

CONTROL & PROTECTION RELAYS

STELLA-**SEPCOS**



STELLA

PROTECTION & SUPERVISION



Sécheron has been developing and manufacturing safety devices for DC traction systems for the railway industry for decades. We have drawn upon our extensive experience with DC traction systems and the related industry standards to develop our STELLA product range.

All STELLA products, including control and protection devices (SEPCOS), control and supervision (KEOPS), stray current monitoring system (SCMS) and operation and predictive maintenance (IOMS), are based on our strong experience in the field and on customer feedback to meet our customers' railway network requirements and simplify the operation and maintenance of their traction power substations.

STELLA products are designed with the latest technology. Their modular design allows the customer needs to be met even on the most complex of projects.

GENERAL INFORMATION

SEPCOS is made of high-tech equipment which satisfies the most demanding safety requirements applicable to DC traction distribution networks.

It is a powerful electronic system based on advanced technology (with several microprocessors).

Used as a control and protection unit, SEPCOS integrates the necessary functions for the protection, control and measurement of DC traction equipment related to transportation systems (streetcars, underground railways, commuter trains, trolley buses etc.).

SEPCOS is stand alone, modular, extending and easily adaptable by software. It is equipped with a programmable logic unit which allows to freely define the operating logic functions, in order to match the requirements of the unit or the system to supervise.

Moreover, SEPCOS is widely open to modern communication equipment. It delivers network communication or serial line monitoring facilities.

Sécheron is the pioneer in the field of IEC 61850 adapted for DC traction power and has already successfully commissioned many projects worldwide using this standard.

MAIN BENEFITS

- ✓ Certified IEC 61850 Ed2 server/client level A (KEMA)
- ✓ Key strengths = Modularity and adaptability
- ✓ Application adapted to each project and functionality
- ✓ Numerous functions (control, protection and recording)
- ✓ External synchronization (NTP/SNTP)
- ✓ Simple, user-friendly and modern communication tools
- ✓ Full network redundancy implemented according to IEC 62439-3 (PRP/HSR)
- ✓ Monitoring of analog measurements
- ✓ High accuracy and very good noise immunity thanks to a high sampling rate based on high performance 16-bit A/D converter
- ✓ Provide data to our intelligent operation & maintenance system (IOMS)
- ✓ Safe and reliable

MODULARITY

SEPCOS is made of several modules that can be adapted in order to meet the needs of each customer:

- Power supply (PWR)
- Control/Command (CPU & nCPU)
- Protection (PRO & ePRO)
- Digital Inputs/Outputs (DIO & DI)

By combining these modules, Sécheron is able to provide a modular range of SEPCOS with dedicated functions.



STANDARDS

SEPCOS is fully approved in railway substation environments according to the following standards:

- **IEC 60255-1 (EN 60255-1)** | Measuring relays and protection equipment – Part 1: Common requirements
- **IEC 60255-21 (EN 60255-21)** | Electrical relays – Part 21: Vibration, Shock, Bump and Seismic tests on measuring relays and protection equipment
- **IEC 60255-26 (EN 60255-26)** | Measuring relays and protection equipment – Part 26: Electromagnetic compatibility requirements
- **IEC 60255-27 (EN 60255-27)** | Measuring relays and protection equipment – Part 27: Product safety requirements
- **IEC 61131-3 (EN 61131-3)** | Programmable controllers – Part 3: Programming languages
- **IEEE C37.90** | Relays and relay systems associated with electric power apparatus

/// Main characteristics – According to the standards mentioned

	Unit	Values
Supply voltage	[V]	24 to 48 (-20% / +10%) 60 to 220 (-20% / +10%)
Insulation	[kV]	2 kV AC, 50 Hz, 1min
Analog voltage input levels	[V]	±5, ±10, 0-5, 0-10 ⁽¹⁾
Analog current input levels	[mA]	±20, 0-20, ±40, 0-40, 4-20, 4-20 extended ⁽¹⁾
Degree of protection	-	SEPCOS: IP20 / IP42 ⁽²⁾ Display: IP40 / IK05
Storage temperature	[°C]	-40 to +85
Operating temperature	[°C]	-25 to +70
Max. humidity	[%]	93 ⁽³⁾

⁽¹⁾ Configurable software.

⁽²⁾ Mounted in LV compartment of cubicle.

