eliwell
by Schneider Electric

FREE ADVANCE

Logic controller

USER MANUAL

9MA10265.00

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Eliwell nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein.
If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Eliwell software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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SAFETY INFORMATION

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to inform of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards.
Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result** in death or serious injury**.**

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result** in death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.
No responsibility is assumed by Eliwell for any consequences arising out of the use of this material.
A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Permitted use

This product is used to control HVAC and Pumping applications.

For safety reasons, the device must be installed and used in accordance with the instructions provided. In particular, parts carrying dangerous voltages must not be accessible under normal conditions.

The device must be adequately protected from water and dust with regard to the application, and must only be accessible using tools (with the exception of the front panel).

The device is also suitable for use in household and commercial refrigeration appliances and/or similar equipment and has been tested for safety aspects in accordance with the harmonized European reference standards.

Prohibited use

Any use other than that expressed above under Permitted use is strictly prohibited.

The relay contacts supplied are of an electromechanical type and subject to wear. Functional safety protection devices, specified in international or local standards, must be installed externally to this device.

Liability and residual risks

Eliwell liability is limited to the proper and professional use of this product under the guidelines contained in the present and other supporting documents, and does not extend to damages caused by (but not limited to):

- Unspecified installation/use and, in particular, in contravention of the safety requirements of established legislation or specified in this document;
- Use on equipment which does not provide adequate protection against electrocution, water and dust in the actual installation conditions;
- Use on equipment in which dangerous components can be accessed without the use of specific tools;
- Installation/use on equipment which does not comply with established legislation and standards.

Disposal

The appliance (or the product) must be disposed of separately in compliance with the local standards in force on waste disposal.

Product Related Information

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Always use a properly rated voltage sensing device to confirm the power is removed.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

This equipment has been designed to operate outside of any hazardous location.
Only install this equipment in zones known to be free of hazardous atmosphere.

⚠ DANGER

POTENTIAL FOR EXPLOSION

Install and use this equipment in non-hazardous locations only.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.(1)
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

(1) For additional information, refer to NEMA ICS 1.1 (latest edition), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS 7.1 (latest edition), “Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems” or their equivalent governing your particular location.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only use software approved by Eliwell for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

ABOUT THE BOOK

Document Scope

This document describes the **FREE Advance logic controllers** and accessories including installation and wiring information.

Use this document to:

- Install and operate your **FREE Advance logic controller**.
- Connect the **FREE Advance logic controller** to a programming device equipped with **FREE Studio** software.
- Interface the **FREE Advance logic controller** with I/O expansion modules, HMI and other devices.
- Familiarize yourself with the **FREE Advance logic controller** features.

NOTE: Read and understand this document and the related documents before installing, operating, or maintaining your controller.

Validity Note

This document is valid for **FREE Studio (v.3.5 or greater)**.

The technical characteristics of the devices described in this manual also appear online.

The characteristics that are presented in this manual should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the manual and online information, use the online information as your reference.

Related Documents

Title of Documentation	Reference Document Code
User Guide FREE Advance	9MA00265 (ITA)
User Guide FREE Smart - SKP SKW	9MA10251 (ENG) 9MA00251 (ITA)
User Guide FREE Evolution - FREE Panel	9MA10252 (ENG) 9MA00252 (ITA)
User Guide XVD	9MA10254 (ENG) 9MA00254 (ITA)
User Guide FREE Studio	9MA10255 (ENG) 9MA00255 (ITA)
FREE Studio software HelpOnLine Manual	9MA10256 (ENG) 9MA00256 (ITA)
FREE Evolution 27 I/O – Instruction Sheet	9IS54403
FREE EVS Plugin – Instruction Sheet	9IS54405
FREE EVK1000 – Instruction Sheet	9IS54408
FREE Advance 28/42 IO – Instruction Sheet	9IS54473

You can download these technical publications and other technical information from our website at:
www.eliwell.com

CHAPTER 1
Introduction

1.1. General description of FREE Advance

The **FREE Advance** Logic Controller is a Eliwell logic control part of the range **FREE Evolution / Panel / Advance**, suitable for managing a wide range of HVAC, Pumping and many other applications, from the simplest to the most complex.

In this manual, the photos and drawings are intended to show the **FREE Advance** programmable controller (and other **FREE** devices) and are for illustrative purposes only. The relative sizes and proportions may not be indicative of actual dimensions nor to scale. In addition, any wiring diagrams or electrical schematics are to be considered as simplified renditions and not literal representations thereof.

1.1.1. FREE Advance offer

The **FREE Advance** (see **Fig. 1 on page 11**) offer is made of:

- **FREE Advance AVC-AVD8400 (28 I/Os) with built-in display or blind**
- **FREE Advance AVC-AVD12600 (42 I/Os) with built-in display or blind**

FREE	Reference	Description
AVC-AVD 8400 (28 I/Os)	**AVC8400060500**	FREE AVC8400/C/L/U Blind 28 I/Os, Ethernet, 2 Modbus, BACnet
	AVD8400060500	FREE AVD8400/C/L/U Display 28 I/Os, Ethernet, 2 Modbus, BACnet
	AVD84SS060500	FREE AVD8400/C/L/U/SSR Display 28 I/Os, Ethernet, 2 Modbus, BACnet, 2 SSR
AVC-AVD 12600 (42 I/Os)	**AVC1260060500**	FREE AVC12600/C/L/U Blind 42 I/Os, Ethernet, 2 Modbus, BACnet
	AVD1260060500	FREE AVD12600/C/L/U Display 42 I/Os, Ethernet, 2 Modbus, BACnet
	AVD126S060500	FREE AVD12600/C/L/U/SSR Display 42 I/Os, Ethernet, 2 Modbus, BACnet, 2 SSR

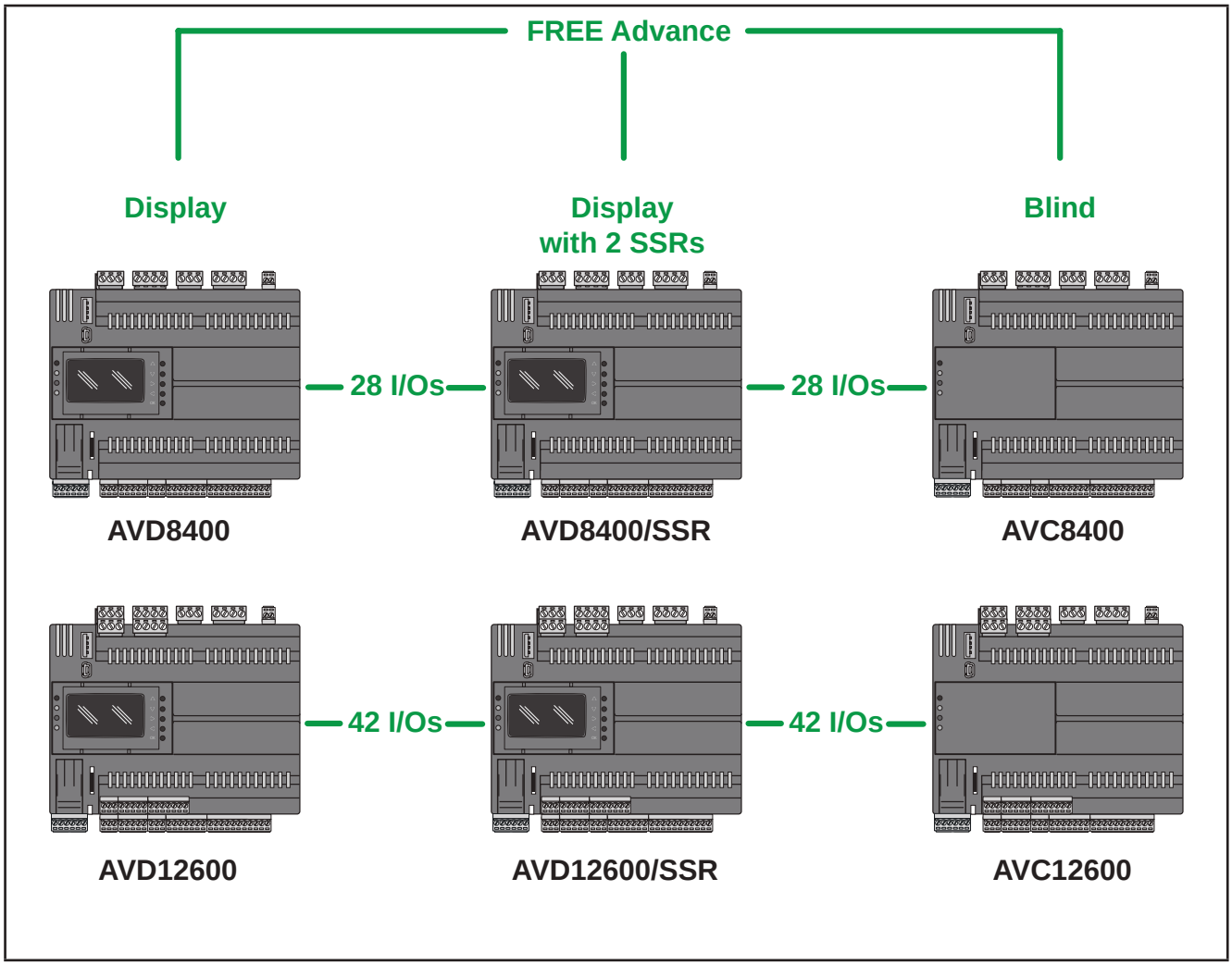


Fig. 1. FREE Advance offer

1.1.2. Delivery Content

The **Fig. 2 on page 12** shows the content of the delivery for a **FREE Advance Logic Controller.**

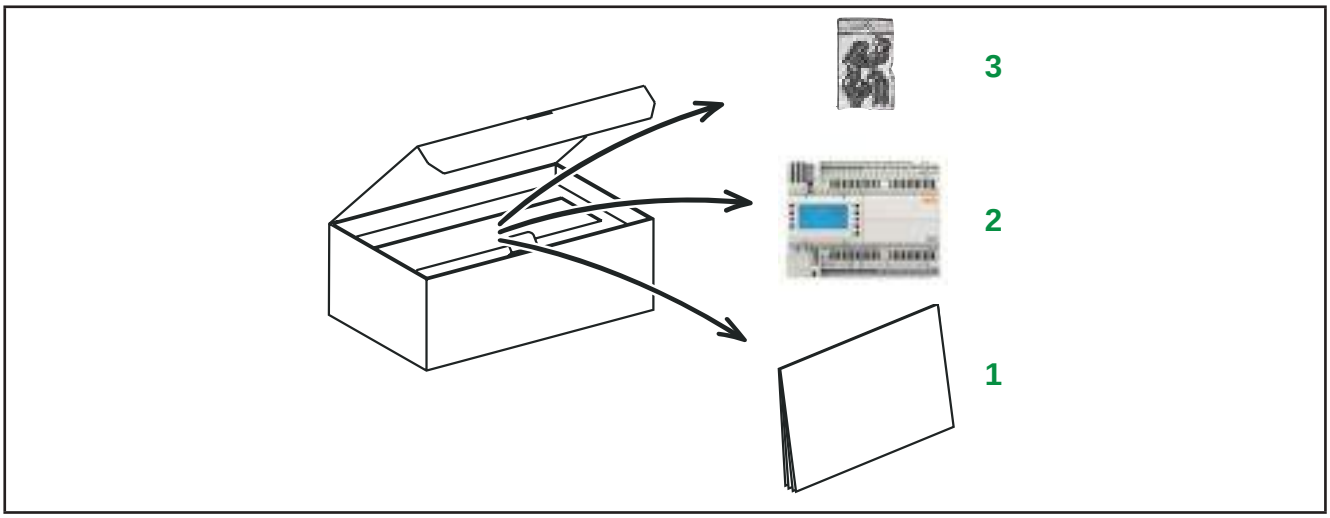


Fig. 2. Delivery Content

Label	Description
1	**FREE Advance Logic Controller** Instruction Sheet
2	**FREE Advance Logic Controller**
3	**Screw terminals block**

1.1.3. FREE Advance overview

FREE Advance delivers performance in terms of connectivity, scalability and user interface as well as straightforward programming, maintenance and servicing.

The references are available as 8DIN rail-mounted versions, which saves time in terms of wiring. The 8DIN format provides extra flexibility and easy installation.

A wide range of 2 DIN rail mounted Communication Modules (part of the range **FREE Evolution / Panel / Advance**) allow integration with industrial systems and BMS.
Lastly, sensors and displays can also be connected with no need for further serial interfaces.

In association with the **FREE Advance** hardware, there is also the **FREE Evolution / Panel**, controller and accessories, which can be connected.
FREE Evolution / Panel accessories are compatible with **FREE Advance**, except for **EVS ETH**, **EVS PROFIBUS**, **EVS ETH + RS485**; moreover, there is also the **FREE Studio** (**v3.5 or greater**) development tool to program and customize new programs for many HVAC- and pumping-related applications.

The use of several different programming languages in accordance with IEC61131-3 regulations makes it possible to develop new algorithms or programs, which can then be downloaded to the **FREE Advance** controller via PC or standard USB.

Web functionalities

The **FREE Advance** also features web functionalities, offering makers of machinery and systems integrators remote access. Having a web-based connection in machines reduces support and maintenance by minimizing call-out charges. End users also benefit, as they can monitor their own systems both locally and from distance, using the graphics interface of any browser.

Main web functionalities

- Web-based access.
- Remote reading and support.
- Local and remote system control, including alarms management.
- Preventive and predictive maintenance.
- Email alarm alerts.

Care must be taken and provisions made for use of this product as a control device to avoid inadvertent consequences of commanded machine operation, controller state changes, or alteration of data memory or machine operating parameters.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Configure and install the mechanism that enables the remote HMI local to the machine, so that local control over the machine can be maintained regardless of the remote commands sent to the application.
- You must have a complete understanding of the application and the machine before attempting to control the application remotely.
- Take the precautions necessary to assure that you are operating remotely on the intended machine by having clear, identifying documentation within the application and its remote connection.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

1.1.4. FREE Advance main features

The **FREE Advance** (see **Fig. 3 on page 14**) offer is made of:

- **FREE Advance AVC-AVD8400 (28 I/Os)**, made up of a "Base board" internally;
- **FREE Advance AVC-AVD12600 (42 I/Os)**, made up of a "Base board" and a "Upper board" internally.

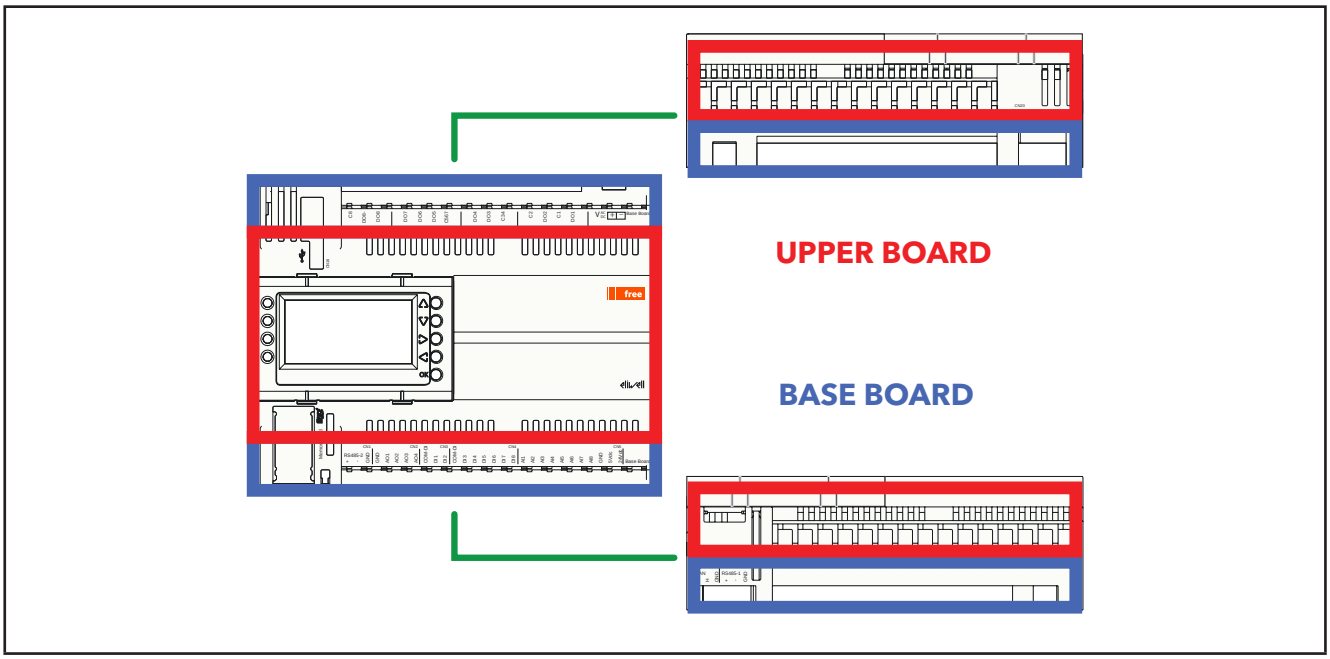


Fig. 3. FREE Advance : Base board and Upper board

The following table shows the main features for each **FREE Advance** reference:

	Power supply	Number of I/O	Type of I/O	Display	Communication ports / slots
FREE Advance	24 Vac/dc	**28**	**AVC-AVD8400/C/L/U(/SSR)** is equipped with 28 inputs/outputs, including: • 4 analog outputs, • 8 analog inputs, • 8 relay digital outputs (or 6 relays + 2 SSRs), • 8 digital inputs (2 DI can be High Speed Counter).	**AVD8400/C/L/U(/SSR)** has a built-in graphical user display.	**FREE Advance** is equipped with: • 2 RS 485 serial ports, • 1 CAN Expansion Bus • 1 Ethernet port. • Type A USB port for downloading or uploading parameter maps, program, BIOS or files. • Type mini-B USB port as programming port with debug. • Memory Card Slot (Micro SD [1]) for extending internal memory (for Datalogging and Webserver storage).
				AVC8400/C/L/U has no display.	
		42	**AVC-AVD12600/C/L/U(/SSR)** is equipped with 42 inputs/outputs, including: • 6 analog outputs, • 12 analog inputs, • 12 relay digital outputs (or 10 relays + 2 SSRs), • 12 digital inputs (2 DI can be High Speed Counter).	**AVD12600/C/L/U(/SSR)** has a built-in graphical user display.	
				AVC12600/C/L/U has no display.	

[1] Micro SD optional, not included in the package.

In addition to the **FREE Advance** hardware, there is also the **FREE Evolution / Panel** accessories, which can be connected:

- **FREE Evolution Display Graphic (EVK1000)**
- **FREE Evolution Expansion(s)**
- **FREE Evolution Communication Module(s)**

Compatible FREE Evolution \ Panel Devices	**Function**	**References**
FREE Evolution Display Graphic (EVK1000)	**FREE Evolution Display Graphic** (**EVK1000**) allows the configuration of **FREE Advance** controller BIOS parameters.	**AVD8400-12600/C/L/U(/SSR)** has a built-in graphical user display and it can be connected to a remote **FREE Evolution Display Graphic** (**EVK1000**)
		AVC8400-12600/C/L/U has no display and it can be connected to a remote **FREE Evolution Display Graphic** (**EVK1000**)
FREE Evolution Expansion(s)	**FREE Advance** controller can be expanded to include up to 12 extra modules.	**EVE7500 expansion 27 I/Os** module: Inputs: • 9 digital inputs including 1 fast input • 6 analog inputs Ouputs: • 7 relay outputs • 5 analog outputs
		EVE4200 expansion 14 I/Os module Inputs: • 4 digital inputs • 4 analog inputs Ouputs: • 4 digital outputs • 2 analog outputs
FREE Evolution Communication Module(s)	**FREE Advance** controller supports **EVS** Communication Modules, to interface with several networks and fieldbus (CAN, RS 232, RS 485, LON) for integration with industrial systems and BMS.	**FREE Advance** can be expanded with one of the following Communication Modules: • **EVS CAN** • **EVS RS232/R** • **EVS RS485 BACnet MS/TP** • **EVS RS485** • **EVS LON**

1.1.5. FREE Advance main components

The components of the **FREE Advance Logic Controller** depend on the controller reference.
In the **Fig. 4 on page 16** the **FREE Advance Logic Controller** has the terminal blocks installed.

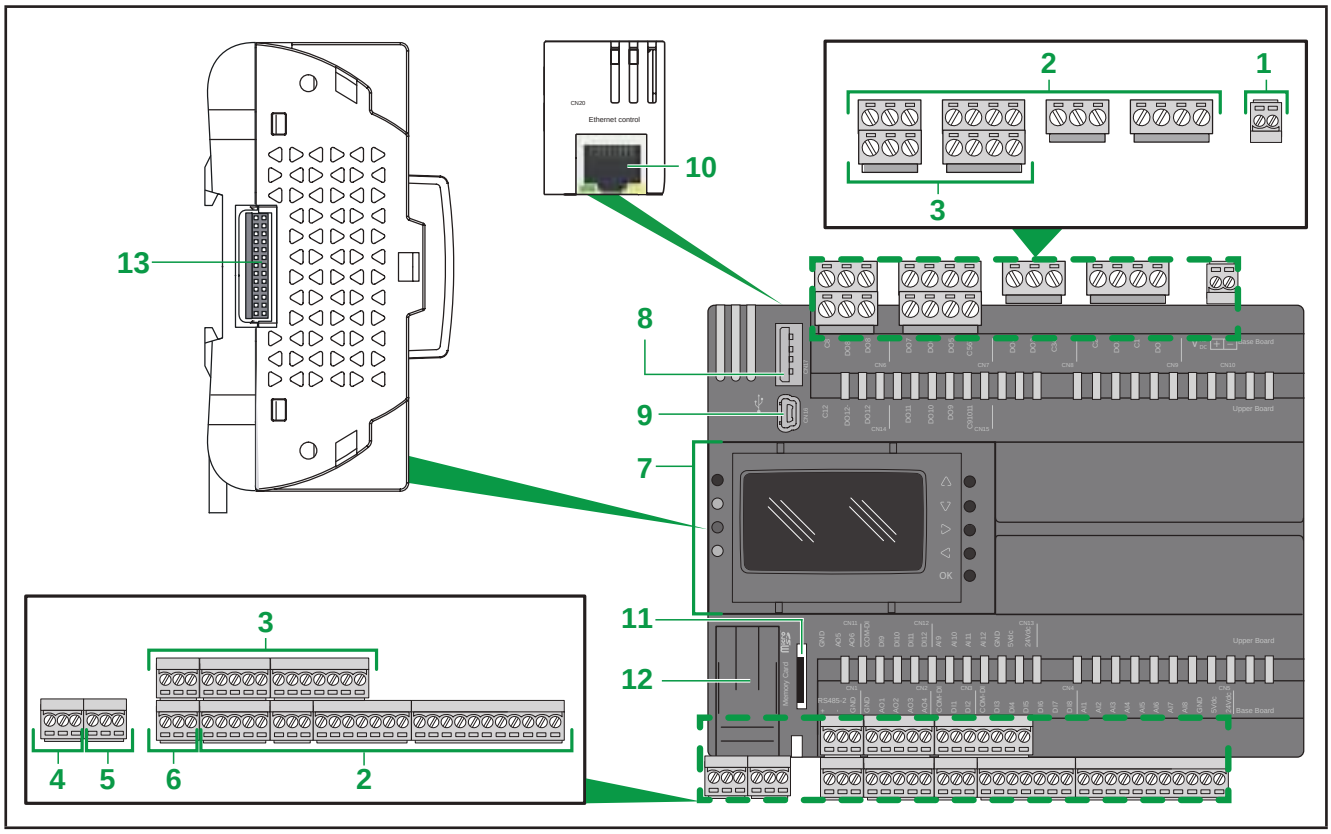


Fig. 4. FREE Advance main components

Label	Description	Placed on	For further information, refer to
1	Power supply	Base board	**4.9. Power supply on page 69**
2	I/O terminal block	Base board	**3.3.1. Wiring diagram of the Base board screw terminals on page 37**
3	I/O terminal block	Upper board	**3.3.2. Wiring diagram of the Upper board screw terminals on page 38**
4	CAN Expansion bus port	Base board	**3.1.6. Serial connections on page 32** and **4.6. Serials on page 63**
5	Serial line port 1 (RS 485)	Base board	**3.1.6. Serial connections on page 32** and **4.6. Serials on page 63**
6	Serial line port 2 (RS 485)	Base board	**3.1.6. Serial connections on page 32** and **4.6. Serials on page 63**
7	Display (with 4 status LEDs and 5 keys)	Base board	**4.5. Display on page 63**
8	Type A USB port	Base board	**3.1.6. Serial connections on page 32** and **4.6.1. USB ports on page 64**
9	Type mini-B USB port	Base board	**3.1.6. Serial connections on page 32** and **4.6.1. USB ports on page 64**
10	Ethernet port (RJ45)	Base board	**3.1.6. Serial connections on page 32** and **4.6. Serials on page 63**
11	Memory card slot	Base board	**4.8.2. External memory on page 67**
12	Service battery door	/	**4.7. Service battery door on page 66**
13	Communication Module connector	Base board	**2.8. Assembling the EVS Communication Modules on page 25**

To identify the Base board and its components, refer to **1.1.1. FREE Advance offer on page 10** and **3.2.1. FREE Advance Base board connectors on page 35.**
To identify the Upper board and its components, refer to **1.1.1. FREE Advance offer on page 10** and **3.2.2. FREE Advance Upper board connectors on page 36**.

CHAPTER 2
Mechanical installation

2.1. Before Starting

Read and understand this chapter before beginning the installation of your system. The use and application of the information contained herein require expertise in the design and programming of automated control systems. Only you, the user, machine builder or integrator, can be aware of all the conditions and factors present during installation and setup, operation, and maintenance of the machine or process, and can therefore determine the automation and associated equipment and the related safeties and interlocks which can be effectively and properly used. When selecting automation and control equipment, and any other related equipment or software, for a particular application, you must also consider any applicable local, regional or national standards and/or regulations. Pay particular attention in conforming to any safety information, different electrical requirements, and normative standards that would apply to your machine or process in the use of this equipment.

⚠ WARNING

REGULATORY INCOMPATIBILITY

Be sure that all equipment applied and systems designed comply with all applicable local, regional and national regulations and standards.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

2.2. Disconnecting Power

All options and modules should be assembled and installed before installing the control system on a mounting rail, into a panel door or onto a mounting surface. Remove the control system from its mounting rail, mounting plate or panel before disassembling the equipment.

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Always use a properly rated voltage sensing device to confirm the power is removed.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

2.3. Programming Considerations

The products described in this manual have been designed and tested using Eliwell programming, configuration and maintenance software products.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only use software approved by Eliwell for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

2.4. Operating Environment

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER

POTENTIAL FOR EXPLOSION

Install and use this equipment in non-hazardous locations only.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Install and operate this equipment according to the conditions described in the Environmental and electrical characteristics.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

2.5. Installation Considerations

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use appropriate safety interlocks where personnel and/or equipment hazards exist.
- Install and operate this equipment in an enclosure appropriately rated for its intended environment.
- Power line and output circuits must be wired and fused in compliance with local and national regulatory requirements for the rated current and voltage of the particular equipment.
- Do not use this equipment in safety-critical machine functions.
- Do not disassemble, repair, or modify this equipment.
- Do not connect any wiring to reserved, unused connections, or to connections designated as No Connection (N.C.).
- Do not mount devices in extremely damp and/or dirt-laden areas.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: JDYX2 or JDYX8 fuse types are UL-recognized and CSA approved.

For mechanical dimensions, refer to **4.10. Mechanical dimensions on page 71**.

The **FREE Advance** devices are intended for DIN rail mounting, panel mounting or wall mounting.

Care must be taken to avoid damage from electrostatic sources when handling this equipment. In particular exposed connectors and, in some cases, exposed printed circuit boards are vulnerable to electrostatic discharge.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION DUE TO ELECTROSTATIC DISCHARGE DAMAGE

- Keep equipment in the protective conductive packaging until you are ready to install the equipment.
- Only install equipment in approved enclosures and / or locations that prevent unauthorized access and provide electrostatic discharge protection as defined by IEC 1000-4-2.
- Use a conductive wrist strap or equivalent field force protective device attached to an earth ground when handling sensitive equipment.
- Always discharge yourself by touching a grounded surface or approved antistatic mat before handling the equipment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

2.6. FREE Advance DIN rail mounting

The equipment is intended for 8DIN rail mounting (see **Fig. 5 on page 21** and **Fig. 7 on page 23**).
For DIN rail installation, follow the steps described below:

1. Move the two clip-on locks outwards (use a screwdriver to press against the relative compartments). In **FREE Advance**, only the two lower clip-on locks can move. Two upper clip-on locks can be ordered separately as an accessory for panel mounting (reference: **AVA00PMCL0000**).
2. Mount the device on the DIN rail.
3. Press the clip-on locks inwards to put them into the locked position.

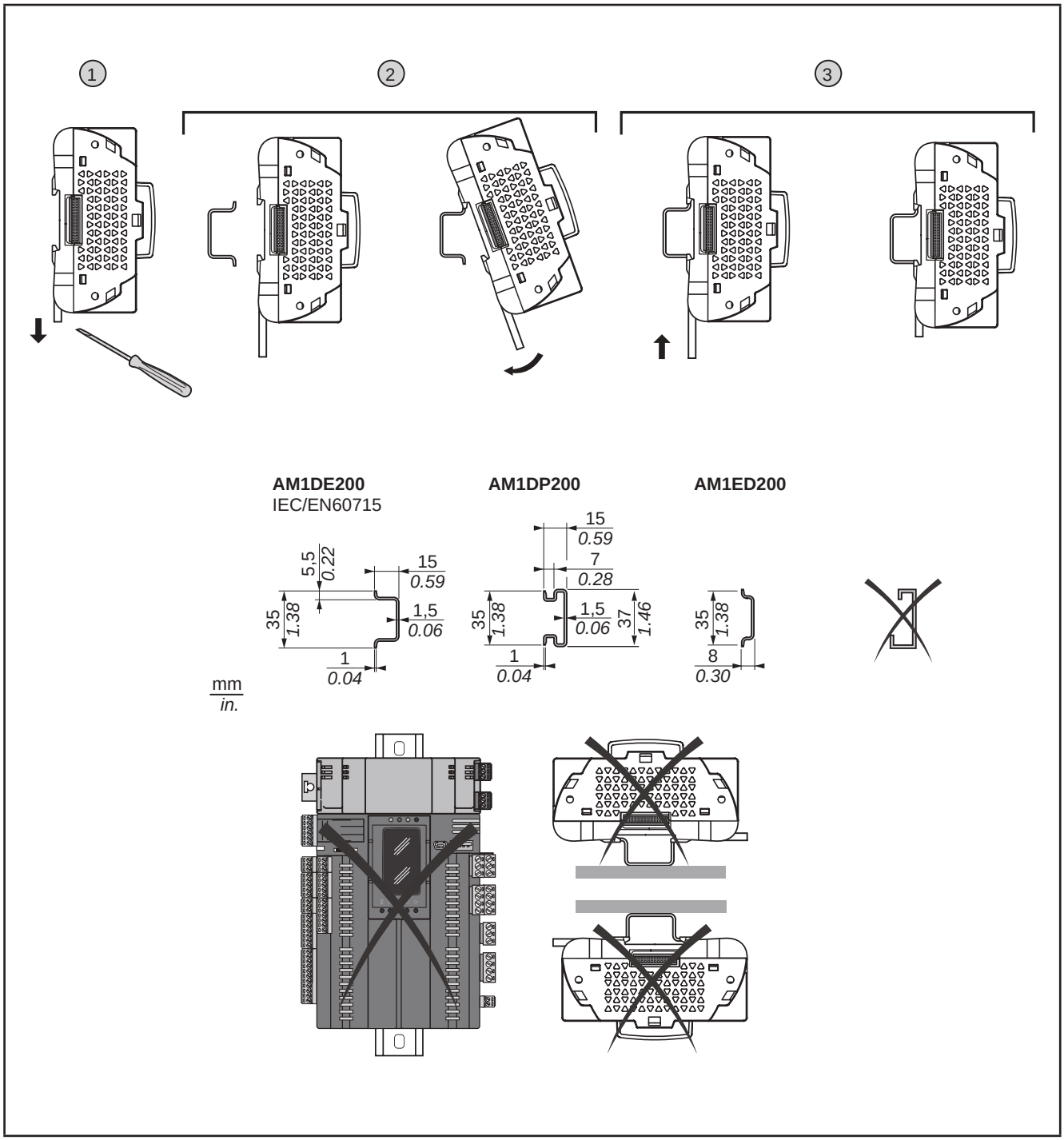


Fig. 5. FREE Advance DIN rail mounting

The **FREE Advance logic controller** has been designed as an IP20 product and must be installed in an enclosure. Clearances must be respected when installing the product (see **Fig. 6 on page 22**).
There are 3 types of clearances between:

- The **FREE Advance** and all sides of the cabinet (including the panel door).
- The **FREE Advance** terminal blocks and the wiring ducts.
  This distance reduces electromagnetic interference between the controller and the wiring ducts.
- The **FREE Advance** and other heat generating devices installed in the same cabinet.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Place devices dissipating the most heat at the top of the cabinet and ensure adequate ventilation.
- Avoid placing this equipment next to or above devices that might cause overheating.
- Install the equipment in a location providing the minimum clearances from all adjacent structures and equipment as directed in this document.
- Install all equipment in accordance with the specifications in the related documentation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

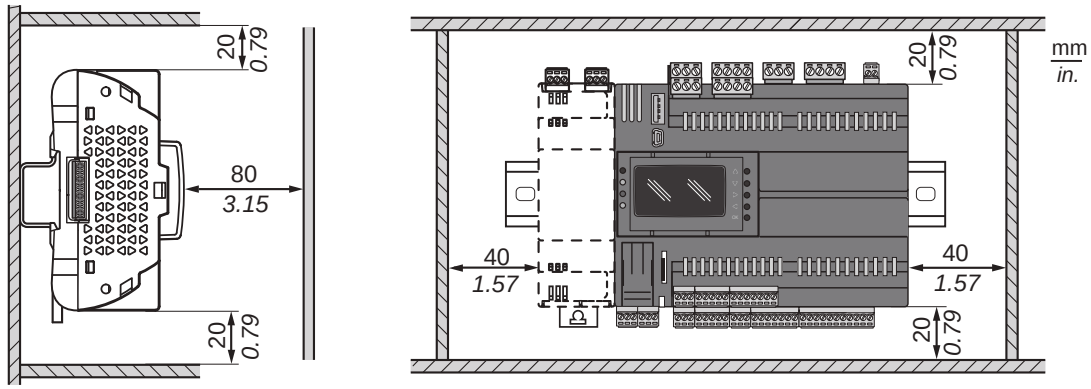


Fig. 6. Clearances

2.7. FREE Advance panel mounting

The equipment is also intended for panel mounting (see **Fig. 7 on page 23** and **Fig. 8 on page 24**).

