AGD101

Low Voltage EtherCAT Drive

Product Manual

agito

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Member of Akribis Systems group

Revision History

Version	Description	Date
2.1	Updated electrical interface connection diagrams and pinout drawings. Revised the connector pin names to match the terminal names of electrical interface connection diagrams. Corrected isolated input quantity and digital input 8 description. Added thermostat option to PT100 port. Deleted AqB encoder disconnected function.	15 July 2025
2.0	Updated X8: Silkscreen image and details correction	27 May 2024
1.0	Initial release	2 Jan 2024

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Warranty

This product is warranted to be free of defects in material and workmanship and conforms to the specifications listed in this manual, for a period of 12 months from the shipment date from factory.

Contents

1 Product Description

1.1 General Description

AGD101 is a high-performance, low voltage EtherCAT servo drive and single-axis motion controller.

An EtherCAT (CoE) interface compliant with CiA 402 drive profile.

The AGD101 can drive many types of motors, such as voice coil, brushed, and brushless, including direct-drive linear and rotary motors. The drive provides numerous digital and analog inputs and outputs for application interfaces. It also supports various incremental and absolute encoders.

Figure 1. AGD101

Advanced features include position event, position lock (capture), error mapping, dual-loop control, closed-loop force mode, and ultra-precision modes.

The AGD101 includes programing capabilities, and supports up to 8 multi-threading tasks, each of which can be configured with a different priority. It can also serve as a full-featured single-axis standalone controller.

The AGD101 also supports receiving analog input ±10V current or velocity commands, and pulse and direction position commands.

Agito PCSuite software is used for configuration and tuning via an Ethernet port on the drive.

1.2 Part Numbering

Product Description	Part Number Format
Standalone Drive	AGD101-EC-2Dyy[-CCC]

EC: Full-feature model with EtherCAT

2D: 12–90 VDC

yy: Continuous and peak current options

- 05: 5 A_{rms} continuous, 10 A_{rms} peak
- 10: 10 A_{rms} continuous, 20 A_{rms} peak

CCC: Optional customization number

Example: **AGD101-EC-2D05** indicates 5 A_{rms} continuous, 10 A_{rms} peak current

1.3 System Design

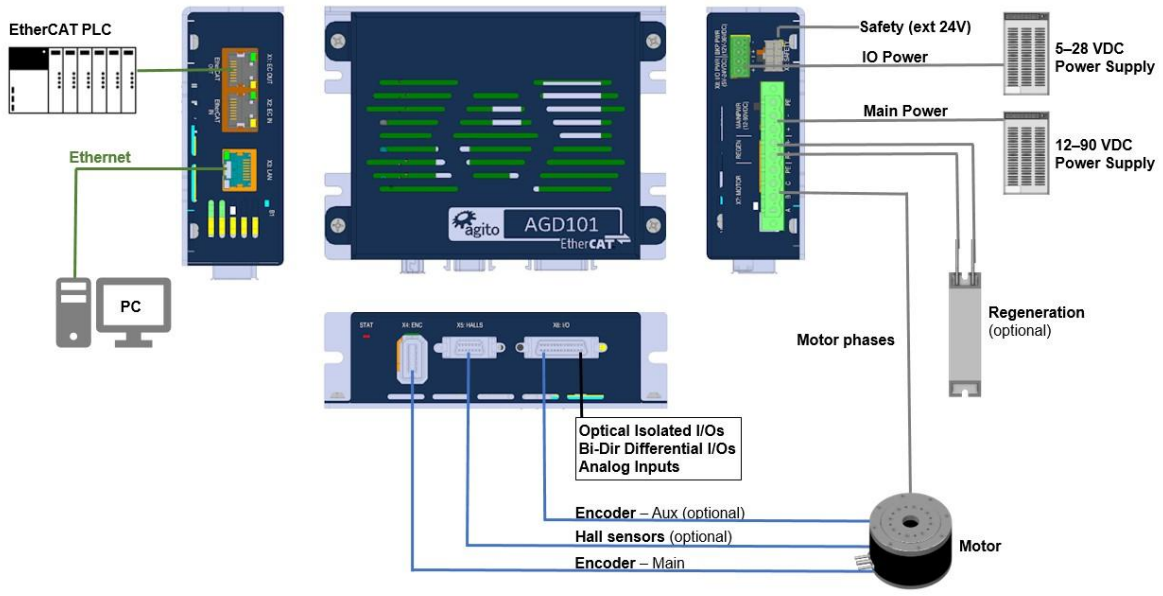

Figure 2. System Connection and Wiring

Electrical Specifications

Feature	AGD101- EC-2D05	AGD101- EC-2D10
Number of axes	1	
Nominal supply voltage	12–90 VDC	
Minimum supply voltage	12 VDC	
Maximum supply voltage	100 VDC	
Logic power supply	12–36 VDC	
Continuous output current (Internally limited by firmware)	5 A_{rms}	10 A_{rms}
Peak output current (Internally limited by firmware)	10 A_{rms}	20 A_{rms}
Output power @ 90 VDC	0.636 kVA	1.273 kVA
Peak current time	2 sec	
Output frequency	0 – 599 Hz	
Isolated digital inputs	8	
Isolated digital outputs	4	
Differential digital inputs	0	
Differential digital outputs	0	
Bi-directional differential I/Os (RS422)	4	
Analog inputs	1 (12-bit)	
Analog outputs	0	

Feature	AGD101- EC-2D05	AGD101- EC-2D10
PT100/PT1000/Thermostat inputs	1	
Brake outputs	0	
Regeneration outputs	Supports external regeneration resister up to 10A	
Encoder ports	1 (The bi-directional differential IO can be used for auxiliary encoder connection)	
Hall sensors ports	1	
Motor types	Voice coil, brushed or brushless linear or rotary motor. 2-phase steppers (open and closed loop, micro-stepping)	
Communication	Ethernet, EtherCAT (CoE)	
Ethernet port	100 Mb	
PWM Frequency	16 kHz	
Power supply to external devices	Voltage: 5V Overall max. current: 1A	

Encoder Ports Specifications

Feature	Specification
Encoder types	Incremental: AqB Analog: Sin/Cos Absolute: EnDat 2.2, BiSS-C
Aux encoder port (in I/O connector)	Incremental: AqB Absolute: EnDat 2.2, BiSS-C *Please consult agito sales representative if this feature is required.
Power supply to encoder	0.5 A per encoder port
Power supply to encoder port	Voltage: 5V Current: 0.5 A
Max. cable length	40 m
Incremental encoder	Hardware: Differential RS422/RS485 Max. input frequency: 6.25 MHz Termination: 120 Ω Commutation: Auto-phasing, Hall sensors
Sin/Cos encoder (available on Main Encoder port only)	Hardware: Differential RS422/RS485, 1V pkp @2.5V Max. input frequency: 500 kHz Termination: 120 Ω Max interpolation: 13 bits (x 8192) Commutation: Auto-phasing, Hall sensors
Absolute BiSS-C	Hardware: Differential RS422/RS485, clock (MA), data (SLO) Clock frequency: 1 MHz Max. position bits: 32 bits Commutation: Auto-phasing, by absolute offset

Feature	Specification
Absolute EnDat 2.2	Hardware: Differential RS422/RS485, clock, data Clock frequency: 1 MHz Max. position bits: 32 bits Commutation: Auto-phasing, by absolute offset
Hall sensors	Opto-isolated 5V with internal or external power supply

I/O Specifications

Feature	Specification
Power supply for optically isolated I/Os	Voltage: 5-28 VDC
Optically isolated digital inputs	Type: PNP/NPN Propagation delay: 10 µs Max. frequency: 100 kHz Functionality: limit switches, home, captures, start motion, gain scheduling, and others
Optically isolated digital outputs	Type: Sink/Source Max current: 0.5A (for Sink type), 0.3A (for Source type) Propagation delay: 10 µs Max. frequency: 100 kHz Functionality: alarm, in-position, event (PEG), and others
Bi-directional differential I/Os	Hardware: Differential RS422 Termination: 120 Ω Propagation delay: 100 ns Max. frequency: 5 MHz Direction: Input or output, set by Agito PCSuite Functionality: Any differential input or output functionality. Bi-dir differential output voltage: 2.3 VDC
Bi-directional differential I/O with single ended inputs	Support 5V single ended inputs
Analog inputs	Operational voltage: ±12V Resolution: 12 bits
Temperature sensors inputs	PT100/PT1000/Thermostat

Dimensions and Weight

Feature	Specification
Unit dimensions (max)	H= 130 mm, W= 37 mm, D= 95 mm
Package dimensions	190 mm x 142 mm x 53 mm
Unit weight	325 g
Shipping weight	427.5 g

