

LC700

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MAINTENANCE AND
OPERATION MANUAL

LC700 User's Guide



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AVOIDING ELECTROSTATIC DISCHARGES



ATTENTION

Electrostatic discharges may damage semiconductor electronic components in printed circuit boards. They usually occur when touching components or connector pins from modules and racks, without wearing the appropriate equipment to prevent discharges. It is recommended to take the following precautions:

- Before handling modules and racks, remove the electrostatic charge from your body by wearing a proper wristband or touching grounded devices;
- Avoid touching electronic components or connector pins from racks and modules.

INTRODUCTION

Since 1978 Smar has been a constant collaborator in the technology evolution in Automation. We have worked hard and actively to produce new products and new ideas to satisfy user's dreams about process control. The first 16-bits digital controller, the first transmitter with a PID controller and the first commercial line with Fieldbus products for process automation are examples of the pioneering achievements of Smar.

The LC700 now joins the family of Smar products building the bridge between process and manufacturing automation. This LC700 operates with the configurator (CONF700) which is software based on Windows. With CONF700, you can configure the hardware for the LC700 system, create the control logic through the Ladder Structure language, create User-Functions, test the application and have it optimized.

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RETURNING MATERIALS A.2

OVERVIEW OF A LC700 SYSTEM

The LC700 is a powerful device added to Smar's line of products. LC700 is a compact programmable logic controller, fully-modular to adapt into a large variety of applications. This innovative product works with an advanced CPU supplying a higher performance. Fieldbus modules are available making the LC700 ready to interact with Fieldbus signals from different devices.

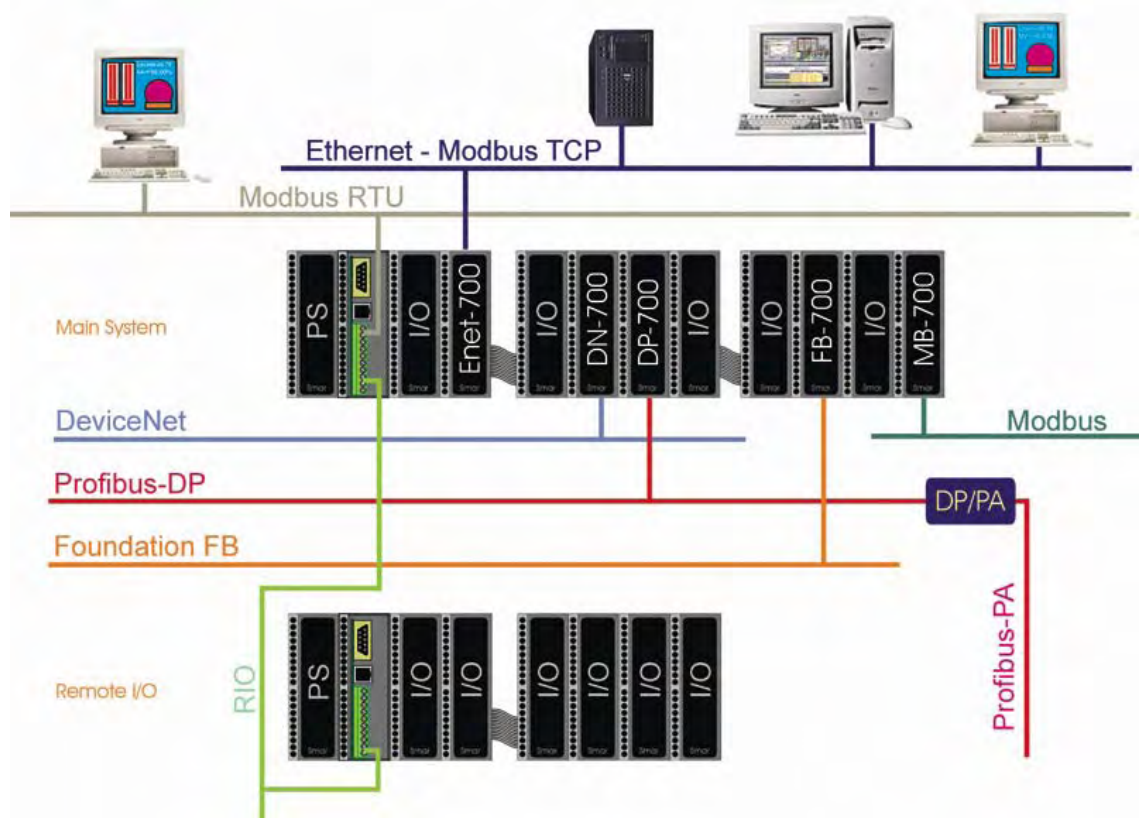


Figure 1.1 – Overview of a LC700 system and interfaces DeviceNet, Profibus and Fieldbus

Note

Check with the factory for availability of DN-700 and DP-700 modules.

Moreover, programming is turned into a simple configuration due to an easy to use Windows based software. Configuration is compatible with IEC-61131-3 Ladder Logic standards. In addition, the software makes it possible to segment the solution creating simple or complex logic ladder networks. Creating Boolean functions as well as assign I/O and auxiliary signals to the logic is as easy as a couple of mouse clicks! Memory allocation and default names are automatically created! No more extra thinking in arranging memory space! Let the computer work for you!

The LC700 brings speed, modularity and fieldbus interface combined with reliability and low cost for the plant.

Its modular design gives tremendous flexibility to the application. The I/O modules can be selected from a broad range of different signal types to perfectly fit the plant necessities.

The LC700 is able to deal with a total of 2000(*) discrete points, 1024 analog variables and carries a large list of function blocks from the most standard instructions to more sophisticated ones for process control.

The LC700 processing power, modularity and reliability makes it an intelligent choice for a wide range of applications in Process Control and Automation .

(*) For the CPU-700-E3

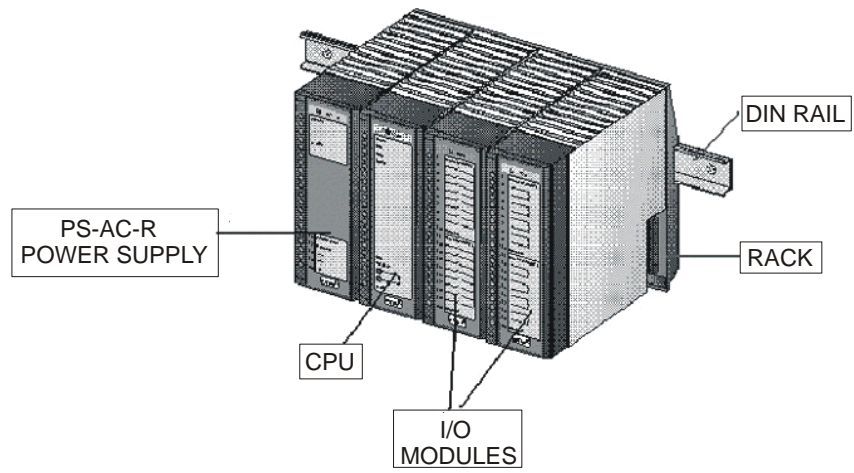


Figure 1.2 - CPU



Figure 1.3– Picture of a LC700 System

LC700 ARCHITECTURE

Racks and Modules

The most important elements of an LC700 system are the Racks and Modules. To build a LC700 system, we basically need a CPU Module, one or more Power Supply Modules and a set of I/O Modules to interact with field signals.

Modules are plugged into the Slots that are part of the Racks. The Slots connect the Modules through a common bus called Inter-Module-Bus (IMB) used by the CPU to communicate with them.

Racks can be interconnected for system expansion. Each Rack has four (4) Slots. This means that every added Rack makes room for four (4) extra Modules (See Figure 2.1).

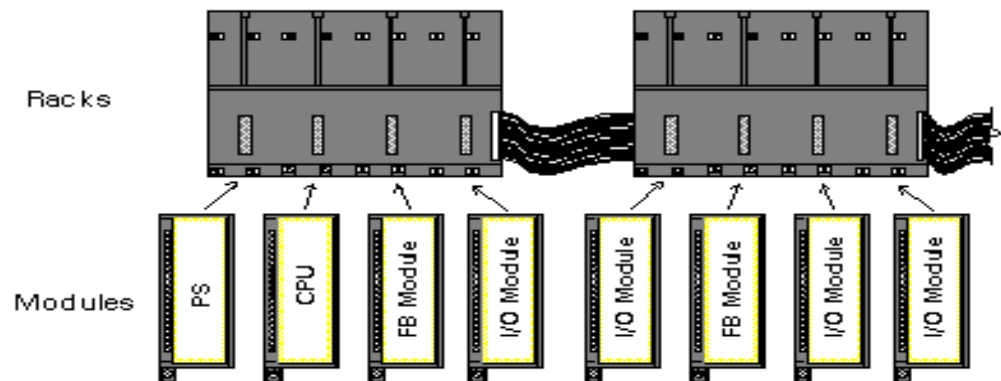


Figure 2.1 - Racks and Modules

One LC700 system can have up to fifteen (15) Racks. This implies a maximum of sixty (60) Modules per system.

This section provides instructions on how to build an LC700 system. The next topic will describe the basic components of an LC700 system and how to install them.

Basic Components

Rack - A Rack is basically a plastic support for the Inter-Module-Bus (IMB) that carries connectors for the plugs for the Modules. These connectors that fit the Modules are called Slots.

Notes:

- The Rack has a rotating switch where one address can be selected. Possible addresses are: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E.
- Note that the "F" is not a possible address.
- The main function of IMB is transporting the signals between the Modules and the CPU.

Module - Plastic box with a labeled cover explaining the terminal connections. There are many types of Modules offered for the applications (see Modules and Accessories section). The main Module is the CPU-Module. It is responsible for executing the user configuration during run time. There are other Modules such as: Power Supply, Discrete I/O, Analog I/O, High Speed Counters, Motor Controllers, fieldbus scanners, Remote I/O, etc.

Racks, cables and accessories of LC700 system

Código	Descrição
M-000	Blind module to fill empty slots
R-700-4A	Rack with 4 slots - support to shielded flat cable
T-700	Terminator for last the rack – right side
FC-700-0	Flat Cable to connect 2 racks (6.5 cm)
FC-700-1A	Shielded Flat cable to connect 2 racks (65.0 cm)
FC-700-2A	Shielded Flat cable to connect 2 racks (81.5 cm)
FC-700-3A	Shielded Flat cable to connect 2 racks (98.0 cm)
FC-700-4A	Shielded Flat cable to connect 2 racks (110.0 cm)
DF9	Support for a single module
ICP-700-D3R	Cable to connect coprocessors
DF90	IMB power cable
DF91	Lateral adapter
DF93	Rack with 4 slots, with diagnostic
DF96	Terminator for the last rack – left side
DF101	Flat cable to connect racks by left side – length 70 cm
DF102	Flat cable to connect racks by right side – length 65 cm
DF103	Flat cable to connect racks by right side – length 81 cm
DF104	Flat cable to connect racks by right side – length 98 cm
DF105	Flat cable to connect racks by right side – length 115 cm

Installing the system's base with DF93 racks

In the following figure is shown the DF93 rack with its components.

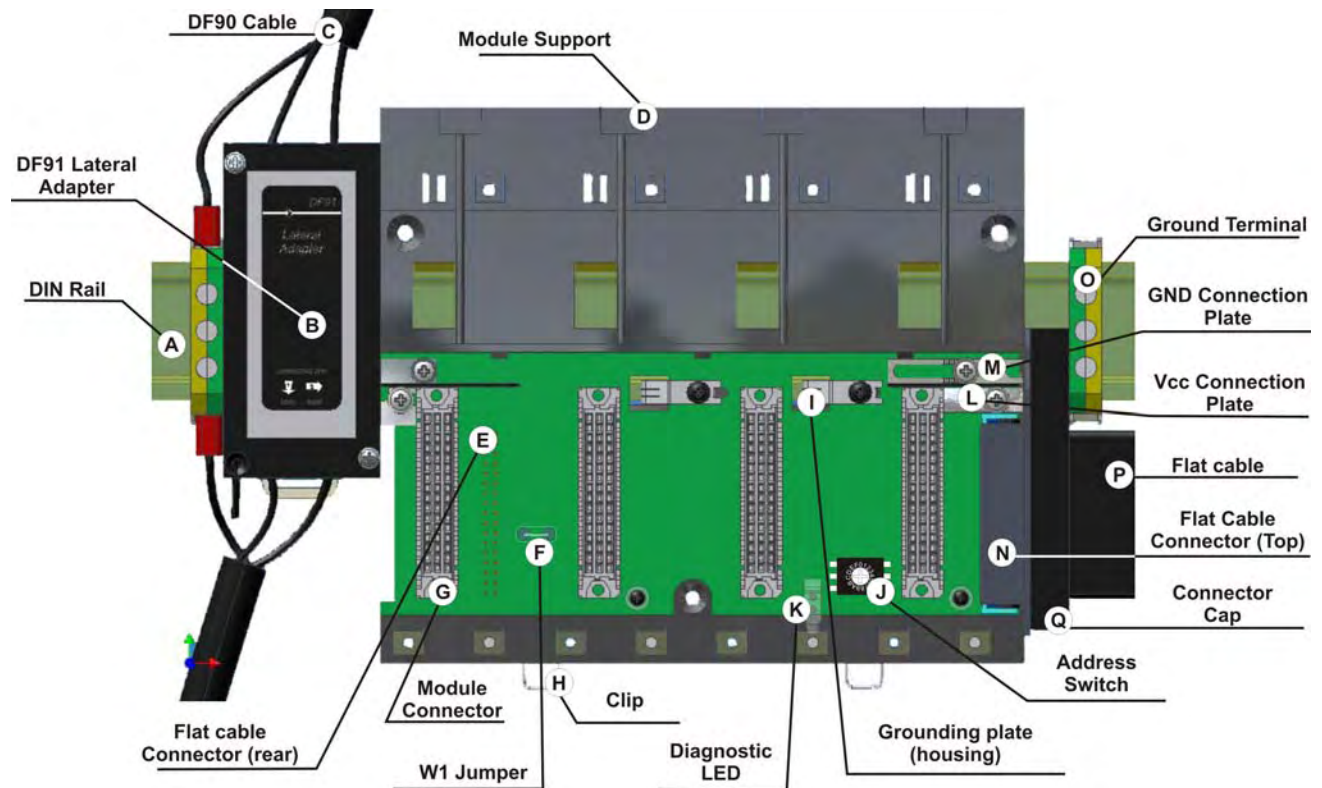


Figure 2.2 - DF93 components

A – DIN rail - Base for rack connection. It should be tightly fixed to the place where the rack is being mounted.

B – Lateral adapter DF91 – It allows the connection of DF90 cables to rack.

C – DF90 cable – Cable for IMB power transmission. In this cable is the Vcc and GND of IMB and it has to be connected in the rack's left side.

D – Module support - Module holder located in the top of the rack.

E – Flat Cable Connector (rear) – It allows that two racks are interconnected by flat cable (P). When there is more than one rack in a same DIN rail, the user should proceed as described in the “Connection between adjacent racks” topic.

F – W1 Jumper – To disconnect the rack from the power of the previous rack, W1 must be cut, together with the Vcc connection plate (L) of the previous rack. This condition is necessary if a new power supply is inserted from this rack.

G – Module connector – Connector to attach the module's bottom part to the rack.

H – Clips – The metal clips, located in the rack's bottom part, allow attaching the rack to the DIN rail. They must be pulled before fitting the rack on DIN rail, and then, pushed for pieces fixation.

I – Grounding plate (housing)

J – Address switch – When there is more than one rack in same data bus, the addressing switch allows different addresses to each rack.

K – LED for diagnostic – It is used for diagnostic of the rack's voltage.

L – Vcc connection plate – Vcc terminal (for power transmission).

M – GND connection plate - GND terminal (for power transmission).

N – Flat Cable Connector (top) – It allows that two racks are interconnected by flat cable (P). When there is more than one rack in a same DIN rail, the user should proceed as described in the “Connection between adjacent racks” topic.

O – Ground terminal – It is used to ground the flat cables shield.

P – Flat Cable – Cable used to interconnect the data bus among racks.

Q – Connector cap – To meet the EMC requirements a protector against ESD must be installed in the flat cables connections, at right.

Installing Racks - DF93

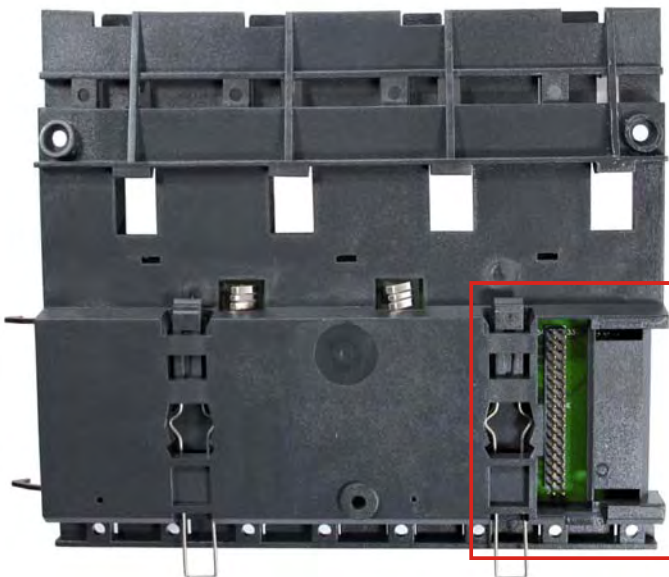


Figure 2.3 - Rear connector of DF93 rack

IMPORTANT

Remember to leave a space in the DIN rail to install the DF91 and the grounding terminal at rack's left side.

Installing racks in the DIN rail

IMPORTANT

Before installing the rack on DIN rail, connect the flat cable to rear's connector (E) if you will connect this rack to another at left. After connected to the DIN rail is not possible place the flat cable on the rear's rack without remove it.

1. Use a screwdriver (or your fingers) to pull the clips down.
2. Place the back of the rack on the top of the DIN rail edge.
3. Accommodate the rack on the DIN rail and push the clips up. You will hear a click sound when they lock properly.
4. Set the correct address for the DF93 rack using its rotating switch (J).

Connection between adjacent racks

1. The adjacent cards to the joining part, between the racks, must be removed allowing access to this operation (racks's third slot, at left and slot 0 of rack, at right).
2. Connect the two racks using FC-700-0 flat cable. This flat cable should already be connected to the connector on the rear's rack at right. And then, connect it to the top connector (N) of the rack at left.
3. Connect the two racks to the power connectors (L and M), moving them with a screwdriver and fixing with screws. Loose the screws only the sufficient avoiding them from falling when making the connection. See the next figure.

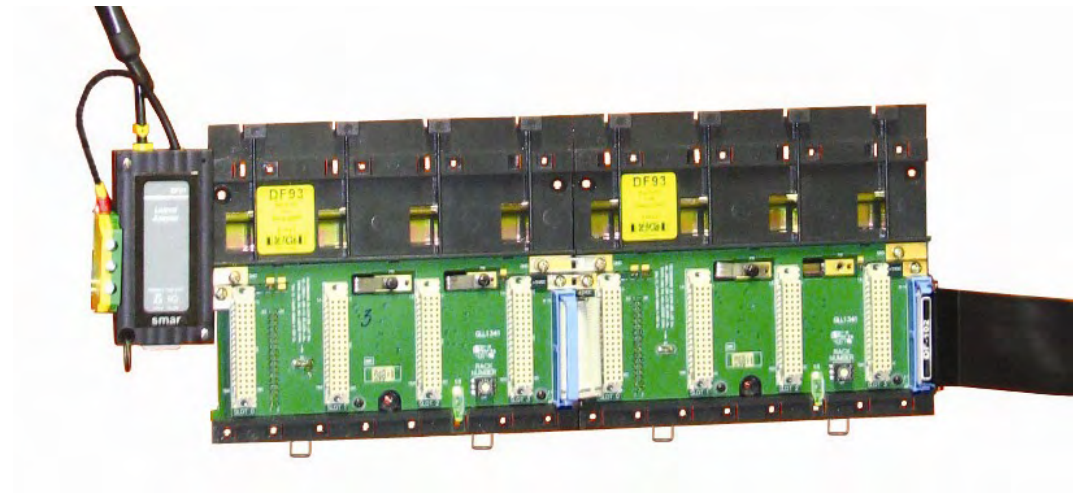


Figure 2.4 - Connection between adjacent racks

Using the DF91

The DF91 must be installed at left side of each row of racks, to meet the requirements of EMC standards even if no expansion of power.

For further details about DF91 installation, refer to “Expanding the system’s power supply – DF90 and DF91” topic.

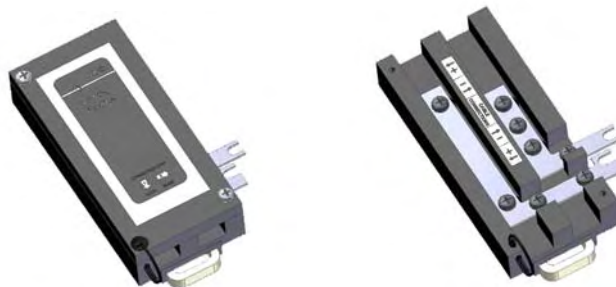


Figure 2.5 - DF91 details

Disconnecting racks

1. The adjacent cards to the joining part, between the racks, must be removed allowing access to this operation.
2. Remove the flat cable of top connector (N) of the adjacent rack, at left.
3. Remove the power connections (L and M) of both sides of the rack that will be disconnected. For that, with a screwdriver, release the screws (only the sufficient) and move the connection plates to left until they are completely withdrawn, thus the rack is free to be removed.
4. If the DF91 (B) is connected to rack that will be removed, remove it until the rack to be free.
5. Remove the rear connector (E) after removing the rack from DIN rail.

Installing the expansion flat cables - DF101, DF102, DF103, DF104 and DF105.

These flat cables are used when the LC700 is expanded in more than one row of racks, i.e., in different DIN rail segments, one below the other.

DF101 - Flat cable to connect racks by left side

It is installed in the rack's rear connectors (E) of the left extremity of each row of racks, interconnecting the rows 2-3, 4-5 and 6-7 (if they exist).

To ground the flat cables shield, use the ground terminal (O) next to flat cables connection. The available terminal, next to each DF91 (B), can be used.

DF102, DF103, DF104 and DF105 - Flat cable to connect racks by right side

They are installed on the upper connectors (N) of the right extremity rack of each row of racks, interconnecting the rows 1-2, 3-4 and 5-6 (if they exist).

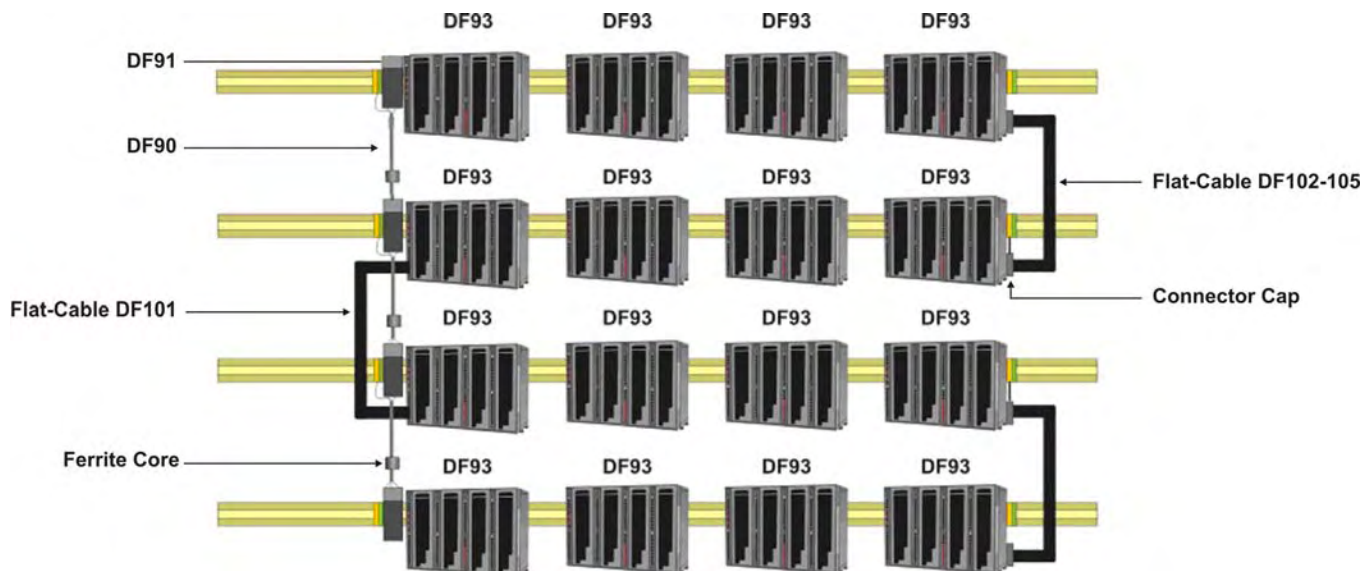


Figure 2.6 - Illustration - DF101 and DF102-105 Flat cables

To ground the flat cables shield, use the ground terminals (O) next to flat cables connection.

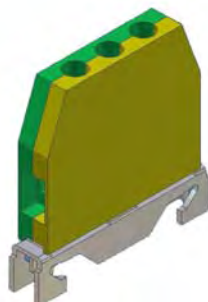


Figure 2.7 - Ground terminal

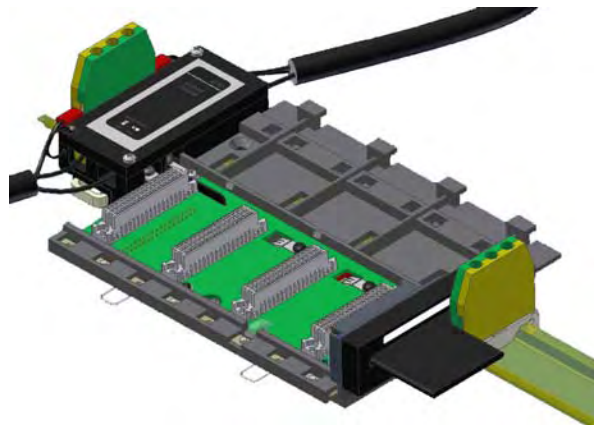


Figure 2.8 - Ground terminal installed

Flat cables protector (connector cap)

To meet the EMC requirements a protector against ESD has to be installed on the flat cables connection, at right. In the following figure a flat cable protector is shown when it is being installed on the cable connector.

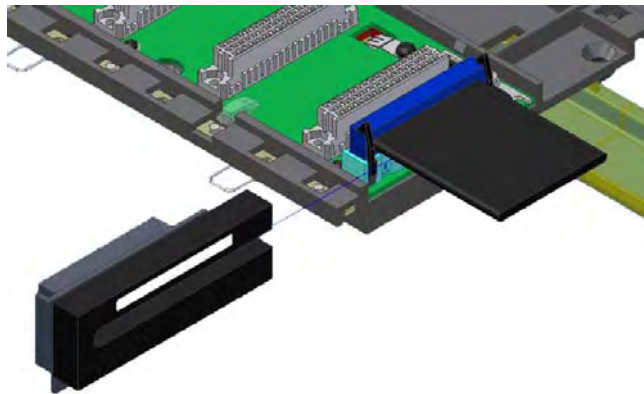


Figure 2.9 - Installing the connector cap

In the following figure is shown a connector cap installed.

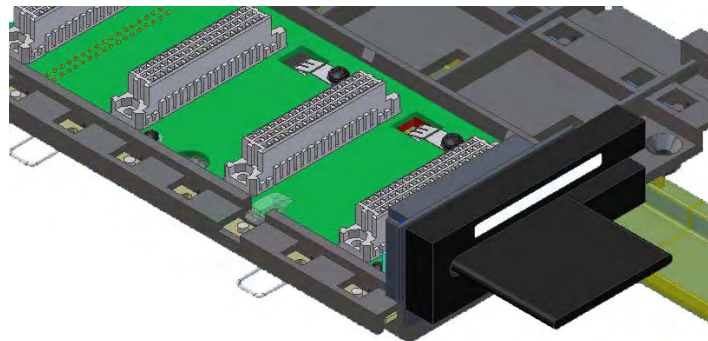


Figure 2.10 - Connector cap installed

Installing the IMB terminator – T-700 or DF96

Only one of these two terminators types (T-700 or DF96) must to be installed at the end of IMB bus. It will depend on which side the last rack is connected to the system.

T-700 – IMB terminator for right side

It is connected to connector N of the last rack, when it is connected to the others by the left side. See the next figure.

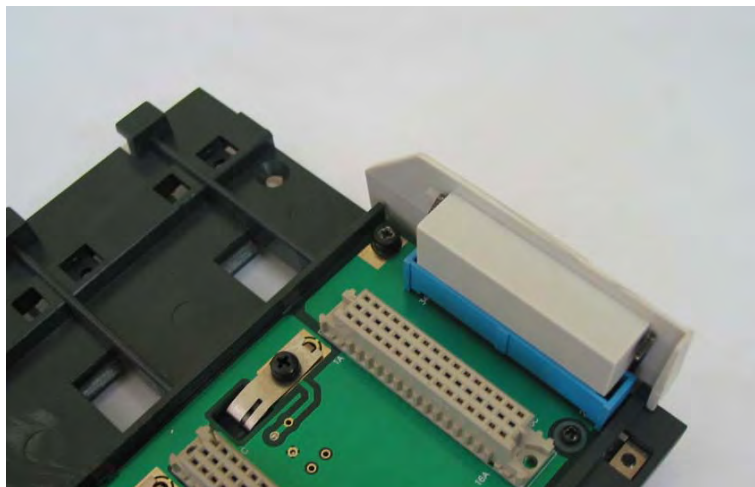


Figura 2.11 – T-700 terminator installed in the rack

Installation

Follow the pictures below to install correctly the T700.

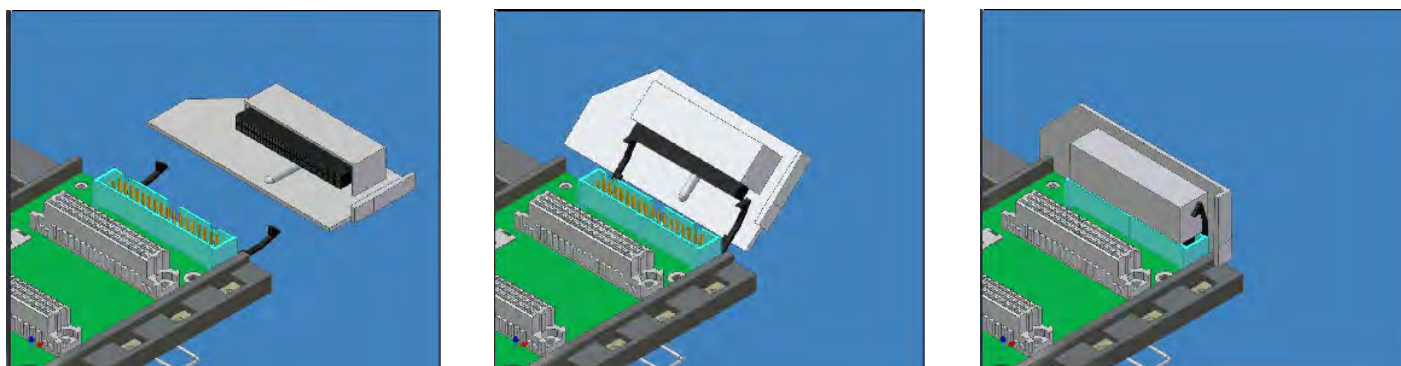


Figure 2.12 – Installation steps, T-700 terminator

DF96 – IMB terminator for left side

It is connected to connector E of the last rack, when it is connected to the others by the right side. See the next figure.

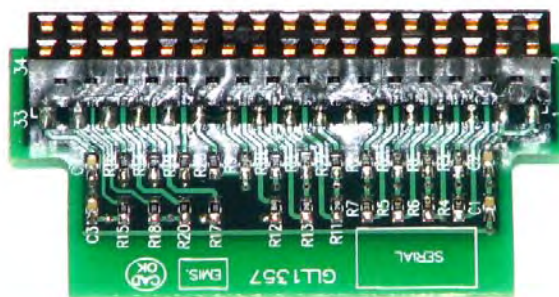
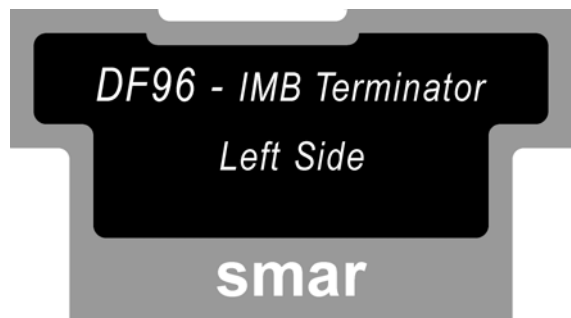


Figure 2.13 - DF96 terminator

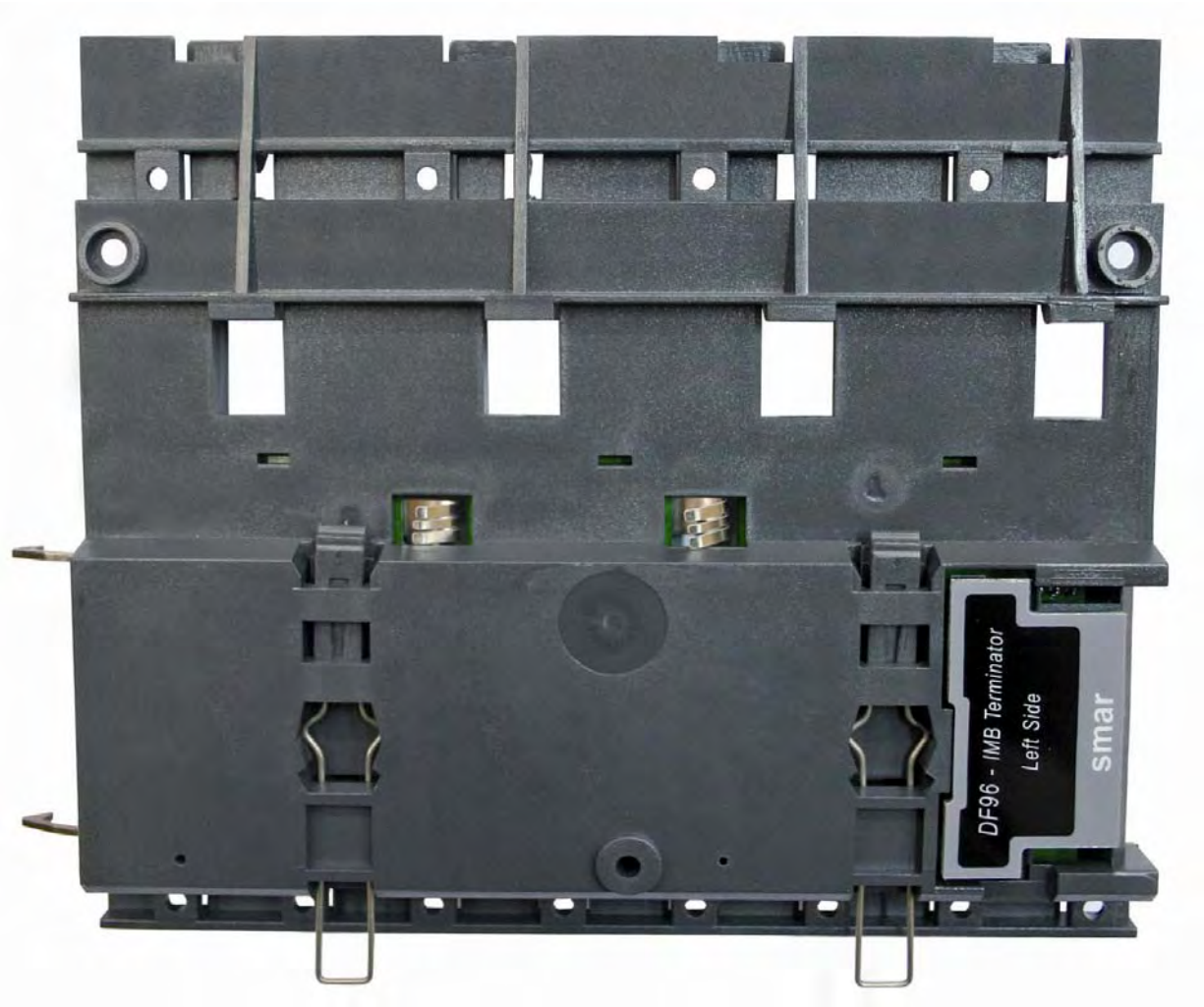


Figure 2.14 - DF96 terminator installed in the DF93 rack

Summarizing, if the last rack has a flat cable connected by left side, use the T-700 terminator. If the last rack has a flat cable connected by right, use DF96 rack. Both cases depend on the number of row of racks, if it is even or odd.

Expanding the system's power - DF90 and DF91

This expansion has to be used when the LC700 is expanded in more than one row of racks, i.e., in different DIN rail segments, one below the other.

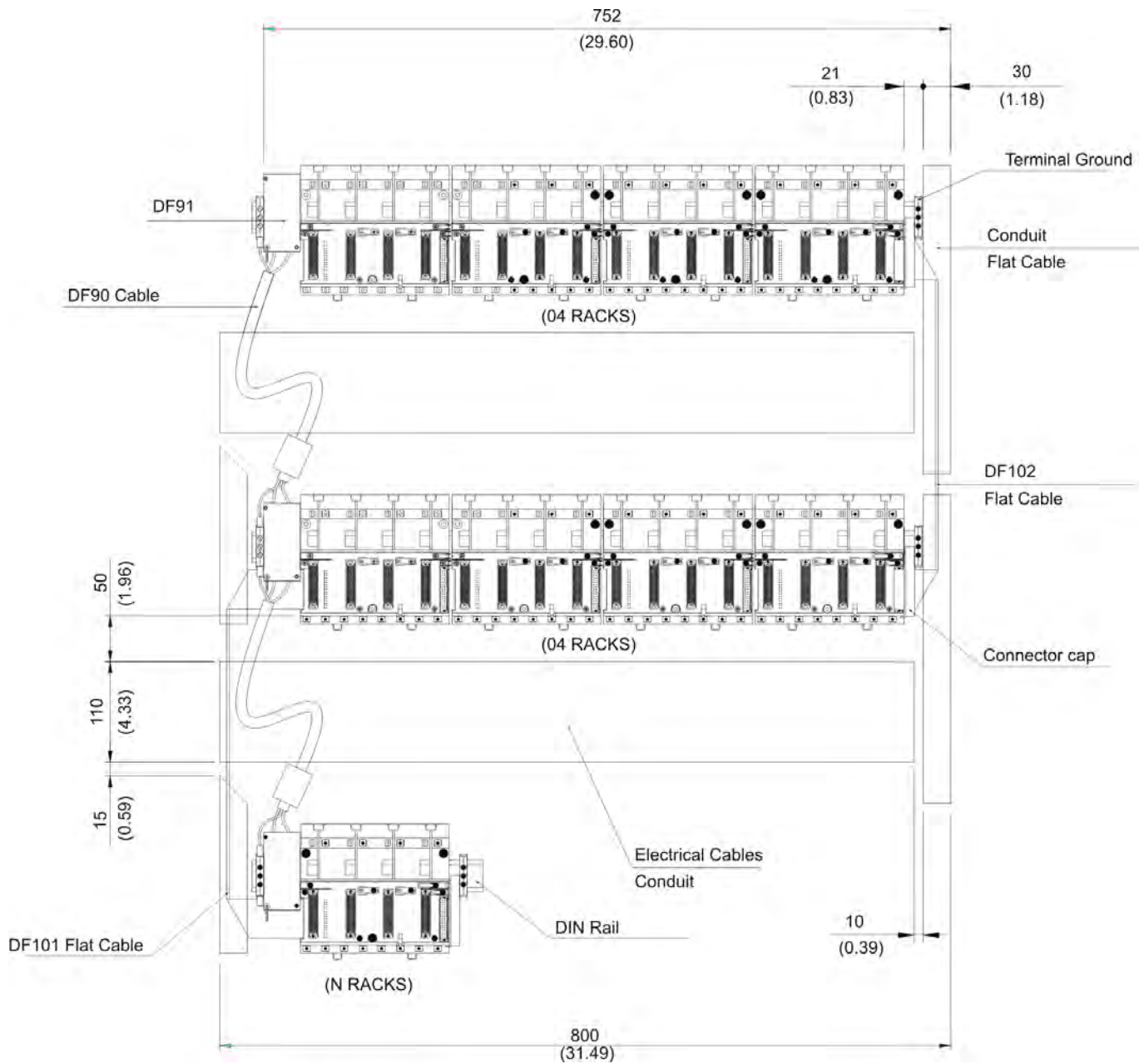


Figure 2.15 - Example of expanded system

IMPORTANT

The DF91 must be installed at left side of each row of racks, to meet the requirements of EMC standards even if no expansion of power.

Installing the DF91 in the DIN rail

The DF91 is installed on the rack of the left extremity of each row of racks.

To connect the DF91 to the DIN rail, fix the DF91's rear part in the upper edge of the DIN rail, and then, accommodate the DF91 in the rail, pushing it until you hear a "click" sound.



Figure 2.16 - DF91 rear part

Connecting the DF91 to rack

The first rack's slot needs to be empty allowing access to this operation.

1. Loosen the screws (only the sufficient) of the rack's power connector. See the next figure.

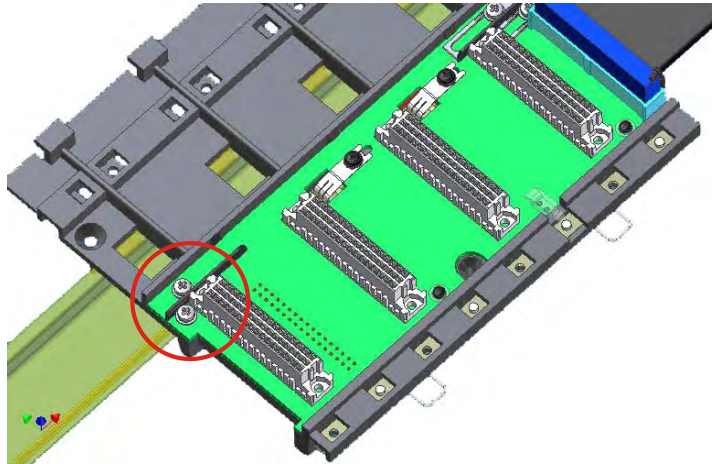


Figure 2.17 - Details of screws of the rack's power connector

2. Move the DF91 to the right up to fix it in the screws.
3. Tighten the screws.
4. After connecting the DF91 to the rack, install the terminal ground in the left side of DF91, keeping it firm to the rack. This terminal also will be used for grounding of DF90's shield.

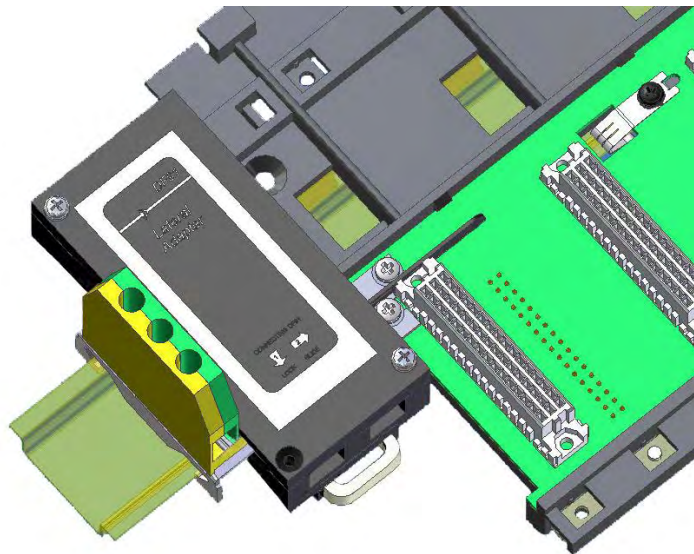


Figure 2.18 - DF91 connected to rack

Installing DF90



Figure 2.19 - IMB power cable (DF90)

The cable DF90 must be connected only through DF91, interconnecting two of them. Follow the next steps to execute that procedure.

1. With DF91 already connected to rack, release the cover's screws, and open it;
2. Release the DF91's screws indicated by labels (+) and (-);

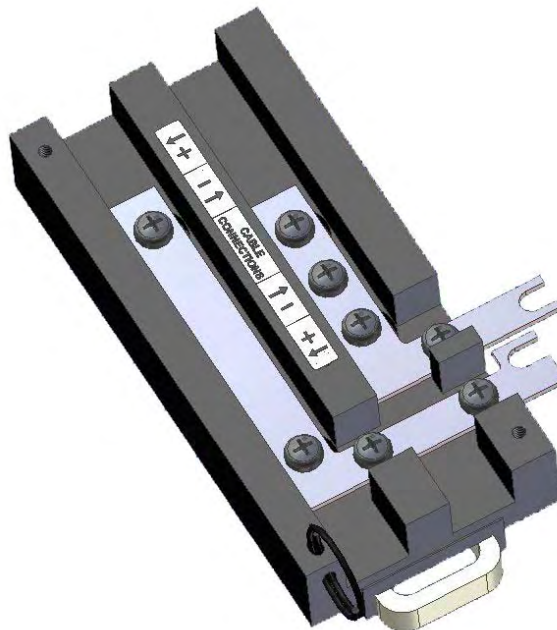


Figure 2.20 - DF91 detail

3. Attach the DF90's terminals with the DF91's screws, obeying the polarity indications;
4. Connect the DF90's shield terminal to the ground terminal next to DF91;

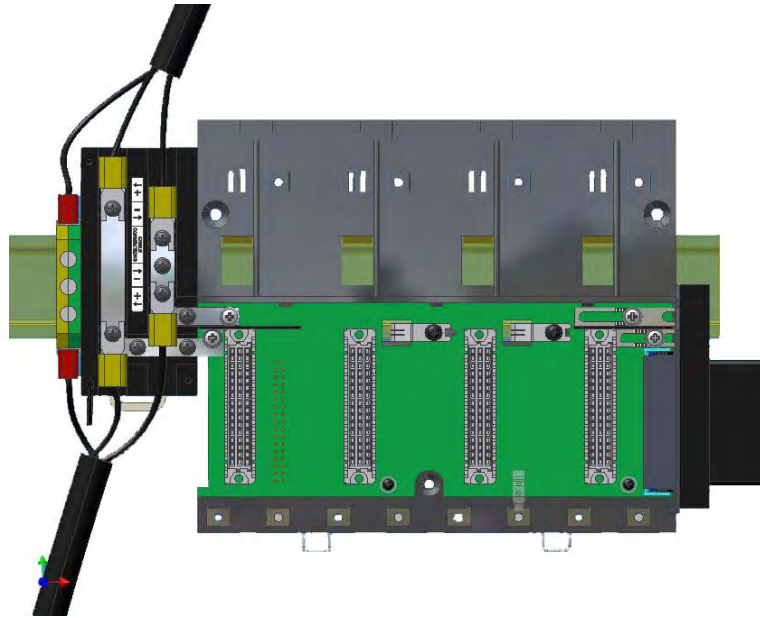


Figure 2.21 - DF91 installed in the rack

5. Close the DF91 cover and tighten the screws.

Disconnecting DF91 from rack

1. The first card of the rack that will be disconnected must be removed allowing access to this operation;
2. Release (only the sufficient) the connector's screws of rack power, where DF91 is connected;
3. Move the DF91 to left (without separate it from rail) until the DF91's connection plates are out of rack's edge;
4. Tighten again the rack's screws if you will not connect them;
5. To remove the DF91, with a screwdriver, unlock it from DIN rail by pulling down the lock at its bottom part and removing that part from the rail.

Diagnostic resources

The DF93 rack has simple resources, but valuable, for voltage diagnostic in the bus. See the following table.

LED	Status
Off	Without voltage or voltage very low
Red	Insufficient voltage
Green	Sufficient voltage

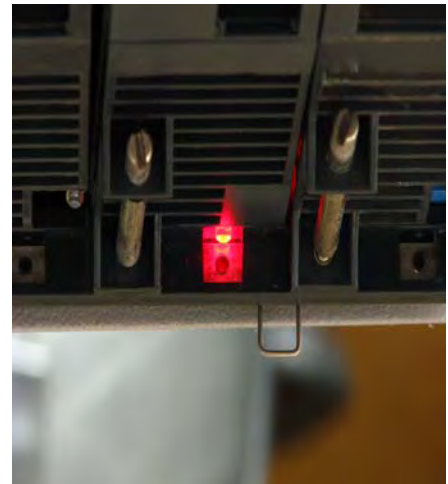
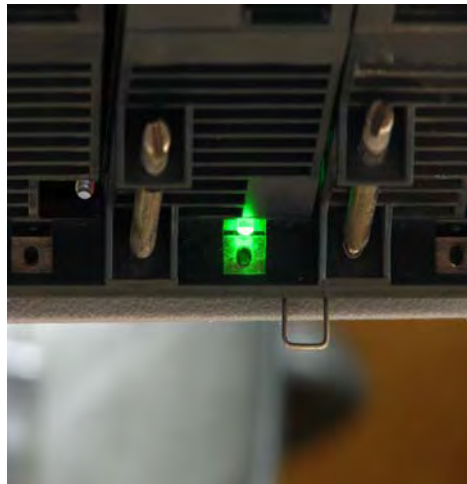


Figure 2.22 - LEDs for diagnostic in the DF93 rack

Installing the system's base with R-700-4A rack

See below the figures and descriptions of module and rack:

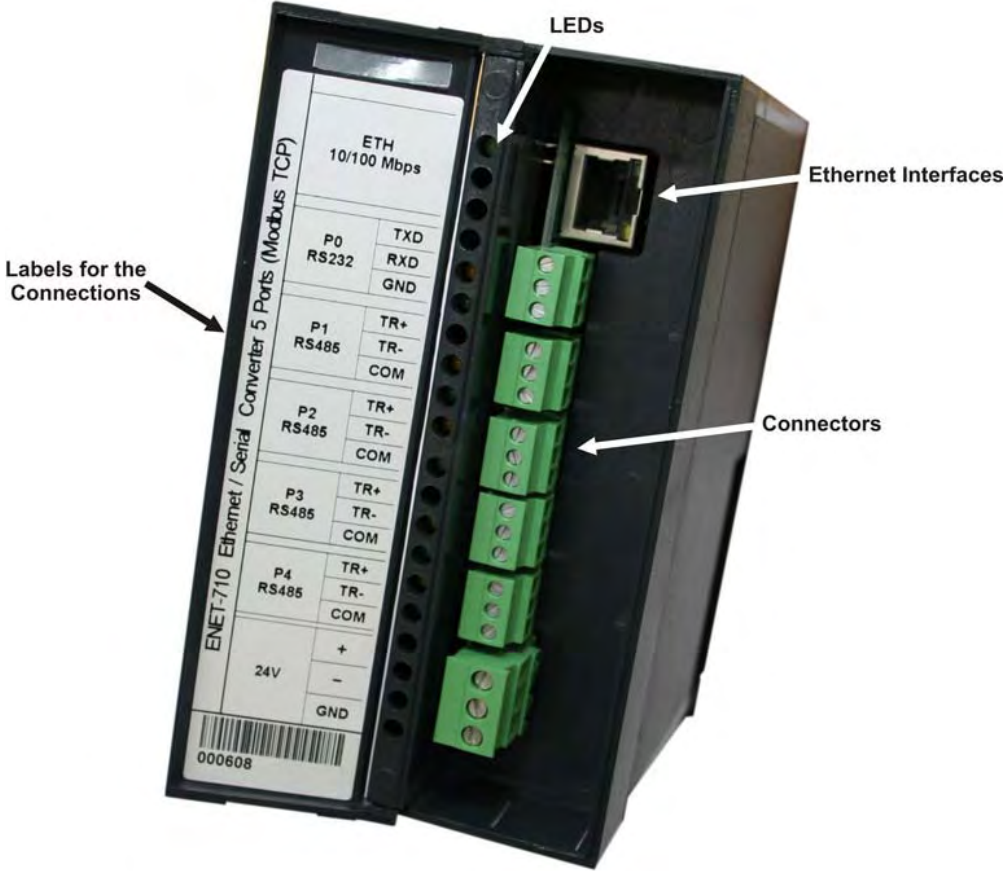


Figure 2.23 - ENET-710 Module

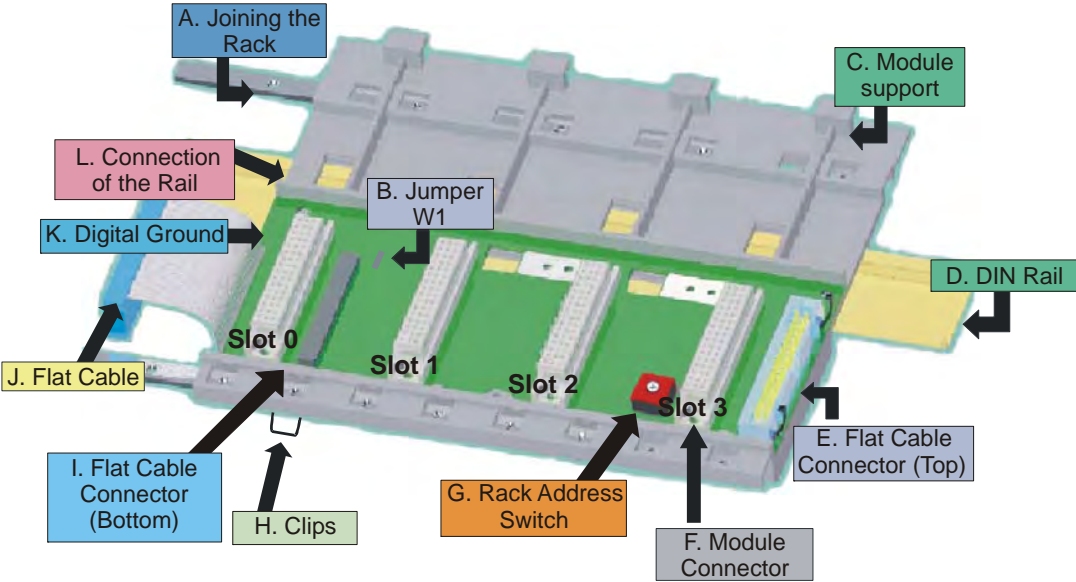


Figure 2.24 - Rack – R-700-4

A - Joining the Rack: When assembling more than one rack in the same DIN rail, use this metallic piece to interconnect the racks. This connection generates stability to the assembly and makes possible the digital ground connection (K).

B - Jumper W1: When connected, it allows the rack to be powered by the previous rack.

C - Module support: Module holder located in the top of the rack.

D - DIN Rail: base rack connection. It should be tightly fixed to the place where the rack is being mounted.

E - Flat Cable Connector (Top): When existing more than one rack in the same DIN rail, they must be hooked up by a flat cable (J) connected to the flat cable connectors (I) and (E).

F - Module Connector: Bottom connection of the module to the rack.

G - Rack Address Switch: When using more than one rack in the DIN rail, the rack address switch allows a distinct address to each rack.

H - Clips: The clips, located above of the rack, allow it to be connected in the DIN rail. It should be pushed down before inserting the rack in the DIN rail and after that pushed up to fix the pieces.

I - Flat Cable Connector (Bottom): When existing more than one rack in the same DIN rail, they must be hooked up by a flat cable (J) connected to the flat cable connectors (I) and (E).

J - Flat Cable: Cable used to connect the data bus between the racks.

K - Digital Ground: When using more than one rack in the same DIN rail, the connection between digital grounds (K) must be reinforced through appropriate metallic piece.

L - Connection of the Rail: Support that brings the connection between the rack and the DIN rail (D).

Installing a Rack in the DIN rail

1. In case of only one rack, this fixation can be done as the first step, even before of fixing any module to the rack.
2. Use a screwdriver (or your fingers) to pull the clips (H) down.
3. Place the back of the rack on the top of the DIN rail edge.
4. Accommodate the rack on the DIN rail and push the clips up. You will hear a click sound when they lock properly.
5. Set the correct address for the rack using the rotating switch at the rack.

Adding Racks

1. In case of using more than one rack in the same DIN rail, take a look in the flat cable connections (J) in the top connector of the first rack and in the bottom connector in the second rack, before plugging the new module in the slot 3 of the first rack;
2. Fix one rack to the other through the joining part of the rack (A). Pass the metal connector of one rack to the other and fix with screws;
3. Connect the digital ground (K), using one metallic connection fixed by screws.
4. Do not forget to place a terminator in the last rack. The terminator should be plugged in the flat cable connector (top) (E);
5. Set the address for the new rack using the rotating switch.

Tips for Assembling

- If there is more than one rack in the same system:
- Do the grip in the DIN rail at the end of the assembly.
- Keep free the slot 3 of the rack to connect the other module through the flat cable connector.
- Check the addresses configuration (rack address switch), as well as the jumper W1 and the cable of the bus.
- Remember that to give continuity to the DC power supply to the previous rack, it is necessary to have the jumper W1 connected.
- Make the amendment of racks and strengthens the digital ground of the hardware.

Improving Signal Ground of LC700 (R-700-4A)

Besides the fact that the racks of the LC700 system are connected by flat cables for signal and power transportation, it is possible to occur some fading in the signal ground for applications that make use of many modules. A solution to keep the signal ground stable and the system more immune to electrical noises is to add an extra wire between racks.

These wires should follow the flat cable path to avoid ground loops. Wire must be strained and have a diameter of at least the AWG18.

For adjacent racks, use the “extending connector” placed on its left side. Obviously, it is possible to have a system with adjacent and non-adjacent racks.

