PROAT®

Catalog

CRS

Resistive Silicone Sensor

DC Voltage Detectors

DC Voltage Detectors

up to 4000 V_{DC}

Description

✓ **DC Voltage Detectors** are DC voltage monitoring and measurement devices designed to continuously supervise the status of an electrical installation.

✓ They measure the **DC voltage level**, detect **voltage presence, absence, overvoltage or undervoltage conditions**, and generate the signals and alarms required to facilitate installation monitoring and diagnosis.

✓ They are particularly suitable for **railway and industrial applications, as well as DC power supply systems**.

✓ **DC Voltage Detectors** consist of a **CRS –Resistive Silicone Sensor** and one of the following outputs:

- **Reed Relay** – Changeover Contact
- **CBI21** – 4–20 mA Output
- **FO** – Fiber Optic Output
- **PTC-M1** – DC Voltage Presence Detector
- **LED** – Light Indicator
- **SMFR** – Signal Light

Applications

Detection and Measurement of **DC Voltage** in Railway Installations and Electrical Installations:

- Conventional Trains
- Metros
- Trams
- Power Lines
- Industrial Installations

Voltage Detectors for Catenary

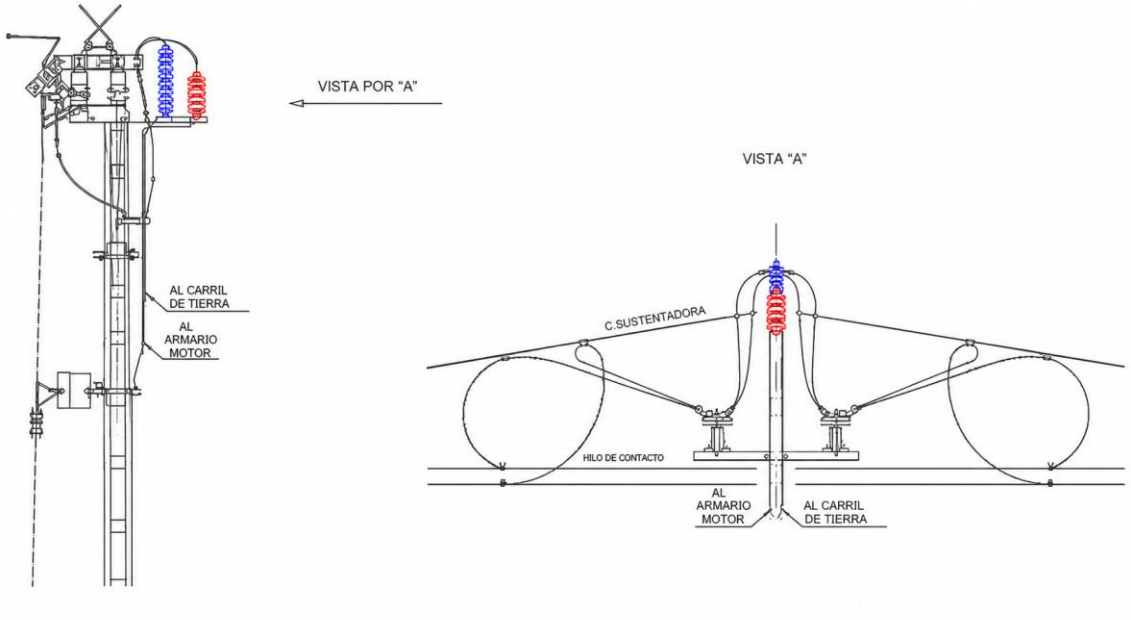
Continuous Monitoring

1 CRS/CCS
Catenary voltage detectors

2 Remote control cabinet
Data acquisition

3 Control center
Real-time monitoring

Assembly Diagram



CRS

Resistive Silicone Sensor

- ✓ **DC** Detection and Measurement up to **4,000 V_{DC}**
- ✓ **Aluminum** terminals and **Silicone** outer coating
- ✓ Creepage Distance: **618 mm**
- ✓ CRS4000 sensor only weight: **1.2 kg**
- ✓ Complete CRS4000 equipment weight: **2.25 kg**
- ✓ **High resistance** to manipulation and vandalism
- ✓ Lower weight, improved resistance and better impact durability than epoxy sensors
- ✓ Mounting accessories, waterproof enclosure, screws, and hardware in **stainless-steel**, with **Nord-Lock®** anti-vibration washers
- ✓ Cable gland or conduit gland, depending on the model.
- ✓ **Vertical mounting** with **M16** hexagonal screw adaptable to any installation
- ✓ Optional **mounting bracket** for **beam** or **catenary** attachment for vertical installation, adaptable to any installation

Models

Model	Voltage Service	Supports 27.5 kV_{AC}	Test 1 min 50 Hz	Creepage Distance	Pollution Zone	Sensor's Height	Sensor Weight
CRS750	0-750 V_{DC}	No	4 kV_{DC}	618 mm	Medium	210 mm	1.2 kg
CRS1500	0-1500 V_{DC}	No	5 kV_{DC}	618 mm	Medium	210 mm	1.2 kg
CRS3000	0-3000 V_{DC}	No	10 kV_{DC}	618 mm	Medium	210 mm	1.2 kg
CRS4000	0-4000 V_{DC}	No	10 kV_{DC}	618 mm	Medium	210 mm	1.2 kg
CRS27500	0-4000 V_{DC}	Yes	10 kV_{DC} and 50 kV_{AC}	972 mm	Medium	300 mm	1.8 kg

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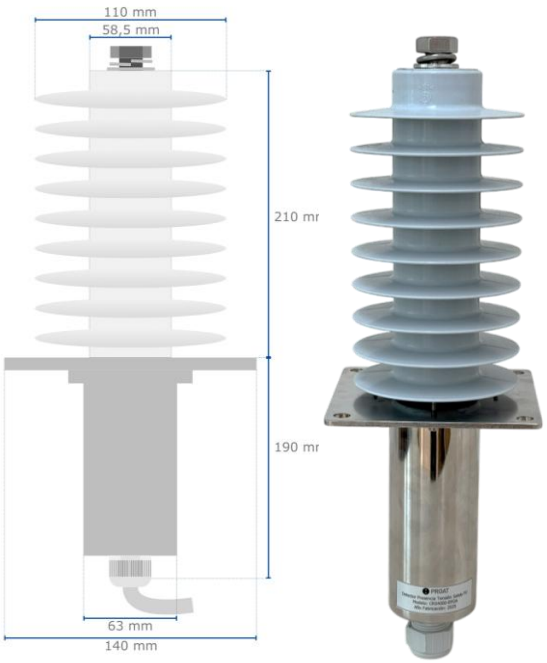
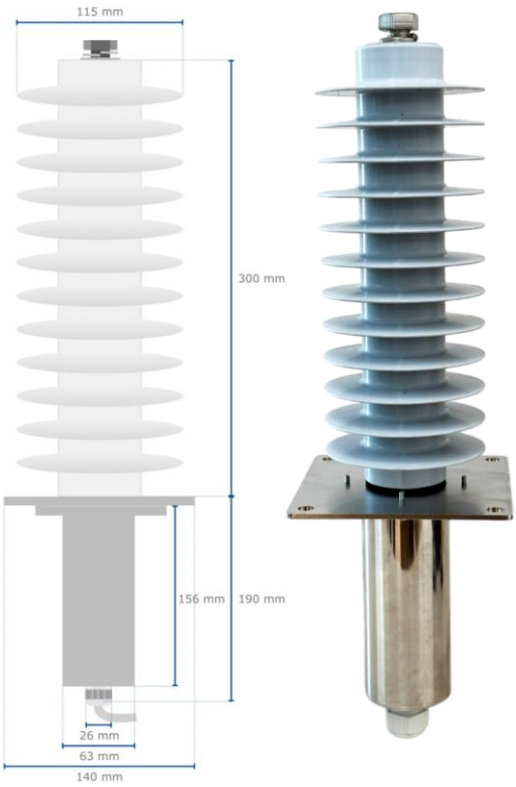
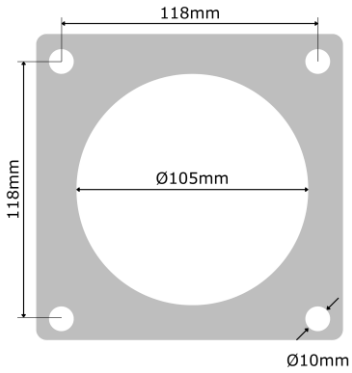
Dimensions