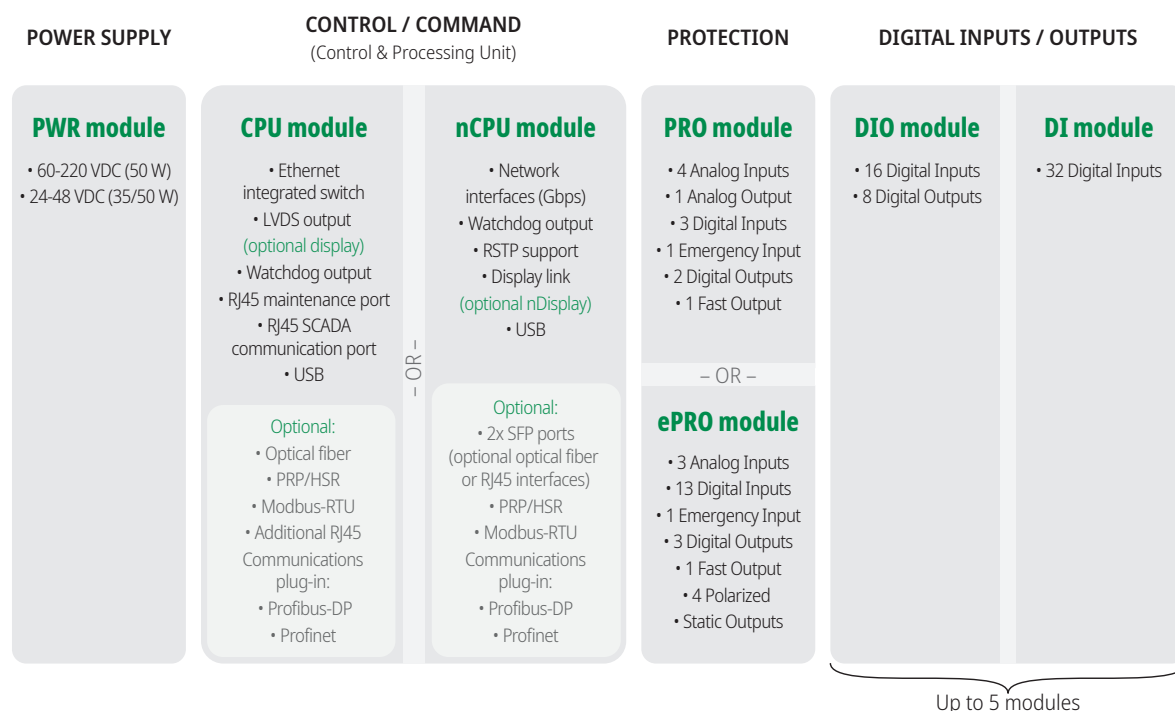
⁽³⁾ Without condensation.

ARCHITECTURE

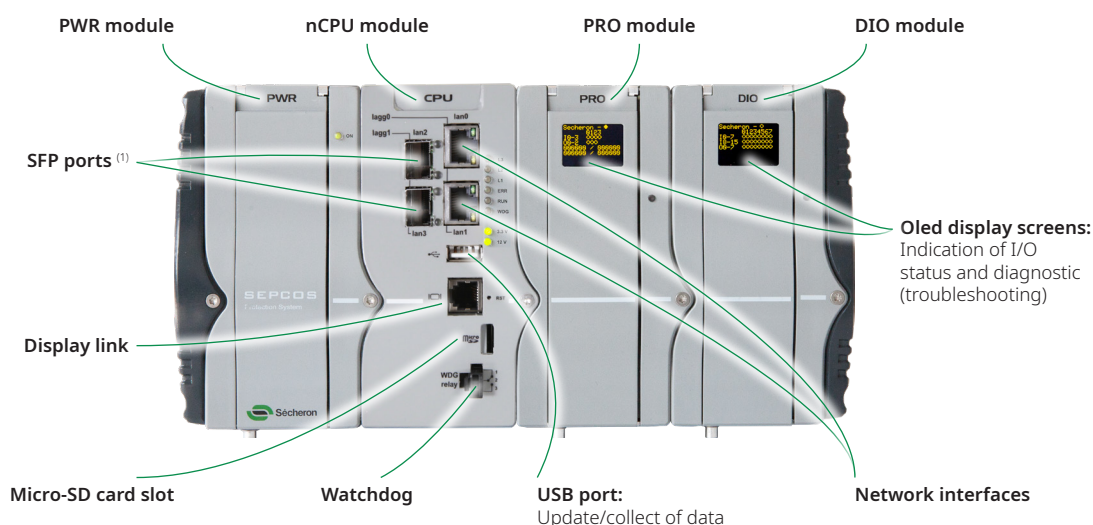
The modules are integrated in aluminium frames. Electrical connections (power supply, analog and digital signals, network, etc.) are located behind closing flaps at the front of the housing to protect against intrusion, dust, accidental contact, and water.

