ICS2.0P - smar

USERS MANUAL

SERIAL CONVERTER INTERFACE
EAI-232-D <=> EIA-485

JUL / 03
ICS2.0P

I C S 2 0 P M E

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Table of Contents

Section 01

INTRODUCTION

OVERVIEW

The serial converter interface ICS was designed by Smar to convert signals from the standard serial communication EIA 232 to EIA 485 signals. This interface is used to interconnect one or more serial digital communication systems in commercial and industrial applications that requires:

- ✓ High baudrates.
- ✓ Communication without modem control signals; typically known as three wires 232 communication.
- ✓ Long distances between devices.
- ✓ High immunity to EMI.
- ✓ Decoupling between system grounds.
- ✓ Immunity to high variations of the AC power supply.

CONVENTIONS USED IN THIS DOCUMENT

This document uses a few abbreviations and nomenclature conventions as described below:

✓ Standard interface	EIA-232 (old RS-232-C)
✓ Standard interface	EIA-485 (old RS-485)
✓ Full Duplex	Two way communication where the transference is made in both directions at any moment.
✓ Half Duplex	Two way communication where the transference only occurs in one way at a specific time.
✓ Baudrate	Communication rate given in bits per second (bps).
✓ EIA	Abbreviation for Electronic Industries Association.
✓ EMI	Electromagnetic interference.
✓ Point-to-point	Communication between devices in a bus with two communication nodes.
✓ Multidrop	Communication between devices in a bus with more than two communication nodes.
✓ Bus Busy	Mechanism to avoid 485 contention in the communication bus.
✓ Driver	Circuit that generates the transmission signal.

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). **Figure 1-** ICS2.0P Block Diagram shows details of these modules.

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 baudrate.

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.

BLOCK DIAGRAM

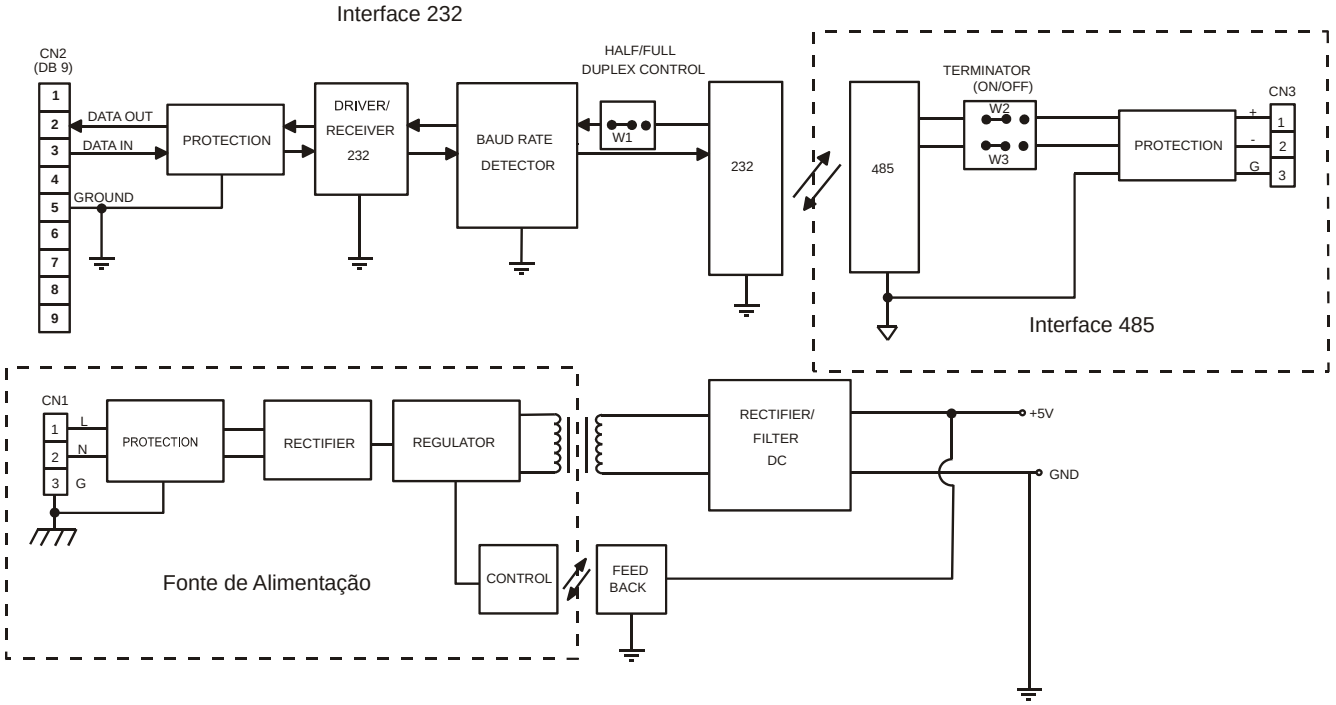


Fig.1 – ICS2.0P Interface Block Diagram

POWER SUPPLY

The ICS2.0P uses a switching power supply with single output with 5 V_{DC} at 2.5W. Its universal input accepts 90 to 240 V_{AC} voltage variations at 50-60 Hz. Its DC input is electrically isolated from its AC input supporting an unbalance up to 1600 V_{RMS} (1 minute) or 2000 V_{RMS} (1 second).

As a protection, this power supply has a 250 mA input fuse in the phase input L and protection circuits against overvoltage and overcurrent. The connection to the electrical network is made through terminals placed in its front part and it is made through three signals:
L: AC phase signal
N: Neutral, in case of monophasic or phase to two-phase
G: To housing grounding

NOTE
In case the connection to the electrical network is two-phase, we recommend the use of an external additional fuse to protect the unprotected phase, connected to the N phase. Use terminal bars with protection terminal fuses to achieve it.

232 INTERFACE

The 232 interface is Full Duplex and was built with the three signal main lines: TxD, RxD and GND. The remaining modem control signals like RTS, CTS, DTR and DRS were suppressed. Thus, the 232 interface is physically a 3 wires interface. The socket used is a 9 pins female delta set as DTE. The pins were designs dispposed to directly connect the serial output of the workstations using the standard 9-pin RS232 Serial Port, avoiding the use twisted pair cables. The connection is direct pin to pin.

NOTE
In a few serial ports, the CTS modem control signal requires its activation so that interface is active. In this case, we recommend that the pin 7 and pin 8 of the socket are connected, thus connecting RTS to CTS.

485 INTERFACE

The 485 interface is Half Duplex and was built with only 3 signals: (+), (-) and GND. The (+) and (-) signals are differential and defined by the 485 standard. The GND signal is very useful to eliminate common mode voltages when the 485 bus becomes too big. The interconnection of the GND signal between various devices requires that the 485 driver of these modules are electrically isolated from the main circuit or that the device is floating so that the interconnection can be grounded in a single point. The conection with the bus is made through a 3 way terminal with screws.

Parallel to the communication signal generation, the 485 interface has an option (set through jumpers) to enable or disable the 485 bus terminator. This terminator is not conventional and it is different from the 485 standard, due to many or in the connection with most types of devices. During the functional tests, a few 422/485 receivers did not correctly interpret the bus signal when the terminator was only a 120 Ohms resistor. In this case, with the generators at high impedance, the not active bus implied in zero (0) level for a few receivers. By adding bias resistors in each of the differential signals, all the receivers started to work properly. Thus, the ICS2.0P terminator design includes bias resistors in addition to the terminator described in the 485 standard.

232 <=> 485 CONVERTION

This circuit is the core of the interface project. It interconnects interfaces with totally opposed features (point-to-point with multidrop/ Full Duplex with Half Duplex) and works totally automatic. The project uses an innovative solution to handle the enabling of the 485 driver without making any conection in the drivers and it is totally independent of the baudrate used.

