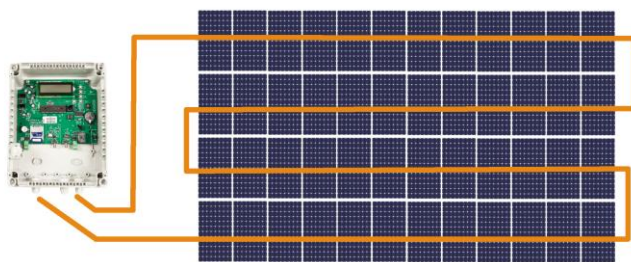


LITESUN *PLUS*

ANTI-THEFT SECURITY SYSTEM OVER PLASTIC OPTICAL FIBER FOR THE PROTECTION OF SOLAR PANELS

(detection of bend and cut of fiber)



INSTALLATION MANUAL



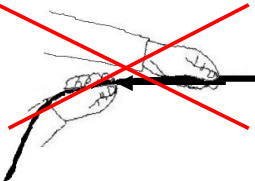
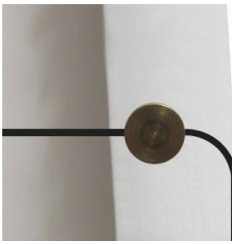
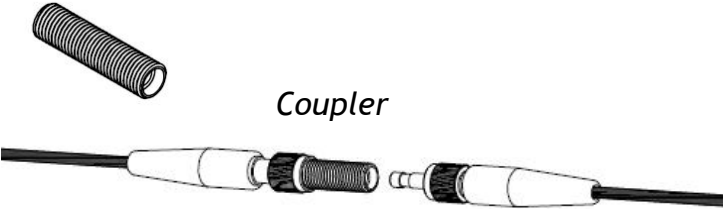
LiteSUN Plus
Analyser
LSUN300P011S



LiteSUN Plus AMPLI
Amplifier
SUN300P011A

General precautions

Plastic fiber is very resistant and does not break easily, but bends and passages on edges may reduce, also significantly, the maximum operating range of the system.

Do not tread or walk on the cable LiteWIRE 	 NO !
Do not pull hard on the cable LiteWIRE 	 NO !
Minimum bending radius of 2.5 cm 	 2.5 cm
Do not make narrow angles and do not run the cable in holes with sharp edges	 NO!  OK!
Do not pull the fiber on edges because it risks straining and damaging inside	 NO!
Do not over-tighten cable ties: the fiber must pass without friction	
Repair the cable mechanically, using a coupler. DO NOT USE HEAT SCHRINK TUBING! <i>N.B. Every reparation reduces the maximum operating distance by - 0.2dB (about 20m)</i> 	 Coupler

These conditions are increased if the fiber is laid at low temperatures.



- Do not insert the fiber directly in the holes of the panel frames: use the recommended special bolts/drilled pins/structural tape
- Do not drill the solar panels (it could invalidate the warranty)

*This manual must be read **before** installation: very often, the problems occurring during installation are due to installation mistake which can be avoided by reading this manual carefully.*



Note 1: This equipment design typically applies to commercial or industrial equipment expected to be installed in locations where only adults are normally present

This equipment is not suitable for use in locations where children are likely to be present

The device cannot be used where children are present without adult supervision.

The appliance is intended for use by expert and duly trained personnel only.

LiteSUN Plus - How it works

This system works like a chain: the fiber plastic is attached to the solar panels to link them together and is connected to the analyser LiteSUN Plus, which can detect both the cut and the bend of the fiber. When an attempt of theft results in deformation or interruption of the fiber, the optical analyser LiteSUN Plus detects the variation of the light signal and triggers an alarm. After that, if the fiber has remained intact, the system resets automatically, adapting to the (new) position.

ZERO FALSE ALARMS: the plastic fiber must be bent or cut in order for the analyser to trigger an alarm. For this reason, all the stresses due to weather conditions (like wind, rain or snow), leaves or birds do not trigger any false alarms.

In addition, plastic fiber is an electrical insulator and it is not influenced by any electro-magnetic noise.

This anti-theft system is composed of 3 elements:

- “LiteSUN Plus” analyser, which sends a light signal and analyzes the flow of light received, generating an alarm both when the cable is cut and when the cable is bent or stretched out.
- Plastic fiber cable “LiteWIRE” (with anti-UV filters for installation in the direct sunlight) which transmits the light signal
- Elements which secure the fiber to the solar panels (drilled bolts, drilled pins, fast bolts or adhesive tape.)

It is important to make sure that the cable LiteWIRE is installed correctly.

The instructions contained in this manual will enable you to install the plastic fiber cable correctly.

*If your plant has more than one analysers, **FIRST** install one analyser with its link of fiber, and check that the system works properly and as expected, before installing the system on the plant **ONLY AFTER THAT** install all the fiber and the analysers on the plant.*

