Pietro Fiorentini

STARBOX LX2

RTU for gas network monitoring and remote control



Revision A - Edition 05/2026

USE, MAINTENANCE AND WARNING MANUAL

EN

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1 - INTRODUCTION

FOREWORD

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The Manufacturer is in no way responsible for the consequences of operations carried out in a manner not in accordance with the manual.

GENERAL REMARKS

All operating instructions and recommendations described in this manual must be followed in order to:

- obtain the best possible performance from the equipment;
- keep the equipment in efficient conditions.

Training the personnel in charge is of particular importance in order to:

- use and service the equipment properly;
- correctly apply the safety alerts and procedures indicated.

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1.1 - REVISION HISTORY

Revision index	Date
A	05/2026
-	-

Tab. 1.1.

Pietro Fiorentini

INDEX

1 - INTRODUCTION 3

1.1 - REVISION HISTORY 5

2 - GENERAL INFORMATION 11

2.1 - MANUFACTURER IDENTIFICATION 11
2.2 - IDENTIFICATION OF THE PRODUCT 11
2.3 - REGULATORY FRAMEWORK 11
2.4 - WARRANTY 11
2.4.1 - REFERENCE OPERATING CONDITIONS 12
2.5 - ADDRESSEES, SUPPLY AND STORAGE OF THE MANUAL 12
2.6 - LANGUAGE 13
2.7 - SYMBOLS USED IN THE MANUAL 13
2.8 - APPLIED NAMEPLATES 14
2.8.1 - DESCRIPTION OF THE NAMEPLATE 15
2.9 - GLOSSARY OF UNITS OF MEASUREMENT 16
2.10 -QUALIFIED PROFESSIONAL FIGURES 17

3 - SAFETY 19

3.1 - GENERAL SAFETY WARNINGS 19
3.1.1 - SAFETY INSTRUCTIONS FOR INSTALLATION 20
3.2 - PERSONAL PROTECTIVE EQUIPMENT 21
3.3 - OBLIGATIONS AND PROHIBITIONS 22
3.4 - RESIDUAL RISKS 22
3.5 - SAFETY PICTOGRAMS 23
3.6 - NOISE LEVEL 23

4 - DESCRIPTION AND OPERATION 25

4.1 - GENERAL DESCRIPTION 25
4.2 - DESCRIPTION OF THE DEVICE 27
4.2.1 - SERIAL PORTS 27
4.2.1.1 - COM1 27
4.2.1.2 - COM2/COM4 27
4.2.1.3 - COM3 28
4.2.2 - ETHERNET PORTS 28
4.2.3 - USB HOST 28

4.2.4 - I/O 29
4.2.4.1 - ANALOGUE INPUTS 29
4.2.4.2 - DIGITAL INPUTS 31
4.2.4.3 - DIGITAL OUTPUTS 32
4.2.4.4 - ANALOGUE OUTPUTS 32
4.2.4.5 - POWER SUPPLY 33
4.3 - INTENDED PURPOSE 34
4.3.1 - INTENDED USE 34
4.3.2 - REASONABLY FORESEEABLE MISUSE 34
4.4 - TECHNICAL DATA 34
4.5 - I/O CHANNELS 36
4.6 - DATA COMMUNICATION 36
4.7 - WIRING 36

5 - USER INTERFACE 37

5.1 - GENERAL DESCRIPTION 37
5.1.1 - LOCAL COMMUNICATION INTERFACE 37
5.2 - CONNECTION FROM PC TO STARBOX LX2 37
5.3 - SOFTWARE UPDATE PROCEDURE 38
5.4 - GATEWAY FUNCTIONALITY 38
5.5 - INTEGRATED WEB SERVER 39
5.5.1 - INSTANTANEOUS 40
5.5.2 - LOGGED DATA 40
5.5.2.1 - GRAPHS 40
5.5.2.2 - DOWNLOAD 41
5.5.3 - ALARM LOG 42
5.5.4 - CONFIGURATION 42
5.5.4.1 - ALARMS & SCALES 43
5.5.4.2 - NETWORK 43
5.5.4.3 - LOCALISATION 43
5.5.5 - OPERATING PARAMETERS 43
5.5.6 - REAL TIME 44
5.5.7 - MAINTENANCE 44

6 - TRANSPORT AND HANDLING 45
6.1 - SPECIFIC WARNINGS FOR TRANSPORT AND HANDLING 45
6.1.1 - PACKAGING AND FASTENERS USED FOR TRANSPORT 45
6.2 - PACKAGING CONTENT 46
6.3 - PHYSICAL CHARACTERISTICS OF THE DEVICE 47
6.3.1 - FRONT SIDE 47
6.3.2 - UPPER SIDE 47
6.3.3 - LEFT SIDE 48
6.3.4 - RIGHT SIDE 48
6.4 - EQUIPMENT ANCHORING AND LIFTING METHOD 49
6.4.1 - FORKLIFT HANDLING METHOD 50
6.5 - PACKAGING REMOVAL 52
6.5.1 - PACKAGING DISPOSAL 52
6.6 - STORAGE AND ENVIRONMENTAL CONDITIONS 53
6.6.1 - STORAGE OF THE SPARE BATTERIES 53

7 - INSTALLATION 55
7.1 - GENERAL WARNINGS 55
7.2 - INSTALLATION PRE-REQUISITES 55
7.2.1 - ENVIRONMENTAL CONDITIONS ALLOWED 55
7.3 - CHECKS BEFORE INSTALLATION 56
7.4 - INSTALLATION PROCEDURE 57

8 - CONFIGURATION 59
8.1 - SAFETY REQUIREMENTS FOR CONFIGURATION 59
8.2 - EQUIPMENT CONFIGURATION 59
8.2.1 - STARTING THE RAINBOW SOFTWARE 60
8.2.2 - OPENING THE DATABASE 61
8.3 - RTU MENU 63
8.3.1 - READING LOGGED DATA 64
8.3.2 - READ/SEND RTU CONFIGURATION 64
8.3.3 - COMMUNICATION 65
8.3.3.1 - ADD ETH 66
8.3.3.2 - ADD SERIAL 71

8.3.4 - ALARM ACTIONS 85
8.3.5 - IMPORT VPN FILES 86
8.3.6 - ADDITIONAL PARAMETERS 86
8.3.6.1 - NETWORK SECTION: 86
8.3.6.2 - FUNCTIONS SECTION 87
8.3.6.3 - FIREWALL SECTION 88
8.3.6.4 - VPN SECTION 89
8.3.6.5 - DYNAMIC DNS 90
8.3.6.6 - SECONDARY ETHERNET 90
8.3.6.7 - KEEP ALIVE 91
8.3.6.8 - WIFI 92
8.3.7 - VARIABLE LIST 93
8.3.7.1 - CREATE A NEW VARIABLE 93
8.3.7.2 - CLONE A VARIABLE 96
8.3.7.3 - DELETE A VARIABLE 96
8.3.8 - GROUPINGS 96
8.3.8.1 - CREATING A GROUP OF VARIABLES 97
8.3.8.2 - ADD GROUP 98
8.3.8.3 - CREATE AUTOMATIC PAGE 101
8.3.8.4 - SORT 102
8.3.8.5 - DELETE GROUPS 102
8.3.8.6 - MANAGEMENT OF OPERATING VARIABLES 102
8.3.9 - SAFE IMPORT 103
8.3.10 - VIEW LOG TRENDS 103
8.3.11 - LADDER EDITOR 103
8.3.12 - IMPORT IO FROM LADDER 103
8.3.13 - INFORMATIVE DESCRIPTIONS 104
8.3.14 - EXPORT MODBUS MAP 104
8.4 - LOGICLAB 105
8.4.1 - INTEGRATED FUNCTIONS 105

9 - MAINTENANCE AND FUNCTIONAL CHECKS 107

9.1 - GENERAL WARNINGS 107

10 - UNINSTALLATION AND DISPOSAL 109

10.1 -GENERAL SAFETY WARNINGS 109
10.2 -QUALIFICATION OF THE OPERATORS IN CHARGE 109
10.3 -INFORMATION REQUIRED IN CASE OF NEW INSTALLATION 109
10.4 -STORAGE OF THE BATTERIES 109
10.5 -INFORMATION REQUIRED IN CASE OF RE-INSTALLATION 109
10.6 -DISPOSAL INFORMATION 110
10.7 - BATTERY DISPOSAL 111
10.7.1 - BATTERY PACKAGING 111

11 - RECOMMENDED SPARE PARTS 113

11.1 -GENERAL WARNINGS 113
11.2 -HOW TO REQUEST SPARE PARTS 113

2 - GENERAL INFORMATION

2.1 - MANUFACTURER IDENTIFICATION

Manufacturer	PIETRO FIORENTINI S.P.A.
Address	Via Enrico Fermi, 8/10 36057 Arcugnano (VI) - ITALY **Tel. +39 0444 968511 Fax +39 0444 960468** **www.fiorentini.com sales@fiorentini.com**

Tab. 2.2.

2.2 - IDENTIFICATION OF THE PRODUCT

Equipment	RTU FOR GAS NETWORK MONITORING AND REMOTE CONTROL
Series	STARBOX LX2
Models	Starbox LX2

Tab. 2.3.

2.3 - REGULATORY FRAMEWORK

PIETRO FIORENTINI S.P.A. with registered office in Arcugnano (Italy) - Via E. Fermi, 8/10, declares that the equipment of the series described in this manual is designed, manufactured, tested and checked in compliance with:

- the requirements of the Directives:
  - 2014/53/EU “RED”
  - 2014/30/EU “EMC”

NOTICE!

For specific type approvals, see the appropriate section on the Manufacturer’s website: https://www.fiorentini.com

NOTICE!

The declaration of conformity in its original version is delivered together with the equipment.

2.4 - WARRANTY

PIETRO FIORENTINI S.P.A. guarantees that the equipment was manufactured using the best materials, with high-quality workmanship, and complies with the quality requirements, specifications and performance set out in the order.
The warranty shall be considered null and void and PIETRO FIORENTINI S.P.A. shall not be liable for any damage and/or malfunctions:

- due to any acts or omissions of the purchaser or end-user, or any of their carriers, employees, agents, or any third party or entity;
- in the event that the purchaser, or a third party, makes changes to the equipment supplied by PIETRO FIORENTINI S.P.A. without the prior written approval of the latter;
- in the event of failure by the purchaser to comply with the instructions contained in this manual, as provided by PIETRO FIORENTINI S.P.A.

NOTICE!

The warranty conditions are specified in the commercial contract.

2.4.1 - REFERENCE OPERATING CONDITIONS

The reference operating conditions for autonomy calculations are described in Tab. 2.4:

Operating condition	Reference indications
Sensor acquisition	• 2 4-20 mA sensors at full scale • 1 RS232 serial interface for modem
Communication	1 data transmission per minute.

Tab. 2.4.

Ambient temperature has an effect on buffer battery life. The operating profile used to calculate the battery life expectancy is indicated in Tab. 2.5:

	Reference indications
Temperature (ambient)	0.3% of the time at -25 °C
	0.5% of the time at -20 °C
	2.6% of the time at -10 °C
	41.0% of the time at +5 °C
	43.0% of the time at +20 °C
	11.8% of the time at +35 °C
	0.5% of the time at +50 °C
	0.4% of the time at +60 °C

Tab. 2.5.

2.5 - ADDRESSEES, SUPPLY AND STORAGE OF THE MANUAL

The instruction manual is intended for the qualified operator responsible for using and managing the equipment throughout its service life.
It contains the necessary information to properly use the equipment and keep its functional and qualitative characteristics unchanged over time. All information and warnings for safe, correct use are also provided.
The manual, as well as the declaration of conformity and/or test certificate, is an integral part of the equipment and must always accompany it whenever it is moved or changes ownership. The equipment must be used and managed by qualified professional figures (see paragraph 2.10).

⚠ WARNING!

Removing, rewriting or editing the pages of the manual and their contents is not allowed.
PIETRO FIORENTINI S.p.A. shall not be held liable for any damage to people, animals and property caused by failure to adhere to the warnings and operating procedures described in this manual.

2.6 - LANGUAGE

The original manual has been drawn up in Italian.
Any translations into additional languages are to be made from the original instruction manual.

HAZARD!

The translations into other languages cannot be fully verified. If any inconsistency is found, the text of the original manual must be followed.
If inconsistencies are found or the text does not make sense:

- **stop any actions;**
- **contact PIETRO FIORENTINI S.p.A. immediately at the addresses given in paragraph 2.1 ("Manufacturer identification").**

WARNING!

PIETRO FIORENTINI S.p.A. shall be held liable for the information provided in the original manual only.

2.7 - SYMBOLS USED IN THE MANUAL

Symbol	Definition
	Symbol used to identify important warnings for the health and safety of the operator or safety of the equipment.
	Symbol used to identify an ELECTRICAL HAZARD to the health and safety of the operator.
	Symbol used to identify information of particular importance in the manual. The information may also concern the safety of the personnel involved in using the equipment.
	Obligation to consult the instruction manual/booklet. Indicates a requirement for the personnel to refer to (and understand) the operating and warning instructions of the equipment before working with or on it.

Tab. 2.6.

HAZARD!

Alerts to a hazard with a high level of risk, an imminent hazardous situation which, if not prevented, will result in death or severe damage.

WARNING!

Alerts to a hazard with a medium level of risk, a potentially hazardous situation which, if not prevented, may result in death or severe damage.

ATTENTION!

Alerts to a hazard with a low level of risk, a potentially hazardous situation which, if not prevented, could result in minor or moderate damage.

NOTICE!

Alerts to specific warnings, directions or notes of particular concern, that are not related to physical injury, as well as practices for which physical injury is not likely to occur.

2.8 - APPLIED NAMEPLATES

The equipment is equipped with a nameplate.
The plate specifies identification details of the equipment and its accessories to be provided, if necessary, to PIETRO FIORENTINI S.p.A.

Id.	Type of plate	Image
1	STARBOX LX2	

Tab. 2.7.

⚠ WARNING!

Removing nameplates and/or replacing them with other plates is strictly not allowed.
Should the plates be unintentionally damaged or removed, the customer must notify PIETRO FIORENTINI S.p.A.

2.8.1 - DESCRIPTION OF THE NAMEPLATE

The following information, described in Tab. 2.8, is shown on the nameplate:

Pos.	Description
1	Manufacturer's logo
2	Equipment model
3	Equipment revision status
4	Equipment serial number
5	Supply voltage
6	Average power consumption
7	CE Marking
8	Manufacturer's address

Tab. 2.8.

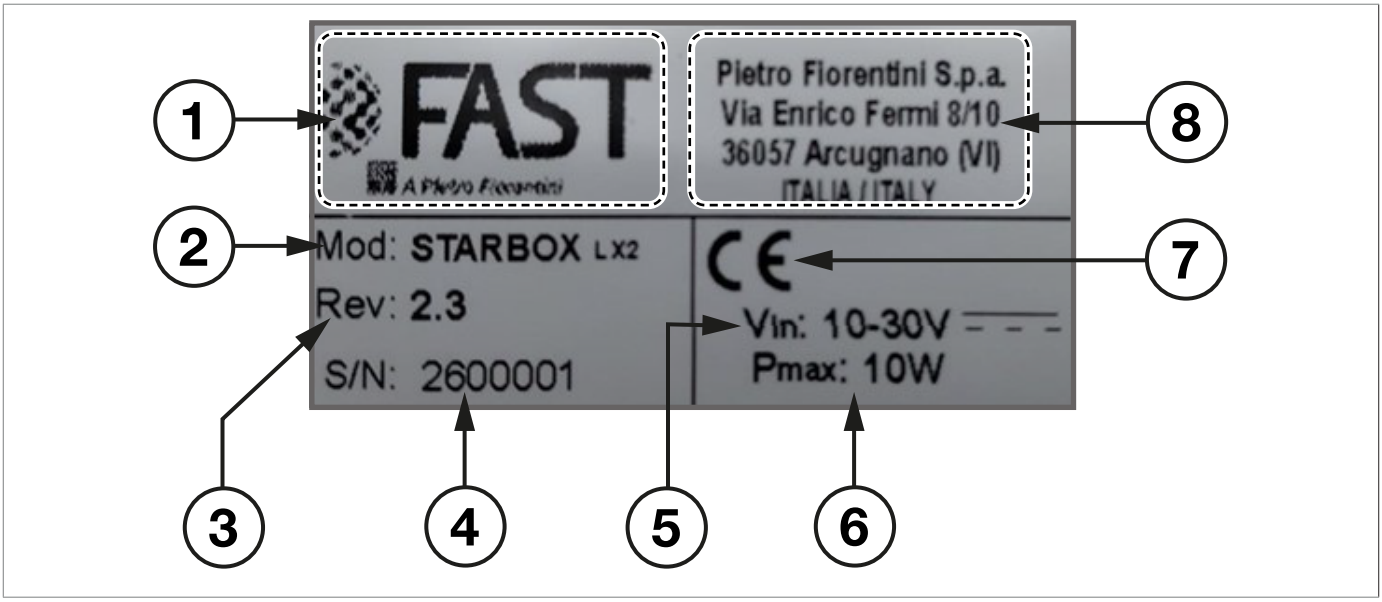

Fig. 2.1. Description of the nameplate

2.9 - GLOSSARY OF UNITS OF MEASUREMENT

Type of measurement	Unit of measurement	Description
Consumption and Volumetric flow rate	Sm^3/h	Standard cubic metres per hour
	Sm^3	Standard cubic metres
	m^3/h	Cubic metres per hour
	m^3	Cubic metres
	l/s	Litres per second
	l	Litres
Pressure	bar	Bar
	″wc	Inch of water column
	Pa	Pascal
Temperature	°C	Degree centigrade
	°F	Degree Fahrenheit
	K	Kelvin
Tightening torque	Nm	Newton metre
Sound pressure	dB	Decibel
Other measurements	V	Volt
	W	Watt
	Ω	Ohm

Tab. 2.9.

2.10 - QUALIFIED PROFESSIONAL FIGURES

Qualified operators entrusted with the use and operation of the equipment in all its technical life stages for the use for which it was supplied:

Professional figure	Definition
Installer	Qualified operator able to: • handle materials and equipment. • carry out all the operations necessary to properly install the equipment safely; • perform all the operations necessary to properly operate the equipment and system safely; • be able to perform all the operations necessary to uninstall and subsequently dispose of the equipment in compliance with the regulations in force in the country of installation.
Specialised technician/ Maintenance technician	Trained and authorised technician on the management and use of the equipment, who must: • be able to perform all operations required for the proper functioning of the equipment and the system while ensuring their own safety and that of any third parties present; • perform maintenance on all parts of the equipment subject to maintenance (board and batteries); • access all device parts for visual inspection, checking equipment status, making adjustments and calibrations; • have proven experience in properly using equipment similar to that described in this manual, and be trained, informed and instructed in this regard.
Maintenance technician (electrical)	Qualified technician able to: • perform preventive/corrective maintenance operations on all electrical parts of the device subject to maintenance or repair; • read wiring diagrams and check the correct functional cycle; • perform adjustments and operate on electrical systems for maintenance, repair and replacement of worn parts. The electrical maintenance technician can operate in the presence of voltage inside the electrical panels, junction boxes, control equipment etc. only if the person is suitable (PEI). For general requirements, refer to the CEI EN 50110-1:2014 standard.
Worker in charge of transport, handling, unloading and placement on site	Operator qualified in: • the use of lifting equipment; • the safe handling (even manual) of materials and equipment. The equipment must be lifted and handled strictly in accordance with the instructions provided by the Manufacturer as well as the regulations in force at the place where the equipment is installed.

Tab. 2.10.

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3 - SAFETY

3.1 - GENERAL SAFETY WARNINGS

⚠ WARNING!

- **It is strictly forbidden to repair or make any modifications to the equipment.**
- **For information and warnings regarding replacing batteries, refer to chapter 9 in this manual.**

⚠ ATTENTION!

Authorised operators must not carry out operations or services on their own initiative that do not fall within their competence.
Never work on the equipment:

- **while under the influence of intoxicating substances such as alcohol;**
- **if you are taking medication that may slow reaction times.**

NOTICE!

The employer must train and inform operators on how to behave during operations and on the equipment to be used.

Before installation, commissioning or maintenance, operators must:

- take note of the safety regulations applicable to the place of installation they are working in;
- obtain the necessary permits to operate when required;
- wear the personal protective equipment required by the procedures described in this instruction manual:
- ensure that the required collective protective equipment and safety information are available in the area they are operating in.

3.1.1 - SAFETY INSTRUCTIONS FOR INSTALLATION

Versions of the STARBOX LX2 series must be installed and commissioned in accordance with the applicable regulations and standards.

NOTICE!

PIETRO FIORENTINI S.p.A. shall not be liable for damage resulting from failure to comply with the instructions and from misuse.

Safety warnings

All operations on the equipment must be performed by qualified personnel.

Transformation and spare parts

Any technical change is forbidden. Use only original spare parts as prescribed by PIETRO FIORENTINI S.p.A.

Transport

- As a rule, the equipment must be transported in an upright position and inside the original packaging box provided by PIETRO FIORENTINI S.p.A.
- Upon receipt of the device, examine the supplied material.
- Immediately report any shipping damage.

Storage

The equipment must be stored horizontally in a dry place at room temperature (see paragraph 6.6.1).

WARNING!

- **Install the device in a compartment that meets the provisions in force on safety, away from any possible damage of mechanical origin, away from sources of heat or naked flames, in a dry place and protected from external agents.**
- **During installation, avoid mechanical stress to the inlet and outlet connections.**
- **It is forbidden to repair or make any modifications to the device.**
- **The installation, removal, and any operations must be performed by qualified personnel, in compliance with the provisions in force concerning safety.**

3.2 - PERSONAL PROTECTIVE EQUIPMENT

The following table shows the Personal Protective Equipment (PPE) and its description; an obligation is associated with each symbol.
Personal protective equipment means any equipment intended to be worn by the worker in order to protect them against one or several risks that are likely to threaten their safety or health during work.
For the operators in charge, depending on the type of work requested, the most appropriate PPE from those listed in Tab. 3.11 will be indicated and must be used:

Symbol	Meaning
	**Obligation to use safety or insulated gloves.** Indicates a requirement for the personnel to use safety or insulated gloves.
	**Obligation to use safety goggles.** Indicates a requirement for personnel to use protective goggles for eye protection.
	**Obligation to use safety shoes.** Indicates a requirement for personnel to use accident-prevention safety shoes to protect their feet.
	**Obligation to use noise protection equipment.** Indicates a requirement for the personnel to use ear muffs or ear plugs to protect their hearing.
	**Obligation to wear protective clothing.** Indicates a requirement for personnel to wear specific protective clothing.
	**Obligation to use a protective mask.** Indicates a requirement for the personnel to use respiratory masks in the event of a chemical risk.
	**Obligation to use a protective helmet.** Indicates a requirement for the personnel to use protective helmets.
	**Obligation to wear high-visibility vests.** Indicates a requirement for the personnel to use high-visibility vests.

Tab. 3.11.

⚠ WARNING!

Each authorised operator is obliged to:

- **take care of his/her own health and safety and that of other people in the workplace who are affected by his/her actions or omissions, in accordance with the training, instructions and equipment provided by the employer;**
- **appropriately use the PPE made available;**
- **immediately report to the employer, the manager or the person in charge any deficiencies in the equipment and devices, as well as any dangerous conditions they may become aware of.**

3.3 - OBLIGATIONS AND PROHIBITIONS

The following is a list of obligations and prohibitions to be observed for the safety of the operator.

It is compulsory:

- to carefully read and understand the use, maintenance and warning manual;
- before installing the equipment, to strictly refer to the details specified on the nameplates and in the manual;
- to avoid knocks and violent impact that could damage the equipment.

It is forbidden to:

- operate in various capacities on the equipment without the PPE indicated in the work procedures described in this manual;
- operate in the presence of open flames or bring open flames close to the work area;
- smoke near the equipment or while working on it;
- use the equipment with parameters other than those indicated on the nameplate;
- use the equipment outside the operating temperature range specified in this manual;
- install or use the equipment in environments other than those specified in this manual.

3.4 - RESIDUAL RISKS

The equipment does not present residual risks for the operator related to its normal operation.

⚠ WARNING!

If there are any functional faults, do not operate.
Immediately contact PIETRO FIORENTINI S.p.A. for the necessary directions.

3.5 - SAFETY PICTOGRAMS

The equipment and/or packaging of PIETRO FIORENTINI S.p.A. may bear the safety pictograms described in Tab. 3.12:

Symbol	Definition
	Symbol used to identify a GENERIC HAZARD.
	Symbol used to identify DANGERS GENERATED BY STATIC ELECTRICITY.
	Symbol applied to the packaging to identify the type of danger and risks related to the transported product, based on the classification of the European ADR agreement. Class 9 (Miscellaneous dangerous substances and articles). ADR - UN3090 (lithium metal batteries).
	The symbol indicates that the product must not be disposed of as unsorted waste but must be sent to separate collection facilities for recovery and recycling (WEEE Directive 2012/19/EU on waste electrical and electronic equipment - WEEE)

Tab. 3.12.

⚠ WARNING!

It is forbidden to remove or alter the safety pictograms on the equipment or the packaging.

3.6 - NOISE LEVEL

The STARBOX LX2 series has no moving parts.
For the value of the noise generated by the equipment and further information, contact PIETRO FIORENTINI S.p.A.

⚠ ATTENTION!

The obligation to use ear muffs or ear plugs to protect the hearing of qualified professional figures (reference paragraph 2.10) remains in the event that the noise in the installation environment of the equipment (depending on specific operating conditions) exceeds the value of 85 dBA.

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4 - DESCRIPTION AND OPERATION

4.1 - GENERAL DESCRIPTION

STARBOX LX2 is an automation and remote control system used in various types of applications: remote control, aqueduct automation, gas distribution network monitoring, photovoltaic system management, landslide monitoring, etc.

STARBOX LX2 includes in a single product functions typical of PLCs, data loggers, ladder logic execution, alarm notification systems, VPNs and many other functions that would otherwise require the creation of a complicated and heterogeneous system.

The device uses several interfaces for data acquisition from the field (RS232, RS485, R422, Ethernet) and supports a wide range of protocols.

STARBOX LX2 can be used:

- stand alone via SMS, email or web interface (thanks to an integrated web server) which allows you to view information, edit parameters, view historical trends or access on-board synoptics;
- interfacing with an HMI SCADA system for the complete management of the related data, using the communication technologies currently available: ADSL, GSM, GPRS, UMTS, HSPA also in the VPN environment.

The combination of these resources makes STARBOX LX2 an intelligent and multimedia unit for the control of distributed units in civil and industrial environments.

The heart of the STARBOX LX2 system can be represented by the flow that the data follows within it, in particular the information passes through the following phases:

1. Data acquisition “from the outside world”.
2. Data processing.
3. Writing data “to the outside world”.

The main elements are (see Fig. 4.2):

Pos.	Description	Pos.	Description
1	Digital input terminal block (No. 16)	10	Analogue output terminal block (No. 1)
2	Digital output terminal block (No. 8)	11	USB port (OTG/HOST)
3	Aluminium enclosure	12	ETH0 Ethernet interface
4	Input/output activity LEDs	13	ETH1 Ethernet interface
5	CANBUS serial interface	14	ETH2 Ethernet interface
6	RS232 serial interface	15	VGA video output (optional)
7	RS422/RS485 serial interface	16	Power supply (10-30 VDC)
8	ZigBee antenna (optional)	17	Metrological battery*
9	Analogue input terminal block (No. 8)	-	-

* *Metrological battery not visible in figure*

Tab. 4.13.

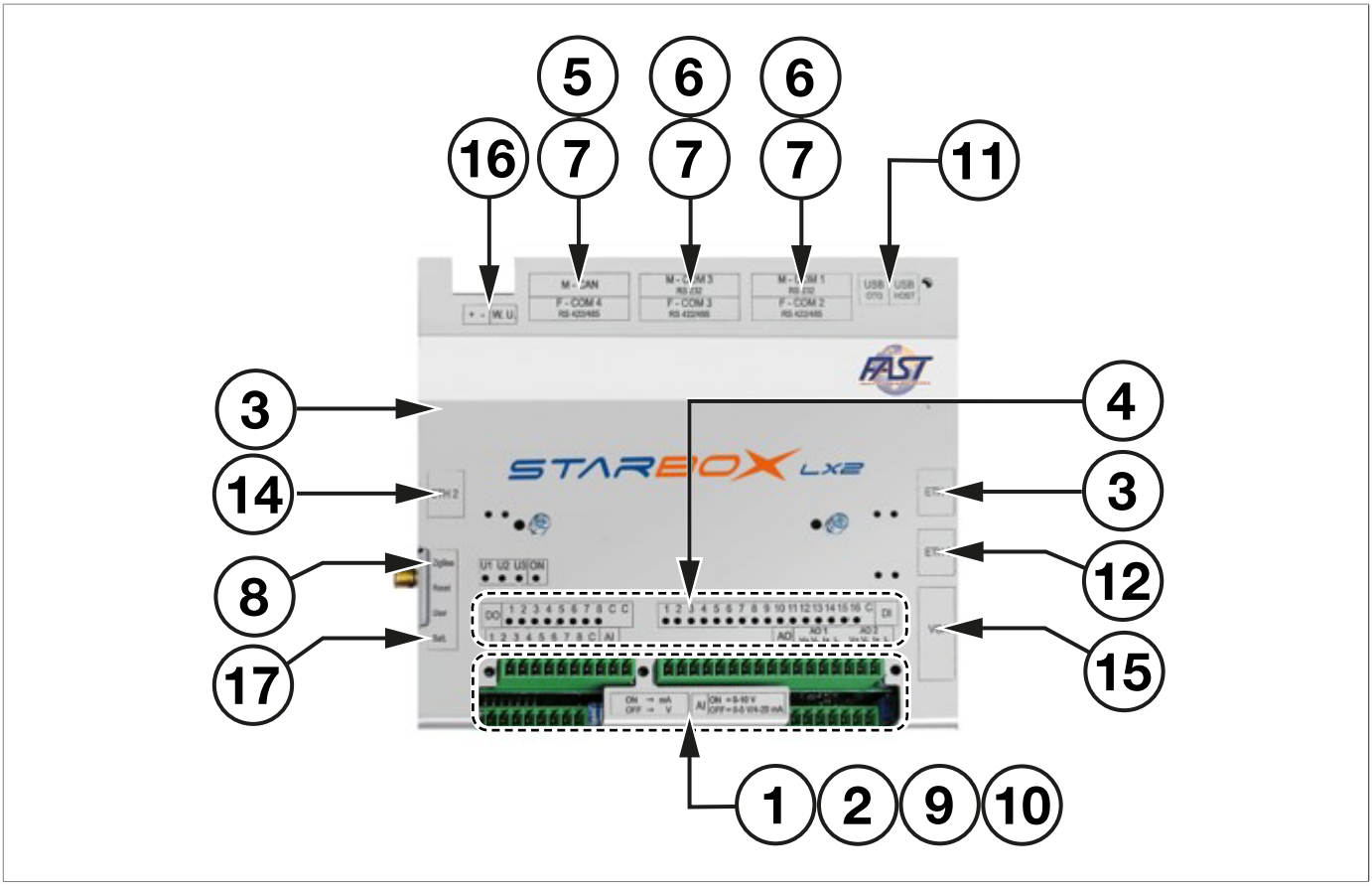


Fig. 4.2. General description STARBOX LX2

4.2 - DESCRIPTION OF THE DEVICE

The following paragraphs describe the hardware interfaces to/from the field supplied with the equipment STARBOX LX2.