The 232 interface is originally full duplex and the 485 is half duplex. So, mixing these two interfaces in the ICS2.0P implies that all data sent through the 232 interface may be echoed to its reception channel. It has resulted in failures in a few devices once the communication package would not allow simultaneous transmitting and receiving (the package would not support the physical feature of the Full Duplex, even though the interruptions are enabled). A configuration jumper puts the interface in Half Duplex mode, in other words, if the 232 interface sends a message, this configuration option disables any kind of return in the reception channel.

CONFIGURATION

The serial converter interface ICS2.0P has two main jumper sets to configure the operation. The first set allows to select the 232 channel mode of operation between Full Duplex and Half Duplex and the second set enables or disables the 485 bus terminator . Figure 2 shows the position of these jumpers in the electronic board.

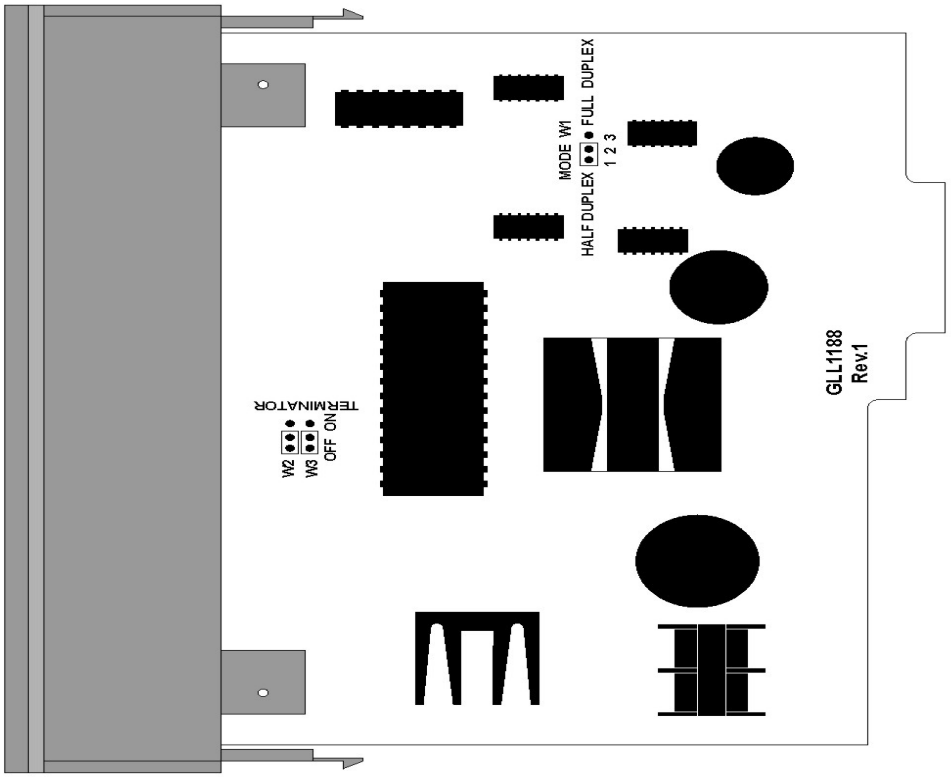


Fig. 2- Postion of the Jumpers on the electronic board

FULL/HALF DUPLEX MODE

The operation mode of the 232 channel is set by the jumper W1. When the Full Duplex mode is set, the 232 channel is totally activated, allowing that any signal from the 485 bus is redirected to the 232 channel, independently of the status of the transmission to the 485 channel. In the Half Duplex mode, the circuit disables the return of the signal from the 485 channel to the 232, when the 232 channel transmits to the 485. This is useful when the 232 communication drivers do not allow reception of the echo from the transmitted message.

ENABLING THE TERMINATORS

To enable the 485 terminators use the W2 and W3 jumpers. Putting these jumpers on the ON position either in the terminator regular mode or polarization terminators are connected to the 485 bus. If this is not made, the 485 bus will have its impedance decreased, and the communication signal quality of the 485 bus will also be decreased.

TECHNICAL SPECIFICATIONS

GENERAL SPECIFICATIONS

- Baudrate	Up to 250Kbps, auto adjustable.
- Operation temperature	-10 to 60 ^{o}C @ 100% RH max.
- Storage	-30 to90 ^{o}C @ 90% RH max.
- Certification	CE
- Optical and galvanic isolation	Up to 1600 V_{RMS} (1 minute) or 2000 V_{RMS} (1 second) between the network source and the buses among the buses.
- Indications	Energization LEDs and presence of communication of signal.
- Dimensions	142 x 40 x 127 mm, (5.59 x 1.57 x 5.00”), max (see Figure 3).
- Weight	265 g.
- Fixation	Through a support for DIN rail or using empty slots of a rack model R-700-4 (rack with four slots) (installation).

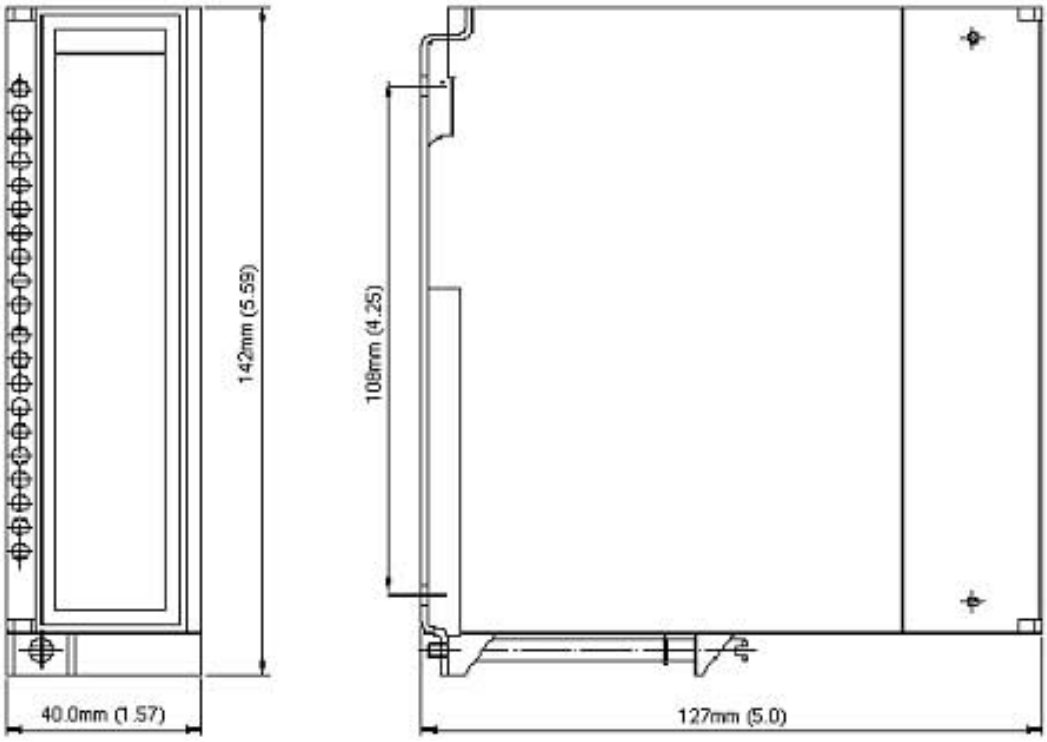


Fig. 3- ICS2.0P Dimensional Drawing.

POWER SUPPLY

- Consumption 3 Watts max.
- Input voltage 90 to 240 Vac @48 to 70 Hz, simple or two-phase.
- Output voltage 5 Vdc, 0.5A max.
- Protection Against overcurrent, overvoltage and instantaneous surge and EMI.
- Protection fuse 250 mA
- Connection 3 writes, L, N, G, through terminals with screw.

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

OBS: When using the two-phase input, we recommend the use of an external fuse in the N line.

