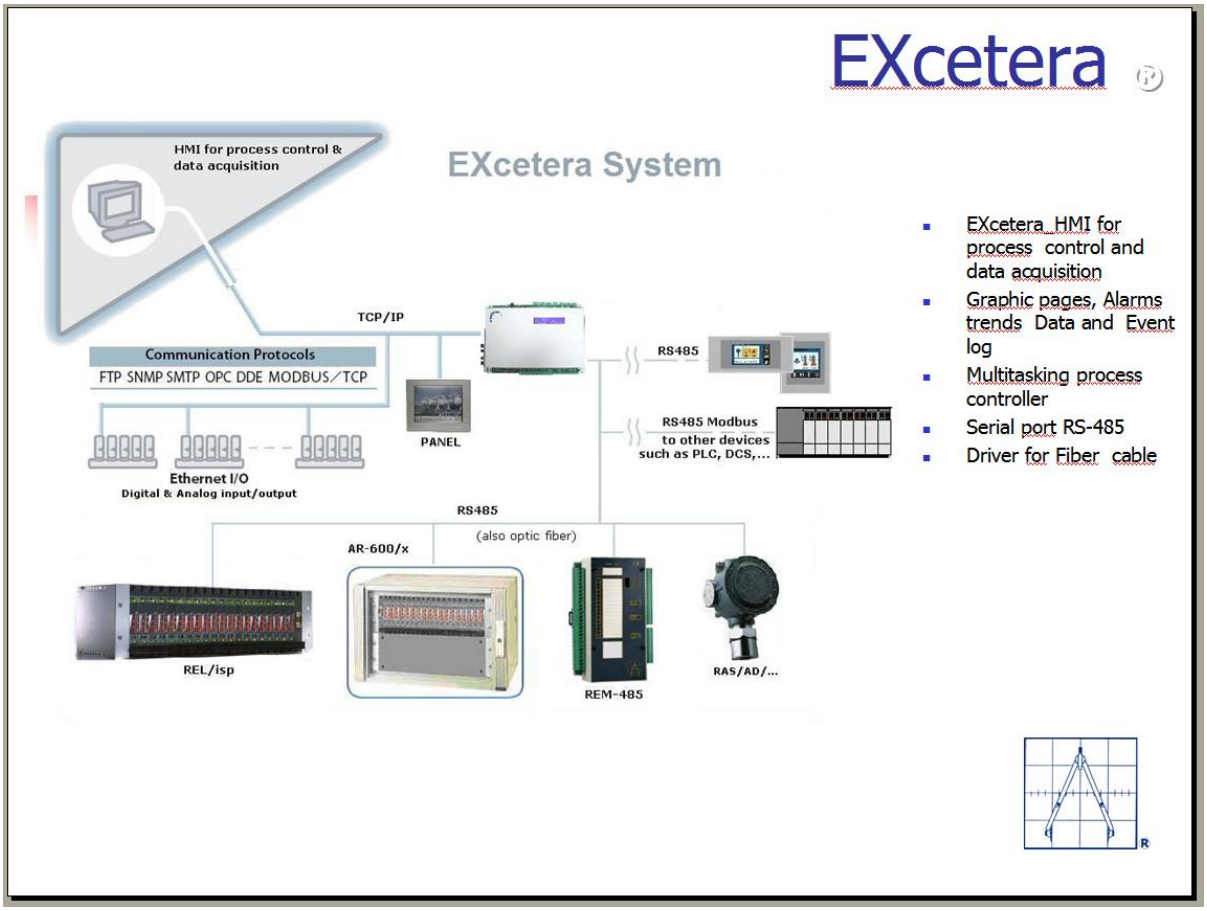
EXcetera® gas detection control system



Users Manual

August 2013
Made by OGGIONI s.a.s.
Via Lavoratori Autobianchi, 1 20832 Desio (MB) Italia

1st Edition

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Warranty

Oggioni S.a.s. warrants that all items delivered under this agreement will be free from defects in material and workmanship, conform to applicable specifications, and, to the extend that detailed designs have not been furnished by the buyer, will be free from design defects. Oggioni S.a.s. shall not be liable for the goods being fit for a particular purpose. The above warranty is given by Oggioni S.a.s. subject to the following conditions:

Oggioni S.a.s. shall not be liable in respect of any defect in the goods arising from any design or specification supplied by the buyer;

Oggioni S.a.s. shall not be liable under the above warranty if the total price for the goods has not been paid by the time period specified in charter 6 of the present conditions of sales.

The above warranty does not extend to parts, materials or equipments manufactured by or on behalf of the buyer unless such warranty is given by the manufacturer to Oggioni S.a.s.

If so required by Oggioni S.a.s. the Products will be returned to Oggioni S.a.s. by the buyer at the buyer's risk and expense;

This warranty does not cover defects in or damage to the products which are due to improper installation or maintenance, misuse, neglect or any cause other than ordinary commercial application. Any claim by the buyer which is based on any defect in the quality or condition of the goods or their failure to correspond with specifications shall be notified to Oggioni S.a.s. within 24 months from the date of delivery, unless otherwise specified by Oggioni S.a.s. in writing.

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When ordering goods to Oggioni S.a.s. the buyer undertake burden to be in knowledge of all legal limitations and applications and security norms about use of supplied goods. It is therefore excluded any responsibility of Oggioni S.a.s. about use, wrong use, impossibility of use of supplied devices; compensation requests for direct or indirect damages caused by use, wrong use, impossibility of use of supplied devices for whatever reason will thereby not be possible.

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GENERAL DESCRIPTION

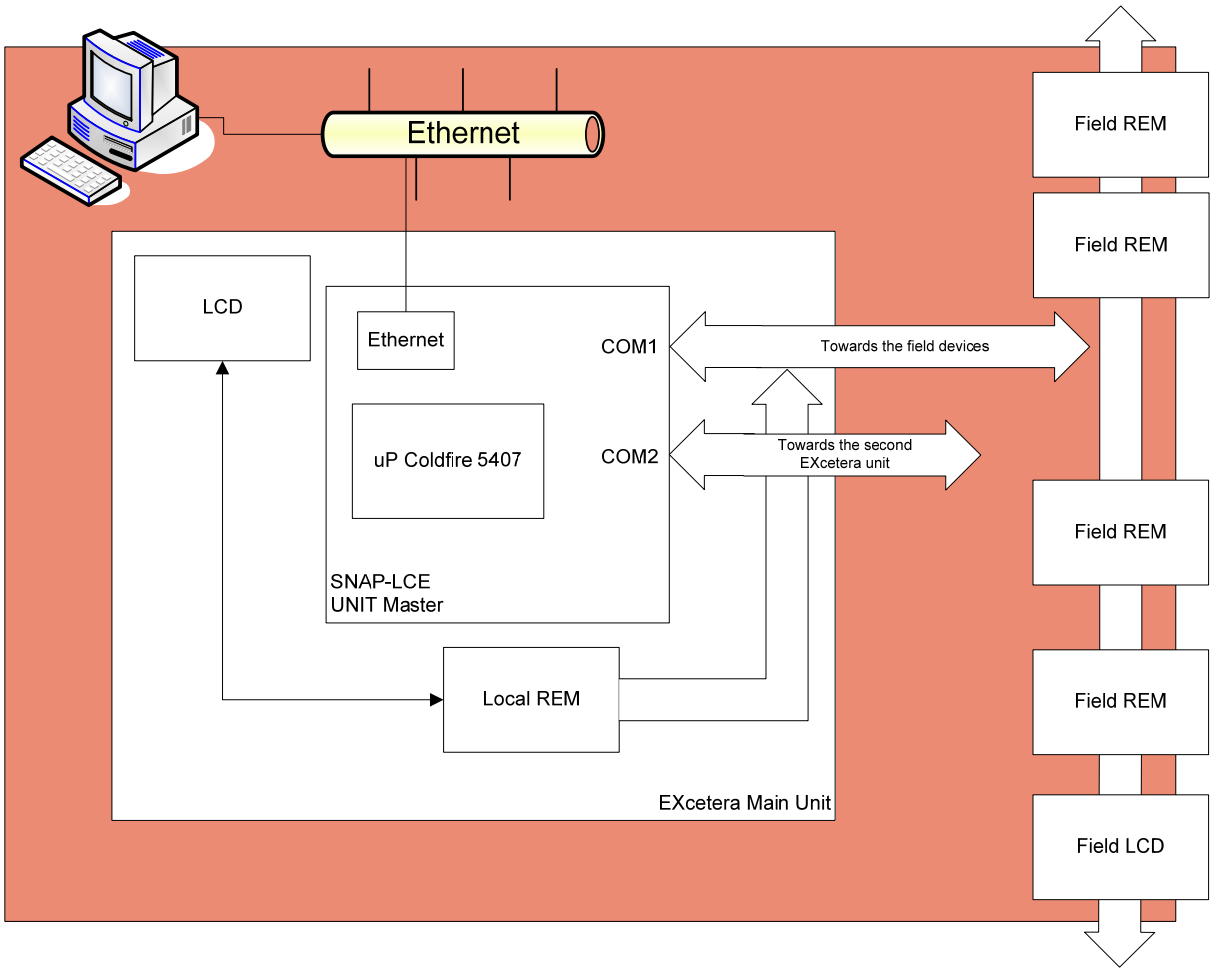
The EXcetera® control system has been developed following the functional security standard EN 61508 and the specific ones for gas detection EN 50402

EXcetera® is a programmable control system to reach the SIL2 Safety Integrity Level, based on a Coldfire 32 bit Motorola 5047 controller.