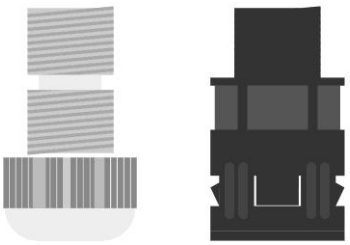
CRS750 - CRS4000



CRS27500



Detector Base



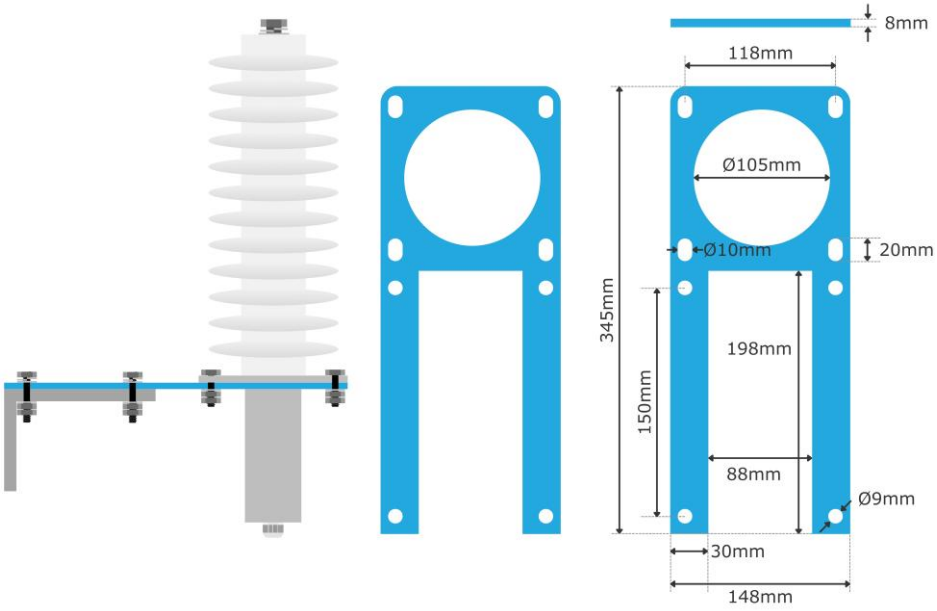
Cable or **Conduit Gland**

Technical data

	CRS
Specifications	
Silicone	ISO 37
Elongation at break	630 %
Tensile strength	8.5 N/mm^2

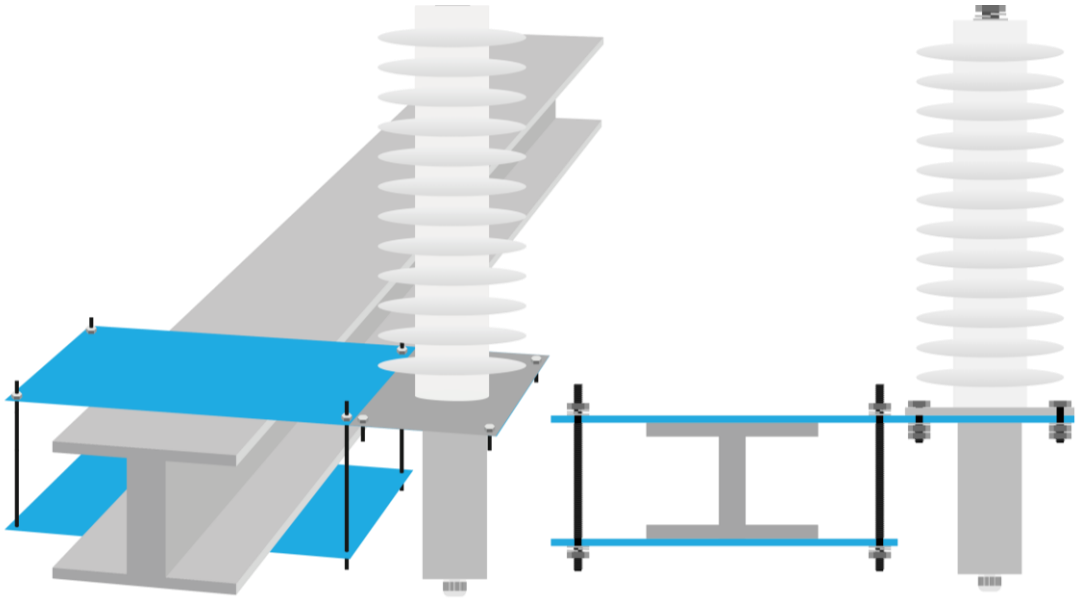
Mounting Bracket – SOP-006

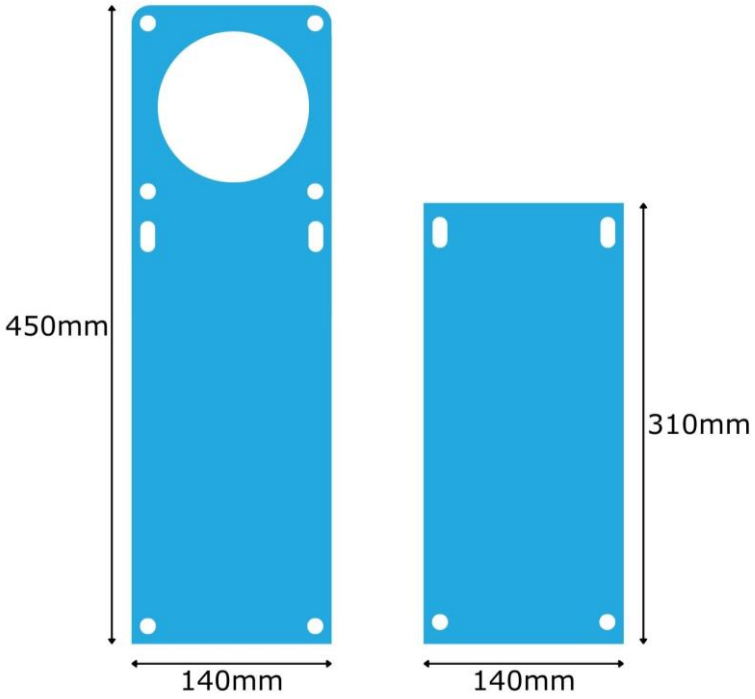
- Zinc-plated mounting Bracket kit for **catenary attachment**
- Adaptable to any installation



Mounting Bracket – SOP-008

- Galvanized mounting bracket kit and stainless-steel screws for **beam mounting**
- Adaptable to any installation
- Approved by ADIF
- Made of hot-dip galvanized steel **UNE-EN ISO 1461**