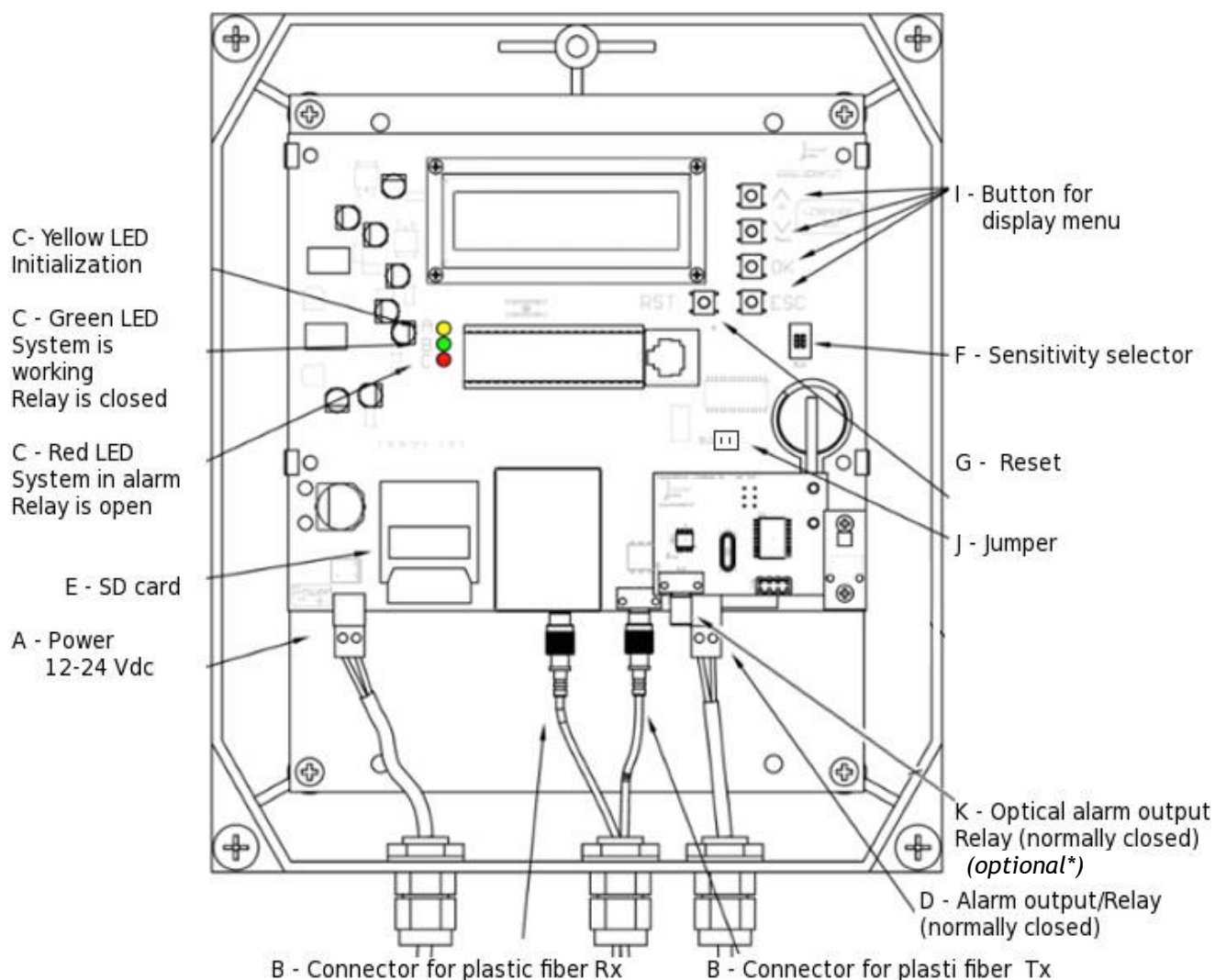
The conditions mentioned in this manual are suitable for most photovoltaic plants. However, there may be variables which are not take into account in this manual.

If the detection of intrusion in the trial installation is not satisfactory, please contact **Naria Security** per further tips and suggestions on how to make the LiteSUN Plus system suitable for your photovoltaic plant.

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LiteSUN Plus - Reference figures



** The optical alarm relay output and the built-in optical power meter are available on request. The optical alarm relay output must be connected to plastic fiber, which will reach a receiver (item no. LCUT300S011S) converting the optical signal into an electrical signal. The optical power budget of the receiver is -30dB, which equals to about 300m of plastic fiber LiteWIRE, and it can be amplified by using additional devices of the same type (item no. LCUT300S011S) setting them as amplifiers.*

LiteSUN Plus AMPLI , used as signal amplifier, has the same features as LiteSUN Plus, except for:

- SD card
- Display with information about system status

LiteSUN Plus - Equipment markings

The identification plate of the product is placed inside the protective case, as the installation could be exposed to the elements. To locate the CE tag, remove the housing cover.



LiteSUN Plus - Technical specifications

LiteSUN Plus and LiteSUN Plus AMPLI - analyser

Protection rate	IP55; IK07; glow wire temperature:750°C
Operating range	0-300m (max 30dB) <i>This distance can be reached if the installation is carried out correctly (attenuation of the fiber lower than 0.1dBm at 525nm). Bends, passages on edges, misplaced or over-tightened cable ties and mechanical stresses on the fiber can increase the attenuation of the optical signal, reducing, even considerably, the maximum operating range, even preventing the system from working correctly.</i>
Optical power budget	30dB
Optical Power Meter	Optional*
Alarm relay output	5A/240 Vdc NC or optical output (optional**)
Power (DC)	12V-24V±10%
Operating temperature***	-20° +70° C
Humidity	from 5 to 90%
Consumption at 12VDC	200mA
Max. Power	3W
Weight and dimensions in IP55 casing	670g ; 190x255x90 mm
Optical connector	F-SMA
Immunity to EMI/RFI	EMC 2014/30/UE FCC Class B: verification level part 15
Anti-tampering sensor	mechanic

* The optical alarm relay output and the built-in optical power meter are available on request. The optical alarm relay output must be connected to plastic fiber, which will reach a receiver (item no. LCUT300S011S) converting the optical signal into an electrical signal. The optical power budget of the receiver is-30dB, which equals to about 300m of plastic fiber LiteWIRE, and it can be amplified by using additional devices of the same type (item no. LCUT300S011S) setting them as amplifiers.