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 3 wires, TxD, RxD and GnD and through the 9 pins Delta connector, female.

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.

485 INTERFACE

- Operation mode Automatic control of the transmission driver, independent of the baudrate.
- Terminators Activation through jumpers
- Protection Voltage peaks
- Cabling Up to 1200 m, without repeater, using two twisted pairs and with shielding. Connect the shielding to the grounding pin GND..
- Connection 3 wires. With differential signals (+) and (-) and grounding GND.

Pin	I/O	Signal	Description
1	I/O	+	485 positive differential signal
2	I/O	-	485 negative differential signal
3	-	GND	Grounding. Usefull to eliminate the effects of common mode voltage.

ACCESSORIES

The complete ICS2.0P kit consists of the following products and accessories:

- ICS2.0P Interface
- EIA-232 cable, male-female, 1/1 according to figure4. The length must be specified according to the part number.

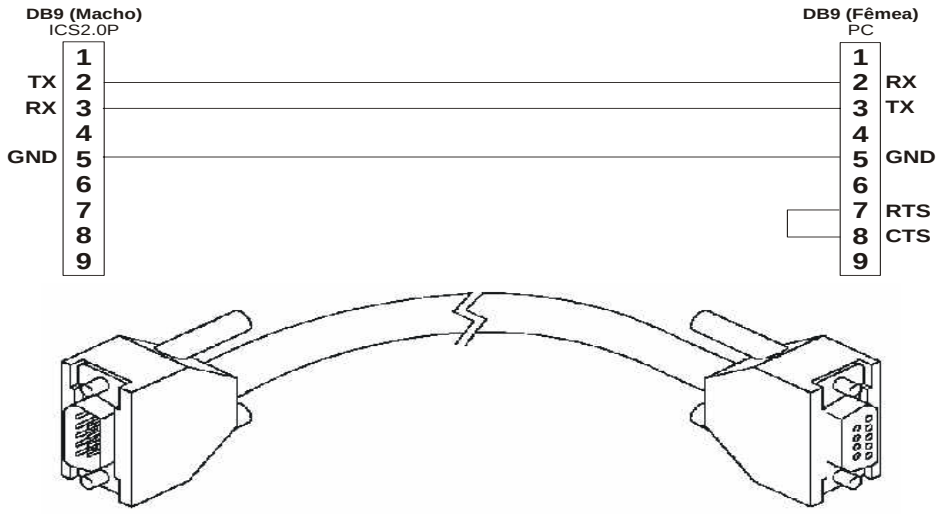


Fig. 4- EIA-232 Communication Serial Cable

NOTE
In a few serial ports, the modem control signal requires its activation so that the interface is enabled. In this case, we recommend that the connection of the pin 7 to the pin 8 of the connector, which it will connect RTS to CTS.

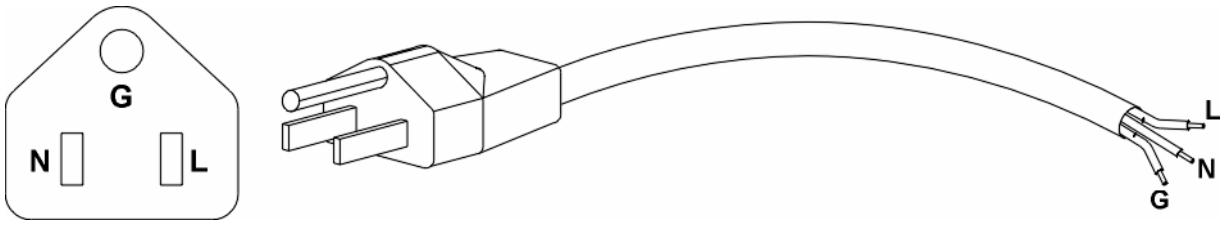


Fig. 5 – Voltage Cable

2 connectors type terminal block female, 3 pins.

Unitary support DF9

Tecnical reference manual

SPARE PARTS

- ICS2.0P interface (see part number)
- EIA-232 cable, male-female, 1/1 (see part number)
- Unitary DF9 support (support for one module0 (see part number)
- Multiple support, model R-700-4 (rack with 4 slots) (see part number).
- Box (rear of the module) (see part number)

PART NUMBER

Complete Kit

MODEL	ICS2.0P	RS-232/RS-485 Converter interface
	CODE	EIA-232 standard Cable
	C0	Does not include cable.
	C1	Include a 3 meters cable.
	C2	Include a 5 meters cable.
	C3	Include a 10 meters cable.
	C4	Include a 15 meters cable.

Example:	ICS2.0P - C1	(Interface + 3 meter of cable standard EIA-232)

❑ Spare parts

RS-232/RS-485 Converter interface	
CODE	EIA-232 standard cable
400-0625	3 meter cable.
400-0626	5 meter cable.
400-0627	10 meter cable.
400-0628	15 meter cable.
CÓDIGO	Support
DF9	Single support for module

Example:	400-0626	5 meter cable.

INSTALLATION

The serial converter interface ICS2.0P requires the use of a support to fix it in a DIN rail. It can use its own DF9 support (support for 1 module) to individual mounting or rack mode R-700-4 (rack with 4 slots) of the LC700 line to fix multiple interfaces. In case of a specific supply of use of the ICS2.0P, the rack R-700-4 will be supplied without the standard LC700 backplane. The rack will be completely passive. See the part number to select the proper item to each application.

Figure 6 presents a perspective drawing of the single DF9 support and figure 7, presents the dimensional drawing of the ICS2.0P interface mounted in this support.