NOTES

- 1- The Rack containing the CPU-Module must be set with address “0”, always.
- 2- All other Racks can have any address from 1 to14.
- 3- Addresses can NOT be repeated in the same LC700 system.



NOTE: Always use the Terminator Board, T-700, in the last rack.
The Racks

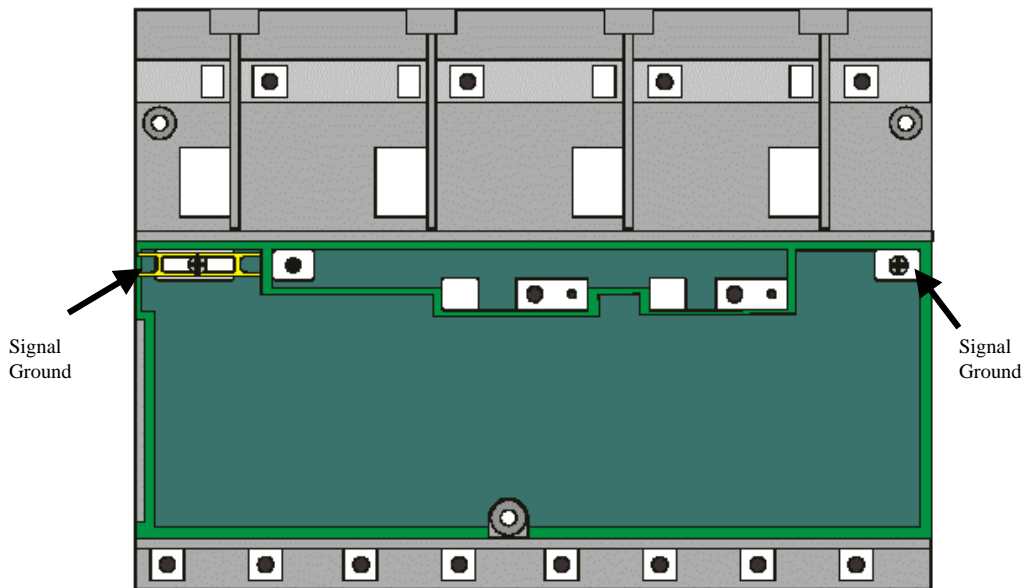


Figure 2.25 - A Rack showing points to connect the Signal Ground wire.

Non-adjacent Racks

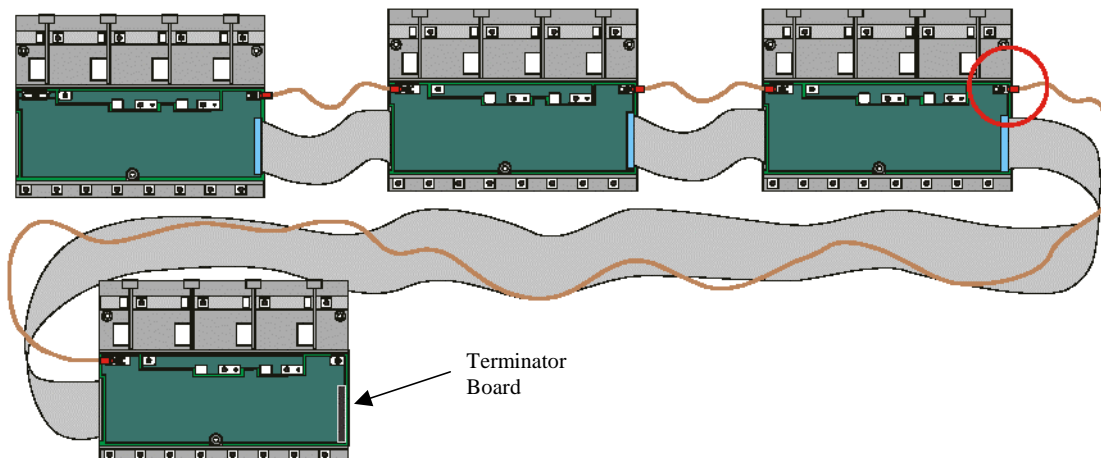


Figure 2.26 - Shows how the Signal Ground cable is connected between Racks

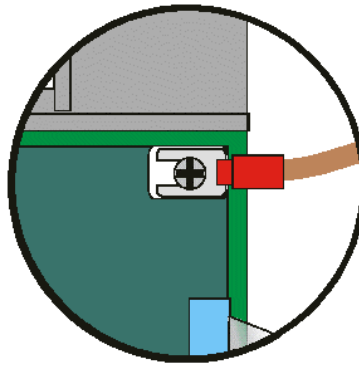


Figure 2.27 - Detail of the Signal Ground connecting wire

Adjacent Racks

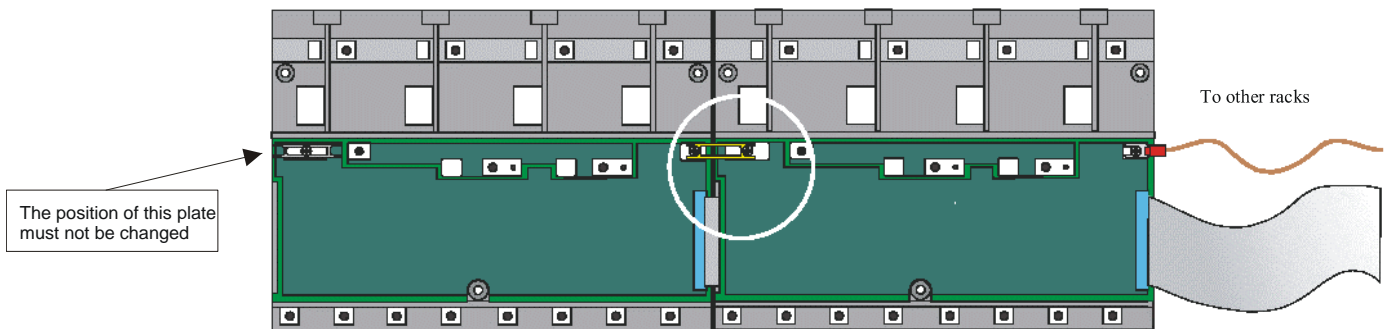


Figure 2.28 - Connecting adjacent Racks

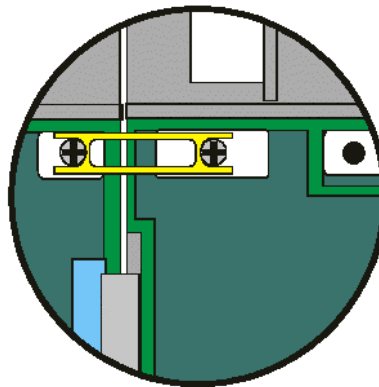


Figure 2.29 - Detail of the adjacent Rack

Important

It is not recommended to connect digital ground and housing ground.

Installing a Module

It is possible to mix different types of input and output modules at any position of the backplane despite its voltage levels. However, to improve performance it is recommended that the FB700 and M-402 modules are placed as close as possible from the power source module.

Be sure to write the description for each input or output channel to make the identification easier. Some modules require an auxiliary 24 Vdc Power Source. This can be supplied through the PS-AC-R module or an external power source. These modules also can be used to supply external sensors, transmitters and others.

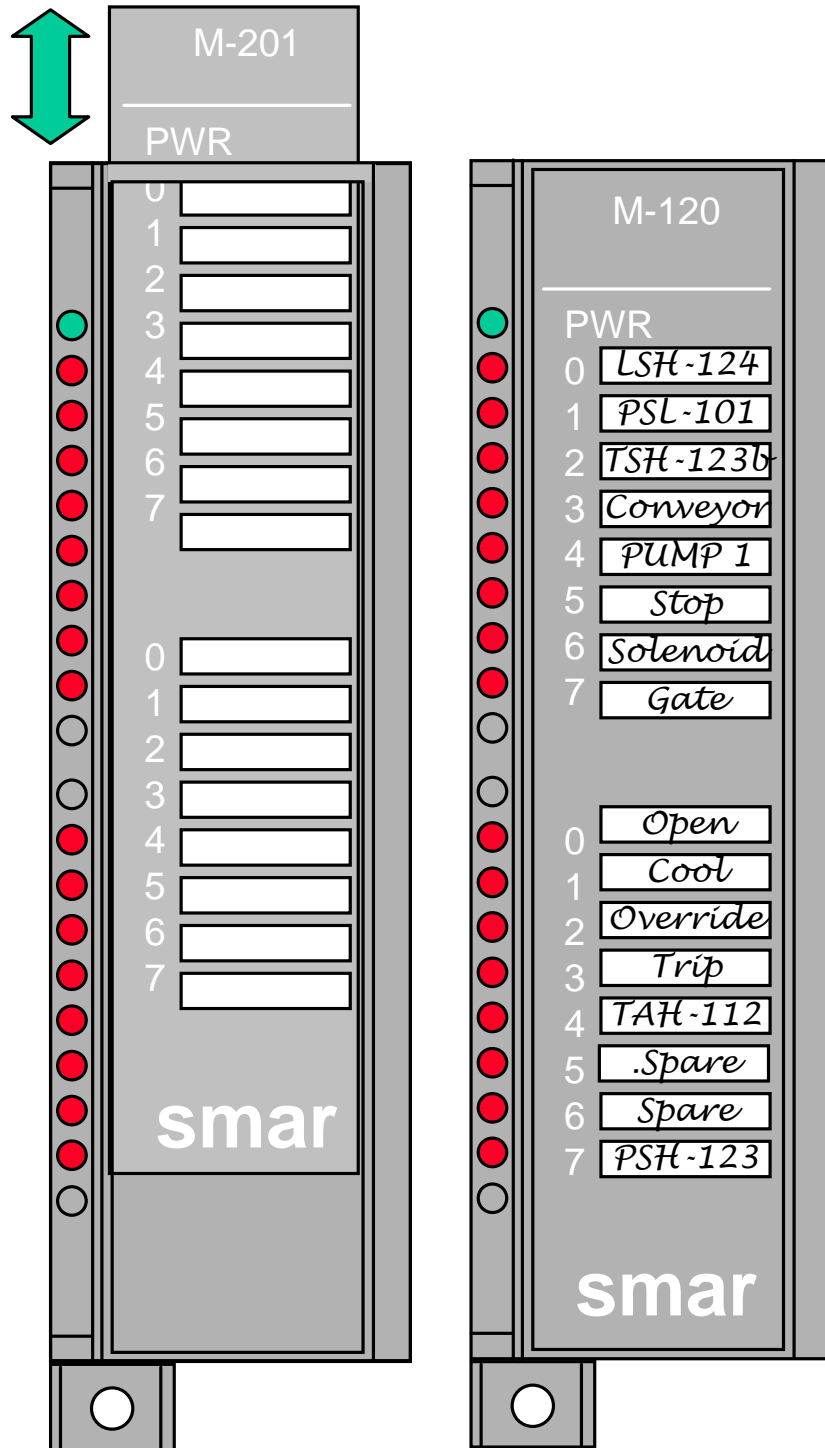
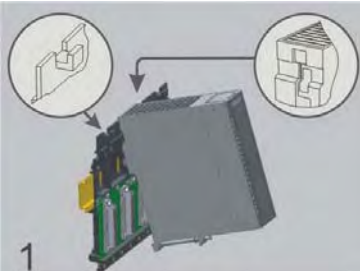
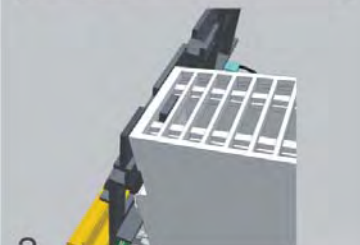
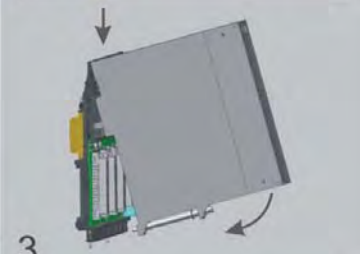
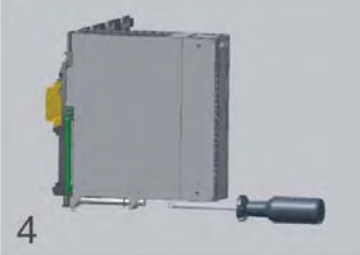


Figure 2.30 - Writing The Description For Each Module Channel

Installing a module in the rack

Follow the steps below to install a module in the rack.

 <p>1</p>	<p>Attach the top of the module (with a 45o inclination) to the module support located on the upper part of the rack.</p>
 <p>2</p>	<p>Mounting detail.</p>
 <p>3</p>	<p>Push the module fixing it to the module connector.</p>
 <p>4</p>	<p>Next, fix the module to the rack using a screwdriver, and fasten the fixation screw at the bottom of the module.</p>

How to open a Module

See in the next picture how to open a module.



Figure 2.31 - Opening a Module

Basic Steps to Specify a LC700 System

1- A wide variety of SMAR parts for the LC-700 are available in the Modules and Accessories chapter. If you have not yet taken a look at this section, please take a moment to review the parts available in the LC700 family.

2 - Specify Communication Demands.

The LC700 CPU offers two options of communication, the first: serial EIA-232-C port and the second: EIA-485 ports to remote connection in an industrial environment. For further details check the communication's section in the "LC700 Configuration Manual". The ENET-710 module allows connection of a LC700 system to an Ethernet network. The OPT700 module allows the connection of a LC700 system to a fiber optical network.

3 - Check the available I/O modules

The LC700 system has different types of I/O modules. Check the chapter "Modules and Accessories" and take note of the modules for use in the next project.

4 - Choose and check the power supply and quantity.

There are two available types of power supply modules:

- PS-AC-R (AC Power Supply Module)
- PS-DC-R (DC Power Supply Module).

It is important to calculate the power consumption of the modules in order to determine how many power supplies will be required.

NOTE

CONF700 can calculate the power consumption for you! It is necessary to enter the modules in the Hardware Page, and then simply click the Balance. To know more about this feature, see the Getting Started section of the CONF700 manual.

5- Send a fax to quote on our competitive prices

For your convenience, CONF700 prepares the quote form and fills out your selected modules and all accessories to accomplish the specified application..

See the topic, "Looking at the Balance" in the Getting Started section of the CONF700 manual.

NOTE

In case of use of long flat-cables, the IMB Vdc voltage should be measured to check the need of adding a new power supply module. If the measured voltage is shorter than 4.95 V a new power supply must be added. The Vdc voltage can be measured between the pins 16A and 16C from any of the connectors in the last rack.

Dimensional Drawings of R700-4 and Modules

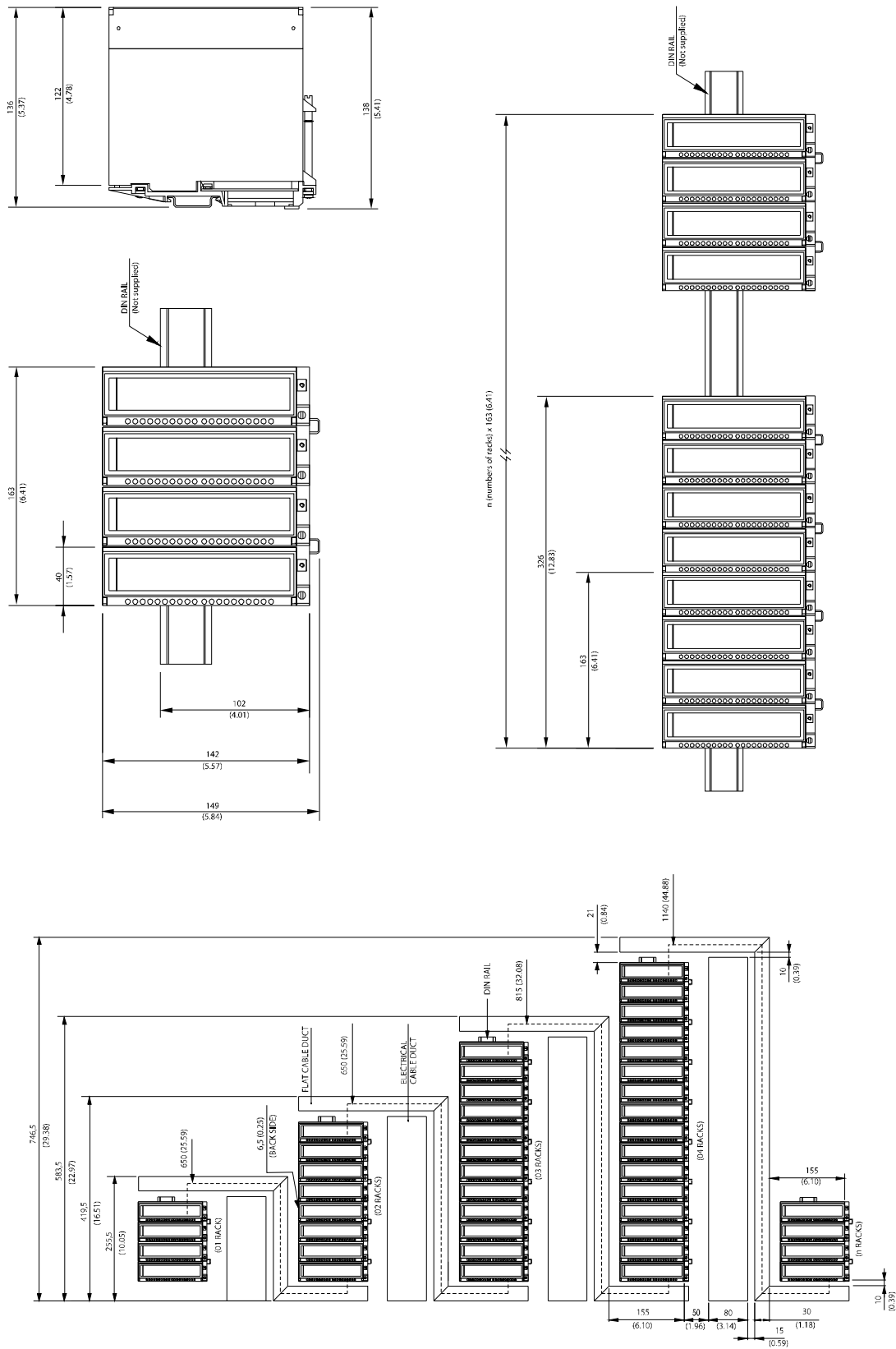
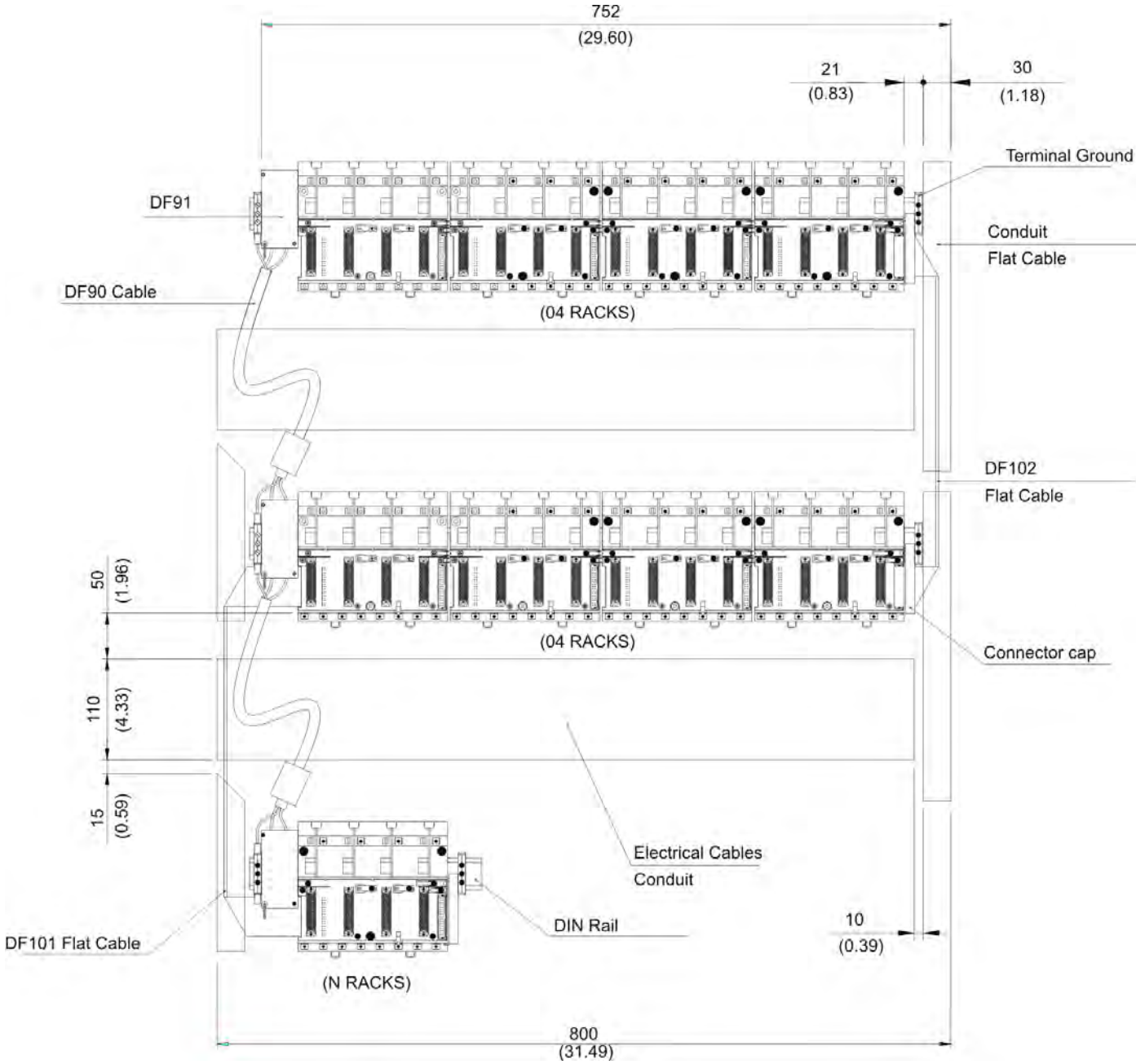
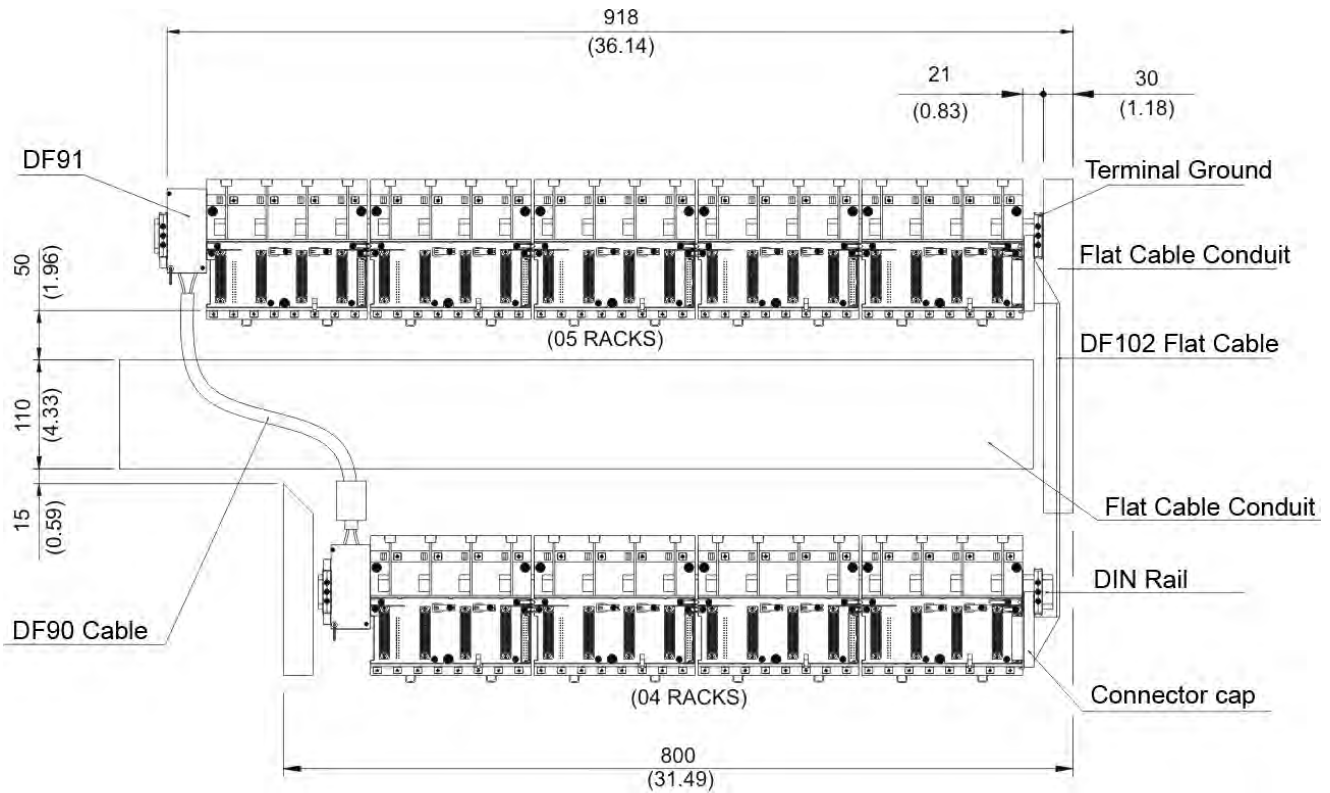


Figure 2.32 - Dimensional Drawings of the modules and Racks

Dimensional Drawings of DF93 and Modules

The following figures shows two possible combinations.





Requeriments for LC700 Installation and Transportation

Initial Inspection

After receiving the LC700, check:

- If the model of the device corresponds to your purchase.
- If the device has not suffered external damage in the handling and/or transportation.
- The User's Guide, Configuration Manual and the CONF700 software CD are according to the order.

Local Conditions for Installation

Power Supply

To obtain a stable and reliable system operation, it is required a high quality energy system, following the requirements on the table below:

AC Power Supply	Voltage Variation	90 -264 Vac
	Frequency Variation	45-65 Hz
DC Power Supply	Voltage Variation	20-30 Vdc

Environment Conditions

The temperature and relative humidity in the control room should be within the ranges specified below:

- Temperature: 0 to 60° C
- Relative Humidity: 20 to 90% RH (non condensed).
- Storage temperature: -30 to 70° C

Air Purity

It is particularly desirable to minimize the corrosive gases and other conductive particles in the air.

Operation Mechanical Conditions

The limits below must be respected in order to the LC700 operates adequately.

- Vibration Immunity: 5Hz to 2KHz, 0,4 mm pp/2,5g mounting in panel.

- Shock Immunity: 10 g, 2 times.
- Noise Immunity: 1,000Vpp, 1 μ s.

Protection against Pollution

The LC700 is intended for use in a Pollution Degree 2 industrial environment.

Altitudes

This equipment can operate up to 2000 meters.

Transportation Conditions

Transportation Temperature

The temperature range allowed for this equipment is -25 °C to 70 °C.

Transportation Precautions

- Always carry the controllers on the packages supplied by Smar according to the position indicated on the box.
- Always protect the product from sunlight, moisture, shocks and vibration when transporting.
- If the boxes need to be opened for some reason, be sure to re-package, according to what was previously packaged by **Smar**.
- Always keep the packages indoors, away from direct sunlight, corrosive gases, shocks and vibrations.

CPU Communication

The LC700 programmable logic controller can communicate with a host (supervisory and/or configurator) using one of the three channels in the CPU Module. This communication can be established via the Serial Port EIA-232-C for local connection or EIA-485 for long distance connections in an industrial environment.

The protocol used in these 3 channels is the “Modbus” defined by AEG. This protocol defines the message structure which controllers will recognize and use, no matter what type of physical network they communicate through.

These Modbus channels can be used for configuration or monitoring when the EIA-232-C channel is used, it automatically cancels the use of EIA-485 and maintains communication with the local computer until it is disconnected.

The EIA-232-C provides a point-to-point transaction for a local connection while the EIA-485 provides multi drop capability and better noise immunity performance for high speed and larger distances communication.

With the EIA-232-C or EIA-485 channel using Modbus protocol, we can access:

- All I/O signals (discrete or analog) from the Modules and the Auxiliary Variables (Virtual Variables).
- All linked signals (discrete or analog) from the I/O interface blocks from any Fieldbus Module installed.

NOTES

- The Modbus protocol provides the internal standard for analyzing messages. When communicating on a Modbus network, the protocol determines how each controller knows its assigned address, recognize a message addressed to each device, determines the type of action to be performed, and extracts information contained in the message.
- Many of the Man Machine Interface packages on the market are able to interact with the LC700 for monitoring purposes. Consult your local distributor for details.
- Also see the Modbus Communication section for more information.

MODBUS and HMI Interface

As mentioned before the CPU-700 communicates using the MODBUS RTU protocol. MODBUS is an open protocol defined by AEG and widely accepted by manufacturers of industrial devices. This fact also gives the advantage that probably every important provider of a Man-Machine-Interface (MMI) or SCADA software has drivers ready for MODBUS. Once the LC700 system is configured using the CONF700 you will be able to display or print a list with all I/O points (Discrete and Analog) and Parameters of all Function Blocks used.

With this list the user can complete the information for the communication database of the MMI software. Once the MMI knows the variables and their addresses it can now read or write to them allowing the operator to be completely connected to the LC700 logic controller".

HOT SWAP

A few modules have a new hardware feature that allows hot swap module replacement without causing trouble to the CPU control. With this new feature it is possible to add or remove new modules with the IMB bus energized.

MODULE ID

This additional circuit allows the CPU to identify new modules of its system through CONF700 without the modules previously being informed in the CONF700 hardware page. During control the CPU checks the existence of modules. Through the Status block the user keeps an updated run time check of the modules defined in the hardware page. To do so the user must add the racks in the hardware page of CONF700 and click on the button CHECK MODULE ID in the lower left part of the screen. In this way CONF700 informs the user of the modules connected to the respective selected racks. To check which modules are connected click at USE I/O MODULE ID and so modules are automatically checked.

NOTE
The M-000 module must be used when there is one available slot in the rack.

Fieldbus Support

As the industry leading provider of Fieldbus solutions Smar offers a few Modules to interface the LC700 with Fieldbus.

Each channel operates as an independent Fieldbus device in the network. The CPU Module interacts with it through a set of special Fieldbus blocks to interchange data called Fieldbus Interface Blocks (FBIB). These Fieldbus blocks can be linked with any other blocks in devices that are in the network.

The CPU Module sees any Fieldbus Module as a regular I/O Module. The user is the one that configures (within a limit) the number of input and output signals in the Fieldbus Module that will interact with the LC700 CPU Module. Those I/O signals can be of mixed types as discrete or analog.

It must be clear that not every link of the Fieldbus Block configuration will be visible from the CPU Module but only those signals connected to the Fieldbus Interface Blocks (FBIB).

The Fieldbus Block configuration can be achieved by the Smar SYSCON. When preparation of the LC700 system is necessary it will inform the CONF700 which FBIB's were used. From this point all of the signals from the Fieldbus network connected to those FBIB's are available to the Ladder Logic in the logic controller control strategy.

To use Smar's Syscon you will need a PC with a PCI card or a DFI302 linking device. After the Fieldbus network configuration the PCI won't be necessary unless the user wants to keep it for maintenance purposes.

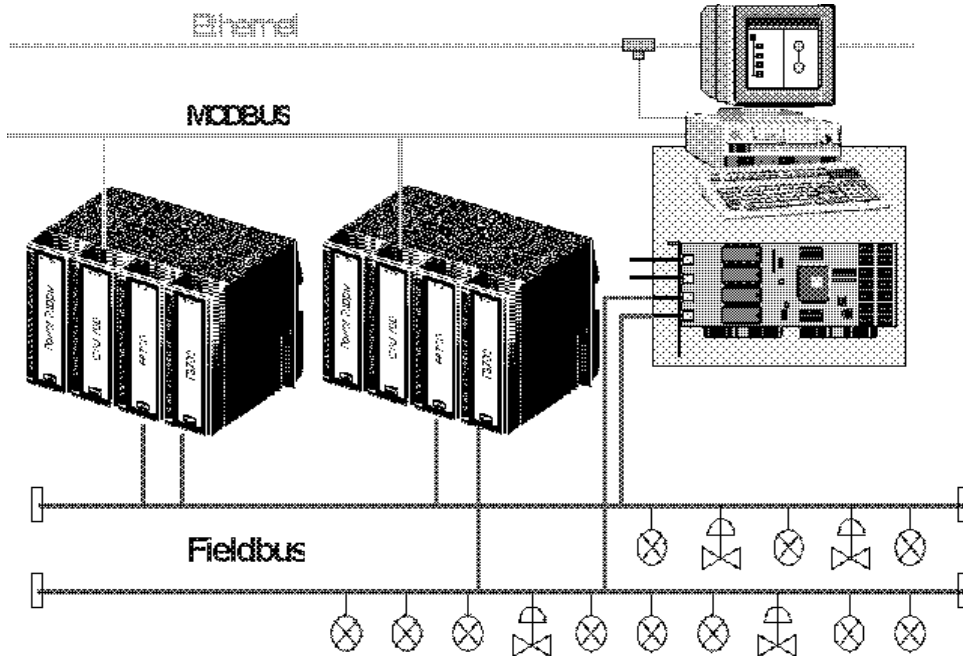


Figure 2.33 - Fieldbus System using the LC700

Chapter 3

MODULES AND ACCESSORIES

Introduction

There are several modules available for the LC700 System. Plus, this list presented here, many other modules are being developed to adapt to a new wide range of applications in the industry of automation and Process Control.

Note:

These modules leave the factory with a thin plastic adhesive label that must be removed after installation of modules

Modules List

MAIN CPUs	
CPU-700-C3	CPU module with 30 Kbytes of non-volatile memory for user configuration and a microcontroller of 15 MHz.
CPU-700-D3	CPU module with 28 Kbytes of non-volatile memory for user configuration and a microcontroller of 15 MHz with real time clock and remote I/O (Master).
CPU-700-D3R	CPU module with 23 Kbytes of non-volatile memory for user configuration and a microcontroller of 15 MHz with real time clock and remote I/O (Redundant Module).
CPU-700-E3	CPU module with 52 Kbytes of non-volatile memory for user configuration and a microcontroller of 15 MHz with real time clock and remote I/O (Master).
CPU-700-E3R	CPU module with 44 Kbytes of non-volatile memory for user configuration and a microcontroller of 15 MHz with real time clock and remote I/O (Redundant Module).

POWER SUPPLY	
PS-AC-R	AC Power Supply for IMB: input: 90 to 264 Vac or 127 to 135 Vdc .With Redundancy capability
PS-DC-R	DC Power Supply for IMB: 20 to 30 Vdc. With Redundancy capability
PS302P AC	AC Power Supply 90 to 264 Vac or 127 to 135 Vdc
PS302P DC	DC Power Supply 20 to 30Vdc

INPUTS	
M-001	2 groups of 8 24 Vdc inputs (optically isolated)
M-002	2 groups of 8 48 Vdc inputs (optically isolated)
M-003	2 groups of 8 60 Vdc inputs (optically isolated)
M-004	2 groups of 8 125 Vdc inputs (optically isolated)
M-005	2 groups of 8 24 Vdc inputs (optically isolated)
M-010	2 groups of 4 120 Vac Inputs (optically isolated)
M-011	2 groups of 4 240 Vac inputs (optically isolated))
M-012	2 groups of 8 120 Vac inputs (optically isolated)
M-013	2 groups of 8 240 Vac inputs (optically isolated)
M-020	1group of 8 push-button On/Off inputs (optically isolated)
M-302	2 groups of 8 pulse inputs 0-100 Hz-24Vdc
M-303	2 groups of 8 pulse inputs 0-10 KHz- 24 Vdc
M-304	2 groups of 8 pulse inputs 0-10 KHz- AC
M-401-R	8 Voltage/Current Analog Inputs with internal Shunt Resistor (optically isolated)
M-401-DR	8 Voltage/Current Analog Inputs with internal Shunt Resistor (optically isolated)
M-402	8 Low Level Signal (TC, RTD, mV, Ω) Inputs (optically isolated)

OUTPUTS	
M-101	1 group of 16 Open Collector Outputs (optically isolated)
M-102	2 groups of 8 Transistor Outputs Source (optically isolated)
M-110	1 group of 8 120/240 Vac Outputs (optically isolated)
M-111	2 groups of 8 120/240 Vac Outputs (optically isolated)
M-120	2 groups of 4 N.O. Relay Outputs (optically isolated)
M-121	2 groups of 4 N.C. Relay Outputs (optically isolated)

OUTPUTS	
M-122	1 group of 4 N.O. and 1 Group of 4 N.C. Relay Outputs (optically isolated)
M-123	2 groups of 8 N.O. Relays Outputs (optically isolated)
M-124	2 groups of 4 N.O. Relay Outputs (optically isolated)
M-125	2 groups of 4 N.C. Relay Outputs (optically isolated)
M-126	1 group of 4 N.O. and 1 Group of 4 N.C. Relay Outputs (optically isolated)
M-127	2 groups of 8 N.O Relay Outputs with internal RC (optically isolated)
M-501	4 Current and Voltage Analog Outputs (optically isolated)

INPUTS/OUTPUTS	
M-201	1 group of 8 24 Vdc Inputs and 1 Group of 4 N.O. Relay Outputs (optically isolated)
M-202	1 group of 8 48 Vdc Inputs and 1 Group of 4 N.O. Relay Outputs (optically isolated)
M-203	1 group of 8 60 Vdc Inputs and 1 Group of 4 N.O. Relay Outputs (optically isolated)
M-204	1 group of 8 24 Vdc Inputs and 1 Group of 4 N.C. Relay Outputs (optically isolated)
M-205	1 group of 8 48 Vdc Inputs and 1 Group of 4 N.C. Relay Outputs (optically isolated)
M-206	1 group of 8 60 Vdc Inputs and 1 Group of 4 N.C. Relay Outputs (optically isolated)
M-207	1 group of 8 24 Vdc Inputs and 1 Group with 2 N.O. and 2 N.C. Relay Outputs (optically isolated)
M-208	1 group of 8 48 Vdc Inputs and 1 Group with 2 N.O. and 2 N.C. Relay Outputs (optically isolated)
M-209	1 group of 8 60 Vdc Inputs and 1 Group with 2 N.O. and 2 N.C. Relay Outputs (optically isolated)

OTHER MODULES	
RIO-700-D3	Remote I/O Interface Module
RIO-700-E3	Remote I/O Interface Module
FB-700	One H1 Fieldbus Foundation Channel Module (Isolated)
ENET-700	Modbus/TCP 10Base-T Ethernet Module
ENET-710	MODBUS / CDBUS TCP 10/100 Base-T Ethernet Module
MB-700	Modbus RTU and TCP/IP Processor Module
SI-700	EIA-232/ EIA RS485 Interface Module
OPT-700	EIA-232/ EIA RS485 Interface Module
SW-700	Ethernet Switch Module
ICS2.0P	Serial Converter Interface

SOFTWARE	
CONF700	LC700 Configurator, Programming Tool and Optimizer
SYSCON	Fieldbus network configurator

CABLES AND ACCESSORIES	
R-700-4A	Rack with 4 slots - support to shielded flat cable
DF93	Rack with 4 slots, with diagnostic
C232-700	EIA-232 Cable to connect LC700/FB-700 and computer (183 cm)
C232-1-700	EIA232 Cable to connect CPU-700-X3 and ENET-700 (X means D or E)
C232-2-700	EIA -232 Cable to connect CPU-700-X3R and ENET-700 (X means D or E)
C232-3-700	EIA-232 Cable to connect CPU-700-X3 and MB-700 (X means D or E)
C232-4-700	EIA-232 Cable to connect CPU-700-X3R and MB-700 (X means D or E)
ICP-700	Cable to connect coprocessors - CPU-700-C3R
ICP-700-D3	Cable to connect coprocessors – CPU-700-E3R/D3R
DF90	IMB power cable
DB9-EXT	Extension for DB9 connector
FC-700-0	Flat Cable to connect 2 racks (6.5 cm)
FC-700-1	Flat cable to connect 2 racks (65.0 cm)
FC-700-2	Flat cable to connect 2 racks (81.5 cm)
FC-700-3	Flat cable to connect 2 racks (98.0 cm)
FC-700-4	Flat cable to connect 2 racks (114.0 cm)
FC-700-1A	Shielded Flat cable to connect 2 racks (65.0 cm)
FC-700-2A	Shielded Flat cable to connect 2 racks (81.5 cm)
FC-700-3A	Shielded Flat cable to connect 2 racks (98.0 cm)

CABLES AND ACCESSORIES	
FC-700-4A	Shielded Flat cable to connect 2 racks (114.0 cm)
M-000	Blind module to fill empty slots
T-700	Terminator for last the rack – right side
DF9	Support for a single module
DF91	Lateral adapter
DF96	Terminator for the last rack – left side
DF101	Flat cable to connect racks by left side – length 70 cm
DF102	Flat cable to connect racks by right side – length 65 cm
DF103	Flat cable to connect racks by right side – length 81 cm
DF104	Flat cable to connect racks by right side – length 98 cm
DF105	Flat cable to connect racks by right side – length 115 cm

GENERAL SPECIFICATIONS	
Power Voltage	PS-AC-R: 90 to 264 Vac (47-63 Hz)
	PS-DC-R: 20 to 30 Vdc
Consumption	PS-AC-R: 72 VA
	PS-DC-R: 42 W
Operating Temperature	0 °C to 60 °C
Cooling Method	Air Convection
Storage Temperature	-20 °C a 80 °C
Ambient Humidity	20 a 90% (no condensing)
Vibration Immunity	5 Hz to 2 kHz, 0.4 mm pp / 2.5 g panel mounted, 1 hr per axis
Shock Immunity	10 g, 2 Times
Noise Immunity	1,000Vpp, 1µs
Ambient Atmosphere	No corrosive gases or dust accumulation

NOTE
For aggressive areas, the user must consult the manufacturer about tropical modules.

Module Specification Format

The module specification is shown in a format similar to the example below. The Module specifications explain functionality, field connection, and electrical characteristics. It also shows a simplified schematic of the interface circuit for better understanding.

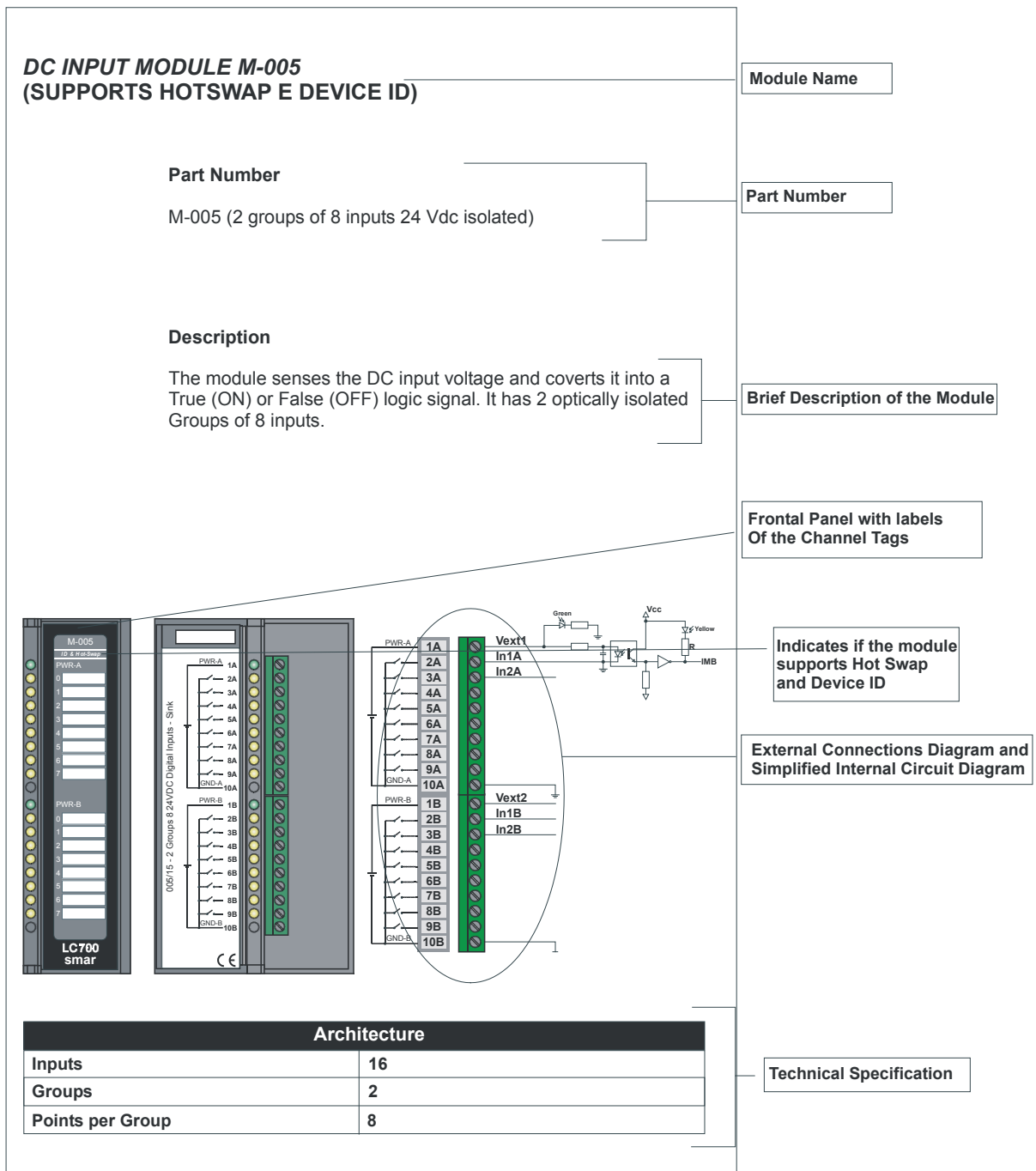


Figure 3.1 – Module Specification Format

CPU-700-C3 - Processor Module

(Supports Hot Swap)

Part Number:

CPU-700-C3 - CPU module with 30 Kbytes of non-volatile memory for user configuration and a microcontroller of 15 MHz with real time clock.

Description

The CPU-700 is the processor module for the LC700 system. It is being also referred as the CPU-Module. It is the Module that executes the programmed configuration and interacts with every other Module of the LC700 system through a local bus IMB (Inter-Module-Bus) and/or Remote I/O Channel.

The CPU-Module must always be plugged in the second Slot of the Rack addressed as ZERO (0). A rotating switch, located in the circuit board of the Rack, is used to set the Rack number. The First Slot on Rack 0 is always reserved for the Power Supply Module.

NOTE

In case the connection of the DB9 port is permanent, use the DB9-EXT to allow the user to close the front panel of the module.

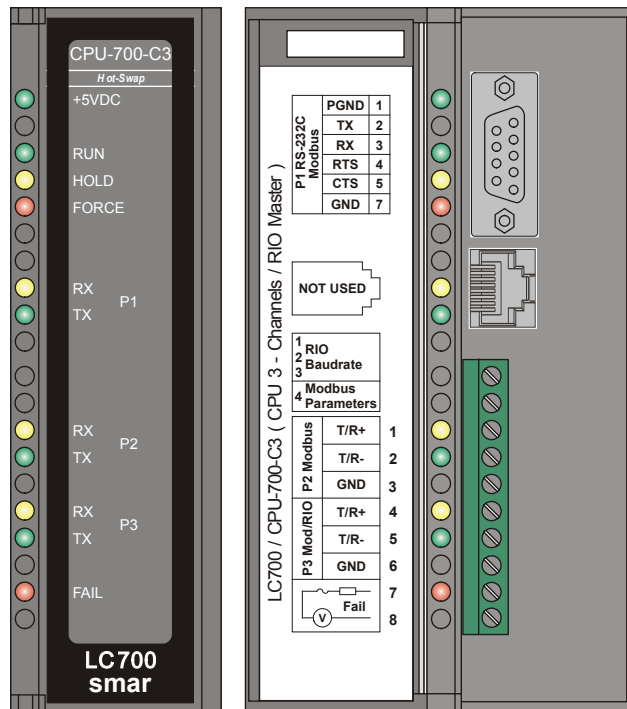


Figure 3.2- CPU-700-C3 Processor Module

Technical Specifications

CONFIGURATION MEMORY	
Type	Electrical Erasable Programmable Read Only Memory (EEPROM)
Available Size	30 Kbytes for CPU-700-C3

NUMBER of POINTS AVAILABLE FOR CONFIGURATION	
Digital Points	1024
Analog Points	1024

CONFIGURATION/OPTIMIZATION	
Software Package	CONF700
Operating System	Windows XP SP3, Windows 7 SP1 Professional 64-bit, Windows 10 Professional, Windows Server 2008 R2 64-bit, Windows Server 2012 R2, and Windows Server 2016 Standard.

COMMUNICATION PORTS	
Quantity	3 (P1, P2, P3)
Types	P1 – EIA - 232C (Point-to-Point) Modbus RTU P2 – EIA - 485 (Multi-drop) Modbus RTU P3 – EIA - 485 (Multi-drop) Modbus RTU
Connectors	DB9 Female for P1 Terminal Block (3 Points)
Operation	Independent
Label	See Modules and Accessories
Baud Rate/Address	P1 1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K bps P2/P3 as Modbus RTU: 1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K, 115200K bps
Protocol	Modbus RTU (Slave) or Dedicated SMAR Remote I/O
CPU ID (Modbus Address)	1 to 200 assigned by the user (1 is the default address)
Maximum Number of LC700 CPU's per Network	31

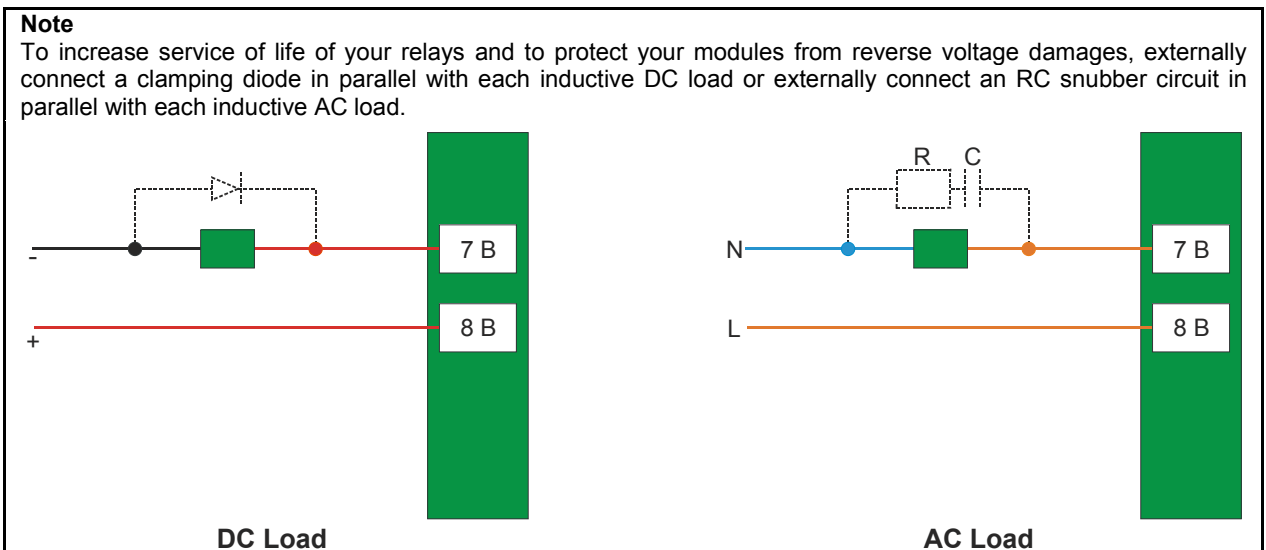
INTERNAL POWER	
Provided by the IMB bus	5VDC, @ 240mA
Total Maximum Dissipation	1.20W
Power Indicator	"+5VDC" Green LED

FAILURE CIRCUIT	
Output Type	Relay, Normally Close (NC). Relay is OPEN for normal operation
Contact Voltage Limits	20 – 115 VAC/VDC
Maximum Contact Current for 115 VAC	1.0 A (resistive); 0.5 A (inductive)
Maximum Contact Current for 24 VDC	1.0A (resistive); 0.5A (inductive)
Maximum Initial Contact Resistance	50 mΩ
Status Display	Red LED "Fail" (Contact Closed)
Relay Power Indicator	Green LED - ON if the relay circuit is powered (contact closed)
Leakage	500 mA @ 100VAC
Over Load Protection	Should be provided externally
Internal RC Protection Circuit	62 Ω in series with 0.01 μF
Operate Time	10 ms maximum
Release Time	10 ms maximum
Electrical service life	100.000 operations min @ 0.5A , 115 VAC
External Power Indicator	"Relay Coil Power" Green LED
External Power	8.3 mA @ 24 VDC
External Voltage Range	23-30 VDC (excessive voltage can burn the relay coil)
Resistance	2880 Ω (Coil)
Inductance	2.7 H (Coil)
Optical Isolation	5000Vac before the Relay's isolation.

OTHER LEDs	
RUN	Green LED indicates that program is running
HOLD	Yellow LED indicates that program is in hold
FORCE	Red LED indicates that inputs and/or outputs are in the force mode.
Rx (Yellow LED) Tx (Green LED)	Rx - Displays Modbus Communication receipt (EIA-485) Tx - Displays Modbus Communication transmission (EIA-485)
Rx (Yellow LED) Tx (Green LED)	Rx - Displays Modbus Communication receipt (EIA-485) Tx - Displays Modbus Communication transmission (EIA-485)

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm ; (1.57 x 5.39 x 5.57in)
Weight	0.286 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)



Communication Channels

The CPU-700-C3 has 3 communication channels that supply the user with 3 independent channels (ports) identified as P1 (EIA-232), P2 (EIA-485) and P3 (EIA-485).

All of the 3 channels can be used at the same time with the following features:

- P1 (RS-232- C) is for programming and monitoring, point-to-point short connections.
- P2/P3 (RS-485) is for programming and monitoring, point-to-point or multi-drop in long distance industrial connections.
- Any of the ports can be connected to the ENET-700/ENET-710 (Ethernet/Serial) converter module.

In one Network it is possible to have up to 31 CPU-700 modules. In order to make the correct communication, each CPU-700 module must have an unique MODBUS ID (address) and a baudrate for P1 (Modbus) and other baudrate for P2 and P3 (Modbus). Modbus baudrates are configurable by software throughout the use of CONF700.



Restrictions:

- Only one channel can be used at the same time to monitor the network through the CONF700. Other channels will be blocked after the first one begins.
- All channels are referred with the same address.
- Channel P2 and P3 share the same baud rate. P1 has dedicated one!

Device Communication Baud Rate and Device Address

The CPU Module has a mini slide type of switch (communication button) on the top grid of the plastic module that can set these communication parameters to Default values. Default values are: 1 for the address (also known as the Modbus ID), 9600 for the baudrate, parity even with 1 stop bit.

Default values apply to all of the three channels P1, P2 and P3 (case it is in Modbus Mode!) when the Communication Switch is toward the 'Back-Plane'.

When the Communication Switch is pointing to the front panel of the Module, indicates that the programmed communication parameters (in the memory) are going to be used instead of Default values. Communication parameters can be changed any time using the CONF700 programming software.

CPU-700-C3 as a Regular CPU

The CPU-700-C3 can work as a Regular CPU with 3 Modbus/RTU channels or as a Master CPU in a Remote I/O (RIO) system where 2 channels (P1 and P2) will work as Modbus/RTU and P3 as a remote master channel.

Regular CPU - Means that no Remote I/O unit is attached. This implies that P3 together with P1 and P2 are available as MODBUS/RTU slave channels. Note that none of them can act as a MODBUS MASTER channel!

P1, P2 and P3 are independent MODBUS RTU slave channels. They can all be used at the same time! P1 is dedicated for a point-to-point connection, while P2 and P3 can be used in two different networks (master-slave) to increase CPU accessibility via two Computers (Masters) or in a redundant architecture where the user may swap between channels in a failure situation.

Configuration:

- Rotary switch must be in the number 8.
- One MODBUS ID for P1, P2 and P3 configurable by software (CONF700)
- P1 baud rate and P2/P3 baud rate configurable by software (CONF700).
- DIP switches are disregarded!

CPU-700-D3 - Processor Module

(Supports Hot Swap)

Part Number:

CPU-700-D3 - CPU module with 28 Kbytes of non-volatile memory for user configuration and a microcontroller of 15 MHz with real time clock and remote I/O (Master).

Description

The CPU-700 is the processor module for the LC700 system. Also referred to as CPU module. It is the module that runs the programmed configuration and interacts with all the other modules of the LC700 System.

It must be plugged into the second slot of the rack addressed with 0 (zero). This rack number is adjusted through a rotating switch located in the electronic circuit of the rack. The first slot of rack 0 must always be reserved for the power supply module.

NOTE

The firmware update is made using Smar's software LC700Tools.