The system is a modular one, it can receive the signals from 4-20mA transmitters locally connected to the central unit or through remote concentrators. (REM 485 modules)
The central unit works as a MASTER, taking the decisions based on the input signals or just monitoring the safety integrity level and managing the user's interface devices.

Figure 1. EXcetera® main unit flow chart

In the main unit there are two BUS RS-485. In a SIL2 configuration both will be used to connect the in the field concentrators.



The EXcetera® main unit can be set to operate as a MASTER, managing the remote concentrators (REM-485 modules) that, in this case, will work just as Slaves units.

Alternatively the system can be set as a distributed intelligence architecture, in this case the managers of the decisions can be the in field concentrators themselves (REM 485 modules), while the EXcetera® central unit obtains the information, manages the local outputs and the user's interface units, forwarding the system general status.

It is recommended to link up to a maximum of 20 REM modules for every serial line.
The devices in the field can be concentrators for the link with the 4-20mA transmitters, digital I/O modules and display units.

Following the main characteristics of the system:

160 transmitters 4-20mA in field (20 REM 485 modules)
120 programmable outputs
1 display modules VT Terminal in field (optional)
PC interface to monitor and set the system
4 RS-485 drivers, used to link the in field devices

Software Characteristics

- The program code and the parameters configuration are protected from non authorized changes. The user will not have the possibility to change the software mode of operation.

- The system parameters configuration is accessible only by a configuration software EXcetera_GFG, using a PC

- The parameters configuration in the configuration SW is automatically verified for validity. Non valid inputs will be refused.

- Only authorized personnel can change the configuration using a high level password (level 2)

- The programs code update are under the manufacturer control. The download of a new software version will be possible only with Oggioni s.a.s. authorization.

- The user can identify the firmware version installed on the EXcetera® panel and on the REM concentrators with the LCD display and/or with the local display of the REM modules.

OPERATION MODE

EXcetera®, being designed on the standard EN 50402, is a suitable system to detect gases. This is why the operation mode will reflect the requirements of the norm itself.

The measuring method will be the standard one, the input signals from the detectors in the field are within the standard 4-20mA measuring range.
In this range the system can identify 4 status for the different system elements:

NORMAL – the device is in normal conditions, no faults and no alarms.

ALARM – this is the condition to measure the system, when at least one of the alarm threshold in at least one channel has been exceeded.
The event will be memorized in the event log with the details of the concerned threshold.
Depending on the configuration, the output will be activated and will return automatically in the normal status when the alarm conditions will end or they will remain memorized and it will be necessary to reset them manually.
If memorized, the resetting will be a Acknowledge and Reset action made by an authorized user using a password.
The Reset operations are memorized in the events log, too.

FAULT – One or more devices of the system are in fault conditions or they don't work properly .
The event is memorized in the events log with the details of the device in fault conditions.
Depending on the configuration, the output will be activated and will return automatically in the normal status when the fault conditions will end or they will remain memorized and it will be necessary to reset them manually.
If memorized, the resetting will be a Acknowledge and Reset action made by an authorized user using a password.
The Reset operations are memorized in the events log, too.

The fault condition will be activated in case of one of the following situations:

FAULT MODES:

Gas detector fault

- The gas detector has an inner fault and the output signal lowers to 2mA
- The microprocessor of the gas detector is in a fault condition and the Watch Dog control lowers the output signal down to 2mA
- The detector is in a fault condition due to of a wrong calibration procedure.

Fault condition in the connection between the 4-20mA detector and the REM 485 module (concentrator)

- Circuit breaking or lack of power to the detector – in both situations the detector output is 0mA
- short circuit to earth – signal to 0mA
- short circuit to (+)

REM 485 (concentrator) fault

The following are normal faults that can occur in the REM 485 module:
- Lack of power
- Battery LOW or NO battery at all (if this function is enabled)

The fault due to the microprocessor will be detected with the serial line from the EXcetera® unit and eventually will cause an Emergency because the entire REM 485 module will be unusable.

The following situation will override the fault condition:

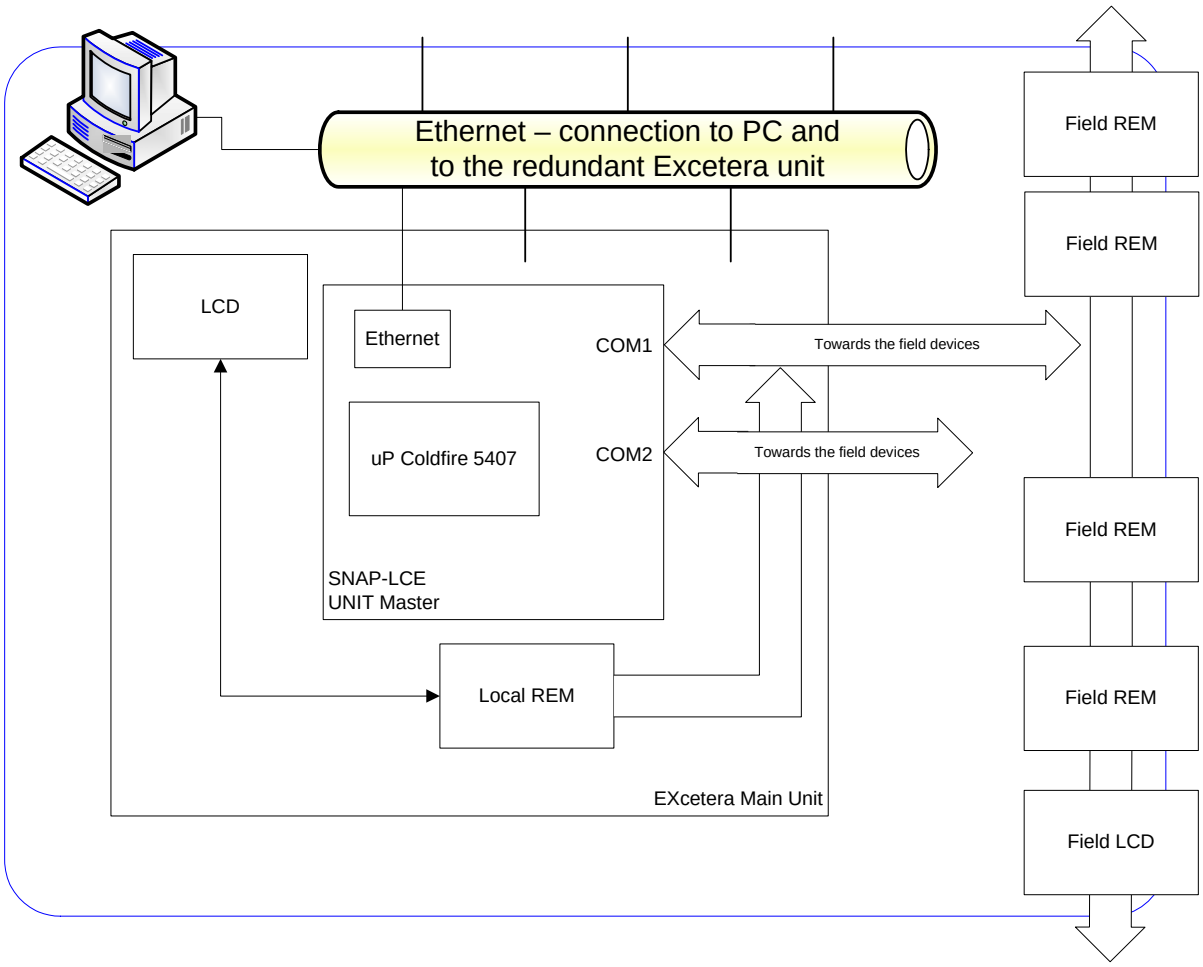
- Alarm signals
- Deactivation of a device
- Test/Maintenance condition of a device

SERVICE – The user, if authorized, can deliberately exclude one part of the system for maintenance, calibration, parameters configuration, etc.
The Service status is used to make tests and the maintenance of the system.

