CARLO GAVAZZI
Automation Components

Eos-Gate installation and operation manual

- This manual is integral part of the Eos-Gate product. Please read it carefully, as it contains important information regarding safety.
- The manufacturer is responsible for the product in its original configuration; every intervention which changes operation and structure of the Eos-Gate must be authorized by the manufacturer.
- The Eos-Gate must be used only for those kinds of usage it has been designed for. Every other kind of usage is potentially unsafe. The manufacturer is not responsible for improper usage.
- The manufacturer is not responsible for the consequences which come from the usage of not original spare parts.
- This manual is subject to change without notice
- The Eos-Gate is built using hardware provided by Moxa(R) and a customized software developed by Carlo Gavazzi Controls SpA. This software is property of Carlo Gavazzi Controls SpA and it cannot be copied, diffused, reverse-engineered, modified for whatever reason without an explicit written authorization provided by Carlo Gavazzi Controls SpA
- The Eos-Gate is designed to work as a gateway for monitoring web platforms; as the web platform targeted by Eos-Gate may be provided and maintained by third parties (e.g. Fat Spaniel ®), please read the relevant documentation provided by the third parties.

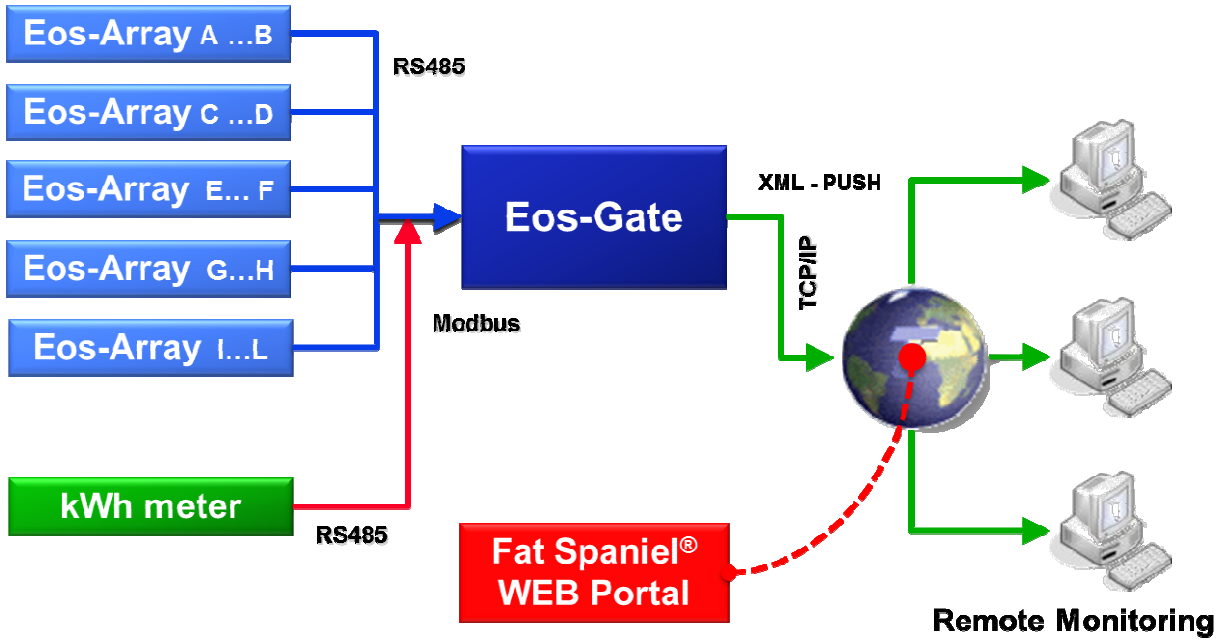
1 Summary

2 Overview

This manual is about the Eos-Gate product. The Eos-Gate is a device to be installed in photovoltaic plants with 3 main features:

1. Polling data from a set of field devices (Eos-Array/Eos-Array Lite, AC meters) with a planned time interval
2. Storing data into memory for safety reason
3. Pushing data to the Fat Spaniel® Portal, allowing to monitor the photovoltaic installation

The following diagram illustrates a typical architecture in which the Eos-Gate is used:



Measured variables and alarms are polled from the field devices, according to the desired time interval (suggested default 30 seconds). Data are stored into the SD memory, until they are correctly transmitted to the monitoring portal, for data safety reasons. With an opportune time interval (suggested default 10 minutes) data are then sent to the portal and the SD memory is freed. When data have been taken in charge by the web portal, the remote monitoring is possible using the Fat Spaniel® Solar Plant Vision[(1)] platform.

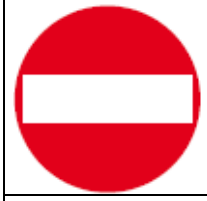
Notes:

(1) It is necessary to be Fat Spaniel®'s customers for using the above monitoring platform. The Eos-Gate provides connectivity for the field devices, but the usage of Fat Spaniel® platform and resourced is regulated by an agreement between the user and Fat Spaniel®

3 Important safety related information

This section contains important safety related information and statements. In the case of missed observance to these instructions serious damages may occur to devices and serious injuries and death may occur to people. Please read carefully this manual before beginning any installation, maintenance and operative activity on the equipment.

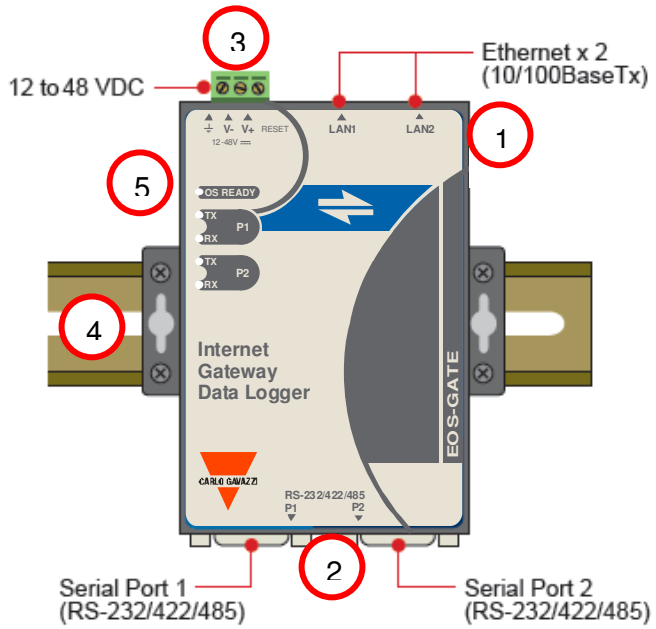
3.1 Safety recommendations to follow when installing, operating and maintaining the equipment.

SAFETY RECOMMENDATIONS		The manufacturer decline every direct or indirect responsibility for the consequences for the missing observance of the above mentioned prescriptions and for every wrong or improper uses of the equipment
	**THE EQUIPMENT MUST BE OPERATED ONLY BY SKILLED PERSONNEL**	For safety reason and for the need to grant a correct system operation, only skilled personnel is allowed to operate the equipment.
	**USERS ARE NOT ALLOWED TO OPEN THE DEVICE COVER**	The product cover cannot be removed and the product cannot be open without explicit authorization of the manufacturer.
	**DO NOT USE WATER TO PUT OUT FIRE**	It is forbidden to direct water jets and jets of other liquids on the device
	**DO NOT CONNECT VOLTAGES EXCEEDING RATED VALUES**	Do not connect voltages exceeding rated values to avoid damages to the equipment and potential risks of injuries for operators
	**ELECTRICAL COMPONENTS CONSTANTLY UNDER HIGH VOLTAGE**	The product does not operates at high voltages by itself, but it is installed in photovoltaic plants where high voltages are in use. According to the installation requirements, safety countermeasures must be used to preserve the system from damages and people from injuries