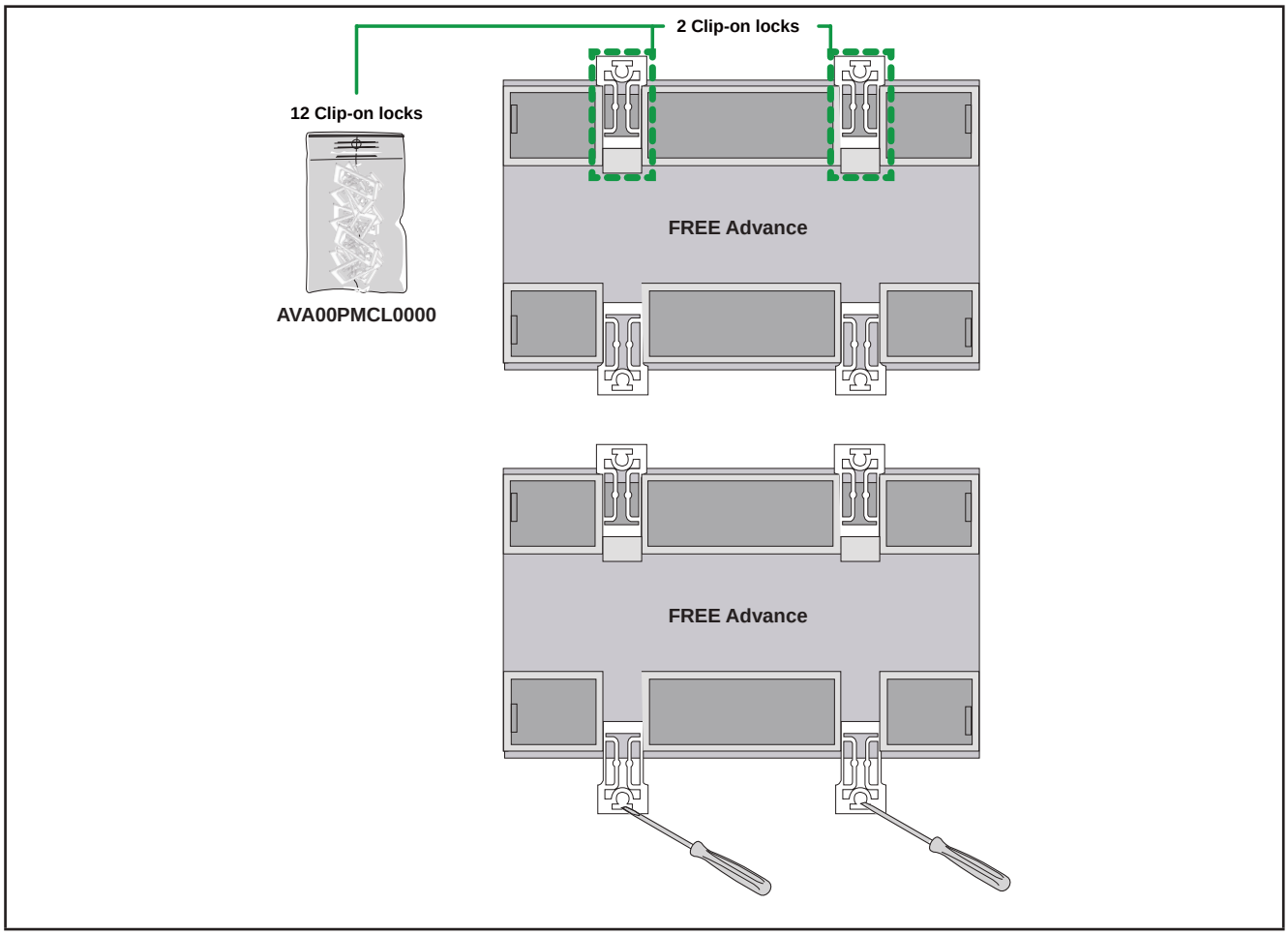


Fig. 7. Details of clip-on locks

Follow the instructions below to install it on a panel:

1. Make four holes in the panel (for the distance between holes and hole diameter, see **Fig. 8 on page 24**).
2. Take two clip-on locks from the **AVA00PMCL0000.**
   A **AVA00PMCL0000** contains 12 clip-on locks, therefore they can be used to installed up to 6 **FREE Advance**.
3. Install two clip-on locks on the upper position of the **FREE Advance.**
4. Move the clip-on locks outwards using a screwdriver.
5. Align the four clip-on locks in the **FREE Advance** with four holes in the panel.
6. Fix the **FREE Advance** with the screws.

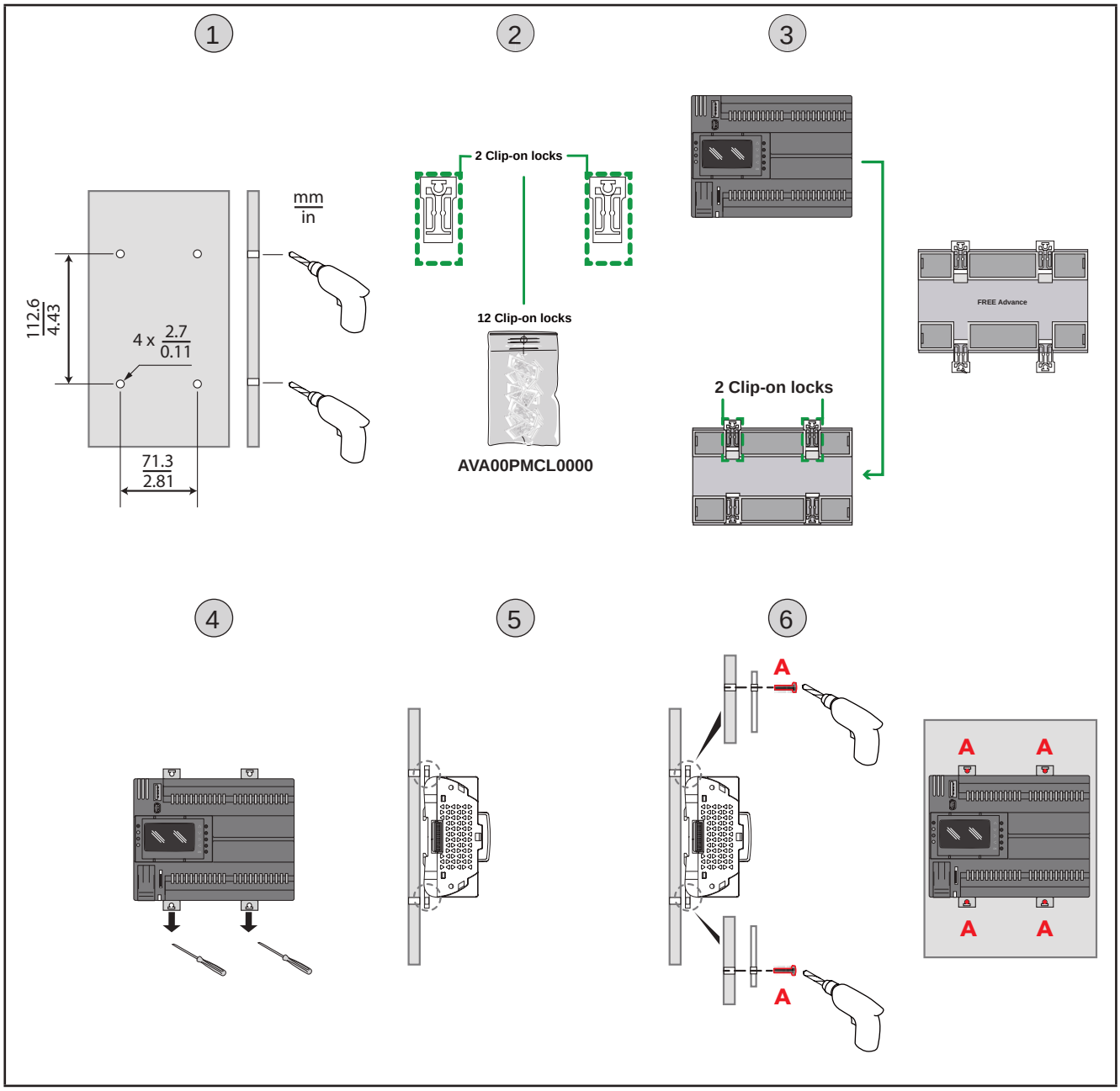


Fig. 8. FREE Advance panel mounting

2.8. Assembling the EVS Communication Modules

EVS Communication Modules are 2DIN modules that can be connected to an **FREE Advance** controller (see **Fig. 9 on page 25**) to increase the number and/or type of communication ports.

Before assembling **EVS** to **FREE Advance** controller, verify that cylindrical plastic cones are not present on the right side of the **EVS.**
On the contrary, in case you are using an older version of the product, remove only one cone on the upper-right side of **EVS** by using a pincers or a suitable tool.

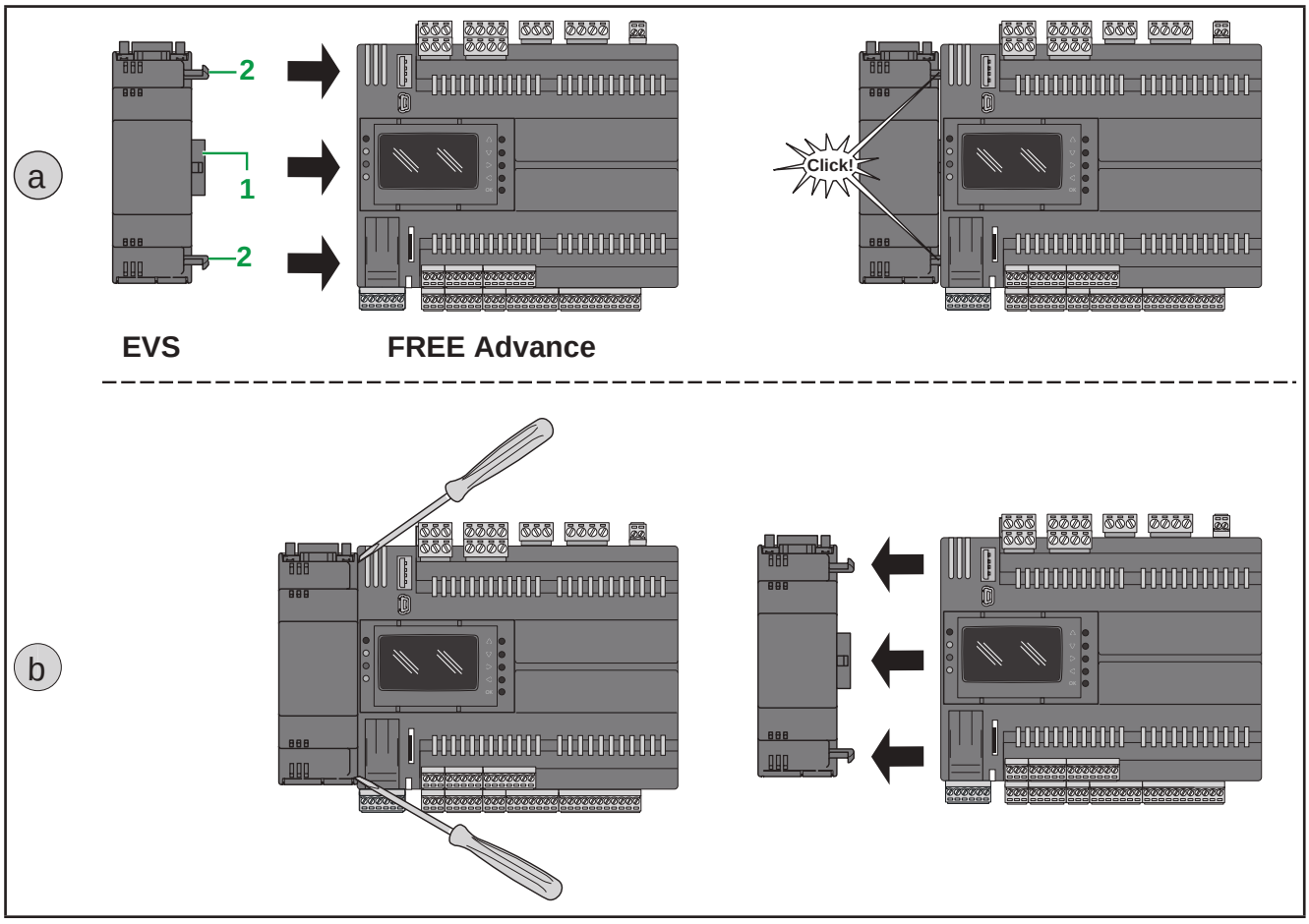


Fig. 9. Assembling (a) / Removing (b) the EVS Communication Modules

(a) To assemble **EVS** to **FREE Advance**, anchor **EVS** to the **FREE Advance** controller:

1. via the Communication Module connector (see 1 in **Fig. 9 on page 25**),
2. with the two fixing hooks (see 2 in **Fig. 9 on page 25**) to which the Communication Module is anchored.

(b) To remove **EVS** from **FREE Advance**, use a screwdriver to press the cylindrical plastic cones anchored to **FREE Advance** controller.

Follow the instructions below to install it on DIN rail:

1. Move the clip-on locks outwards (use a screwdriver).
2. Install **FREE Advance** with the **EVS** on the DIN rail.
3. Press the lower clip-on locks inwards.

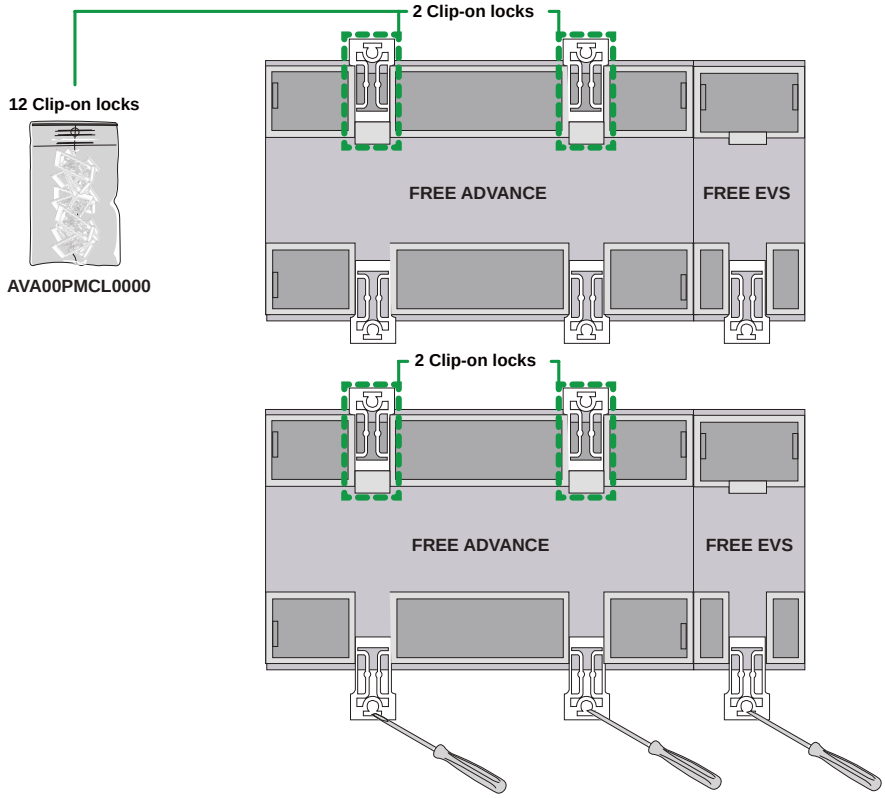


Fig. 10. Details of clip-on locks

Communication Modules Compatibility With FREE Advance

The following **EVS** Communication Modules can be connected to **FREE Advance** controllers:

FREE Evolution Communication Module	Description	Protocols
EVS CAN	**FREE Evolution** Communication Module CAN	1 x CAN - Daisy chain
EVS RS485	**FREE Evolution** Communication Module Modbus SL	Modbus Serial Line (SL)
EVS RS485 BACnet MS/TP	**FREE Evolution** Communication Module BACnet MSTP or Modbus	Modbus Serial Line or BACnet MS/TP
EVS RS232/R	**FREE Evolution** Communication Module RS232 with relay	RS232 ASCII - 1 Relay 5 A SPDT
EVS LON	**FREE Evolution** Communication Module LonWorks	LonWorks

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Verify all wiring connections before applying power.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Use only the listed compatible communication modules in association with the **FREE Advance** logic controller.

NOTE: The LonWorks communication module supports up to 63 nodes. Exceeding this specification may result in an electrical overload condition in the **EVS LON** Communication Module and consequently in the **FREE Advance logic controller**.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed the maximum of 63 nodes on the **EVS LON** Communication Module.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

For more information on the LonWorks network, visit www.echelon.com/technology/lonwork/

CHAPTER 3
Electrical connections

3.1. Wiring Best Practices

The following information describe the wiring guidelines and associated best practices to be respected when using the **FREE Advance logic controller**.

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Always use a properly rated voltage sensing device to confirm the power is removed.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.[1]
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS 7.1 (latest edition), “Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems” or their equivalent governing your particular location.

3.1.1. Wiring Guidelines

The following rules must be applied when wiring an **FREE Advance logic controller**:

- Make connections as short as possible and do not wind them around electrically connected parts.
- Verify that the operating conditions and environment are within the specification values.
- Use proper wire sizes to meet voltage and current requirements.
- Use copper conductors (required).

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use twisted pair, shielded cables for all fast I/O, analog I/O and communication signals [(1)].
- Ground cable shields for all analog I/O, fast I/O and communication signals at a single point [(1)(2)].
- Route communication and I/O cables separately from power cables.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

[(1)] If you do not use shielded cable for these connections, electromagnetic interference can cause signal degradation. Degraded signals can cause the controller or attached modules and equipment to perform in an unintended manner.

[(2)] Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short-circuit currents.

NOTE: Surface temperatures may exceed 60 °C. Route primary wiring (wires connected to power mains) separately and apart from secondary wiring (extra low voltage wiring coming from intervening power sources). If that is not possible, double insulation is required such as conduit or cable gains.

3.1.2. Rules for Removable Screw Terminals Block

The following table presents the cable types and wire sizes for a **3.50 pitch** removable screw terminals block:

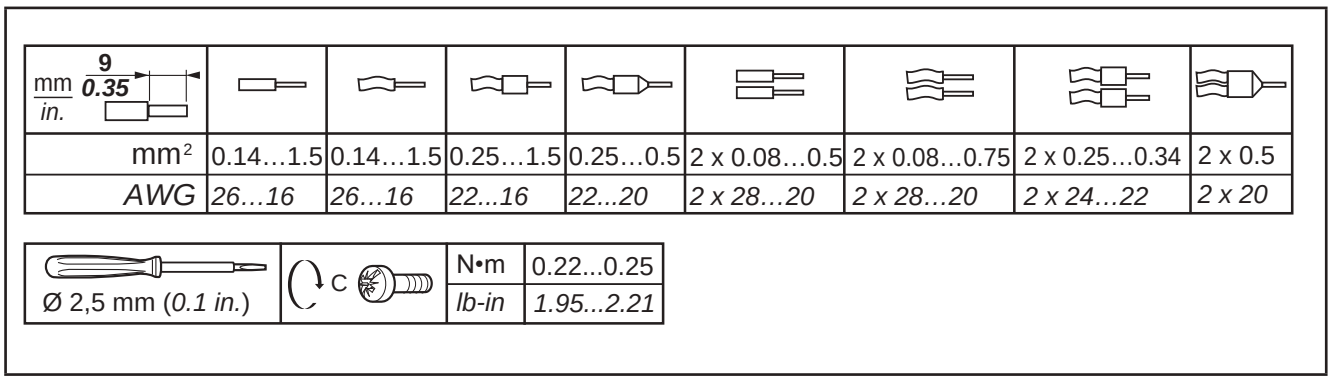


Fig. 11. Pitch 3.50 mm (0.14 in.)

The following table presents the cable types and wire sizes for a **5.08** or **5.00 pitch** removable screw terminals block:

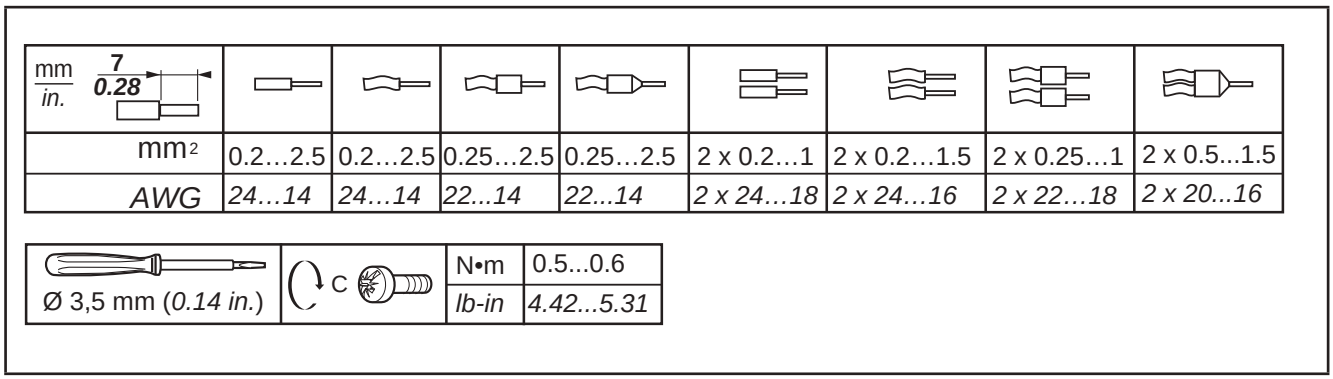


Fig. 12. Pitch 5.08 mm (0.20 in.) or 5.00 mm (0.197 in.)

⚠ ⚠ DANGER

LOOSE WIRING CAUSES ELECTRIC SHOCK

Tighten connections in conformance with the torque specifications.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

FIRE HAZARD

- Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.
- For 2 A - relay output wiring, use conductors with a cross section at least equal to 0.5 mm^2 (AWG 20) and a temperature rating at least equal to 80 °C (176 °F).
- For 3 A - relay output wiring, use conductors with a cross section at least equal to 1.5 mm^2 (AWG 16) and a temperature rating at least equal to 80 °C (176 °F).
- For common conductors of 8 A - relay output wiring, or greater than 3 A - relay output wiring, use conductors with a cross section at least equal to 2.0 mm^2 (AWG 12) and a temperature rating at least equal to 80 °C (176 °F).

Failure to follow these instructions will result in death or serious injury.

3.1.3. Protecting Outputs from Inductive Load Damage

If your controller or module contains relay outputs, these types of outputs can support up to ~250 V (~240 V if SSR). Inductive damage to these types of outputs can result in welded contacts and loss of control. Each inductive load must include a protection device such as a peak limiter, RC circuit or flyback diode. Capacitive loads are not supported by these relays.

⚠ WARNING

RELAY OUTPUTS WELDED CLOSED

- Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.
- Do not connect relay outputs to capacitive loads.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Depending on the load, a protection circuit may be needed for the outputs on the controllers and certain modules. Inductive loads using DC voltages may create voltage reflections resulting in overshoot that will damage or shorten the life of output devices.

⚠ CAUTION

OUTPUT CIRCUIT DAMAGE DUE TO INDUCTIVE LOADS

Use an appropriate external protective circuit or device to reduce the risk of inductive direct current load damage

Failure to follow these instructions can result in injury or equipment damage.

Choose a protection circuit from the following diagrams according to the power supply used. Connect the protection circuit to the outside of the controller or relay output module.

Protective circuit A: this protection circuit can be used for both AC and DC load power circuits.

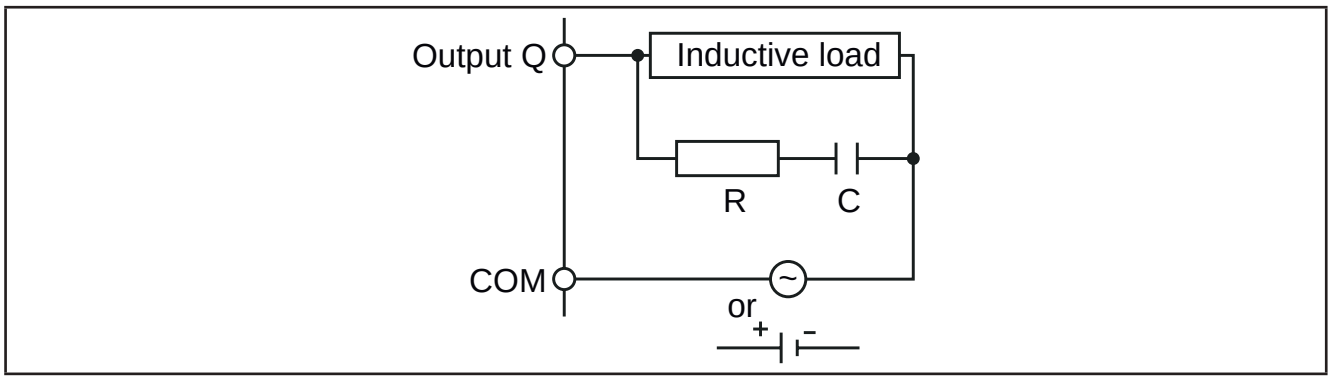


Fig. 13. Protective circuit A

Use:
- **A capacitor (C)** value from 0.1 to 1 µF.
- **A resistor (R)** of approximately the same resistance value as the load.

Protective circuit B: this protection circuit can be used for DC load power circuits.

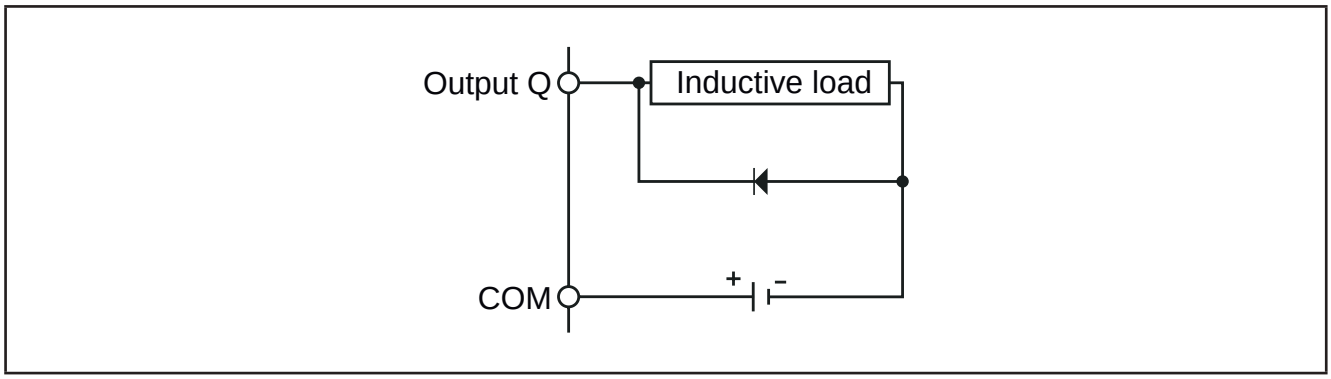


Fig. 14. Protective circuit B

Use a diode with the following ratings:
- Reverse withstand voltage: power voltage of the load circuit x 10.
- Forward current: more than the load current.

Protective circuit C: this protection circuit can be used for both AC and DC load power circuits.

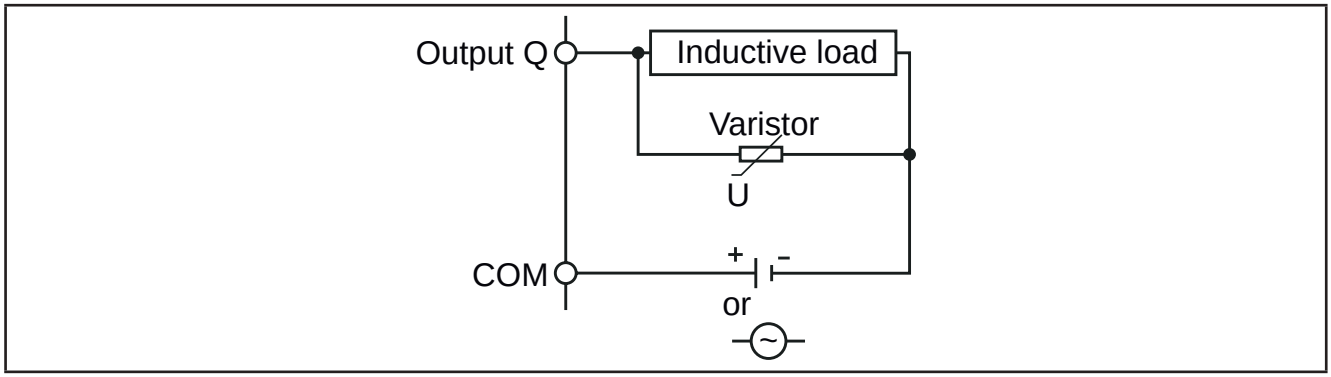


Fig. 15. Protective circuit C

Use a **varistor (U)**.

In applications where the inductive load is switched on and off frequently and/or rapidly, ensure that the continuous energy rating (J) of the varistor exceeds the peak load energy by 20 % or more.

NOTE: Place protection devices as close to the load as possible.

3.1.4. Special handling considerations

Care must be taken to avoid damage from electrostatic sources when handling this equipment. In particular exposed connectors and, in some cases, exposed printed circuit boards are vulnerable to electrostatic discharge.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION DUE TO ELECTROSTATIC DISCHARGE DAMAGE

- Keep equipment in the protective conductive packaging until you are ready to install the equipment.
- Only install equipment in approved enclosures and / or locations that prevent unauthorized access and provide electrostatic discharge protection as defined by IEC 1000-4-2.
- Use a conductive wrist strap or equivalent field force protective device attached to an earth ground when handling sensitive equipment.
- Always discharge yourself by touching a grounded surface or approved antistatic mat before handling the equipment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

3.1.5. Analog Inputs-Probes

Temperature probes have no connection polarity and can be extended using a normal bipolar cable.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION DUE TO CONNECTION

- Apply power to all externally powered devices after applying power to the **FREE Advance logic controllers**.
- Signal leads (probes, digital inputs, communication and the electronic supply) must be routed separately from power cables.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTICE

INOPERABLE EQUIPMENT

Verify all wiring connections before applying power.

