



*Catalog*  
**CRS**  
**Resistive**  
**Silicone Sensor**

Voltage Detectors  
for DC Catenary



## Resistive Silicone Sensor

- ✓ Voltage presence detector for catenary **V<sub>DC</sub>**
- ✓ Models from **750 V<sub>DC</sub>** to **4.000 V<sub>DC</sub>**
- ✓ **Aluminum** terminals and **Silicone** outer coating
- ✓ Leakage Line: **618mm**
- ✓ Output Options:
  - **Reed Relay**
  - **CBI21** – Output 4-20 mA
  - **FO** – Fiber Optic Output
  - **PTC-M1** – Current Voltage Presence Detector
  - **Led** – Light Indicator
  - **SMFR** – Semaphore
- ✓ Sensor weight: **1,2 Kg**
- ✓ Complete equipment weight: **2,25 Kg**
- ✓ **High resistance** to manipulation and vandalism
- ✓ Better weight, endurance, and shock resistance compared to epoxy-coated sensors
- ✓ Mounting accessories, waterproof case and **Stainless-Steel** screws with anti-vibration **Nord-Lock®** washers
- ✓ **Vertical assembly** with **M16** hexagonal screw adaptable to any installation, optional side support
- ✓ Optional SOP-008 for **beam anchoring for vertical mounting**. Adaptable to any installation. Approved by ADIF.



### Applications

Detection of DC Voltage presence in Railway Installations:

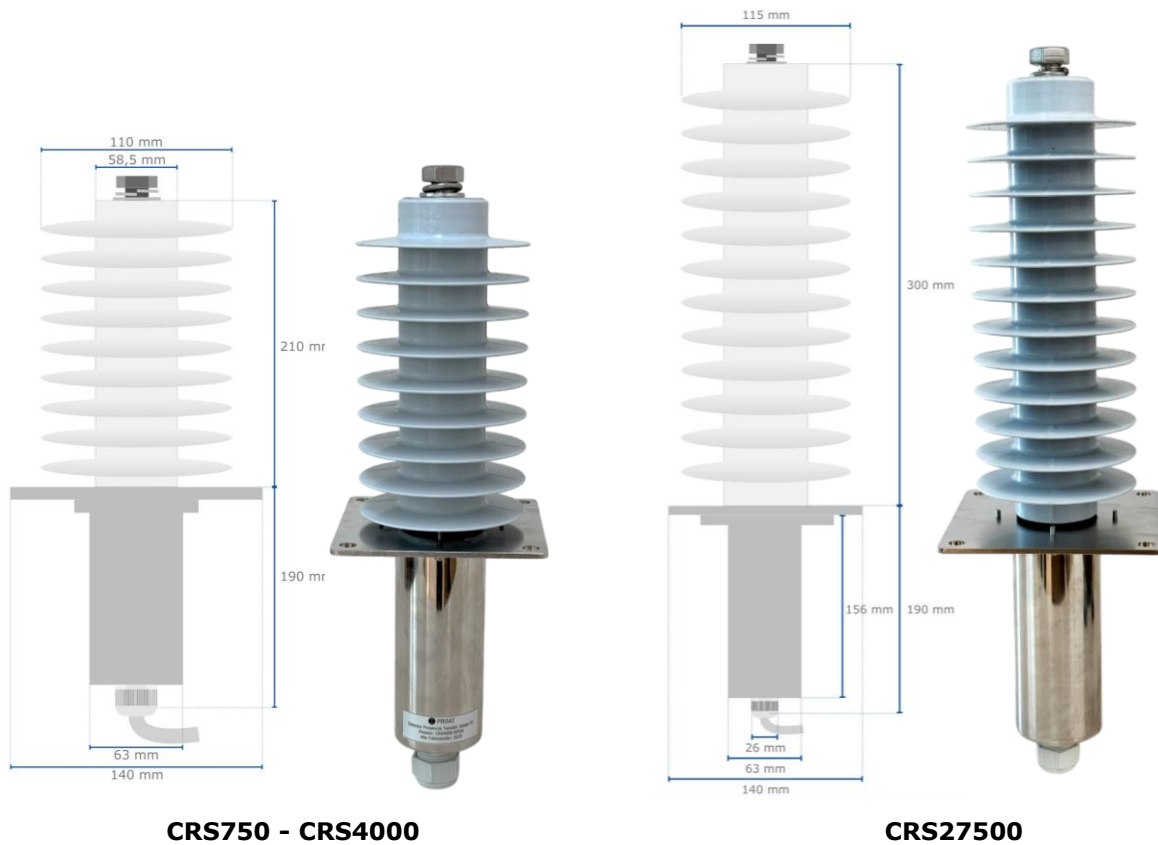
- Conventional Trains
- Metros
- Trams



## Models

| Model           | Voltage Service        | Supports 27,5 kV <sub>AC</sub> | Test 1 min 50 Hz                          | Leakage Line | Pollution Zone | Sensor's Height | Sensor Weight |
|-----------------|------------------------|--------------------------------|-------------------------------------------|--------------|----------------|-----------------|---------------|
| <b>CRS750</b>   | 0-750 V <sub>DC</sub>  | No                             | 4 kV <sub>DC</sub>                        | 618mm        | Average        | 210mm           | 1,2 kg        |
| <b>CRS1500</b>  | 0-1500 V <sub>DC</sub> | No                             | 5 kV <sub>DC</sub>                        | 618mm        | Average        | 210mm           | 1,2 kg        |
| <b>CRS3000</b>  | 0-3000 V <sub>DC</sub> | No                             | 10 kV <sub>DC</sub>                       | 618mm        | Average        | 210mm           | 1,2 kg        |
| <b>CRS4000</b>  | 0-4000 V <sub>DC</sub> | No                             | 10 kV <sub>DC</sub>                       | 618mm        | Average        | 210mm           | 1,2 kg        |
| <b>CRS27500</b> | 0-4000 V <sub>DC</sub> | Yes                            | 10 kV <sub>DC</sub> y 50 kV <sub>AC</sub> | 972mm        | Average        | 300mm           | 1,8 kg        |