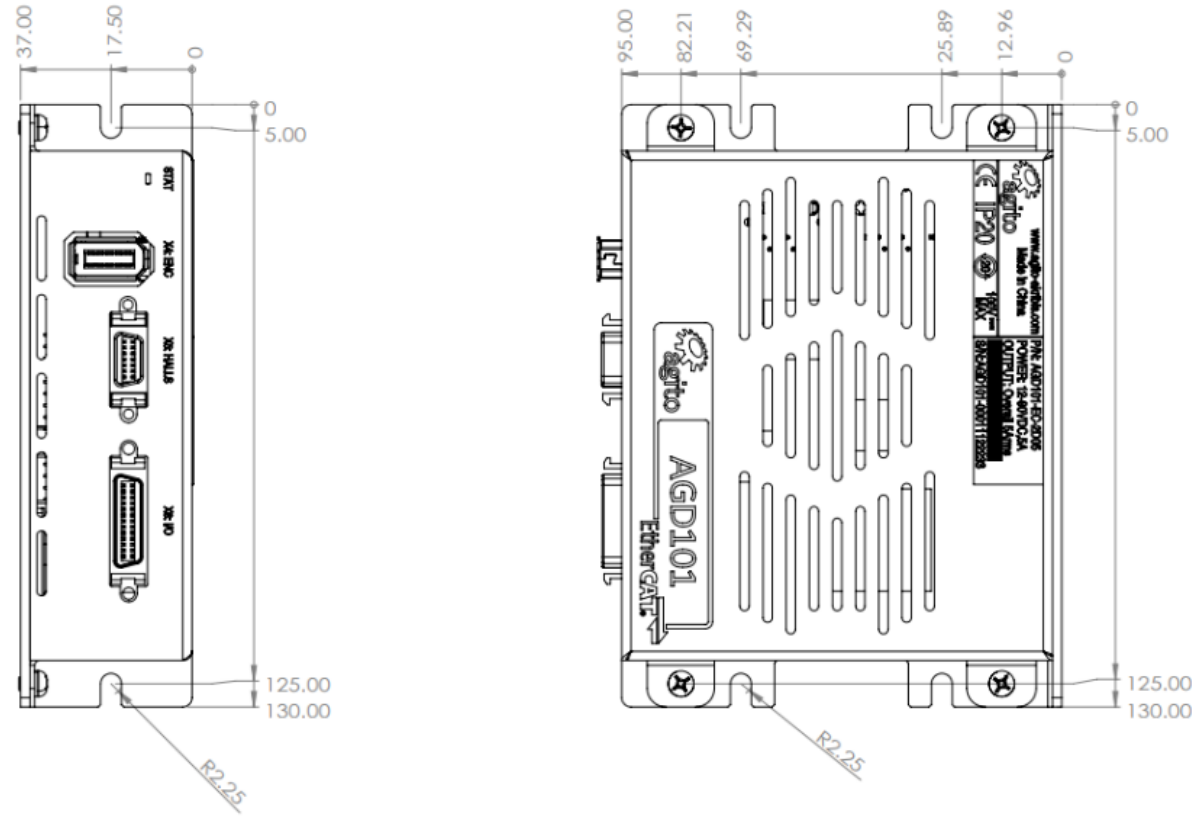

Figure 3. Product Dimensions (mm)

1.4 Motion Control Specifications

Motion Control Specifications

Feature	Specification
Key Features	Encoder error mapping: 1D, 2D Auto-loop shaping (auto-tuning) Frequency domain system identification and modeling Flexible gain scheduling based on motion conditions Position lock and event Advanced Auto-tuning algorithm in frequency domain Force control and mode switching
Advanced Features	Ultra Precision Mode (UPM) Input-shaping Profile-shaping Machine vibration control with external sensor Spring and friction compensation
Control Sampling Rate	16 kHz (profiler, position, velocity, optional force, current)
Motion Modes	Point-to-point Repetitive Jog ECAM Gearing Joystick Handwheel Pulse and direction
Operational Modes	Position Velocity Force Current (torque) modes
Motion Modes Switching	Motion parameters, such as speed, acceleration, deceleration, and target position can be all modified on-the-fly
Programming Interfaces	Standalone user programs Multi-threaded with priority setting environment, up to 8 threads Execution time: 50 low script commands in 1 millisecond High level C-language-like script programming language integrated in Agito PCSuite
IDE and Host Interfaces	Windows PC Suite IDE and configuration software Windows .NET API available in NuGet package manager Linux .NET API The API can also be used in MATLAB, LabVIEW and other environments compatible with Windows .NET Standard TCP/IP communication ASCII string commands or binary CAN format

1.5 Environmental Specifications

Environmental Specifications

Feature	Specification
Operating temperature	0°C to 50°C
Storage temperature	-20°C to 70°C
Operating humidity	< 90%
Storage humidity	< 40%
Pollution degree	2
Vibration	1G @ 150 Hz according to IEC 60068-2-6
Operating conditions	Protection class: IP20

2 Safety

2.1 Safety Symbols

Safety symbols indicate a potential for personal injury or equipment damage if the prescribed precautions and safe operating practices are not followed.

The following safety symbols are used in the product documentation.

Safety Symbols

Symbol	Meaning	Description
	Hazardous voltage	Indicates hazards arising from dangerous voltages.
	Earthing PE (protective earth)	Identifies any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth (ground) electrode.
	Caution, hot surface	Indicates the marked item can be hot and should not be touched without taking care.

2.2 Safety Guidelines

To achieve optimum and safe operation of the product, it is important to follow the safety procedures specified in this manual.

Only qualified personnel may install, maintain, or repair the product. Before starting installation, maintenance or operation, ensure that all system components are connected to protective earth ground (PE).

The PE wire must be colored green-yellow, in accordance with local electrical wiring standards.

This product contains electrostatic-sensitive components. Proper handling procedures must be observed to avoid damage to the product.

To avoid electric arcing and hazards, never connect or disconnect any connector while the power source is on.

The maximum power supply voltage connected to the product must comply with the ratings provided in this manual.

Always disconnect the power cables before servicing the product.

Pay attention to safety symbols on the product or in the manual. Follow proper safety precautions when installing or operating the product.

Attention

All power connectors must be securely tightened before any operation.

Attention

Do not attempt to hinder or override the product's or system's fault detection or protection circuits. You must determine the cause of a fault and correct it before you attempt to operate the system. Failure to correct the fault could result in personal injury and/or damage to equipment.

2.3 Compliance

Standards Compliance

Directive	Standard
2014/35/EU – EC Machinery Low Voltage Directive	IEC 61800-5-1:2007/A1:2017
2014/30/EU – Electromagnetic Compatibility Directive (EMC)	IEC 61800-3-2017
RoHS 2011/65/EU + (EU)2015/863	EN 50581:2012

This product is intended to operate in a machine or equivalent end-product. The machine or end-product must comply with any necessary safety standard as typically required for the same type of machine or end-product. It is the responsibility of the machine or end-product manufacturer to ensure the final machine or end-product meets the requirement of any safety and EMC regulations.

3 Installation

3.1 Unpacking and Packing

Save the original box and packing materials in case you need to pack and return the product to the manufacturer.

To unpack the product:

1. Carefully remove the product from the box and the packing materials.
2. Visually inspect the product to ensure that there is no damage. If any damage has occurred, report it immediately to the carrier that delivered the package.
3. After unpacking, locate the part number label on the product, and make sure it matches the product your ordered, and that the voltage meets your specific requirements.

3.2 Mounting

3.2.1 Mounting the AGD101

The heatsink of AGD101 includes slots for mounting the unit. The AGD101 is mounted in book mount position using 2 M4 screws, as shown in Figure 4. Alternatively, it can be mounted flat using 4 M4 screws.

The heatsink of the AGD101 is electrically conductive and serves as the protective earth (PE) ground of the product. However, it is critical to ensure the PE terminals are electrically conducting between the PE of AGD101 and the PE of main power supply in the system.

All cables connected to the product must be securely constrained to avoid vibration that causes stress concentration at the cables or connectors which may result in breakage of electrical conductivity.

Warning – Metal Base Plate for Heat Dissipation

The product is supplied with the mounting plate built into the heatsink. At full power operation, the heatsink can be quite warm, around 50°C. It is recommended to mount the product on a large metal panel to help dissipate the heat generated in the product.

3.2.2 Mounting Multiple AGD101 Units

When mounting multiple AGD101 units within a cabinet, clearance between units must be at least 10 mm. In addition, top and bottom clearance must be at least 50 mm for the cables to be routed.

Ambient temperature in the cabinet must not exceed 50°C

If controllers are mounted on a backplane, the backplane temperature must not exceed 60°C

It is recommended to install a cooling fan at the bottom of the cabinet for best circulation.

