AGM800

8-axis Central-i Master Controller

Product Manual

agito

www.agito-akribis.com

Member of Akribis Systems group

Revision History

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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 4
1.1 General Description 4
1.2 Central-i Overview 4
1.3 Part Numbering 5
1.4 Technical Specifications 6
1.5 Environmental Specifications 8
2 Safety 9
2.1 Safety Symbols 9
2.2 Safety Guidelines 9
2.3 Compliance 10
3 Installation 11
3.1 Unpacking and Packing 11
3.2 Mounting 11
3.2.1 Mounting the AGM800 11
3.2.2 Mounting Multiple Units 12
3.3 Electrical Installation 13
3.3.1 Power Supply 13
3.3.2 Wire and Cable Guidelines 13
3.3.3 Grounding 13
3.4 Communication – Central-i 13
3.4.1 Interface ST: Status LED 14
3.5 Electrical Interfaces 15
3.5.1 Interface X11: Power 15
3.5.2 Interface X2: Ethernet (LAN) 16
3.5.3 Interface X4-ab: CAN bus, RS232 and RS485 17
3.5.4 Interface X1: Micro USB 18
3.5.5 Interface X3: SD Card 18
3.5.6 Interface X10: Central-i Ports 19
4 Operation 21
4.1 Central-i Connection 21
4.2 Motor Configuration and Tuning Operations 21

1 Product Description

1.1 General Description

The AGM800 is a high performance 8-axis Central-i master motion controller. It has 12 Central-i ports, eight of which can be connected to any remote Central-i amplifier, while another four can be connected to a remote device, such as an I/O module or a link adapter.

The AGM800 executes motion profiles and all servo control loops at a 16 kHz sampling rate, thus enabling multi-axis synchronization within nanoseconds.

The AGM800 is equipped with large amounts of flash and RAM memories to support complex applications and features, such as CNC motion and 3D error mapping.

AGM800 is ideally suited to control direct drive and servo motors, providing highly coordinated multi-axis motion with excellent position/velocity tracking, and settling performance. The AGM800 controller supports many advanced features such as active yaw gantry control, force control, CNC modes, user programs, and 2D/3D error compensation as standard features, and has user friendly configuration tools for easy implementation.

Figure 1. AGM800

1.2 Central-i Overview

To support industrial machinery performance demands, Agito developed a distributed control fieldbus for motion control systems. The core of a Central-i system is a multi-axis master controller, which performs all control algorithms, including trajectory planning, position, velocity, and current loops.

The remote units do not require any computational resources or configuration memory, and receive algorithm results via the simple and efficient Central-i digital protocol. The system's star communication topology enables synchronization of all remote devices and their power PWM signals within nanoseconds.

A Central-i system is easily setup by simply plugging in the cables. The system adapts itself to the connected remote devices, without needing to learn complex networking protocols or object items.

Although the hardware is distributed, it operates as a centralized system, in which the master controller has access to all signals at the remote devices in every sampling cycle. The system designer designs the system as a distributed system, with various locations and types of remote units. The system integrator configures, tunes and programs the system with all configuration, data and calculations stored and executed within a single, master controller.

The Central-i network contains all the necessary functionalities for semiconductors, electronic assembly, 3D printing, flat panel display (FPD), and other high performance applications.

1.3 Part Numbering

Product Description	Part Number Format
8-Axis Central-i Master Controller	AGM800-CI[-CCC]

CI: Central-i communication

CCC: Optional customization number

Example: AGM800-CI

1.4 Technical Specifications

General Specifications

Feature	Specification
Number of Central-i ports	12
Number of axes	8
Power supply	9–36 VDC
CPU	ARM Cortex A9, 900 MHz dual core
Flash memory	128 MB (and external SD card)
RAM	8 GB
Communication	Ethernet, RS232
Fieldbus to amplifiers and I/O	Central-i
Key Features	Encoder error mapping: 1D, 2D or 3D 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 Ultra Precision mode (UPM) Input-shaping Profile-shaping Machine vibration control with external sensor Spring and friction compensation Active-yaw gantry control
Control sampling rate	16 kHz (position, velocity, optional force, current)
Motion modes	Point-to-point, Repetitive, Jog, ECAM, Gearing, Joystick, Handwheel, Pulse and direction, Gantry, Vector, Tracking, CNC sequential contour (G-codes)
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
Interface to camera/laser	Via fast differential or optically isolated I/Os in remote AGIO or AGA10x: Event – position output event (1D or 2D), Lock – position capture. User programmable PWM output via remote unit with 1 MHz frequency.
CNC mode	CNC sequential contour (G-codes) support, FIFO buffering, Corners compensation, Linear, Circular and Helical interpolations.
Homing modes	User programmable: on encoder index, home switch, limit switch, hard stop. Easily configurable to any sequence.
Commutation	Motor learning, Auto-phasing (for incremental encoders), Hall sensors, Absolute encoder.