## Measurements

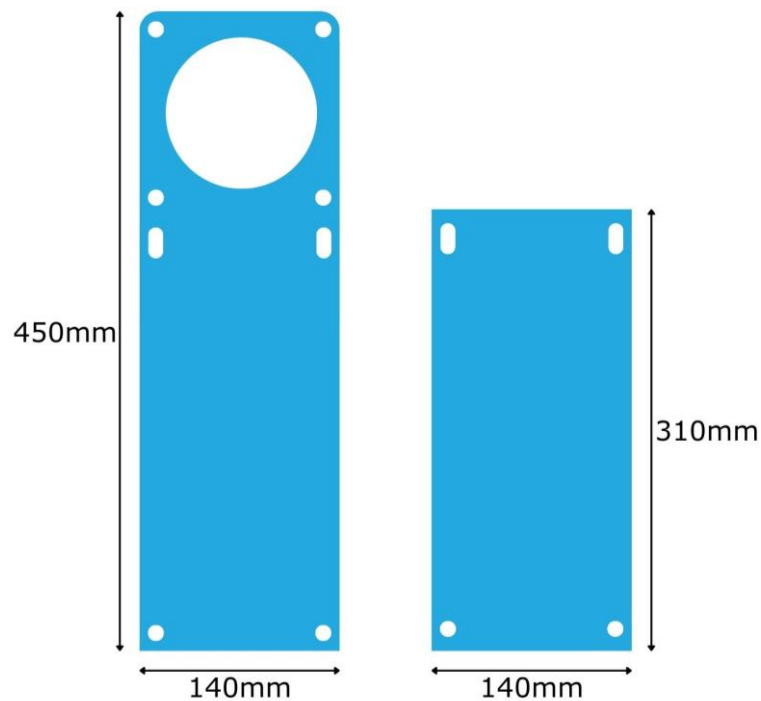
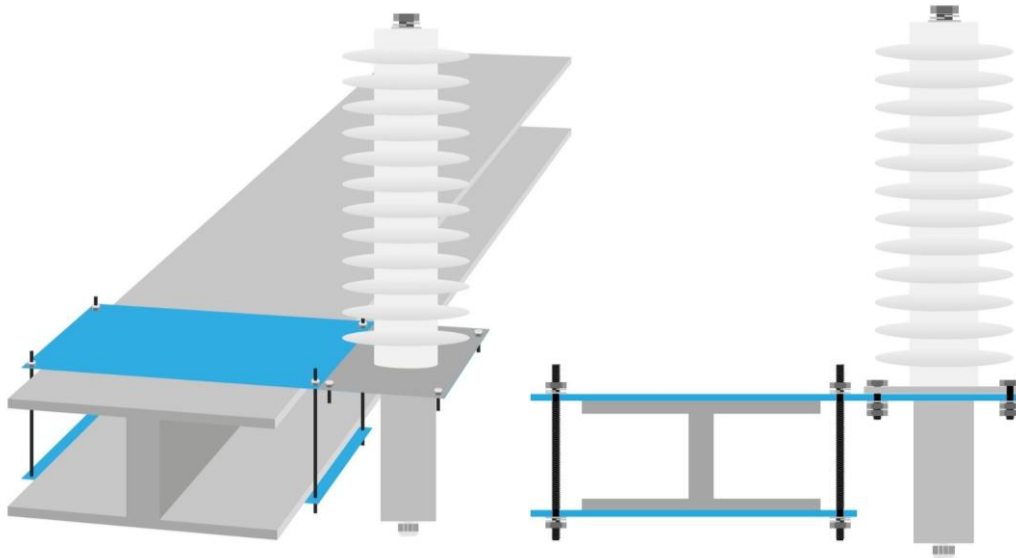


## Technical Data

| CRS                    |                       |
|------------------------|-----------------------|
| Silicone               | ISO 37                |
| Elongation upon impact | 630 %                 |
| Resistance to traction | 8,5 N/mm <sup>2</sup> |

## Support – SOP-008

- Bracket for **mounting beam anchor**
- Adaptable to any installation
- **Approved by ADIF**
- Made of hot-dip galvanized steel **UNE EN ISO 1461**



# **CRS + RL** **Resistive Silicone Sensor** **+** **Reed Relay Output**

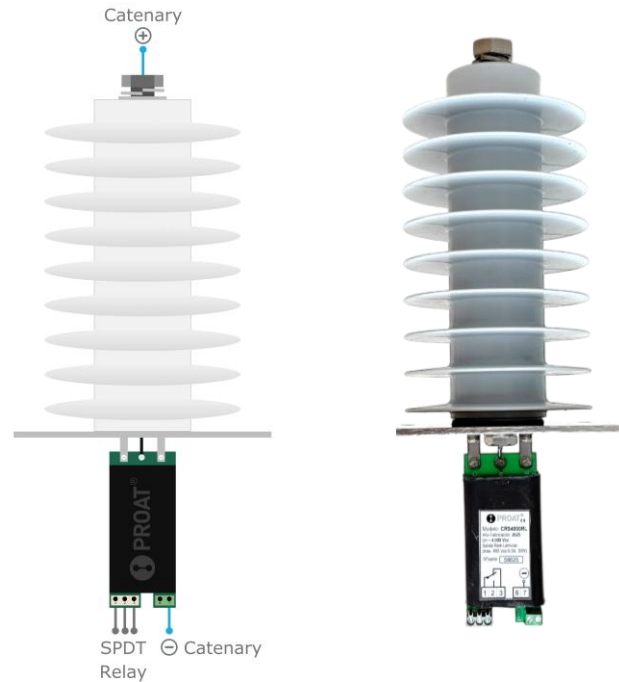
- ✓ Resistive Silicone Sensor **CRS**
- ✓ Reed Relay with **potential-free switched contact** output:
  - Activation at **>40%** of the nominal voltage
  - Deactivation at **<30%** of the nominal voltage
- ✓ **Self-powered** of the catenary voltage itself
- ✓ Very low power solution: **3mA**
- ✓ Response Time: **15ms**
- ✓ **Epoxy** coated circuit installed in waterproof case
- ✓ Approved by ADIF with Registration Number **64999051E** on 1-Sept-2016



## **Models**

| Model               | Nominal Voltage      | Leakage Line | Output     | Auxiliary Voltage |
|---------------------|----------------------|--------------|------------|-------------------|
| <b>CRS750 + RL</b>  | 750 V <sub>DC</sub>  | 618 mm       | Reed Relay | Self-powered      |
| <b>CRS1500 + RL</b> | 1500 V <sub>DC</sub> | 618 mm       | Reed Relay | Self-powered      |
| <b>CRS3000 + RL</b> | 3000 V <sub>DC</sub> | 618 mm       | Reed Relay | Self-powered      |
| <b>CRS4000 + RL</b> | 4000 V <sub>DC</sub> | 618 mm       | Reed Relay | Self-powered      |

## Connection



## Technical Data

### Reed Relay

| Specifications             |                                        |
|----------------------------|----------------------------------------|
| Contact Type               | SPDT                                   |
| Switching Capacity         | <60 VA                                 |
| Switching Voltage          | <400 V <sub>AC</sub> / V <sub>DC</sub> |
| Switching Current          | <1.0 A                                 |
| Transport/Carrying Current | <2.0 A                                 |
| Insulation Resistance      | >10 <sup>9</sup> Ω                     |
| Operating Temperature      | -40° a +125°                           |

## Tests

Tests **Norm UNE 21138**:

- Mechanical flexural strength tests: 20N
  - Dry lightning impulse withstand voltage tests

Tests **Norm UNE 600068**:

- Corrosion test

Otros tests:

- Operating Temperature

# **CRS + CBI21**

## Resistive Silicone Sensor

+

## Output 4-20mA

- ✓ Resistive Silicone Sensor **CRS**
- ✓ Current loop converter **CBI21** with isolated **4-20mA** output proportional to catenary voltage
- ✓ Auxiliary voltage **85-264 V<sub>AC</sub> | 85-370 V<sub>DC</sub> , 48 V<sub>DC</sub> , 24 V<sub>DC</sub>** depending on model
- ✓ CRS+CBI21 withstands lightning impulses up to **95kV**
- ✓ Epoxy coated circuit installed in waterproof case