The power unit is modular and is chosen according to the input voltage.

Different options are available for the CPU module in order to meet the customer specific needs regarding network topology, protocols and even redundancy.



Example of SEPCOS configuration



⁽¹⁾ The connectors present in this area depend on the type of CPU module

CYBERSECURITY

The nCPU and Display modules were developed with cybersecurity requirements integrated from the initial specification phase through hardware and software design.

Cybersecurity has been a major development driver to support compliance with the **IEC 62443-4.2 Security Level 2 (SL2)** requirements.

The nCPU module incorporates a latest-generation high-performance microprocessor, providing the processing capacity needed to guarantee strong cybersecurity capabilities.

To further strengthen system integrity, the platform features Secure Boot technology and an integrated Trusted Platform Module (TPM). These technologies ensure that only authenticated and trusted software can be executed on the device, protecting it against unauthorized modifications and malicious code.

For enhanced protection against unauthorized access, the USB port can only be enabled or disabled through password-protected access.

This feature prevents the USB interface from remaining permanently active, thereby reducing the attack surface and ensuring optimal cybersecurity throughout the product's operational life.

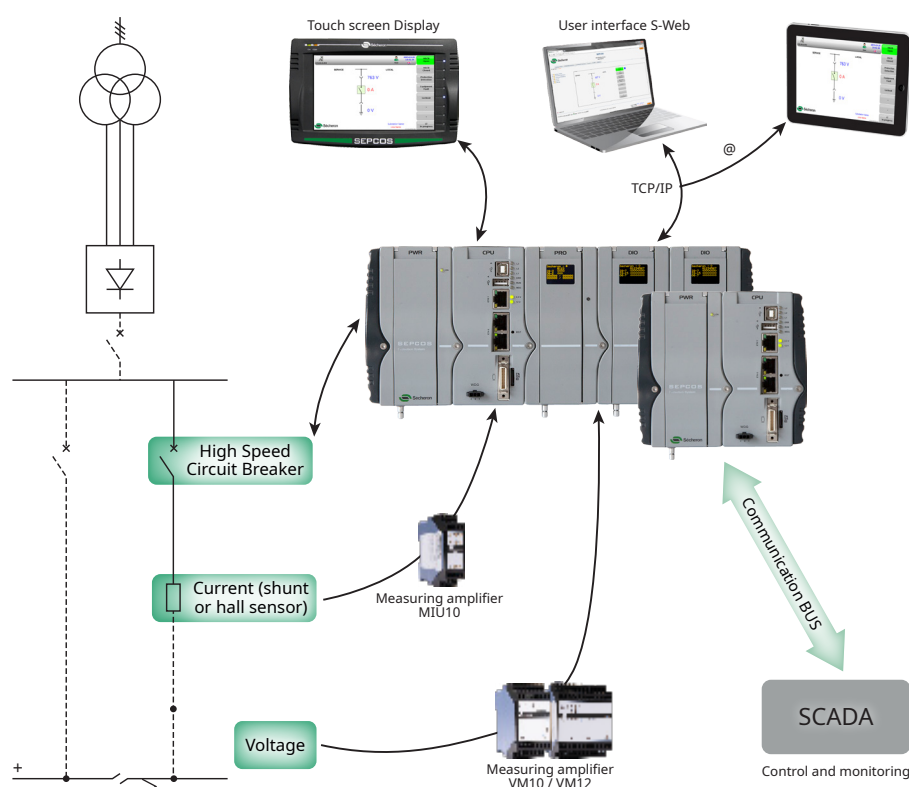
APPLICATIONS

With many control/command and protection functions, SEPCOS satisfies the needs of DC power traction networks.

SEPCOS is used for monitoring traction network segments and for logging events. It analyses the current gradient and voltages through cyclic measurements at the feeding point of the substation to the catenary.

SEPCOS can be used in a large panel of cubicles (feeder, rectifier breaker, negative cubicle, voltage limiting devices (VGUARD), local SCADA, stray current monitoring systems (SCMS), etc.). The measurements are made through an electrically isolated transducer (i.e. Sécheron's VM10/VM12 or MIU10 measuring amplifiers).