450mm
140mm
310mm
140mm

CRS + RL

Resistive Silicone Sensor

+

Reed Relay Output

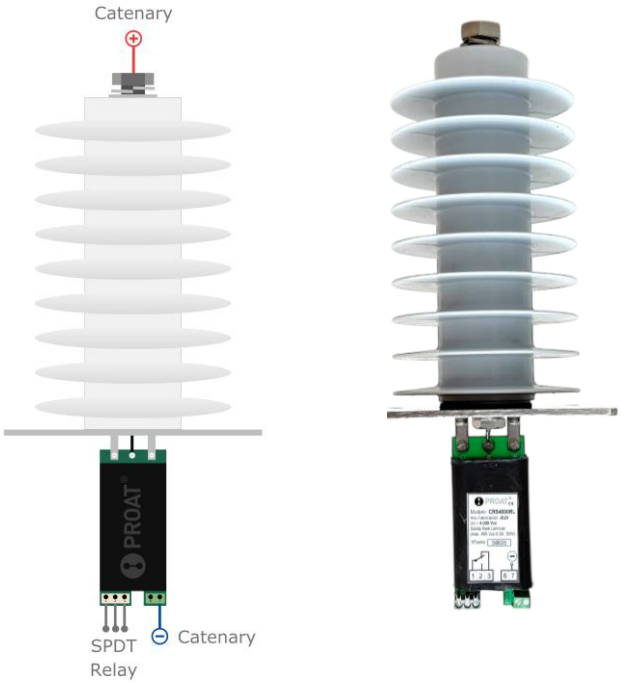
- ✓ Resistive Silicone Sensor **CRS**
- ✓ Reed Relay with **potential-free changeover contact** output:
  - Activation at **> 40%** of the nominal voltage
  - Deactivation at **< 30%** of the nominal voltage
- ✓ **Self-powered** by the catenary voltage
- ✓ Very low power solution: **3 mA**
- ✓ Response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

Models

Model	Nominal Voltage	Leakage Line	Output	Auxiliary Voltage
CRS750 + RL	750 V_{DC}	618 mm	Reed Relay	Self-powered
CRS1500 + RL	1500 V_{DC}	618 mm	Reed Relay	Self-powered
CRS3000 + RL	3000 V_{DC}	618 mm	Reed Relay	Self-powered
CRS4000 + RL	4000 V_{DC}	618 mm	Reed Relay	Self-powered

*Custom electrical panels with CRS+RL equipment can be manufactured upon request

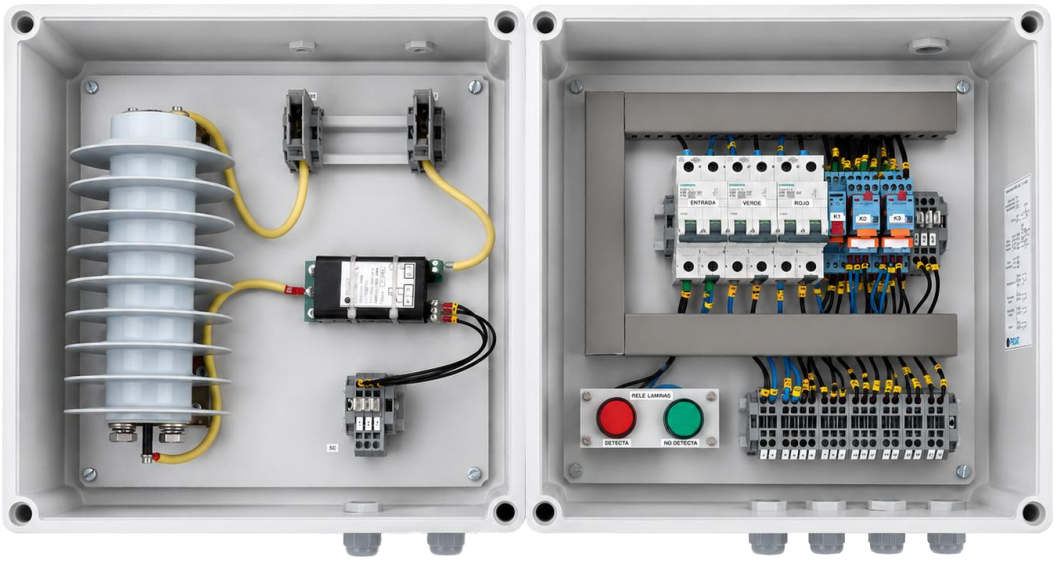
Wiring



Technical data

	CRS + Reed Relay
Specifications	
Contact type	SPDT
Switching capacity	< 60 VA
Switching voltage	< 400 V_{AC} / V_{DC}
Switching current	< 1.0 A
Max switching power	< 40 W
Carry current	< 2.0 A
Insulation resistance	$>10^9$ Ω
Operating temperature	-40º C to +125º C
Tests	
UNE 21138 Standard	Mechanical bending resistance tests: 20 N
	Dry lightning impulse withstand voltage tests
UNE 60068 Standard	Corrosion test
Other tests	Operating temperature test

CRS + RL Electrical Panels



CRS + CBI21

Resistive Silicone Sensor

+

4-20 mA Output

- ✓ Resistive Silicone Sensor **CRS**
- ✓ **CBI21** current loop converter with isolated **4-20 mA** output proportional to catenary voltage
- ✓ Auxiliary voltage **85-264 V_{AC} | 85-370 V_{DC}, 48 V_{DC}, 24 V_{DC}** depending on model
- ✓ CRS+CBI21 withstands lightning impulses up to **95 kV**
- ✓ **Epoxy coated** circuit installed in waterproof enclosure

Models

Model	Compatible Sensor	Output	Auxiliary Voltage
CBI21-CA	CRS750 to CRS4000	4-20 mA	85-264 V_{AC} | 85-370 V_{DC}
CBI21-CA-24	CRS750 to CRS4000	4-20 mA	24 V_{DC}
CBI21-CA-48	CRS750 to CRS4000	4-20 mA	48 V_{DC}
CBI21-FA	CRS27500	4-20 mA	85-264 V_{AC} | 85-370 V_{DC}
CBI21-FA-24	CRS27500	4-20 mA	24 V_{DC}
CBI21-FA-48	CRS27500	4-20 mA	48 V_{DC}

Order Example: CRS4000 + CBI21-CA-24

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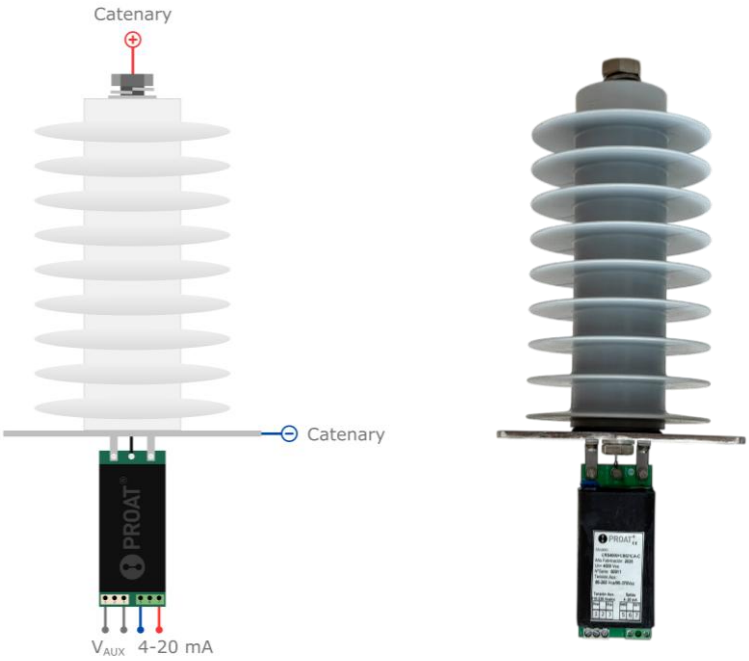
Wiring



