

# Teslights+

by SCALAMAX



## Teslights Hybrid Lighting SCALAMAX Protocol CA10 Head End Series

Technical Manual, DM15-3841

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## Index

Warning .....	2
Disclaimer .....	2
1. Overview .....	3
1.1 SCALAMAX Protocol Head End .....	3
1.2 CA10 Series Head End .....	5
1.3 Block Diagram .....	6
1.4 Connectors .....	7
2. Technical Specifications .....	7
3. Environmental data .....	8
4. Dimensions .....	8
5. Approvals .....	8
6. Installation guide .....	9
6.1. Single-phase / three-phase power input .....	9
6.2. Current transformers connection .....	10
6.3 RS-485 Connection .....	10
6.4 3G Antena installation .....	11
6.5 PLC connection .....	11
6.6 Installation example. CA13 Head End and MR-4850 .....	12
7. Cautions and warnings.....	13
8. Product Limited Warranty .....	13
9. Release Dates .....	13

## Warning

This guide is for persons who have received training and are qualified to work with electricity and electrical metering equipment. All applicable national and local electrical codes and standards must be followed. Failure to follow proper procedures may result in serious bodily harm including death.

## Disclaimer

The product described herein may be changed or enhanced from time to time. This information does not constitute commitments or representations by Teslights, LLC and is subject to change without notice. Images shown are a representation only. They may not match exactly with the real equipment.

## 1. Overview

### 1.1 SCALAMAX Head End

The Head End includes a SCALAMAX modem, a complete Linux system and an internal power supply. The SCALAMAX modem is a device which allows to transmit and receive data from/to the low voltage power line, using OFDM (Orthogonal Frequency Division Multiplexing) multicarrier modulation technology. It communicates with nodes using the power line.

It uses a 10 MHz bandwidth (2 – 12 MHz). Its Firmware allows the management of multipoint MACs (Medium Access Control) with auto-repeating capability, so each node is able to extend the network. At the same time, it allows the auto-regeneration of the network depending on the changes at the power line environment.

The device includes a powerful error correction system which provides maximum robustness over any power line wire. The DES, 3DES and AES encryption guarantees total data security.

The Head End is the element which manages the energy efficiency of the system. It is accessible through various interfaces, whether wired or wireless. It can be managed independently through a Web interface, or through a central management software (CMS), Smart Firefly®.

The internal power supply has a three phase rectifier, which ensures its operation in both single phase and three phases power lines, even if one or two of the phases lose power. It is installed inside an electrical cabinet, where power is provided to all the luminaires. It manages the network through the nodes located in the streetlights and the MR-48xx device, which controls the On / Off lighting switches.

The devices includes an embedded Linux operating system based on a microprocessor. It allows remote software upgrades.

The Head End is able to send alerts via SMS or e-mail to report faults. Two CA10 models incorporate the feature of measuring the power consumption at the electrical cabinet (voltage, current, power and power factor of each phase). The measured data is stored in memory and can be accessed remotely.



## 1.2 CA10 Series Head End

The CA10 Series is a SCALAMAX Head End with additional interfaces and functionalities. The series consists of three devices with common features and some individuals.

Every CA10 Head End includes:

- Broadband power line communications.
- RS-485 communications port.
- Ethernet 10/100 Mbps Full-Duplex port and auto MDI/MDIX with RJ45 connector for IP connectivity to devices such as computers, cameras, audio systems ...
- Real Time Clock (RTC) which ensures the maintenance of the date and time after an off state.