The test/maintenance situation can be activated for the following devices:
Single input (analogue or digital)
Single analogue output
Single digital output
Single device

The operation is memorized in the event log with the details of the disengaged device.

HARDWARE ARCHITECTURE



Motherboard Architecture:

The motherboard architecture is based on a double microprocessor with different assignments.
An 8 bit microprocessor and a logic programmable for the communication functions on the serial loops and on the diagnostics, and an industrial 32 bit SNAP-LCE of OPTO 22 Coldfire controller to manage the inside of the system.

The board also has 6 digital inputs opto-isolated and 7 relays outputs with SPDT contacts. The outputs are used to report the main system status and can be programmed depending on the signal arriving from the field.

Touch Screen devices are available for the user's interface. They visualize the system conditions and can be connected (linked) to a serial line (Com 3) of the motherboard.

EXcetera® control unit Technical Characteristics:

- Diagnostic LCD display 2x20 prints for diagnostic indications
- System status indicator LED
- 4 configurable serial lines RS-485
- Ethernet port
- 2 drivers for communication on optical fibre cable (optional)

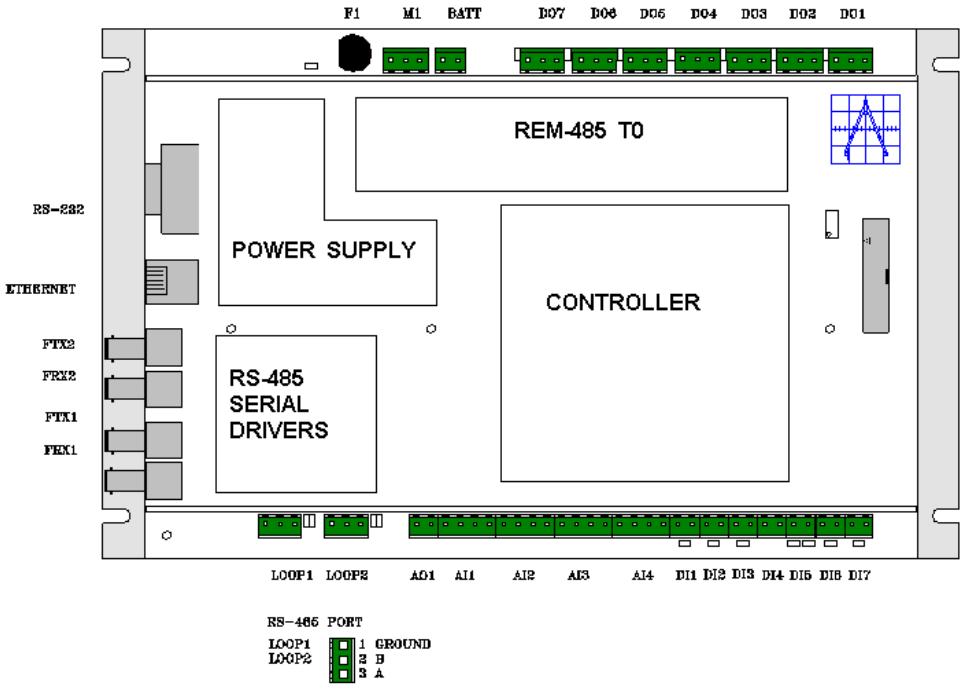
Local outputs:

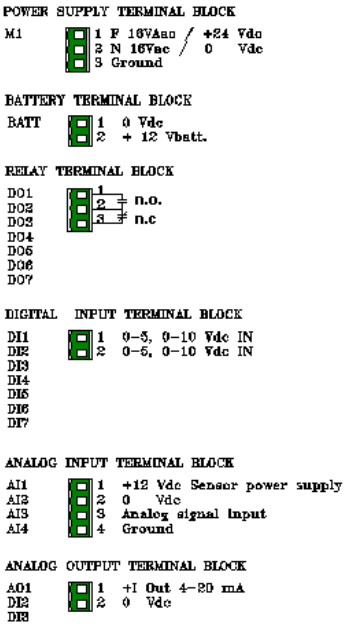
- 7 programmable relays SPDT 5A @ 110 Vac

Digital inputs:
- 6 Optoisolated inputs 0-10 ; 0-24 Vcc. For higher tensions it is recommended to use a current limiting resistance at 20 mA

Diagnosis LED

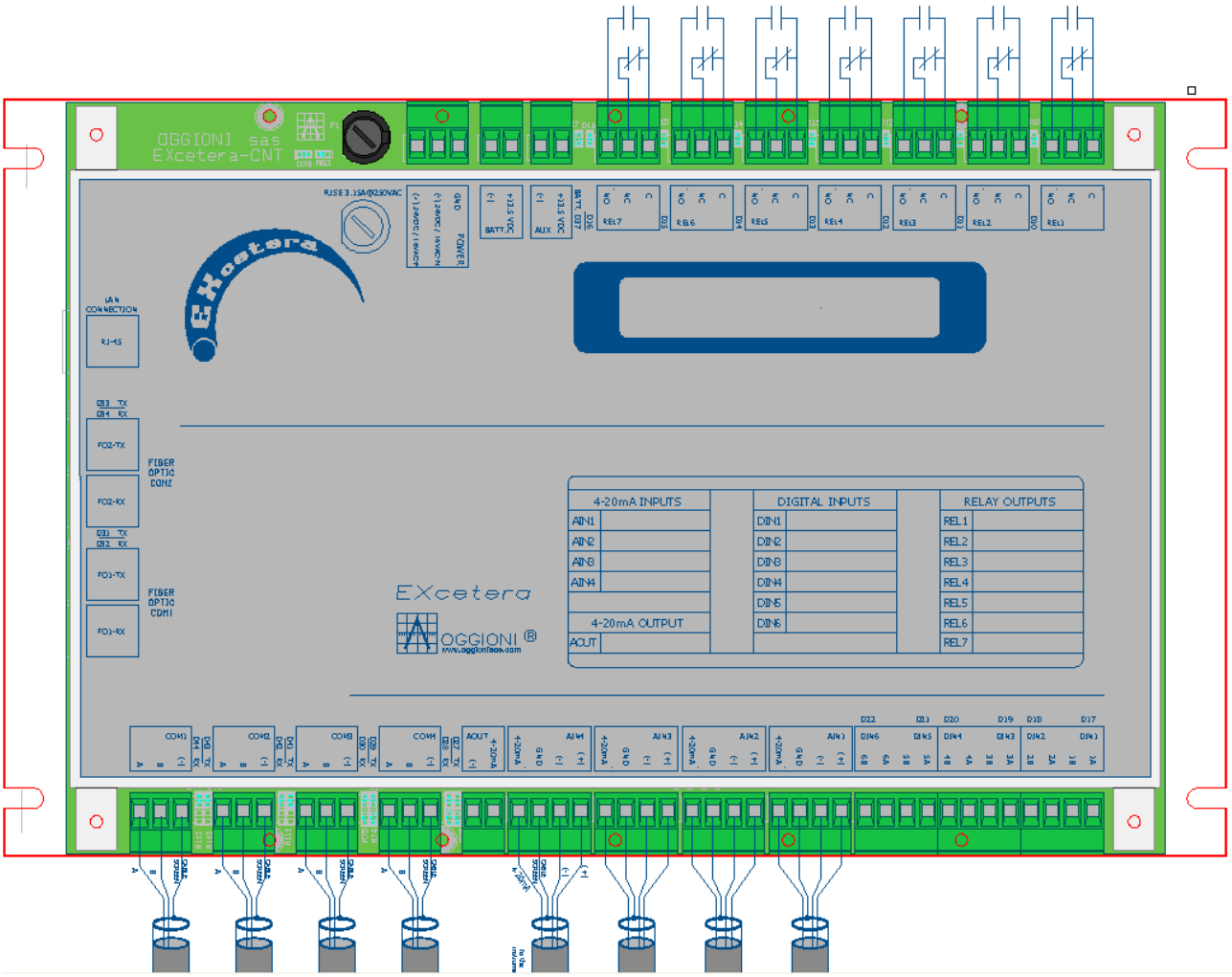
7	Red LED for relays status
6	Green LED for the digital input status
1	Green LED for the presence of the Back Up battery
1	Green LED for power presence
4	Red LED for every Tx signal of the COM lines.
4	Green LED for every Rx signal of the COM lines.
2	Red LED for every Tx signal of the optical fibre lines
2	Green LED for every Rx signal of the optical fibre lines.