LiteWIRE Simplex - Plastic optical fiber

Plastic fiber	SI-POF (980/1000)
Numerical aperture (NA)	0,46+-0,025
Max. attenuation @525nm/@650nm	100dB/km 150dB/km
Bandwidth	30MHz at 100m
Diameter of bare/jacketed plastic fiber	1mm/2,2mm ± 0,1mm
Min. bending radius	20mm at 25 °C
Jacket	Anti UV with <i>meter marking</i>
Weight	6kg/km
Max polling force	65N at 25 °C
Operating temperature***	-40 °C +85 °C <i>During installation at low temperatures, the fiber tends to be more rigid and less elastic, so more care is required.</i>
Immunity to EMI/RFI	Total
Reaction to fire	ECA

Attenuation of plastic fiber cable LiteWIRE

Plastic optical fiber is a polymeric material which transmits light inside and it also permits the transmission of a light signal. While this signal propagates along the fiber, it gradually loses optical power: this is called **attenuation**.

Every meter of plastic fiber introduces an attenuation (= loss of optical power): the more fiber is installed, the more attenuation is introduced, the lower will the optical power be at the end of the fiber.

Some factors related to the installation of the fiber (e.g. over-tightened cable ties, tensioning bolts, etc.) increase its attenuation.

The power of the light signal is measured in dBm.

Example:



Attenuation = loss of optical power = 10dB

LiteSUN Plus analyser works correctly if optical power is between 0 and -30dBm. In a standard installation, the following elements are considered:

25dB = attenuation of 250m of fiber

4 or 5dB = attenuation due to possible future junctions on the cable after attempts of theft (every junction attenuates around 2 dB, so 2 x 2 = 4 dB)

It is possible to build an optical power meter in LiteSUN Plus on request: in this way, the installer will be able to monitor attenuation constantly, in every step of installation, and will be able to solve any installation mistakes promptly.

These distances can be reached if the installation is carried out correctly (attenuation of the fiber lower than 0.1dBm at 525nm). Bends, passages on edges, misplaced or over-tightened cable ties and mechanical stresses on the fiber can increase the attenuation of the optical signal, reducing, even considerably, the maximum operating range, even preventing the system from working correctly.

Connection schemes

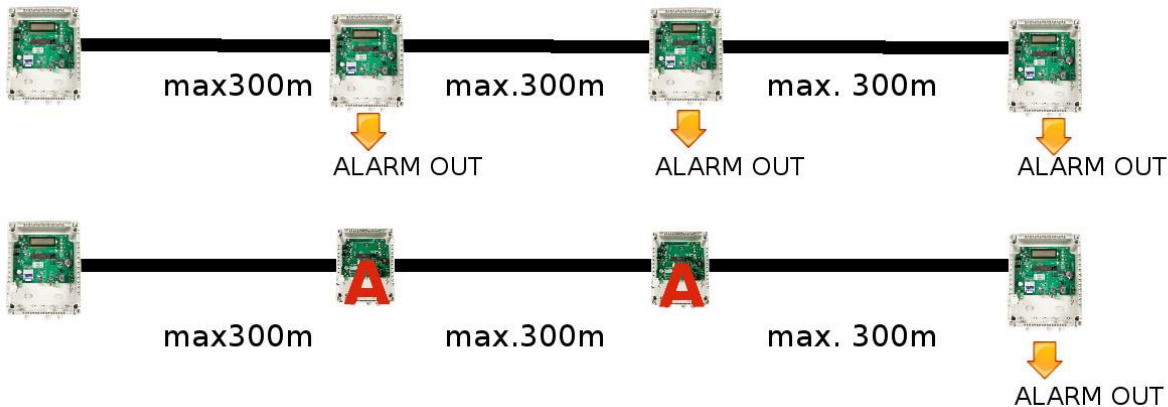
All LiteSUN Plus analysers have a normally closed (NC) alarm output

The NC contact has either a standard electrical output or an optical output for plastic fiber (on request).

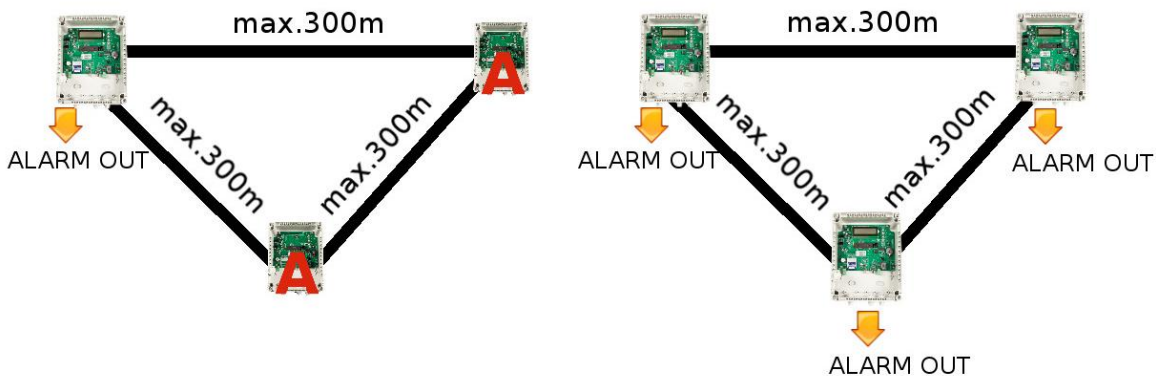
In case the optical output is used, the plastic fiber cable LiteWIRE must be connected to a receiver for optical NC contact (cod. LCUT300S001S), which converts it back into electrical.