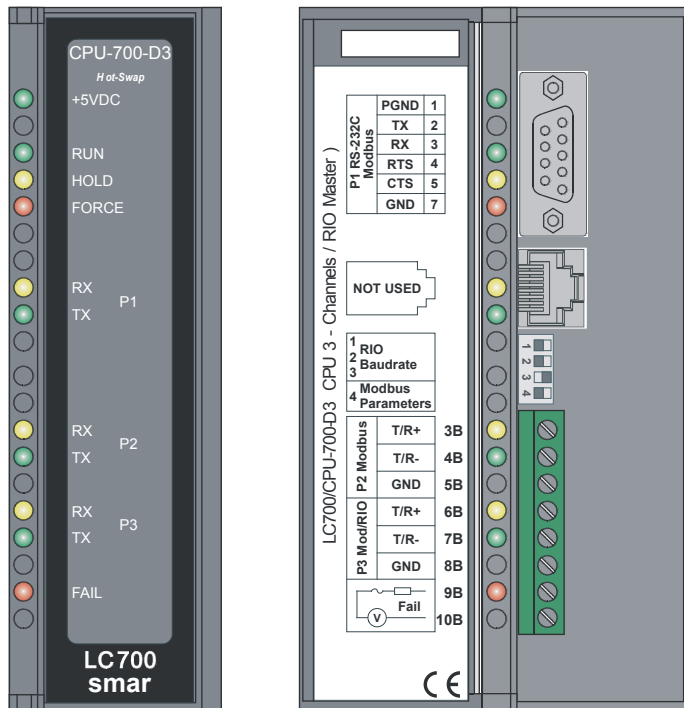


Figure 3.3 – Processor Module

NOTES

The CPU-700-D3 can read all I/O modules that do not support Module ID since the option "Use Module I/O with ID" in the CONF700 is disabled. Thus, in systems having modules that do not have these features or systems that combine modules with these features it is necessary to disable this flag in the CONF700.

In case the connection of the DB9 port is permanent, the DB9-EXT cable must be used which allows the user to close the front panel of the module.

Technical Specifications

CONFIGURATION MEMORY	
Type	Non volatile Memory
Available Size	28Kbytes

NUMBER OF AVAILABLE POINTS FOR CONFIGURATION	
Digital Points	1024 (discrete and auxiliary points)
Analog Points	1024

CONFIGURATION/OPTIMIZATION	
Software Package	CONF700 Version 6.50 or higher
Operating System	Windows XP SP3, Windows 7 SP1 Professional 64-bit, Windows 10 Professional, Windows Server 2008 R2 64-bit, Windows Server 2012 R2, and Windows Server 2016 Standard.

COMMUNICATION PORTS	
Quantity	3
Types	1-EIA-232-C (P1) 2-EIA-485 (multidrop, P2 e P3)
Connectors	Female DB9 to EIA-232-C (P1) Terminal blocks for EIA-485, remote I/O
Baud Rate/Address	P1: 9600 bps P2 9600-115200 bps P3 (Modbus): 9600 bps ~115200 bps P3 (RIO): 57600 bps ~230400 bps
Protocol	Modbus RTU (Slave)
Slave Address	2 a 127, Set by User(1 is default) 2 to 121, set by user (1 is the default address)
Maximum number of LC700 per network	31

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 320 mA
Total Maximum Dissipation	1.6 W
Power Indicator	Green LED, +5Vdc

FAILURE RELAY	
Output type	Solid state relay, Normally Close (NC)
Limits	6 W, 30 Vdc Max, 200 mA Max.
Maximum Initial Contact Resistance	<13Ω
Status Indication	Red LED - FAIL
Logic Indicator	LED ON (relay closed)
Over Load Protection:	Should be provided externally
Operation Time	5 ms maximum
Release Time	5 ms maximum

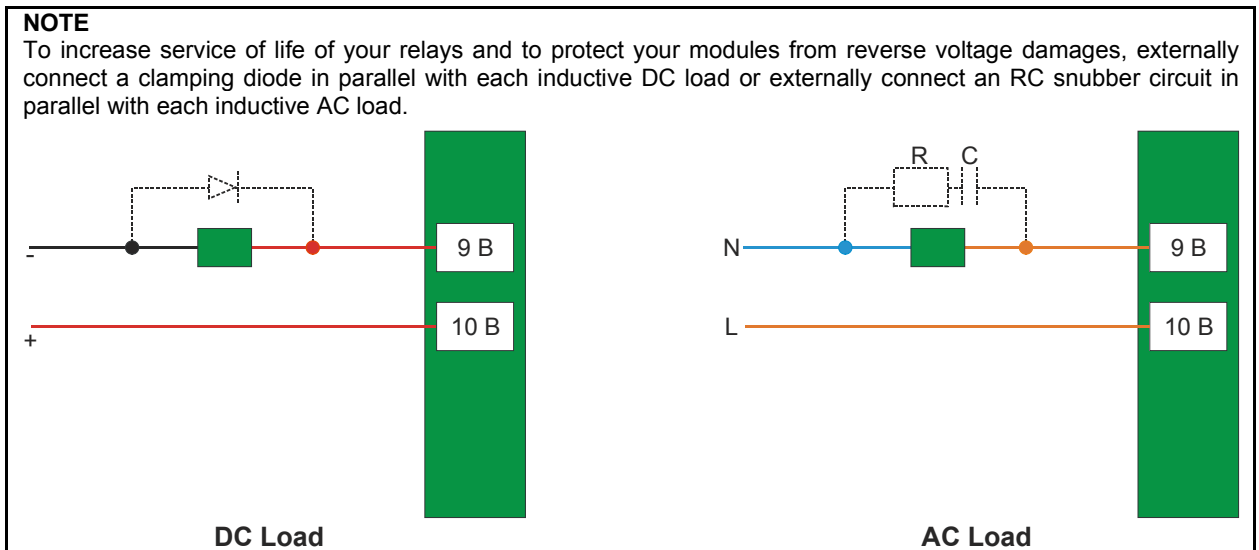
NOTE	
To meet the EMC standards requirements, the wires' length to the failure relay must be less than 30 meters. The power supply of activated load by the failure relay must not be from external network.	

INDICATION LEDs		
RUN		Green LED- indicates program running
HOLD		Yellow LED- indicates program in hold mode
FORCE		Red LED- indicates all inputs and/or outputs are in the force mode
Rx (Yellow LED) Tx (Green LED)	P1	Displays Modbus Communication (EIA-232)

Rx (Yellow LED) Tx (Green LED)	P2	Displays Modbus Communication (EIA-485)
Rx (Yellow LED) Tx (Green LED)	P3	Displays Modbus Communication (EIA-485)
FAIL		Red LED- Indication of failure

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm (1.57 x 5.39 x 5.57 in)
Weight	0.286 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)



Communication Channels

The CPU-700 has three communication channels that supply the user with 3 independent channels (ports) identified as P1 (EIA-232), P2 (EIA-485) and P3 (EIA-485).

The three channels may be used at the same time with the following features:

- P1 (EIA-232-C) is for programming and monitoring, point-to-point short connections.
- P2 (EIA-485) is for programming and monitoring, point-to-point or multi drop in long industrial connections.
- P3 can mimic P2 or act as a Master channel for a remote I/O connection Remote I/O interface module (RIO-700-3). A rotary switch on the CPU Module card can set the P3 channel behavior.
- Any of the ports can be connected to the Smar ENET-700/ENET-710 (Ethernet-Serial) converter module.

In one Network it is possible to have up to 31 CPU-700 modules. In order to make the correct communication, each CPU-700 module must have an unique MODBUS ID (address) and a baudrate for P1 (Modbus) and other baudrate for P2 and P3 (Modbus). Modbus baudrates are configurable by software throughout the use of CONF700.



Restrictions:

- o Only one channel can be used at the same time to monitor the network through the CONF700. Other channels will be locked after the first one begins.
- o All channels are referred with the same address.
- o Channels P2 and P3 shares the same baud rate. P1 has a dedicated one.

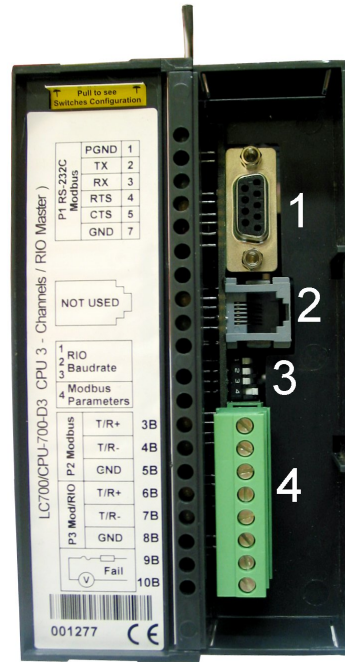


Figure 3.4 - Communication Channels of the CPU-700-D3.

In the picture above:

- 1- This is the CPU-700 P1 port. It is the EIA-232-C channel.
- 2- This is the SSIO channel used by the redundant CPU-700. See "CPU-700 Redundant Module" for further details.
- 3- These are the Dip-switches used to change the CPU communication parameters.
- 4- Ports P2 and P3 of the CPU-700. These are EIA EIA-485 channels.

There are 3 serial communication ports on the CPU700: one EIA-232 port (P1) and two EIA-485 ports (P2 and P3). The user should set to any of these ports: baud rate, parity and other specific parameters.

Port P1

Baudrate: 9600 bps
Parity (Odd or Even)

RTS/CTS Timeout

CTS: Signal that indicates the device is ready for transmission.
RTS: Signal to request data transmission

The PC requests a connection with the CPU. The LC700 receives this request and processes it. Next, the LC700 sends the RTS signal and it waits for the CTS signal during the time interval set on the RTS/CTS Timeout parameter.

Off Duty

Available time for communication when the CPU is not running a ladder diagram. The bigger the value set for Off Duty, the bigger the available time for communication.

Time Delay

The PC sends a frame to the CPU-700, i.e., makes a communication request. The CPU-700 waits the amount of time set on Time Delay to process the frame request and send the answer.

NOTE:

For **better performance** of your system we recommend:

- **OFF Duty** must be set as 20 % of the Ladder cycle of execution.
- **Time Delay** depends on the Workstation's processor. If the processor is higher than a Pentium MMX 233 MHz we recommend that Time Delay is set for 5 ms. Otherwise we recommend that the Time Delay is set with its default value.
- When the Dip switch 4 is in the default position or IF the value set for OFF-DUTY is set for position, the value set for OFF-DUTY will be 20% of the cycle (the I/O module scan plus Ladder execution)

Device Communication Baud Rate and Device Address

The CPU module has a key where the user may select default communication parameters (DCP-Switch 4 ON) or programmed communication parameters (PCP-Switch 4 OFF). Default parameters are address 1 and baud rate 9600 bits/s.

In the PCP position the user might select a new address and/or baud rate, using CONF700. The new adjustment of parameters will be accepted only after the key being moved to the PCP position. In the PCP position the user is also able to change the communication parameters. In this case they will be accepted immediately after they have been sent.

The default values apply to three channels: P1, P2 and P3. The user can set the Dip Switches using a key as the figure below shows:

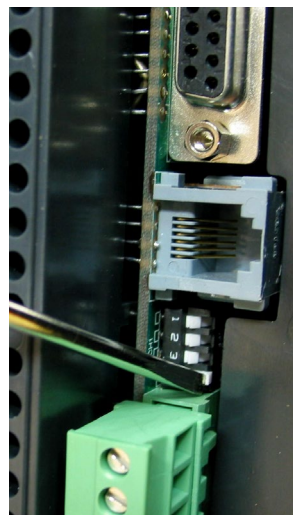


Figure 3.5 -Setting the Communication Parameters Of The CPU-700.

CPU-700 Operation Modes

The CPU-700 may act as:

- A CPU with three MODBUS/RTU channels.
- Master CPU in a system with Remote I/O (RIO) where 2 channels work as MODBUS/RTU and the remaining one (P3) as remote master channel.

To change the operation mode of the CPU-700, the user needs to change the Rotary Switch position. This rotary key is located underneath the CPU-700 module as shown in the next picture.

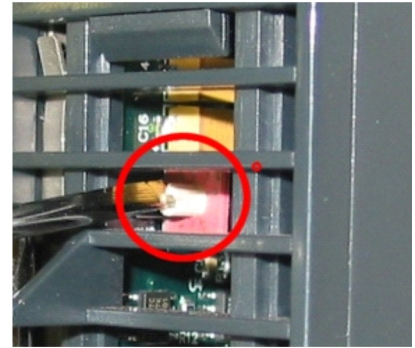


Figure 3.6 - Locating the CPU-700 Rotary Switch.

Detail: The Rotary Switch

CPU-700 with 3 MODBUS RTU Channels

When the CPU-700 is used as a regular CPU, it means that no Remote I/O module is being used. Also, either P3 as P1 and P2 may act as MODBUS/RTU channels. Note that none of them can act as a MODBUS master.

P1, P2 and P3 are independent MODBUS/RTU slave channels. They can be used at the same time. P1 is recommended for point-to-point connections whereas P2 and P3 may be used in two different networks (master and slave) to increase accessibility of the CPU through two computers (masters) or in a redundant architecture where the user can alternate between the channels in a failure situation.

Settings:

- The rotary key must be in the position 8.
- One MODBUS ID set for P1, P2 and P3 (set on CONF700).
- The P1, P2 and P3 baud rates are set on CONF700.

CPU-700 master in a remote I/O System

The CPU-700 can be also a master in a Remote I/O system. This means that the CPU-700 acts as the main processing unity acquiring data from the Remote I/O modules in its own IMB and also from any remote I/O connected to it.

In this case P3 is completely dedicated to Remote I/O communication data. P1 and P2 are slave MODBUS/RTU independent channels. P1 is used for point-to-point applications whereas P2 may be used in a multi drop network.

Settings:

- The rotary Switch must be in the position 0.
- One ID MODBUS for P1 and P2 set on CONF700.
- P1 and P2 baud rates are set on CONF700.
- P3, the RIO channel, has its own dedicated baud rate set through the frontal dip switch.

Factory Init

The user can carry out a procedure to make the CPU-700 to assume its factory configuration. This procedure is called factort-init.

To do it:

1. Remove the CPU-700 from the power supply.
2. Put the Rotary Switch on the position 7
3. Put the Dip Switch 4 in the default position
4. Connect the CPU-700 to the power supply and wait until the HOLD led starts to blink
5. Remove the CPU-700 from the power supply.
6. Set the rotary switch



Observation

After the **Factory Init** procedure, the user must set the Rotary Switch when a new download is done.

CPU-700-D3R - Redundant CPU Module

Part Number

CPU-700-D3R - CPU module with 23 Kbytes of non-volatile memory for user configuration and a microcontroller of 15 MHz with real time clock and remote I/O (For CPU redundancy).

Introduction

The redundancy with the CPU-700-D3 is based on a hot-standby mechanism. Therefore, just one CPU runs the ladder logic as well as the communication with HMI at a specific moment. The active CPU scans the Remote I/O module while the passive CPU monitors the status of the active CPU through another port.

However, there is communication between the CPUs to keep the synchronization of the configuration and also to provide fresh dynamic data to the passive CPU. For example: the Modbus Variables.

The algorithm responsible for choosing the active CPU tries to minimize the number of control switches; therefore, if a CPU runs as active, it remains in this state, unless something happens to put this CPU in worse conditions.

Terminology and Initial Descriptions

Main and backup CPUs

The redundancy status depends on a lot of items as: **configuration of the CPU, communication status through SSIO, communications with the remote I/O modules RIO-700-D3 (RIOs)**. This status defines whether the CPU will run the ladder logic as well as scanning the RIOs.

The CPU may assume two roles: Active and Passive. The active CPU runs the ladder logic and scans the MODBUS variables. The passive CPU periodically checks the active CPU in order to check if it is necessary to take control.

The configuration of CPU role is set through the rotary switch in the CPU module:

- **Rotary Switch in the position 0 (Main):** When both CPUs are powered-up at the same time and, the algorithm checks the rotary switch position (of both CPUs) to choose which CPU is active and which one is the passive.

- **Rotary Switch in the position 9 (Backup):** The CPU set as backup grants the control to the other CPU their current status is both passives and both actives. This configuration is used only when the CPUs are simultaneously powered-up and when both are passive or active at the same time before the last power-down.

Configuration Transference

During the power-up procedure, the configuration of the active CPU is passed to the passive CPU.

This transference is always made from active to passive and never in the contrary direction and it uses the Synchronous Serial I/O (SSIO) Port of the CPU. This synchronous serial communication channel is used exclusively to transfer the configuration.

During this process two new terms need to be defined:

- **Sender:** This is the CPU responsible for the communication. The sender CPU handles the configuration transference between the CPUs.

- **Addressee:** This is the CPU that receives the configuration.

Configuration synchronism between the CPUs

This is accomplished in two main phases:

Phase 1- Configuration Transfer

When a sequential power-up procedure takes place, the first CPU powered-up becomes the active CPU and it transfers the configuration to the other one.

Phase 2- Updating Transference

After the Configuration Transfer Phase, it is necessary to transfer only the dynamic variables and the settings that can be done without configuration download.

Note: This refers to Modbus variables, configuration of switches in the CPU module and communication settings.

Rules to select the Sender and Addressee

When the CPU detects the presence of the other CPU through the SSIO, they exchange some status information to decide which will be the Sender of configuration.

Three main cases may happen:

Situation	Rule	Scenario
0	If configuration name, date and time in both CPUs are the same and Good-Config, the rules to select the active CPU will be applied, and the active CPU will be also the Sender.	Power cycle of configured system
1	If configurations mismatch and a sequential power up happened and the first CPU has a Good-Config, then the first CPU to power up will be the Sender.	Replace of CPU module
2	All other cases (configuration mismatch and simultaneous power up OR one or both with bad-config) CPUs do not enter transference status.	First power up of system after a firmware download or abnormal cases.

The SSIO port diagram

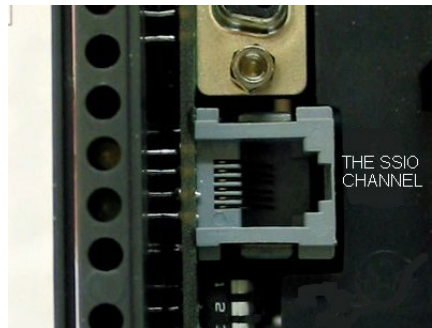


Figure 3.7- The SSIO channel

To transfer the configuration from the active CPU to the passive it is necessary to use a special cable to connect the two CPUs. This cable part number is ICP-700-D3.

This port cable is a 4 wires-cable that implements a full-duplex channel whose baud rate is 1.875 Mbits/second.

Architecture

Consider the figure below:

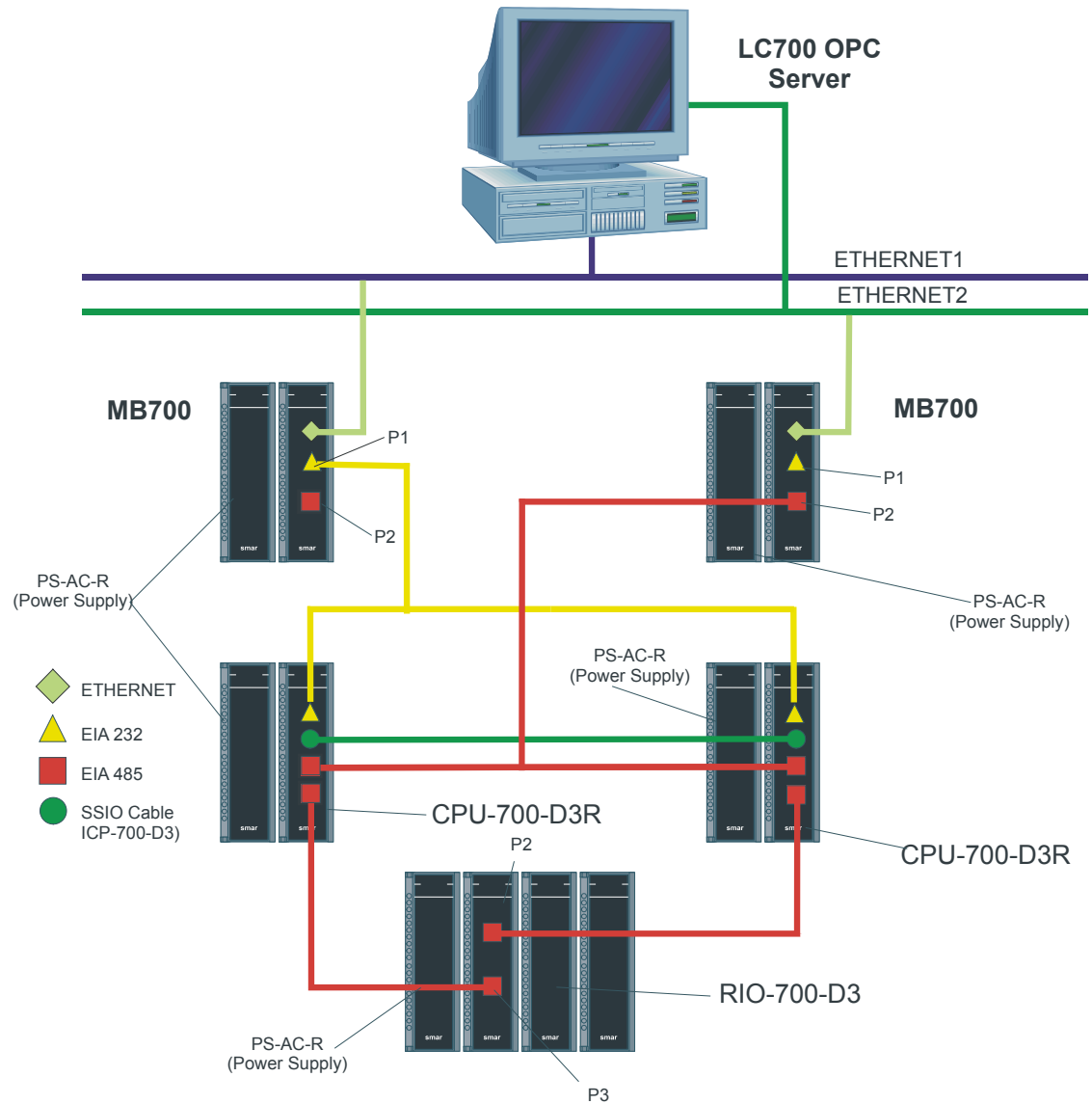


Figure 3.8 - The above architecture shows an illustrative example of the hardware used in the CPU-700-D3R redundancy.

- Two Ethernet paths
- Two MB700 modules allow complete redundancy
- Two CPUs with main and backup roles
- A RIO module scans the MODBUS variables.

Note: The I/O modules are only included in the racks where the RIO module is present.

Power –Up Procedure

Breakers

- One breaker to the main CPU.
- One breaker to the backup CPU.
- One breaker to the RIO modules.

Power-up sequence

Power-up sequence refers to the order that each CPU is turned –on. There is a specific breaker configuration.

1. First, the breaker of the power supply modules of the RIO modules is turned on.
2. Next each the two breakers of each CPU are turned on.
3. Before the CPUs start searching for another CPU, the state of both becomes passive.
4. After powering-up a CPU and if it does not find an active CPU, then, during 2 seconds interval it will search for another CPU.
5. If it does not find another active CPU it becomes the Active CPU.

I - The algorithm checks which CPU was active in the last power-down. The active CPU in the last power-down becomes the current active CPU. The CPU passive in the last power-down becomes the current passive.

II - If both CPUs were passive or active simultaneously in the last power-down, the algorithm checks the rotary keys to define which CPU will be active. If the rotary key is in the main position (0), then the CPU is considered active. If the rotary is in the backup position, then the algorithm considers this CPU as passive.

For further explanation, please check the flowchart in the next page.

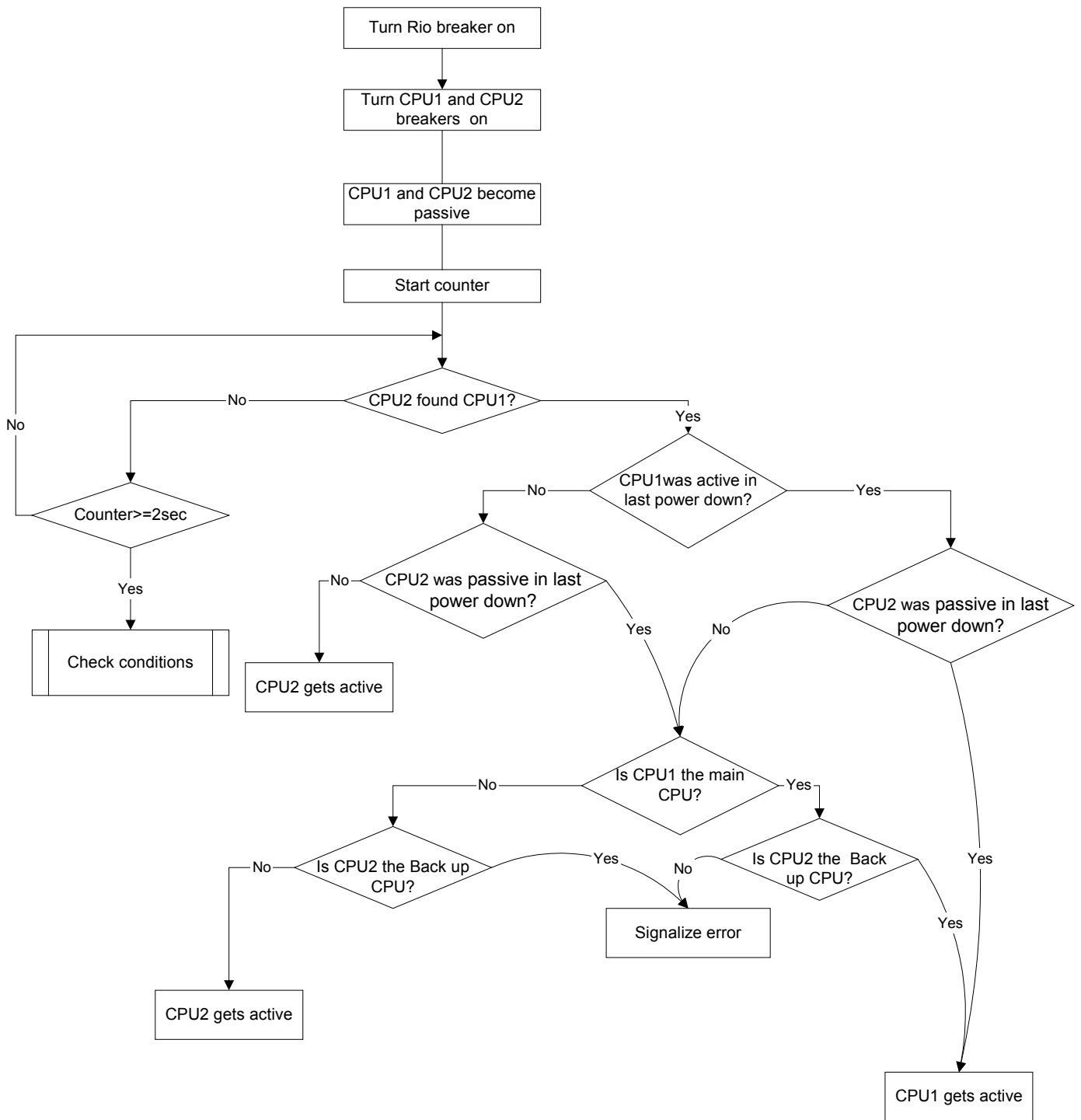


Figure 3.9 - Flow chart representing the algorithm that decides which CPU will be active

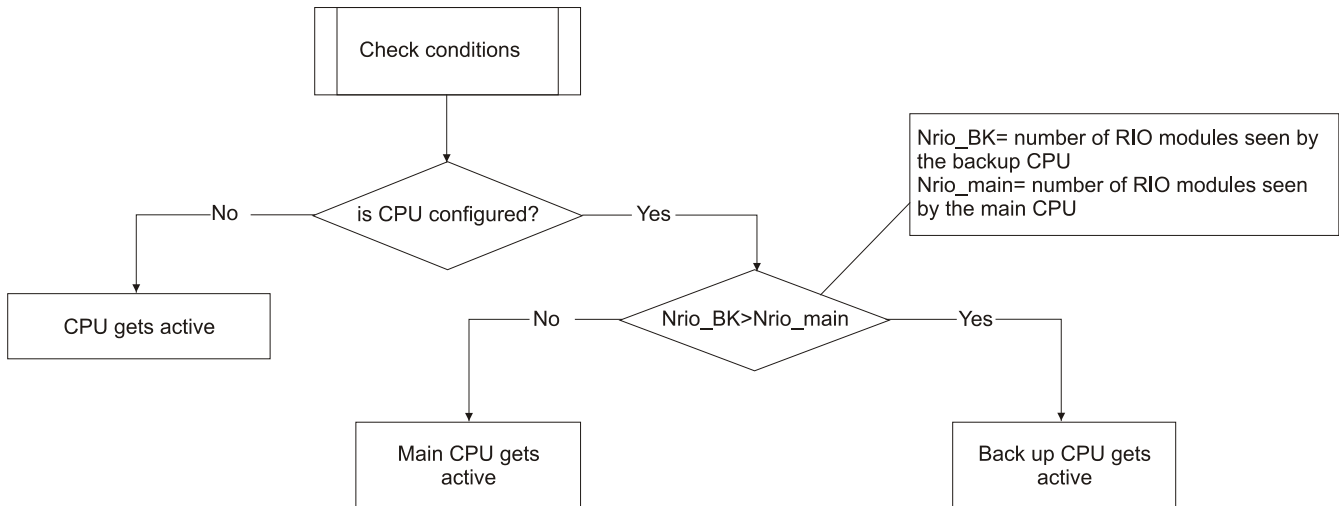


Figure 3.10 - Flow chart representing the check conditions procedure

Communication with the Remote I/O Modules

The remote I/O modules (RIO) are scanned only if the name of the configuration and data are the same in the main CPU and RIO CPU. The passive CPU sends polling commands to check periodically whether it is necessary to assume control.

As seen in the system architecture picture, the RIO modules are connected to the system through two different and redundant channels.

There are two ports to be considered:

- RIO Active Port: Port being scanned by the active CPU, i.e., through this port the MODBUS variables are read and written.
- RIO Passive Port: In this port the passive CPU checks the conditions of the active and passive ports.

Switch over procedure

During the normal functioning of the system, there's a switching procedure. It is based on the number of the RIO CPUs that the active CPU can communicate with (**NRIOactive**) and the number of RIO CPUs that the passive CPU can communicate with (**NRIOpassive**).

If NRIOactive is shorter than NRIOpassive, then there is a switching over procedure that makes the current active CPU the passive CPU and the old passive CPU the current active CPU. This procedure ensures that the system reads the biggest amount of I/O MODBUS variables.

LEDs for Status Indication

- A solid RUN LED (green, on or off) indicates if the CPU is in Active state while a blink RUN LED indicates that the CPU is in Passive state.
- A solid HOLD LED (yellow, on or off) indicates if the CPU has been configured properly, while a blink HOLD LED indicates that it was not.
- A solid FORCE LED (red, on or off) indicates if the CPU is in FORCE-IN, FORCE-OUT or SAFE-OUT mode, or not.
- FORCE LED indicator on Passive CPU is blinking. It indicates that the hardware settings is not correct (rotary switch BR for RIO or firmware version).

Technical Specifications

CONFIGURATION MEMORY	
Type	Non volatile Memory
Available Size	23 Kbytes

NUMBER OF AVAILABLE POINTS FOR CONFIGURATION	
Digital Points	1024 (discrete and auxiliary points)
Analog Points	1024

CONFIGURATION/OPTIMIZATION	
Software Package	CONF700 Version 6.50 or higher
Operating System	Windows XP SP3, Windows 7 SP1 Professional 64-bit, Windows 10 Professional, Windows Server 2008 R2 64-bit, Windows Server 2012 R2, and Windows Server 2016 Standard.

COMMUNICATION PORTS	
Quantity	3
Types	1-EIA-232-C (P1) 2-EIA-485 (multidrop, P2 e P3)
Connectors	Female DB9 to EIA-232-C (P1) Terminal blocks for EIA-485, remote I/O
Baud Rate/Address	P1: 9600 bps P2 9600-115200 bps P3: 57600 bps ~230400 bps
Protocol	Modbus RTU (Slave)
Slave Address	2 a 127, Set by User (1 is default) 2 to 121, set by user (1 is the default address)
Maximum number of LC700 per network	31

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 320 mA
Total Maximum Dissipation	1.6 W
Power Indicator	Green LED, +5Vdc

FAILURE RELAY	
Output type	Solid state relay, Normally Close (NC)
Limits	6 W, 30 Vdc Máx, 200 mA Máx.
Maximum Initial Contact Resistance	<13Ω
Status Indication	Red LED - FAIL
Logic Indicator	LED ON (relay closed)
Over Load Protection:	Should be provided externally
Operation Time	5 ms maximum
Release Time	5 ms maximum

NOTE	
To meet the EMC standards requirements, the wires' length to the failure relay must be less than 30 meters. The power supply of activated load by the failure relay must not be from external network.	

INDICATION LEDS		
RUN		Green LED- indicates program running
HOLD		Yellow LED- indicates program in hold mode
FORCE		Red LED- indicates all inputs and/or outputs are in the force mode
Rx (Yellow LED) Tx (Green LED)	P1	Displays Modbus Communication (EIA-232)
Rx (Yellow LED) Tx (Green LED)	P2	Displays Modbus Communication (EIA-485)
Rx (Yellow LED) Tx (Green LED)	P3	Displays Modbus Communication (EIA-485)
FAIL		Red LED- Indication of failure

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm (1.57 x 5.39 x 5.57 in)
Weight	0.286 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

RIO-700-D3 - Remote I/O Communication Interface

Part Number

RIO-700-D3 – Remote I/O Interface (Slave)

Description

Remote I/O modules are located close to the field devices and allow a flexible architecture to the system. Remote I/O units use the same I/O modules designed for the regular LC700 system combined with the RIO-700-D3 module.

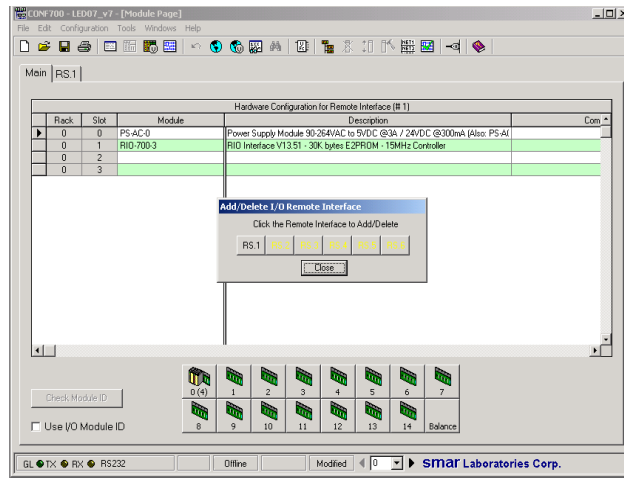
This module must used together with CPU-700-D3 and CPU-700-D3R.

NOTE

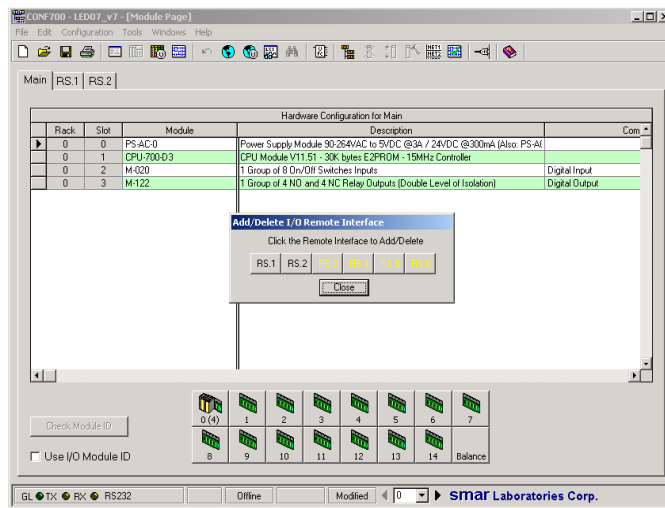
The firmware update is made using Smar's software LC700Tools.

Adding a remote I/O unit

To add a remote I/O system, first click on the Go to I/O module page, next click on Add/Delete Remote I/O system. The following page will be showed.



Choose a remote I/O system and click on the corresponding button.



Warning

The address and baud rate of the RIO-700-D3 interface module must be set. Interface modules and power supply modules for remote I/O are automatically set.

Remote I/O Architecture

The Remote I/O System is basically composed of a Master Unit and up to 6 Slave Units. Master Unit and Slave Units are connected through a multi-drop cable that can reach a total length of 4000ft. The proper cable length and baud rate depend on the level of noise in the application environment.

The available Rack/Slots will limit the total number of modules per System and the maximum number of Discrete and Analog Points that the LC700 will be able to handle. Each Remote I/O needs, at least, one power supply. LC700 Remote I/O system structure is shown as follows:

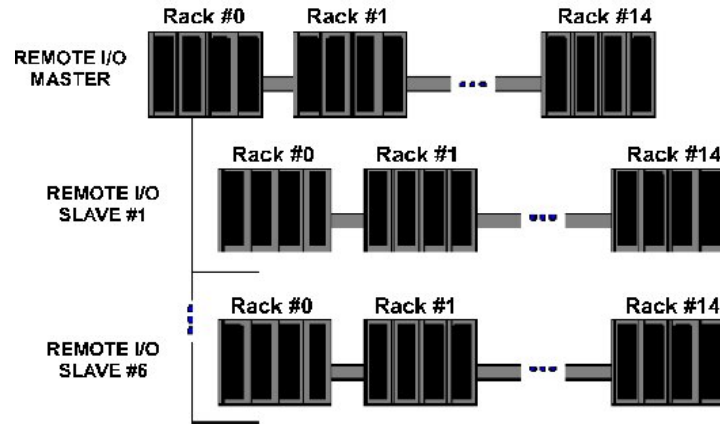


Figure 3.11- Remote I/O Architecture

Baud Rate and RIO Address Settings

Baud Rate Settings

Each Remote I/O Interface Module (Master or Slave) has a DIP switch to set the baud rate (communication speed). The DIP switch is located in the frontal panel of the Module and can be accessed with a small screwdriver.



Observation

Make sure to disconnect the Module while setting the switch. Also note that both the Master and Slave I/O interface must be configured with the same baud rate.

Setting Address of the Remote I/O Interface Module

There is also a dedicated *Rotary Switch* at the bottom of the Slave Module to set the Slave device address. Each Remote Unit connected to the Master Unit has to have a unique address. Available addresses are: 1, 2, 3, 4, 5 and 6.

RIO Limits

To follow has a utilization descriptive of remote and redundant CPU's in LC700. For each master CPU is possible to have up to 6 RIO's slave, and to each RIO had:

120 Words (240 bytes) of analog inputs, for example:

- 120 inputs for PT100 (15 X M-402) or;
- 120 inputs 4 to 20 mA (15 X M-401R) or;
- 60 inputs through FB700.

120 Words (240 bytes) of analog outputs, for example:

- 120 outputs 4 to 20 mA (30 X M-501) or;
- 60 outputs through FB700.

The digital inputs and outputs are limited for the total number in the CPU.

For the updating of redundant CPUs, where it is necessary to use remotes, prevail the same rule. Whenever the necessity goes bigger than these limits, the user will need to divide in more remotes.

CPU-700-E3 - Processor Module

Part Number:

CPU-700-E3 - CPU module with 52 Kbytes of non-volatile memory for user configuration and a microcontroller of 15 MHz with real time clock and remote I/O (Master).

Description

The CPU-700 is the processor module for the LC700 system. Also referred to as the CPU module. It is the module that runs the programmed configuration and interacts with all the other modules of the LC700 System.

It must be plugged into the second slot of the rack addressed with 0 (zero). This rack number is adjusted through a rotating switch located in the electronic circuit of the rack. The first slot of rack 0 must always be reserved for the power supply module.

NOTE

The firmware update is made using Smar's software LC700Tools.

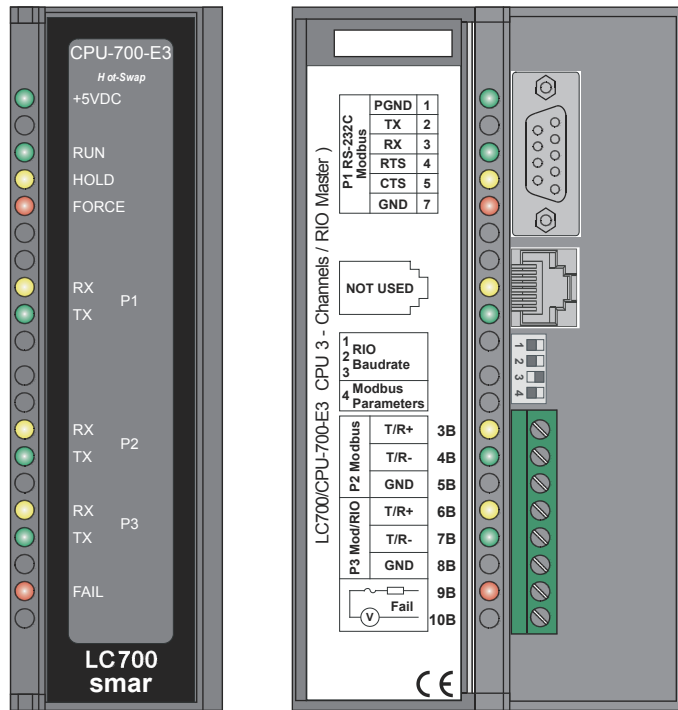


Figure 3.12 – Processor Module

NOTES

The CPU-700-E3 can read all I/O modules that do not support Module ID since the option “Use Module I/O with ID” in the CONF700 is disabled. Thus, in systems having modules that do not have these features or systems that combine modules with these features it is necessary to disable this flag in the CONF700.

In case the connection of the DB9 port is permanent, the DB9-EXT cable must be used which allows the user to close the front panel of the module.

Technical Specifications

CONFIGURATION MEMORY	
Type	Non volatile Memory (NVRAM)
Available Size	52 Kbytes (CPU-700-E3)

NUMBER OF AVAILABLE POINTS FOR CONFIGURATION	
Digital Points	2000 (discrete and auxiliary points)
Analog Points	1024

CONFIGURATION/OPTIMIZATION	
Software Package	CONF700 Version 8.55
Operating System	Windows XP SP3, Windows 7 SP1 Professional 64-bit, Windows 10 Professional, Windows Server 2008 R2 64-bit, Windows Server 2012 R2, and Windows Server 2016 Standard.

COMMUNICATION PORTS	
Quantity	3
Types	1-EIA-232-C (P1) 2-EIA-485 (multidrop, P2 e P3)
Connectors	Female DB9 to EIA-232-C (P1) Terminal blocks for EIA-485, remote I/O
Baud Rate/Address	P1: 9600 bps P2: 9600– 115200 bps P3 (Modbus): 9600-115200 bps P3 (RIO): 57600-230400 bps
Protocol	Modbus RTU (Slave)
Slave Address	2 a 127, Set by User (1 is default) 2 to 121, set by user (1 is the default address)
Maximum number of LC700 per network	31

INTERNAL POWER	
Provided by the IMB bus	5 Vdc, @ 320 mA
Total Maximum Dissipation	1.6 W
Power Indicator	Green LED, +5VDC

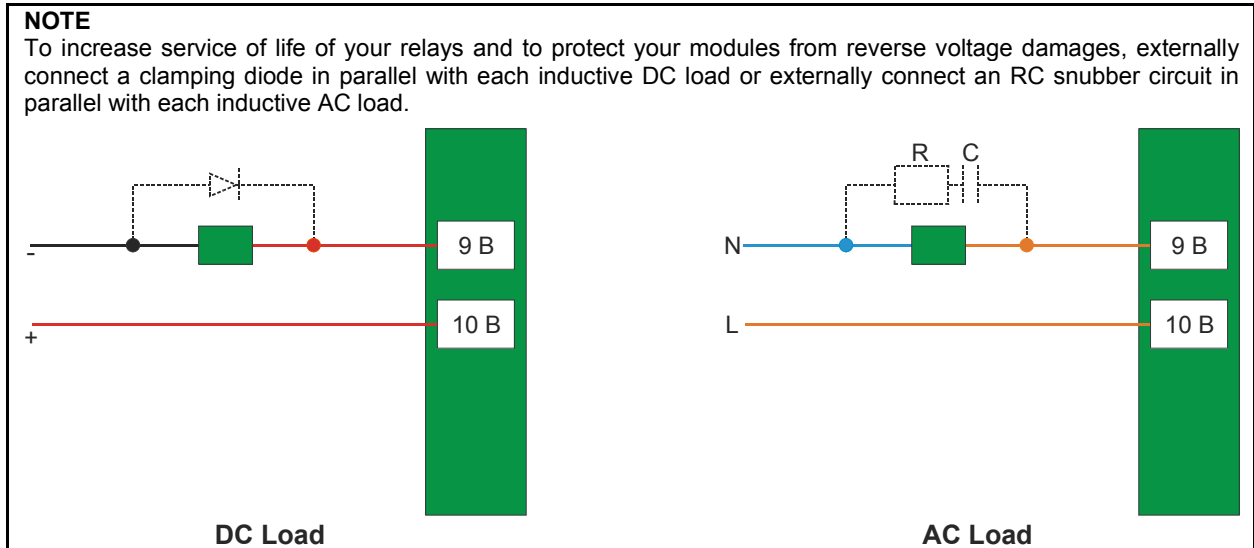
FAILURE RELAY	
Output type	Solid state relay, Normally Close (NC)
Limits	6 W, 30 Vdc Max, 200 mA Max.
Maximum Initial Contact Resistance	<13Ω
Status Indication	Red LED- FAIL
Logic Indicator	LED ON (relay closed)
Overload Protection:	Should be provided externally
Operation Time	5 ms maximum
Release Time	5 ms maximum

NOTE	
To meet the EMC standards requirements, the wires' length to the failure relay must be less than 30 meters. The power supply of activated load by the failure relay must not be from external network.	

OTHER LEDS		
RUN		Green LED- indicates program running
HOLD		Yellow LED- indicates program in hold mode
FORCE		Red LED- indicates all inputs and/or outputs are in the force mode.
Rx (Yellow LED) Tx (Green LED)	P1	Displays Modbus Communication (EIA-232)
Rx (Yellow LED) Tx (Green LED)	P2	Displays Modbus Communication (EIA-485)
Rx (Yellow LED) Tx (Green LED)	P3	Displays Modbus Communication (EIA-485)
FAIL		Red LED- Indication of failure

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm (1.57 x 5.39 x 5.57 in)
Weight	0.286 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)



Communication Channels

The CPU-700 has three communication channels that supply the user with 3 independent channels (ports) identified as P1 (EIA-232), P2 (EIA-485) and P3 (EIA-485).

The three channels may be used at the same time with the following features:

- P1 (EIA-232-C) is for programming and monitoring, point-to-point short connections.
- P2 (EIA-485) is for programming and monitoring, point-to-point or multi drop in long industrial connections.
- P3 can mimic P2 or act as a Master channel for a remote I/O connection Remote I/O interface module (RIO-700-3). A rotary switch on the CPU Module card can set the P3 channel behavior.
- Any of the ports can be connected to the Smar ENET-700 (Ethernet-Serial) converter module.

In one Network it is possible to have up to 31 CPU-700 modules. For the correct communication, each CPU-700 module must have a unique MODBUS ID (address) and a baudrate for P1 (Modbus) and other baudrate for P2 and P3 (Modbus). Modbus baudrates are configurable by software throughout the use of CONF700.



Restrictions:

- Only one channel can be used at the same time to monitor the network through the CONF700. Other channels will be locked after the first one begins.
- All channels are referred with the same address.
- Channels P2 and P3 shares the same baud rate. P1 has a dedicated one.



Figure 3.13 - Communication Channels of The CPU-700-E3.

In the picture above:

- 1- This is the CPU-700 P1 port. It is the EIA-232-C channel.
- 2- This is the SSIO channel used by the redundant CPU-700. See "CPU-700 Redundant Module" for further details.
- 3- These are the Dip-switches used to change the CPU communication parameters.
- 4- Ports P2 and P3 of the CPU-700. These are EIA EIA-485 channels.

There are 3 serial communication ports on the CPU700: one EIA-232 port (P1) and two EIA-485 ports (P2 and P3). The user should set to any of these ports: baud rate, parity and other specific parameters.

Port P1

Baudrate: 9600 bps
Parity (Odd or Even)

RTS/CTS Timeout

CTS: Signal that indicates the device is ready for transmission.
RTS: Signal to request data transmission

The PC requests a connection with the CPU. The LC700 receives this request and processes it. Next, the LC700 sends the RTS signal and it waits for the CTS signal during the time interval set on the RTS/CTS Timeout parameter.

Off Duty

Available time for communication when the CPU is not running a ladder diagram. The bigger the value set for Off Duty, the bigger the available time for communication.

Time Delay

The PC sends a frame to the CPU-700, i.e., makes a communication request. The CPU-700 waits the amount of time set on Time Delay to process the frame request and send the answer.

NOTE:

For **better performance** of your system we recommend:

- **OFF Duty** must be set as 20 % of the Ladder cycle of execution.
- **Time Delay** depends on the Workstation's processor. If the processor is higher than a Pentium MMX 233 MHz we recommend that Time Delay is set for 5 ms. Otherwise we recommend that the Time Delay is set with its default value.
- When the Dip switch 4 is in the default position or IF the value set for OFF-DUTY is set for position, the value set for OFF-DUTY will be 20% of the cycle (the I/O module scan plus Ladder execution)

Device Communication Baud Rate and Device Address

The CPU module has a key where the user may select default communication parameters (DCP-Switch 4 ON) or programmed communication parameters (PCP-Switch 4 OFF). Default parameters are address 1 and baud rate 9600 bits/s.

In the PCP position the user might select a new address and/or baud rate, using CONF700. The new adjustment of parameters will be accepted only after the key being moved to the PCP position. In the PCP position the user is also able to change the communication parameters. In this case they will be accepted immediately after they have been sent.

The default values apply to three channels: P1, P2 and P3. The user can set the Dip Switches using a key as the figure below shows:

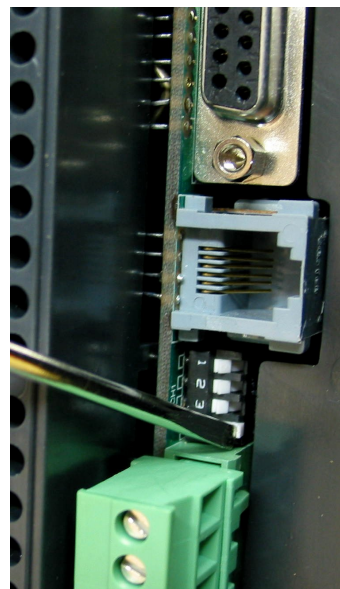


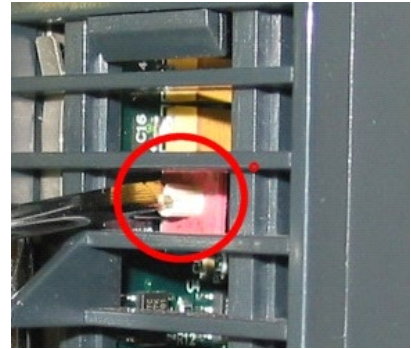
Figure 3.14 - Setting the CPU-700 Communication Parameters

CPU-700 Operation Modes

The CPU-700 may act as:

- A CPU with three MODBUS/RTU channels.
- Master CPU in a system with Remote I/O (RIO) where 2 channels work as MODBUS/RTU and the remaining one (P3) as remote master channel.

In order to change the operation mode of the CPU-700 the user needs to change the Rotary Switch position. This rotary key is located underneath the CPU-700 module. See picture bellow to locate it.



CPU-700 with 3 MODBUS RTU Channels

When the CPU-700 is used as a regular CPU, it means that no Remote I/O module is being used. Also, either P3 as P1 and P2 may act as MODBUS/RTU channels. Note that none of them can act as a MODBUS master.

P1, P2 and P3 are independent MODBUS/RTU slave channels. They can be used at the same time. P1 is recommended for point-to-point connections whereas P2 and P3 may be used in two different networks (master and slave) to increase accessibility of the CPU through two computers (masters) or in a redundant architecture where the user can alternate between the channels in a failure situation.

Settings:

- The rotary key must be in the position 8.
- One MODBUS ID set for P1, P2 and P3 (set on CONF700).
- The P1, P2 and P3 baud rates are set on CONF700.

CPU-700 master in a remote I/O System

The CPU-700 can be also a master in a Remote I/O system. This means that the CPU-700 acts as the main processing unity acquiring data from the Remote I/O modules in its own IMB and also from any remote I/O connected to it.

In this case P3 is completely dedicated to Remote I/O communication data. P1 and P2 are slave MODBUS/RTU independent channels. P1 is used for point-to-point applications whereas P2 may be used in a multi drop network.

Settings:

- The rotary Switch must be in the position 0.
- One ID MODBUS for P1 and P2 set on CONF700.
- P1 and P2 baud rates are set on CONF700.
- P3, the RIO channel, has its own dedicated baud rate set through the frontal dip switch.

Factory Init

The user can carry out a procedure to make the CPU-700 to assume its factory configuration. This procedure is called factort-init.

To do it:

7. Remove the CPU-700 from the power supply.
8. Put the Rotary Switch on the position 7
9. Put the Dip Switch 4 in the default position
10. Connect the CPU-700 to the power supply and wait until the HOLD led starts to blink
11. Remove the CPU-700 from the power supply.
12. Set the rotary switch



Observation

After the **Factory Init** procedure, the user must set the Rotary Switch when a new download is done.

CPU-700-E3R - Redundant CPU Module

Part Number

CPU-700-E3R - CPU module with 23 Kbytes of non-volatile memory for user configuration and a microcontroller of 15 MHz with real time clock and remote I/O (For CPU redundancy).

Introduction

The redundancy with the CPU-700-E3 is based on a hot-standby mechanism. Therefore, just one CPU runs the ladder logic as well as the communication with HMI at a specific moment. The active CPU scans the Remote I/O module while the passive CPU monitors the status of the active CPU through another port.

However, there is communication between the CPUs in order to keep the synchronization of the configuration and also to provide fresh dynamic data to the passive CPU. For example: the Modbus Variables.

The algorithm responsible for choosing the active CPU tries to minimize the number of control switches; therefore, if a CPU runs as active, it remains in this state, unless something happens to put this CPU in worse conditions.

Terminology and Initial Descriptions

Main and backup CPUs

The redundancy status depends on a lot of items as: **configuration of the CPU, communication status through SSIO, communications with the remote I/O modules RIO-700-E3 (RIOs)**. This status defines whether the CPU will run the ladder logic as well as scanning the RIOs.

The CPU may assume two roles: Active and Passive. The active CPU runs the ladder logic and scans the MODBUS variables. The passive CPU periodically checks the active CPU in order to check if it is necessary to take control.

The configuration of CPU role is set through the rotary switch in the CPU module:

- **Rotary Switch in the position 0 (Main):** When both CPUs are powered-up at the same time and, the algorithm checks the rotary switch position (of both CPUs) to choose which CPU is active and which one is the passive.

- **Rotary Switch in the position 9 (Backup):** The CPU set as backup grants the control to the other CPU their current status is both passives or both actives. This configuration is used only when the CPUs are simultaneously powered-up and when both are passive or active at the same time before the last power-down.

Configuration Transference

During the power-up procedure, the configuration of the active CPU is passed to the passive CPU.

This transference is always made from active to passive and never in the contrary direction and it uses the Synchronous Serial I/O (SSIO) Port of the CPU. This synchronous serial communication channel is used exclusively to transfer the configuration.

During this process two new terms need to be defined:

- **Sender:** This is the CPU responsible for the communication. The sender CPU handles the configuration transference between the CPUs.

- **Addressee:** This is the CPU that receives the configuration.

Configuration synchronism between the CPUs

This is accomplished in two main phases:

Phase 1- Configuration Transfer

When a sequential power-up procedure takes place, the first CPU powered-up becomes the active CPU and it transfers the configuration to the other one.

Phase 2- Updating Transference

After the Configuration Transfer Phase, it is necessary to transfer only the dynamic variables and the settings that can be done without configuration download.

Note: This refers to Modbus variables, configuration of switches in the CPU module and communication settings.

Rules to select the Sender and Addressee

When the CPU detects the presence of the other CPU through the SSIO, they exchange some status information to decide which will be the Sender of configuration.

Three main cases may happen:

Situation	Rule	Scenario
0	If configuration name, date and time in both CPUs are the same and Good-Config, the rules to select the active CPU will be applied, and the active CPU will be also the Sender.	Power cycle of configured system
1	If configurations mismatch and a sequential power up happened and the first CPU has a Good-Config, then the first CPU to power up will be the Sender.	Replace of CPU module
2	All other cases (configuration mismatch and simultaneous power up OR one or both with bad-config) CPUs do not enter transference status.	First power up of system after a firmware download or abnormal cases.

The SSIO port diagram

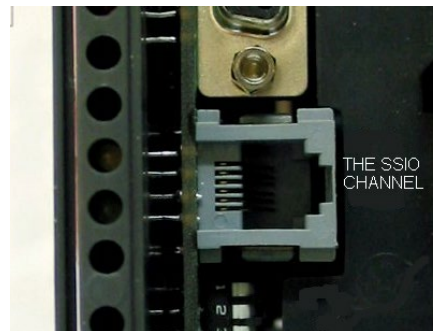


Figure 3.15- The SSIO channel

To transfer the configuration from the active CPU to the passive it is necessary to use a special cable to connect the two CPUs. This cable part number is ICP-700-D3.

This port cable is a 4 wires-cable that implements a full-duplex channel whose baud rate is 1.875 Mbits/second.