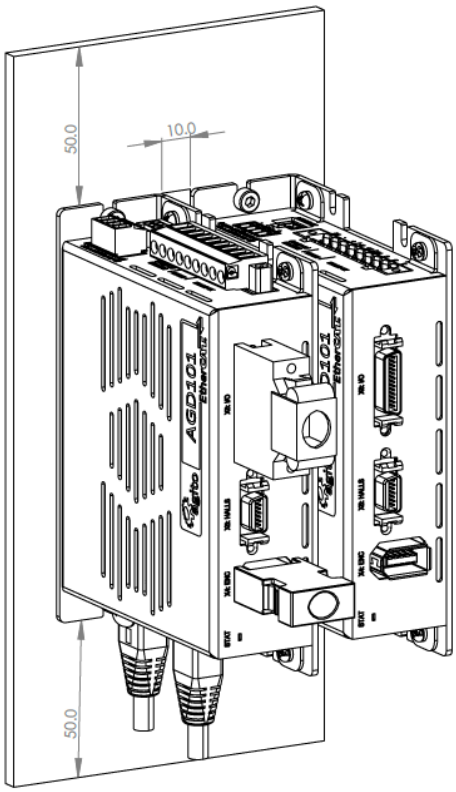

Figure 4. Mounting Multiple Units within Cabinet

3.3 Electrical Installation

3.3.1 Power Wiring

AGD101 is designed to operate on voltage ranging from 12 VDC to 90 VDC, which is supplied to bus voltage, to motor. The logic power is derived via a step-down transformer.

3.3.2 Regeneration

AGD101 uses the main DC power input to output a controlled electrical power through the phases of the motor. The motor converts this electrical power to a mechanical power that moves the load. During motor deceleration and stopping, the inertia of the load drives the movement of the motor, not the servo drive. Due to back EMF, the motor acts as a generator and returns energy to the DC bus supply, which causes the DC bus voltage to increase to undesirable level.

Maximum allowable DC bus voltage is 100 VDC. To prevent excessive DC bus voltage, a regeneration resistor can be connected to the AGD101 X7 connector to dissipate excess regenerated energy and prevent it from reaching undesirable levels. Regeneration voltage threshold parameters are software configurable and can be modified according to the motor's maximum voltage specification.

Warning

DC Vbus is monitored, and motors will be disabled if voltage is too high. However, there is no protection against the connection of an excessive voltage power supply that will damage the product.

For connection details, refer to the section *Interface X7.*

Important Notes

- The regeneration feature, once enabled, is always active, regardless of the motor status (enabled/disabled).
- Current will flow in the regeneration resistor depending on the values of RegenOn and RegenOff, and the power supply voltage.
- There are no current or power protections to protect the regeneration resistor or the internal MOSFET.
- Be sure to set the suitable regeneration parameters for the supply voltage and the external regeneration resistor.
- Plug in the regeneration resistor only after all parameters are set properly, and always when the controller power is off.
- Let the regeneration resistor cool down before touching it. Unplug it only when the controller power is off.
- During development, if the supply voltage is to be modified, first disconnect the regeneration resistor and, before reconnecting the regeneration resistor, be sure to adjust the regeneration parameters to match the new supply voltage.
- We recommend adding external protections (such as PTC) to protect the regeneration resistor.

3.3.3 Grounding

It is recommended to install the AGD101 on a metal plate for better heat dissipation, reduced EMI, and grounding connection. Make sure the plate is not painted.

The heatsink of the AGD101 is electrically conductive and serves as the protective earth (PE) ground of the product. However, it is critical to ensure the PE is electrically conducting between the chassis of AGD101 and the PE of main power supply in the system.

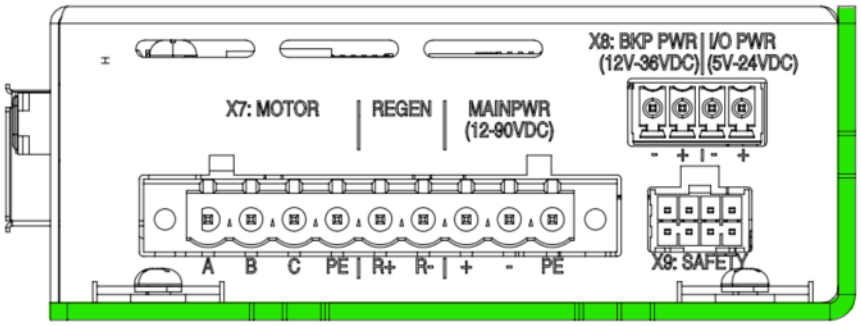

Figure 5. PE Terminal and PE Conductive Base Plate Shown in Green

Note: Within the product, the chassis is not connected to the power supply ground.

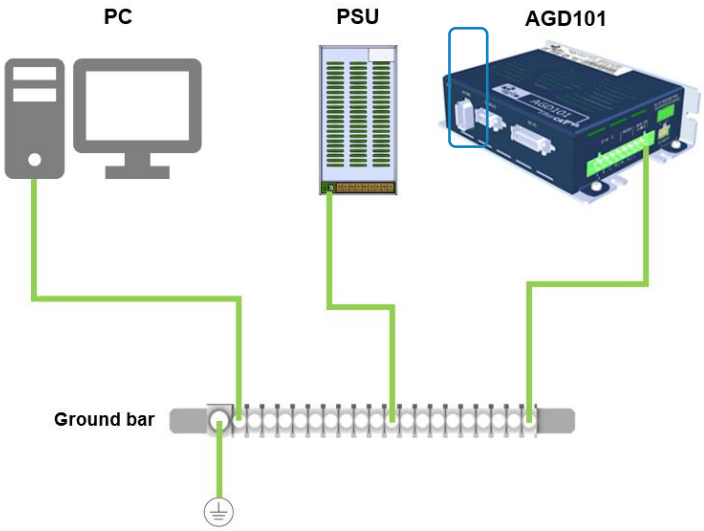

Figure 6. System Grounding

Ground Domains

The following table shows the ground domains in the AGD101 system:

- **GND**. Reference voltage for digital/analog circuits and signals.
- **PGND**. High voltage ground domain (internal).
- **General**. Usually at DC potential close to GND, but not connected internally.

Ground Domains

	Ground Domain	Notes
DC power input	GND (digital ground)	External DC power supply
Digital inputs/outputs	General	Isolated
Differential digital inputs/outputs	GND	Not isolated. To controller/PLC.
Analog inputs	GND	Not isolated
Regeneration output	PGND	
Ethernet communication	General	Isolated
Other communication	GND	Not isolated (unless otherwise stated in manual).

Grounding Policy

Grounding of the product must comply with the following guidelines:

- The enclosures and other external parts that may be touched by the user are in the **safe domain**.
- The AGD101 must be connected to protective earth (PE) and connected to the building's ground. PE is protected with an earth-leakage circuit breaker (ELCB); hence it is safe to touch. Refer to Figure 6.
- PGND is connected directly to mains wires, hence it is just as dangerous as mains to the user.
- All shielded cables, including but not limited to motor, encoders, and power input, have their shield connected to PE as part of the external metal enclosure.
- It is critical to avoid ground loops in the system. A ground loop allows currents to return by two or more different paths, causing electromagnetic interference or even damage to wires.
- The system designer must carefully examine all GND connections in the system to ensure that no loops are created, and that all GND-referenced signals have a GND wire nearby (for both return currents and common mode voltage).

3.3.4 PT100/PT1000/Thermostat Temperature Sensors

AGD101 supports three types of temperature sensors:

- The PT100 temperature sensor is a platinum resistance thermometer. Its resistance value at 0°C is **100Ω**.
- The PT1000 temperature sensor also is a platinum resistance thermometer. Its resistance value at 0°C is **1000Ω**.
- The thermostat is an over-temperature protection device that monitors the motor coil temperature. It remains closed during normal operation and opens its contact when the temperature exceeds a defined limit to protect the motor from overheating damage.

The temperature sensor is wired to the X5 connector as shown in the following table.

PT100/PT1000/Thermostat Temperature Sensor Wiring

Pin #	Pin Name	PT100	PT1000	Thermostat
3	PT1000_EN	NC	Short to pin 6	NC
6	GND	NC	Short to pin 3	NC
8	Temp+	PT100+	PT1000+	Thermostat+
9	Temp-	PT100-	PT1000-	Thermostat-

3.3.5 Status LED Indicator

Color	LED	Meaning
Red	On steady	There is a controller fault.
	Blinking	Commutation is needed and failed at last attempt.
Green	Blinking	Commutation is needed but not done yet
	On steady	All is okay.

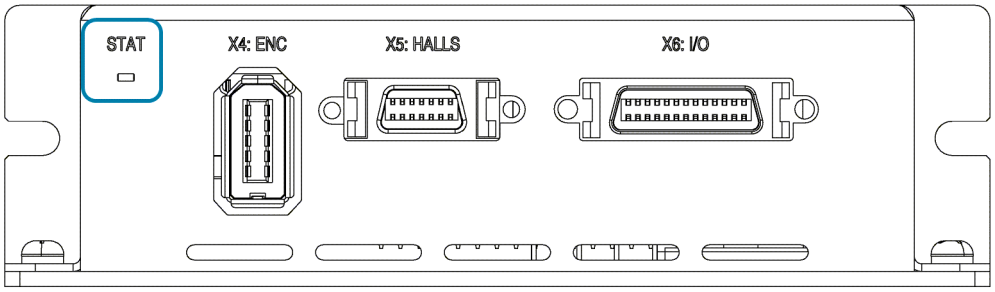

Figure 7. Status (LED) Indicator

3.4 Electrical Interfaces

This section provides a detailed description of all the power and signal interfaces of the product.