Technical data

	CRS + CBI21
Specifications	
Output (RL = 500 Ω)	4-20 mA
Maximum load resistance	750 Ω
Linearity	1%
Accuracy	±1%
Power consumption	3 W
Input-Output isolation	3 kV
Operating temperature	-30º C to +75 º C
Tests	
UNE 21138 Standard	Mechanical bending resistance tests: 20 N
	Dry lightning impulse withstand voltage tests
	Dry power-frequency withstand voltage tests
	Wet power-frequency withstand voltage tests
UNE 60068 Standard	Corrosion test
Other tests	Operating temperature test
	Voltage measurement accuracy

CRS + FO

Resistive Silicone Sensor

+

Fiber Optic Output

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

EFO – Fiber Optic Transmitter

- ✓ **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 **5000** meters
- ✓ Linearity: **±2%**
- ✓ **Self-powered or Auxiliary Voltage ±12 V_{DC}** depending on model
- ✓ Optional **FA1212-18** ±12 V_{DC} power supply for voltages **85-264 V_{AC} | 85-370 V_{DC}** with galvanic isolation input-output **18.5 kV_{AC}**
- ✓ **Epoxy coated** circuit installed in waterproof enclosure

RFO – Fiber Optic Receiver

- ✓ **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

- ✓ **4-20 mA** output proportional to the catenary voltage
- ✓ Installation on **DIN Rail** or in a **19" Rack Submodule** depending on model
- ✓ Auxiliary voltage **85-264 V_{AC} | 85-370 V_{DC}** or **24 V_{DC}**

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Models – Fiber Optic Transmitters

Model	Fiber Optic	Auxiliary Voltage
EFO	SL Connector	Self-powered from the catenary
EFOA	SL Connector	±12 V_{DC}
EFO-LD	ST Connector	Self-powered from the catenary
EFOA-LD	ST Connector	±12 V_{DC}

Order Example: CRS4000 + EFOA with
Power supply FA1212-18 and compatible RFOA-D receiver
*Custom electrical panels with CRS+FO equipment can be manufactured upon request

Models – Fiber Optic Receivers

Model	Fiber Optic	Compatible Transmitter	Installation	Real-Time Display	4-20 mA Output	Output Contacts	Auxiliary Voltage
RFO	SL Connector	EFO	19" Rack Submodule	No	No	Yes	85-264 V_{AC} | 85-370 V_{DC}
RFO-D	SL Connector	EFO	DIN Rail	Yes	Yes	Yes	85-264 V_{AC} | 85-370 V_{DC}
RFO-D-24	SL Connector	EFO	DIN Rail	Yes	Yes	Yes	24 V_{DC}
RFOA	SL Connector	EFOA	19" Rack Submodule	No	No	Yes	85-264 V_{AC} | 85-370 V_{DC}
RFOA-D	SL Connector	EFOA	DIN Rail	Yes	Yes	Yes	85-264 V_{AC} | 85-370 V_{DC}
RFOA-D-24	SL Connector	EFOA	DIN Rail	Yes	Yes	Yes	24 V_{DC}
RFO-LD	ST Connector	EFO-LD	19" Rack Submodule	No	No	Yes	85-264 V_{AC} | 85-370 V_{DC}
RFO-D-LD	ST Connector	EFO-LD	DIN Rail	Yes	Yes	Yes	85-264 V_{AC} | 85-370 V_{DC}
RFO-D-LD-24	ST Connector	EFO-LD	DIN Rail	Yes	Yes	Yes	24 V_{DC}
RFOA-LD	ST Connector	EFOA-LD	19" Rack Submodule	No	No	Yes	85-264 V_{AC} | 85-370 V_{DC}
RFOA-D-LD	ST Connector	EFOA-LD	DIN Rail	Yes	Yes	Yes	85-264 V_{AC} | 85-370 V_{DC}
RFOA-D-LD-24	ST Connector	EFOA-LD	DIN Rail	Yes	Yes	Yes	24 V_{DC}

* Other models can be manufactured upon request

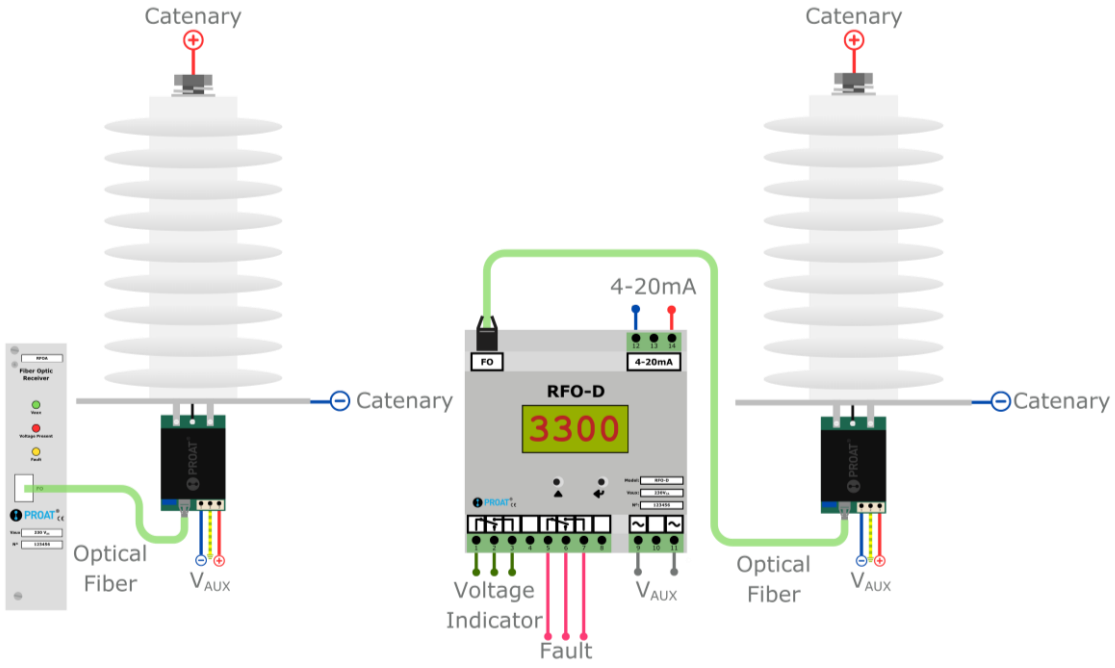
Models – Fiber Optic Patch cords

Model	Connector	Distance
LG-xxx	SL Connector	5 to 100 meters
LG-xxx-LD	ST Connector	5 to 5000 meters
LG-xxx-LD-R	ST Connector	5 to 5000 meters – Reinforced

