SW5A9052H221-30 - Drives

Installation instructions

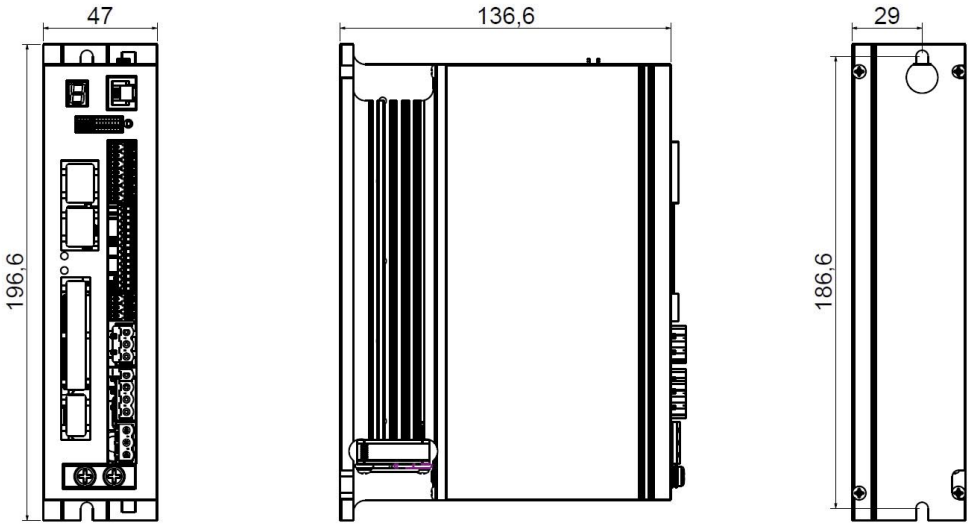
Refer to installation use and maintenance manual for more information.

2 phase bipolar stepper drive technical data:

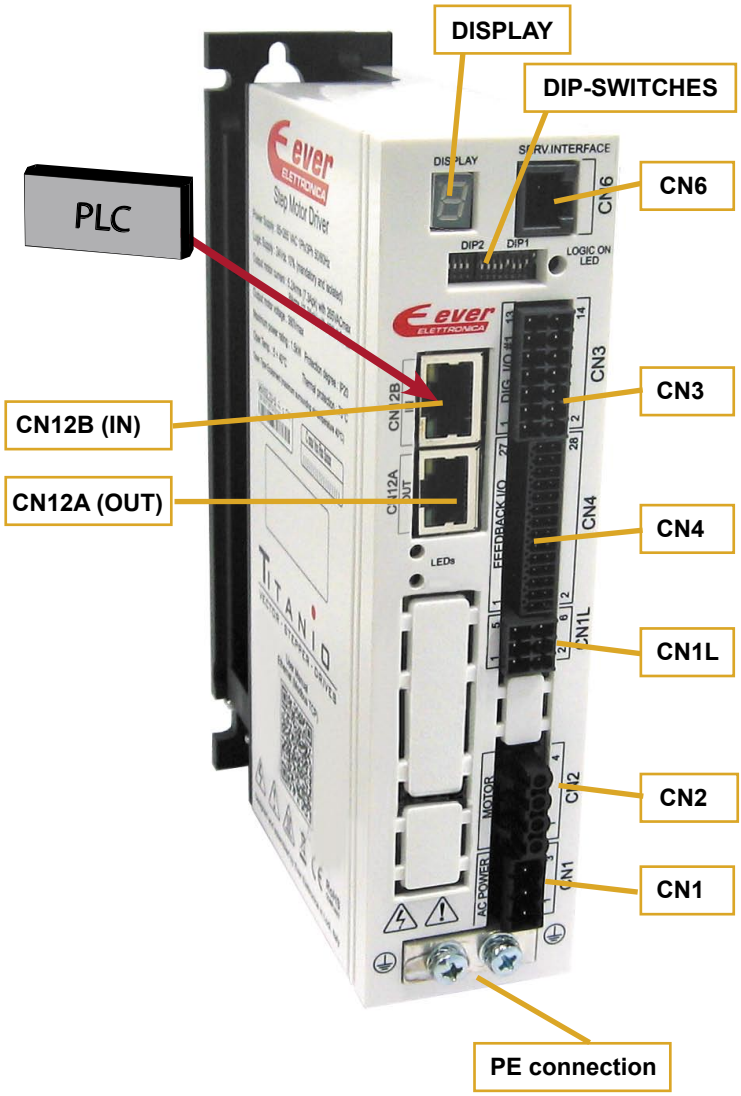
- *AC power supply: 100-240 Vac monophase or triphase;*
- *DC logic supply: 24 Vdc (mandatory and isolated);*
- *Phase current: up to 5,2 Arms (7,3 Apk) with 265VAC MAX or 8 Arms (11,3 Apk) with 120VAC MAX*
- *Chopper frequency: ultrasonic 40KHz;*
- *Stepless Control Technology (65536 position per turn)*
- *Protections against: over current, over/under voltage, overheating, short circuit between motor phase-tophase and phase-to-ground;*
- *EtherCAT communication interface*
- *Incremental Encoder Input: 5V Differential (RS422) or 5V single-ended TTL/CMOS*
- *Incremental Encoder Output: 5V Differential (RS422)*
- *Absolute Encoder Input: 5V BISS-C or SSI interface*
- *Service SCI interface for programming and real time debugging*
- *Safe Torque Off (STO) inputs (opto-coupled)*
- *4 digital inputs (opto-coupled)*
- *3 digital outputs (opto-coupled)*
- *Dimensions: 196.6 x 136.6 x 47 mm (without connectors);*
- *Protection degree : IP20;*
- *Pollution degree 2*
- *Overvoltage Category III*
- *Short Circuit Current: 5 KA*
- *Protection Class: Class I Equipment*
- *Working temperature 5°C ÷ 50°C; Storage temperature -25°C ÷ 55°C*
- *Humidity : 5% ÷ 85% not condensing*