3.4.1 Interface X7: Main Power – Regeneration – Motor

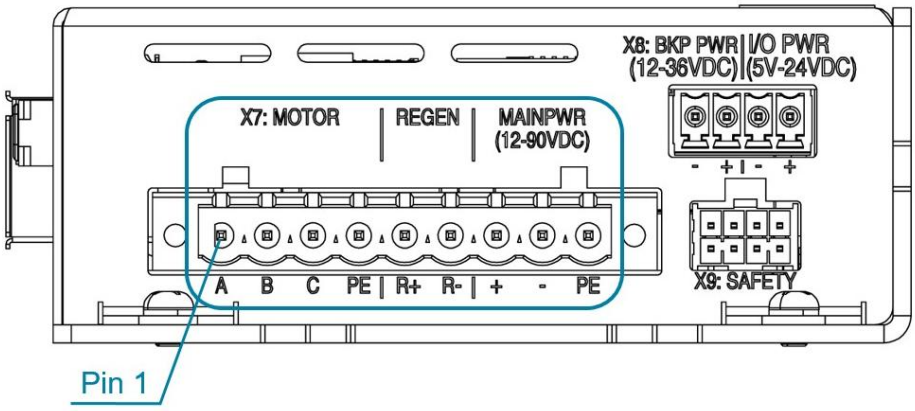

Figure 8. Power Connector

Connector	Degson	2EDGRM-5.08-10030001958
Mating connector options	Degson Phoenix Contact	2EDGKM-5.08-.09P-10010002629 1777992
Wiring	28–12 AWG, insulation rated for 320 V	

X7: Motor

Connector X7 supplies power to the motor, which can be a 3-phase brushless motor, or a 1-phase brushed motor or voice coil motor.

X7: Brushless Motor

Pin #	Label	Name	Description
1	A	Phase A	Motor phase A (M1)
2	B	Phase B	Motor phase B (M2)
3	C	Phase C	Motor phase C (M3)
4	PE	PE	Protective earth (motor power cable shield)

X7: Brushed or Voice Coil Motor

Pin #	Label	Name	Description
1	A	Motor Phase +	Positive terminal, phase A or M1
2	B	Motor Phase -	Negative terminal, phase B or M2
3	C	NC	Do not connect
4	PE	PE	Protective earth (motor power cable shield)

X7: Regeneration

Connector X7 is used to connect an external power resistor to dissipate energy generated by the motor, typically during deceleration. The motor-generated energy will charge up the internal capacitor. When the internal capacitor is fully charged, the bus voltage will increase. When bus voltage is higher than the operating limit of the product, it will trigger over-voltage protection and disable the motor. To prevent this from happening, users can connect an external power resistor to dissipate the unwanted energy.

Refer to the section *Regeneration* for more information.

Connector X7: REGEN

Pin #	Label	Name	Description
5	R+	VB+	The internal DC bus power.
6	R-	RGN (Regeneration)	Regeneration pin to be connected to an external regeneration resistor. Designed for 10A (not protected). When Regeneration is triggered, this pin is connected internally to PGND. The other end of the external regeneration resistor should be connected to VB+, the Internal DC Bus power (pin 1).

X7: Main Power

Connector X7 is used to supply 12–90 VDC to the AGD101.

Pin #	Label	Name	Description
7	+	Main Power	Power input: 12–90V, up to 7.07A/14.14A continuous
8	–	Power GND	Ground – power return
9	PE	GND-Earth	Protective earth

Warning - Hot plugging is forbidden!

Plug or unplug the power connector only when power is off! Plugging the power connector when power is on may cause power surges through connected devices and possibly damage them.

3.4.2 Interface X8: I/O and Backup Power

Connector X8 provides optional backup (12–36VDC) power for the logic components and enables communication with the controller when interface X7: MAINPWR is disconnected.

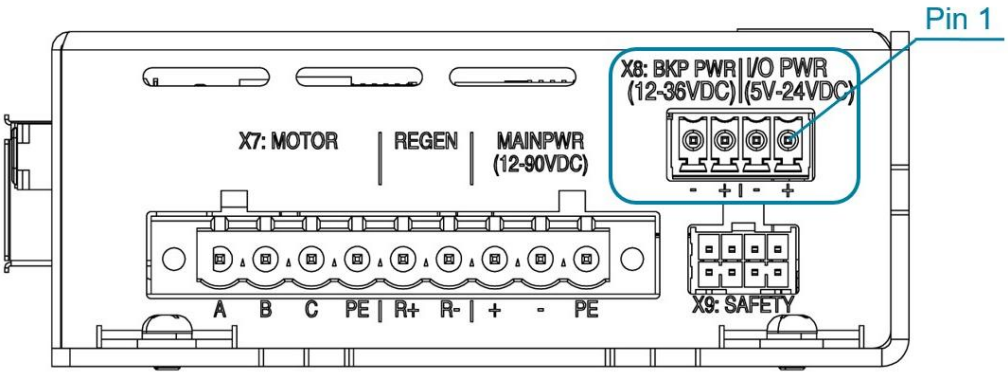

Figure 9. I/O and Backup Power Connector

Connector X8 allows the user to provide a DC power supply to the digital I/Os. Typically, the digital I/Os use 24 VDC. The I/O power is internally connected to each I/O port to allow users to tap this power supply easily within the same connector.

Connector X8: I/O and Backup Power

Pin #	Label	Name	Description
1	+	I/O Power	5–28 VDC – user supplied I/O power input, up to 2A
2	-	I/O Power Return	Ground – I/O power return
3	+	Backup/logic power	12–36 VDC – backup/logic power, up to 50W
4	-	Backup power GND	Ground – backup/logic power return

Connector	Wurth	691322110004
Mating connector options	Degson	15EDGK-3.5-04P-14-00A
	Phoenix	1840382
	Wurth	691361100004
Wiring	28–16 AWG, insulation rated for 300V	

Warning - Hot plugging is forbidden!

Plug or unplug the power connector only when power is off! Plugging the power connector when power is on may cause power surges through connected devices and possibly damage them.

3.4.3 Interface X9: Safety

Connector X9 is used for the hardware safety function that disables power to the motor.

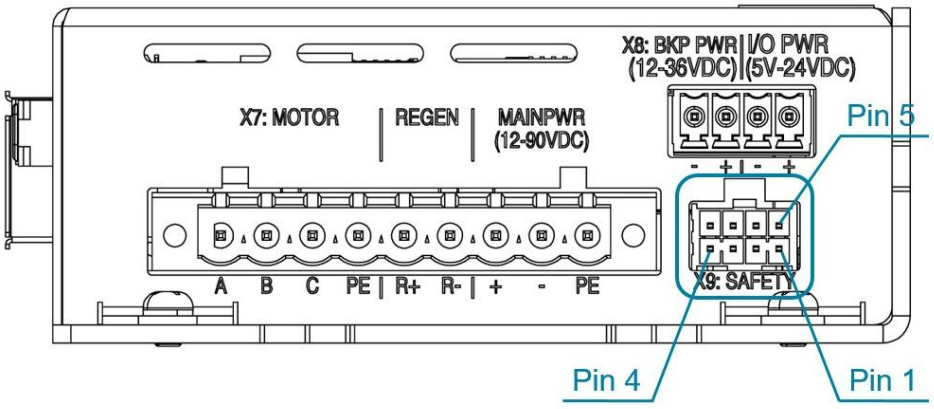

Figure 10. Safety Connector

Connector X9: SAFETY

Pin #	Name	Type	Description
1	5V	PWR - OUT	5V supply for safety circuits
2	Feedback -	OUT	Safety Feedback negative (emitter) output
3	Safety 2 -	IN	Safety Input 2 negative input
4	Safety 1 -	IN	Safety Input 1 negative input
5	GND	PWR	GND
6	Feedback +	OUT	Safety Feedback positive (collector) output
7	Safety 2 +	IN	Safety Input 2 positive input
8	Safety 1 +	IN	Safety Input 1 positive input

Mating connector options	Samtec	IPD1-04-D-K
Crimp	Samtec	CC79L-2630-01-L
Wiring	26 AWG, insulation rated for 100 V	

- Safety 1 and Safety 2 function independently, thus providing safety redundancy. Each one can disable the power to the motor.
- Both Safety 1 and Safety 2 disable the power to the motor through hardware circuitry, without any software intervention.
- Both Safety 1 and Safety 2 are defined with a positive pin (+) and a negative pin (-). However, the opto-coupler at the Safety Input has two input diodes, which enable operation at "positive" or "negative" input voltage. The input is activated when current is sufficient at one of the input diodes, regardless of the current direction. This enables NPN or PNP connection to the safety inputs.
- The Safety Input protection logic is designed so that both Safety Inputs must be powered to enable motor operation. Leaving a Safety Input disconnected prevents motor operation. This logic is required to ensure that a disconnected safety cable is considered an unsafe condition by the control unit. When sufficient current is driven through a Safety Input, the state of this input is **Safe**. When insufficient current is driven through a Safety Input, the state of this input is **Unsafe**.