SAFETY RECOMMENDATIONS		The manufacturer decline every direct or indirect responsibility for the consequences for the missing observance of the above mentioned prescriptions and for every wrong or improper uses of the equipment
	**DANGER !!! RISK OF DAMAGES AND INJURIES FOR IMPROPER WIRING**	Carefully check wiring. Improper wiring of the device terminals can cause irreversible damages to the equipment and injuries to operators.
	**CAUTION!!! RISK OF DAMAGES FOR ELECTROSTATIC DISCHARGE**	The equipment contains electronic components which may be damaged by electrostatic discharges. Do not touch them if it is not strictly necessary.
	**FOLLOW THE RELEVANT GUIDELINES WHEN WIRING THE EQUIPMENT**	The RS-485 and Ethernet guidelines have to be used when connecting the equipment. If RS-485 and / or Ethernet wirings are not made following the relevant bad practices, problems in the system operations may appear

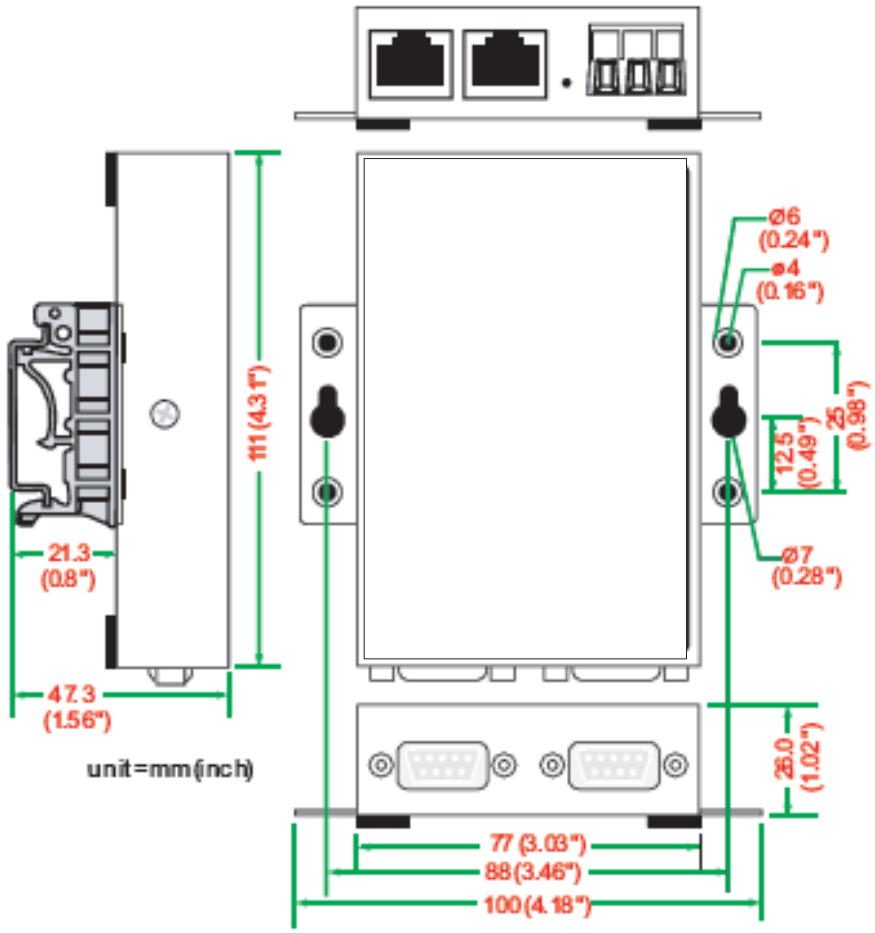
4 Product overview

4.1 System layout



1. Ethernet ports
The equipment is provided with two Ethernet ports, with the purpose of connecting them to the LAN
2. Serial ports
The equipment has two serial ports for RS-485 connections. The serial port 1 has to be connected to the Eos-Array/ Eos-Array Lite devices and to the AC meter; the port 2 is for third party devices
3. Power supply
The system operates with a 12 to 48 VDC supply. An universal power adaptor is supplied with the system
4. DIN Rail / Panel mounting
The system is enabled for DIN rail mounting or panel mounting. An opportune set of DIN rail adapters is included
5. LED signals
The system has an opportune set of led signals to show working conditions

4.2 Dimensions



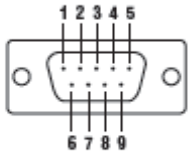
4.3 Packing list

When receiving the Eos-Gate, check that the following items are included into the package:

Packing list	
Item	**Notes**
Eos-Gate hardware	
Ethernet cable	RJ45 to RJ45 crossover cable, 100 cm
Universal power adaptor	Includes terminal block to power jack converter
Installation and operation manual	
DIN rail kit	Kit to be mounted for DIN rail installations

4.4 Serial ports' pin assignment

DB9 male connector



PIN	RS-422/485-4W	RS-485-2W
1	TxD-(A)	-
2	TxD+(B)	-
3	RxD-(A)	Data+(B)
4	RxD-(A)	Data-(A)
5	GND	GND
6	-	-
7	-	-
8	-	-

4.5 Hardware specifications

Hardware specifications	
Description	**Value**
Type	Embedded PC Operating system: Linux kernel 2.6 Processor: ARM9 RISC 32-bit 192 MHz Operation: Fan-less
Memory	RAM: 32 MB Flash ROM: 16 MB Integrated SD: 1GB, SLC Type industrial grade
Alert tools	Built-in RTC (real-time clock) Built-in buzzer
Communication ports	1 port for Eos-Array, Eos-array Lite and AC meters 1 port for third party devices
DC Supply	From 12 to 48 VDC
Power-ON indication	System Ready LED
Power consumption	340 mA @ 12 VDC (4.5 watts)
AC/DC power supply adapter	Universal power adaptor included
LAN	Ethernet : 2 auto sensing 10/100 Mbps ports Connector: RJ45 Magnetic Isolation Protection: 1.5 kV built-in Link Indicator: LED 10M/Link (x2) , 100M/Link (x2)
Serial Interface	RS-485 ports: 2 Connector: DB9 male ESD protection: 15 KV for all signals Indicators: LED TxD (x2), RxD (x2) Baudrate: selectable from 9600 bps to 115200 bps
Management	Eos-Gate Configuration Manager: software for configuration and testing based on a web server integrated into the Eos-Gate. The software allows to configure and test the Eos-Gate through a TCP/IP connection
Operating temperature	-10°C to +60°C 5% to 95% RH
Storage temperature	-20°C to +80°C
EMC	CE (EN55022 Class A, EN61000-3-2 Class A, EN61000-3-3, EN55024) FCC (Part 15 Subpart B, CISPR 22 Class A)
Safety	UL/cUL (UL60950-1, CSA C22.2 No. 60950-1-03) EN60950-1