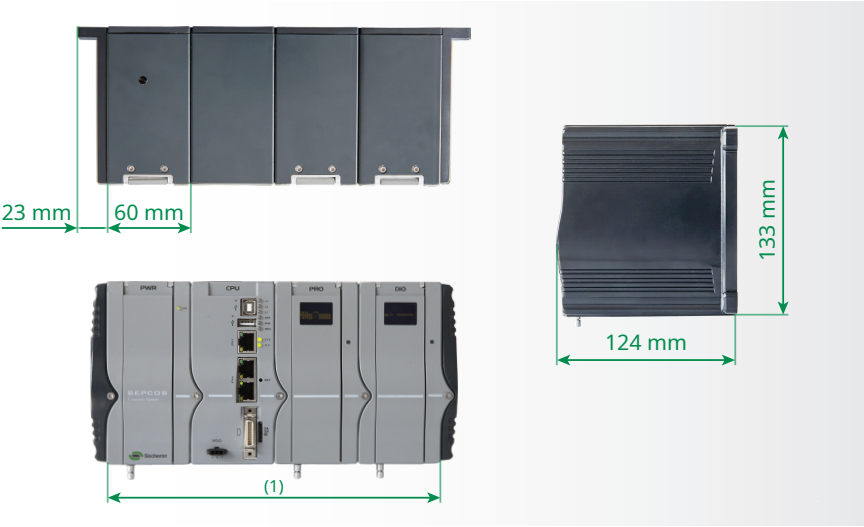
Example of SEPCOS typical use



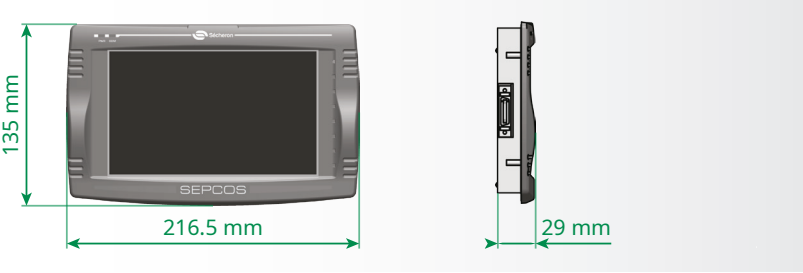
MECHANICAL CHARACTERISTICS

	Unit	SEPCOS	Display
Height	[mm]	133	135
Width	[mm]	46 + 60 per module ⁽²⁾	216.5
Depth	[mm]	124	29
Typical weight	[kg]	2.5	0.6

⁽²⁾ Total width of the SEPCOS depends on the configuration. Each module width is 60 mm.



SEPCOS



Display (optional)
Door mounted: IP40 / IK05

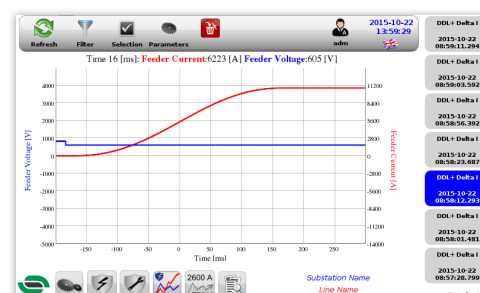
SEPCOS and Display integrated in MBS



PROTECTION

MAIN FEATURES

- For each detection, 1 set of 3 curves is memorized:
 - current (I)
 - voltage (U)
 - di/dt
- Curve memorized pitch: 200 μ s to 5 s
- Sampling rate: $\sim 20 \mu$ s per analog input (total = 80 μ s)
- Time stamps: 1 ms
- Availability of the last 5000 events and 1000 curves



List of protection functions

- | | | | |
|------------------------|------------------------|---------------------|---|
| • DDL+ Delta I (di/dt) | • Incomplete sequence | • Ufeeder Min | • Umax+ / Umax++ |
| • DDL+ Delta T (di/dt) | • Thermic | • Ufeeder max | • Umax- / Umax-- |
| • DDL- Delta I | • HSCB maintenance | • Track alive | • Amp monitoring |
| • DDL- Delta T | • IDMT Level 1 / 2 / 3 | • Falling voltage | • Cable insulation fault ⁽³⁾ |
| • DDL Limited (di/dt) | • Imax+ / Imax++ | • Umin+ | • Interrupted arc ⁽³⁾ |
| • Open arm | • Imax- / Imax-- | • Energy+ / Energy- | • Load transfer ⁽³⁾ |

⁽³⁾ Not included with ePRO module

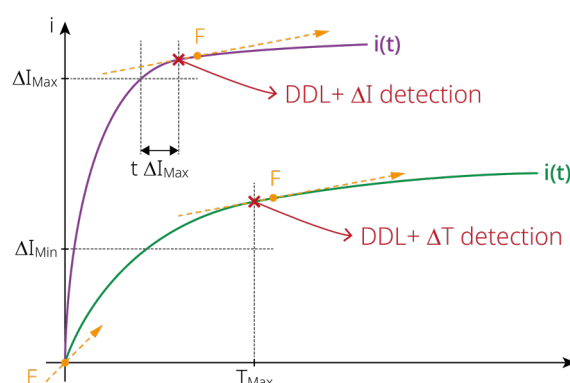
RATE OF RISE PROTECTION FUNCTIONS (DI/DT)

DDL+ Delta T

If the value measured of Delta T is higher than the parameter Tmax and the value measured of Delta I is higher than the parameter Delta Imin, the function declares a detection by DDL+ Delta T and tripping is initiated.