STO
Safe Torque Off
SIL3
PLe

Mechanical data



Connectors:

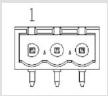

DISPLAY
DIP-SWITCHES
PLC
CN6
CN12B (IN)
CN3
CN12A (OUT)
CN4
CN1L
CN2
CN1
PE connection

System connection

CN1: Power supply

3 positions, pitch 5.08mm double row, PCB header connector

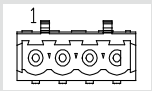
CN1.1	ACin	PWR_IN	AC power supply input
CN1.2	ACin	PWR_IN	AC power supply input
CN1.3	ACin	PWR_IN	AC power supply input



CN2: Motor connection

4 positions, pitch 5.08mm single row, PCB socket connector

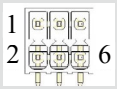
CN2.1	A/	PWR_OUT	Motor output phase A/
CN2.2	A	PWR_OUT	Motor output phase A
CN2.3	B	PWR_OUT	Motor output phase B
CN2.4	B/	PWR_OUT	Motor output phase B/



CN1L: 24Vdc Logic Supply and STO inputs

6 positions, pitch 3.5mm double row, PCB header connector

CN1L.1	VLOG -	PWR_IN	Negative DC logic supply input
CN1L.2	VLOG +	PWR_IN	Positive DC logic supply input
CN1L.3	STO1 -	PWR_IN	STO1 input negative side
CN1L.4	STO1 +	PWR_IN	STO1 input positive side
CN1L.5	STO2 -	PWR_IN	STO2 negative side
CN1L.6	STO2 +	PWR_IN	STO2 positive side



LOGIC 24 Vdc MANDATORY and ISOLATED

CN6: Service SCI Interface

RJ11, 6P4C, PCB header connector

CN6.1	TX/RX	Transmit / Receive Line
CN6.2	DE/RE	Drive Emable Negated /Receive Enable
CN6.3	+5V	+5V power out
CN6.4	GND	GND power out

This connection is only possible with hardware and software provided by Ever.

CN12A e CN12B: Ethernet-Based Fieldbus interface

RJ45, 8 positions shielded, PCB header connector

Dual RJ45 connectors (IN-OUT)
100BASE-TX (100 Mb/sec) ports
Accept standard Ethernet cable (CAT5 or higher)

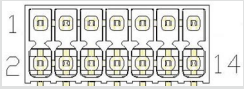
CN12A (OUT)

CN12B (IN)