Failure to follow these instructions can result in equipment damage.

NOTE: The extension of the probes influences the electromagnetic compatibility (EMC) of the equipment.

NOTE: Connection polarity must be correctly respected for probes which need a specific polarity.

3.1.6. Serial connections

The **FREE Advance logic controller** has the following on-board communication ports:

- CAN Expansion Bus
- 2 x RS 485
- Ethernet
- USB (Type A)
- USB (Type mini-B)

Pay special attention when connecting serial lines. Miswiring may lead to inoperable equipment.

NOTICE

INOPERABLE EQUIPMENT

- Do not connect equipments that communicate using RS 485 serial to CAN Expansion Bus terminals.
- Do not connect equipments that communicate using CAN Expansion Bus to RS 485 terminals.

Failure to follow these instructions can result in equipment damage.

EVS Communication Modules provide additional serial ports for integration with industrial systems and BMS.
FREE Advance logic controller serials are defined as “on-board” (OB) whereas serials on **EVS** are referred to as Communication Modules (PI, stands for "Plug In").

CAN Expansion Bus

- Use a shielded and "**twisted pair**" cable with two 0.5 mm^2 section conductors (AWG 22), plus braid such as Belden cable reference 3105A (characteristic impedance 120 Ω) with PVC sleeve, nominal capacity between conductors 36 pF/m, nominal capacity between conductor and shielding 68 pF/m.
- Always follow regulations applicable to the routing and connection of cables. Make certain that data transmission circuits are properly separated from power lines.
- For connections over longer distances, it is better to end the line with resistors on both ends, inserting the two **R TERM** jumpers (available on the terminal strip next to the CAN Expansion Bus as the default configuration).
- The maximum distance depends on the baud setting (see the following table).

Kb/s (kbaud)	On-board CAN (m) - FREE Advance	CAN Communication Module (m)
50	1000	1000
125	500	500
250	200	250
500	30	60

- CAN Expansion Bus is used to communicate with **FREE Evolution Display Graphic** (**EVK1000**) terminal and **FREE Evolution Expansion** terminal.

RS 485

- Use a shielded and "**twisted pair**" cable with two 0.5 mm^2 section conductors (AWG 22), plus braid such as Belden cable reference 3105A (characteristic impedance 120 Ω) with PVC sleeve, nominal capacity between conductors 36 pF/m, nominal capacity between conductor and shielding 68 pF/m. Alternatively use a shielded and "**twisted pair**" cable with two 0.5 mm^2 section conductors (AWG 20), plus braid such as Belden cable reference 8762 with PVC sleeve, nominal capacity between conductors 89 pF/m, nominal capacity between conductor and shielding 161 pF/m. See EN 50174 standard on IT cabling for indications on how cables should be routed.
- Always follow regulations applicable to the routing and connection of cables. Make certain that data transmission circuits are properly separated from power lines.
- RS 485 network up to 1200 m in length with a maximum of 32(1) devices can be connected directly to the controller.

  (1) Example of **FREE Advance** Modbus Slave with single Master supervisor.
  This length can be extended and the number of devices for each channel increased using appropriate repeater modules.
- Single terminal strip with 3 conductors: use all 3 conductors (“+”, “-“ for the signal and “GND” for the braid).
- Attach the 120 Ω 1/4 W resistors between the "+" and "-" terminals of the interface and the last controller in each branch of the network.
- Maximum settable speed 115200 baud.
- RS 485 physical layer can be used for Modbus SL, as well as for BACnet MS/TP communication.
  Concurrent communication of different protocols on the same serial port is **NOT** allowed.

Pay special attention when connecting serial lines. Miswiring may lead to inoperable equipment.

NOTICE

INOPERABLE EQUIPMENT
Do not communicate through Modbus SL and BACnet MS/TP concurrently on the same serial port.
Failure to follow these instructions can result in equipment damage.

Ethernet

The Ethernet connection allows the **FREE Advance** to communicate on an Ethernet network using TCP/IP protocol.
The connection allows:

- connection of different controllers and/or applications exchanging variables and/or parameters (network).
- connection of a supervision system using Modbus TCP protocol.
- connection of an IEC 61131-3 **FREE Studio** (**v3.5 or greater**) development system.
- connection on device on a BACnet/TCP network, with B-AAC profile

Concurrent communication of different protocols using the same Ethernet port is allowed.

The Ethernet connector shield is internally connected to the earth of the equipment and therefore to the reference of the input and output channels.

NOTE: This information concerns the embedded Ethernet port only. Use only the listed compatible communication modules in association with the **FREE Advance** logic controller.

For further information, refer to **4.6.2. Ethernet port on page 65**.

USB

There are 2 USB connectors placed on the upper-left side of the controller (in the front view) (see **Fig. 37 on page 64**).

- USB Type A is a connector for USB memory key.
- USB Type mini-B is used for programming purposes.

For further information, refer to **4.6.1. USB ports on page 64**.

3.2. Connectors

The **FREE Advance** (**Fig. 3 on page 14**) offer is made of:

- **FREE Advance AVC-AVD8400 (28 I/Os)**, made up of a "Base board" internally;
- **FREE Advance AVC-AVD12600 (42 I/Os)**, made up of a "Base board" and a "Upper board" internally.

For the connectors available on the "Base board", refer to **3.2.1. FREE Advance Base board connectors on page 35**.
For the connectors available on the "Upper board", refer to **3.2.2. FREE Advance Upper board connectors on page 36**.
I/Os and ports labels are marked onto the **FREE Advance** case (see **Fig. 16 on page 35** and **Fig. 17 on page 36**).

3.2.1. FREE Advance Base board connectors

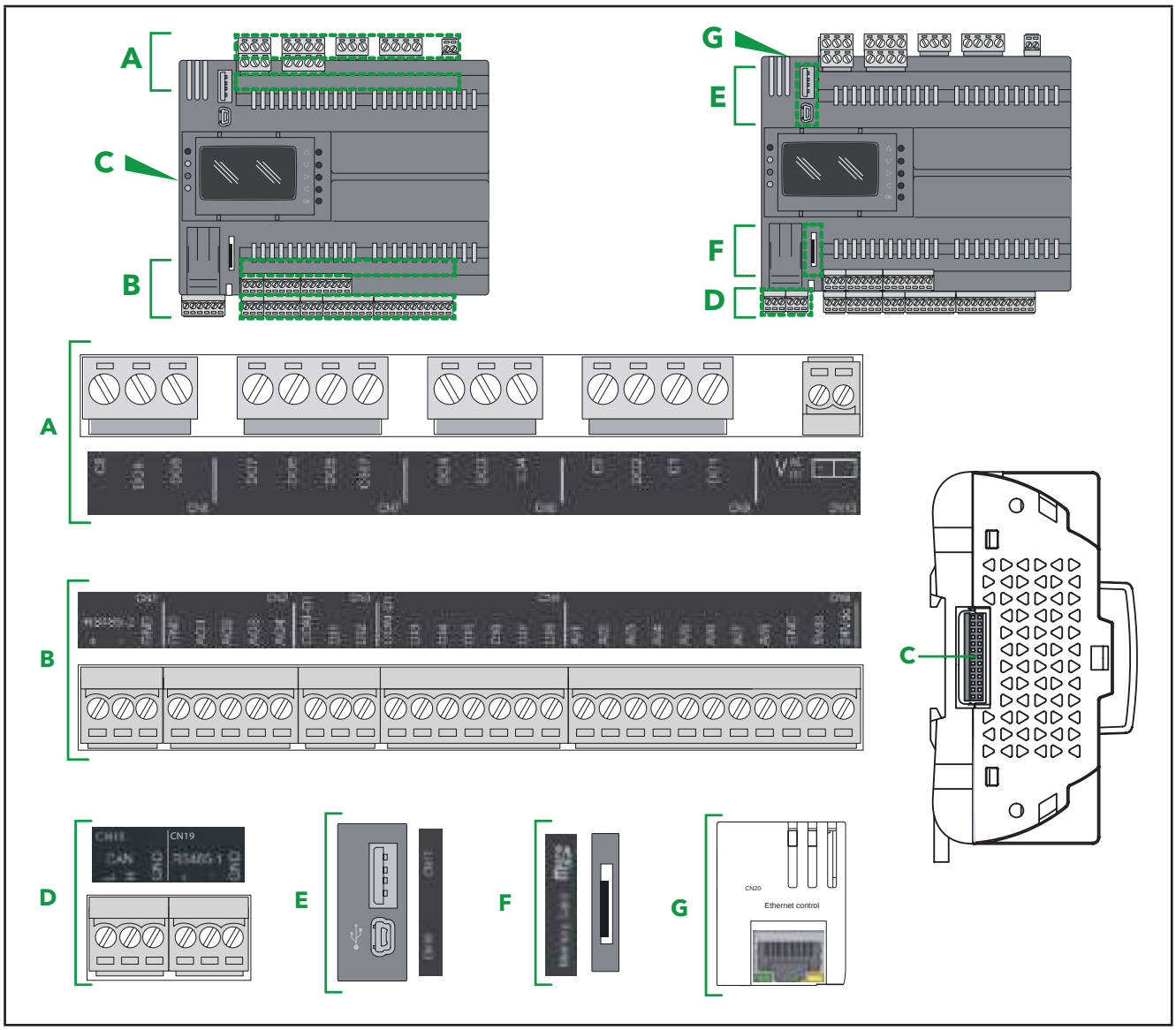


Fig. 16. FREE Advance Base board connectors

3.2.2. FREE Advance Upper board connectors

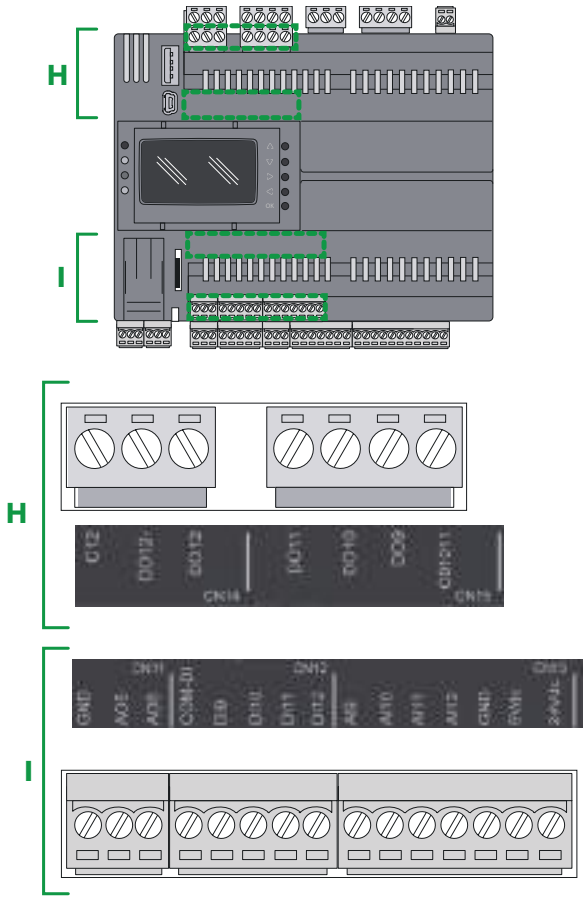


Fig. 17. FREE Advance Upper board connectors

3.3. FREE Advance wiring diagrams

Miswiring irreversibly damages the **FREE Advance** .

For **FREE Advance AVC-AVD8400 (28 I/Os)** wiring diagram, refer to **3.3.1. Wiring diagram of the Base board screw terminals on page 37**.
FREE Advance AVC-AVD12600 (42 I/Os) wiring diagram is composed to the **FREE Advance AVC-AVD8400 (28 I/Os)** wiring diagram and the wiring diagram described to **3.3.2. Wiring diagram of the Upper board screw terminals on page 38.**

NOTICE
INOPERABLE EQUIPMENT Verify all wiring connections before applying power. **Failure to follow these instructions can result in equipment damage.**

3.3.1. Wiring diagram of the Base board screw terminals

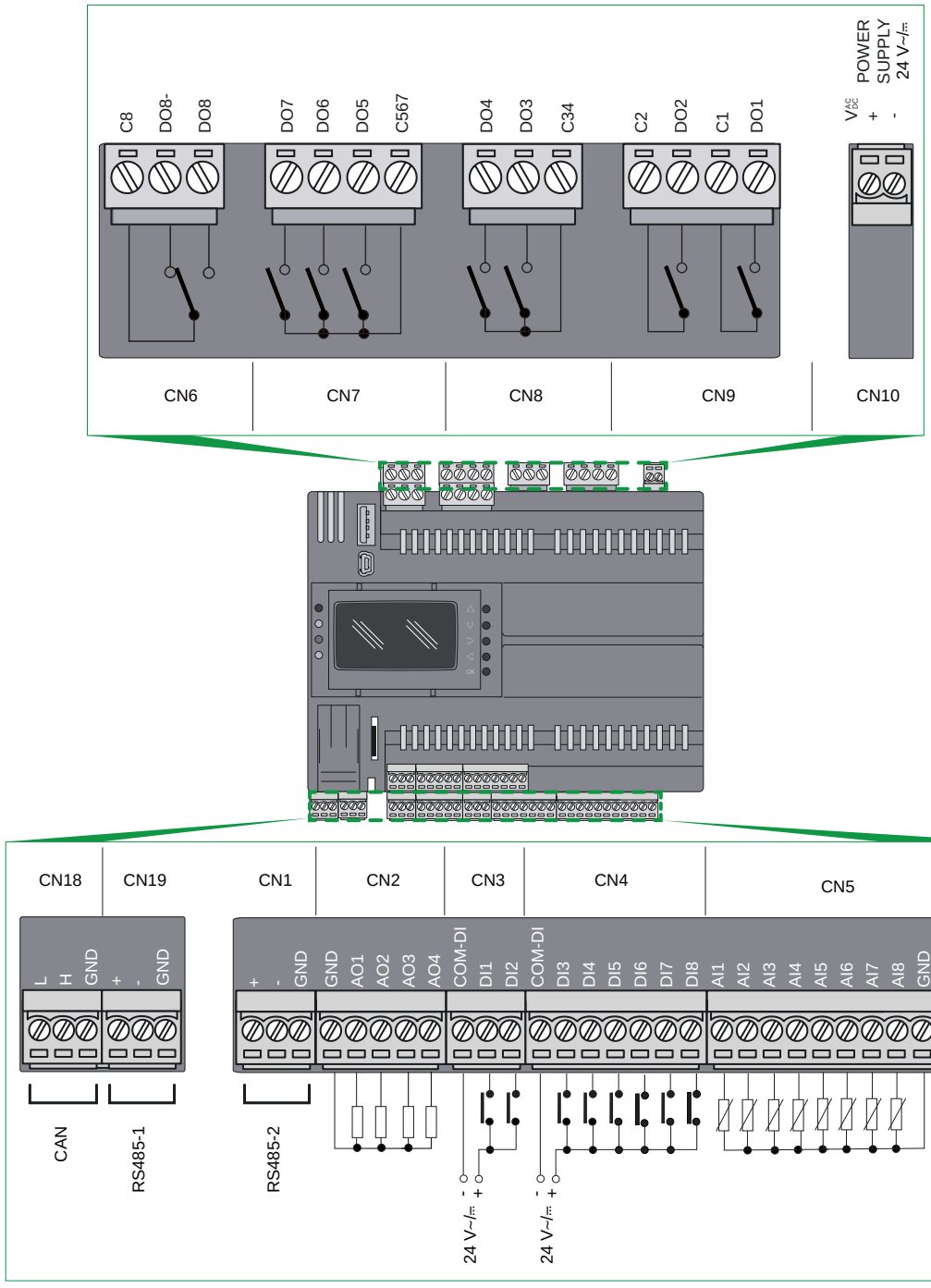


Fig. 18. Wiring diagram of the Base board screw terminals

For further information, see **CHAPTER 4 Technical data on page 58**.

3.3.2. Wiring diagram of the Upper board screw terminals

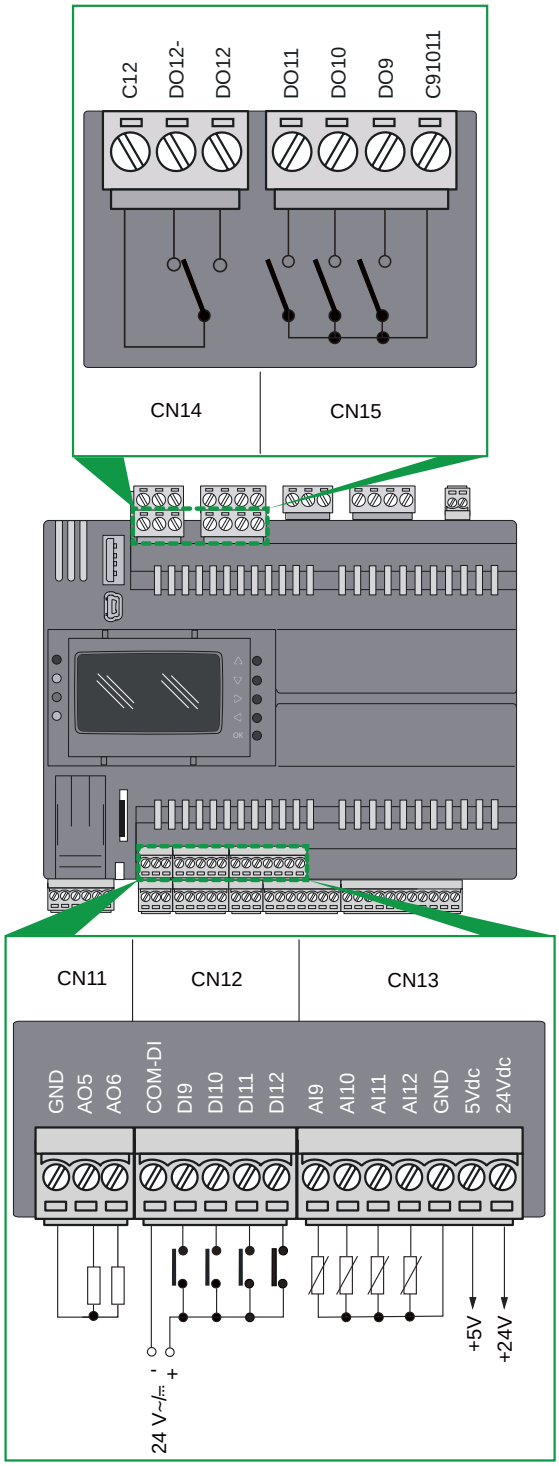


Fig. 19. Wiring diagram of the Upper board screw terminals

For further information, see **CHAPTER 4 Technical data on page 58**.

Connector Labels Related To The Base Board Screw Terminals

The following screw terminals can be founded in the **FREE Advance** AVC-AVD8400 (28 I/Os) and in the Base Board of the **FREE Advance** AVC-AVD12600 (42 I/Os).

	Connector	Label	Description
POWER SUPPLY	**CN10**	**V AC DC**	+24 Vac/dc power supply **FREE Advance** have a specific connection polarity for DC power supply, which must be observed.
POWER OUT	**CN5**	**24Vdc**	+24 Vdc power out for analog inputs, max current 150 mA ([1])
		5Vdc	+5 Vdc power out for ratiometric analog inputs, max current 50 mA ([2])
CAN	**CN18**	**H**	"High" signal for CAN Expansion Bus
		L	"Low" signal for CAN Expansion Bus
		GND	0 V signal ground
RS 485-1	**CN19**	**+**	"+" signal for RS 485-1 serial port
		-	"-" signal for RS 485-1 serial port
		GND	0 V signal ground
RS 485-2	**CN1**	**+**	"+" signal for RS 485-2 serial port
		-	"-" signal for RS 485-2 serial port
		GND	0 V signal ground
FAST DIGITAL INPUTS	**CN3**	**DI1, DI2**	Fast digital inputs 1, 2 (Pulse/frequency counter up to 2 kHz)
		COM-DI	Common for digital inputs 1, 2
REGULAR DIGITAL INPUTS	**CN4**	**DI3, DI4, DI5, DI6, DI7, DI8**	Regular digital inputs 3, 4, 5, 6, 7, 8
		COM-DI	Common for digital inputs 3, 4, 5, 6, 7, 8
DIGITAL OUTPUTS	**CN9**	**DO1**	Output relay 1 SPST (for **AVD8400-12600/C/L/U/SSR** this output is a SSR)
		C1	Common for output relay 1
		DO2	Output relay 2 SPST (for **AVD8400-12600/C/L/U/SSR** this output is a SSR)
		C2	Common for output relay 2
	CN8	**DO3, DO4**	Output relay 3, 4 SPST
		C34	Common for output relays 3, 4
	CN7	**DO5, DO6, DO7**	Output relay 5, 6, 7 SPST
		C567	Common for output relays 5, 6, 7
	CN6	**DO8, DO8-**	SPDT Relay 8: DO8 is the normally open side DO8- is the normally closed side
		C8	Common for output relay 8
ANALOG INPUTS	**CN5**	**AI1, AI2, AI3, AI4, AI5, AI6, AI7, AI8**	Analog inputs 1, 2, 3, 4, 5, 6, 7, 8 or voltage-free digital inputs
		GND	0 V signal ground
ANALOG OUTPUTS	**CN2**	**AO1, AO2,**	Analog outputs 1, 2
		AO3, AO4	Analog outputs 3, 4 or open collector PWM outputs
		GND	0 V signal ground

([1]) 150 mA is the sum between the max currents supplied from the different "+24 Vdc" terminals (the "24 Vdc" terminal in the CN5 connector and the "+24 Vdc" terminal in the CN13 connector, if device is **AVC-AVD12600/C/L/U(/SSR)**).
([2]) 50 mA is the sum between the different "+5 Vdc" terminals max current ("+5 Vdc" terminal in the CN5 connector and "5Vdc" terminal in the CN13 connector, if device is **AVC-AVD12600/C/L/U(/SSR)**).

The COM-DI terminals are not internally connected to one another. However, the terminals marked GND are internally connected to one another.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Be sure to connect each COM-DI independently to the reference voltage for the group of inputs on its connector.
- Do not rely on the disconnection of any one GND marked terminal in order to interrupt the circuit of any device on its connector.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Connector Labels Related To The Upper Board Screw Terminals

The following screw terminals can be founded in the Upper Board of the **FREE Advance** AVC-AVD12600 (42 I/Os).

	Connector	Label	Description
POWER OUT	**CN13**	**24Vdc**	+24 Vdc power out for analog inputs, max current 150 mA ([1])
		5Vdc	+5 Vdc power out for ratiometric analog inputs, max current 50 mA ([2])
DIGITAL INPUTS	**CN12**	**DI9, DI10, DI11, DI12**	Digital inputs 9, 10, 11, 12
		COM-DI	Common for digital inputs 9, 10, 11, 12
DIGITAL OUTPUTS	**CN15**	**DO9, DO10, DO11**	Output relays 9, 10, 11 SPST
		C91011	Common for output relays 9, 10, 11
	CN14	**DO12, DO12-**	SPDT Relay 12: DO12 is the normally open side DO12- is the normally closed side
		C12	Common for output relay 12
ANALOG INPUTS	**CN13**	**AI9, AI10, AI11, AI12**	Analog inputs 9, 10, 11, 12
		GND	0 V signal ground
ANALOG OUTPUTS	**CN11**	**AO5, AO6**	Analog outputs 5, 6
		GND	0 V signal ground

([1]) 150 mA is the sum between the max currents supplied by the different "+24 Vdc" terminals (the "+24 Vdc" terminal in the CN5 connector and the "+24 Vdc" terminal in the CN13 connector, if device is **AVC-AVD12600/C/L/U(/SSR)**).
([2]) 50 mA is the sum between the max currents supplied by the different "+5 Vdc" terminals ("+5 Vdc" terminal in the CN5 connector and "+5 Vdc" terminal in the CN13 connector, if device is **AVC-AVD12600/C/L/U(/SSR)**).

The COM-DI terminals are not internally connected to one another. However, the terminals marked GND are internally connected to one another.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Be sure to connect each COM-DI independently to the reference voltage for the group of inputs on its connector.
- Do not rely on the disconnection of any one GND marked terminal in order to interrupt the circuit of any device on its connector.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

3.3.3. Examples of analog input connection

Analog inputs can be configured through parameters as described in **CHAPTER 6 Physical I/O and serial ports configuration on page 74.**

NTC/PT1000 Probe Connection

Parameter	Value
Cfg_AI1	0 (if NK103) or 2 (if 103AT)
Cfg_AI2	0 (if NK103) or 2 (if 103AT)
Cfg_AI3	0 (if NK103) or 2 (if 103AT)
Cfg_AI4	0 (if NK103) or 2 (if 103AT)
Cfg_AI5	6
Cfg_AI6	6
Cfg_AI7	9
Cfg_AI8	9

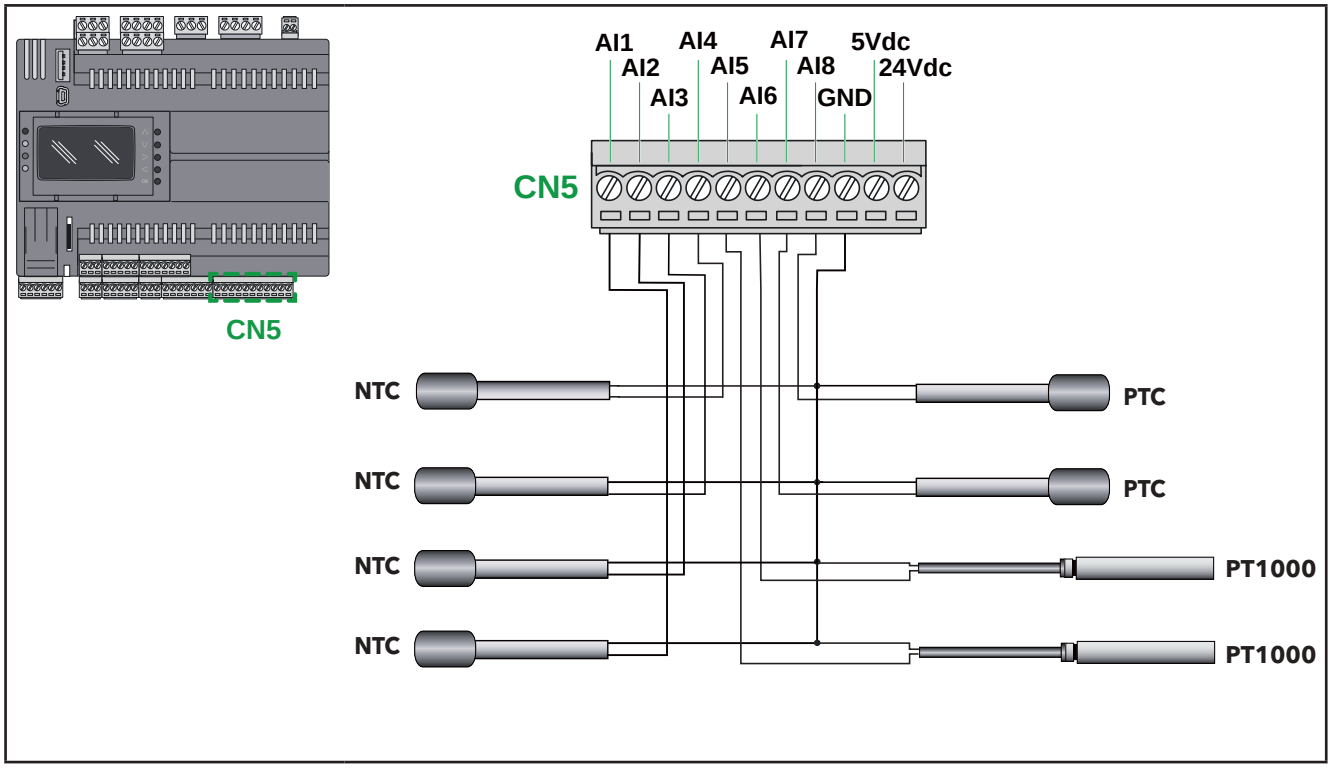


Fig. 20. NTC/PT1000 probe connection

0-10 V Transducer Connection

Parameter	Value
Cfg_AI1	4
Cfg_AI2	4
Cfg_AI3	4
Cfg_AI4	4
Cfg_AI5	4
Cfg_AI6	4
Cfg_AI7	4
Cfg_AI8	4

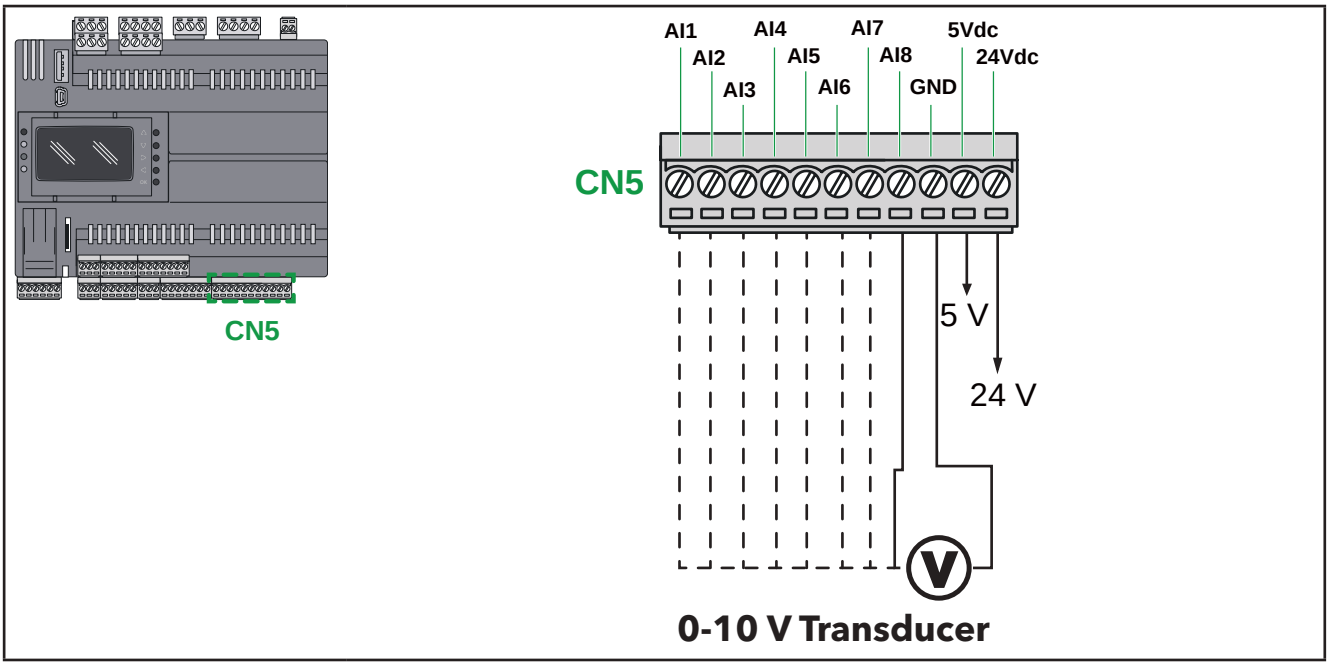


Fig. 21. 0-10 V transducer connection

0/4...20 mA Pressure Transducer Connection

Parameter	Value
Cfg_AI4	11
Cfg_AI5	11
Cfg_AI6	11
Cfg_AI7	3
Cfg_AI8	3

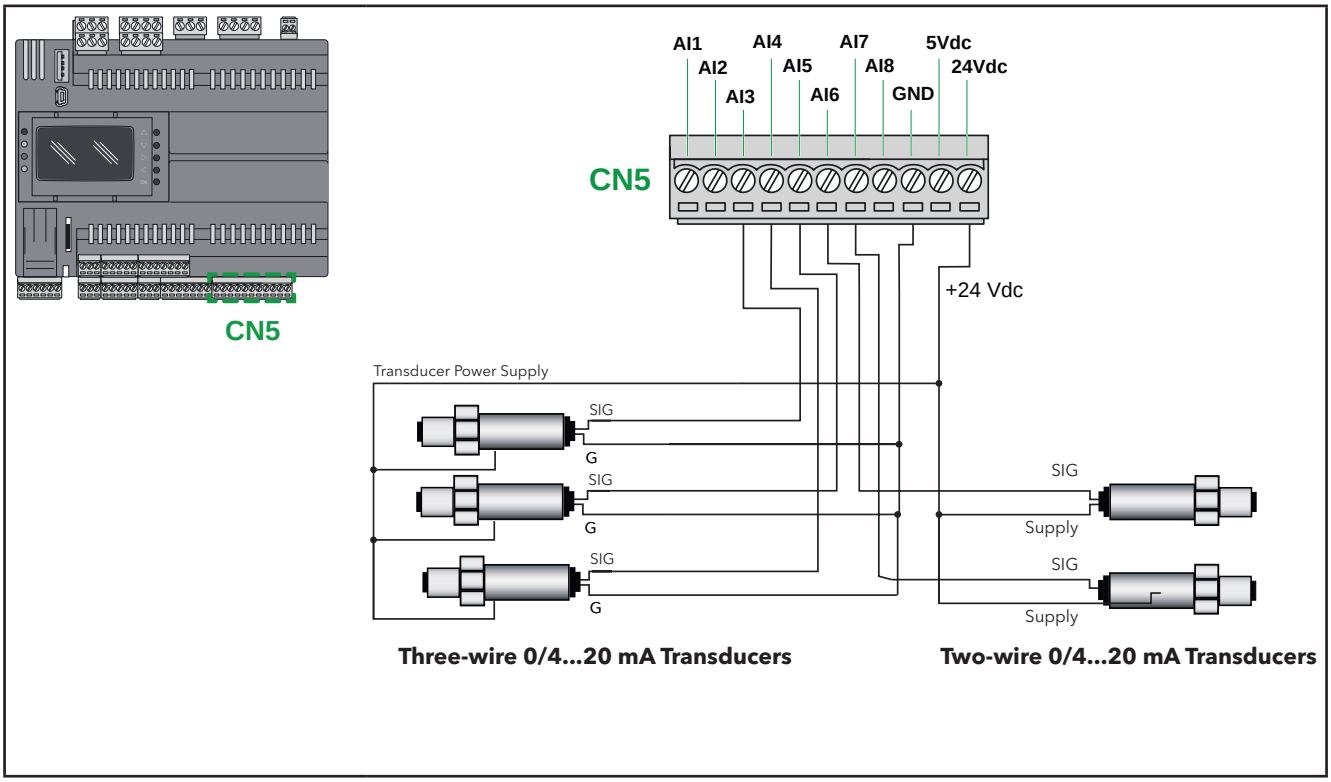
In the case of a generic 3-wire transducer, connect the 0 V reference wire (ground if so indicated by the transducer manufacturer) to terminal GND and the transducer power supply to **24 Vdc** screw terminal.