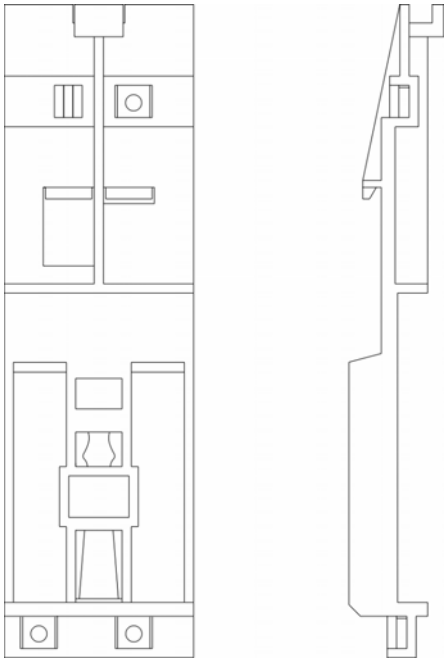


Figure 6- Perspective drawing of the single support DF9

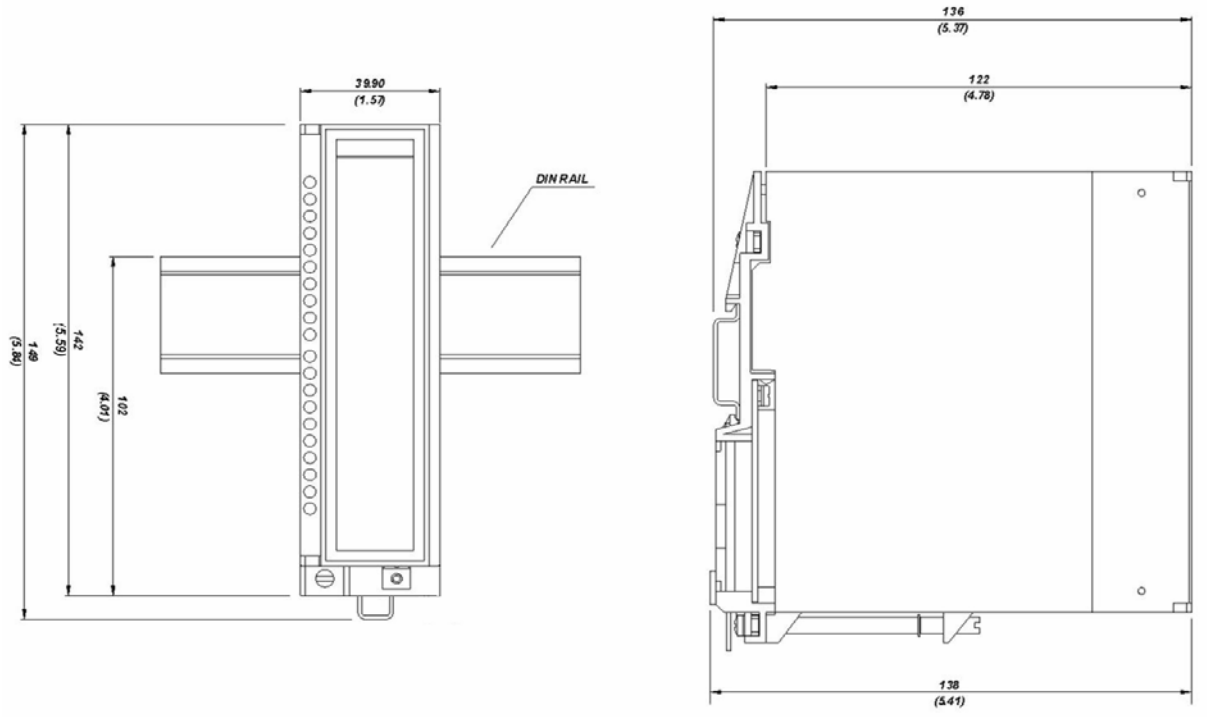


Fig. 7 Dimensional drawing of the ICS2.0P mounted in the DF9 support.

The mounting using the R-700-4 rack allows the modular installation of up to 4 interfaces. Figure 8 presents the perspective drawing of the R-700-4 rack.

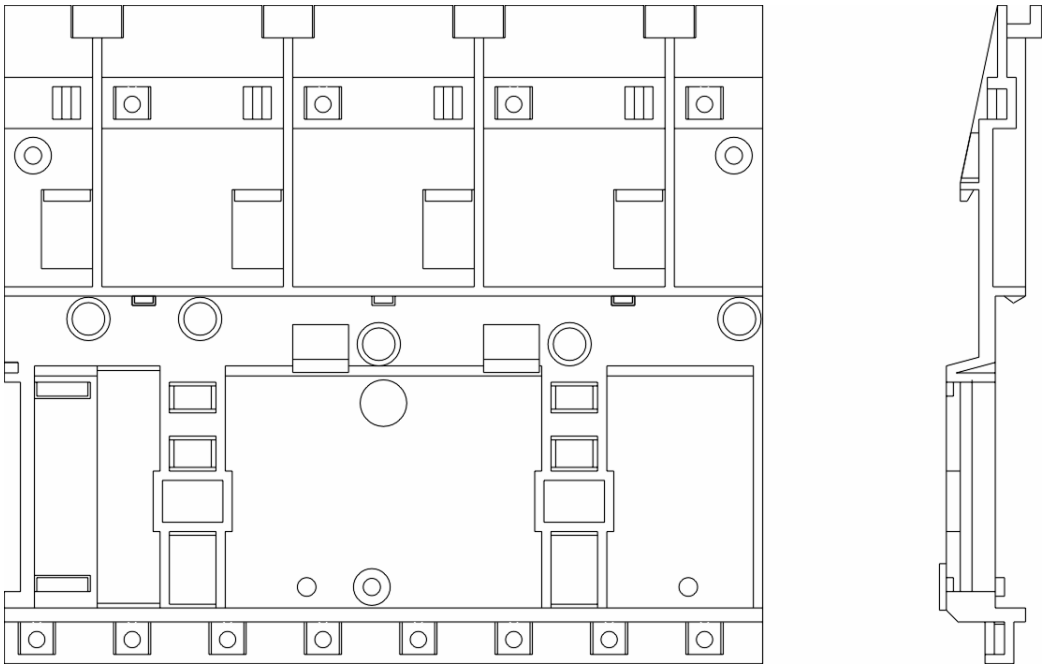


Fig.7- Perspective drawing of the R-700-4 rack

To fix the ICS2.0P on the R-700-4 rack proceed as follows:

Ataching the module to the rack

1. Atach the upper part of the module (approximately 45 ^{o});
2. Place the module so it fits the connector;
3. Fix the module through the fixation screw.

Ataching *the rack to the DIN rail*

1. In case there is only one rack, this fixation can be made as the first step, even before attaching any module in the rack.
2. Place (pull) rack the metallic strips;
3. Slant the rack and atach its part to the upper DIN rail;
4. Drive the rack base of the rail until the contact is made;
5. Fix the rack to the Din, pushing the metallic strips;

In order to fix the ICS2.0P in the DF9 support proceed as follows:

It is possible to fix the ICS2.0P through the rack or through the DF9 support (following figure):

1. Fix the DF9 support directly through screws or in a DIN rail.
2. Atach the ICS2.0P to the DF9 support.

MAINTENANCE

Due to the falt of the ICS2.0P being a modular project, it has specific purpose components, which makes maintenance difficult. It is recommendes a stock of spare units for fast replacements, and sending them to smar for repair

A few simple maintenance actions could be carried on by the user, basically to check damanges or to preventive maintenance: visual analysis and cleaning. The visual analysis could be the checking of the protection fuse conditions or internal parts.

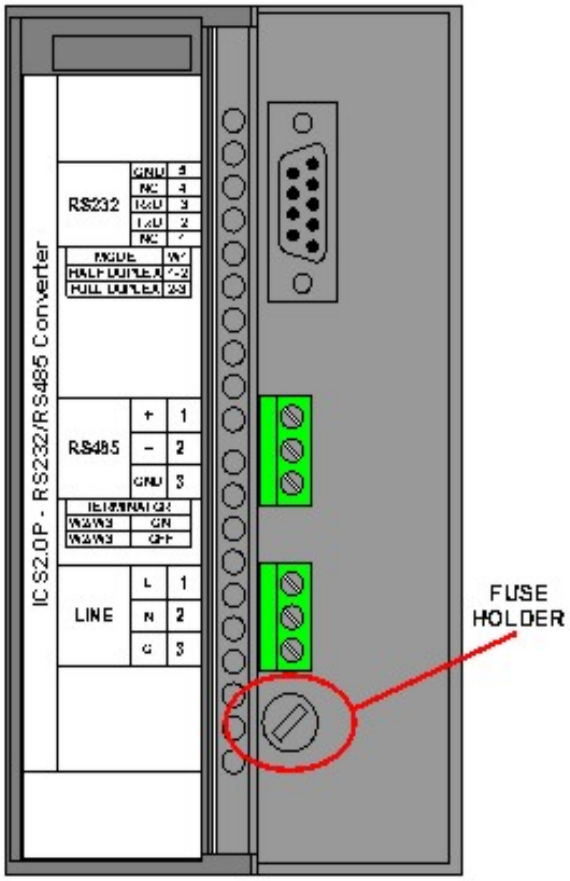


Fig 9. Locating the fuse

FUSE REPLACEMENT

To accomplish the fuse replacement, remove the top of the fuse head located in front of the ICS2.0P, figure 9, with the aid of a screwdriver. Remove the damaged fuse and replace it whti a new fuse. Finally, mount the top of the fuse head again.

ACCESS TO THE INTERNAL PART

To remove the cover of the ICS2.0P interface it is necessary to unlock the pins of the wrapper. First disconnect all the cable connections made in the interface. The serial cable is disconnected by the Delta connector and does not require the terminal unscrewing because the terminals are fast clamp types.

Figure 10 shows the locations of the wrapper locks of the ICS2.0P.