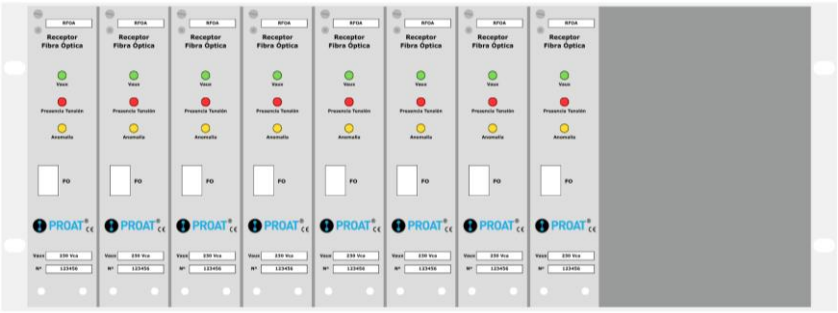
Models – Power Supply

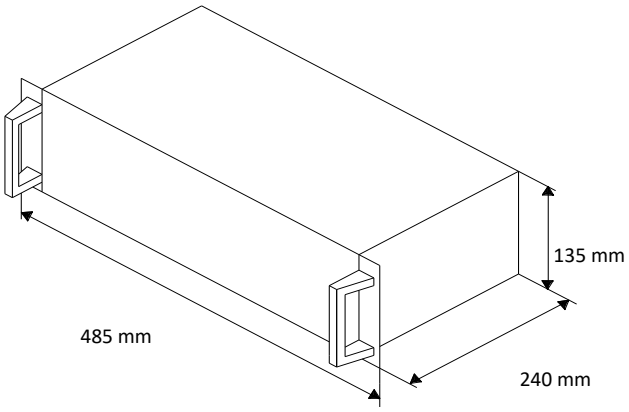
Model	Input	Output	Isolation Input-Output
FA1212-18	85-264 V_{AC} | 85-370 V_{DC}	±12 V_{DC}	18.5 kV_{AC}

Wiring



19” Rack mounting case for 12 Modules



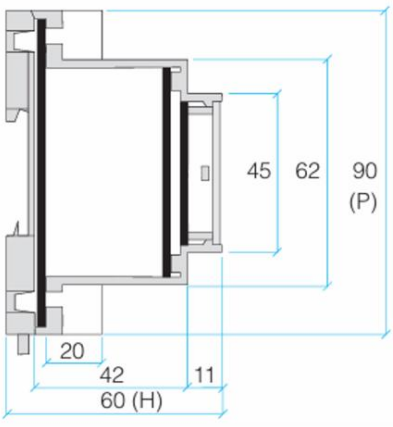


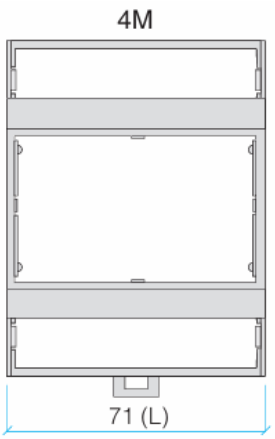
Technical data – RFO-D

	RFO-D
Specifications	
Contact type	SPDT
Switching capacity	1000 VA
Switching voltage	≤ 230 V_{AC}
Response time	< 1 s
Reading range	0 - U_N +10%
Auxiliary voltage	85-264 V_{AC} | 85-370 V_{DC} 24 V_{DC}
Standby power consumption	< 5 W
Operating temperature	-10º C to +60º C
Regulations	CE

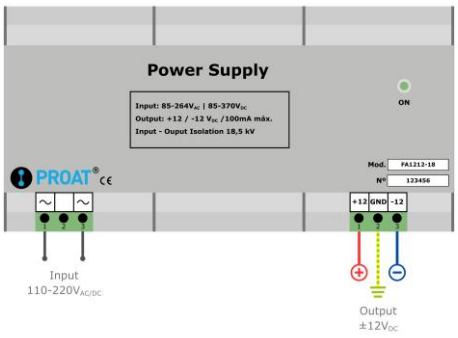
Constructive Characteristics – RFO-D

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



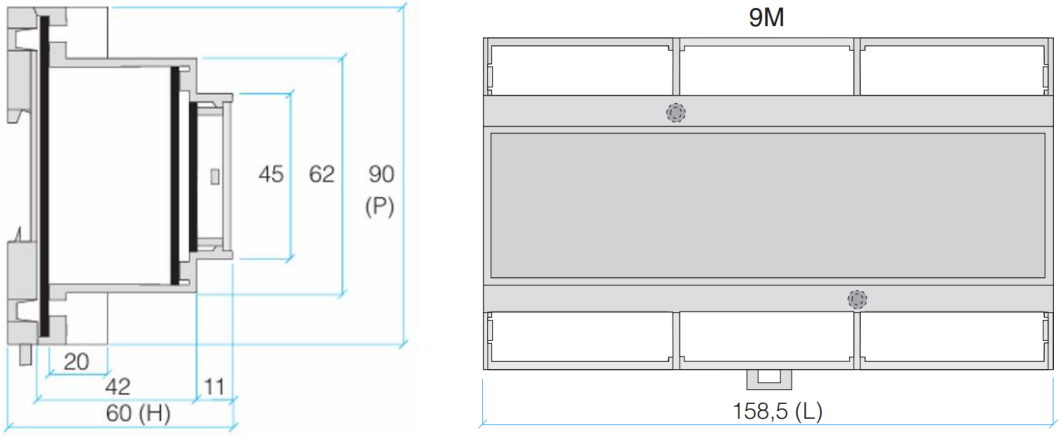


Power Supply – FA1212-18



Constructive Characteristics – FA1212-18

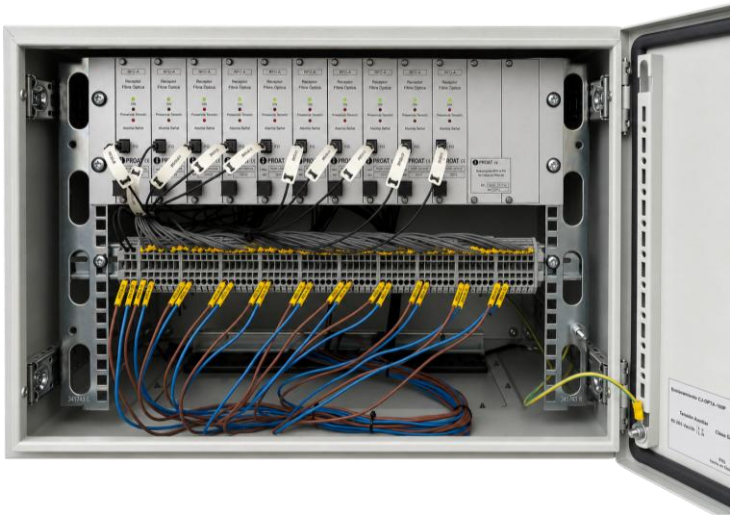
- DIN Rail installation
- Front Plate Terminals
- Self-extinguishing plastic case class V0



Technical data – FA1212-18

	FA1212-18
Tests	
UNE 21138 Standard	Mechanical bending resistance tests: 20 N
	Dry lightning impulse withstand voltage tests
UNE 60068 Standard	Corrosion test
Other tests	Operating temperature test

CRS + FO Electrical Panels



Panel with RFO and FA1212-12

Remot-Control Panel

CRS + PTC-M1

Resistive Silicone Sensor

+

DC Voltage Presence Detector

- ✓ Resistive Silicone Sensor **CRS**
- ✓ Remote DC voltage indication in electrical panels for disconnectors and circuit breakers.
- ✓ **PTC-M1** amplifies the signal from a Resistive Silicone Sensor
- ✓ Input **150 V_{DC}**, activation with **>30%**
- ✓ Potential-Free Switched Contact **Output**
- ✓ Voltage indication by Red LED indicator
- ✓ Auxiliary voltage **120-230 V_{DC} | 120-230 V_{AC}** or **48 V_{DC}** depending on the model
- ✓ Contacts on an **11-pin socket**, **DIN rail** mounting