4.2.1 - SERIAL PORTS

The system has 4 opto-isolated serial ports described in the following paragraphs with their respective pinouts.

4.2.1.1 - COM1

RS232 serial port of DTE type on DB9 male connector:

Pin	Signal
2	RX
3	TX
5	GND
7	RTS
8	CTS

Tab. 4.14.

4.2.1.2 - COM2/COM4

RS485 serial ports (422) on DB9 female connector:

Pin	Signal
1	SHIELD
3	TX+
4	RX-
5	GND
6	Vcc
8	TX-
9	RX+

Tab. 4.15.

The selection of half-duplex (2 wires, 3:DATA+, 8:DATA-) or full-duplex (4 wires) mode is done via software settings and by short-circuiting the pairs of pins 3-9 and 4-8 two by two, which can be done via a specific jumper bank on the circuit board, inside the chassis of the STARBOX LX2 device, as shown in Fig. 4.3.

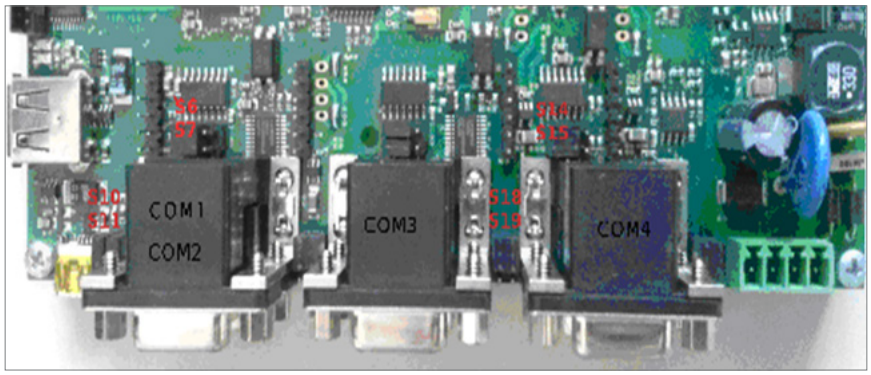


Fig. 4.3. Jumper references for serial port configuration

In particular, the pair of jumpers **S6-S7** allows you to configure COM2, while the pair **S14-S15** allows you to configure the COM4 port. Moving the jumpers towards the side:

- of the USB ports, half-duplex mode is applied;
- opposite the USB ports, full-duplex mode is obtained.

These two ports allow you to insert end-of-line termination resistors via two jumper banks, respectively bank **S10-S11** for COM2 and bank **S18-S19** for COM4. With the jumpers in the position towards:

- the internal side, the resistors are off;
- the outer side, they are on.

4.2.1.3 - COM3

There is a DTE-type RS232 serial port on a DB9 male connector or an RS485 (422) serial port on a DB9 female connector.

The selection of one function or the other must be done only via software configuration (see the Rainbow Configurator manual) and therefore does not require any hardware setting.

The relevant pinouts are those shown in Tab. 4.15. and Tab. 4.16. respectively.

4.2.2 - ETHERNET PORTS

The device has a 10/100 Mb/s Ethernet port, called ETH0, accessible via a standard RJ 45 connector (IEEE 802.3 Ethernet Controller) on the input.

Through this network interface you can access the STARBOX LX2 device locally for various functions such as:

- Access via Rainbow for reconfiguration operations or real-time viewing of information.
- Access via browser for viewing current values and any parameters with a web interface.
- File transfer via SSH protocol.
- Inserting the STARBOX LX2 device in a LAN, even in a VPN environment.

4.2.3 - USB HOST

The system has a USB port in “Host” configuration, accessible via the connector called USB HOST.

This port can be used, for example, to connect a USB memory stick when necessary to perform a configuration and/or application update from a pen drive.

4.2.4 - I/O

The detail of the sections of the STARBOX LX2 device related to I/O is shown in Fig. 4.4 and described below:

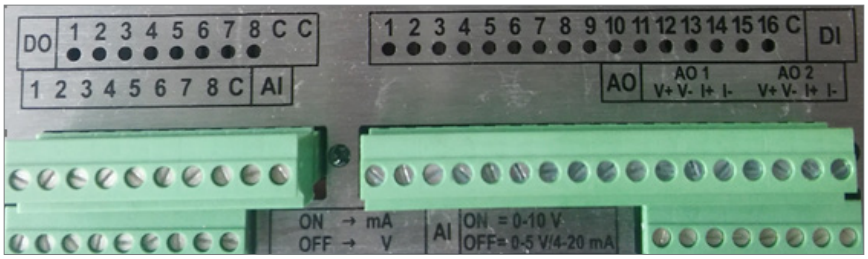


Fig. 4.4. I/O Sections STARBOX LX2

4.2.4.1 - ANALOGUE INPUTS

The system has 8 analogue inputs with 16-bit resolution for current and voltage readings, accessible via the 9-pin connector indicated with “AI” (Fig. 4.4).

The reading mode for each channel is set via the 2 banks of dip switches shown in Fig. 4.5.

The left bank allows you to insert the voltage-to-current conversion resistor, thereby selecting the current reading (0-20 mA, 4-20 mA) or the voltage reading (0-5 V, 0-10 V), while the right bank allows you to choose in voltage mode between a full scale measurement of 5 V and 10 V.

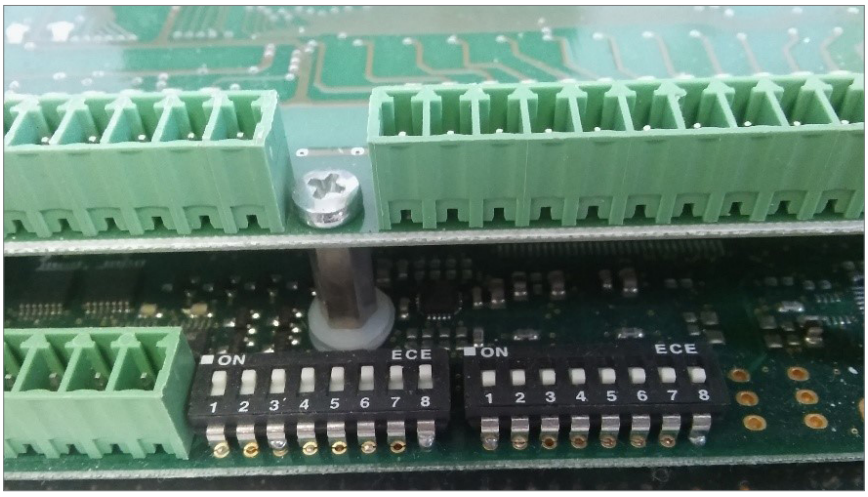


Fig. 4.5. Analogue inputs STARBOX LX2

Available dip switch combinations:

Lh Dip Switch	Rh Dip Switch	Reading type
ON	OFF	0-20mA 4-20mA
OFF	ON	0-10 V
OFF	OFF	0-5 V

Tab. 4.16.

When connecting field instrumentation to the analogue inputs, remember that these inputs are passive. The current or voltage measurement signal must therefore be powered independently: the negative polarity of the signal must be connected to the common terminal of the connector (C) while the positive polarity must be connected to the channel terminal, as outlined in Fig. 4.5.

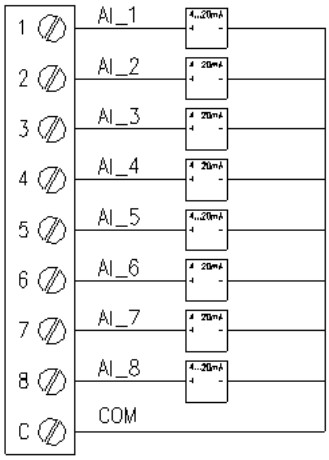


Fig. 4.6. Analogue inputs connection

Input voltage limits for each channel: 30 V.

NOTICE!

Since all eight inputs have the same common, the field instrumentation must be equipped with galvanic separation of the generated signal, to avoid short-circuiting different ground signals.
In the absence of this property, you must interpose galvanic separation interfaces between STARBOX LX2 and instrumentation.

NOTICE!

When using analogue voltage inputs (0-10V, 0-5V) it is recommended to insert a resistor with a value between 8Kohm and 80Kohm between the input and the common (COM), preferring the lowest resistance range, compatible with what the sensor is able to drive.
Although this insertion is not necessary on good-quality sensors with feedback output, it is nonetheless recommended to insert the resistor, which in the worst case scenario will be superfluous but will not affect the measurement.

4.2.4.2 - DIGITAL INPUTS

The system has 16 digital inputs accessible via the connector called “DI”.

Each line has an LED to indicate the current status of the associated input and is also protected by:

- a reverse polarity protection diode;
- an opto-isolating stage;
- a buffer final stage.

Each input is paired with the counting functionality with a maximum frequency of 1000 Hz.

When connecting field instrumentation to the digital inputs, remember that these inputs are passive. The negative polarity of the field signal must be connected to the common terminal of the connector (C), while a positive voltage must be applied to the channel terminal in the ON state and zero voltage in the OFF state, as shown in Fig. 4.7.

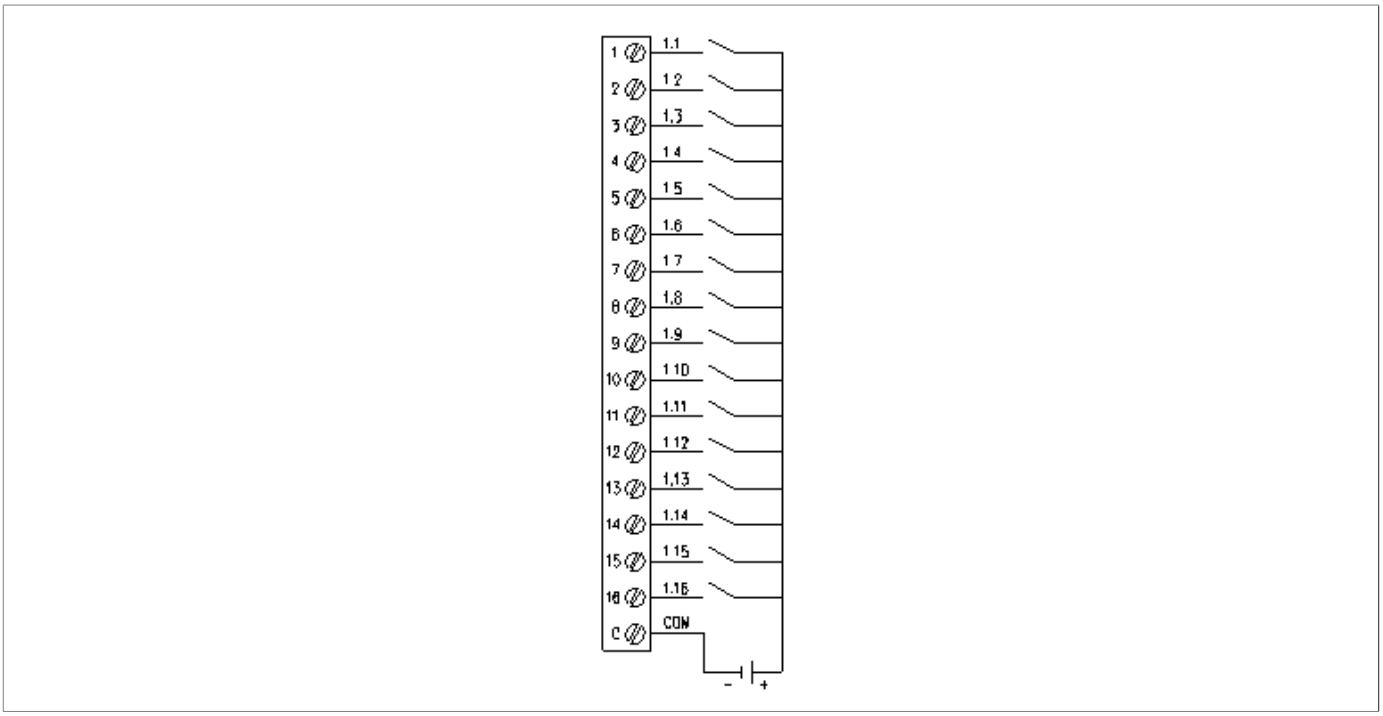


Fig. 4.7. Digital inputs connection

Minimum voltage for ON state: 8.5 V.

Maximum tolerable voltage: 30 V.

Opto-isolation up to 2500 V.

4.2.4.3 - DIGITAL OUTPUTS

The system features 8 NPN open collector digital outputs accessible via the connector called “DO”. When connecting these digital outputs to external loads, pay attention to the maximum current that can be supplied.

The ground reference of the voltage to be triggered must be connected to the common terminal of the connector (C) (Fig. 4.8). in state:

- “OFF” of the digital output, there will be an open circuit between the channel terminal and the common.
- “ON” there will be a closed circuit, so the ground is applied to the output.

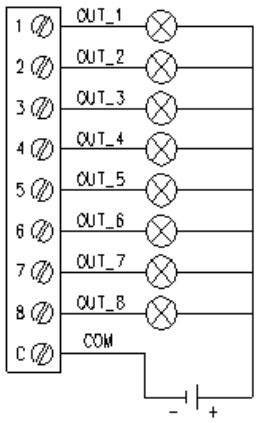


Fig. 4.8. Digital outputs connection

Opto-isolation up to 2500 V.

Maximum current supplied 20 mA.

4.2.4.4 - ANALOGUE OUTPUTS

The AO1 port (Fig.4.9) can be used to drive a current or voltage load.

- Voltage: minimum load of 1 KΩ.
- Current: maximum load of 250 Ω with loop powered at 12 V (isolated from the power supply of the STARBOX LX2 device)

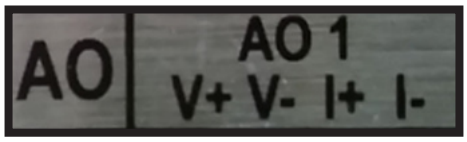


Fig. 4.9. Analogue outputs connection

4.2.4.5 - POWER SUPPLY

The device is designed to be powered by direct voltage, not necessarily stabilised, with voltages in the range 10 – 30 V.

The overall system current consumption varies depending on the peripheral devices used, typically in the range of 200-500 mA at 12 V.

There is no switch to turn the system “OFF” / “ON”. The power circuit is protected against accidental polarity reversal.

The current power status is indicated by the ON LED as shown in Fig.4.10:

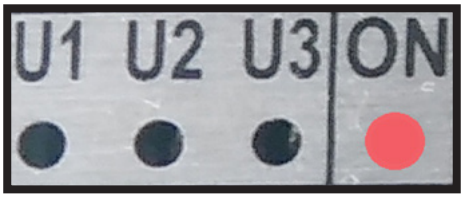


Fig. 4.10. Power LED

Once the power is supplied, there is a start-up and initialisation phase lasting approximately 30 seconds, after which the U3 LED goes from off to flashing to indicate that the STARBOX LX2 device is in the “alive” state, therefore in normal operating condition.

4.3 - INTENDED PURPOSE

4.3.1 - INTENDED USE

The equipment in question is intended for the:

Operation allowed	Not allowed	Work environment
Water mains monitoring	Any type of medium other than that permitted.	Application in water network installations and nodes.

Tab. 4.17.

The equipment referred to was designed to be used exclusively within the limits specified on the nameplate and according to the instructions and limits of use specified in this manual.

Safe work conditions are as follows:

- use within the limits stated on the nameplate and in this manual;
- compliance with the user manual procedures;
- routine maintenance to be carried out when and how indicated;
- special maintenance to be carried out if required;
- do not tamper with and/or bypass the safety devices.

4.3.2 - REASONABLY FORESEEABLE MISUSE

Reasonably foreseeable incorrect use means the use of the equipment in a way not foreseen in the design phase but which can result from readily predictable human behaviour:

- using the equipment in a manner other than that referred to under paragraph "**Intended use**".
- instinctive reaction of an operator in the event of a malfunction, accident or breakdown while using the equipment;
- behaviour resulting from carelessness;
- behaviour resulting from the use of the equipment by unauthorised and unsuitable people (children, disabled persons).

Any use of the equipment other than the intended use must be previously approved in writing by PIETRO FIORENTINI S.p.A.

If no written approval is provided, use shall be considered "**improper**".

In the event of "improper use", PIETRO FIORENTINI S.p.A. shall not be held liable for any damage caused to people or property, and any type of warranty on the equipment shall be deemed void.

4.4 - TECHNICAL DATA

General features	
External enclosure	Anodised aluminium
Casing protection rating	IP20
Ambient temperature range of operation	from -20 °C to +80 °C
Humidity	0-95% non-condensing
Storage temperature range	from -25 °C to +80 °C
Supply voltage	10-30 VDC
Power consumption (typical)	2-4 Watt
System memory	128MB RAM
Data memory	256MB FLASH, expandable via USB Stick
Microprocessor	32bit, 400MHz clock
Real Time Clock	Yes (with buffer battery guaranteed for 10 years)

Tab. 4.18.

I/O	
Digital inputs	No. 16, 10-30 V DC type, opto-isolated and with 2500 V galvanic isolation, also configurable as fast counters up to 300 Hz
Analogue inputs	No. 8, 16-bit type 4-20 mA / 0-5 / 10 V DC with galvanic isolation 2500 V
Digital outputs	No. 8, 10-30 V DC type, opto-isolated and with 2500 V galvanic isolation
Analogue outputs	No. 2, 16-bit type 0-10 V DC with galvanic isolation 2500 V

Tab. 4.19.

Communication features	
RS232	No. 2
RS422/RS485	No. 2
Ethernet	No. 3 general purpose (Removable HD, Memory exp. Protocol Converters, Media Converters, Video Cameras, Still Cameras, Audio Sets, Displays).
CanBUS	No. 1
USB	• No. 1 HOST • No. 1 DEVICE
Centre protocols (slave)	• MODBUS RTU • MODBUS TCP • IEC 60870-5-104 • Others on request (optional)
Field protocols (master)	• Modbus RTU • Modbus TCP • Siemens S7 TCP/IP • Omron Hostlink • Others on request (optional)
Alarms/Events	Signalling and management of alarms and events generated by exceeding thresholds and/or reaching physical and logical states. Using the message service for alarm notification.
Synchronisation	Daily synchronisation via SCADA server.
Data connection	Programmable centre call, configuration, missing data download, archive, date/time alignment.
Communication	Periodic, scheduled or event-driven.

Tab. 4.20.

4.5 - I/O CHANNELS

STARBOX LX2 acquires the following signals:

- 8 analogue inputs 0-10V / 4-20mA.
- 16 digital inputs.
- 8 digital outputs.
- 1 analogue output 0-10V / 4-20mA.
- 2 RS232 serial interfaces.
- 2 RS422/RS485 serial interfaces.
- 1 CanBUS serial interface.
- 2 USB interfaces, 1 10/100 Mbit Ethernet interface.

4.6 - DATA COMMUNICATION

STARBOX LX2 can be connected to a modem via RS232/RS485/USB serial interface or to a router via Ethernet port.

4.7 - WIRING

STARBOX LX2, can acquire and manage the following I/O interfaces:

- 8 analogue inputs 0-10V / 4-20mA.
- 16 digital inputs.
- 8 digital outputs.
- 1 analogue output 0-10V / 4-20mA.

5 - USER INTERFACE

5.1 - GENERAL DESCRIPTION

The following paragraphs describe the methods for local interaction with the STARBOX LX2 device for configuration, monitoring and maintenance operations.

5.1.1 - LOCAL COMMUNICATION INTERFACE

STARBOX LX2 has an Ethernet interface through which you can connect a PC. You can access the integrated web server, the device for monitoring and firmware update operations or use the “Rainbow Configurator” software on a Windows PC that allows you to configure the device.

NOTICE!

For details on using the “Rainbow Configurator” software, please refer to chapter 8 (configuration).

Local communication methods are listed below.

5.2 - CONNECTION FROM PC TO STARBOX LX2

To connect from a PC to the STARBOX LX2 device, use the ETH0 Ethernet connection with a straight or crossover RJ45 cable, as shown in Fig. 5.11:



Fig. 5.11. Ethernet connection

The network card of your PC must be set to allow the two devices to communicate. In particular, the IP address of the PC must be set within the same subnet as the IP address of the STARBOX LX2.

For example, if the STARBOX LX2 has the factory address 192.168.0.234, you can assign the PC the address 192.168.0.x with x between 1 and 255 and different from 234.

If the PC and the STARBOX LX2 are connected to a LAN, make sure that the IP address assigned to the STARBOX LX2 or to the PC is not already in use on the network.

5.3 - SOFTWARE UPDATE PROCEDURE

Via the USB Host interface it is possible to update the configuration and/or applications of the STARBOX LX2.

All you need is a properly configured pen drive to perform the update. To perform the update, proceed as follows:

1. Insert the pen drive into the USB Host connector.
2. Restart the RTU with the reset button. The U1 LED (Fig. 5.12) remains on with a steady light throughout the update phase.
3. Wait for the STARBOX LX2 to reboot at the end of the update.

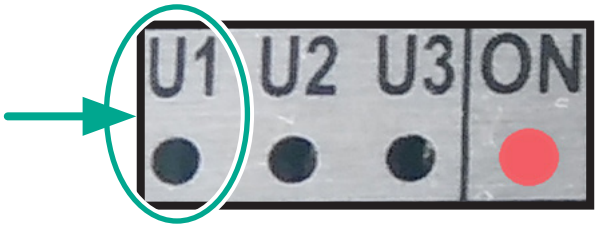


Fig. 5.12. Power LED

Successful completion of the update is indicated by the U1 LED flashing for a few tens of seconds. From this point on, you can remove the pen drive from the STARBOX LX2.

5.4 - GATEWAY FUNCTIONALITY

STARBOX LX2 is able to acquire analogue and digital signals through the hardwired I/O section described in the relevant section.

In addition to this acquisition mode, STARBOX LX2 is able to interface with various types of devices such as:
PLCs, meters, inverters, weather stations, etc. with serial or Ethernet connections using the specific protocol for the given device.

STARBOX LX2 is able to:

- both read information from one of these devices and perform write operations where provided for by the protocol in use. The read variables are mapped into the internal memory of the STARBOX LX2, available for example for ladder logic processing or for logging.
- act as a gateway, using modems, between the supervision centre (which typically operates in Modbus TCP/IP) and the various devices with which STARBOX LX2 is able to communicate (each with its own protocol).

Due to its characteristics, STARBOX LX2 is a multi-protocol gateway, capable of adding new protocols based on the user's specific needs.

5.5 - INTEGRATED WEB SERVER

The web server present on the STARBOX LX2 allows interfacing with the device via a common browser, to access the display of the quantities at any time or act on the operating parameters (such as thresholds, application parameters, etc.).

The “Rainbow Configurator” allows you to configure which information is made available on the web pages of the STARBOX LX2, which are read-only and which are read/write (for how to configure the web pages, see the Rainbow manual and its appendix for STARBOX LX2).

You may log on to the web server in different contexts: LAN, WAN or GPRS, including via VPN.

Fig. 5.13 shows the interface (home page) that opens when you type the address of the STARBOX LX2 in the browser address bar (or the equivalent dynamic DNS in the case of GPRS connections → REMOTE connection):

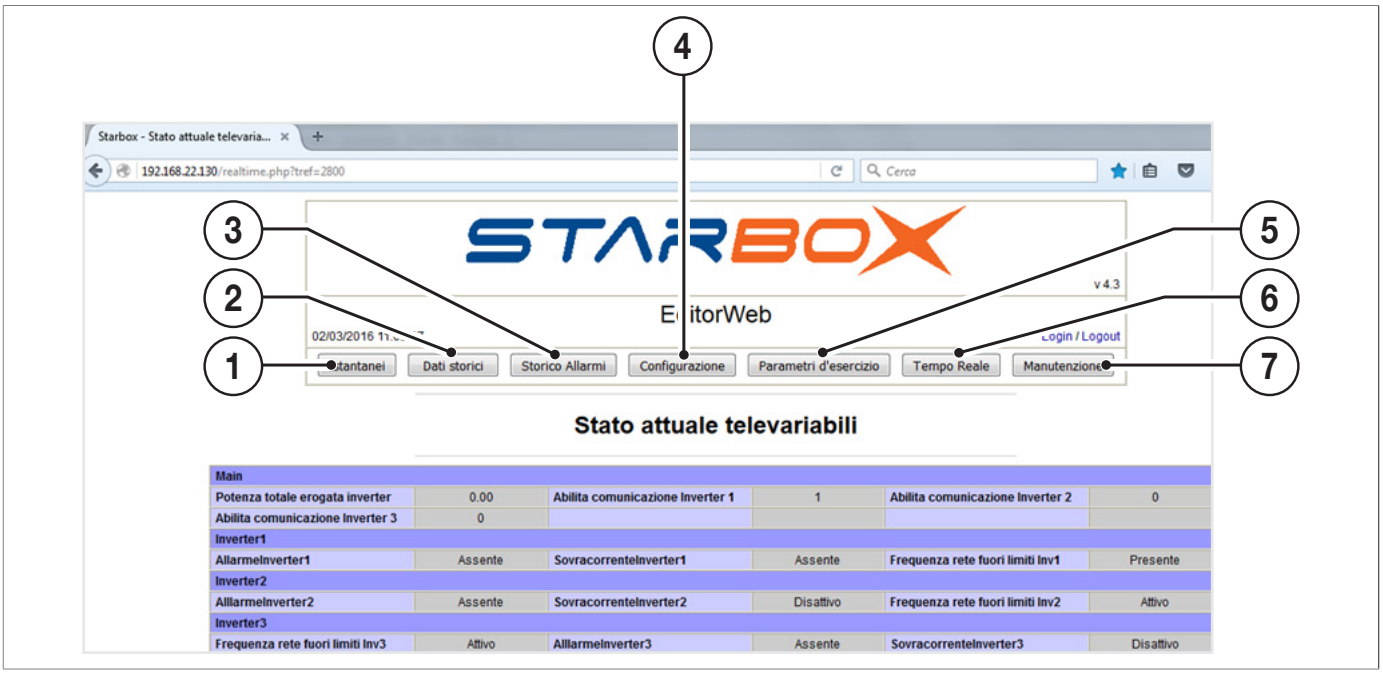


Fig. 5.13. Home page STARBOX LX2

Access to the web pages is protected with any passwords present in the device configuration.

The following menus are available in the home page (Fig. 5.13):

Pos.	Menu
1	Instantaneous
2	Logged data
3	Alarm log
4	Configuration
5	Operating parameters
6	Real time
7	Maintenance

Tab. 5.21.

5.5.1 - INSTANTANEOUS

In this section you can see the variables that have the HMI display property present in their configuration.

You can organise the information you want to view in different submenus of the main Instantaneous menu. The web page paired with each submenu can in turn be divided into subtables, each with its own header.

Alternatively, there is a default viewing mode where variables are displayed grouped by their type (BV, LV, FV).

5.5.2 - LOGGED DATA

In “Logged data” you can view the logged data in graphic (1) or text (2) format and download it (3), choosing one of the three available submenus (Fig. 5.14):

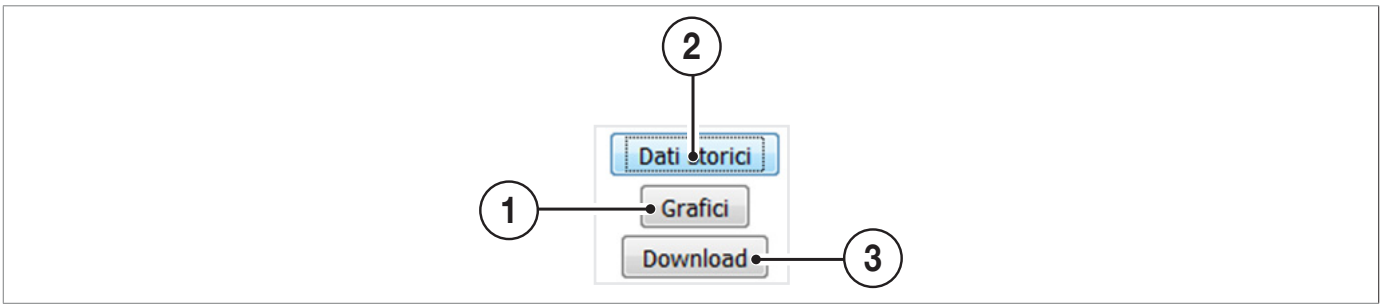


Fig. 5.14. Options for viewing logged data

5.5.2.1 - GRAPHS

Selecting the “Graphs” submenu opens the interface (Fig. 5.15) from which you can select up to 6 quantities with associated logging and select the period of interest.