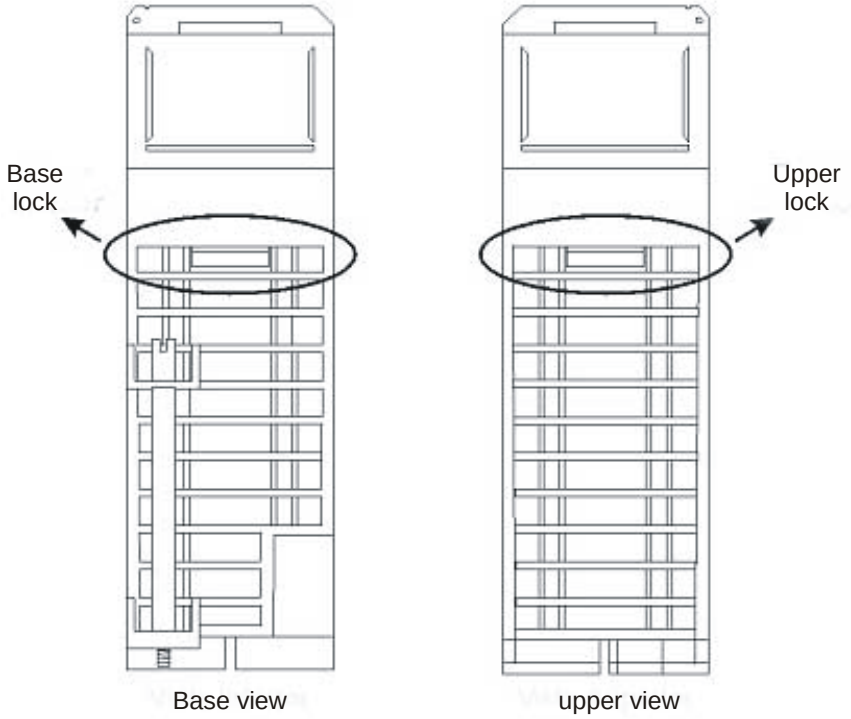


Fig.10- Locating the locks

Appendix A

EIA STANDARD INTERFACES

THE EIA-232 STANDARD

This standard defines the physical chracteristics (electrical), functioning and procedures for communication between two devices. However, in this specific case, the electric specification of this standard will be the main approach, focusing on the behavior of the drivers and receivers for this standard.

The 232 communication (as previously mentioned) is point-to-point and not multidrop or bus driven. It allows the use of full and half duplex protocols because the transmission and reception lsignal lines are independent.

The standard establishes a maximum baudrate of 20Kbps and a maximum length of 15 meters to the signal cables. However, pratical experiments shows that it is possible to work with communication rates a bit higher when the length of the line is shorter. This extension is valid only to enviroments that have moderate electromagnetic interference (EMI) and with the use of a shielded cable. Figure 11 shows what is recommended for the 232 standard.

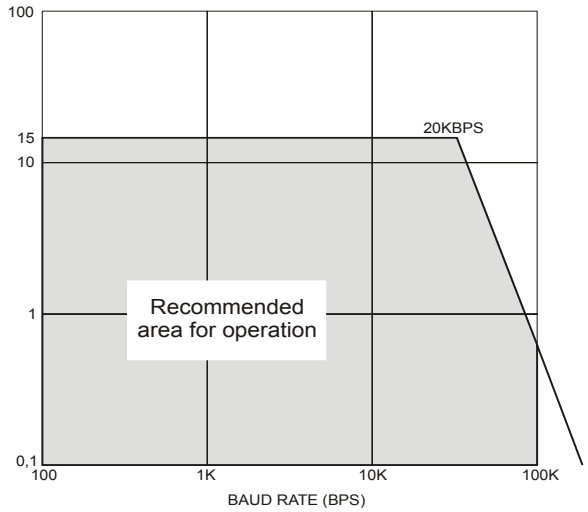


Fig 11.- Recommendation for the EIA 232 standard (shielded cable, moderated EMI)

THE EIA-485 STANDARD

The EIA-485 standard establishes only a few physical characteristics (eletrical) for serial communicaton between devices using a multidrop bus.

In the 485 case, there is only one bus for TX and RX. So, we must certify that only one signal is present at each moment, avoiding collisions and consequent failures in the communication. Thus, the 485 standard allows only half-duplex mode.

Even in the cases where the communication protocol requires to work with collisions (CSMA/CD ou CA) the ICS2.0P can be used because its 422/485 drivers have output current limitation and are not damaged by.

Every signal in the 485 bus, including the echo can appear in the reception of the 232 signal (RxD) since it was set to the operation mode Full Duplex. With this resource it is possible to achieve the desired communication and make on-line tests of the interface system. It is also possible to check the occurrence of collisions and communication failures. The electrical characteristics of the 485 can be seen on figure 12.

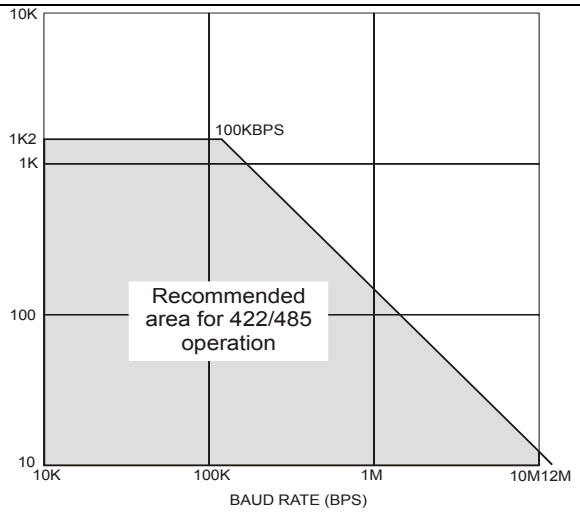


Fig 12- Recommended area for the 485 standard

Attention
Figure 12 data is valid to shielded twisted pair buses 2x1.5mm^2 and terminator resistors of 120 Ω in both edges.

NOTE
The transmission echo reception can be used in shielded twisted pair buses allowing the complete communication system to be tested ON-LINE. It is also possible to check the occurrence of collisions and communication errors.

