SGC

SWITCHGEAR CONTROL SYSTEM

USER MANUAL

ELECTRONICA
DIGITAL DE
PROTECCION

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1 INTRODUCTION

The SGC is an electronic controller for automatization of medium voltage switchgear providing multiple control and protection functions.

There are three main models for the SGC:

- **SGC180: Control functions.**
  - Control of one circuit breaker with operation verification, kA2 counter, logging of external signals, register of events,....
  - Passing fault detection, voltage detection, open phase detection and sectionaliser automatism.
  - Remote measurement of phasorial voltage, current and power.
- **SGC195:** SGC180 with an integrated multiprotocol RTU in small form factor. It's an ideal solution for space constrained remote control applications, such as overhead line circuit breakers.

For switchgear manufacturers, the SGC is ready to be integrated with in switchgear itself, given its small size and short depth. This kind of installation is usually the most economical, as the field installation is simplified, no external components are needed and most cabling errors are avoided.

Each model is available for either horizontal or vertical mounting, with frontal, rear or DIN RAIL fixing options.

Illustration 1: SGC180 and SGC195 devices

1.1 DESCRIPTION

The SGC is composed of these main parts:

- Power supply.
- Processing module.
- Analog measurement module.
- Digital I/O module.
- Communications module.

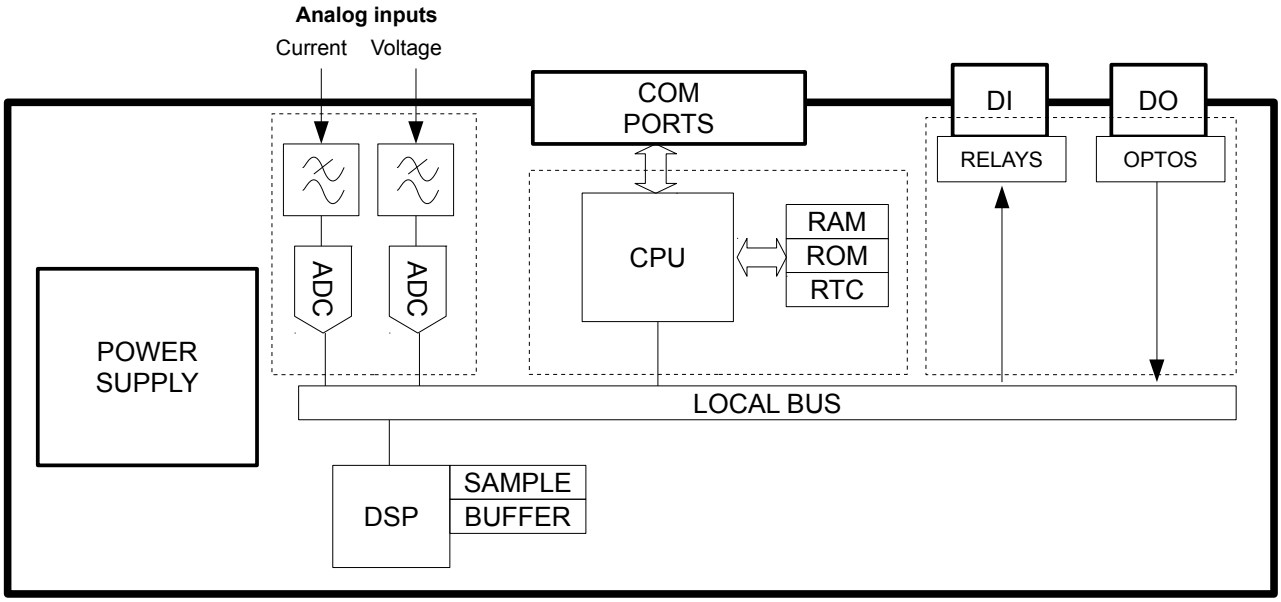


Illustration 2: Block diagram.

1.2 FUNCTIONS

1.2.1 CONTROL FUNCTIONS

The SGC device has a wide range of control functions to meet any customer requirements.

1.2.1.1 EVENT/FAULT LOG

Every event detected by the SGC is stored in a non-volatile memory.

Up to 100 events are stored, with associated information (depending on event type).

The main types of events stored include:

- Changes on internal state.
- Pickups, trips and resets of the protection functions.
- Changes on every digital input.
- Switchgear commands.

1.2.1.2 CIRCUIT BREAKER SUPERVISION

The correct operation of the circuit breaker is guaranteed by these functions:

- Open/close operation monitoring.
- Maneuver counter.
- $\sum kA^2$ counter.

1.2.1.3 TIME SYNCHRONIZATION

Time is synchronized via the communication protocol, ensuring time stamps coherence between primary and secondary stations.

The SGC also provides an internal real time clock, so timekeeping is accurate even when the power or communication link is down.

1.2.1.4 SWITCHGEAR CONTROL

Several parameters can be programmed to tailor the needs of the specific medium voltage equipment (open/close operation time, latch time, etc.)

There are plenty of digital inputs and outputs fully configurable and available to the user for switchgear monitoring or other equipment such as: breaker position, fuse protection, personal presence, etc...

1.2.2 MEASUREMENT FUNCTIONS

The measurements done by the SGC are readily available for remote reading, whether them are direct measurements (such as voltage and current) or computed measurements (active/reactive/apparent power).

There are also some other computed measures available such as average line current, maximum line current, composite voltage, etc.

1.2.2.1 CAPACITIVE TRANSDUCER CONNECTION

There are sometimes when it is not possible to install a voltage transformer to do medium voltage measurements due to space or cost constraints.

In these occasions the capacitive connection on the switchgear bushings (commonly used for voltage presence indication), can be use as a voltage transducer.

There are two main ways in which the SGC can use this capacitive connection:

- *Direct mode*[1]: the voltage inputs of the SGC are parallel connected to the preinstalled voltage indicators. This can be done in a non-intrusive way thanks to the very high input impedance of the voltage inputs.
- *Indirect mode*: substituting the preinstalled voltage indicator on the switchgear with an EDP HVR3A voltage meter.

  The HVR3A doubles its function as a voltage indicator (so it can be installed in place of the current voltage indicator) and as a voltage amplifier, with an analog output ready to be connected to the SGC with no loss of phase or magnitude information. More on this solution can be found on chapter 5.

1.2.3 PROTECTION FUNCTIONS

Depending on the model, there can be one or more of these functions:

- Phase and Neutral overcurrent protection 50/51/50N/51(N).
- Phase and Neutral Directional protection (67/67N).

All the data relative to these units is always available through remote communications, being able to be read from the primary station.

1.2.4 OTHER FUNCTIONS

- Passing fault detection.
- Voltage detection.
- Sectionaliser automatism.

1.2.5 SELF CHECKING

The SGC is constantly performing background control and verification tasks to ensure that its performance is always within limits.

1 Due to the distortion created by most voltage indicators, this mode is only useful for voltage detection, but not measurement.

1.2.6 FIRMWARE UPDATES

The SGC is fully field-upgradeable. New firmware/software versions can be deployed via the frontal maintenance port (please refer to 3.3.1 if you have either SGC180 or SGC185 devices or refer to 4.4.4 if you have SGC195 devices for a more detailed explanation).

1.2.7 LOCAL OPERATION

Basic SGC is intended for remote operation and there are no direct controls for local operation. Them can be added optionally.

It is always possible to monitor and configure the unit locally with a computer connected to the frontal communications port with our software qtAjustes[2].

The software functions are:

- Monitor and download of settings files.
- Direct reading of digital inputs/outputs and analog measurements.
- Capacitive transducer field-calibration for its use with a HVR3A meter.
- Simulation of events in order to check the interoperability with the primary station during the commissioning.

2 This software can be downloaded from Support → Download Software from Electrónica Digital de Protección S.A. webpage. Either Sign in or Login is mandatory.

2 USER INTERFACE

2.1 ELEMENTS

SGC devices with local user interface have keyboard, LCD display and local/remote switch on its frontal panel. This option is available with the ordering code referred to the section 9.

1.1 INDICATOR LEDS FOR SGC180 DEVICES

The SGC device has 5 LEDs in the frontal panel to show up the state of the device:

- VCC: Shows that the device has supply voltage.
- Tx/Rx: Shows that the communications port is transmitting.
- ERR: Shows that some anomaly has taken place in the device.
- LOCAL: Shows that the device is operating in local mode(automatic operation and remote commands are disabled).
- REMOTE: Shows that the device is operating in remote mode.
- LEDs with configurable state: above the display there are 4 LEDs that can be assigned to any internal signal of the device. The signal labeled are shown on the display screen.
- To know more about LEDs in the communication device see iGrid iRTU communications device manual.

1.2 INDICATOR LEDS FOR SGC195 DEVICES

The SGC195 device has 13 state LEDs in the front panel:

- VSGC: Shows supply voltage presence on the switchgear control unit (SCU).
- VRTU: Shows there are supply voltage presence on the remote terminal unit (RTU).
- COM 4: Shows receiving data Rx and transmitting data Tx through the COM4 port.
- COM 1: Shows receiving data Rx and transmitting data Tx through the COM1 port.
- ETH: Shows when there are LAN connection Tx and receiving/transmitting data Rx
- A: Together with STAT shows some states of the RTU. See Table 1 for more detailed information. Together with B shows upgrade states of the RTU. See Table 2 for more detailed information.
- B: Together with A shows some state during upgrading firmware and settings of the RTU. See Table 2 for more detailed information.
- STAT: Together with A shows some states of the RTU. See Table 1 for further information.
- ERR: Shows that there have been some SCU internal error.
- ICOM: Shows that the SCU and RTU are transmitting internally.

Cause	STAT	A	Comments
Enabling microSwitch 4		-	Switch every 500ms
Connecting miniUSB (MGMT)		-	Stays fixed
Both connecting miniUSB and enabling microSwitch 4		-	Switch every 500ms
Error when RTU starts			Switch every 50ms

Table 1: RTU LEDs state definition.

Cause	B	A	Comments
Upgrading			Switch every 500ms
Upgrade done			Switch every 100ms

Table 2: RTU LEDs upgrade definition.

1.3 KEYBOARD

Multifunction keys A/B/C/D allow doing different functions depending on the contextual menu in the display.

Keys “I” and “O” allow doing switchgear close/open manoeuvres:

To do a manoeuvre, push the command key (C in the main menu) together with the desired key (“I” to close, “O” to open). A confirmation screen will appear where the key “B” will be pushed to accept it or the key “C” will be pushed to cancel it.

1.4 LOCAL/REMOTE SWITCH

There is a two-position switch in the frontal panel to choose the device operating mode, between local and remote.

The operating mode of the device can be known because is shown by 2 LEDs placed in both sides of the local/remote switch.

The local operating mode always has priority. Thus, if an additional digital input are used to change between local/remote operating mode, the device will be operating in remote mode only when both switch and digital input will be placed in remote mode state. In case that one of them stay in local mode state, the device will remain operating in local mode.

1.5 FRONTAL AND SIDE MICROSWITCH

Devices with integrated RTU have a microswitch to add an end-of-line load to the communication ports COM1 and COM4. They are placed in the right side of the corresponding connector.

Furthermore it have a 4-position microswitch at the side and 1-position microswitch at the frontal panel SW. The SW microswitch allows to activate the RTU maintenance start and is connected to the 4rt microswitch on the side, thus an end-user can use the frontal microswitch to activate the RTU maintenance start.

Remaining side microswitchs (1st – 3rd) doesn't have a specific use but they will be implemented in next releases.

1.6 LCD DISPLAY

The LCD Display shows the most part of the data. The main screen are composed by these elements:

- LED labels: name of the associated states to the LEDs.
- Line name: Identifier to the Switchgear control module.
- Voltage presence: the voltage presence of each phase is shown in the main screen of the LCD display.
- Date and time: Current date and time configured in the device.
- Contextual menu: this menu change depending on the current screen, identifying which function have each button (A, B, C, D) that are placed in the keyboard under the LCD display.