Feature	Specification
Programming interfaces	Standalone multi-tasking user programs – high level script-based program executed in the controller (up to 8 multi-threading programs with priority setting for each thread. More than 300 commands per 1 ms. IDE integrated in Agito PCSuite.
IDE and Host Interfaces	Agito PCSuite 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

Central-i Specifications

Feature	Specification
Topology	Star (peer to peer)
Cycle time	61 µs
Connector type	RJ-45 (Cat5e cable)
Cable length	Up to 100m
Physical layer	Dual channel RS485 full duplex
Baud rate	20 Mbps (per channel)
Synchronization between nodes	8 nanosecond
Supported Central-i devices	AGA101, AGA102, AGA103, AGA155 AGL101, ACL102 AGIO01, AGIO02

Dimensions and Weight

Feature	Specification
Unit dimensions (max)	H=141 mm, W=41 mm, D=107 mm
Package dimensions	155 mm x 55 mm x 120 mm
Unit weight	0.4 kg
Shipping weight	0.5 kg

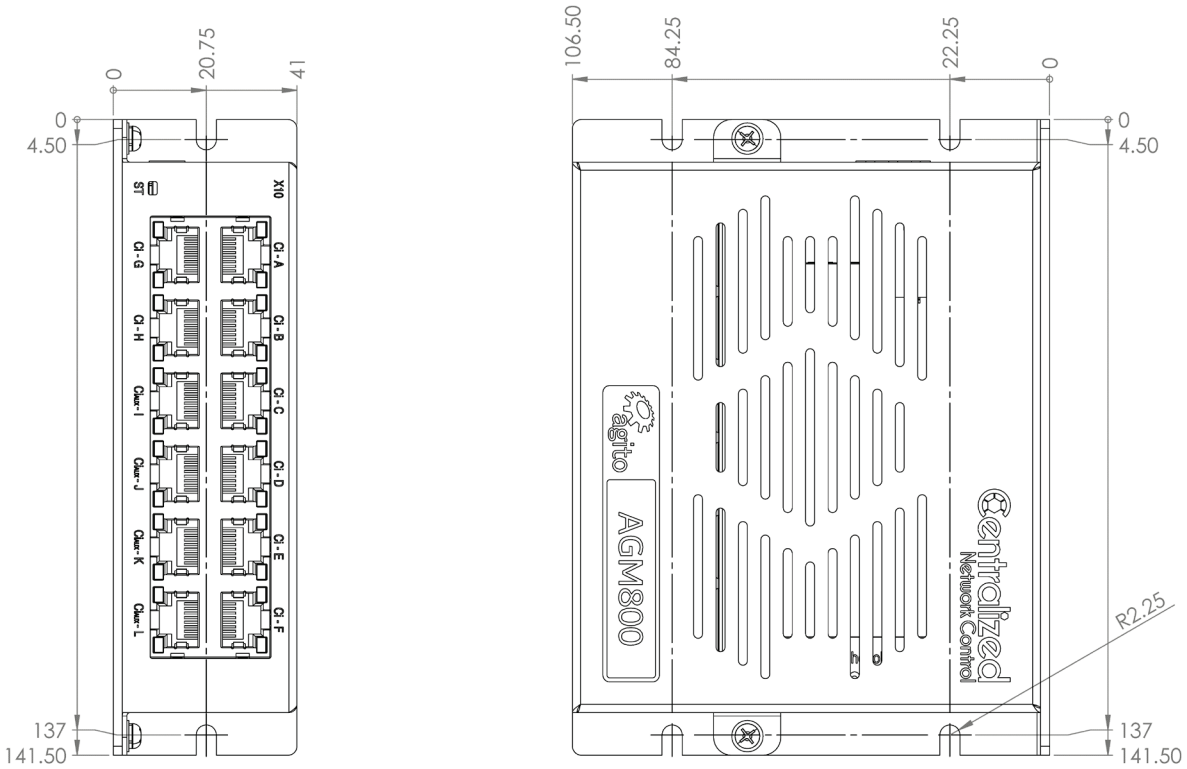

Figure 2. Product dimensions (mm)

1.5 Environmental Specifications

The operational range may be additionally limited by the internal temperature protection of the product. It is the user's responsibility to avoid operating the product in environmental conditions that do not conform to the defined limits.