Appendix B

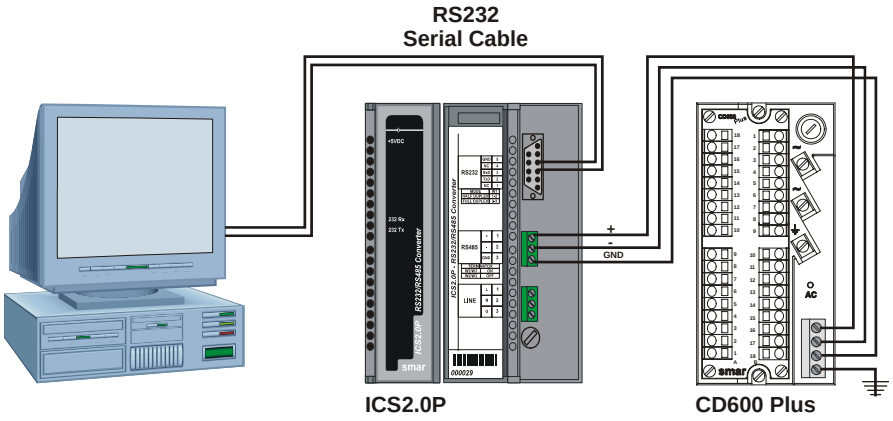
APPLICATION EXAMPLES

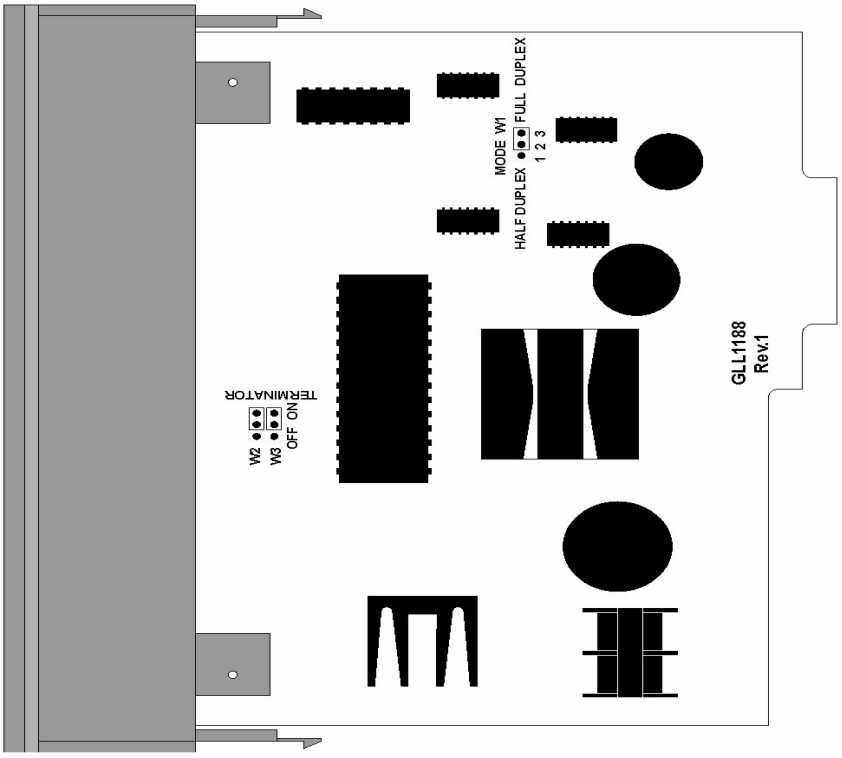
NOTE
The ICS2.0P jumper is configured in the factory with the following settings: Terminator: W1 and W2 to the OFF position. Mode: W1 in the half duplex position.

CONF600 <=> CD600 COMMUNICATION

To the CONF600 and CD600 communication proceed as follows:

1. Connect the EIA-232 cable at the serial output COM1 or COM2 of the PC (female) with the ICS2.0P serial input (male).
2. Connect the EIA-485 of the ICS2.0P of the EIA-485 input of the CD600 as the next figure shows.
3. Set the jumpers as the next figure shows (jumper W1 on the Full Duplex/Half Duplex and jumpers W2/W3 on the ON position.

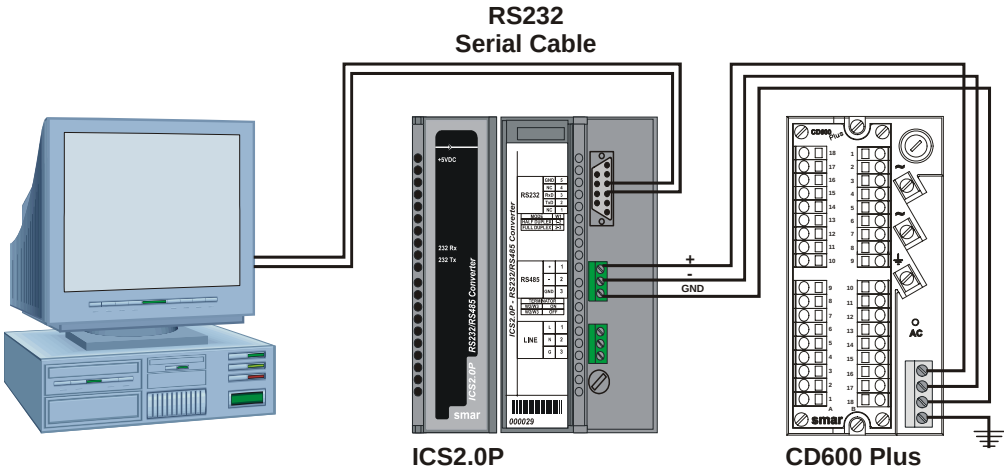


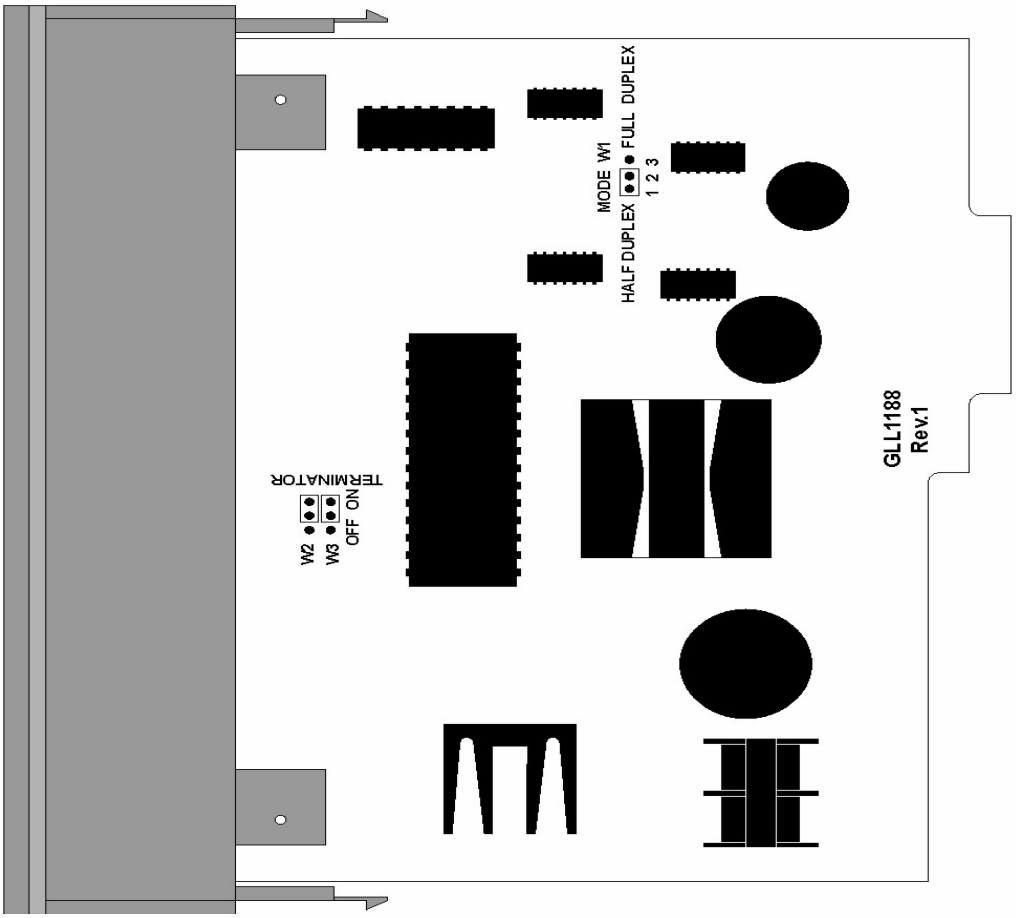


AIMAX <=> CD600 COMMUNICATION

To the AIMAx and CD600 communication proceed as follows:

1. Connect the EIA-232 cable in the PC serial output COM1 or COM2 (Female) to the serial input of the ICS2.0P (male).
2. Connect the EIA-485 output of the ICS2.0P in the EIA-485 input of the CD600 as the following figure presents.
3. Set the jumpers as the next figure shows (jumper W1 in the Full Duplex/Half Duplex position and jumpers W2/W3 in the ON position.

