control electronic
Programmed and reprogrammable in BASIC





Overview

The **Tinaxis DC400 INTELLIGENT controller** is a powerful DC motor driver, pre-programmed for simple amplifier use, also programmable in **BASIC**

48V– 6A continuous, up to 10 A peak

- PWM amplifier: 4 quadrants
- Integrated output filter
- Tacho input
- High performance multiple PID controllers, predictive module
- Programmable in BASIC (12kB program flash), configuration wizard for easy use
- 50 MHz, 32 bit microcontroller (ARM)
- 5 inputs (2 analog, 3 digital, with time counting capability: 20ns resolution)
- 4 outputs: 1 analog 0-4V, 4 digital Open collector NPN, 50mA 35V
- 3 serial connectors: RS232 (TTL levels), RS485, SPI
- Encoder input: A/B + Index, with line driver or without (SSI possible on SPI)
- I/O Sampling frequency: 1kHz, calculation frequency: 1kHz, current regul. 10kHz

	Parameter (summary)	unit	value
1	Supply voltage POWER and LOGIC separated	V	10-52V
2	Driver current (continuous / peak) (On high values, be careful of temperature elevation)	A	6 / 10
3	Input current when motor OFF	mA	30 to 100 (depend on voltage)
4	General purpose inputs:		

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	2 analog input, ±12V with, impedance: ~30kOhm 3 digital. In timer mode, time resolution 20ns An input not connected is low levelled (<100mV or logical 0). Compatible with PNP 24V logic.		
5	General purpose outputs: 3 digital outputs, open collector to GND, max 100mA 35V, visualized by LEDs		
8	PWM frequency	kHz	7 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		

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: www.dynamicmotion.ch > products > download > setup_dynamicmotion.exe
An RS232 or USB to TTL adapter cable is required (provided by Dynamic Motion)
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 DC400 offers the extended parametric motion calculator.

Driver detailed electrical characteristics

Power connector

Pin	*Function*	*Range*
1	Enable	0V or unconnected: output power not enabled 2 to 48V: output power enabled
2	Motor -	Connection to motor. This contact is positive when output voltage register is positive
3	Motor +	Connection to motor, negative
4	GND (0V)	Negative voltage and reference for I/O
5	+ 12 to 48V supply	Supply voltage

Connector type: 5mm pitch, terminal block, for up to 2.5 mm2

I/O connector (Inputs – Outputs)

Pin	*Function*	*Description*
1	GND	Use it to reference the I/O. Do not supply from this pin. Internally connected to power GND
2	+5V out (max 100mA)	5V output, to supply low current devices, such as switchs, leds, potentiometers, ...
3	Tacho -	Tacho negative pin connection
4	IN1 or Tacho +	Can be used for tacho or general purpose analog input. Both together is not possible
5	IN2	Analog input ±12V. This input is not available when potentiometer is used (jumpers)
6	IN3	Digital input, references to GND
7	IN4	Digital input, references to GND
8	IN5	Digital input, references to GND
9	Out1	Analog output 0 to 4V / 5mA
10	Out2	Digital output: NPN transistor connected to GND
11	Out3	Digital output: NPN transistor connected to GND
12	Out4	Digital output: NPN transistor connected to 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

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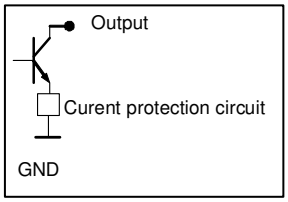
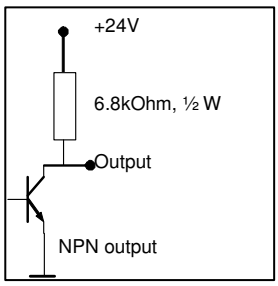
channels. When an over-current is detected, the outputs are disabled up to the next reset (power off of logic supply). The state of the outputs are shown with the LED

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 blue connector may be used for downloading the BASIC software and for remotely control the electronic.

Encoder connector

10 PIN HE10 / DIN41650
Pinout:

1. GND
2. +5V
3. GND
4. GND
5. A- (or left open when not using differential signals)
6. A+
7. B- (or left open when not using differential signals)
8. B+
9. I+ (Index, or left open when index not used)
10. I- (or left open when not using differential signals)

SPI connector

6 PIN (used for LCD display or flash memory or absolute encoder or additional inputs/outputs)
Pinout:

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

RS485 connector

3 PIN (used for serial connection between a computer / PLC and 1 or many boards. Also for board to board data exchange)
Pinout: shown on package

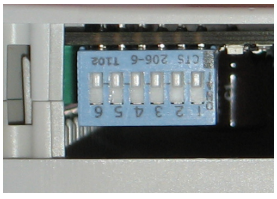
Jumpers

1. IN2 is active
2. Potentiometer is active
3. Tacho range: not in place=±45V, plugged: ±10V

Note: Jumper 1 and 2 are exclusive, only 1 jumper must be plugged at the place 1 or 2. When IN2 is selected, the register POT has no meaning. On the opposite, when Potentiometer is selected, the register IN2 has no meaning.