CN3: Digital Inputs / Outputs #1

14 positions, pitch 3,5mm double row, PCB header connector

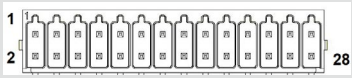
CN3.1	VSS#1	PWR_IN	Negative supply for digital outputs B0 on CN3
CN3.2	V-OUT	PWR_IN	24Vdc supply for digital outputs B0 on CN3
CN3.3	B0_OUT0	DIG_OUT	PNP digital output B0_OUT0
CN3.4	B0_OUT1	DIG_OUT	PNP digital output B0_OUT1
CN3.5	B0_OUT2	DIG_OUT	PNP digital output B0_OUT2
CN3.6	N.C.	---	Not connected
CN3.7	-B0_IN0	DIG_IN	Digital input B0_IN0 negative side
CN3.8	+B0_IN0	DIG_IN	Digital input B0_IN0 positive side
CN3.9	-B0_IN1	DIG_IN	Digital input B0_IN1 negative side
CN3.10	+B0_IN1	DIG_IN	Digital input B0_IN1 positive side
CN3.11	-B0_IN2	DIG_IN	Digital input B0_IN2 negative side
CN3.12	+B0_IN2	DIG_IN	Digital input B0_IN2 positive side
CN3.13	-B0_IN3	DIG_IN	Digital input B0_IN3 negative side
CN3.14	+B0_IN3	DIG_IN	Digital input B0_IN3 positive side



CN4: Feedback connection

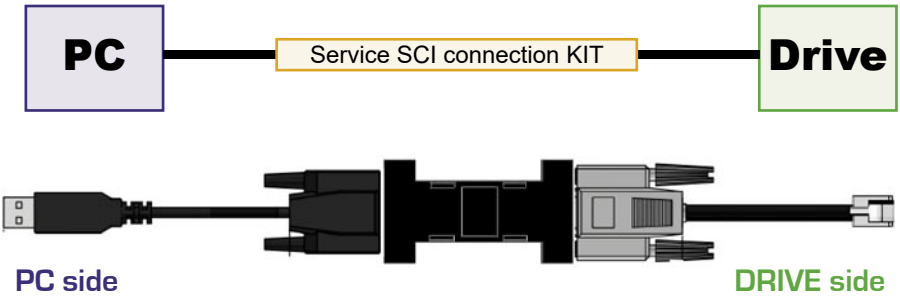
28 position, pitch 2,54mm double row, PCB header connector

CN4.1	Shield	/	Cable shield connection for feedback interface
CN4.2	Shield	/	Cable shield connection for feedback interface
CN4.3	N.C.	---	Not connected
CN4.4	N.C.	---	Not connected
CN4.5	DATA-	DIG_IN	Absolute encoder data input negative
CN4.6	DATA+	DIG_IN	Absolute encoder data input positive
CN4.7	CLK-	DIG_OUT	Absolute encoder clock output negative
CN4.8	CLK+	DIG_OUT	Absolute encoder clock output positive
CN4.9	Reserved	---	Reserved pin
CN4.10	Reserved	---	Reserved pin
CN4.11	Reserved	---	Reserved pin
CN4.12	N.C.	---	Not connected
CN4.13	ENCZ-	DIG_IN	Encoder Zero differential input negative
CN4.14	ENCZ+	DIG_IN	Encoder Zero differential input positive
CN4.15	ENCB-	DIG_IN	Encoder Phase B differential input negative
CN4.16	ENCB+	DIG_IN	Encoder Phase B differential input positive
CN4.17	ENCA-	DIG_IN	Encoder Phase A differential input negative
CN4.18	ENCA+	DIG_IN	Encoder Phase A differential input positive
CN4.19	0VE	PWR_OUT	Negative side of supply
CN4.20	+5E	PWR_OUT	+5Vdc power supply output
CN4.21	OUT_ENCZ-	DIG_OUT	Encoder Zero differential output negative
CN4.22	OUT_ENCZ+	DIG_OUT	Encoder Zero differential output positive
CN4.23	OUT_ENCB-	DIG_OUT	Encoder Phase B differential output negative
CN4.24	OUT_ENCB+	DIG_OUT	Encoder Phase B differential output positive
CN4.25	OUT_ENCA-	DIG_OUT	Encoder Phase A differential output negative
CN4.26	OUT_ENCA+	DIG_OUT	Encoder Phase A differential output positive
CN4.27	0VE	PWR_OUT	Reference ground for feedback interface
CN4.28	0VE	PWR_OUT	Reference ground for feedback interface

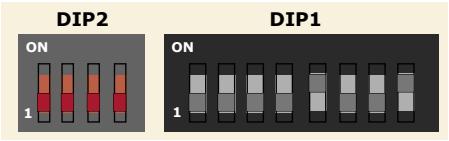


Service SCI connection

This connection is only possible with hardware and software provided by Ever.
Kit code: SW5_SERV00-SL or SW5-SERV00-EE.