- The two Safety Inputs must be in the Safe state to enable motor operation.
- Both Safety 1 and Safety 2, although acting on the drive hardware directly, are also monitored by the controller software. The controller software generates a feedback signal to the user (Safety Feedback), which is also an isolated signal. This feedback is generated by the software and is activated if at least one of Safety 1 or Safety 2 signals is in the Unsafe state.
- The electrical characteristics of Safety 1 and Safety 2 are identical to those of all other isolated digital inputs of the controller.
- The safety inputs implemented in the product are currently pending certification Functional Safety Standards.

Disabling Safety function

If the Safety function is not required in your application, you can disable it by using a bypass plug from Agito. Part number: C-AGD301-SFT

Safety Connection Diagram Example

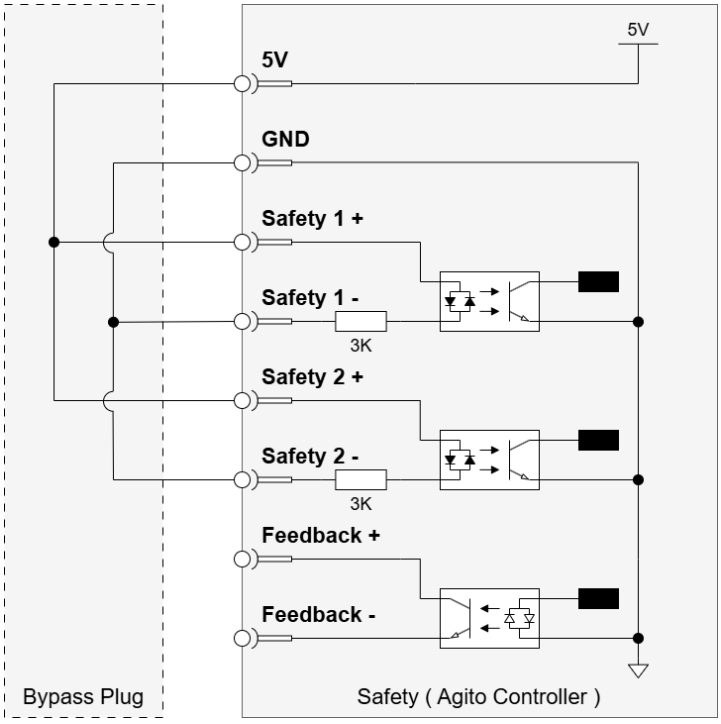

Figure 11. Safety Bypass

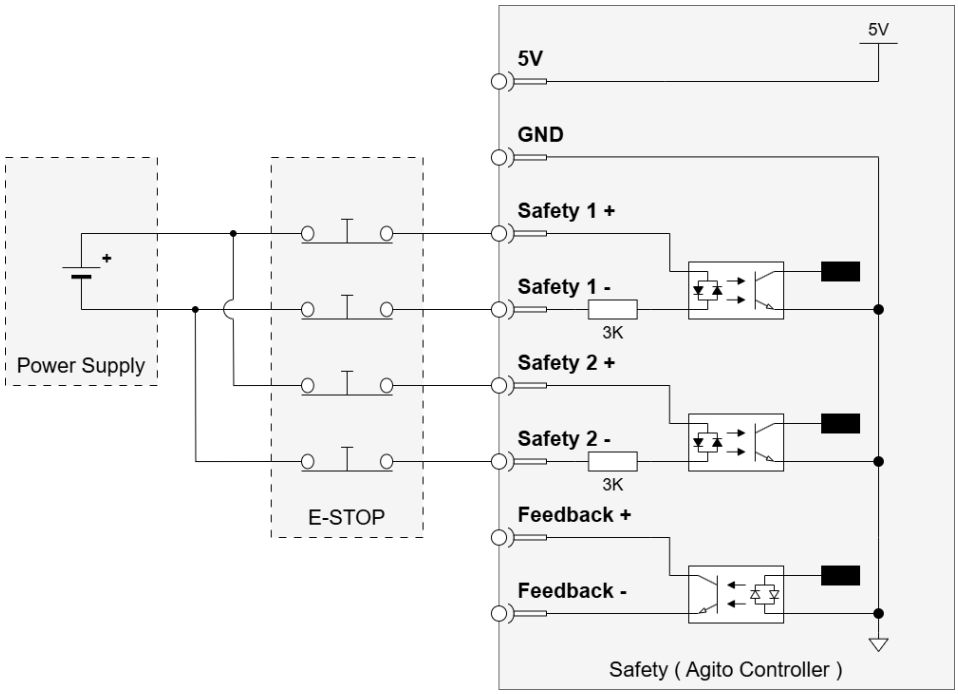

Figure 12. Safety with E-STOP

3.4.4 Interface X3: Ethernet (LAN)

Connector X3 is an Ethernet communication port.

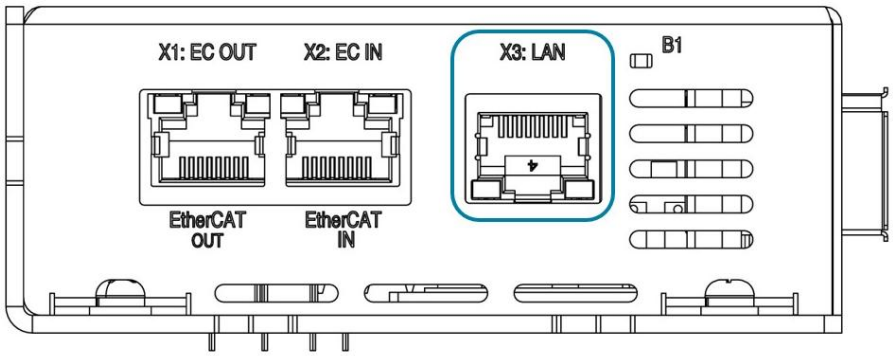

Figure 13. Ethernet Connector

Connector X13: LAN (Ethernet)

Pin #	Name	Description
1	TX+_D1	Transmit data +
2	TX-_D1	Transmit data -
3	RX+_D2	Receive data +
4	BI+_D3	Bi-directional +
5	BI-_D3	Bi-directional +
6	RX-_D2	Receive data -
7	BI+_D4	Bi-directional +

Pin #	Name	Description
8	BI-_D4	Bi-directional -

Connector type	RJ45 LAN 10/100Base-T connector
Mating connector part number	Any CAT5e compatible shielded connector
Cable	CAT5e or higher, standard Ethernet straight cable
Wiring	26 AWG, insulation rated for 100 V

3.4.5 Interfaces X1, X2: EtherCAT Fieldbus

Connectors X1 and X2 are EtherCAT communication ports.

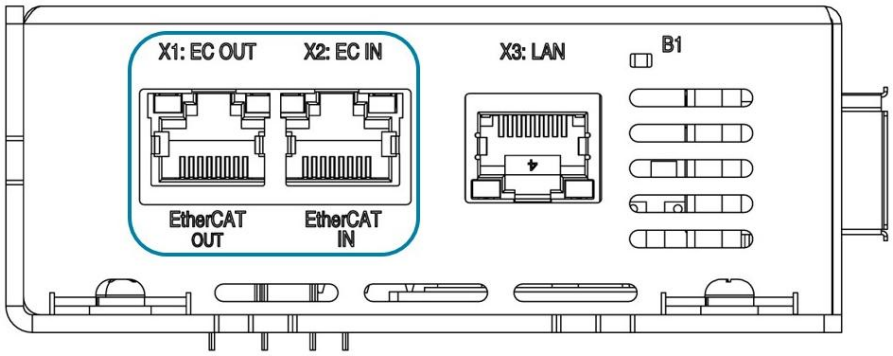

Figure 14. EtherCAT Communication Connectors

Connectors X11 and X12: EtherCAT IN and EtherCAT OUT

Pin #	Name	Description
1	TX +	Transmit data +
2	TX -	Transmit data -
3	RX +	Receive data +
4	–	–
5	–	–
6	RX -	Receive data -
7	–	–
8	–	–

Connector type	RJ45 LAN 10/100Base-T connector
Mating connector	Any CAT5e compatible shielded connector
Cable	CAT5e or higher, standard Ethernet straight cable
Wiring	26 AWG, insulation rated for 100 V

3.4.6 Interface X4: Encoder

The X4 encoder port is designed to interface with the main (primary position feedback) encoder for the axis.