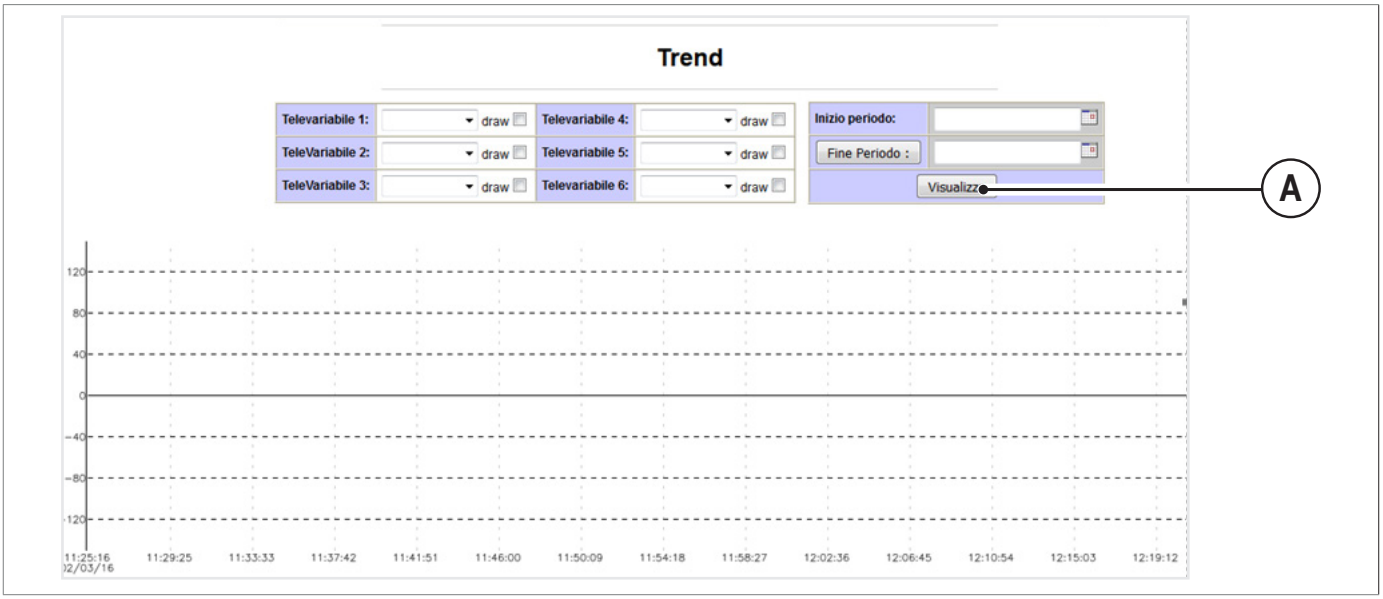


Fig. 5.15. Interface for trend visualisation

Pressing the “View” button (A) displays the relevant trends (Fig. 5.16).

NOTICE!

To view the values in detail, scroll through the graph.

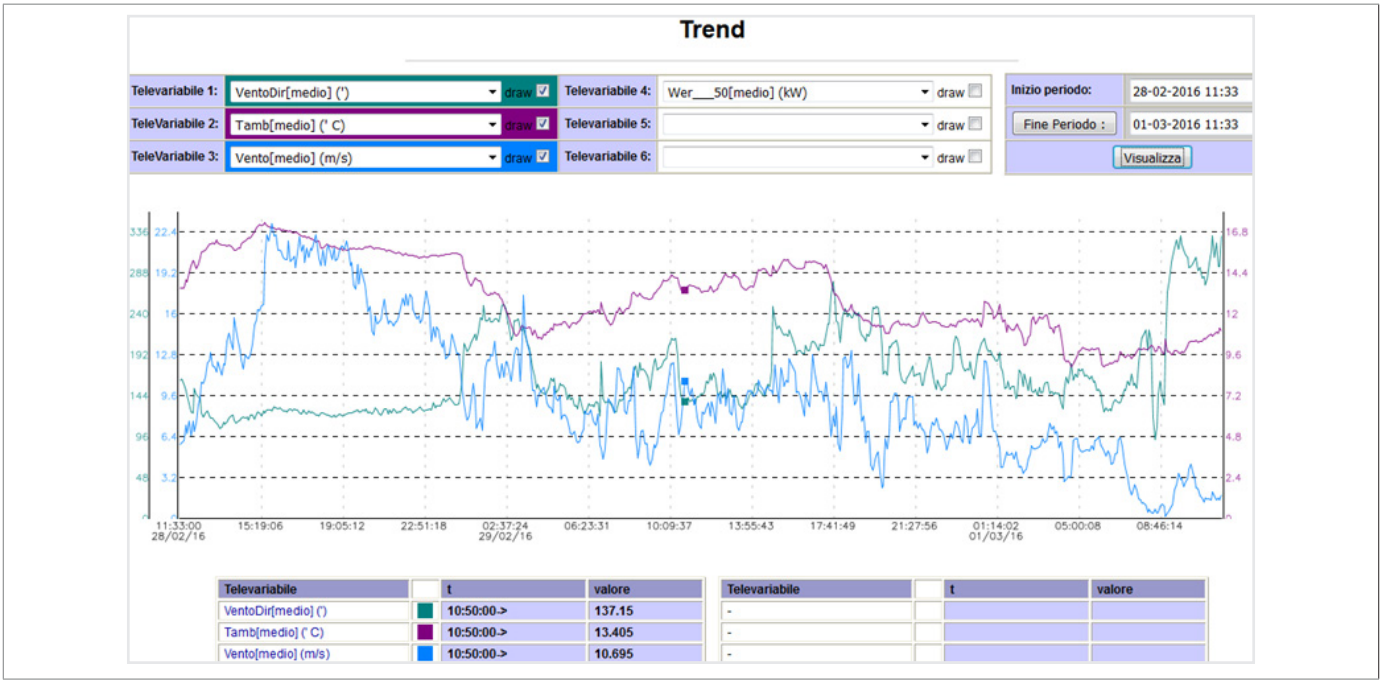


Fig. 5.16. Trend display example

5.5.2.2 - DOWNLOAD

This submenu allows you to download the data for the selected quantity and save it to a file (.csv format).

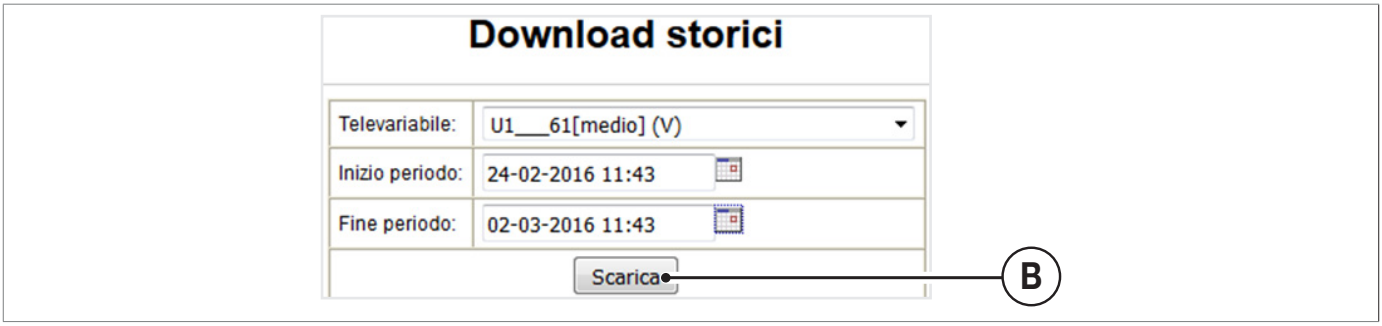


Fig. 5.17. Settings for downloading data in .csv files

Once the quantity of interest and the relevant period have been selected, the download starts using the “Download” button (B), indicated by the following message:



Fig. 5.18. Download submenu data processing message

Once the download is complete, you can save the file or open it for immediate viewing.

Any invalid data for a quantity (for example outside the full scale) is indicated with the text:

- NaN in graphs
- NV in .csv files.

5.5.3 - ALARM LOG

Allows you to view the alarm events present on the peripheral device:



Storico allarmi

Data/Ora	TeleVariabile	Stato Allarme	Codice Err	Valore
02/03/16 11:26:22	Temperatura locale inverter	Scattato su soglia alta		
02/03/16 10:11:19	Temperatura locale inverter	Rientrato su soglia alta		
02/03/16 09:24:53	Temperatura locale inverter	Scattato su soglia alta		
02/03/16 09:02:02	Tutti gli inverter in run	Rientrato		
02/03/16 09:00:07	Tutti gli inverter in run	Scattato		
02/03/16 07:37:07	10.Controllore permanente isolamento	Rientrato		
02/03/16 06:36:17	10.Controllore permanente isolamento	Scattato		
02/03/16 06:33:47	10.Controllore permanente isolamento	Rientrato		
02/03/16 06:30:21	10.Controllore permanente isolamento	Scattato		
02/03/16 06:18:33	Allarme comunicazione JB 2.2	Rientrato		
02/03/16 06:18:18	Allarme comunicazione JB1.7	Rientrato		
02/03/16 06:18:13	Allarme comunicazione JB1.6	Rientrato		
02/03/16 06:17:43	Allarme comunicazione JB1.2	Rientrato		

Fig. 5.19. Example of alarm log on web page

Each alarm event is defined by:

- time;
- event date;
- description of the quantity affected by the event;
- description of the alarm status (active or cleared).

5.5.4 - CONFIGURATION

From the “Configuration” submenu you can access a series of information relating to the configuration of the peripheral device:

1. Alarms & Scales.
2. Network.
3. Localisation.

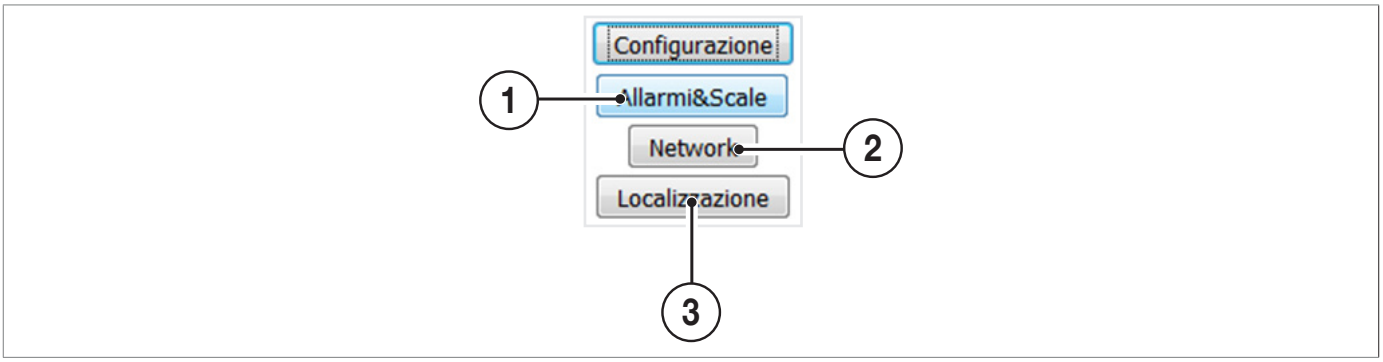


Fig. 5.20. Configuration submenu options

5.5.4.1 - ALARMS & SCALES

In this section you can view and edit the following information:

- any recipients of alarm actions;
- alarm thresholds for analogue quantities and related alarm event signalling times;
- alarm activation status for digital quantities and related alarm event signalling intervals;
- display of the full scale of the analogue inputs.

5.5.4.2 - NETWORK

In this section you can configure the device's network settings:

- native Ethernet interface network configuration;
- Wi-Fi configuration, dynamic DNS, firewall, VPN.

The adjustable parameters are the same as those described in the configuration manual.

5.5.4.3 - LOCALISATION

In this section (Fig. 5.21) you can set:

- current time and date of the STARBOX LX2.
- latitude and longitude of the installation site (required in particular applications);

The entered values are set on the device by pressing the "Save changes" button.

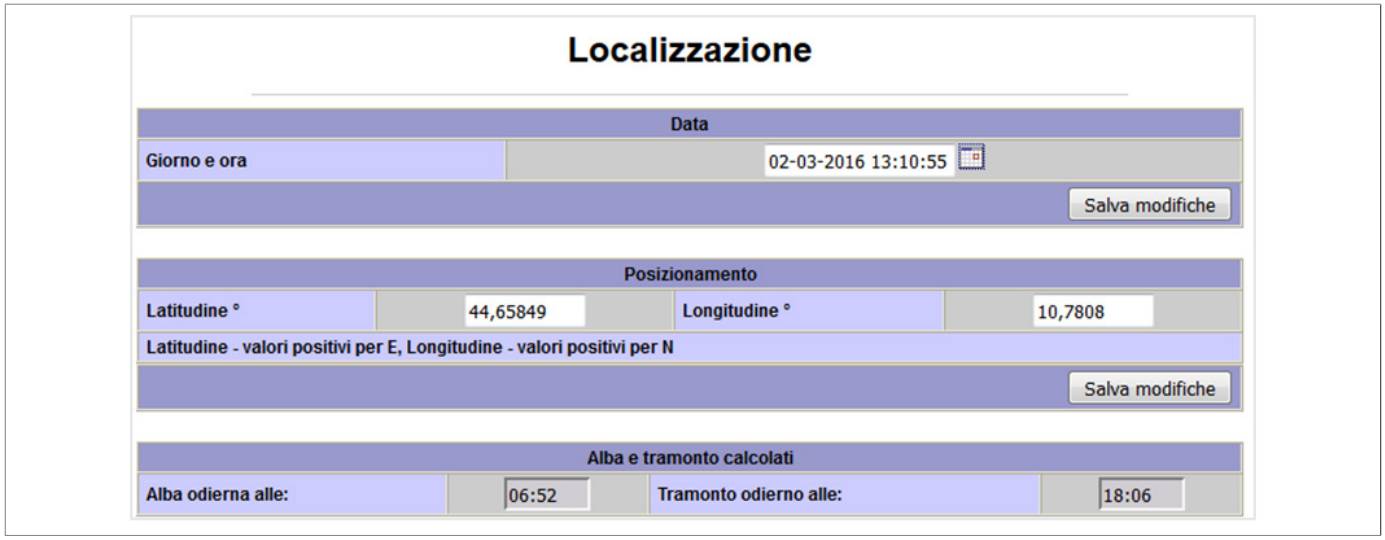


Fig. 5.21. Localisation section settings

5.5.5 - OPERATING PARAMETERS

In this submenu, all variables with the "Editable HMI" property enabled are shown. To edit the properties of a variable you need to access the "Configuration" submenu.

The entered values are set on the device by pressing the "Save changes" button.

5.5.6 - REAL TIME

In this submenu it is possible to show the real-time trend of one of the quantities present in the configuration.

Pressing the “View” button at the top of the interface (Fig. 5.22) starts the real-time trend generation, while the bottom part shows the last acquired value of the selected quantity.

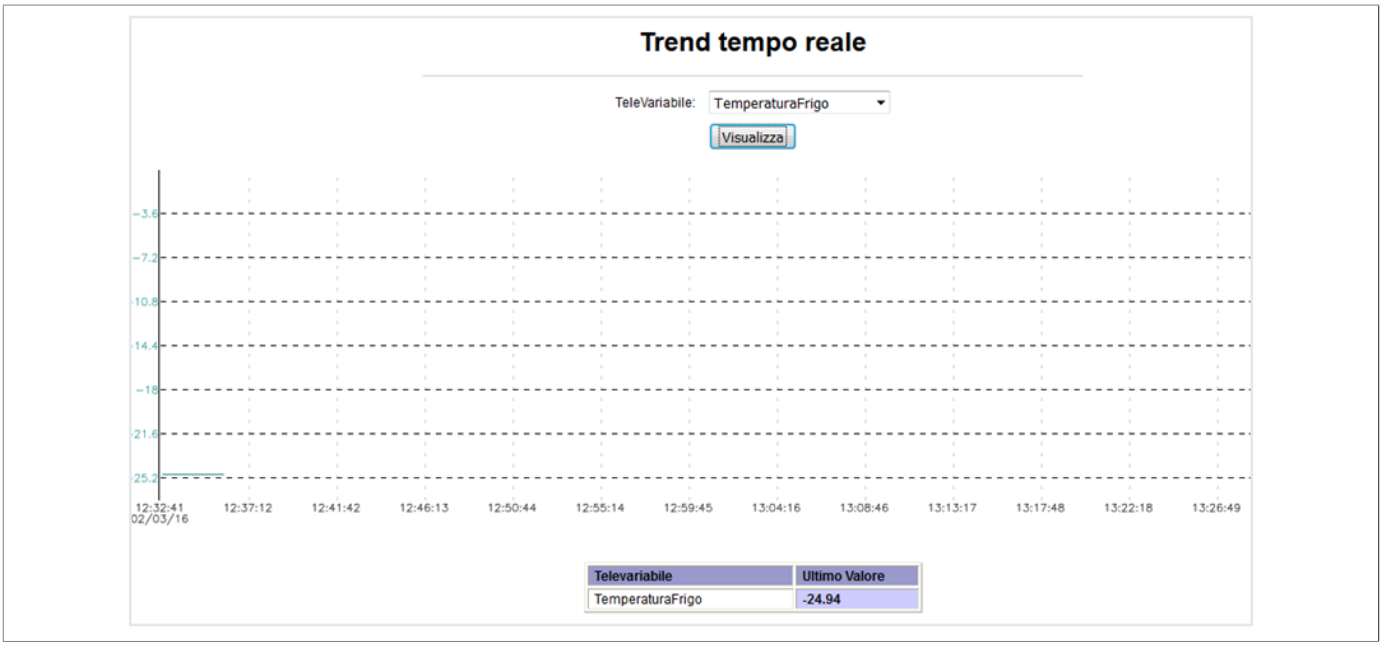


Fig. 5.22. Real-time trend interface example

5.5.7 - MAINTENANCE

This submenu displays the current software versions of the applications on the device. Any applications that are not running are indicated by the words “Version not found”.

There is also a section to allow the user to make a backup of the current device or restore from a previously made backup.

6 - TRANSPORT AND HANDLING

6.1 - SPECIFIC WARNINGS FOR TRANSPORT AND HANDLING

NOTICE!

Transport and handling must be carried out, in compliance with the regulations in force in the country of destination of the equipment, by personnel who are:

- **qualified (specially trained);**
- **familiar with accident prevention and workplace safety regulations;**
- **authorised to use lifting equipment and means.**

Transport and handling	
Operator qualification	• Installer.
PPE required	 **WARNING!** **The PPE listed in this table is related to the risk associated with the equipment. For the required PPE to protect against risks associated with the workplace, installation or operating conditions, reference must be made to:** • **the regulations in force in the country of installation;** • **any information provided by the Safety Manager at the installation facility.**
Equipment weights and dimensions	For dimensions and weights please refer to paragraph “6.3 - Physical characteristics of the device”.

Tab. 6.22.

6.1.1 - PACKAGING AND FASTENERS USED FOR TRANSPORT

The transport packaging has been designed and manufactured to avoid damage during normal transport, storage and handling.

The equipment must be kept in the packaging until installation.

Upon receiving the equipment, it is necessary to:

- check that the packaging is intact and that no part has been damaged during transport and/or handling;
- immediately report any damage found to PIETRO FIORENTINI S.p.A..

NOTICE!

PIETRO FIORENTINI S.p.A. shall not be liable for any damage to people or property caused by accidents due to failure to comply with the instructions provided in this manual.

The types of packaging used are described in Tab. 6.23:

Ref.	Type of packaging	Image
A	Single box	

Tab. 6.23.

6.2 - PACKAGING CONTENT

STARBOX LX2 is shipped with:

- battery inside (to be connected);
- internal antenna;
- expansion board (on request);
- wall-mounting bracket (on request).

6.3 - PHYSICAL CHARACTERISTICS OF THE DEVICE

6.3.1 - FRONT SIDE

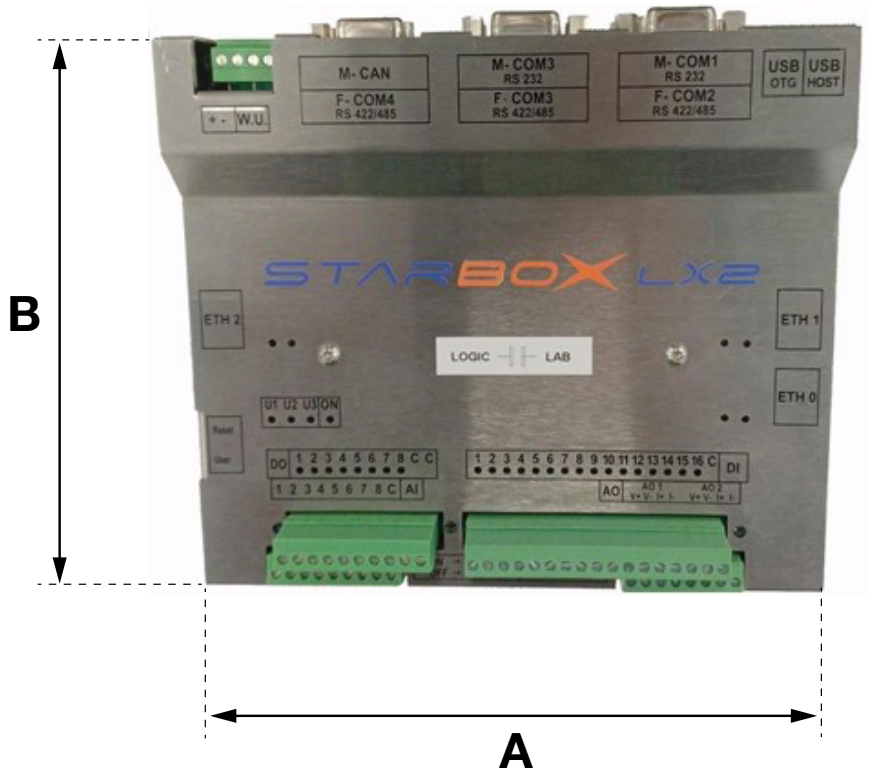


Fig. 6.23. Dimensions STARBOX LX2 front view

Weights and dimensions	
A	165 mm
B	140 mm
Weight	2 kg

Tab. 6.24.

6.3.2 - UPPER SIDE

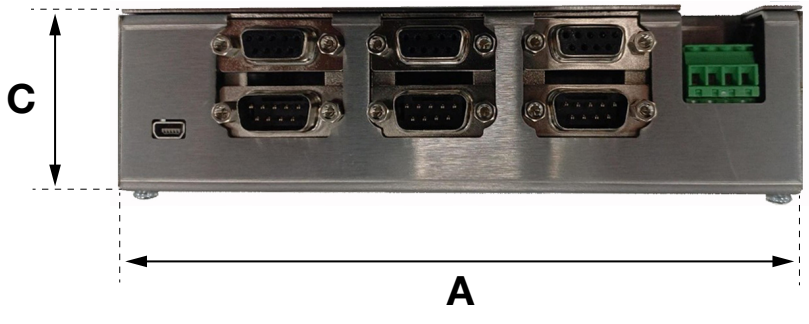


Fig. 6.24. External view of the top

Dimensions [mm]	
A	165 mm
C	45 mm

Tab. 6.25.

6.3.3 - LEFT SIDE

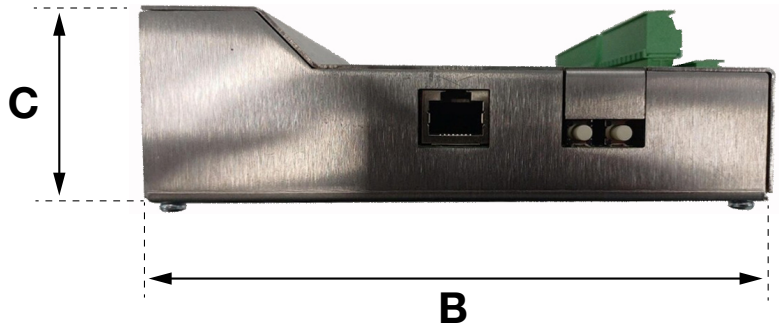


Fig. 6.25. External view, left side

Dimensions [mm]	
B	140 mm
C	45 mm

Tab. 6.26.

6.3.4 - RIGHT SIDE

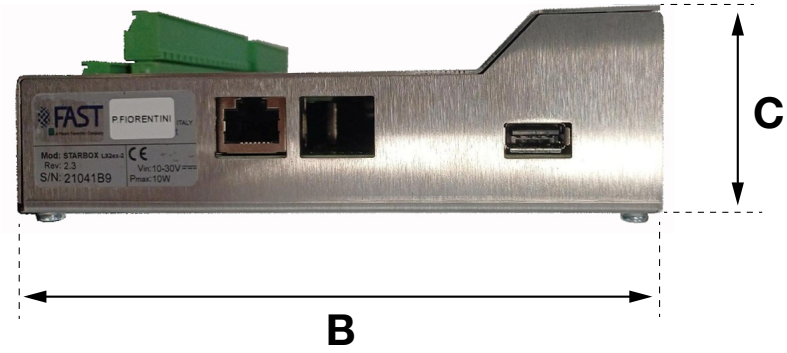


Fig. 6.26. External view, right side

Dimensions [mm]	
B	140 mm
C	45 mm

Tab. 6.27.

6.4 - EQUIPMENT ANCHORING AND LIFTING METHOD

HAZARD!

Using lifting equipment (if necessary) for unloading, carrying and handling packages is reserved only for skilled operators who have been properly trained and instructed (with licence if required by the regulations in force in the country of installation) and are familiar with:

- **accident prevention rules;**
- **workplace safety provisions;**
- **lifting equipment features and limits.**

HAZARD!

Before handling a load, make sure that its weight does not exceed the load capacity of the lifting equipment (and any other lifting tools) specified on the specific plate.

ATTENTION!

Before handling the equipment:

- **remove any movable or hanging component or firmly secure it to the load;**
- **protect the most fragile equipment;**
- **check that the load is stable;**
- **be sure to have perfect visibility along the route.**

6.4.1 - FORKLIFT HANDLING METHOD

⚠ HAZARD!

It is forbidden to:

- **transit under suspended loads;**
- **move the load over the personnel operating in the site/plant area.**

⚠ WARNING!

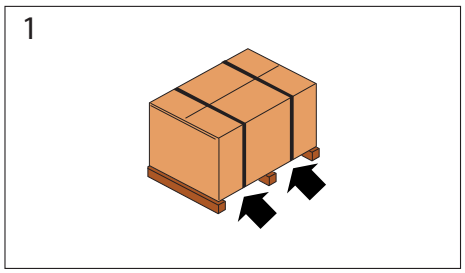
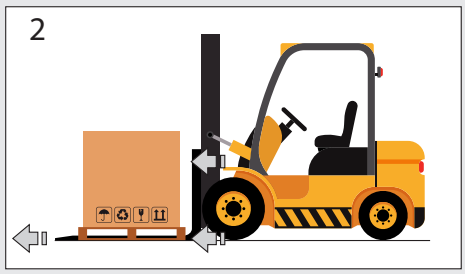
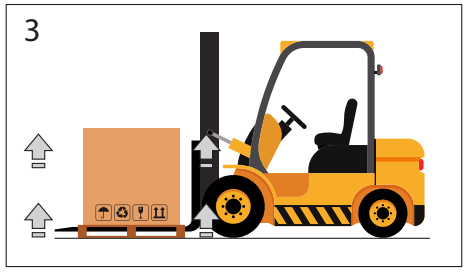
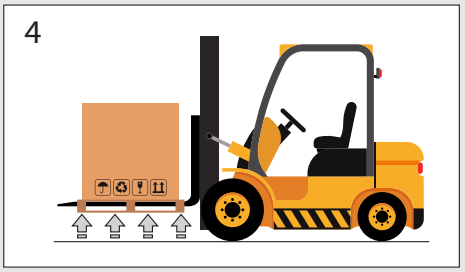
The following is not allowed on forklifts:

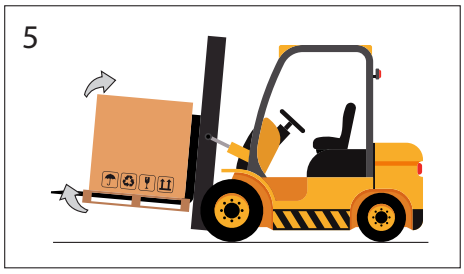
- **carrying passengers;**
- **lifting people.**

⚠ WARNING!

During all handling operations, pay close attention to avoid impact or vibrations of the equipment batteries.

If cardboard boxes (single or multiple) are carried on a pallet, proceed as indicated in Tab. 6.28:

Step	Action	Image
1	Place the forks of the forklift under the load surface.	
2	Make sure that the forks protrude from the front of the load (by at least 5 cm), far enough to eliminate any risk of the transported load tipping.	
3	Raise the forks until they are touching the load. **NOTICE!** **Fasten the load to the forks with clamps or similar devices if required.**	
4	Slowly lift the load by a few dozen centimetres and check its stability, making sure that the centre of gravity of the load is at the centre of the lifting forks.	

Step	Action	Image
5	Tilt the mast backwards (towards the driver's seat) to help the overturning moment and to ensure greater load stability during transport.	
6	Adjust transport speed according to the type of floor and load, avoiding jerky movements. **⚠ WARNING!** **If:** • **obstacles along the path;** • **particular operating situations;** **hinder operator visibility, the assistance of a ground operator is required, standing outside the range of action of the lifting equipment,** **with the task of signalling.**	-
7	Place the load in the chosen installation area.	-

Tab. 6.28.

6.5 - PACKAGING REMOVAL

Packaging removal	
Operator qualification	• Installer.
PPE required	 **WARNING!** **The PPE listed in this table is related to the risk associated with the equipment. For the PPE necessary to protect against risks associated with the workplace or operating conditions, reference must be made to:** **• the regulations in force in the country of installation;** **• any information provided by the Safety Manager at the installation facility.**

Tab. 6.29.

To unpack the cardboard boxes (single or multiple) supported by a pallet, proceed as described in Tab. 6.30:

Step	Action
1	Remove the stretch film around the pallet.
2	Remove the 4 support corners.
3	Move the boxes of the equipment from the pallet to their intended place. **NOTICE!** **Have at least 2 operators manually move the packages if required due to their dimensions/ weight.**

Tab. 6.30.

NOTICE!

After removing all packaging materials, check for any anomalies.
If there are anomalies:
- **do not install the equipment;**
- **contact PIETRO FIORENTINI S.p.A. and specify the details provided on the equipment nameplate.**

WARNING!

The single piece of equipment is contained in a specifically created cardboard box.
Avoid taking the equipment out of the box before its installation.

6.5.1 - PACKAGING DISPOSAL

NOTICE!

Sort the various materials making up the packaging and dispose of them in compliance with the regulations in force in the country of installation.