Dip-Switched Settings



NOTE: the device reads the Dip-Switches only during the Power up. If it's necessary a setting change, shut down the system, change the settings and start up the system again to make the changes operating.

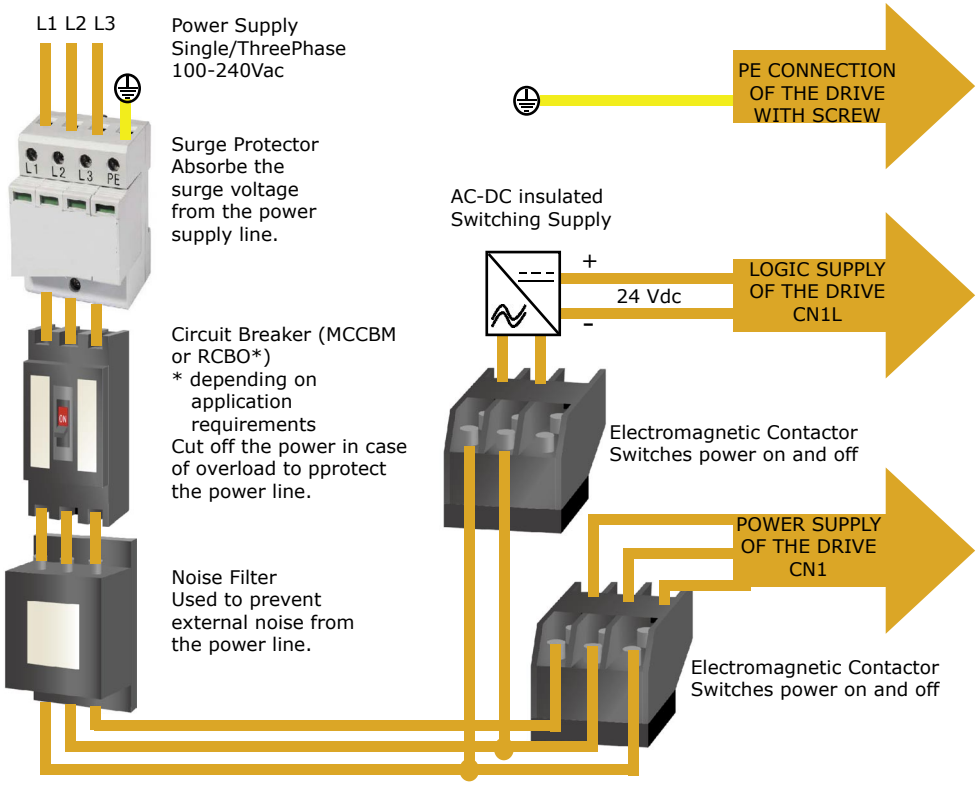
The default configuration of the DIPs is:
- DIP1.5 and DIP1.8 = ON and other contacts DIP1 = OFF
- all contacts DIP2 = OFF

The fuctionality of the Dip-Switches depends on the Firmware installed on the drive (Refer to the Software Manual).

Display Status

Operational statuses and their signals	
C	Missing Operating System: no software application stored on drive
U	Firmware update: Updating of new software in progress.
I	Initialization: the drive executes the start-up procedure (a few seconds after the start-up procedure has begun).
S	Correct functioning
S + 1	Voltage of the DC bus near to the limit value (minimum or maximum)
S + 3	Drive temperature is near to the maximum value
S + 7	Warning: EEprom near Write Overrun
S + 8	Warning: EEprom near End of Life
S flashing	Enable OFF, current zero
- flashing	$I_{nominal}$ not computed
E + 3	Error: expired eePLC software trial
E + 0	Error: Security intervention of watchdog
E + 1	Error: Internal Software Error
E + 2	Error: Missing calibration values
E + 3	Error: Management EEPROM
E + 4	EEPROM fail
E + 6	Error: eePLC application error
E + 7	Error: EEprom Write Overrun
E + U	Error: Feature Unavailable (the application tried to use a feature that is not available in the current drive configuration)
P + 0	Open motor phases
P + 1	Over/under voltage
P + 2	Over current on the motor output
P + 3	Over temperature of the drive
P + 5	Missing Torque Enable ("missing Safe Torque Off")
P + 6	Drive over power protection and/or current regulation out of range
P + 7	eePLC User Protection (generated by setting bit #0 of eePLC_User_Settings)
P + 9	Motor feedback error