LiteSUN Plus analysers can be connected in line, keeping their alarm zones either separate or grouped. In this case, we suggest combining LiteSUN Plus with LiteSUN Plus AMPLI.

Example: point-to-point connection with several alarm zones or one alarm zone



Example: loop connection with one alarm zone or several alarm zones



Normally, the **jumper (J)** is on: in this way, every alarm zone is separate and alarm s not propagated (Number of LiteSUN PLUS analyzers - Number of alarm zones).

If the **jumper** is off, the alarm is propagated over to the next device, creating one single alarm zone (Number of LiteSUN PLUS analysers- 1 single alarm zone). In this case the first device must have the jumper on, the following devices must have the jumper off.

After setting the jumpers on/off, press RESET.

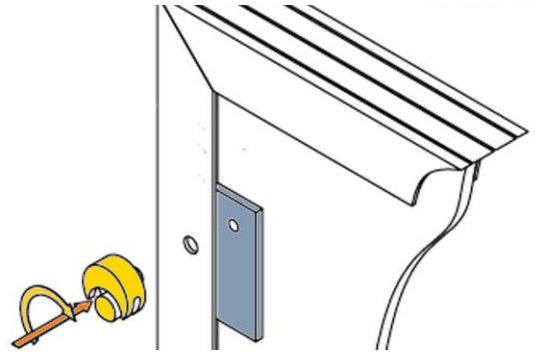
How to install LiteSUN Plus

1 - Fix the bolt or the drilled pin to the panel

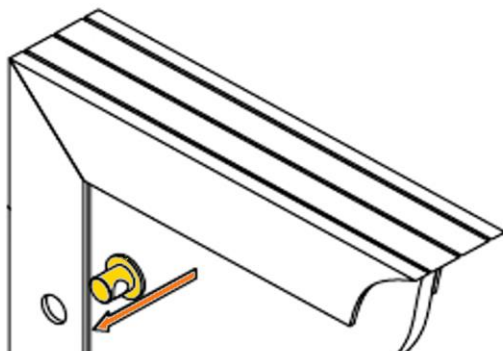
Fast bolt

Recommended with LiteSUN Plus because:

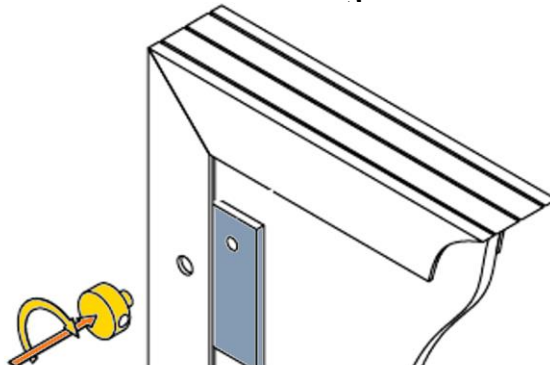
- it halves installation time (in comparison to drilled bolts for ground mounted panels).
- in case of maintenance to the panel the fiber can be easily removed and re-positioned: no need to unthread and thread it into the bolts



Drilled pin for rooftop mounted panels



Drilled bolts for ground mounted panels



Fixing LiteWIRE with structural tape and with fast bolts on omega brackets

In case of rooftop mounted panels where the back of the frame is no more accessible, you can attach the plastic fiber cable to the frame of the panel with a special **structural tape** which polymerize over time, increasing its adhesion to the surface. The attempt of removing the fiber will deform the fiber itself, generating an alarm. Usually 5cm of structural tape are fixed on every panel, after the surface of the frame has been cleaned, following the specific instructions provided.



To check if this fixing system is appropriate and for more information, please contact Naria Security.

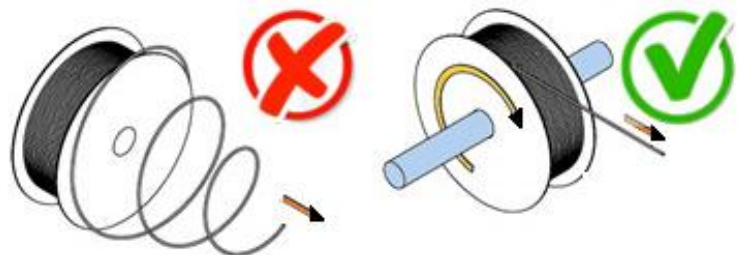
In addition to the structural tape, you can use **fast bolts mounted on omega brackets**, suitably drilled. These bolts are normally used when panels have no holes on the frame and standard bolts cannot be used.



To check if this fixing system is appropriate and for more information, please contact Naria Security.