4.6 Main Functions

Main functions			
Supported field devices	**Type**	**Brand**	**Model**
	AC meter	Carlo Gavazzi	EM21(1)
	AC meter	Carlo Gavazzi	EM24(1)
	AC meter	Carlo Gavazzi	EM26(1)
	AC meter	Carlo Gavazzi	WM30(1)
	AC meter	Carlo Gavazzi	WM40(1)
	AC meter	Carlo Gavazzi	WM5(1)
	DC monitoring device	Carlo Gavazzi	Eos-Array(2)
	DC monitoring device	Carlo Gavazzi	Eos-Array Lite(2)
	Notes: (1) up to 1 AC-meter can be managed by the Eos-Gate (2) up to 10 Eos-Arrays can be managed by the Eos-Gate		
Supported Web Portals	Fat Spaniel® Insight Platform and Fat Spaniel® Solar Plant Vision		
Polling time interval	From 30 seconds to 60 minutes (default 30 seconds)		
Transmission interval	Default 10 minutes		
Historical data storing	Up to 30 days if internet communication is broken		
Managed data: Eos-Array	Electrical measurements: instantaneous values for DC current, DC voltage, DC power, DC energy, string Efficiency at string level and string-combiner level Environmental measurements: instantaneous values for cell temperature, ambient temperature, solar irradiation, wind speed according to the installed Eos-Array modules and sensors Alarms: relevant Eos-Array's status information		
Managed data: Eos-Array Lite	Measurements: : instantaneous values for DC current, DC voltage, at string level and string-combiner level level Environmental measurements: instantaneous values for ambient temperature and solar irradiation according to the installed Eos-Array Lite modules and sensors Alarms: relevant Eos-Array Lite's status information		
Managed data for AC meters, 1-phase system	V = AC Voltage, instantaneous variable A = AC Current , instantaneous variable W = AC active power, instantaneous variable kWh- = AC energy produced, instantaneous variable kWh+= AC energy consumed, instantaneous variable		
Managed data for AC meters, 3-phase, 4 wires system	V_{L1} = AC Voltage phase L1, instantaneous variable V_{L2}= AC Voltage phase L2, instantaneous variable V_{L3} = AC Voltage phase L3, instantaneous variable V_{L1-2} = AC Voltage phase L1 to L2, instantaneous variable V_{L2-3} = AC Voltage phase L2 to L3, instantaneous variable V_{L3-1} = AC Voltage phase L3 to L1, instantaneous variable I_{L1} = AC Current phase L1, instantaneous variable I_{L2} = AC Current phase L2, instantaneous variable I_{L2} = AC Current phase L3, instantaneous variable W_{L1} = AC active power phase L1, instantaneous variable W_{L2} = AC active power phase L2, instantaneous variable W_{L3}= AC active power phase L3, instantaneous variable Wsys = AC active power ,system, instantaneous variable kWh- = AC energy produced, instantaneous variable kWh+= AC energy consumed, instantaneous variable		

Managed data for AC meters, 3-phase, 3 wires system	V_{L1-2} = AC Voltage phase A to B, instantaneous variable V_{L2-3} = AC Voltage phase B to C, instantaneous variable V_{L3-1} = AC Voltage phase C to A, instantaneous variable I_{L1} = AC Current phase A, instantaneous variable I_{L2} = AC Current phase B, instantaneous variable I_{L2} = AC Current phase C, instantaneous variable W_{L1} = AC active power phase A, instantaneous variable W_{L2} = AC active power phase B, instantaneous variable W_{L3}= AC active power phase C, instantaneous variable Wsys = AC active power ,system, instantaneous variable kWh- = AC energy produced, instantaneous variable kWh+= AC energy consumed, instantaneous variable

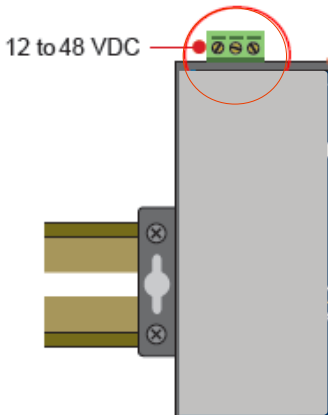
4.7 Eos-Gate configuration manager

Eos-Gate configuration manager	
Feature	**Description**
Eos-Gate configuration manager	Free English language software for Eos-Gate parameters programming and testing. The program is based on a web server integrated into the Eos-Gate and can be used by means of a common web browser
Network Configuration	RS485 parameters configuration TCP/IP network parameters configuration
Field devices configuration	Scanning mode available for Eos-Array/Eos-Array Lite and Carlo Gavazzi's AC meters automatic discovering
Web Portal parameters configuration	Configuration of the relevant Web Portal parameters (internet address, authentication codes)
Software update	Possibility of remotely updating the Eos-Gate software
Configuration management	Possibility of saving and recovering configurations on a PC for faster installation of multiple Eos-Gate devices.

5 Electrical connections

5.1 Connecting the power supply

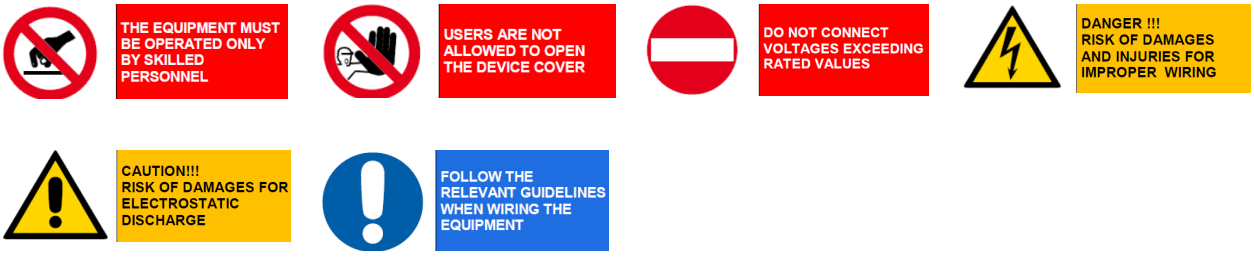
An opportune power supply must be connected using the special universal power adaptor included with the Eos-Gate. Relevant guidelines for connecting electrical devices must be used.
The power adaptor must be connected to the terminals shown in the picture.



IMPORTANT NOTE: the device is provided with a RESET button which restores the system at its basic factory defaults, but lets the system in an useless status. For this reason the RESET button has to be used by support personnel only.

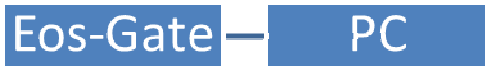
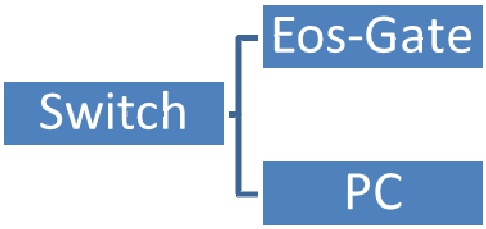
5.1.1 Relevant safety issues

IMPORTANT SAFETY PRESCRIPTIONS	Read carefully! Please refer to section 3.1 for further information
The manufacturer decline every direct or indirect responsibility for the consequences for the missing observance of the above mentioned prescriptions and for every wrong or improper uses of the equipment	



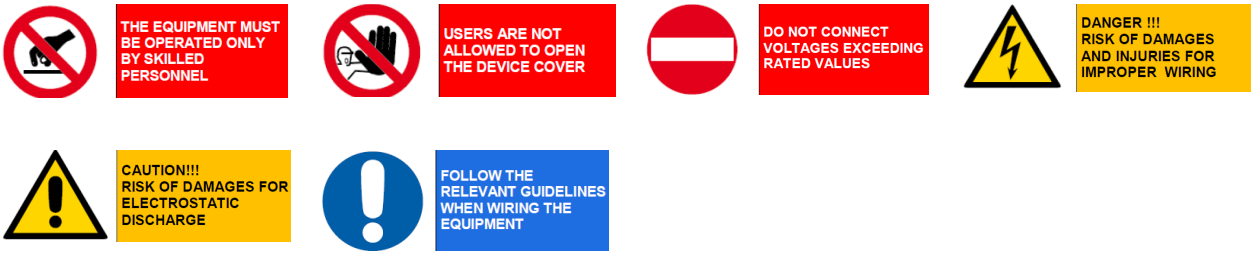
5.2 Connecting the Ethernet LAN adaptor to a PC

The RJ45 Ethernet ports may be connected to a PC for the initial configuration. The RJ45 to RJ45 cross-over cable included in the package may be used to directly connect one of the 2 RJ45 ports to the RJ45 Ethernet port of a personal computer.
To connect the Eos-Gate to a device other than a PC (e.g. an Ethernet Switch or Hub) an Ethernet RJ45 direct cable (not included in the package) has to be used.