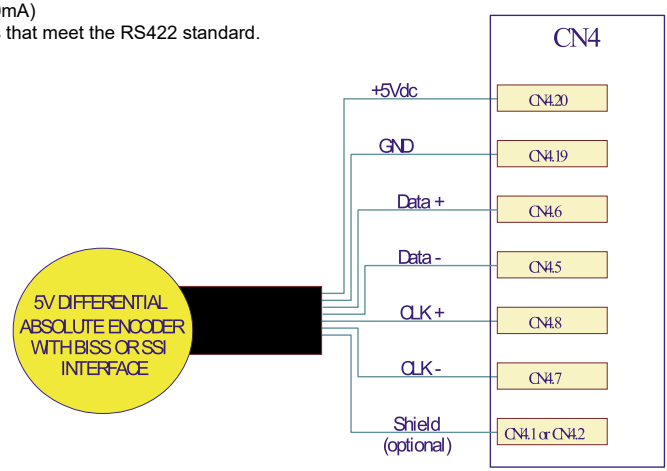
Power & Logic Supply connections



N.B. In order to comply with cURus certification other requirements **must be met,** refer to chapter UL REGULATION REQUIREMENTS

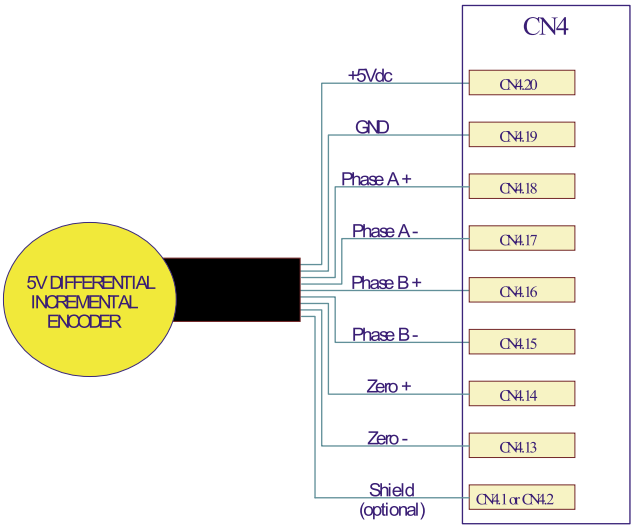
Absolute Encoder input connection

(Maximum supply current 100mA)
Differential 5Vdc digital inputs that meet the RS422 standard.

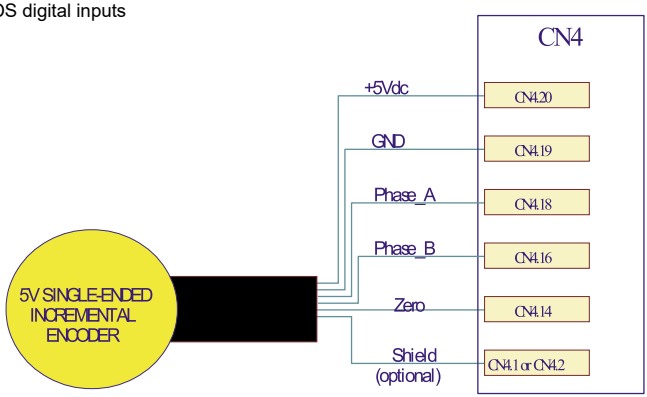


Incremental Encoder input connection

(Maximum supply current 100mA)
Differential 5Vdc digital inputs that meet the RS422 standard.

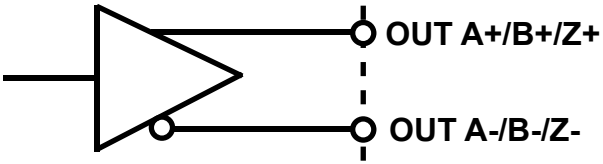


Single-Ended 5Vdc TTL/CMOS digital inputs



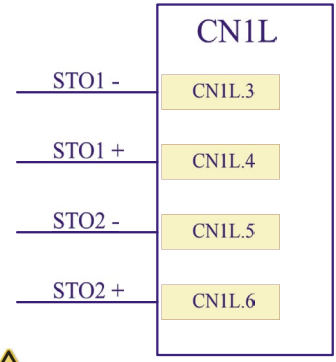
Incremental Encoder output connection

Outputs reports the used interface for encoder input : Differential or Single-Ended.
Differential 5V digital outputs that meets RS422 stardard.