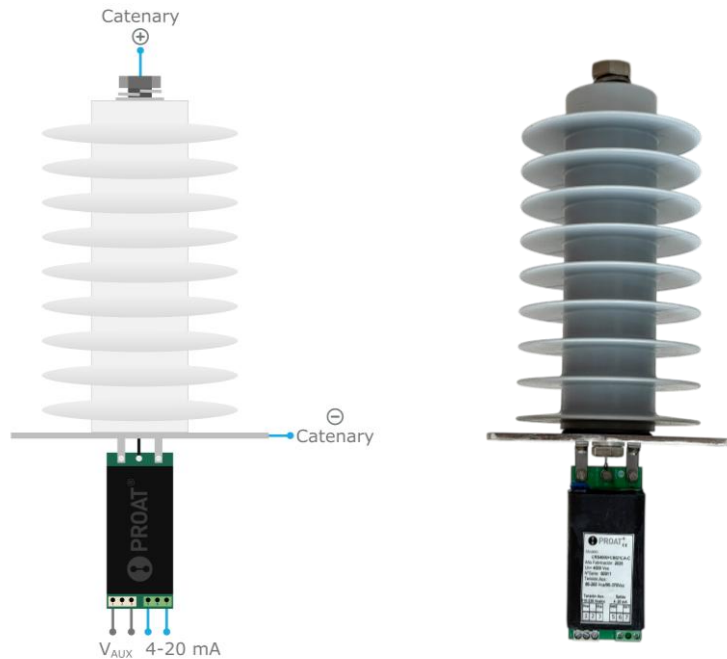


### **Models**

| Model              | Compatible Sensor | Output | Auxiliary Voltage                               |
|--------------------|-------------------|--------|-------------------------------------------------|
| <b>CBI21-CA</b>    | CRS750 to CRS4000 | 4-20mA | 85-264 V <sub>AC</sub>   85-370 V <sub>DC</sub> |
| <b>CBI21-CA-24</b> | CRS750 to CRS4000 | 4-20mA | 24 V <sub>DC</sub>                              |
| <b>CBI21-CA-48</b> | CRS750 to CRS4000 | 4-20mA | 48 V <sub>DC</sub>                              |
| <b>CBI21-FA</b>    | CRS27500          | 4-20mA | 85-264 V <sub>AC</sub>   85-370 V <sub>DC</sub> |
| <b>CBI21-FA-24</b> | CRS27500          | 4-20mA | 24 V <sub>DC</sub>                              |
| <b>CBI21-FA-48</b> | CRS27500          | 4-20mA | 48 V <sub>DC</sub>                              |

Example order: CRS4000 + CBI21-CA-24

## Connection



## Technical Data

### CBI21

| Specifications              |              |
|-----------------------------|--------------|
| Output (RL = 500 $\Omega$ ) | 4-20 mA      |
| Maximum load resistance     | 750 $\Omega$ |
| Linearity                   | 1%           |
| Accuracy                    | $\pm 1\%$    |
| Consumption                 | 3W           |
| Input-Output isolation      | 3kV          |
| Operating temperature       | -30° to +75° |

## Tests

### Tests **Norm UNE 21308-1:**

- Mechanical Testing
- Dry lightning impulse voltage tests
- Voltage tests supported at dry industrial frequency
- Voltage tests supported at industrial frequency in rain

### Tests **Norm UNE 600068:**

- Corrosion test

### Other Tests:

- Operating temperature
- Accuracy of voltage response

# **CRS + FO**

## Resistive Silicone Sensor + Fiber Optic Output

- ✓ Resistive Silicone Sensor **CRS**
- ✓ Fiber Optic Transmitter-Receiver **EFO** and **RFO**
- ✓ CRS+FO supports lightning impulses up to **95kV**
- ✓ The CRS + FO set is **ADIF** approved (DPA-FO) with reference number **2014/00067** on 29 January 2014

### **EFO – Emisor Fibra Óptica**

- ✓ **Light pulse** output proportional to catenary voltage
- ✓ Models for:
  - Fiber Optic with **SL connector** up to **100** meters
    - Fiber Optic with **ST connector** up to **5.000** meters
- ✓ Linearity: **±5%**
- ✓ **Self-powered or Auxiliary Voltage ±12V<sub>DC</sub>** depending on model
- ✓ Optional **FA1212** ±12V<sub>DC</sub> power supply for voltages **85-264 V<sub>AC</sub>** | **85-370V<sub>DC</sub>** with galvanic isolation input-output **18,5kV**

### **RFO – Fiber Optic Receiver**

- ✓ With **Real-time display** of catenary voltage for Din Rail models
- ✓ **2 potential-free** output contacts:
  - Presence of voltage – Programmable levels
  - Anomalies – Fiber Optic communication error
- ✓ **Programmable levels** of the presence and absence of voltage contact for Din Rail models
- ✓ **4-20mA** output proportional to the catenary voltage
- ✓ Installation on **Din Rail** o **Rack Submodule 19'** depending on model
- ✓ Auxiliary voltage **85-264 V<sub>AC</sub>** | **85-370V<sub>DC</sub>** or **24 V<sub>DC</sub>**



## Models – Fiber Optic Emitters

| Model          | Fiber Optic  | Auxiliary Voltage     |
|----------------|--------------|-----------------------|
| <b>EFO</b>     | SL Connector | Catenary Self-powered |
| <b>EFOA</b>    | SL Connector | ±12V <sub>DC</sub>    |
| <b>EFO-LD</b>  | ST Connector | Catenary Self-powered |
| <b>EFOA-LD</b> | ST Connector | ±12V <sub>DC</sub>    |

Example order: CRS4000 + EFOA with  
Power supply FA1212-18 and compatible receiver RFOA-D

## Models – Fiber Optic Receivers

| Model               | Fiber Optic  | Compatible Emitter | Installation       | Real Time Visualization | 4-20 mA Output | Output Contacts | Auxiliary Voltage                               |
|---------------------|--------------|--------------------|--------------------|-------------------------|----------------|-----------------|-------------------------------------------------|
| <b>RFO</b>          | SL Connector | EFO                | 19' Rack Submodule | No                      | No             | Yes             | 85-264 V <sub>AC</sub>   85-370 V <sub>DC</sub> |
| <b>RFO-D</b>        | SL Connector | EFO                | Din Rail           | Yes                     | Yes            | Yes             | 85-264 V <sub>AC</sub>   85-370 V <sub>DC</sub> |
| <b>RFO-D-24</b>     | SL Connector | EFO                | Din Rail           | Yes                     | Yes            | Yes             | 24 V <sub>DC</sub>                              |
| <b>RFOA</b>         | SL Connector | EFOA               | 19' Rack Submodule | No                      | No             | Yes             | 85-264 V <sub>AC</sub>   85-370 V <sub>DC</sub> |
| <b>RFOA-D</b>       | SL Connector | EFOA               | Din Rail           | Yes                     | Yes            | Yes             | 85-264 V <sub>AC</sub>   85-370 V <sub>DC</sub> |
| <b>RFOA-D-24</b>    | SL Connector | EFOA               | Din Rail           | Yes                     | Yes            | Yes             | 24 V <sub>DC</sub>                              |
| <b>RFO-LD</b>       | ST Connector | EFO-LD             | 19' Rack Submodule | No                      | No             | Yes             | 85-264 V <sub>AC</sub>   85-370 V <sub>DC</sub> |
| <b>RFO-D-LD</b>     | ST Connector | EFO-LD             | Din Rail           | Yes                     | Yes            | Yes             | 85-264 V <sub>AC</sub>   85-370 V <sub>DC</sub> |
| <b>RFO-D-LD-24</b>  | ST Connector | EFO-LD             | Din Rail           | Yes                     | Yes            | Yes             | 24 V <sub>DC</sub>                              |
| <b>RFOA-LD</b>      | ST Connector | EFOA-LD            | 19' Rack Submodule | No                      | No             | Yes             | 85-264 V <sub>AC</sub>   85-370 V <sub>DC</sub> |
| <b>RFOA-D-LD</b>    | ST Connector | EFOA-LD            | Din Rail           | Yes                     | Yes            | Yes             | 85-264 V <sub>AC</sub>   85-370 V <sub>DC</sub> |
| <b>RFOA-D-LD-24</b> | ST Connector | EFOA-LD            | Din Rail           | Yes                     | Yes            | Yes             | 24 V <sub>DC</sub>                              |