DDL+ Delta I

If the current rise measured of Delta I is higher than the parameter Delta Imax during a time higher or equal to the parameter Delta Tmax, the function declares a detection by DDL+ Delta I and tripping is initiated.



CABLE INSULATION FAULT (optional)

In DC traction applications, power cables built with metal shields must be protected against high touch voltage. This protection must be active when a dangerous contact voltage or a high current appears on the shield in case of insulation fault.

The system is designed to detect a leak current either between shield and conductor or between shield and earth. If a fault occurs, actuation of intertripping out signal can be selected.

The settings for this function can be adjusted with the S-Web tool.

BUS CONNECTIONS

Modularity and adaptability are the key strengths of SEPCOS.

Sécheron developed this control & protection relay with the objective of getting the closest match to their client's specific needs. Sécheron can provide engineering support while elaborating a network regardless of the type of communication and its architecture.

SEPCOS is open to all customers' networks and protocols.

Flexible connectivity

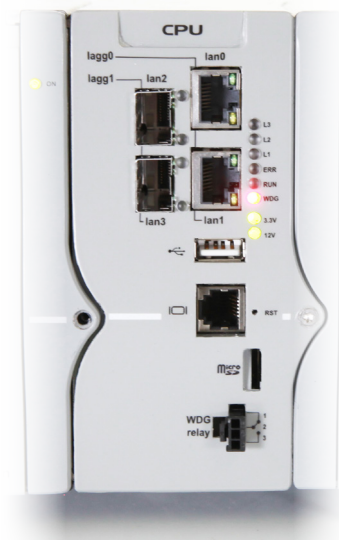
- Copper cable (RS485, RJ45)
- Optical fiber

Redundancy

- Dual independent networks
- Parallel redundancy Protocol (PRP) / High Availability Seamless (HSR)
- Bonding active backup network
- Rapid Spanning Tree Protocol (RSTP)

A wide choice of communication bus

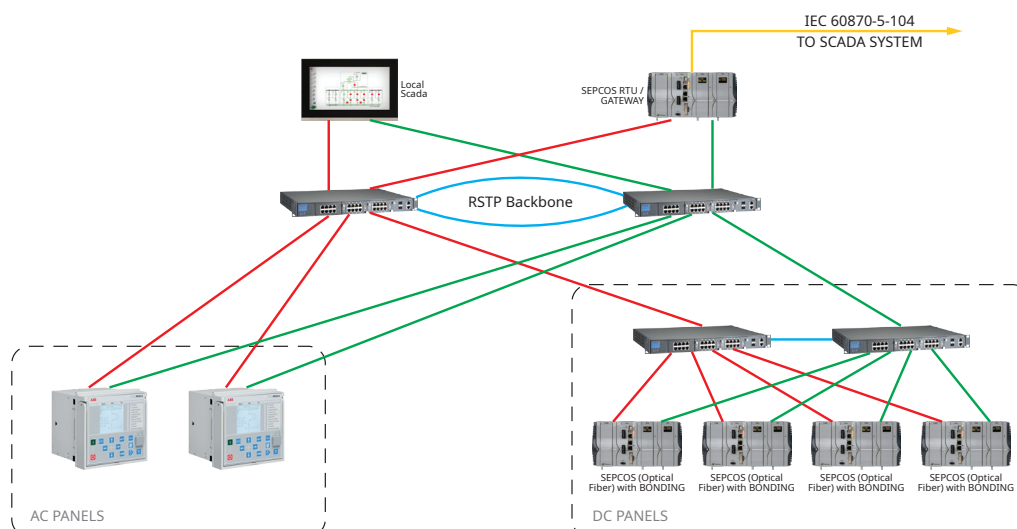
- IEC 60870-5-104 (-5-101)
- IEC 61850 Ed2 server/client level A, incl. GOOSE
- IEC 62439-3 PRP/HSR
- DNP 3.0 (Serial/Ethernet)
- Modbus-TCP
- Modbus-RTU
- Profibus-DP
- Profinet