Ethernet based connection to Eos-Gate	
Direct Eos-Gate to PC connection: use a RJ45 to RJ45 cross-over cable	
Eos-Gate to PC connection using an Ethernet Switch: use 2 RJ45 to RJ45 direct cables	

5.2.1 Relevant safety prescriptions

IMPORTANT SAFETY PRESCRIPTIONS	Read carefully! Please refer to section 3.1 for further information
The manufacturer decline every direct or indirect responsibility for the consequences for the missing observance of the above mentioned prescriptions and for every wrong or improper uses of the equipment	



5.3 Connecting the RS-485 ports to a serial RS-485 network

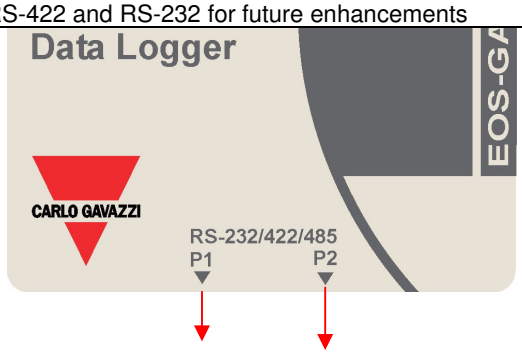
The Eos-Gate is provided with 2 RS-485 ports:

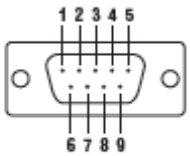
- Serial port 1: to be connected to Eos-Array / Eos-Array Lite devices and Carlo Gavazzi's AC meters
- Serial port 2: to be connected to third party devices

The connection to a serial RS-485 bus must be done following the relevant best practices. Please read the appendix "Modbus over serial line guidelines" at the end of this document.
An RS-485 network installed or operated without following the relevant prescriptions and guidelines can cause problems to data communication and damages to the connected devices.

<table>
<tr><th colspan="2">RS-485 connection to Eos-Gate</th></tr>
<tr><td>Connection guidelines</td><td>

Serial port 1: to be connected to Eos-Array / Eos-Array Lite devices and AC meter
Serial port 2: to be connected to third party devices

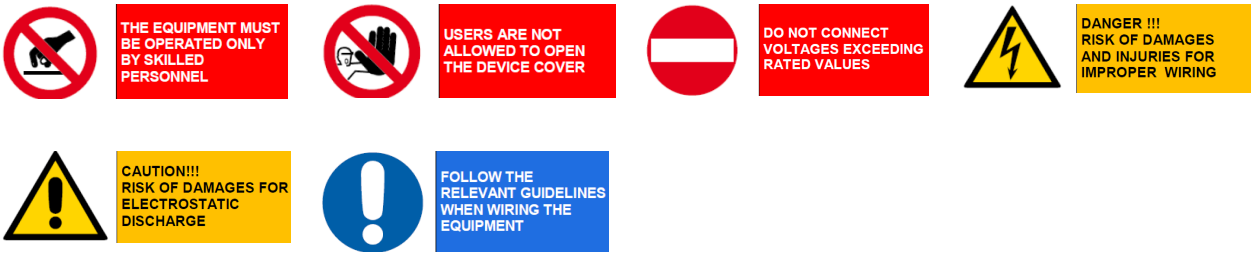
IMPORTANT NOTE: only RS-485 Bus must be used even if the device is designed to provide serial connectivity over RS-485, RS-422 and RS-232 for future enhancements


</td></tr>
<tr><td>Eos-Gate RS-485 pinout</td><td>
DB9 male connector


<table>
<tr><th>PIN</th><th>RS-422/485-4W</th><th>RS-485-2W</th></tr>
<tr><td>1</td><td>TxD-(A)</td><td>-</td></tr>
<tr><td>2</td><td>TxD+(B)</td><td>-</td></tr>
<tr><td>3</td><td>RxD-(A)</td><td>Data+(B)</td></tr>
<tr><td>4</td><td>RxD-(A)</td><td>Data-(A)</td></tr>
<tr><td>5</td><td>GND</td><td>GND</td></tr>
<tr><td>6</td><td>-</td><td>-</td></tr>
<tr><td>7</td><td>-</td><td>-</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td></tr>
</table>

5.3.1 Relevant safety prescriptions

IMPORTANT SAFETY PRESCRIPTIONS	Read carefully! Please refer to section 3.1 for further information
The manufacturer decline every direct or indirect responsibility for the consequences for the missing observance of the above mentioned prescriptions and for every wrong or improper uses of the equipment	



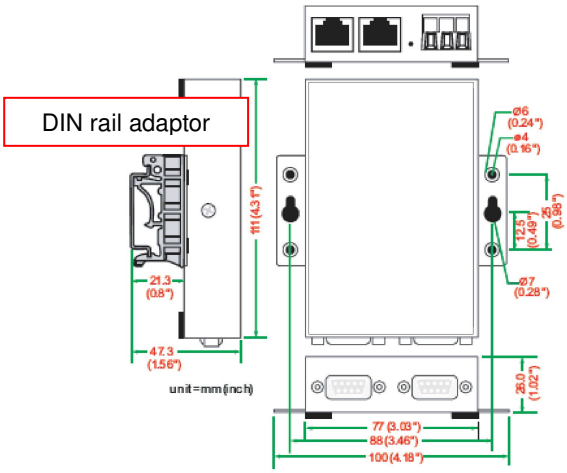
6 Eos-Gate installation

6.1 hysical installation

The Eos-Gate is designed to be installed:

1. By using DIN rails
2. Wall-mounted

In the first case the 2 special plastic DIN rail adaptors supplied in the Eos-Gate package must be used.
Observe the specified limits in terms of environmental conditions of use, with a special care for the ambient temperature.



6.2 Wiring

As far as wiring is concerned refer to the relevant information in the previous section and in the appendix. To proceed with the software configuration of the Eos-Gate, the following conditions must be true:

1. The Eos-Gate is connected to one or more Eos-Array / Eos-Array lite devices (up to 10) by means of a RS-485 serial line (serial port 1)
2. The Eos-Gate is connected to one AC meter by means of a RS-485 serial line (serial port 1)
3. The Eos-Gate is connected to a PC by means of either an Ethernet LAN or a direct connection through a cross-over using the Ethernet port 1 .(1)
4. The Eos-Gate is connected to internet by means of an Ethernet LAN and is reachable by internet for web connections over TCP/IP (port 80) using the Ethernet port 1.(1)

(1) Points (3) and (4) are to be considered as alternatives

6.3 Internet access prerequisites

According to the requested service level, if the Eos-Gate is placed behind a Firewall to protect the network, the following prerequisites have to be satisfied:

Needed feature	Prerequisite
Data transmission to the web portal	TCP ports 80,443,53 opened IN(1) to enable HTTP,HTTPS,DNS
Eos-Gate remote configuration using configuration manager	TCP ports 80,443 opened OUT(1) to enable the Eos-Gate to act as a web server
Eos-Gate remote access for support service	TCP port 22 (SSH) opened OUT(1) to enable the Eos-Gate to be accessed by SSH connections

Notes:
(1) IN: firewall rule to allow connections from inside the LAN to outside; OUT: the opposite

7 Eos-Gate configuration

7.1 Configuration steps

The following table shows the sequence of steps to follow for a complete configuration of an Eos-Gate based system. It should be considered as a guideline for partial configurations when needed.

Use case	Description	Following step	
		Condition	Use case
A5	Configuring a PC connection to the Eos-Gate through a LAN	TCP/IP check OK	A6
		TCP/IP check KO for LAN	A100
A6	Configuring Network parameters	Network OK	A7
A7	Configuring Time Server	Time Server OK	A10
A10	Checking RS-485 connectivity for Eos-Array	Serial port connectivity OK	A15
		Serial port connectivity KO	A110
A15	Checking RS-485 connectivity for the AC meter	Serial port connectivity OK	A20
		Serial port connectivity KO	A110
A20	Checking connectivity to the Fat Spaniel® portal	Connectivity OK	A30
		Connectivity KO	A120
A30	Configuring the AC meter parameters	Configuration OK	A40
		Configuration KO	STOP
A40	Configuring the Eos-Array / Eos-Array Lite parameters	Configuration OK	A50
		Configuration KO	STOP
A50	Uploading configuration to the Fat Spaniel® Portal	Upload OK	A60
		Upload KO	A20
A60	Starting data communication to the Fat Spaniel® Portal	Transmission OK	END
		Transmission KO	A20
A100	Checking LAN network	Check OK	A5
		Check KO	STOP
A110	Checking RS-485 network	Check OK	A10,A15
		Check KO	STOP
A120	Checking Fat Spaniel® relevant data	Check OK	A20
		Check KO	STOP