2 - Un-spool the cable

Use a cable de-reeler to prevent the cable from twirling

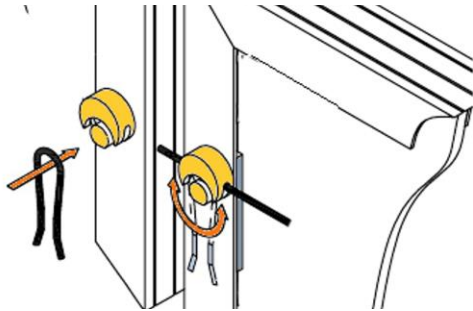


3 - Pass the fiber through the bolts or the pins

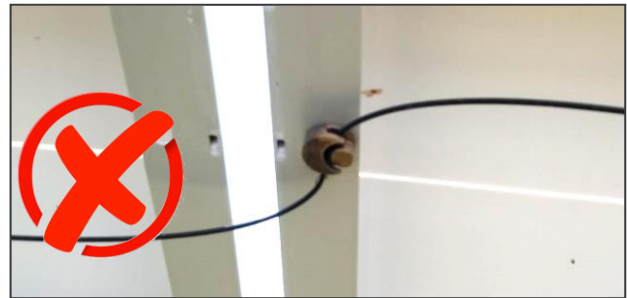
Fast bolt

Recommended for LiteSUN Plus

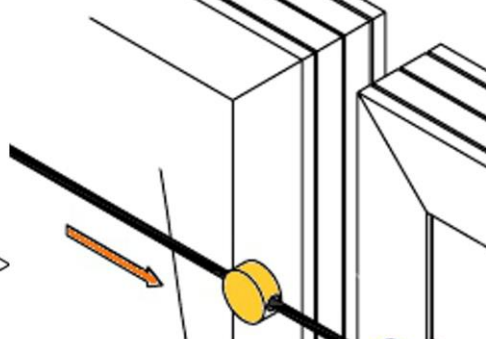
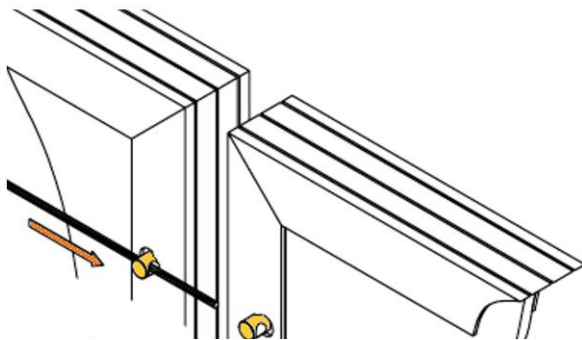
In order to make the installation easier and quicker with the fast bolts, un-spool the cable and lay the cable on the ground in front of the panels to be protected. Then, hook the fiber to the fast bolts on the panels as straight as possible



Drilled pins for roof mounted panels



Drilled bolts for ground mounted panels



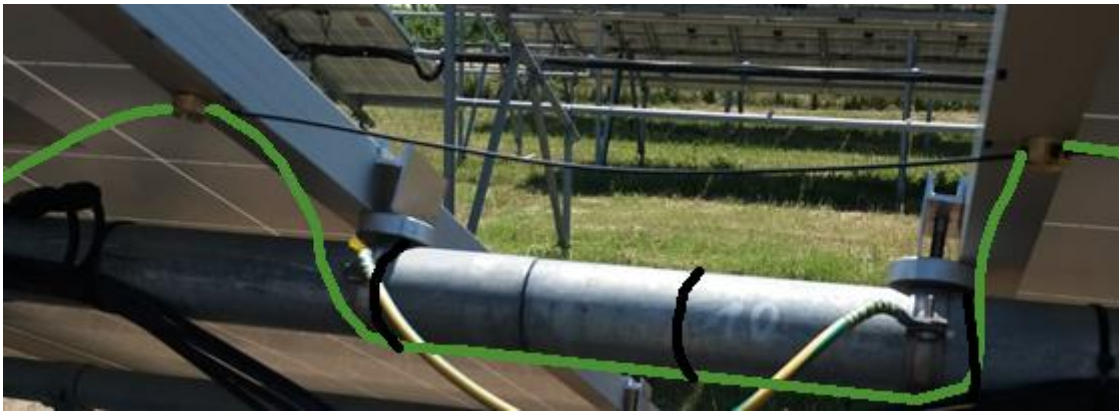
When drilled pins or drilled bolts are used, the fiber is threaded into the holes while it is unspooled.

4 - Protect the fiber exposed to possible weather damages

Especially on roofs, where the fiber might be dragged by snow, branches, leaves or exposed to birds, we recommend protecting it properly, e.g. corrugated tube.



In the situation shown above, the plastic fiber cable is exposed to possible false alarms due to birds or weather conditions. To prevent them, the cable can be run under the structure supporting the panels and fastened with cable ties, which shouldn't be overtightened (the cable must be able to move).



5 - Insert the LiteWIRE cables through the cable glands of the water tight box and crimp the connectors on the fiber.

See “Termination of LiteWIRE cable”

6 - Connect LiteWIRE to the analyser and power it

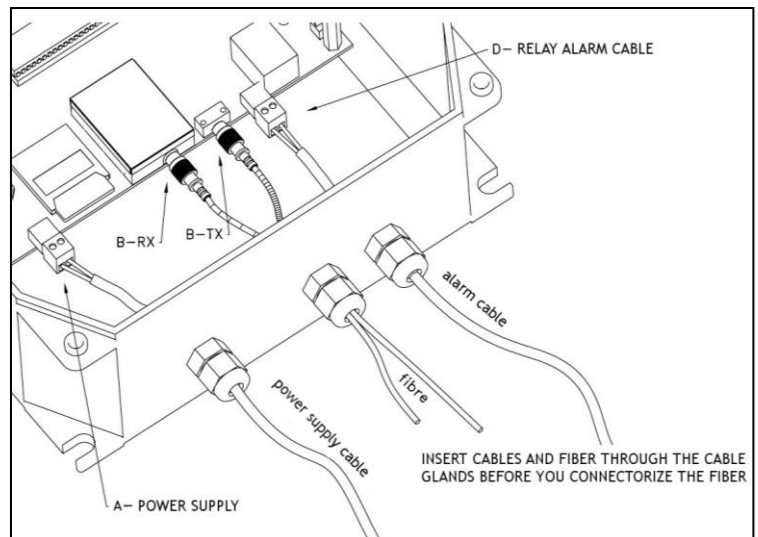
FIRST insert the LiteWIRE cables through the cable glands of the water tight box, THEN crimp the connectors (see *Termination of LiteWIRE*) and connect them to the device (B).