Applications

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

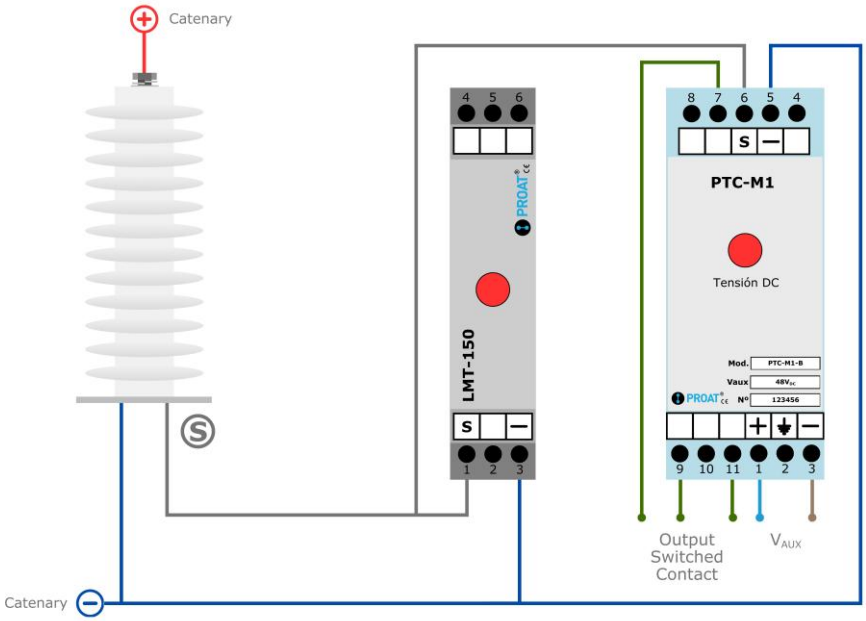
- Conventional Trains
- Metros
- Trams

Models

Model	Auxiliary Voltage
PTC-M1	120-230 V_{DC} | 120-230 V_{AC}
PTC-M1-48	48 V_{DC}

Order Example: CRS1500 + PTC-M1

Wiring



LMT-150 Limiter

The function of the LMT-150 limiter is to prevent the output voltage from reaching 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 light
LMT-150	No
LMT-150-L	Yes

Constructive Characteristics– PTC-M1

- DIN rail installation
- Terminals on UNDECAL base
- Contacts on an 11-pin socket
- Enclosure dimensions: 80 mm × 77 mm × 42 mm
- UNDECAL base dimensions: 64 mm × 38 mm × 23 mm
- Self-extinguishing plastic enclosure, class V0

Technical data – PTC-M1

	PTC-M1
Specifications	
Input voltage	0-150 V_{DC}
Presence detection level	100 V ±20%
Response time	30 ms
Standby power consumption	1 W
Fault power consumption	< 2 W
Standards complied with	
Insulation test voltage	
High-frequency disturbances	
Fast transients	
Voltage impulse	
Relay contact characteristics	
Continuous current	5 A
Switching voltage	< 230 V_{AC}
Switching power	< 2000 VA

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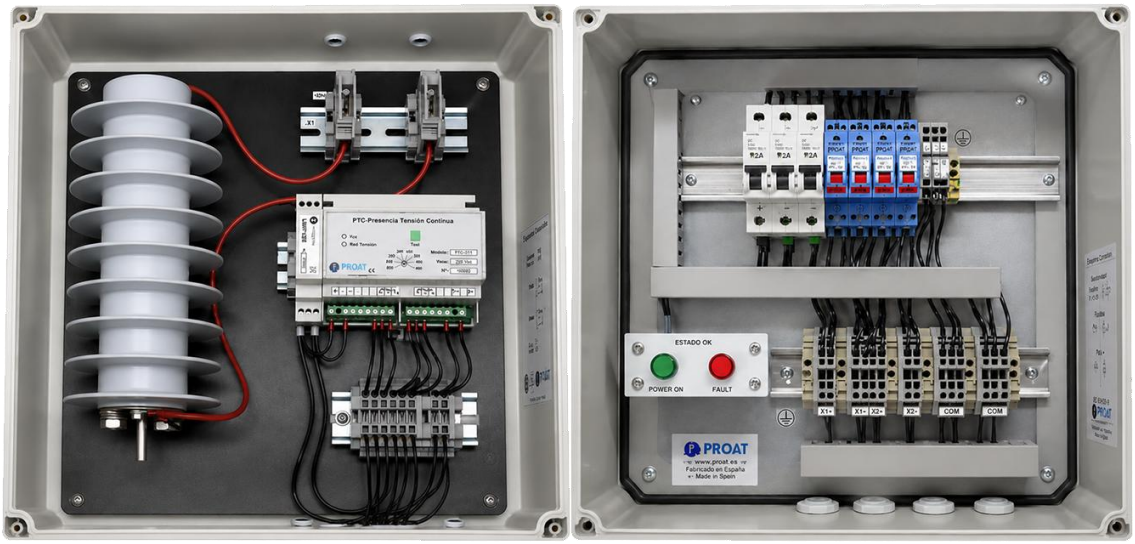
CRS + PTC Electrical Panels



Onboard DC Voltage Detector for Locomotives

CRS + LED

Resistive Silicone Sensor

+

Flashing LED Indicator

- ✓ Resistive Silicone Sensor **CRS**
- ✓ Control circuit and a **Flashing LED Indicator**
- ✓ 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
- ✓ LED board service life: **> 50,000 hours**
- ✓ **Epoxy** coated circuit installed in waterproof enclosure

Models

Model	Voltage Service	Auxiliary Voltage
CRS750 + LED	0-750 V_{DC}	Self-powered
CRS1500 + LED	0-1500 V_{DC}	Self-powered
CRS3000 + LED	0-3000 V_{DC}	Self-powered
CRS4000 + LED	0-4000 V_{DC}	Self-powered
CRS27500 + LED	0-4000 V_{DC}	Self-powered

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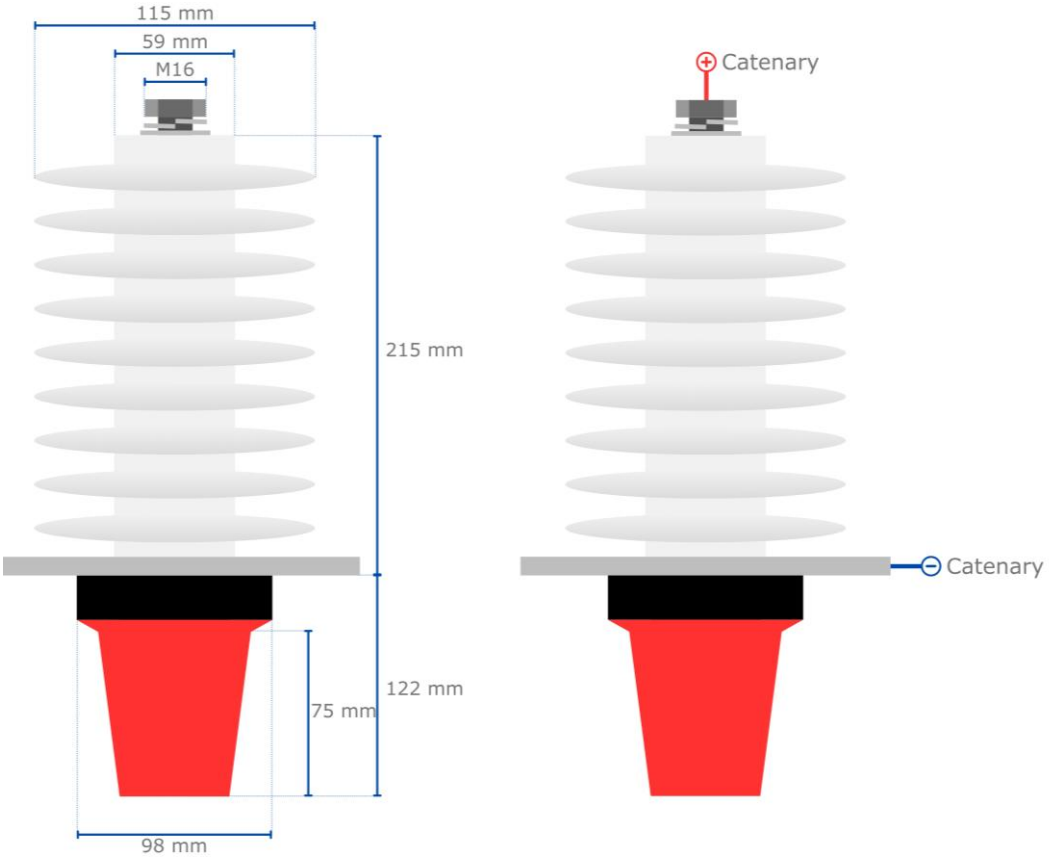
Wiring and Dimensions