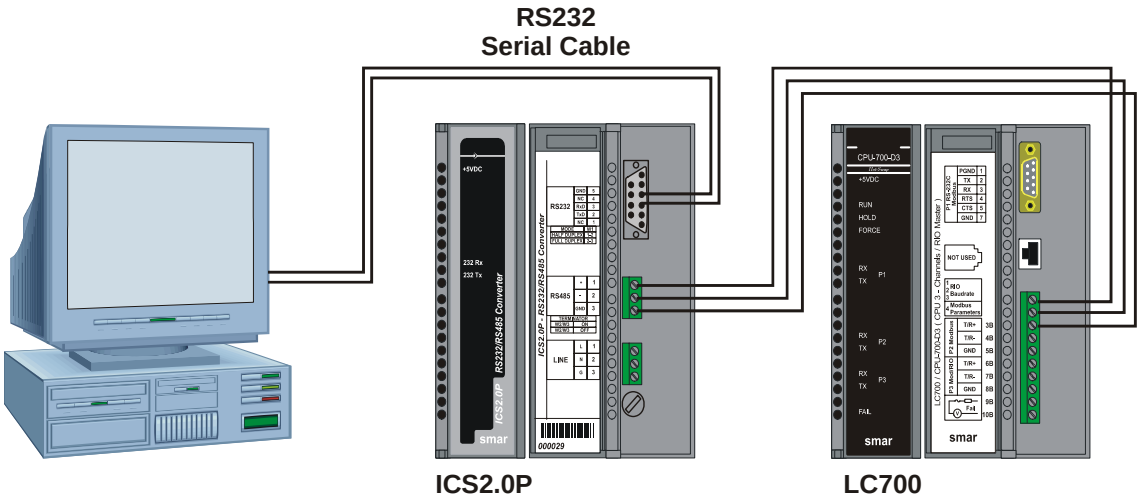


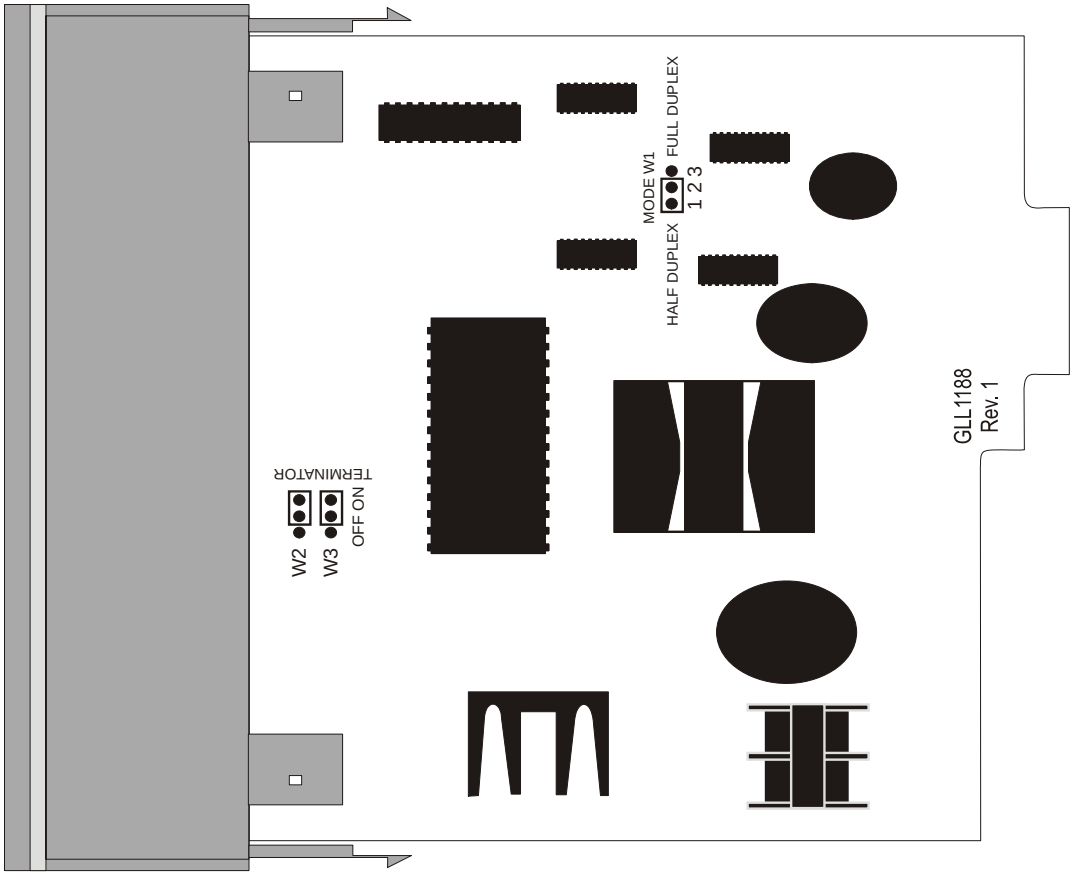


CONF700 <=> LC700 COMMUNICATION

To the CONF700 and LC700 communication proceed as follows

1. Connect the EIA-232 cable in the PC serial output COM1 or COM2 (Female) to the serial input of the ICS2.0P (male).
2. Connect the EIA-485 output of the ICS2.0P in the EIA-485 input of the LC700 as the following figure presents.
3. Set the jumpers as the next figure shows (jumper W1 in the Full Duplex/Half Duplex position and jumpers W2/W3 in the ON position).