ELECTRICAL CONNECTIONS

Connections are made via screw terminals that accept wire section:
#22 AWG ÷ #14 AWG (0.5 ÷ 2.5 mm^2).
Before powering up the device, ensure that all electrical connections have been completed and are correct.



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System Power Supply

The EXcetera® panel is equipped with a built-in 20W power supply, with the possibility to charge a 24V /3 A/h backup battery.

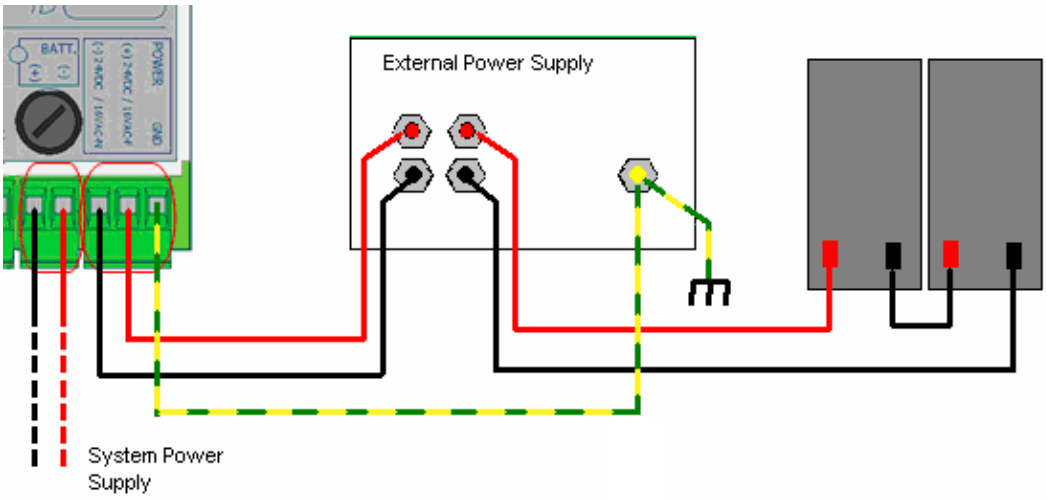
Before starting the installation verify that the current consumption of the system devices (sensors, concentrators, actuators, etc.) doesn't exceed the maximum capability.

Alternatively it will be necessary to use an external power supply with an adequate power, in this case it is recommended to verify that the device has an appropriate EMC filter according to current guidelines.

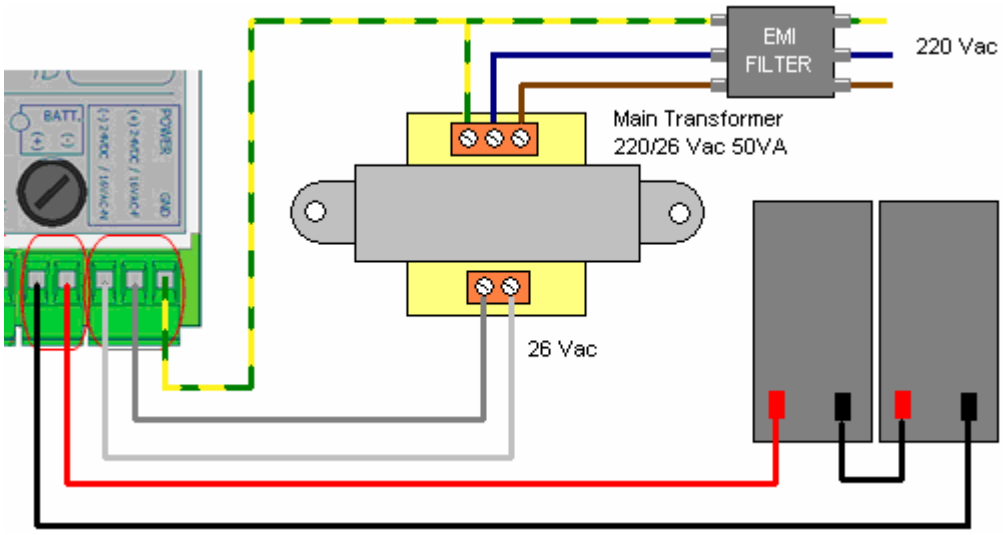
Power Supply Sizing

Device	Consumption
Enose RAS or DUST type With catalytic sensor	1,2 W
Enose RAS or DUST type With HQ catalytic sensor	2 W
Enose RAS or DUST type With IR sensor	1,9 W
Enose RAS or DUST type With electrochemical cell	1,3 W
REM remote concentrator	Max 9 W

The EXcetera unit may be supplied by an alternate voltage 26 Vac (25Vac...28 Vac) 100VA or by an external auxiliary power supply of 24 Vdc (24 ... 32 Vdc) with a power adequate to the system needs.



Power supply from external auxiliary power supply, maximum output current 6A.



Electrical wiring for internal power supply configuration, maximum output current 1.5A.

Overload control

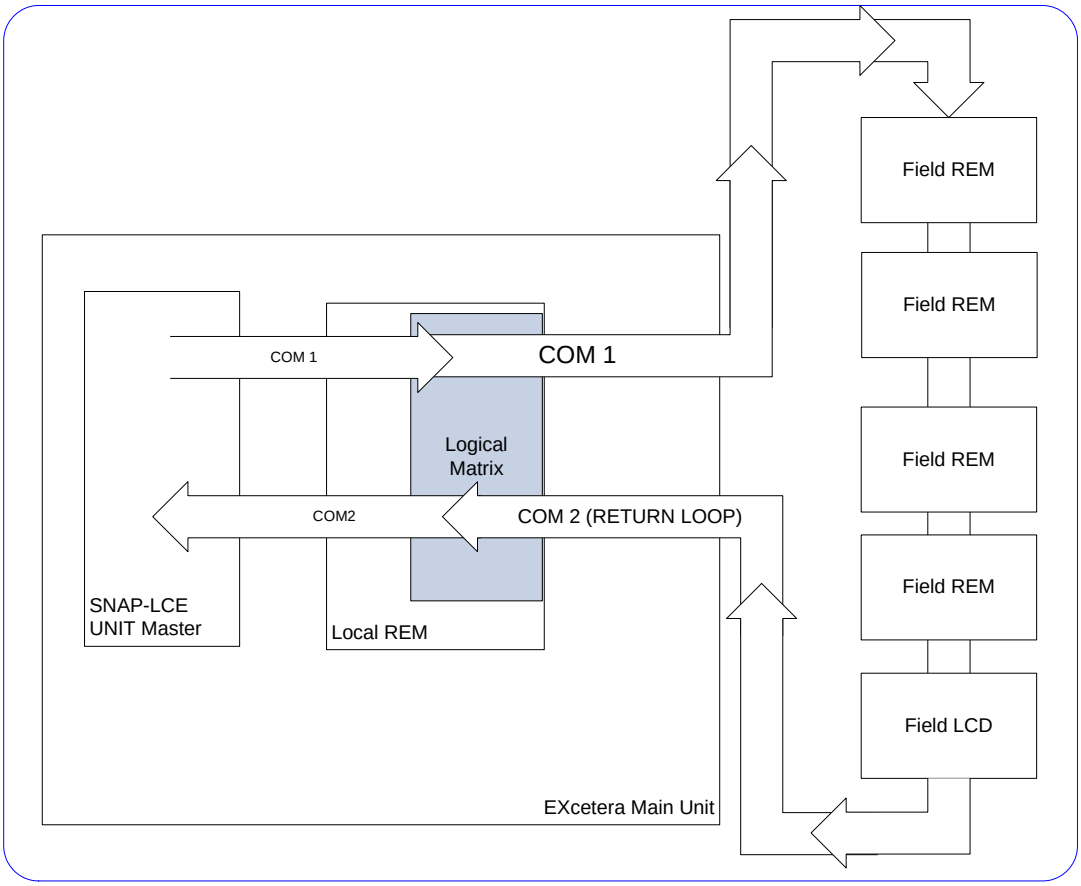
If the 24V power supply collapses to an excessive current demand, the protection circuit operates automatically limiting the output voltage
Below the threshold of about 19.2V power is interrupted, the battery will be isolated and the system must be reset manually.