6.6 - STORAGE AND ENVIRONMENTAL CONDITIONS

⚠ WARNING!

Protect the equipment from blows and impacts, even accidental, until it is installed.

The minimum environmental conditions required if the equipment is to be stored for an extended period are given in Tab. 6.31. Compliance with these conditions guarantees the declared performance:

Conditions	Data
Maximum storage period	A maximum storage period is not defined as it is only limited by the life span of the product.
Storage temperature	from -25°C to +80°C
Relative humidity	95%

Tab. 6.31.

6.6.1 - STORAGE OF THE SPARE BATTERIES

Any spare battery packs ordered must be stored:

- in their original packaging or alternatively in ADR-compliant packaging, by placing the containers at ground level (do not stack above 1.2 m);
- in a place with a temperature ≤ 25°C in order to preserve their electrical characteristics;
- away from flammable material, water and rain, corrosive agents, heat sources;
- in the absence of direct sunlight;
- away from metal objects;
- so as to prevent any accidental movement;
- so as to prevent their terminals from bearing the weight of other elements stacked on them.

Battery packs must not be stored:

- with damaged batteries;
- with exhausted batteries.

NOTICE!

The packages must be labelled in accordance with ADR, i.e. with the diamond-shaped label shown alongside and code UN3090.



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7 - INSTALLATION

7.1 - GENERAL WARNINGS

WARNING!

The installation must be performed by qualified personnel, in compliance with the provisions in force concerning safety.

WARNING!

For the safe use of the equipment, respect the permitted environmental conditions and comply with the data shown on the nameplate.

WARNING!

It is forbidden to make any modifications to the equipment.

WARNING!

PIETRO FIORENTINI S.p.A. is not liable for damage caused by incorrect installation of the equipment and/or otherwise different from that indicated in this manual.

7.2 - INSTALLATION PRE-REQUISITES

7.2.1 - ENVIRONMENTAL CONDITIONS ALLOWED

NOTICE!

For details on the allowed environmental conditions (temperature range and classification) refer to paragraph “4.4 - Technical data”.

WARNING!

PIETRO FIORENTINI S.p.A. is not liable for damage and/or malfunctions caused by installation in environments other than those permitted.

7.3 - CHECKS BEFORE INSTALLATION

The installation site must be suitable for the safe use of the equipment.
The equipment installation area must have lighting that guarantees the operator good visibility during the installation phases.

Before installation, it must be ensured that:

- the installation compartment meets the current safety regulations
- there are no impediments that could hinder the installer's installation operations;
- the equipment connections are clean and undamaged.

Installation	
Operator qualification	• Installer.
PPE required	 **WARNING!** **The PPE listed in this table is related to the risk associated with the equipment. For the required PPE to protect against risks associated with the workplace, installation or operating conditions, reference must be made to:** **• the regulations in force in the country of installation;** **• any information provided by the Safety Manager at the installation facility.**
Necessary equipment	Spanners for tightening the inlet and outlet fittings/connections of the equipment.

Tab. 7.32.

7.4 - INSTALLATION PROCEDURE

For the connection of sensors and/or external equipment via digital exchange signals, use cables suitable for the installation site.

Neoprene cables are preferred over others due to their compactness and elasticity. They ensure that tightness is maintained in the coupling with the cable gland even as they age.

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8 - CONFIGURATION

8.1 - SAFETY REQUIREMENTS FOR CONFIGURATION

Configuration	
Operator qualification	• Specialised technician. • Installer.
PPE required	 **⚠ WARNING!** **The PPE listed in this table is related to the risk associated with the equipment. For the required PPE to protect against risks associated with the workplace, installation or operating conditions, reference must be made to:** • **the regulations in force in the country of installation;** • **any information provided by the Safety Manager at the installation facility.**

Tab. 8.33.

8.2 - EQUIPMENT CONFIGURATION

NOTICE!

Equipment configuration must be carried out by authorised and qualified personnel.

The STARBOX LX2 RTUs can be configured using the **Rainbow software**. Refer to the software manual for detailed operating instructions.

The tool's main features and advanced firmware functionality will be described below.

8.2.1 - STARTING THE RAINBOW SOFTWARE

To start the software:

1. Launch the Rainbow program.
2. Select the desired language (Fig. 8.27).
3. Select the desired RTU (Fig. 8.28).

NOTICE!

If the desired RTU is not present, follow the procedure outlined in paragraph 8.2.2.

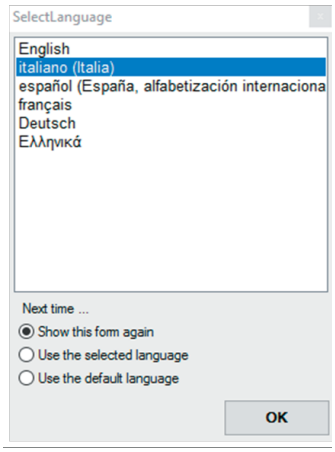


Fig. 8.27. Select language

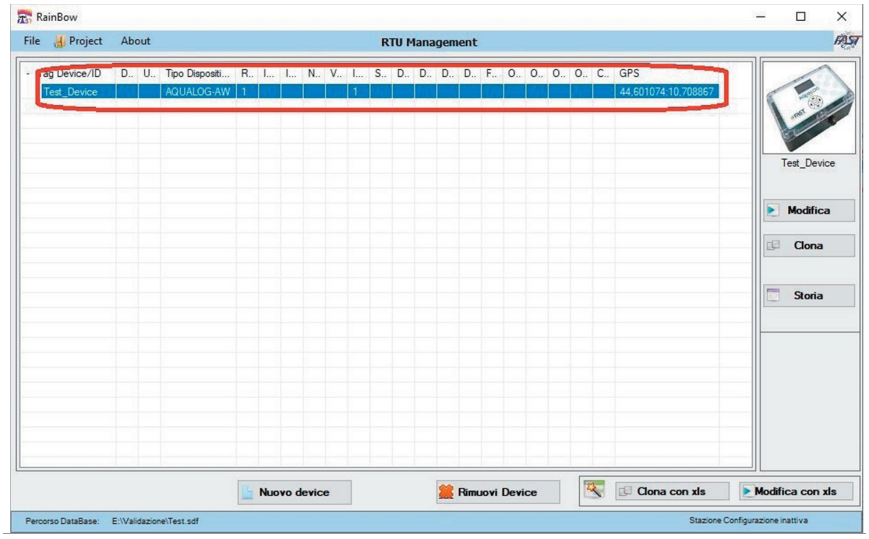


Fig. 8.28. Select RTU

8.2.2 - OPENING THE DATABASE

The list of RTUs is associated with a database saved in a file with the extension **.sdf**.

If you need to select an RTU from another list, you must:

1. At the top left, select "**File**", then "**Open Database**" and left-click the mouse.

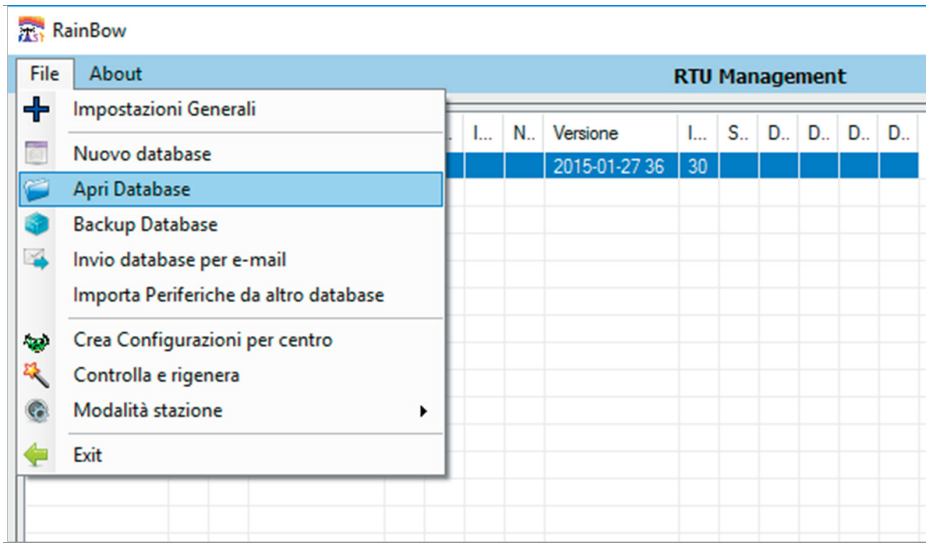


Fig. 8.29. Opening the database

2. Search for the file with the extension **.sdf** in the network disk of your PC and click "**Open**".

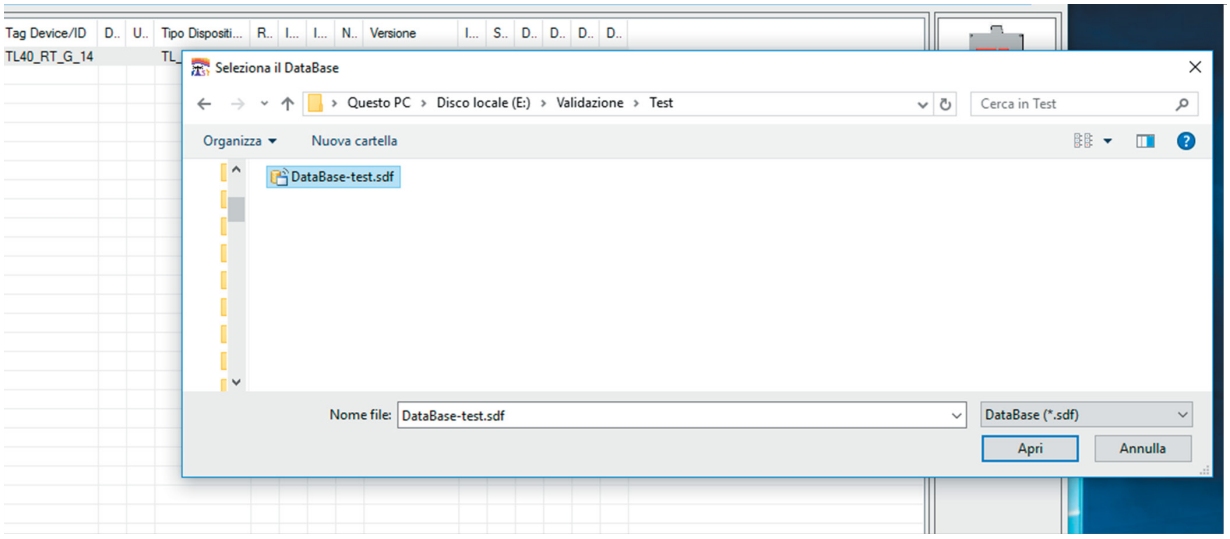


Fig. 8.30. .sdf file

3. Check the program screen for the correct file extension.

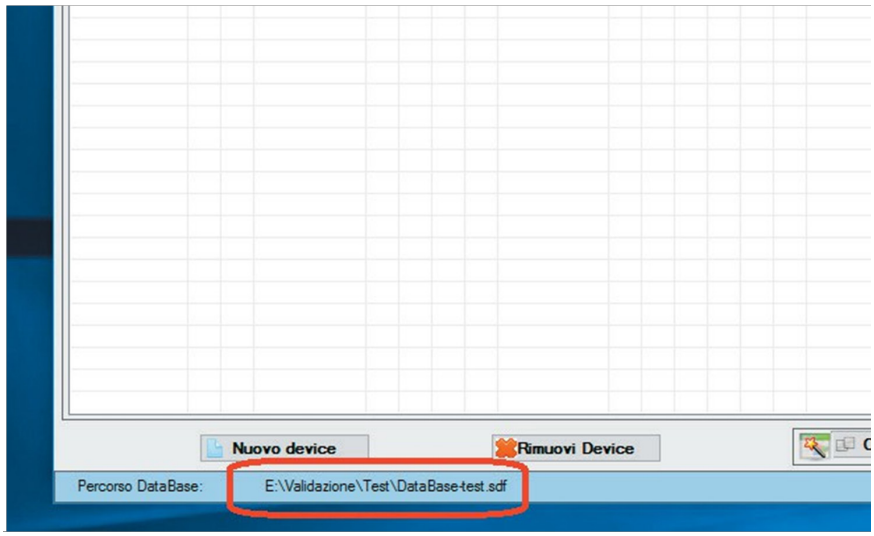


Fig. 8.31. Database verification

8.3 - RTU MENU

The Rainbow sections that allow you to configure the various functions of the STARBOX LX2 can be accessed from the “RTU” menu visible on the main screen in Fig. 8.32 and in the submenu detail in Fig. 8.33.

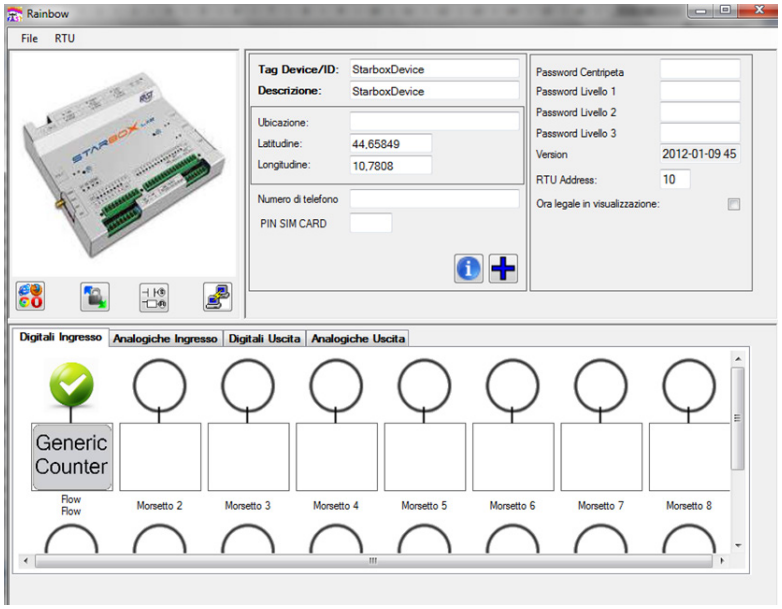


Fig. 8.32. RTU Menu

The “RTU” menu is divided into several submenus which are described below.

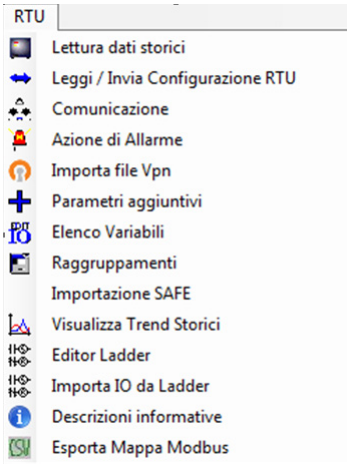


Fig. 8.33. RTU submenu detail

8.3.1 - READING LOGGED DATA

NOTICE!

This section is not available for aqualog master

8.3.2 - READ/SEND RTU CONFIGURATION

This section allows you to read the current configuration of the device for subsequent saving to the database or to reconfigure it.

The following form is displayed (Fig. 8.34), showing the IP address currently present in the STARBOX LX2 configuration, to which the configuration tool will connect, and the related connection ports (by default port 502 is used for the Modbus connection and 22 for the SSH connection).

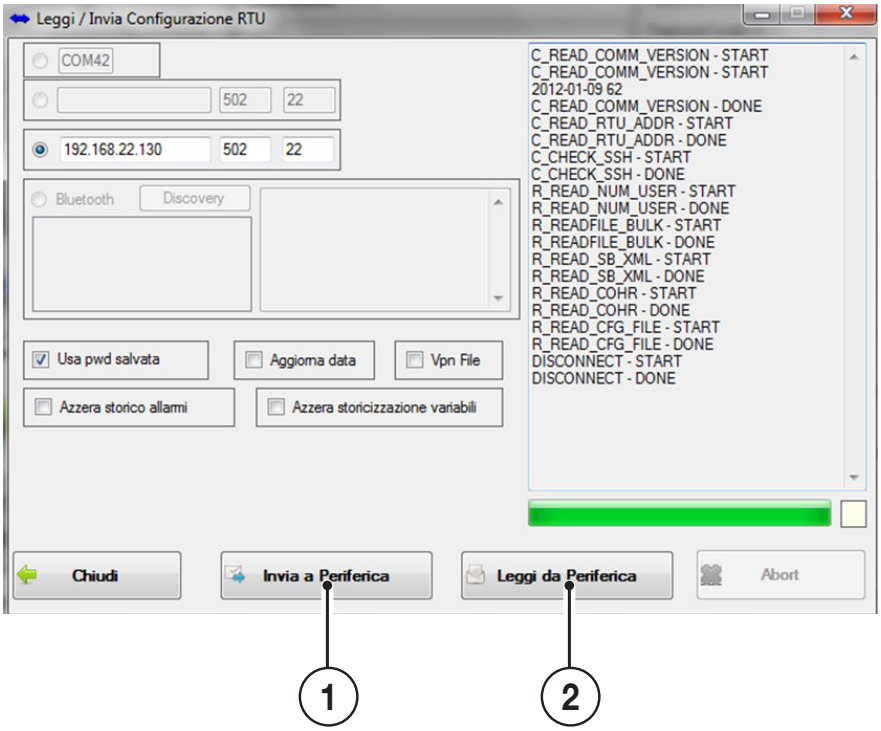


Fig. 8.34. Read/write configuration operation

By pressing the “Read from Device” button (2), the reading of the current device configuration starts.

The completion of the procedure is highlighted by the progress bar and the message DISCONNECT-DONE in the diagnostic window.

If you want to permanently keep the reread configuration, it must be saved in the database, as reminded by the message in Fig. 8.35 displayed when the connection window is closed.

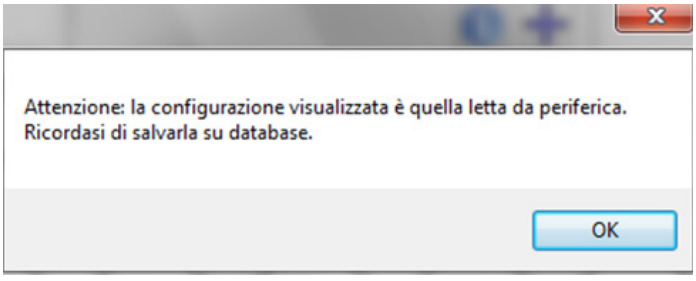


Fig. 8.35. Saving configuration

Conversely, using the “Send to Device” button (1), the STARBOX LX2 is reconfigured with the configuration currently selected in Rainbow and used for the connection to the device.

Both the read and write configuration operations require comparing the password present in the configuration on the database with the one present on the device to be reconfigured.

In conjunction with one of these procedures it is possible to set some specific commands, shown in fig 8.34:

- **Use saved psw**: If this field is ticked, the password set in the current configuration is used to access the device. If it is not ticked, the user will have to enter the password in the field shown in Fig. 8.36 and confirm with OK.

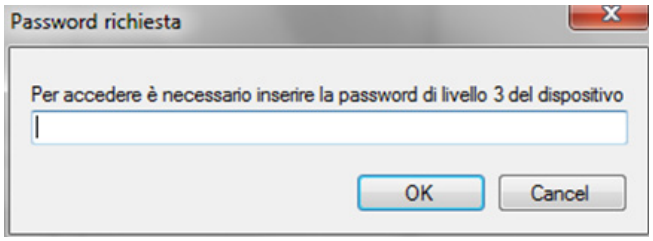


Fig. 8.36. Password request

- **Update date**: Synchronises the time of the STARBOX LX2 with the time on the PC.
- **Vpn file**: Acquisition or download of the files with the VPN keys.
- **Reset alarm log**: Allows the alarm log buffer to be reset.
- **Reset variable logging**: Allows the historical trends on the device to be reset.

8.3.3 - COMMUNICATION

STARBOX LX2 has several communication channels with which to interface with external devices both locally and remotely.

Via the “Communication” submenu in Fig. 8.33, one or more of these communication channels can be added and configured accordingly.

If no communication task is configured by the user, STARBOX LX2 can still be reached via its native interface channel, i.e. the Modbus TCP/IP protocol on the Ethernet port. This is precisely the channel used by Rainbow to download or upload the configuration.

By selecting the Communication submenu, the following form is displayed (Fig. 8.37):

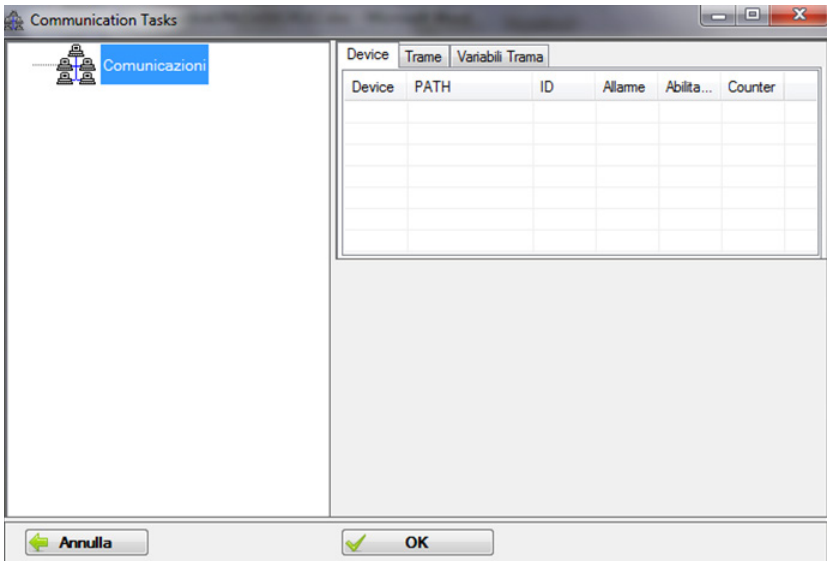


Fig. 8.37. Creating Communication Tasks

Right-clicking on the box highlighted in blue in Fig. 8.37 displays the list of communication channels that can be added, as shown in Fig. 8.38.

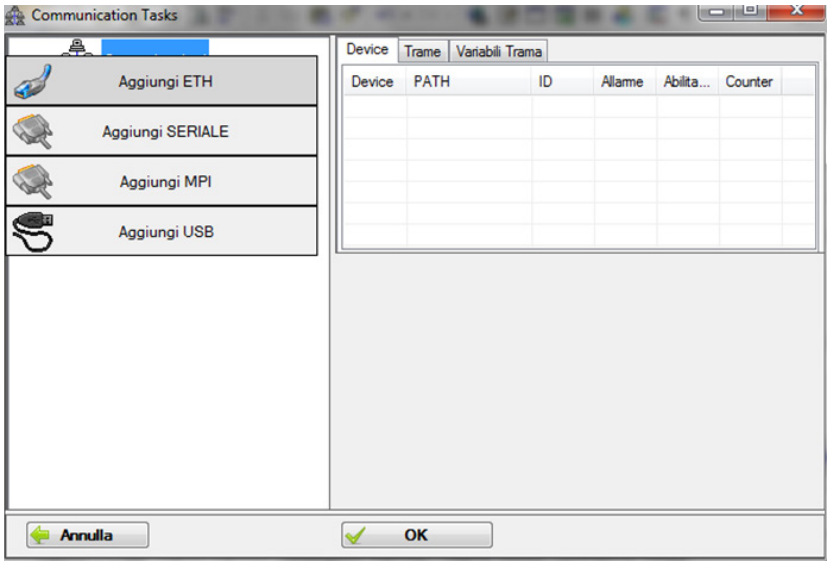


Fig. 8.38. Available communication tasks

8.3.3.1 - ADD ETH

A communication task that can be configured on the STARBOX LX2 is the Ethernet type, selectable from the “Add ETH” menu (Fig. 8.38).

This communication task allows you to configure Ethernet communication to the local or centre-type device. In general, there are two types of connections:

- Inbound
- Outbound

The inbound connection is the one in which STARBOX LX2 makes the connection towards the centre, otherwise it is called an outbound connection.

Fig. 8.39 shows the possible protocols that can be configured in a centre-type Ethernet communication task.

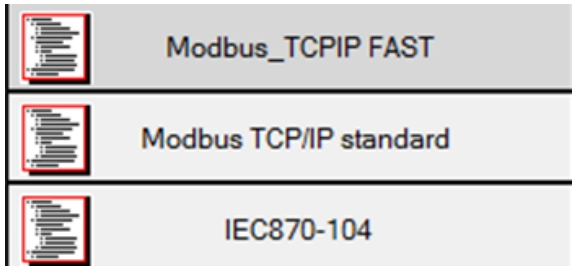


Fig. 8.39. List of centre-type Ethernet protocols

The possible configuration options for a local ETH communication task are:

Pos.	Local Ethernet protocols
1	MB TCP
2	S7TCP
3	MB TCP INCOMING
4	P2P TCP/IP

Tab. 8.34.

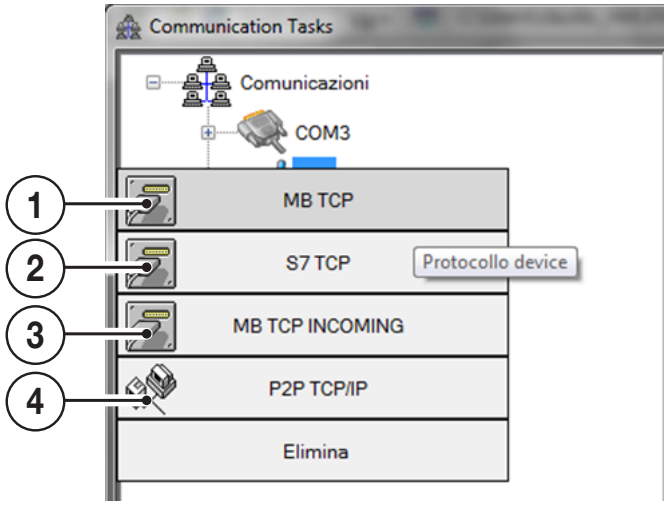


Fig. 8.40. List of local Ethernet protocols

MB TCP (1)

This enables Modbus Ethernet communication where the STARBOX LX2 establishes a TCP/IP connection to a device to forward Modbus frames.

Right-clicking on the blue box in Fig. 8.44 displays the interface for inserting a slave device.

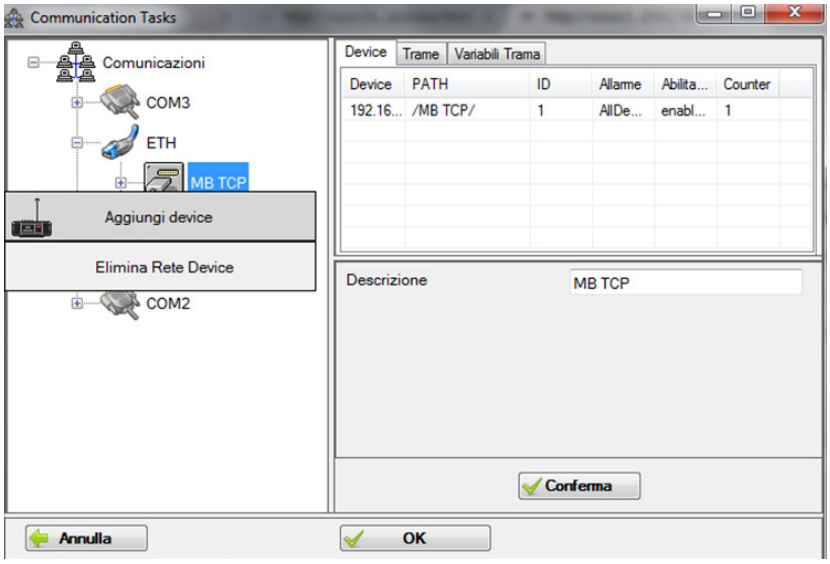


Fig. 8.41. Inserting a slave device

Selecting “Add device” displays the form in which to enter the device configuration information.
Two bits are added to a new device, indicating the communication status (BV Communication Alarm) and communication enabling (BV Communication Enabling) respectively. The user is asked whether they want them to be created when the device is created or not.

- The “BV Communication Alarm” bit is a BV type variable (virtual bit) which is normally OFF (therefore it is 1 if communication between the STARBOX LX2 and the slave device is not carried out correctly).
- The “BV Communication Enabling” bit allows you to interrupt communication between the STARBOX LX2 and the related device: it is normally closed so it must be set to zero to disable communication.

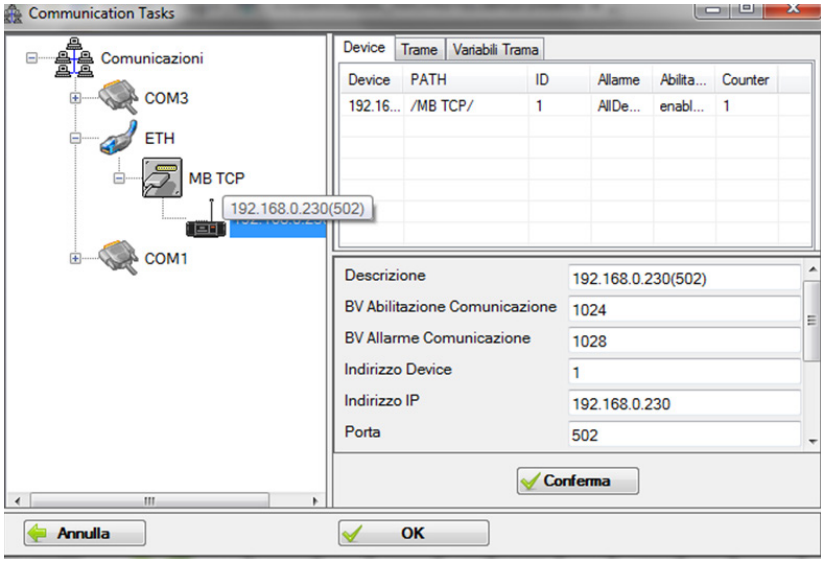


Fig. 8.42. Slave device

Right-clicking the blue box in fig. 8.42 displays the form for defining the communication frames between the STARBOX LX2 and the configured slave.