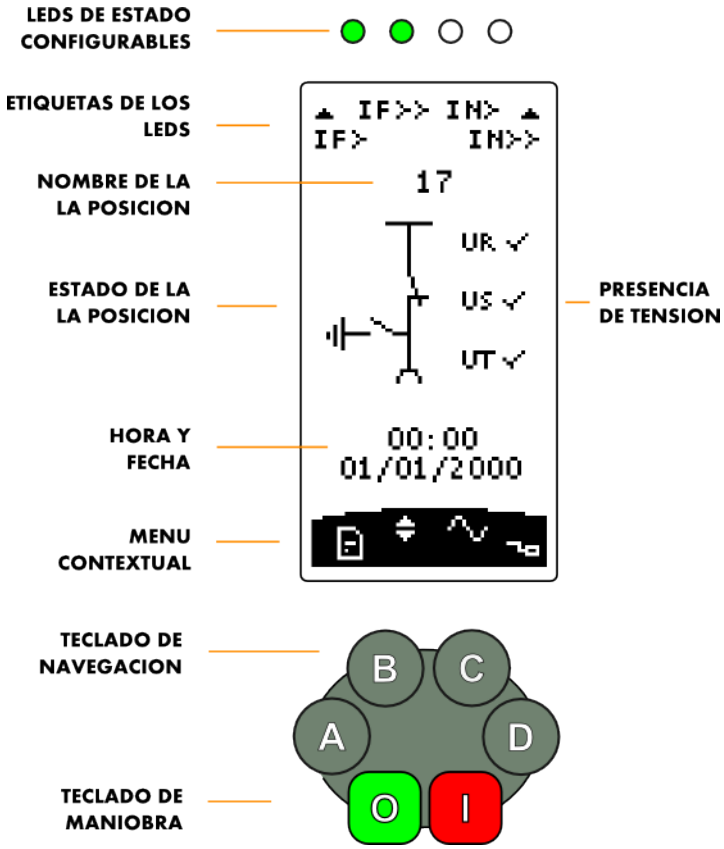


Illustration 3: User interface (main screen)

2.2 USAGE

2.1 MAIN SCREEN

- When the device starts the main screen is always shown. This contains data about the device state and a contextual menu.
- In case that no key has been pushed in 60 seconds the device will come back to the main screen.
- In the main screen the available functions in the contextual menu are:
- Look-up menu (**A**): shows the device event log.
- Settings menu (**B**): shows the settings and allows modifying it.
- Input Menu (**C**): shows analog inputs measurement and digital states.
- Command (**D**): allows doing manoeuvres over the switchgear.

2.2 NAVIGATION:

- Inside of each menu will appear either look-ups, settings or inputs submenus with its corresponding contextual navigation menu that will have the next options:
- Back (**A**): Goes back to the previous menu.
- Edit (**B**): If the selected value is editable, this push button will start the edition mode.
- Previous (**C**): Moves the cursor towards the previous element in the screen.
- Next (**D**): Moves the cursor towards the next element in the screen.

2.3 EDITION

- To edit any value, we push the edition key (**B**) and we will come to the edition mode[3], with the next contextual menu.
- Accept (**A**): Validates the configured value.
- Cancel (**B**): Leaves from edition mode and the settings value comes back to the initial value.
- Increase (**C**): Increases the settings value.
- Decrease (**D**): Decreases the settings value.

3 In order to edit device settings, the device password will be asked. By default the device password is "1111".

3 SGC180 COMMUNICATIONS

SGC180 device have two independent communication ports, with a third optionally available for special applications.

Depending on the particular model options (see chapter 9), the available ports are:

	COM1	COM2	COM3	ETH
1TP	✓	✓	×	×
2TP	✓	✓	✓	×

Table 3: Available communications options in SGC180 device.

3.1 COM1 PORT

COM1 is the port on the equipment frontal, it can be connected to any laptop through serial protocol in order to configuration and local monitoring of the device.

1.1 CONFIGURATIONS

COM1 has always the same configuration parameters:

- Bit-rate: 19200bps
- Data bits: 8bit
- Parity: None
- Stop bits: 1
- Flow control: None

1.2 PROTOCOL AND CONNECTION

This port can be connected to any RS232 serial port, with a standard DB9 connector cable.

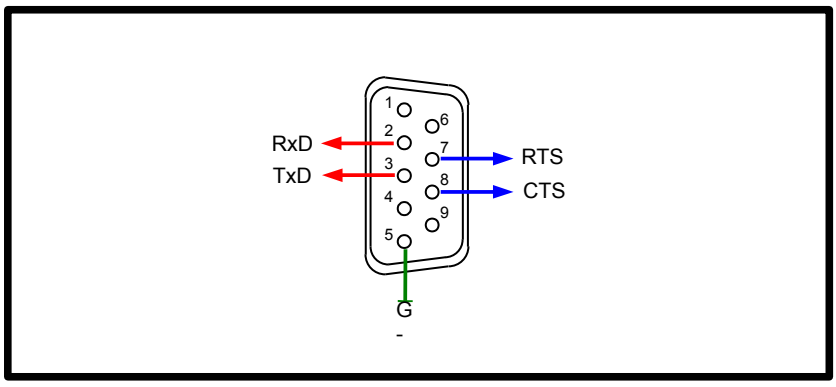


Illustration 4: COM1 (RS232) Pinout.

Communication can be established with any terminal software[4], but the use of the provided software is preferred for user convenience.

4 Device is responsible to do keyboard echo and manage line breaks, if you notice erratic behavior, make sure that the ASCII terminal settings is configured to not perform local echo and does not add newlines with the carriage return.

3.2 COM2/3 PORT

COM2/COM3 ports allow the connection to other telecontrol equipment with a PROCOME or MODBUS protocol.

2.1 CONFIGURATION

The settings of this port are fully configurable as described in the “Communication Settings” section on the “General configuration” chapter.

2.2 PROTOCOL AND CONNECTIONS

On 1TP and 2TP models, the connection with the other equipment is run over a serial RS485 link. An RJ45 connector is used.

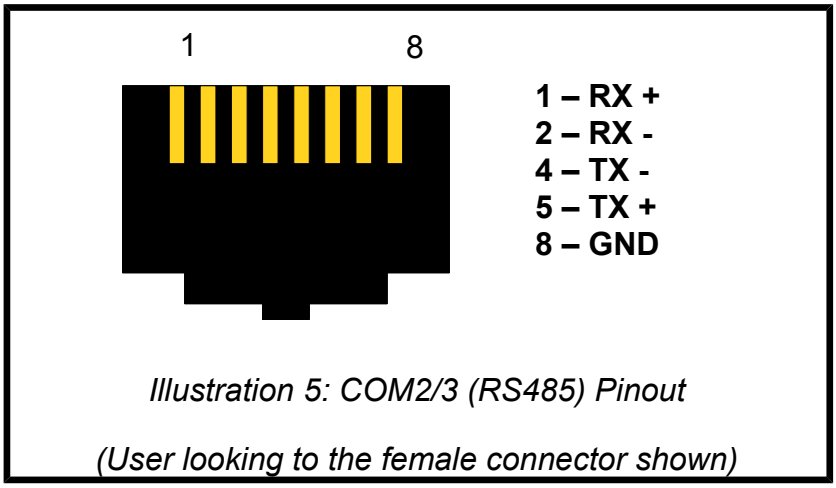


Illustration 5: COM2/3 (RS485) Pinout

(User looking to the female connector shown)

Connection can be configured either half-duplex or full-duplex, depending on the setting of internal jumpers. Default mode is half-duplex.

4 COMMUNICATIONS FOR SGC195 DEVICES

The **SGC195** device has the RTU unit **iGRID T&D iRTU** integrated. It has an Ethernet port and until two communication independent ports ready to connect to the control center and/or others devices. Furthermore it has a maintenance port miniUSB and other for USB keys.

Communications configuration of the device can be as follows and each available ports will be:

	COM1	COM4	ETH	miniUSB
1TP	✓	×	✓	✓
2TP	✓	✓	✓	✓

Table 4: Available ports in the SGC195 devices.

4.1 COM1 PORT

COM1 is a RS232(modem RS232)/RS422/RS484 software configurable port with 3kV isolated that connects the SGC195 device with the either control center or other communication devices.

1.1 PROTOCOL AND CONNECTIONS

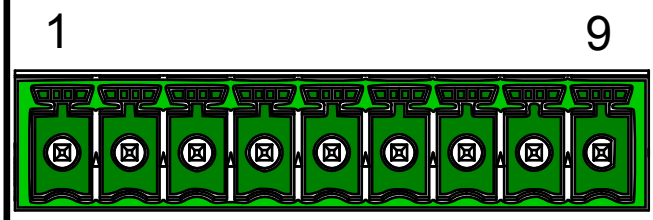
Data transmission to the control center can be configured by using any of the following protocols:

- IEC60870-5-101
- DNP3.0
- Modbus RTU.

In addition it can be connected to a communicable device by using any of the next protocols:

- IEC60870-5-101
- Modbus RTU
- DLMS
- Procome.

To connect with the communication COM1 unit a connector Phoenix Contact model MC1.5/9-G-3.5 of 9 contacts is used with the next configuration:



Pin	Mode RS232	Mode RS422/ RS485
1	Rx	Rx+
2	CTS	Rx-
3	Tx	Tx-
4	RTS	Tx+
5	GND	GND
6	DSR	
7	DCD	
8	DTR	
9	RI	

Figure 6: COM1 connector pinout (RS232/RS422/RS485)

(User looking to the female connector shown)

To work with protocols using RS232 modem mode a connector Phoenix Contact MC 1,5/9-ST-3,5 will be used. Whereas the protocols using either RS422 or RS485 modes they will use a connector Phoenix Contact MC 1,5/5-ST-3,5[5]

5 This connector is the same as used in COM4 port at chapter 4.2.2.1

4.2 COM4 PORT

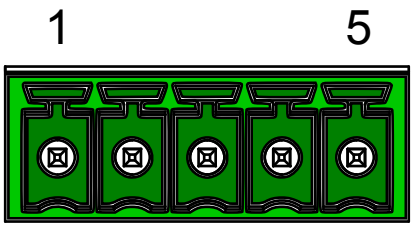
The COM4 port is a RS485 port isolated 3kV that allows the SGC195 device to connect with other devices with serial communications.

2.1 PROTOCOL AND CONNECTION

COM4 can be used to communicate with other devices by means of the next protocols:

- PROCOME
- MODBUS.

To connect with the communication COM4 unit a connector Phoenix Contact model MC1.5/5-G-3.5 of 5 contacts is used with the next configuration:



Pin	Mode RS422/ RS485
1	Rx+
2	Rx-
3	Tx-
4	Tx+
5	GND

Figure 7: COM4 connector pinout (RS232/RS422/RS485)

(User looking to the female connector shown)

To work with protocols using either RS422 or RS485 mode a connector Phoenix Contact MC 1,5/5-ST-3,5 will be used.

4.3 ETHERNET PORT

The Ethernet port is type 10/100 with a RJ45 connector that allows to SGC195 device to connect to the control center by means a IP network[6].

3.1 PROTOCOL AND CONNECTION

The Ethernet port allows a remote connection with either a control center or another device communicable by means of a network IP by using any of the following protocols:

- IEC60870-5-104
- Modbus TCP
- Serial Protocols indicated at the chapter 4.1.1.1 and encapsulated in TCP.

3.2 MAINTENANCE THROUGH FTP

This port communicates directly to the integrated RTU and allows to do RTU maintenance operations through FTP.

To gain access through FTP to the RTU we will use the current SGC195 device IP address (indicating user: **isupport** and password: **irtusupport**) in your FTP manager.

Furthermore Ethernet port allows to do SGC195 device maintenance and commissioning operations by connecting a computer through Ethernet port (**ETH**) and using qtAjustes software.

For further information refer to the Commissioning manual.

4.4 MINIUSB PORT

The frontal maintenance port miniUSB allows to connect a computer to the SGC195 device to do maintenance operations[7].

4.1 MAINTENANCE THROUGH FTP

To do local maintenance tasks to the SGC195[8] device connecting a computer to the USB_OTG (**MGMT**) port, computer Windows®[9] installed driver will be used. When Windows doesn't installs correctly the driver ***iGrid_iRTU_driver.inf*** will need to be installed to the computer.

To gain access through FTP to the RTU we will use the current SGC195 device IP address (indicating user: **isupport** and password: **irtusupport**) in your FTP manager[10].

With the computer connected to the USB OTG (**MGMT**) port and using the qtAjustes[11] software is possible to do maintenance and commissioning operations to the switchgear control unit[12].

For more detailed information refer to the Commissioning manual[13].

6 By default the configured IP address in the **Ethernet** port is **192.168.1.100**
7 The IP address of the maintenance port **MGMT** is always **10.10.10.100**.
8 This concerns the maintenance ops from switchgear control unit and remote terminal unit.
9 It has been tested with Windows® XP SP3, Windows® Vista, Windows® 7 and Windows® 10.
10 By default the configured **RTU** maintenance port is **23** (FTP).
11 This software can be downloaded from Support → Download Software from Electrónica Digital de Protección S.A. webpage. Either Sign in or Login is mandatory.
12 By default the configured switchgear control unit maintenance port is **10002**.
13 This manual can be downloaded from Support → Download User Manuals from Electrónica Digital de Protección S.A. webpage. Either Sign in or Login is mandatory.