7.2 A5 - Configuring a PC connection to the Eos-Gate through a LAN

1	Use case name	**Configuring a PC connection to the Eos-Gate through a LAN**
2	Use case ID	A5
3	Description	This use case covers the connection of a personal computer to the Eos-Gate device over a LAN network
4	Use case goal	The user's PC is successfully connected to the Eos-Array device
5	Primary actors	Eos-Gate, User's PC,
6	Secondary actors	LAN
7	Pre-conditions	• PC running a web browser • PC connected to LAN • Eos-Gate connected to LAN
8	Post-conditions	Success end conditions: • The PC communicates with the Eos-Gate Failure end conditions: • The PC cannot communicate with the Eos-Gate
9	Trigger	
10	Scenario description	• The user picks the IP standard address for the Eos-Gate device printed on the backside label (192.168.3.127 or 192.168.4.127) and connects an Ethernet cable to the relevant Ethernet port • The user configures networks settings on its PC according to the above IP (refer to the appendix "IP network setting guidelines") • The user runs the Eos-Gate Configuration Manager • The user opens the Tools menu and runs "Ping" to an opportune IP address • According to the result the user goes to the following step
11	Special requirements	
12	Information	

7.3 A6 - Configuring Network parameters

1	Use case name	**Configuring TCP/IP Network parameters for the Eos-Gate**
2	Use case ID	A6
3	Description	This use case covers the configuration of the relevant network parameters to allow Eos-Gate to communicate through internet
4	Use case goal	The Eos-Gate is enabled to communicate using TCP/IP
5	Primary actors	Eos-Gate, User's PC,
6	Secondary actors	LAN
7	Pre-conditions	• PC running a web browser • PC connected to LAN • Eos-Gate connected to LAN • Eos-Gate Configuration Manager up and running
8	Post-conditions	Success end conditions: • The Network parameters are correctly configured Failure end conditions: • The Network parameters are not correctly configured
9	Trigger	
10	Scenario description	• Using Eos-Gate Configuration Manager, go to Network • Configure the relevant parameters under "IP address" • Configure the relevant parameters under "DNS" • Configure the relevant parameters under "Dyn DNS" if a Dyn DNS service is supposed to be used (please read the relevant documentation available on internet about Dyn DNS services before using this option) • According to the result the user goes to the following step
11	Special requirements	
12	Information	Regarding the Dyn DNS service: • We performed our tests with dyndns.org • Carlo Gavazzi does not assume responsibility for services provided by third party service providers

7.4 A7 - Configuring Network Time Server

1	Use case name	**Configuring Network Time Server for the Eos-Gate**
2	Use case ID	A7
3	Description	This use case covers the configuration of the relevant network parameters to allow Eos-Gate to communicate with a NTP server
4	Use case goal	The Eos-Gate is enabled to gather NTP data from a time server
5	Primary actors	Eos-Gate, User's PC,
6	Secondary actors	LAN
7	Pre-conditions	• PC running a web browser • PC connected to LAN • Eos-Gate connected to LAN • Eos-Gate Configuration Manager up and running • TCP/IP network configured correctly
8	Post-conditions	Success end conditions: • The NTP server is communicating with Eos-Gate Failure end conditions: • The NTP server is not communicating with Eos-Gate
9	Trigger	
10	Scenario description	• Using Eos-Gate Configuration Manager, go to Network • Configure the relevant parameters under "Time Server" • Check "ON" the "Enable Network Time Server" Option • Check the NTP communication by pressing the "Update now" button • According to the result the user goes to the following step
11	Special requirements	**Please note that having an NTP server configured correctly with Eos-Gate is MANDATORY to allow Eos-Gate to send correctly timestamped data to the monitoring web portal**
12	Information	You are free to use the NTP server you prefer. We performed our tests with 3.pool.ntp.org Carlo Gavazzi does not assume responsibility for services provided by third party service providers

7.5 A10 - Checking RS-485 connectivity for Eos-Array / Eos-Array Lite

1	Use case name	**Checking RS-485 connectivity for Eos-Array**
2	Use case ID	A10
3	Description	This use case covers the check for Eos-Array / Eos-Array Lite connectivity
4	Use case goal	The Eos-Array / Eos-Array Lite devices are successfully connected to the Eos-Gate
5	Primary actors	Eos-Gate, User's PC, Eos-Array / Eos-Array Lite
6	Secondary actors	RS-485
7	Pre-conditions	• Step A5 OK • Eos-Array / Eos-Array Lite correctly configured according to the relevant guidelines • Eos-Gate connected to the RS-485 bus of the Eos-Array / Eos-Array Lite
8	Post-conditions	Success end conditions: • The Eos-Gate communicates with the Eos-Array / Eos-Array Lite devices Failure end conditions: • The Eos-Gate cannot communicate with the Eos-Array / Eos-Array Lite devices
9	Trigger	
10	Scenario description	• Using the Eos-Gate configuration manager, open the Eos-Array tab • Configure the relevant RS-485 parameters • Start the "Show Eos Array" action • Compare the "Device List" with the real configuration of the system • According to the comparison, go to the following step
11	Special requirements	
12	Information	

7.6 A15 - Checking RS-485 connectivity for the AC meter

1	Use case name	**Checking RS-485 connectivity for the AC meter**
2	Use case ID	A15
3	Description	This use case covers the check for the AC meter connectivity
4	Use case goal	The AC meter is successfully connected to the Eos-Gate
5	Primary actors	Eos-Gate, User's PC, AC meter
6	Secondary actors	RS-485
7	Pre-conditions	• Step A5 OK • AC meter correctly configured according to the relevant guidelines • Eos-Gate connected to the RS-485 bus of the AC meter (serial port P1)
8	Post-conditions	Success end conditions: • The Eos-Gate communicates with the AC meter Failure end conditions: • The Eos-Gate cannot communicate with the AC meter
9	Trigger	
10	Scenario description	• Using the Eos-Gate configuration manager, open the AC meter tab • Configure the relevant RS-485 parameters • Configure the AC meter settings • Start the "Show AC meter" action • According to the result, go to the following step
11	Special requirements	
12	Information	

7.7 A20 - Checking connectivity to the Fat Spaniel® Portal

1	Use case name	**Checking connectivity to the Fat Spaniel® Portal**
2	Use case ID	A20
3	Description	This use case covers the check for the Fat Spaniel® portal connectivity
4	Use case goal	The Fat Spaniel® Portal is successfully connected to the Eos-Gate
5	Primary actors	Eos-Gate, User's PC, Fat Spaniel®
6	Secondary actors	Internet
7	Pre-conditions	• Step A5 OK • Fat Spaniel® account available • Eos-Gate connected to internet
8	Post-conditions	Success end conditions: • The Eos-Gate communicates with the Fat Spaniel® Portal Failure end conditions: • The Eos-Gate cannot communicate with the Fat Spaniel® Portal
9	Trigger	
10	Scenario description	• Using the Eos-Gate configuration manager open the Web Platform tab • Configure the parameters • Using the Eos-Gate configuration manager open the Tools tab • Choose the "Web portal connection test" action • According to the result, go to the following step
11	Special requirements	
12	Information	

7.8 A30 - Configuring the AC meter parameters

1	Use case name	**Configuring the AC meter parameters**
2	Use case ID	A30
3	Description	This use case covers the AC meter's parameters configuration
4	Use case goal	The AC meter is correctly configured in the Eos-Gate
5	Primary actors	Eos-Gate, User's PC, AC meter
6	Secondary actors	RS-485
7	Pre-conditions	• Step A15 OK
8	Post-conditions	Success end conditions: • The Eos-Gate's configuration for AC meter is OK Failure end conditions: • The Eos-Gate's configuration for AC meter is not OK
9	Trigger	
10	Scenario description	• Using the Eos-Gate configuration manager, open the "AC meter" tab • Check the parameters and compare them with the real installation • According to the result, go to the next step
11	Special requirements	
12	Information	