Architecture

Consider the figure below:

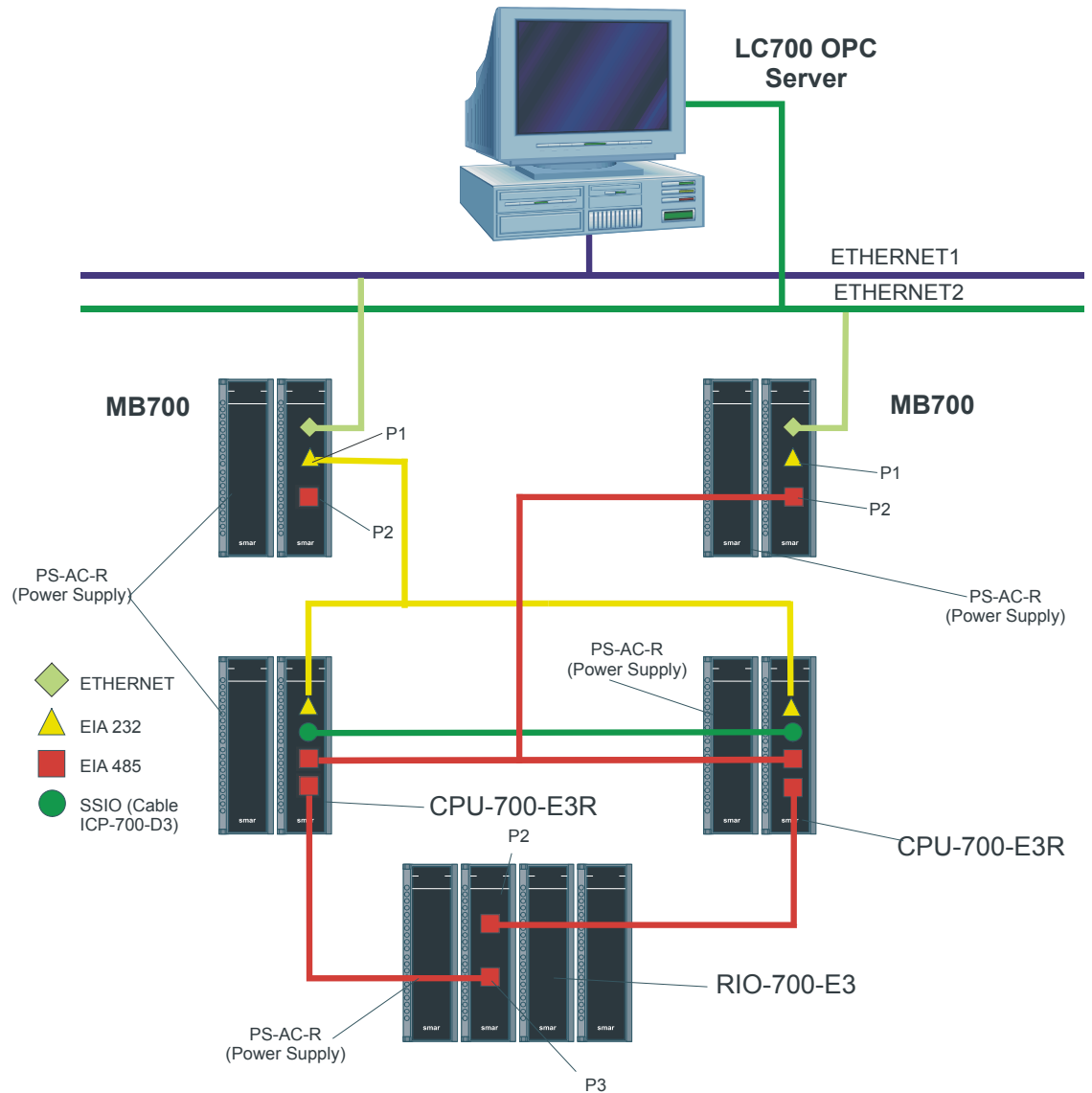


Figure 3.16 - The above architecture shows an illustrative example of the hardware used in the CPU-700-E3R redundancy.

- Two Ethernet paths
- Two MB-700 modules allow complete redundancy
- Two CPUs with main and backup roles
- A RIO module scans the MODBUS variables.

Note: The I/O modules are only included in the racks where the RIO module is present.

Power –Up Procedure

Breakers

- One breaker to the main CPU.
- One breaker to the backup CPU.
- One breaker to the RIO modules.

Power-up sequence

Power-up sequence refers to the order that each CPU is turned –on. There is a specific breaker configuration.

1. First, the breaker of the power supply modules of the RIO modules is turned on.
2. Next each the two breakers of each CPU are turned on.
3. Before the CPUs start searching for another CPU, the state of both becomes passive.
4. After powering-up a CPU and if it does not find an active CPU, then, during 2 seconds interval it will search for another CPU.
5. If it does not find another active CPU it becomes the Active CPU.

I - The algorithm checks which CPU was active in the last power-down. The active CPU in the last power-down becomes the current active CPU. The CPU passive in the last power-down becomes the current passive.

II - If both CPUs were passive or active simultaneously in the last power-down, the algorithm checks the rotary keys to define which CPU will be active. If the rotary key is in the main position (0), then the CPU is considered active. If the rotary is in the backup position, then the algorithm considers this CPU as passive.

Communication with Remote I/O Modules

The remote I/O modules (RIO) are scanned only if the name of the configuration and data are the same in the main CPU and RIO CPU. The passive CPU sends polling commands to check periodically whether it is necessary to assume control.

As seen in the system architecture picture, the RIO modules are connected to the system through two different and redundant channels.

There are two ports to be considered:

- RIO Active Port: Port being scanned by the active CPU, i.e., through this port the MODBUS variables are read and written.
- RIO Passive Port: In this port the passive CPU checks the conditions of the active and passive ports.

Switch over procedure

During the normal functioning of the system, there's a switching procedure. It is based on the number of the RIO CPUs that the active CPU can communicate with (**NRIOactive**) and the number of RIO CPUs that the passive CPU can communicate with (**NRIOpassive**).

If NRIOactive is shorter than NRIOpassive, then there is a switching over procedure that makes the current active CPU the passive CPU and the old passive CPU the current active CPU. This procedure ensures that the system reads the biggest amount of I/O MODBUS variables.

LEDs for Status Indication

- A solid RUN LED (green, on or off) indicates if the CPU is in Active state while a blink RUN LED indicates that the CPU is in Passive state.
- A solid HOLD LED (yellow, on or off) indicates if the CPU has been configured properly, while a blink HOLD LED indicates that it was not.
- A solid FORCE LED (red, on or off) indicates if the CPU is in FORCE-IN, FORCE-OUT or SAFE-OUT mode, or not.
- FORCE LED indicator on Passive CPU is blinking. It indicates that the hardware settings is not correct (rotary switch BR for RIO or firmware version).

Technical Specifications

CONFIGURATION MEMORY	
Type	Non volatile Memory (NVRAM)
Available Size	44 Kbytes

NUMBER OF AVAILABLE POINTS FOR CONFIGURATION	
Digital Points	2000 (discrete and auxiliary points)
Analog Points	1024

CONFIGURATION/OPTIMIZATION	
Software Package	CONF700 Version 8.54
Operating System	Windows XP SP3, Windows 7 SP1 Professional 64-bit, Windows 10 Professional, Windows Server 2008 R2 64-bit, Windows Server 2012 R2, and Windows Server 2016 Standard.

COMMUNICATION PORTS	
Quantity	3
Types	1-EIA-232-C (P1) 2-EIA-485 (multidrop, P2 e P3)
Connectors	Female DB9 to EIA-232-C (P1) Terminal blocks for EIA-485, remote I/O
Baud Rate/Address	P1: 9600 bps P2: 9600– 115200 bps P3: 57600-230400 bps
Protocol	Modbus RTU (Slave)
Slave Address	2 a 127, Set by User (1 is default) 2 to 121, set by user (1 is the default address)
Maximum number of LC700 per network	31

INTERNAL POWER	
Provided by the IMB bus	5 Vdc, @ 320 mA
Total Maximum Dissipation	1.6 W
Power Indicator	Green LED, +5VDC

FAILURE RELAY	
Output type	Solid state relay, Normally Close (NC)
Limits	6 W, 30 Vdc Max, 200 mA Max.
Maximum Initial Contact Resistance	<13Ω
Status Indication	Red LED- FAIL
Logic Indicator	LED ON (relay closed)
Overload Protection:	Should be provided externally
Operation Time	5 ms maximum
Release Time	5 ms maximum

NOTE	
To meet the EMC standards requirements, the wires' length to the failure relay must be less than 30 meters. The power supply of activated load by the failure relay must not be from external network.	

OTHER LEDES		
RUN		Green LED- indicates program running
HOLD		Yellow LED- indicates program in hold mode
FORCE		Red LED- indicates all inputs and/or outputs are in the force mode.
Rx (Yellow LED) Tx (Green LED)	P1	Displays Modbus Communication (EIA-232)
Rx (Yellow LED) Tx (Green LED)	P2	Displays Modbus Communication (EIA-485)
Rx (Yellow LED) Tx (Green LED)	P3	Displays Modbus Communication (EIA-485)
FAIL		Red LED- Indication of failure

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm (1.57 x 5.39 x 5.57 in)
Weight	0.286 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

RIO-700-E3 - Remote I/O Communication Interface

Part Number

RIO-700-E3 – Remote I/O Interface (Slave)

Description

Remote I/O modules are located close to the field devices and allow a flexible architecture to the system. Remote I/O units use the same I/O modules designed for the regular LC700 system combined with the RIO-700-E3 module.

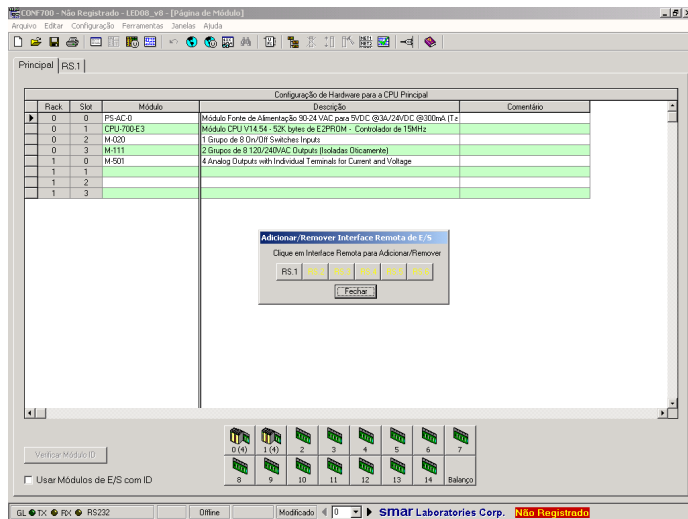
This module must used together with CPU-700-D3 and CPU-700-E3R.

NOTE

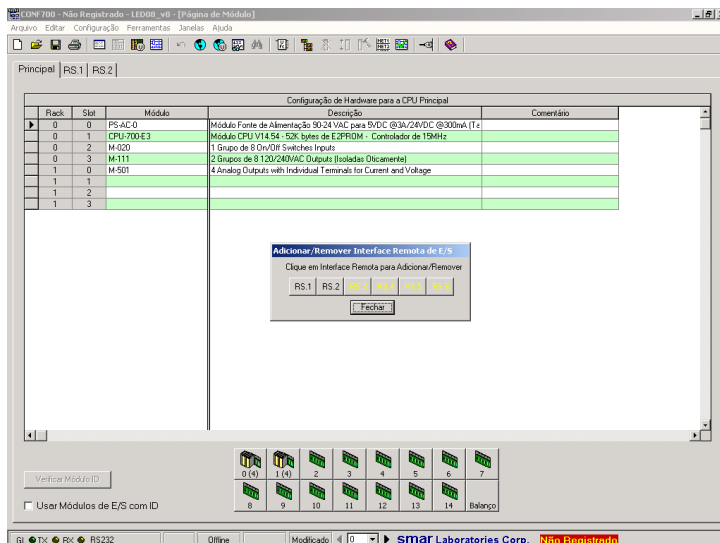
The firmware update is made using Smar’s software LC700Tools.

Adding a remote I/O unit

To add a remote I/O system, first choose **Go to I/O module page**, next click Add/Delete Remote I/O system. The following page will be showed.



Choose a remote I/O system and click the corresponding button.



 **Warning**

The address and baud rate of the RIO-700-E3 interface module must be set. Interface modules and power supply modules for remote I/O are automatically set.

Remote I/O Architecture

The Remote I/O System is basically composed of a Master Unit and up to 6 Slave Units. Master Unit and Slave Units are connected through a multi-drop cable that can reach a total length of 4000ft. The proper cable length and baud rate depend on the level of noise in the application environment.

The available Rack/Slots will limit the total number of modules per System and the maximum number of Discrete and Analog Points that the LC700 will be able to handle.

Each Remote I/O needs, at least, one power supply. LC700 Remote I/O system structure is shown as follows:

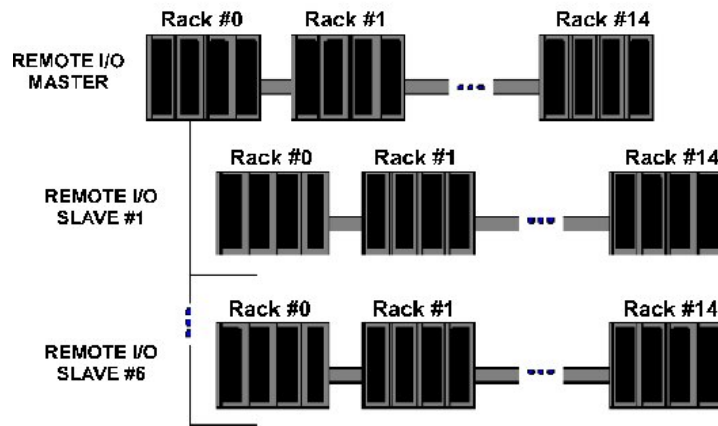


Figure 3.17- Remote I/O Architecture

Baud Rate and Address Settings

Baud Rate Settings

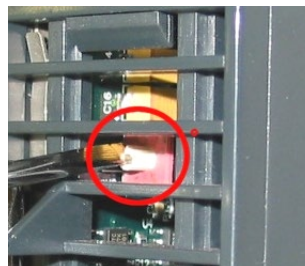
Each Remote I/O Interface Module (Master or Slave) has a DIP switch to set the baud rate (communication speed). The DIP switch is located in the frontal panel of the Module and can be accessed with a small screwdriver.

 **Observation:**

Make sure to disconnect the Module while setting the switch. Also note that both the Master and Slave I/O interface must be configured with the same baud rate.

Setting Address of the Remote I/O Interface Module

There is also a dedicated *Rotary Switch* at the bottom of the Slave Module to set the Slave device address. Each Remote Unit connected to the Master Unit has to have a unique address. Available addresses are: 1, 2, 3, 4, 5 and 6.



RIO Limits

To follow has a utilization descriptive of remote and redundant CPU's in LC700. For each master CPU is possible to have up to 6 RIO's slave, and to each RIO had:

120 Words (240 bytes) of analog inputs, for example:

- 120 inputs for PT100 (15 X M-402) or;
- 120 inputs 4 to 20 mA (15 X M-401R) or;
- 60 inputs through FB700.

120 Words (240 bytes) of analog outputs, for example:

- 120 outputs 4 to 20 mA (30 X M-501) or;
- 60 outputs through FB700.

The digital inputs and outputs are limited for the total number in the CPU.

For the updating of redundant CPUs, where it is necessary to use remotes, prevail the same rule. Whenever the necessity goes bigger than these limits, the user will need to divide in more remotes.

PS-AC-R - Power Supply Module - 90 to 264 Vac input - Redundant

Description

This redundant power supply works independently or in conjunction with other redundant power supply module to ensure a constant supply of power to the application.

When two redundant power supplies are used, if one of them fails, the backup will automatically assume the operation. A relay is provided to indicate failure on each power supply giving the user a chance to replace the faulty one.

This module provides two voltage outputs:

5 Vdc @ 3 A: distributed by Power Lines in the Inter-Module-Bus (IMB) throughout the racks to supply the module circuits;

24 Vdc @ 300 mA: for external use through the terminals 1B and 2B.

The applied AC voltage, the 5 Vdc and the 24 Vdc are all isolated between them.

Installation and Configuration

For systems based on DF93 rack, with DF90 and DF91

Redundant mode options

- Splitting Power concept:** In this situation, two modules will supply power to a bus segment. If one of them was turned off or fails, the other power supply must be able to supply energy, alone, to the segment.
The **CH1** jumper (power supply) must be set in **R** position for both modules and **W1** jumper (power supply) must be opened for both modules.
- Standby concept:** In this case, just one power supply provides energy to the system. If it was turned off or fails, the backup module will assume the operation. In both modules, the jumper **CH1** (power supply) must be set in the **R** position and **W1** jumper (power supply) must be placed only in the backup module.

Expansion of load capacity by adding power supplies

If the system consumption is greater than 3A, it can be subdivided in up to 8 groups sized for consumption of up to 3A each, and each group is individually powered by a power supply. More details on the Power supplies positioning topic.

The **PS-AC-R CH1** jumper always must be connected to the **E** position.

Power supplies positions in the racks

On **DF93** is recommended the placement of the redundant pair in the first and second slots, but it can be installed in any slots if necessary.

For systems based on R-700-4A rack

Non-redundant (single module) - power consumption limited to 3A

There is an addressing restriction related to the power supply location. The restriction is that the first rack (address 0) must always contain a power supply module at the first slot. In the power supply module the **CH1** jumper must be set in **E** position.

Non-redundant (more than one module) - power consumption bigger than 3A

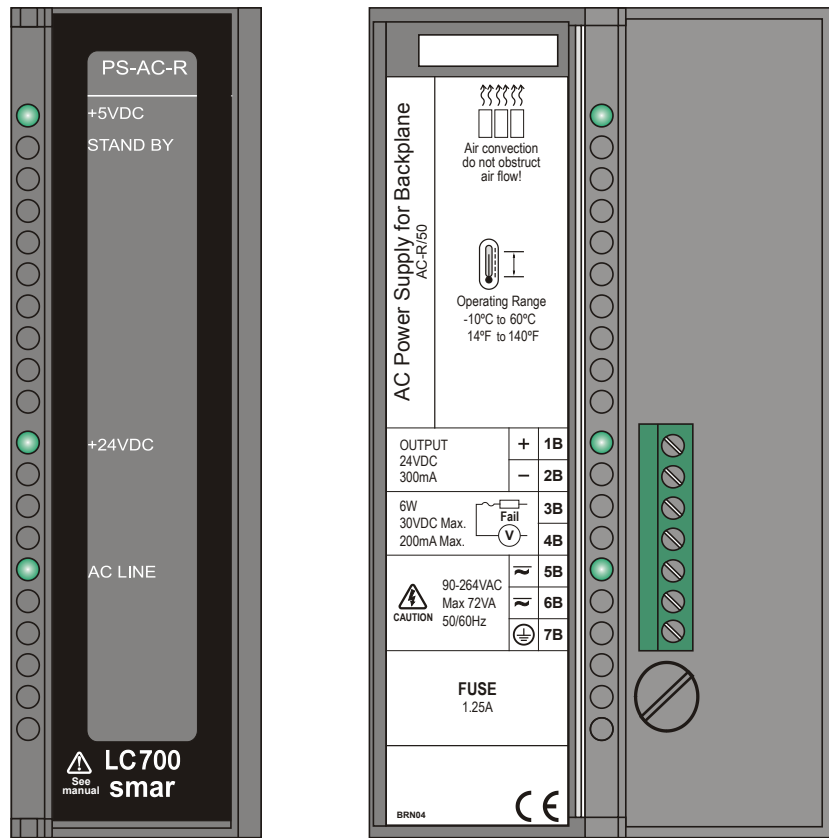
Additional modules are placed in the bus in parallel, but isolated one of the other. For systems based on **R-700-4A** rack, the power supplies modules must always be placed at the first rack's slot. The jumper **W1** (in the rack), where is the new power supply module, must be cut. The new power supply module will only supply power to the rack where it is sitting on and to the consecutive ones (never backwards).

In all power supplies modules, the **CH1** jumper must be set in **E** position.

Redundant mode:

- **Split power concept:** In this case of redundancy, the user may have two power supplies modules in parallel in first and third slots of rack **R-700-4A**. The **CH1** jumper (power supply) must be set in **R** position in both modules and **W1** jumper (power supply) must be opened in both modules. In this situation, the two modules will supply power to the bus.

- **Standby concept:** In this case, the main module must be placed in the first slot and the backup module in the third slot of rack **R-700-4A**. In both modules, the jumper **CH1** must be set in the position **R** and **W1** jumper must be placed only in the backup module.



AC Power Supply Module: PS-AC-R

Technical specifications

INPUTS	
DC	127 to 135 Vdc
AC	90 to 264 Vac, 50/60 Hz (nominal), 47 to 63 Hz (range)
Inrush Current	< 36 A @ 220 Vac. [$\Delta T < 740 \mu s$]
Time until Power Fail	6 ms @ 102 Vac (120 Vac – 15%) [Full Load]
Time until Shutdown	> 27 ms @ 102 Vac; > 200 ms @ 220 Vac [Full Load]
Maximum Consumption	72 VA
Indicator	AC LINE (Green LED)

OUTPUTS	
a) Output 1 (internal use)	5.2 Vdc +/- 2%
Current	3 A Maximum
Ripple	100 mVpp Maximum
Indicator	+5 Vdc (Green LED)
Hold up time	> 40 ms @ 120 Vac [Full Load]
b) Output 2 (external use)	24 Vdc +/- 10%
Current	300 mA Maximum
Ripple	200 mVpp Maximum
Short circuit current	700 mA
Indicator	+24 Vdc (Green LED)

ISOLATION	
Input, internal output and external output signals are isolated between them.	
Between outputs and ground	1000 Vrms
Between input and output	2500 Vrms

FAILURE RELAY	
Type of Output	Solid state relay, normally closed (NC), isolated
Limits	6 W, 30 Vdc max, 200mA max
Maximum Initial Contact Resistance	<13Ω
Overload Protection	Should be provided externally
Operation Time	5 ms maximum

TEMPERATURE	
Operation	-10 °C to 60 °C (14 °F to 140 °F)

DIMENSIONS AND WEIGHT	
Dimensions (L X H X D)	39.9 x 137.0 x 141.5 mm (1.57 x 5.39 x 5.57 in)
Weight	0.450 kg

CABLES	
One wire	14 AWG (2 mm ²)
Two wires	20 AWG (0.5 mm ²)

NOTES	
1)	If the power consumption exceeds the power supplied, the system may operate in an unpredictable manner that may causes damages to the equipment or risk of personal injury. Hence, the power consumption must be calculated correctly and install more power supplies modules, if it is necessary.
2)	To increase the service life of your contacts and protect the modules from potential reverse voltage damage, connect externally a clamping diode in parallel with each inductive DC load or connect a RC snubber circuit in parallel with each inductive AC load.
3)	To meet the EMC standards requirements, the wires' length to the failure relay must be less than 30 meters. The power supply of activated load by the failure relay must not be from external network.
4)	The redundancy feature is only assured for the hardware with GLL1270 equal or greater than Revision 2. Hardware models which are below the review referred need consulting the Smar technical support for compatibility check.

Calculating the Power Consumption

Since the power available from the power supply is limited, it is important to calculate the modules power consumption that will be used. One way of doing that is constructing a sheet to summarize all current supplied and required from each module and the associated devices (such as operator interface). And then, to calculate the maximum current required and the maximum current supplied. If “maximum current required” is greater than “current supplied” the power consumption will be exceeded. If this is the case, it will be unsafe to use this configuration and you will need to review the system design or add more power supply modules throughout the racks.

However, **CONF700** software for **LC700** offers the fastest way to obtain the total power consumption for an application. Once the modules in the **Hardware Page** have been selected, the power consumption report is immediately available! To learn how to use this feature of **CONF700**, refer to the **LC700** Configuration Manual for further information.

The Power Supply Concept of a LC700 System

If the **LC700** needs more power supply modules, each one of the power supply modules will provide current up to the maximum value of modules located on its right-hand side. The following steps will help you to understand how many power supply modules are required for the **LC700** system:

- Observe the maximum current values from the power supply module specification.
- Be sure that the consumption of the modules to the right of the power supply does not exceed the maximum value.
- Follow the steps in the next topic if the power consumption exceeds the limit.

To add a new power supply module

- Determine the rack where the new power supply will be installed.
- Cut the jumper W1 located on the rack.
- Plug the new power supply at the first slot of the rack (Slot 0).
- In this case the **CH1** of all **PS-AC-R** modules must be set in **E** position.

Power supplies positioning

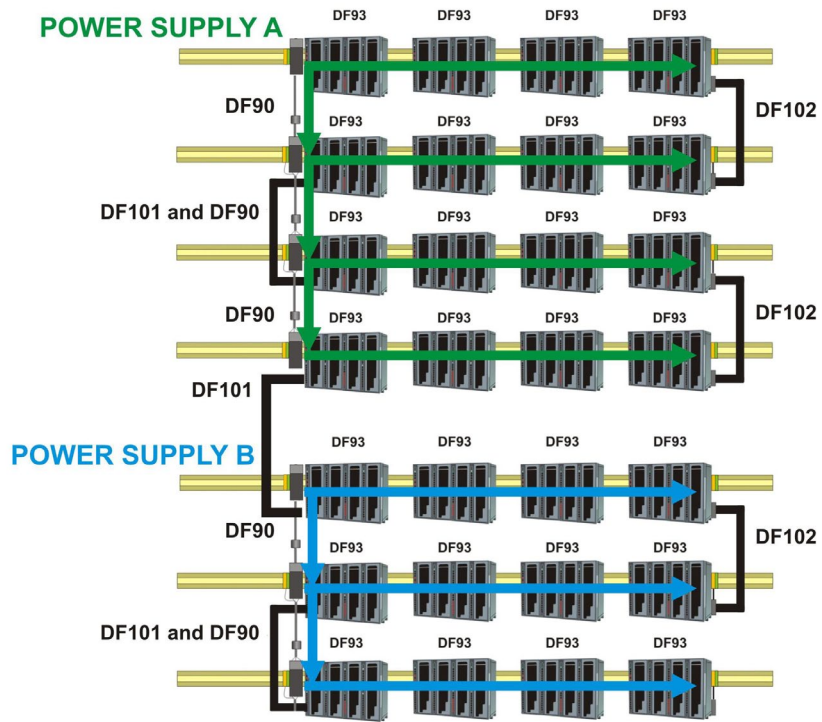
For systems based on DF93 rack with DF90 and DF91

A power supply connected to a rack, in a system, provides current to the racks row that are horizontally interconnected to it by their terminals of lateral connections, and vertically through DF90 cables, thus forming a group of rows of racks that use the same power supply.

The system can have only one power supply (or pair of redundant power supplies) or it can be subdivided in several of these groups¹, each one powered by a power supply (or pair of redundant power supplies).

The recommended way to distribute the power is to divide the system in groups of horizontal rows of racks. In this scheme, each power supply must be positioned on the top left of the group of rows of racks that it powers. The rack were is the power supply must be the **W1** jumper cut and the **DF90** cable must not be connected to the rows powered by other power supplies (top rows). See in the following figure an example of system powered by two power supplies, each one powers a part of rows represented in green and blue.

¹ Maximum 8 groups allowed when the PS-AC-R power supplies are used.



System powered by two power supplies

Note that this system, for greater efficiency, is optimized for power distribution by groups of rows of racks. Thus, a power supply powers a whole number of rows it supports. However, in rare cases, with long rows or many modules with great consumption in the same row, there is the option to add power supplies in the middle of the row, dividing the power within this row. In this case, the power supply added powers only the modules positioned on the right in the same row, up to the end, or even where there is another power supply added. In the rack where the power supply was added, in this scheme, the **W1** jumper must be cut and left lateral connection terminal (+5 Vdc) must be disconnected (collapsed).

In this system, **PS-AC-R** modules must be their **CH1** jumper always configured in **E**.



ATTENTION

A mixture of these power supplies with the **CH1** configured in **R** and in **E** in any **LC700** system, is not allowed!

On **DF93** is recommended the placement of the redundant pair in the first and second slots, but it can be installed in any slots if necessary.

The system has diagnostic for voltage level distributed to racks. It also supports modules with great power consumption in any place on the bus. Nevertheless, is recommended to place those modules close to the power supplies, to avoid unnecessary power transmission.

For systems based on R-700-4A rack

1. Observe the maximum current values from the power supply module specification. The limit for **PS-AC-R** is 3 A.
2. After the connection with long cables (**FC-700-1A**, **FC-700-2A**, **FC-700-3A** and/or **FC-700-4A**) you must put another power supply module in the first slot of the first rack.

3. Use up to 6 modules **M-401-R/M-401-DR** per power supply; always place the **M-401-R/M-401-DR** consecutively and close to the power supply. Because of the high current consumption of the modules **M-401-R/M-401-DR**, a not desired voltage drop in the bus can occur if these modules are placed after other modules.
4. When is necessary to add interface modules, such as **MB700** and **SI-700**, in the same bus which is used by output and input modules, is recommended that these modules are placed close to the power supply, because in the same way as described in the previous item, a not desired voltage drop in the bus can occur if these modules are placed after other modules.
5. Adding a new power supply module:
 - Determine the rack where the new power supply will be installed.
 - Cut the jumper **W1** of the rack.
 - Plug the new power supply at the first slot of the rack (slot 0).
 - In this case, the **CH1** jumper of all **PS-AC-R** modules must be set in **E** position.

PS-DC-R– Power Supply for Backplane 20 – 30 Vdc

Description

This redundant power supply works independently or with another redundant power supply module to assure a constant power supply to the application.

When two redundant power supplies are used, if one of them fails, the backup will automatically assume the operation. A relay is provided to indicate failure on each power supply giving the user a chance to replace the faulty one.

This module has two voltage outputs:

- a) **5 Vdc @ 3A** distributed by *Power Lines* in the Inter-Module-Bus (IMB) through racks to supply module circuits.
- b) **24 Vdc @ 300mA** for external use through terminals 1B and 2B.

The DC applied voltage and the 5 Vdc and 24 Vdc are isolated.

Installation and Configuration

For systems based on DF93 racks, with DF90 and DF91

Redundant mode

Splitting Power concept: In this situation, two modules will supply power to a bus segment. If one of them was turned off or fails, the other power supply must be able to supply energy, alone, to the segment. The PS-DC-R **CH1** jumper always must be connected to the **R** position.

Expansion of load capacity by adding power supplies

If the system consumption is greater than 3A, it can be subdivided in up to 8 groups sized for consumption of up to 3A each, and each group is individually powered by a power supply. More details on the Power supplies positioning topic.

The PS-DC-R **CH1** jumper always must be connected to the **E** position.

For systems based on R-700-4A rack

Single Module: Less than 3 A are required.

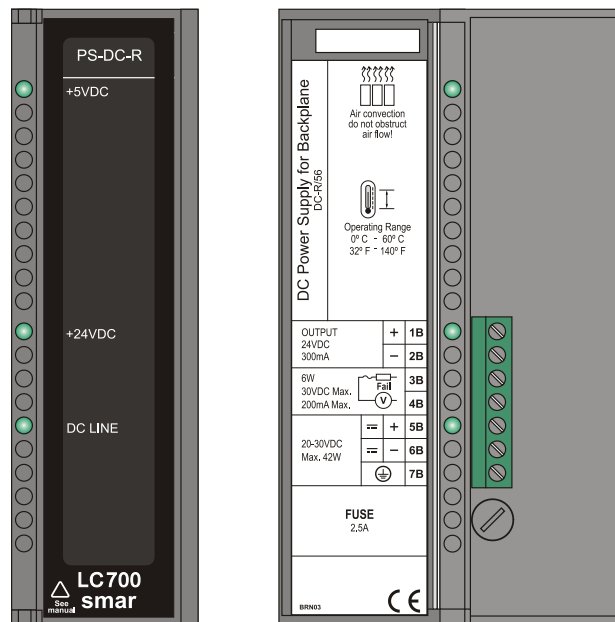
There is an address restriction related to the location of the power supply. This restriction is the first rack (address 0) must have a power supply module in the first slot. The **CH1** jumper (power supply) must be set in the **E** position.

More Than One Module: More than 3 A are required.

For systems based on **R-700-4A rack** they must be placed in the first slot of the rack. Jumper **W1** on the rack that has the new power supply must be cut. Every new power supply will only supply energy to the rack in which it is located and, with the jumper cut off, it will not supply energy to the previous racks. All modules must have the **CH1** jumper (power supply) set in the **E** position.

Redundant Mode:

In redundant mode, the power supply modules must be placed in the first and third slots of rack **R-700-4A**. In both, the **CH1** jumper (power supply) must be set in the **R** position. In this condition, the power supply modules will split the power. This topology is called "split power mode".



Power Supply: PS-DC-R

Technical Specifications

INPUTS	
DC	20 to 30 Vdc
Inrush Current	< 20.6 A @ 30 Vdc [$\Delta T < 430 \mu s$]
Maximum Consumption	42 W
Indicator	DC LINE (Green LED)

OUTPUTS	
a) Output1 (Internal Use)	5.2 Vdc +/- 2%
Current	3 A Maximum
Ripple	100 mVpp Maximum
Indicator	+5 Vdc (Green LED)
Hold up Time	> 47 ms @ 24 Vdc [Full Load]
b) Output 2 (External Use)	24 Vdc +/- 10%
Current	300 mA Maximum
Ripple	200 mVpp Maximum
Indicator	+24 Vdc (Green LED)
Short Circuit Current	700 mA

ISOLATION	
Input signal, internal outputs and the external output are isolated between them.	
Between Outputs and Ground	500 Vrms
Between Input and Output	1500 Vrms

FAILURE RELAY	
Type of Output	Solid state relay, normally closed (NC), isolated
Limits	6 W, 30 Vdc Max, 200 mA Max
Maximum Initial Contact Resistance	<13 Ω
Overload Protection	Should be provided externally.
Operation Time	5 ms maximum

TEMPERATURE	
Operation	-10 °C to 60 °C (14 °F to 140 °F)

DIMENSIONS AND WEIGHT	
Dimensions (W x H x D)	39.9 x 137.0 x 141.5 mm (1.57 x 5.39 x 5.57 in)
Weight	0.450 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

NOTES	
1.	If the power consumption exceeds the power supplied, the LC700 system may operate in an unpredictable manner that may causes damages to the equipment or risk of personal injury. Therefore, the power consumption must be calculated correctly, and a detailed analysis should be performed to define the installation of extra power supply modules.
2.	The hardware revisions which are GLL1279 Rev1 and previous revisions do not support redundancy feature.
3.	To meet the EMC standards requirements, the wires' length to the failure relay must be less than 30 meters. The power supply of activated load by the failure relay must not be from external network.

Calculating the Power Consumption

Since the power available in the power supply is limited, it is important to calculate the power consumption of modules in use. The user can create a worksheet to summarize all supplied and required current from each module and associated equipment (such as operator interface).

Example of worksheet with the module's consumption, and some power supplies' specification.

LC700 POWER BUDGET										
Module	Description	Qty.	Consumption Unit Power (mA)		Total Power (mA)		Supply Unit Power (mA)		Total Power (mA)	
			@24 V	@5 V	@24 V	@5 V	@24 V	@5 V	@24 V	@5 V
CPU-700-E3	Controller	1	0	320	0	320				
M-001	2*8 DI 24 VDC		65	80	0	0				
M-002	2*8 DI 48 VDC		65	80	0	0				
M-003	2*8 DI 60 VDC		62	80	0	0				
M-004	2*8 DI 125 VDC		40	80	0	0				
M-005	2*8 DI 24 VDC (sink)		0	80	0	0				
M-010	2*4 DI 120 VAC		0	50	0	0				
M-011	2*4 DI 240 VAC		0	50	0	0				
M-012	2*8 DI 120 VAC		0	87	0	0				
M-013	2*8 DI 240 VAC	2	0	87	0	174				
M-020	8 switches		0		0	0				
M-401-R	8 AI		0	320	0	0				
M-401-DR	8 AI		0	320	0	0				
M-402	8 Temperature Inputs		0	55	0	0				
M-101	16 DO (transistor)		65	70	0	0				
M-102	2*8 DO (transistor)		65	70	0	0				
M-110	8 DO (TRIAC)		0	70	0	0				
M-111	2*8 DO (triac)		0	115	0	0				
M-120	2*4 DO (relay)		134	20	0	0				
M-121	2*4 DO (relay)		134	20	0	0				
M-122	2*4 DO (relay)		134	20	0	0				
M-128	2*8 DO (relay)		180	30	0	0				
M-124	2*4 DO (relay)		134	20	0	0				
M-125	2*4 DO (relay)		134	20	0	0				

LC700 POWER BUDGET										
Module	Description	Qty.	Consumption Unit Power (mA)		Total Power (mA)		Supply Unit Power (mA)		Total Power (mA)	
			@24 V	@5 V	@24 V	@5 V	@24 V	@5 V	@24 V	@5 V
M-126	2*4 DO (relay)		134	20	0	0				
M-501	4 AO		180	20	0	0				
M-201	8 DI 24 VDC, 4 DO (relay)		67	60	0	0				
M-202	8 DI 48 VDC, 4 DO (relay)		67	60	0	0				
M-203	8 DI 60 VDC, 4 DO (relay)		67	60	0	0				
M-204	8 DI 24 VDC, 4 DO (relay)		67	60	0	0				
M-205	8 DI 48 VDC, 4 DO (relay)		67	60	0	0				
M-206	8 DI 60 VDC, 4 DO (relay)		67	60	0	0				
M-207	8 DI 24 VDC, 4 DO (relay)		67	60	0	0				
M-208	8 DI 48 VDC, 4 DO (relay)		67	60	0	0				
M-209	8 DI 60 VDC, 4 DO (relay)		67	60	0	0				
TOTAL					0	494				
PS-AC-R		1					300	3000	300	3000
PS-302		1					1500	0	1500	0
TOTAL									1800	3000

Power supplies positioning

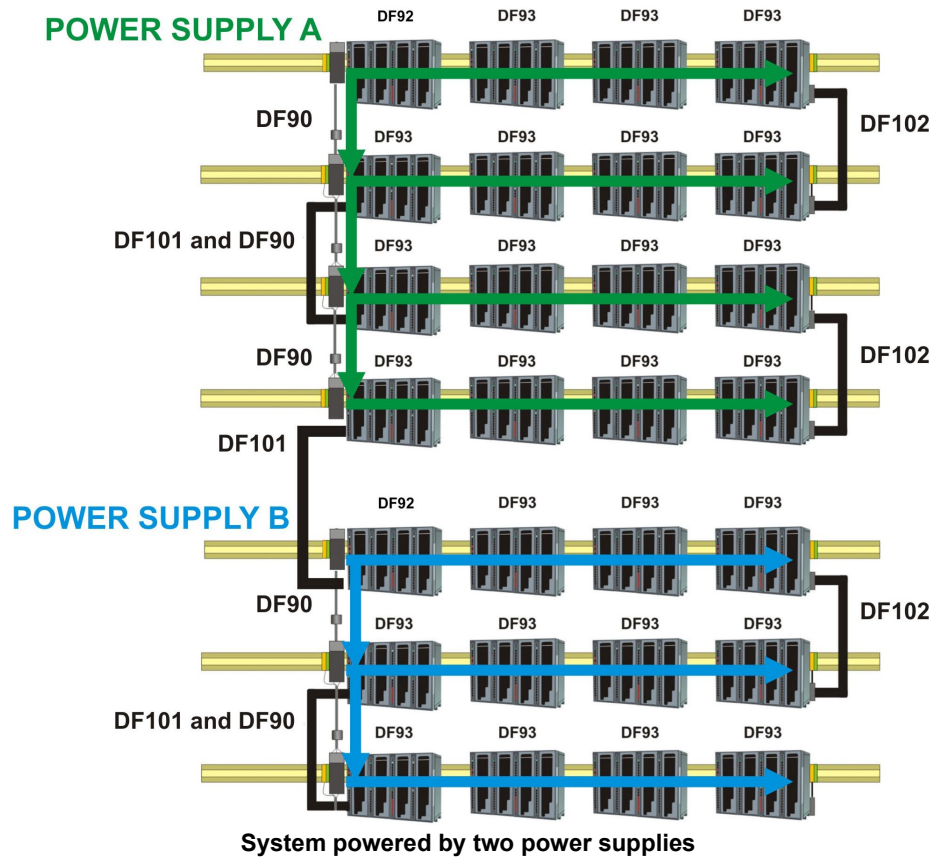
For systems based on DF93 rack with DF90 and DF91

A power supply connected to a rack, in a system, provides current to the racks row that are horizontally interconnected to it by their terminals of lateral connections, and vertically through DF90 cables, thus forming a group of rows of racks that use the same power supply.

The system can have only one power supply (or pair of redundant power supplies) or it can be subdivided in several of these groups², each one powered by a power supply (or pair of redundant power supplies).

The recommended way to distribute the power is to divide the system in groups of horizontal rows of racks. In this scheme, each power supply must be positioned on the top left of the group of rows of racks that it powers. The rack were is the power supply must be the **W1** jumper cut and the DF90 cable must not be connected to the rows powered by other power supplies (top rows). See in the following figure an example of system powered by two power supplies, each one powers a part of rows represented in green and blue.

² Maximum 8 groups allowed when the PS-DC-R power supplies are used.



Note that this system, for greater efficiency, is optimized for power distribution by groups of rows of racks. Thus, a power supply powers a whole number of rows it supports. However, in rare cases, with long rows or many modules with great consumption in the same row, there is the option to add power supplies in the middle of the row, dividing the power within this row. In this case, the power supply added powers only the modules positioned on the right in the same row, up to the end, or even where there is another power supply added. In the rack where the power supply was added, in this scheme, the **W1** jumper must be cut and left lateral connection terminal (+5 Vdc) must be disconnected (collapsed).

In this system, the PS-DC-R modules must be their **CH1** jumper always configured in **E**.



ATTENTION

A mixture of these power supplies with the **CH1** configured in **R** and in **E** in any **LC700** system, is not allowed!

On **DF93** is recommended the placement of the redundant pair in the first and second slots, but it can be installed in any slots if necessary.

The system has diagnostic for voltage level distributed to racks. It also supports modules with great power consumption in any place on the bus. Nevertheless, is recommended to place those modules close to the power supplies, to avoid unnecessary power transmission.

For systems based on R-700-4A Racks

1. Observe the maximum current values from the power supply module specification. The limit for PS-DC-R is 3 A.
2. After the connection with long cables (FC-700-1A, FC700-2A, FC700-3A, FC700-4A) you have to put another power supply module in the first slot of the first rack.

3. Use up to 6 modules M-401R/M401DR per power supply; always place consecutively the M-401R/M401DR and close to the power supply. Because of the high current consumption of the modules M-401R/M401DR, a not desired voltage drop in the bus can occur if these modules are placed after other modules.

4. When is necessary to add interface modules, such as MB700, SI-700, in the same bus which is used by output and input modules, is recommended that these modules are placed close to the power supply, because in the same way as described in the previous item, a not desired voltage drop in the bus can occur if these modules are placed after other modules.

5. Adding a new power supply module

- Determine the rack where the new power supply will be installed.
- Cut the jumper **W1** of the rack.
- Plug the new power supply at the first slot of the rack (slot 0).
- In this case, the **CH1** jumper of all modules PS-DC-R must be set in **E** position.

PS302P/PS302P DC - FIELDBUS POWER SUPPLY MODULE

Part Number:

PS302P (AC Power Supply)
PS302P DC (DC Power Supply)

These modules were specially developed to power the fieldbus networks. The only difference between the modules is the input voltage:

PS302P (90 ~264 Vac)
 PS302P DC (20 ~30 Vdc)

The **PS302P** power supply unit is a non-intrinsically safe equipment with a universal AC input (90 to 264 Vac, 47 to 63 Hz or 127 to 135 Vdc), and a 24 Vdc isolated output, with short-circuit and overcurrent protection, ripple and fault indication, appropriated to power fieldbus elements.

The **PS302P DC** power supply unit is a non-intrinsically safe equipment with a DC input (20 to 30 Vdc) and a 24 Vdc isolated output, with short-circuit and overcurrent protection, ripple and fault indication, appropriated to power fieldbus elements.

The interconnection of Fieldbus elements to the **PS302P/PS302P DC** unit shall be done as shown in figure below. There is no overshoot when it is switched on or off. The **PS302P/PS302P DC** can power on up to 4 fully loaded Fieldbus elements.

OBSERVATION

Cables that interconnect the **PS302P/PS302P DC** to PS1302P modules should have a maximum of 3 meters

If any abnormal condition occurs in the output like overloading or short-circuiting, the **PS302P/PS302P DC** internal switching is automatically switched off, thus protecting its circuit. Upon the outputs return to normal conditions of operation, the circuit is automatically switched on.

The **PS302P/PS302P DC** allows redundancy without requiring any component coupled to its output.

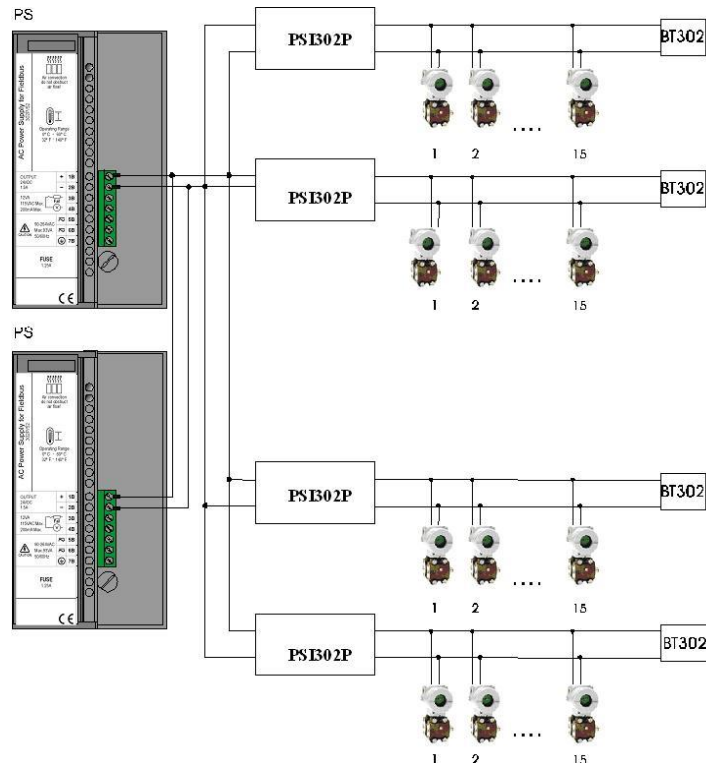


Figure 3.18 - Connection Diagram of Fieldbus Elements to PS302P

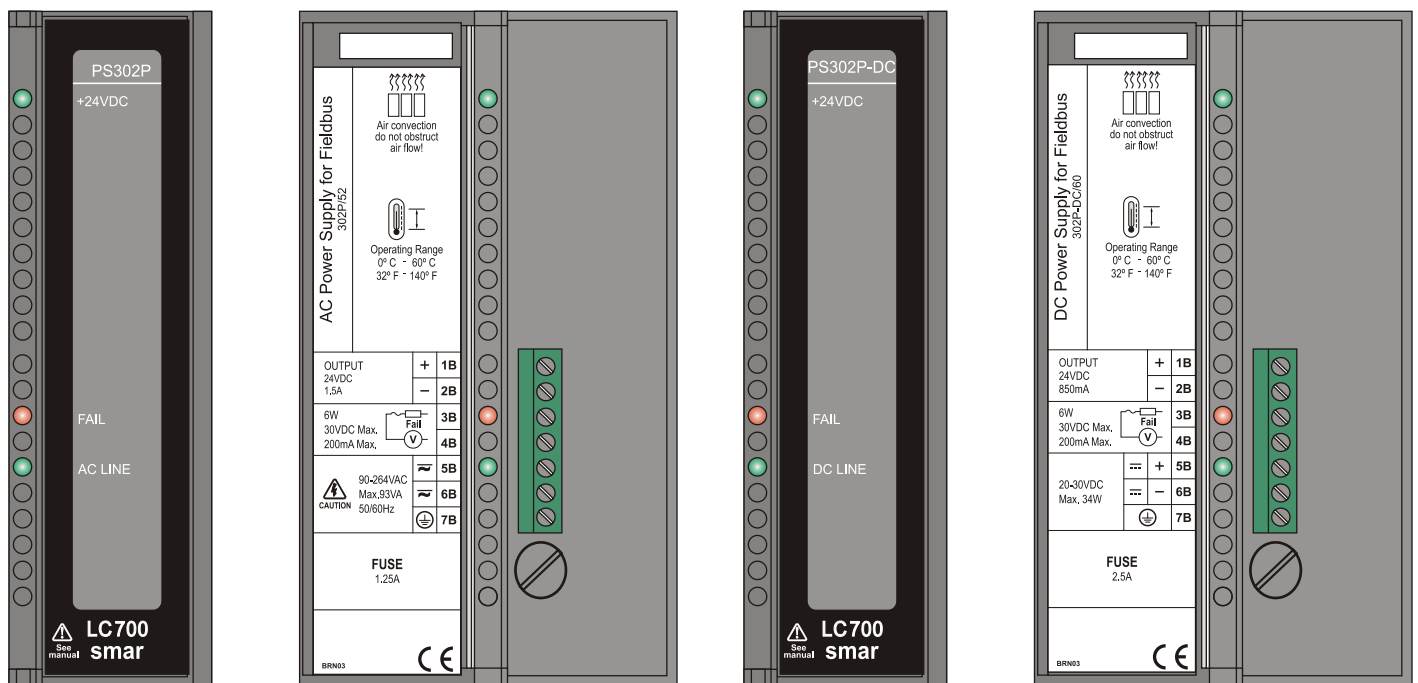


Figure 3.19 - Power Supply for Fieldbus: PS302P/PS302P DC

Technical Specifications

PS302P INPUTS	
DC	127 to 135 Vdc.
AC	90 to 264 Vac, 50/60 Hz (nominal), 47 to 63 Hz
Maximum Inrush Current	<30 A @ 220 Vac [$\Delta T < 640 \mu s$]
Maximum Consumption	93 VA
Indicator	AC LINE (Green LED)

PS302P DC INPUTS	
DC	20 to 30 Vdc.
Maximum Inrush Current	<24 A @ 30 Vdc [$\Delta T < 400 \mu s$]
Maximum Consumption	34 W
Indicator	DC LINE (Green LED)

OUTPUTS		
Output	24 Vdc \pm 1%	
Current	PS302P	PS302P DC
	1.5 A maximum	850 mA maximum
Ripple	20 mVpp maximum	
Indicators	+ 24 VDC (Green Led)	
	FAIL (Red LED)	

ISOLATION		
Input signal, internal outputs and the external output are isolated between them	PS302P	PS302P DC
Between the outputs and ground	1000 Vrms	500 Vrms
Between input and output	2500 Vrms	1500 Vrms

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.450 kg

TEMPERATURE	
Operation	0 °C to 60 °C
Storage	-30 °C to 70 °C

Discrete Input Types

Hysteresis

The on and off states have different trigger levels, in between it remains at the last state.

To avoid fast switching between states 0 and 1, when an input has noise level close to the transition levels, these inputs will support Hysteresis.

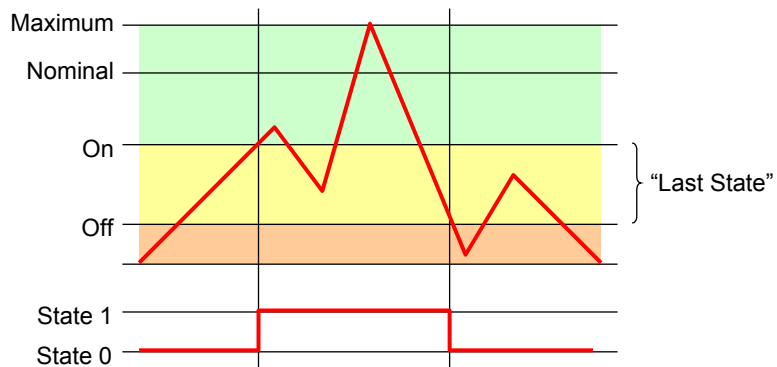


Figure 3.20 –I/O Input Module Hysteresis

When the signal level exceeds the On-level the state turns true and remains true even when the signal level goes below the On-level (as long as it remains above the Off-level). Only when the signal level goes below the Off-level the state becomes false, and then remains false even when the signal goes above the Off-level (as long as it does not exceed the On-level).

The LC700 discrete input modules have triggered levels in accordance with the IEC 61131-2 standard for Programmable Controller hardware.

Wiring

NPN and PNP sensors

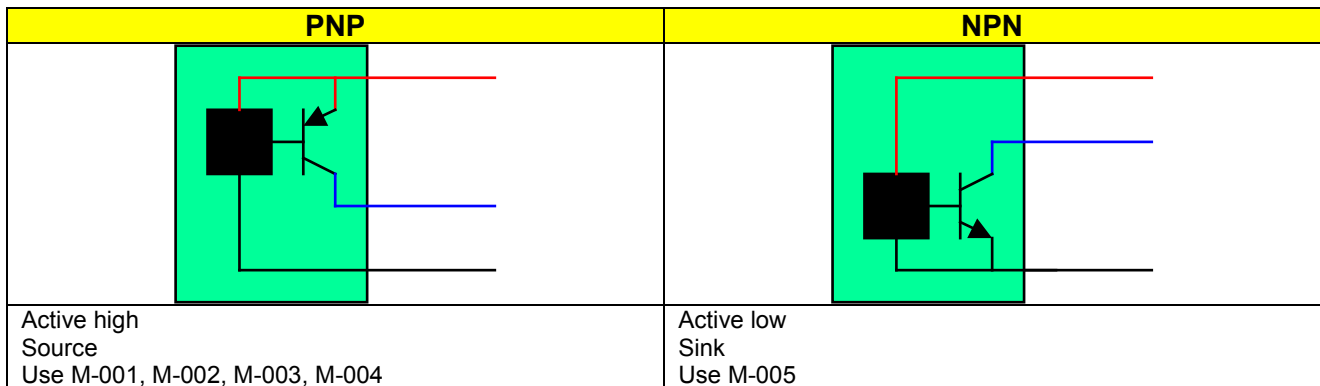


Figure 3.21 – Sensor Types

M-001/M-002/M-003/M-004 - DC Discrete Input Module

(Supports Hot Swap and Device ID)

Part Number

- M-001** (2 groups of 8 24 Vdc inputs isolated)
- M-002** (2 groups of 8 48 Vdc inputs isolated)
- M-003** (2 groups of 8 60 Vdc inputs isolated)
- M-004** (2 groups of 8 125 Vdc inputs isolated)

Description

The Module senses the DC input Voltage and converts it into a True (ON) or False (OFF) logic signal. It has 2 optically isolated groups of 8 inputs to detect 24/48/60/125 Vdc (M-001/M-002/M-003/M-004 respectively).

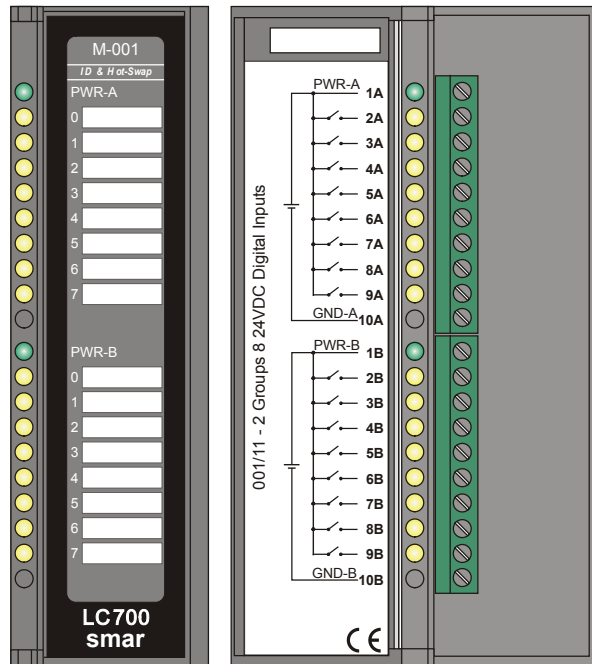


Figure 3.22 - DC Input Module M-001

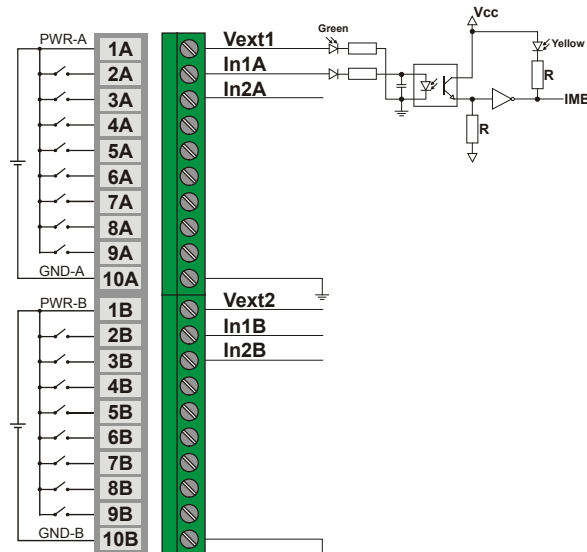


Figure 3.23 – External Connection

The positive pole can be also connected to the 1A and 1B terminals. It makes the Green LED turns on indicating the powering is ON, but it does not have other function.