This port supports digital quadrature incremental encoders (AqB), analog sin/cos encoders, absolute BiSS-C encoders, and absolute EnDat2.2 encoders. The type of encoder connected to the AGD101 is configured in the Agito PCSuite software.

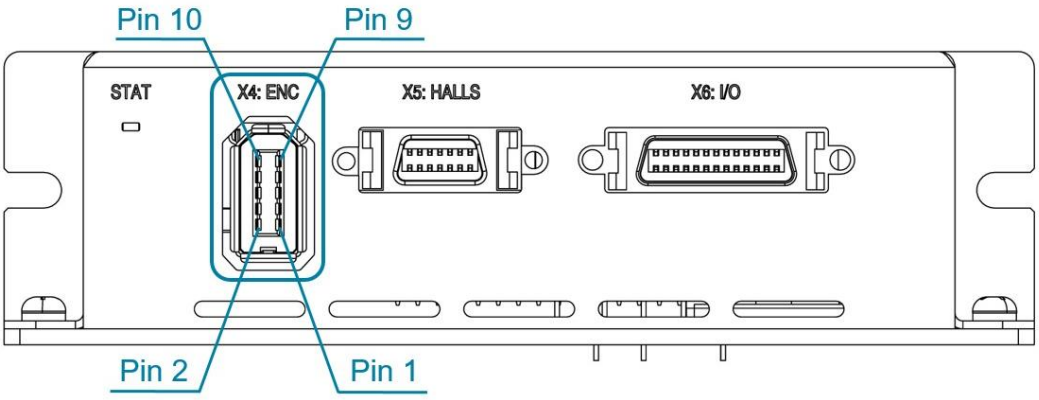

Figure 15. Main Encoder Connector

Connector X4: ENC

Pin #	Name	Encoder Types				Description
		AqB	Sin/Cos	BiSS-C	EnDat 2.2	
1	5V					5V power supply (limited to 0.5A per connector)
2	GND					5V return and reference for differential signals
3	Encoder_1+			CLOCK+	CLOCK+	Clock+ pin for absolute encoder
4	Encoder_1-			CLOCK-	CLOCK-	Clock- pin for absolute encoder
5	Encoder_2+	A+	SIN+			A+ (for AqB) or sin+ (for analog sin/cos)
6	Encoder_2-	A-	SIN-			A- (for AqB) or sin- (for analog sin/cos)
7	Encoder_3+	B+	COS+			B+ (for AqB) or cos+ (for analog sin/cos)
8	Encoder_3-	B-	COS-			B- (for AqB) or cos- (for analog sin/cos)
9	Encoder_4+	Z+	Z+	DATA+	DATA+	Data+ for absolute encoder, or Z+ for both AqB and analog sin/cos encoder
10	Encoder_4-	Z-	Z-	DATA-	DATA-	Data- for absolute encoder, or Z- for both AqB and analog sin/cos encoder

Mating connector options	3M	36210-0100PL + 36310-3200-008
	Sunchu	SC-10-4P
	Dowei	DW-10-4P
Wiring	AWG 26, insulation rated for 100 V	

Note – Incremental encoder interface details

By default, the product does not support single-ended encoder. For use of single-ended encoder, contact Technical Support.

Note – 5V supply limitation

The maximum current available for the encoder is 0.5 A.

3.4.7 Interface X5: Halls

Connector X5 provides the interface for the digital Hall effect sensors and temperature sensor from the motor.

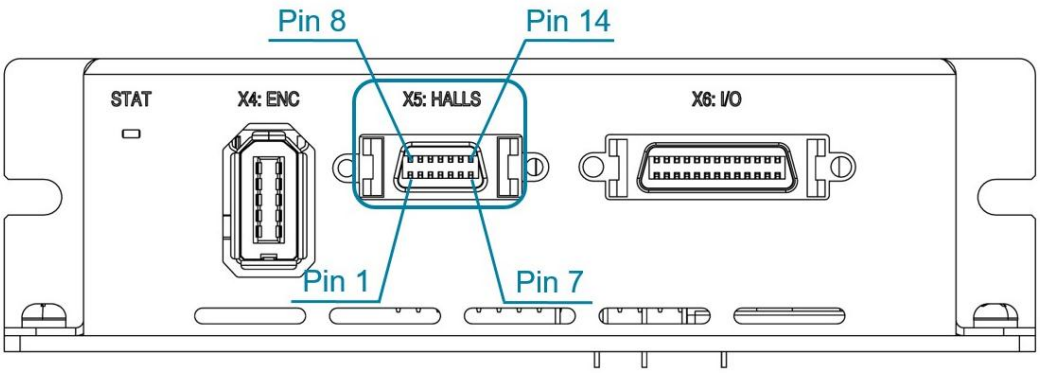

Figure 16. Hall Sensor Connector

Connector X5: HALLS

Pin #	Name	Software Representation	Description
1	5V		5V supply Hall sensors. Connect to pin 10 when using digital inputs 5 to 7 for Hall sensors.
2	GND		GND for 5V
3	PT1000_EN		For PT1000 temperature sensor, this pin is shorted to pin 6 (GND). For PT100 temperature sensor, this pin is not connected.
4	Digital Input 5 (Hall A)	DInPort.bit(4)	Isolated digital input 5 (NPN or PNP, depending on the connection of the group's common pin). To use as Hall input, go to the Agito PCSuite Digital Input page, and configure as Hall A. The following inputs (6 and 7) will be set automatically as Hall B and Hall C.
5	Digital Input 6 (Hall B)	DInPort.bit(5)	Isolated digital input 6 (NPN or PNP, depending on the connection of the group's common pin)
6	GND		GND for 5V
7	PE		PE

Pin #	Name	Software Representation	Description
8	Temp+		PT100+ /Thermostat+ (or PT1000+ if Pin 3 is shorted to pin 6).
9	Temp-		PT100- /Thermostat- (or PT1000- if Pin 3 is shorted to pin 6).
10	Digital Input Common (5 to 8)		Common pin (power or return, depending on external connection) for digital input 5 to 8
11	Digital Input 7 (Hall C)	DInPort.bit(6)	Isolated digital input 7 (NPN or PNP, depending on the connection of the group's common pin)
12	Digital Input 8	DInPort.bit(7)	Isolated digital input 8 (NPN or PNP, depending on the connection of the group's common pin)
13	I/O Power		Internally connected to connector X8: I/O PWR pin 1, I/O Power
14	I/O Power Return		Internally connected to connector X8: I/O PWR pin 2, I/O Power Return

Mating connector options	3M 10114-3000PE + 10314-52A0-008 Sunchu SC-14-3 Dowei DW-14-3
Wiring	AWG 26, insulation rated for 100 V

Note – 5V supply limitation

The 5V supply provided at pin 1 is limited to 0.5A per connector. The maximum total current provided by all the 5V pins in the product is limited to 1.5A.

Hall Sensor Connection Diagram Example

- Motor Hall sensors can be connected to opto-isolated digital inputs 5, 6, and 7 on connector X5 (HALLS). In Agito PCSuite the first input must be configured to mode 23-Hall A.
- It is recommended that Hall sensors be used with incremental encoders. Typically, Hall sensors are called Ha Hb Hc, or Hu Hv Hw, or H1 H2 H3, which correspond to the motor phases. A typical Hall sensor is an open collector (NPN) type and requires a 5 VDC power supply.
- Motor Hall sensors are wired as standard digital inputs.

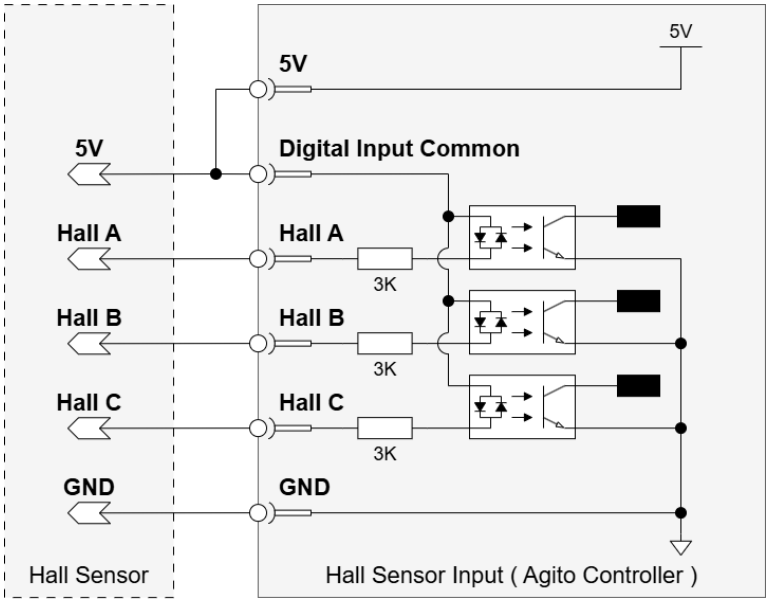

Figure 17. Hall Sensor

3.4.8 Interface X6: I/Os

Connector X6 provides the interface for I/O devices, such as a limit sensor and home switch, which are typically mounted on the actuator or on the machine.