Connect power supply (e.g. from the battery of the alarm panel).

The yellow LED glows for some seconds and the green led glows.

From this moment on, the transmission port (TX) emits codified light signals which pass through the plastic optical fiber and arrives at the receiving port (Rx). The device will continually control the power of the signal received. **When the device detects a difference in power, due to cable cut or bends on the fiber, an alarm will go off and the red LED is lit** (see “LED indicators”).

When the board receives the signal, the green LED glows (C).



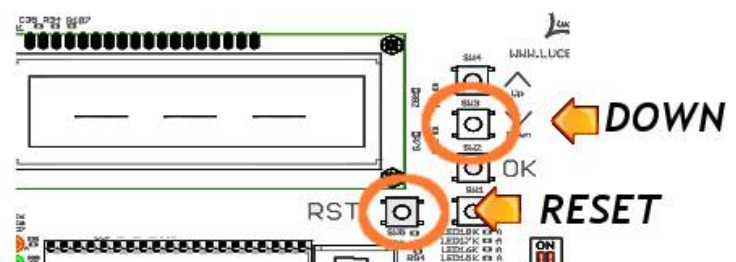
7. If the Power Meter is built-in, set LiteSUN Plus to POWER METER mode

To prevent increase of attenuation when the cable is being installed into the bolts or fastened with cable ties, it is VERY IMPORTANT to keep the optical power received by LiteSUN Plus constantly monitored.

- Keep the DOWN button pressed while you switch on the system, until a dashed line appears on the display

OR

- if the analyser is already powered, reset it before setting it to *Power Meter* mode. While you keep the DOWN button pressed, press the Reset button, and then release Reset first and DOWN afterwards. After a few seconds a dashed line will appear.



8. Check that the attenuation is corresponds with the fiber installed

Check that the attenuation rate of the fiber matches with the length of the fiber installed (see “Attenuation of the plastic fiber LiteWIRE”)

EXAMPLE: if installed correctly, 210m of fiber should attenuate around 21dBm $\pm$ 2dB on the *Optical Power Meter*. If the attenuation rate were lower (e.g. -24dBm), check that the fiber has no angles and that it hasn't been damaged during installation.

9 - If the Optical Power Meter is not present, check that the analyser has operating margin

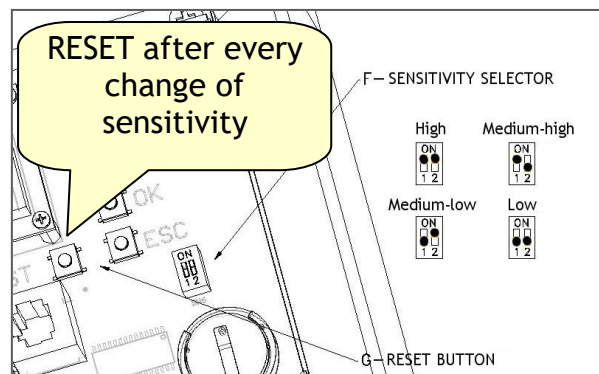
In order to prevent false alarms, make sure that the analyser has enough operating margin. The value P2 (see “Status” in the user's interface) must be <60.

10 - Set sensitivity level after real tests

This device has 4 sensitivity settings you can select according to your application using the selector (F).

- S1 = High sensitivity
- S2 = Medium-high sensitivity (recommended)
- S3 = Medium-low sensitivity
- S4 = Low sensitivity

Usually, S1 or S2 are selected.



11 - Connect the alarm zone

Connect the alarm zone (D) to the alarm panel (from 5A to 240VAC). It is recommended to add balancing resistors in series. *The anti-tampering sensor is mechanical and has a separate alarm output.*

Normally, the jumper (J) is on: in this way, every alarm zone is separate and alarm s not propagated (Number of LiteSUN Plus - Number of alarm zones).

If the jumper is off, the alarm is propagated over to the next device, creating one single alarm zone (Number of LiteSUN Plus - 1 single alarm zone). In this case the first device must have the jumper on, the following devices must have the jumper off.

After setting the jumpers on/off, press RESET.

The circuit is normally closed, so the relay is closed when there are no alarms. *In case of disconnection, cable break, no power or cable bending, the circuit opens.*

IMPORTANT: In a loop connection with one single analyser, if the jumper is off, the analyser will not work. The transmission LED will only glow if a signal in reception is present.



12. Remove the battery film and set date/time

12. Once installation is finished, insert the SD card



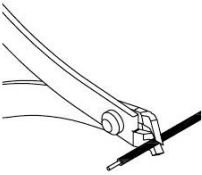
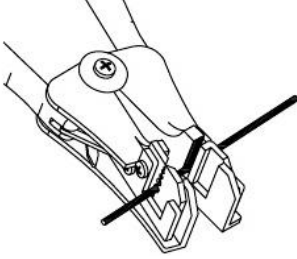
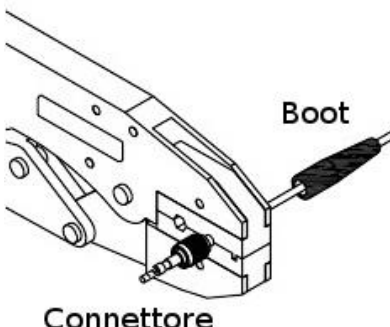
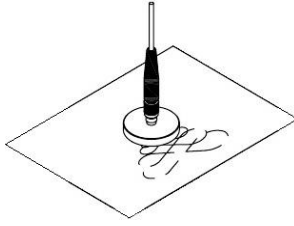
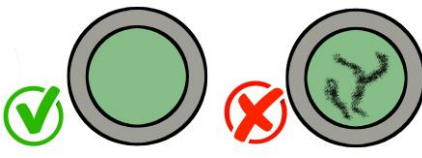
When the SD card is inserted, the LED18K will glow