NOTICE

INOPERABLE EQUIPMENT

Verify all wiring connections before applying power.

Failure to follow these instructions can result in equipment damage.

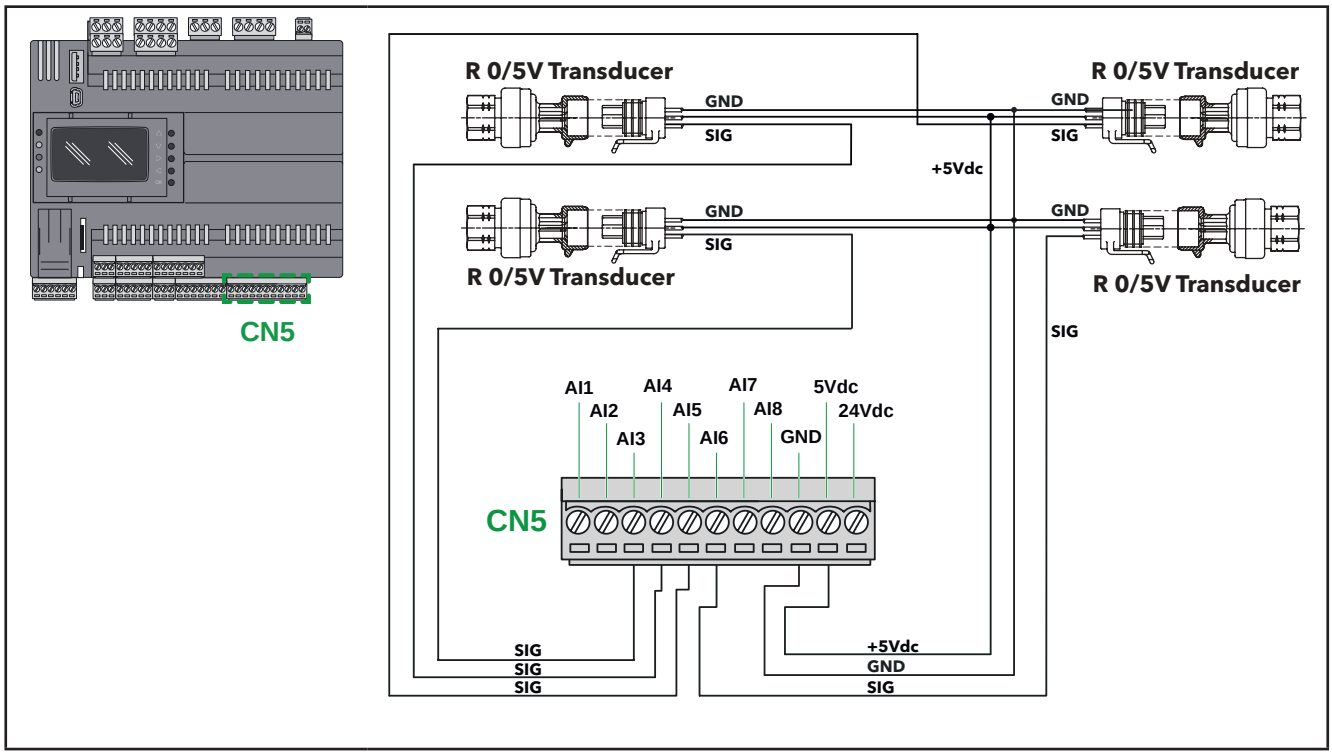


FREE Advance	Three-wire transducer	Two-wire transducer
GND	G	-
AI4, AI5, AI6, AI7, AI8	SIG	SIG
24Vdc	Transducer Power Supply	Supply

Fig. 22. 0/4...20 mA pressure transducer connection

Ratiometric Transducer Connection

Parameter	Value
Cfg_AI3	5
Cfg_AI4	5
Cfg_AI5	5
Cfg_AI6	5



FREE Advance	R 0/5 V transducer
GND	GND
AI3 AI4 AI5 AI6	SIG
5Vdc	+5 Vdc

Fig. 23. Ratiometric transducer connection

Digital Input Connection (through analog input terminal)

Parameter	Value
Cfg_AI1	1
Cfg_AI2	1
Cfg_AI3	1
Cfg_AI4	1
Cfg_AI5	1
Cfg_AI6	1
Cfg_AI7	1
Cfg_AI8	1

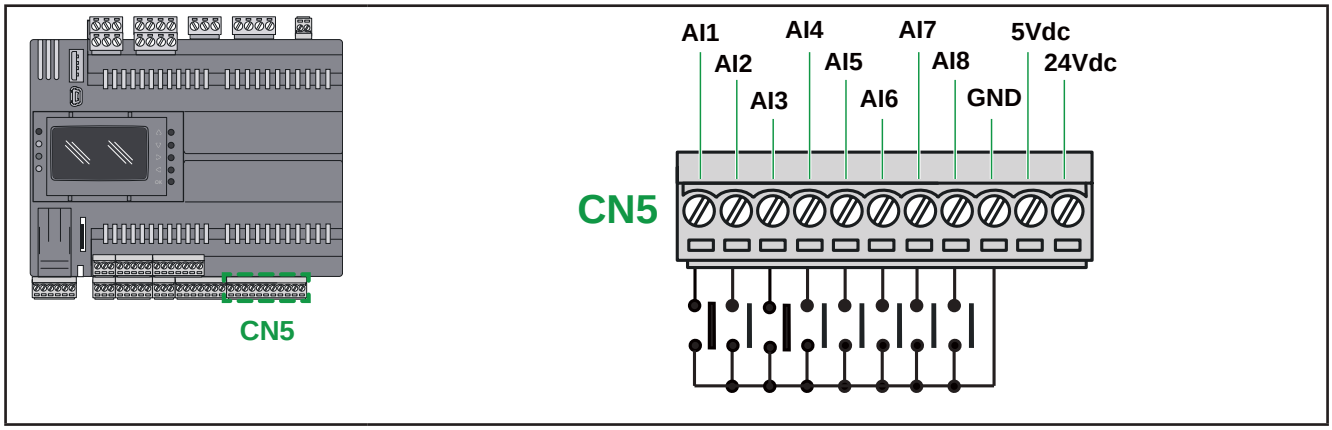


Fig. 24. Digital input connection (through analog input terminal)

3.3.4. Examples of Analog Output Connection

Voltage / Current Connection

Parameter	Value
Cfg_AO3	2
Cfg_AO4	2

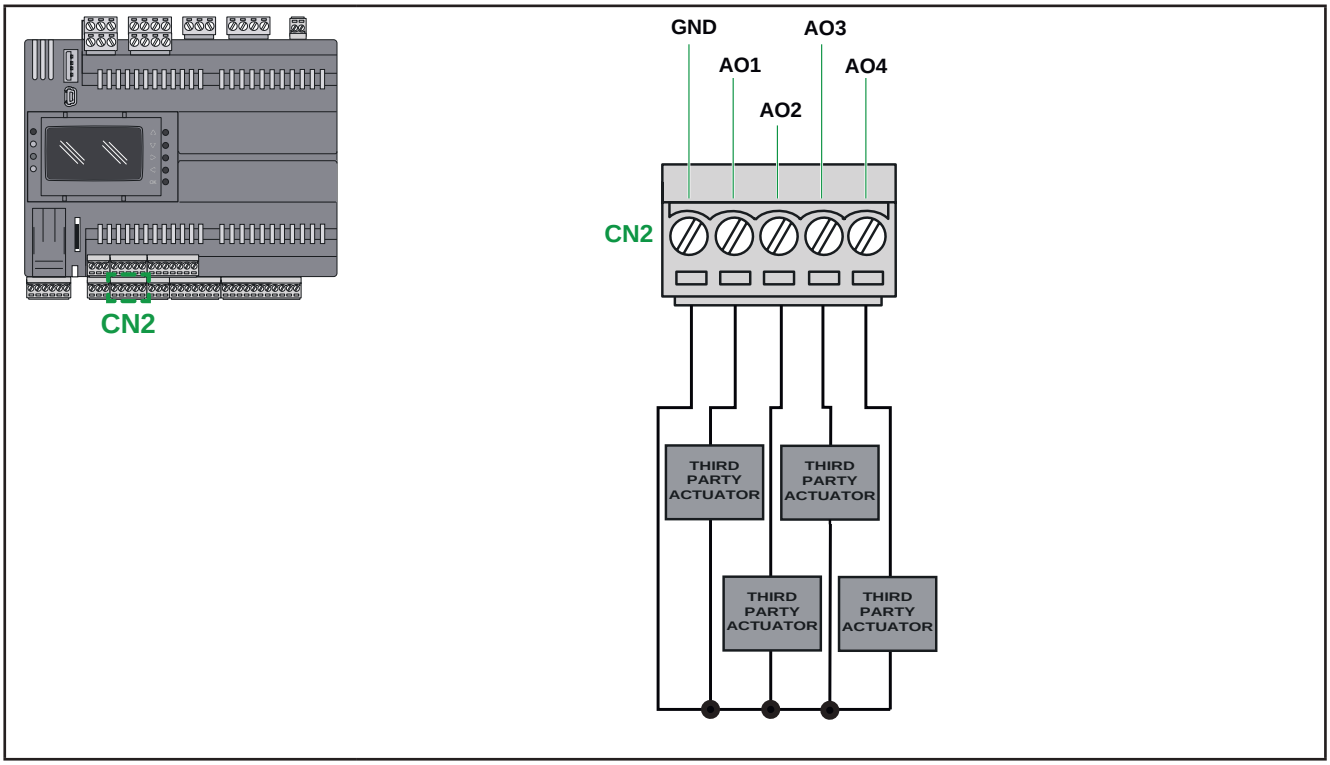


Fig. 25. Voltage / current connection

External Relay Connection

Parameter	Value
Cfg_AO3	3
Cfg_AO4	3

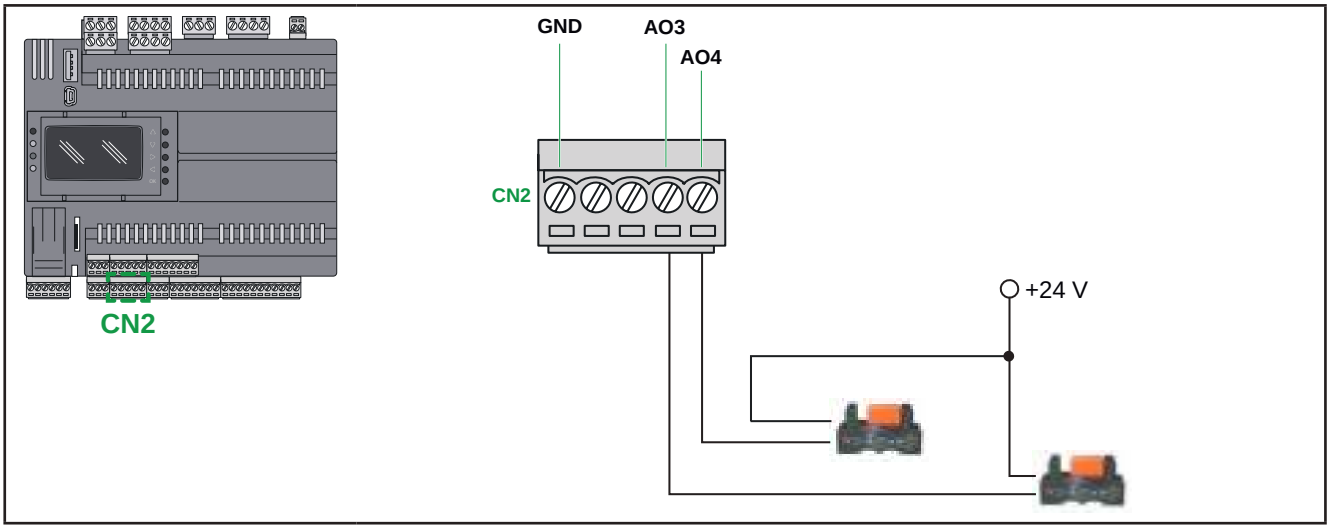


Fig. 26. External relay connection

3.4. FREE Advance protocol connectivity

In this section the examples shows **FREE Advance** AVC-AVD12600 (42 I/Os) devices; the examples with **FREE Advance** AVC-AVD8400 (28 I/Os) devices are the same.

3.4.1. Example: CAN Expansion Bus (Field) network connection

A CAN Expansion Bus (Field) network connection can be constituted by:

- Max 1 **FREE Advance AVD12600/C/L/U(/SSR)** functioning as MASTER
- Max 12 **FREE Evolution EVE** functioning as SLAVES
- No more than two **FREE Evolution Display Graphic** (**EVK1000**) can be added to the network connected to **FREE Advance AVD12600/C/L/U(/SSR)**

The **FREE Evolution Display Graphic** (**EVK1000**) is supplied externally.

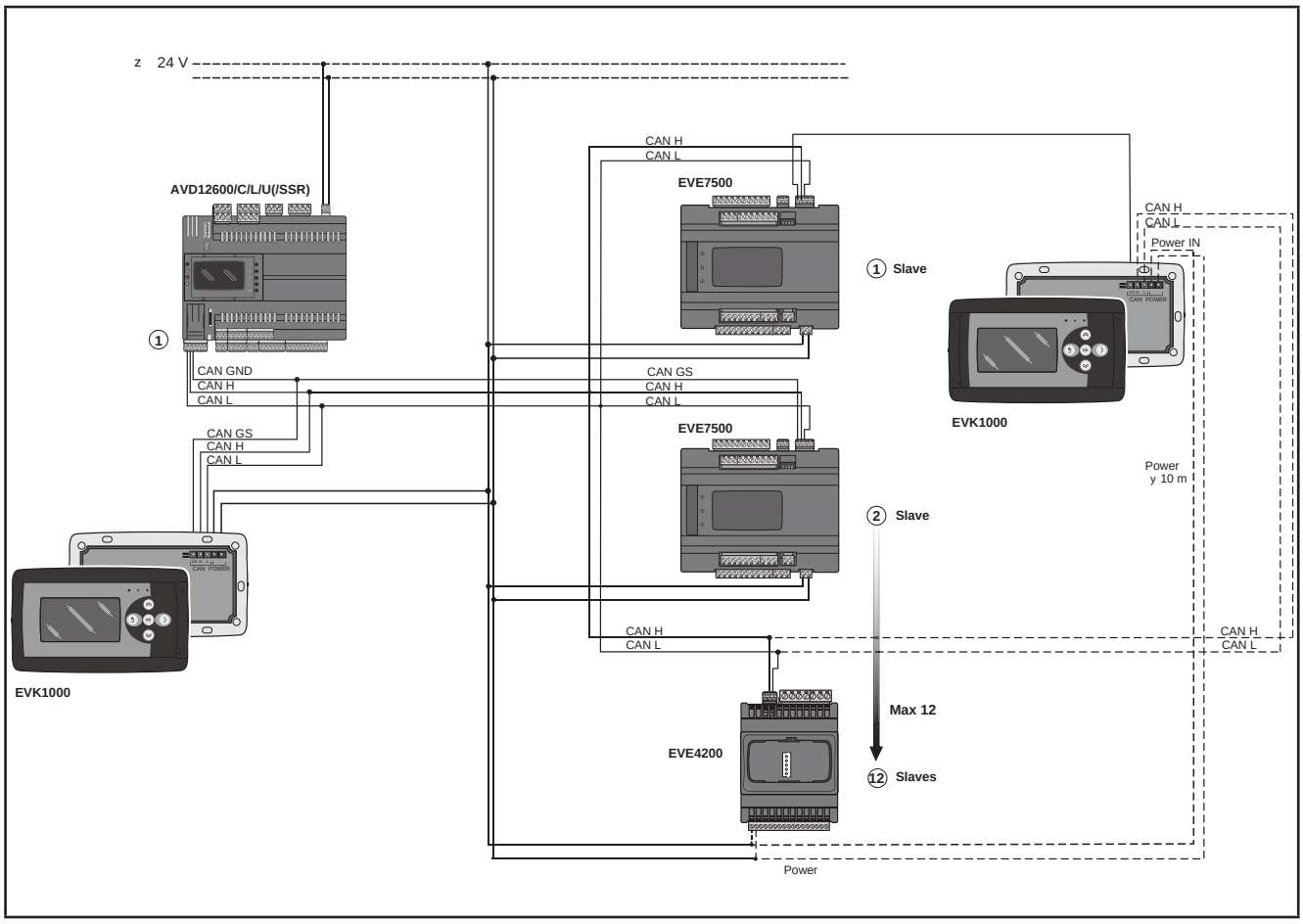


Fig. 27. CAN Expansion Bus (Field) network connection using FREE Advance

3.4.2. Example: CAN Expansion Bus connection (Network)

A CAN Expansion Bus connection (Network) can be constituted by:

- 1 **FREE Advance AVD12600/C/L/U(/SSR)**
- Max 10 **FREE Advance AVC12600/C/L/U** connected in CAN Expansion Bus binding [1]
- 1 **FREE Evolution Display Graphic** (**EVK1000**) connected in CAN Expansion Bus to **FREE Advance AVC-AVD12600/C/L/U(/SSR)**

[1] For more details on binding functionalities, refer to **FREE Studio** (**v.3.5 or greater**) software, Programming Guide.

The **FREE Evolution Display Graphic** (**EVK1000**) is supplied externally.

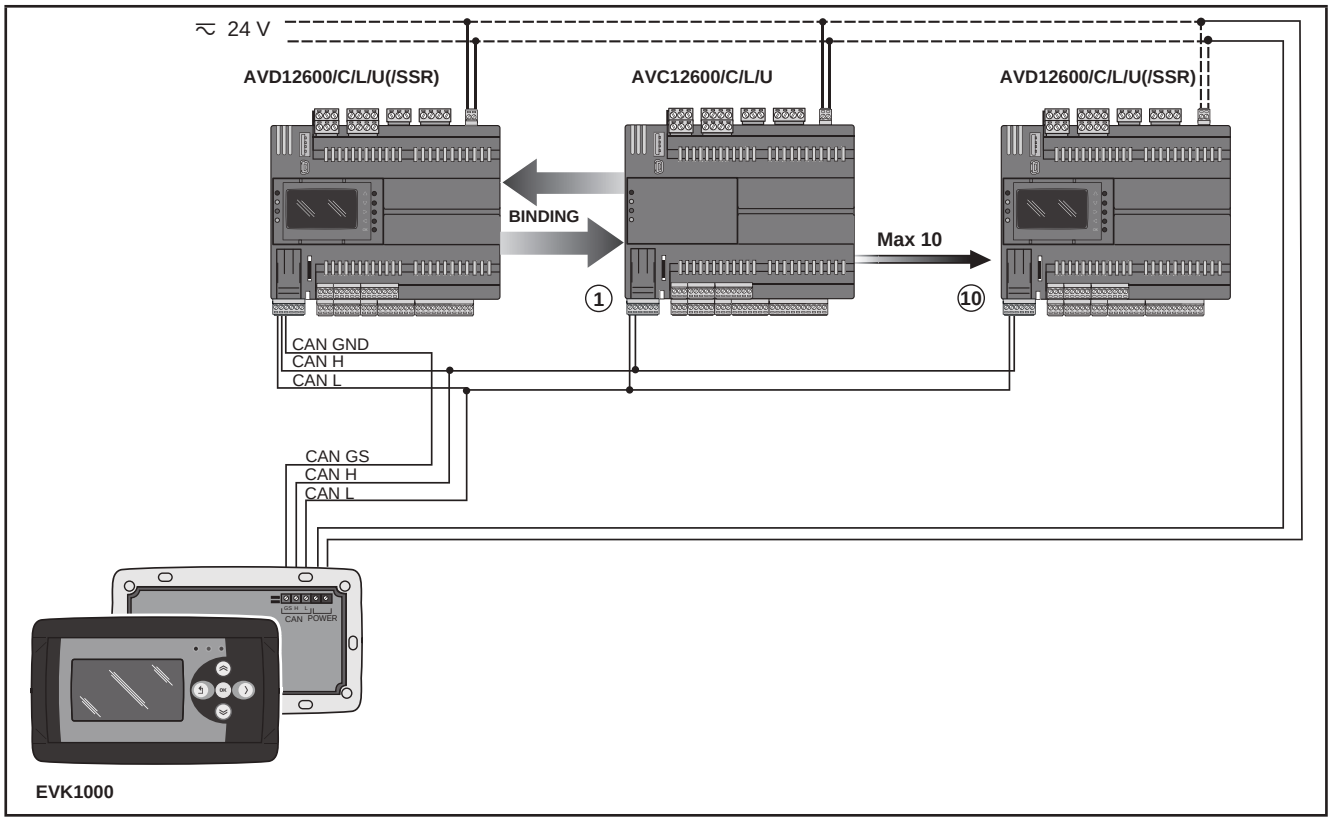


Fig. 28. CAN Expansion Bus connection (Network) using FREE Advance

3.4.3. Example: RS 485 connection (Field)

A RS 485 connection (Field) can be constituted by:

Description	Notes
1 **FREE Advance AVD12600/C/L/U(/SSR)**	**AVD12600/C/L/U(/SSR)** is in Modbus RTU Master mode
	Max 32 modules connected in RS 485
1 **FREE Evolution Display Graphic** (**EVK1000**) connected in CAN Expansion Bus to **FREE Advance AVD12600/C/L/U(/SSR)**	-

The **FREE Evolution Display Graphic** (**EVK1000**) is supplied externally.

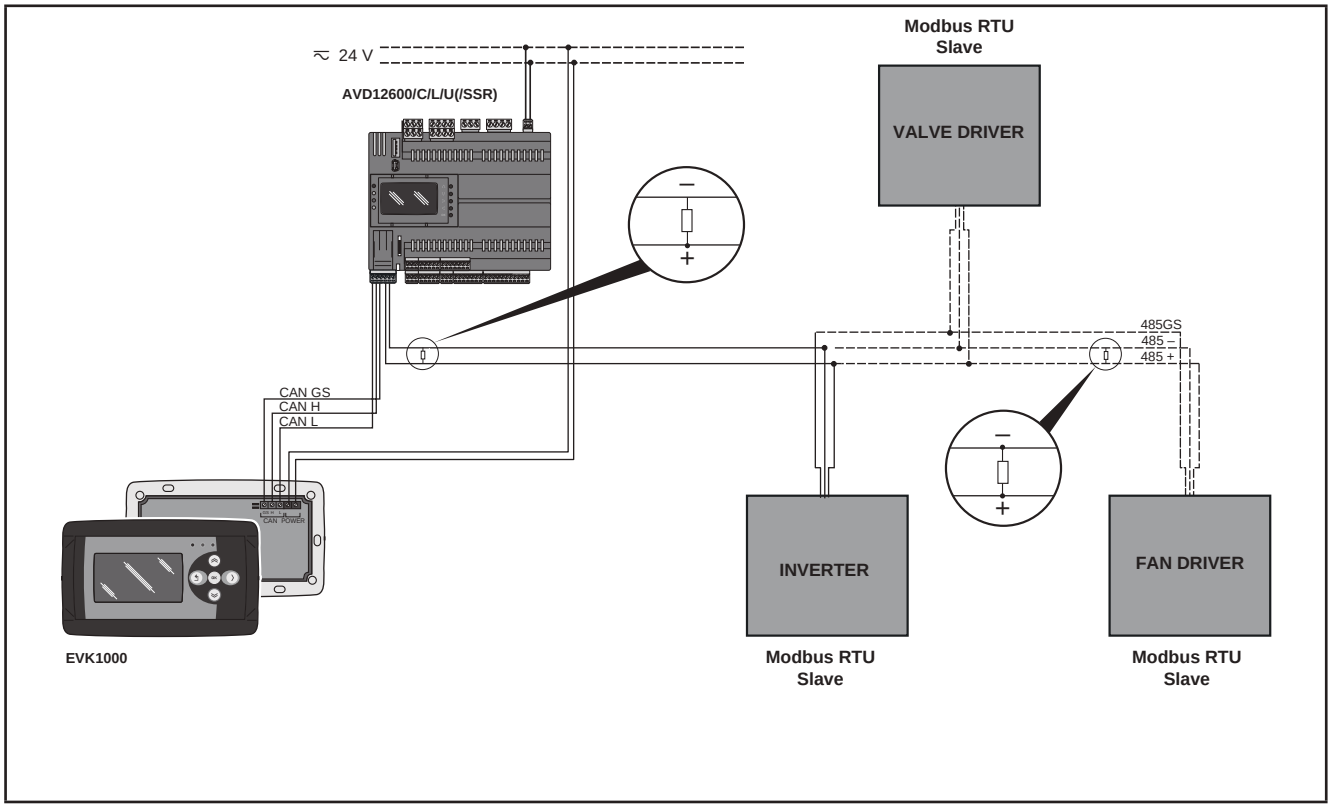


Fig. 29. RS 485 connection (Field) using FREE Advance

3.4.4. Example: BACnet MS/TP on RS 485 network

Description	Notes
(A) **1 FREE Advance AVD12600/C/L/U(/SSR)**	• Modbus RTU Master mode on RS485-1 • BACnet node on RS485-2 Max 32 modules connected in RS 485
(B) **1 FREE Advance AVD12600/C/L/U(/SSR)**	BACnet node on RS485-2 Max 32 modules connected in RS 485
1 **FREE Evolution Display Graphic** (**EVK1000**) connected in CAN Expansion Bus to **FREE Advance AVD12600/C/L/U(/SSR)**	-

The **FREE Evolution Display Graphic** (**EVK1000**) is supplied externally.

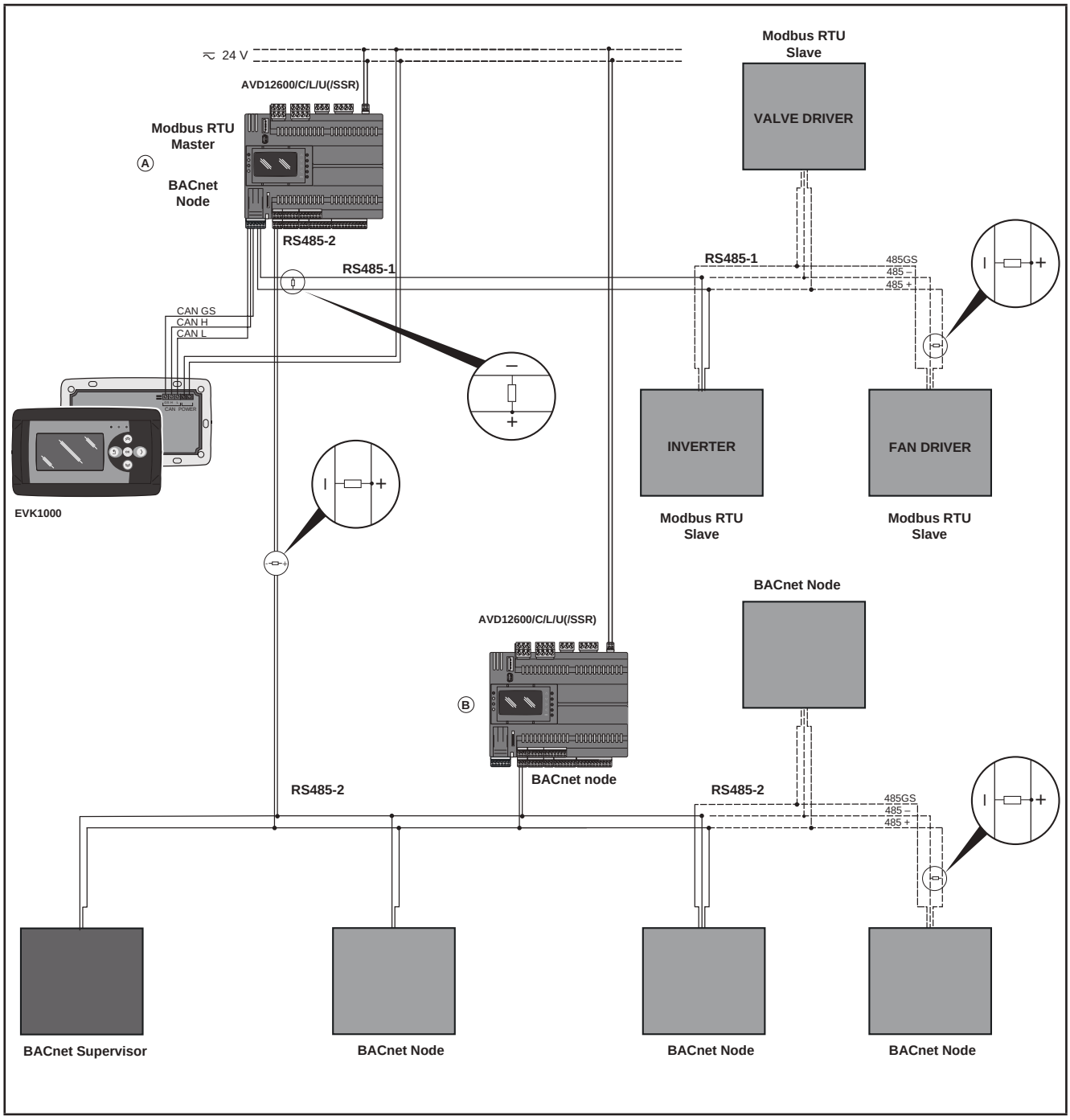


Fig. 30. BACnet MS/TP on RS 485 network using FREE Advance

3.4.5. Example: BACnet / IP

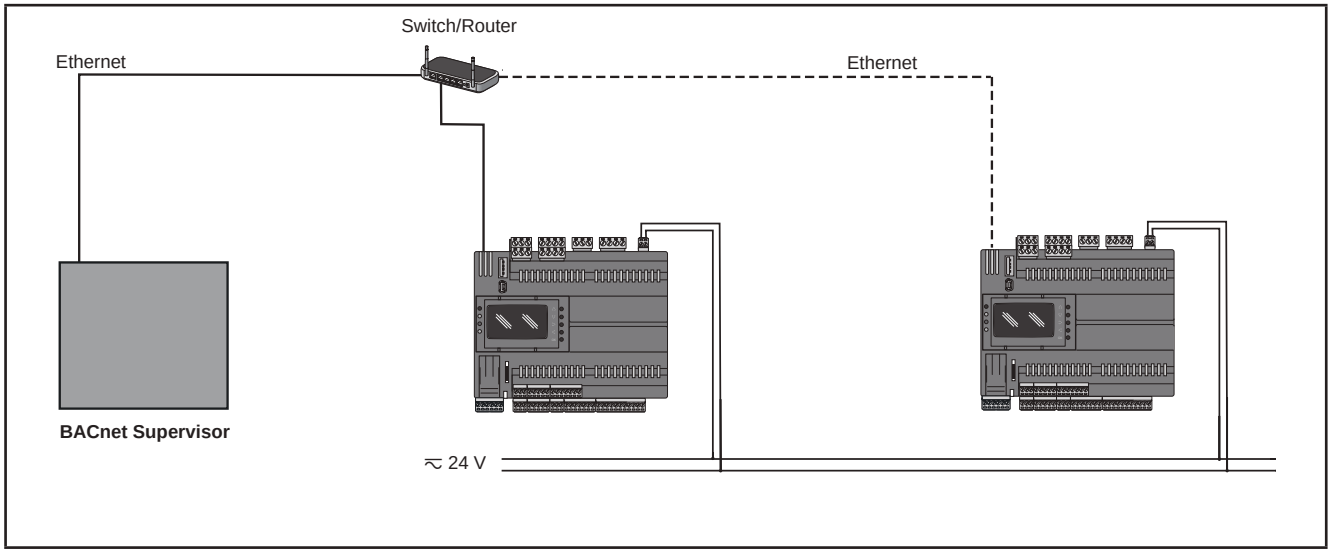


Fig. 31. BACnet IP protocol using Ethernet port of the FREE Advance

3.4.6. Example: RS 485 connection with the FREE Smart network

A RS 485 set as Modbus Master connection with the **FREE Smart** network can be constituted by:

Description	Notes
FREE Advance AVD12600/C/L/U(/SSR)	**AVD12600/C/L/U(/SSR)** is in Modbus RTU Master mode on RS485-2 [1]
Max 32 **FREE Advance AVC-AVD12600/C/L/U(/SSR) or FREE Smart Modbus Slave (SMC-SMD-SMP4500-5500/C/S / SMD3600/C/S 2T)** or Eliwell and/or third-party devices equipped with RS 485 serial (for example: **EVD7500/C/U(/SSR)**)	All devices equipped with RS 485 are in Modbus RTU Slave mode (including the **FREE Evolution / Panel / Smart** modules) See also the **FREE Smart** manual for further details.
For CAN Expansion Bus network, refer to **3.4.1. Example: CAN Expansion Bus (Field) network connection on page 47**.	The CAN Expansion Bus connection can be: • Field, as illustrated • Network, if one or more **FREE Advance AVC-AVD12600/C/L/U(/SSR)**s are connected in binding
1 **FREE Evolution Display Graphic** (**EVK1000**) connected in CAN Expansion Bus to **FREE Advance AVD12600/C/L/U(/SSR)**	-

[1] Only RS485-2 on **FREE Advance logic controller** or RS485 on Commincation Module can be set in Modbus RTU Master Mode.