4.5 USB TYPE A PORT

The USB type A port allows you to download the ***iGrid_iRTU_driver.inf.***

5.1 MAINTENANCE THROUGH USB KEY

Furthermore through USB type A port allows to load settings to the iRTU. For that we need a USB pendrive with the next folders in its root:

..\UPLOAD_BIN\iDevSetup.bin

..\UPLOAD_BIN\iGRTU.bin

..\UPLOAD_CONF\[User protocol settings].ccx

..\UPLOAD_CONF\IED_mProcome_DI_0001.ccx

..\UPLOAD_CONF\rtu.ccx

..\UPLOAD_CONF\states.ccx

..\UPLOAD_IKERNEL_AUTO\iKernel.bin

The RTU upgrading will do following next steps:

1. Start unplugging the voltage supply to the SGC195 device.
2. Plug the USB pendrive, with the folders shown previously, to the USB type A port.
3. Plug the voltage supply and starts SGC195 device.
4. When the USB pendrive is connected (usually a LED from pendrive is on) the upgrading process will start. During the upgrading process “A” and “B” LEDs will start to blinking every 500ms. See table 2.
5. The upgrading process will take around 40 seconds. Once this process is done, “A” and “B” LEDs start to blinking every 100ms. This shows that the upgrading process is successfully ended. See table 2.
6. Unplug the USB pendrive and the voltage supply from the SGC195 device.

For more detailed information refer to the Commissioning manual[14].

14 This manual can be downloaded from Support → Download User Manuals from Electrónica Digital de Protección S.A. webpage. Either Sign in or Login is mandatory.

5 GENERAL CONFIGURATION

5.1 COMMUNICATION SETTINGS

The following settings allow changing the communication parameters for telecontrol ports (COM2/3).

SETTING	DESCRIPTION	RANGE	STEP
Protocol	*Communication protocol used.*	PROCOME MODBUS ASCII MODBUS RTU	
Address	*Address of the equipment for communication.*	0-254	1
BPS	*Communication bit-rate.*	300, 1200, 2400, 4800, 9600, 19200 o 38400bps	
STOP Bits	*Stop bit count.*	1 or 2	
Parity	*Parity.*	Even, Odd o None	
Password	*Remote connection password protection.* *(Only for PROCOME)*	8 alphanumeric chars.	

Table 5: Communication settings

5.2 DIGITAL INPUT/OUTPUT SETTINGS

The physical inputs and outputs are assignable to any equipment internal signal with the settings shown in this section. It is possible to logically negate the signals whether the inputs as the outputs.

The digital inputs can also be disabled in order to avoid either to log or to send unintended events or due to malfunction of the connected equipment.

The assignment of signals can be done through the setting's software, as explained in its own manual.

2.1 INPUTS SETTINGS

SETTING	DESCRIPTION	VALUES
Digital inputs	*Assignment list of physical inputs to logic internal signals.*	Module, unit and signal
DI Enable	*The reading of the input is enabled.*	ON or OFF
DI Negate	*When enabled, the logical read value is the complement of the input.*	ON or OFF

Table 6: Digital input settings.

2.2 OUTPUT SETTINGS

SETTINGS	DESCRIPTION	VALUES
Digital output	*Assignment to any of the logic internal signals.*	Module, unit and signal
DO Enable	*The writing of the output is enabled.*	ON or OFF
DO Negate	*When enabled, the logical output value is the complement of the signal.*	ON or OFF

Table 7: Digital output settings

2.3 ASSIGNABLE LOGIC SIGNALS

Any logic signal listed as “Input” or “Command” in the description of each functional module is assignable to any digital input or digital output, respectively. To avoid conflicts, each signal can only be assigned once.

There are also the following global input signals available.

For each SGC	
To Local	*When logic high, the SGC is in local mode (any remote operation is disabled).*
Manually close	*When logic high, the SGC sends a close command to the switchgear.*
Manually open	*When logic high, the SGC sends an open command to the switchgear.*
For each line	
LCB Closed	*Line circuit breaker is closed.*
LCB Open	*Line circuit breaker is open*
ECB Closed	*Earthing circuit breaker is closed.*
ECB Open	*Earthing circuit breaker is open*
PCB Closed	*Protection (transformer) circuit breaker closed.*
PCB Open	*Protection (transformer) circuit breaker open.*

Table 8: Global Inputs

There are also the following global output signals available.

For each SGC	
Anomaly	*The self checking process has detected a malfunction.*
Local	*The equipment is in local mode (any automatic/remote operation is disabled).*
Remote	*The equipment is in remote mode.*

Table 9: Global outputs

5.3 OTHER SETTINGS

3.1 LED SETTINGS

When the model has available configurable leds, any “command” signal can be assigned to them with these settings.

SETTING	DESCRIPTION	VALUE
LEDs	*List of assigned signals to LEDs*	Module, unit and signal

Table 10: LED settings.

3.2 ID INFORMATION

A brief string describing the controlled equipment. For reference only.

6 FUNCTIONS

6.1 FAULT PASS DETECTION

1.1 DESCRIPTION

The fault pass detection unit (FPD) uses the voltage/current measures from the analog inputs to detect and signal passing faults.

Phase and neutral faults can be independently detected. Voltage detection is used to improve the detection of faults and service restoration.

The signaling can be reset by a timer and/or by service restoration. There is also the possibility of using a digital input to reset the detector.

1.2 SIGNALS

The inputs are: analog inputs and external reset.

There are two types of outputs:

1. **Fault detection:** points out a fault detection and it is an impulsive signal (only activations can be read)
2. **Fault detection signaling:** it becomes logical '1' when a fault is detected, and it is reset to '0' according to the reset settings.
3. **Directional detection indicators:** signal the fault direction.

OUTPUTS	
Fault pass detection	*Fault pass detected (either phase or neutral)*
Phase Fault pass detection	*Phase Fault pass detected*
Neutral Fault pass detection	*Neutral Fault pass detected*
Fault pass signaling	*Fault pass signaling (either phase or neutral)*
Phase Fault pass signaling	*Phase Fault pass signaling*
Neutral Fault pass signaling	*Neutral Fault pass signaling*
Directional enable	*Enables fault direction discrimination*
Direction	*Direction of fault detection:* *0: Output* *1: Input*
COMMANDS	
Reset	*External signaling reset*
Directional enable	*Enables fault direction discrimination*

Direction switch	*Switches the direction selected between output/input*

Table 11: FPD Signals.

1.3 SETTINGS

The timings of the pass fault detector are the same for phase and neutral. Each unit can be disabled independently.

1.3.1 GENERAL

NAME	RANGE	STEP	OTHER
Fault verify time (Tv)	0,05-10 s	0,05 s	
Service restore reset (Ts)	0-30 s	0,1 s	0 value disables function
Timed Reset (Tri)	1-250 m	1 m	
Directional	ES/FS		

Table 12: General FPD settings.

1.3.2 PHASE DETECTOR

NAME	RANGE	STEP	OTHER
Enable			*ON/OFF*
Current threshold	100-1000 A	1 A	*Primary setting*

Table 13: Phase FPD settings.

1.3.3 NEUTRAL DETECTOR

NAME	RANGE	STEP	OTHER
Enable			*ON/OFF*
Current threshold	5-100 A	1 A	*Primary setting*

Table 14: Neutral FPD settings.

1.3.4 SENSITIVE NEUTRAL DETECTOR (OPTIONAL)

NAME	RANGE	STEP	OTHER
Enable			*ON/OFF*
Current threshold	5-5000 mA	1 mA	*Secondary setting*

Table 15: Sensitive neutral FPD settings.

1.4 OPERATION

The phase and neutral fault pass detectors are independent. Each unit has a dedicated output.

Additionally, there is a common output, which is a logical OR between each of the outputs.

The minimal fault detection time is To < 25ms.

If the fault last longer than this time, the detection algorithm is started.

When the fault is cleared (the current falls below the threshold), the fault verification timer is started (Tv).

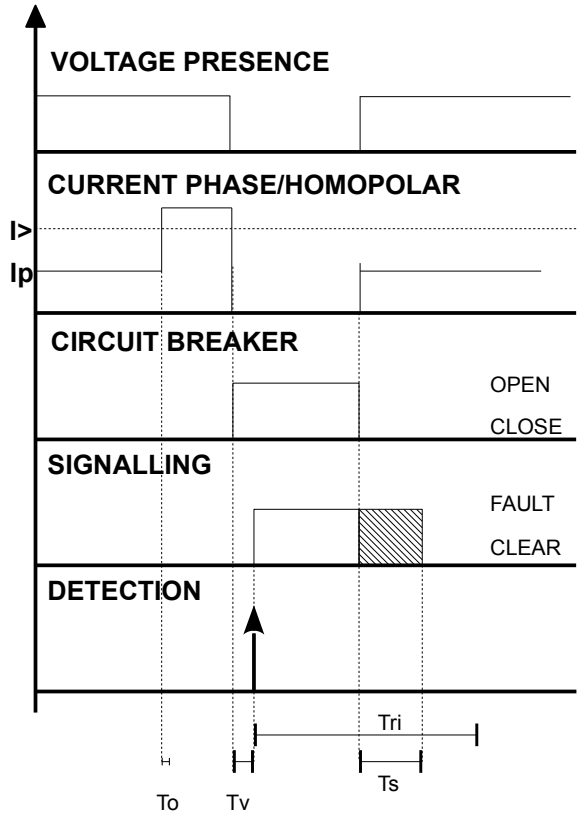
When the fault verification timer has expired, voltage presence on the line is checked. If there is voltage on the line the fault is cleared and no signaling is done. If there is no voltage then the fault is deemed permanent and thus signaled.

For the correct operation of the module the detection time settings must be coherent with voltage detector time settings and recloser configuration.

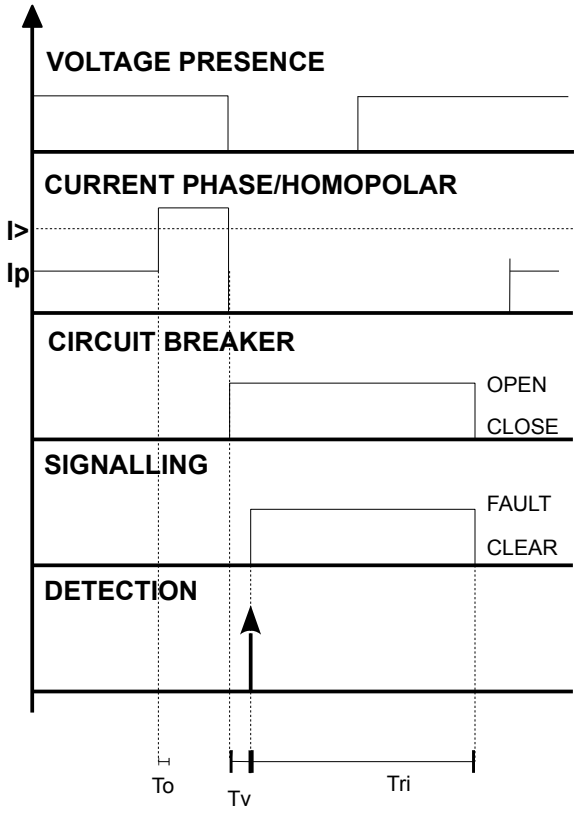
Fault pass signaling is reset by one of these procedures:

1. Service restored: when voltage presence is detected during Tri seconds, the signaling is reset. This signal comes from the voltage presence detector module.
2. Timed reset: when the signaling is started a Ts timer is started. When it expires, the signaling is reset.

In the next page a diagram with the device behavior in the case of reset by service restoration (fault is cleared) and by time reset (fault is deemed permanent).



a) Service restored afeter Tri.



b) Timed reset.

I>: Fault threshold current.
Ip: Line current.
To: Fault detection time.
Tv: Fault verification time.
Tri: Service restore reset time.
Ts: Timed reset time.

Service restored

The fault pass detector also has directional fault discrimination functions, with a three-phase unit for phases and a monophasic one for neutral.

6.2 VOLTAGE PRESENCE DETECTION UNIT

2.1 DESCRIPTION

The voltage presence detection unit (VPD) processes the voltage analog inputs to asses the presence of voltage on the line. This is done by the comparison with a configurable threshold, as a percentage of the configurable nominal voltage.