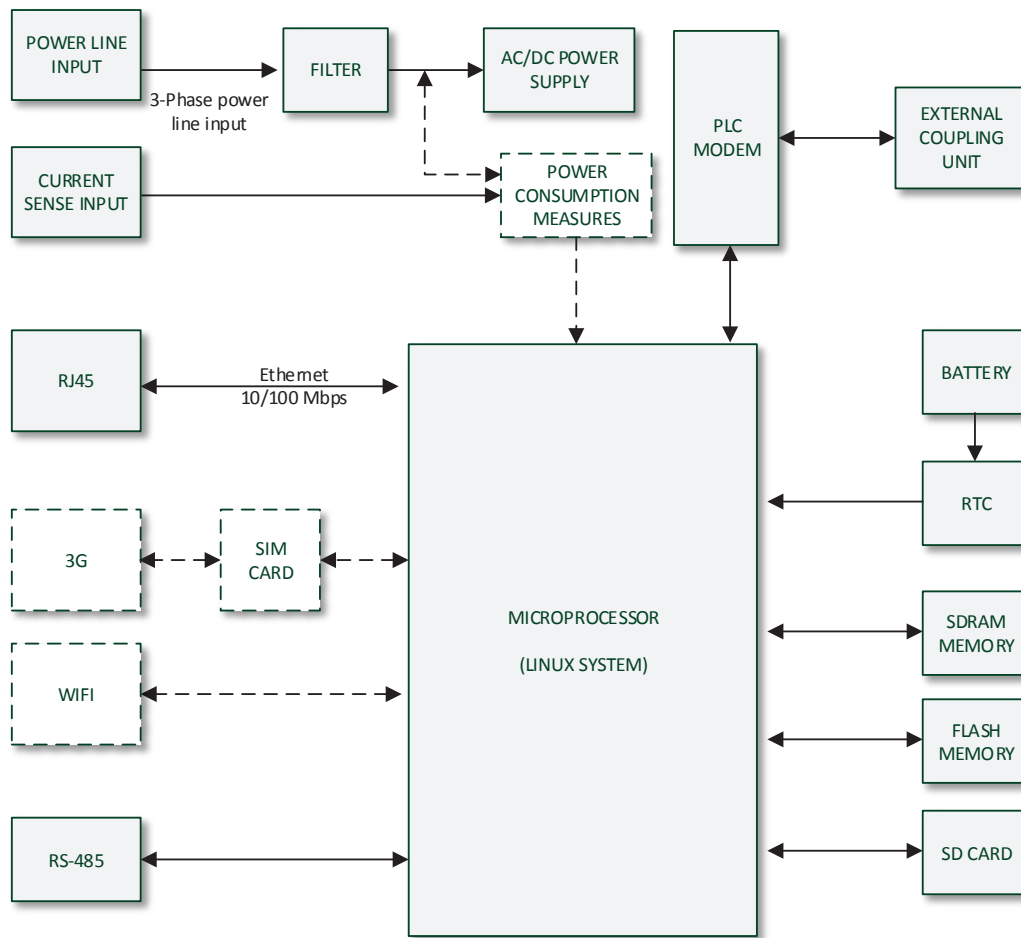
Optional features are:

- Measurement of the power consumption at the electrical cabinet and power fault detection.
- 3G/GPRS modem, which allows communications with the system remotely, and WIFI.

These are the CA10 Series devices:

Devices	Feature	
	Power consumption measurement / Fault Detection	3G / WIFI
CA11		
CA12	X	
CA13	X	X

### 1.3 Block Diagram



NOTE: Optional elements are shown in dashed line.

This is the CA10 block diagram:

The Head End can be powered from a single-phase or a three-phase power line and can work even if one or two phases lose the supply. This voltage is filtered. An AC/DC power supply and DC/DC devices generate all the voltages required by the circuits.

In the case of devices incorporating power measurements (CA12 and CA13) this voltage is measured. It also has a header to connect three current transformers outside of the Head End. With these parameters, the electrical power consumption is calculated.

The SCALAMAX modem is connected to the power line using an external coupling unit. It can be a single-phase or three-phases device.

The microprocessor manages the entire system and has a SDRAM and a Flash memory. It includes a real time clock (RTC) that allows to know the date and time at all times, even after prolonged disconnection from the mains, through a support battery, which allows the system to save all the data in memory before shutting down in the event of power failures.

In addition, the CA13 device includes wireless communications. These are 3G technology, which requires an external antenna and a SIM card, and WIFI.

Ethernet 10 /100 Mbps is provided through the RJ45 connector.

## 1.4 Connectors

The equipment has the following connectors:

**Power line input connector.** These are the pins:

- Earth: Earth connection
- Neutral: Neutral input
- Phase 1: Phase 1 input
- Phase 2: Phase 2 input
- Phase 3: Phase 3 input

**Current sense connector.** These are the pins:

- CT Phase 3: Phase 3 current sense input
- CT Phase 2: Phase 2 current sense input
- CT Phase 1: Phase 1 current sense input

**RJ-45 connector.** Ethernet port.

**RS-485 connector.** It is used to communicate to other devices using the RS-485 bus, mainly to MR-4850 and MR-4859.

**PLC Signal connector.** It is used to plug the external Coupling unit.

**3G Antenna connector.** SMA connector to plug a 3G antenna.

**SIM connector.** Connector to insert a SIM card.

**SD connector.** This is a connector to insert a SD card. It is not accessible from the outside of the Device. It is used to update the software.

The device is supplied with three additional cable connectors, where voltage, current sense and RS-485 bus cables shall be inserted. Depending on the model, all the connectors will be available or not.