The **FREE Evolution Display Graphic** (**EVK1000**) is supplied externally.

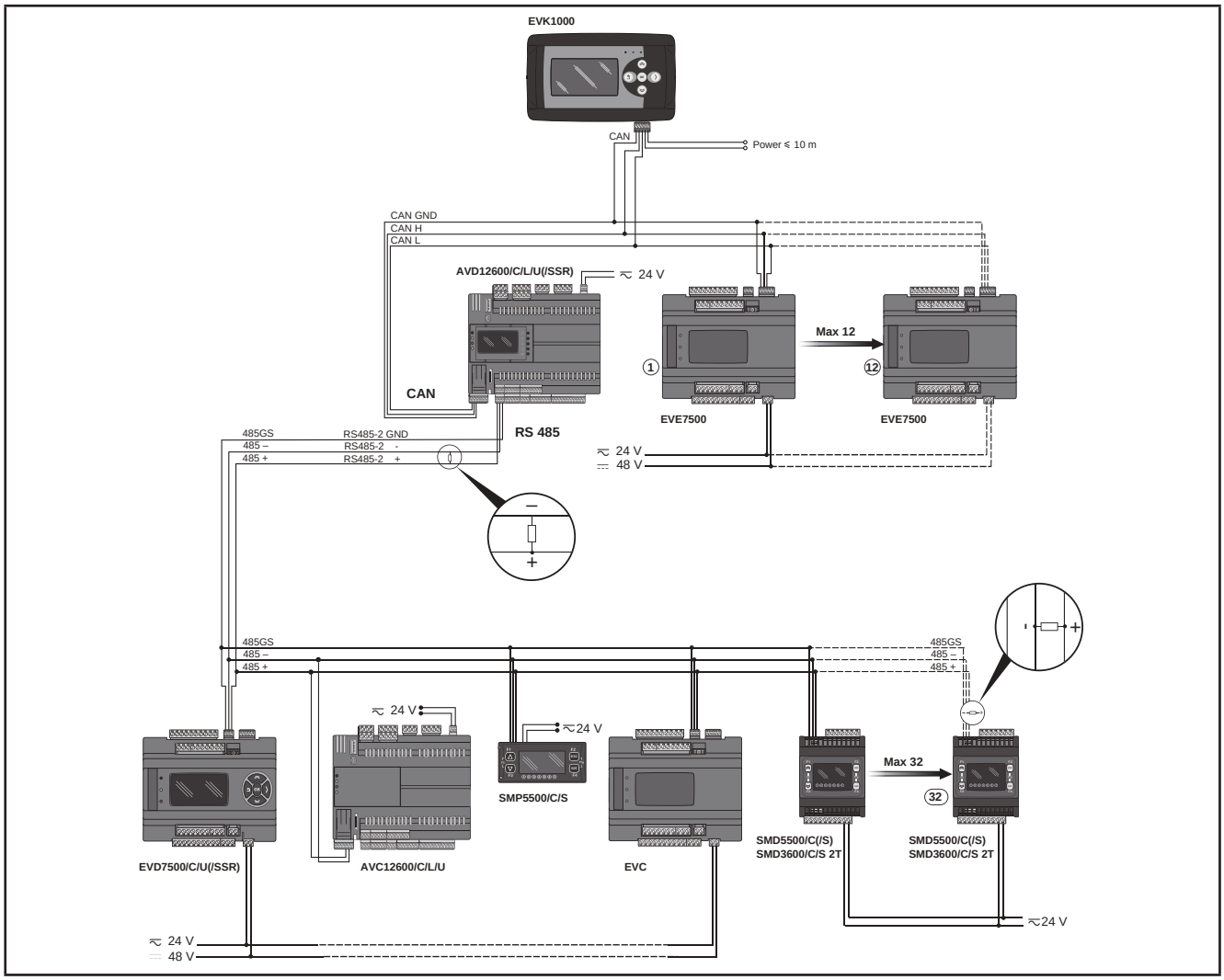


Fig. 32. RS 485 connection with the FREE Smart network using FREE Advance

3.5. Ethernet connection

The **FREE Advance** product is also designated **FREE WEB** (WEB SERVER HTTP).
The Ethernet connection also allows communication using HTTP protocol, i.e. access to a Web Server contained in **FREE Advance** (see **Fig. 4 on page 16**: Ethernet port CN20)**.**

FREE WEB (WEB SERVER HTTP)

FREE Studio (**v3.5 or greater**) allows the creation and management of web pages internally of **FREE WEB (WEB SERVER HTTP)**, i.e. a website in miniature.

WEB functionalities allow local and remote access by way of an ordinary browser. Thanks to the web connection, the system provides reading, support and diagnostics services, as well as e-mail alarm alerts.

Main web functionalities:

- Web-based access.
- Remote reading and support.
- Local and remote system control, including alarms management.
- Preventive and predictive maintenance.
- Email alarm alerts.

Care must be taken and provisions made for use of this product as a control device to avoid inadvertent consequences of commanded machine operation, controller state changes, or alteration of data memory or machine operating parameters.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Configure and install the mechanism that enables the remote HMI local to the machine, so that local control over the machine can be maintained regardless of the remote commands sent to the application.
- You must have a complete understanding of the application and the machine before attempting to control the application remotely.
- Take the precautions necessary to assure that you are operating remotely on the intended machine by having clear, identifying documentation within the application and its remote connection.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

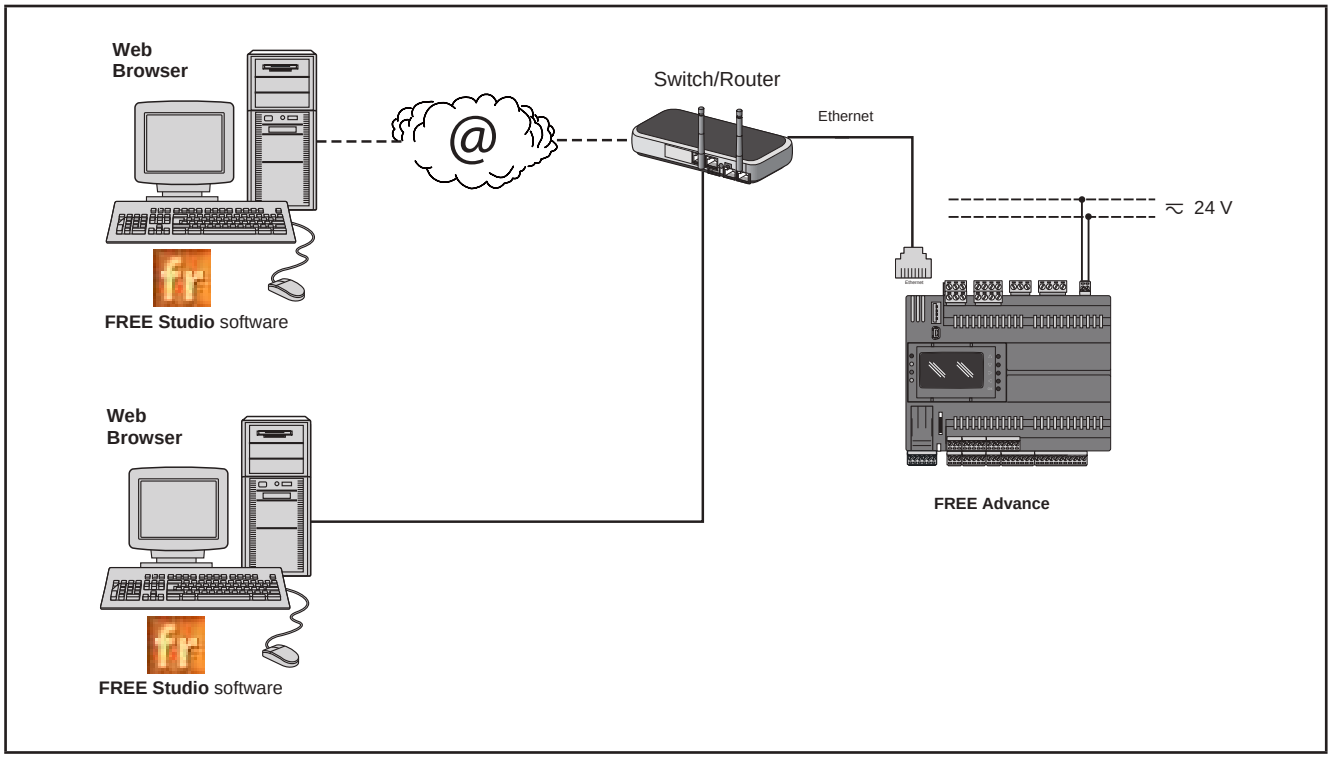


Fig. 33. FREE WEB (WEB SERVER HTTP) using FREE Advance

BRIDGE

FREE Studio (**v3.5 or greater**) allows monitoring of the **FREE Smart** tools or third party tools, typically Modbus/RTU slaves, where **FREE WEB (WEB SERVER HTTP)** (or **FREE Advance**) is the Master Modbus/RTU.

In a **FREE Studio** (**v3.5 or greater**) project, **FREE WEB (WEB SERVER HTTP)** is used as a Modbus/TCP to Modbus/RTU protocol conversion element for Modbus 0x03 and 0x10 commands.

From **FREE Studio** (**v3.5 or greater**), set the connection with the **FREE Smart** as Modbus/TCP, inserting the **FREE WEB (WEB SERVER HTTP)** IP address and the Modbus/RTU address of the **FREE Smart** slave.

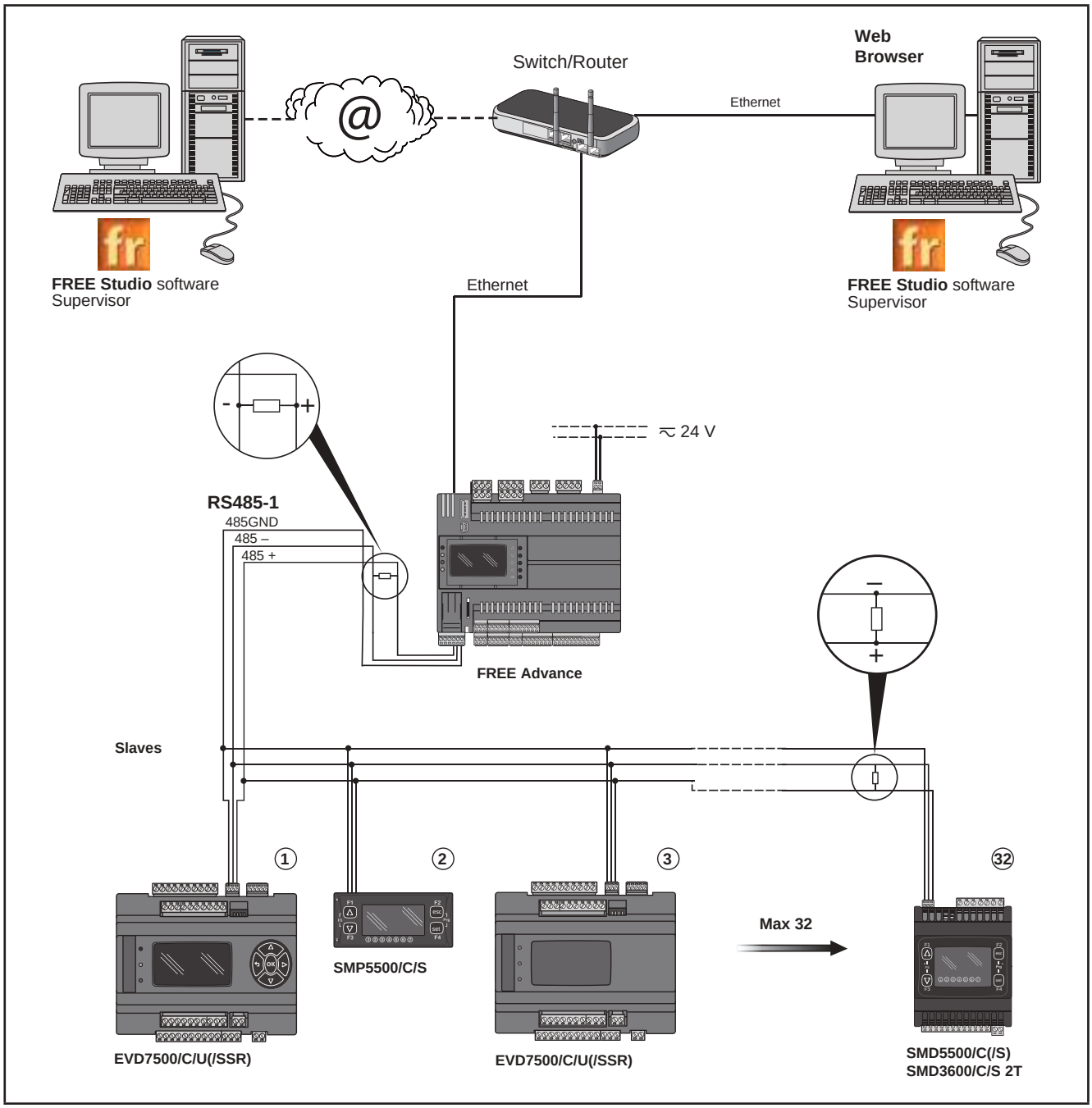


Fig. 34. BRIDGE using FREE Advance

3.5.1. Example: Binding TCP

VPN is not necessary when using DynDNS connection.

Protocol	Field	Network
Modbus TCP	-	Max 4 **FREE Advance** + 2 **FREE Evolution Display Graphic** (**EVK1000**) Max Modbus Messages = 128 / number of **FREE Advance** connected Example: 128 / 4 **FREE Advance** connected Max Modbus Messages ➔ 128/4 ➔ 32

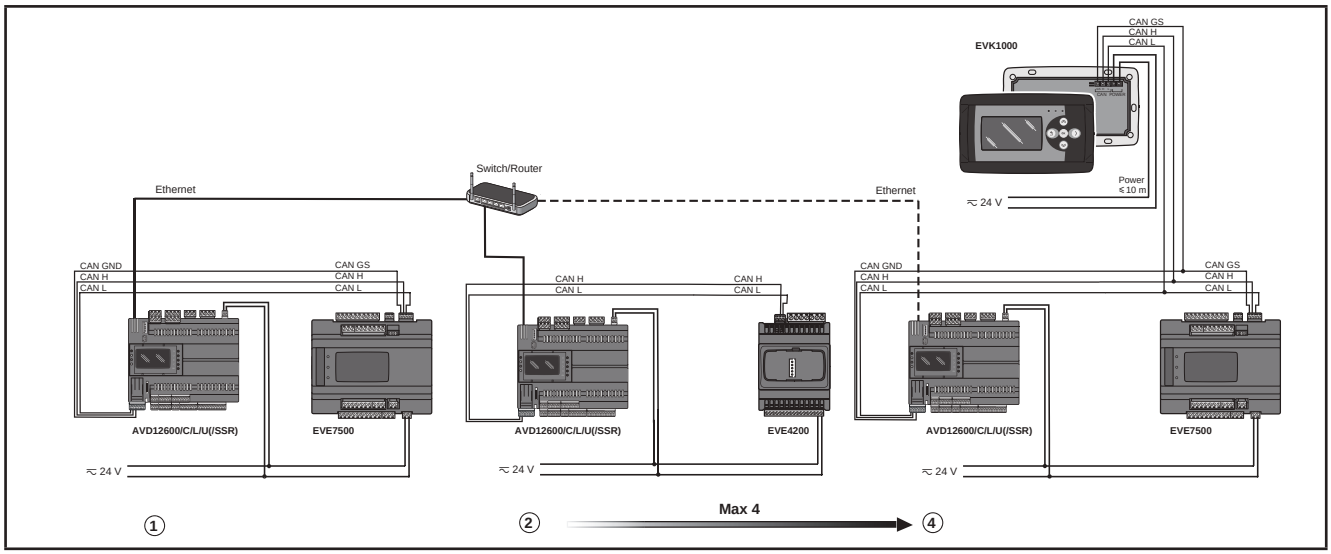


Fig. 35. Modbus TCP protocol using Ethernet port of the FREE Advance

3.6. Compatible EVS Communication Modules

Communication Modules are 2DIN modules that can be connected to an **FREE Advance logic controller** via the Communication Module connector on the left side of the controller, behind the removable flap. The Communication Module is anchored to the controller with the two fixing hooks.
It mounts to the DIN rail in the same way as the controller.

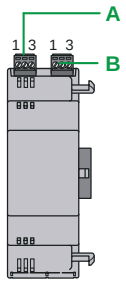
Interface for	Communication Module	
RS 232	**EVS RS232/R**	5A SPDT relay available
RS 485	**EVS RS485** **EVS RS485 BACnet MS/TP**	RS 485 in Daisy Chain ([1])
CAN Expansion Bus	**EVS CAN**	CAN Expansion Bus in Daisy Chain ([1])
LON	**EVS LON**	LonWorks Communication Module

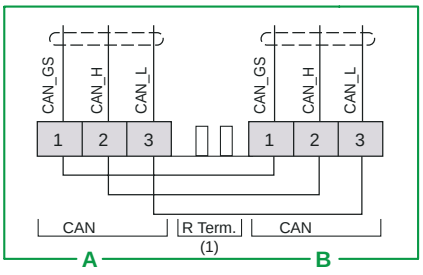
([1]) Use a shielded cable. See **3.1.6. Serial connections on page 32**.

EVS Communication Modules compatible with **FREE Advance** are shown in **Fig. 36 on page 57**.

For details about **EVS RS232/R / EVS RS485 / EVS RS485 BACnet MS/TP / EVS CAN / EVS LON** Communication Modules, refer to **FREE Evolution / Panel Logic Controllers** Hardware User Manual.

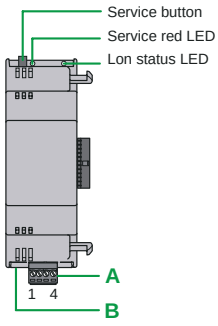
EVS CAN

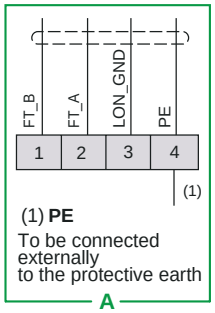


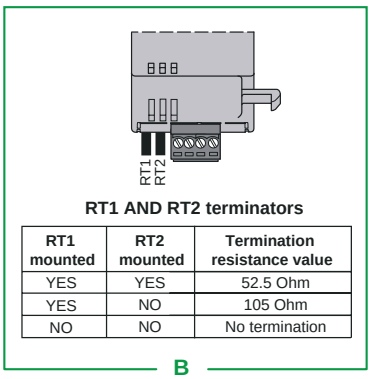


(1) CAN terminal resistance.

EVS LON





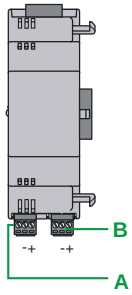


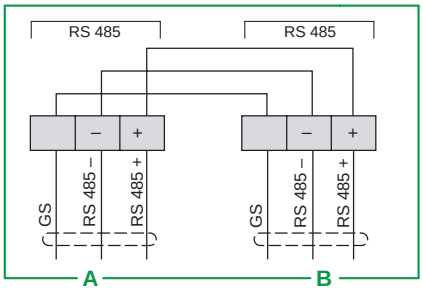
RT1 AND RT2 terminators

RT1 mounted	RT2 mounted	Termination resistance value
YES	YES	52.5 Ohm
YES	NO	105 Ohm
NO	NO	No termination

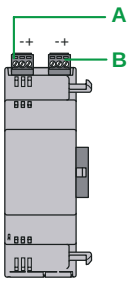
B

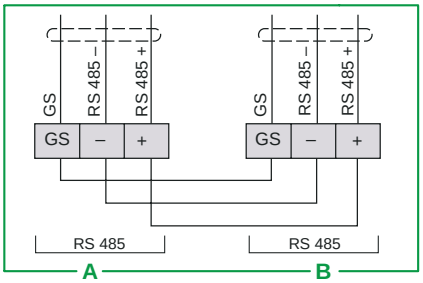
EVS RS485 BACnet MS/TP



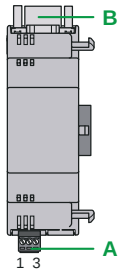


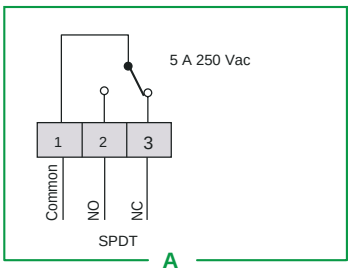
EVS RS485





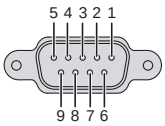
EVS RS232/R





RS 232

N°	RS232
1	GND
2	DTR
3	TXD
4	RXD
5	DCD
6	RI
7	CTS
8	RTS
9	DSR



Sub-DB9

B

Fig. 36. Communication Modules

CHAPTER 4
Technical data

All **FREE Advance logic controllers** system components meet European Community (CE) requirements for open equipment. You must install them in an enclosure or other location designed for the specific environmental conditions and to minimize the possibility of unintended contact with hazardous voltages. Use metal enclosures to improve the electromagnetic immunity of your **FREE Advance logic controllers** system. This equipment meets CE requirements as indicated in the table below.

Applying incorrect current or voltage levels on analog inputs and outputs could damage the electronic circuitry. Further, connecting a device current output to an analog input configured as voltage, and vice-versa, will likewise damage the electronic circuitry.

NOTICE

INOPERABLE EQUIPMENT

- Do not apply voltages above 11 V to the analog inputs of the controller or Input/Output expansion module when analog input is configured as 0-5 V or 0-10 V input.
- Do not apply current above 30 mA to the analog inputs of the controller or Input/Output expansion module when analog input is configured as 0-20 mA or 4-20 mA input.
- Do not mismatch applied signal with analog input configuration.

Failure to follow these instructions can result in equipment damage.

4.1. Environmental and electrical characteristics

	Standard	Min	Max
Supply voltage	+24 Vac ± 10% NOT ISOLATED	-	-
	+20...38 Vdc NOT ISOLATED	-	-
Supply frequency	50 Hz / 60 Hz	-	-
Power draw	35 VA / 15 W	-	-
Insulation class	2	-	-
Ambient operating temperature for /SSR models	25 °C / 77 °F	-20 °C / -4 °F	55 °C / 131 °F
Ambient operating temperature for all other models	25 °C / 77 °F	-20 °C / -4 °F	65 °C / 149 °F(1)
Ambient operating humidity (non-condensing)	30%	5%	95%
Ambient storage temperature	25 °C / 77 °F	-30 °C / -22 °F	70 °C / 158 °F
Ambient storage humidity (non-condensing)	30%	5%	95%

(1) For **FREE AVD-AVC8400, AVD-AVC12600**, the ambient operating temperature is limited to 60°C / 140 °F when DO8 is active.

If the specified current limits within temperature range are not maintained, the products may not function as intended or may become damaged and inoperable.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: When supplying power from the **FREE Advance logic controllers**, make the power connection cable as short as possible.

NOTICE

INOPERABLE EQUIPMENT

Do not connect a power cable longer than 10 m.

Failure to follow these instructions can result in equipment damage.

Classification	
The product complies with the following harmonized regulations:	EN 60730-2-9 / EN 60730-1
Use	In terms of construction as a DIN rail mounting incorporated electronic control
Mounting	DIN Omega bar support, optional Panel mounting (with accessories)
Type of action	1.B – 1.Y
Pollution class	2 (normal)
Over voltage category	II
Nominal pulse voltage	2500 V
Digital outputs	Refer to the label on the device
Fire resistance category	D
Software class and structure	A
Type of disconnection or suspension for each circuit	Micro disconnection
PTI of materials used for insulation	PTI 250 V
Period of electrical stress on the insulating parts	Long period

4.2. FREE Advance AVC-AVD8400 features

FREE Advance AVC-AVD8400 features for inputs and outputs.

I/O	Label	Description	Devices
2 FAST DIGITAL INPUTS	**DI1, DI2**	2 opto-isolated digital inputs (Pulse count + Read frequency) Note: measure a signal with a maximum frequency of 2 kHz Digital inputs can be used as pulse counters. The length of the pulse (positive or negative) must be greater than 0.15 ms	**AVC-AVD8400/C/L/U(/SSR)**
6 SELV REGULAR DIGITAL INPUTS	**DI3, DI4, DI5, DI6, DI7, DI8**	6 opto-isolated regular digital inputs Working voltage +24 Vac/dc Power draw max. 5 mA Digital inputs can be used as pulse counters. The length of the pulse (both positive or negative) must be greater than 20 ms (if DI3, DI4) or 40 ms (if DI5, DI6, DI7, DI8)	
8 HIGH VOLTAGE RELAY DIGITAL OUTPUTS (1)	**DO1, DO2, DO3, DO4, DO5, DO6, DO7**	7 x 3 A SPST +250 Vac relays	**AVC-AVD8400/C/L/U**
	DO8	1 x 1 A SPDT +250 Vac relays	
6 HIGH VOLTAGE RELAY DIGITAL OUTPUTS + 2 HIGH VOLTAGE SSR DIGITAL OUTPUTS (1)	**DO3, DO4, DO5, DO6, DO7**	5 x 3 A SPST +250 Vac relays	**AVD8400/C/L/U/SSR**
	DO8	1 x 1 A SPDT +250 Vac relays	
	DO1, DO2	2 x 0.5 A +240 Vac SSR	
8 ANALOG INPUTS	**AI1, AI2, AI3, AI4, AI5, AI6, AI7, AI8**	See the table in **4.4.1. Analog inputs features on page 62**	**AVC-AVD8400/C/L/U(/SSR)**
4 SELV ANALOG OUTPUTS	**AO1, AO2**	2 x outputs (Voltage modulation **0..10 V**) Range: 0..1000 Accuracy: 1% full scale Resolution: 1 digit Load impedance: > 700 Ω	**AVC-AVD8400/C/L/U(/SSR)**
	AO3, AO4	2 x configurable outputs: • Current modulation **4..20 mA**, • Current ON-OFF: current (ON) is 25 mA, current (OFF) is 0 mA • Voltage modulation **0..10 V**, Range: 0..1000 Accuracy: 1% full scale Resolution: 1 digit Load impedance: > 700 Ω • PWM mode: Frequency 1 Hz to 2000 Hz (1 Hz accuracy), Duty Cycle 0,0% to 100,0% (0,1% accuracy) Open Collector output, 30 mA, +24 Vdc max. Features of two analog configurations: see the table in **4.4.2. Analog output features on page 63**	

(1) Double isolation between each digital output and the rest of the controller.

4.3. FREE Advance AVC-AVD12600 features

FREE Advance AVC-AVD12600 features for inputs and outputs.

I/O	Label	Description	Devices
2 FAST DIGITAL INPUTS	**DI1, DI2**	2 opto-isolated digital inputs (Pulse count + Read frequency) Note: measure a signal with a maximum frequency of 2 kHz Digital inputs can be used as pulse counters. The length of the pulse (positive or negative) must be greater than 0.15 ms	**AVC-AVD12600/C/L/U(/SSR)**
10 SELV REGULAR DIGITAL INPUTS	**DI3, DI4, DI5, DI6, DI7, DI8, DI9, DI10, DI11, DI12**	10 opto-isolated digital inputs Working voltage + 24 Vac/dc Power draw max. 5 mA Digital inputs can be used as pulse counters. The length of the pulse (both positive or negative) must be greater than 20 ms (if DI3, DI4) or 40 ms (if DI5, DI6, DI7, DI8, DI9, DI10, DI11, DI12)	
12 HIGH VOLTAGE RELAY DIGITAL OUTPUTS	**DO1, DO2, DO3, DO4, DO5, DO6, DO7, DO9 DO10, DO11**	10 x 3 A SPST +250 Vac relays	**AVC-AVD12600/C/L/U**
	DO8, DO12	2 x 1 A SPDT +250 Vac relays	
10 HIGH VOLTAGE RELAY DIGITAL OUTPUTS + 2 HIGH VOLTAGE SSR DIGITAL OUTPUTS (1)	**DO3, DO4, DO5, DO6, DO7, DO9, DO10, DO11**	8 x 3 A SPST +250 Vac relays	**AVD12600/C/L/U/SSR**
	DO8, DO12	2 x 1 A SPDT +250 Vac relays	
	DO1, DO2	2 x 0.5 A +240 Vac SSR	
12 ANALOG INPUTS	**AI1, AI2, AI3, AI4, AI5, AI6, AI7, AI8, AI9, AI10, AI11, AI12**	See the table in **4.4.1. Analog inputs features on page 62**	**AVC-AVD12600/C/L/U(/SSR)**
6 SELV ANALOG OUTPUTS	**AO1, AO2, AO5, AO6**	4 x outputs (Voltage modulation **0..10 V**) Range: 0..1000 Accuracy: ±2% full scale Resolution: 1 digit Load impedance: > 700 Ω	**AVC-AVD12600/C/L/U(/SSR)**
	AO3, AO4	2 x configurable outputs: • Current modulation **4..20 mA**, • Current ON-OFF: current (ON) is 23 mA, current (OFF) is 0 mA • Voltage modulation **0..10 V**, Range: 0..1000 Accuracy: 1% full scale Resolution: 1 digit Load impedance: > 700 Ω • PWM mode: Frequency 1 Hz to 2000 Hz (1 Hz resolution), Duty Cycle 0,0% to 100,0% (0,1% resolution) Open Collector output, 30 mA, +24 Vdc max. Features of two analog configurations: see the table in **4.4.2. Analog output features on page 63**	

(1) Double isolation between each digital output and the rest of the controller

4.4. Analog features

4.4.1. Analog inputs features

Type of analog input	Range	Accuracy (1)	Accuracy range	Resolution	Input impedance
NTC (NK103) 10 kΩ at 25°C BETA value 3435	-40..+137 °C (-40.. +278.6 °F)	±0.5% full scale + 1 digit	-40..+110 °C (-40.. +230 °F)	0.1 °C	10 kΩ
		±1% full scale + 1 digit	+110..+137 °C (+230.. +278.6 °F)		
DI (voltage free digital input)	-	-	-	-	10 kΩ
NTC (103AT-2) 10 kΩ at 25°C BETA value 3435	-50..+110 °C (-58..+230 °F)	±0.5% + 1 digit	-	0.1 °C	10 kΩ
PT1000	-200..+850 °C (-328.. 1562 °F)	±10% + 1 digit	-200..-100 °C (-328.. -148 °F)	0.1 °C	2 kΩ
		±5% + 1 digit	-100..-51 °C (-148.. -59.8 °F)		
		±1% + 1 digit	-50..+100 °C (-58.. +212 °F)		
		±0.8% + 1 digit	+101..+400 °C (+213.8.. +752 °F)		
		±2.2% + 1 digit	+401..+850 °C (+753.8.. +1562 °F)		
PTC (KTY81)	-55..+150 °C (-67.. 302 °F)	±0.5% full scale + 1 digit	-	0.1 °C	2 kΩ
0-20 mA 4-20 mA	0..1000	±1% full scale + 1 digit	4..20 mA	1 digit	< 150 Ω
		±2% full scale + 1 digit	0..4 mA		
0-10 V	0..1000	±1% full scale + 1 digit	-	1 digit	> 10 kΩ
0-5 V	0..1000	±1% full scale + 1 digit	-	1 digit	> 20 kΩ
0-5 V Ratiometric (2)					
hΩ (NTC)	0..1500 hΩ	±0.5% full scale + 1 digit	-	1 hΩ	10 kΩ
daΩ (PT1000)	0..300 daΩ	±0.5% full scale + 1 digit	-	1 daΩ	2 kΩ

(1) Accuracy full scale, or related to range described in the Accuracy range column where applicable.
(2) 0-5 V Ratiometric: ratiometric range is 0.5 V to 4.5 V. Maximum current at 5 V is 50 mA.