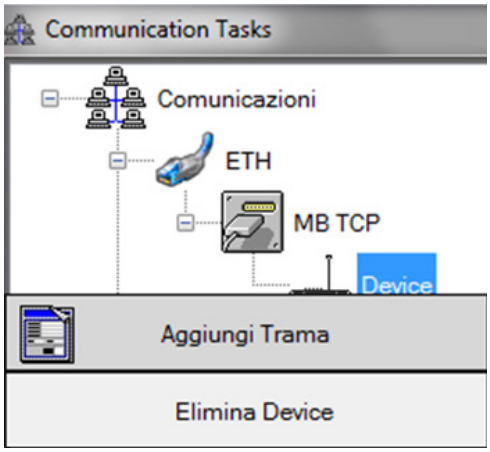


Fig. 8.43. Inserting communication frame

NOTICE!

See the “Add Frame” section for details on how to configure a communication frame.

S7TCP (2)

This enables Ethernet communication to a Siemens S7 PLC according to the S7 protocol specifications.

MB TCP INCOMING (3)

It enables Modbus Ethernet communication where the STARBOX LX2 acts as a Modbus master after receiving an incoming TCP/IP connection (“centre-like” communication mode).

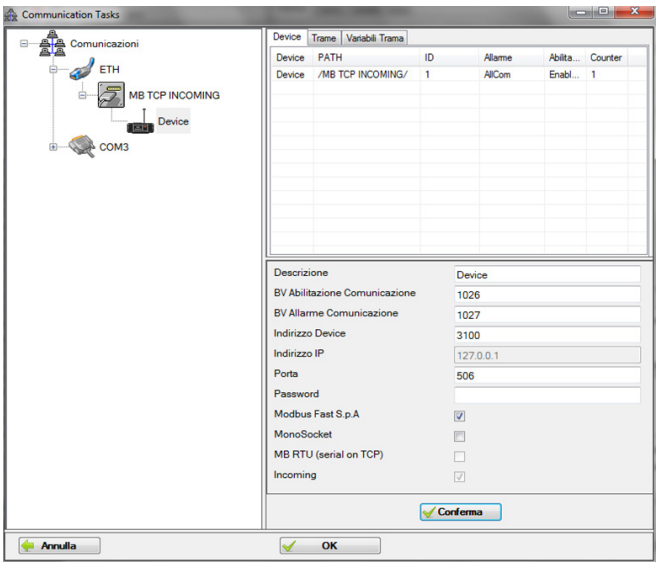


Fig. 8.44. Example ETH MB TCP incoming configuration

In Fig. 8.47, for example, communication is configured with a remote device with Modbus address 3100 that connects to port 506 of the STARBOX LX2, with which the STARBOX LX2 will communicate via the Modbus FAST protocol (with authentication).

The “Incoming” flag, set by default, indicates that the STARBOX LX2 listens on port 506 for an incoming connection from the remote device described above.

Next, the communication frames between the Master and the Slave must be defined.

P2P TCP/IP (4)

This allows you to configure an inbound or outbound connection using the current network interface as shown in Fig. 8.45:

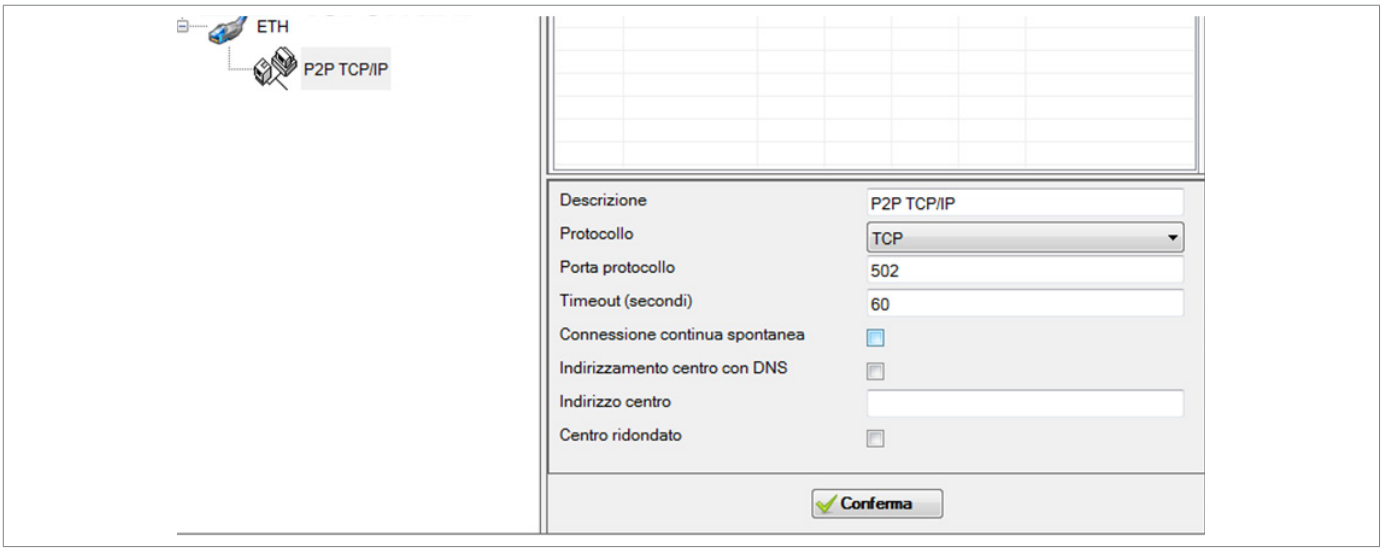


Fig. 8.45. Example ETH P2P TCP/IP configuration

An example of this configuration is the case where the STARBOX LX2 is inside a VPN network where the SCADA centre is also present.

Leaving the “Centre address” field empty configures an outbound connection; conversely, specifying a centre address configures an inbound connection from the STARBOX LX2 towards that address.

Next, a communication protocol must be selected from those shown in fig. 8.39.

8.3.3.2 - ADD SERIAL

This communication task allows you to configure a serial communication channel by selecting the “Add serial” item.

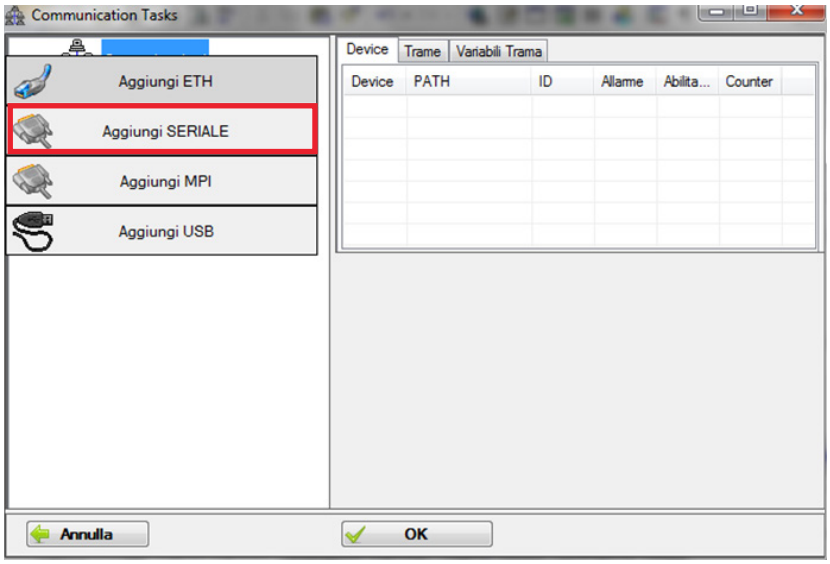


Fig. 8.46. Add serial

The number of the COM used for communication must be entered, as shown in Fig. 8.47.

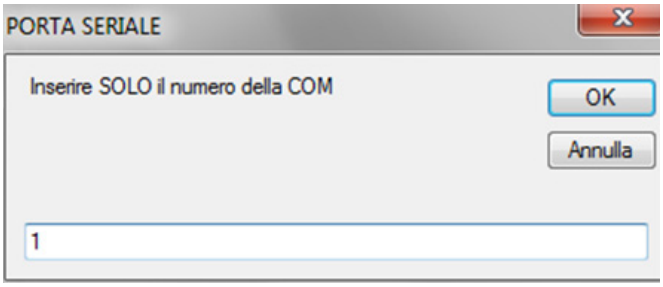


Fig. 8.47. COM number entry

Clicking “OK” displays the list of COM ports currently present in the configuration.

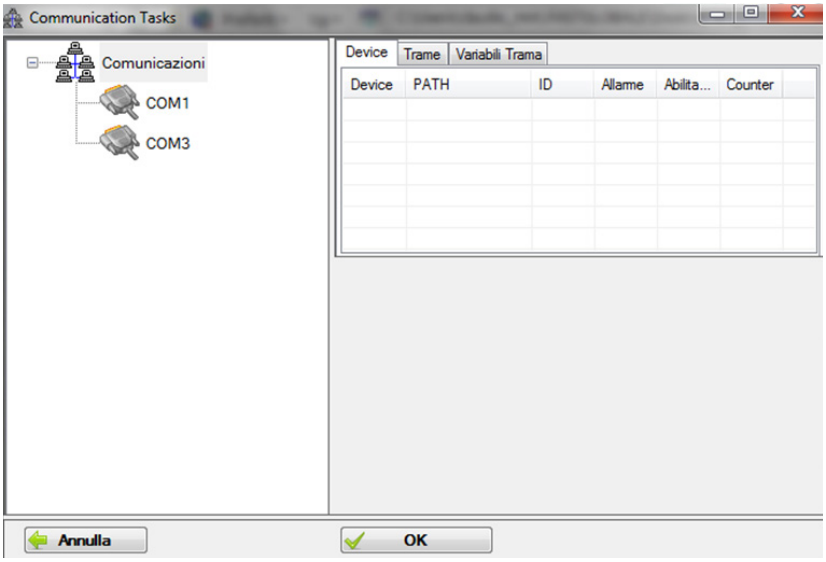


Fig. 8.48. Example of inserting serial communication channels

Left-clicking on the symbol representing the COM to be configured (Fig. 8.48) displays the configuration section (FIG. 8.49).

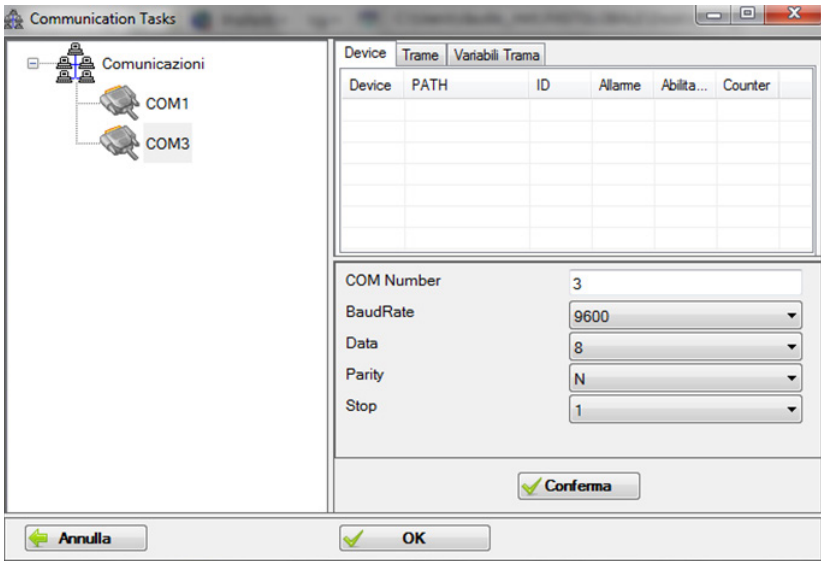


Fig. 8.49. Setting the parameters of a serial COM

To add the relevant communication task to a given COM, right-click on its symbol to display the following list of configuration options:

Pos.	CONFIGURATION OPTIONS
1	MB RTU
2	SNAM SERIAL
3	P2P SERIAL
4	SWITCHED MODEM
5	GPRS

Tab. 8.35.

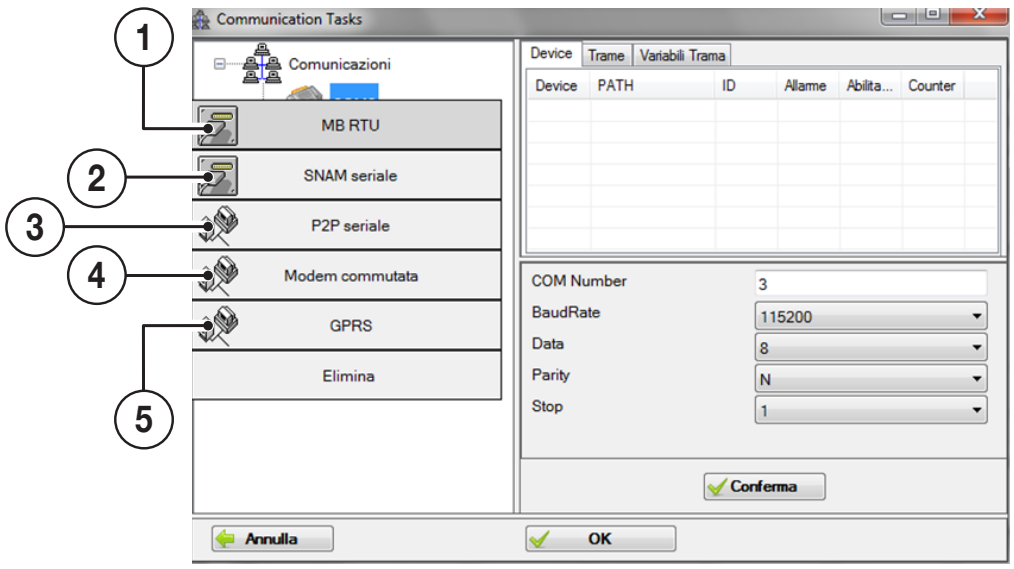


Fig. 8.50. COM configuration options

MB RTU (1)

Communication task for serial communication via serial Modbus protocol, where the STARBOX LX2 acts as Master towards a field device that acts as Slave.

Right-clicking on the communication task symbol displays the form in fig. 8.51.

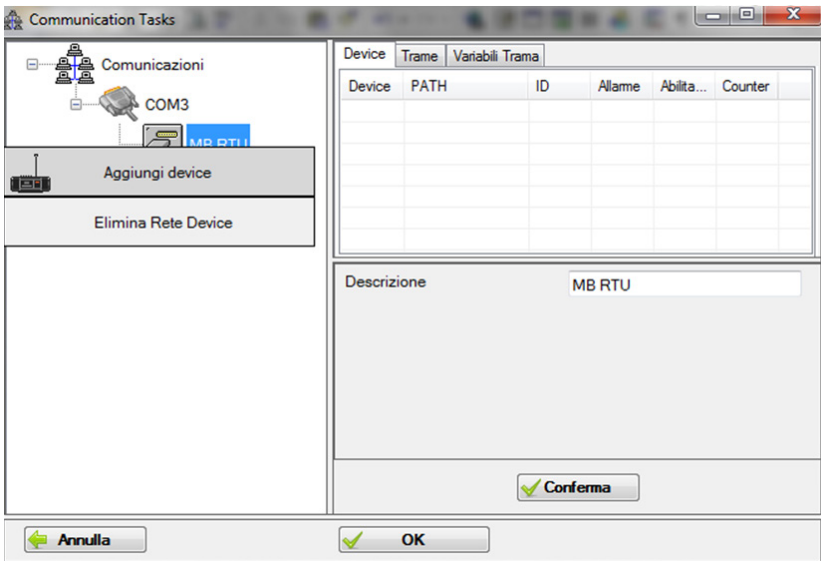


Fig. 8.51. RTU Tasks

- The “Delete Device Network” button allows you to remove a communication network with a previously entered device.
- The “Add device” button adds a device to the communication network, which will act as a slave, specifying its description, its Modbus address and two bits that indicate the communication status and communication enabling respectively.

The bit:

- “Communication status” is a BV (virtual bit) type variable which is normally OFF (therefore it is 1 if the communication between the STARBOX LX2 and the slave device is not carried out correctly).
- “Communication enabling” allows you to interrupt communication between the STARBOX LX2 and the related device: it is normally closed so it must be set to zero to disable communication.

In the example shown in Fig. 8.55, the BV variable with address 1027 has been paired with the communication alarm, the one with address 1026 with communication enabling, while the device is identified via the Modbus address 1 and the description ModbusSlave.
Once the device has been added, it is necessary to configure the Modbus frames that the STARBOX LX2 must exchange with the slave: each such frame can be a read or a write frame.

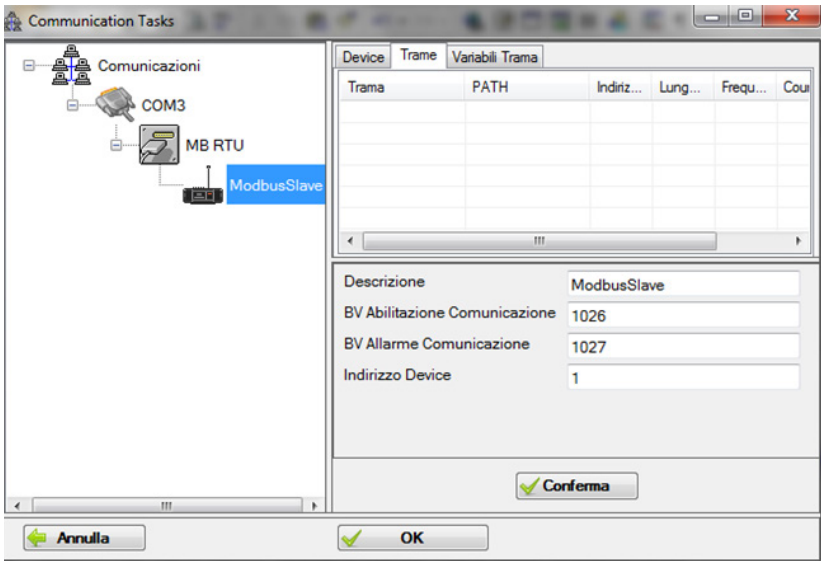


Fig. 8.52. Adding a Modbus RTU Slave device

To add a read frame you need to specify the address and the type of Modbus area to be read in the slave and the variables of the STARBOX LX2 in which to map the information read.
Right-clicking on the device symbol displays the following form:

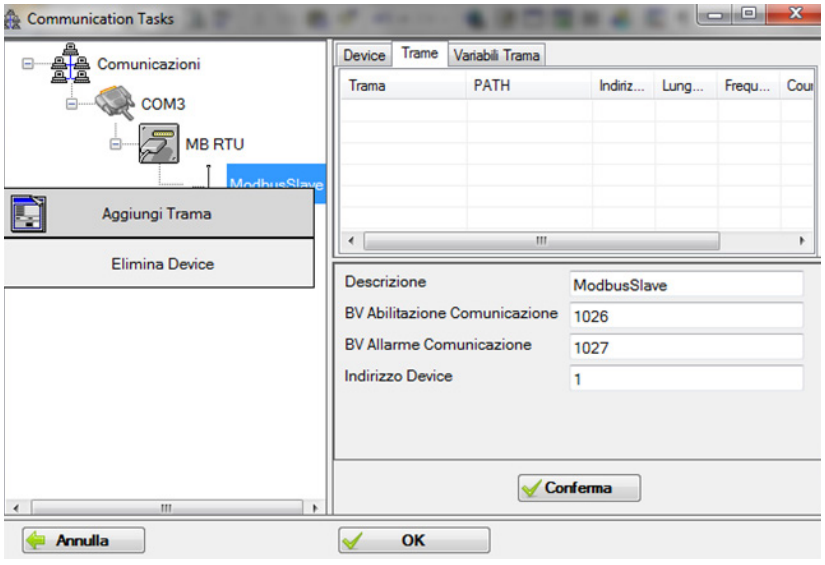


Fig. 8.53. Inserting communication frame

Add Frame:

Adds a frame to the communication network using the form shown in Fig. 8.54.

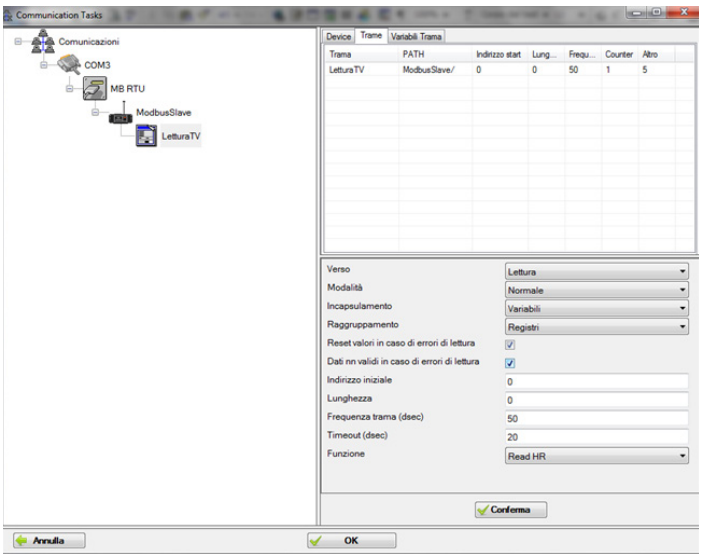


Fig. 8.54. Add frame

The parameters to configure a frame are:

1. Direction: Read/Write specifies whether the current frame performs a read or write operation towards the device. A read frame consists of a data request made by the STARBOX LX2; data is read from the external device and copied into the STARBOX LX2 memory. A write frame consists of sending data from the STARBOX LX2 memory to the external device: typically, writing is done when a change occurs on the STARBOX LX2 in the data to be written (dirty mode).
2. Mode: Normal/Dirty Dirty mode is an additional option for write-type frames, which indicates that the STARBOX LX2 memory area corresponding to the frame is kept at the default value 0xFF so as to detect the change even when the modified value is the same as the last change made. In this case, the “frame rate” is used to filter out an excessive number of transmissions of a write frame: even if the STARBOX LX2 data area undergoes repeated and continuous changes, the write frame is not sent until this time interval in seconds has elapsed since the last transmission.
3. Encapsulation: Variable encapsulation mode ensures that the information read from the slave is paired with specific variables present in the configuration.
4. Grouping: Bit/Registers This specifies whether the basic frame data is of bit or register type.
5. Reset values in case of read errors: if this flag is ticked, in case of communication errors the read values are forced to zero.
6. Invalid data on read error: if this flag is ticked, in case of a communication error the data is marked as invalid, that is, the quality attribute of the value of the variables paired with the frame in error is set to the “invalid” state.
7. Start address: Modbus address of the slave from which to start the read/write operation.
8. Length: number of Registers/Bits involved in the read/write operation.
9. Frame rate (dsec): indicates the frequency with which to forward the frame from the STARBOX LX2 to the slave (in tenths of a second).
10. Timeout (dsec): if the slave response does not reach the STARBOX LX2 within the time set in “Timeout” from when the frame was sent, a communication timeout occurs.
11. Function: this specifies the type of Modbus area to read on the slave.
12. Read HR: frame for reading the Holding Register area.
13. Read IR: frame for reading the Input Register area.
14. Read CO: frame for reading the Coil area.
15. Read IS: frame for reading the Input Status area.
16. Write HR: frame for writing the Holding Register area.
17. Write CO: frame for writing the Coil area.

NOTICE!

You can add multiple frames for a given device, each with its own paired variables.

Add Variable:

Once a frame has been added, the variables to be paired with it must be specified. A variable of this type is defined as external device (ED) type, to indicate that it is related to a variable present in an external device.

To add a variable to a frame, right-click on the TV Read symbol as shown in the following figure.

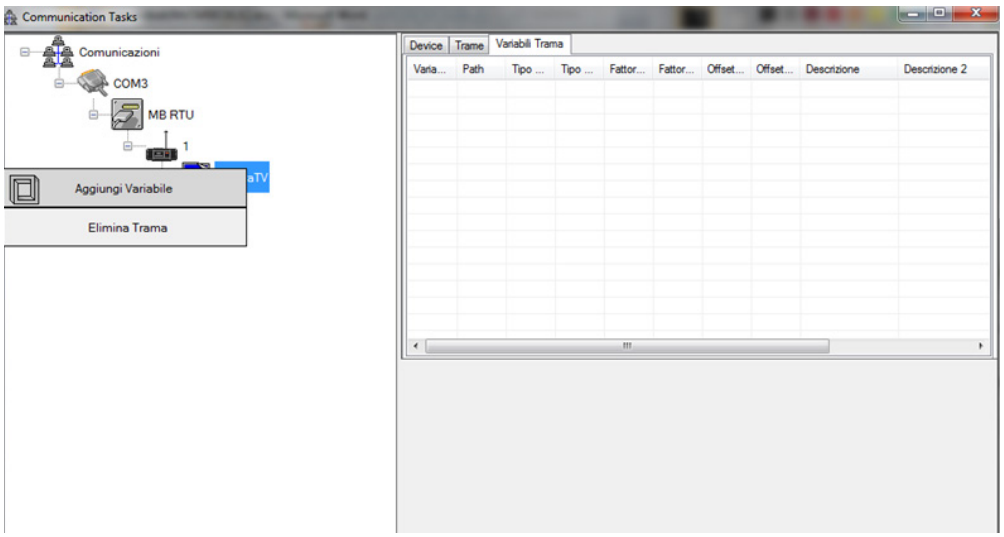


Fig. 8.55. Add variable

By clicking on “Add Variable”, you are prompted whether you want to create a new variable or if you want to use one of the variables already present in the configuration.

In the first case, you must specify the name of the new variable as in the following example:

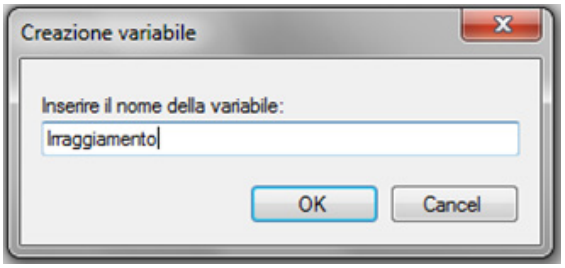


Fig. 8.56. Variable creation

By confirming with “OK” the form shown in fig. 8.57 appears in which the characteristics of the variable must be defined, as described in the “Variable List” section.

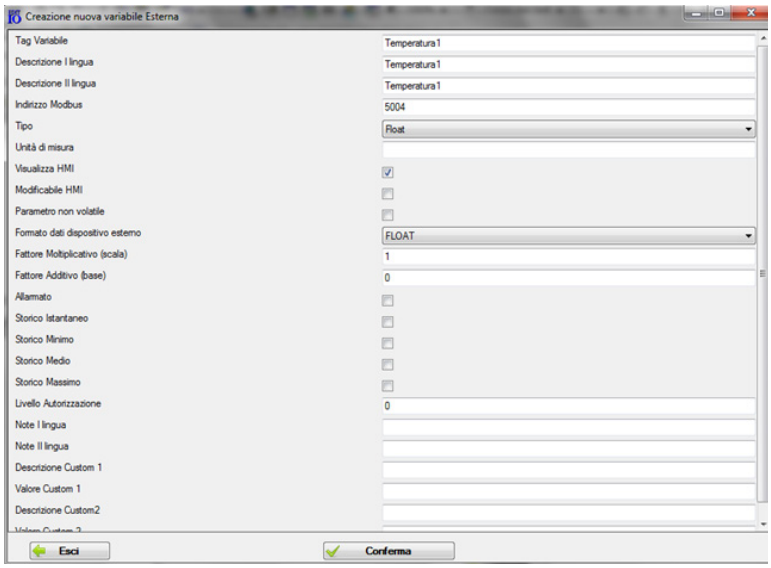


Fig. 8.57. Characteristics of the new variable

The variables added to a given frame are displayed in the “Frame Variables” section, as shown in Fig. 8.58:

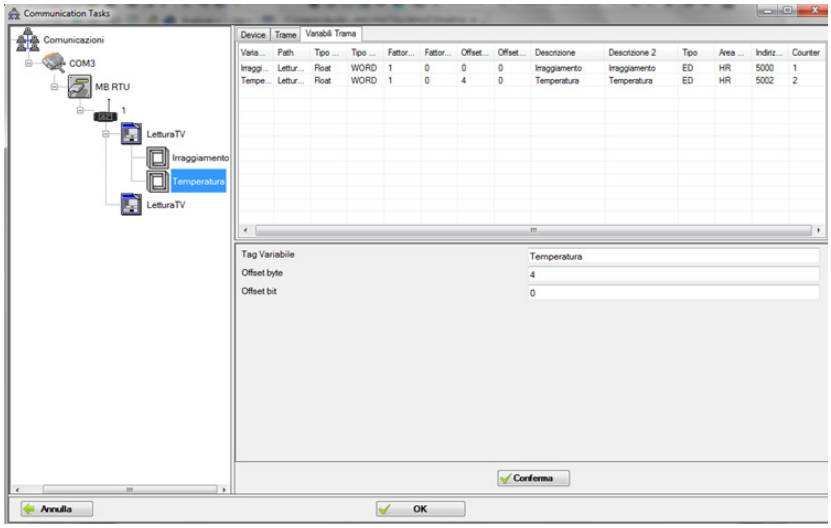


Fig. 8.58. Frame variables section

Note that for each variable the relative offset within the Modbus frame must be specified.
In the example given, the temperature variable has an offset of 4 bytes, the irradiance variable of 0 bytes.
In general, the Byte Offset and the Bit Offset indicate exactly where the variable is located from the beginning of the frame.
By adding the variable offset to the frame address you should get the absolute address of the televariable on the external device.

- Modbus address: Modbus address in which the read variable is mapped.
- Type: Indicates whether the variable on the STARBOX LX2 has float (FV), long (LV) or bit format.
- External device data format: This parameter specifies the format of the data on the device (coil, byte, word, float). Additionally, there are special cases for handling signed data formats or swapped byte-based or word-based formats.
- Additive Factor/Multiplicative Factor: A linear transformation (base factor and scale factor) can be configured to convert the value of the televariable on the STARBOX LX2 before writing it to the external device or after reading it from the external device.

SNAM SERIAL (2)

It allows you to interface a fiscal volume corrector with OLD SNAM protocol.

P2P SERIAL (3)

Identifies a communication task in which the STARBOX LX2 interfaces with an external device via a serial interface. A typical application is one in which the STARBOX LX2 receives Modbus commands from a remote Modbus device via radio modem.