HARDWARE SYSTEM CONFIGURATION DETAILS

Two serial lines, managed by the internal controller, are available.
On the motherboard there is a logic programmable matrix that controls the two serial lines on the 4 ports.
The same programmable logic assures the possibility to have different configurations for the serial lines.

The serial lines can be set as closed loop. In this case, the system reliability is higher, as a mechanical interruption of the loop will not switch off any device.
All the devices will be accessible from both sides of the loop, through COM 1, COM 2 and likewise COM 3 and COM 4.

Closed loop configuration:
COM1 will be at one end of the loop and COM 2 on the other end.



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OPEN loop Simple Configuration (factory default)

The second serial line on the motherboard becomes a second independent loop.
In this case if the loop is interrupted from any mechanical fault, all the devices linked to that loop will be inaccessible.

Normally, only two ports are used, one for every communication line. So the system is virtually divided in two main areas A and B and COM 1 and COM 2 are respectively assigned to the areas.

In case of open loop:
Having four connectors the user can use two connectors for every loop, having the possibility to divide the number of the devices on every single loop and go in different directions, as in the drawing.

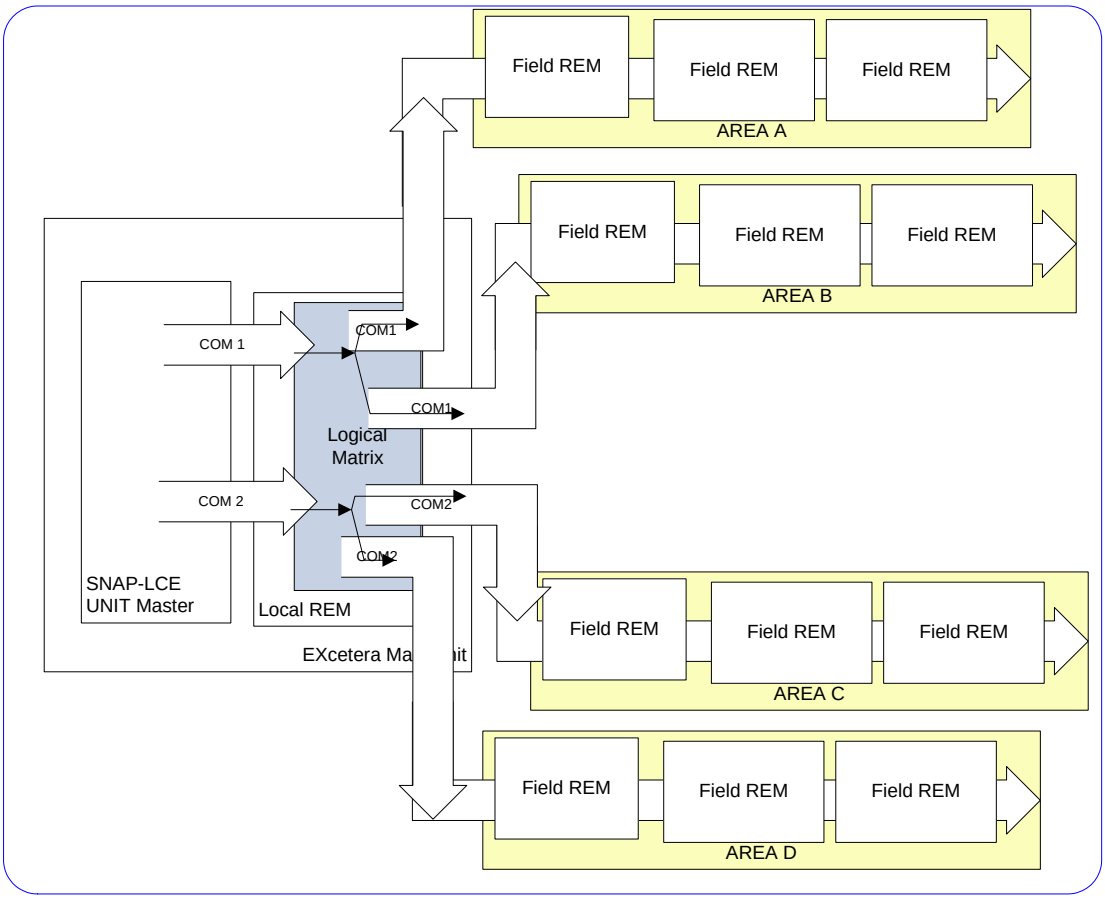


Figure 4 Open Loop separated configuration

If the distance is a problem, it could be helpful to use 4 ports, two for every communication line. This configuration has the advantage that the devices on a loop can be connected using two lines, so that the double of the normal length. See figure 4. The system is divided in 4 virtual areas and the two serial lines cover respectively two areas each: in the example COM 1 covers areas A and B and COM 2 covers areas C and D.

OPEN Loop Redundant bus configuration

To settle, it is also possible to redound physically the line, with a second cable, connected to the second serial door and on the REM 485 module in the field.
The bus redundancy strengthens the total redundancy and increases the reliability of the devices in the field.