EXAMPLES OF CONFIGURATIONS

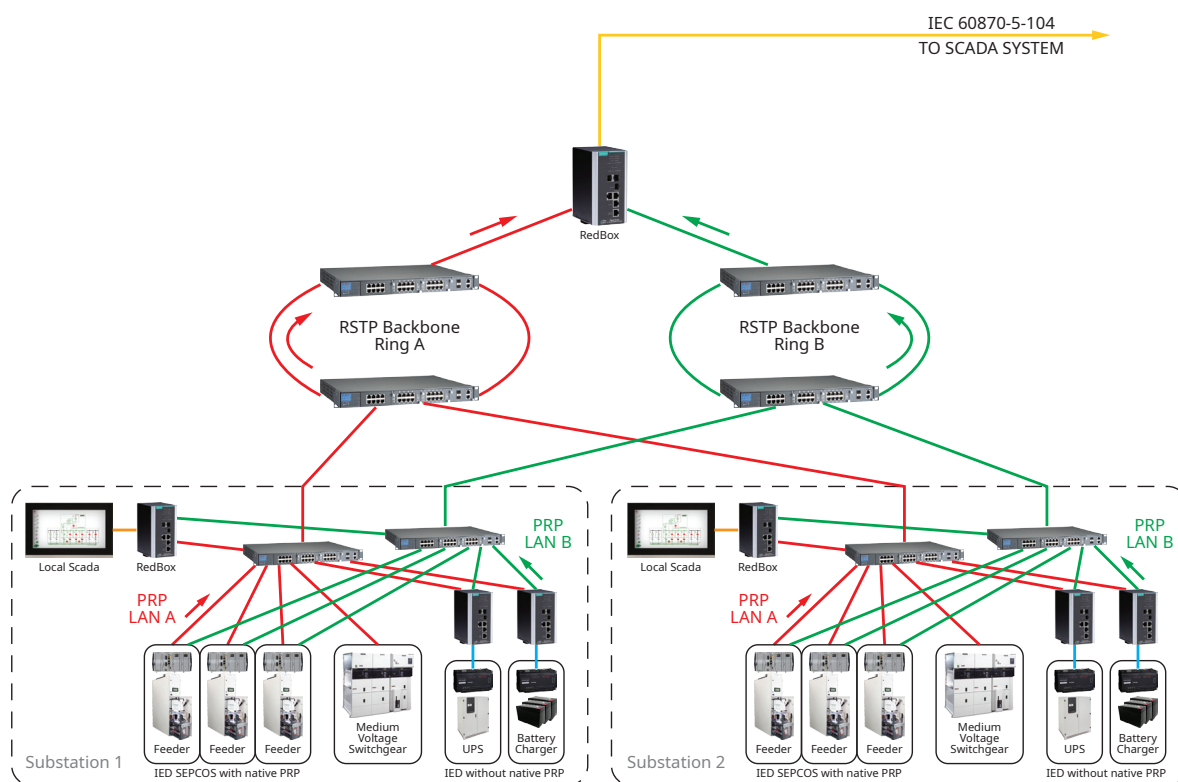
Bonding active backup redundancy star network

The bonding feature provides an interesting solution of redundancy network without huge infrastructure. Only one network interface is active while the other is simply waiting for a failure in the link (interface down or unplugged) to the primary network interface card: it will keep the network traffic up and alive.