\* Other models can be manufactured upon request

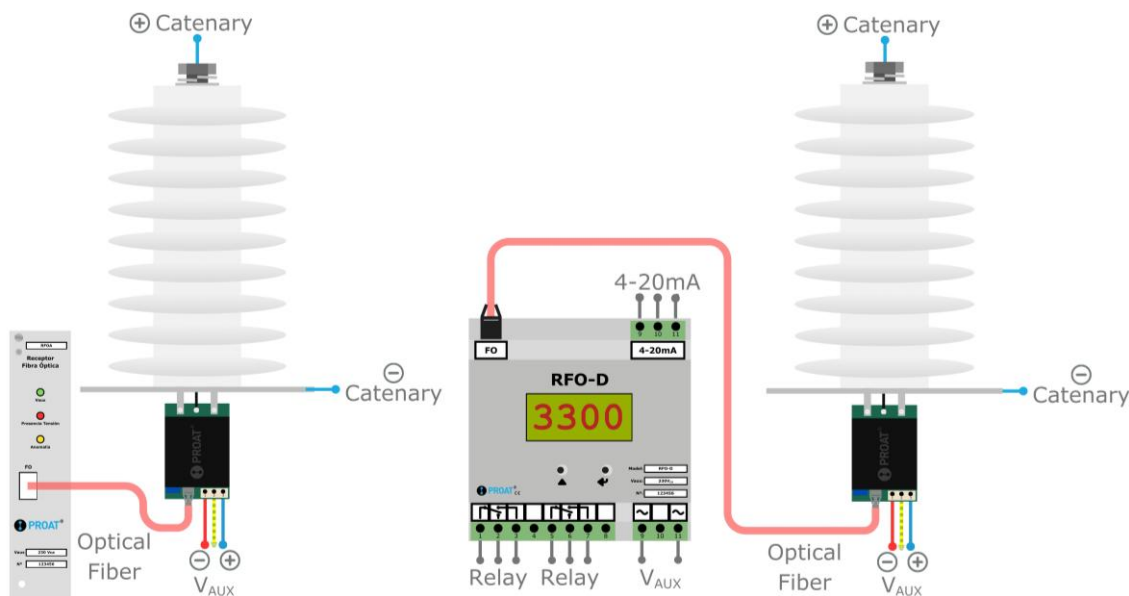
## Models – Fiber Optic Patch cords

| Model              | Connector    | Distance                              |
|--------------------|--------------|---------------------------------------|
| <b>LG-xxx</b>      | SL Connector | 5 to 100 meters models                |
| <b>LG-xxx-LD</b>   | ST Connector | 5 to 5,000 meters models              |
| <b>LG-xxx-LD-R</b> | ST Connector | 5 to 5,000 meters models - Reinforced |

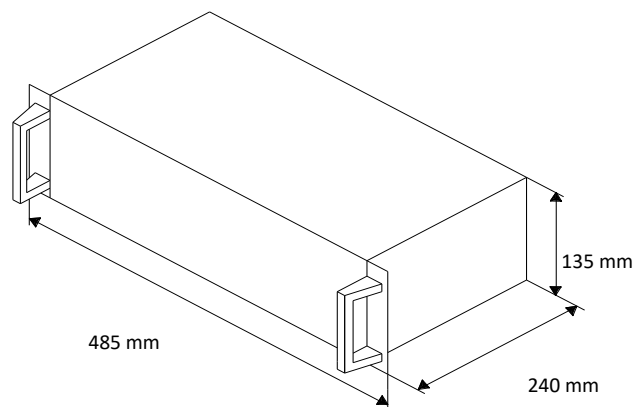
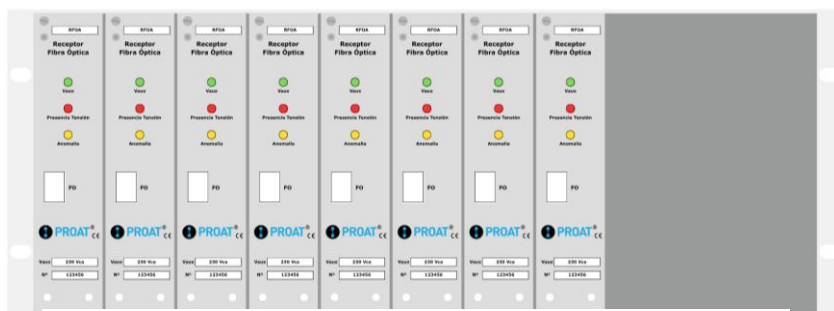
## Models – Power Supply

| Model     | Input                                          | Output             | Isolation Input-Output |
|-----------|------------------------------------------------|--------------------|------------------------|
| FA1212-18 | 85-264 V <sub>AC</sub>   85-370V <sub>DC</sub> | ±12V <sub>DC</sub> | 18,5 kV <sub>AC</sub>  |

## Connection



## 19' Rack mounting case for 12 Modules



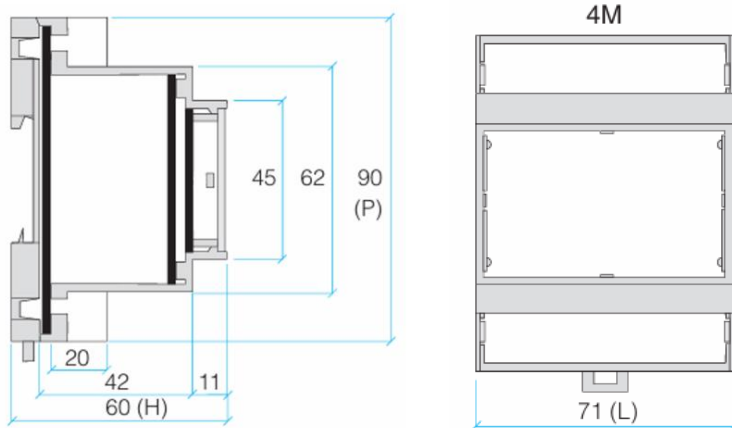
## Technical Data – RFO-D

### RFO-D

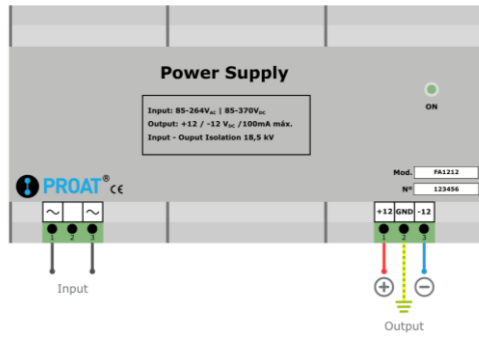
| Specifications            |                                               |
|---------------------------|-----------------------------------------------|
| Contact Type              | SPDT                                          |
| Switching Capacity        | 1000 VA                                       |
| Switching Voltage         | $\leq 230 V_{AC}$                             |
| Response Time             | $< 1s$                                        |
| Reading Range             | $0 - U_N + 10\%$                              |
| Auxiliary Voltage         | $85-264 V_{AC}   85-370 V_{DC}$<br>$24V_{DC}$ |
| Standby Power Consumption | $< 5W$                                        |
| Operating Temperature     | $-10^{\circ} a +60^{\circ}$                   |
| Regulations               | CE                                            |