Technical data

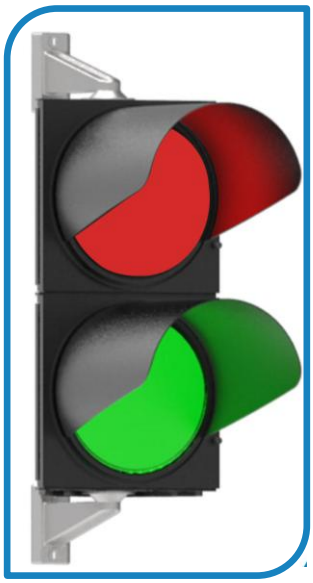
	CRS + LED
Specifications	
Maximum current	< 3 mA
Flashing frequency at U_N	1 Hz
LED activation	> 30% U_N
LED service life	> 50 000 hours
Tests	
UNE 21138 Standard	Mechanical bending resistance tests: 20 N
	Dry lightning impulse withstand voltage tests
UNE 60068 Standard	Corrosion test
Other tests	Operating temperature test

CRS + SMFR

Resistive Silicone Sensor

+

Green/Red Signal Light



✓ Resistive Silicone Sensor **CRS + CBI21** for DC voltage measurement with **4-20 mA output**

✓ Green/Red Signal Light for catenary voltage signaling:

- High-intensity **Ø 200 mm** LED modules
- Enclosure color: **dark gray**

✓ Voltage **Presence Controller PTC-E1**:

- **4-20 mA** measurement reading
- Power-on LED
- Measurement LED
- Anomaly LED
- Two voltage-free changeover contacts:
  - Voltage
  - Anomaly
- Auxiliary voltage 85-264 V_{AC} | 85-370 V_{DC} or 24 V_{DC}

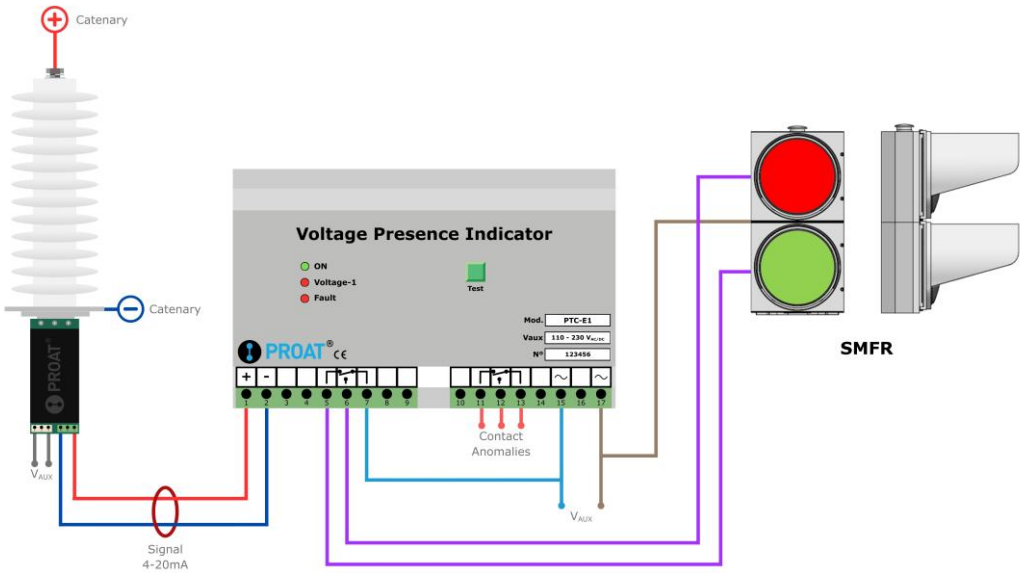
Models

Configuration Options:

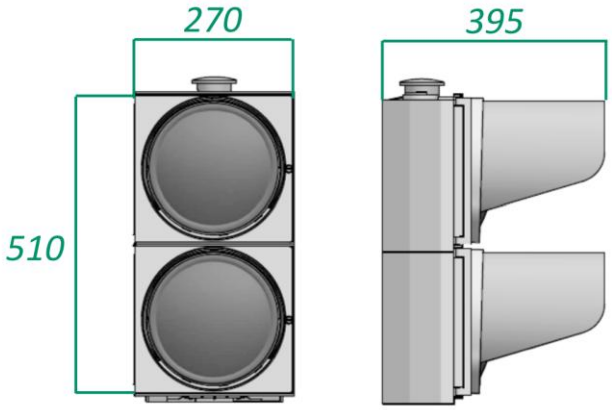
- **CRS** - Any Model
- **CBI21** - Any Model
- **PTC-E1** - Voltage Presence Controller
- **SMFR** - Green – Red Signal Light
- **Signal Light Attachment** - Any Model

Pol. Ind. Can Tapioles c/Narcís Monturiol, 4 nave 10, 08110 Montcada-Reixac (Barcelona) SPAIN
Tel. +34 935790610 · comercial@proat.es · www.proat.es

Wiring

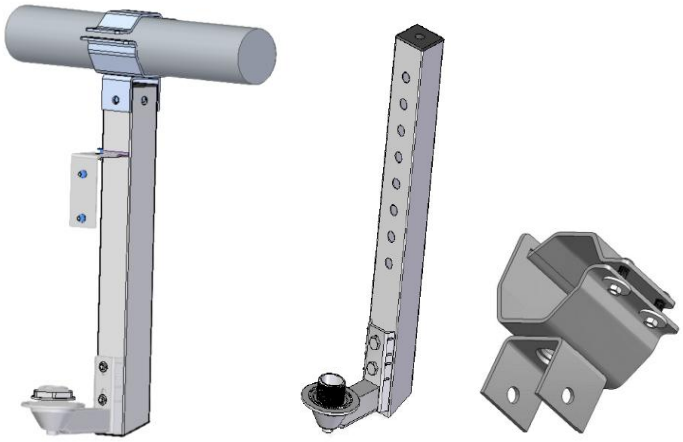


Constructive Characteristics



Mounting Bracket SOP-SMFR-001

- Mounting Bracket for attachment to a **76 mm diameter bracket**
- Made of galvanized steel