Software characteristics

Integrated software: the boards are delivered with a standard software written in BASIC. This software allows the user to create simple application without writing code. The standard software can be edited to change it's properties, it can be used as example to start a more complex application.
The integrated DIP switch (picture on the right) allows the user to select the correct sub-program. In case the standard software is not used, the DIP switches are freely available.
Notation: The DIP switch binary number is: switch 1= first digit, ...
Example: if all the switches are "OFF" except the switch nr 2, the resulting binary number is 000010



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Sub Program 0: Voltage amplifier (dip switches xxx000)

Role of inputs:
IN1: set point
IN2 or Potentiometer: current limit (0..6A)
IN3: Disable
DIP switches 4 and 5: gain
DIP switch 6: direction
Notes:
The gain (voltage out= gain x IN1)
Sw= x00000: gain = 0.5
Sw= x01000: gain = 1
Sw= x10000: gain = 2
Sw= x11000: gain = 4

Sub Program 1: Current amplifier (dip switchs xxx001)

Role of inputs:
IN1: set point
IN2 or Potentiometer: voltage limit (0..48V)
IN3: Disable
DIP switches 4 and 5: gain
DIP switch 6: direction
Notes:
The gain (current out[A]= gain x IN1[V])
Sw= x00000: gain = 0.125
Sw= x01000: gain = 0.25
Sw= x10000: gain = 0.5
Sw= x11000: gain = 1

Sub Program 2: Speed loop, tacho feedback (dip switchs xxx010)

Role of inputs:
IN1: set point
IN2 or Potentiometer: PID gain (loop stability)
DIP switches 4 and 5: reserved
DIP switch 6: direction
Notes:
Regulation loop may require editing the P, I, D parameters as well as other registers. This is done by editing the software.

Sub Program 3: Speed loop, motor current feedback, method R·I

(dip switches xxx011)
Role of inputs:
IN1: speed set point (fixed gain: 2.5, output voltage = 25V when input voltage = 10V)
IN2 or Potentiometer: regulation gain
IN3: Disable
DIP switches 4 and 5: maximum current setup
DIP switch 6: gain range: use OFF for motor with resistance lower than 2 Ohm and ON for lower than 30 Ohm
Notes:
Tune the potentiometer to find the stability.
Sw= x00000: max current=1A
Sw= x01000: max current=2A
Sw= x10000: max current=4A
Sw= x11000: max current=8A

Sub Program 4: Position loop on encoder input (dip switches xxx100)

Role of inputs:
IN1: position set point
IN2 or Potentiometer: speed set point during moves
DIP switches 4 and 5: gain for position set-point
DIP switch 6: direction
Notes:
Regulation loop may require editing the P, I, D parameters as well as other registers. This is done by editing the software.

Sub Program 5: Speed loop on encoder input (dip switches xxx101)

Role of inputs:
IN1: Speed set point
IN2 or Potentiometer: acceleration set-pont
DIP switches 4 and 5: gain for speed set-point
DIP switch 6: direction
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Regulation loop may require editing the P, I, D parameters as well as other registers. This is done by editing the software.

Sub Program 6: Position loop on encoder and tacho inputs (dip switches xxx110)

Role of inputs:
IN1: Position set point
IN2: or Potentiometer: speed set point during moves
DIP switches 4 and 5: gain for position set-point
DIP switch 6: direction
Notes:
Regulation loop may require editing the P, I, D parameters as well as other registers. This is done by editing the software.

Sub Program 7: reserved (dip switches xxx111)

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

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

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)
TIME	Time in seconds since last power-up (68 year counting)

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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
```

voltage, GND= connected to GND

Typical connections

(with power supply unpowered)
Connect the power supply, typically 24V, to the "GND" and "+ 12 to 48V supply" on the power connector
Connect the motor to the 2 corresponding pins on the power connector
Connect the "ENABLE" pin to "+ 12 to 48V supply" (both on the power connector)
Connect the voltage set-point to IN1, referenced to GND which is common for signal and power

Optionally select the sub-program with the dip-switchs
Optionally move the jumpers to their final place

Switch on the power supply, the motor should rotate according the input
Optionnaly move the potentiometer to adjust current limitation or adjust related parameter

Ordering information

	Désignation	Article
1	Tinaxis Plus DC400.01	P010-E290

Custom versions possible

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

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