## Constructive Characteristics – RFO-D

- DIN Rail installation
- Front Plate terminals
- Self-extinguishing plastic case class V0

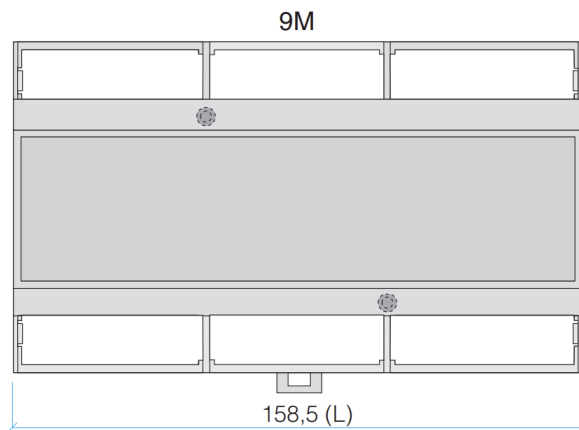
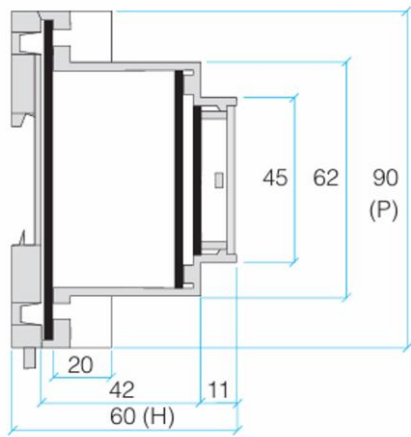


## ⚙️ Power Supply – FA1212



## ⚙️ Constructive Characteristics – FA1212

- DIN Rail installation
- Front Plate Terminals
- Self-extinguishing plastic case class V0



## ⚙️ Tests

Tests **Norm UNE 21138**:

- Mechanical flexion strength tests: 20N
- Dry lightning impulse withstand voltage tests

Tests **Norm UNE 600068**:

- Corrosion test

Other Tests:

- Operating Temperature

# **CRS + PTC-M1**

## Resistive Silicone Sensor

+

## Current Voltage Presence Detector

- ✓ Silicone Resistive Sensor **CRS**
- ✓ Remote signalling in electrical panel, for disconnectors or circuit breakers.
- ✓ **PTC-M1** amplifies the signal coming from a Resistive Sensor. Input **150 V<sub>DC</sub>**, activation with **>30%**
- ✓ Potential-Free Switched Contact **Output**
- ✓ Voltage indication by Red Led diode
- ✓ Auxiliary voltage **120-230 V<sub>DC</sub> | 120-230 V<sub>AC</sub> OR 48 V<sub>DC</sub>**  
Depending on the model
- ✓ Socket contacts **11 Pins, DIN rail mounting**



### Applications

Detection of the presence of **DC voltage** in Railway Installations:

- Conventional Trains
- Metros
- Trams

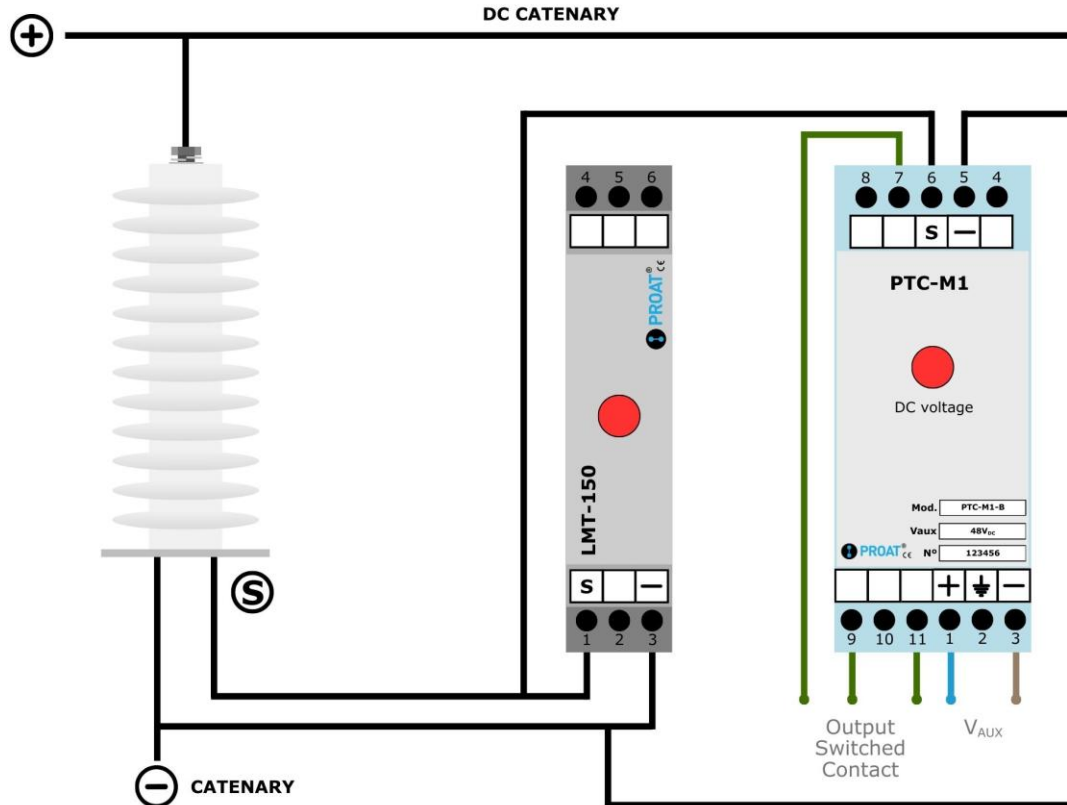


### Models

| Model            | Auxiliary Voltage                                 |
|------------------|---------------------------------------------------|
| <b>PTC-M1</b>    | 120-230 V <sub>DC</sub>   120-230 V <sub>AC</sub> |
| <b>PTC-M1-48</b> | 48 V <sub>DC</sub>                                |

Example of order: CRS1500 + PTC-M1

## Connection



## LMT-150 Limiter

The function of the LMT-150 limiter is to prevent the output voltage from remaining at non-hazardous levels (<150 V) when the PTC-M1 is disconnected from the base.