The VPD also signals the event of “phase open/fail” which signals that the voltage on one or two lines is below the threshold (no signaling is done when there is no voltage on any phase, as this usually means the main circuit breaker is open, and is of no indication of phase failure).

The VPD also doubles as a dip/surge detector. The maximum deviation from nominal voltage can be programmed to activate a signal when the voltage is out of nominal range.

The signals “Voltage Presence Signal” and “Phase Open/Fail Signal” are programmable timed alarms originated from the after-mentioned algorithms.

2.2 SIGNALS

OUTPUTS	
Voltage Presence A	*Voltage on line A is above threshold*
Voltage Presence B	*Voltage on line B is above threshold*
Voltage Presence C	*Voltage on line C is above threshold*
Voltage Presence	*Voltage on line A/B/C is above threshold*
Phase Open/Fail	*There is no voltage presence on one or two phases*
Voltage Presence Signal	*Timed version of “Voltage Presence” signal.*
Phase Open/Fail Signal	*Timed version of “Voltage Presence Signal”*
Swell Voltage Start/Peak/End A	*Shows the Start, peak and end values of the swell voltage on line A.*
Sag Voltage Start/Peak/End A	*Shows the Start, peak and end values of the sag voltage on line A.*
Swell Voltage Start/Peak/End B	*Shows the Start, peak and end values of the swell voltage on line B.*
Sag Voltage Start/Peak/End B	*Shows the Start, peak and end values of the sag voltage on line B.*
Swell Voltage Start/Peak/End C	*Shows the Start, peak and end values of the swell voltage on line C.*
Sag Voltage Start/Peak/End C	*Shows the Start, peak and end values of the sag voltage on line C.*

Table 16: VPD signals.

2.3 SETTINGS

NAME	RANGE	STEP	OTHER
Enabled			*ON/OFF*
Voltage presence threshold	0 – 100% Un	1% Un	
Overvoltage Threshold	100 – 250% Un	1% Un	
Detection time	0 – 1 s	0,05 s	
VP Timer (Tspt)	0-300 s	1 s	
Phase Open/Fail Timer (Tfff)	0-300 s	1 s	
Sag/Swell detection	ON/OFF		
Sag threshold	50 – 80%	1% Un	
Swell threshold	110 – 150%	1% Un	
Sag/Swell Minimum time	0,1 – 1000 ms	10 ms	
Sag/Swell limit	5 – 25%	1% Un	

Table 17: VPD Settings

2.4 OPERATION

The VPD compares the analog input magnitude with the configured thresholds using a comparator with hysteresis.

The general Voltage Presence Signal is the logical OR between all each phase presence signal.

There is one Phase Open/Fail alarm which is active when any of the line voltages is outside the presence-overvoltage threshold. This alarm is disabled in a three-phase undervoltage situation.

The signal outputs are timed versions of the logical signals for filtering out line transients, and avoid false event logging.

The swell/sag voltage detection unit is monitoring the voltage rate within phases.

When this go out of its nominal range, after passed a minimum time the monitoring of the sag/swell voltage starts.

In case that a sag/swell event occurs this will be considered a valid event neither the value is over/under a previous configured limit nor take more time that a configured time.

The limit is defined as an increase in the threshold, that means:

- Swell threshold = 120% Un
- Swell limit = +20% Un
- The swell range will be: 120% Un < U < (120%+20%) Un

When a sag/swell event is validated a log is written with the events and measures with the start/peak/end values and its related time log.

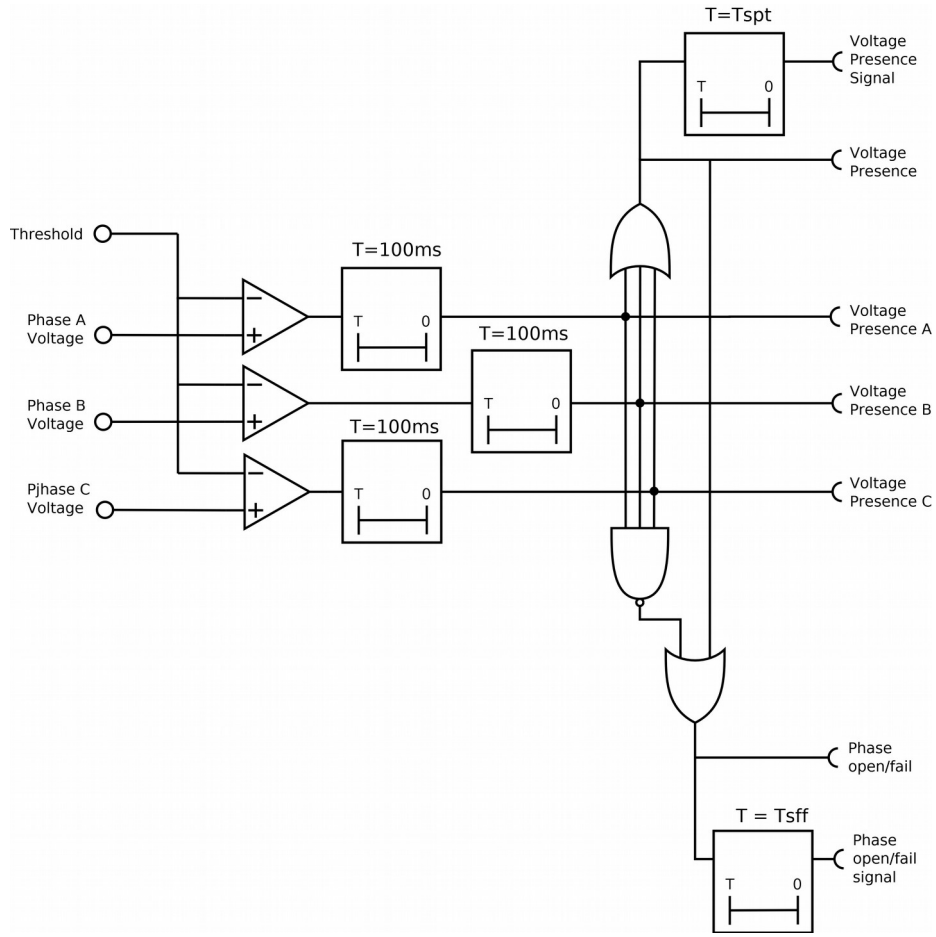


Illustration 8: VPD unit logic diagram.

6.3 SECTIONALISER AUTOMATISM

3.1 DESCRIPTION

The sectionaliser uses the signals generated by the Pass Fault Detector (PFD) and the Voltage Presence Detector (VPD) to implement a sectionaliser algorithm.

This unit is also occupied with the CB related configurations parameters, such as the motor command actuation time.

3.2 SIGNALS

The inputs of the unit are the logic signals “Voltage Presence Detection” and “Fault Pass detection”, and outputs an open command to the circuit breaker.

The automatism will not be active in case that the device is working in local mode. Two different operating modes are possible:

- In local, out of service: The automatism will be out of service when the device change to local mode and will need a command to enable the automatism when the device goes back to the remote mode.
- In local, blocked: The automatism will be blocked when the device change to local mode and will be unblocked when the device goes back to remote mode.

There are several state signaling outputs: enabled, blocked and command executed.

The outputs “LCB Open” and “LCB Close” are usually assigned to physical outputs connected to the circuit breaker operation controls.

OUTPUTS	
Enabled	*Automatism is enabled*
Disabled	*Automatism is disabled*
Blocked	*Automatism blocked*
Open command	*Automatism has commanded CB open operation.*
LCB open	*Command for CB opening*
LCB close	*Command for CB closing*
COMMANDS	
LCB open command	*Remotely command the unit to issue the CB opening.*
LCB close command	*Remotely command the unit to issue the CB closing.*
Enable automatism	*Automatism enable*
Disable automatism	*Automatism disable*

Table 18: Sectionaliser signals.

3.3 SETTINGS

The sectionaliser algorithm can be configured to work with up to 100 reclosing of fixed time.

NAME	RANGE	STEP	OTHER
Enabled			*ON/OFF*
Recloser count	1-100	1	
Reclosing time	1-500 s	0,5 s	
Command time	0,1-15 s	0,1 s	
Switchgear name	12 char alphanumeric		Name of associated switchgear

Table 19: Sectionaliser settings

3.4 OPERATION

Sectionaliser operational principle is based on the use of fault pass detector to monitor the main circuit breaker reclosing cycle.

The voltage presence detector is used to verify whether the reclosing cycle has succeeded or not.

At first, the automatism is awaiting a fault pass indication. When it occurs a timer T, corresponding to the first reclosing cycle, is started.

If there is a fault pass detection during the T time, and there is not voltage presence on the line, a failed reclosing cycle is assumed. Then the T timer is restarted.

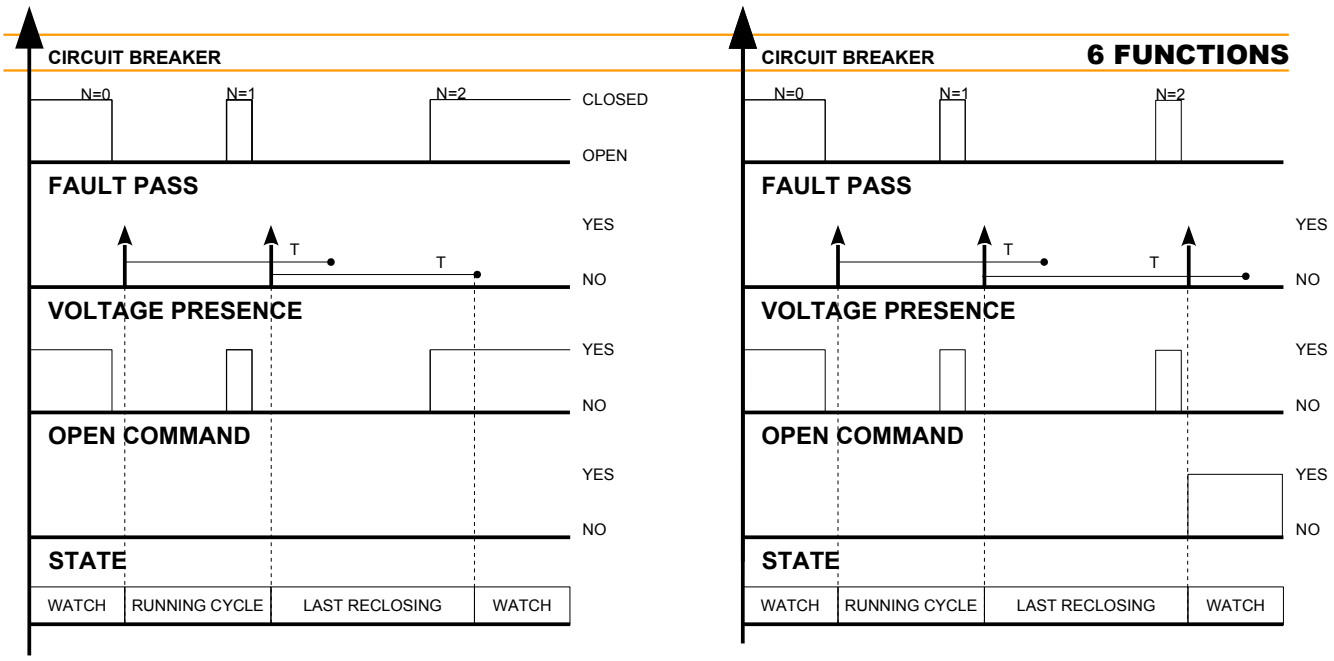
If there is not a fault pass detection during the T time, or a fault is detected but with voltage presence on the line, it is assumed the fault has been cleared, so the automatism returns to the initial state.

If the current reclosing cycle is the last one programmed, the voltage presence is checked once the timer is expired.

If the fault has been cleared, the automatism returns to the initial state (example a).

If the fault has not been cleared (example b), the associated circuit breaker open command is issued (no voltage on line).

The command is executed as a programmable pulse/latch signal according to the setting “Command Time”.



a) Reclosing count = 2
Failed reclosings = 1

b) Reclosing count = 2
Failed reclosings = 2

Illustration 9: Example of sectionalizer automatism working.