Safe Torque Off inputs (STO)

2 terminals, 24V compatible (optoisolated)



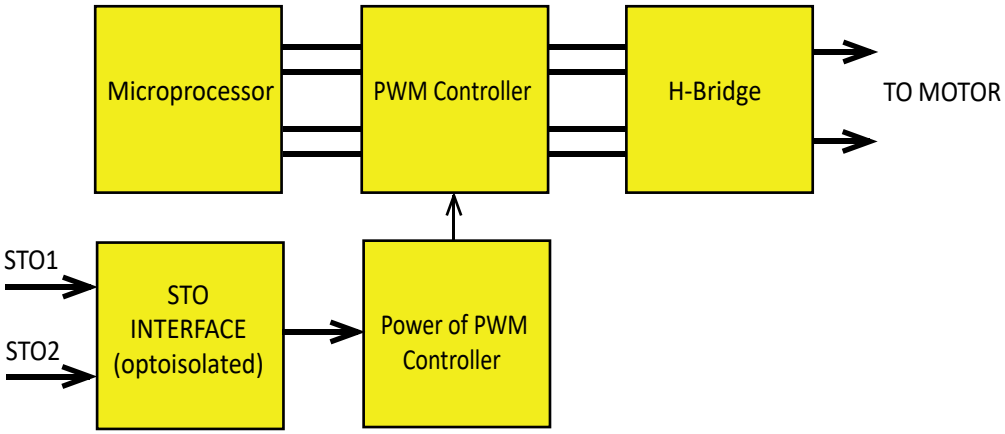
STO1	STO2	Drive Status	Motor Status
+24Vdc	+24Vdc	Enable	SW controlled
+24Vdc	Not connected	Disable	Stop for inertia
Not connected	+24Vdc	Disable	Stop for inertia
Not connected	Not connected	Disable	Stop for inertia

STO inputs are optoisolated, shall not be used the same 24 Vdc of logic supply for their connection.

Safety specifications		
Safety function	STO	Safe Torque Off
Category	4	In according with EN ISO 13849-1
Performance Level	PLe	In according with EN ISO 13849-1
Safety Integrity Level	SIL3	In according with EN ISO 13849-1 table 3
DC_{avg} [%]	99	Average Diagnostic Coverage
PFH_D [1/h]	6.44×10^{-9}	Probability of dangerous failure per hour
T Service Life [Years]	20	In accordance with EN ISO 13849-1
Type test	The STO function has been certified by an independent testing body.	

Refer to the “Safety Manual_STO on SW5-AW5 Series_GB” for more details of the Safe Torque Off function characteristics. Contact EVER in order to have a copy of the manual.

Principle of operation:



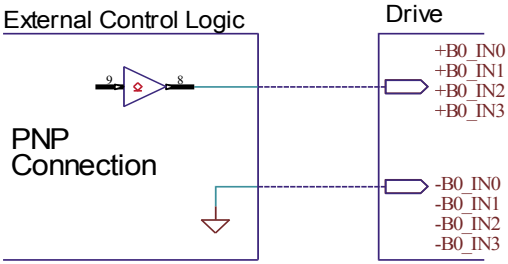
The drive has a safety feature that is designed to provide the Safe Torque Off (STO) function as defined in IEC 61800-5-2. Two input signlas are provided which, when not connected, prevent the upper and lower devices in the PWM outputs from being operated by the digital control core. This provides a positive OFF capability that cannot be overridden by the control firmware, or associated hardware components. When both STO signals are activated (current is flowing in the input diodes of the optocouplers), the control core will be able to control the on/off state of the PWM outputs.

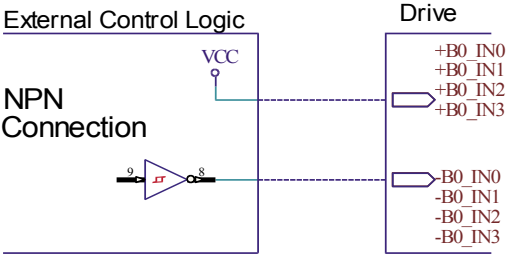
If not using the STO feature, both signals must be connected to a 24Vdc supply in order enabled the drive.