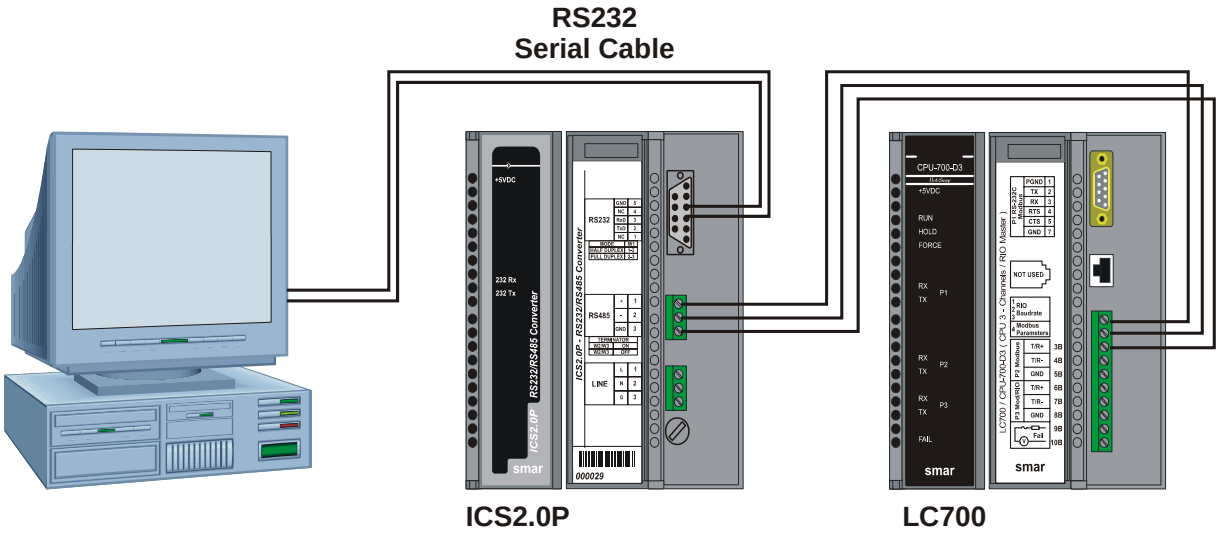


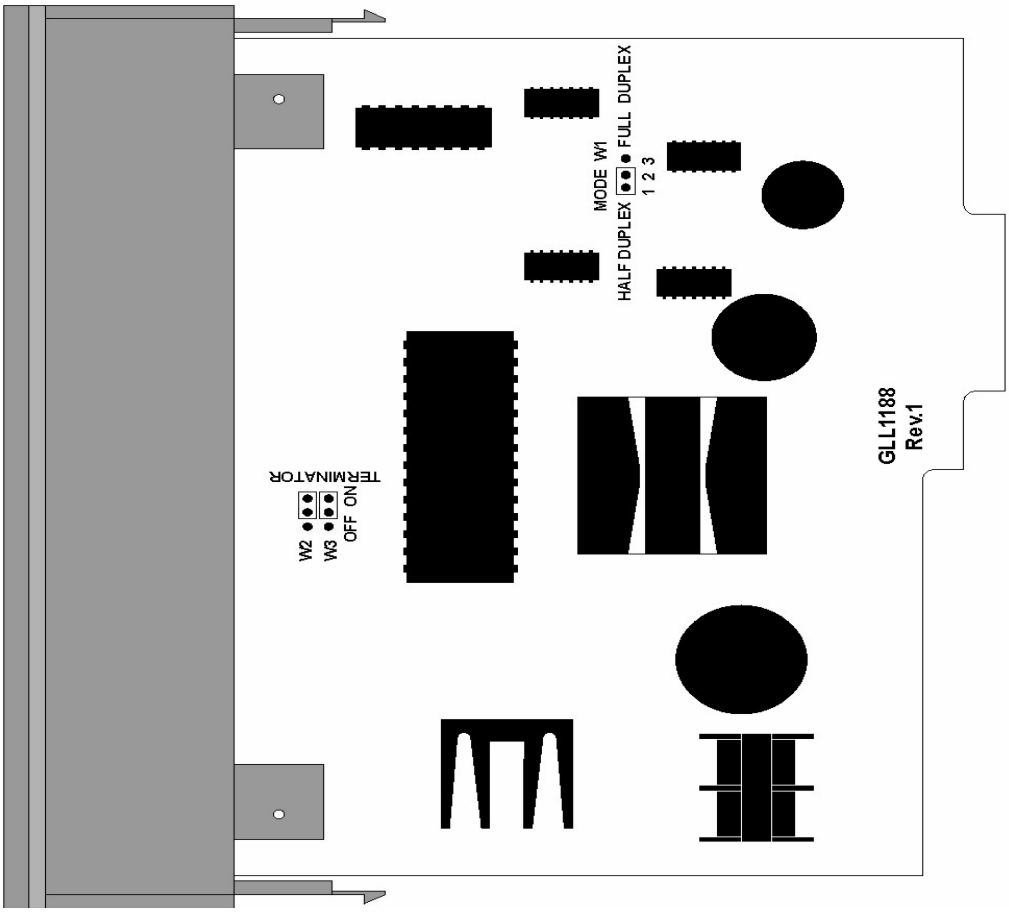


AIMAX <=> LC700 COMUNICATION

To the AIMAX and LC700 communication proceed as follows

1. Connect the EIA-232 cable in the PC serial output COM1 or COM2 (Female) to the serial input of the ICS2.0P (male).
2. Connect the EIA-485 output of the ICS2.0P in the EIA-485 input of the LC700 as the following figure presents.
3. Set the jumpers as the next figure shows (jumper W1 in the Full Duplex/Half Duplex position and jumpers W2/W3 in the ON position).

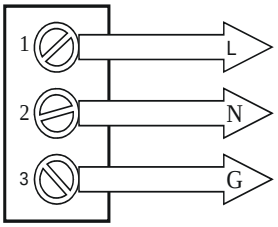




Appendix C

DIAGNOSIS

1. LED +5Vdc is not ON:



1.1 Check whether the connection to the line is correct.

1.2 Check whether there is voltage in the network (90 to 240 Vac @ 48 to 70 Hz).

1.3 Check if the fuse is not damaged.

1.4 Check if the LED is not burned.

1.5 Check the continuity of the power supply cable.

2. Communication LEDs RS-232DX/ RS-232TX do no light up.

2.1 Check if the EIA-232 cable is connected to the ICS2.0P.

2.2 Check if the PC serial port requires that the CTS signal is active: connect the RTS to the CTS (short circuit between pins 7 and 8 of the female connector)

2.3 Check the configuration of the EIA-232 and EIA-485 cables.

2.4 Check the continuity of the EIA-232 and EIA-485 cables.

3. It is not communicating.

3.1 Check the W1, W2 and W3 jumpers settings.

3.2 Check if the EIA-232 cable is connected to the ICS2.0P.

3.3 Check the cables configuration EIA-232 and EIA-485.

3.4 Check the continuity of the EIA-232 and EIA-485 cables.

SMAR WARRANTY CERTIFICATE

1. SMAR guarantees its products for a period of 24 (twenty four) months, starting on the day of issuance of the invoice. The guarantee is valid regardless of the day that the product was installed.

2. SMAR products are guaranteed against any defect originating from manufacturing, mounting, whether of a material or manpower nature, provided that the technical analysis reveals the existence of a quality failure liable to be classified under the meaning of the word, duly verified by the technical team within the warranty terms.

3. Exceptions are proven cases of inappropriate use, wrong handling or lack of basic maintenance compliant to the equipment manual provisions. SMAR does not guarantee any defect or damage caused by an uncontrolled situation, including but not limited to negligence, user imprudence or negligence, natural forces, wars or civil unrest, accidents, inadequate transportation or packaging due to the user's responsibility, defects caused by fire, theft or stray shipment, improper electric voltage or power source connection, electric surges, violations, modifications not described on the instructions manual, and/or if the serial number was altered or removed, substitution of parts, adjustments or repairs carried out by non-authorized personnel; inappropriate product use and/or application that cause corrosion, risks or deformation on the product, damages on parts or components, inadequate cleaning with incompatible chemical products, solvent and abrasive products incompatible with construction materials, chemical or electrolytic influences, parts and components susceptible to decay from regular use, use of equipment beyond operational limits (temperature, humidity, etc.) according to the instructions manual. In addition, this Warranty Certificate excludes expenses with transportation, freight, insurance, all of which are the customer's responsibility.

4. 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

5. In cases needing technical assistance at the customer's facilities during the warranty period, the hours effectively worked will not be billed, although SMAR shall be reimbursed from the service technician's transportation, meals and lodging expenses, as well dismounting/mounting costs, if any.

6. The repair and/or substitution of defective parts do not extend, under any circumstance, the original warranty term, unless this extension is granted and communicated in writing by SMAR.

7. No Collaborator, Representative or any third party has the right, on SMAR's behalf, to grant warranty or assume some responsibility for SMAR products. If any warranty would be granted or assumed without SMAR's written consent, it will be declared void beforehand.

8. Cases of Extended Warranty acquisition must be negotiated with and documented by SMAR.

9. If necessary to return the equipment or product for repair or analysis, contact us.
   See item 4.

10. In cases of repair or analysis, the customer must fill out the Revision Requisition Form (FSR) included in the instructions manual, which contains details on the failure observed on the field, the circumstances it occurred, in addition to information on the installation site and process conditions. Equipments and products excluded from the warranty clauses must be approved by the client prior to the service execution.

11. In cases of repairs, the client shall be responsible for the proper product packaging and SMAR will not cover any damage occurred in shipment.

12. In cases of repairs under warranty, recall or outside warranty, the client is responsible for the correct packaging and packing and SMAR shall not cover any damage caused during transportation. Service expenses or any costs related to installing and uninstalling the product are the client´s sole responsibility and SMAR does not assume any accountability before the buyer.

13. It is the customer's responsibility to clean and decontaminate products and accessories prior to shipping them for repair, and SMAR and its dealer reserve themselves the right to refuse the service in cases not compliant to those conditions. It is the customer's responsibility to tell SMAR and its dealer when the product was utilized in applications that contaminate the equipment with harmful products during its handling and repair. Any other damages, consequences, indemnity claims, expenses and other costs caused by the lack of decontamination will be attributed to the client. Kindly, fill out the Declaration of Decontamination prior to shipping products to SMAR or its dealers, which can be accessed at www.smar.com/doc/declarationofcontamination.pdf and include in the packaging.

14. This warranty certificate is valid only when accompanying the purchase invoice.