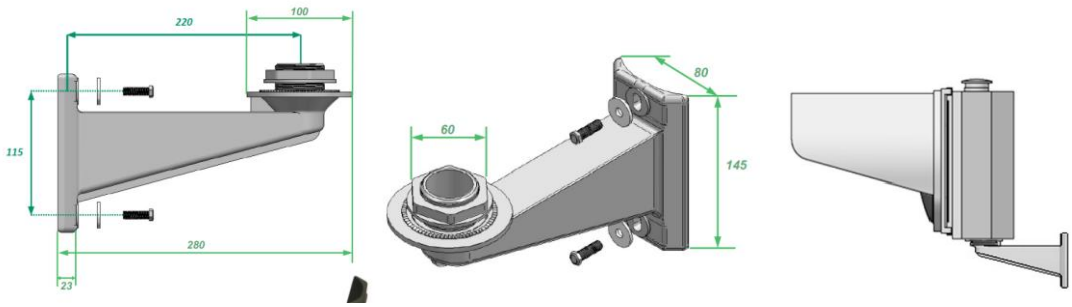


Mounting Bracket SOP-SMFR-002

- Mounting Bracket for attachment to wall or **column Ø 100 mm**
- Made of cast **aluminum**
- **Coated** with **polyester** powder polymerized at 230 °C
- Fixed with 2 M8 screws
- Internal positioning and anti-rotation serration of the coupled Signal Light head.
- Signal Light fixing by sleeve-nut assembly 1½" made of aluminum

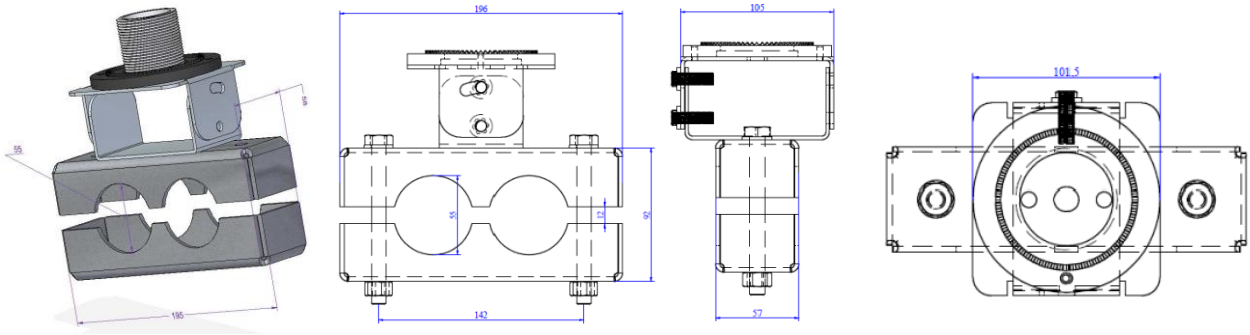
Advantages

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



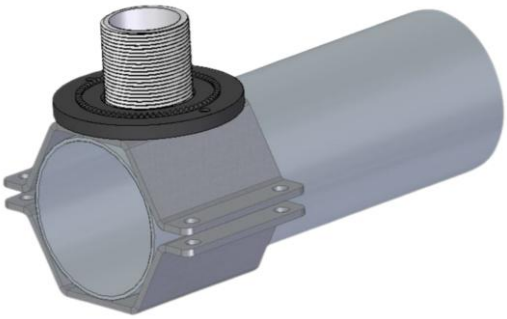
Mounting Bracket SOP-SMFR-003

- Mounting Bracket for attachment to a double 76 mm diameter bracket
- Made of galvanized steel



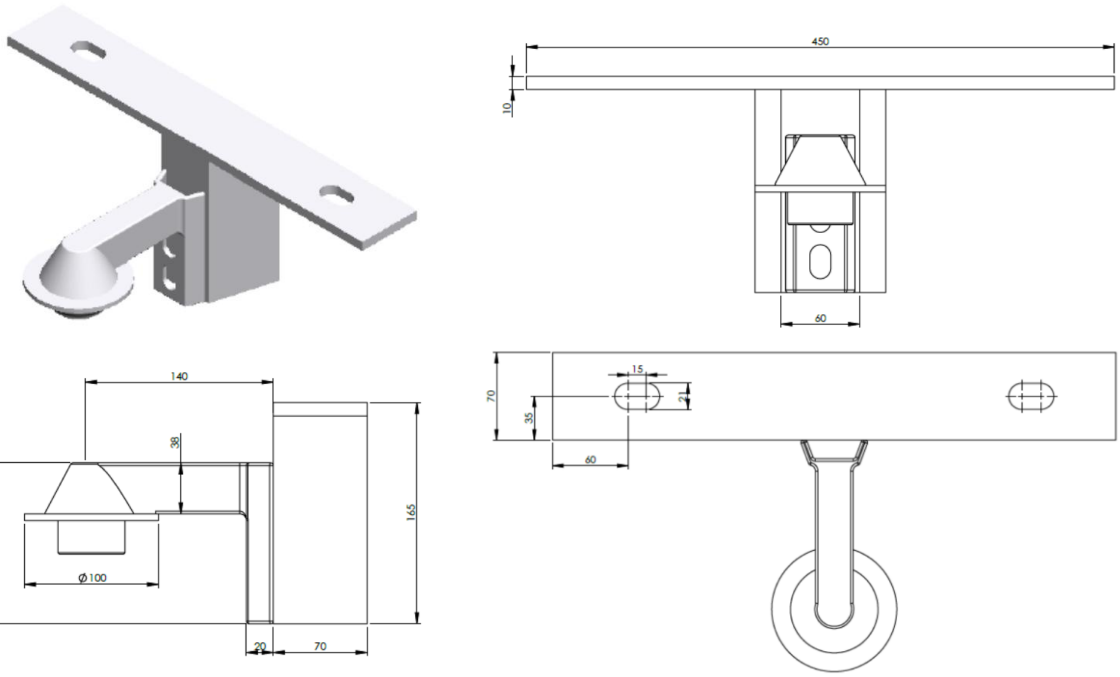
Mounting Bracket SOP-SMFR-004

- Mounting Bracket for attachment to a **76 mm diameter bracket**
- Made of galvanized steel



Mounting Bracket SOP-SMFR-005

- Mounting Bracket for inverted ceiling mounting
- Made of **galvanized steel**



Mounting Bracket SOP-SMFR-006

- Mounting Bracket for mounting in **ceiling or vault**
- Made of galvanized steel

Technical data

	SMFR
Case Specifications	
Enclosure material	Colored UV-stabilized polycarbonate
IP rating	IP55 (according to EN 60529)
Degree of impact resistance	IR3 (according to EN 60598)
Electromagnetic Compatibility	According to EN 50293
Operating temperature	-40º C to +60º C
Certificate and marking	According to EN 12368
LED Optics (PIL)	200 x 200 mm
External dimensions	270 x 510 mm
Enclosure color	Gray, black, yellow or green
LED colors	Green and Red

	LED Optics
Specifications	
Nominal voltage	125 V_{DC} or 230 V_{AC}
Power consumption	< 8 W
Number of LEDs (Red or Green)	120
On/off reaction time	< 50 ms
Environmental requirements (EN 12368 – 5.1)	Class A, B, C (operating temperature of -30ºC to + 70ºC)
Electromagnetic compatibility (EMC)	Complies with the requirements of EN 50278
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 5 (Green)
Colors of light signals (EN 12368 – 6.7)	620-630 nm (Red) 502-508 nm (Green)
Environmental protection grade (EN 60598)	IP65
Degree of impact resistance (EN 60598-1)	IR3
Front lens material	UV-stabilized transparent polycarbonate
Enclosure material	Black ABS

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