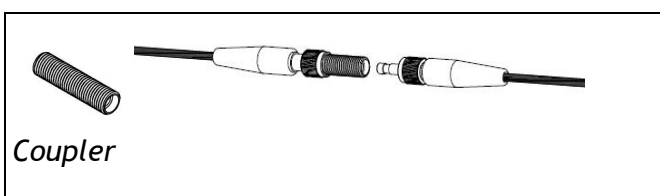
Termination of LiteWIRE

FIRST insert the LiteWIRE cables through the cable glands of the water tight box, **THEN** crimp the connectors. All the tools are contained in the "LiteWIRE termination kit".



SCAN ME

	1- Cut the fiber with a cutter.
	2- Fase: Remove the jacket Remove about 1 cm of jacket. The jacket of the optical cable has a diameter of 2.2mm. The fiber has a diameter of 1 mm. ATTENTION! Use a standard cable stripper with a hole of 1.0 mm or more, so you will not damage the fiber.
 Boot Connettore	3 - Crimp the connector Insert the protection boot. Insert the FSMA connector onto the cable till the jacket stops against the connector; the fiber should come 2mm out of the connector. Crimp the FSMA connectors on the cable jacket. ATTENTION The connector must be crimped on the cable jacket and must not be crimped directly on the fiber. The crimp tool for FSMA connectors must have a hexagonal crimping diameter of 3mm. Use the 1.22" hexagonal hole.
 1mm	4 - Cut excess fiber. It is NECESSARY to leave 1mm or 2mm of excess fiber out of the connector: this prevents micro-fractures on the fiber, which would increase fiber attenuation 
	5 - Fiber polishing Level the fiber by polishing the connector on sand paper using the metal polishing disc. ATTENTION! You should make some "8"-shapes with the connector on the sand paper. Wipe the connector with a finger
	6 - Visual check Put the other end of the fiber on a light source (eg. LED of the transmitter), watch the light coming out of the connector and make sure that there are no cracks on the surface of the fiber. If there are cracks, remove the connector and put a new one on.



DO NOT USE HEAT SCHRINK TUBING!
Every reparation reduces the maximum operating distance by 2dB (about 20m)

Data analysis

LiteSUN Plus continually logs the attenuation rates over the cable (one log every second) as well as alarms, recording them to an SD memory card (E). It is important that DATE and TIME are set correctly on the device.

After one month of operation, you can send the SD memory card in the device to Naria Security: we will give you free support about the most appropriate level of sensitivity that should be selected on the device.

WARNING: the files reporting the logs can only be read by a special software of Naria Security. **Do not try to open the SD memory card, as all data could be cancelled.**

Disconnect power before removing the SD card, otherwise the card could be damaged.

LED indicators

ORANGE: initialization of device; wait until the device starts working and the LED turns green. If the signal received is too low, the yellow LED will remain on.

GREEN: system working, closed relay

RED: alarm, open relay

ORANGE+GREEN: the device is working but the maximum attenuation rate has been reached, with the following alert on the display “ATTENTION LOW SIGNAL”

>>>check that the fiber/bolts/clips/sensors/cable ties are installed correctly and do not increase attenuation; in case, set a lower sensitivity level with the dip switches (F).

ORANGE+RED: the anti-tampering sensor is triggering the alarm OR the light signal has been totally interrupted (e.g. fiber cut) >>>wait till the green LED glows or check that the light comes out of the fiber