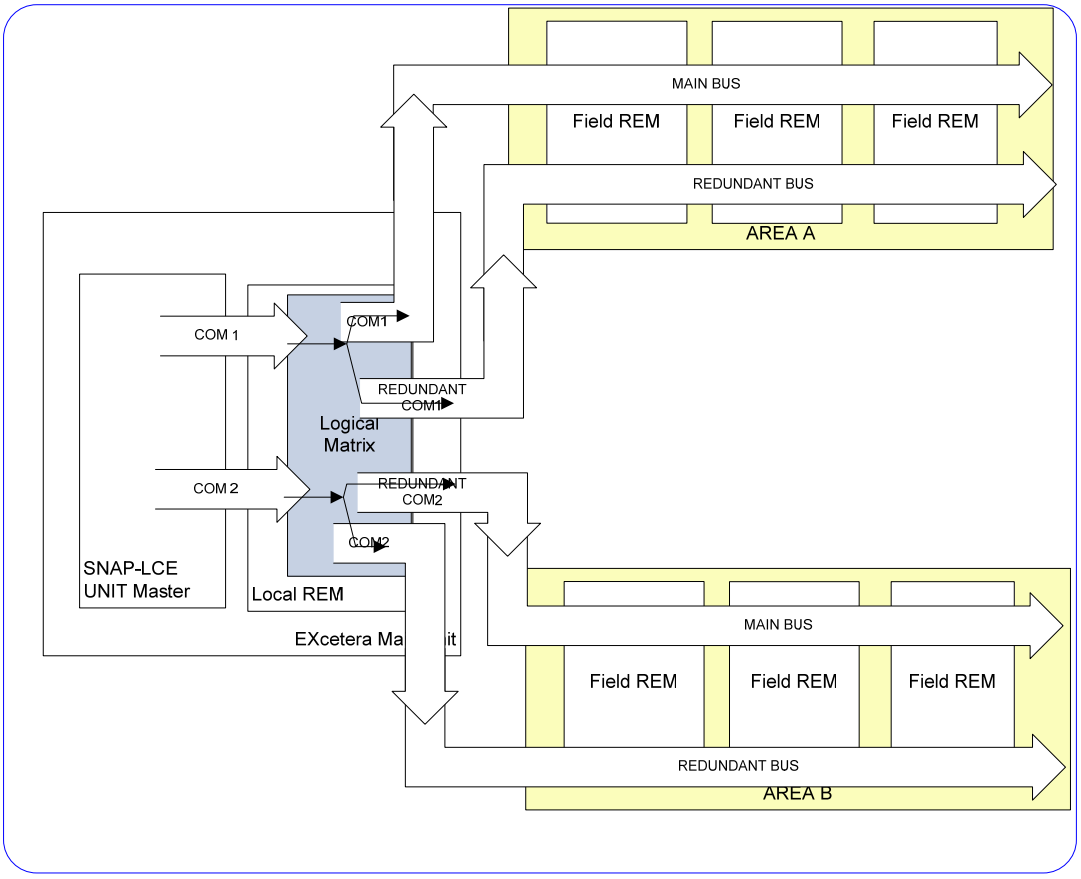
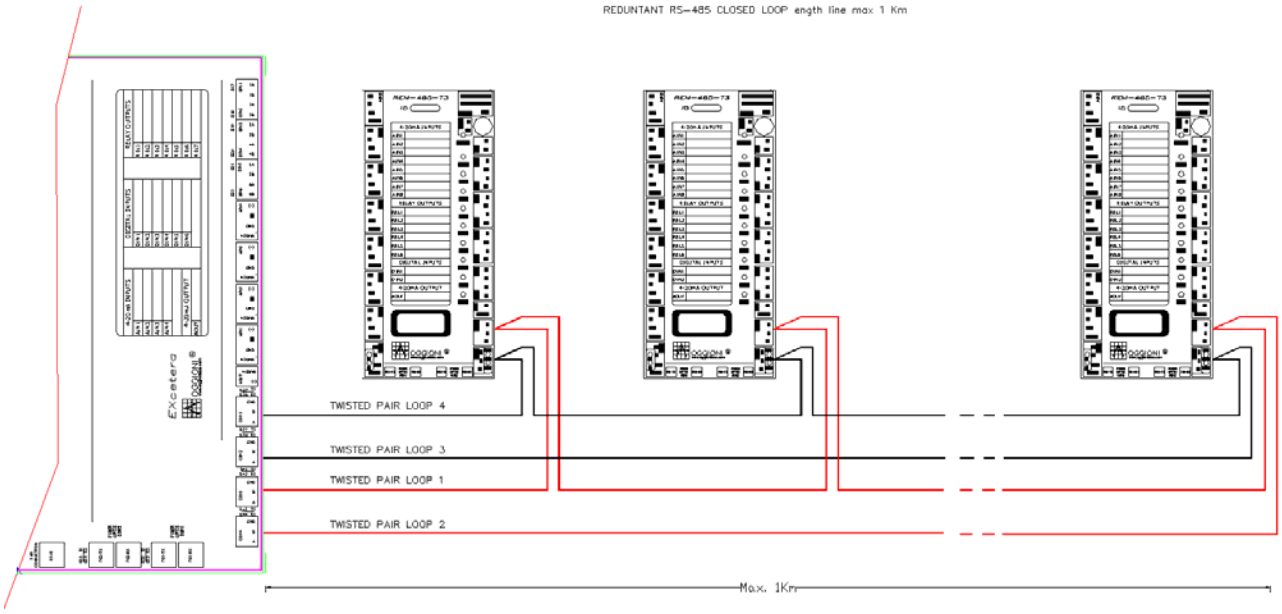
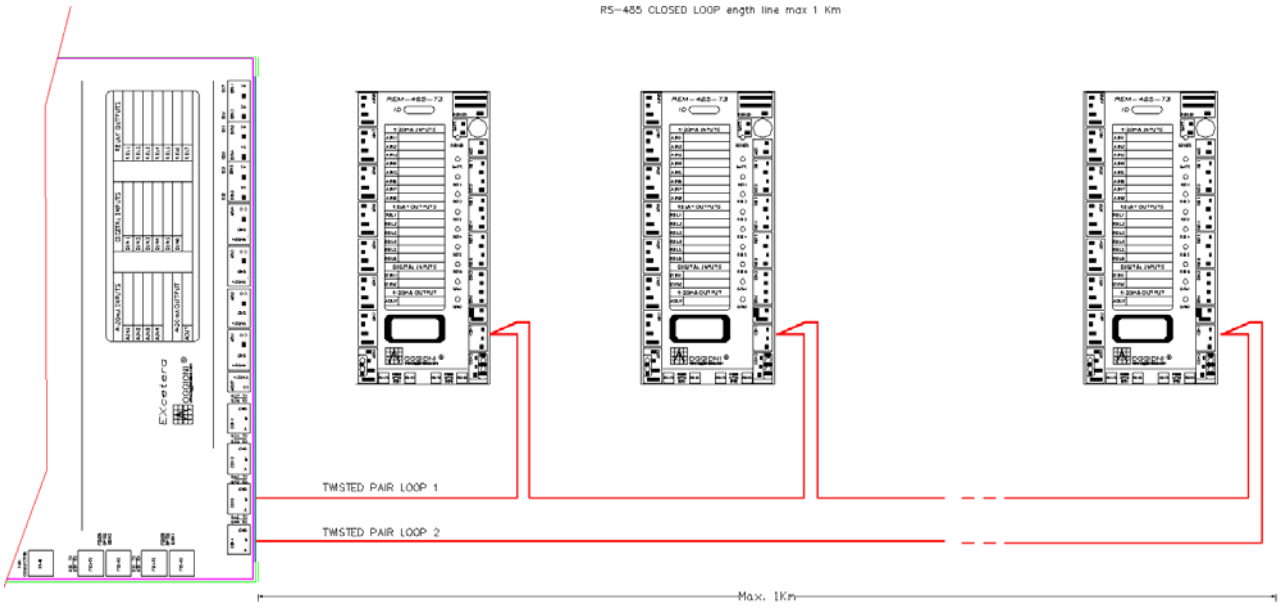
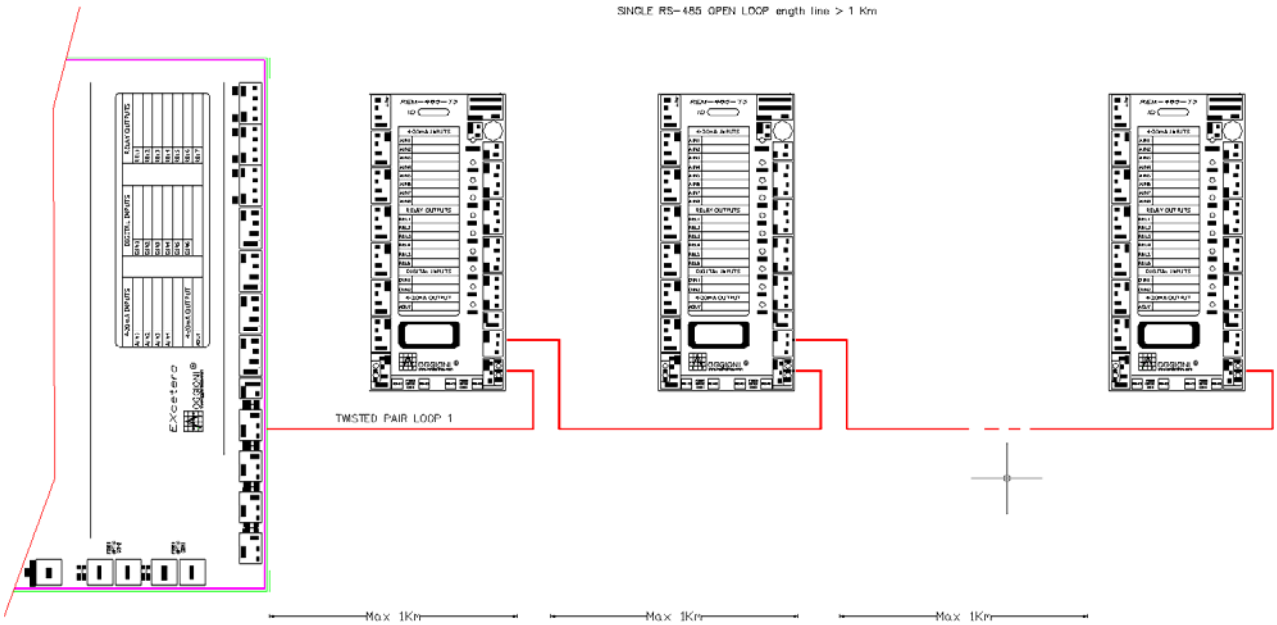