Technical Specifications

ARCHITECTURE	
Number of Inputs	16
Number of groups	2
Number of points per group	8

ISOLATION	
Groups are isolated individually	
Optical Isolation up to	5000 Vac

EXTERNAL POWER	
Power Supply per Group	20 - 30 Vdc (M-001)
	36 - 60 Vdc (M-002)
	45 - 75 Vdc (M-003)
	95 - 140 Vdc (M-004)
Maximum Consumption per Group	65 mA @ 24 Vdc (M-001)
	65 mA @ 48 Vdc (M-002)
	62 mA @ 60 Vdc (M-003)
	40 mA @ 125 Vdc (M-004)
Power Supply Indicator	Green LED

INTERNAL SOURCEPOWER	
Provided by the IMB bus	5 Vdc @ 80 mA maximum
Total Maximum dissipation	0.4 W
Power Supply Indicator	None

INPUTS	
ON State Voltage Range (logic "1")	20-30 Vdc (M-001)
	30-60 Vdc (M-002)
	38-75 Vdc (M-003)
	95-140 Vdc (M-004)
OFF State Voltage Range (logic "0")	0-5 Vdc (M-001)
	0-9 Vdc (M-002)
	0-12 Vdc (M-003)
	0-25 Vdc (M-004)
Input Impedance (typical)	3.9 kΩ (M-001)
	7.5 kΩ (M-002)
	10 kΩ (M-003)
	39 kΩ (M-004)
Status Display	Yellow LED
Input Current per Point	8 mA @ 24 Vdc (M-001)
	8 mA @ 48 Vdc (M-002)
	7.5 mA @ 60 Vdc (M-003)
	5 mA @ 125 Vdc (M-004)

SWITCHING INFORMATION	
Minimum Voltage for logic level "1"	20 Vdc (M-001)
	30 Vdc (M-002)
	38 Vdc (M-003)
	95 Vdc (M-004)

SWITCHING INFORMATION	
Maximum Voltage for logic level "0"	5 Vdc (M-001) 9 Vdc (M-002) 12 Vdc (M-003) 25 Vdc (M-004)
Time from "0" to "1"	30 μ s
Time from "1" to "0"	50 μ s

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.285 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

M-005 – DC Discrete Input Module

(Supports Hot Swap and Device ID)

Part Number

M-005 (2 groups of 8 24 Vdc inputs – isolated)

Description

The Module senses the DC input Voltage and converts it into a True (ON) or False (OFF) logic signal. It has 2 optically isolated groups of 8 inputs.

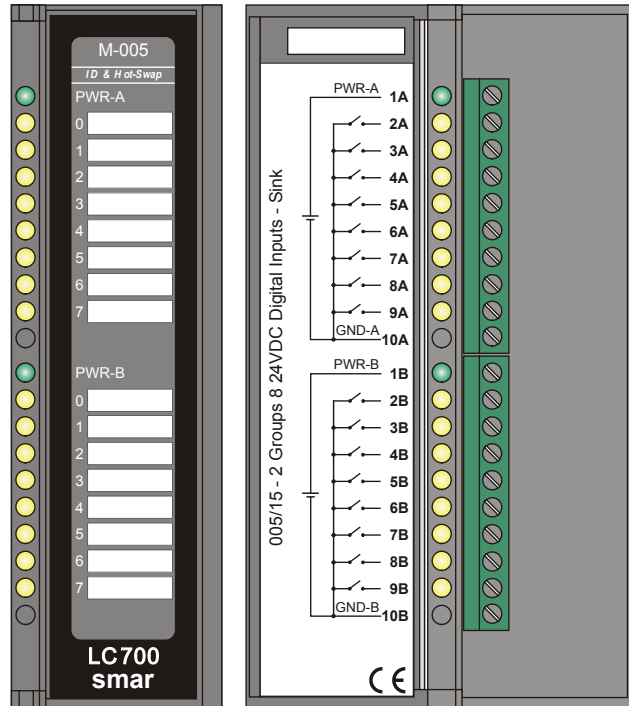


Figure 3.24 -- DC INPUT MODULE M-005

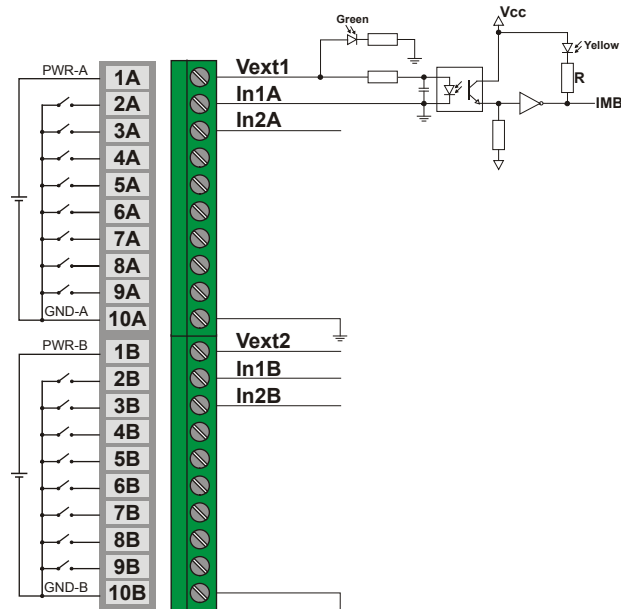


Figure 3.25 - External Connection

Technical Specifications

ARCHITECTURE	
Number of Inputs	16
Number of groups	2
Number of points per group	8

ISOLATION	
Groups are isolated individually	
Optical Isolation up to	5000 Vac

EXTERNAL POWER	
Power Supply per Group	20 -30 Vdc
Typical consumption per group	65 mA
Power Supply Indicator	Green LED

INTERNAL POWER	
Supplied by the IMB bus	5 Vdc @ 80 mA maximum
Total Maximum Dissipation	0.4 W
Power Supply Indicator	None

INPUTS	
ON state voltage range (logic "1")	0 – 5 Vdc @ $Z_{load} < 200 \Omega$
OFF state voltage range (logic "0")	20 – 30 Vdc @ $Z_{load} > 10 K\Omega$
Typical Impedance	3.9 K Ω
Status display	Yellow LED
Input current per Point	7.5 mA (typical)

SWITCHING INFORMATION	
Time from "0" to "1"	30 μ s
Time from "1" to "0"	50 μ s

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.285 kg

CABLES	
One wire	14 AWG (2 mm ²)
Two wires	20 AWG (0.5 mm ²)

M-010/M-011 - AC Discrete Input Module

Part Number

M-010 (2 groups of 4 120Vac digital inputs)

M-011 (2 groups of 4 240Vac digital inputs)

Description

This Module senses the AC input Voltage and converts it to a True (ON) or False (OFF) logic signal. It has 2 optically isolated groups of 4 inputs to detect 120/240 Vac (M-010/M-011 respectively).

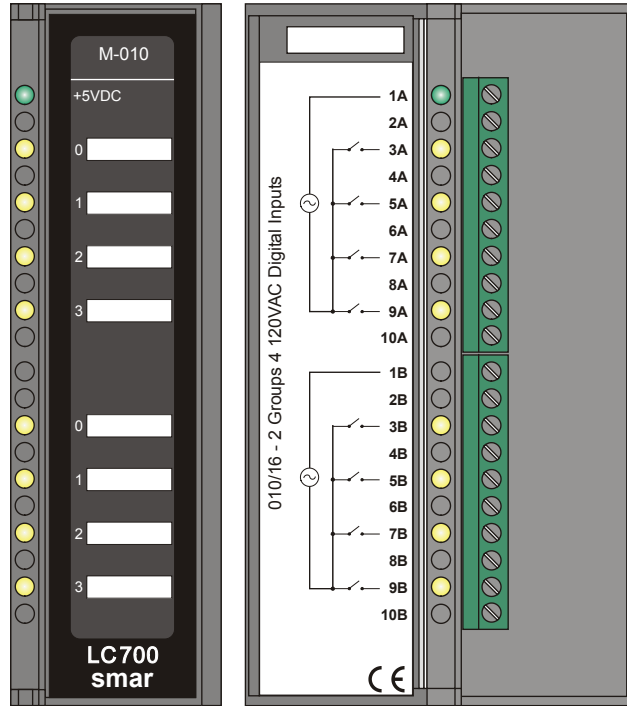


Figure 3.26– AC Input Module- M-010

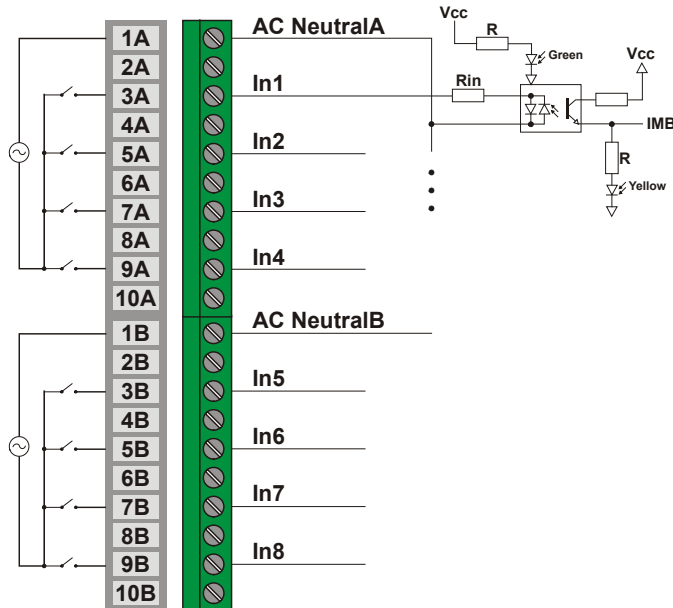


Figure 3.27- External Connection

Technical Specifications

ARCHITECTURE	
Number of inputs	8
Number of groups	2
Number of points per group	4

ISOLATION	
Groups are isolated individually	
Optical Isolation up tp	5000 Vac

EXTERNAL POWER	
Power Supply per Group	120 Vac (M-010) 240 Vac (M-011)
Typical consumption per point	10 mA
Power Supply Indicator	None

INTERNAL POWER	
Supplied by the IMB bus	5 Vdc @ 50 mA maximum
Maximum Total Dissipation	0.25 W
Power Supply Indicator	Green LED

INPUTS	
ON State Voltage Range (logic "1")	100-140 Vac (M-010) 200-264 Vac (M-011)
OFF State Voltage Range (logic "0")	0-30 Vac (M-010) 0-50 Vac (M-011)
Input Current (Typical)	10 mA @ 60 Hz
Power Supply Indicator	Yellow LED

SWITCHING INFORMATION	
Minimum Voltage for logic level "0"	100 Vac (M-010), 45 to 60 Hz 200 Vac (M-011), 45 to 60 Hz
Maximum Voltage for logic level "0"	30 Vac (M-010), 45 to 60 Hz 50 Vac (M-011), 45 to 60 Hz
Typical Hysteresis	70 Vac (M-010) 150 Vac (M-011)
Time from 0 to 1	5 ms
Time from 1 to 0	42 ms

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.285 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

M-012/M-013 - AC Discrete Input Module

(Supports Hot Swap and Device ID)

Part Number

M-012 (2 groups of 8 120 Vac digital inputs)

M-013 (2 groups of 8 240 Vac digital inputs)

Description

This Module senses the AC input Voltage and converts it to a True (ON) or False (OFF) logic signal. It has 2 optically isolated groups of 8 inputs to detect 120/240 Vac (M-012/M-013 respectively).

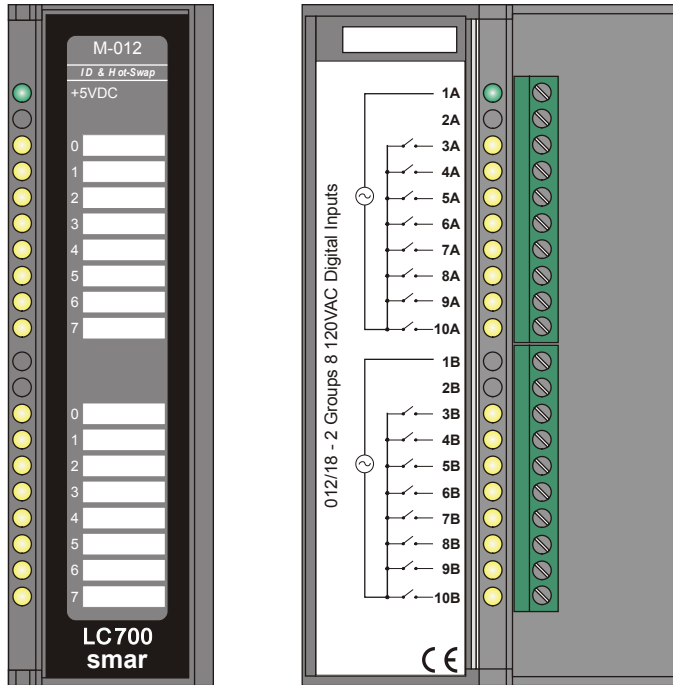


Figure 3.28 - AC Input Module M-012

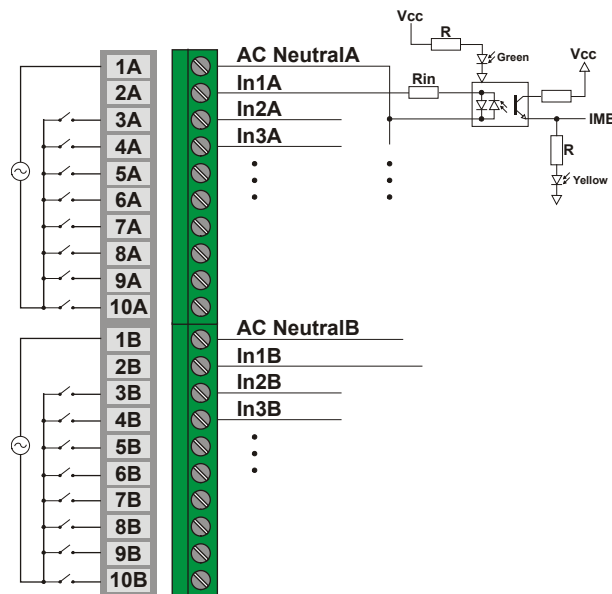


Figure 3.29 - External Connection

Technical Specifications

ARCHITECTURE	
Number of inputs	16
Number of groups	2
Number of points per group	8

ISOLATION	
Groups are isolated individually	
Optical isolation up to	5000 Vac

EXTERNAL POWER	
Power Supply per Group	120 Vac (M-012) 240 Vac (M-013)
Typical consumption per point	10 mA
Power Supply Indicator	None

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 87 mA maximum
Total Maximum Dissipation	0.435 W
Power Supply Indicator	Green LED

INPUTS	
ON state voltage range (logic "1")	100-140 Vac (M-012) 200-264 Vac (M-013)
OFF state voltage range (logic "0")	0-30 Vac (M-012) 0-50 Vac (M-013)
Input Current (typical)	10 mA
Indicator of status	Yellow LED

SWITCHING INFORMATION	
Minimum Voltage for logic level "1"	100 Vac (M-012), 45 a 60 Hz 200 Vac (M-013), 45 a 60 Hz
Maximum Voltage for logic level "0"	30 Vac (M-012), 45 a 60 Hz 50 Vac (M-013), 45 a 60 Hz
Typical Hysteresis	70 Vac (M-012) 150 Vac (M-013)
Time from 0 to 1	5 ms
Time from 1 to 0	42 ms

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.300 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

M-020 - Switch Input Module

Part Number

M-020 (1 group with 8 On/Off switches)

Description

This Module simulates 8 discrete inputs using switches.

The Module can be used to set regular keys. The key may be useful to interact with the logic of the program or in the “debugging” process for verification of functionality and optimization. Remember that the CONF700 has “monitoring” and the “force individual signals” features for testing and optimization.

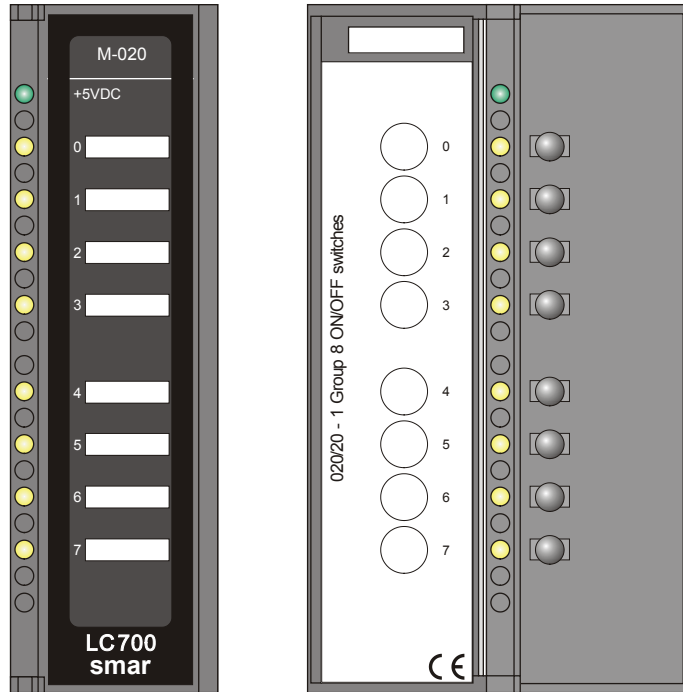


Figure 3. 30 - DC Switches Input Module M-020

Technical Specifications

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 45 mA maximum
Total Maximum Dissipation	0.225 W
Power Supply Indicator	Green LED

SWITCHES	
Indicator of status	Yellow LED
Indicator Logic	LED ON- Switch is pressed

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.250 kg

NOTE	
The user may also debug using the online mode of the CONF700 configuration tool.	

M-302/M-303 - Pulse Input Module – Low / High Frequency - DC

(Supports Hot Swap and Device ID)

Part Number

M-302 (2 groups of 8 24 Vdc pulse inputs 0-100 Hz).

M-303 (2 groups of 8 24 Vdc pulse inputs 0-10 KHz)

Description

These modules have two groups of 8 inputs to count pulses and to be accumulated until the CPU module can read them. After the CPU reading, each individual counter will be cleared. The hardware will reset to prevent the loss of any input pulse during this acquisition process.

The ACC Block was especially designed to be used with modules M-302 and M-303 to accumulate input pulses from an external source. Usually, one of the module inputs is connected to the IN input of the ACC block.

During the control cycle these modules accumulate pulses in a local register in their circuit. At the end of every control cycle the CPU reads the total accumulated value and automatically clears the internal register for the next cycle (avoiding capacity overload). When the logic control is executed, the ACC block generates an integer number representing the number of pulses accumulated. It then adds them to an internal accumulator TOT_L and TOT_H. This accumulator is shared as outputs of the ACC block.

Values accumulated in TOT_L and TOT_H are moved to the registers MEM_L and MEM_H. Contents of TOT_L and TOT_H are cleared.

M-302 is an indicator to count frequencies from 0 to 100 Hz and may be controlled by a mechanical relay contact or reed-switch. An internal filter has a cutoff frequency at approximately 200 Hz

M-303 is used to count pulses from a higher frequency source that will not generate bouncing during switching. These modules can read from 0 to 10 KHz. An internal filter has cut off frequencies at around 20 KHz to eliminate high frequency noise.

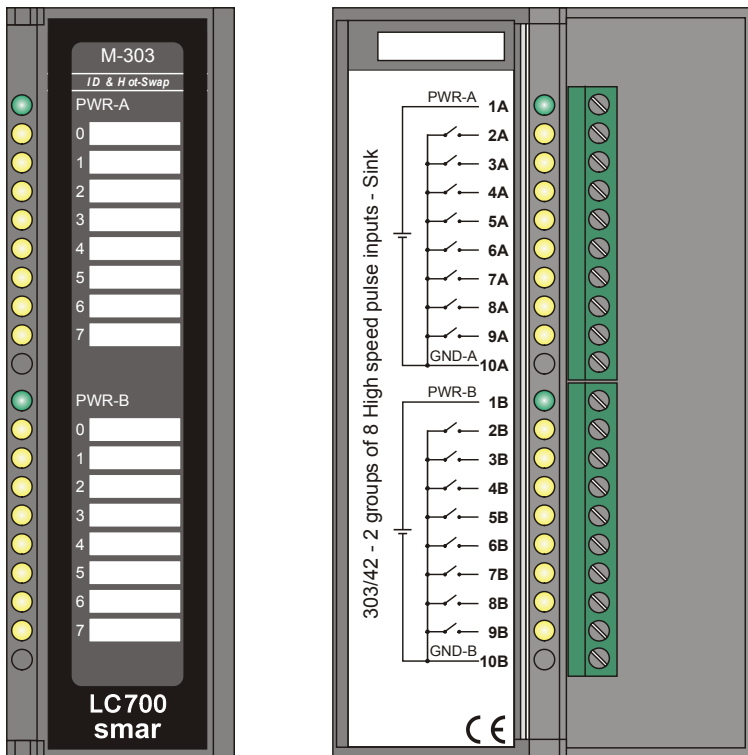


Figure 3.31 - Pulse Counter Module M-303

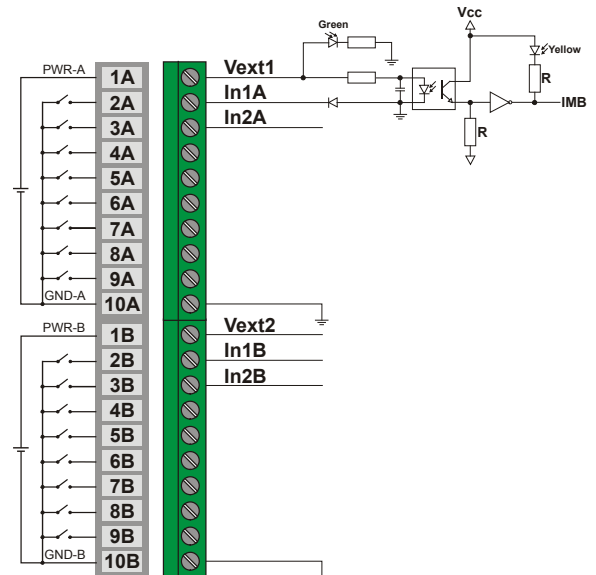


Figure 3.32- External Connection

NOTE

To comply with the EMC standard, use shielded cables in signal inputs (ground the shield in the panel only in one side of the cable) and cables less than 30 meters for power source inputs.

IMPORTANT

These modules have 12-bit counters to accumulate up to 4096 pulses, for each one of 16 channels, before a overflow occurs. Therefore, considering the maximum operation frequency, they have the following minimum overflow times:

- M-302: 4096 pulses / 10000 Hz = 0,4096 s ;
- M-303: 4096 pulses / 100 Hz = 40,96 s ;

The system macro-cycle must be lower than the pulse counter modules overflow times.

Technical Specifications

ARCHITECTURE

Number of inputs	16
Number of groups	2
Number of points per group	8

ISOLATION

Groups are isolated separately	
optical isolation up to	5000 Vac

EXTERNAL POWER

Power Supply per Group	20-30 Vdc
Typical Consumption Per group	65 mA @24 Vdc
Power Supply Indicator	Green LED

INTERNAL POWER

	M-302	M-303/
Provided by the IMB bus(5 VDC)	90 mA	130 mA
Maximum total dissipation	0.425 W	0.650 W
Power Supply Indicator	None	None

INPUTS

ON State Level (True Logic)	0-5 Vdc; <200Ω (M-302/M-303)
OFF State Level (false Logic)	20-30 Vdc;>10 KΩ (M-302/M-303)
Typical Impedance	3.9 KΩ
Display status	Yellow LED
Input current per point	7.5 mA (typical)
Maximum input frequency	M-302: 0-100 Hz M-303: 0-10 KHz

DIMENSIONS AND WEIGHT

Dimensions (W x D x H)	39.9 x 137.0 x 141.5mm; (1.57 x 5.39 x 5.57 in)
Weight	0.342 kg

CABLES

One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

M-304 - Pulse Input Module – High Frequency - AC

Part Number

M-304 (2 groups of 8 pulse inputs 0-10 KHz –AC).

Description

This module was designed for a direct connection to the AC generator sensors. It also has two groups of 8 inputs to accumulate pulses until they can be read by the CPU module. After the CPU reading, each individual counter will be cleared. The hardware is set to prevent the loss of any input pulse during this acquisition process.

The ACC block was especially designed to work with the M-304 module accumulating input pulses from an external source. Typically, one of the module inputs is connected to the IN input of the ACC block.

During the control cycle these modules accumulate pulses in a local register in their circuit. At the end of every control cycle the CPU reads the total accumulated value and automatically clears the internal register to the next cycle (avoiding capacity overload). When the logic control is executed, the ACC block generates an integer number representing the number of pulses accumulated and adds them to an internal accumulator TOT_L and TOT_H. This accumulator is shared as outputs of the ACC block.

Values accumulated in TOT_L and TOT_H are moved to the registers MEM_L and MEM_H. The contents of TOT_L and TOT_H are cleared. The M-304 module can read frequencies ranging from 0 to 10 KHz.

An internal filter cuts signals with frequencies from 20 KHz in order to eliminate high frequencies noise.

All the inputs of a group have a not isolated common reference. In the case of non isolated sensors, use isolation transformers.

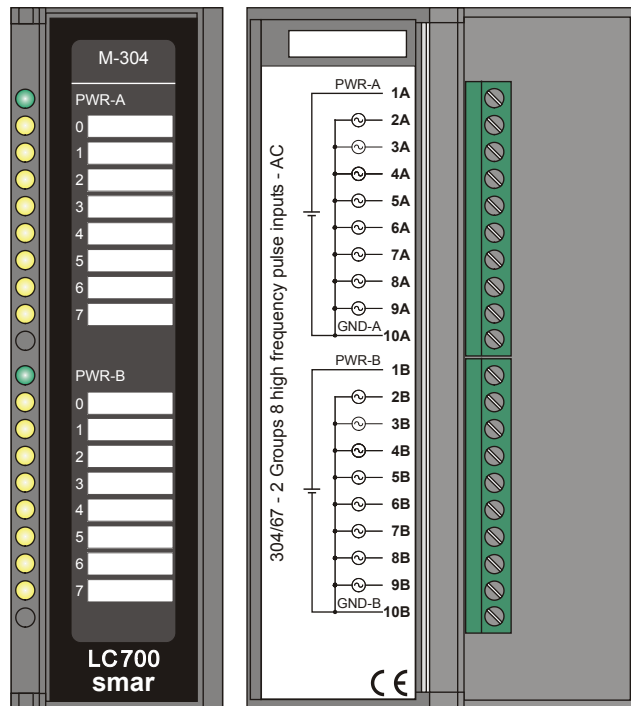


Figure 3.33- – Pulse Input Module M-304

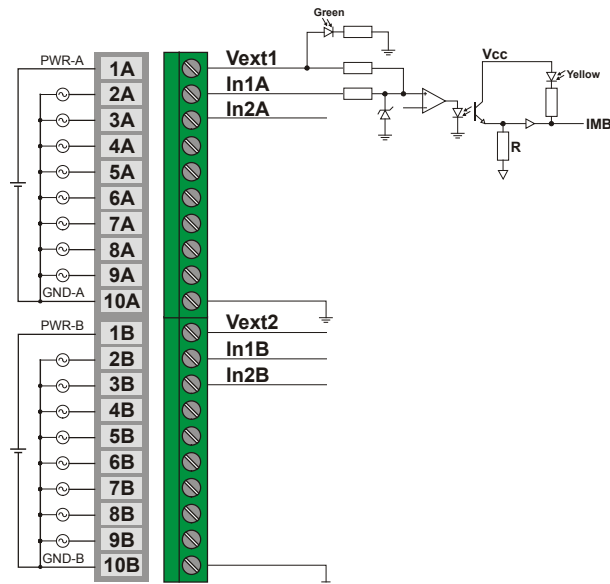


Figure 3.34- External Connection

NOTE

To comply with the EMC standards, use shielded cables in signal inputs (ground the shield in the panel only in one side of the cable) and cables less than 30 meters for power source inputs.

IMPORTANT

This module has 12-bit counters to accumulate up to 4096 pulses, for each one of 16 channels, before an overflow occurs. Therefore, considering the maximum operation frequency, it has the following minimum overflow time:

- M-304: $4096 \text{ pulses} / 10000 \text{ Hz} = 0,4096 \text{ s}$

The system macro-cycle must be lower than the pulse counter module overflow time.

Technical Specifications

ARCHITECTURE

Number of inputs	16
Number of groups	2
Number of points per group	8

ISOLATION

Groups are isolated separately	
Optical isolation up to	5000 Vac

EXTERNAL POWER

Power Supply per Group	20-30 Vdc
Typical consumption per group	12 mA @ 24 Vdc
Power Supply Indicator	Green LED

INTERNAL POWER

Provided by the IMB bus (5 VDC)	130 mA
Maximum total dissipation	650 mW
Power Supply indicator	None

INPUTS	
Maximum input voltage	Vin = 30 Vac
ON State Level (True Logic)	Vin < -1.5V
OFF State Level (false Logic)	Vin > +1.5V
Status Display	Yellow LED
Impedance	3.9 kΩ
Maximum input frequency	10 KHz

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5mm; (1.57 x 5.39 x 5.57 in)
Weight	0.342 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

M-401-R/ M-401-DR - Voltage/Current Analog Input Module

(Supports Hot Swap and Device ID)

Part Number

M-401-R (8 analog inputs of voltage/current with internal shunt resistor)

M-401-DR (8 analog inputs of voltage/current with internal shunt resistor)

Description

This module reads 8 analog continue voltage or current signals. Inputs are isolated from the IMB. Inputs are set to individually read:

M-401-R: The inputs are individually configured to read:

- 0-5 V, 1-5 V, 0-10 V, ± 10 V with the internal shunt resistor in the position “V”.
- 0-20 mA, 4-20 mA, with the internal shunt resistor in the position “I”.

M-401-DR: The inputs are differential and are individually configured to read:

- 0-5 V, 1-5 V, 0-10 V with the internal shunt resistor in the position “V”.
- 0-20 mA, 4-20 mA, with the internal shunt resistor in the position “I”.

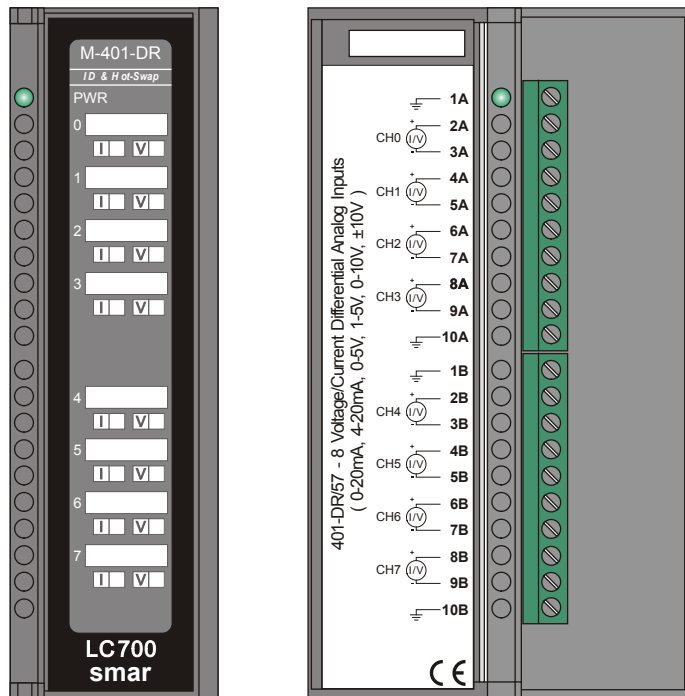
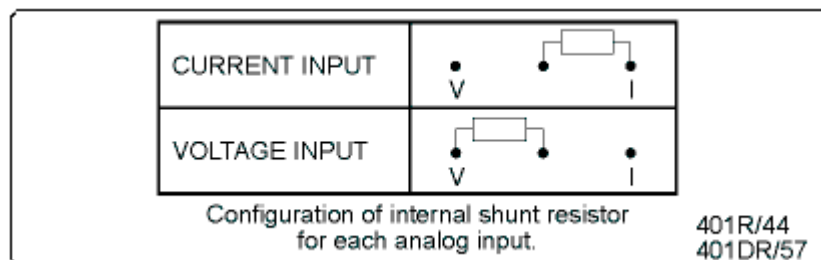


Figure 3.35- Voltage/Current Analog Inputs M-401-DR



NOTES

To comply with the EMC standards, use shielded cables in signal inputs (ground the shield in the panel only in one side of the cable).

The user can mark these labels if the input is set for current or internally set for voltage. (This refers to the shunt position).

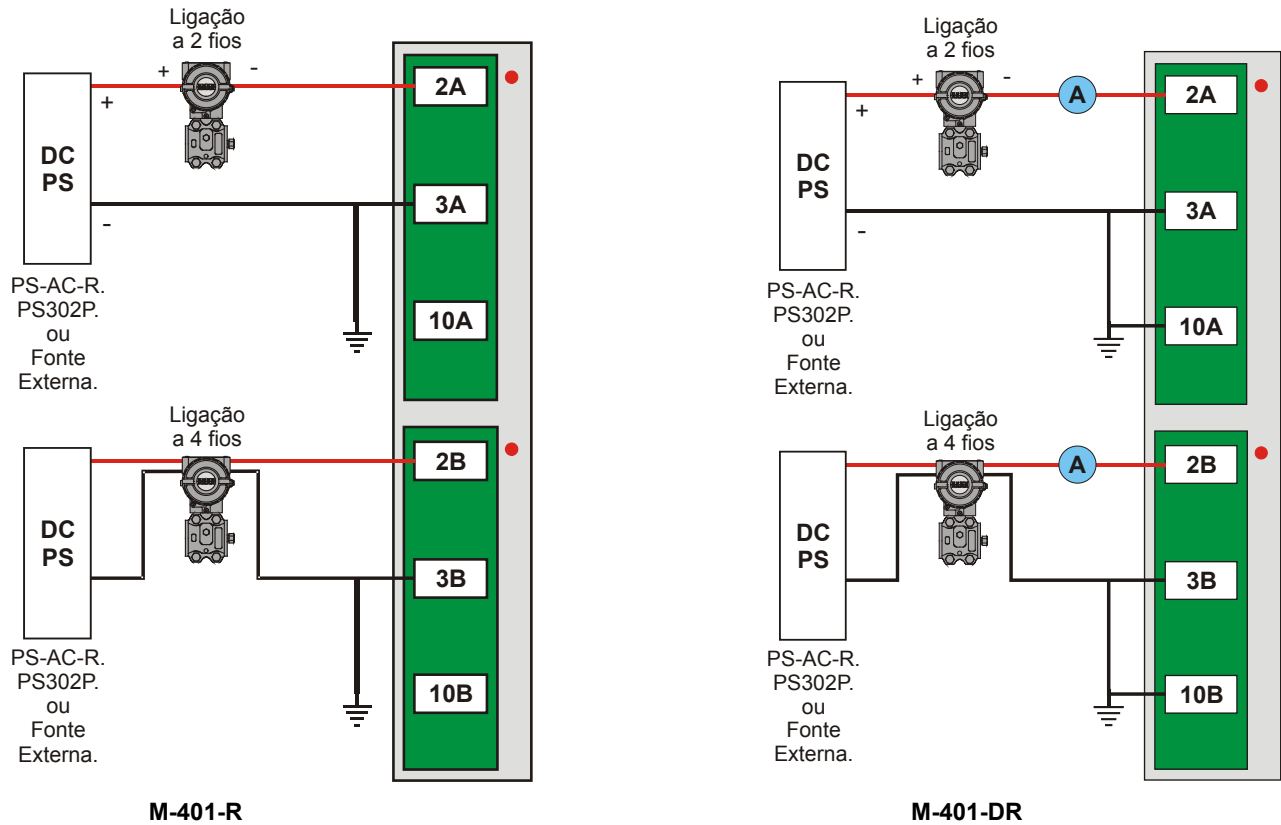


Figure 3.36 - External Connection

Observation: In the picture above, the Ammeter for the M-401-DR is not mandatory

Technical Specifications

ARCHITECTURE	
Number of inputs	8
Number of groups	1
Number of points per group	8

ISOLATION	
Channel for Bus	Isolation up to 1500 Vrms

INTERNAL POWER	
Supplied by the IMB bus	5 Vdc @ 320 mA maximum
Total Maximum Dissipation	1.6 W
Power Supply Indicator	Green LED

INPUTS	
Linear measuring range	M-401-R/M-401-DR: 0-20 mA, 4-20 mA, 0-5V, 1-5 V, 0-10 V, ± 10 V.
Typical Input impedance	M-401-R/M-401-DR: 1 MΩ for voltage input 250 Ω for current input

A/D CONVERSION	
Conversion Time	20 ms/channel
Sample Rate	5 Hz
Resolution	16 bits

PRECISION AT 77°F (25°C):	
Range: 0-5 V, 1-5 V, 0-10 V	0.1% of span (Linearity/Interference)
Range: 0-20 mA, 4-20 mA	0.12% of span (Linearity/Interference)
Range: ±10 V	0.2% of Span (Linearity/Interference)

EFFECT OF AMBIENT TEMPERATURE	
Range: 0-20 mA, 4-20 mA, 0-5 V, 0-10 V	0.2% of Span/ 77 °F (25 °F)
Range: 10 V	0.1% of Span/ 77 °F (25 °F)

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.201 kg

CABLES	
One wire	14 AWG (2 mm ²)
Two wires	20 AWG (0.5 mm ²)

M-402 - Analog Input Module - Temperature / Low Level Signals

(Supports Hot Swap and Device ID)

Part Number

M-402 (8 Low Signal Input for TC, RDT, mV and Ohm)

Description

This module measures temperature from a large variety of Thermocouples (TC) and RTD's as well as Millivolts and resistance with high accuracy. Temperature measurements are internally linearized and in the case of TC's, a cold junction compensation is already built-in close to the terminals of the module.

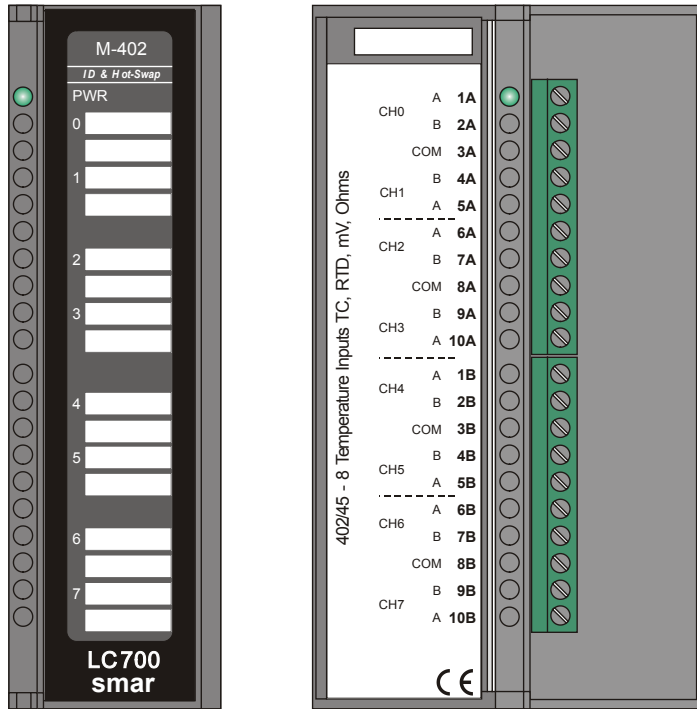
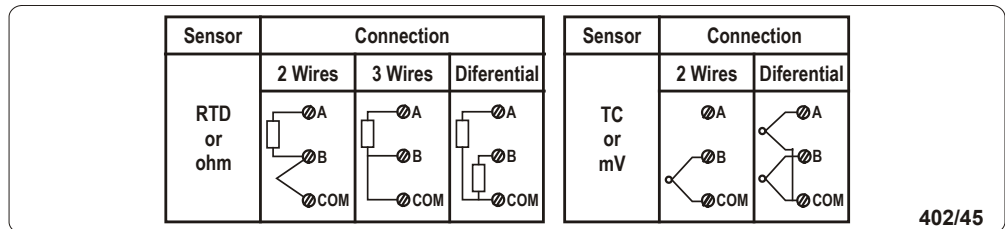


Figure 3. 37- Temperature And Low Level Signal Inputs M-402

! IMPORTANT

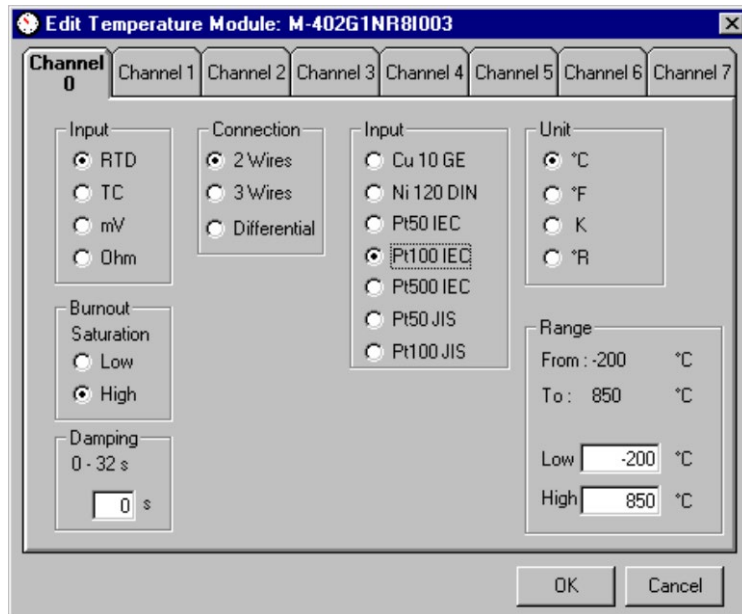
During the process, if there was the need of replacing the M-402 module, it must be reconfigured. For more details, see the LC700 – Configuration Manual.



Sensor type, unit, range, dumping and burnout for the input channel are set on CONF700.

NOTES

To comply with the EMC standards, use shielded cables in signal inputs (ground the shield in the panel only in one side of the cable).



For each input the M-402 module supplies an integer value and Boolean status. The status indicates if there is a sensor burnout. This status may be used to alert the operator and also be used for failure interlock logic.

DEFAULT TAG	DATA TYPE	PARAMETER
M-402G1B8Irrm.c	Boolean	Sensor burnout status
M-402G2NR8Irrm.c	Integer	Temperature value

Technical Specifications

ARCHITECTURE	
Number of inputs	8
Number of groups	1
Number of points per group	8

ISOLATION	
Channel for bus	Isolation up to 1500 V _{RMS}

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 35 mA maximum, during operation 5 Vdc @ 55 mA maximum, during configuration
Total Maximum Dissipation	0.250 W
Power Supply Indicator	Green LED

INPUTS	
Typical input impedance	1 MΩ

A/D CONVERSION	
Conversion Time	90 ms/channel
Resolution	16 bits
Precision at 77 °F (25 °C)	0.05% of span for the ranges 3 and 6*
Effect of the ambient temperature	0.004% of maximum span / °C

* 0.15 % of span for the ranges 2 and 5.

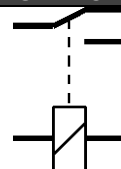
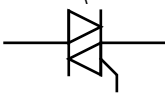

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.202 kg

CABLES	
One wire	14 AWG (2 mm ²)
Two wires	20 AWG (0.5 mm ²)

SENSOR	2 OR 3 WIRES			DIFFERENTIAL	
	TYPE	RANGE [°C]	RANGE [°F]	RANGE [°C]	RANGE [°F]
RTD	Cu10 GE	-20 to 250	-4 to 482	-270 to 270	-486 to 486
	Ni 120 DIN	-50 to 270	-58 to 518	-320 to 320	-576 to 576
	Pt50 IEC	-200 to 850	-328 to 1562	-1050 to 1050	-1890 to 1890
	Pt100 IEC	-200 to 850	-328 to 1562	-1050 to 1050	-1890 to 1890
	Pt500 IEC	-200 to 450	-328 to 842	-650 to 650	-1170 to 1170
	Pt50 JIS	-200 to 600	-328 to 1112	-800 to 800	-1440 to 1440
	Pt100 JIS	-200 to 600	-328 to 1112	-800 to 800	-1440 to 1440
THERMO-COUPLE	B NBS	+100 to 1800	+212 to 3272	-1700 to 1700	-3060 to 3060
	E NBS	-100 to 1000	-148 to 1832	-1100 to 1100	-1980 to 1980
	J NBS	-150 to 750	-238 to 1382	-900 to 900	-1620 to 1620
	K NBS	-200 to 1350	-328 to 2462	-1550 to 1550	-2790 to 2790
	N NBS	-100 to 1300	-148 to 2372	-1400 to 1400	-2520 to 2520
	R NBS	0 to 1750	32 to 3182	-1750 to 1750	-3150 to 3150
	S NBS	0 to 1750	32 to 3182	-1750 to 1750	-3150 to 3150
	T NBS	-200 to 400	-328 to 752	-600 to 600	-1080 to 1080
	L DIN	-200 to 900	-328 to 1652	-1100 to 1100	-1980 to 1980
U DIN	-200 to 600	-328 to 1112	-800 to 800	-1440 to 1440	

SENSOR mV	2 WIRES	DIFFERENTIAL	RANGE
	-6 a 22 mV	-28 a 28 mV	1
	-10 a 100 mV	-110 a 110 mV	2
	-50 a 500 mV	-550 a 550 mV	3
SENSOR Ω	2 OR 3 WIRES	DIFFERENTIAL	RANGE
	0 a 100 Ω	-100 a 100 Ω	4
	0 a 400 Ω	-400 a 400 Ω	5
	0 a 2000 Ω	-2000 a 2000 Ω	6

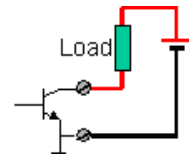
Discrete Output Types

TYPE	CHARACTERISTICS	SYMBOL
Relay	<ul style="list-style-type: none"> AC or DC operation. Physically opened when off: "dry contact". High current surge and voltage transient capacity. Mechanical, damaged by wear and tear. 	
Triac	<ul style="list-style-type: none"> Only AC operation. Sensitive to current surge. Silent. Solid state, no moving parts, no mechanical wear and tear. 	
Transistor	<ul style="list-style-type: none"> Only DC operation. Sensitive current surge and voltage transient. Silent. Solid state, no moving parts, no mechanical wear and tear. Fast. 	

Sink and Source Outputs

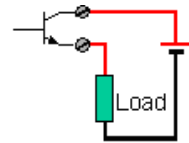
Sink Output:

Loads have common positive
 Module group has common negative
 Open collector transistor configuration



Source Output:

Loads have common negative
 Module group has common positive
 Open emitter transistor configuration



Switching Inductive DC Loads

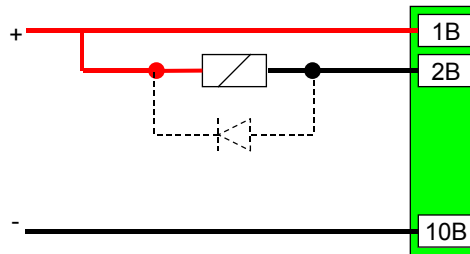


Figure 3. 38 - DC Switching of Inductive Loads

A diode connected in reverse direction may be used protect the transistor output driving inductive loads from surges as the output is switched off.

Switching Inductive AC Loads

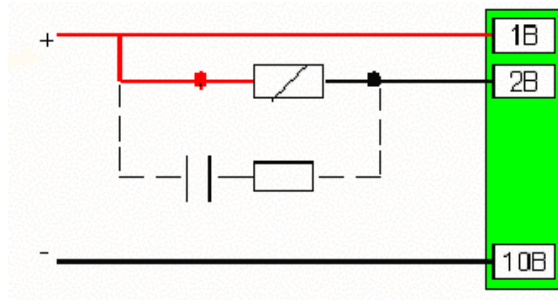


Figure 3. 39 -AC Loads Switching

TRIAC Zero Crossing Switching

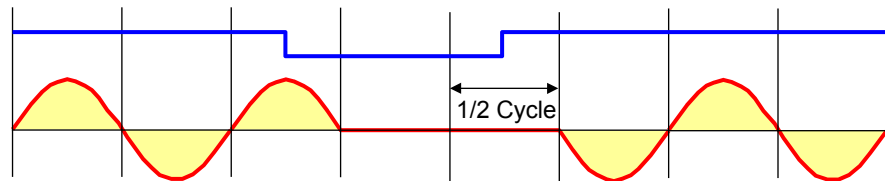


Figure 3. 40 - Zero Crossing TRIAC Switching

The Triac output switches the load On or Off only when the AC cycle crosses zero to ensure that there are no surges or noise due to switching of inductive loads. Therefore there may always be a delay of up to 1/2-cycle in switching waiting for the zero crossing.

Triacs need a minimum current to remain on. For very low power lamps a shunt may be needed.

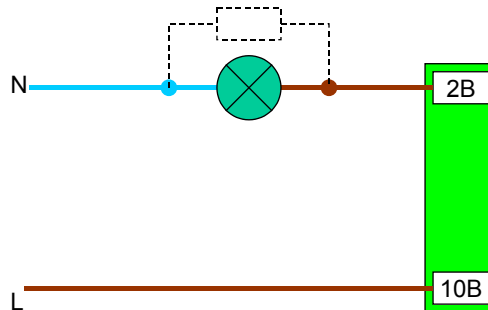


Figure 3. 41 – Lamp Switching

M-101 – DC Discrete Output Module

(Supports Hot Swap and Device ID)

Part Number

M-101 (1 group of 16 open collector outputs)

Description

This Module is designed with open collector NPN transistors that can drive relays, incandescence lamps, solenoids and other loads with up to 0.5 A per output. It has one group of 16 optically isolated open collector outputs. This means that all of them work under a common ground.

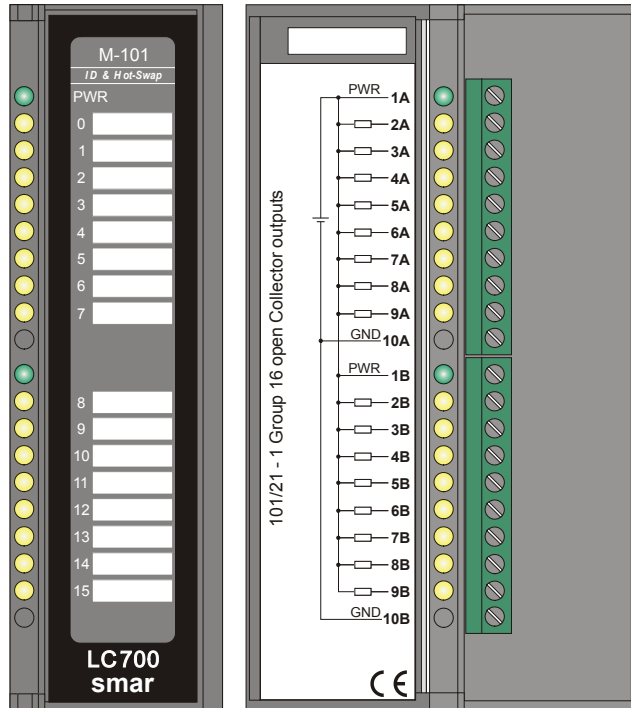


Figure 3.42- Open Collector Outputs Module M-101

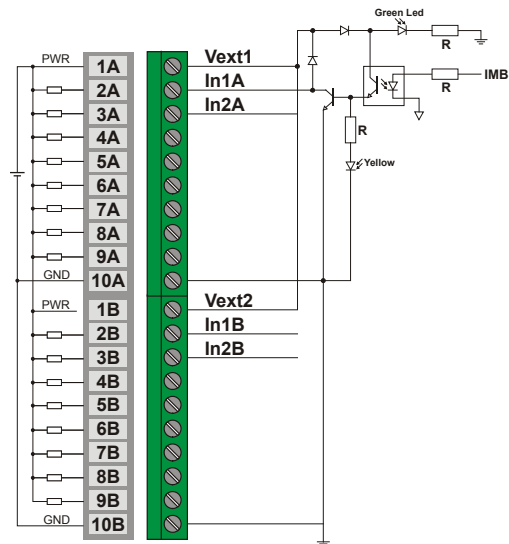


Figure 3.43 - External Connection

**Warning**

This module has an internal protection against inductive load switching. Each digital output terminal has a diode that suppresses the reverse voltage peak created by inductive loads. To make it, it is necessary to connect the power supply of the loads in the terminal 1A, so that these diodes are placed in parallel with the load. If we do not make this connection and if we do not have necessary power supply to the modules, the diode conducts and activates the loads.

Technical Specifications

ARCHITECTURE	
Number of inputs	16
Number of groups	1
Number of points per group	16

ISOLATION	
Optical Isolation up to	5000 Vac

EXTERNAL POWER	
Power Supply	20 to 30 Vdc
Maximum consumption	65 mA
Power Supply Indicator	Green LED

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 70 mA maximum
Total Maximum Dissipation	0.35 W
Power Supply Indicator	None

OUTPUTS	
Maximum Switched Voltage	30 Vdc
Maximum Saturation Voltage	0.55 V @ 0.5 A
Maximum Current per Output	0.5 A
Status Display	Yellow LED
Indicator Logic	LED ON- when the transistor is ON
Maximum Leakage Current	10 μ A @ 35 Vdc
Switch Capacity for Bulbs	15 W

INDEPENDENT PROTECTION PER OUTPUT	
Thermal Shutdown	165 °C
Thermal Hysteresis	15 °C
Overcurrent protection	1.3 A @ 25 Vdc maximum

SWITCHING INFORMATION	
Time from 0 a 1	250 μ s
Time from 1 a 0	3 μ s

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.260 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

M-102 – DC Discrete Output Module

(Supports Hot Swap and Device ID)

Part Number

M-102 (2 groups of 8 transistor Outputs (source))

Description

This Module is designed with NPN transistors that can drive relays, solenoids and other loads with up to 1 A per output. It has two groups of 8 optically isolated transistor outputs.

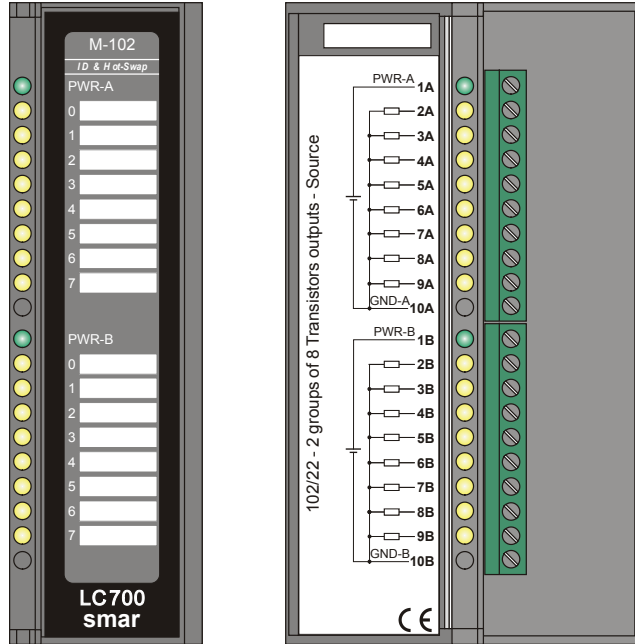


Figure 3.44- Transistor Outputs (Source) Module M-102

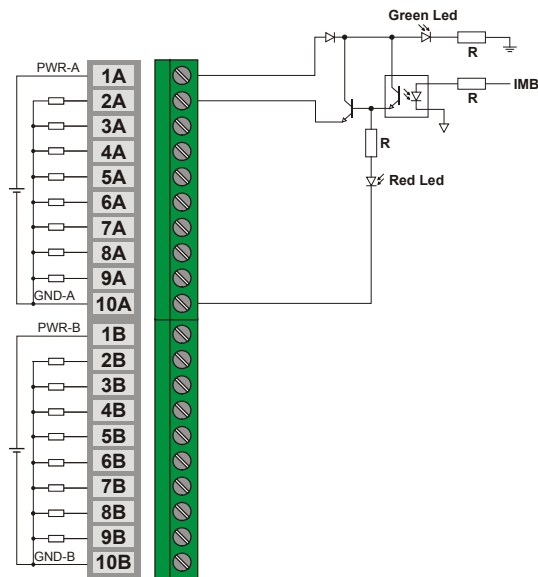


Figure 3.45 - External Connections

Technical Specifications

ARCHITECTURE	
Number of inputs	16
Number of groups	2
Number of points per group	8

ISOLATION	
Optical isolation up to	5000 Vac

EXTERNAL POWER	
Power Supply per Group	20 to 35 Vdc
Maximum consumption	65 mA
Power Supply Indicator	Green LED

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 70 mA maximum
Total Maximum Dissipation	0.35 W
Power Supply Indicator	None

OUTPUTS	
Maximum Switched Voltage	35 Vdc
Maximum Saturation Voltage	0.3 V@ 1 A
Maximum Current per Output	1 A
Status Display	Yellow LED
Indicator Logic	LED ON- Transistor in ON
Maximum Leakage Current	200 μ A @ 35 Vdc
Switch Capacity for Bulbs	15 W

INDEPENDENT PROTECTION PER OUTPUT	
Overload Protection	5.3 A

SWITCHING INFORMATION	
Time from 0 to 1	600 μ s
Time from 1 to 0	300 μ s

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.260 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

M-110 - AC Discrete Output Module

Part Number

M-110 (2 isolated groups of 4 240 Vac outputs)

Description

This Module is designed to drive relays, pilot lamps, valves and other loads up to 1A per output. It has 2 optically isolated groups of 4 outputs. These outputs can switch any voltage from 20 to 240 Vac.