In this case, the Modbus RTU Standard protocol must be associated, as shown in Fig. 8.59:

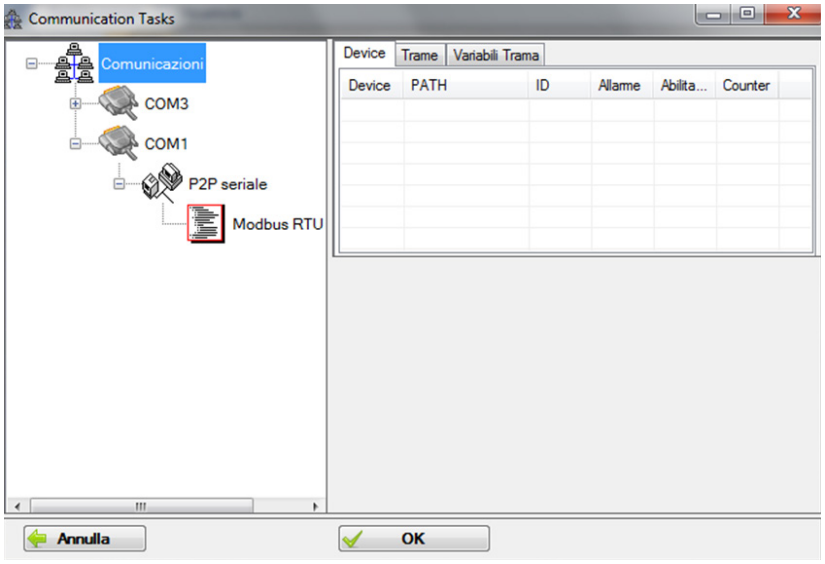


Fig. 8.59. P2P serial

SWITCHED MODEM (4)

You can use one of the STARBOX LX2 COM ports to interface it with a modem in GSM operating mode.
This is done via a switched modem communication task, as shown in Fig. 8.60:

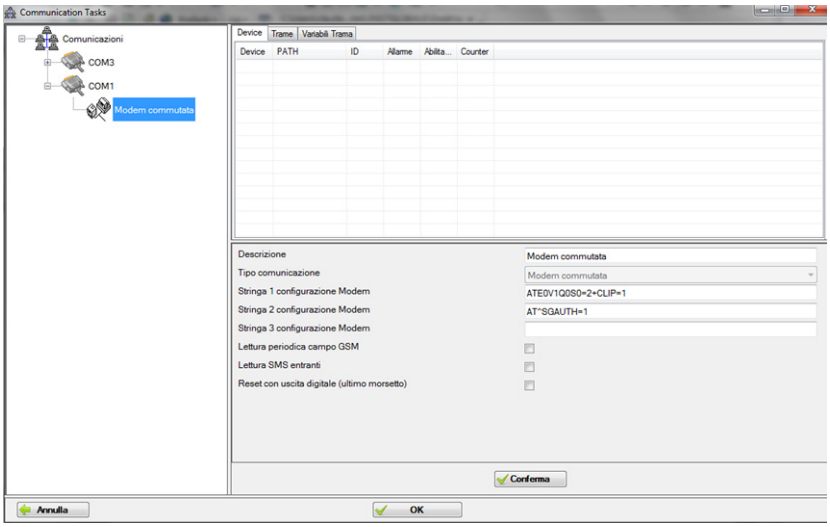


Fig. 8.60. Switched modem communication

This screen shows the default commands used to initialise a CINTERION modem. For configuration strings for other types of modems, refer to the relevant instruction manual.

Certain functions can be enabled when configuring the modem:

- Periodic GSM field reading: enables GSM field reading
- Read incoming SMS: enables the SMS reading function in the modem
- Reset with digital output (last terminal): enables the modem reset function via the digital output of terminal 8 if modem configuration fails.

Then, to specify the type of protocol to use, right-click on the “Switched Modem” symbol to access the menu shown in Fig. 8.61:

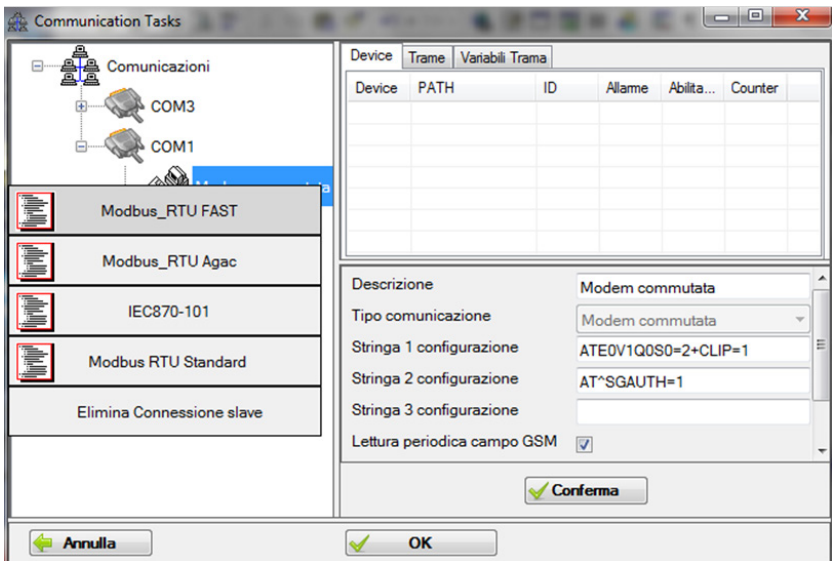


Fig. 8.61. Switched modem menu

In particular, the Modbus_RTU FAST protocol identifies a variant of the Modbus protocol that allows two STARBOX LX2 devices to communicate with each other. If, for example, the other party is a remote device with the standard Modbus protocol, the Modbus RTU Standard protocol must be selected.

GPRS (5)

A STARBOX LX2 communication mode in GPRS (GPRS/3G/4G technology) can be enabled via a suitable modem connected via COM, in either of the following modes:

- inbounding (the STARBOX LX2 is a client that connects to a slave reachable via a public address);
- outbounding (the STARBOX LX2 is always on, waiting for a connection from a networked device that knows the address of the STARBOX LX2).

An example of an inbounding GPRS connection is one in which the STARBOX LX2 periodically starts a connection to a SCADA to acquire logged data.

An example of an outbounding GPRS connection is one in which the STARBOX LX2 is within an always-on VPN network where the VPN server is connected in real time.

The configuration of a GPRS communication task is done by setting the parameters and strings of the following form:

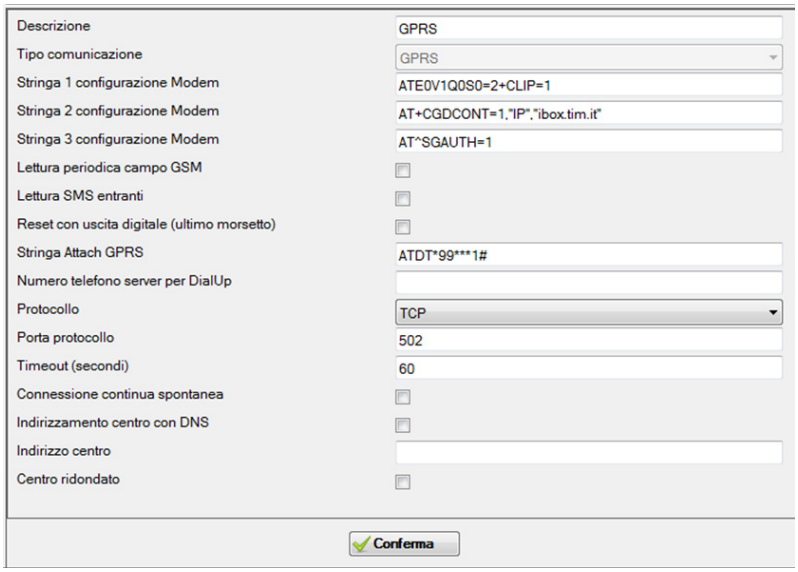


Fig. 8.62. GPRS modem configuration

NOTICE!

In "Modem configuration string 2" you will need to specify the operator's APN (in the example shown it is that of the Tim operator).

Inbound GPRS task configuration

Fig. 8.63 shows an example of GPRS Inbound configuration.

The following parameters must be set:

- Spontaneous continuous connection: Indicates that the STARBOX LX2 is always on.
- Centre address: IP address to which the STARBOX LX2 connects.
- Timeout: Time interval within which the STARBOX LX2 expects to receive at least one frame from the centre.

It is possible to:

- Specify the connection centre via dynamic DNS by ticking the “Centre addressing with DNS” option. In this case, the “Centre address” field must be the dynamic DNS paired with the centre.
- Set a second centre to be used as an alternative to the main one if it is not possible to establish a connection with the primary centre. In this case, the Redundant Centre option must be ticked and the “Centre address 2” field must be set.

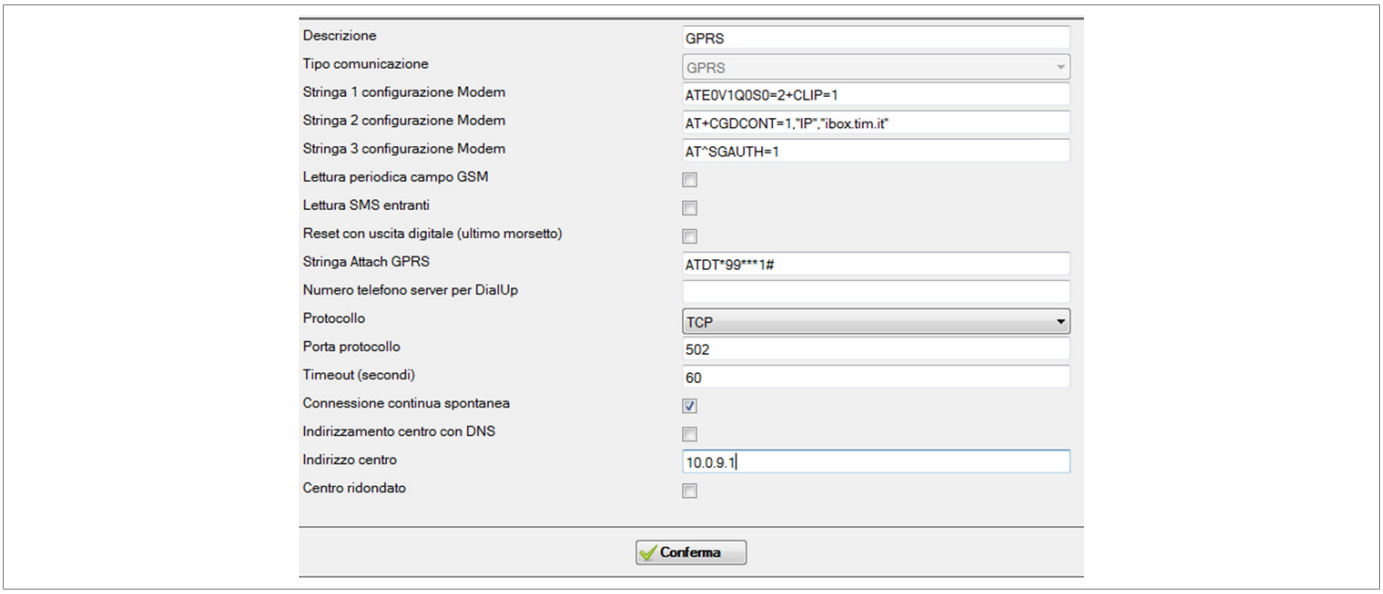


Fig. 8.63. Configuring communication tasks for GPRS Inbound connection

Outbound GPRS task configuration

Another type of GPRS configuration is Outbound, in which the STARBOX LX2, once a GPRS IP address has been acquired, does not connect to a centre, but waits for a TCP/IP connection from a client (for example for remote access to the STARBOX LX2 web pages, or a centre that interrogates it in real time).

In this type of configuration, the STARBOX LX2 may require a public IP address, therefore visible from any device on the network. This requires the use of a SIM card enabled for this function and the setting of the relevant APN.

Fig. 8.64 shows an example of this type of configuration:

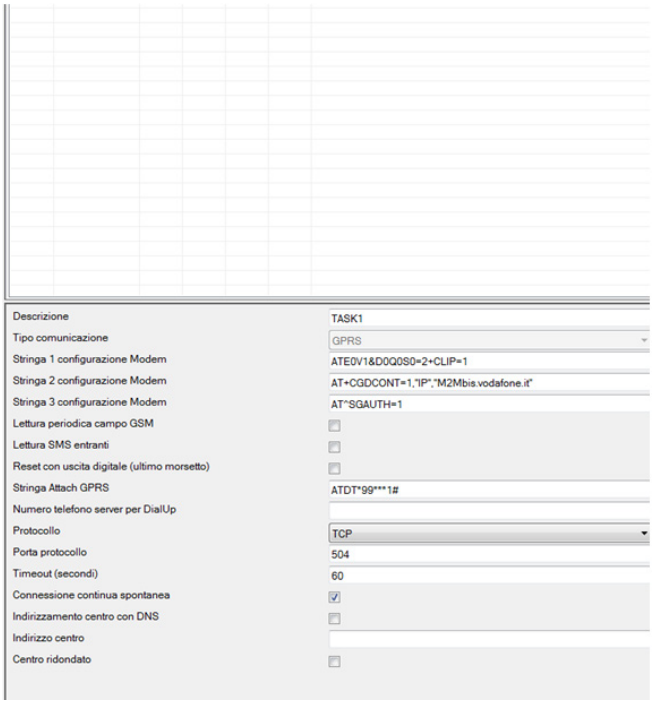


Fig. 8.64. GPRS Outbound configuration example

Then, select the protocol to be used, as shown in Fig. 8.65:

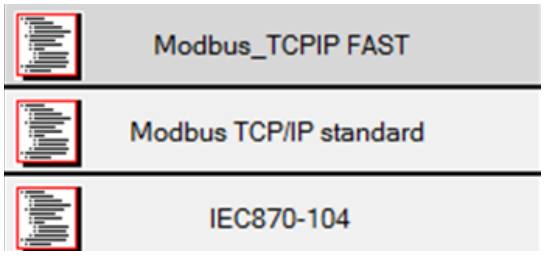


Fig. 8.65. List of GPRS communication protocols

NOTICE!

The Modbus_TCPIP FAST protocol must be set in case of communication with a FAST SCADA centre.

Add MPI

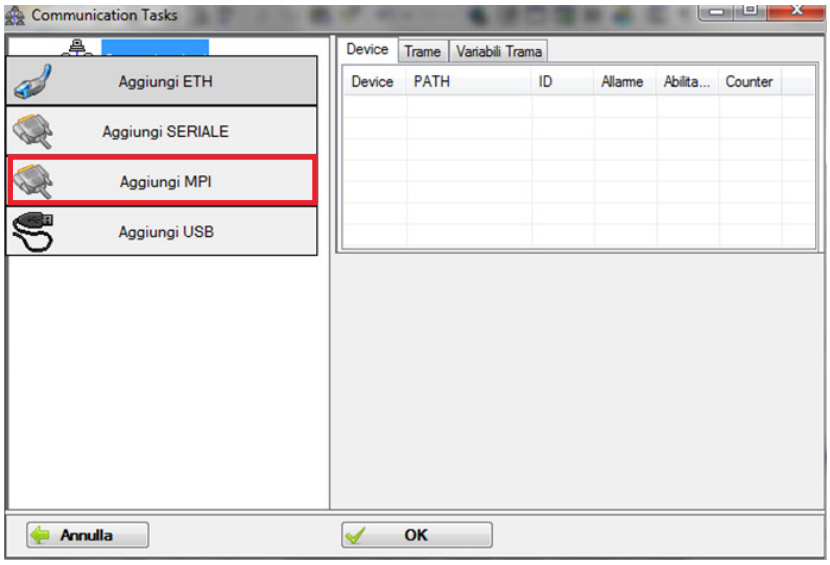


Fig. 8.66. Add MPI

This allows you to insert a communication task for reading and writing DBs to Siemens S7 PLCs.
It uses a specific module that can be integrated into the STARBOX LX2.

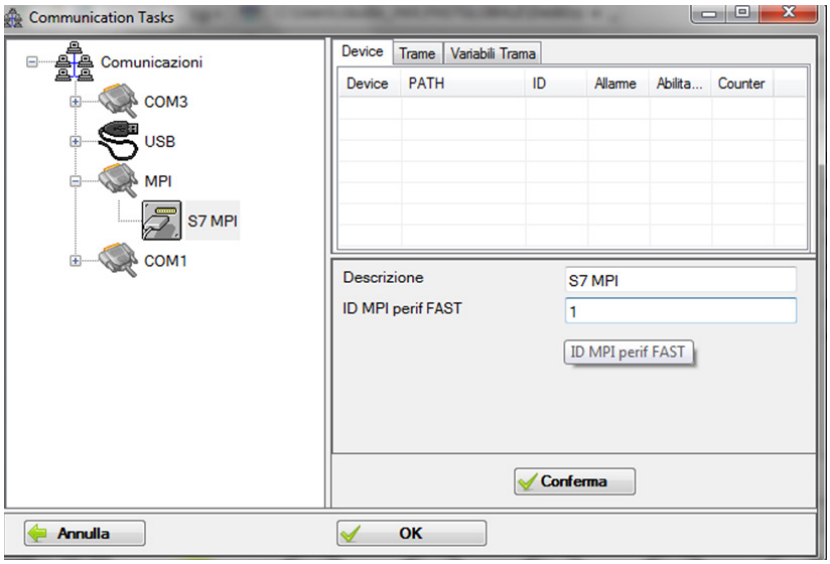


Fig. 8.67. MPI configuration example

Add USB

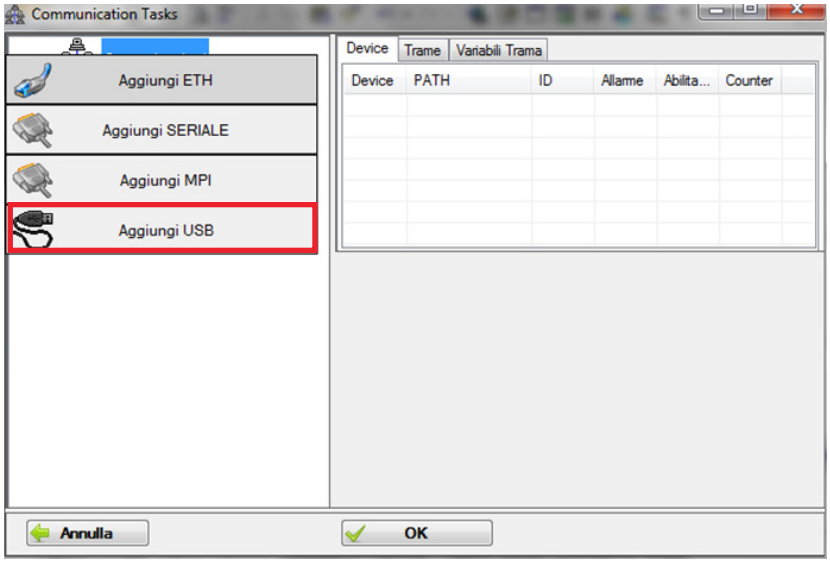


Fig. 8.68. Add USB

Below is an example configuration that allows interfacing with the MPI adapter shown in Fig. 8.69 (Version 1 deprecated).



Fig. 8.69. MPI adapter

Fig. 8.70 shows the related configuration interface.

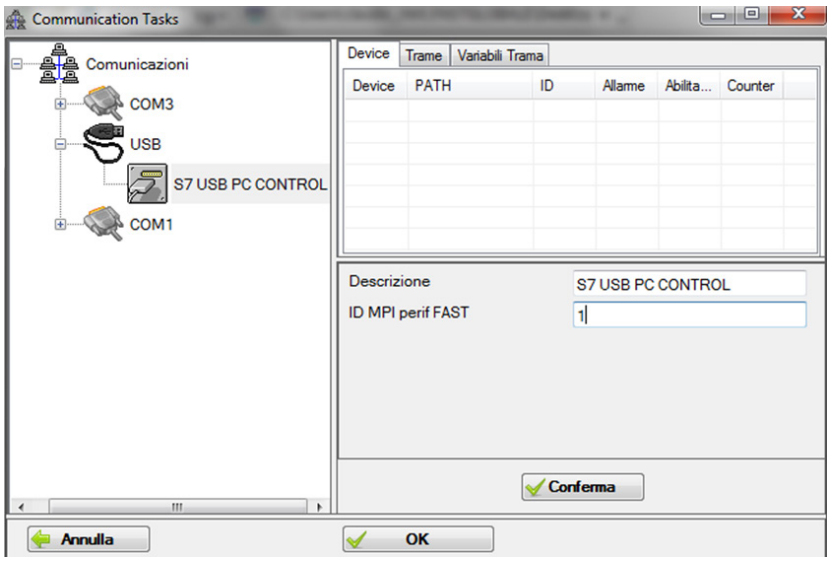


Fig. 8.70. Configuration interface

8.3.4 - ALARM ACTIONS

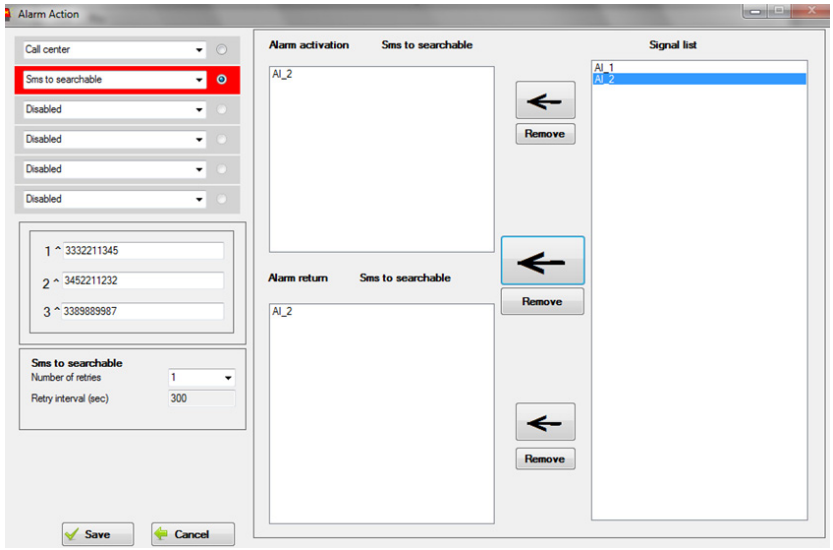


Fig. 8.71. Alarm actions

When the alarm event is triggered (threshold, state other than NC/NO), the alarm is saved as an event in the peripheral device without having to configure any special alarm actions.

To introduce a new alarm action, simply choose the alarm action you want to pair from the drop-down menu, activate it, and set the parameters for the selected alarm action.

The common types are:

- **Call Centre**: Generates a call to the supervision centre present in the configuration for the periodic download of logged data.
- **SMS to on-call personnel**: Sends a notification SMS to up to 3 mobile numbers associated with on-call personnel.

The right window (Signal List) displays the alarm signals present in the configuration.

Once the current alarm action has been selected, add the signals to be associated with the alarm action, both as alarm activation and as alarm deactivation, using the arrow buttons shown in Fig. 8.71.

For each alarm signal, the alarm retransmission attempts in case of failure are configured:

- Number of attempts.
- Waiting interval between one attempt and the next (expressed in seconds).

By selecting the alarm action it is possible to pair/unpair the configuration signals (right column) to the two central panels of the alarm action (for active alarm and cleared alarm).

For example, if the signal is added for alarm clearing only, the action will only be performed when the alarm is cleared.

8.3.5 - IMPORT VPN FILES

This opens a dialog box for selecting the VPN key files to use for setting up a VPN network (.key extension files).

8.3.6 - ADDITIONAL PARAMETERS

This section is also accessible by pressing the + button and shows the additional parameters, specific to the STARBOX LX2 device type, where you can view and edit the communication configuration parameters.

It is divided into the subsections described below.

8.3.6.1 - NETWORK SECTION:

In this section you can set the network parameters of the STARBOX LX2.

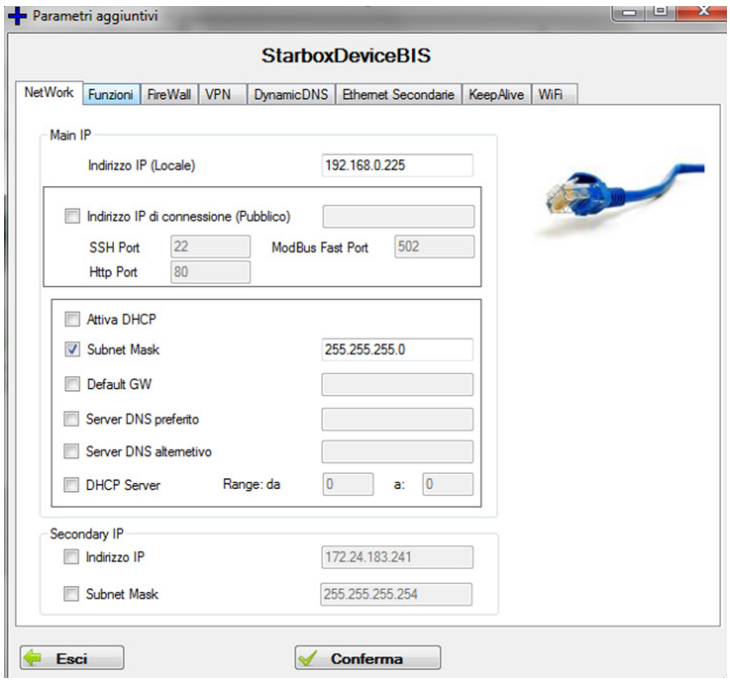


Fig. 8.72. Network section

Main IP: Main configuration of the device's Ethernet interface:

- **IP Address (Local)**: Ethernet address to be assigned to the local network card of the STARBOX LX2. The factory default address is 192.168.0.234. Therefore, to access the STARBOX LX2 locally via Ethernet, the PC used for the connection must have a network address on the same subnet set in IP Address (in this case subnet 0).
- **Connection IP Address (Public):** by ticking this option, you can set the public network address (or the related DNS address) that Rainbow will use to establish the remote connection to the STARBOX LX2, the relevant SSH port, the Modbus port used for data exchange and the HTTP port. The ports used by default for connections to the device are:
  - 22 SSH terminal connection
  - 502 Modbus TCP FAST
  - 80 web server
- **Enable DHCP**: Enable if you want the network address to be assigned to the STARBOX LX2 by a DHCP server
- **Subnet Mask**: "subnet mask" to be associated with the network address. Typical value 255.255.255.0.
- **Default_GW**: IP address of the gateway used to route data packets to a network address outside the local network.
- **Preferred DNS server**: IP address of the primary DNS server.
- **Alternate DNS server**: IP address of the secondary DNS server.
- **DHCP Server**: to be enabled to activate the functionality of the STARBOX LX2 to issue IP addresses to devices connected to the same subnet, with the last octet of the assigned address falling within the range specified in the Range From to fields.

Secondary IP: Secondary configuration section of the network card (present only in the STARBOX LX2 Smart model).

8.3.6.2 - FUNCTIONS SECTION

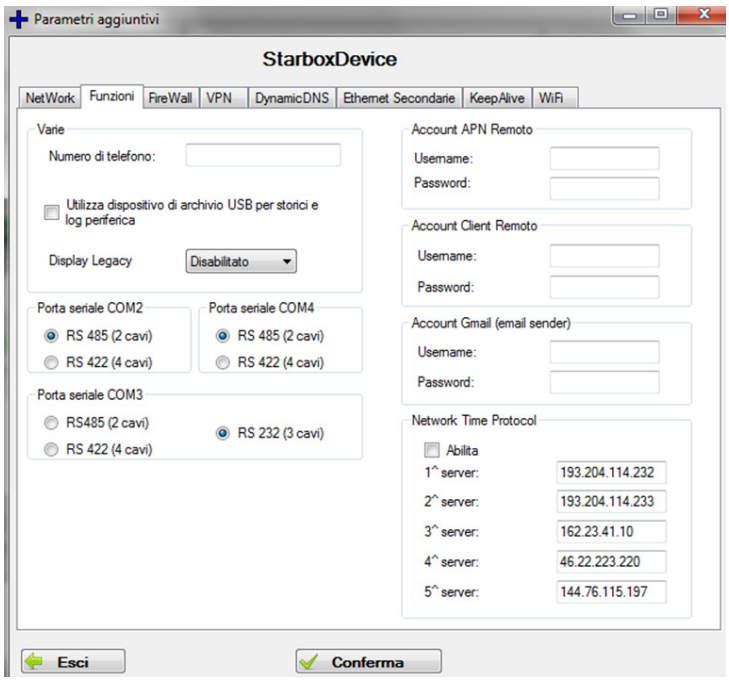


Fig. 8.73. Functions section

- **Telephone number**: Field in which to enter the SIM card number of the modem connected to the STARBOX LX2, if any.
- **Legacy Display**: Enables communication between the STARBOX LX2 and its display, by specifying the communication COM port.
- **COM Settings**: The operating mode of the COM ports, which can operate in either RS484 or RS422, must be set in this section. See the STARBOX LX2 user manual for a detailed description of how to use the COM ports.
- **Remote APN Account**: Account to be used if the STARBOX LX2 is configured to access a VPN.
- **Network Time Protocol**: When this function is enabled, the STARBOX LX2 synchronises its clock by connecting to the list of servers shown below.

8.3.6.3 - FIREWALL SECTION

Firewall functions can be enabled on the STARBOX LX2 to allow or deny access to specific ports, as shown in Fig. 8.74:

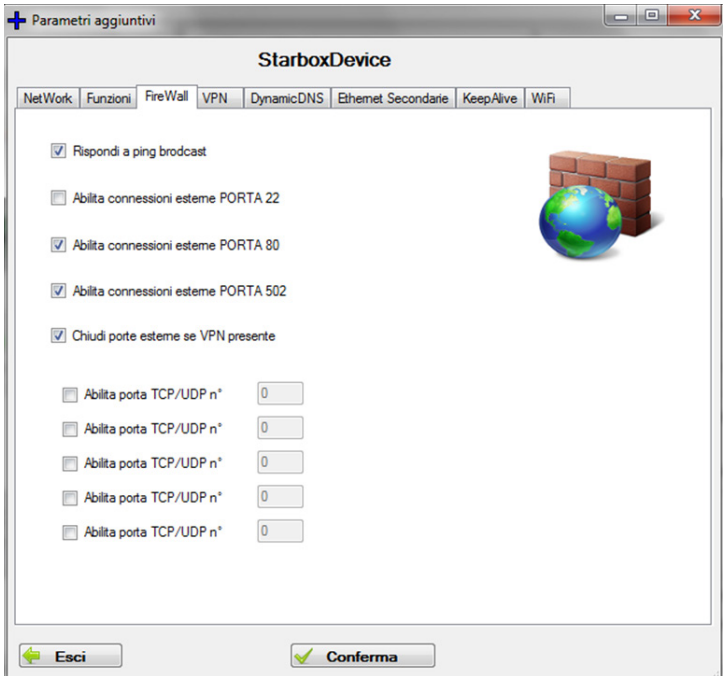


Fig. 8.74. Firewall Section

- **Reply to broadcast ping**: Enables or disables the response of the STARBOX LX2 to the broadcast ping.
- **Enable external PORT 22 connections**: Enables external access to port 22.
- **Enable external PORT 80 connections**: Enables external access to port 80.
- **Enable external PORT 502 connections**: Enables external access to port 502.
- **Close external ports if VPN is present**: If ticked, access to the STARBOX LX2 ports is disabled if a VPN network is present in the configuration.