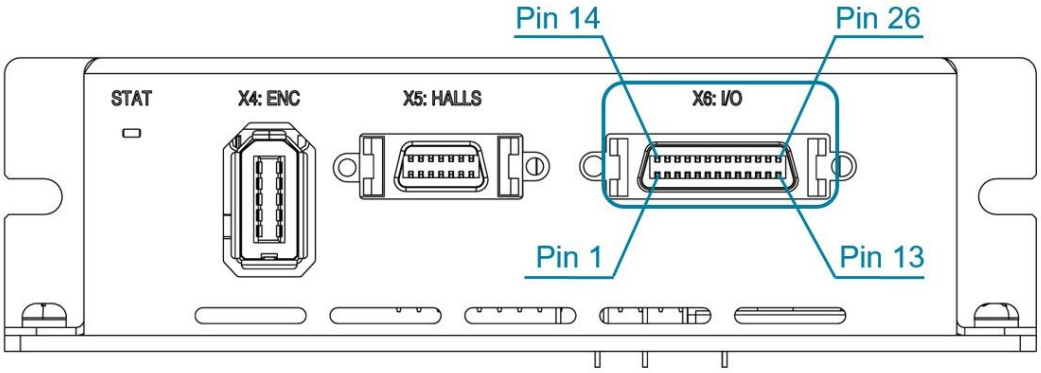

Figure 18. I/O Connector

Pin #	Name	Software Representation	Description
1	Bi-Dir Diff I/O 1 +	DInPort.bit(8) DOutPort.bit(4)	Bi-directional differential I/O+ | Aux Encoder 1+ input Software configurable: BiDirConfig.bit(0) = 0 for input BiDirConfig.bit(0) = 1 for output
2	Bi-Dir Diff I/O 1 -		Bi-directional differential I/O- | Aux Encoder 1- input

Pin #	Name	Software Representation	Description
3	Bi-Dir Diff I/O 2 +	DInPort.bit(9) DOutPort.bit(5)	Bi-directional differential I/O+ | Aux Encoder 2+ input Software configurable: BiDirConfig.bit(1) = 0 for input BiDirConfig.bit(1) = 1 for output
4	Bi-Dir Diff I/O 2 -		Bi-directional differential I/O- | Aux Encoder 2- input
5	Bi-Dir Diff I/O 3 +	DInPort.bit(10) DOutPort.bit(6)	Bi-directional differential I/O+ | Aux Encoder 3+ input Software configurable: BiDirConfig.bit(2) = 0 for input BiDirConfig.bit(2) = 1 for output
6	Bi-Dir Diff I/O 3 -		Bi-directional differential I/O- | Aux Encoder 3- input
7	Bi-Dir Diff I/O 4 +	DInPort.bit(11) DOutPort.bit(7)	Bi-directional differential I/O+ | Aux Encoder 4+ input Software configurable: BiDirConfig.bit(3) = 0 for input BiDirConfig.bit(3) = 1 for output
8	Bi-Dir Diff I/O 4 -		Bi-directional differential I/O- | Aux Encoder 4- input
9	5V		5V supply
10	Digital Input Common (1 to 4)		Common pin (power or return, depending on external connection) for digital input 1 to 4
11	GND		GND for 5V
12	Analog Input	AInPort[1]	Analog input, ±12V full scale
13	Analog Input Return		Analog input, return
14	Digital Output 1	DOutPort.bit(0)	Isolated digital output 1, programmable sink or source
15	Digital Output 2	DOutPort.bit(1)	Isolated digital output 2, programmable sink or source
16	Digital Output 3	DOutPort.bit(2)	Isolated digital output 3, programmable sink or source
17	Digital Output 4	DOutPort.bit(3)	Isolated digital output 4, programmable sink or source
18	Digital Output Common Power (1 to 4)		Common power pin for isolated digital outputs 1 to 4
19	Digital Output Common Return (1 to 4)		Common power return pin for isolated digital outputs 1 to 4
20	Digital Input 1	DInPort.bit(0)	Isolated digital input 1 (NPN or PNP, depending on the connection of the group's common pin).

Pin #	Name	Software Representation	Description
21	Digital Input 2	DInPort.bit(1)	Isolated digital input 1 (NPN or PNP, depending on the connection of the group's common pin).
22	Digital Input 3	DInPort.bit(2)	Isolated digital input 1 (NPN or PNP, depending on the connection of the group's common pin).
23	Digital Input 4	DInPort.bit(3)	Isolated digital input 1 (NPN or PNP, depending on the connection of the group's common pin).
24	GND		GND for 5V
25	I/O Power		Internally connected to connector X8: I/O PWR pin 1, I/O Power
26	I/O Power Return		Internally connected to connector X8: I/O PWR pin 2, I/O Power Return

Mating connector options	3M 10126-3000PE + 10326-52A0-008 Sunchu SC-26-3 Dowei DW-26-3
Wiring	AWG 26, insulation rated for 100 V

Note – 5V Digital Output Common Power source mode limitation.

When using 5V Digital Output Common Power in source mode, higher current (but less than the absolute maximum value of 250 mA) can be driven. However, the output high voltage will drop significantly. To maintain output high voltage at > 4.5V, limit the current to 60 mA.

I/O Connection Diagram Example

Isolated Digital Inputs 1 to 4, 5 to 8

- The interface circuit is identical for all digital inputs.
- Digital Input Common is grouped by digital inputs 1 to 4, 5 to 8.
- Each group is fully isolated and independent of the other groups.
- Each group can be connected as NPN or PNP interfaces, depending on the wiring of the group's Digital Input Common pin. If the Digital Input Common pin is connected to power (between 5V and 28V), then the inputs of this group can be used with external NPN devices (external current sinking devices). If the Digital Input Common is connected to the GND of an external power supply, then the inputs of this group can be used with external PNP devices (external current sourcing devices).
- The input circuit of the opto-couplers includes two diodes. This enables use as NPN or PNP.
- One group can be wired to interface external NPN devices and another group can be wired to interface PNP devices. However, within a group, all interfaces (NPN or PNP) must be the same, as they are based on the connection of the group's Digital Input Common pin.