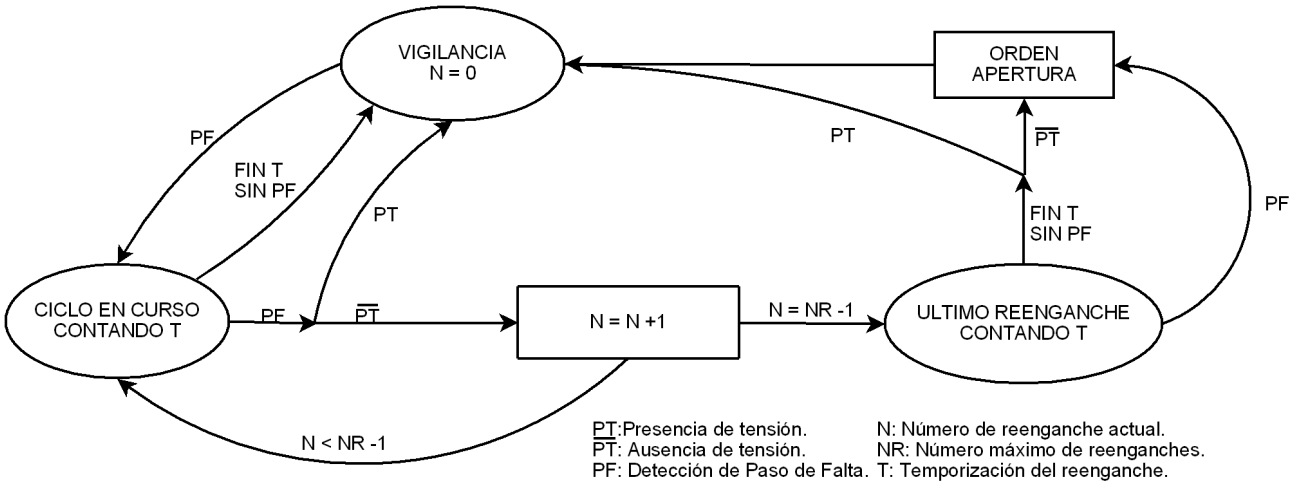


Illustration 10: Operation and state diagram of sectionaliser algorithm.

6.4 CIRCUIT BREAKER FAILURE MONITORING

4.1 DESCRIPTION

The circuit breaker monitor detects errors in the operation of the circuit breaker by means of the following procedures:

- The circuit breaker does not switch position when commanded.
- The circuit breaker has open, but there is still current running through it.
- Motor keeps operating when the switching is done or a timeout has occurred.

4.2 SIGNALS

OUTPUTS	
CB Failure	*CB Failure detection (any of them)*
CB Failure O	*Failure detected during CB opening*
CB Failure I	*Failure detected during CB closing*
Motor Failure	*Failure detected on motor operation*
INPUTS	
LCB Open	*Open signaling from the CB*
LCB Closed	*Closed signaling from the CB*
Motor	*Motor operating signaling from the CB*

Table 20: CB Monitoring signals

4.3 SETTINGS

NAME	RANGE	STEP	OTHER
Open failure threshold current (phases)	0 – 100 A	5 A	0 disables checking
Open failure threshold current (neutral)	0 – 100 A	1 A	0 disables checking
Maximum open time	0 – 60 s	0,02 s	0 disables checking
Maximum close time	0 – 60 s	0,02 s	0 disables checking
Maximum motor time	0 – 60 s	1 s	0 disables checking
Signaling time	0 – 60000ms	1 ms	0 latches output

Table 21: CB failure settings

4.4 OPERATION

Each time the circuit breaker is commanded (either from a remote command or an internal generated signal), the circuit breaker failure detection process is started.

For openings, once the command is sent, a timer (“Maximum open time”) is started and then it waits for the switch position indicator to change to open. If the timer expires and there is no switching, the “CB failure O” signal is activated.

If the switching is correct, then the current trough the circuit breaker is measured. If the current is above a set threshold, then the “CB failure O” signal is activated.

For closing the behavior is the same, but there is no current checking and the failure signal is “CB Failure I”.

There is also an optional motor failure checking to prevent it from running continuously when there is a problem in its control circuit. This is done by triggering the “Motor Failure Signal” when the motor is on more than the “Maximum motor time” setting. This signal can be assigned to a digital output to open the motor circuit.

The reset of the signaling is done after the “Signaling time” programmed or when the next command succeeds. Signal “CB Failure” is the logic OR of all the previous signals.

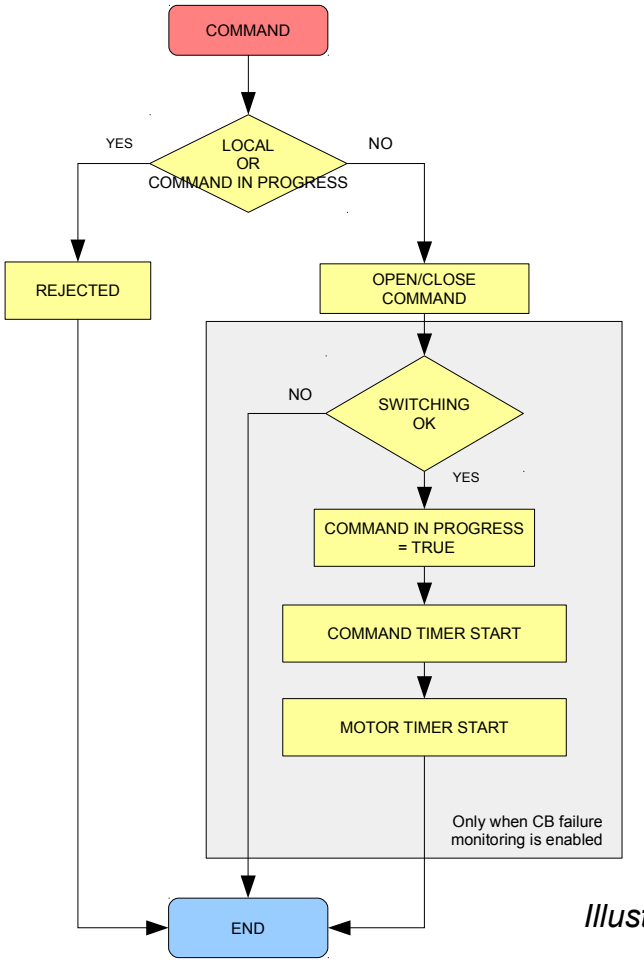


Illustration 11: Command execution order.

6.5 CIRCUIT BREAKER SUPERVISOR

5.1 DESCRIPTION

The circuit breaker supervision function is able to detect situations of CB deterioration or operation under abnormal conditions. This is done by kA^2 monitoring and excessive operation count alarm.

This function only generates alarm events, its signals do not block any command execution.

5.2 SIGNALS

OUTPUTS	
Max breaking count	*The circuit breaker has done too many breaking operations during the programmed time window.*
kA^2 threshold alarm	*The programmed kA^2 threshold has been surpassed.*

Table 22: Circuit breaker supervisor signals

5.3 SETTINGS

NAME	RANGE	STEP	OTHER
Initial kA^2 value	0 – 65535 kA^2	1 A	
kA^2 threshold	0 – 65535 kA^2	1 A	65535 inhibits the alarm
Maximum number breaking operations	0 – 248	1	0 disables the alarm
Breaking counter time window	60 – 43200 s	1s	

Table 23: Circuit breaker supervisor signals

5.4 OPERATION

5.4.1 KA^2 COUNTER

This function keeps the sum of kA^2 from breaking operations of the circuit breaker on a non-volatile memory. When this number exceeds a preprogrammed threshold, a signal is activated as an alarm.

The initial value is defined in the settings, and it can be changed as needed.

5.4.2 MAX BREAKING COUNT

This function activates a warning signal when the switch has done too many breaking operations during a configurable window time.

The number of breaking operations is stored on a non-volatile memory, it keeps counting even when a reset is applied.

5.4.3 TRIP OPERATIONS

This function keeps the sum of opening manoeuvres given to the switchgear. It gives us information only doesn't performs any blocking order to the cabinet.

6.6 PROTECTION FUNCTIONS

6.1 OVERCURRENT 50/51/50N/51N

6.1.1 DESCRIPTION

Functions 50/51/50N/51N are meant to protect the line against overloads and shortcircuits.

The 50/50N functions are protections against shortcircuits between phases (50) or phases and neutral (50N). This is done by an instantaneous breaking command when the current is above a configurable threshold.

The 51/51N functions are protections against overloads between phases (51) or phase-neutral overcurrents (51N). This is done by a timed breaking command, configurable as a timer or a current-dependent timer.

6.1.2 SIGNALS

OUTPUTS	
Pickup	*The current is above the pickup threshold*
Pickup Phase	*The phase current is above the pickup threshold*
Pickup Neutral	*The neutral current is above the pickup threshold*
Trip	*Tripping order to the circuit breaker*
Trip 51	*Tripping order from function 51*
Trip 51N	*Tripping order from function 51N*
Trip 50	*Tripping order from function 50*
Trip 50N	*Tripping order from function 50N*
Blocked	*The unit is in blocked state*
MEASUREMENTS	
Value peak pickup phases	*Gives the maximum value of a phase pickup process*
Value peak pickup neutral	*Gives the maximum value of a neutral pickup process*
COMMANDS	
Pickup Signal Reset	*Resets the pickup signalization*
INPUTS	
Block	*The unit is disabled*
Direction	*The unit will only trip when the directional module allows it.*

Table 24: Protection function signals 50/51/50N/51N

6.1.3 SETTINGS[15]

NAME	RANGE	STEP	OTHER
Phase pickup threshold	0.5 – 8 A	0.25 A	
Phase timing type	EI-VI-NI-DT-DI		
Phase curve number	0.1 – 10	0.1	
Phase timing	0.5 – 10 s	0.1 s	
Phase instantaneous threshold	1 – 25 times	0.1 t	
Phase additional instantaneous time	0.1 – 10 s	0.1 s	
Phase overcurrent block threshold	DI/ 1-25 times	1 t	

Table 25: Protection function 50/51 settings

NAME	RANGE	STEP	OTHER
Neutral pickup threshold	0.125 – 4 A	0.125 A	
Neutral timing type	EI-VI-NI-DT-DI		
Neutral curve number	0.1 – 10	0.1	
Neutral timing	0.5 – 10 s	0.1 s	
Neutral instantaneous threshold	1 – 25 times	0.1 t	
Neutral additional instantaneous time	0.1 – 10 s	0.1 s	

Table 26: Protection function 50N/51N settings

6.1.4 OPERATION

PICKUP

When the line current reaches the pickup level, the protection function starts the timing.

The return from pickup threshold is 95% of the nominal pickup threshold.

OVERCURRENT BLOCKING

To ease the protection coordination with other elements (i.e: fuses), a programmable block threshold can be configured which disables the overcurrent trip when the line current is greater than the setting.

50/50N FUNCTION

The 50/50N function trips instantaneously when the line current surpasses the threshold. This setting is relative to the pickup current.

Optionally, the 50/50N function can also be timed.

15 All settings refer to secondary values.

51/51N FUNCTION

Definite time:

Trip order is done when the line current exceeds the threshold during more than an adjustable time.

Inverse time:

The inverse time characteristic is determined by the following equation:

$$t = \frac{K}{\left(\frac{I}{I_a}\right)^n - 1}$$

Where:
I= Line current (A)
Ia= Pickup current (A)
t = Time (s)

The K and n values for each curve family are:

- N.I.: Normal Inverse (K=0.14 y n= 0.02).
- V.I.: Very Inverse (K=13.5 y n=1).
- E.I.: Extremely Inverse (K=80 y n=2).
- D.T.: Definite time.
- DI: Disabled.

6.2 DIRECTIONAL UNIT 67/67N

6.2.1 DESCRIPTION

There is a tree-phase directional unit (67) and a monophasic directional unit for neutral (67N).

Directional unit operation is divided in three zones, according to the current/voltage phase.

1. Allowing zone: the tripping operation is allowed.
2. Transition zone: the tripping operation may or may not be allowed.
3. Blocking zone: the tripping operation is inhibited.

6.2.2 SIGNALS

OUTPUTS	
Enabled	*True when the directional unit is functioning.*
Direction	*Sets the direction of the allowing zone.* *0: Output* *1: Input*
COMMANDS	
Enable directional	*Enables the directional functionality*
Switch direction	*Switches the current direction of the allowing zone.*

Table 27: 50/51/50N/51N Protection function signals.

6.2.3 SETTINGS

NAME	RANGE	STEP	OTHER
Enable			*ON/OFF*
Maximum torque angle	0-359º	1º	
Direction	In/Out		
Polarizing voltage	0,5-60V	0,5V	*Secondary voltage*

Table 28: Phase Directional function settings.