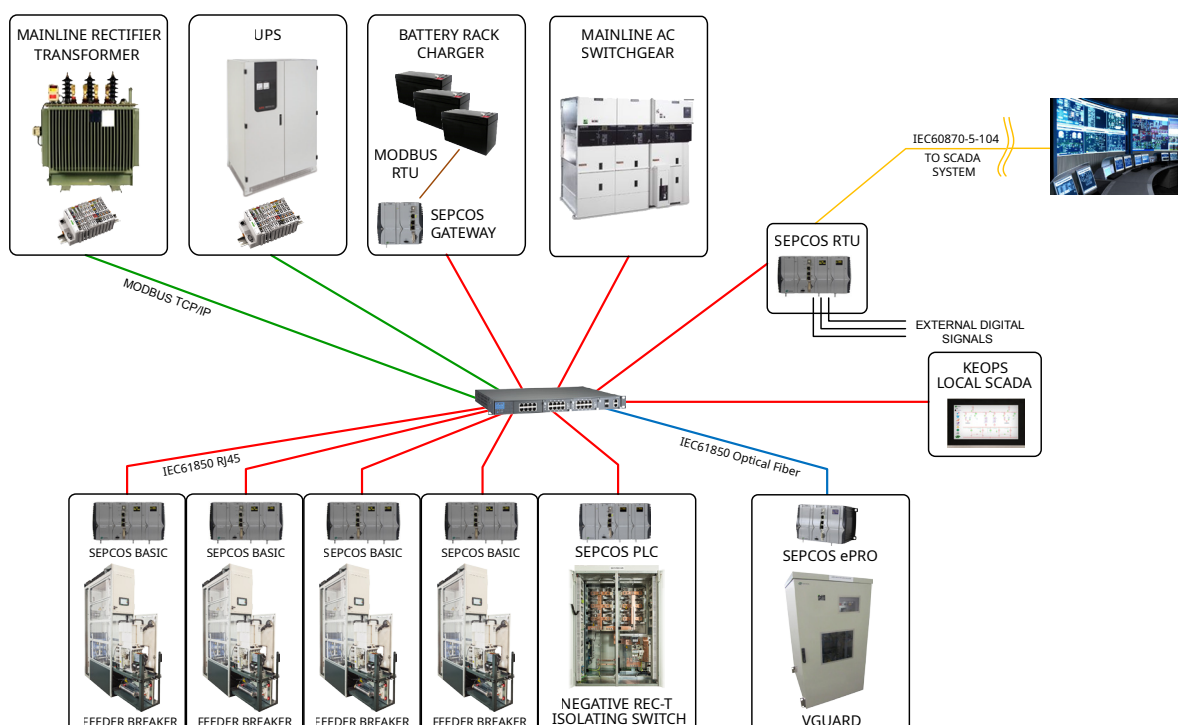
PRP redundancy star network

The source sends the same frame over both networks (LANs). The destination receives it from both LANs within a certain time, consumes the first frame and discards the duplicate.



Typical star network

The modularity of the SEPCOS allows it to be adapted to the specific requirements of the cubicle or to the technology network (i.e. SEPCOS, SEPCOS RTU or SEPCOS Gateway).



DISPLAY

A user-friendly interface is associated through a high resolution 7" graphic color display and capacitive dual touch screen allowing easy and intuitive navigation.

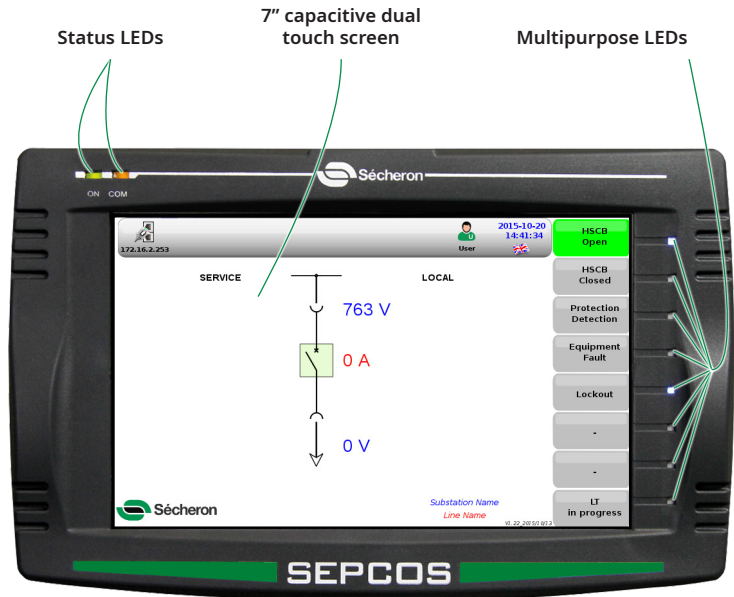
This device is equipped with 8 LEDs related to dynamic labels (color and text) for the visualization of the state of the PLC (position, type of fault, etc.).

The Display allows a complete visualization, control and setting of the equipment and collects the information available from SEPCOS.

It includes the modification of SEPCOS parameters (command parameters, setting protections, etc.).

Control and configuration actions are password protected.

In case of nCPU usage, a nDisplay should be used, involving a mechanical plug & play only.