7.9 A40 - Configuring the Eos-Array / Eos-Array Lite parameters

1	Use case name	**Configuring the Eos-Array / Eos-Array Lite parameters**
2	Use case ID	A40
3	Description	This use case covers the Eos-Array/Eos-Array Lite parameters configuration
4	Use case goal	The AC Eos-Array/Eos-Array Lite devices are correctly configured in the Eos-Gate
5	Primary actors	Eos-Gate, User's PC, Eos-Array/Eos-Array Lite
6	Secondary actors	RS-485
7	Pre-conditions	• Step A10 OK
8	Post-conditions	Success end conditions: • The Eos-Gate's configuration for Eos-Array/Eos-Array Lite is OK Failure end conditions: • The Eos-Gate's configuration for Eos-Array/Eos-Array Lite is not OK
9	Trigger	
10	Scenario description	• Using the Eos-Gate configuration manager, open the "AC meter" tab • Check the parameters and compare them with the real installation • According to the result, go to the next step
11	Special requirements	
12	Information	

7.10 A50 - Uploading configuration to the Fat Spaniel® Portal

1	Use case name	**Uploading configuration to the Fat Spaniel® Portal**
2	Use case ID	A50
3	Description	This use case covers the upload of the plant configuration to the Fat Spaniel® portal. This is the action which builds the system on the remote monitoring web portal. Pay care to plan, execute and check this action correctly because a wrong upload may cause problems in the following monitoring
4	Use case goal	The eos-Gate successfully uploads the plant configuration to the Fat Spaniel® Portal
5	Primary actors	Eos-Gate, User's PC, Fat Spaniel®
6	Secondary actors	Internet
7	Pre-conditions	• All steps from A1 to A49 OK
8	Post-conditions	<u>Success end conditions:</u> • The Eos-Gate's configuration is uploaded to Fat Spaniel® portal <u>Failure end conditions:</u> • The Eos-Gate's configuration cannot be uploaded to Fat Spaniel® portal
9	Trigger	
10	Scenario description	• Carefully check the configuration data for "PV-Plant, "Eos-Array", "AC meter" tabs • Carefully check of having correctly completed all the previous steps (from A1 to A49). • Choose "Plant Creation" • Press "Discover devices" • Check the action's result; if everything is correct, press "Create Plant" • Check the action's result
11	Special requirements	Note: Only some of the uploaded configuration data may be edited in the Fat Spaniel® Portal at a second time. Wrong configuration data uploaded may cause problems in the monitoring features. It is not possible to overwrite an uploaded configuration with a new configuration. For these reasons it is important to be particularly careful with this phase. Please read the relevant Fat Spaniel® documentation for further information regarding data editing in the portal
12	Information	

7.11 A60 - Starting data communication to the Fat Spaniel® Portal

1	Use case name	**Starting data communication to the Fat Spaniel® Portal**
2	Use case ID	A60
3	Description	This use case covers the data (measurements and alarms) communication from the Eos-gate to the Fat-Spaniel® portal
4	Use case goal	The Eos-Gate successfully uploads the plant configuration to the Fat Spaniel® Portal
5	Primary actors	Eos-Gate, User's PC, Fat Spaniel®
6	Secondary actors	Internet
7	Pre-conditions	• All steps from A1 to A59 OK
8	Post-conditions	Success end conditions: • The Eos-Gate's data are transmitted to Fat Spaniel® portal Failure end conditions: • The Eos-Gate's data cannot be correctly transmitted to the Fat Spaniel® portal
9	Trigger	
10	Scenario description	• The EosGate starts automatically to send data after having completed successfully the "Create Plant" action; check the Fat Spaniel website for coming data
11	Special requirements	Note: Only some of the uploaded configuration data may be edited in the Fat Spaniel® Portal at a second time. Wrong configuration data uploaded may cause problems in the monitoring features. It is not possible to overwrite an uploaded configuration with a new configuration. For these reasons it is important to be particularly careful with the configuration phase. If, for any reason, a new upload of the configuration is requested, a new plant will appear on the Fat Spaniel® Portal and the previous collected data will not be lost, but they will be stored under the old plant's root. Please read the relevant Fat Spaniel® documentation for further information .
12	Information	

7.12 A100 – Checking LAN network

1	Use case name	**Checking LAN network**
2	Use case ID	A100
3	Description	This use case covers the LAN checking guidelines in the case of connectivity related problems
4	Use case goal	The Eos-Gate is successfully connected to LAN
5	Primary actors	Eos-Gate, User's PC
6	Secondary actors	LAN
7	Pre-conditions	
8	Post-conditions	Success end conditions: • The Eos-Gate is successfully connected to LAN Failure end conditions: • The Eos- Gate cannot be successfully connected to LAN
9	Trigger	A5
10	Scenario description	• Carefully check correct cable type being in use • Carefully check for a correct physical connection • Check for LAN issues on every device in the LAN path under exam • Check LED status on the Eos-Gate • Check LED status on every device in the LAN path under exam
11	Special requirements	Note: for further information about the solution of LAN related issues, please read the appendix "LAN network guidelines" at the end of this document
12	Information	

7.13 A110 – Checking RS-485 network

1	Use case name	**Checking RS-485 network**
2	Use case ID	A110
3	Description	This use case covers the RS-485 checking guidelines in the case of connectivity related problems
4	Use case goal	The Eos-Gate is successfully connected to RS-485
5	Primary actors	Eos-Gate, User's PC
6	Secondary actors	RS-485 bus
7	Pre-conditions	
8	Post-conditions	Success end conditions: • The Eos-Gate is successfully connected to RS-485 bus Failure end conditions: • The Eos- Gate cannot be successfully connected to RS-485 bus
9	Trigger	A10, A15
10	Scenario description	• Carefully check correct cable type being in use • Carefully check for a correct physical connection • Carefully check for a correct network topology • Carefully check for RS-485 grounding • Check for RS-485 issues on every device in the LAN path under exam
11	Special requirements	Note: for further information about the solution of LAN related issues, please read the appendix "MODBUS over RS-485 serial line" at the end of this document
12	Information	

7.14 A120 - Checking Fat Spaniel® relevant data

1	Use case name	**Checking Fat Spaniel® relevant data**
2	Use case ID	A120
3	Description	This use case covers the Fat Spaniel® relevant data checking
4	Use case goal	Fat Spaniel® data are correctly configured
5	Primary actors	Eos-Gate, User's PC,Fat Spaniel®
6	Secondary actors	
7	Pre-conditions	
8	Post-conditions	Success end conditions: • Fat Spaniel® data are correctly configured Failure end conditions: • Fat Spaniel® data are not correctly configured
9	Trigger	A20
10	Scenario description	• Carefully check user ID and password (provided by Fat Spaniel®) • Carefully check API key (provided by Fat Spaniel®) • Carefully check Fat Spaniel® server address
11	Special requirements	Note: for further information about Fat Spaniel® solutions please examine the Fat Spaniel® relevant documentation.
12	Information	

8.1 Maintenance steps

Use case	Description	Following step	
		Condition	Use case
B10	Managing configurations		
B20	Downloading a configuration from Eos-Gate		
B30	Uploading a configuration to Eos-Gate		
B40	Uploading an updated software to Eos-Gate		

8.2 B10 - Managing configurations

1	Use case name	**Managing configurations**
2	Use case ID	B10
3	Description	This use case covers the actions needed to manage the Eos-Gate configuration (e.g. for copying configuration from one device to another)
4	Use case goal	
5	Primary actors	Eos-Gate, User's PC,
6	Secondary actors	
7	Pre-conditions	• Web browser available in the PC
8	Post-conditions	Success end conditions: • Eos-Gate configuration may be managed Failure end conditions: • Eos-Gate configuration may not be managed
9	Trigger	

10	Scenario description	• Start Eos-Gate configuration manager
		• Open the Tools menu
		• The available actions under the Tools menu allow to :
		  ○ Upload an existing configuration from the PC
		  ○ Download the actual configuration from the EosGate