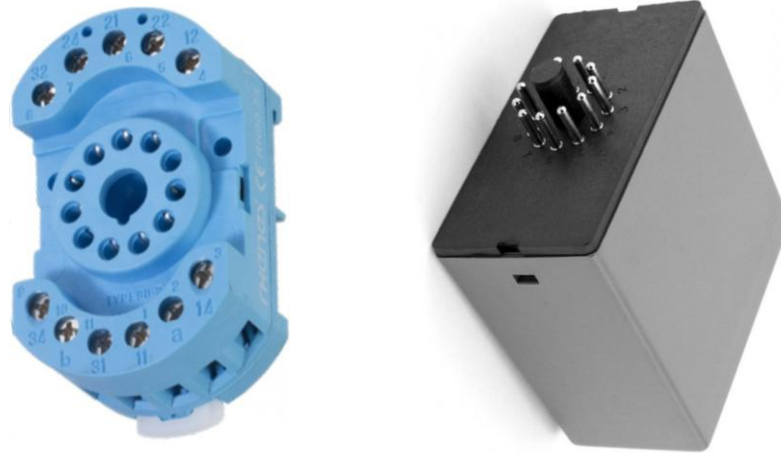
A red LED indicates the presence of voltage in the catenary.

| Model     | LED |
|-----------|-----|
| LMT-150   | No  |
| LMT-150-L | Yes |



## ❶ Constructive Characteristics– PTC-M1

- DIN rail installation
- UNDECAL base terminals
- Self-extinguishing plastic enclosure, class V0



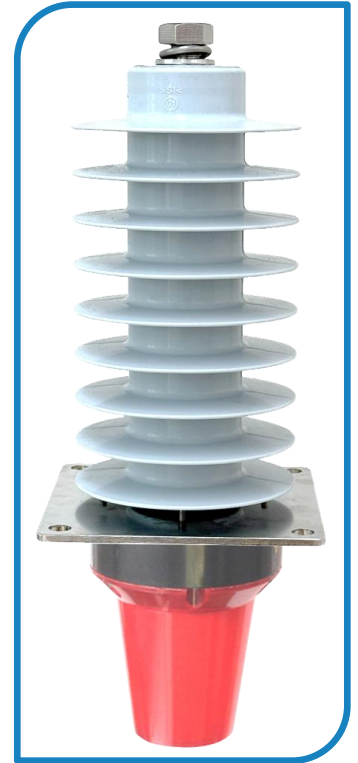
## ❷ Technical data – PTC-M1

| MODEL                                | PTC-M1                |
|--------------------------------------|-----------------------|
| <b>Technical data</b>                |                       |
| Input Voltage                        | 0-150 V <sub>DC</sub> |
| Presence detection level             | 30%                   |
| Quiescent consumption                | 1 W                   |
| Fault consumption                    | <2 W                  |
| <b>Standards complied with</b>       |                       |
| Insulation Test Voltage              |                       |
| High-frequency disturbances          |                       |
| Fast Transients                      |                       |
| Voltage Impulse                      |                       |
| <b>Relay Contact Characteristics</b> |                       |
| Continuous Current                   | 5 A                   |
| Switching Voltage                    | <230 V <sub>AC</sub>  |
| Switching Power                      | <2000 VA              |

# **CRS + LED**

## Resistive Silicone Sensor + LED Light Indicator

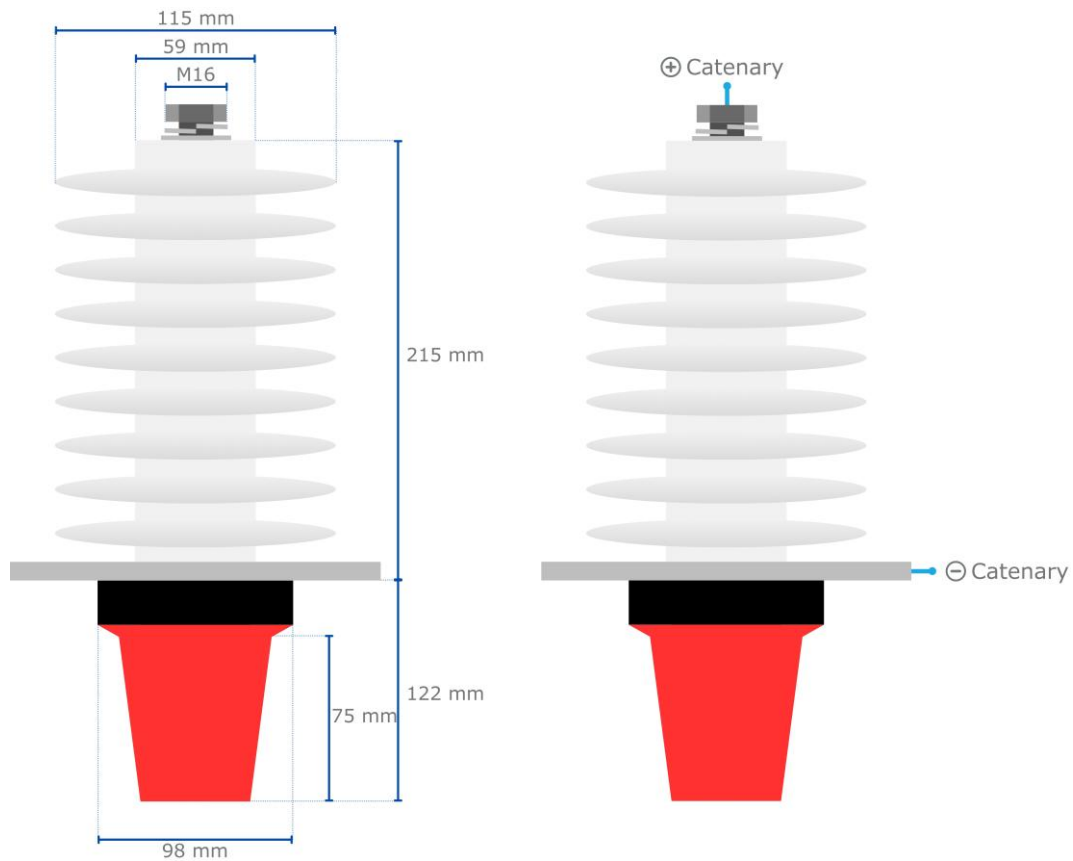
- ✓ Resistive Silicone Sensor **CRS**
- ✓ Control circuit and a **LED** flashing light lamp
- ✓ Black ABS base and Red translucent polycarbonate lampshade
- ✓ **Self-powered** from the catenary
- ✓ **Voltage signaling** in tunnels, workshops, etc. For maintenance or emergency tasks.
- ✓ Light indicator activation **> 30%** of nominal voltage
- ✓ Life of light cards **>50000 hours**
- ✓ **Epoxy** coated circuit installed in waterproof case



### **Models**

| Model                 | Voltage Service        | Auxiliary Voltage |
|-----------------------|------------------------|-------------------|
| <b>CRS750 + LED</b>   | 0-750 V <sub>DC</sub>  | Self-powered      |
| <b>CRS1500 + LED</b>  | 0-1500 V <sub>DC</sub> | Self-powered      |
| <b>CRS3000 + LED</b>  | 0-3000 V <sub>DC</sub> | Self-powered      |
| <b>CRS4000 + LED</b>  | 0-4000 V <sub>DC</sub> | Self-powered      |
| <b>CRS27500 + LED</b> | 0-25k V <sub>AC</sub>  | Self-powered      |

## ⚙ Measurements and Connection



## ⚙ Tests

Tests **Norm UNE 21138:**

- Mechanical flexion strength tests: 20N
- Dry lightning impulse withstand voltage tests

Tests **Norm UNE 60068:**

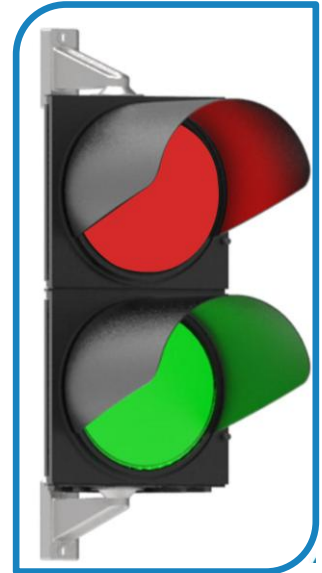
- Corrosion test

Other Tests:

- Operating Temperature

# **CRS + SMFR** **Resistive Silicone Sensor** + **Green/Red Semaphore**

- ✓ Capacitive Silicone Sensor **CRS** + **CBI21** for AC voltage measurement with output 4-20mA
- ✓ Semaphore Green/Red for catenary voltage signalling:
  - Optical LED high **luminosity** in  $\Phi$  200 mm
  - Enclosure color: **Dark Gray**
- ✓ Voltage **Presence Controller PTC-E1**:
  - Reading of the measures **4-20mA**
  - Signage **LED** of the measure
  - Signage **LED Independent** from Ignition and Anomalies
  - Output with **2 Potential-Free Switched Contacts**:
    - Voltage
    - Anomaly
  - Auxiliary voltage **85-264 V<sub>AC</sub> | 85-370 V<sub>DC</sub> or 24 V<sub>DC</sub>**

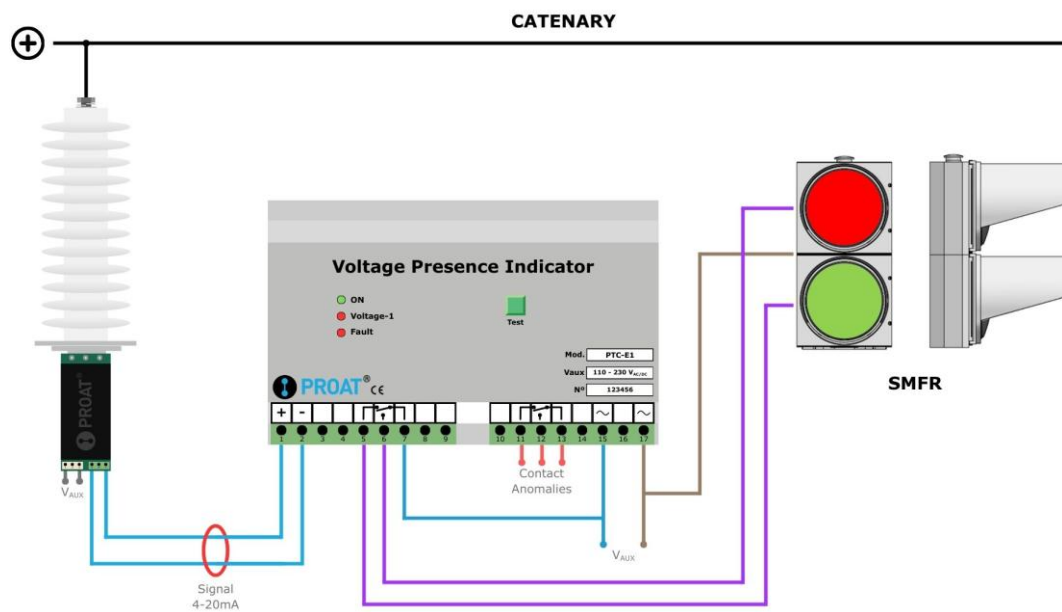


## **Models**

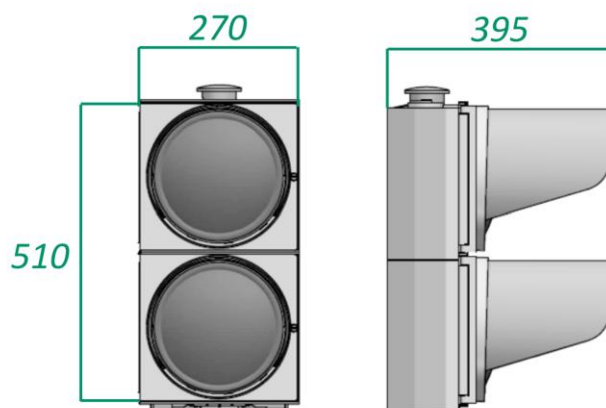
Configuration Options:

- **CRS** - Any Model
- **CBI21** - Any 4 Wire Model
- **PTC-E1** - Voltage Presence Controller PTC-E1
- **SMFR** - Green – Red semaphore
- **Semaphore Support** - Any Model

## Connection

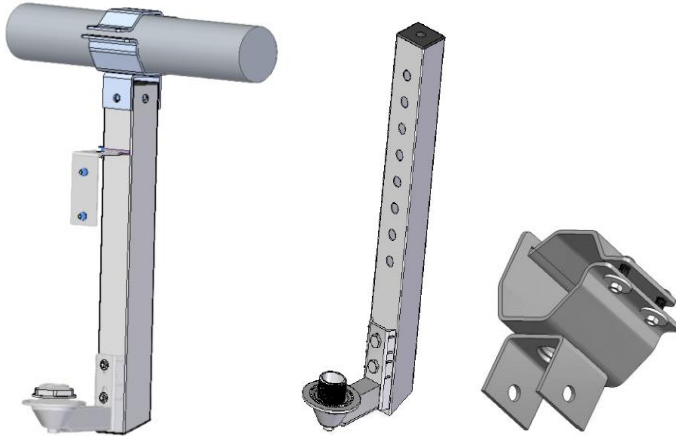


## Constructive Characteristics



### Support SOP-SMFR-001

- Support for anchoring on **Bracket of diameter 76mm**
- Made of **galvanized steel**

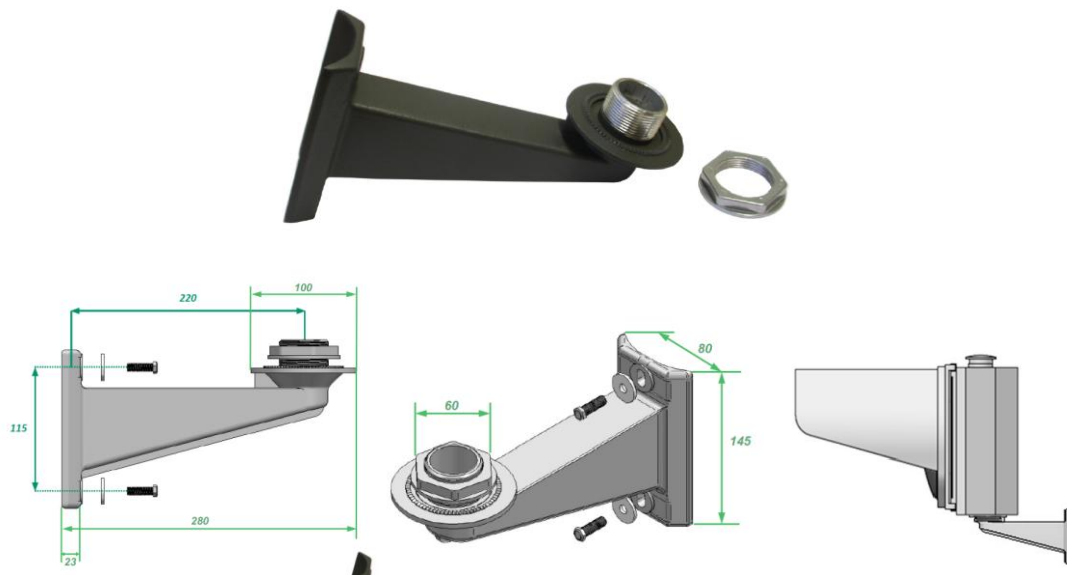


### Support SOP-SMFR-002

- Support for anchoring on wall or **column Ø 100 mm**
- Made of cast **aluminum**
- **Coated in powder polyester** polymerized at 230°C
- Fixing by 2 M-8 screws.
- Internal positioning and anti-rotation serration of the coupled semaphore head.
- Traffic light fixing by sleeve-nut assembly 1½" made of aluminum