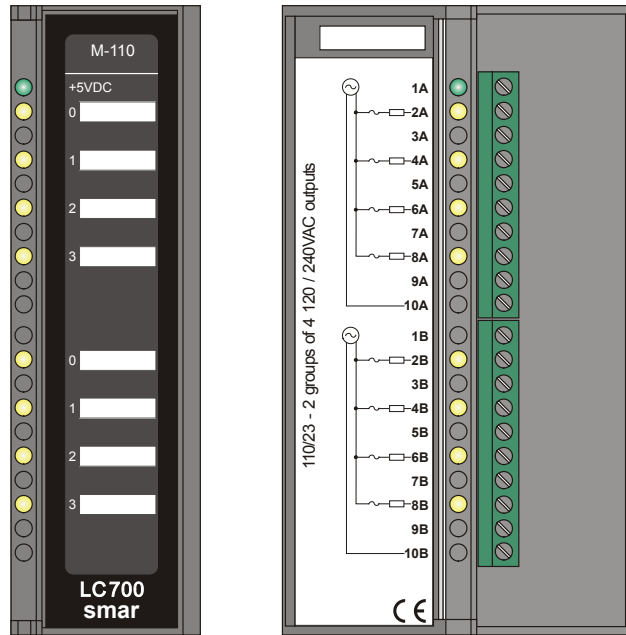


Figure 3.46 - AC Outputs Module M-110

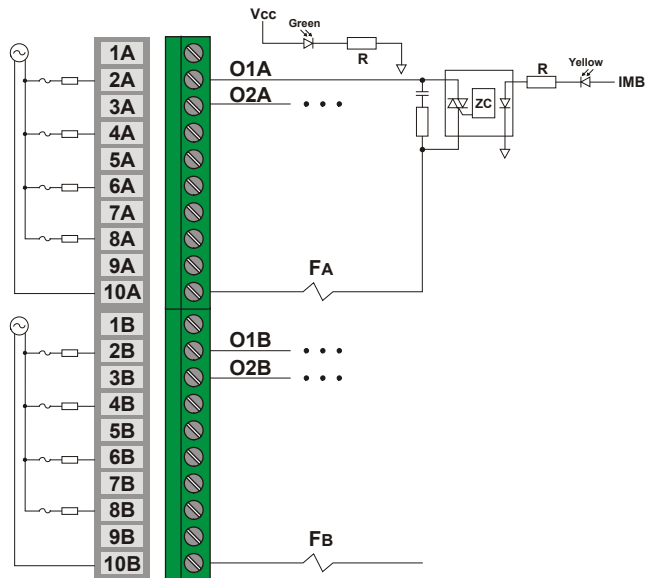


Figure 3.47 - External Connection

Technical Specifications

ARCHITECTURE	
Number Of Outputs	8
Number of groups	2
Number of points per group	4

ISOLATION	
Groups are isolated individually	
Optical isolation up to	2500 Vac

EXTERNAL POWER	
Power Supply per Group	20 to 240 Vac, 45 to 65 Hz
Maximum Consumption per group	4 A
Power Supply Indicator	None
Protection	One fuse per group

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 70 mA maximum
Total Maximum Dissipation	0.35 W
Power Supply Indicator	Green LED

OUTPUTS	
Voltage Output	20 to 240 Vac, 45-65 Hz
Maximum Current per Output	1 A
Maximum Total Current per Group	4 A @ Tamb 0-40 °C (32-104 °F) 2 A @ Tamb 40-60 °C (104-140 °F)
Maximum Surge Current	15 A / 0.5 cycle, 1 surge per minute maximum
Status Display	Yellow LED
Indicator Logic	When Active
Off state Voltage Leakage Current	500 μ A @ 100 Vac
On state Voltage drop	1.5 Vac rms maximum
Over Load Protection per Output	Should be provided externally (fast acting fuse rated at 1.5 times user continuous current).

SWITCHING INFORMATION	
Zero cross operation; Ton, Toff	1/2 cycle
RC circuit for protection	62 Ω in series with 0.01 μ F

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.295 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

M-111 - AC Discrete Output Module

(Supports Hot Swap and Device ID)

Part Number

M-111 (2 isolated groups of 8 240 Vac outputs)

Description

This Module is designed to drive relays, pilot lamps, valves and other loads up to 1A per output. It has 2 optically isolated groups of 8 outputs. These outputs can switch any voltage from 20 to 240 Vac.

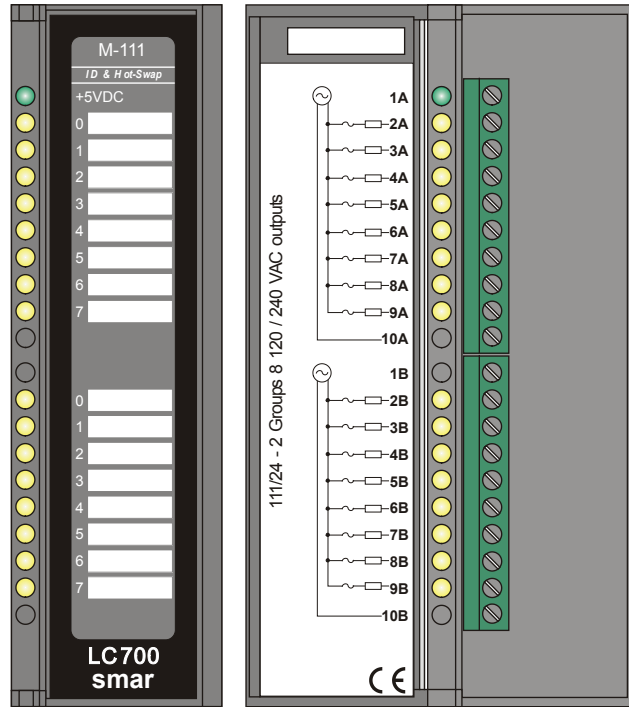


Figure 3.48 - AC Outputs Module M-111

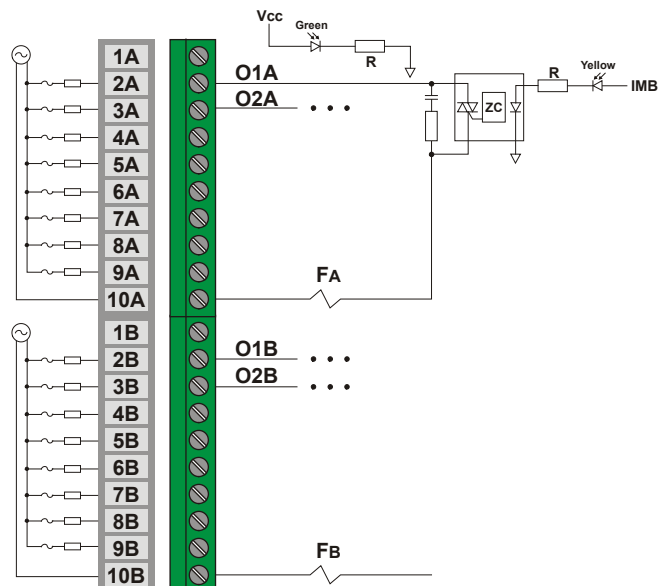


Figure 3.49 - External Connection

Technical Specifications

ARCHITECTURE	
Number of outputs	16
Number of groups	2
Number of points per group	8

ISOLATION	
Groups are isolated individually	
Optical Isolation up to	2500 Vac

EXTERNAL POWER	
Power Supply per Group	20 a 240 Vac, 45 to 65 Hz
Maximum consumption per group	4 A
Power Supply Indicator	None
Protection	One fuse per group

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 115 mA maximum
Total Maximum Dissipation	0.575 W
Power Supply Indicator	Green LED

OUTPUTS	
Voltage Output	20 to 240 Vac, 45-65 Hz
Maximum Current per Output	1 A
Maximum Total Current per Group	4 A @ T _{amb} 0-40 °C (32-104 °F) 2 A @ T _{amb} 40-60 °C (104-140 °F)
Maximum Surge Current	15 A / 0.5 cycle, 1 surge per minute maximum
Status display	Yellow LED
Indicator Logic	When Active
Off state Voltage Leakage current	500 µA @ 100 Vac
On state voltage drop	1.5 Vac rms Maximum
Overload Protection per Output	Should be provided externally (fast acting fuse rated at 1.5 times user continuous current)

SWITCHING INFORMATION	
Zero cross operation; Ton, Toff:	1/2 cycle
RC circuit for protection	62 Ω in series with 0.01 µF

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.330 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

M-120/M-121/M-122/M-124/M-125/M-126 – AC/DC Discrete Output Module

(Supports Hot Swap and Device ID)

Part Number

- M-120** (2 groups of 4 NO relay outputs with RC)
- M-121** (2 groups of 4 NC relay outputs with RC)
- M-122** (1 group of 4 NO and 4 NC relay outputs with RC)
- M-124** (2 groups of 4 NO relay outputs)
- M-125** (2 groups of 4 NC relay outputs)
- M-126** (1 group of 4 NO and 4 NC relay outputs)

Description

This relay output Module is designed to switch pilot lamps, valves, and relay coils up to 5 A per output. The relays can drive loads ranging from 20 to 110 Vdc or from 20 to 250 Vac. Two screw terminals are reserved for each relay output. Two groups are separated with individual common power grounds.

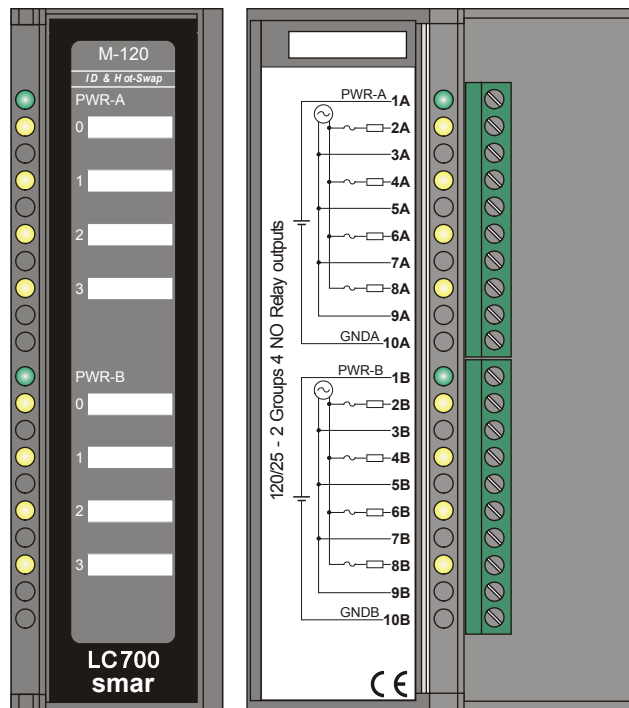


Figure 3. 50 - Relay Output Module M-120

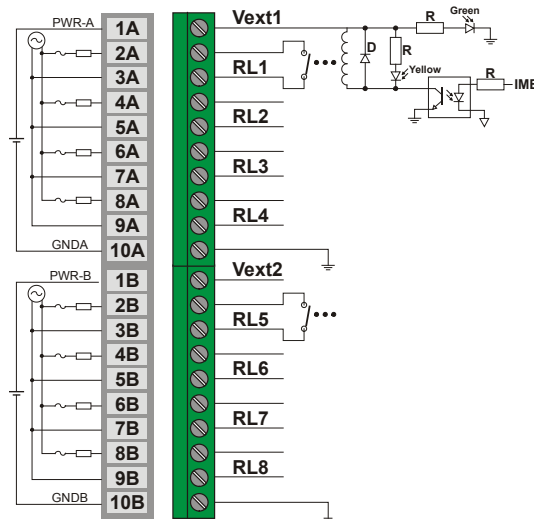


Figure 3.51 - External Connection

It is necessary to a power supply to load the relay. The user can use the PS302P or an external source. A source can load several groups since its capacity is enough. Only one group per phase, but the groups may have different phases.

Technical Specifications

ARCHITECTURE	
Number of outputs	8
Number of groups	2
Number of points per group	4

ISOLATION	
8 relay contacts individually isolated	
The driver for each relay is optically isolated from IMB up to:	5000 Vac

EXTERNAL POWER	
Power Supply per Group	20-30 Vdc
Maximum Current per Group	52 mA @ 24 Vdc
Typical Consumption per Point	12 mA @ 24 Vdc
Power Supply Indicator per group	Green LED

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 20 mA maximum
Total Maximum Dissipation	0.1 W
Power Supply Indicator	None

OUTPUTS	
Vac Range	20-250 Vac (M-120/M-121/M-122/M-124/M-125/M-126)
Vdc Range	20-125 Vdc (M-120/M-121/M-122/M-124/M-125/M-126)
Maximum Current for 30 Vdc/250 Vac	5A (resistive); 2A (inductive) (M-120/M-121/M-122/M-124/M-125/M-126)
Minimum Current	10 mA (M-120/M-121/M-122/M-124/M-125/M-126)
Initial contact resistance maximum	30 mΩ (M-120/M-121/M-122/M-124/M-125/M-126)
Status display	Yellow LED
Indicator Logic	ON if the relay's coil is active
Leakage	500 μA @ 100 Vac (M-120/M-121/M-122) None (M-124/M-125/M-126)
Overload protection per output	Should be provided externally

SWITCHING INFORMATION	
RC Protection Circuit	62 Ω in series with 0.01 μF (M-120/M-121/M-122) None (M-124/M-125/M-126)
Operate Time	10 ms Maximum (M-120/M-121/M-122/ M-124/M-125/M-126)
Release Time	10 ms Maximum (M-120/M-121/M-122/ M-124/M-125/M-126)

ELECTRICAL SERVICE LIFE	
Switching Cycles	100.000 minimum operations @ maximum current (M-120/M-121/M-122/ M-124/M-125/M-126)

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.305 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

Note
To increase service of life of your relays and to protect your modules from reverse voltage damages, externally connect a clamping diode in parallel with each inductive DC load or externally connect an RC snubber circuit in parallel with each inductive AC load.

DC Load

AC Load

M-123/M-127 – AC/DC Discrete Output Module

(Supports Hot Swap and Device ID)

Part Number

M-123 (2 groups of 8 NO relay outputs)

M-127 (2 groups of 8 NO relay outputs with RC)

Description

This high-density relay output module is designed to switch pilot lamps, valves, like relay coils up to 5 A per output. Relays may drive charges from 20 to 110 Vdc or from 20 to 250 Vac. Each group of 8 relays has one common terminal and only one screw terminal is reserved for each relay output.

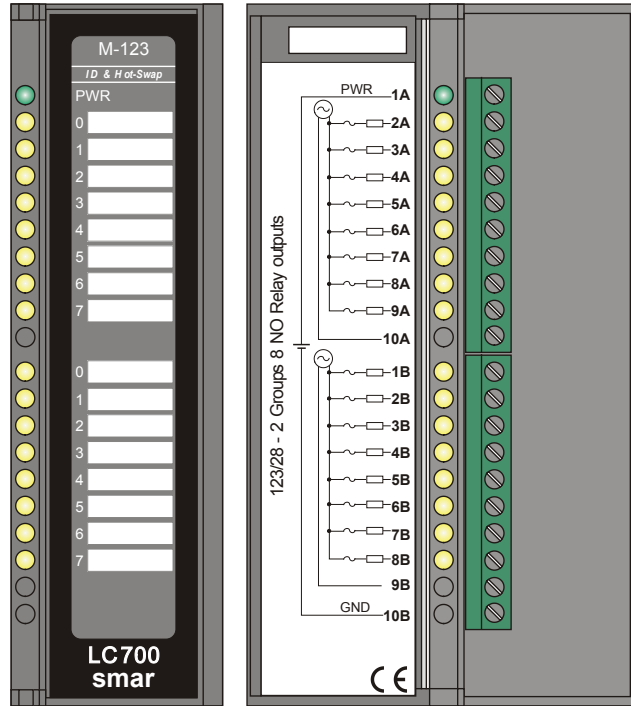


Figure 3.52 - High Density Relay Output Module

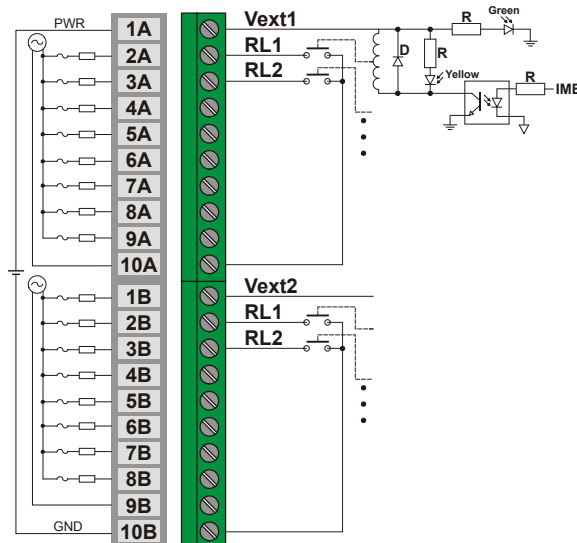


Figure 3.53 - External Connection

It is necessary a source to feed the relay. The user can use the PS-AC-R or an external source. One source may load several groups since its capacity is enough. Just one group per phase, but the groups may have different phases.

Technical Specifications

ARCHITECTURE	
Number of outputs	16
Number of groups	2
Number of points per group	8

ISOLATION	
The driver for each relay is optically Isolated from IMB up to	5000 Vac
Each group of 8 relays has one common contact.	

EXTERNAL POWER	
Power Supply	20 - 30 Vdc
Maximum current per group	90 mA @ 24 Vdc
Maximum consumption per point	11.3 mA @ 24 Vdc
Power Supply Indicator per group	Green LED

INTERNAL POWER	
Provided by the IMB bus	5 Vdc @ 30 mA maximum
Total Maximum Dissipation	0.15 W
Power Supply Indicator	None

OUTPUTS	
Vac Range	20-250 Vac
Vdc Range	20-110 Vdc
Maximum Current for 250 Vac	5 A (resistive); 2 A (inductive)
Maximum Current for 30 Vdc	5 A (resistive); 2 A (inductive)
Maximum total current per group	10 A
Initial contact resistance maximum	100 mΩ
Status display	Yellow LED
Indicator Logic	LED ON - relay coil is active
Leakage Current	M-123:0 M-127:500μA @ 100Vac
Overload protection per output	Should be provided externally

SWITCHING INFORMATION	
Operate Time	10 ms maximum
Release Time	10 ms maximum

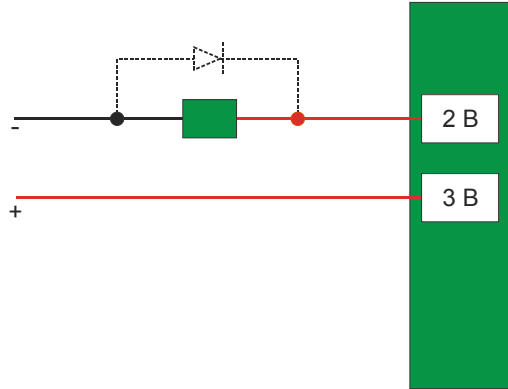
ELECTRICAL SERVICE LIFE	
Switching Cycles	20.000.000 minimum operations @ maximum current

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.301 kg

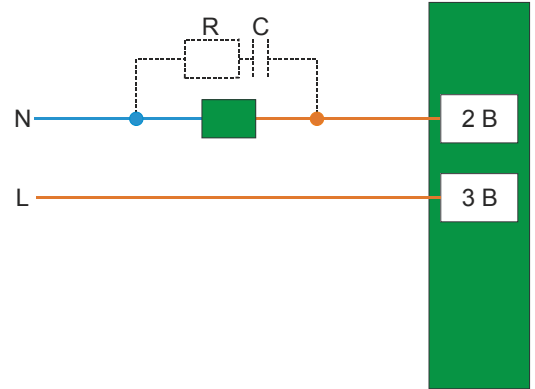
CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

Note

To increase service of life of your relays and to protect your modules from reverse voltage damages, externally connect a clamping diode in parallel with each inductive DC load or externally connect an RC snubber circuit in parallel with each inductive AC load.



DC Load



AC Load

M-501 - Analog Output Module – Voltage / Current

(Supports Hot Swap and Device ID)

Part Number

M-501 (4 Current and 4 Voltage Analog Outputs)

Description

This module has 4 analog outputs, 0-3. Each analog output is available in the terminal in current and voltage. Current outputs can be individually configured on ranges of 0-20 mA or 4-20 mA. Voltage output ranges are: +/-10 V, 0-10 V, +/-5 V, 0-5 V and 1-5 V.

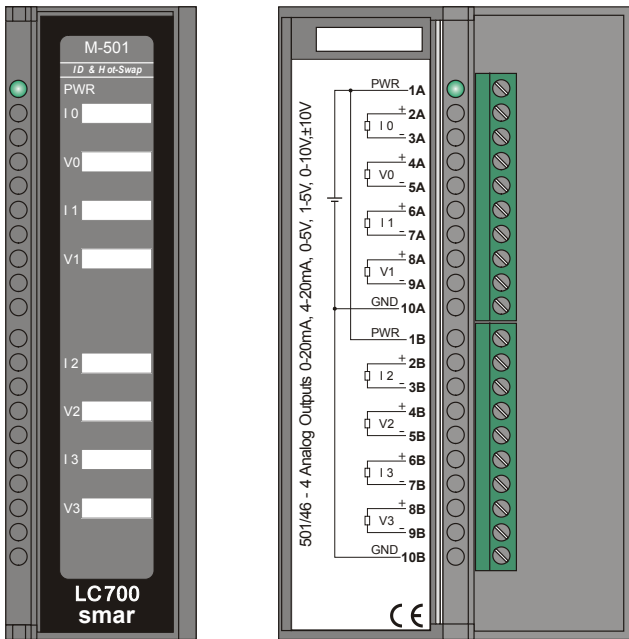


Figure 3.54 - Current and Voltage Analog Output Module M-501

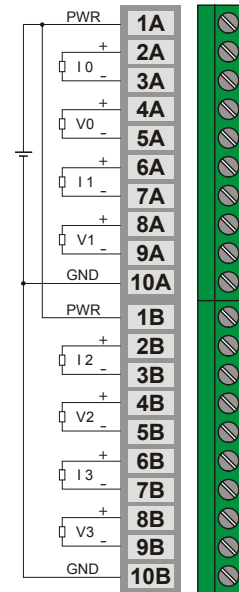


Figure 3.55- External Connection

The signal output range for the output channels is set in the CONF700 (zero) and through the Dip Switches (span) of the module.

DipSwitch 1 - UP Side: Configure the Group of Ranges of Channel 0 (I0/V0)

DipSwitch 2 - UP Side: Configure the Group of Ranges of Channel 1 (I1/V1)

DipSwitch 1 - DOWN Side: Configure the Group of Ranges of Channel 2 (I2/V2)

DipSwitch 2 - DOWN Side: Configure the Group of Ranges of Channel 3 (I3/V3)

NOTE

To comply with the EMC standards, use shielded cables in signal inputs (ground the shield in the panel only in one side of the cable) and cables less than 30 meters for power source inputs.

Technical Specifications

ARCHITECTURE	
Number of outputs	4
Number of groups	1
Number of points per group	4

ISOLATION	
Channel for bus	Optical Isolation up to 3700 Vrms
Channel for external source	1500 Vac

INTERNAL POWER	
Supplied by the IMB bus	5 Vdc @ 20 mA maximum
Total Maximum Dissipation	0.1 W

EXTERNAL POWER	
In Rush Current consumption	2.3 A, 10 ms Maximum @ 24 Vdc
Power Supply	20-30 Vdc
Maximum Current	180 mA
Power Supply Indicator	Green LED

OUTPUTS	
Outputs Type	Single ended (1 ground)
Load Impedance	5 V: 2 k Ω minimum; 10 V: 5 k Ω minimum 20 mA: 750 Ω maximum

OUTPUTS RANGE	RANGE 1	RANGE 2	RANGE 3
Voltage Output Dip Switch OFF	1 V to 5 V	0 V to 5 V	-5 V to 5 V
Voltage Output Dip Switch ON	2 V to 10 V	0 V to 10 V	-10 V to 10 V
Current Output	4 mA to 20 mA	0 mA to 20 mA	0 mA to 20 mA

A/D CONVERSION	
Conversion rate	8 ms/channel
Resolution	12 bits
Precision at 77°F (25°C)	+/- 0,5% of span

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.330 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

M-201 to M-209 - Discrete DC Input and AC/DC Output Module

Part Number

- M-201** (1 group of 8 24 Vdc inputs and 1 group of 4 NO relay)
- M-202** (1 group of 8 48 Vdc inputs and 1 group of 4 NO relay)
- M-203** (1 group of 8 60 Vdc inputs and 1 group of 4 NO relay)
- M-204** (1 group of 8 24 Vdc inputs and 1 group of 4 NC relay)
- M-205** (1 group of 8 48 Vdc inputs and 1 group of 4 NC relay)
- M-206** (1 group of 8 60 Vdc inputs and 1 group of 4 NC relay))
- M-207** (1 group of 8 24 Vdc inputs and 1 group of 2 NO and 2 NC relay)
- M-208** (1 group of 8 48 Vdc inputs and 1 group of 2 NO and 2 NC relay)
- M-209** (1 group of 8 60 Vdc inputs and 1 group of 2 NO and 2 NC relay)

Description

This combo module with DC Inputs and relay outputs is designed to drive relays, pilot lamps, valves and other loads up to 5 A. It also senses the DC input Voltage and converts them to a True or False logic Signal.

It has 1 group of 8 optically isolated 24/48/60 Vdc inputs (M-201, M-204, M-207/M-202, M-205, M-208/M-203, M-206, M-209) and 4 relay outputs (M-201 to M-209). The relays can drive loads ranging from 24 Vdc to 110 Vdc or from 24 to 250 Vac. Two screw terminals are reserved for each relay output, though they are isolated between them.

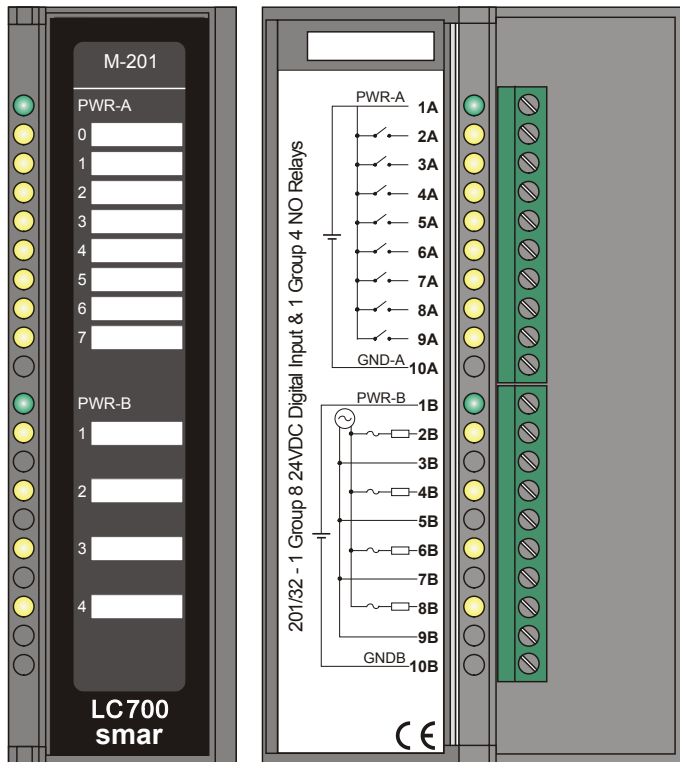


Figure 3.56- DC Input And Relay Output Module M-201

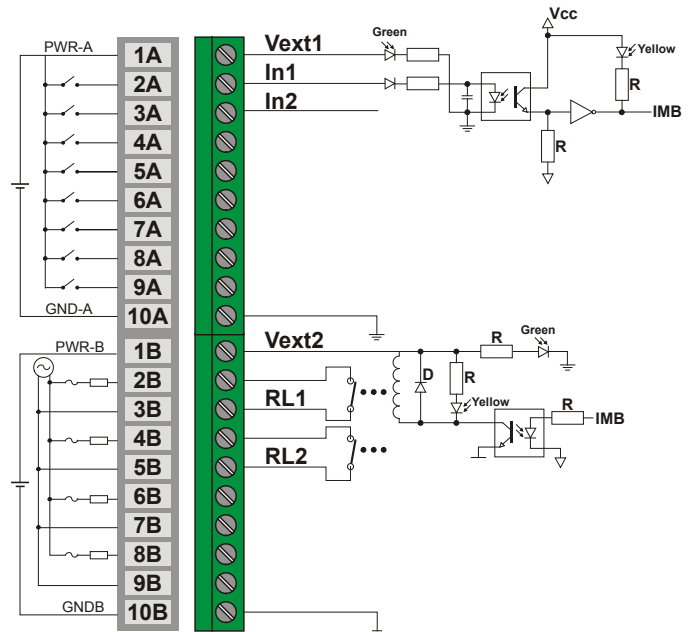


Figure 3.57- External Connection

It is necessary to a power supply to load the relay. The user can use the PS-AC-R or an external source. A source can load several groups since its capacity is enough.

Technical Specifications

ARCHITECTURE	
Number of groups	2
Number of Vdc inputs	8
Number of outputs	4

ISOLATION	
Groups are individually isolated	
8 individually isolated relay contacts. The power supply for the groups is individually isolated.	
The driver for each relay is optically Isolated from IMB up to:	5000 Vac

INTERNAL POWER	
Provided by the IMB bus:	5 Vdc @ 60 mA typical
Total Maximum Dissipation	0.3 W
Indicator Of Source	None

For the Vdc Inputs:

ARCHITECTURE	
Number of Points	8

ISOLATION	
Isolation up to	5000 Vac

EXTERNAL POWER	
Power Supply for Inputs	20-30 Vdc (M-201, M-204, M-207) 36-60 Vdc (M-202, M-205, M-208) 45-75 Vdc (M-203, M-206, M-209)
Maximum Consumption per Group	65 mA @ 24 Vdc (M-201) 65 mA @ 48 Vdc (M-204) 62 mA @ 60 Vdc (M-207)
Power Supply Indicator	Green LED

INPUTS	
ON State Voltage range (logic "1")	20-30 Vdc (M-201, M-204, M-207) 30-60 Vdc (M-202, M-205, M-208) 38-75 Vdc (M-203, M-206, M-209)
ON State Voltage range (logic "0")	0-5 Vdc (M-201, M-204, M-207) 0-9 Vdc (M-202, M-205, M-208) 0-12 Vdc (M-203, M-206, M-209)
Input Impedance (Typical)	3,9 K Ω (M-201, M-204, M-207) 7,5 K Ω (M-202, M-205, M-208) 10 K Ω (M-203, M-206, M-209)
Input Current per Point	8 mA @ 24 Vdc (M-201, M-204, M-207) 8 mA @ 48 Vdc (M-202, M-205, M-208) 7,5 mA @ 60 Vdc (M-203, M-206, M-209)
Status display	Yellow LED
Indicator Logic	On when active

SWITCHING INFORMATION	
Minimum Voltage for logic level "1"	20 Vdc (M-201, M-204, M-207) 30 Vdc (M-202, M-205, M-208) 38 Vdc (M-203, M-206, M-209)
Maximum Voltage for logic level "0"	5 Vdc (M-201, M-204, M-207) 9 Vdc (M-202, M-205, M-208) 12 Vdc (M-203, M-206, M-209)
Time from "0" to "1"	30 μ s
Time from "1" to "0"	50 μ s

For the Relay Outputs:

ARCHITECTURE	
Number Of Outputs	4

ISOLATION	
Group is individually isolated	Each Relay has two dedicated Terminals
Optical Isolation up to:	5000 Vac (Before the Relay Isolation it self)

EXTERNAL POWER	
Power Supply per Group	20-30 Vdc
Maximum Consumption per Group	52 mA @ 24 Vdc
Typical Consumption per Point	12 mA @ 24 Vdc
Power Supply Indicator per Group	Green LED

OUTPUTS	
Vac Range	20-250 Vac
Vdc Range	20-110 Vdc
Maximum Current for 250 Vac	5A (Resistive);
Maximum Current for 30 Vdc	5A (Resistive)
Status display	Yellow LED
Indicator Logic	ON if the relay coil is active
Leakage	500 μ A @ 100 Vac

SWITCHING INFORMATION	
RC Protection Circuit	62 Ω in series with 0.01 μ F
Time to activate	10 ms
Time to deactivate	10 ms

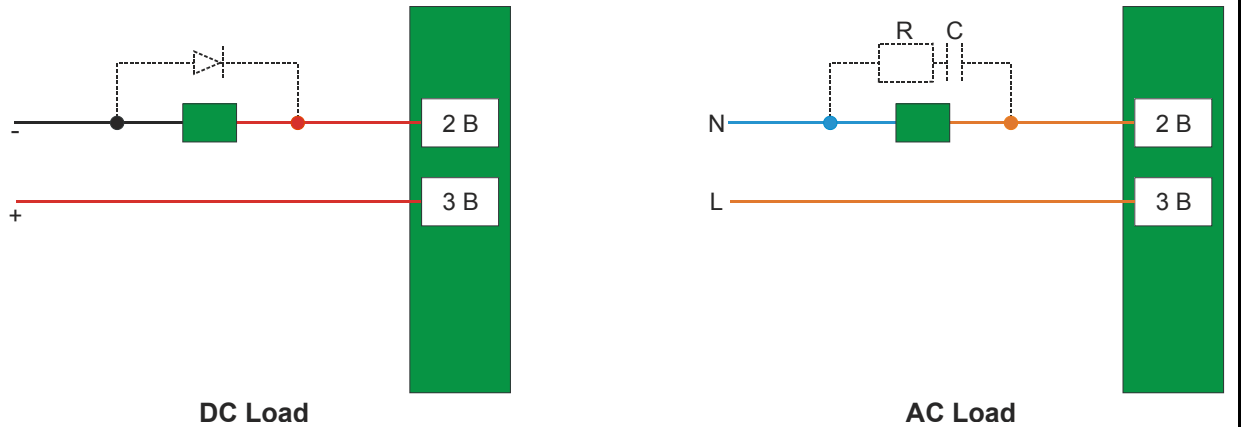
ELECTRICAL SERVICE LIFE	
Switching Cycles	100.000 operations minimum @ maximum current

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.298 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

Note

To increase service of life of your relays and to protect your modules from reverse voltage damages, externally connect a clamping diode in parallel with each inductive DC load or externally connect an RC snubber circuit in parallel with each inductive AC load.



FB-700 - FIELDBUS MODULE

(Supports Hot Swap and Device ID)

Part Number

FB-700 (Fieldbus Module)

Description

The FB-700 is a Fieldbus interface card for the LC700 programmable controller. It integrates the discrete control capability of LC700 with Fieldbus.

The Foundation™ Fieldbus interoperability feature assures that the FB-700 will work perfectly with any other FF device, even from manufacturers other than Smar.

The FB-700 is directly attached to the LC700 backplane. The LC700 accesses it as a regular I/O card, which supports many digital and analog I/O points mapped to the FB-700 function blocks. For proper operation, both CONF700 and SYSCON should configure the card.

Function Blocks

FB-700 can execute the following function blocks, some of which are pre-instantiated:

Block Type	Description	Number of instantiations
RS	Resource	1
DIAG	Diagnostics Transducer	1
MAI	Multiple Analogic Inputs	2
MDI	Multiple Discrete Inputs	3
PID	PID Control	1
EPID	Enhanced PID Control	0
ARTH	Arithmetic	0
SPLT	Split Range	0
CHAR	Signal Characterizer	0
INTG	Integrator	0
AALM	Analogic Alarm	1
ISEL	Input Selector	0
SPG	Set point Ramp Generator	0
TIME	Time and Logic	0
LLAG	Lead-Lag	0
OSDL	Output Selector/Dynamic Limiter	0
CT	Constant	0
MAO	Multiple Analogic Output	2
MDO	Multiple Discrete Output	4

In the table above:

- Block Type: it means the available block types for the device
- Description: it shows the description of each block.
- Number of instantiations:
 0 – this block type is not pre-instantiated in the FB-700.
 1 to 4 – it indicates the quantity of pre-instantiated blocks in the FB-700.

There are blocks that have correlation with the LC700. These blocks are described below:

Block Type	Description	LC700 Block
MDI	Multiple Discrete Inputs	CODD
MDO	Multiple Discrete Outputs	CIDD
MAI	Multiple Analogic Inputs	COAD
MAO	Multiple Analogic Outputs	CIAD

Connecting FB-700 to LC700

Before connecting or disconnecting the FB-700 from the LC700 backplane, please be sure that the LC700 power is OFF.

LEDs behavior

The FB-700 red and yellow LEDs indicate errors and warnings as described in the following tables:

- **Yellow LED**

<i>Always on</i>	FB-700 is saving nonvolatile data. After finishing this operation the yellow LED will be turned off.
<i>Blinking at 1s rate</i>	LC700 and FB-700 do not have the same configuration parameters. Please, check both SYSCON and LC700 configurations to ensure that the number of function blocks and FB700 TAG are the same.
<i>Blinking at 3s rate</i>	There is a new configuration in the dual port memory, but the LC700 does not check it.
<i>Blinking at 5s rate</i>	There is a new configuration in the dual port memory without any MIO function block.

- **Red LED**

<i>Always on</i>	A critical error happened and FB-700 is in a permanent failure state. FB-700 must be reset.
<i>Blinking at 1s rate</i>	LC700 is not accessing FB-700. Possible causes are LC700 is not running properly, FB-700 is not present in LC700 configuration or rack addressing is wrong.

FB-700 is developed to communicate with fieldbus devices through the FOUNDATION fieldbus™ H1 channel.

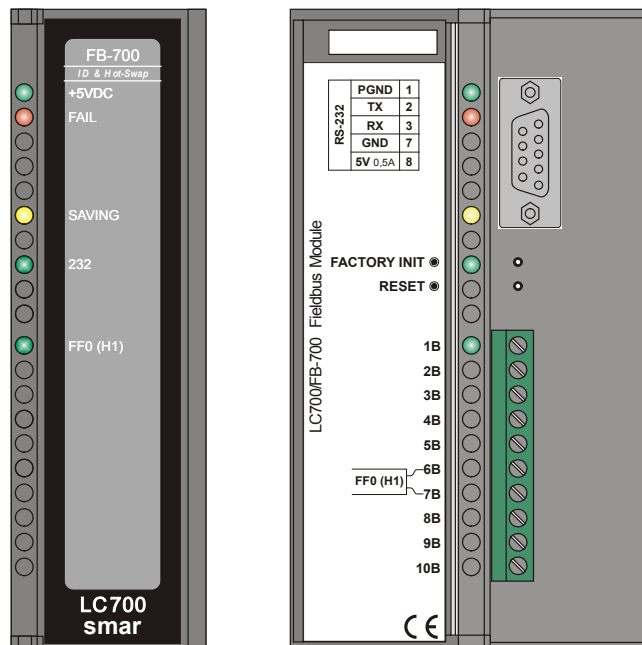


Figure 3. 61 - Fieldbus Module FB-700

Technical Specifications

CPU	
Type	Low Power Microcontroller
Architecture	8-bit CISC

MEMORY		
	Capacity	Functionality
Code	512 kB, 8-bit Flash	Downloadable firmware
Data	128 kB, 8-bit RAM	Dynamic data
Retention	8 kB, 8-bit serial EEPROM	Configuration retention
Dual-Port	32 kB, 8-bit DPRAM	LC700 interface

FIELDBUS INTERFACE	
Number of Channels	1 H1 channel (31,25 Kbps)
Controller	FB3050 SMAR (DMA Integrated)
Physical Layer Standard	ISA-S50.02-1992
Fieldbus Interface	Passive (not bus powered)
Intrinsic Safety	NOT compliant

INTERNAL POWER	
Supplied by the IMB bus	5 Vdc @ 110 mA
Total Maximum Dissipation	0.55 W
Source Indicator	Green LED + 5 Vdc

TEMPERATURE	
Operation	0 to 60 °C
Storage	-20 to 80 °C

ISOLATION	
IMB Communication Channel	500 Vac

DIMENSIONS AND WEIGHT	
Dimensions (W x H x D)	39.9 x 137.0 x 141.5 mm (1.57 x 5.39 x 5.57 in)
Weight	0.261 kg

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

MB-700 –Modbus RTU TCP/IP Processor Module

Part Number

MB-700 (Modbus RTU/TCP Processor Module)

Description

The MB-700 is a multi-function module integrated into the SYSTEM302 that has two types of functions: bypass (gateway MODBUS TCP/IP e MODBUS RTU) and Modbus data concentrator. The MB-700 allows the remote configuration of devices that use the MODBUS RTU protocol. So, when the device receives a Modbus TCP/IP message and does not have its address, it will pass the communication frame to a lower level of the Modbus RTU network. At the same time the MB-700 collects data from lower levels of this network communicating with the CPU through the Ethernet network. It uses a PS-AC-R Power Source Module. Please refer to the MB-700 manual for further details.

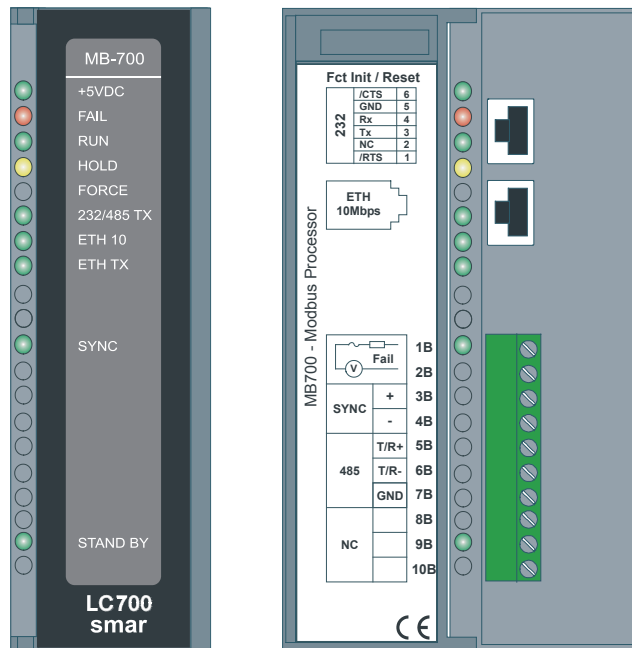


Figure 3.62 – Modbus RTU-TCP/IP Processor MB-700

Technical Specifications

CONTROLLER	
Type	32 Bit RISC (CPU Clock @ 25 MHz)
Performance	50 MIPS
Code memory	2 Mbytes, 32 Bits Flash Memory (recordable Firmware)
Data memory	2 Mbytes, 32 Bits NVRAM (Data storage and configuration)

COMMUNICATION PORTS	
Ethernet	1 Port Ethernet @ 10 Mbits (Connector RJ-45)
Serial	1 Port EIA 232 @ 9.6Kbps-115,2 Kbps (Connector RJ11) 1 Port EIA 485 @ 9.6 Kbps-115.2 Kbps
Synchronism Channel	1 Port Independent com DMA-Baud rate 31.25 Kbps (SYNC)

INTERNAL POWER	
Provided by the IMB	5Vdc/950 mA
Total dissipation	4.75 W

STATUS INDICATION	
+5 VDC	Green LED indicating module energizing
FAIL	Red LED indicating processor failure
RUN	Green LED indicating program running
HOLD	Yellow LED indicating program is in waiting mode
FORCE	Not used
232/485TX	Green LED indicating transmission of EIA-232 and EIA-485 data
ETH 10	Green LED indicating Ethernet cable connected
ETH TX	Green LED indicating data transmission using Ethernet
SYNC	Green LED indicating data synchronism
STANDBY	Green LED Indicating Standby mode (waiting mode when the MB700 is redundant.

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 (mm); (1.57 x 5.39 x 5.57 in)
Weight	0.340 kg

TEMPERATURE	
Operation	0 °C to 60 °C
Storage	-30 °C a 70 °C

CABLES	
One Wire	14 AWG (2 mm ²)
Two Wires	20 AWG (0.5 mm ²)

ENET-700 - Modbus/TCP 10 Base-T Ethernet Module

Part Number

ENET-700 (Modbus/TCP 10Base-T Ethernet Module)

Description

The Main objective for this Module is to allow the connection of an LC700 system to an Ethernet network for local or remote communications. This new feature will allow multi-computer architecture to access one or more LC700 and inter-net communications.

One side of the ENET-700 connects to the 10-Base-T network through the RJ-45 connector while the other side must be connected to one of the serial ports in the CPU-700 Module. The ENET-700 allows selection between EIA-232-C and EIA-485.

Adding an ENET-700 Module to an LC700 system (it takes one slot of the Rack), the user can access one or more of the CPU-700 Modules connected between them in a Multi-drop EIA-485 connection.

The ENET-700 Module will be responsible for the bridge between the Ethernet Modbus/TCP and the Serial Modbus/RTU Channel in the CPU's. Up to eight computers can access the ENET-700 at the same time to communicate with a single CPU or any of the CPUs in the EIA-485 Multidrop link. On the EIA-485 side we can have up to 31 CPUs connected. The CONF700 has a special tool to configure the ENET-700 Module. The user must set the IP Address, and serial channel parameters to communicate with the CPU-700 Modules and parameters such as baud rate, 8 data bits, even parity and 1 stop bit. The CPU-700 will need to agree with the configured baud rate.

The CONF700 is ready to work with the Modbus/TCP through the Ethernet Network. The user must go to the menu Tools/Comm. Settings and set the protocol parameters in the dialog box. Please note that by using one EIA-485 port (P2 or P3) on a 3-channel CPU, the user will still have 2 serial ports available for other connections, if necessary!

The Ethernet redundant network is possible with the use of a second ENET-700 Module in the LC700 system In this case another serial port (EIA-485) on the CPU should be used. This is possible only if 3-channel CPUs are used.

NOTE

In case the connection of the DB9 port is permanent, the DB9-EXT cable must be used which allows the user to close the front panel of the module.

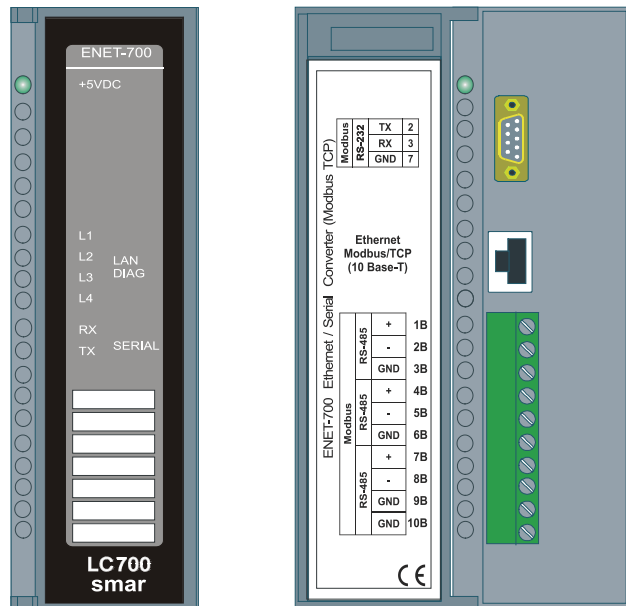


Figure 3.63 - ENET-700 (Modbus/TCP 10Base-T Ethernet Module)

Technical Specifications

Rate in Mbps	10
a) Maximum segment length (m)	100
b) Stations/Segment	12/hub
c) Medium	Unshielded twisted pair
Topology	Star
Part Number	ENET-700
Open TCP Connections	Maximum of 8
Communication Channels	10Base-T (RJ45) EIA-232-C (DB-9 Female) EIA-485 (Terminals)
Serial Baud rate	300bps to 38.4Kbps
EIA-485 Isolation	1600V _{RMS} @ 1minute 2000V _{RMS} @ 1second
Maximum Nodes	125
Compatibility	Ethernet Version 2.0/IEEE 802.3
Management	Telnet Login and SNMP (only reading)
Diagnostic LEDs	Transmit Data Receive Data Link working properly Good Link
Firmware	New software can be downloaded via TFTP or serial port.
Current Consumption of the +5VDC Internal Power Supply	270 mA

LED Status Display

L1 (Good link)

When the LED is on, it means there is a link in the network.

L2

When the L2 LED is ON or blinking, take a look at the LED L4 because it will display the diagnostic code. In this case there is a fatal error and the ENET-700 is not working properly.

L2 stable in ON, and L4 is blinking:

- 1x: EEPROM-checksum error
- 2x: RAM-error
- 3x Network controller error (Token Ring)
- 4x: E²PROM checksum error or bad
- 5x: IP address already used on network

LED L2 is blinking and LED 4 is blinking:

- 4x: The connection with the network faulty. This code should only appear after the turn-on procedure. Even if the ENET-700 goes to the operation mode, the problem might still persist.
- 5x: There was no answer from the DHCP server.

L3

This LED is not used.

L4

LED 4 indicates the channel state. LED L2 will stay in OFF while the ENET-700 is in the normal operation.

- **Stable color:** there no is connection
- **Blinking in 1 second cycles:** ENET-700 is connected to the network.

+5VDC

Indicates whether the module is fed properly with +5Vdc.

RX
Indicates whether the module is reading data.

TX
Indicates whether the module is sending data.

Setting the ENET-700

Setting your workstation to change the IP address

Connect one DF55 cable connecting workstation to the module on test (ENET-700)
Access MS-DOS (Windows NT) or Command Prompt (Windows 2000) and type the following commands:

Note: * means SPACEBAR.

C:\wini**pcfg** WIN 95 ; or, C:\>**ping** "workstation name"

(It will check the IP of your workstation)

C:\>**ping***workstation IP Address *Ex: 192.168.8.227*

C:\>**arp***-a

C:\>**arp***-s*new IP address*Ethernet address

Where: - New IP address to the ENET-700 = network.123 *Ex: 192.168.8.123*

Ethernet address = located in the label of the U4 board. *Ex: 00-20-4a-11-00-c3*

C:\>Telnet*new IP address*1

Observation: In the Telnet window show the Failure Message (Connect Failed!)

Changing IP address of ENET700 module

- Still on **Telnet**, start a new connection:
- Set **Connect, Remote System** on **Host name** the new IP address at port = 9999
Where the ENET-700 should be set (IP, baud rate and RS232) as shown below:

CoBox MB Setup, Lantronix, Inc.

1) Network/IP Settings:

Ethernet Interface Autodetect

IP Address novo IP address *Ex: 192.168.8.123*

Default Gateway Not Set

Netmask Not Set

2) Serial & Mode Settings:

Protocol Modbus/RTU,Slave(s) attached

Serial Interface 19200,8,E,1,RS232

3) Modem Control Settings:

RTS Output Fixed High/Active

4) Advanced Modbus Protocol settings:

Slave Addr/Unit Id Source .. Modbus/TCP header

Modbus Serial Broadcasts ... Disabled

Character,Message Timeout .. 00010 ms,05000 ms

NOTE: The serial interface must always be set for RS232.

5) Select **S(ave)**.

Setting the ENET-700 on LC700

Within the CONF700 the module must be set by following these steps:

- Cancel Initial Screen
- Go to the menu Tools/Comm. Settings
- Choose Ethernet Interface
- On IP Address type the new IP address of the ENET-700 module.
- Next go on line and the CONF700 will find the ENET-700 IP address.

NOTE: The ENET-700 card must be located in the same network subnet where your workstation is placed. A Subnet would be **192.168.161.XXX**.

In case of a wire cross-over the network would be PC (HOST) and ENET-700

NOTE: In case of using an HUB, the IP address of your ENET must be the same of your HUB, i.e., the user will have to set the wire cross over and the new IP address of the current network. (This is necessary because the Ethernet board of the Enet700 does not support dhcp).

NOTE

Do not use the address xxx.xxx.xxx. 255. It is a reserved address.

ENET-710 – Modbus/CDBus TCP 10/100 Base-T Ethernet MODULE

(Supports Hot Swap)

Part Number

ENET-710 (Módulo Modbus/CDBus TCP 10/100 Base-T Ethernet)

Description

The ENET-710 is a data communication module that bridges Ethernet and Serial communication networks. With the increasing importance of networking for industrial control/automation, the ENET-710 module provides Ethernet-networked computers the ability to perform remote monitoring and control of serial Modbus compatible industrial devices in the field as well as access to LC700 PLC CPU modules and the CD600 Multi-Loop Controller.

The module can be installed in the LC700 Programmable Logic Controller (PLC) to receive power, or it can be operated in a stand-alone fashion with an external +24VDC power source. There is also a redundant power supply mode when using both power sources.

For more details about this module, see its equipment manual.

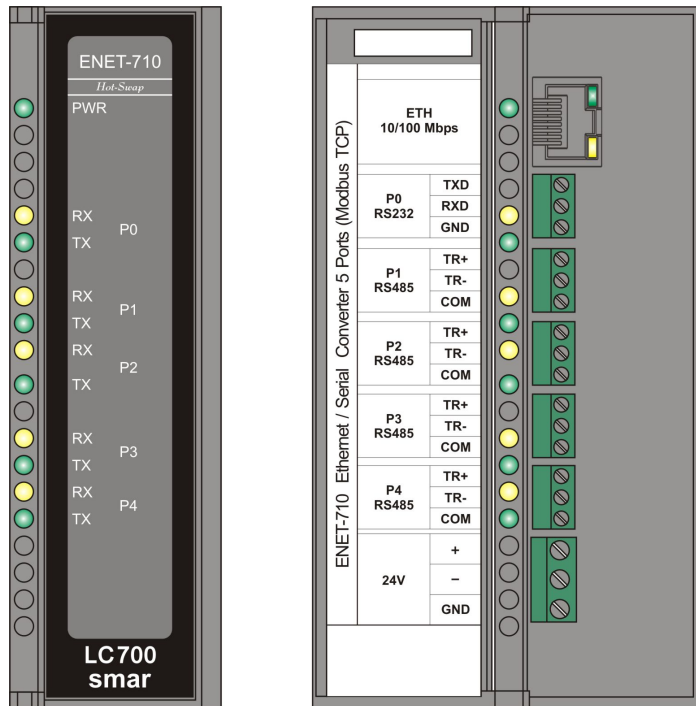


Figure 3.64 – ENET-710 Module

Technical Specifications

CONTROLLER	
Type	8-bit
Program Memory	Flash

NETWORK INTERFACE	
Ethernet	IEEE 802.3 10Mbps 10BASE-T IEEE 802.3u 100Mbps 100BASE-TX
Medium	Category 5 or UTP
Protocols	Modbus TCP, TCP/IP e HTTP
Open TCP connections	Maximum of 7
Isolation	1500V

SERIAL PORTS P0-P4	
Mode	Asynchronous
Baud rate (bps)	9600, 19200, 38400, 57600 and 115200
Character size	8 bits
Parity	Odd, even or none
Stop bits	1 or 2
Interface	RS-232C (P0, full-duplex, point to point) RS-485 (P1 – 4, half-duplex, multidrop)
Protocols	Modbus/RTU and CD600
Isolation	P0 – none P1, P2 – 1600V P3, P4 – 50V

INDICATOR LEDS	
Power	On (green)
Ethernet	Link (green)
Serial	Activity in jack Tx/Rx (yellow) Rx – yellow Tx – green (for each port)

CONNECTORS	
Ethernet	8 conductor modular RJ-45
Serial	3 conductor terminal blocks, 3.81 mm pitch
+24 Vdc Power Supply	3 conductor terminal block, 5.08 mm pitch

POWER SUPPLY	
Internal	5 Vdc @ 450 mA typical
External	18-36Vdc, 130 mA typical @ 24Vdc Recommended: 20-32 Vdc

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm (1.57 x 5.39 x 5.57 in)
Weight	0.300 kg

Procedure to replace the ENET-700 for ENET-710

In the EIA-232 connection port, the connector DB-9 must be replaced by the 3-conductor terminal (3 conductor terminal blocks – 3.81 mm). For the EIA-485 port, the 10 points connector must be replaced by the 3 terminal connector (3 conductor terminal blocks – 3.81 mm), selecting one of the ports P1 up to P4.

SW-700 – Switch Ethernet Module

(Supports Hot Swap)

Part Number

SW-700 - Ethernet Switch

Description

Smarter SW-700 module is a Fast Ethernet Switch that provides LAN networks with 10 Base-T/100 Base-TX high-speed auto-sensing connectivity. Five ports, where one is dedicated for the Uplink will provide access for many devices and will help to eliminate traffic congestions that can't be well treated by Network Hubs.

The SW-700 is also a great choice when connecting different speed networks as Ethernet and Fast Ethernet and will also optimize finding the right path for same type of Ethernet. There are LED indicators for link/activity, speed, full/half duplex and collision for each individual port and one for module power.

It can be powered by the Rack or by an external 24Vdc. Power supply redundancy circuit will automatically switch from the user preferred supply to the other one in case of failure. Industrial design, no internal fans and low EMC makes it a great option for automation and process control applications.

For more details about the SW-700 module, see its equipment manual.