## 2. Technical Specifications

### Input

Input voltage range (1-phase) (VAC):	100 ~ 277 VAC
Input frequency:	50 ~ 60Hz
Power factor:	> 0.80
Maximum power consumption:	15 W

### Ethernet

Throughput:	10 / 100 Mbps
MDI / MDIX	Yes
Full Duplex	Yes

### PLC Bandwidth

Initial frequency:	2 MHz
Final frequency:	12 MHz
Bandwidth:	10 MHz

### 3. Environmental data

Usage for open type applications:

- IEC<sup>1</sup> 60529, IP-65.
- Nema<sup>2</sup>, Type-1.

Operating temperature range: -25 °C ~ 55°C.  
Storage temperature range: -25 °C ~ 85°C.  
Maximum temperature at the case: 55 °C

### 4. Dimensions and Weight

These are the dimensions and the weight:

- Dimensions: 105 mm (Width) x 316 mm (Length\*) x 30 mm (Height).
- Weight: 900 g.

**\*NOTE: Length does not include the external connectors neither the 3G antenna**

The Head End is located within a housing of aluminum with two plastic lids bolted to the sides.

The serial number, MAC, electrical specifications and the connectors pin-outs are drawn at the aluminum to ease the installation.

### 5. Certificaciones

Teslights, LLC certifies that the device meets the requirements of the following directives:

2006/95/CE	EN 60950-1:2006 + A11:2009 EN 60529:1991 + A1:2000
2004/108/CE	EN 55022:2006 + A1:2007 EN 55024:1998 + A1:2001 + A2:2003 EN 61000-3-2:2006 EN 61000-3-3:2008 EN 61547:1995: A1:2000 TGN 17 v2.0

1. International Electrotechnical Commission, 3 Rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland  
2. National Electrical Manufacturers Association, 1300 North 17th Street, Rosslyn, VA 22209





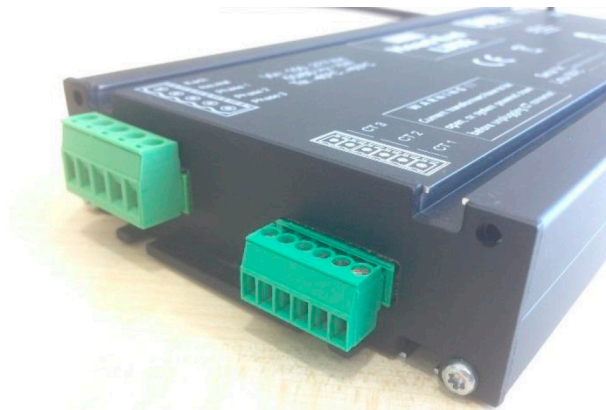
## 6. Installation guide

The Head End is installed within an electrical cabinet, where it is not accessible from the outside. It shall be watertight. The installation process will be performed without powerline mains voltage, so first of all the input switch shall be turned Off, then, please check there is no voltage.

**NOTE: The pictures in the following sections of the installation process may vary slightly from the supplied device. It could be a similar or an improved model.**

### 6.1 Single-phase / three-phase power line connection

There's a cable connector for the voltages inputs (Earth, Neutral and Three-Phases). One cable for each net will be used



*NOTE: In the photo, the input voltage connector and the input current sensors one are shown.*

The European Union Low Voltage Regulation requires that all cables entering terminals include wire ferrule terminals. They shall be well screwed at the connector and no fine thread shall be loosed to prevent short circuits.



After that, the connector will be plugged.

The others ends of the cables shall be screwed at main circuit breaker outputs of the electrical cabinet. Once again, wire ferrule terminals are required.

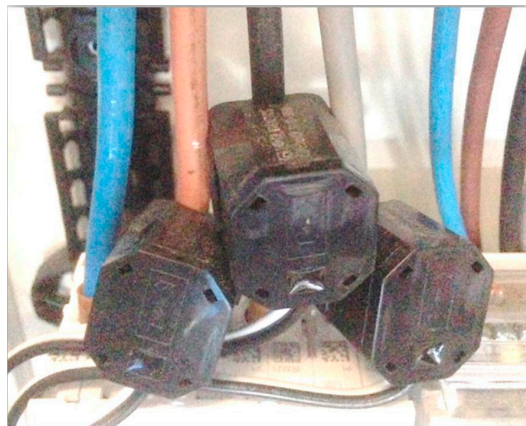
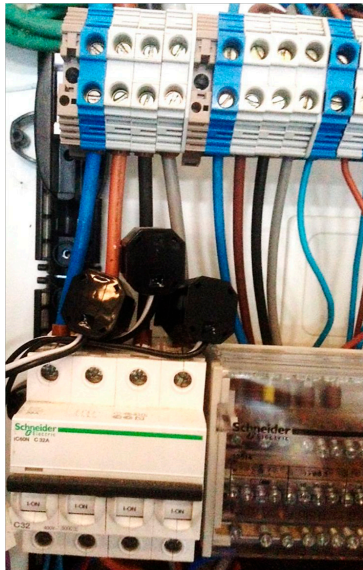
The "PLC Injection Techniques in Low Voltage Power Lines" Application Note explains how to power the Head End in the best location in the electrical cabinet.