The analog inputs configured as digital inputs are not isolated.

NOTICE

INCORRECT INPUT WIRING TO NON ISOLATED INPUTS
Only use voltage free type inputs on analog inputs configured as digital inputs.
Failure to follow these instructions can result in equipment damage.

Also refer to **6.1. Analog inputs configuration on page 75** for further information.

4.4.2. Analog output features

Type of analog output	Range	Accuracy	Resolution	Load impedance
Voltage modulation **0..10 V**	0..1000	±2% full scale	1 digit	≥ 700 Ω
Current modulation **4..20 mA**	0..1000	±2% full scale	1 digit	≤ 450 Ω

4.5. Display

AVD8400-12600/C/L/U(/SSR) references have a monochromatic LCD graphic display 128x64px

- backlit with LEDs
- 4 LEDs

LEDs and backlighting can be controlled from the controller application.
For further information, refer to **"CHAPTER 5" FREE Advance User interface on page 72**.

4.6. Serials

Serial	Description	Notes
CAN	CAN Expansion Bus	max 50 m at 500 kpbs; 200 m at 125 kpbs
		If necessary, apply a 120 Ω termination resistor to both the ends
RS 485	2 x RS 485 serial	If the controller is connected at the end of the RS 485 communication line, apply a 120 Ω termination resistor between line + and line - of the RS 485
		Only one RS 485 serial port can be configured as Modbus master at the same time.
USB	1 Type A USB female connector (Host)	'Mass Storage' profile External memory, **FAT32** formatting For further information, refer to **4.6.1. USB ports on page 64**.
	1 Type mini-B USB female connector (Device)	Connection between PC and device through USB standard CDC profile For further information, refer to **4.6.1. USB ports on page 64**.
ETHERNET	Modbus TCP ETHERNET port	**FREE Advance** includes MACADDRESS, in barcode and 12-digit alphanumeric format For further information, refer to **4.6.2. Ethernet port on page 65.**

For further information, refer to **3.1.6. Serial connections on page 32**.

Pay special attention when connecting serial lines. Miswiring may lead to inoperable equipment.

NOTICE

INOPERABLE EQUIPMENT

- Do not connect equipments that communicate using RS 485 serial to CAN Expansion Bus terminals.
- Do not connect equipments that communicate using CAN Expansion Bus to RS 485 terminals.

Failure to follow these instructions can result in equipment damage.

4.6.1. USB ports

USB type	Purpose	Note
A (HOST)	Used to connect a USB memory key when downloading the application. This should be done from the controller keypad (**AVD8400-12600/ C/L/U(/SSR)** references) or from the **FREE Evolution Display Graphic** (**EVK1000**) (**AVC8400-12600/C/L/U** reference).	-
Mini-B (DEVICE)	Used to connect **FREE Advance** to a PC via mini-B USB cable for debugging, commissioning, downloading, uploading with **FREE Studio** (**v3.5 or greater**): **FREE Advance** seen as a virtual COM. Serial communication is performed with a CDC profile (USB standard).	Compatible with the following operating systems: • Windows Vista Business x86 + x64 (Service Pack 2) • Windows 7 x86 + x64 (Service Pack 1) • Windows 8 / 8.1 x86 + x64 • Windows 10 • Windows Server 2008, SP2, and R2 • Windows Server 2012 and R2 The driver is supplied with the **FREE Studio (v3.5 or greater)** software.

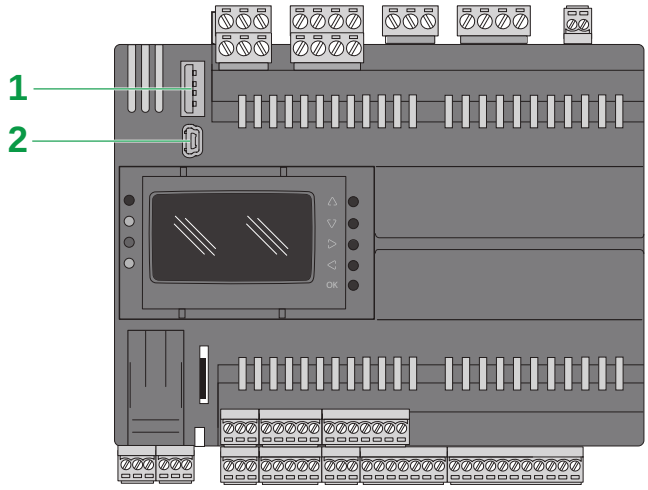


Fig. 37. FREE Advance: Type A USB and Type mini-B USB

Label	Description
1	Type A USB connector
2	Type mini-B USB connector

4.6.2. Ethernet port

The **FREE Advance** logic controllers are equipped with an Ethernet communication port.
The **Fig. 4 on page 16** shows the location of the Ethernet port on the **FREE Advance** logic controllers.

Characteristics

The following table describes Ethernet characteristics:

Characteristic	Description
Protocol	Modbus TCP/IP
Connector type	RJ45
Driver	10 M / 100 M auto negotiation
Cable type	Shielded
Automatic cross-over detection	Yes

Pin Assignment

The **Fig. 38 on page 65** shows the RJ45 Ethernet connector pin assignment.

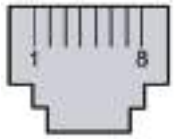


Fig. 38. Pin Assignment

The following table describes the RJ45 Ethernet connector pins:

Pin N°	Signal
1	TD+
2	TD-
3	RD+
4	-
5	-
6	RD-
7	-
8	-

NOTE: The controller supports the MDI/MDIX auto-crossover cable function. It is not necessary to use special Ethernet crossover cables to connect devices directly to this port (connections without an Ethernet hub or switch).

Status LED

The following figures show the RJ45 connector status LED:

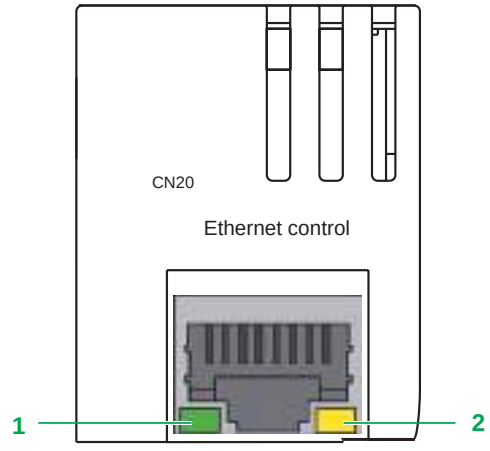


Fig. 39. Status LED

The following table describes the Ethernet status LEDs.

Label	Signal	LED		
		Color	Status	Description
1: ACT	Ethernet activity	Green	Off	No activity
			Flashing	Activity
2: LINK	Ethernet link	Green / Yellow	Off	No link
			On (Yellow)	Link speed: 10 Mb
			On (Green)	Link speed: 100 Mb

4.7. Service battery door

The **FREE Advance** logic controllers have a removable flap (see 1 in **Fig. 40 on page 66**) placed in the lower-left side of the front view. Behind the service door, there is a battery compartment and a 5-pole male connector (reserved). To replace the internal battery, contact Eliwell technical support department.

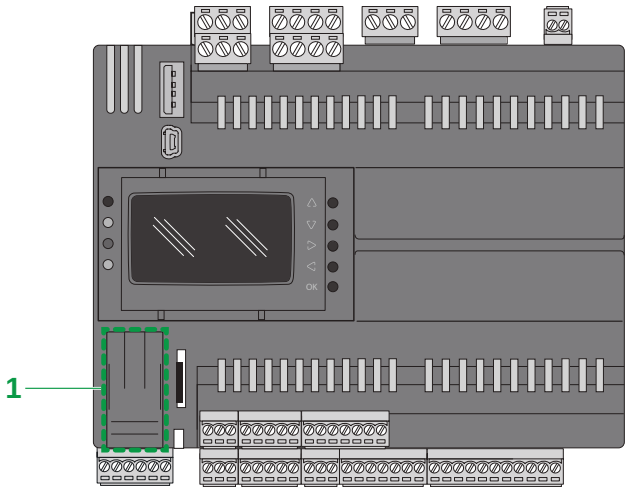


Fig. 40. FREE Advance: Service battery door

⚠ WARNING

NON USER SERVICABLE COMPONENT

Do not attempt to replace the battery without qualified Eliwell personnel

Failure to follow these instructions can result in death, serious injury, or equipment damage.

4.8. Memory capacity

The **FREE Advance** logic controllers have two different ways for data storing:

- internal memory (refer to **4.8.1. Internal memory on page 66**);
- external memory (through a slot to insert external memory card) (refer to **4.8.2. External memory on page 67**).

4.8.1. Internal memory

The **FREE Advance** logic controllers have the following memory capacities.

Capacity	Type
512 kB	Flash
96 kB	RAM
8 MB	NOR flash
32 MB	SDRAM

4.8.2. External memory

The **FREE Advance** logic controllers have a Memory Card slot (see 1 in **Fig. 41 on page 67**) for micro SD cards to, in certain cases, extend internal memory.

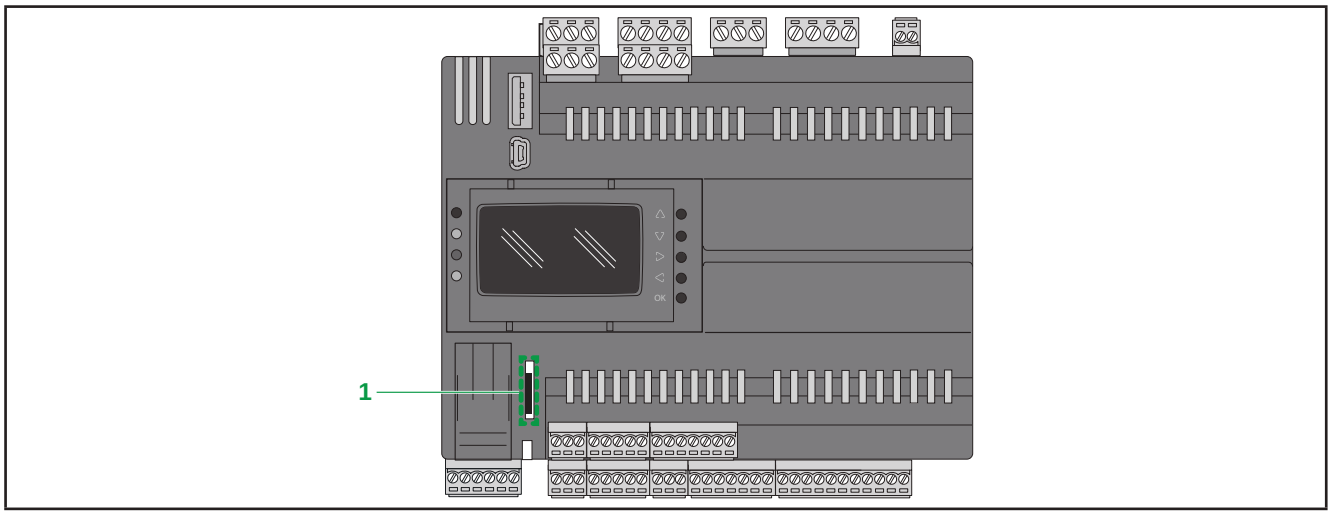


Fig. 41. FREE Advance: Memory Card slot

UHS-I compatibility has been tested.
Do not use UHS-II cards.
Max capacity of memory tested: 16 GB.

When handling the micro SD card, follow the instructions below to help prevent internal data on the micro SD card from being corrupted or lost or a micro SD card malfunction from occurring:

NOTICE

INOPERABLE EQUIPMENT

- Do not store the micro SD card where there is static electricity or probable electromagnetic fields.
- Do not store the micro SD card in direct sunlight, near a heater, or other locations where high temperatures can occur.
- Do not bend the micro SD card.
- Do not drop or strike the micro SD card against another object.
- Keep the micro SD card dry.
- Do not touch the micro SD card connectors.
- Do not disassemble or modify the micro SD card.
- Use only micro SD card formatted using FAT32.

Failure to follow these instructions can result in equipment damage.

The **FREE Advance** logic controller does not recognize NTFS formatted micro SD cards. Format the micro SD card on your computer using FAT32.

When using the **FREE Advance logic controller** and a micro SD card, observe the following to avoid losing valuable data:

- Accidental data loss can occur at any time. Once data is lost it cannot be recovered.
- If you forcibly extract the micro SD card, data on the micro SD card may become corrupted.
- Removing a micro SD card that is being accessed could damage the micro SD card, or corrupt its data.
- If the micro SD card is not positioned correctly when inserted into the controller, the data on the card and the controller could become damaged.

NOTICE

LOSS OF APPLICATION DATA

- Backup micro SD card data regularly.
- Do not remove power or reset the controller, and do not insert or remove the micro SD card while it is being accessed.
- Become familiar with the proper orientation of the micro SD card when inserting it into the controller.

Failure to follow these instructions can result in equipment damage.

Micro SD Card Slot Characteristics

Topic	Characteristics	Description
Supported type	Standard Capacity	Micro SD
	High Capacity	Micro SDHC
Global memory	Size	Maximum 32 GB
Speed	Classes	4...10
Memory organization	Maximum size for files	Maximum 4 GB
	Maximum number of files	Maximum 512 files (max indicization)
Robustness	Temperature operating range	See the characteristics provided by your Micro SD card provider for the value.
	Write/erase cycles (typical)	
	File retention time	

Micro SD Card Characteristics

For commercially available cards, consult your local sales representative.

4.9. Power supply

The **FREE Advance logic controllers** and associated devices require power supplies with a nominal voltage of 24 Vac/dc. The power supplies/transformers must be rated Safety Extra Low Voltage (SELV) according to IEC 61140. These sources of power are isolated between the electrical input and output circuits of the power supply as well as simple separation from ground (earth), PELV and other SELV systems.

⚠ ⚠ DANGER

GROUND LOOP CAUSING ELECTRIC SHOCK AND/OR INOPERABLE EQUIPMENT

- Do not connect the 0 V power supply/transformer connection (indicated as '-' on the power supply connector) supplying this equipment to any external ground (earth) connection.
- Do not connect any 0 V or ground (earth) of the sensors and actuators connected to this equipment (indicated as 'GND' on the respective connector) to any external ground (earth) connection.
- If necessary, use separate power supplies/transformers to power sensors or actuators isolated from this equipment.
- If necessary, use separate power supplies/transformers in a multiple **FREE Advance** network, or alternatively, do not connect any 0 V signal ground between the equipment (indicated as 'GND' on the **FREE Advance** connectors).

Failure to follow these instructions will result in death or serious injury.

If the specified voltage range is not maintained, or the effective separation of the SELV circuit connected to the concerned equipment is compromised, the products may not function as intended or may become damaged and inoperable.

⚠ WARNING

POTENTIAL OF OVERHEATING AND FIRE

- Do not connect the equipment directly to line voltage.
- Use only isolating SELV power supplies/transformers to supply power to this equipment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The equipment must be connected to a suitable power supply/transformers with the following features:

Primary voltage	Depending on requirements of the individual device and/or country of installation.
Secondary voltage	+24 Vac/dc
Power supply frequency Vac	50 / 60 Hz
Power consumption	35 VA max.

If necessary, use separate power supplies/transformers in a multiple **FREE Advance** network. See example with CAN network:

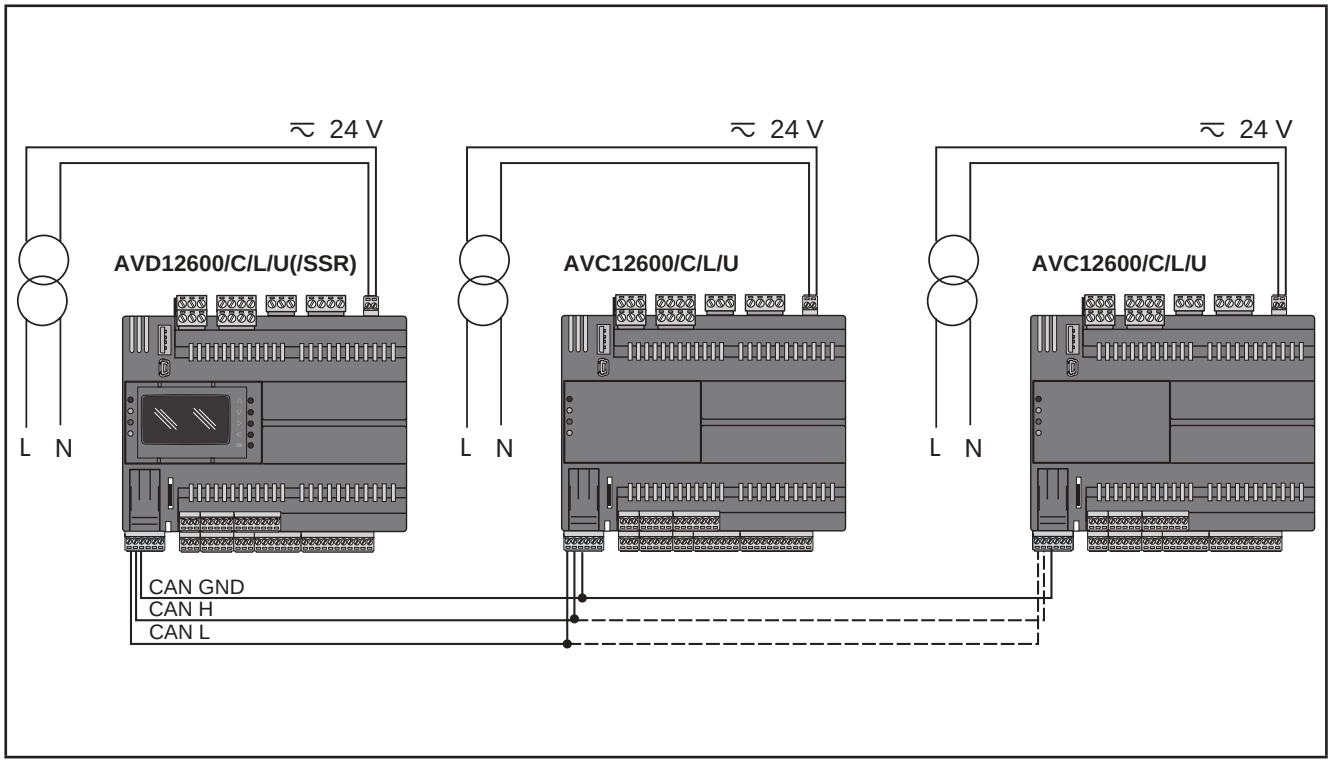


Fig. 42. FREE Advance: CAN network example separate power lines

Alternatively, do not connect any 0 V signal ground between the equipment (indicated as 'GND' on the **FREE Advance** connectors).

See example with CAN network:

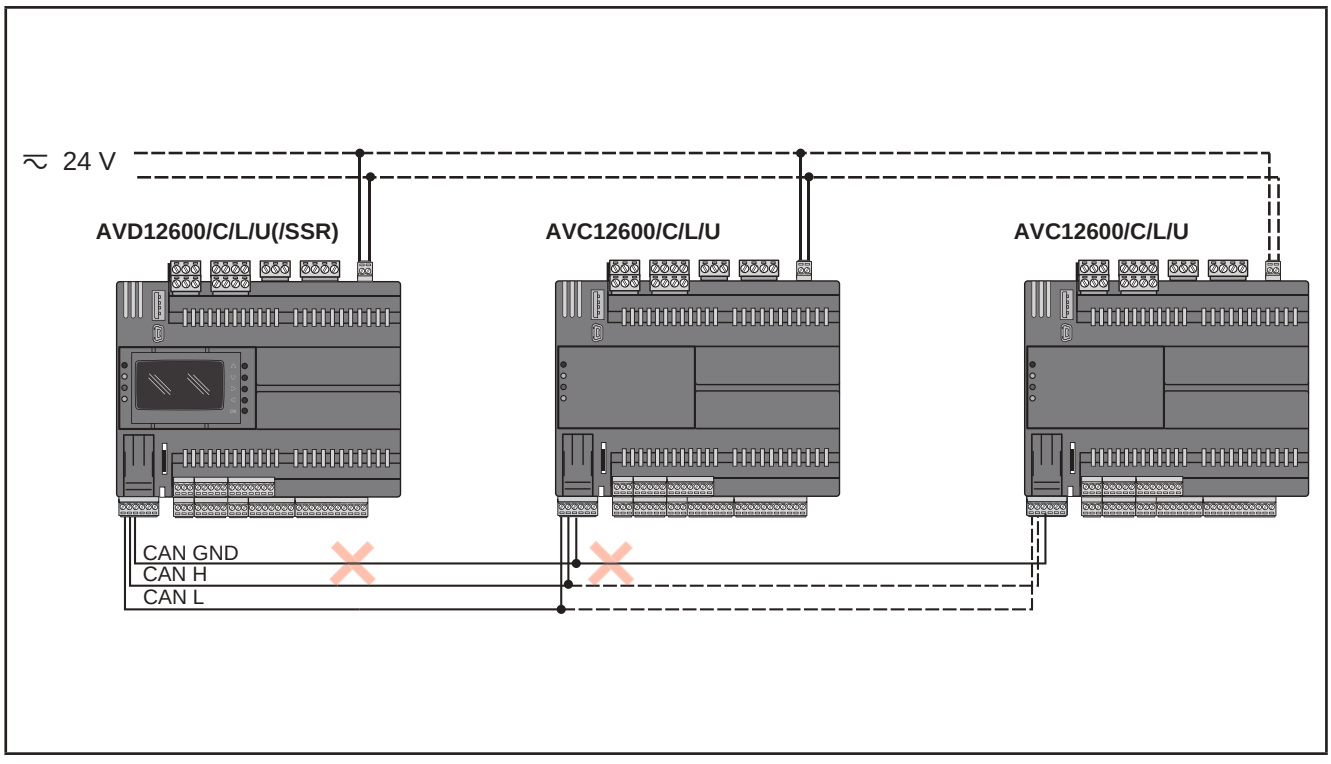


Fig. 43. FREE Advance: CAN network example with 0 V signal ground not connected

4.10. Mechanical dimensions

	Length mm in	Depth mm in	Height mm in
FREE Advance	144 5.67	60.5 2.38	110 4.33

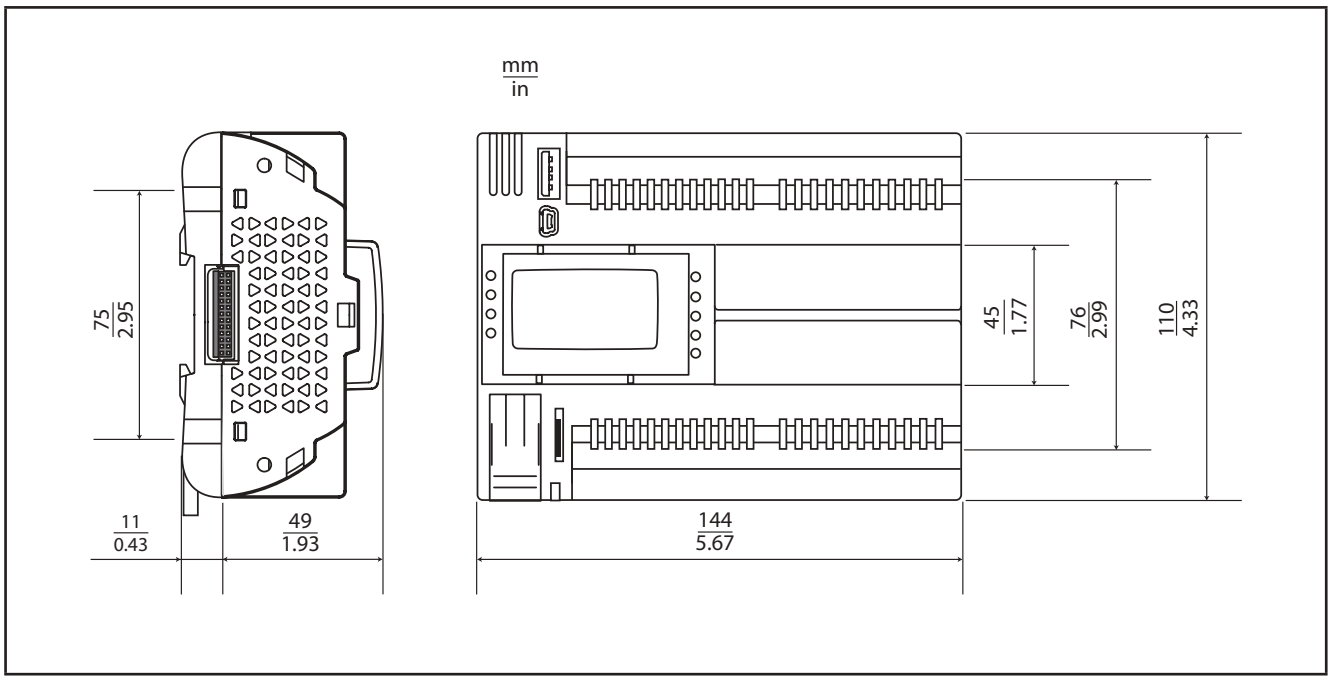


Fig. 44. Mechanical dimensions

CHAPTER 5
FREE Advance User interface

The interface, comprising the front cover of the controller, allows you to perform operations to use the device.

5.1. Keys and LEDs

The data provided for keys refers to **AVD8400-12600/C/L/U(/SSR)** references.
The **AVC8400-12600/C/L/U** logic controllers have no display. Use the **FREE Evolution Display Graphic** (**EVK1000**) to work with these controllers.

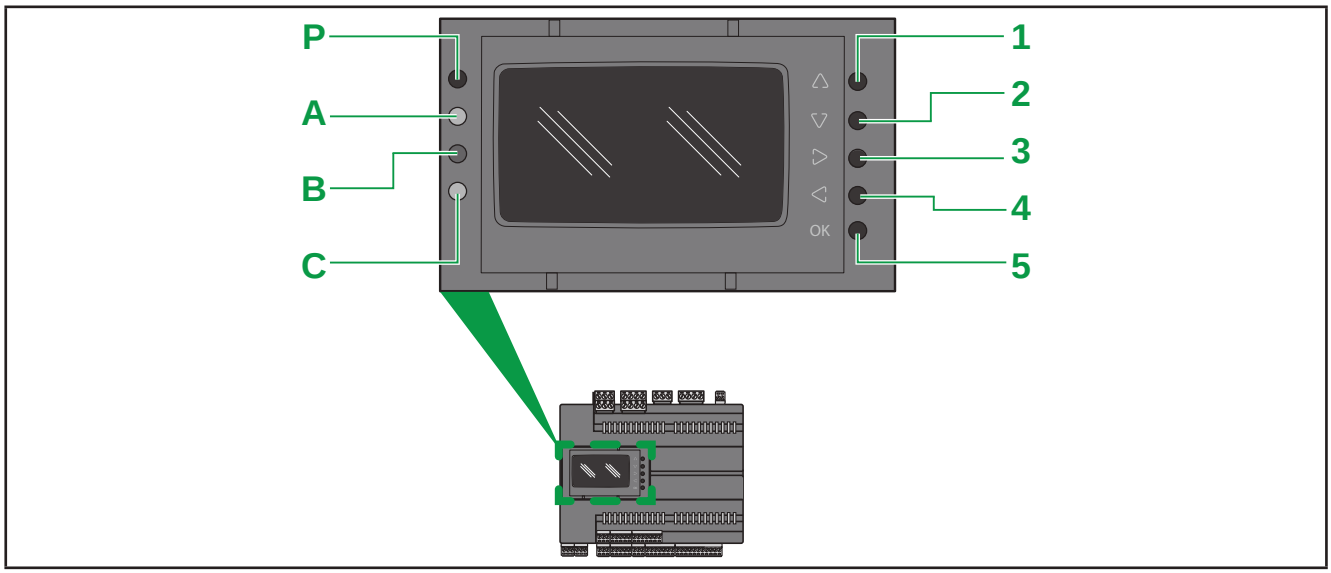


Fig. 45. AVD8400-12600/C/L/U(/SSR)

The keys can be programmed from the controller application. In the following table are described the keys default setting (keys are configurable through the logic controller).

No.	Key	Press once (press and release)
1	△ **UP**	• Scroll up • Increase/modify a value • Go to next label
2	**DOWN** ▽	• Scroll down • Decrease/modify a value • Go to previous label
3	**RIGHT** ▷	• Move cursor to right in Edit Mode
4	**LEFT** ◁	• Exit menu page / go back to previous menu • Move cursor to left in Edit Mode • (press and hold) Exit Edit Mode without saving
5	**OK**	• Scroll down • Move to next level/menu (open folder, subfolder, parameter, value) • Enter/exit Edit mode • Confirm operation

In the following table are described color and function for each **FREE Advance** LED.

LED	Color	Function
P	Green LED	On when **FREE Advance** is powered
A	Red LED	Programmable from the controller application
B	Yellow LED	Programmable from the controller application
C	Green LED	Programmable from the controller application

By default, A, B, C LEDs are used for USB management.

CHAPTER 6
Physical I/O and serial ports configuration

From time to time, new input modules, output modules or other devices are made available that are not documented in the following information. For information on new devices, contact your local Eliwell representative.

NOTICE

INOPERABLE EQUIPMENT

Update the controller firmware to the latest version every time you install a newly released Input/Output expansion module or other device to this equipment.

Failure to follow these instructions can result in equipment damage.

NOTE: For more information on how to update the controller firmware, contact your local Eliwell representative.

The **FREE Advance** I/Os and ports are configurable by parameters; for each input, output and serial ports, refer to the following table.

	For further information, refer to
Analog inputs	**6.1. Analog inputs configuration on page 75**
Analog outputs	**6.2. Analog outputs (LOW VOLTAGE - SELV) configuration on page 78**
Digital inputs (Clean Contact)	**7.1. FREE Advance parameter table on page 79**
Digital inputs (Low voltage - SELV)	**7.1. FREE Advance parameter table on page 79**
Digital outputs (Low voltage - SELV)	**7.1. FREE Advance parameter table on page 79**
Serial ports	**7.1. FREE Advance parameter table on page 79**

Applying incorrect current or voltage levels on analog inputs and outputs could damage the electronic circuitry. Further, connecting a current output device to an analog input configured as voltage, and vice-versa, will likewise damage the electronic circuitry.

NOTICE

INOPERABLE EQUIPMENT

- Do not apply voltages above 11 V to the analog inputs of the controller or Input/Output expansion module when analog input is configured as 0-5 V or 0-10 V input.
- Do not apply current above 30 mA to the analog inputs of the controller or Input/Output expansion module when analog input is configured as 0-20 mA or 4-20 mA input.
- Do not mismatch applied signal with analog input configuration.

Failure to follow these instructions can result in equipment damage.