Environmental Specifications

Feature	Specification
Operating temperature	0°C to 45°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

Description	Standard
Safety requirements – Electrical, thermal and energy	IEC-61800-5-1
EMC requirements and specific test methods	IEC-61800-3

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 AGM800

The heatsink on the back of the AGM800 has 6 slots for mounting the unit. The AGM800 must be mounted vertically (book mounting), as shown in Figure 3.

The AGM800 can be mounted either on its narrow side using 2 M4 screws, or on its wider side using 4 M4 screws. It is important to mount the product on a metal panel for both grounding and secure connections.

The heatsink of the AGM800 is electrically conductive and serves as the protective earth (PE) ground of the product. However, it is critical to ensure the PE screws are electrically conducting between the PE of AGM800 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 45°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 Units

When mounting multiple units within a cabinet, clearance between units must be at least 5 mm. In addition, top and bottom clearance must be at least 50 mm.

Ambient temperature in the cabinet must not exceed limit defined in the section Environmental Specifications.

If adapters are mounted on a backplane, the backplane temperature must not exceed the ambient limit defined in the section Environmental Specifications.

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

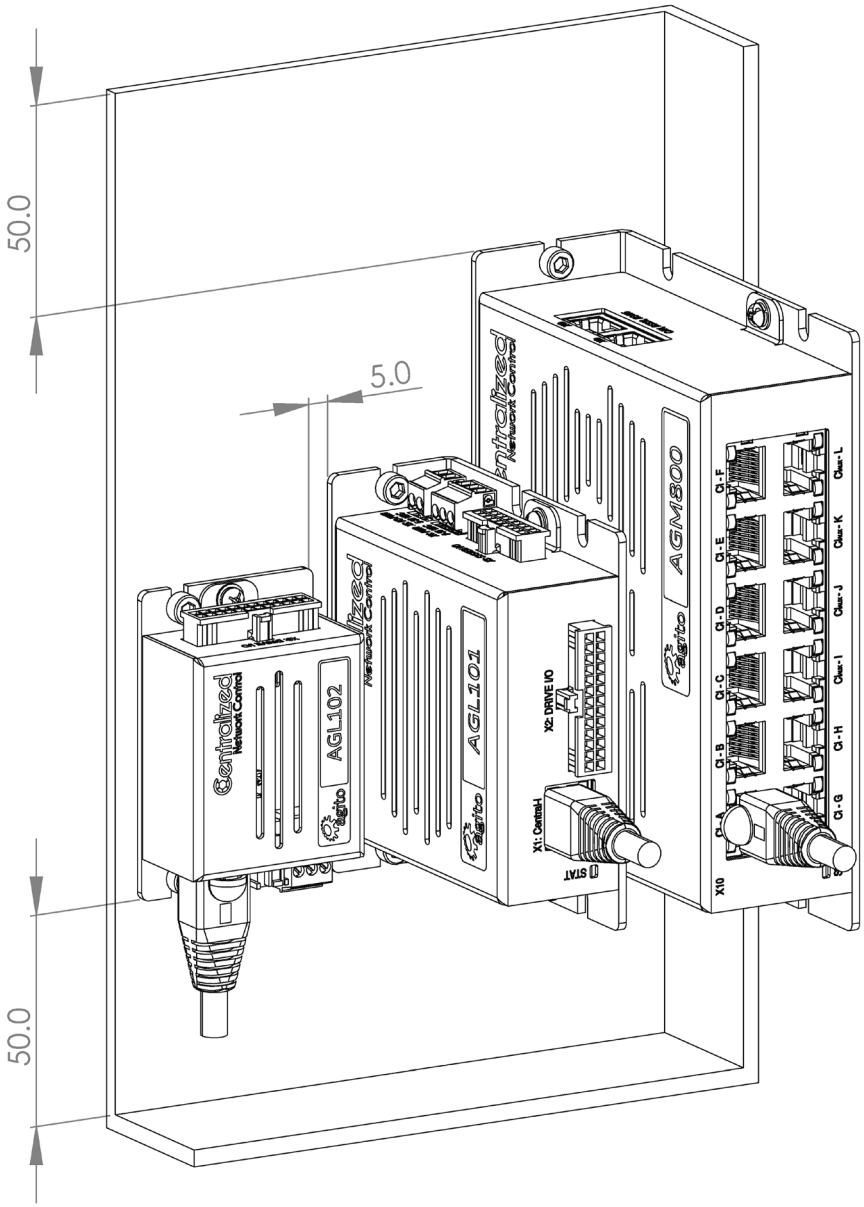

Figure 3. Mounting multiple units within cabinet

3.3 Electrical Installation

3.3.1 Power Supply

The AGM800 receives power from one 9–36 VDC power source.

3.3.2 Wire and Cable Guidelines

To prevent EMI and ensure high performance of the system, be sure to comply with the following guidelines:

- Use twisted pair shielded wires for the control, feedback, and communication.