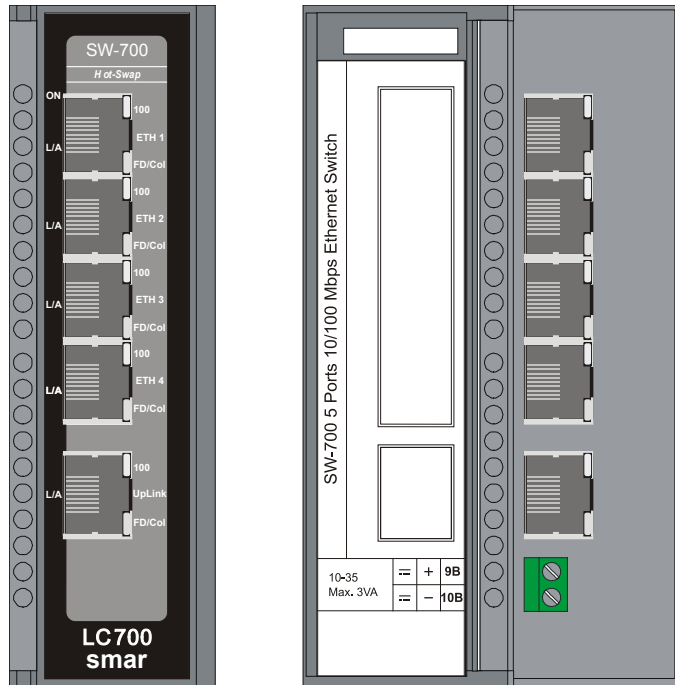


Figure 3.65 – SW-700 Switch Ethernet

Technical Specifications

PORTS	
4 Ports (Regular ports)	RJ-45 Regular ports
1 Port (Uplink Port)	RJ-45 (no cross cable to connect to a HUB or a SWITCH)

INTERNAL POWER	
Internal (IMB)	5 Vdc
Current Consumption	500 mA maximum

EXTERNAL POWER	
Voltage Range	10 - 35Vdc
Current Consumption	115 mA@24 Vdc maximum.
Power Consumption	2.8 W maximum

COMPATIBILITY	
Fully compliant with IEEE 802.3 and 802.3u	

NETWORK	
Connector Type: RJ45 Ethernet 10Base-T and High Speed Ethernet 100Base-TX	

LED INDICATORS	
System: Power LED Individual Ports: Collision/Speed/Active Uplink: Collision/Speed/Active	

POWER SAVING	
Each port automatically enters power saving mode 10 seconds after cable disconnect.	

REDUNDANCY	
Between Internal IMB Vcc and the External Power Supply	

TEMPERATURE	
Operation	0°C to 60°C

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	39.9 x 137.0 x 141.5 mm; (1.57 x 5.39 x 5.57 in)
Weight	0.290 kg

SI-700 - EIA-232/EIA-485 Interface Module

Part Number

SI-700 (Interface EIA-232/EIA-485)

Description

This module converts the electrical characteristics of the communication signal from the EIA-232 specification to the EIA-485 specification. Due to the fundamental differences between the EIA-232 and the EIA-485, the first option EIA-232 is used in peer-to-peer applications) this module was implemented to work automatically. No control signal is necessary to manage the bus contention on the EIA-485 side. It is necessary to connect the transmission and reception lines on both sides to make the interface work.

The converter circuit provides signal isolation to grant a safe connection between two systems. This module was designed to use the DFI/LC platform. No power supply was embedded in the board. It uses the +5Vdc lines from the IMB bus to energize the circuit.

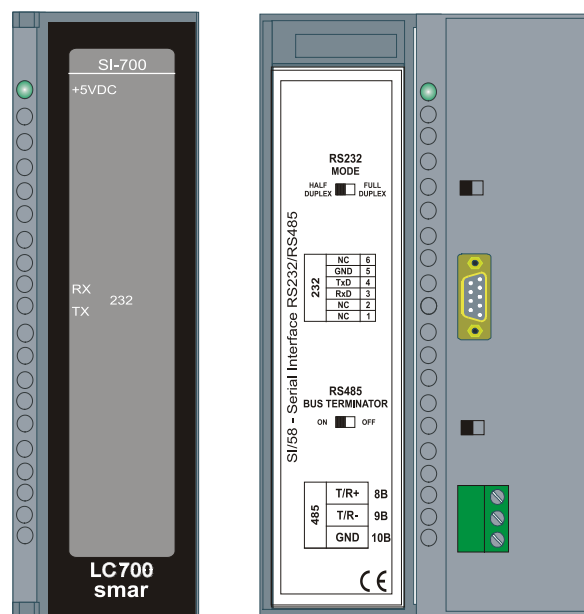


Figure 3.66 - SI-700 Interface RS232/RS485

Interface Settings

There are two interface settings located on the front panel to adapt this interface to the applications: RS232 Mode and RS485 Bus Terminator.

- RS232 Mode: Half-Duplex/Full-Duplex

The RS232 Mode setting adapts the use of RS232/RS485 Interface to the communication driver at the RS232 side. Normally interfaces of this type connect unidirectional buses with a bi-directional bus. The unidirectional bus will be able to present the Full Duplex features caused by transmission message reflection (echo). If the driver used does not treat properly the reception and the transmissions messages simultaneously, either disabling the reception or discarding the reflected message, it will be necessary to select the Half-Duplex option. If the reflected message doesn't disturb the applications, you can select the Full-Duplex option.

- RS485 Bus Terminator: On/Off

The RS485 is a Multidrop type bus. The transmitter driver is put in the high impedance (Hi-Z) state when there is no message to transmit. Therefore, the RS485 bus requires a bus terminator to prevent noise problems during the idle state of the RS485.

For the proper line impedance matching it is necessary to activate only one terminator by bus. Leave the other terminators deactivated.

Connectors

There are two connectors on the front panel to interconnect two communication systems. The first, an RJ12 type connector is used for the RS232 systems and the other, a terminal block type connector is used for the RS485 systems.

RJ12 Pin Assignment

Pin Number	Description
1	Connected to 6 pin.
2	Not used
3	RxD: EIA-232 input signal - reception
4	TxD: EIA-232 output signal - transmission
5	GND: EIA-232 signal ground
6	Connected to pin 1

NOTE	
Pins 1 and 6 are interconnected to allow the handshaking between the modem signals when required by communication drivers, such as Clear-To-Send (CTS) with Request-To-Send (RTS) interconnection.	

Pin Block Terminal

Pin Number	Description
1	+: EIA-485 Non inverting signal
2	-: EIA-485 Inverting Signal
3	GND: Reference for EIA-485 Communication Signal.

NOTE	
The GND pin is used to set up a voltage reference for all EIA-485 nodes, on the same bus. The EIA-485 side of EIA-232/EIA-485 Interface is isolated and is left in a floating state. To avoid undesirable high common mode voltage it is recommended to make all of the EIA-485 nodes on the same voltage reference by connecting all GND pins and grounding at just one point.	

Technical Specifications

Number of Communication Channels	1
Data Communication Interface	EIA-232 / EIA-485
Baud rate	Up to 200 KBPS enable
EIA-232 side	Enables EIA-232 Half-Duplex or Full-Duplex mode
EIA-485 side	Enables Embedded Bus Terminator activation
Protection EIA-485	No transmission when the bus is in break state
Isolation	1600 V _{RMS} @1 minute, typical
Power Supply	Provided by the IMB bus, +5 Vdc, @ 100 mA Typical



Note

In the interconnection of the 485 network, to attend the EMC standard (Electromagnetic capability), it is necessary to use a three way shielded twisted pair cable. Where, two ways are used to communication and the third is used as reference. The shielding must be connected in one of the housing endings."

ICS2.0P - Serial Converter Interface Module

Part Number

ICS2.0P (Serial Converter Interface)

Description

The serial converter interface ICS2.0P is a device composed of an universal power supply and inputs and outputs for both standards 232 and 485 interfaces. The three modules (power supply, 232 interface and 485 interface) are electrically isolated resisting typically to voltages up to 1600 V_{RMS} (1 minute) or 2000 V_{RMS} (1 second).

Due to its particular feature, where two communication interfaces with different communication modes are connected (232 is full Duplex while 485 is Half Duplex), this interface allows to choose between Full Duplex and Half Duplex in the 232 interface. Besides, because the 232 interface is used in point-to-point communications and the 485 interface is mostly used in multidrop communications, an automatic mechanism toggles the 485 transmission despite the selected baud rate.

The Bus Busy feature checks if the 485 line has a present signal or if it is on break mode. In this case, this circuit blocks any signal from the 232 bus to the 485 bus.

For more details about this interface, consult its manual.

Technical Specifications

POWER SUPPLY	
Consumption	3 W max.
Input Voltage	90 to 240 Vac @ 48 to 70 Hz, simple or two-phase.
Output Voltage	5 Vdc, 0.5 A max.
Protection	Against overcurrent, overvoltage and instantaneous surge and EMI.
Protection Fuse	250 mA

CERTIFICATION	
According to CE.	

ISOLATION	
Optical and Galvanic	Up to 1600 V_{RMS} (1 minute) 2000 V_{RMS} (1 second) between the network source and the buses among the buses.

BAUD RATE	
Baud Rate	Up to 250 Kbps, auto adjustable.

INDICATION	
Energization LEDs and presence of communication of signal.	

TEMPERATURE	
Operation	-10 to 60 °C @ 100% RH max.
Storage	-30 to 90 °C @ 90% RH max.

CONNECTION			
Pin	I/O	Signal	Description
1	I	L	Phase input
2	I	N	Neutral input (single phase)/ Phase (two-phase)
3	-	G	Housing grounding pin

Connection: 3 wires, L, N, G, through terminals with screw.

OBS: When using the two-phase input, we recommend the use of an external fuse in the N line.

FIXATION	
Through a support for DIN rail or using empty slots of a rack model R-700-4 (rack with four slots) (installation).	

DIMENSIONS AND WEIGHT	
Dimensions (W x D x H)	40 x 127 x 142 mm; (1.57 x 5.00 x 5.59 in)
Weight	0.265 kg

232 Interface

OPERATION MODE	Full Duplex or Half Duplex
PROTECTION	Voltage peaks
CABLING	Up to 15 m (25 m with shielding), between ICS2.0P and the 232 device

CONNECTION			
Pin	I/O	Signal	Description
2	O	TxD	Output 232 signal to be sent to the receiver of the 232 device
3	I	RxD	Input 232 signal to be sent to the transmitter of the 232 device
5	-	GND	Reference grounding of the 232 signals.

Connection: 3 wires, TxD, RxD and GND and through the 9 pins Delta connector, female.

485 Interface

OPERATION MODE	Automatic control of the transmission driver, independent of the baud rate.
TERMINATORS	Activation through jumpers
PROTECTION	Voltage Peaks
CABLING	Up to 1200 m, without repeater, using two twisted pairs and with shielding. Obs.: Connect the shielding to the grounding pin GND.

CONNECTION			
Pin	I/O	Signal	Description
1	I/O	+	485 positive differential signal
2	I/O	-	485 negative differential signal
3	-	GND	Grounding. Useful to eliminate the effects of common mode voltage.

Connection: 3 wires. With differential signals (+) and (-) and grounding GND.

OPT-700 - Serial to Fiber Optics Converter Module

(Supports Hot Swap)

Part Number

OPT-700 (EIA-232/EIA-485 to Fiber Optics Converter)

Description

The OPT-700 is a Fiber Optic Modem designed to provide a versatile connection between asynchronous serial communication interfaces such as EIA-232-C and EIA-485 using Fiber Optic cable. It will allow any piece of equipment that uses half-duplex asynchronous serial communication at distances up to 4.0 km with great benefit of EMI immunity.

It can be configured point-to-point or in a multi-drop configuration using the Repeat feature.

The OPT-700 supports a broad range of configurable baud rates for the asynchronous serial communication. EIA-232-C can work between 2400 and 115.2Kbps, while EIA-485 works from 2400 till 920Kbps.

Once Fiber Optic is immune to EMI/RFI and ground loops, the Modem can replace converters and isolators when connecting remote devices.

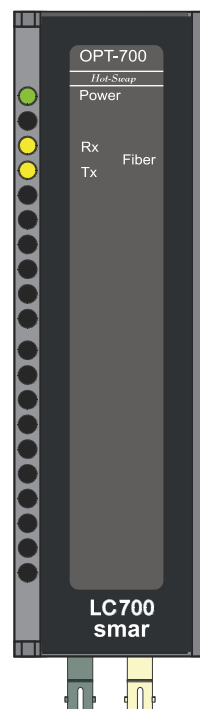


Figure 3.67– Serial to Fiber Optics Converter- OPT-700

Main Characteristics

- ✓ Works directly in the LC700/DFI back-plane draining power from the Inter-Module-Bus (IMB).
- ✓ Can be used in a stand-alone mode with an external power supply.
- ✓ Accepts EIA-232-C or EIA-485 with configurable baud rates.
- ✓ Point-to-Point or Multi-drop Fiber Optic communication.
- ✓ Great solution to increase link distances and eliminate EMI or Grounding problems.

Fiber Optic Cable

This is a Dual or Simple multi-mode, 62.5 or 50/125 μ m fiber optic cable with ST connectors and a Maximum length of 4000m (12,000ft).

Basic Installation Steps

- ✓ Set the internal jumper (J1) to use internal or external power supply. To remove the circuit board from the plastic Module push with moderate pressure each tab (top and bottom) close to the grids, while forcing to separate the box from the front plastic panel.
- ✓ Decide which RS asynchronous interface is going to be used. Configure Switch #1 (see table below.)
- ✓ Find out the working baud rate and configure Switch #2 (high or low baud rate range) then turn on only one of the switches between #4 and #8.
- ✓ Determine the necessity to work with point-to-point or multi-drop connection and define all necessary cable, and then make sure the repeat Switch#2 is correctly configured on each OPT-700 converter.
- ✓ Make all connections and start the system. Follow the signal by the Rx and Tx LEDs on the front panel. They will blink according to the data across the fiber line.
- ✓ If there are any problems go to the "Troubleshooting" section of this Manual.

Front Panel Overview

The Figure below shows the OPT-700 Module with the front cover opened. From top to bottom we can see the DB9 connector for the EIA-232-C, the 5-position terminal for the EIA-485 and external power supply, 8 DIP switches for configuration, and finally the fiber optic receiver and transmitter.

NOTE

If the connection with the DB9 port is permanent, the DB9-EXT cable must be used to allow the panel to be opened.

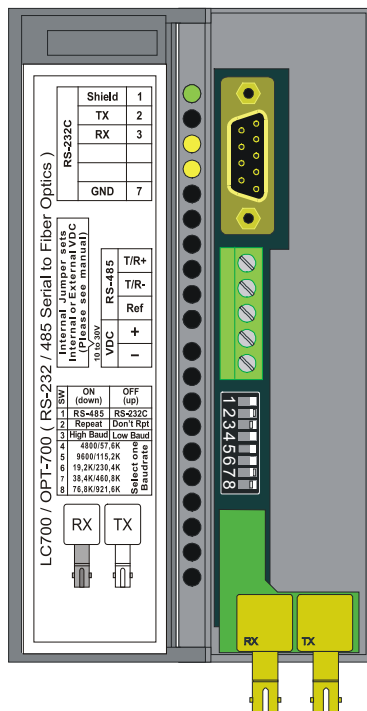


Figure 3.68 – Overview of the front panel

SETTING DIP SWITCHES

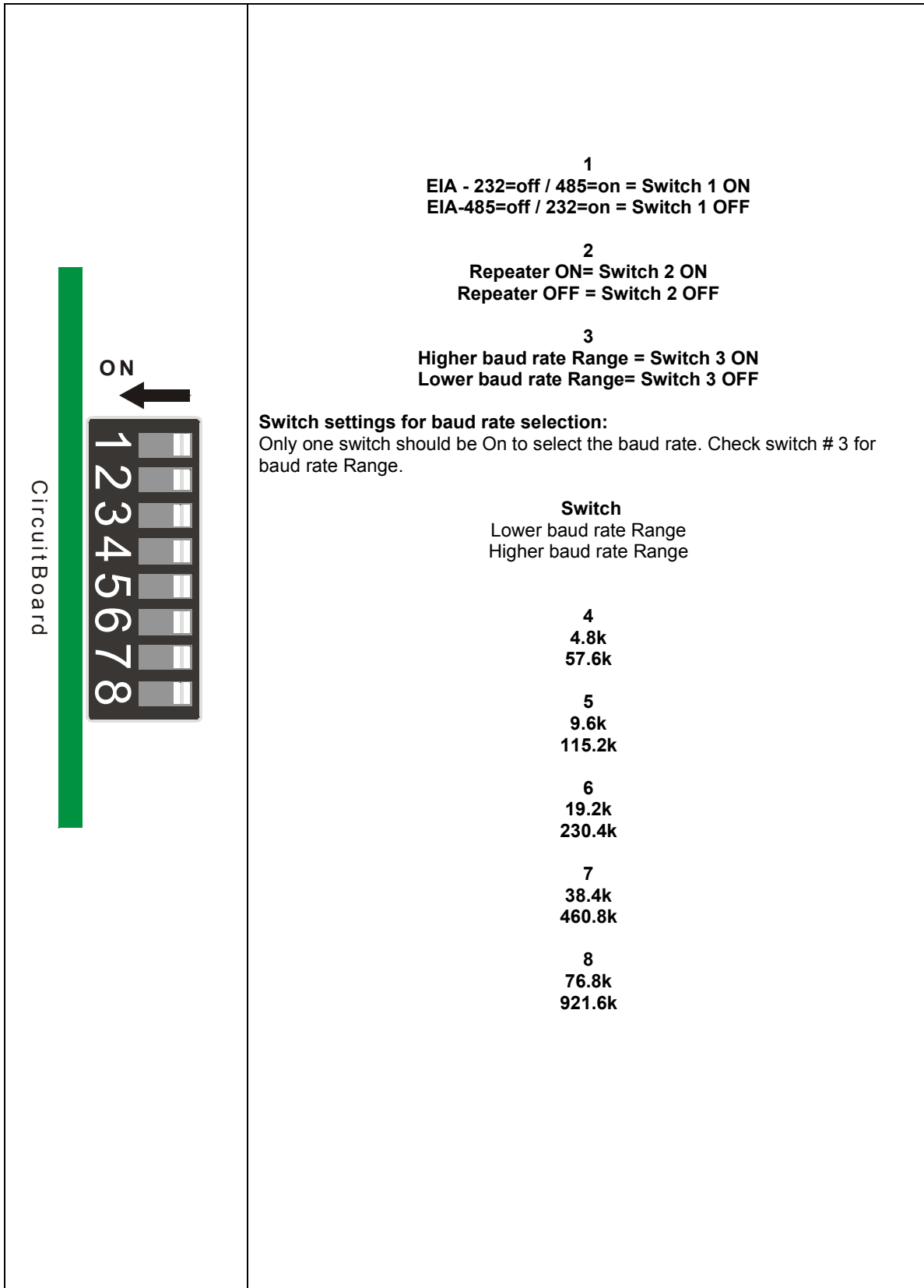


Figure 3. 69- Setting DIP Switches

Connecting in an External Source

Using this modem as a stand-alone device requires that the internal jumper (J1) be removed from the default position and placed into the “external PS” position. The circuit must be removed from the box to modify the jumper configuration!

Next connect an external power supply to terminal VDC +/- . The OPT-700 can work with a range of 12 to 30 Vdc and will drain a maximum current of 200mA.

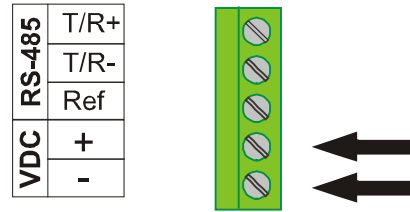


Figure 3.70 – Connecting an external source

Point to Point Operation

It is the simplest type of link. Configure each side of the link with the appropriate RS interface and Baud rate. Notice that the RS interfaces on both sides can be different and the baud rate on both sides need to match. In this case both units must have the Repeat Switch #2 OFF. See figure below.

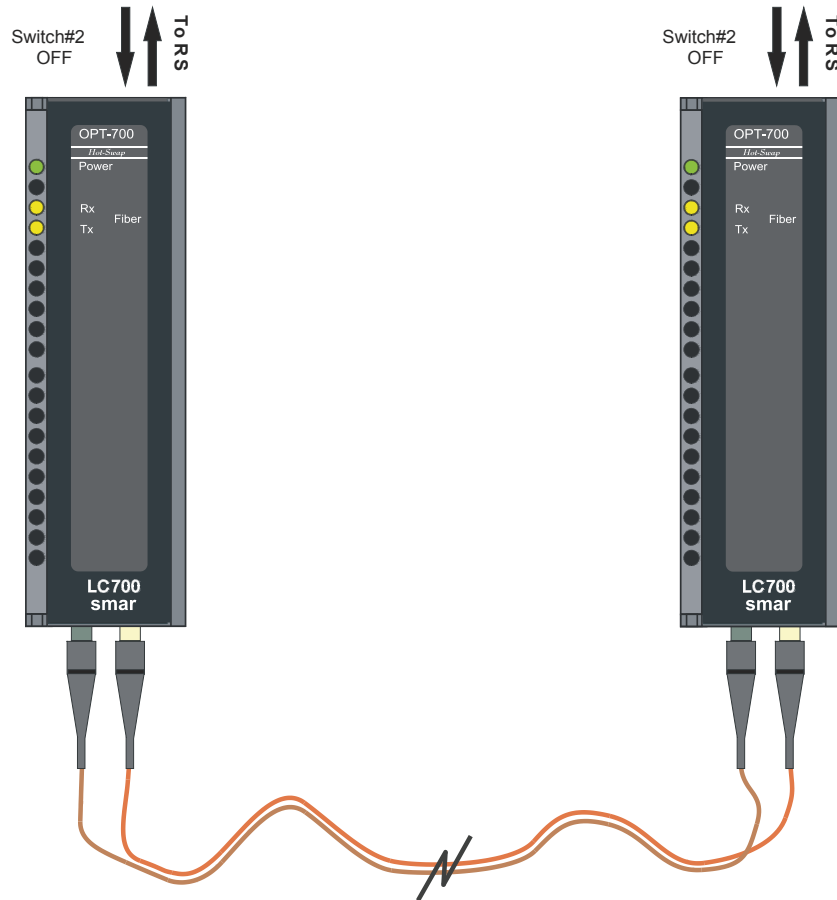


Figure 3.71 – Point to point operation

Multi-drop Operation

The OPT-700 can also be used for multiple drops by forming a ring configuration. In this way when a Master modem transmits the signal all of the Slave devices are able to receive the information.

The Master OPT-700 will be in the “Do Not Repeat” mode Switch#2 OFF while all SLAVES require Switch #2 set to the ON position (Repeat Mode.)

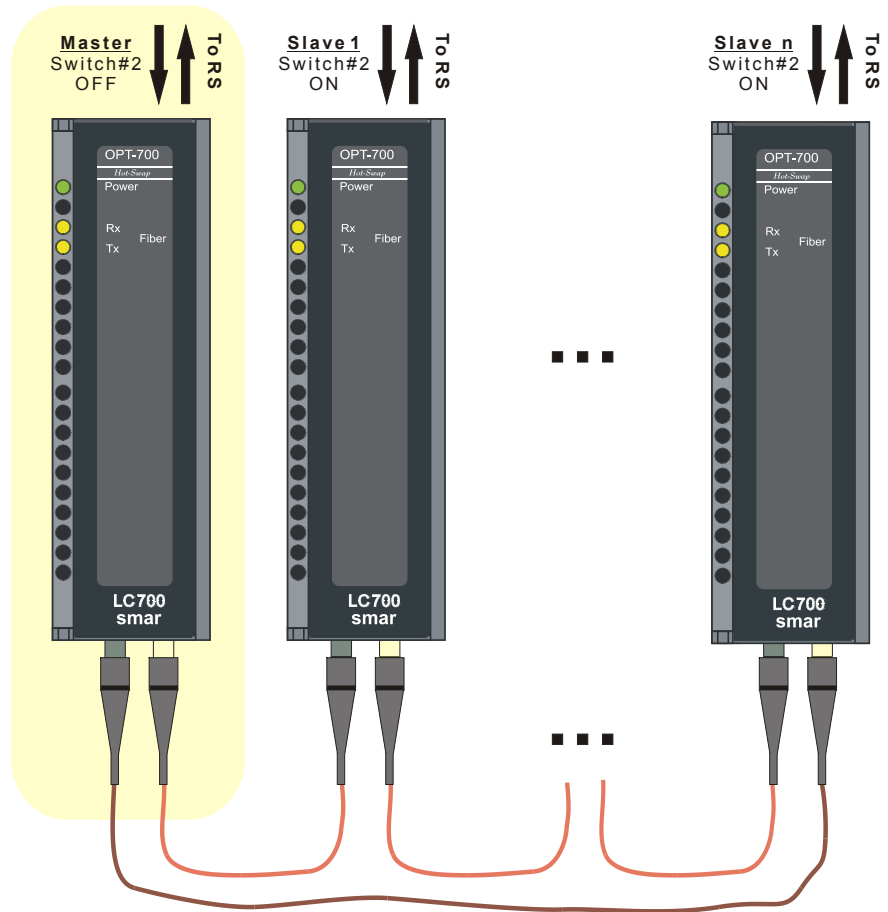


Figure 3.72 - Multi- Drop operation

RS-232 CONNECTOR

PIN	FUNCTION
1	Shield
2	Receives
3	Transmits
7	Ground (Reference Signal)

Technical Specifications

INTERNAL POWER	
IMB	5 Vdc
Power Consumption	1.9 W
Current Consumption	260 mA max.

EXTERNAL POWER	
Voltage Range	10 to 35Vdc
Current Consumption	80 mA @ 24 Vdc

OPTICAL TRANSMISSION	
Optical Transmission Line	62,5 or 50/125 μ m optical cable with ST connectors
Optical Wavelength	820 nm
Typical Maximum Fiber Length	4000 m (12000 ft)
Baud Rates	EIA-232, 2.4Kbps to 57Kbps EIA-485, 4.8Kbps to 920Kbps

COATING	
None (Special orders must consult the factory)	

LC700 Applications

The OPT-700 is a great solution for reliable long-distance communications with the Smar LC700 Universal Hybrid Controller.

It can be used in the following ways:

- MODBUS Point-to-point to a computer for Monitoring or Configuration. Computer is the Master and LC700 is the Slave.
- MODBUS Multi-drop. One computer connects to many LC700s and other MODBUS devices. Computer is the Master and all others are Slaves.
- Connect the LC700 CPU to the Remote I/O Interfaces. One RIO interface in point-to-point or more than one RIO in a multi-drop repeat optical loop.

TROUBLESHOOTING

Make sure that all of the connections are complete, and the power is ON. If power is not on then check the power source selection jumper that is located on the circuit board "J1".

While you are using the EIA-232 configuration, the EIA-485 should be disconnected and the switch # 1 should be in the off position. The repeater switch # 2 should be in the off position (except for OPT-700 connected to Slave devices in a multi-drop mode).

While you are using the EIA-485 configuration, the EIA-232 should be disconnected and the switch # 1 should be in the on position. For the multi-drop mode, the repeater switch#2 should be in the on position for all OPT-700 except the one attached to the Master device.

Make sure that all of the devices in the communication system are using the same baud rate.

All fiber cables should be connected, see point-to-point or multi-drop connection.

DF93 - Rack with 4 slots (with diagnostic)

Description

The DF93 rack is integral part of the new power system of LC700. Its features provide low voltage drop through the IMB bus, so it is more efficient. Besides, the diagnostics resources of DF93 help in the problems detection minimizing the time stop and maintenance. The diagnostic can be obtained observing the diagnostics LEDs.

The DF93 rack has Vcc and GND terminals at laterals (for power transmission). DF93's finishing avoids short circuits between the Vcc and GND connections at laterals.

As in the previous system, new racks can be added to the LC700 system according to the application needs. Up to 15 racks are allowed. The racks can be connected among them (expanding the bus) using flat cables (DF101 to DF107), DF90 (IMB power cable), and DF91 (lateral adapter).

Remember that the distance between the first module and the last module of a LC700 system, expanded by flat cables cannot exceed 22.97ft (7 meters).

NOTE

Each Rack has a rotating switch to select the address. The possible addresses are **0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F**. Note that the "F" address is not allowed. See Chapter 2 - LC700 Architecture.

There are restrictions related to the module location on the rack. The restrictions are as follows:

1. The first slot of rack 0 is always reserved for the power supply module.
2. The second slot of rack 0 is always reserved for the controller module.
3. All additional power supplies need to be placed in the slot 0 of the desired rack (jumper W1 in the rack must be cut and the DF90 cable from the previous racks must be disconnected before plugging the power supply).
4. The last rack must have a terminator installed – T-700 (right side) or DF96 (left side). For further details refer to Chapter 2.
5. Grounding terminals must be used. See the next figure.

Technical Specifications

DIMENSIONS AND WEIGHT	
Dimensions (W x H x D)	148.5 x 25 x 163 mm; (5.85 x 0.98 x 6.42 in.)
Weight	0.216 kg

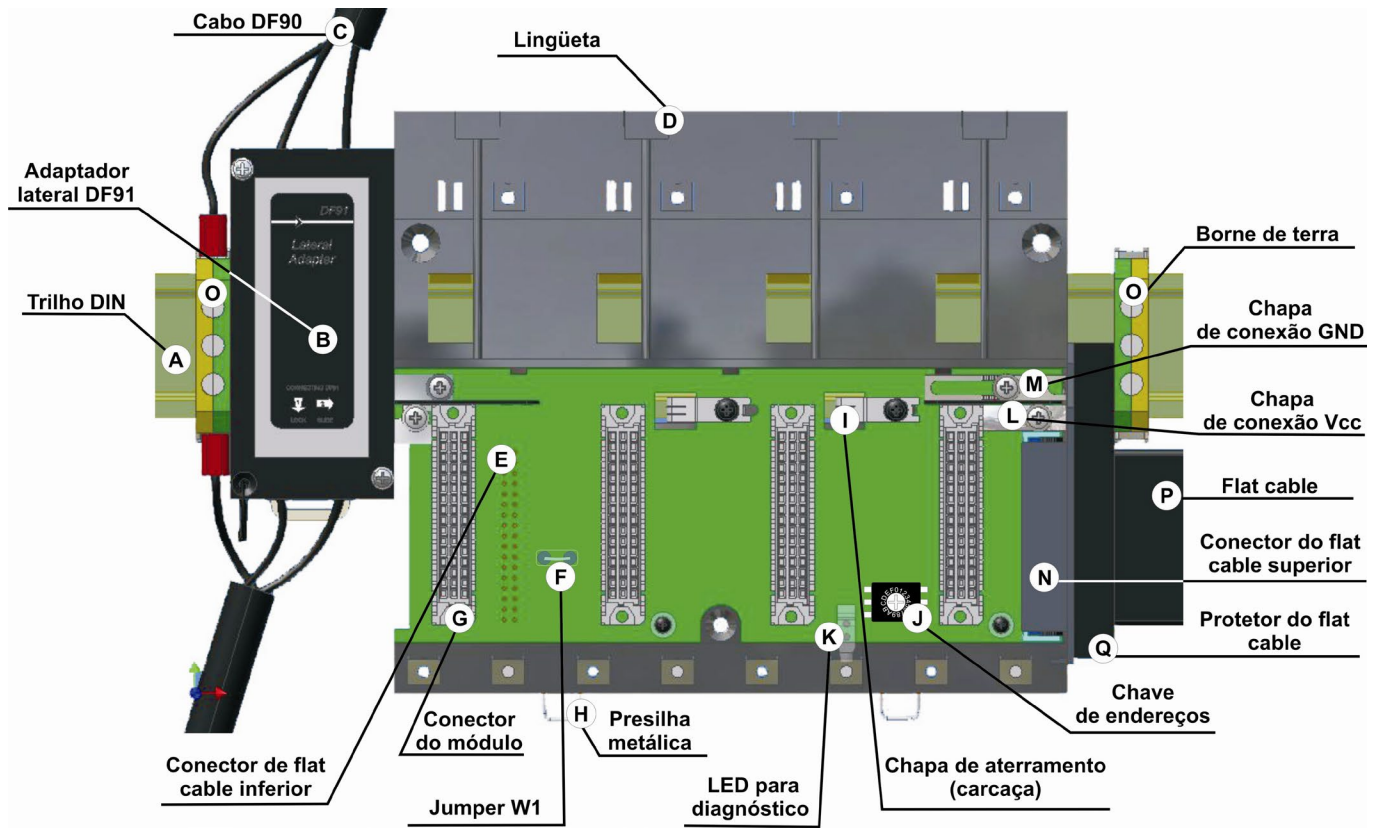


Figure 3.73 – Rack DF93

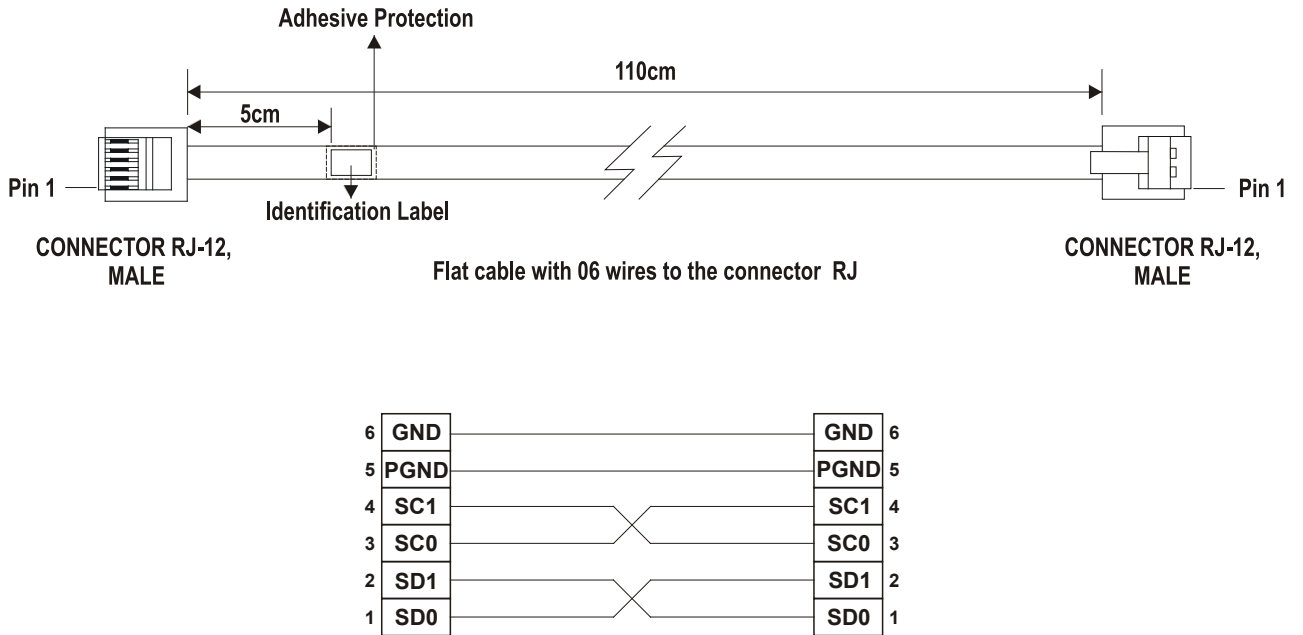
ICP-700-D3 – CABLE to connect Redundant CPUs

Part Number

ICP-700-D3 (Cable to connect redundant CPUs)

Description

To transfer the configuration from active CPU to passive CPU, it is necessary to use a special cable between these two CPUs. This cable is connected to the SSIO port of the redundant CPU. It has 4 wires to implement a full duplex channel which baud rate is 1.875 Mbits/second.



OBSERVATION: The cable colors can change.
The pin connection must be observed.

Figure 3.74– ICP-700-D3 Cable

C232-700 - EIA-232 Cable for CPU-700- X3* or FB-700

Part Number

C232-700 (Cable for CPU-700 or FB-700)

Description

The main purpose of this cable is to connect the CONF700 with the CPU700 Module for configuration and/or optimization of a LC700 system. It can also be used with the FB-700 Module to change the version of the internal firmware in the Flash Memory.

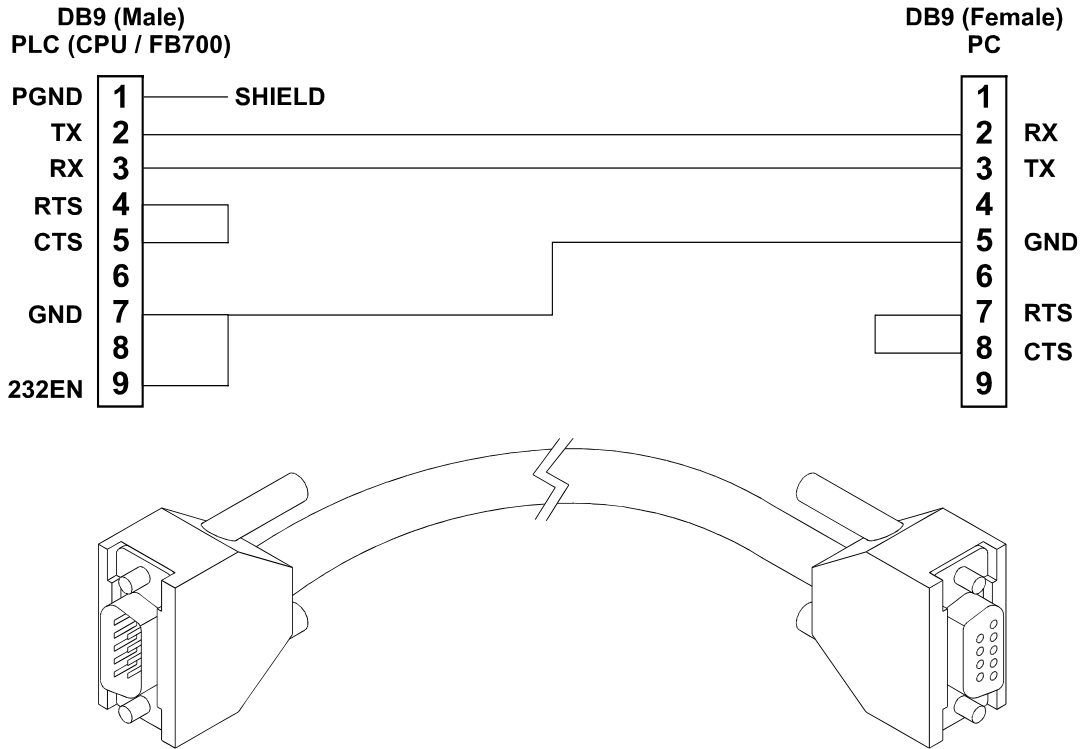


Figure 3.75 - EIA-232 Cable for CPU-700 or FB-700

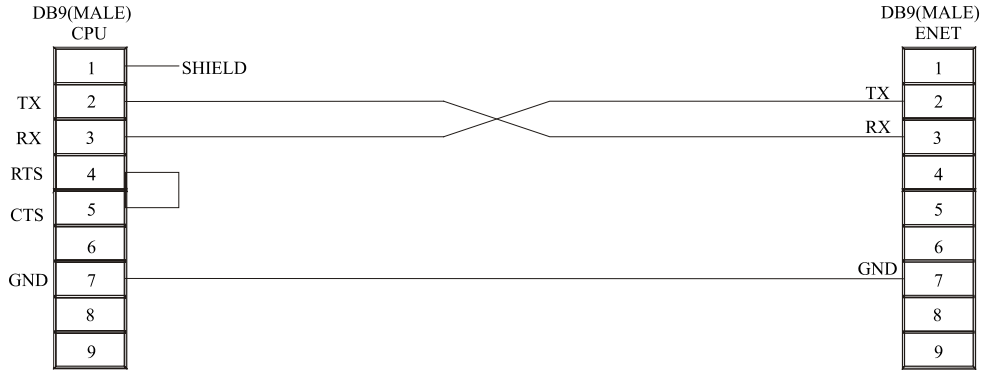
* X means D or E.

C232-1-700 - EIA-232 Cable to connect CPU-700- X3R* and ENET-700

Part Number

C232-1-700 (Cable to connect CPU-700 and ENET-700)

CABLE CONNECTION DIAGRAM



CABLE ASSEMBLING

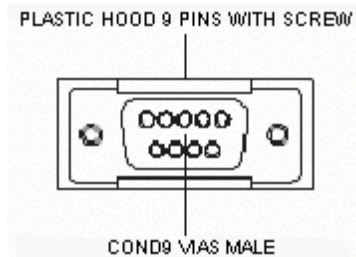
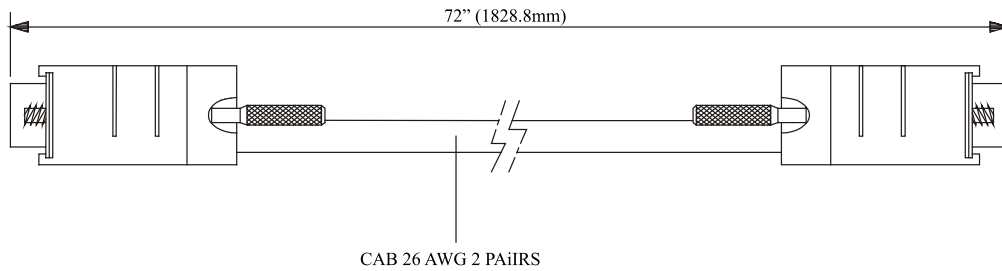
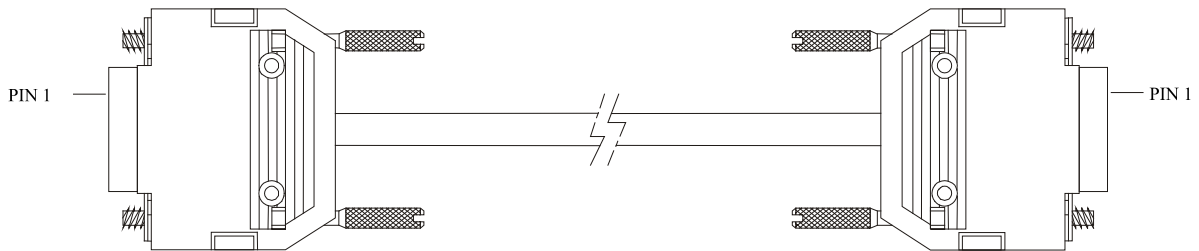


Figure 3.76 - EIA-232 Cable for CPU-700- X3R and ENET-700

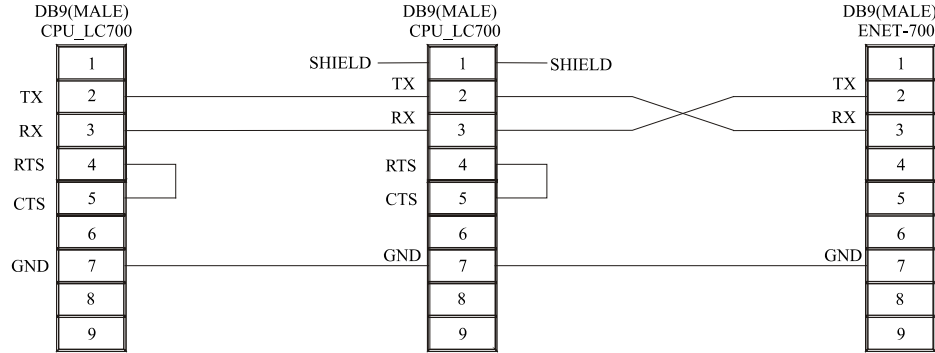
* X means D or E.

C232-2-700 - EIA-232 Cable to connect CPU-700-X3R* and ENET-700

Part Number

C232-2-700 (Cable for CPU-700 and ENET-700)

CABLE CONNECTION DIAGRAM



CABLE ASSEMBLING

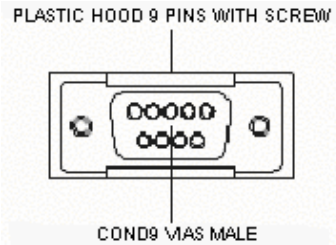
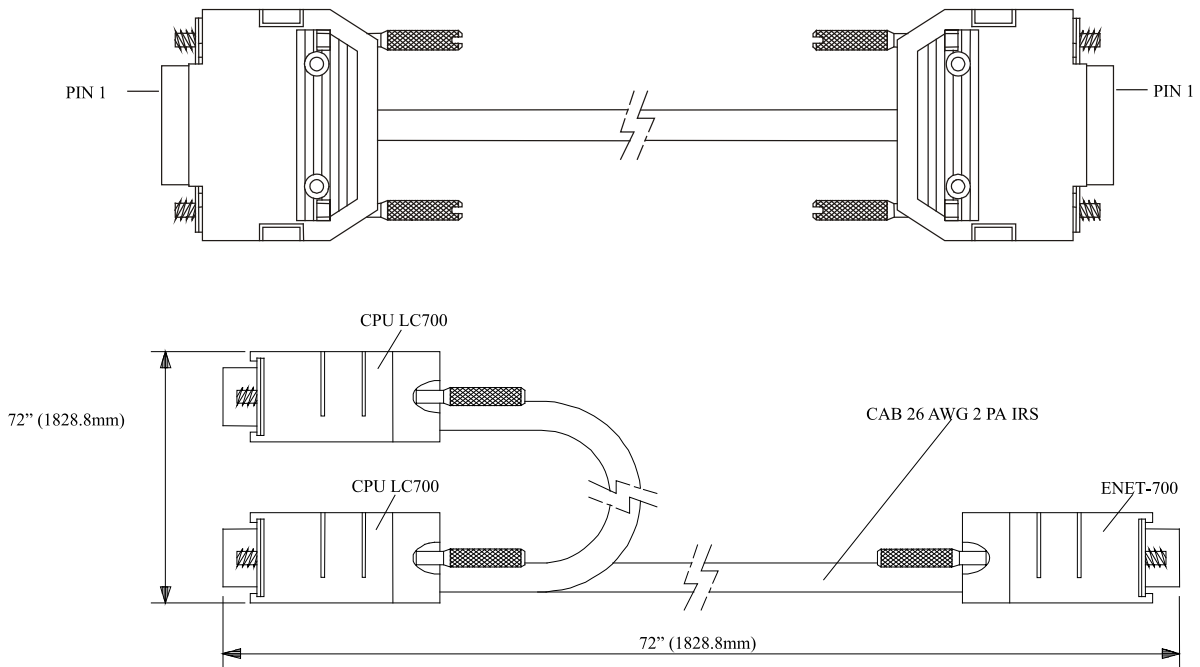


Figure 3.77- EIA-232 Cable for CPU-700- X3R and ENET-700

* X means D or E.

C232-3-700 - EIA -232 Cable to connect CPU-700-X3* and MB-700

Part Number

C232-3-700 (Cable to connect CPU-700 and MB-700)

Cables Connection Diagram

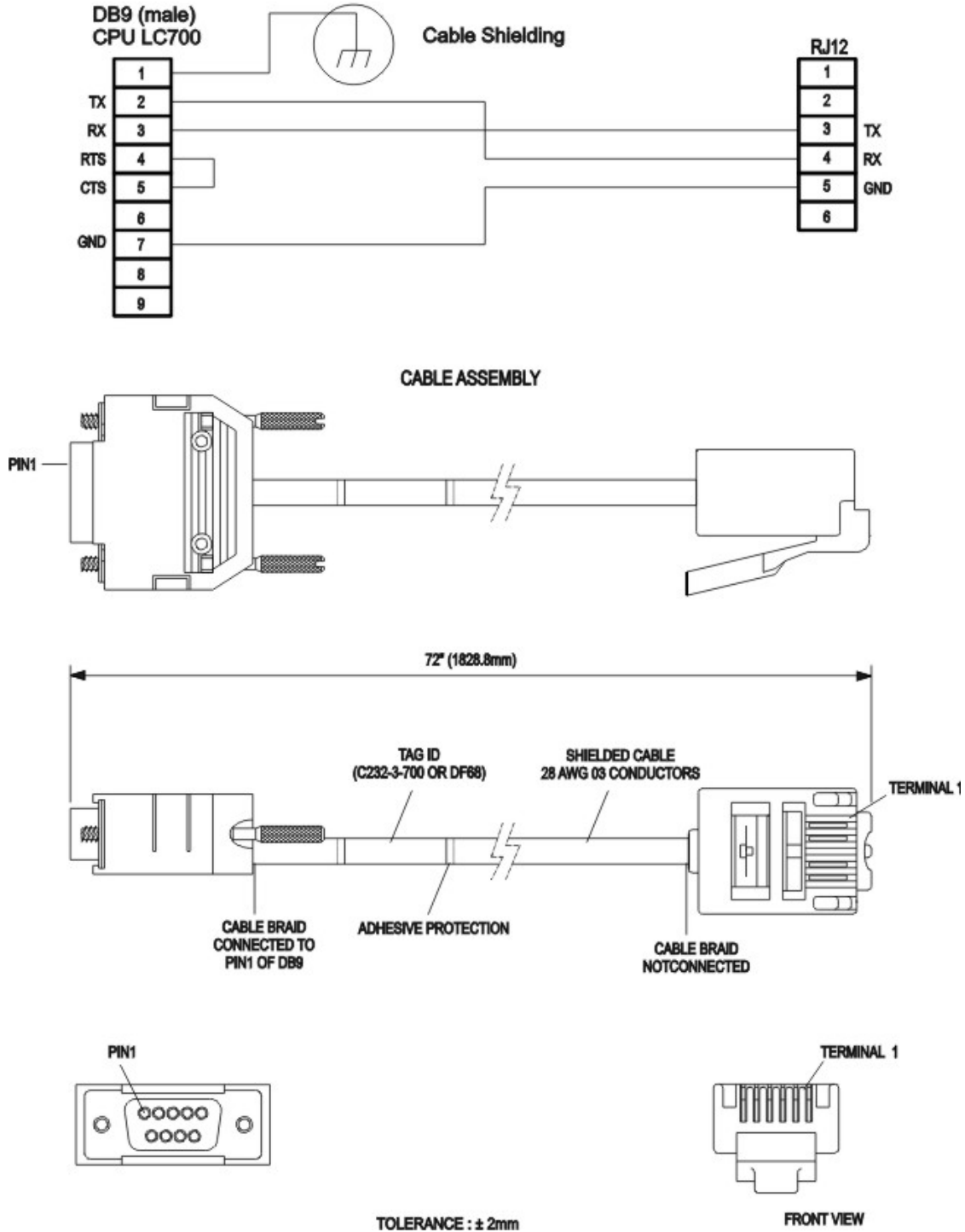


Figure 3.78 - EIA-232 Cable for CPU-700- X3 and MB-700

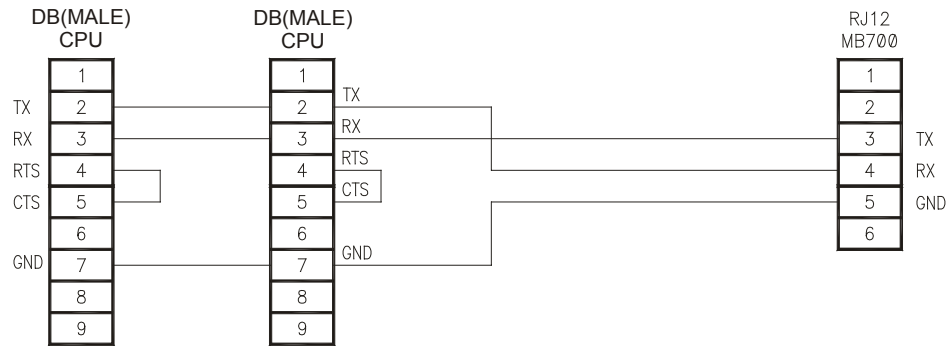
* X means D or E.

C232-4-700 - EIA -232 Cable to connect CPU-700-X3R* and MB-700

Part Number

C232-4-700 (Cable to connect CPU-700R and MB-700)

CABLE CONNECTION DIAGRAM



CABLE ASSEMBLY

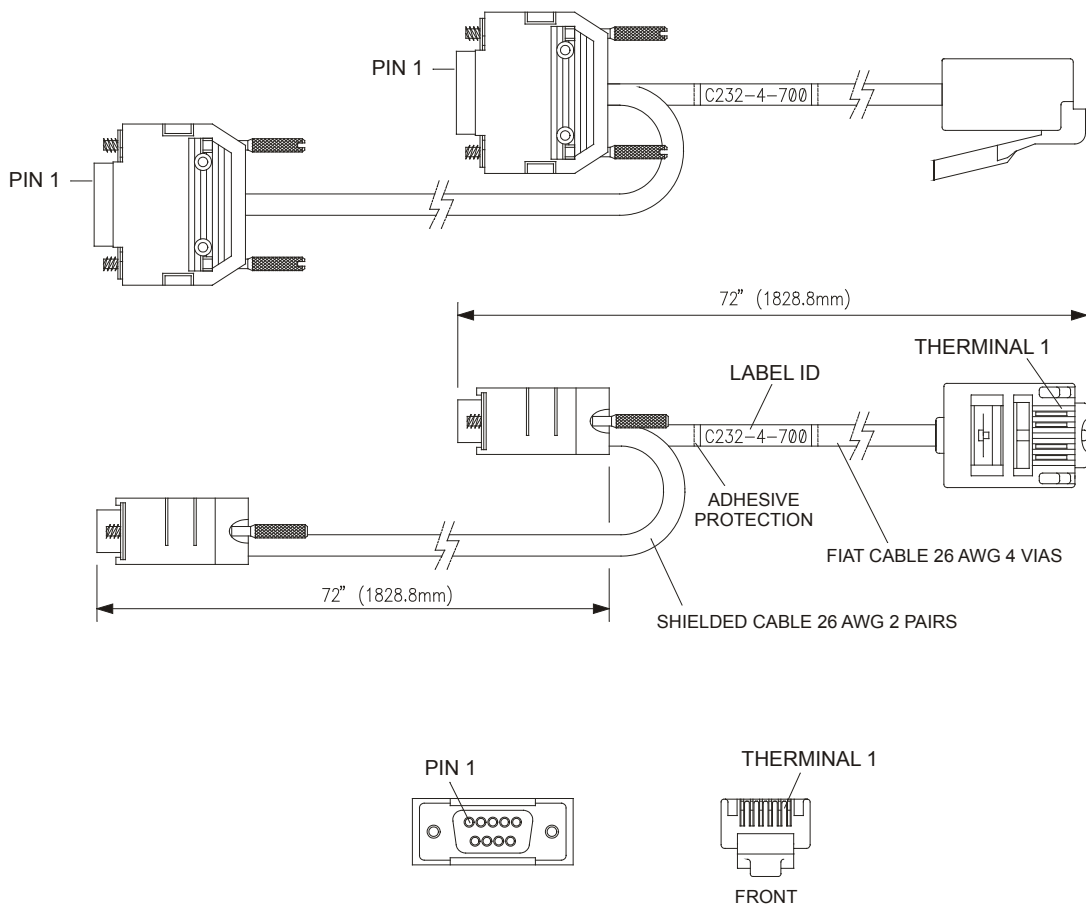


Figure 3.79 - EIA-232 Cable for CPU-700- X3R and MB-700

* X means D or E.

DB9-EXT - EXTENSION for DB9 connector

Part Number

DB9-EXT (Extension for DB9 Connector)

CABLE ASSEMBLING

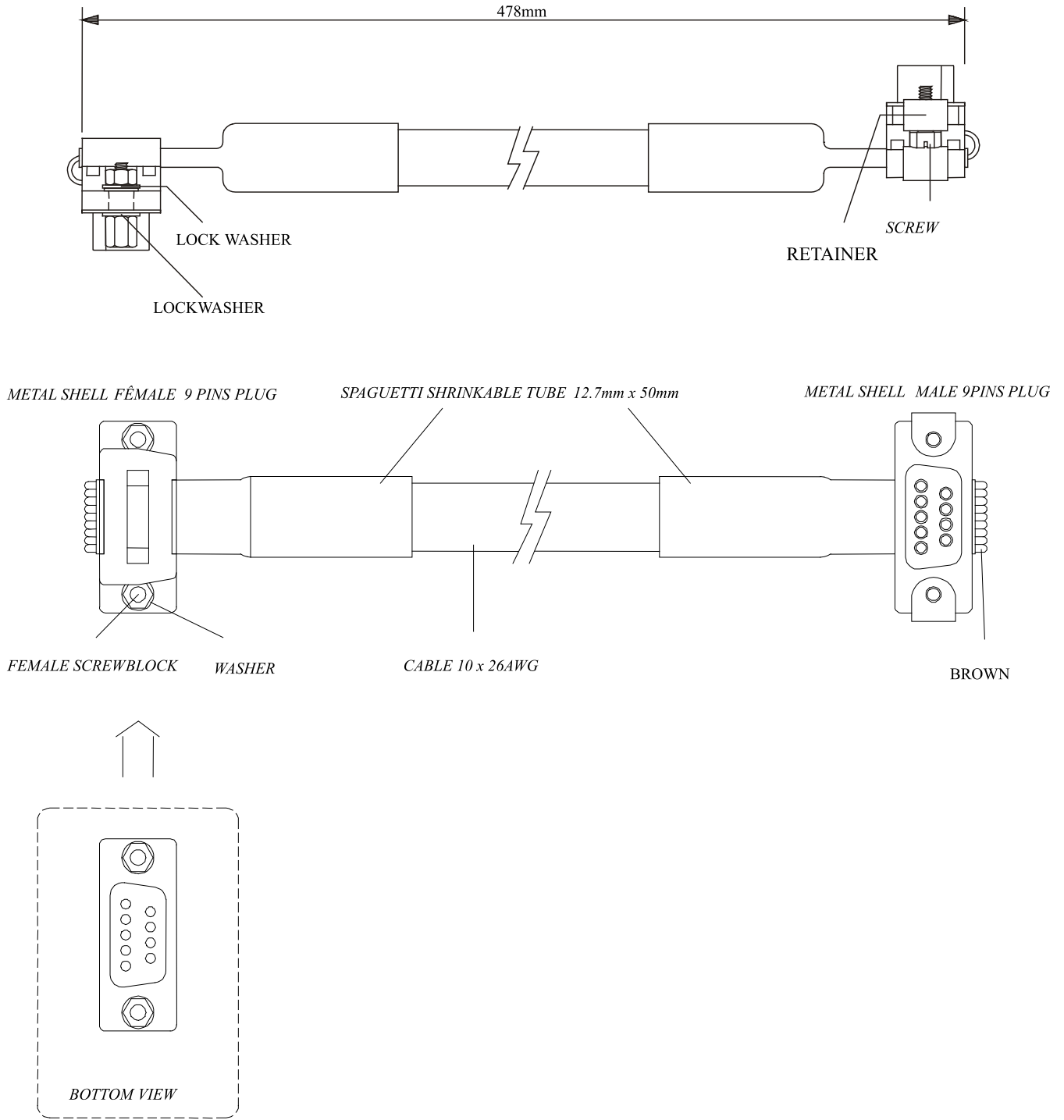


Figure 3.80 – Extensor for DB9 Connector

Cables for Racks Interconnection and Power Distribution

Depending on the rack model different types of cables are necessary to interconnect racks and for power distribution throughout the IMB bus. In the following table are the available cable types.