6.1. Analog inputs configuration

FREE Advance AVC-AVD8400 (28 I/Os) and **FREE Advance AVC-AVD12600 (42 I/Os)** have analog inputs.
- **FREE Advance AVC-AVD8400 (28 I/Os)** has 8 analog inputs, referred to as AI1…AI8.
- **FREE Advance AVC-AVD12600 (42 I/Os)** has 12 analog inputs, referred to as AI1…AI12.

Using the parameters, an input can be configured to acquire a signal by a physical resource (probe, digital input, voltage/current signal) as specified in the following tables. **Not all configurations are allowed**, in particular the inputs are configurable in pairs:
- with 8 analog inputs there are 4 couples of NTC type probe, PTC type probe, PT1000, etc.
- with 12 analog inputs there are 6 couples of NTC type probe, PTC type probe, PT1000, etc.

For further information, refer to **6.1.1. Allowed configurations for analog inputs on page 76**.

Inputs can be configured as temperature probes (NTC, PTC or PT1000), as digital inputs or as a current/voltage input (0/4-20 mA, 0-10 V, 0-5 V, 0-5 V ratiometric).

Type of analog input AIx	Value					
Parameter	**0**	**1**	**2**	**3**	**4**	**5**
Cfg_AIx **x=1...8** if **FREE Advance 28 I/Os** **x=1...12** if **FREE Advance 42 I/Os**	NTC probe (NK103)	DI (1)	NTC probe (103AT)	4-20 mA (2)	0-10 V (2)	0-5 V Ratiometric
Parameter	**6**	**7**	**8**	**9**	**10**	**11**
Cfg_AIx **x=1...8** if **FREE Advance 28 I/Os** **x=1...12** if **FREE Advance 42 I/Os**	PT1000	hΩ (NTC) (3)	daΩ (PT1000) (4)	PTC (KTY81)	0-5 V	0-20 mA

(1) Input configured as voltage-free digital input

(2) 4-20 mA / 0-10 V:

Minimum full scale AIx
- for current probe, value = 0/4 mA,
- for 0÷10 V voltage probe, value = 0 V,
- for ratiometric probe (0÷5 V), value = 10% (corresponding to 0.5 V)

Maximum full scale AIx
- for current probe, value = 20 mA,
- for 0÷10 V voltage probe, value = 10 V,
- for ratiometric probe (0÷5 V), value = 90% (corresponding to 4.5 V)

(3) Cfg_AIx = 7 Resistance value read, expressed in hΩ, for a resistance applied to the input using the controller in NTC configuration, i.e. **creating a divider with pull-up resistance of 10k**.

(4) Cfg_AIx = 8 Resistance value read, expressed in daΩ, for a resistance applied to the input using the controller in PT1000 configuration, i.e. **creating a divider with pull-up resistance of 2k**.

Note: Typically used with potentiometer at input.
The resistance range for the hΩ(NTC) configuration is up to 150K, and up to 30K for the daΩ(PT1000) configuration.

FREE Advance AVC-AVD8400 (28 I/Os) Parameters to configure for Analog Inputs

Parameter	Description	Range
FullScaleMin_AI1	Analog input AI1 start of scale value	-9999…+9999
FullScaleMax_AI1	Analog input AI1 full scale value	-9999…+9999
...	...	...
FullScaleMin_AI8	Analog input AI8 start of scale value	-9999…+9999
FullScaleMax_AI8	Analog input AI8 full scale value	-9999…+9999

FREE Advance AVC-AVD8400 (28 I/Os) Parameters to read for Analog Inputs

Parameter	Description	Range
Calibration_AI1	Analog input AI1 differential	-1000 … 1000
...	...	...
Calibration_AI8	Analog input AI8 differential	-1000 … 1000

FREE Advance AVC-AVD12600 (42 I/Os) Parameters to configure for Analog Inputs

Parameter	Description	Range
FullScaleMin_AI1	Analog input AI1 start of scale value	-9999…+9999
FullScaleMax_AI1	Analog input AI1 full scale value	-9999…+9999
...	...	...
FullScaleMin_AI12	Analog input AI12 start of scale value	-9999…+9999
FullScaleMax_AI12	Analog input AI12 full scale value	-9999…+9999

FREE Advance AVC-AVD12600 (42 I/Os) Parameters to read for Analog Inputs

Parameter	Description	Range
Calibration_AI1	Analog input AI1 differential	-1000 … 1000
...	...	...
Calibration_AI12	Analog input AI12 differential	-1000 … 1000

For further information, refer to **"CHAPTER 7" Parameters on page 79**

6.1.1. Allowed configurations for analog inputs

The **FREE Advance** logic controllers have analog inputs that can be configured to acquire signals from the following probes: NTC, digital input, 0/4..20 mA 0..5 V, 0..10 V, PT1000, PTC.
Both **FREE Advance AVC-AVD8400 (28 I/Os) and FREE Advance AVC-AVD12600 (42 I/Os)** have the analog inputs: AI1, AI2, AI3, AI4, AI5, AI6, AI7, AI8; **FREE Advance AVC-AVD12600 (42 I/Os)** also has the analog inputs: AI9, AI10, AI11, AI12. These analog inputs (AI1...AI12) are configurable in pairs: (AI1, AI2) is the first pair, (AI3, AI4) is the second pair and so on, up to the last pair (AI11, AI12).
For each pair of analog inputs, not all signals can be acquired at the same time: the following table shows the allowed configurations, marked with ✓.

Applying not allowed configuration will produce the 0x8003 (decimal: 32771) error on the field value of both probes.

		A (for example: Cfg_AI1)										
		0	1	2	3 &11	4	5	6	7	8	9	10
B (for example: Cfg_AI2)	0	✓	✓	✓	-	-	-	-	✓	-	-	-
	1	✓	✓	✓	-	-	-	-	✓	-	-	-
	2	✓	✓	✓	-	-	-	-	✓	-	-	-
	3&11	-	-	-	✓	-	-	-	-	-	-	-
	4	-	-	-	-	✓	-	-	-	-	-	-
	5	-	-	-	-	-	✓	-	-	-	-	✓
	6	-	-	-	-	-	-	✓	-	✓	✓	-
	7	✓	✓	✓	-	-	-	-	✓	-	-	-
	8	-	-	-	-	-	-	✓	-	✓	✓	-
	9	-	-	-	-	-	-	✓	-	✓	✓	-
	10	-	-	-	-	-	✓	-	-	-	-	✓

For the other configurable analog input pairs, substitute the following in the previous table:

- **A** label with: **Cfg_Ai1, Cfg_Ai3**, **Cfg_Ai5**, **Cfg_Ai7**, **Cfg_Ai9** (only for AVC-AVD12600), **Cfg_Ai11** (only for AVC-AVD12600)
- **B** label with **respectively**: **Cfg_Ai2, Cfg_Ai4**, **Cfg_Ai6**, **Cfg_Ai8**, **Cfg_Ai10** (only for AVC-AVD12600, **Cfg_Ai12** (only for AVC-AVD12600)

	Label in the previous table	
Pairs of allowed parameters in the previous table	**A**	**B**
Pair #1	Cfg_Ai1	Cfg_Ai2
Pair #2	Cfg_Ai3	Cfg_Ai4
Pair #3	Cfg_Ai5	Cfg_Ai6
Pair #4	Cfg_Ai7	Cfg_Ai8
Pair #5	Cfg_Ai9	Cfg_Ai10
Pair #6	Cfg_Ai11	Cfg_Ai12

6.2. Analog outputs (LOW VOLTAGE - SELV) configuration

See **CHAPTER 3 Electrical connections on page 28** for the number and type of analog outputs used and for information on the symbols used on labels supplied with the controller.
There are

- 4 extra-low voltage (SELV) analog outputs for **FREE Advance AVC-AVD8400 (28 I/Os);**
- 6 extra-low voltage (SELV) analog outputs for **FREE Advance AVC-AVD12600 (42 I/Os);**

with the following characteristics.

Configuration of low voltage (SELV) analog output

Analog outputs	Description	Reference
AO1	Low voltage output (SELV)	**AVC-AVD8400-12600/C/L/U(/SSR)**
AO2	Low voltage output (SELV)	**AVC-AVD8400-12600/C/L/U(/SSR)**
AO3	Parameter **Cfg_AO3**: • 0=current modulation 4..20 mA • 1=current ON-OFF: current (ON) is 23 mA, current (OFF) is 0 mA • 2=voltage modulation 0..10 V • 3=PWM mode (configurable polarity): Frequency 1 Hz to 2000 Hz (1 Hz accuracy), Duty Cycle 0,0% to 100,0% (0,1% accuracy). Open Collector output, 30 mA, ⎓ 24 V max.	**AVC-AVD8400-12600/C/L/U(/SSR)**
AO4	Parameter **Cfg_AO4**: • 0=current modulation 4..20 mA • 1=current ON-OFF: current (ON) is 23 mA, current (OFF) is 0 mA • 2=voltage modulation 0..10 V • 3=PWM mode (configurable polarity): Frequency 1 Hz to 2000 Hz (1 Hz resolution), Duty Cycle 0,0% to 100,0% (0,1% resolution). Open Collector output, 30 mA, ⎓ 24 V max.	**AVC-AVD8400-12600/C/L/U(/SSR)**
AO5	Low voltage output (SELV)	**AVC-AVD12600/C/L/U(/SSR)**
AO6	Low voltage output (SELV)	**AVC-AVD12600/C/L/U(/SSR)**

For further information, refer to **"CHAPTER 7" Parameters on page 79**

CHAPTER 7
Parameters

The **FREE Advance** is fully configurable through the user-parameterization.
Parameters can be changed using:

- Keys on the **AVD8400-12600/C/L/U(/SSR)** front panel or remote **FREE Evolution Display Graphic** (**EVK1000**) panel (programmable through controller application).
- PC and **FREE Studio** (**v3.5 or greater**) software.

The following sections provide a detailed analysis of each parameter, divided into categories (folders).

For **FREE Advance**, the parameter table shows the configuration parameters for the controller saved in the non-volatile memory.

Modbus commands and data areas

The following commands are implemented:

Modbus command	Description of command
3 (**0x03**)	Read multiple registers on Client side
6 (**0x06**)	Write single register on Client side
16 (**0x10**)	Write multiple registers on Client side
43 (**0x2B**)	Read device ID: • Manufacturer ID • Model ID • Version ID

NOTE

- Command **6 (0x06)** not supported by **EVE7500 expansion 27 I/Os**
- Command **15 (0x0F)** 'Write multiple coils on Client side', supported only by **EVE7500 expansion 27 I/Os**
- **FREE Advance controllers** configured as Modbus Master support also commands 1, 2, 4 and 15 up to 16 registers.

7.1. FREE Advance parameter table

This table presents the column headers of the parameter table that follows.

Column	Description
LABEL	Indicates the label used to display the parameters in the menu of the controller.
PAR. VALUE ADDRESS	Indicates the address of the modbus register containing the resource to be accessed.
DATA SIZE	Indicates the size of the data in bits.
CPL	Indicates the register value conversion. To carry out the conversion, proceed as follows: • If the value in the register is between 0 and 32767, the result is the value itself (zero and positive values) • If the value in the register is between 32768 and 65535, the result is the value of the register minus 65536 (negative values) • If the field indicates “-1”, the value read by the register requires conversion, because the value represents a number with a sign.
RESET	Indicates whether the controller MUST be rebooted after the parameter has been modified. • Y = YES the controller MUST be rebooted to modify the parameter. • Empty " " = NO the controller does not need to be rebooted to modify the parameter
RANGE	Describes the interval of values that can be assigned to the parameter. It can be correlated with other equipment parameters (indicated in the parameter label).
DEFAULT	Indicates the factory setting for the reference.
U.M.	Indicates the unit of measurement for values converted according to the rules indicated in the CPL column The unit of measurement shown is for example purposes only, as it may change depending on the application (e.g. parameters with a U.M. in °C/bar could also have %RH)

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
ACKNOWLEDGEMENT folder								
Par_TAB	**15716**	WORD	-	Y	**Map code** Note: read/write parameter	0 … 65535	0	num
Par_POLI	**15717**	WORD	-	Y	**Model Code** Note: read/write parameter	0 … 65535	2049	num
Par_PARMOD	**15719**	BOOL	-	-	**Parameter modified** Flag indicating change to default settings. • 0 **(False)** = map not modified. • 1 **(True)** = at least one parameter has been modified with respect to the original configuration.	0, 1	0	num
AI CALIBRATION folder								
Gain_10V_AI1	**15527**	WORD	-	-	**0-10 V calibration gain AI1**	0 … 65535	32768	num
Gain_10V_AI10	**15590**	WORD	-	-	**0-10 V calibration gain AI10**	0 … 65535	32768	num
Gain_10V_AI11	**15597**	WORD	-	-	**0-10 V calibration gain AI11**	0 … 65535	32768	num
Gain_10V_AI12	**15604**	WORD	-	-	**0-10 V calibration gain AI12**	0 … 65535	32768	num
Gain_10V_AI2	**15534**	WORD	-	-	**0-10 V calibration gain AI2**	0 … 65535	32768	num
Gain_10V_AI3	**15541**	WORD	-	-	**0-10 V calibration gain AI3**	0 … 65535	32768	num
Gain_10V_AI4	**15548**	WORD	-	-	**0-10 V calibration gain AI4**	0 … 65535	32768	num
Gain_10V_AI5	**15555**	WORD	-	-	**0-10 V calibration gain AI5**	0 … 65535	32768	num
Gain_10V_AI6	**15562**	WORD	-	-	**0-10 V calibration gain AI6**	0 … 65535	32768	num
Gain_10V_AI7	**15569**	WORD	-	-	**0-10 V calibration gain AI7**	0 … 65535	32768	num
Gain_10V_AI8	**15576**	WORD	-	-	**0-10 V calibration gain AI8**	0 … 65535	32768	num
Gain_10V_AI9	**15583**	WORD	-	-	**0-10 V calibration gain AI9**	0 … 65535	32768	num
Gain_5Vr_AI1	**15526**	WORD	-	-	**0-5 Vr calibration gain AI1**	0 … 65535	32768	num
Gain_5V_AI1	**15529**	WORD	-	-	**0-5 V calibration gain AI1**	0 … 65535	32768	num
Gain_5Vr_AI10	**15589**	WORD	-	-	**0-5 Vr calibration gain AI10**	0 … 65535	32768	num
Gain_5V_AI10	**15592**	WORD	-	-	**0-5 V calibration gain AI10**	0 … 65535	32768	num
Gain_5Vr_AI11	**15596**	WORD	-	-	**0-5 Vr calibration gain AI11**	0 … 65535	32768	num
Gain_5V_AI11	**15599**	WORD	-	-	**0-5 V calibration gain AI11**	0 … 65535	32768	num
Gain_5Vr_AI12	**15603**	WORD	-	-	**0-5 Vr calibration gain AI12**	0 … 65535	32768	num
Gain_5V_AI12	**15606**	WORD	-	-	**0-5 V calibration gain AI12**	0 … 65535	32768	num
Gain_5Vr_AI2	**15533**	WORD	-	-	**0-5 Vr calibration gain AI2**	0 … 65535	32768	num
Gain_5V_AI2	**15536**	WORD	-	-	**0-5 V calibration gain AI2**	0 … 65535	32768	num
Gain_5Vr_AI3	**15540**	WORD	-	-	**0-5 Vr calibration gain AI3**	0 … 65535	32768	num
Gain_5V_AI3	**15543**	WORD	-	-	**0-5 V calibration gain AI3**	0 … 65535	32768	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
Gain_5Vr_AI4	**15547**	WORD	-	-	**0-5 Vr calibration gain AI4**	0 ... 65535	32768	num
Gain_5V_AI4	**15550**	WORD	-	-	**0-5 V calibration gain AI4**	0 ... 65535	32768	num
Gain_5Vr_AI5	**15554**	WORD	-	-	**0-5 Vr calibration gain AI5**	0 ... 65535	32768	num
Gain_5V_AI5	**15557**	WORD	-	-	**0-5 V calibration gain AI5**	0 ... 65535	32768	num
Gain_5Vr_AI6	**15561**	WORD	-	-	**0-5 Vr calibration gain AI6**	0 ... 65535	32768	num
Gain_5V_AI6	**15564**	WORD	-	-	**0-5 V calibration gain AI6**	0 ... 65535	32768	num
Gain_5Vr_AI7	**15568**	WORD	-	-	**0-5 Vr calibration gain AI7**	0 ... 65535	32768	num
Gain_5V_AI7	**15571**	WORD	-	-	**0-5 V calibration gain AI7**	0 ... 65535	32768	num
Gain_5Vr_AI8	**15575**	WORD	-	-	**0-5 Vr calibration gain AI8**	0 ... 65535	32768	num
Gain_5V_AI8	**15578**	WORD	-	-	**0-5 V calibration gain AI8**	0 ... 65535	32768	num
Gain_5Vr_AI9	**15582**	WORD	-	-	**0-5 Vr calibration gain AI9**	0 ... 65535	32768	num
Gain_5V_AI9	**15585**	WORD	-	-	**0-5 V calibration gain AI9**	0 ... 65535	32768	num
Gain_mA_AI1	**15528**	WORD	-	-	**0/4-20 mA calibration gain AI1**	0 ... 65535	32768	num
Gain_mA_AI10	**15591**	WORD	-	-	**0/4-20 mA calibration gain AI10**	0 ... 65535	32768	num
Gain_mA_AI11	**15598**	WORD	-	-	**0/4-20 mA calibration gain AI11**	0 ... 65535	32768	num
Gain_mA_AI12	**15605**	WORD	-	-	**0/4-20 mA calibration gain AI12**	0 ... 65535	32768	num
Gain_mA_AI2	**15535**	WORD	-	-	**0/4-20 mA calibration gain AI2**	0 ... 65535	32768	num
Gain_mA_AI3	**15542**	WORD	-	-	**0/4-20 mA calibration gain AI3**	0 ... 65535	32768	num
Gain_mA_AI4	**15549**	WORD	-	-	**0/4-20 mA calibration gain AI4**	0 ... 65535	32768	num
Gain_mA_AI5	**15556**	WORD	-	-	**0/4-20 mA calibration gain AI5**	0 ... 65535	32768	num
Gain_mA_AI6	**15563**	WORD	-	-	**0/4-20 mA calibration gain AI6**	0 ... 65535	32768	num
Gain_mA_AI7	**15570**	WORD	-	-	**0/4-20 mA calibration gain AI7**	0 ... 65535	32768	num
Gain_mA_AI8	**15577**	WORD	-	-	**0/4-20 mA calibration gain AI8**	0 ... 65535	32768	num
Gain_mA_AI9	**15584**	WORD	-	-	**0/4-20 mA calibration gain AI9**	0 ... 65535	32768	num
Gain_Ntc_AI1	**15524**	WORD	-	-	**NTC calibration gain AI1**	0 ... 65535	32768	num
Gain_Ntc_AI10	**15587**	WORD	-	-	**NTC calibration gain AI10**	0 ... 65535	32768	num
Gain_Ntc_AI11	**15594**	WORD	-	-	**NTC calibration gain AI11**	0 ... 65535	32768	num
Gain_Ntc_AI12	**15601**	WORD	-	-	**NTC calibration gain AI12**	0 ... 65535	32768	num
Gain_Ntc_AI2	**15531**	WORD	-	-	**NTC calibration gain AI2**	0 ... 65535	32768	num
Gain_Ntc_AI3	**15538**	WORD	-	-	**NTC calibration gain AI3**	0 ... 65535	32768	num
Gain_Ntc_AI4	**15545**	WORD	-	-	**NTC calibration gain AI4**	0 ... 65535	32768	num
Gain_Ntc_AI5	**15552**	WORD	-	-	**NTC calibration gain AI5**	0 ... 65535	32768	num
Gain_Ntc_AI6	**15559**	WORD	-	-	**NTC calibration gain AI6**	0 ... 65535	32768	num
Gain_Ntc_AI7	**15566**	WORD	-	-	**NTC calibration gain AI7**	0 ... 65535	32768	num
Gain_Ntc_AI8	**15573**	WORD	-	-	**NTC calibration gain AI8**	0 ... 65535	32768	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
Gain_Ntc_AI9	**15580**	WORD	-	-	**NTC calibration gain AI9**	0 … 65535	32768	num
Gain_PT1000_AI1	**15525**	WORD	-	-	**PT1000 calibration gain AI1**	0 … 65535	32768	num
Gain_PT1000_AI10	**15588**	WORD	-	-	**PT1000 calibration gain AI10**	0 … 65535	32768	num
Gain_PT1000_AI11	**15595**	WORD	-	-	**PT1000 calibration gain AI11**	0 … 65535	32768	num
Gain_PT1000_AI12	**15602**	WORD	-	-	**PT1000 calibration gain AI12**	0 … 65535	32768	num
Gain_PT1000_AI2	**15532**	WORD	-	-	**PT1000 calibration gain AI2**	0 … 65535	32768	num
Gain_PT1000_AI3	**15539**	WORD	-	-	**PT1000 calibration gain AI3**	0 … 65535	32768	num
Gain_PT1000_AI4	**15546**	WORD	-	-	**PT1000 calibration gain AI4**	0 … 65535	32768	num
Gain_PT1000_AI5	**15553**	WORD	-	-	**PT1000 calibration gain AI5**	0 … 65535	32768	num
Gain_PT1000_AI6	**15560**	WORD	-	-	**PT1000 calibration gain AI6**	0 … 65535	32768	num
Gain_PT1000_AI7	**15567**	WORD	-	-	**PT1000 calibration gain AI7**	0 … 65535	32768	num
Gain_PT1000_AI8	**15574**	WORD	-	-	**PT1000 calibration gain AI8**	0 … 65535	32768	num
Gain_PT1000_AI9	**15581**	WORD	-	-	**PT1000 calibration gain AI9**	0 … 65535	32768	num
Gain_PTC_AI1	**15530**	WORD	-	-	**PTC calibration gain AI1**	0 … 65535	32768	num
Gain_PTC_AI10	**15593**	WORD	-	-	**PTC calibration gain AI10**	0 … 65535	32768	num
Gain_PTC_AI11	**15600**	WORD	-	-	**PTC calibration gain AI11**	0 … 65535	32768	num
Gain_PTC_AI12	**15607**	WORD	-	-	**PTC calibration gain AI12**	0 … 65535	32768	num
Gain_PTC_AI2	**15537**	WORD	-	-	**PTC calibration gain AI2**	0 … 65535	32768	num
Gain_PTC_AI3	**15544**	WORD	-	-	**PTC calibration gain AI3**	0 … 65535	32768	num
Gain_PTC_AI4	**15551**	WORD	-	-	**PTC calibration gain AI4**	0 … 65535	32768	num
Gain_PTC_AI5	**15558**	WORD	-	-	**PTC calibration gain AI5**	0 … 65535	32768	num
Gain_PTC_AI6	**15565**	WORD	-	-	**PTC calibration gain AI6**	0 … 65535	32768	num
Gain_PTC_AI7	**15572**	WORD	-	-	**PTC calibration gain AI7**	0 … 65535	32768	num
Gain_PTC_AI8	**15579**	WORD	-	-	**PTC calibration gain AI8**	0 … 65535	32768	num
Gain_PTC_AI9	**15586**	WORD	-	-	**PTC calibration gain AI9**	0 … 65535	32768	num
Offs_Ntc_AI1	**15608**	WORD	-1	-	**NTC calibration offset AI1**	-32768 … 32767	0	num
Offs_PT1000_AI1	**15609**	WORD	-1	-	**PT1000 calibration offset AI1**	-32768 … 32767	0	num
Offs_5V_AI1	**15610**	WORD	-1	-	**0-5 V calibration offset AI1**	-32768 … 32767	0	num
Offs_10V_AI1	**15611**	WORD	-1	-	**0-10 V calibration offset AI1**	-32768 … 32767	0	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
Offs_mA_AI1	**15612**	WORD	-1	-	**0/4-20 mA calibration offset AI1**	-32768 ... 32767	0	num
Offs_5V_AI1	**15613**	WORD	-1	-	**0-5 V calibration offset AI1**	-32768 ... 32767	0	num
Offs_PTC_AI1	**15614**	WORD	-1	-	**PTC calibration offset AI1**	-32768 ... 32767	0	num
Offs_Ntc_AI2	**15615**	WORD	-1	-	**NTC calibration offset AI2**	-32768 ... 32767	0	num
Offs_PT1000_AI2	**15616**	WORD	-1	-	**PT1000 calibration offset AI2**	-32768 ... 32767	0	num
Offs_5V_AI2	**15617**	WORD	-1	-	**0-5 V calibration offset AI2**	-32768 ... 32767	0	num
Offs_10V_AI2	**15618**	WORD	-1	-	**0-10 V calibration offset AI2**	-32768 ... 32767	0	num
Offs_mA_AI2	**15619**	WORD	-1	-	**0/4-20 mA calibration offset AI2**	-32768 ... 32767	0	num
Offs_5V_AI2	**15620**	WORD	-1	-	**0-5 V calibration offset AI2**	-32768 ... 32767	0	num
Offs_PTC_AI2	**15621**	WORD	-1	-	**PTC calibration offset AI2**	-32768 ... 32767	0	num
Offs_Ntc_AI3	**15622**	WORD	-1	-	**NTC calibration offset AI3**	-32768 ... 32767	0	num
Offs_PT1000_AI3	**15623**	WORD	-1	-	**PT1000 calibration offset AI3**	-32768 ... 32767	0	num
Offs_5V_AI3	**15624**	WORD	-1	-	**0-5 V calibration offset AI3**	-32768 ... 32767	0	num
Offs_10V_AI3	**15625**	WORD	-1	-	**0-10 V calibration offset AI3**	-32768 ... 32767	0	num
Offs_mA_AI3	**15626**	WORD	-1	-	**0/4-20 mA calibration offset AI3**	-32768 ... 32767	0	num
Offs_5V_AI3	**15627**	WORD	-1	-	**0-5 V calibration offset AI3**	-32768 ... 32767	0	num
Offs_PTC_AI3	**15628**	WORD	-1	-	**PTC calibration offset AI3**	-32768 ... 32767	0	num
Offs_Ntc_AI4	**15629**	WORD	-1	-	**NTC calibration offset AI4**	-32768 ... 32767	0	num
Offs_PT1000_AI4	**15630**	WORD	-1	-	**PT1000 calibration offset AI4**	-32768 ... 32767	0	num
Offs_5V_AI4	**15631**	WORD	-1	-	**0-5 V calibration offset AI4**	-32768 ... 32767	0	num
Offs_10V_AI4	**15632**	WORD	-1	-	**0-10 V calibration offset AI4**	-32768 ... 32767	0	num
Offs_mA_AI4	**15633**	WORD	-1	-	**0/4-20 mA calibration offset AI4**	-32768 ... 32767	0	num
Offs_5V_AI4	**15634**	WORD	-1	-	**0-5 V calibration offset AI4**	-32768 ... 32767	0	num
Offs_PTC_AI4	**15635**	WORD	-1	-	**PTC calibration offset AI4**	-32768 ... 32767	0	num
Offs_Ntc_AI5	**15636**	WORD	-1	-	**NTC calibration offset AI5**	-32768 ... 32767	0	num
Offs_PT1000_AI5	**15637**	WORD	-1	-	**PT1000 calibration offset AI5**	-32768 ... 32767	0	num
Offs_5V_AI5	**15638**	WORD	-1	-	**0-5 V calibration offset AI5**	-32768 ... 32767	0	num
Offs_10V_AI5	**15639**	WORD	-1	-	**0-10 V calibration offset AI5**	-32768 ... 32767	0	num
Offs_mA_AI5	**15640**	WORD	-1	-	**0/4-20 mA calibration offset AI5**	-32768 ... 32767	0	num
Offs_5V_AI5	**15641**	WORD	-1	-	**0-5 V calibration offset AI5**	-32768 ... 32767	0	num
Offs_PTC_AI5	**15642**	WORD	-1	-	**PTC calibration offset AI5**	-32768 ... 32767	0	num
Offs_Ntc_AI6	**15643**	WORD	-1	-	**NTC calibration offset AI6**	-32768 ... 32767	0	num
Offs_PT1000_AI6	**15644**	WORD	-1	-	**PT1000 calibration offset AI6**	-32768 ... 32767	0	num
Offs_5V_AI6	**15645**	WORD	-1	-	**0-5 V calibration offset AI6**	-32768 ... 32767	0	num
Offs_10V_AI6	**15646**	WORD	-1	-	**0-10 V calibration offset AI6**	-32768 ... 32767	0	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
Offs_mA_AI6	**15647**	WORD	-1	-	**0/4-20 mA calibration offset AI6**	-32768 ... 32767	0	num
Offs_5V_AI6	**15648**	WORD	-1	-	**0-5 V calibration offset AI6**	-32768 ... 32767	0	num
Offs_PTC_AI6	**15649**	WORD	-1	-	**PTC calibration offset AI6**	-32768 ... 32767	0	num
Offs_Ntc_AI7	**15650**	WORD	-1	-	**NTC calibration offset AI7**	-32768 ... 32767	0	num
Offs_PT1000_AI7	**15651**	WORD	-1	-	**PT1000 calibration offset AI7**	-32768 ... 32767	0	num
Offs_5V_AI7	**15652**	WORD	-1	-	**0-5 V calibration offset AI7**	-32768 ... 32767	0	num
Offs_10V_AI7	**15653**	WORD	-1	-	**0-10 V calibration offset AI7**	-32768 ... 32767	0	num
Offs_mA_AI7	**15654**	WORD	-1	-	**0/4-20 mA calibration offset AI7**	-32768 ... 32767	0	num
Offs_5V_AI7	**15655**	WORD	-1	-	**0-5 V calibration offset AI7**	-32768 ... 32767	0	num
Offs_PTC_AI7	**15656**	WORD	-1	-	**PTC calibration offset AI7**	-32768 ... 32767	0	num
Offs_Ntc_AI8	**15657**	WORD	-1	-	**NTC calibration offset AI8**	-32768 ... 32767	0	num
Offs_PT1000_AI8	**15658**	WORD	-1	-	**PT1000 calibration offset AI8**	-32768 ... 32767	0	num
Offs_5V_AI8	**15659**	WORD	-1	-	**0-5 V calibration offset AI8**	-32768 ... 32767	0	num
Offs_10V_AI8	**15660**	WORD	-1	-	**0-10 V calibration offset AI8**	-32768 ... 32767	0	num
Offs_mA_AI8	**15661**	WORD	-1	-	**0/4-20 mA calibration offset AI8**	-32768 ... 32767	0	num
Offs_5V_AI8	**15662**	WORD	-1	-	**0-5 V calibration offset AI8**	-32768 ... 32767	0	num
Offs_PTC_AI8	**15663**	WORD	-1	-	**PTC calibration offset AI8**	-32768 ... 32767	0	num
Offs_Ntc_AI9	**15664**	WORD	-1	-	**NTC calibration offset AI9**	-32768 ... 32767	0	num
Offs_PT1000_AI9	**15665**	WORD	-1	-	**PT1000 calibration offset AI9**	-32768 ... 32767	0	num
Offs_5V_AI9	**15666**	WORD	-1	-	**0-5 V calibration offset AI9**	-32768 ... 32767	0	num
Offs_10V_AI9	**15667**	WORD	-1	-	**0-10 V calibration offset AI9**	-32768 ... 32767	0	num
Offs_mA_AI9	**15668**	WORD	-1	-	**0/4-20 mA calibration offset AI9**	-32768 ... 32767	0	num
Offs_5V_AI9	**15669**	WORD	-1	-	**0-5 V calibration offset AI9**	-32768 ... 32767	0	num
Offs_PTC_AI9	**15670**	WORD	-1	-	**PTC calibration offset AI9**	-32768 ... 32767	0	num
Offs_Ntc_AI10	**15671**	WORD	-1	-	**NTC calibration offset AI10**	-32768 ... 32767	0	num
Offs_PT1000_ AI10	**15672**	WORD	-1	-	**PT1000 calibration offset AI10**	-32768 ... 32767	0	num
Offs_5V_AI10	**15673**	WORD	-1	-	**0-5 V calibration offset AI10**	-32768 ... 32767	0	num
Offs_10V_AI10	**15674**	WORD	-1	-	**0-10 V calibration offset AI10**	-32768 ... 32767	0	num
Offs_mA_AI10	**15675**	WORD	-1	-	**0/4-20 mA calibration offset AI10**	-32768 ... 32767	0	num
Offs_5V_AI10	**15676**	WORD	-1	-	**0-5 V calibration offset AI10**	-32768 ... 32767	0	num
Offs_PTC_AI10	**15677**	WORD	-1	-	**PTC calibration offset AI10**	-32768 ... 32767	0	num
Offs_Ntc_AI11	**15678**	WORD	-1	-	**NTC calibration offset AI11**	-32768 ... 32767	0	num
Offs_PT1000_ AI11	**15679**	WORD	-1	-	**PT1000 calibration offset AI11**	-32768 ... 32767	0	num
Offs_5V_AI11	**15680**	WORD	-1	-	**0-5 V calibration offset AI11**	-32768 ... 32767	0	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
Offs_10V_AI11	**15681**	WORD	-1	-	**0-10 V calibration offset AI11**	-32768 ... 32767	0	num
Offs_mA_AI11	**15682**	WORD	-1	-	**0/4-20 mA calibration offset AI11**	-32768 ... 32767	0	num
Offs_5V_AI11	**15683**	WORD	-1	-	**0-5 V calibration offset AI11**	-32768 ... 32767	0	num
Offs_PTC_AI11	**15684**	WORD	-1	-	**PTC calibration offset AI11**	-32768 ... 32767	0	num
Offs_Ntc_AI12	**15685**	WORD	-1	-	**NTC calibration offset AI12**	-32768 ... 32767	0	num
Offs_PT1000_ AI12	**15686**	WORD	-1	-	**PT1000 calibration offset AI12**	-32768 ... 32767	0	num
Offs_5V_AI12	**15687**	WORD	-1	-	**0-5 V calibration offset AI12**	-32768 ... 32767	0	num
Offs_10V_AI12	**15688**	WORD	-1	-	**0-10 V calibration offset AI12**	-32768 ... 32767	0	num
Offs_mA_AI12	**15689**	WORD	-1	-	**0/4-20 mA calibration offset AI12**	-32768 ... 32767	0	num
Offs_5V_AI12	**15690**	WORD	-1	-	**0-5 V calibration offset AI12**	-32768 ... 32767	0	num
Offs_PTC_AI12	**15691**	WORD	-1	-	**PTC calibration offset AI12**	-32768 ... 32767	0	num
AO CALIBRATION folder								
Gain_10V_AO1	**15692**	WORD	-	-	**0-10 V calibration gain AO1**	0 ... 65535	32768	num
Gain_10V_AO2	**15694**	WORD	-	-	**0-10 V calibration gain AO2**	0 ... 65535	32768	num
Gain_10V_AO3	**15696**	WORD	-	-	**0-10 V calibration gain AO3**	0 ... 65535	32768	num
Gain_10V_AO4	**15698**	WORD	-	-	**0-10 V calibration gain AO4**	0 ... 65535	32768	num
Gain_10V_AO5	**15700**	WORD	-	-	**0-10 V calibration gain AO5**	0 ... 65535	32768	num
Gain_10V_AO6	**15702**	WORD	-	-	**0-10 V calibration gain AO6**	0 ... 65535	32768	num
Gain_mA_AO1	**-**	-	-	-	**not used**	-	-	-
Gain_mA_AO2	**-**	-	-	-	**not used**	-	-	-
Gain_mA_AO3	**15697**	WORD	-	-	**0/4-20 mA calibration gain AO3**	0 ... 65535	32768	num
Gain_mA_AO4	**15699**	WORD	-	-	**0/4-20 mA calibration gain AO4**	0 ... 65535	32768	num
Gain_mA_AO5	**-**	-	-	-	**not used**	-	-	-
Gain_mA_AO6	**-**	-	-	-	**not used**	-	-	-
Offs_10V_AO1	**15704**	WORD	-1	-	**0-10 V calibration offset AO1**	-32768 ... 32767	0	num
Offs_mA_AO1	**15705**	WORD	-1	-	**0/4-20 mA calibration offset AO1**	-32768 ... 32767	0	num
Offs_10V_AO2	**15706**	WORD	-1	-	**0-10 V calibration offset AO2**	-32768 ... 32767	0	num
Offs_mA_AO2	**15707**	WORD	-1	-	**0/4-20 mA calibration offset AO2**	-32768 ... 32767	0	num
Offs_10V_AO3	**15708**	WORD	-1	-	**0-10 V calibration offset AO3**	-32768 ... 32767	0	num
Offs_mA_AO3	**15709**	WORD	-1	-	**0/4-20 mA calibration offset AO3**	-32768 ... 32767	0	num
Offs_10V_AO4	**15710**	WORD	-1	-	**0-10 V calibration offset AO4**	-32768 ... 32767	0	num
Offs_mA_AO4	**15711**	WORD	-1	-	**0/4-20 mA calibration offset AO4**	-32768 ... 32767	0	num
Offs_10V_AO5	**15712**	WORD	-1	-	**0-10 V calibration offset AO5**	-32768 ... 32767	0	num
Offs_mA_AO5	**15713**	WORD	-1	-	**0/4-20mA calibration offset AO5**	-32768 ... 32767	0	num
Offs_10V_AO6	**15714**	WORD	-1	-	**0-10V calibration offset AO6**	-32768 ... 32767	0	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
Offs_mA_AO6	**15715**	WORD	-1	-	**0/4-20mA calibration offset AO6**	-32768 … 32767	0	num
ANALOG INPUTS folder BASE BOARD								
Temp_UM	**15725**	WORD	-	Y	**Temperature unit of measurement** • 0 = °C; • 1 = °F	0, 1	0	num
Cfg_Ai1	**15726**	WORD	-	-	**Type of analog input Ai1** • 0= NTC (NK103) • 1 = DI Input • 2 = NTC (103AT) • 3 = 4…20 mA • 4 = 0-10 V • 5 = 0-5 V (Ratiometric) • 6 = Pt1000 • 7 = hΩ(NTC) • 8 = daΩ(PT1000) • 9 = PTC • 10 = 0-5 V • 11 = 0…20 mA	0 ... 11	2	num
Cfg_Ai2	**15727**	WORD	-	-	**Type of analog input Ai2** See Cfg_Ai1	0 ... 11	2	num
Cfg_Ai3	**15728**	WORD	-	-	**Type of analog input Ai3** See Cfg_Ai1	0 ... 11	2	num
Cfg_Ai4	**15729**	WORD	-	-	**Type of analog input Ai4** See Cfg_Ai1	0 ... 11	2	num
Cfg_Ai5	**15730**	WORD	-	-	**Type of analog input Ai5** See Cfg_Ai1	0 ... 11	2	num
Cfg_Ai6	**15731**	WORD	-	-	**Type of analog input Ai6** See Cfg_Ai1	0 ... 11	2	num
Cfg_Ai7	**16100**	WORD	-	-	**Type of analog input Ai7** See Cfg_Ai1	0 ... 11	2	num
Cfg_Ai8	**16101**	WORD	-	-	**Type of analog input Ai8** See Cfg_Ai1	0 ... 11	2	num
FullScaleMin_Ai1	**15736**	WORD	-	-	**Analog input Ai1 start of scale value** Note: Minimum full scale: for current probes, value at 4 mA, for 0-10 V voltage probes, value at 0 V, for ratiometric probes (0-5 V), value at 10% (corresponding to 0.5 V).	-9999…+9999	0	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
FullScaleMax_ Ai1	**15737**	WORD	-	-	**Analog input Ai1 full scale value** Note: Maximum full scale for current probes, value at 20 mA, for 0-10 V voltage probes, value at 10 V, for ratiometric probes (0-5 V), value at 90% (corresponding to 4.5 V).	-9999…+9999	1000	num
FullScaleMin_Ai2	**15738**	WORD	-1	-	**Analog input Ai2 start of scale value** See FullScaleMin_Ai1	-9999…+9999	0	num
FullScaleMax_ Ai2	**15739**	WORD	-	-	**Analog input Ai2 full scale value** See FullScaleMax_Ai1	-9999…+9999	1000	num
FullScaleMin_Ai3	**15740**	WORD	-1	-	**Analog input Ai3 start of scale value** See FullScaleMin_Ai1	-9999…+9999	0	num
FullScaleMax_ Ai3	**15741**	WORD	-	-	**Analog input Ai3 full scale value** See FullScaleMax_Ai1	-9999…+9999	1000	num
FullScaleMin_Ai4	**15742**	WORD	-1	-	**Analog input Ai4 start of scale value** See FullScaleMin_Ai1	-9999…+9999	0	num
FullScaleMax_ Ai4	**15743**	WORD	-	-	**Analog input Ai4 full scale value** See FullScaleMax_Ai1	-9999…+9999	1000	num
FullScaleMin_Ai5	**15744**	WORD	-1	-	**Analog input Ai5 start of scale value** See FullScaleMin_Ai1	-9999…+9999	0	num
FullScaleMax_ Ai5	**15745**	WORD	-	-	**Analog input Ai5 full scale value** See FullScaleMax_Ai1	-9999…+9999	1000	num
FullScaleMin_Ai6	**15746**	WORD	-1	-	**Analog input Ai6 start of scale value** See FullScaleMin_Ai1	-9999…+9999	0	num
FullScaleMaxAi6	**15747**	WORD	-	-	**Analog input Ai6 full scale value** See FullScaleMax_Ai1	-9999…+9999	1000	num
FullScaleMin_Ai7	**16106**	WORD	-1	-	**Analog input Ai7 start of scale value** See FullScaleMin_Ai1	-9999…+9999	0	num
FullScaleMax_ Ai7	**16107**	WORD	-	-	**Analog input Ai7 full scale value** See FullScaleMax_Ai1	-9999…+9999	1000	num
FullScaleMin_Ai8	**16108**	WORD	-1	-	**Analog input Ai8 start of scale value** See FullScaleMin_Ai1	-9999…+9999	0	num
FullScaleMaxAi8	**16109**	WORD	-	-	**Analog input Ai8 full scale value** See FullScaleMax_Ai1	-9999…+9999	1000	num
Calibration_Ai1	**15748**	WORD	-1	-	**Analog input Ai1 differential**	-1000 … 1000	0	digit
Calibration_Ai2	**15749**	WORD	-1	-	**Analog input Ai2 differential**	-1000 … 1000	0	digit
Calibration_Ai3	**15750**	WORD	-1	-	**Analog input Ai3 differential**	-1000 … 1000	0	digit