- Always use shielded cables for motor connection.
- Keep all wires and cables as short as possible.
- Keep the motor cables as far as possible from the control, feedback and communication lines and cables.
- Wire impedance must be as low as possible. Refer to the wire gauge definitions for each electrical interface.

3.3.3 Grounding

It is recommended to install the AGM800 on a metal plate for better power dissipation, reduced EMI, and grounding connection. Make sure the plate is not painted.

The heatsink of the AGM800 is electrically conductive and serves as the protective earth (PE) ground of the product. However, it is critical to ensure the PE screws are electrically conducting between the PE of AGM800 and the PE of the main power supply in the system.

The power input (PWR) connector includes a PE pin. Make sure to connect PE to this pin or to the controller's metal heatsink.

Grounding

For diagrams and additional details on grounding, refer to the product manuals for AGA10x, AGA155, and AGL10x.

3.4 Communication – Central-i

The Central-i motion control platform includes a multi-axis motion controller, distributed adapters and sensors, and control software. The master controller performs all the control functions, including trajectory and position, velocity, and current loops. The Central-i digital protocol enables communication and synchronization of the remote devices.

The AGM800 master controller uses Central-i for communication with up to 12 Central-i remote devices, 8 of which can be remote amplifiers.

3.4.1 Interface ST: Status LED

A bi-colored LED marked ST indicates the status of the AGM800.

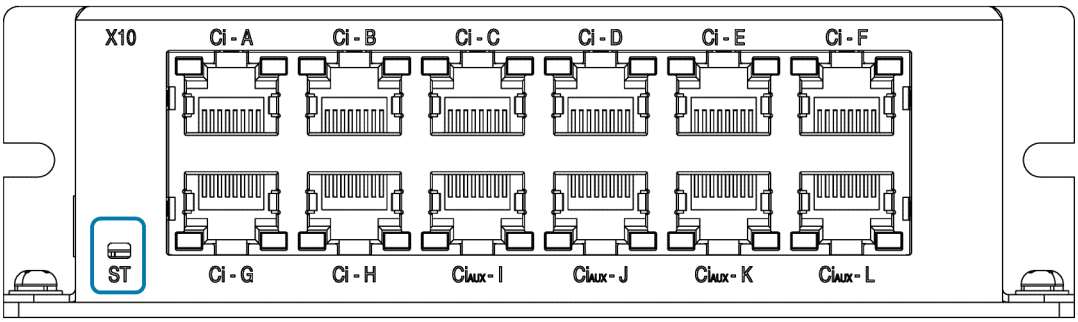

Figure 4. Status (LED) indicator

Central-i Status LED indicator

LED	Meaning
Off	Power off.
Green blinking	Powering on and initialization state.
Green steady	Operational state.
Red blinking	Firmware downloading (Boot mode).
Red steady	Internal error. Contact Technical Support.