System based on DF93	
Code	Description
DF90	IMB power cable
DF101	Shielded flat cable to connect racks by left side – length 70 cm
DF102	Shielded flat cable to connect racks by right side – length 65 cm
DF103	Shielded flat cable to connect racks by right side – length 81 cm
DF104	Shielded flat cable to connect racks by right side – length 98 cm
DF105	Shielded flat cable to connect racks by right side – length 115 cm

For further details about the correct cable installation, please, refer to Chapter 2.

Expansion flat cables for systems based on DF93

These flat cables are used when the LC700 is expanded in more than one row of racks (DF93), i.e., in different DIN rail segments, one below the other. To ground the flat cables' shield, use ground terminals next to the connections among flat cables and racks.

- DF101 - Flat cable to connect racks by left side**
 The DF101 is installed on the rear connectors of the left extremity rack of each row of racks, interconnecting the rows 2-3, 4-5 and 6-7 (if they exist). The available terminal next to each DF91 can be used for grounding.
- DF102, DF103, DF104 and DF105 - Flat cable to connect racks by right side**
 They are installed on the upper connectors of the right extremity rack of each row of racks, interconnecting the rows 1-2, 3-4 and 5-6 (if they exist). See the Installing section.

Flat cables protector (connector cap)

To meet the EMC requirements an ESD protector has to be installed on the flat cables connection, at right. In the following figure a flat cable protector is shown when it is being installed on the cable connector.

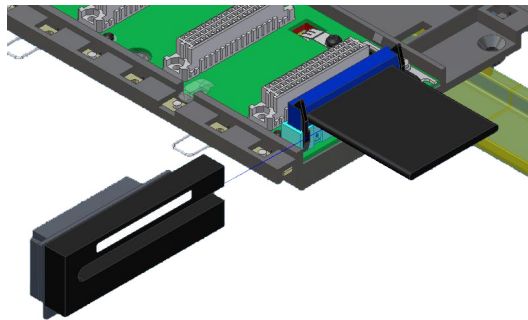


Figure 3.81 - Installing the flat cables protector

The following figure shows the flat cable protector installed.

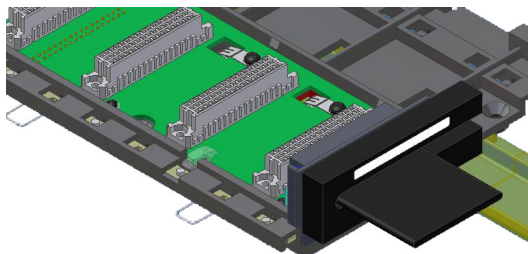


Figure 3.82 - Flat cable protector installed

DF90 cable

The power expansion has to be used when the LC700 is expanded in more than one row of racks, i.e., in different DIN rail segments, one below the other. The DF90 is the IMB power transmission cable. Its features provide low voltage drop and protection against electromagnetic interference.

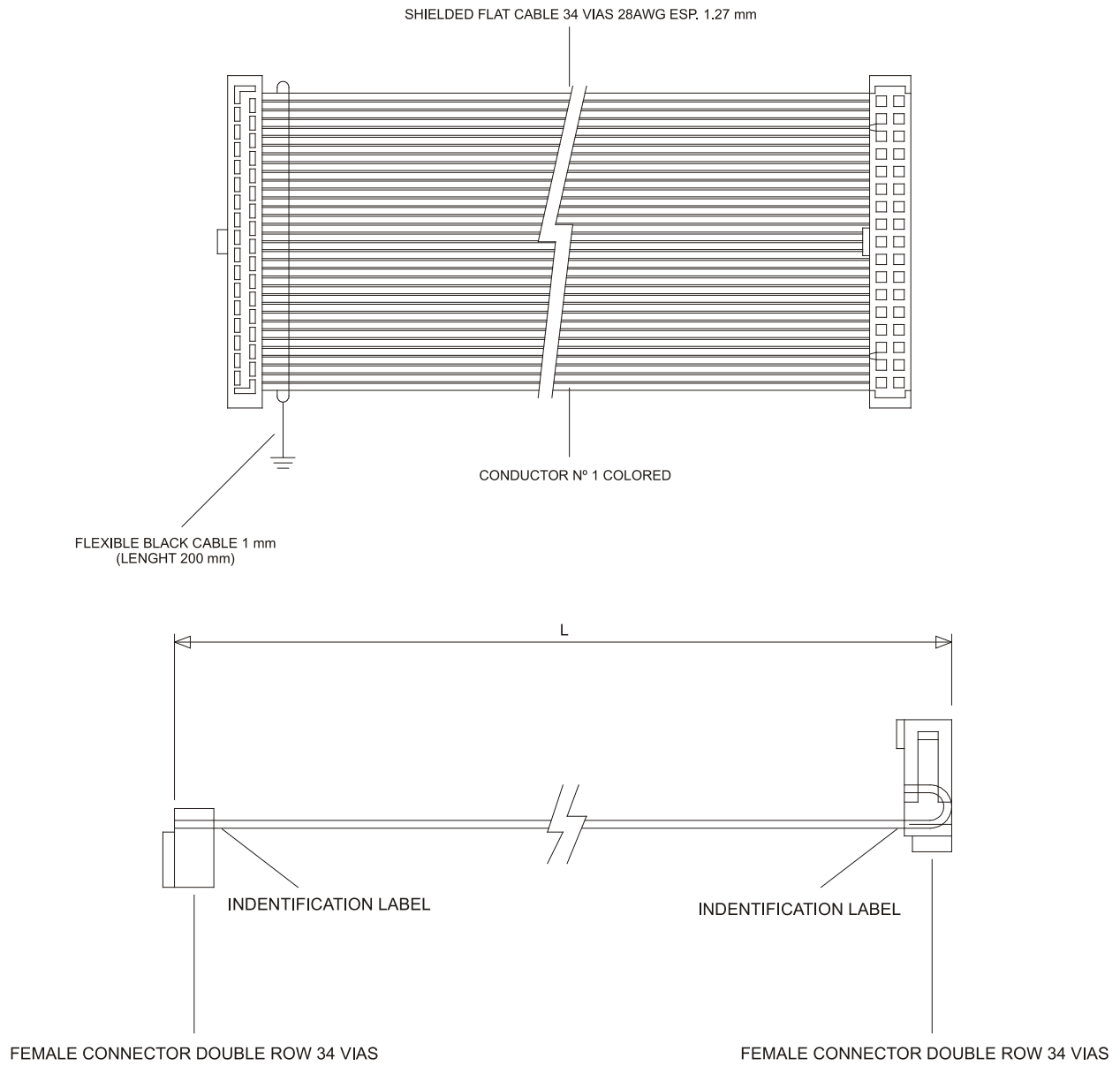
The cable DF90 must be connected only through DF91. It cannot be directly installed in the racks, because it can damage the racks. For further details, see Chapter 2.



Figure 3.83 - IMB power cable (DF90)

Shielded Flat cable

<i>R-700-4A System Base</i>	
Code	Description
FC-700-1A	Flat cable to connect 2 racks – length 65 cm
FC-700-2A	Flat cable to connect 2 racks – length 81,5 cm
FC-700-3A	Flat cable to connect 2 racks – length 98 cm
FC-700-4A	Flat cable to connect 2 racks – length 110 cm



MODEL	LENGHT " L "	FLAT CABLE	TOLERANCE	
DF4A	FC-700-1A	25.62" (651 mm)	25.90" (658 mm)	+10-0 mm
DF5A	FC-700-2A	32.04" (814 mm)	32.32" (821 mm)	+10-0 mm
DF6A	FC-700-3A	38.46" (977 mm)	38.74" (984 mm)	+10-0 mm
DF7A	FC-700-4A	44.88" (1140 mm)	45.15" (1147 mm)	+10-0 mm

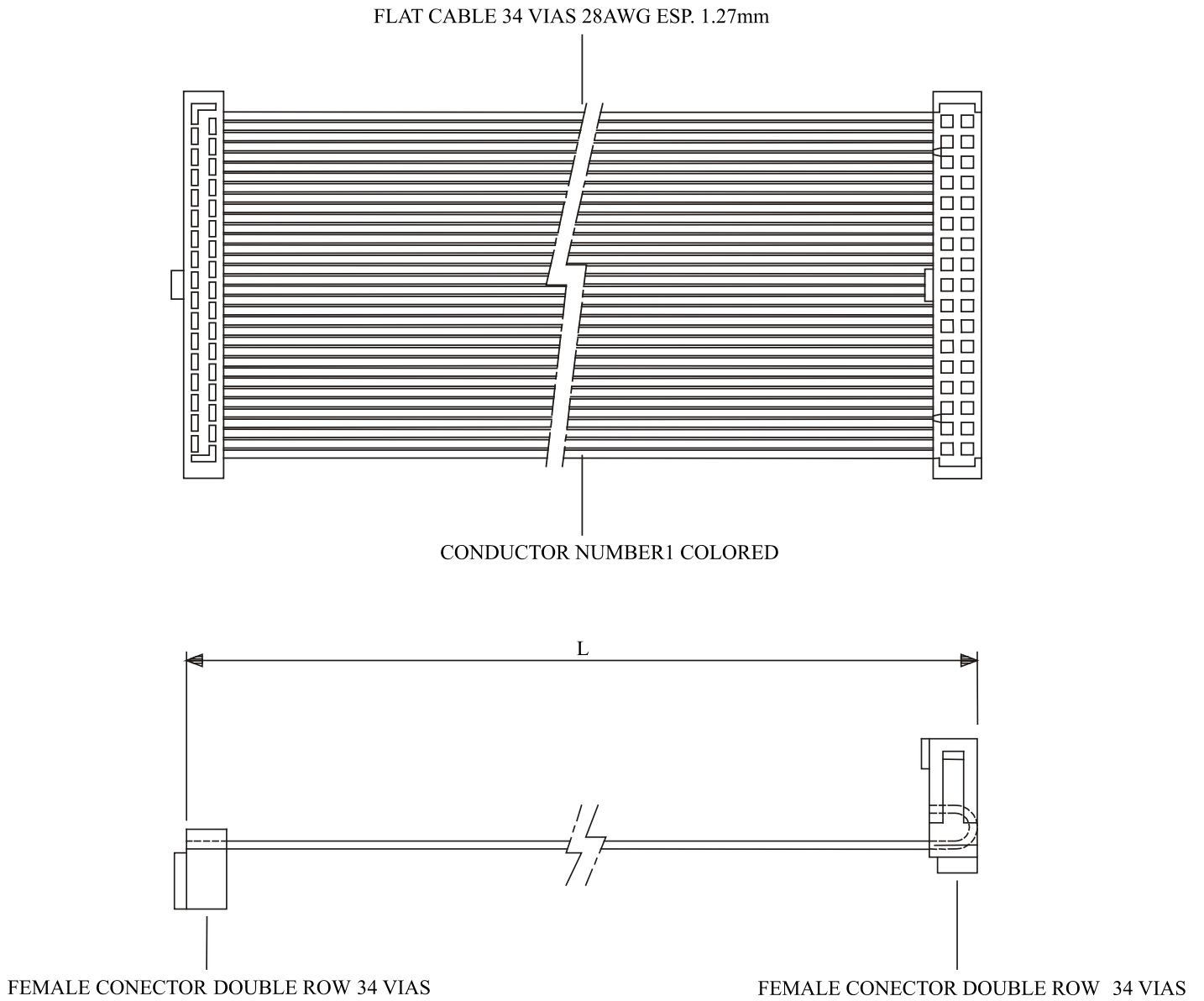
Figure 3.84 – Shielded Flat cable to connect Two Racks



Figure 3.85 - Example of shielded flat cable to connect two racks

Shielded Flat Cable

<i>R-700-4A System Base</i>	
Code	Description
FC-700-0	Flat cable to connect 2 racks – length 6.5 cm
FC-700-1	Flat cable to connect 2 racks – length 65.0 cm
FC-700-2	Flat cable to connect 2 racks – length 81.5 cm
FC-700-3	Flat cable to connect 2 racks – length 98.0 cm
FC-700-4	Flat cable to connect 2 racks – length 114.0 cm



MODEL		LENGHT "L"	FLAT CABLE	TOLERANCE
DF3	FC-700-0	2.56" (65mm)	2.87" (73mm)	+ 2 - 0mm
DF4	FC-700-1	25.62" (651mm)	25.90" (658mm)	+ 10 - 0mm
DF5	FC-700-2	32.04" (814mm)	32.32" (821mm)	+ 10 - 0mm
DF6	FC-700-3	38.46" (977mm)	38.74" (984mm)	+ 10 - 0mm
DF7	FC-700-4	44.88" (1140mm)	45,15" (1147mm)	+ 10 - 0mm

Figure 3. 86 – Flat cable to connect Two Racks

T-700 - IMB terminator for right side

Part Number

T-700 (IMB Terminator for the Last Rack)

Description

The Rack Terminator must be always used in the last rack in order to do the correct impedance matching of the IMB signals.



Figure 3.87 – T-700 (Rack Terminator)

NOTE

For further details about its installation refer to T-700, Chapter 2.

DF96 – IMB terminator for left side

Part Number

DF96 (IMB terminator for left side)

Description

It is connected to connector E of the last rack, when it is connected to the others by the right side. See the next figure.

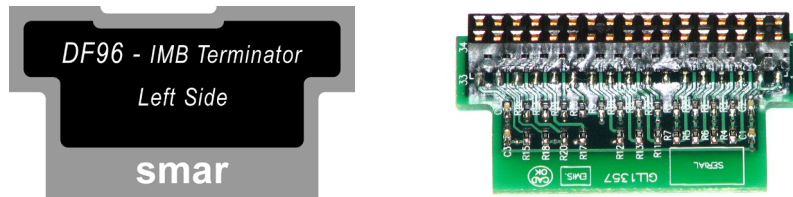


Figure 3.88 - DF96 terminator

NOTE

For further details about its installation refer to DF96, Chapter 2.

INSTALLATION MANUAL

The objective of this Chapter is to provide the **General Procedures for the Installation of Systems of Industrial Automation Smar**, including Programmable Controllers, I/O Modules, Interface Terminals with the Operator and Communication Networks.

This document is organized in the following sections:

- Considerations about the conductor and conduit layouts;
- Conductor Category;
- Conductor positioning;
- Panel layout and rack assembly;
- Assembling and connecting the rack;
- Racks' positioning in the panel;
- Installation of posts in the rails for fixation and modules' safety inside the panel;
- Connection and grounding;
- Power Distribution;
- Summary of the basic rules for assembling panels.

These procedures should be used as a help tool to avoid Electromagnetic Interferences (EMI) and transients that may cause problems in the automation system.

NOTE

1. These procedures do not substitute the local electric codes.
2. Although these rules apply to most installations some electrically severe environment may need additional precautions.
3. Recommendations to avoid problems with Electrostatic Discharge (ESD):
 - Discharge the electrostatic charge found in the body before handling the electronic circuit to avoid electrostatic discharge, which can damage the equipment;
 - Keep the modules' ports closed when in operation;
 - The maintenance of the equipment, when powered, should only be done by trained technicians.

Considerations about the layout of the conductors and conduits

The conductors layout match with the different types of I/O modules positioned in the rack. For that reason, the user should first determine the location of the I/O modules for setting the cables direction.

However, when planning your I/O-module placement, segregate the modules based upon the conductor categories. Also, all conductors (ac or dc) in the same raceway must be insulated for the highest voltage applied to any one of the conductors in the raceway.

Conductors Category

Aggroup the wires and cables complied with the three following categories (Table 4.1). You should refer to the specification of each I/O module to classify the individual category of the conductors for each I/O line.

Aggroup the cables that fit in this description	Categories	Examples
<p>Control and AC Power Supply High Power Cables which are more resistant to electric noises than conductors of the Category 2. They can, also, generate more noise to be induced in the adjacent cables.</p>	Category 1	<ul style="list-style-type: none"> - AC Power lines for power supplies and I/O circuits; - AC high power digital I/O lines - to connect AC I/O modules, classified for high power and high noise immunity; - DC digital I/O high power lines - to connect DC I/O modules classified for high power or input circuits with filters with a big time constant, for high rejection to noise. Typically for connection with dry contact key, relay and solenoid valve.
<p>Sign & Communication Low power cables which are less resistant to electric noises than Category 1 cables. They should also generate less noise that may be induced in the adjacent cables (they are connected to sensors and actuators relatively close to the I/O modules).</p>	Category 2	<ul style="list-style-type: none"> - Analog I/O lines and DC power lines for analog circuits; - AC/DC low power lines of digital I/O to connect I/O modules that are classified for low power, such as output modules of low power; - DC Digital I/O lines for low power: they are used to connect DC I/O modules classified for low power. They have input circuits with filters of low time constant to detect pulses. They typically are connected to equipments similar to keys, photoelectric sensors and codifiers; - Communication cables - for connection among CPUs or for communication interface modules, programming terminals, computers, etc.
<p>Inside the Panel They interconnect the components of the system inside the panel.</p>	Category 3	<ul style="list-style-type: none"> - DC power cables for low power: power cables for Rack; - Communication cables: cables for connection of system components inside the same panel, ICP-700-D3, Flat Cable.

Table 6.1 – Cables Categories

Conductors Positioning

To reduce the transference of conductor noises from one another, maintain the electrically noisy wire, as AC power cables and digital outputs cables physically separated from the lines of low level, as cables of analog inputs and outputs or communication cables. Follow these procedures (Table 4.2) when positioning wires and cables (inside or outside of a panel).

NOTE
<p>These procedures are only for noise immunity. Follow the local standards for safety requirements.</p>

Category	Category According to these Procedures
Category 1	<ul style="list-style-type: none"> - These conductors can be placed in the same duct or conduit with the power conductors of machines up to 600Vac (feeding equipments up to 100 hp).
Category 2	<ul style="list-style-type: none"> - If these conductors need to cross the power lines, this should be done at right angles. - Keep them far, at least, 5 ft (1.5m) from high tension panels or RF radiation sources / microwaves. - If the conductor is in a metal duct or conduit, each segment must be connected to the adjacent segment, so that it has continuity along its length, and must be connected at the panel input point. - Appropriate shield (where applicable) and direct it in a duct separate from the conductors of category 1. - If it is in a adjacent metal duct or conduit, keep it at least 0.08m (3 in) away from the conductors of the category 1 of less than 20A; 0,15m (6 in) of AC power lines with 20A or above, but up to 100 kVA and 0.3m (1 ft) of AC power lines larger than 100 kVA. - If it is not in a continuous duct or conduit, keep it at least 0.15m (6 in) away from conductors of the category 1 of less than 20A; 0.3m (1 ft) of AC power lines 20A or above, but only up to 100 kVA and 0.6m (2 ft) of AC power lines larger than 100 kVA.
Category 3	<ul style="list-style-type: none"> - Direct the conductors in ducts separated from the category 1 conductors with the same striped spacing as the category 2 conductors, where it is possible.

Table 4.2 – Procedures for Positioning the Cables from Noise Protection

IMPORTANT
<p>These procedures presuppose that the user will follow the procedures for Surge-suppression guide lines (Chapter 3 starting on page 3.70). Although these rules apply to most installations, some electrically severe environments may need additional precautions.</p>

The uses of the procedures on Table 4.2 are illustrated on Figure 4.1.

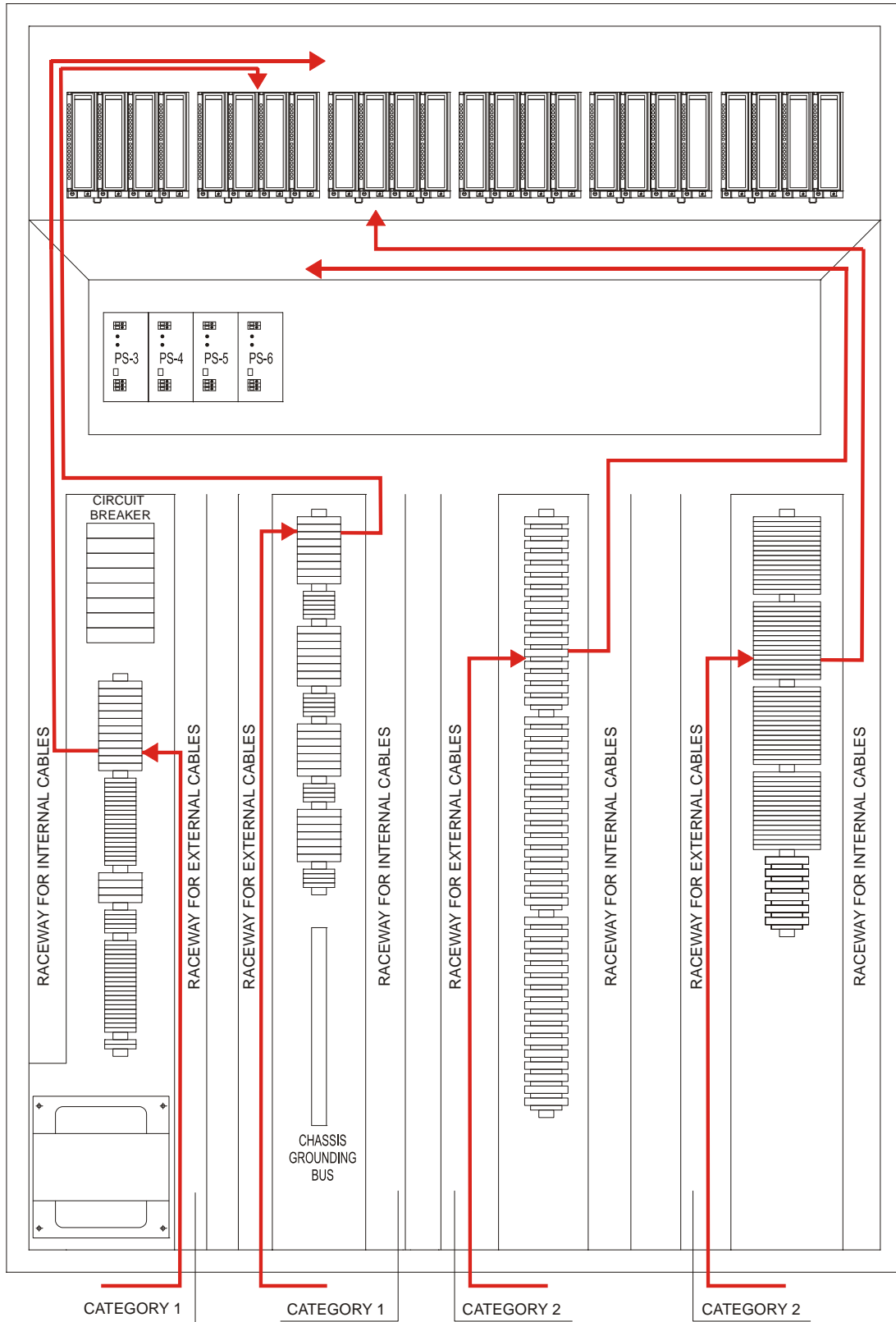


Figure 4.1 – Assembling Details

Panel layout and Rack assembly

It is important to project the panel correctly to assure that the environmental and electric characteristics are suitable to all equipments installed inside the panel. The system installation should comply with all standards, whether electric or operational, to guarantee the good performance of the system. See in the following figure the instructions for rack assembling.

Assembling and connecting the Rack

See in the Chapter 2: LC700 ARCHITECTURE.

Rack positioning in the panel

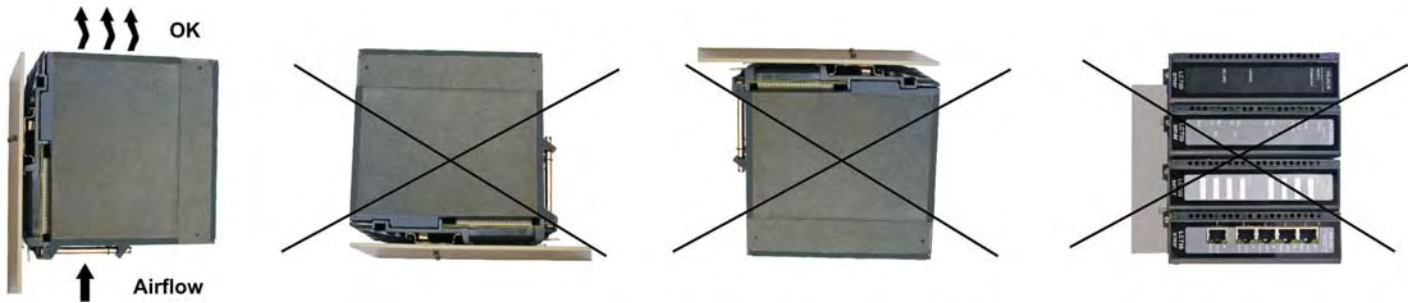


Figure 4.2 – Right Position for Rack Assembling

1. Assemble the racks in horizontal position, to guarantee the air flow for module ventilation;
2. To avoid problems (racks movement on the rail) due to vibration in the panel, at each extremity you should use a fixation connector).
3. Keep an appropriate distance among the racks and the panel's walls guaranteeing appropriate module refrigeration.

Installation of posts in the rails for fixation and modules' safety inside the panel

This process is extremely necessary, because it will protect the Racks in the panel from vibration that usually occurs in plants and provokes their displacement, causing damages to the system.



Figure 4.3 – Final Post that Holds the Racks on the Rail

Connection and Grounding

After establishing the whole layout, the user can begin the assembly, connection and grounding of each chassis. The connection is the links of the chassis' metallic parts, assembly parts, frames, shield and panel, to reduce the EMI effects and grounding noise. Grounding is the connection to the grounding-electrode system to place equipment at earth ground potential.

All equipments powered with AC load should be grounded on the BTC Ground Bar and all analog and digital equipments should be grounded in the BTA Ground Bar. See figure below that shows the connections of BTA and BTC to the plant's ground mesh.

IMPORTANT

For total system's safety the BTA and BTC bar should be grounded.

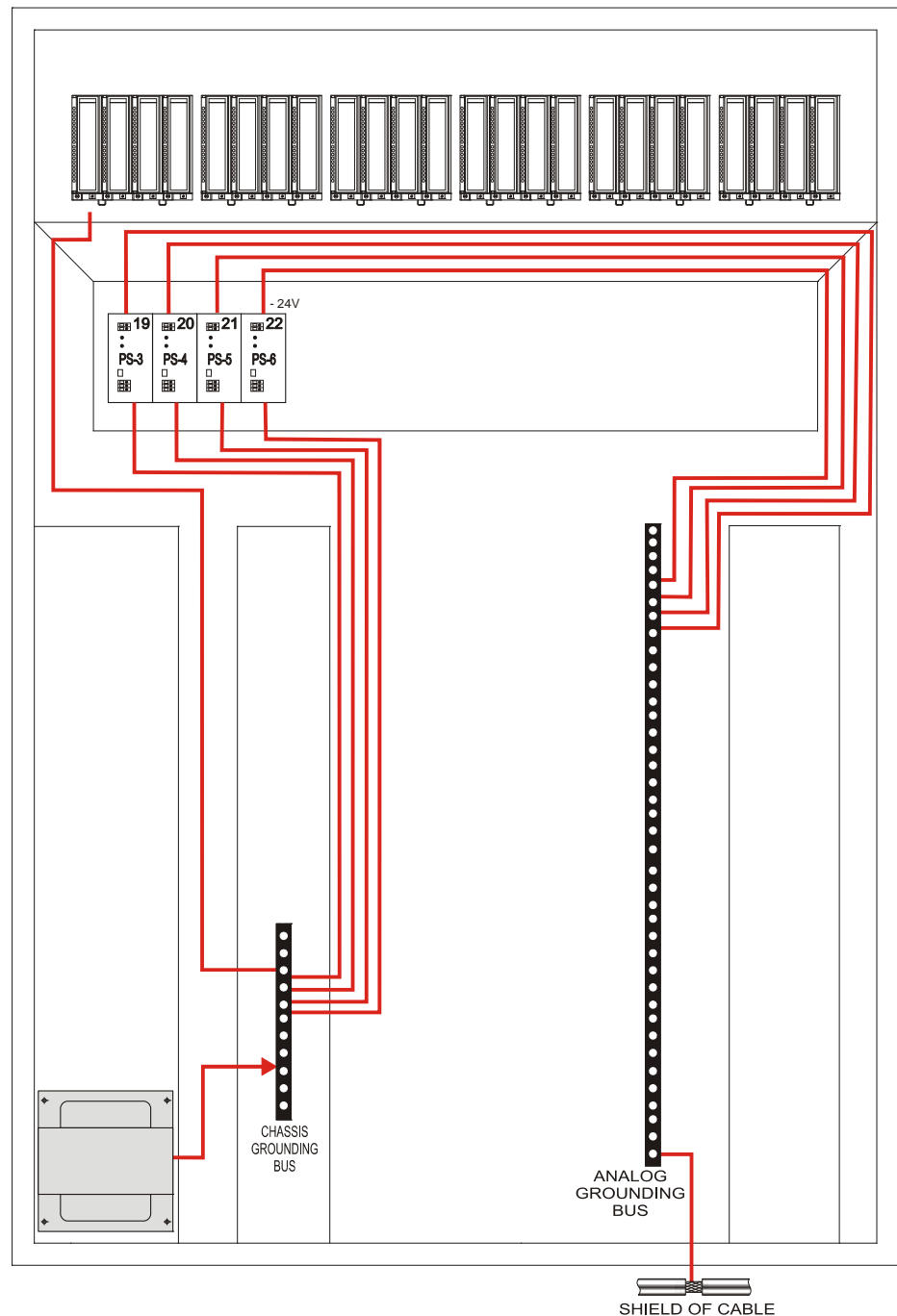


Figure 4.4 – Typical Grounding Configuration

Most of the modules do not have visible chassis grounding, nor a connector or a ground terminal, but they are mounted in the rack, on the DIN rail. The chassis of these modules are grounded by the DIN rail, through the rear ground spring. In this DIN rail, put a ground connector and connect it to the BTC ground bar through an individual conductor.

BTC - Housing Ground Bar

The BTC potential is the ground reference for every AC electric part of the equipments inside the panel. Connect the BTC to the plant's ground mesh using a copper conductor with 8 AWG specification, at least, for protection against EMI.

BTA - Analog Ground Bar

The BTA potential is the ground reference for every analog and digital part of the equipments inside the panel. Connect the BTA to the grounding-electrode system using a copper conductor with 8 AWG specification, at least, for protection against EMI.

Shielded Cables

Some I/O connections, as analog signals, communication, pulse inputs, need shielded cables to help reduce the effects of electric coupling.

- Each shield must be grounded in only single point. A shield grounded at both ends forms a ground loop which can cause a system to fault;
- Connect each shield directly on the Analog Ground Bar (BTA);
- Use twisted pair cable.

Avoid interruption of the shield in the junction boxes. Many types of connections of shielded conductors are available by several manufacturers. If the user needs to interrupt the shield in a junction box, proceed as follows:

- Connect only Category 2 conductors in the junction box.
- Do not remove the shield protection more than the necessary to do the connection.
- Connect the shields of the two cable segments guaranteeing the continuity along the cable length.

Energy Distribution

To isolate the plant's noises, the user can use an isolation transformer to connect the power supply. The transformer provides DC isolation and protects the equipment against high voltage transient that can be generated by the energy distribution system.

In many industrial applications a step-down transformer is already necessary to reduce the voltage to 120 or 220 VCA.

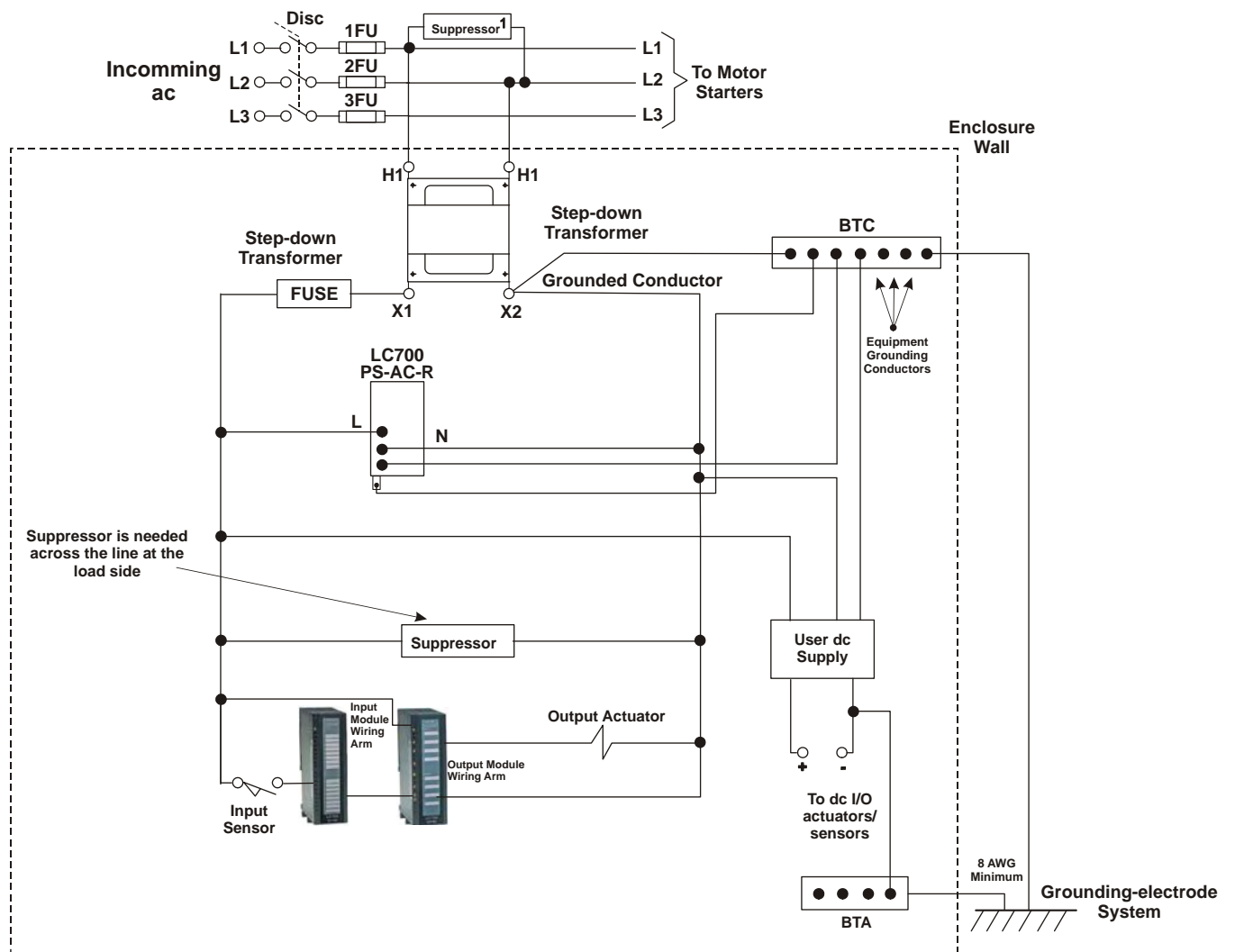


Figure 4.5 – Grounded AC Energy Distribution System

NOTE

To minimize the EMI generation, you need to connect a suppressor in parallel with the inductive load. Contact the motor's manufacturer to verify which the transient suppressor is recommended.

In many applications, a second transformer provides energy to the input circuits and to the power supplies, for the output circuits' isolation.

Second Transformer

The power supplies have circuits that suppress electromagnetic interferences generated by other equipments. However, the isolation among the circuits of the output modules, the power supplies, and the input circuits helps to prevent output transients from being induced in the power supplies and in the inputs. In many applications the energy is supplied to the input circuits and to the power supplies through a second transformer (Figure 4.6).

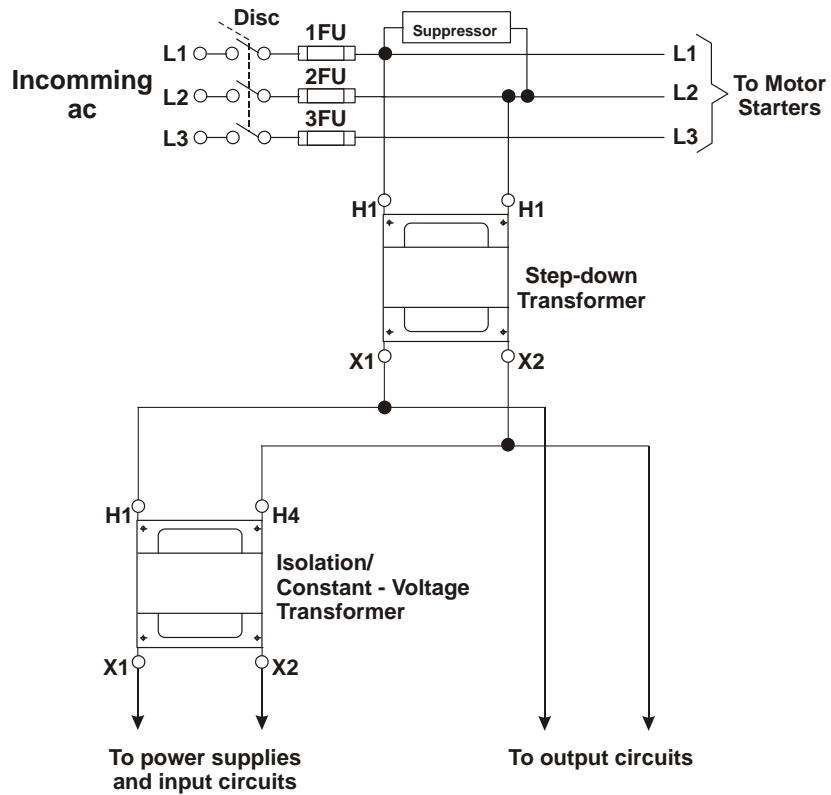


Figure 4.6 – Power Supplies and Input Circuits Receiving Energy through a Separate Transformer

NOTE

To minimize the generation of temporary EMI when the energy is interrupted by the interruption key, connect a suppressor beside the transformer's primary.

Surge Suppression

Transient EMI (electric noise) can be generated during the commutation of every inductive electric load. In many cases, the noise interferes directly on the origin of the commutation command and until may damage electronic components. Those transient peaks have a time of ascent very fast, generating a high induced tension where the automation wiring system works as the signal transmitter and receiver due to their capacitance.

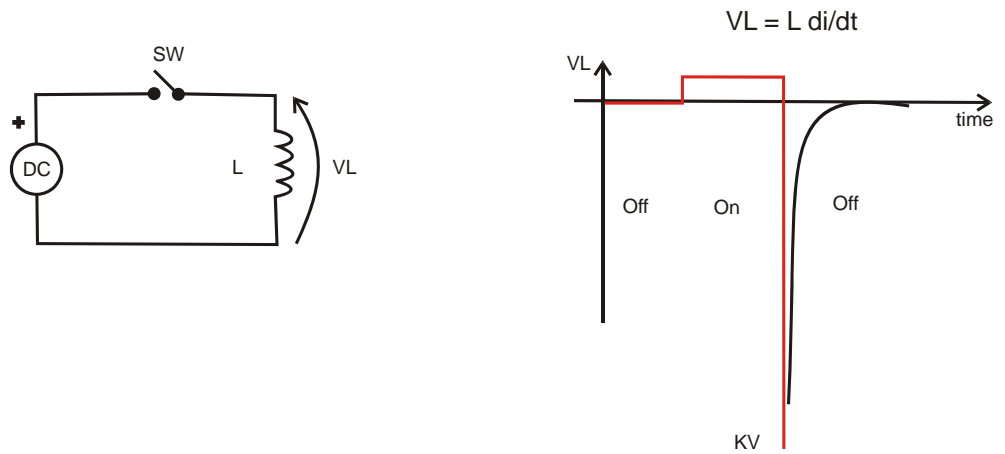


Figure 4.7 – Reverse Voltage Peak

Some alternatives may avoid this interference, like optical couplers, Zero Crossing Switching, indirect startups that prevent the arrival of the noise to the command, but the noise generated by the commuted device continues existing and many times it is induced in the wiring system, reaching other automation electronic points, causing intermittent defects in the system. Therefore, those ways of treating the noise are not effective. It should be eliminated exactly in the noise source, in other words, in order to obtain a filter with better performance, it should be mounted the closest possible to the commuted load.

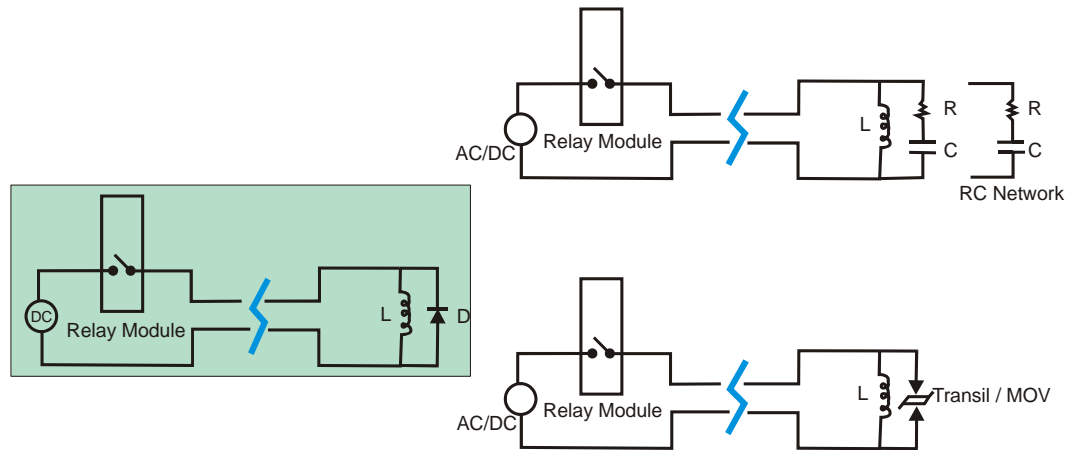


Figure 4.8 – Filters for AC and DC loads

- **Inductive Load:** See the specification of each LC700 I/O module related to the circuit R-C (snubber) and to the protection diode (camlping):
- **Inductive DC load:** In spite of the LC700 digital output modules for the DC load having a campling diode, it is recommended to insert other campling diode close to the inductive load. This will avoid the noise coupling in other cables that are in the same conduit

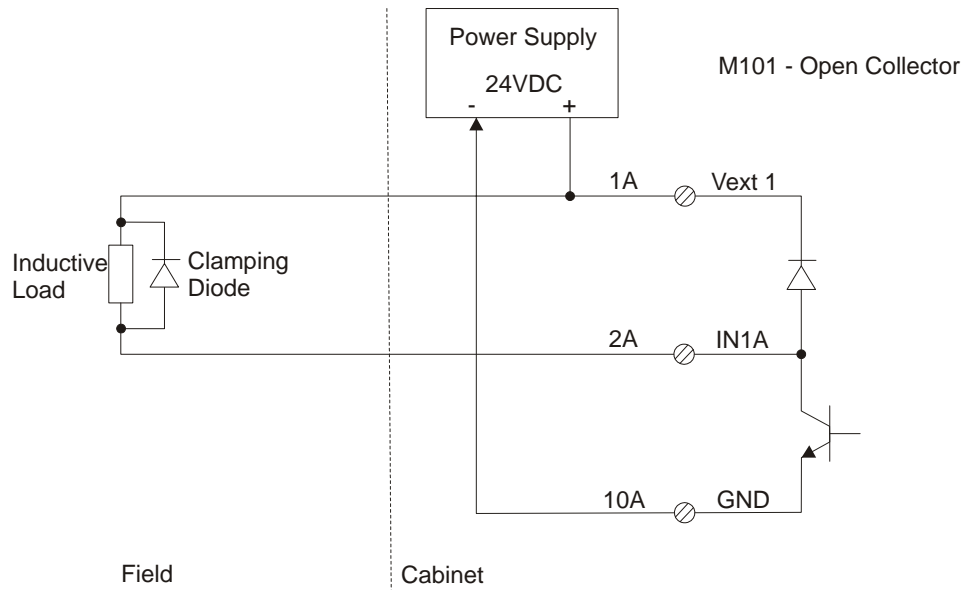


Figure 4.9 – Protection Diode in Parallel to DC Load

- **Inductive AC Load:** In spite of the LC700 digital output modules for the AC load having a snubber circuit, it is recommended to insert other snubber circuit in parallel to the load and close to them. This will avoid the noise coupling in other cables that are in the same conduit.

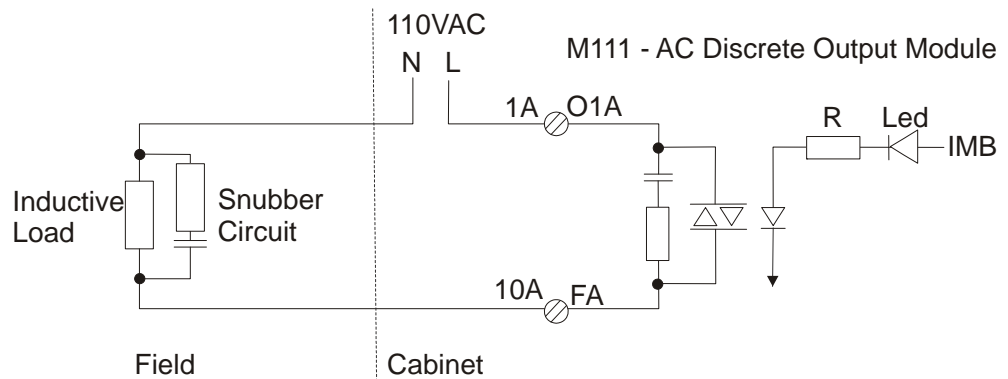


Figure 4.10 – Snubber Circuit in parallel to the AC Load

Suggestion for the RC network components and the clamping diode

The maximum current of the clamping diode should be greater or equal to the load maximum current, and the maximum tension should be 3-4 times greater than the circuit source in 24VDC and 8-10 times greater than the circuit source in 110VDC.

The RC circuit (AC) capacitor should have a tension 2-3 times greater than the power supply voltage. Recommended values:

Load Inductance	Capacitor
25-70mH	0.50µF
70-180mH	0.250µF
180mH - 10H	0.10µF

For loads up to 100 Ω, the RC circuit resistor should be 1 - 3 Ω, 2 Watts.

For loads that exceed 100 Ω, the resistor value should be increased until 47 Ω, ½ Watt.

Several manufacturers supply RC filters ready to be mounted in contactors, valves and other inductive loads. One of them is Murr Elektronik (www.murrelektronik.com) or ICOS (www.icos.com.br).

Ferrite Beads

Ferrite beads can supply additional suppression for EMI transients. The Ferrite of Fair-Rite Products Corporation (ordering code 2643626502) can be used in category 2 and 3 conductors. We can install them using fastening belts. With a ferrite located close to the cable termination, EMI transients induced on the cable can be suppressed by the ferrite, before entering in the equipment.

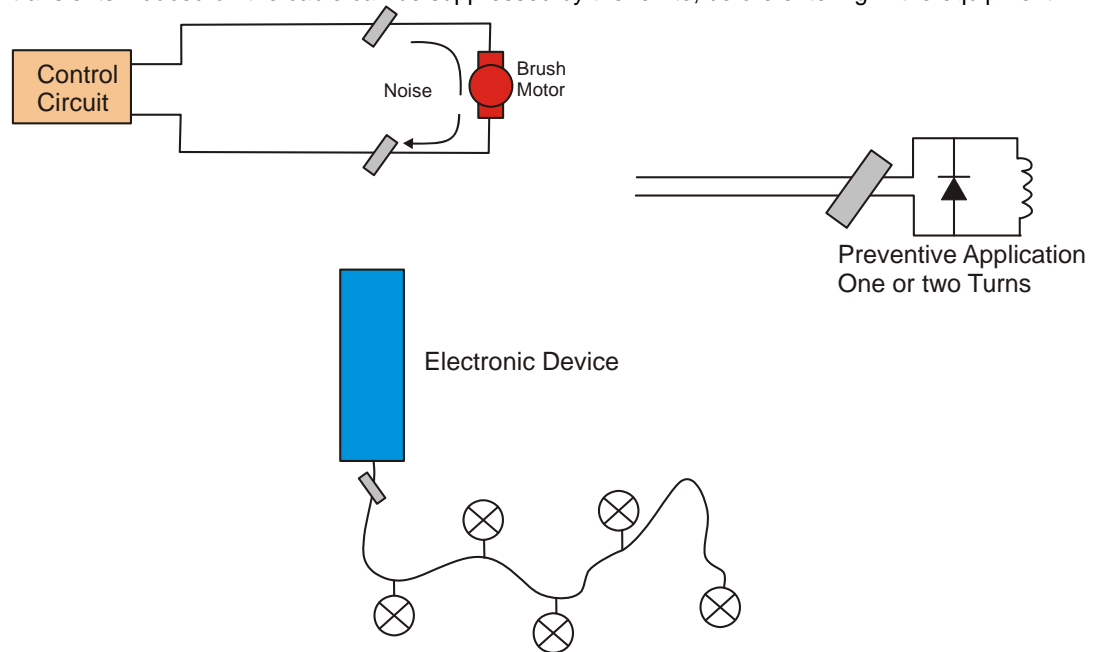


Figure 4.11 – Ferrite Application on Control Lines

EIA-485 in LC700

The LC700 CPU uses RS-485 on ports P2 and P3 in the CPU-700 module. P2 Port is always Modbus Slave RTU while P3 can be used as Modbus Slave RTU, or the master of a remote interfaces network (RIO-700) with higher communication rates.

The CPU700 has 3 terminals for each P2 and P3 ports. Both are isolated from each other and from the CPU digital circuit. This means that the reference of the communication drive, internally is not connected with the housing ground nor with any CPU Internal reference. Consequently, the interface is completely isolated.

A special attention should be given to the network physical installation to obtain good performance, and at the same time, to prevent noises that can damage the normal operation of the connected equipments.

Other Recommendations:

EIA-485

1. Wire connection in an EIA-485 network

The third wire should be connected to the references of all the connected drives. If the reference terminal is not connected, the drives' reference will float, and the data transmission will be more vulnerable to the noise. The Figure 4.12 below shows the correct way to interconnect the ports P2 and P3 on an EIA-485 network.

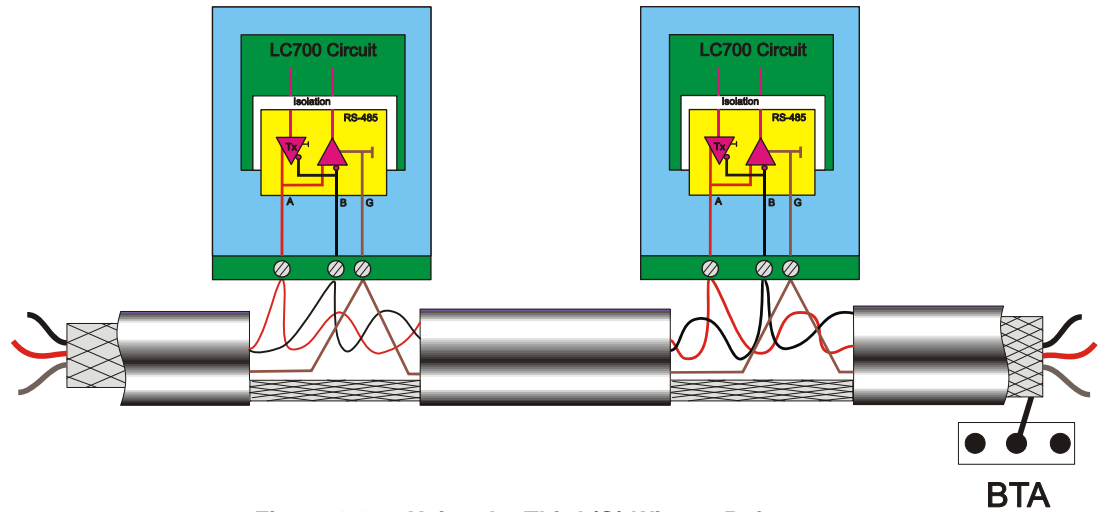
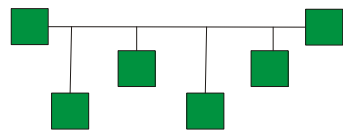


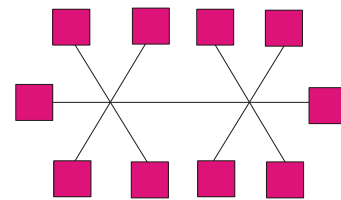
Figure 4.12 – Using the Third (G) Wire as Reference

2. Topology and termination

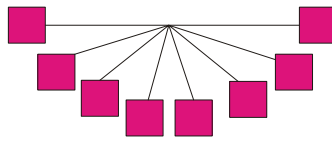
When the transmission rate is high or the distance among the equipments is big, it is very important to pay attention in the topology and in the terminators. The most acceptable topology is the "Daisy Chain". If the segments are not very long, the "Backbone" can be considered.



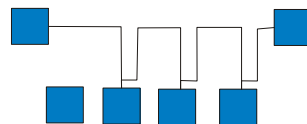
Backbone with stubs (workable)



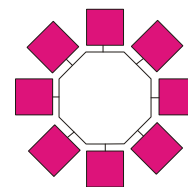
Backbone with stars or clusters (avoid)



Star network (avoid)



Daisy chain (best)



Ring (avoid)

Figure 4.13 – Topology of the EIA-285 Network

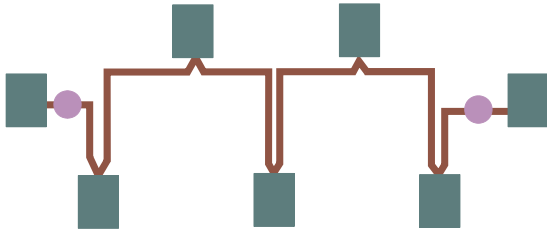


Figure 4.14 – Terminators for EIA-485 Network

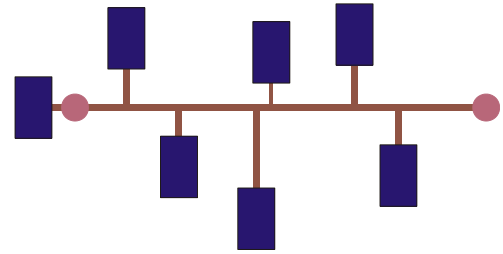


Figure 4.15 - Terminator

3. Terminators

The terminators value should be according to the characteristic impedance of the transmission line cable and it should be installed in parallel to the A and B lines, accordingly Figures 4.14 and 4.15.

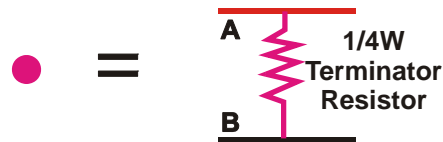



Figure 4.16 – Resistor Value Equal to Z_o (Line Characteristic Impedance)

4. Use cables projected for RS-485.

Summary of Panel Mounting Basic Rules

1. Install electronic equipments Controllers (CLP), Transmitters, Computers in a noise-free power line. Never connect electronic equipments in a noisy power line;
2. Avoid Inductive Loads (solenoid valves, motors) close to electronic equipment inside the electronic panel, if necessary separate them as far as possible.
3. Connect a suppressor in parallel to the inductive load;
4. Separate the wires according to their Categories;
5. Use a line filter in the panel power inputs: This will prevent receiving or sending noises through the electric installation;
6. Make a good grounding for the racks;
7. Connect the power supply ground, the filter for common mode and for electrostatics discharges, will be more effective;
8. Separate the power distribution in the panel;
9. Use shielded cable for signals coming from the field;
10. The shield should be grounded in a single point;
11. Adopt Ferrite to filter high frequency noises from lines that come from the field. Apply in lines that are exposed to noisy ambients;
12. Avoid circuit loops;

Appendix A

	FSR – Service Request Form	
	LC700 – User's Guide	Proposal N°: _____
COMPANY INFORMATION		
Company: _____		
Unit: _____		
Invoice: _____		
COMMERCIAL CONTACT		
Full Name: _____		
Phone: _____		Fax: _____
E-mail: _____		
TECHNICAL CONTACT		
Full Name: _____		
Phone: _____		Extension: _____
E-mail: _____		
EQUIPMENT DATA		
Model: _____		
Serial Number: _____		
PROCESS DATA		
Process Type (Ex. boiler control): _____		
Operation Time: _____		
Failure Date: _____		
FAILURE DESCRIPTON		
(Please, describe the failure, if it is repetitive, how it reproduces, etc.)		

OBSERVATIONS		

USER INFORMATION		
Company: _____		
Contact: _____		
Section: _____		
Title: _____		Signature: _____
Phone: _____		Extension: _____
E-mail: _____		Date: ____/____/____
For warranty or non-warranty repair, please contact your representative. Further information about address and contacts can be found on www.smar.com/contactus.asp .		

Returning Materials

If necessary to return the instrument/device and/or configurator to SMAR, simply contact our office, informing the defective instrument serial number, and return it to our factory.

In order to speed up analysis and solution of the problem, the defective item should be returned with a description of the failure observed, with as much details as possible. Other information concerning the instrument operation, such as service and process conditions, is also helpful.

Instruments returned or to be revised outside the guarantee term should be accompanied by a purchase order or a quote request.