NOTICE!

You can enable up to 5 TCP/UDP ports in addition to the 3 above.

8.3.6.4 - VPN SECTION

The STARBOX LX2 can be configured to connect to an OpenVPN server, after appropriate configuration. The following must be obtained from the server system administrator:

- the client key;
- the server certificate;
- the certificate of the certificate authority.

The related configuration parameters are described below.

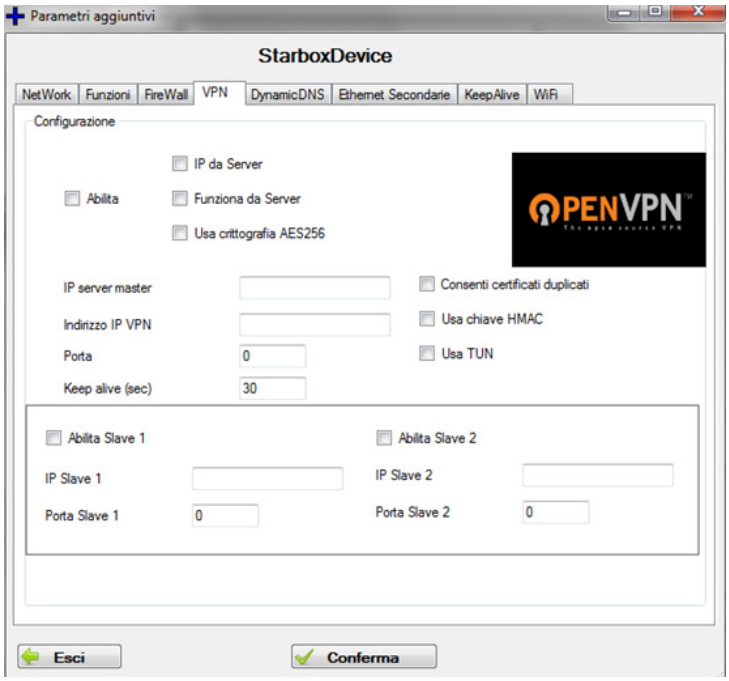


Fig. 8.75. VPN Section

- **Enable**: Enables the VPN configuration.
- **IP from Server**: Configures the STARBOX LX2 as Server in the VPN network.
- **Use AES256 encryption**: Enables AES256 encryption.
- **IP Server Master**: Address of the VPN network server to which the STARBOX LX2 (acting as client) must connect.
- **VPN IP Address**: Address to be assigned to the STARBOX LX2 within the VPN network.
- **Port**: Connection port, default value 1194.
- **Keep Alive (sec)**: Transmission frequency of the STARBOX LX2.
- **Allow duplicate certificates**: Allows duplicate certificates to be used (after enabling the Server IP option).
- **Use HMAC key**: Enables the use of HMAC keys.
- **Use TUN**: If enabled, allows TUN devices to be used in the VPN.

NOTICE!

In addition to the main server, it is possible to provide up to two additional servers enabled with the Enable Server Slave1 and Enable Server Slave 2 flags respectively.

8.3.6.5 - DYNAMIC DNS

You can configure up to 2 Dynamic DNS services in the following section.

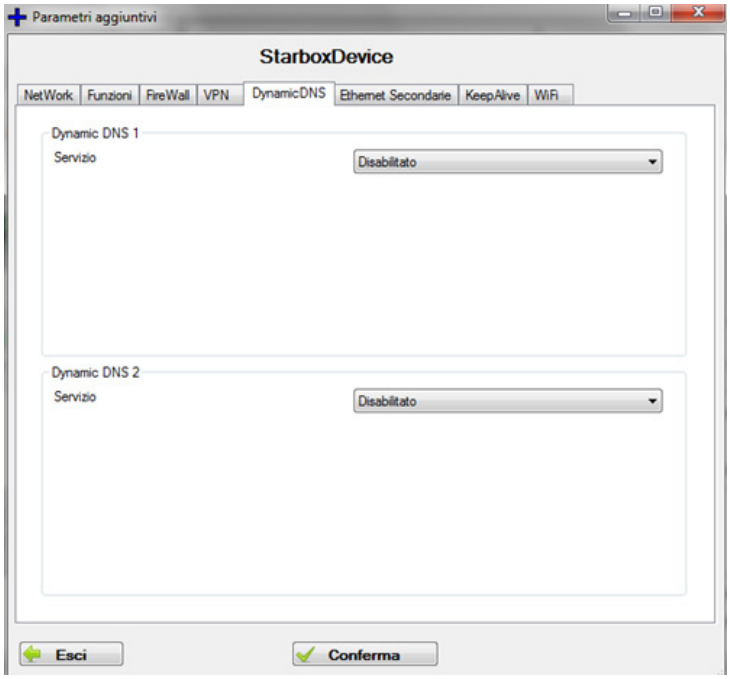


Fig. 8.76. Dynamic DNS section

8.3.6.6 - SECONDARY ETHERNET

This is the configuration section of the two optional additional network cards (present in the STARBOX LX2 Deluxe model).

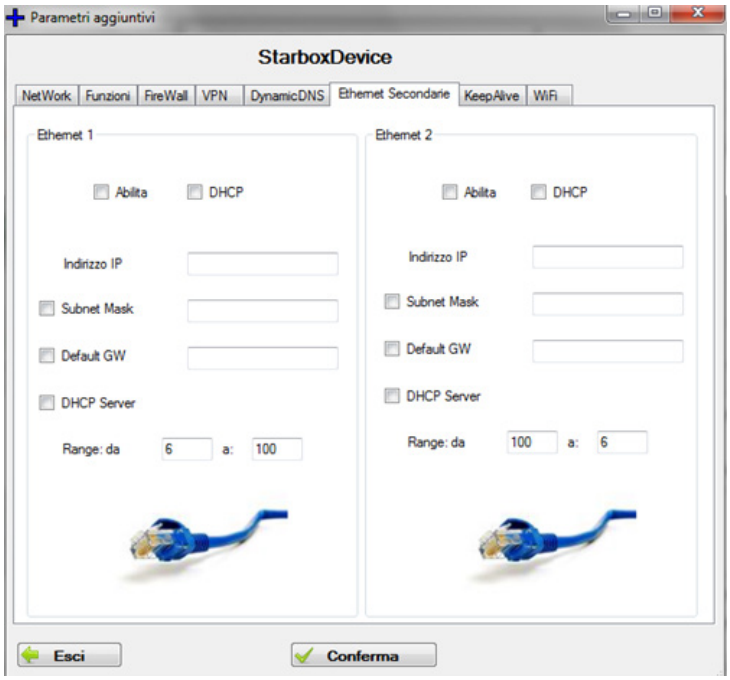


Fig. 8.77. Secondary Ethernet section

8.3.6.7 - KEEP ALIVE

Fig. 8.78 shows the section for configuring the Keep alive function by ticking the “Enable” field.

The STARBOX LX2, at the frequency set in the “Frequency” field, pings the addresses set in 1^ and 2^:

- 1^: first public address
- 2^: first public address

DDNS Check (Url): If the address of the STARBOX LX2 is paired with a DDNS, enabling this option checks the correct name resolution.

If any of these conditions is not met, the digital output specified in Exit DO can be activated.

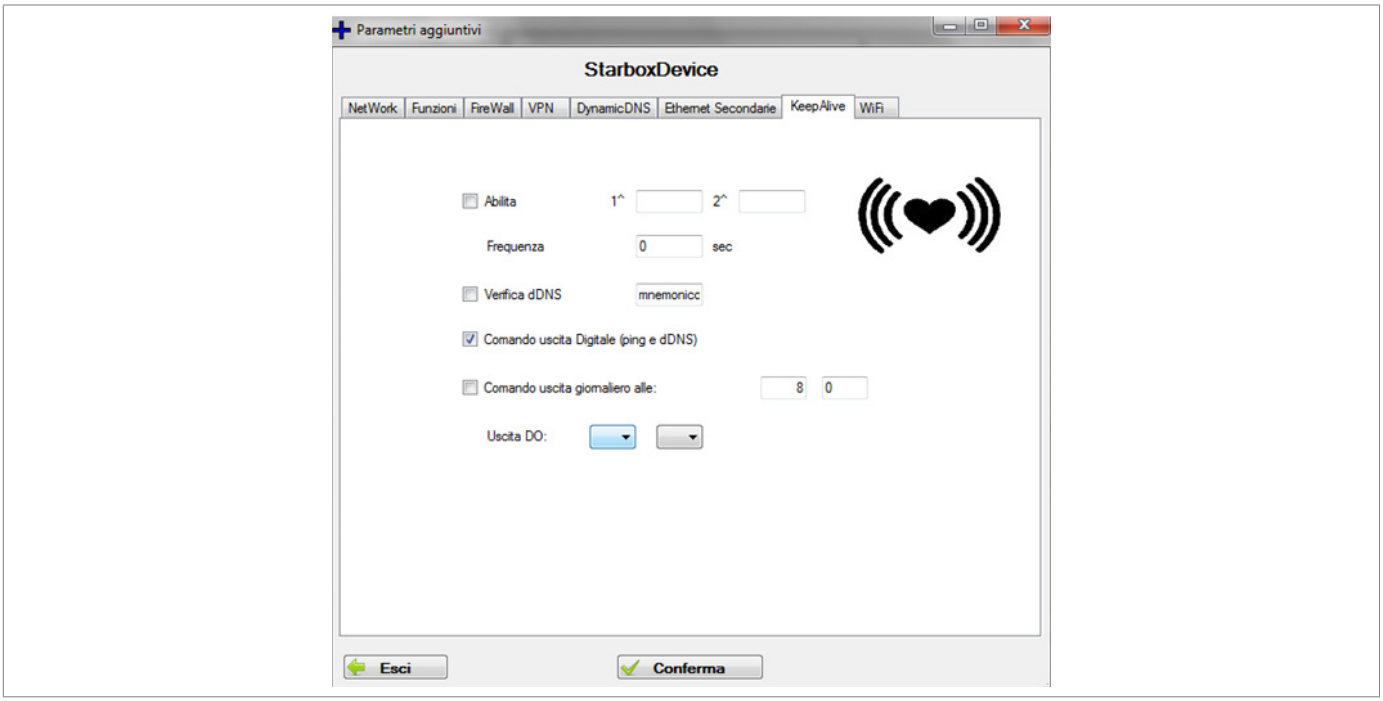


Fig. 8.78. Keep alive section

8.3.6.8 - WIFI

By using appropriate WiFi dongles, it is possible to enable this type of connectivity in the STARBOX LX2, by enabling the "Enable" flag in the following figure.



Fig. 8.79. WiFi section

The STARBOX LX2 can use Wi-Fi in two ways:

1. Server (Access Point Mode)
   - **IP Address (Local)**: Local IP address to be assigned to the STARBOX LX2 in access point mode.
   - **Subnet Mask**: Network subnet mask.
   - **Passphrase**: Authentication string (minimum 8 characters).
   - **SSID**: Name of the network associated with the STARBOX LX2.
   - **DHCP server**: Specifies the address ranges to be assigned to devices connecting to the STARBOX LX2.
2. Client
   - **Enable DHCP**: If enabled, the IP address is assigned by the access point to which the STARBOX LX2 connects; otherwise, this address must be set in IPAddress (Local).
   - **Ap MAC**: MAC address of the access point to connect to.
   - **Subnet Mask**: Network subnet mask.
   - **Passphrase**: Authentication string for the access point.
   - **Ssid**: Name of the network to connect to.

NOTICE!

Contact FAST service regarding the supply of WiFi dongles compatible with this feature of the STARBOX LX2.

8.3.7 - VARIABLE LIST

The “IO Key” section displays the variables present in the configuration with a series of associated information.

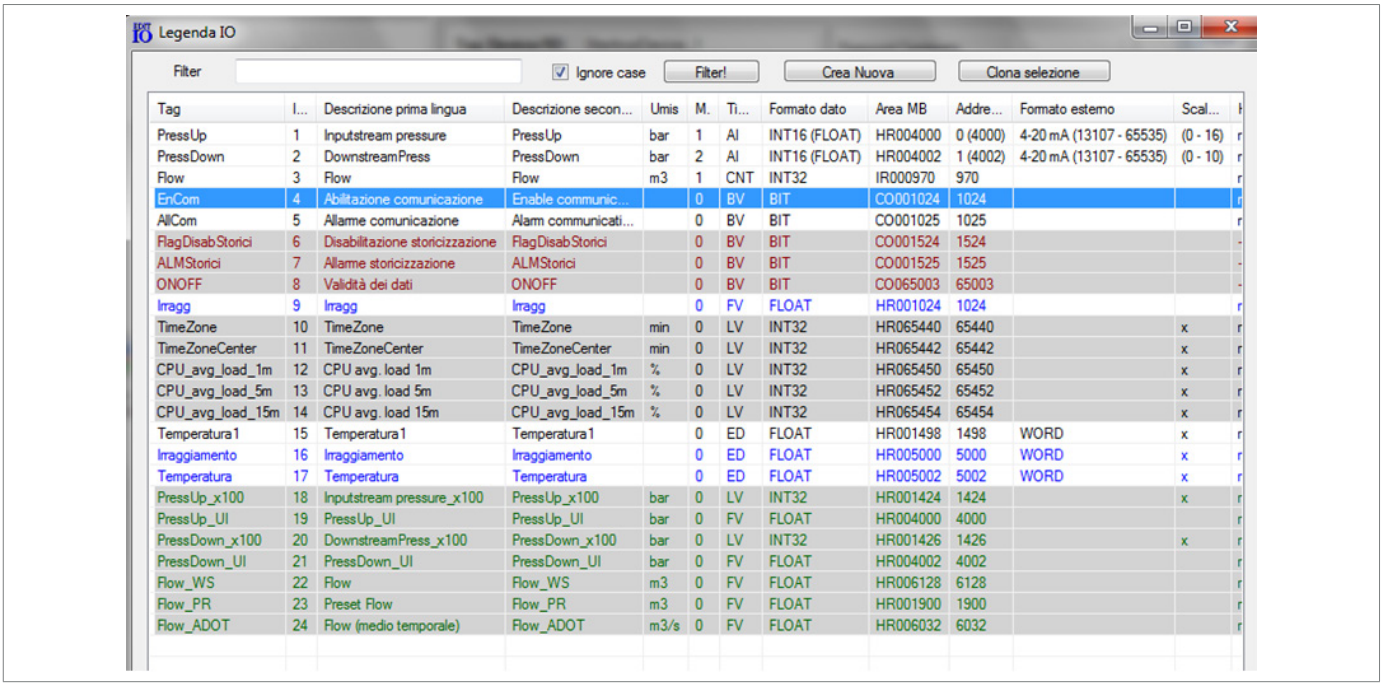
The variables are mapped inside the STARBOX LX2 according to the Modbus nomenclature, whereby each variable has its own area described according to this nomenclature:

1. HR: Holding Register
2. IR: Input Register
3. IS: Input Status
4. CO: Coil

Each variable has a unique address within its corresponding area.

8.3.7.1 - CREATE A NEW VARIABLE

In the “IO Key” section, new variables can be added to the current configuration using the “Create New” button (Fig. 8.80).



Tag	I...	Descrizione prima lingua	Descrizione secon...	Umis	M.	Ti...	Formato dato	Area MB	Addre...	Formato esterno	Scal...	F
PressUp	1	Inputstream pressure	PressUp	bar	1	AI	INT16 (FLOAT)	HR004000	0 (4000)	4-20 mA (13107 - 65535)	(0 - 16)	r
PressDown	2	DownstreamPress	PressDown	bar	2	AI	INT16 (FLOAT)	HR004002	1 (4002)	4-20 mA (13107 - 65535)	(0 - 10)	r
Flow	3	Flow	Flow	m3	1	CNT	INT32	IR000970	970			r
EnCom	4	Abilitazione comunicazione	Enable communic...		0	BV	BIT	CO001024	1024			r
AllCom	5	Allarme comunicazione	Alarm communicati...		0	BV	BIT	CO001025	1025			r
FlagDisabStorici	6	Disabilitazione storicizzazione	FlagDisabStorici		0	BV	BIT	CO001524	1524			-
ALMStorici	7	Allarme storicizzazione	ALMStorici		0	BV	BIT	CO001525	1525			-
ONOFF	8	Validità dei dati	ONOFF		0	BV	BIT	CO065003	65003			-
Irragg	9	Irragg	Irragg		0	FV	FLOAT	HR001024	1024			r
TimeZone	10	TimeZone	TimeZone	min	0	LV	INT32	HR065440	65440		x	r
TimeZoneCenter	11	TimeZoneCenter	TimeZoneCenter	min	0	LV	INT32	HR065442	65442		x	r
CPU_avg_load_1m	12	CPU avg. load 1m	CPU_avg_load_1m	%	0	LV	INT32	HR065450	65450		x	r
CPU_avg_load_5m	13	CPU avg. load 5m	CPU_avg_load_5m	%	0	LV	INT32	HR065452	65452		x	r
CPU_avg_load_15m	14	CPU avg. load 15m	CPU_avg_load_15m	%	0	LV	INT32	HR065454	65454		x	r
Temperatura1	15	Temperatura1	Temperatura1		0	ED	FLOAT	HR001498	1498	WORD	x	r
Irraggiamento	16	Irraggiamento	Irraggiamento		0	ED	FLOAT	HR005000	5000	WORD	x	r
Temperatura	17	Temperatura	Temperatura		0	ED	FLOAT	HR005002	5002	WORD	x	r
PressUp_x100	18	Inputstream pressure_x100	PressUp_x100	bar	0	LV	INT32	HR001424	1424		x	r
PressUp_UI	19	PressUp_UI	PressUp_UI	bar	0	FV	FLOAT	HR004000	4000			r
PressDown_x100	20	DownstreamPress_x100	PressDown_x100	bar	0	LV	INT32	HR001426	1426		x	r
PressDown_UI	21	PressDown_UI	PressDown_UI	bar	0	FV	FLOAT	HR004002	4002			r
Flow_WS	22	Flow	Flow_WS	m3	0	FV	FLOAT	HR006128	6128			r
Flow_PR	23	Preset Flow	Flow_PR	m3	0	FV	FLOAT	HR001900	1900			r
Flow_ADOT	24	Flow (medio temporale)	Flow_ADOT	m3/s	0	FV	FLOAT	HR006032	6032			r

Fig. 8.80. IO Key section

The following pop-up appears in which you must edit the name of the tag to be paired with the new variable.

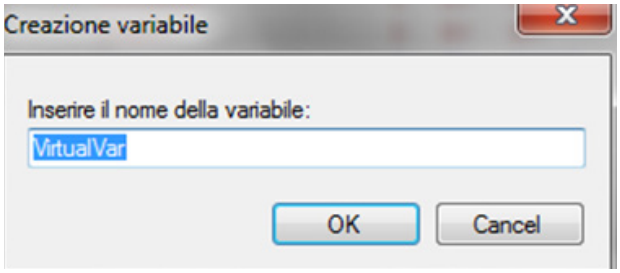


Fig. 8.81. Creating a new variable

Pressing “OK” displays the “Creating new Virtual variable” form (Fig. 8.82), in which the characteristics of the variable to be added, described below, must be entered.

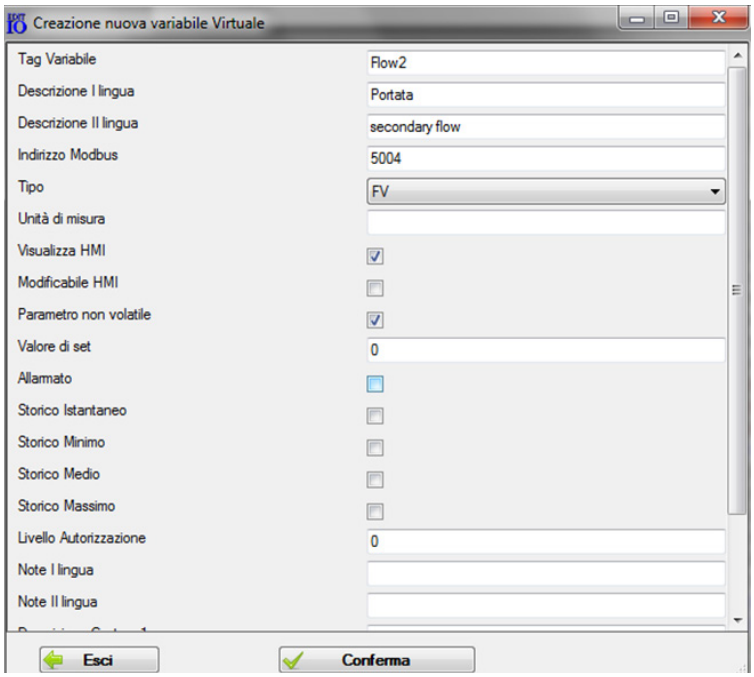


Fig. 8.82. Characteristics of the variable

- **Variable Tag**: Tag associated with the variable.
- **Description I Language**: Description of the variable associated with the first language.
- **Description II Language**: Description of the variable associated with the second language.
- **Modbus address**: Address of the variable within the corresponding area.
- **Type**: Specifies whether the variable is of type bit (BV), long (LV) or float (FV).
- **Unit of measurement**: Unit of measurement associated with the variable.
- **View HMI**: If ticked, this field indicates that the variable is made available for display on a web page or on a display.
- **Editable HMI**: The flag in this field identifies the variable as an operating parameter and therefore editable from the web page, from the centre or from the display.
- **Non-volatile parameter**: The flag in this field specifies that the variable is assigned an address in the non-volatile area; therefore, after a device restart, the value prior to the restart is restored.
- **Alarmed**: This flag enables the alarm function for the current variable.

The following alarm configuration parameters are added:

- **Priority**: ALARM, WARNING, EVENT, used for alarm management in any supervision system.
- **Alarm activation time (sec)**: Time interval during which the alarm condition must persist for the alarm state to be activated.
- **Alarm clearing time (sec)**: Time interval during which the alarm clearing condition must persist for the alarm state to be deactivated.
- **Temporary Alarm Disab.**: When this flag is enabled, the generation of alarm events for this variable will be disabled at the next reconfiguration.

When a variable of type FV or LV is alarmed, the fields for configuring the 4 possible alarm thresholds HH, H, L, LL and the hysteresis for alarm clearing are displayed, as shown in Fig. 8.83:

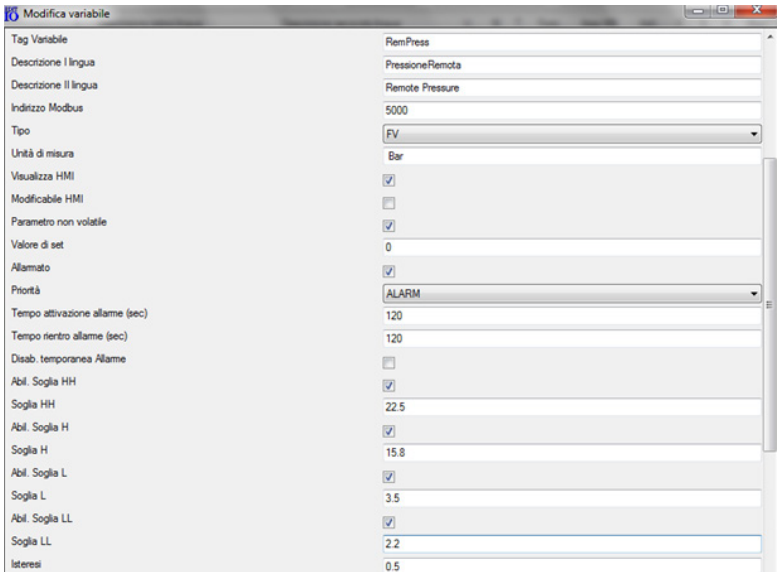


Fig. 8.83. FV/LV variable alarm thresholds

For an alarmed digital variable, the "**Normally closed**" flag is displayed: if ticked, it indicates that the normal state of the signal is ON, otherwise it is OFF.

- **Instantaneous log**
- **Minimum log**
- **Average log**
- **Maximum log**

The logging functionality can be paired with a variable.
Up to 4 types of logs relating to the variable can be paired at the same time: instantaneous value, minimum value, average value, maximum value.

For example, for an Instantaneous type log, 2 parameters must be configured:

- Logging frequency: This is to set how often samples are saved to the log file. You must choose from the options shown in Fig.8.84:

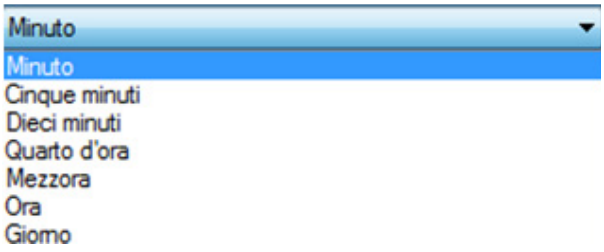


Fig. 8.84. Logging frequency

- Logging duration: Indicates the length of time that log data is retained before being overwritten by new samples:

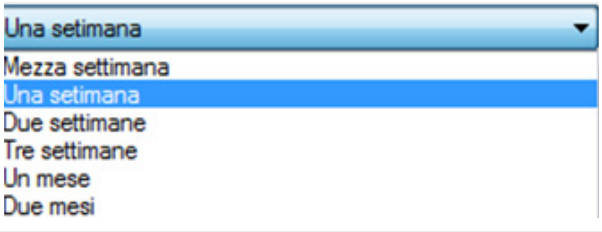


Fig. 8.85. Log duration

For a minimum, average or maximum log, in addition to the 2 aforementioned parameters, the “Sampling Frequency” must be specified: this indicates the frequency with which the value of the variable is analysed to process the value to be logged.

For example, if you configure an average log with a logging frequency of 5 minutes and a sampling frequency of 30 seconds, this means that the partial average is updated every 30 seconds. In this example, the logged value will be the average of the 10 values obtained.

Authorisation Level

The following fields allow you to add additional information:

- Note I Language.
- Note II Language.
- Custom 1 Description.
- Custom 1 Value.
- Custom 2 Description.
- Custom 2 Value.

8.3.7.2 - CLONE A VARIABLE

The “Clone selection” button in Fig. 8.80 allows you to generate a new variable from an existing one.

8.3.7.3 - DELETE A VARIABLE

To delete a variable from the configuration, simply right-click on the corresponding row and confirm the deletion.

Searching for a variable within the existing list can be done using the “Filter” button, based on the search key entered in the field of the same name.

8.3.8 - GROUPINGS

It is possible to view the variables present in a given configuration on a web page or via a display connected to the STARBOX LX2 device.

The variables that can be displayed in this mode are those for which the item “r” or “rw” is displayed in the HMI column in the I/O Key (accessible from the Variable List submenu).

- The item “r” indicates that the variable is available to the web or display interface for reading only.
- The item “rw” indicates that in addition to making it available for reading, its value can also be edited.

The read/write property is set via the “View HMI” and “Editable HMI” flags in the form presented for creating a new variable shown in fig. 8.82.

The default grouping is the one in which the variables are grouped in view based on their type (BV, FV, LV variables are therefore grouped in 3 distinct sections).

You can also customise the view of variables by grouping them into specially created sections, called groups. This section can be accessed from the “Groupings” submenu shown in fig. 8.86:

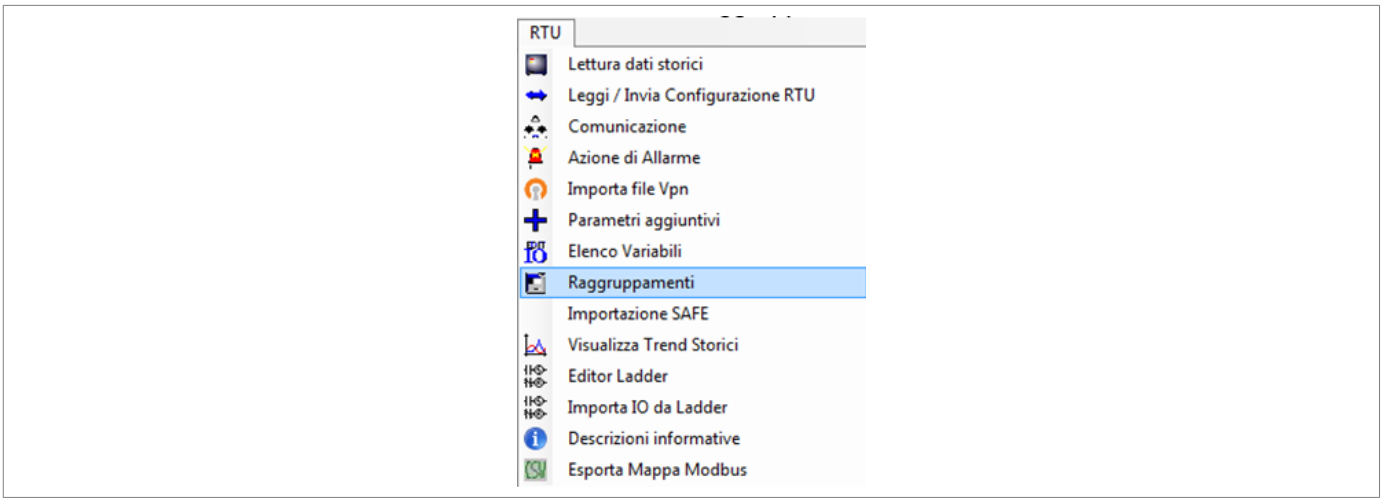


Fig. 8.86. Groupings of variables

For each group, the summary of the variables is displayed as in the following example figure.