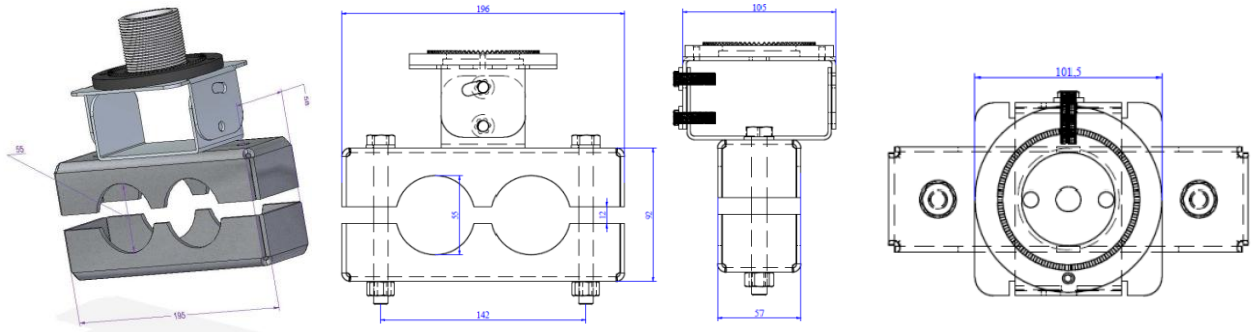
#### Advantages

- High mechanical strength
- High resistance to environmental conditions
- Its hollow structure allows the traffic light to be wired through it



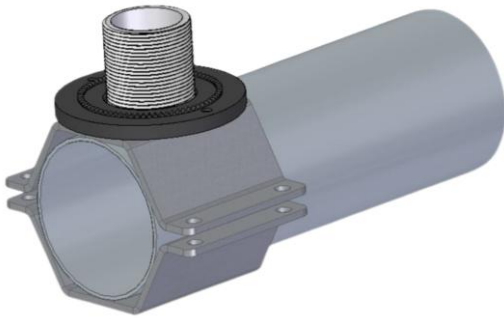
**Support SOP-SMFR-003**

- Support for anchoring on **Bracket of diameter 76mm**
- Made of **galvanized steel**



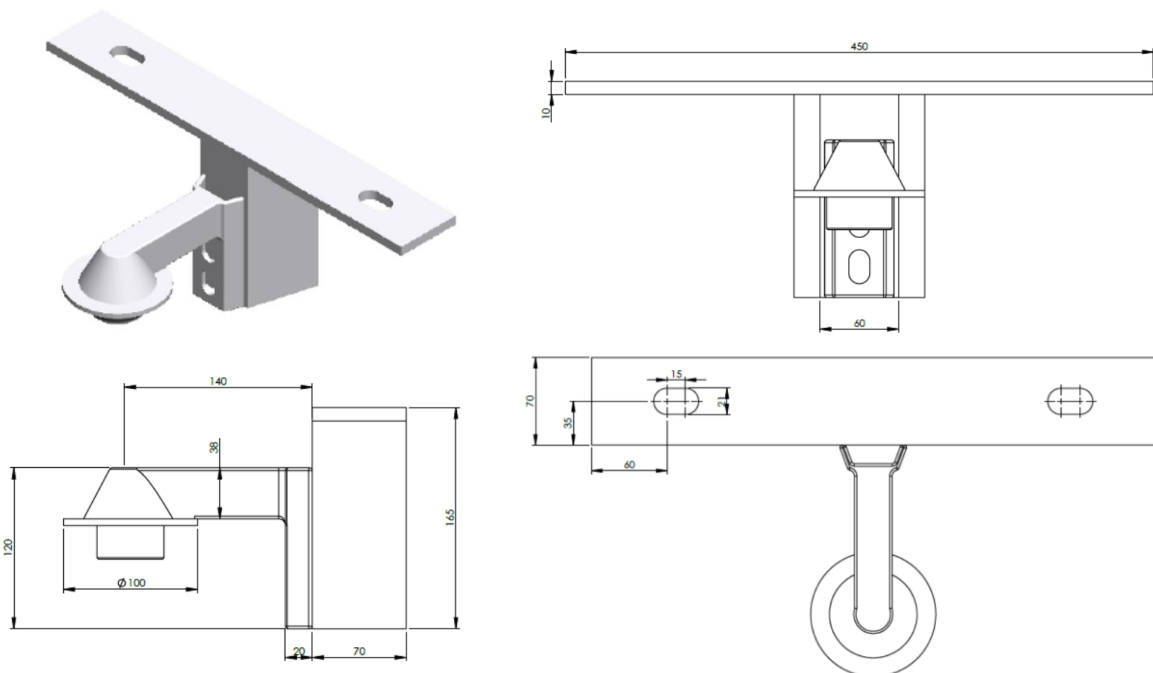
**Support SOP-SMFR-004**

- Support for anchoring on **Bracket of diameter 76mm**
- Made of **galvanized steel**



**Support SOP-SMFR-005**

- Support for **inverted ceiling anchoring**
- Made of **galvanized steel**



## Support SOP-SMFR-006

- Support for anchoring in **ceiling or vault**
- Made of **galvanized steel**



## Technical Data

### SFMR

| Case Specifications            |                                       |
|--------------------------------|---------------------------------------|
| Manufacturing material         | U.V. Colored stabilized polycarbonate |
| Environmental Protection Grade | IP55 (according to EN 60529)          |
| Degree of impact resistance    | IR3 (according to EN 60598)           |
| Electromagnetic Compatibility  | According to EN 50293                 |
| Operating Temperature          | -40°C a +60°C                         |
| Certificate and marking        | According to EN12368                  |
| Square Optics (PIL)            | 200 x 200 mm                          |
| Outside Size                   | 270 x 255 mm                          |
| LED Colors                     | Green, Red                            |

### PIL-200x200 PPC

| Specifications                              |                                                              |
|---------------------------------------------|--------------------------------------------------------------|
| Nominal Voltage                             | 125 V <sub>DC</sub> or 230 V <sub>AC</sub>                   |
| Consumption                                 | < 8W                                                         |
| Number of LEDs (Red, Amber or Green)        | 56                                                           |
| On/off reaction time                        | < 50 ms                                                      |
| Environmental requirements (EN 12368 – 5.1) | Class A, B, C (operating temperature of -30°C to + 70°C)     |
| Electromagnetic Compatibility (EMC)         | Meets standard requirements EN50278                          |
| Luminance Distribution (EN 12368 – 6.4)     | W A3/1                                                       |
| Luminance Uniformity (EN 12368 – 6.5)       | > 1:10                                                       |
| Ghost effect (EN 12368 – 6.6) *             | Class 4 (Red)      Class 4 (Amber)      Class 5 (Green)      |
| Colors of light signals (EN 12368 – 6.7)    | 620-630 nm (Red)    587-592 nm (Amber)    502-508 nm (Green) |
| Environmental Protection Grade (EN 60598)   | IP65                                                         |
| Degree of impact resistance (EN 60598-1)    | IR3                                                          |
| Front Lens Material                         | Stabilized transparent polycarbonate UV                      |
| Enclosure material                          | ABS black                                                    |

(\*) The ghosting effect occurs in halogen or incandescent traffic lights with the parabolic reflector, due to the reflection of the sun. Drivers could get confused and have the impression that the traffic light is on when it is not.



# OTHER ASSEMBLIES

## Models Adapted for Metropolitan Facilities