NAME	RANGE	STEP	OTHER
Enable			*ON/OFF*
Maximum torque angle	0-359º	1º	
Direction	In/Out		
Polarizing voltage	0,5-60V	0,5V	*Secondary voltage*

Tabla 29: Neutral Directional function settings.

6.2.4 OPERATION

The unit's operation zones are defined by the maximum torque angle (MTA) and the configured direction (in or out).

A minimum polarizing voltage can be set to disable the unit when the line voltage is too low.

The “allowing/blocking” signal is routed to other protection units (overcurrent protection, FPD, …). When they have the “directional” flag enabled they can be blocked by this unit.

The following Illustration shows a phasor diagram of the operation zones.

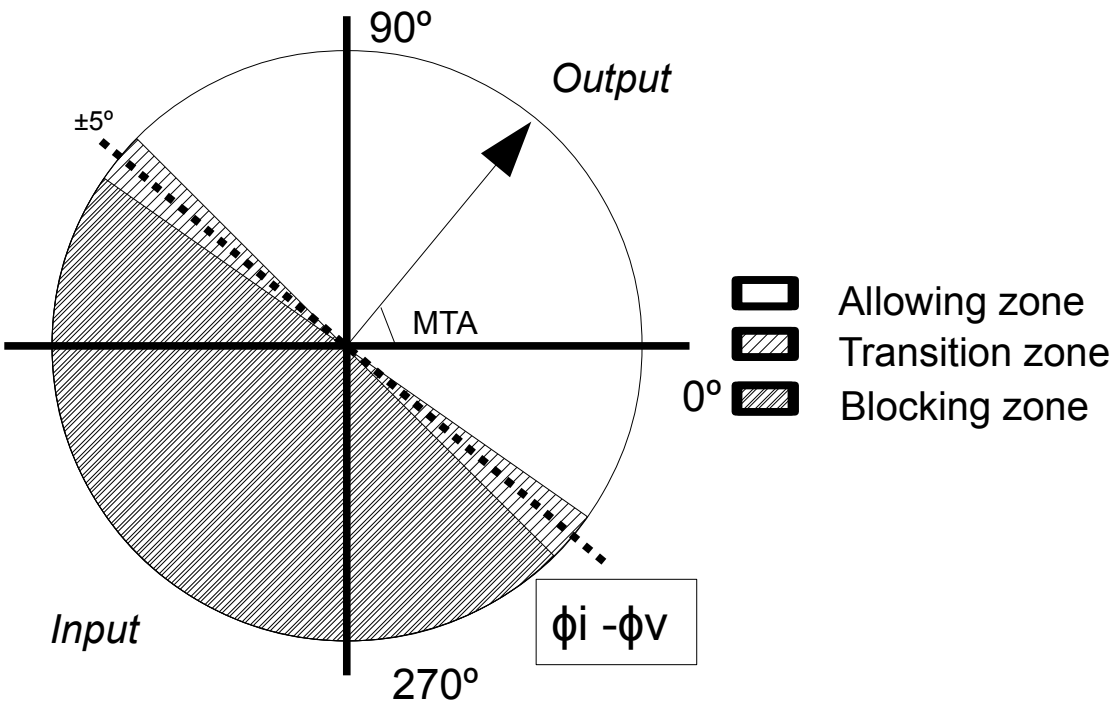


Illustration 12: Operation zones diagram

6.3 MEASUREMENT FUNCTION

6.3.1 DESCRIPTION

The SGC performs a wide range of line parameter measurements which can be obtained local or remotely.

Sign of RMS values indicates direction of current flow.

6.3.2 SETTINGS

NAME	RANGE	STEP	OTHER
Phase Current Transformer Ratio	10-1000 / 1	1	
Neutral Current Transformer Ratio	10-1000 / 1	1	
Phase Voltage Transformer Ratio	10-1000 / 1	1	
Neutral Voltage Transformer Ratio	10-1000 / 1	1	
Voltage Transformer Connection	Phase-phase/ Phase-neutral		
Phase Nominal Current	1 – 5000 A	1 A	*For relative readings*
Phase Nominal Voltage	1-100 kV	1 kV	*For relative readings*
Neutral Nominal Current	1 – 5000 A	1 A	*For relative readings*
Neutral Nominal Voltage	1-100 kV	1 kV	*For relative readings*
Calculate neutral current	On/Off		
Calculate neutral voltage	On/Off		

Table 30: Measurement function settings

The voltage transformer connection establish if the input voltage are line-ground or line-line voltage. In each case the other value is internally calculated by the controller.

The nominal power is also calculated internally as a product of nominal voltage by nominal current.

The device can also calculate the neutral voltage/current by the other phase voltages in the case that is not able to connect directly.

6.3.3 SIGNALS

All the direct and indirect measured analog values available form the SGC are listed in the table on the next page,

OUTPUTS[16]	
Current IA RMS Value	*RMS value with sign*
Current IB RMS Value	*RMS value with sign*
Current IC RMS Value	*RMS value with sign*
Current IN RMS Value	*RMS value with sign*
Voltage UA RMS Value	*RMS value*
Voltage UB RMS Value	*RMS value*
Voltage UC RMS Value	*RMS value*
Voltage UN RMS Value	*RMS value*
Current IB Angle Value	*Angle relative to IA*
Current IC Angle Value	*Angle relative to IA*
Current IN Angle Value	*Angle relative to IA*
Voltage UB Angle Value	*Angle relative to UA*
Voltage UC Angle Value	*Angle relative to UA*
Voltage UN Angle Value	*Angle relative to UA*
Active Power	*Active power computed from voltage/current (kW)*
Reactive Power	*Reactive power computed from voltage/current (kVAr)*
Power Factor	*Power factor (-1 ≤ PF ≤1)*
THD	*Total harmonic distortion (%)*
Average Phase-to-Phase Voltage	*Average of the three phase-neutral voltages*
Average Phase Current	*Average of RMS value of measured currents.*
COMMANDS	

Table 31: Measurement function signals.

16 All values are primary referred

6.4 OSCILLOGRAPHY

6.4.1 DESCRIPTION

The oscillography module captures the waveform on the analog inputs when triggered by a selectable signal.

Up to 4 different trigger signals can be selected, among every logical signal available (i.e: PFD fault signal, overcurrent trip, digital input, etc.). The trigger can be optionally inverted, in case the source signal is active low. A command input for triggering the capture is also available, making remote initiated captures possible.

When a trigger is fired, the capture starts and the rest of the triggers are ignored until the capture has ended.

The capture is done at 64 samples/cycle and stored in non-volatile memory as COMTRADE files downloadable for their analysis. The configurable pretrigger time captures the waveform before the trigger occurs, allowing the context of the capture to be analyzed with more ease.

Up to 8 captures can be stored on the SGC, when this number is reach, the module is disabled.

If “Overwrite Oldest” setting is enabled, the oldest capture data is erased from memory to free space for a new one. In this mode, the module is always ready for a new capture.

6.4.2 SIGNALS

COMMANDS	
Manual trigger	*Manually starts capture function.*

Table 32: Oscillography function signals.

6.4.3 SETTINGS

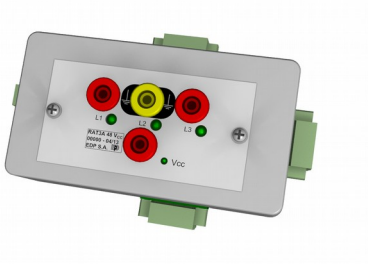
NAME	RANGE	STEP	OTHER
Enable	ON/OFF		*Enables oscillography function*
Trigger Signal[17]			*Module/unit/signal*
Trigger Enable	ON/OFF		*Enables trigger signal*
Trigger Inversion	ON/OFF		*Inverts trigger logic*
Pretrigger time	0-2 cycles	1/4 cycle	*Number of captured pretrigger cycles*
Capture time	0-25 cycles	1/4 cycle	*Number of cycles to capture*
Overwrite oldest	ON/OFF		*Keep/discard old capture files*

Table 33: Oscillography settings

17 Up to 4 different triggers are selectable.

7 ACCESSORIES AND RELATED EQUIPMENT

CAPACITIVE VOLTAGE METER HVR3A



The HVR3A is a voltage detector/meter which can be used with capacitive transducers as those usually found on switchgear bushings.

The output can be feed to an SGC so it can meter power or use directional functions with no voltage transformer needed.

It is designed to replace the lighting voltage presence indicators found in MV switchgear, being small enough to fit in space constrained applications.

It can be also used with any meter with a low voltage AC inputs.

MULTIFUNCTION PROTECTIVE RELAY RS9

The RS9 is a multifunction protective relay with a rich graphical user interface covering most applications needing a protective relay.

- Directional overcurrent: 50/51/50N/51N 67/67N
- Over and under-voltage: 59/27
- Frequency (81) and frequency derivative.
- Directional power (32).
- Recloser (79)
- Other protective functions.

8 TECHNICAL CHARACTERISTICS

Power supply			
Auxiliary input voltage	Option 12:		9,6 – 16[18] Vdc
	Option 24:		18 – 36Vdc
	Option 48/110+:		36 – 150 Vdc
	Option 220:		85 – 264 Vac
Power rating			<5 W
Digital Inputs			
Detection level (Bipolar)	Option 12:	Low:	0 – 4 Vdc
		High:	9,6 – 18 Vdc
	Option 24:	Low:	0 – 8 Vdc
		High	16 – 36 Vdc
	Option 48	Low:	0 – 10 Vdc
		High:	34 – 60 Vdc
	Option 110/110+:	Low:	0 – 10 Vdc
		High:	34 – 150 Vdc
	Option 220:	Low:	0 – 40 Vac
		High:	160 – 264 Vac
Power consumption			<0,1 W
Cabling section			2,5 mm^2
Option 1: 3 isolated inputs and 5 inputs with 1 common. Option 2: 6 isolated inputs and 2 groups of 5 inputs with 1 common.			
Digital Outputs			
Nominal Voltage			250 V
Max Load Current			8 A
Cabling section			2,5 mm^2
Configuration			DPDT Relay Output
Analog Inputs			
Current			
Nominal current			1 or 5 A
Nominal Consumption			0,05 VA
Thermal Current (Ith)			5 In (permanent) / 100 In (1s)
Accuracy	AI model	In < I < 1,2 In 0,2 In < I < In 0,05 In < I < 0.2 In	0,25% 0,35% 0,75%
	Other Models	0,1 In < I < 20 In	1%

18 SGC195 device V_{aux} range is nominal V_{aux} ±20%. †In case that the device is supplied with nominal V_{aux} ±50% it cannot be for more than 1 second or the SGC195 could be permanently damaged.

Voltage			
Nominal Voltage	Option 12/220:	230 Vac	
	Option 24/48/110:	120 / √3 Vac	
	Option 110+	120 / √3 Vac	
Max input voltage	Option 12/220:	350 Vac	
	Option 24/48/110:	150 Vac	
	Option 110+	275 Vac	
Accuracy	AI model	0,8 Un<U< Un	0,2%
	Other Models	0,8 Un <U<1.2 Un	1%
Sampling / Analog Bandwidth	64 samples/cycle		
Analog Bandwidth	1 kHz		
Other			
Temperature range	-10 ºC ÷ 55 ºC		
Body Dimensions (W x H x L)	83 x 177 x 116 mm		
Weight	1.5 kg		

9 VERSIONS

Version	
180	Control functions
180A	Control functions + oscillography + sag/swell protection
195	Control functions + integrated RTU, small form factor

SGC- ☐ / ☐ - ☐ - ☐ - ☐ - ☐ - ☐

Analog inputs	
1A	In = 1A
5A	In = 5A

Power supply	
12	9 – 18 Vdc
24	18 – 36 Vdc
48	36 – 72 Vdc
110	36 – 150 Vdc
220	85 – 264 Vac

Mounting	
M	Rear
D	DIN rail

Communications	
	Non communicable
1TP	1x RS485/RJ45
2TP	2x RS485/RJ45
ETH	Ethernet

Digital IO	
1	8 DI + 4 DO
2	16 DI + 8 DO
	No IO

Options	
	Non UI
U	With UI[19]

19 User Interface: With this option the device adds LCD display, keyboard and Remote/Local switch to allow do local maintenance manoeuvres.