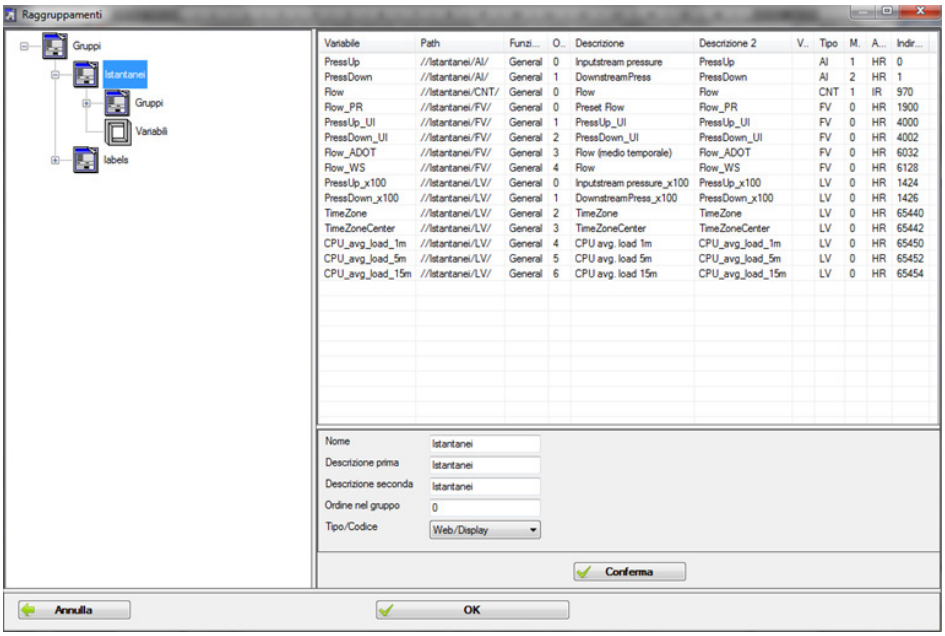


Fig. 8.87. Example of a list of variables paired with a group

You can create up to 9 groups (each corresponding to a web page) and several subgroups (displayed as tables within a given page).

8.3.8.1 - CREATING A GROUP OF VARIABLES

To add a group, right-click on the Groups item (Fig. 8.87); the form (Fig. 8.88) is displayed with the following options:

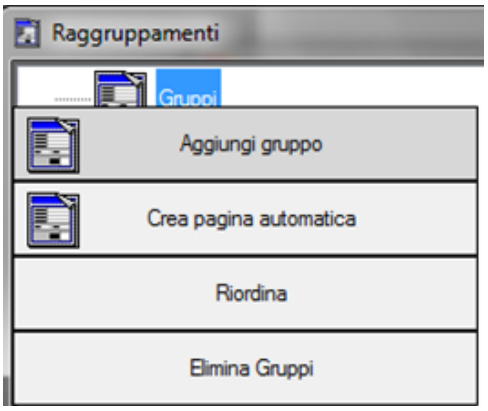


Fig. 8.88. Subgroup management menu

8.3.8.2 - ADD GROUP

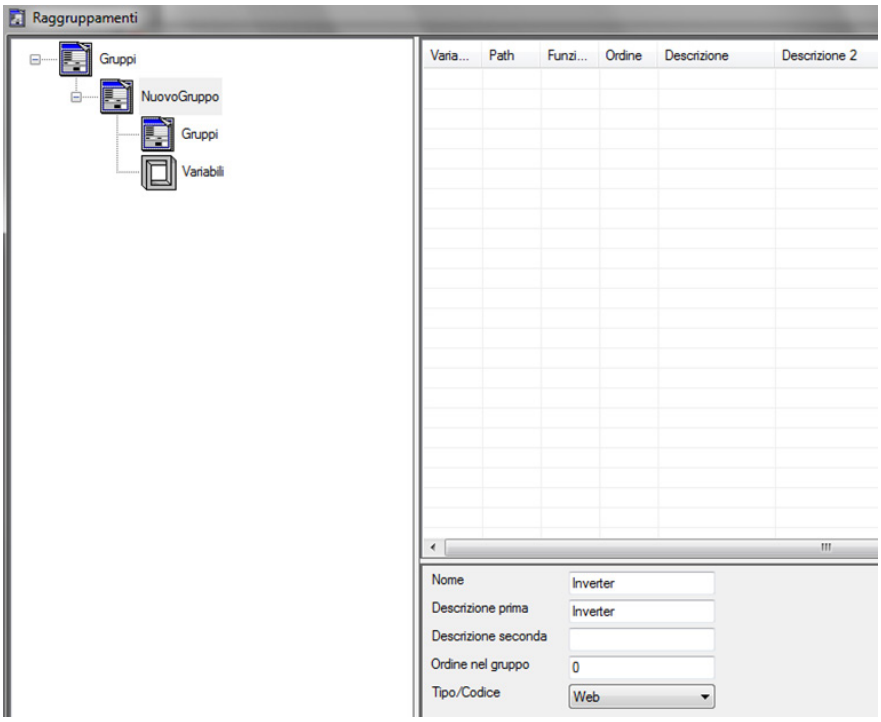


Fig. 8.89. Entry of a new group

You can pair a Name and a description (possibly in two languages where supported) with the new group.
The “Group order” item allows you to establish an order in viewing the various groups entered.
“Type/Code” indicates whether the entered group is to be displayed only on the web page, only on the display, or on both.
Press “Confirm” to make the entered settings effective.

To add variables to the newly entered group, right-click on the “Variables” item and the following form will be displayed.

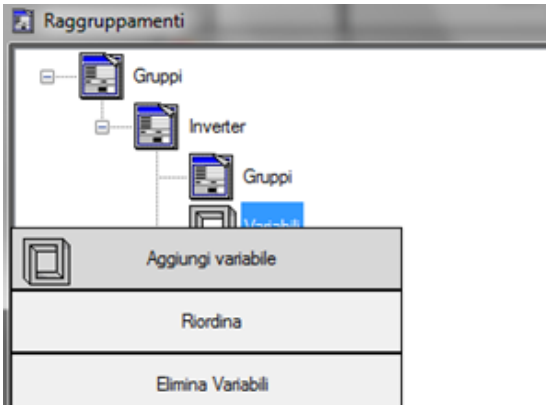


Fig. 8.90. Entering/Deleting variables within a group

In Fig. 8.91, for each group you can set the number of columns into which to divide the web page to display the information (allowed values 2, 3, 4).

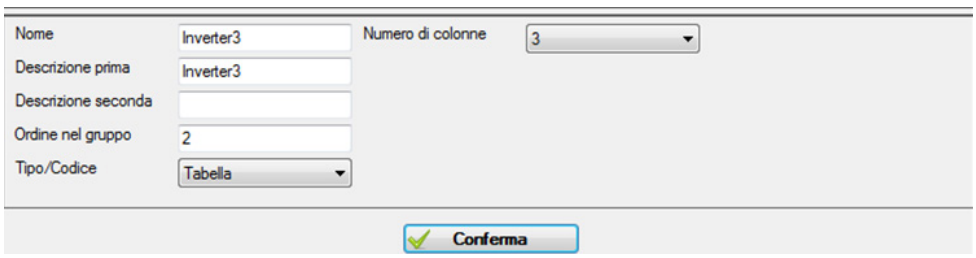


Fig. 8.91. Number of columns

The “Order in group” parameter defines the position of a subgroup within a group. The subgroup of order 0 is shown as the initial one on the web page, followed by subgroups 1, 2 and so on.
The “Type/Code” parameter defines the view format of the variables.
The table format is the one normally used. The other two modes, “Equal prefix in column” and “Equal prefix in row”, are used in special cases.

Let's suppose we have a photovoltaic system with 3 inverters and we want to organise the related information on a web page. A possible group setting is shown in Fig.8.92:

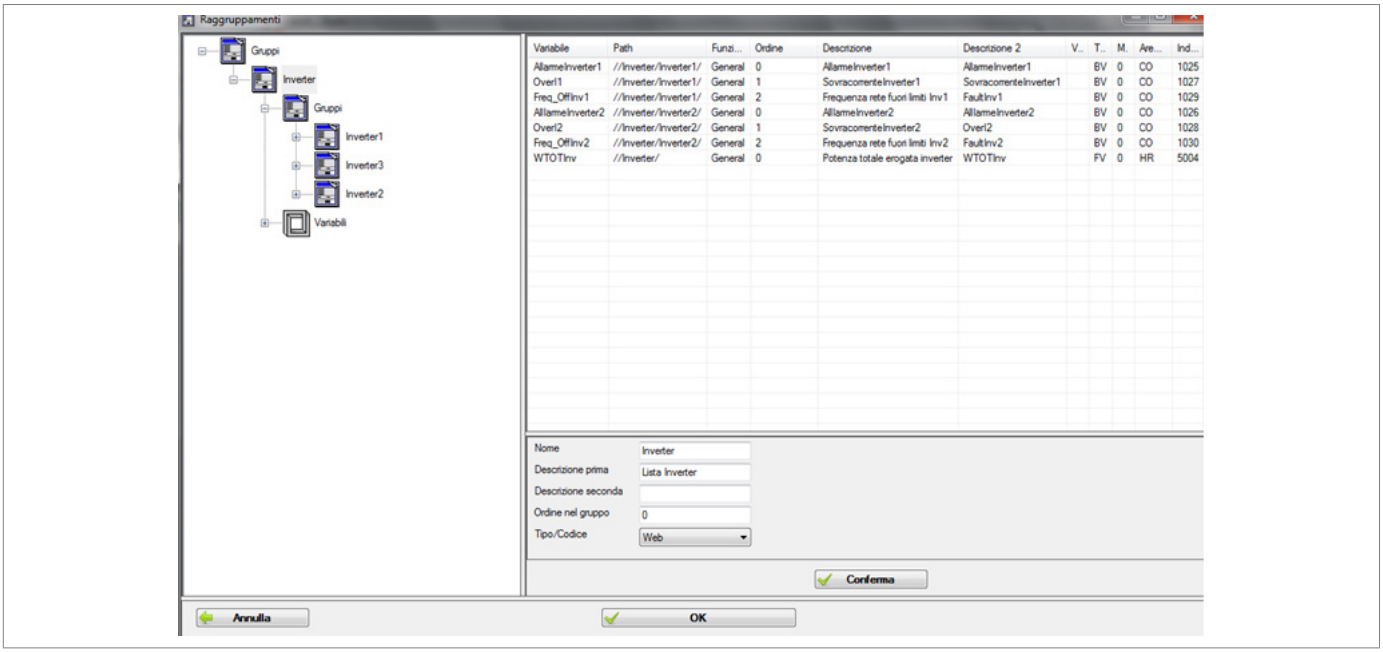


Fig. 8.92. Example of grouping creation

A main "Inverter" group was created and the variable with the total power of the 3 inverters was paired with it. 3 subgroups have been created, one for each inverter, each with information specific to the individual inverter.

By selecting a given group, the list of paired variables and its position in relation to the general structure (Path column) is displayed.

The corresponding display via the web page of the STARBOX LX2 is shown below.



Fig. 8.93. Example of data visualisation on a web page

8.3.8.3 - CREATE AUTOMATIC PAGE

A quick way to view information via the web is to use the “Create automatic page” function (Fig. 8.94).
In this case the variables are grouped as in the following figure.

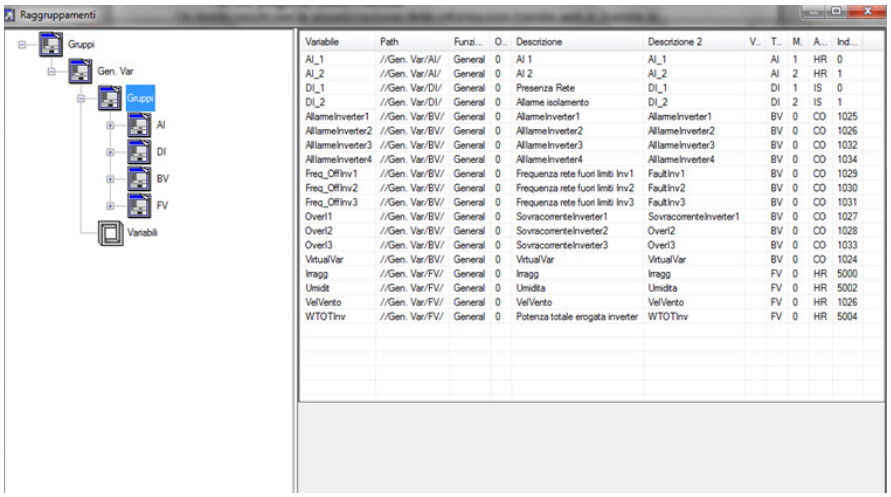


Fig. 8.94. Automatic grouping creation

The corresponding view on the Instantaneous page is shown in Fig.8.95:



Stato attuale televariabili

AI					
Irraggiamneto	0.00 w/m2				
DI					
Presenza Rete	Rete Assente	**Allarme isolamento**	Assente		
BV					
AllarmeInverter1	Assente	**AlllarmeInverter2**	Assente	**AlllarmeInverter3**	Assente
Frequenza rete fuori limiti Inv1	Presente	**Frequenza rete fuori limiti Inv2**	Attivo	**Frequenza rete fuori limiti Inv3**	Attivo
SovracorrenteInverter1	Disattivo	**SovracorrenteInverter2**	Disattivo	**SovracorrenteInverter3**	Disattivo
VirtualVar	0				
FV					
Iragg	0	**Umidita**	0	**VelVento**	0 m/s
Potenza totale erogata inverter	0				

Fig. 8.95. Automatic data display on web page

In this case, hardwired variables are also shown, while virtual variables with the HMI property active are grouped into homogeneous groups based on their type (BV, FV, LV).

8.3.8.4 - SORT

For a variable within its group, you can set its position via the “Group order” field, as shown in Fig. 8.96:



Fig. 8.96. Variable properties

Similarly, you can set the display order of the groups using the “Group order” item.

8.3.8.5 - DELETE GROUPS

Right-clicking on a group and selecting “Delete Group” removes the selected group.

8.3.8.6 - MANAGEMENT OF OPERATING VARIABLES

Variables that have the “Editable HMI” flag enabled are operating parameters and can therefore also be edited from the web page. Including these variables in a group makes them available in the web interface in the Operating parameters section.

For example, let’s create a BV variable for each inverter in the previous example to enable/disable communication with the STARBOX LX2.

In the following figure the 3 variables EnComInv1, EnComInv2, EnComInv3 have been added to the Inverter group.

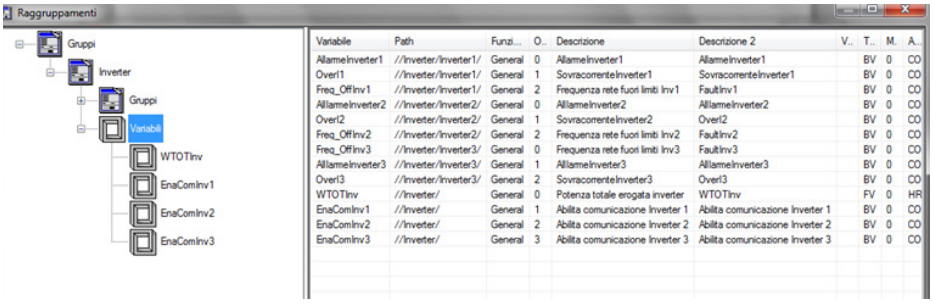


Fig. 8.97. Adding operating parameters to the configuration pages

From the web page they will be accessible as in the figure.

To edit the current value, write the new value in the corresponding text box and press “Save Modified”. The procedure is the same for BV, FV and LV type variables.



Fig. 8.98. Example of editing operating parameters from a web page

8.3.9 - SAFE IMPORT

Function specific to a particular application.

8.3.10 - VIEW LOG TRENDS

This function allows you to select one of the variables associated with a historical trend, select a time interval of interest and generate a graph to show its trend via a browser interface.

8.3.11 - LADDER EDITOR

This menu is equivalent to the  button shown in fig. 8.33. It runs the ladder network creation program for the STARBOX LX2.

When a new configuration is created, on starting the ladder program, a file named in the format Cfg_Configuration-Name_ladder.txt is created in the folder with the same name as the .sdf database; this file contains the I/O list present in the configuration.

When loading a new project, the I/O list can be initialised from the one present in the STARBOX LX2.

8.3.12 - IMPORT IO FROM LADDER

In this section you can import the variables present in a ladder project and have them available in the current configuration of the STARBOX LX2.

8.3.13 - INFORMATIVE DESCRIPTIONS

This section is also accessible via the button visible in fig. 8.33.

In the following form, additional information relating to the device can be entered, such as the serial number and the place and date of installation.

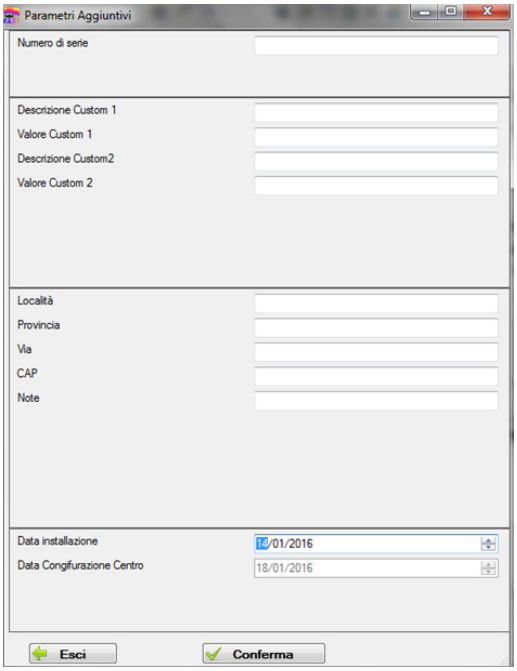


Fig. 8.99. Entering additional information

8.3.14 - EXPORT MODBUS MAP

This submenu of the RTU menu allows you to obtain a CSV file with detailed information on the memory map and the logging of the variables present in the configuration.

Clicking on this submenu opens a dialog box allowing the user to choose the folder in which to save the file. The file is saved with the name ModbusMap_DeviceName_ModbusAddress.csv.

8.4 - LOGICLAB

The software integrates functions for managing the LogicLab project. If the appropriate setting shown in Fig. 8.100 is selected when creating the configuration, the “LogicLab” item appears in the menu.

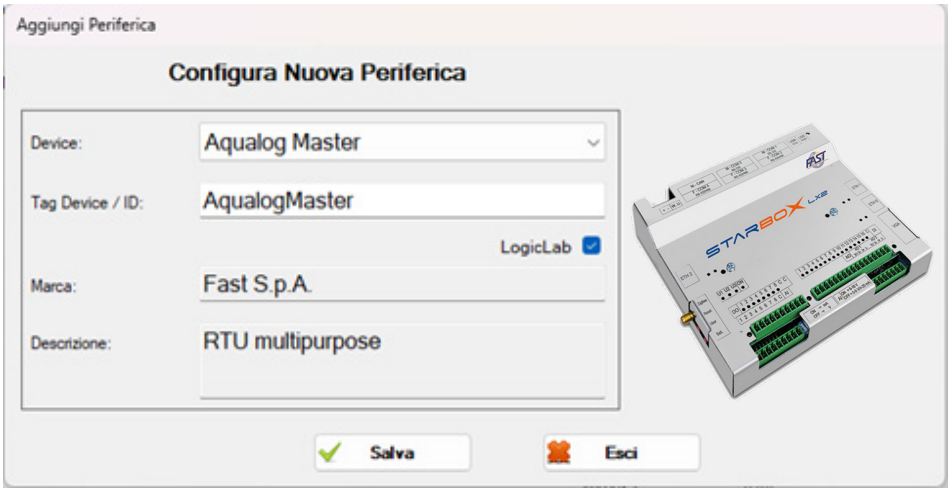


Fig. 8.100. Activating LogicLab functions

NOTICE!

This paragraph describes only the use of the functions integrated with the software.
This manual does not cover how LogicLab works; for these aspects, please refer to the dedicated technical material.

8.4.1 - INTEGRATED FUNCTIONS

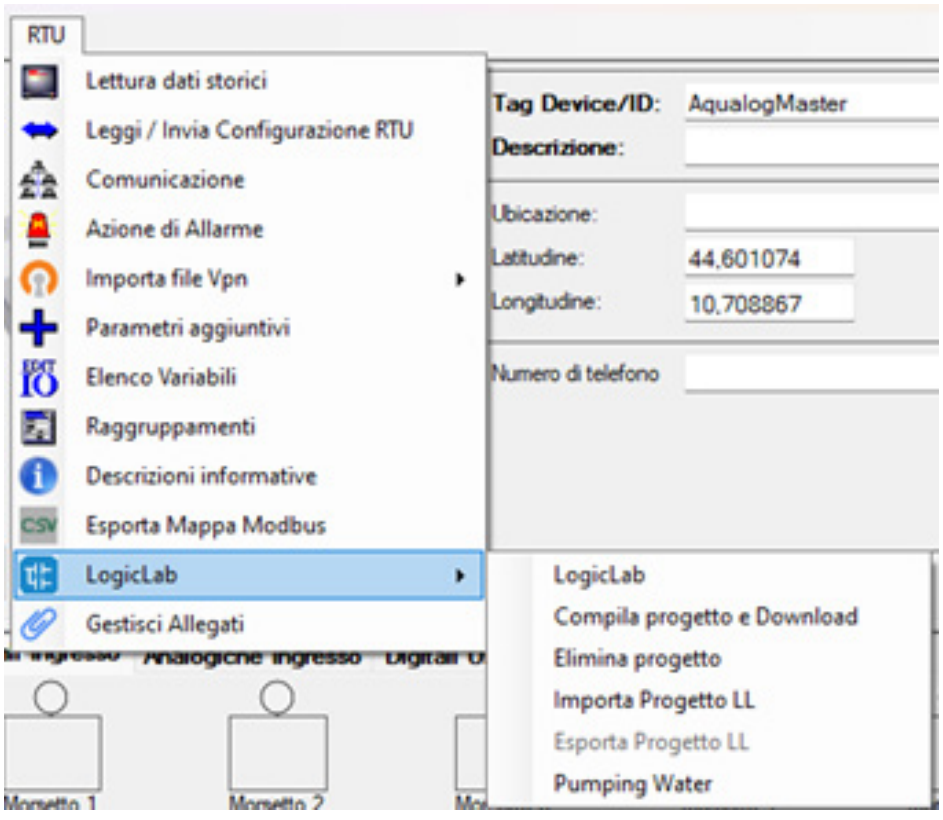


Fig. 8.101. LogicLab

By clicking on the “LogicLab” item, the project saved in the local database is opened in the LogicLab development environment.

If there is no existing project for the current configuration, a new one is created automatically. While the development environment is open, some software functions are disabled.

Once you have finished making changes and closed the development environment, you need to save the project in the configuration using the appropriate button shown in Fig. 8.102:



Fig. 8.102. LogicLab button

This button can have three states:

- : No LogicLab projects saved.
- : LogicLab project edited, saving required.
- : LogicLab project saved.

You can also save a backup of the project using the “Export LL Project” function (Fig. 8.101) or import it using the “Import LL Project” function (Fig. 8.101).

Once the project structure has been defined, it can be automatically compiled and downloaded to the device via Ethernet or Wi-Fi, using the “Compile project and Download” function (Fig. 8.101) and the IP address set in Fig. 8.72.

9 - MAINTENANCE AND FUNCTIONAL CHECKS

9.1 - GENERAL WARNINGS

HAZARD!

- **Maintenance work must be carried out by qualified personnel trained on safety in the workplace and authorised to carry out equipment-related activities.**
- **Repair or maintenance work not covered in this manual may only be carried out with the prior authorisation of PIETRO FIORENTINI S.p.A.. No liability for injury to persons or damage to property can be attributed to PIETRO FIORENTINI S.p.A. for work other than that described or carried out in ways other than those indicated.**

HAZARD!

Special maintenance:

- **requires extensive and specialised knowledge of the equipment, operations required, risks involved and correct procedures to operate safely;**
- **is reserved for qualified, trained and authorised technicians.**

WARNING!

In case of doubt, do not perform any work.
Contact PIETRO FIORENTINI S.p.A. for any necessary clarification.

NOTICE!

Before starting maintenance on the equipment, it is advisable to make sure that the authorised operator has:

- **the necessary equipment;**
- **appropriate spare parts.**

In the event of confirmed equipment malfunctions requiring its removal from the field and replacement, proceed as described in Tab. 9.36:

Step	Action
1	Turn off the main power switch upstream of the equipment (in the case of a device powered by 230VAC mains).
2	Disconnect the cables of any sensors or measurements wired to the instrument.
3	Disassemble the device.
4	Contact PIETRO FIORENTINI S.p.A.

Tab. 9.36.

The equipment maintenance operations are divided, from an operational point of view, into two main categories:

Commissioning maintenance operations	
Routine maintenance	All those operations that the operator must preventively carry out to ensure proper operation of the device over time. **NOTICE!** **The equipment does not require routine maintenance.**
Special maintenance	All those operations to be carried out by the operator when the equipment requires them.

Tab. 9.37.

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10 - UNINSTALLATION AND DISPOSAL

10.1 - GENERAL SAFETY WARNINGS

HAZARD!

Make sure that there are no effective ignition sources in the work area set up to uninstall and/or dispose of the equipment.

WARNING!

Before proceeding with uninstallation and disposal, make the equipment safe by disconnecting it from any power supply.

10.2 - QUALIFICATION OF THE OPERATORS IN CHARGE

Uninstallation	
Operator qualification	• Installer.
PPE required	 **WARNING!** **The PPE listed in this table is related to the risk associated with the equipment. For the required PPE to protect against risks associated with the workplace, installation or operating conditions, reference must be made to:** • **the regulations in force in the country of installation;** • **any information provided by the Safety Manager at the installation facility.**
Necessary equipment	Spanners for tightening the inlet and outlet fittings/connections of the equipment.

Tab. 10.38.

10.3 - INFORMATION REQUIRED IN CASE OF NEW INSTALLATION

NOTICE!

Should the equipment be reused after uninstallation, refer to chapters: "7 - Installation" and "8 - Configuration".

10.4 - STORAGE OF THE BATTERIES

NOTICE!

Refer to paragraph 6.6.1 to store the batteries.

10.5 - INFORMATION REQUIRED IN CASE OF RE-INSTALLATION

NOTICE!

Should the equipment be reused after uninstallation, please refer to chapter "7 - Installation".

10.6 - DISPOSAL INFORMATION

NOTICE!

- **Proper disposal prevents damage to man and the environment and promotes the reuse of precious raw materials.**
- **Bear in mind that the regulations in force in the country where the equipment is installed must be complied with.**
- **Illegal or incorrect disposal involves the application of the penalties provided for by the regulations in force in the country of installation.**

The equipment was manufactured with materials that can be recycled by specialised companies.
For proper disposal of the equipment, proceed as indicated in Tab. 10.39:

Step	Action
1	Set up a large work area, free from obstacles, in which to safely dismantle the equipment.
2	Sort the various components by type of material for easier recycling through separate collection.
3	Send the materials obtained in **Step 2** to a specialised company.

Tab. 10.39.

In all possible configurations, the equipment consists of the materials described in Tab. 10.40:

Material	Disposal/recycling indications
Plastic	It must be dismantled and disposed of separately
Steel	Disassemble and collect separately. It must be recycled through the specific collection centres.
Stainless steel	Disassemble and collect separately. It must be recycled through the specific collection centres
Aluminium	Disassemble and collect separately. It must be recycled through the specific collection centres
Electronic components	Disassemble and collect separately. It must be recycled through the specific collection centres.
Lithium batteries	Refer to paragraph “10.7 - Battery disposal”.

Tab. 10.40.

NOTICE!

The above materials refer to standard versions. Different materials can be provided for specific needs.

10.7 - BATTERY DISPOSAL

Proceed with disposal in compliance with:

- the transport and packaging requirements given in the chapter;
- the legislation in force in the country of installation of the equipment.

⚠ WARNING!

At the time of disposal, the batteries must be removed from the equipment, as indicated in Directive 2006/66/EC art.12 paragraph 3.

The transport of batteries to the intermediate treatment facilities is not subject to the provisions of ADR, if:

- a quality assurance system is implemented to ensure that the total quantity of lithium cells and batteries per transport unit does not exceed 333 kg (the total quantity of lithium cells and batteries in the batch can be determined by a statistical method included in the quality assurance system;
- a copy of the quality assurance records must be made available to the competent authority if it so requests).

NOTICE!

You can ship batteries and/or batteries for recycling or disposal under a partial exemption scheme, in accordance with special provision 636.
This exemption applies to lithium batteries/batteries of gross mass ≤ 500 g per unit.

10.7.1 - BATTERY PACKAGING

NOTICE!

The packages must be labelled in accordance with ADR, i.e. with the diamond-shaped label shown alongside and code UN3090.



NOTICE!

The packages must bear the indication “LITHIUM BATTERIES FOR DISPOSAL” or “LITHIUM BATTERIES FOR RECYCLING”.

The batteries that are removed from the equipment must be packed in such a way as:

- to be protected from any damage due to transport and handling;
- to prevent any accidental movement;
- to prevent the terminals from bearing the weight of other elements;
- to be protected from short circuits.

For this purpose, the original packaging or alternatively, packaging compliant with the ADR regulations, can be used.

If batteries not removed from the equipment but still inside it are transported, the packaging need not be approved but must still be:

- sufficiently robust and able to contain and protect the equipment;
- constructed in such a way as to prevent the equipment from operating accidentally during transport.

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11 - RECOMMENDED SPARE PARTS

11.1 - GENERAL WARNINGS

NOTICE!

If spare parts not recommended by PIETRO FIORENTINI S.p.A. are used, the declared performance cannot be guaranteed.
It is recommended to use original spare parts from PIETRO FIORENTINI S.p.A.
PIETRO FIORENTINI S.p.A. shall not be held liable for any damage caused by using non-original parts or spare components.

11.2 - HOW TO REQUEST SPARE PARTS

NOTICE!

For specific information, please refer to the sales network of PIETRO FIORENTINI S.p.A.

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Pietro Fiorentini