## 6.2 Current transformers connection

For electricity metering, three current transformers are provided (in the devices which include this feature), which will be located at the entrance of the electrical cabinet, after the main circuit breaker, embracing the three phases cables. Neither neutral nor earth cables will be sensed.

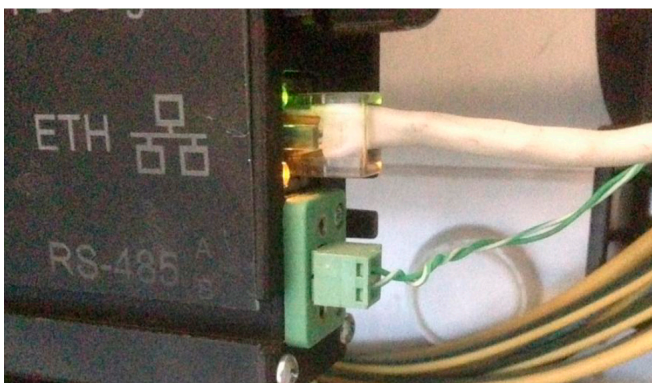
The output wires of these transformers will be well screwed at the current sense connector, using wire ferrule terminals. It is very important to locate the three sensors in the same metering direction, so current sense will be coherent. Otherwise, one sensor could be positive and other/s negative.

**WARNING:** Once the current transformers are installed and the connector plugged, they never shall be disconnected without disconnecting the mains voltages at the electrical cabinet. Otherwise the Head End could be damaged.

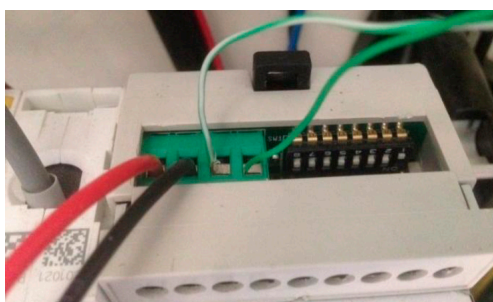


## 6.3 RS-485 Connection

The RS-485 communication uses two wires. That's a differential signal used mainly to control one MR-4850 or MR-4857. This wires shall be screwed at the connector.



The other ends of the wires will be screwed directly at the MR48xx corresponding signal terminals.



## 6.4 3G Antenna installation

Head End devices which include 3G / WIFI features have an antenna plugged by default. However, in some cases, the 3G coverage is quite low, or metallic electrical cabinets are used, which attenuate the radio frequency phone signal. In that case, the antenna can be removed, and another with greater gain can be installed, even outside of the cabinet.

## 6.5 PLC connection

An external Coupling unit will be connected to the signal PLC input/output connector. The output cables (blue and brown cables) of the coupling unit shall be connected to the power line.