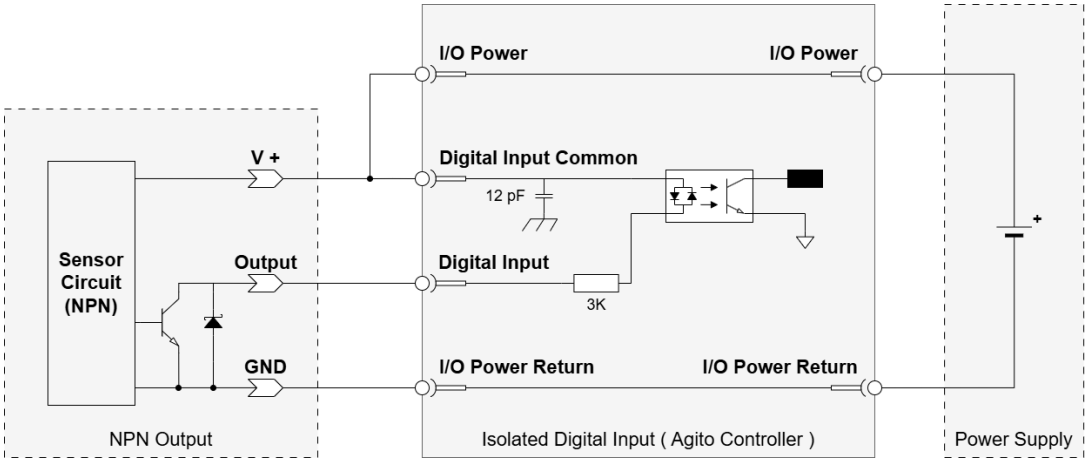

Figure 19. Digital Input with NPN Sensor

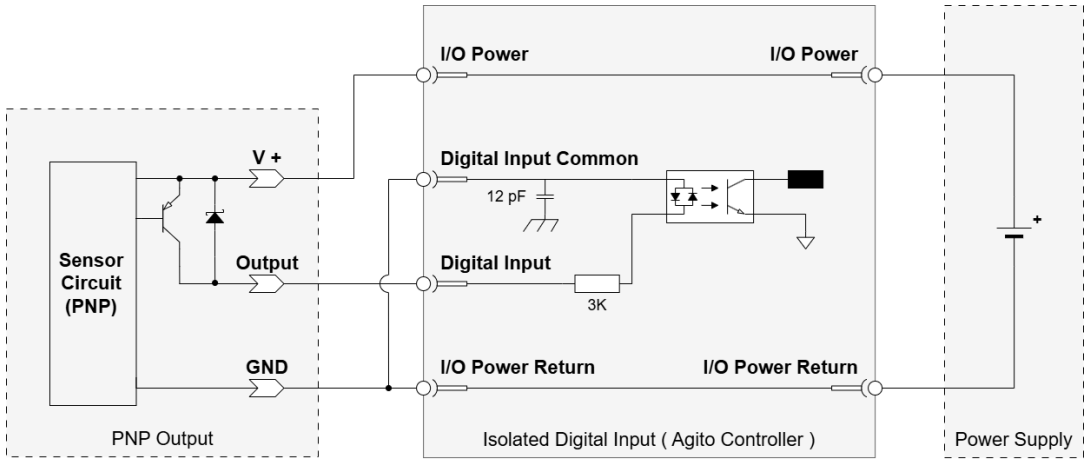

Figure 20. Digital Input with PNP Sensor

Isolated Digital Outputs 1 to 4

- The interface circuit is identical for all outputs.
- Each output can be programmed (by software parameter) to act as a current sourcing output (up to 300mA), or as a current sinking output (up to 500mA).
- Digital Output Common Power is organized into one group – digital output 1 to 4
- The outputs are designed for resistive loads. For inductive loads, an external flyback diode is required.
- Digital outputs specifications:
  - Digital Output Common Power voltage range is between 5V and 28V.
  - Maximal load current, per each output:

    Sink mode, any Digital Output Common Power voltage: 500 mA
    Source mode, at 24V Digital Output Common Power: 300 mA
    Source mode, at 5V Digital Output Common Power: 60 mA (see Note below)

Note – 5V Digital Output Common Power source mode limitation.

When using 5V Digital Output Common Power in source mode, higher current (but less than the absolute maximum value of 250 mA) can be driven. However, the output high

voltage will drop significantly. To maintain output high voltage at > 4.5V, limit the current to 60 mA.

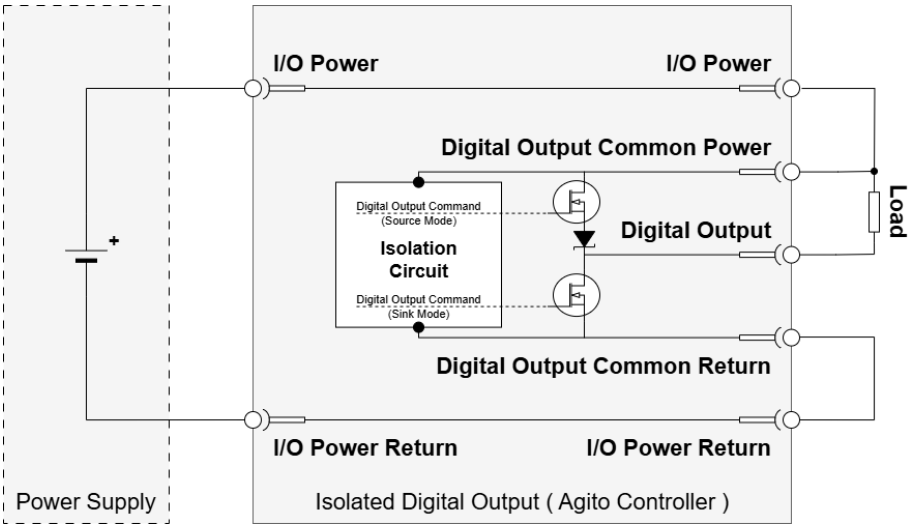

Figure 21. Digital Output (Sink Mode)

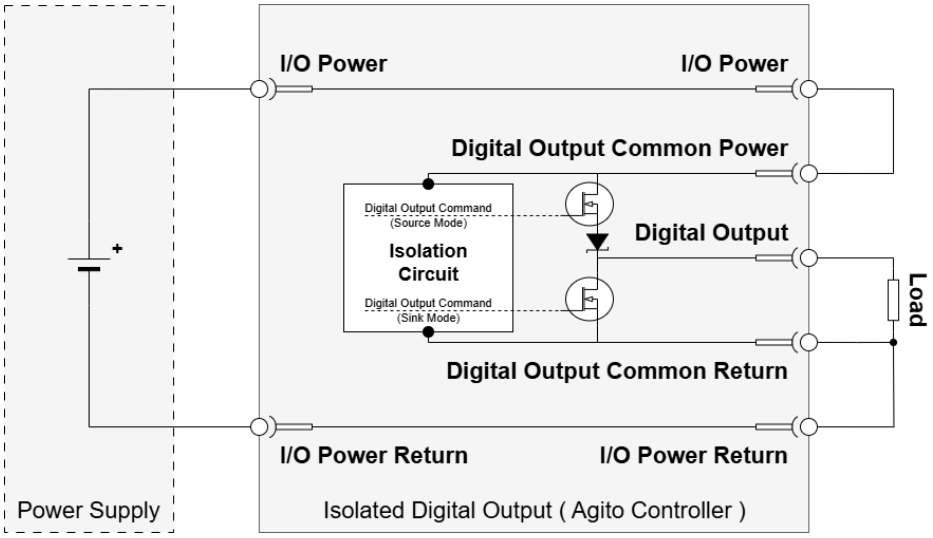

Figure 22. Digital Output (Source Mode)

Bi-Directional Differential I/Os 1 to 4

- Dedicated digital ground: GND (pin 11 connector X6) must be connected to GND of the controller/PLC. PE is not used for digital ground.
- The bi-directional differential output is configurable by software to be differential output or differential input.
- Both + and - pins are pulled up to 3.3V.
- There is a 120Ω termination resistor between the + and - pins.

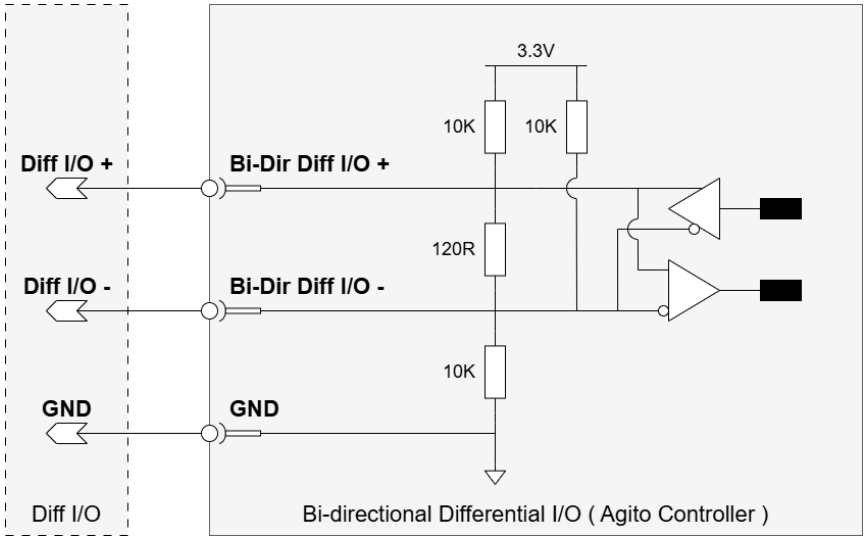

Figure 23. Bi-Directional Differential I/O

Analog Input

- The analog input range is -12V to +12V, and resolution is 12 bits.
- The analog input is designed for standard differential analog input, with a simple input circuit, having an input resistance of ~60 kΩ.
- For single-ended analog inputs, be sure to connect the return line to GND. Do not leave it unconnected.
- Input circuit bandwidth is 1 kHz, -40 dB/decade.
- The controller software provides the following parameters to control the analog input reading:
  - Filter
  - Offset
  - Deadband
  - Gain

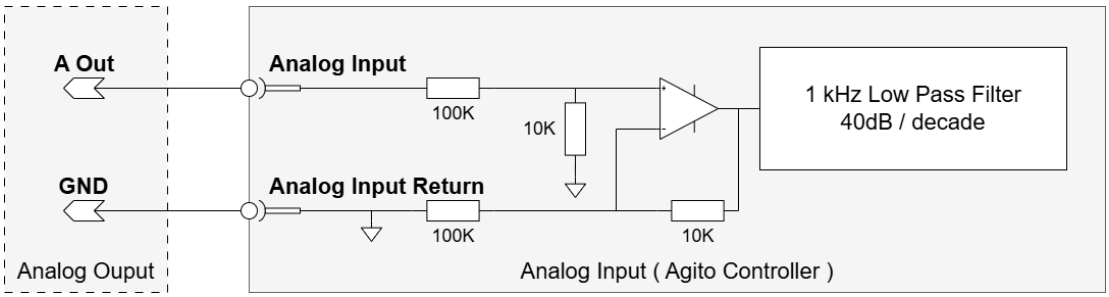

Figure 24. Analog Input