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
Calibration_Ai4	**15751**	WORD	-1	-	**Analog input Ai4 differential**	-1000 … 1000	0	digit
Calibration_Ai5	**15752**	WORD	-1	-	**Analog input Ai5 differential**	-1000 … 1000	0	digit
Calibration_Ai6	**15753**	WORD	-1	-	**Analog input Ai6 differential**	-1000 … 1000	0	digit
Calibration_Ai7	**16118**	WORD	-1	-	**Analog input Ai7 differential**	-1000 … 1000	0	digit
Calibration_Ai8	**16119**	WORD	-1	-	**Analog input Ai8 differential**	-1000 … 1000	0	digit
Cfg_AO3	**15758**	WORD	-	Y	**Type of analog output AO3** • 0 = current modulation • 1 = current ON/OFF • 2= voltage modulation • 3 = PWM mode	0 ... 3	0	num
Cfg_AO4	**15759**	WORD	-	Y	**Type of analog output AO4 See Cfg_ AO3**	0 ... 3	0	num
PWM_frequency_ AO3_AO4	**15769**	WORD	-	Y	**PWM Frequency for AO3 and AO4 in PWM mode**	0 ... 2000	1000	Hz
PWM_polarity_ AO3_AO4	**15770**	WORD	-	-	**PWM Polarity for AO3 and AO4 in PWM mode: 1=direct,0=reversed**	0, 1	1	num
ANALOG INPUTS folder UPPER BOARD								
Cfg_Ai9	**16102**	WORD	-	-	**Type of analog input Ai9** • 0= NTC (NK103) • 1= DI Input • 2= NTC (103AT) • 3 = 4…20mA • 4=0-10 V • 5=0-5 V (Ratiometric) • 6=Pt1000 • 7=hΩ(NTC) • 8=daΩ(PT1000) • 9=PTC • 10=0-5 V • 11=0…20mA	0 ... 11	3	num
Cfg_Ai10	**16103**	WORD	-	-	**Type of analog input Ai10** See Cfg_Ai1	0 ... 11	3	num
Cfg_Ai11	**16104**	WORD	-	-	**Type of analog input Ai11** See Cfg_Ai1	0 ... 11	3	num
Cfg_Ai12	**16105**	WORD	-	-	**Type of analog input Ai12** See Cfg_Ai1	0 ... 11	3	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
FullScaleMin_Ai9	**16110**	WORD	-1	-	**Analog input Ai9 start of scale value** Note: Minimum full scale: for current probes, value at 4 mA, for 0-10 V voltage probes, value at 0V, for ratiometric probes (0-5 V), value at 10% (corresponding to 0.5V).	-9999…+9999	0	num
FullScaleMax_ Ai9	**16111**	WORD	-	-	**Analog input Ai9 full scale value** Note: Maximum full scale for current probes, value at 20 mA, for 0-10 V voltage probes, value at 10 V, for ratiometric probes (0-5 V), value at 90% (corresponding to 4.5 V).	-9999…+9999	1000	num
FullScaleMin_ Ai10	**16112**	WORD	-1	-	**Analog input Ai10 start of scale value** See FullScaleMin_Ai1	-9999…+9999	0	num
FullScaleMax_ Ai10	**16113**	WORD	-	-	**Analog input Ai10 full scale value** See FullScaleMax_Ai1	-9999…+9999	1000	num
FullScaleMin_ Ai11	**16114**	WORD	-1	-	**Analog input Ai11 start of scale value** See FullScaleMin_Ai1	-9999…+9999	0	num
FullScaleMax_ Ai11	**16115**	WORD	-	-	**Analog input Ai11 full scale value** See FullScaleMax_Ai1	-9999…+9999	1000	num
FullScaleMin_ Ai12	**16116**	WORD	-1	-	**Analog input Ai12 start of scale value** See FullScaleMin_Ai1	-9999…+9999	0	num
FullScaleMax_ Ai12	**16117**	WORD	-	-	**Analog input Ai12 full scale value** See FullScaleMax_Ai1	-9999…+9999	1000	num
Calibration_Ai9	**16120**	WORD	-1	-	**Analog input Ai9 differential**	-1000 ... 1000	0	digit
Calibration_Ai10	**16121**	WORD	-1	-	**Analog input Ai10 differential**	-1000 ... 1000	0	digit
Calibration_Ai11	**16122**	WORD	-1	-	**Analog input Ai11 differential**	-1000 ... 1000	0	digit
Calibration_Ai12	**16123**	WORD	-1	-	**Analog input Ai12 differential**	-1000 ... 1000	0	digit

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET (Y/N)	DESCRIPTION	RANGE	DEFAULT	U.M.
ON BOARD RS 485-1 folder								
Addr_RS485_OB1	**16124**	WORD	-	Y	**On-board RS 485 serial address**	0 ... 255	1	num
Proto_RS485_OB1	**16125**	WORD	-	Y	**On-board RS 485 protocol selection** • 2 = uNET • 3 = Modbus/RTU	2, 3	3	num
Databit_RS485_OB1	**16126**	WORD	-	Y	**On-board RS 485 data bit number** Fixed setting 8	8	8	num
Stopbit_RS485_OB1	**16127**	WORD	-	Y	**On-board RS 485 stop bit number** 1= 1 stop bit 2= 2 stop bit	1, 2	1	num
Parity_RS485_OB1	**16128**	WORD	-	Y	**On-board RS 485 protocol parity** • 0= NULL • 1= ODD • 2= EVEN	0 ... 2	2	num
Baud_RS485_OB1	**16129**	WORD	-	Y	**On-board RS 485 protocol baudrate** • 0=9600 baud • 1=19200 baud • 2=38400 baud • 3=57600 baud • 4=76800 baud • 5=115200 baud	0 ... 5	2	num
ON BOARD RS 485-2 folder								
Addr_RS485_OB	**15774**	WORD	-	Y	**On-board RS 485 serial address**	0 ... 255	1	num
Proto_RS485_OB	**15775**	WORD	-	Y	**On-board RS 485 protocol selection** • 2 = uNET • 3 = Modbus/RTU	2, 3	3	num
Databit_RS485_OB	**15776**	WORD	-	Y	**On-board RS 485 data bit number** Fixed setting 8	8	8	num
Stopbit_RS485_OB	**15777**	WORD	-	Y	**On-board RS 485 stop bit number** 1= 1 stop bit 2= 2 stop bit	1, 2	1	num
Parity_RS485_OB	**15778**	WORD	-	Y	**On-board RS 485 protocol parity** • 0= NULL • 1= ODD • 2= EVEN	0 ... 2	2	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET (Y/N)	DESCRIPTION	RANGE	DEFAULT	U.M.
Baud_RS485_OB	**15779**	WORD	-	Y	**On-board RS 485 protocol baudrate** • 0=9600 baud • 1=19200 baud • 2=38400 baud • 3=57600 baud • 4=76800 baud • 5=115200 baud	0 ... 5	2	num
ON BOARD CAN EXPANSION BUS folder								
Addr_CAN_OB	**15780**	WORD	-	Y	**On-board CAN Expansion Bus serial address**	1 ... 127	1	num
Baud_CAN_OB	**15781**	WORD	-	Y	**On-board CAN Expansion Bus protocol baudrate** • 2=500 kbaud • 3=250 kbaud • 4=125 kbaud • 5=125 kbaud • 6=50 kbaud	2 ... 6	2	num
RS 485 COMMUNICATION MODULES PASSIVE folder								
Addr_RS485_PI	**15782**	WORD	-	Y	**RS 485 passive Communication Module serial address**	0 … 255	1	num
Proto_RS485_PI	**15783**	WORD	-	Y	**RS 485 passive Communication Module protocol selection** 2 = uNET 3 = Modbus/RTU	2, 3	3	num
Databit_RS485_PI	**15784**	WORD	-	Y	**RS 485 passive Communication Module data bit number** Fixed setting 8	8	8	num
Stopbit_RS485_PI	**15785**	WORD	-	Y	**RS 485 passive Communication Module stop bit number** • 1= 1 stop bit • 2= 2 stop bits	1, 2	1	num
Parity_RS485_PI	**15786**	WORD	-	Y	**RS 485 passive Communication Module protocol parity** 0= NULL 1= ODD 2= EVEN	0 … 2	2	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET (Y/N)	DESCRIPTION	RANGE	DEFAULT	U.M.
Baud_RS485_PI	**15787**	WORD	-	Y	**RS 485 passive Communication Module protocol baudrate** • 0=9600 baud • 1=19200 baud • 2=38400 baud • 3=57600 baud • 4=76800 baud • 5=115200 baud	0 … 5	2	num
CAN EXPANSION BUS PASSIVE COMMUNICATION MODULE folder								
Addr_CAN_PI	**15788**	WORD	-	Y	**CAN Expansion Bus passive Communication Module serial address**	1 … 127	1	num
Baud_CAN_PI	**15789**	WORD	-	Y	**CAN Expansion Bus passive Communication Module protocol baudrate** • 2=500 kbaud • 3=250 kbaud • 4=125 kbaud • 5=125 kbaud • 6=50 kbaud	2 … 6	2	num
RS 232 PASSIVE COMMUNICATION MODULE folder								
Addr_ RS232_PI	**15790**	WORD	-	Y	**RS 232 passive Communication Module serial address**	0 ... 255	1	num
Proto_ RS232_PI	**15791**	WORD	-	Y	**RS 232 passive Communication Module protocol selection** • 2 = uNET • 3 = Modbus/RTU	2 ... 3	3	num
Databit_ RS232_PI	**15792**	WORD	-	Y	**RS 232 passive Communication Module data bit number** • 7= 7 bit • 8= 8 bit	7 ... 8	8	num
Stopbit_ RS232_PI	**15793**	WORD	-	Y	**RS 232 passive Communication Module stop bit number** • 1= 1 stop bit • 2= 2 stop bits	1... 2	1	num
Parity_ RS232_PI	**15784**	WORD	-	Y	**RS 232 passive Communication Module protocol parity** • 0= NULL • 1= ODD • 2= EVEN	0 ... 2	2	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET (Y/N)	DESCRIPTION	RANGE	DEFAULT	U.M.
Baud_RS232_PI	**15795**	WORD	-	Y	**RS 232 passive Communication Module protocol baudrate** • 0=9600 baud • 1=19200 baud • 2=38400 baud • 3=57600 baud • 4=76800 baud • 5=115200 baud	0 ... 5	2	num
ETHERNET folder								
Port_HTTP_PI	**15796**	WORD	-	Y	**HTTP port** HTTP communication Port number Default 0 corresponds to **port 80**	0 … 65535	0	num
Port_ETH_PI	**15797**	WORD	-	Y	**Port** TCP/IP Modbus communication port. Port 502 for example	0 … 65535	502	num
Ip_1_ETH_PI	**15798**	WORD	-	Y	**Ethernet passive Plug-in IP address (part 1)**	0 … 255	10	num
Ip_2_ETH_PI	**15799**	WORD	-	Y	**Ethernet passive Plug-in IP address (part 2)**	0 … 255	0	num
Ip_3_ETH_PI	**15800**	WORD	-	Y	**Ethernet passive Plug-in IP address (part 3)**	0 … 255	0	num
Ip_4_ETH_PI	**15801**	WORD	-	Y	**Ethernet passive Plug-in IP address (part 4)**	0 … 255	100	num
DefGtwy_1_ETH_PI	**15802**	WORD	-	Y	**Default Gateway (part 1)**	0 … 255	10	num
DefGtwy_2_ETH_PI	**15803**	WORD	-	Y	**Default Gateway (part 2)**	0 … 255	0	num
DefGtwy_3_ETH_PI	**15804**	WORD	-	Y	**Default Gateway (part 3)**	0 … 255	0	num
DefGtwy_4_ETH_PI	**15805**	WORD	-	Y	**Default Gateway (part 4)**	0 … 255	1	num
NetMsk_1_ETH_PI	**15806**	WORD	-	Y	**Net mask (part 1)**	0 … 255	255	num
NetMsk_2_ETH_PI	**15807**	WORD	-	Y	**Net mask (part 2)**	0 … 255	255	num
NetMsk_3_ETH_PI	**15808**	WORD	-	Y	**Net mask (part 3)**	0 … 255	255	num
NetMsk_4_ETH_PI	**15809**	WORD	-	Y	**Net mask (part 4)**	0 … 255	0	num
PriDNS_1_ETH_PI	**15810**	WORD	-	Y	**Primary DNS server (part 1)**	0 … 255	8	num

LABEL	PAR. VALUE ADDRESS	DATA SIZE	CPL	RESET (Y/N)	DESCRIPTION	RANGE	DEFAULT	U.M.
PriDNS_2_ETH_PI	**15811**	WORD	-	Y	**Primary DNS server (part 2)**	0 … 255	8	num
PriDNS_3_ETH_PI	**15812**	WORD	-	Y	**Primary DNS server (part 3)**	0 … 255	8	num
PriDNS_4_ETH_PI	**15813**	WORD	-	Y	**Primary DNS server (part 4)**	0 … 255	8	num
SecDNS_1_ETH_PI	**15814**	WORD	-	Y	**Secondary DNS server (part 1)**	0 … 255	8	num
SecDNS_2_ETH_PI	**15815**	WORD	-	Y	**Secondary DNS server (part 2)**	0 … 255	8	num
SecDNS_3_ETH_PI	**15816**	WORD	-	Y	**Secondary DNS server (part 3)**	0 … 255	4	num
SecDNS_4_ETH_PI	**15817**	WORD	-	Y	**Secondary DNS server (part 4)**	0 … 255	4	num
EnableDHCP_ETH_PI	**15818**	WORD	-	Y	**Enable DHCP** 0 = False, 1=True	0, 1	0	flag
MAC_1_ETH_PI	**16130**	WORD	-	Y	**MAC address (1st part)**	0	0	num
MAC_2_ETH_PI	**16131**	WORD	-	Y	**MAC address (2nd part)**	0 ... 24	24	num
MAC_3_ETH_PI	**16132**	WORD	-	Y	**MAC address (3rd part)**	0 ... 187	187	num
MAC_4_ETH_PI	**16133**	WORD	-	Y	**MAC address (4th part)**	0 … 255	255	num
MAC_5_ETH_PI	**16134**	WORD	-	Y	**MAC address (5th part)**	0 … 255	255	num
MAC_6_ETH_PI	**16135**	WORD	-	Y	**MAC address (6th part)**	0 … 255	255	num

CHAPTER 8
Programming of the FREE Advance

The **FREE Advance** has 2 USB connectors placed on the top-left side of the front view.

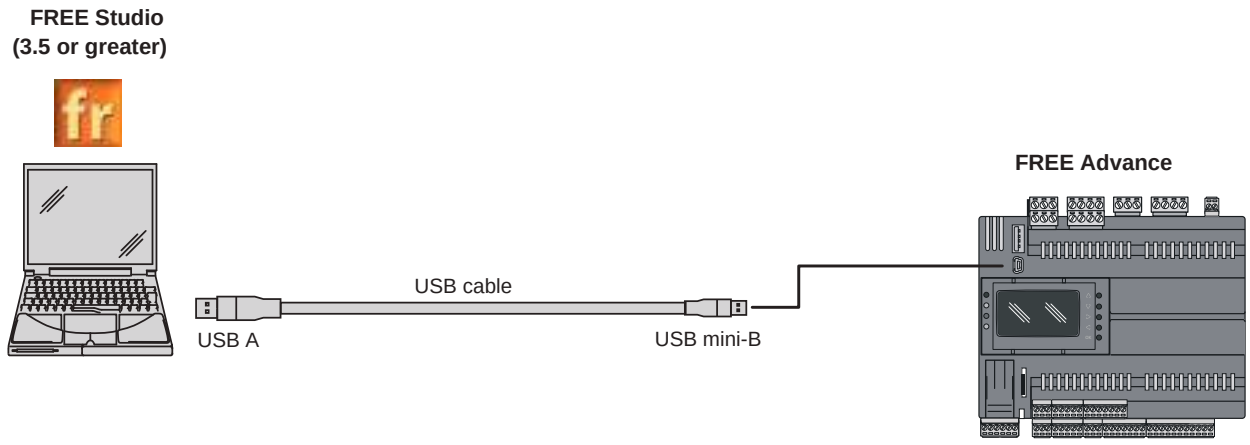
FREE Advance can be connected to a PC through the mini-B USB port and a USB cable:
- Type A USB (HOST). Used to connect a USB memory key drive when downloading the application.
- Type mini-B USB (DEVICE). Used to connect **FREE Advance** to a PC via mini-B/A USB cable for debugging, commissioning, downloading, uploading with **FREE Studio** (**v3.5 or greater**).

The **FREE Advance** can also be supplied through the mini-B USB cable with limited functionalities related to debugging, commissioning, downloading and uploading with **FREE Studio** (**v3.5 or greater**).
For more information, see the **FREE Studio** software, Programming Guide.

NOTE: Do not apply voltage via 24 Vac/dc while the equipment is already connected to a PC via mini-B USB cable.

Before applying power via 24 Vac/dc power supply connection:
1. Disconnect the mini-B USB cable.
2. Supply the **FREE Advance logic controller** via its 24 Vac/dc supply.
3. Re-connect the mini-B USB cable.

8.1. Case 1: connection with a PC through USB cable

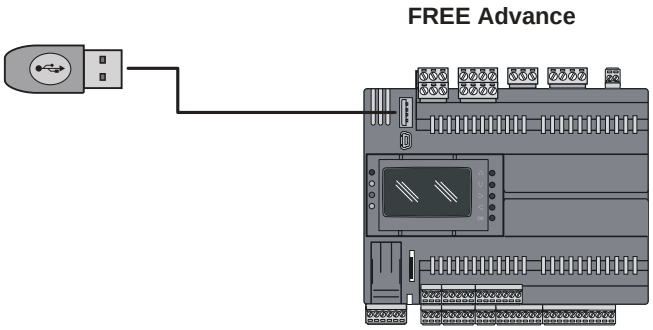


→ Download to the controller		← Upload to the PC	
Parameters	✓	Parameters	✓
Controller application	✓	Controller application	✓
HMI application	✓	HMI application	✓
Data File	✓	Data File	✓
BIOS	✓	BIOS	-

Fig. 46. Connection between PC and the FREE Advance through USB cable

(1) Upload and download of a parameter map to/from one or more targets of the same type.

8.2. Case 2: connection with a USB memory key

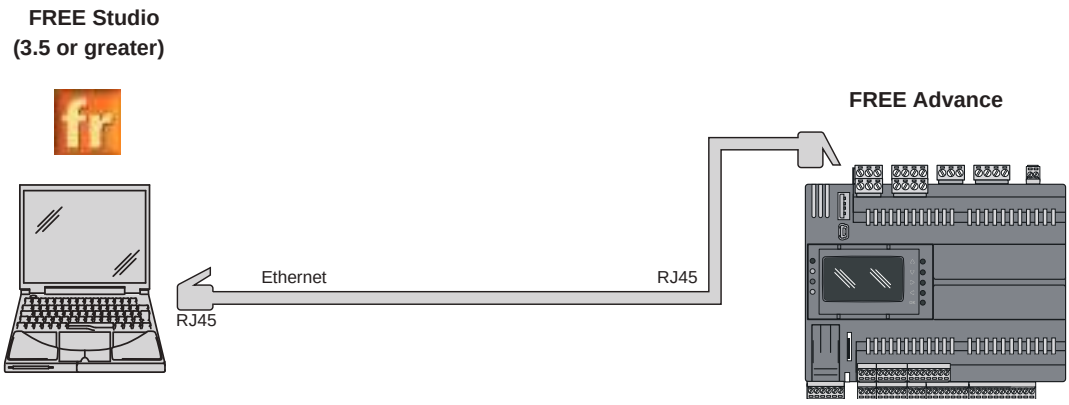


→ Download to the controller		← Upload to the PC	
Parameters(1)	✓	Parameters (1)	✓
Controller application	✓	Controller application	✓
HMI application	✓	HMI application	✓
Data File	✓	Data File	✓
BIOS	-	BIOS	-

Fig. 47. Connection of a USB memory key to the FREE Advance

(1) Upload and download of a parameter map to/from one or more targets of the same type.

8.3. Case 3: connection with a PC through Ethernet cable



→ Download to the controller		← Upload to the PC	
Parameters(1)	✓	Parameters (1)	✓
Controller application	✓	Controller application	✓
HMI application	✓	HMI application	✓
Data File	✓	Data File	✓
BIOS	✓	BIOS	-

Fig. 48. Connections between PC and the FREE Advance through Ethernet cable

(1) Upload and download of a parameter map to/from one or more targets of the same type.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Connect the programming cable to the PC first, then to the programming port of the controller.
- Disconnect the programming cable from the controller before disconnecting it from the PC.

Failure to follow these instructions can result in death, serious injury, or equipment damage

8.4. Download BIOS

There are two ways to update the **FREE Advance** BIOS:
- downloading into the **FREE Advance** from USB memory key
- downloading into the **FREE Advance** from PC with **FREE Studio (v3.5 or greater)**

8.4.1. Download BIOS from USB memory key

1. Trace the BIOS file (it has the file extension ".bin") in one of the following ways alternatively:
   - If you have **FREE Studio (v3.5 or greater)** installed on your PC, BIOS is available in the following:
     C:\Program Files (x86)\Eliwell\free Studio\Catalog\FreeAdvance\Firmware_596
     <firmware> = firmware596 for **FREE Advance**
   - Download .bin file from Web Site - Firmware Update section.
2. Copy this file into a USB memory key (e.g. msk596_00.bin).
3. Connect USB memory key to **FREE Advance.**
   BIOS will be downloaded into **FREE Advance:** yellow LED flashes during download. When the download is completed, green LED flashes twice and switch ON to confirm successfull download.
4. Remove USB memory key.
   FREE Advance will automatically reset and will reboot
   If a SYSTEM FAULT message appears, it is related to a watchdog time out that occurred while updating the bios and, in this case, can be ignored.
   BIOS update has been completed successfully.

FREE Advance will not download a non-compliant BIOS (for example you cannot download BIOS for **FREE Evolution / Panel** or **FREE Smart** into an **FREE Advance** and vice versa).

8.4.2. Download BIOS from PC

1. Connect the **FREE Advance** (via Ethernet or Type mini-B USB) to the PC.
2. Open **FREE Studio (v3.5 or greater)** software.
3. Add an **FREE Advance** target to the project.
   Select the correct target device. The BIOS files links are:
   C:\<Programs>\Eliwell\free Studio\Catalog\FreeAdvance\<firmware> where <firmware> =Firmware_596
4. Select the name of the target and right click on it.
5. Select BIOS download.
6. Open the .bin file you want to download.
7. Click on Download button.
   The operation may take a few minutes. If the download terminates successfully, a confirmation is displayed.
8. Disconnect the **FREE Advance** from the the PC.