3.5 Electrical Interfaces

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

3.5.1 Interface X11: Power

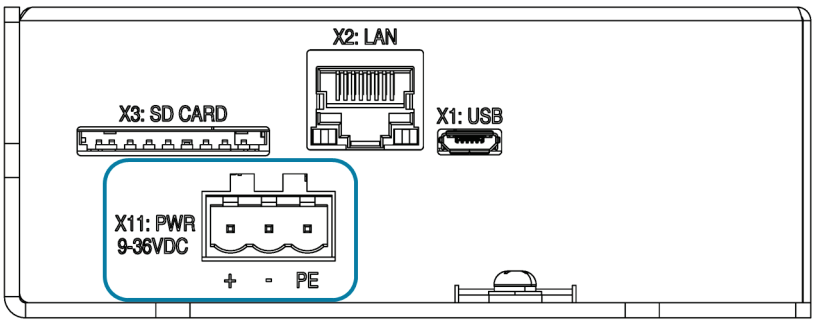

Figure 5. Power Connector

Connector X11: PWR

Pin #	Name	Description
1	Main power	Power input: 9–36V
2	Power GND	Ground – power return
3	PE	Protective earth

Connector manufacturer	DEGSON
Mating connector part number	2EDGKF-5.08-03P-14-1000AH
Connector pitch	5.08 mm
Wiring	AWG 12-24, insulation rated for 50V

Warning - Hot plugging is not supported!

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.

3.5.2 Interface X2: Ethernet (LAN)

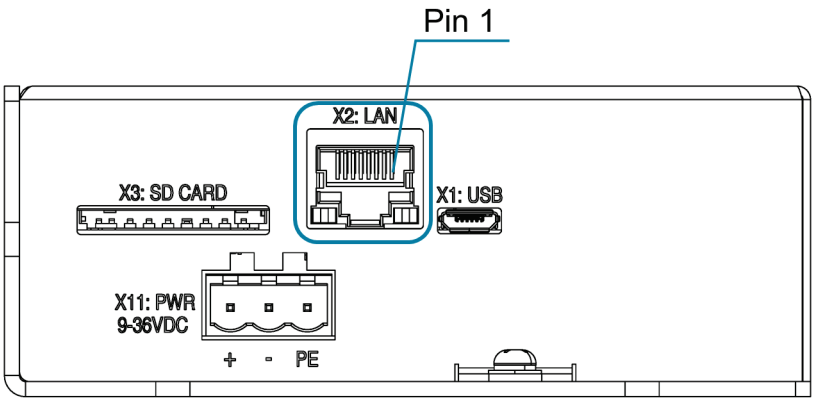

Figure 6: Ethernet Connector

Connector X2: 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 +
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

3.5.3 Interface X4-ab: CAN bus, RS232 and RS485

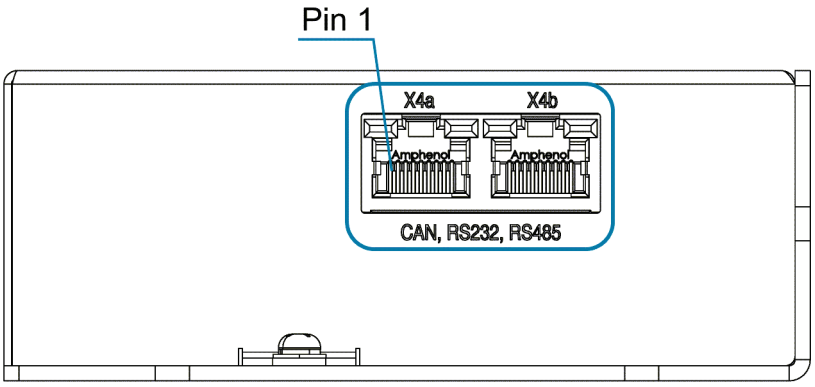

Figure 7: Serial Communication Connectors

Connector X4a and X4b: CAN, RS232, RS485

Pin #	Name	Description
1	GND	Digital Ground
2	RS232_RX	RS232 input (receive at product)
3	RS232_TX	RS232 output (transmit from product)
4	RS485_B	RS485 bus, inverted
5	RS485_A	RS485 bus, not inverted
6	Sync	Reserved for future use
7	CAN_L	CAN bus, Low
8	CAN_H	CAN bus, High

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

Dual port connector

The serial port is a dual-port RJ45 connector. The two ports have identical pinouts and are interchangeable. Two ports are provided to support daisy chain connection of a CAN bus or RS485. It can be also used to connect two types of communication channels at the same time, instead of splitting a cable from a single RJ45 connector.