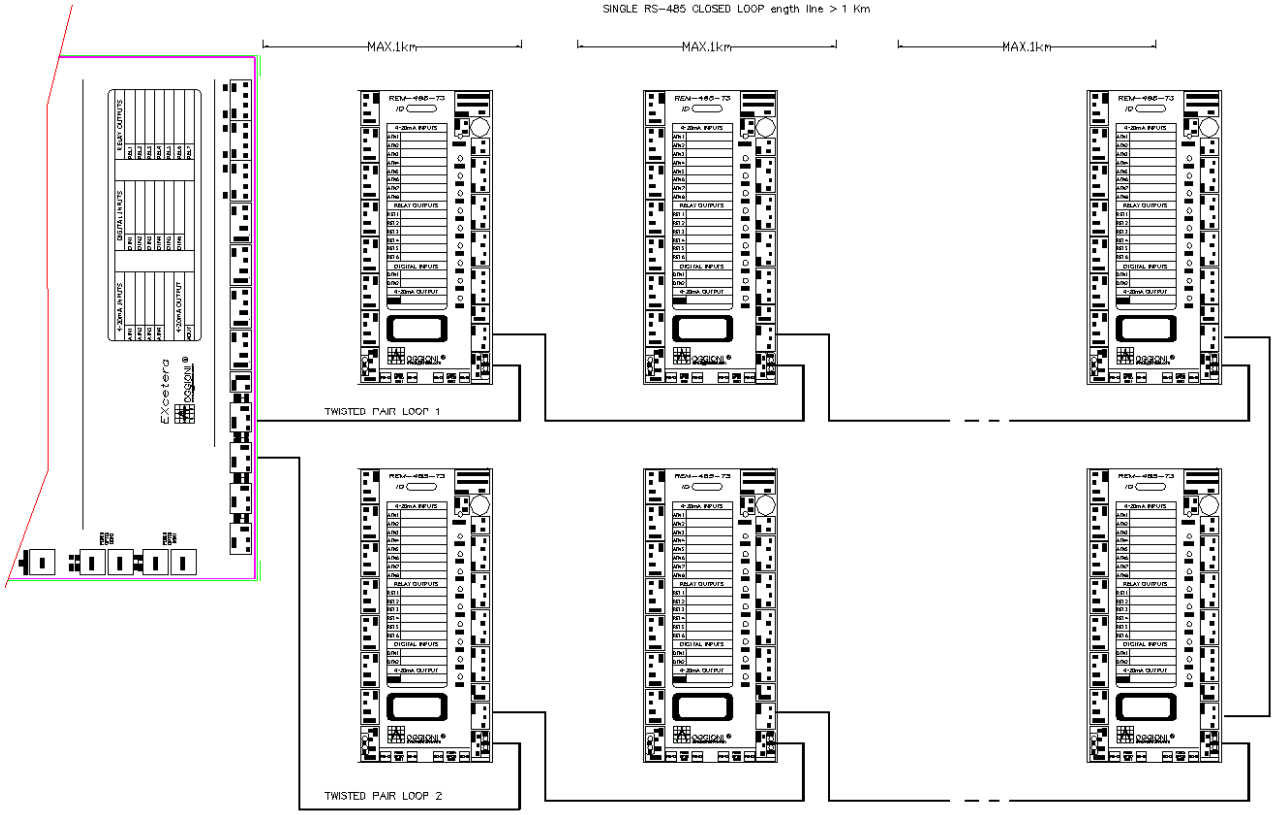
Figure 5 OPEN Loop Redundant bus configuration