If a drive in operation mode is disabled by STO signal, it immediately finish to produce torque but the motor continues to run by inertia until it can stop.

Differential PNP, NPN and Line Driver type.

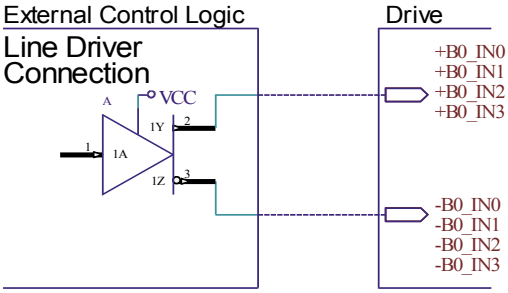
3.3 - 24V INPUT





B0_IN0 and B0_IN1			
Characteristics	**MIN.**	**MAX.**	**Unit**
Supply voltage	2 (1)	24	Vdc
Inputs frequency	--	10	kHz
Threshold switching voltage	1.61 (1)	--	Vdc
Current at 2 Vdc (1)	--	2.53	mA
Current at 3.3 Vdc	--	5.84	mA
Current at 5 Vdc	--	6.28	mA
Current at 24 Vdc	--	8.75	mA

2 - 24V INPUT

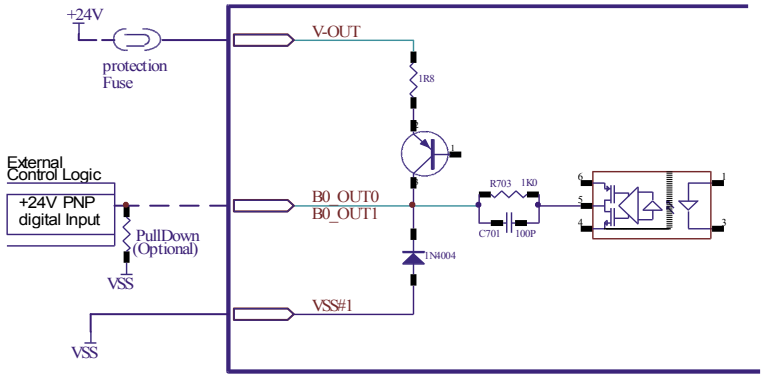


B0_IN0 and B0_IN1			
Characteristics	**MIN.**	**MAX.**	**Unit**
Supply voltage	2 (1)	24	Vdc
Inputs frequency	--	500	kHz
Threshold switching voltage	1.61 (1)	--	Vdc
Current at 2 Vdc (1)	--	2.53	mA
Current at 3.3 Vdc	--	5.84	mA
Current at 5 Vdc	--	6.28	mA

(1) N.B.: it's recommended to use 2 Vdc digital inputs only in differential Line-Driver configuration to have more noise immunity.

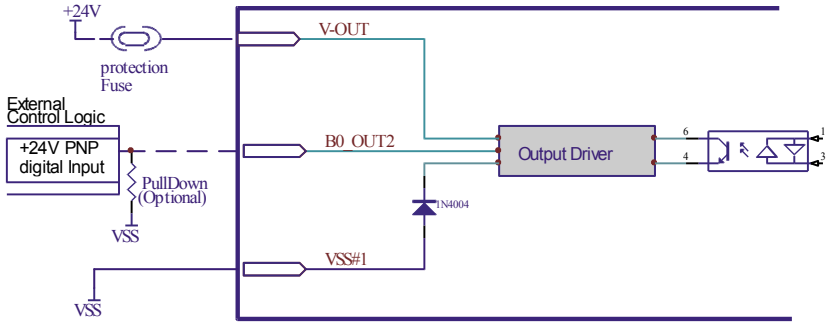
Digital outputs connection (B0_OUT0 and B0_OUT1)

PNP with V_{OUTmax}=24Vdc, I_{OUTmax}=100mA, Fmax = 500kHz



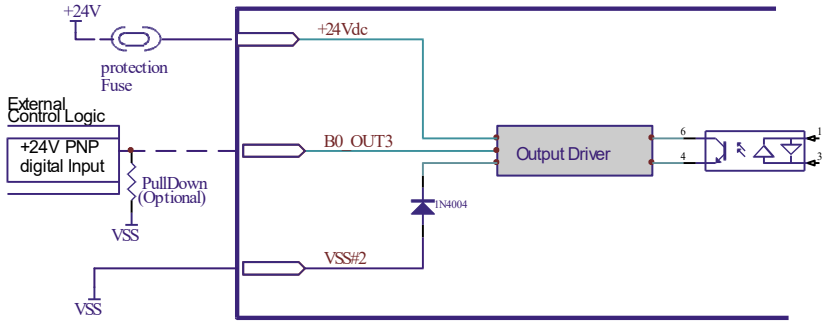
Digital output connection (B0_OUT2)