CAN bus and RS485 terminators

The CAN bus lines have an optional 120Ω terminator that is connected/disconnected by DIP switch #1 in the DIP SW interface (on the top panel). Setting dip switch #1 to the ON position connects a 120Ω terminator between CAN_H and CAN_L. The terminator is required only in the last unit in the CAN bus chain.

The RS485 lines have a built-in (not optional) 120Ω terminator. Communication performance may be degraded if too many units are placed on the RS485 chain.

3.5.4 Interface X1: Micro USB

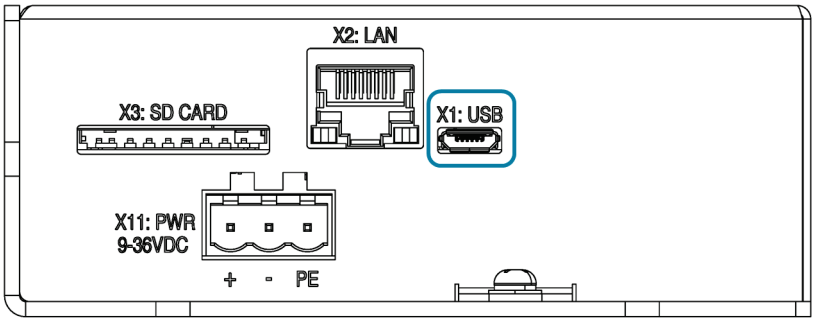

Figure 8: USB connector

Connector X1: Micro USB

Pin #	Name	Description
1	Vcc	5V
2	D-	Data-
3	D+	Data+
4	ID	USB OTG ID
5	GND	GND

Connector type	Micro-USB 2.0 B
Cable	Any Micro-USB 2.0 B-type cable
Wiring	20 to 28 AWG, insulation rated for 100 V

USB to RS232 bridge

The Micro-USB connection is implemented using an internal converter/adapter from USB to RS232 (UART). Typically, the Windows OS contains a built-in driver for the convertor/adapter. If necessary, you can access drivers at: http://www.ftdichip.com/Drivers/D2XX.htm.

3.5.5 Interface X3: SD Card

AGM800 includes a SD card reader to allow expansion of flash memory storage.

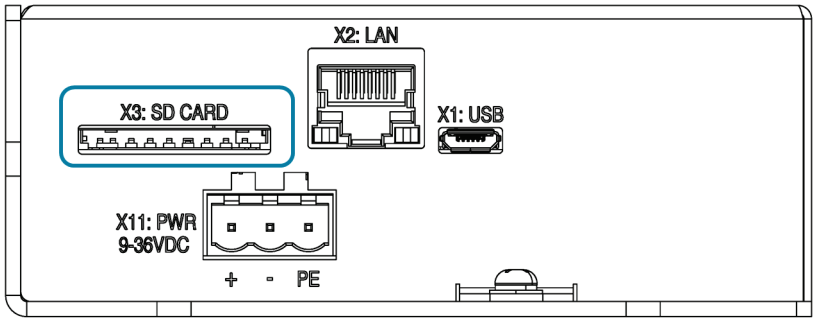

Figure 9 SD card slot

3.5.6 Interface X10: Central-i Ports

The AGM800 controller does not have any I/O interfaces to the system under control.

Instead of I/O ports, the AGM800 master controller uses Central-i ports for communication with all remote devices, such as amplifiers (AGA series), I/O modules (AGIO series), and link adapters (AGL series).

Ports A – H can be connected to any type of remote device.

Ports I – L can be connected only to I/O modules.