Functions	SGC180	SGC180A	SGC195
Fault pass detection	✓	✓	✓
Voltage presence detection	✓	✓	✓
Broken cable detection	✓	✓	✓
Sectionaliser automatism	✓		✓
Circuit breaker failure	✓	✓	✓
Circuit breaker supervisor	*[20]	*	*
Overcurrent protection	*		*
Recloser	*		*
Oscillography		✓	
Configurable inputs	✓	✓	✓
Configurable outputs	✓	✓	✓
Inverse logic signals	✓	✓	✓
Event log	✓	✓	✓
Shell	✓	✓	✓
Real time clock	✓	✓	✓
Current inputs	3F+N	3F+N	3F+N
Voltage inputs	3F	3F	3F
Digital I/O Options	1;2	1;2	1;2
Configurable LEDs	0	0	6
Display and keyboard	✓	✓	✓
PROCOME	✓	✓	✓
101,104, DNP3, Modbus			✓

20 * This indicates that for this option contact to Electrónica Digital de Protección S.A. to activate it in the model asked for.

10 SCHEMATICS

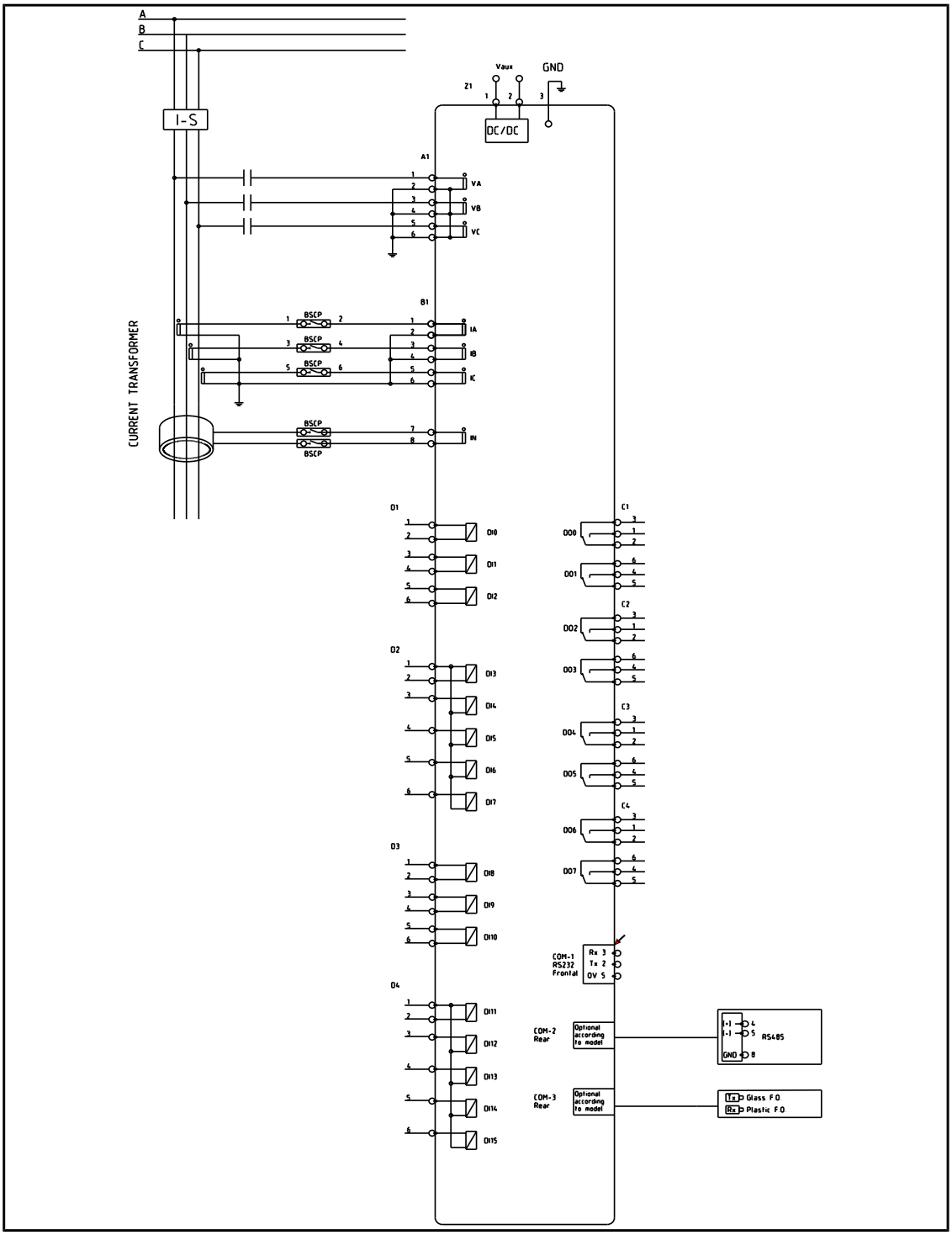


Illustration 13: Connection diagram

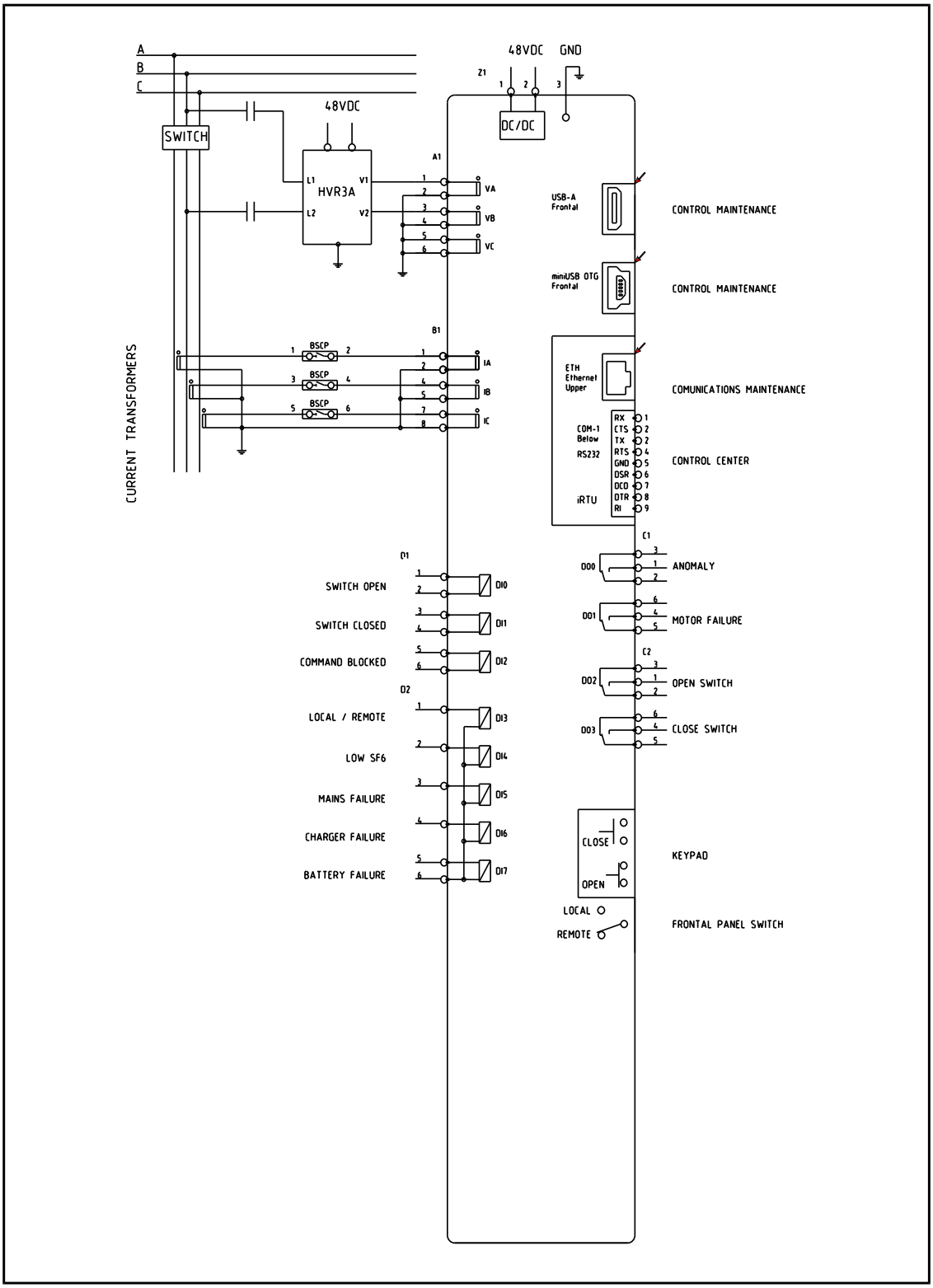


Illustration 14: SGC195 Connection diagram

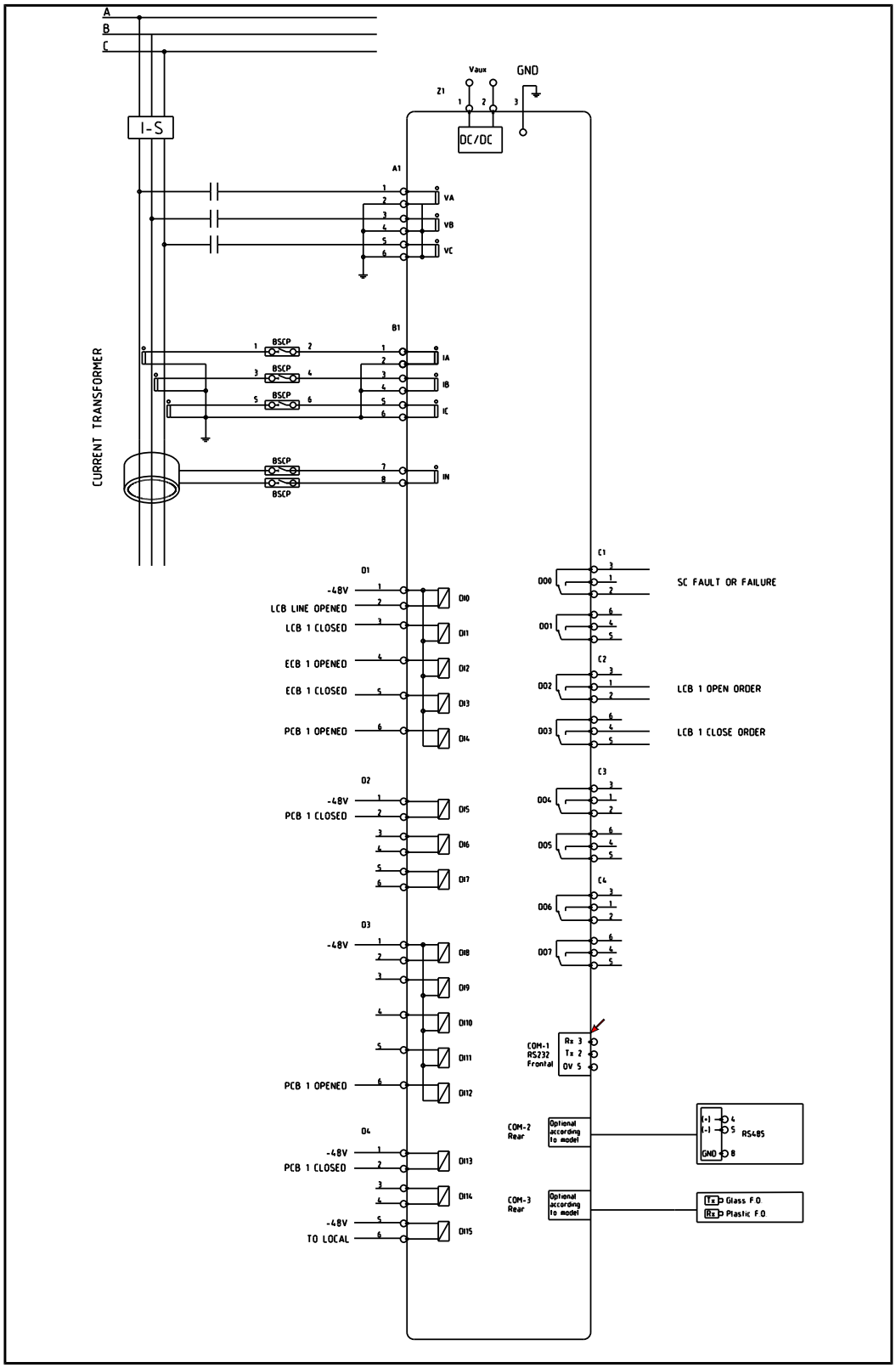
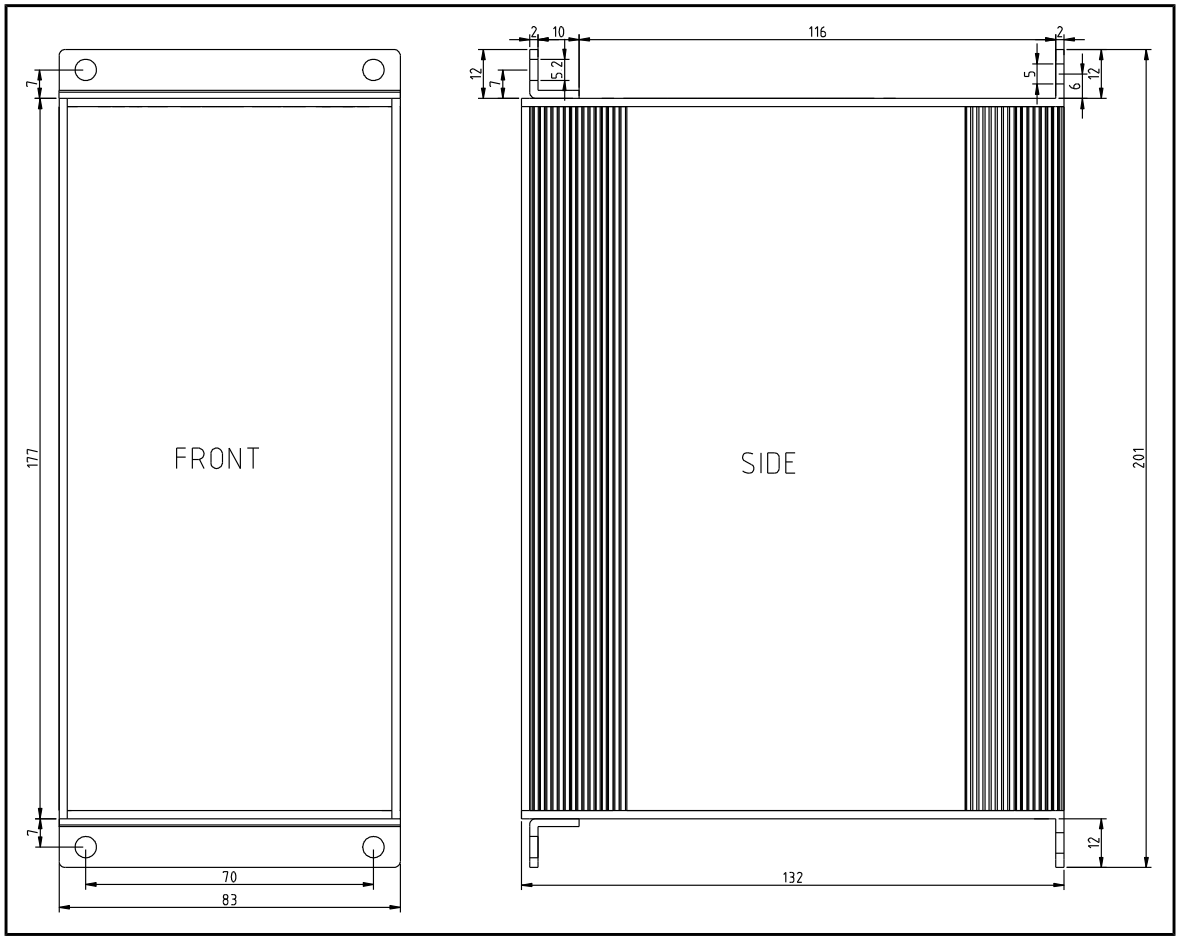
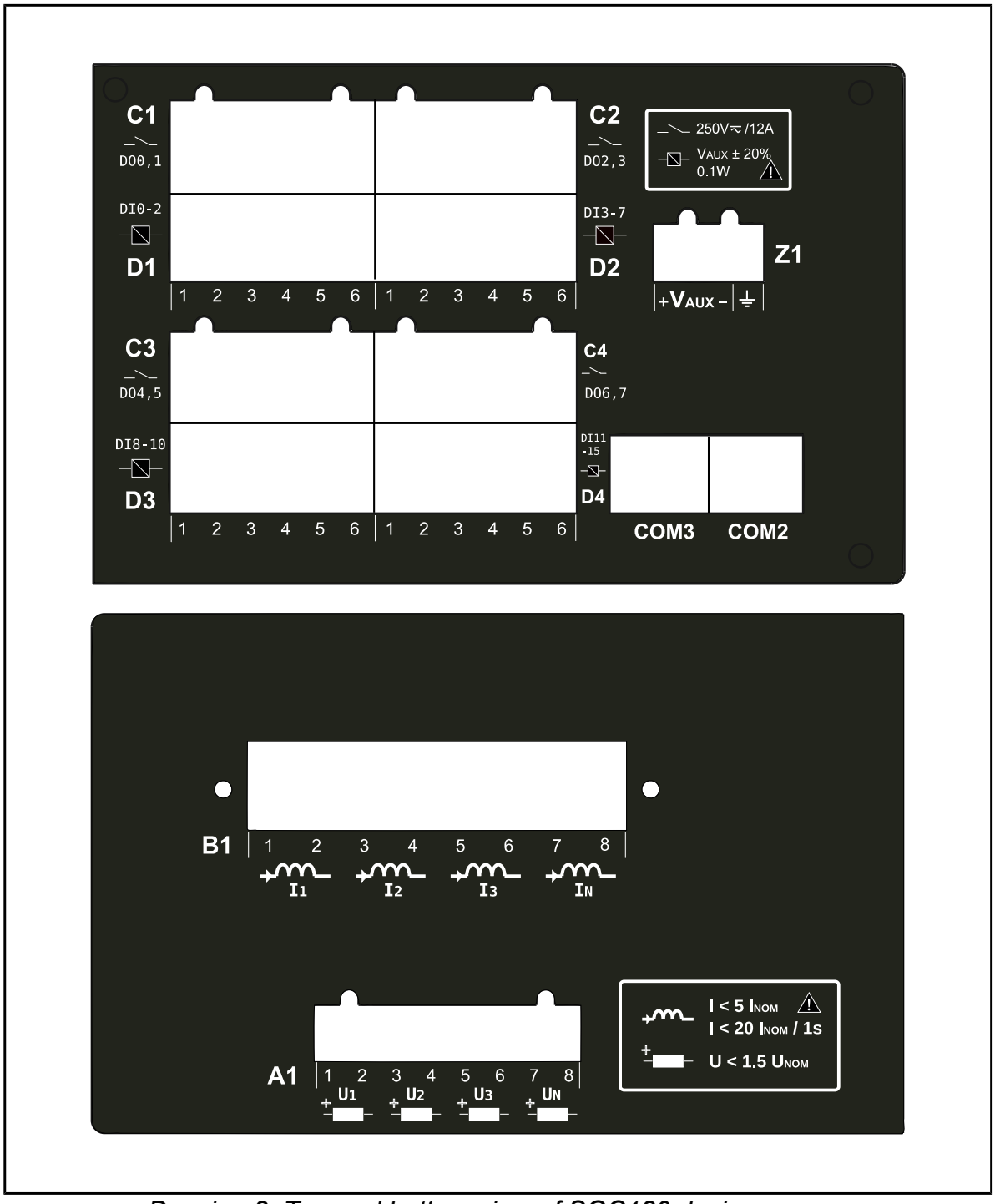


Illustration 15: Connection example (1 Line Circuit Breaker + 2 Protection/Transformer Circuit Breakers)

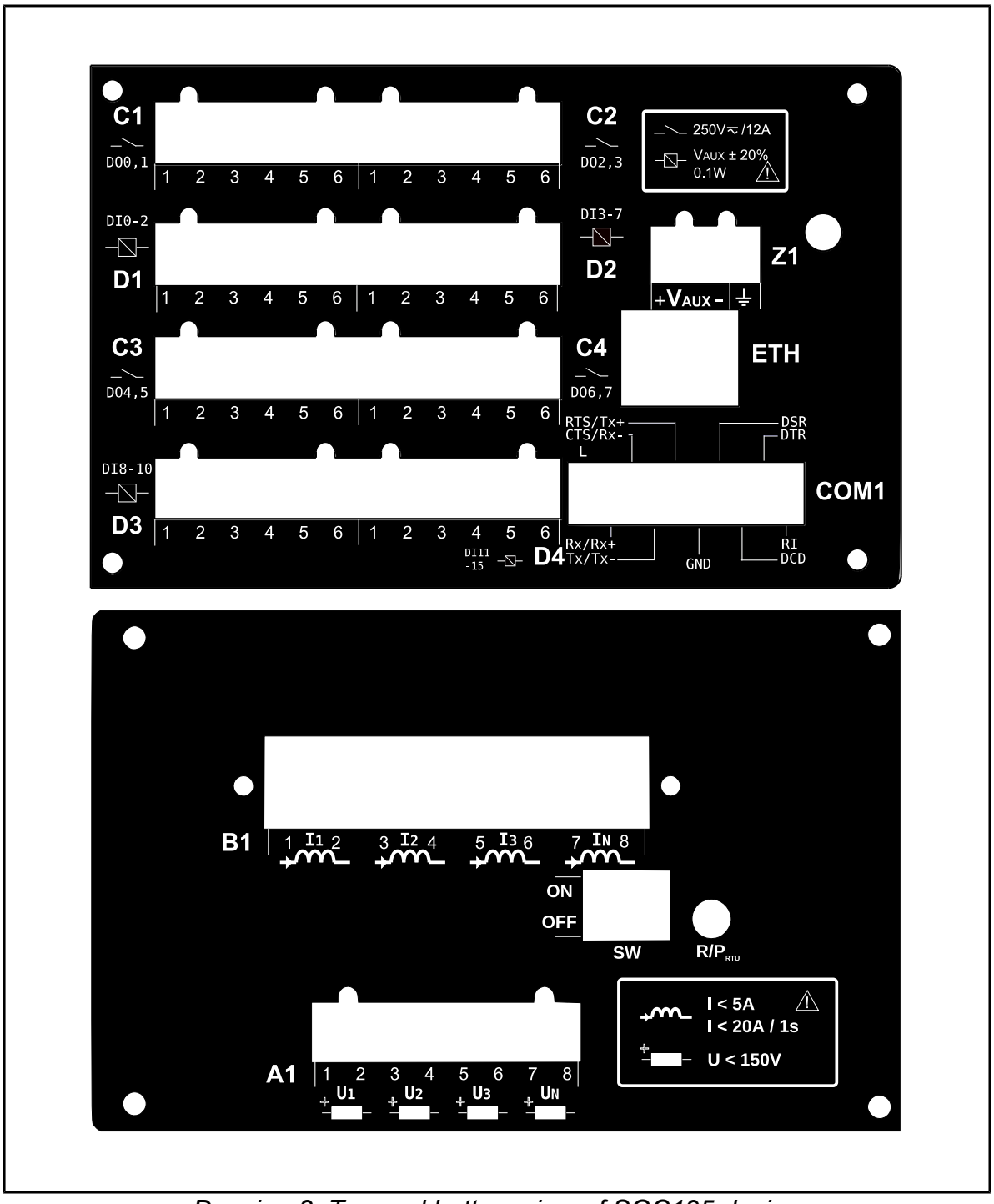
11 SIZE



Drawing 1: Front and side views of SGC180 and SGC195 devices



Drawing 2: Top and bottom view of SGC180 device



Drawing 3: Top and bottom view of SGC195 device

12 TESTINGS

- Dielectric strength: 2kV / 50Hz 1 min. according UNE EN 60255-5.
- Surge: 5kV 1,2/50us according UNE EN 60255-5.
- Electrical disturbance testing: 2.5kV longitudinal / 1kV cross, class III according UNE 21136-22-1.
- Fast transient: 2kV according UNE EN 61000-4-4 class III.
- UNIPEDE ref NORM (SPEC) 13. “Automation and Control Apparatus for Generating Stations and Substations – Electromagnetic Compatibility Requirements”.

We also offer a wide range of protective products to use in medium and high voltage.

- **Capacitive and resistive isolators.**
- **Overcurrent relays.**
- **Overcurrent and undervoltage relays.**
- **Frequency relays**
- **Inverse Power relays**
- **Synchronous checkers**
- **Communication equipment**
- **Converters**
- **Timers**
- **Flow Current checker**
- **Circuit breaker panels**

If you require any further information do not hesitate to contact us.

MANUFACTURER NOTE: This device can be modified in order to introduce improvements, and might not match up with this handbook.

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