PNP with V_{OUTmax}=24Vdc, I_{OUTmax}=1.3A , Fmax = 1kHz



Digital output connection (B0_OUT3)

PNP with V_{OUTmax}=24Vdc, I_{OUTmax}=500mA , Fmax = 1kHz



In order to comply with cURus certification the following requirements must be met:

File number E363861

- Electrical ratings

INPUT

Input Voltage Range	Maximum Input Current
100/50 - 240/120 Vac 1/3 Ph 50/60 Hz	5.2 Arms

OUTPUT

Maximum Output Voltage	Motor Phases Number	Maximum Output Current	Maximum Output Motor Power
340 Vdc	2 or 4	5.2 Arms	1.76 kW

- Earting system

IT ot TN (not corner earthed)
The drive shall considered only for use in system voltage where the maximum voltage between the ungrounded conductors and ground does not exceed 150 V

- Solid state short circuit protection

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Canadian Electrical Code, Part I.

- External Fuses and short circuit protection on AC supply

Suitable for use on a circuit capable of delivering not more than 5000 Arms symmetrical amperes, 240 V max when protected by semiconductor fuses model Cooper Bussmann FWX-20 A14F

- Group installation

Suitable for motor group installation on a circuit capable of delivering not more than 5000 Arms symmetrical amperes, 240 V max when protected by Class CC fuses with a maximum rating of 30A.

Number of drive	Suggested fuse rating
1	10 A
2	15 A
3	20 A
4	25 A
5	30 A

- Discharge time of the capacitors on the AC power supply

WARNING – Risk of Electric Shock

Wait at least 4 minutes after disconnecting AC power supply
Time required for the capacitors to a safe discharge to a level below 50 Vdc.

Mating connectors

Connector	Description
CN1	Phoenix 1762208 (Green) or 1759509 (Black)
CN1L	Phoenix 1790111 (Green) or 1708329 (Black)
CN2	Phoenix 1786190 (Green) or 1731196 (Black)
CN3	Phoenix 1790153 (Green) or DFMC 1,5/ 7-ST-3,5 BK (Black)
CN4	Phoenix 1844691
CN12A/CN12B	RJ45, 8 positions for Ethernet standard cables (CAT5 or higher)

Section of the cables

Function	Cable	
	Minimum	Maximum
Power supply and PE	0.5 mm² (AWG20)	2.5 mm² (AWG12)
Motor outputs	0.5 mm² (AWG20)	2.5 mm² (AWG12)
Feedback	0.12 mm² (AWG26)	0.5 mm² (AWG20)
Logic supply and Inputs / Outputs	0.5 mm² (AWG20)	1.3 mm² (AWG16)
Communication interfaces	Ethernet standard cable CAT5 or higher	

Verify the installation

- Check all connection: power supply, logic supply, STO inputs and inputs/outputs
- Make sure all settings right for the application.
- Make sure the power supply is suitable for the drive.
- If possible, remove the load from the motor shaft to avoid that wrong movements cause damage.
- Enable the current to the motor and verify the applied torque.
- Enable a movement of some steps and verify if the rotation direction is the desired one.
- Disconnect the power supply, connect the load on the motor and check the full functionality.

Analysis of malfunctions

When one of the following situations occur, the drive doesn't function correctly and it is reported an error.

DEFECT	CAUSE	ACTION
The external fuse to the drive burns	May be due to a wrong connection of the power supply.	Adjust the connection and recover the fuse. Use a fuse suitable for the application.
Over temperature protection.	May be due to a duty cycle	Increase the air flux and if it is possible chose a motor with higher torque at same current value.
Over current protection.	May be due to a short circuit on the motor power stage.	Shut down the power supply and check if the motor is damaged
Noisy motor movement with vibrations.	May be caused due to a state of resonance.	Increase the resolution of the step angle and/or change the motor velocity to avoid resonance area
The motor produce torque but doesn't rotate	May be caused due to a wrong connection of the I/O's.	Check the connection of the I/O's

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