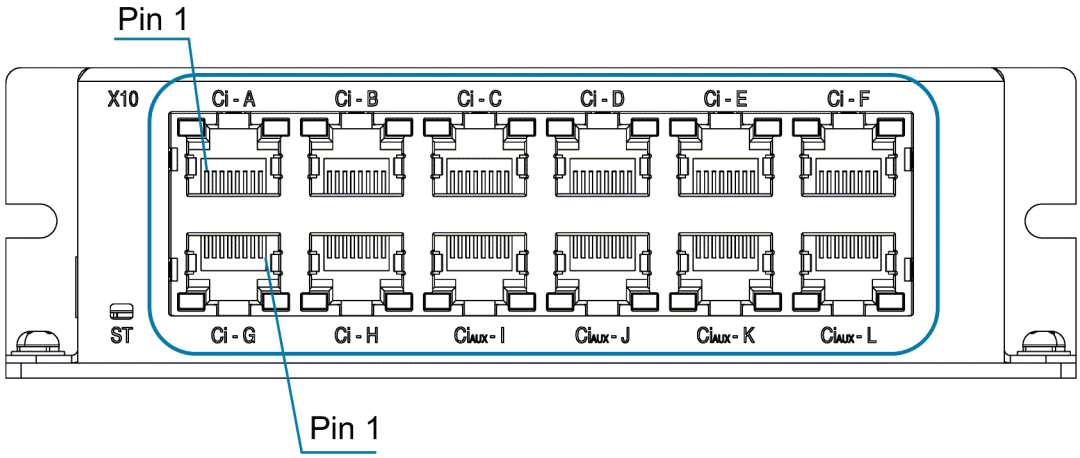

Figure 10. Central-i ports

Connector X10: Central-i Ports

Pin #	Name	Description
1	DATA_0+	Data channel 0+
2	DATA_0-	Data channel 0-
3	DATA_1+	Data channel 1+
4	DATA_2-	Data channel 2-
5	DATA_2+	Data channel 2+
6	DATA_1-	Data channel 1-
7	V_REMOTE	Power supply to remote unit's communication module
8	GND	GND

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

4 Operation

4.1 Central-i Connection

The Central-i Master Controller does not have any I/O interfaces to the system under control. It works with external amplifiers (AGA series), adapters (AGL series), and I/O modules (AGIO series).

Use an Ethernet CAT5e shielded cable to connect between the master's Central-i port to the remote device's Central-i port, power up both master and remote device, then Run Agito PCSuite.

To configure the communication:

1. From the Agito PCSuite main menu, select **CONFIG** > **Ci** to open the Central-i Connection Management screen.
2. Select a remote device type and subtype, and click **Connect**.
3. Repeat for all connected ports.

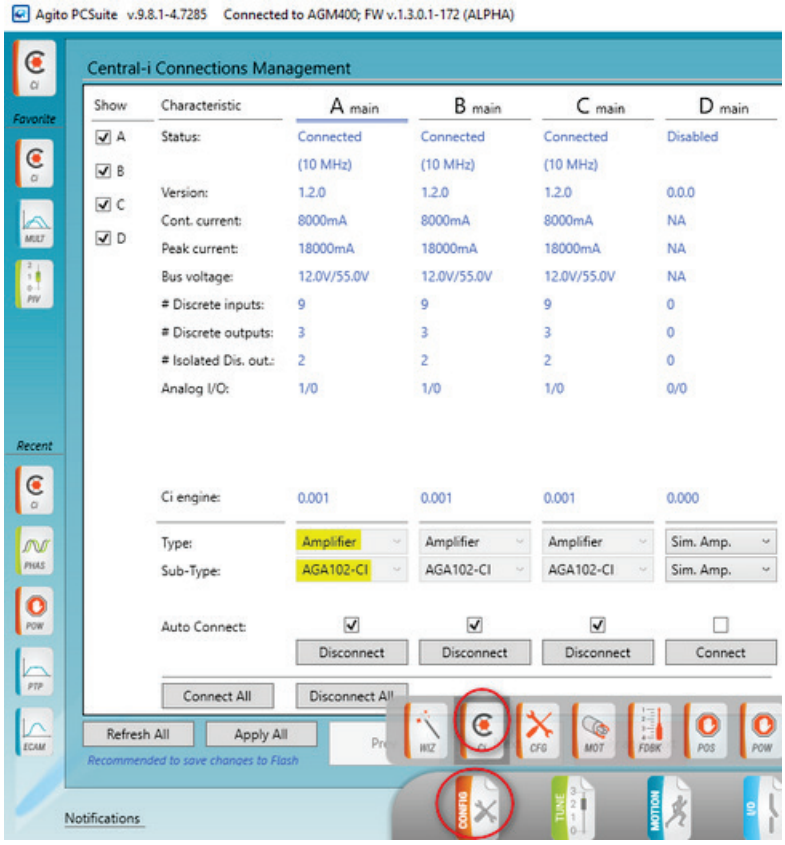

Figure 11 Central-i Connection Management

4.2 Motor Configuration and Tuning Operations

For details on configuration and operation, refer to the product manual for the amplifier in your system.