11	Special requirements	Note: the configuration which is managed is the one in the Eos-Gate memory; action B20, B30 have to be used to interact with the Eos-Gate software
12	Information	

8.3 B20 – Downloading a configuration from the Eos-Gate

1	Use case name	**Downloading a configuration from the Eos-Gate**
2	Use case ID	B20
3	Description	This use case covers the actions needed to download a configuration from an existing Eos-Gate firmware
4	Use case goal	
5	Primary actors	Eos-Gate, User's PC,
6	Secondary actors	
7	Pre-conditions	• Web browser available in the PC • Eos-Gate successfully connected to the PC through LAN
8	Post-conditions	Success end conditions: • Eos-Gate configuration may be downloaded Failure end conditions: • Eos-Gate configuration may not be downloaded
9	Trigger	
10	Scenario description	• Start Eos-Gate configuration manager • Open Tools menu • Choose "Download configuration"
11	Special requirements	Note: when downloading/uploading configuration from different Eos-Gate devices, take care that the same Eos-Gate firmware release and Eos-Gate configuration manager release are in use
12	Information	

8.4 B30 – Uploading a configuration from the Eos-Gate

1	Use case name	**Uploading a configuration from the Eos-Gate**
2	Use case ID	B30
3	Description	This use case covers the actions needed to upload a configuration to an existing Eos-Gate firmware
4	Use case goal	
5	Primary actors	Eos-Gate, User's PC,
6	Secondary actors	

7	Pre-conditions	• Web browsers installed in the PC
		• Eos-Gate successfully connected to the PC through LAN
		• Eos-Gate configuration manager started
		• A correct configuration is present in the Eos-Gate configuration manager :
		  ○ Opened from file
		  ○ Downloaded from an Eos-Gate
		  ○ Written by hand
		• The configuration has been created using the same release of the configuration manager

8	Post-conditions	Success end conditions: • Eos-Gate configuration may be uploaded Failure end conditions: • Eos-Gate configuration may not be uploaded
9	Trigger	
10	Scenario description	• Open Tools menu • Choose "Upload configuration"
11	Special requirements	Note: when downloading/uploading configuration from different Eos-Gate devices, take care that the same Eos-Gate firmware release and Eos-Gate configuration manager release are in use
12	Information	

8.5 B40 – Uploading a software upgrade to the Eos-Gate

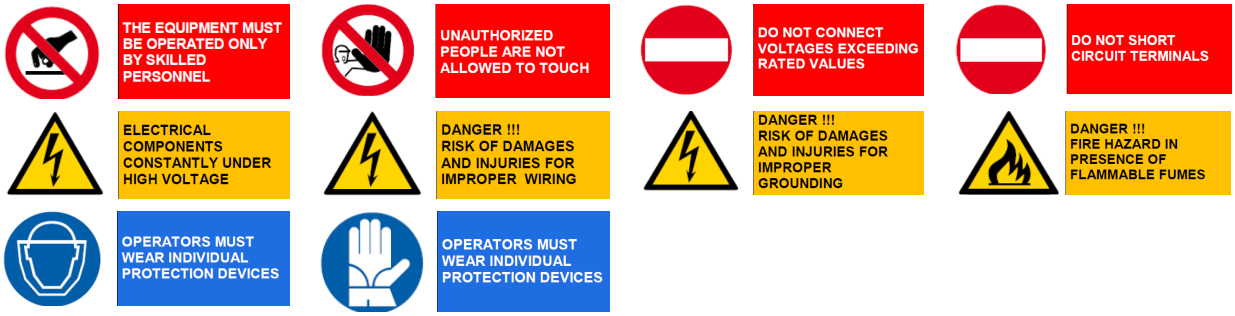
1	Use case name	**Uploading an software-upgrade to the Eos-Gate**
2	Use case ID	B40
3	Description	This use case covers the actions needed to upload an updated software to an existing Eos-Gate
4	Use case goal	
5	Primary actors	Eos-Gate, User's PC,
6	Secondary actors	
7	Pre-conditions	• A web browser installed in the PC • Eos-Gate successfully connected to the PC through LAN • Eos-Gate configuration manager started • An upgraded software release available as a file in the PC
8	Post-conditions	Success end conditions: • Eos-Gate software may be uploaded Failure end conditions: • Eos-Gate software may not be uploaded
9	Trigger	
10	Scenario description	• Open Tools menu • Choose "upload software"
11	Special requirements	Note: when downloading/uploading configuration from different Eos-Gate devices, take care that the same Eos-Gate firmware release and Eos-Gate configuration manager release are in use
12	Information	

9 System operation and monitoring

9.1 Safety recommendations

Eos-Gate together with a Web Portal solution allows to monitor photovoltaic plant's status and history. According to the plant's status actions may be taken to solve problems at the installation plant level. The relevant countermeasures are out of the scope of this manual, because they are related to the plant maintenance at the electrical level.
As a general guideline, only authorized personnel with the appropriate skills to operate with high voltage installations, with adequate protection devices and with a first class knowledge of safety prescriptions and relevant rules and guidelines, in observance of Country specific laws and prescriptions can operate on a photovoltaic installation.

IMPORTANT SAFETY PRESCRIPTIONS	Read carefully!
The manufacturer decline every direct or indirect responsibility for the consequences for the missing observance of the above mentioned prescriptions and for every wrong or improper uses of the equipment	



9.2 Choose the right monitoring solution

The purposes of the monitoring solution in place are essentially two:

1. Provide the user with relevant data to estimate the plant's efficiency and how well it is performing
2. Provide the user with alarms and events useful to plan fast counter-measures for problems and activate maintenance policies based on predictive strategies

9.2.1 Performance and alarm monitoring

The Eos-Gate allows to interface the Eos-Array / Eos-Array Lite solution with the Fat Spaniel® Monitoring Portal providing the user with a turnkey solution for PV plant monitoring.
For the details refer to the relevant datasheets and manuals for the Eos-Array / Eos-Array Lite products and the documentation about Fat Spaniel® photovoltaic monitoring solutions.

9.3 Proactive and predictive maintenance

Proactive and predictive maintenance are best-practice when operating installations in which a high level of reliability is needed.
The only way to operate proactive and predictive maintenance strategies is:

1. Storing historical data
2. Having a reliable alarm polling system
3. Having a good knowledge of the devices in the plant

For each of the above cases the Eos-Array provides the supervision system with the whole set of alarms needed. For the details refer to the relevant datasheets and manuals for the Eos-Array and Eos-Box products.

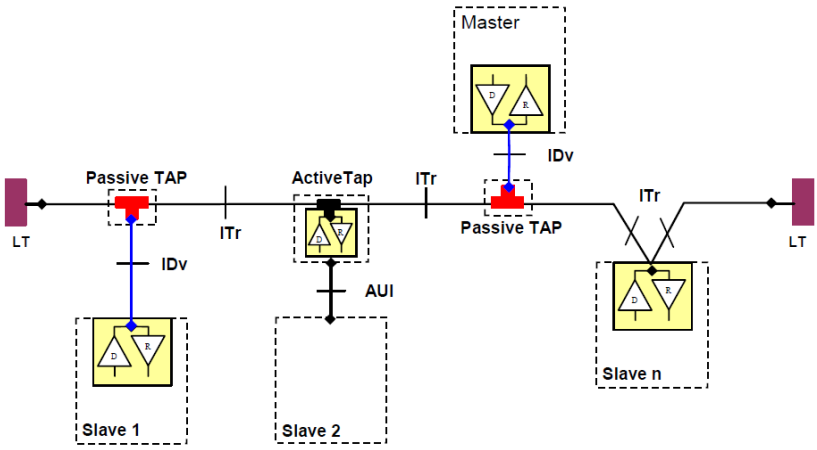
10 Appendix

10.1 MODBUS over Serial line (RS-485) guidelines

10.1.1 Introduction

RS-485 is a half-duplex multidrop network: multiple transmitters and receivers may reside on the same line, but only one transmitter may be active at any given time. The TIA/EIA-485-A says nothing about the communication protocol to be used.
The MODBUS standard defines an application layer messaging protocol. The MODBUS Serial Line is a master-slave protocol which may use RS-485 as its physical interface.
Please refer to the “Modbus over serial line V1.02” specification for further information.
The following picture represents a typical MODBUS over serial line system.