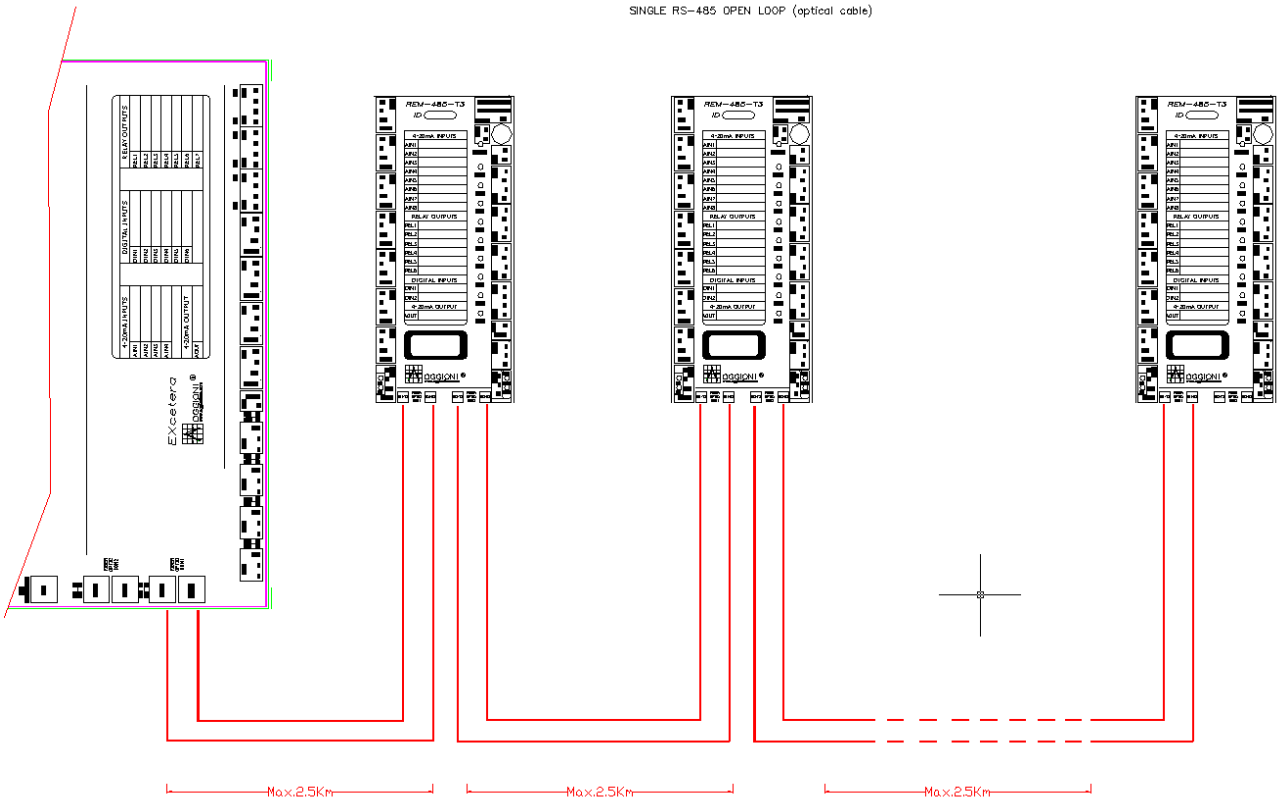
Possible serial loops configurations

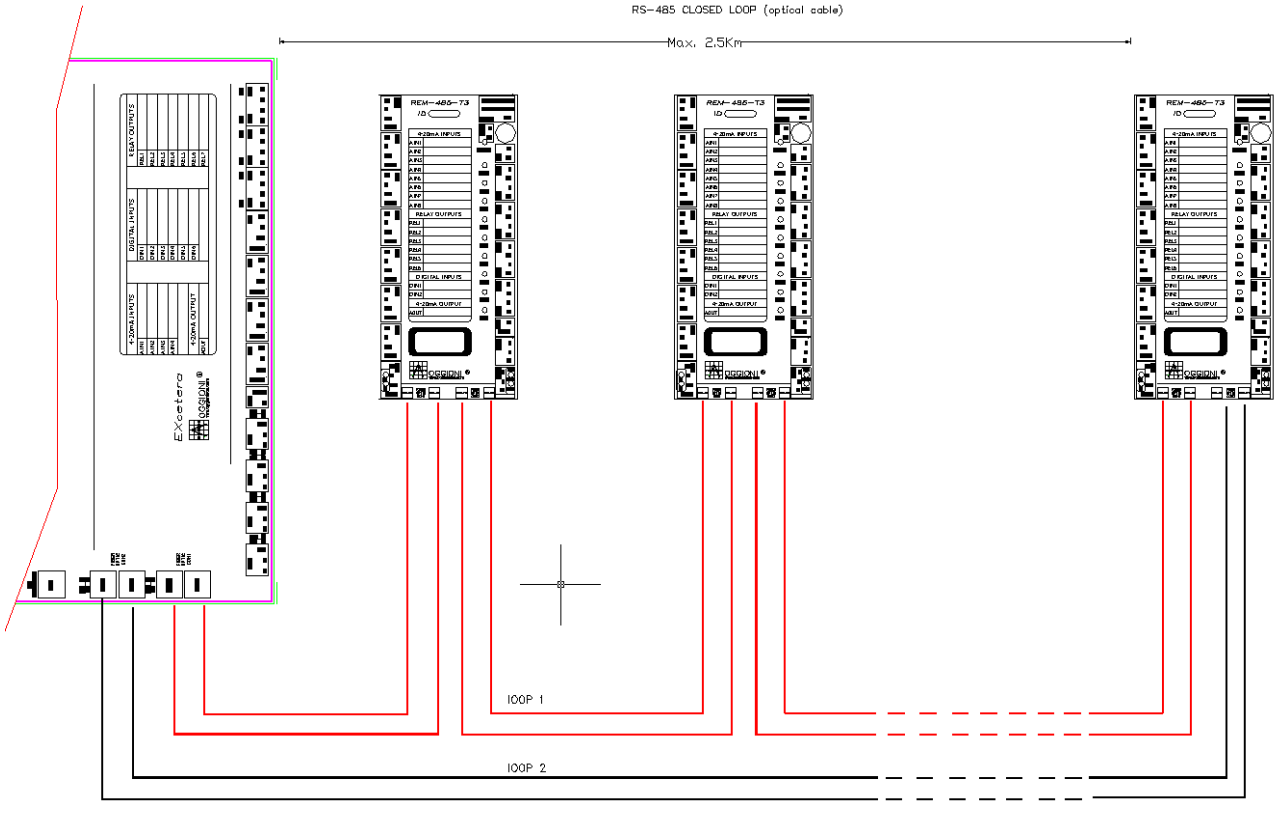





SINGLE RS-485 OPEN LOOP ength line > 1 Km
TWISTED PAIR LOOP 1
Max 1Km
Max 1Km
Max 1Km


SINGLE RS-485 CLOSED LOOP ength line > 1 Km
MAX.1km
MAX.1km
MAX.1km
TWISTED PAIR LOOP 1
TWISTED PAIR LOOP 2





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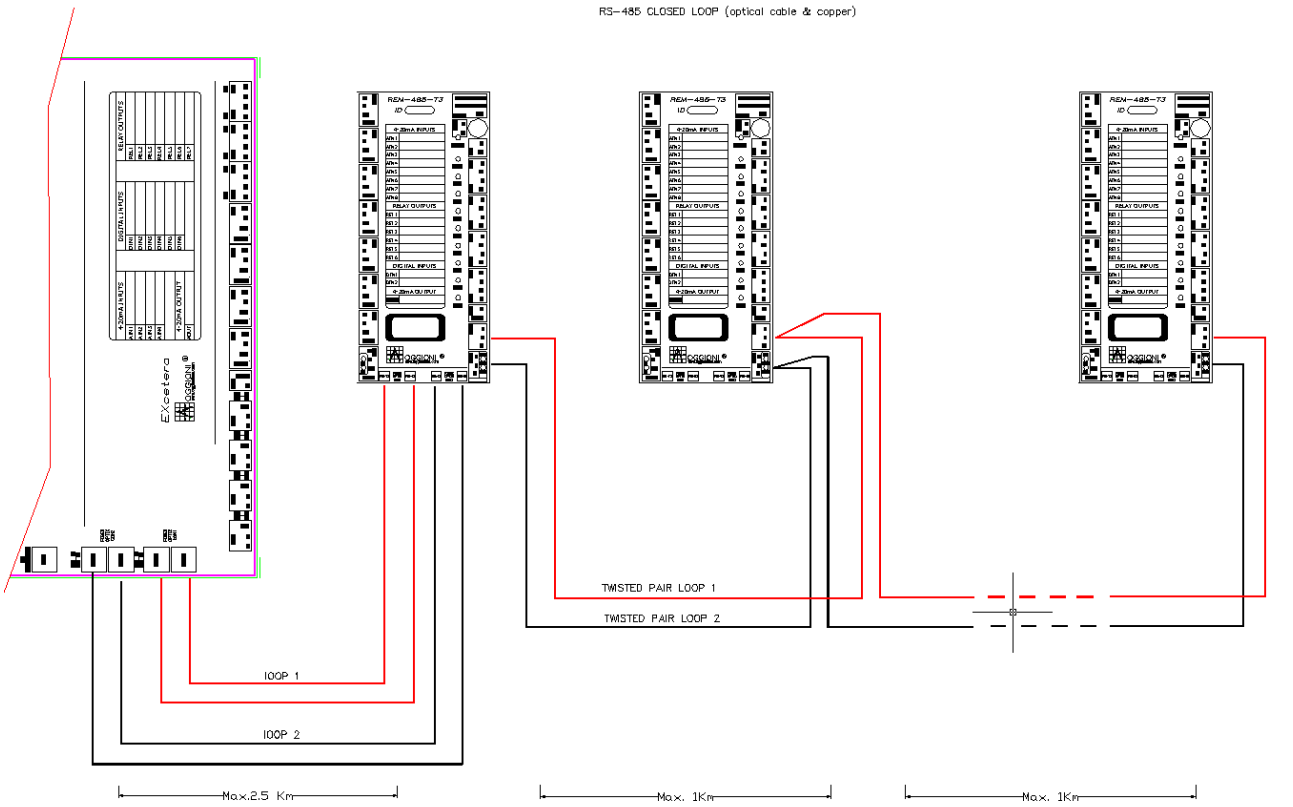
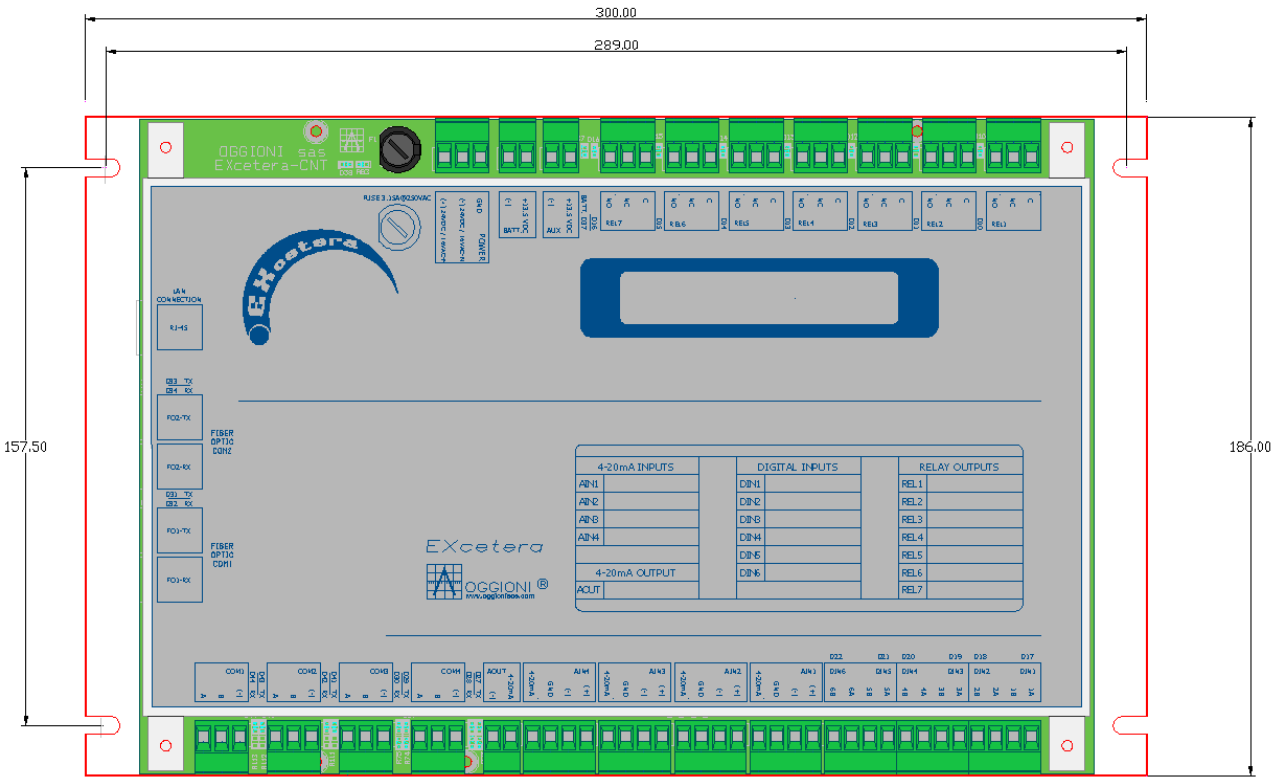

RS-485 CLOSED LOOP (optical cable & copper)
TWISTED PAIR LOOP 1
TWISTED PAIR LOOP 2
LOOP 1
LOOP 2
Max.2.5 Km
Max. 1Km
Max. 1Km

OUTLINE DRAWING



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