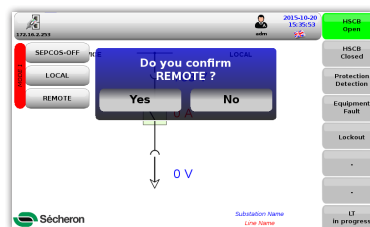


MAIN FEATURES

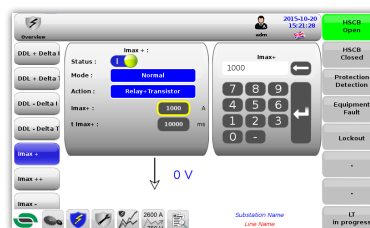
- Control of the equipment (orders in, out, reset, etc.)
- Display of the last 5000 events recorded by SEPCOS and time-stamped
- Multilingual (the languages can be adapted upon request)
- Different administration modes (Root, Admin, PowerUser, Operator and User)
- Backup and export of settings, curves, events or log information on a USB key

EXAMPLES OF SCREENS

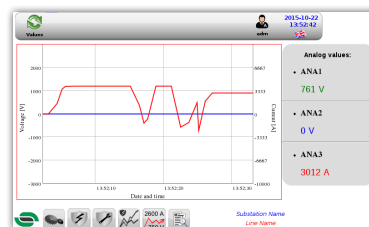
Control orders



Protection parameters



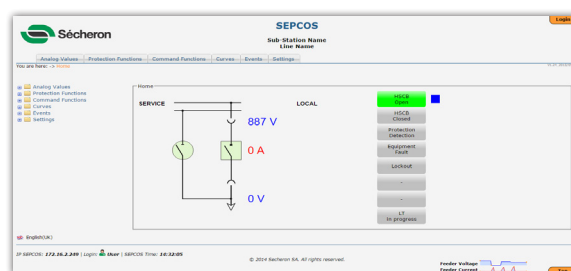
Trends



Events list

Date & Time	From	Type	Description	HSCB
2015-10-20 15:38:12	2015-10-20 15:38:12	CPU	SEPCOS - Lock-out action	Open
2015-10-20 15:38:12	2015-10-20 15:38:12	CPU	STATUS - LTD - Not ended with no OK	Closed
2015-10-20 15:38:12	2015-10-20 15:38:12	CPU	STATUS - LTD - Cooling down resistance 15 minutes	Closed
2015-10-20 15:38:12	2015-10-20 15:38:12	CPU	STATUS - LTD - Cooling down resistance 15 minutes	Closed
2015-10-20 15:38:12	2015-10-20 15:38:12	PLC	DETECTION - LTD - Default line resistance too low	Closed
2015-10-20 15:38:12	2015-10-20 15:38:12	PLC	DETECTION - LTD - Default line resistance too low	Closed
2015-10-20 15:38:12	2015-10-20 15:38:12	PLC	DETECTION - LTD - Default line resistance too low	Closed
2015-10-20 15:38:12	2015-10-20 15:38:12	PLC	DETECTION - LTD - Default line resistance too low	Closed
2015-10-20 15:38:12	2015-10-20 15:38:12	PLC	DETECTION - LTD - Default line resistance too low	Closed
2015-10-20 15:38:12	2015-10-20 15:38:12	PLC	DETECTION - LTD - Default line resistance too low	Closed

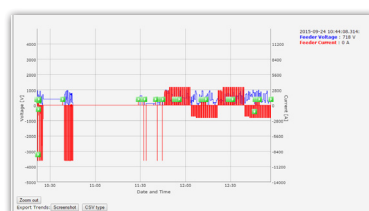
The S-Web tool does not require any software installation on a computer, its operation only requires a web browser.



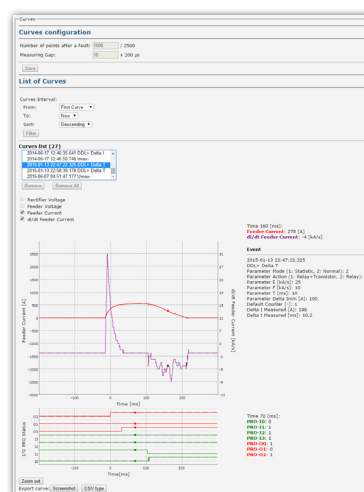
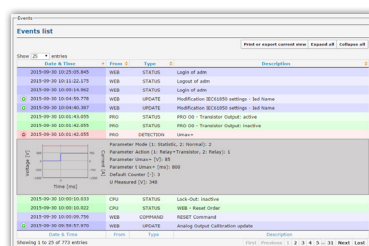
- Reading and modification of the protection and command functions settings
- Collection of data recorded by SEPCOS and download on a PC
- Upload of information (parameters) from a PC to one or more SEPCOS
- Real-time visualization of analog inputs values, detection results and events
- Continuous recording of trends and visualization for a given period
- Display of detection curves (di/dt , U and I) of protection functions
- Application software upgrade
- Multi settings (7 different sets of parameters)

The status of the USB mass storage unit is displayed for information: connected or disconnected and quantity of free space still available. Data are memorized in COMTRADE (Common format for Transient Data Exchange for power systems). It is possible to access the USB key through the FTP.

Trends
(analog values)



Events list



Protection curves



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