Code	Description
IDv	Derivation interface (Passive Tap)
ITr	Interfance with the trunk
AUI	Attachment unit interface (Active Tap)
LT	Line termination

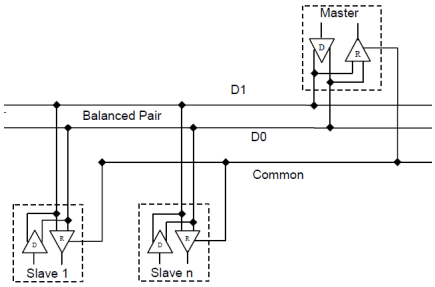


10.1.2 RS-485 cable

The suggested cable is the shielded twisted pair for 2 wires connections (2W-MODBUS) and the shielded double twisted pair for 4 wires connections (4W-MODBUS). If there are not any reason to use the 4W-MODBUS (e.g. an existing serial line) a 2W-MODBUS based system is the right choice because the Eos-Array products are based on a 2 wires system. The following notes are related to 2W-MODBUS systems.
Cables must be at least AWG 24. The typical cable impedance should be between 100 ohm and 120 ohm.
A specific cable for MODBUS RS-485 application must be chosen.

10.1.3 RS-485 grounding

Communication through a RS-485 system is made by means of a balanced pair with a common so a three wire connection is needed . The Common circuit must be connected directly to protective ground, preferably at one point only for the entire bus. Generally this point is to choose on the master device or on its tap and not to be shared with other devices (inverters,…) which could add external noise or disturbance.
The protective shield may be used as Common circuit.

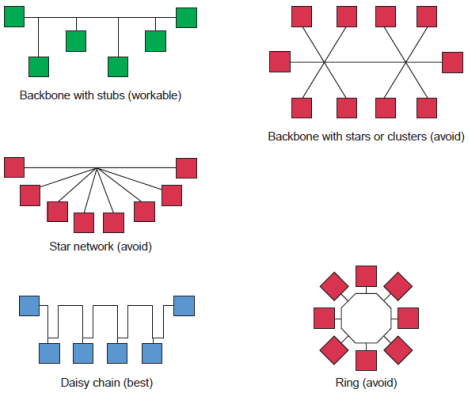


10.1.4 RS-485 shielding

A shielded cable is requested to guarantee high degrees of immunity to EMC and lightning events.
The cable shield can be used as Common circuit .

10.1.5 RS-485 topology

Due to signal reflection issues, topology is not free, but only certain configurations are allowed. The only configuration which guarantees a sufficient reliability level is the daisy-chain.



10.1.6 RS-485 termination

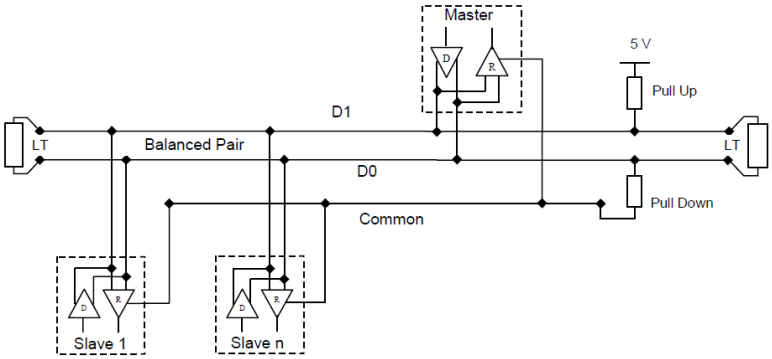
A termination is needed at each end of the bus. Termination must not be placed in other places. Suggested terminations have the following characteristics:

Suggested terminations for MODBUS over RS485 serial line				
Description	**Type**	**Connection**	**Suggested termination**	**Notes**
2W RS-485	Bidirectional termination, resistor only	Between the two conductors of the balanced line (near each end of the bus)	R = 150 ohm/0.5W (resistor)	Preferred without line polarization
	Bidirectional termination, serial capacitor with resistor	Between the two conductors of the balanced line (near each end of the bus)	R = 120 ohm, 0.25W (resistor) in series with C = 1 nF, 10V (capacitance)	Preferred with line polarization
4W RS-485	Bidirectional termination, resistor only	Between each pair of conductors of the balanced line (near each end of the bus)	R = 150 ohm/0.5W (resistor)	Preferred without line polarization
	Bidirectional termination, serial capacitor with resistor	Between each pair of conductors of the balanced line (near each end of the bus)	R = 120 ohm, 0.25W (resistor) in series with C = 1 nF, 10V (capacitance)	Preferred with line polarization

10.1.7 RS-485 MODBUS line polarization.

Every MODBUS device must document if the device needs line polarization, and if it implements such a line polarization.
If one or several devices need polarization, the following resistors must be connected on the RS-485 balanced pair:

- Pull-up resistor to 5V voltage (from 450 ohm to 650 ohm)
- Pull-down resistor to the common circuit (from 450 ohm to 650 ohm)



The two resistors must be connected at one location for the whole bus (possibly near to the master). Other devices must not implement any polarization.

10.1.8 RS-485 wiring procedure

Suitable wire sleeves must be used for wiring. If any wire splice is to be used, this splice must be soldered, taking special care to cover splice with cable shield and to ensure proper continuity.

10.1.9 RS-485 limits

RS-485 limits			
Description	**Limits**	**Suggestions**	**Notes**
Trunk cable length	Depends on cable, speed ,network configuration and number of loads. For example it is 1000 m for a 9600 bps, AWG26 connection		
Derivation cable length	Must be short, never more than 20 m		
Maximum number of RS-485 devices without repeater	32 devices always authorized. Depending on: • all the possible addresses, • the RS-485 unit load used by devices • the polarization a larger number may be authorized	The use of a repeater between two heavy loaded RS-485 MODBUS is possible	The MODBUS device manufacturer must document the how many devices are authorized without repeater
Maximum number of devices addressable by MODBUS on a single Bus	One master and up to 247 slaves		

10.1.10 Further information

Please refer to the following documents for further information:

- "Modbus over serial line V1.02" specification
- TIA/EIA-485-A standard specification

10.2 LAN network guidelines

10.2.1 Cables

Keep care with cables and connections.
The right cable has always to be used.
For the Eos-Gate operation UTP cat. 5 cables with RJ45 terminals have to be used, with cross-over or direct internal wiring according to the connection type:

- Eos-Gate to PC: cross-over cable
- Eos-Gate to Ethernet Switch or Hub: direct cable

10.2.2 Addresses

When operating a LAN network, great care must be kept with IP addressing in the devices.
A simple guideline to operate with the pre-configured IP addresses in the Eos-Gate is the following:

IP network		
Description	**Values**	**Suggestions**
Pre-configured addresses in the Eos-Gate	Port 1: 192.168.3.127 Port 2: 192.168.4.127	Change the IP address of the port 1 according to your policies. Maintain the IP address of the port 2 to grant an easy connection for future needs
Suggested LAN IP set of address	192.168.0.0 - 192.168.255.255, class C (mask 255.255.255.0) e.g. 192.168.3.x to be in the same network as Eos-Gate default port 1 address	This set of addresses has to be changed according to the network policies in use for the installation

10.2.3 Ping

Ping is a useful utility software when debugging TCP/IP networks. The Eos-Gate allows a complete set of TCP/IP checking features under the Tools menu, including the ping feature.
Ping may be used to test connectivity from different devices (e.g. the user's PC) to the Eos-Gate; for example, to check if the Eos-Gate is reachable from your PC, assuming that the Eos-Gate's port 1 is in use, the command:

PING 192.168.3.127

may be used from a COMMAND session of Windows®. For further details please refer to the relevant documentation freely available on Internet.