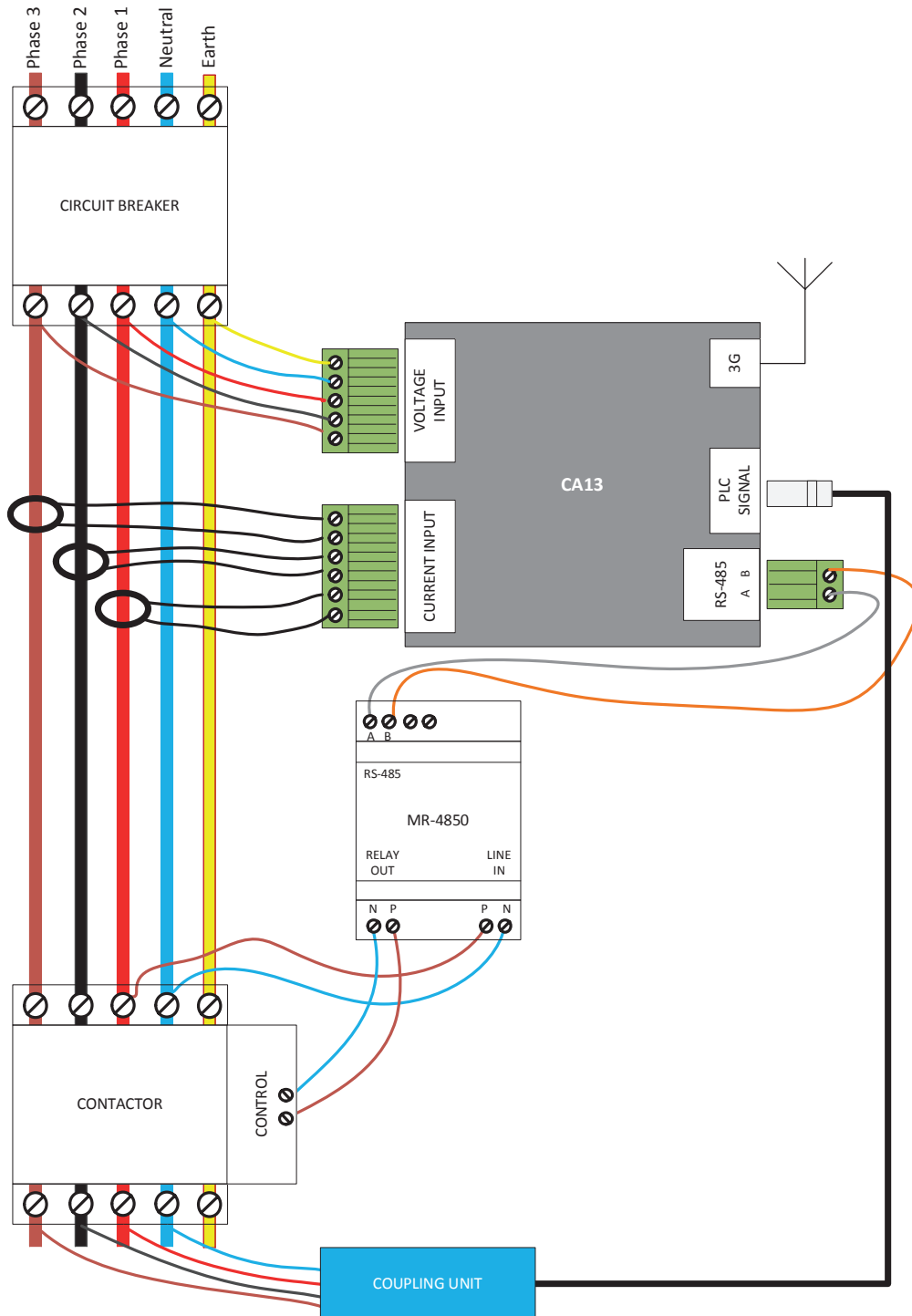
The "PLC Injection Techniques in Low Voltage Power Lines" Application Note explains how to connect the coupling unit to the best location in the electrical cabinet.

Basically, the power supply will be connected upstream, at the input of the cabinet, and the coupling unit downstream, as close as possible at the output terminals.

Depending on whether it is a single-phase or three-phase power line, a single or three-phase coupling unit will be used.

## 6.6 Installation example. CA13 Head End and MR-4850

The following picture illustrates how to connect a CA13 Head End to a MR-4850 in a three-phase electrical cabinet. The MR4850 device controls the opening and closing of the output contactor to the streetlights. The MR4850 power supply is connected between a phase and the neutral cables. Never connect it between two phases. The Coupling unit will be connected at the outputs of the outputs contactor.



## 7. Cautions and warnings

- Do not install if the device is damaged. Inspect the enclosure for obvious defects such as cracks in the housing.
- This device does not include replaceable or interchangeable elements, so it must not be manipulated.
- If the device is installed or used in a manner not specified in this document, the safety of the device may be impaired.
- If the device works abnormally, proceed with caution. The safety of the device may be impaired.
- Do not install the device near combustible gas.
- Do not install the device in an electrical service with current or voltage outside of the specified power range.
- Do not power the device if open.
- Beware of working around this device when the main voltage is powered.
- Check that all connections are reliable and correct before powering the device to the mains voltage.
- Reed instructions shown in the connection diagrams.

## 8. Product Limited Warranty

Teslights, LLC Concepts warrants its equipment for 1 year from the ship date against defects in material or workmanship when installed in accordance with manufacturer's instructions by qualified personnel.

This warranty does not cover installation, removal, installation or labor costs and excludes normal wear and tear. The warranty does not cover a product which has been altered from its original manufactured condition due to faulty installation, tampering, accident, neglect, abuse, force majeure or abnormal conditions of operation.

The obligation under this warranty is limited to repair and/or replacement, at Teslights, LLC option, of the manufactured product and in no event shall Teslights, LLC be liable for consequential or incidental damages.

Please read Teslights' "General Terms and Conditions".

## 9. Release Dates

Manual	Revision	Date
CA10	01	19/01/2016