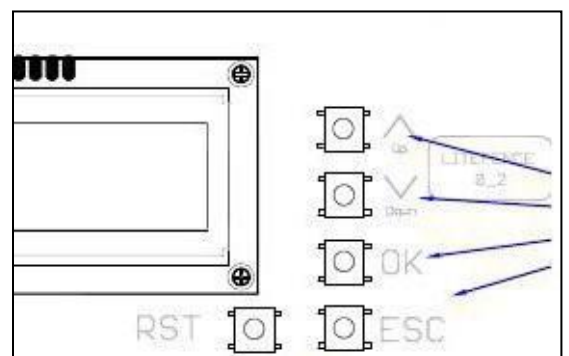
User's interface

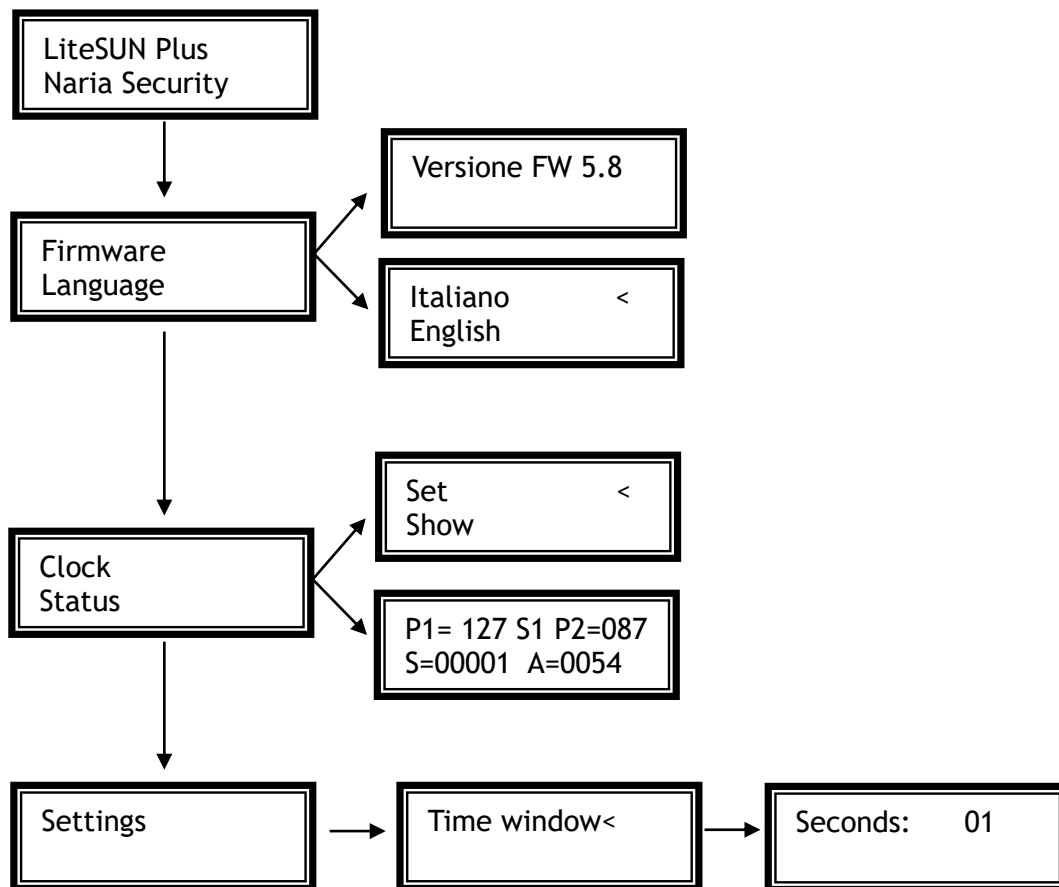
LiteSUN Plus features a text interface which you can access using the button on the right of the display.

Up - menu scroll upwards
Down - menu scroll downwards
OK - option selection
ESC - menu exit
RST - Reset

Sub-menus:

- **Firmware:** shows current firmware version
- **Language:** shows the language
- **Clock:** shows date/time, which can also be set
- **Status:** reports statistical data on how the device is working
- **Settings:** You can set the analysis time window of the light signal attenuation. Rates range from 1s a 60s .





In “Status” menu you can see the following parameters

- **P1 and P2 :**

Statistical data on how the device is working - it cannot be modified

- **S1: Sensitivity** set with selector (F)

S1 = High sensitivity

S2 = Medium-high sensitivity

S3 = Medium-low sensitivity

S4 = Low sensitivity

- **S : Status**

S=00001 Fiber not connected (no light signal received)

S=00002 Fiber connected (light signal received): attenuation analysis/initialization

S=00003 Device is active

- **A: Number of alarms** reported by the analyser

This counter can be re-set by keeping button UP pressed while switching on or while resetting the device.

After the installation, we recommend RESET the alarm log (press “RST” + “\



DICHIARAZIONE DI CONFORMITA'

Declaration of conformity

No.: 007/2021

Naria Security S.r.l.

Con sede legale in Via Cefalonia, 70 - 25124 Brescia

e sede operativa in Via A. Canossi, 18 - 25030 Torbole Casaglia (BS) Italy

dichiara qui di seguito che il prodotto
declares under its responsibility that the product

320.SIS.LSUN300P011S LiteSUN Plus
320.SIS.LSUN300P011A LiteSUN Plus AMPLI
scheda per controllo sistema anti intrusione

risulta in conformità a quanto previsto dalla seguente direttiva comunitaria
complies with the following EEC-directives

Electromagnetic Compatibility: EMC 2014/30/UE

Reduction of Hazardous Substances: 2015/863/UE, ROHS III

e che sono state applicate tutte le norme indicate di seguito.
and is in conformity with the standards listed below.

Data: 10 marzo 2021

(firma)

A handwritten signature in black ink, appearing to read 'R. M. Merco'.

Norme, o parti di esse, utilizzate per la presente dichiarazione di conformità:

Regulations, or part of them, used for this declaration of conformity

EN50130-4: Alarm systems Part 4: Electromagnetic compatibility - Product family standard: Immunity requirements for components of fire, intruder and social alarm system

EN61000-6-3: Electromagnetic compatibility (EMC) Part 6-3: Generic standards - Emission standard for residential, commercial and light industrial environments



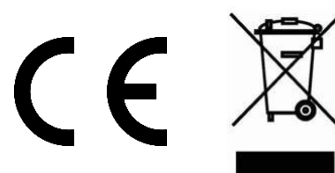
Read this manual carefully before installing the devices and follow all the instructions and suggestions.

Keep the manual in a safe place after reading
so that you can refer to them later.

*Subject to technical modifications with corresponding follow-up certifications.
Do not throw the package away before checking that the devices work correctly.*



Naria Security srl
Headquarters: via Canossi, 18- 25030 Torbole Casaglia (BS) - Italy
R/O: via Cefalonia, 70 - 25124 Brescia - P.IVA: 03757240985
Tel. +39 030 9771125 Fax +39 030 2072965
 WhatsApp for support: +39 375 5813029
www.nariasecurity.it



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