PhaseLog plus Ver.05
VOLTAGE MONITOR WITH PROTECTION FOR THREE-PHASE LOADS AND INTERNAL DATALOGGER

PHASELOGV05-06T-18971

Functions lockdown	Control functions shutdown	LOG Datalogger	Serial programming	Sitrad System supervisor	Protocol Modbus	IP 65 FRONT Protection level

1. DESCRIPTION

The **PhaseLog plus** is an instrument for monitoring and protection of electrical equipment for industrial, commercial and residential facilities.

Through the method of True RMS* voltage measurement, the **PhaseLog plus** also monitors power quality and protects mono / bi / three phase loads against: under and over voltage, angular asymmetry, modular asymmetry, phase loss and phase sequence inversionThe internal datalogger stores the voltages of each phase of the electrical grid during periods of time determined by the user. Time and date of each sample is stored as well (internal real-time clock). All functions of the **PhaseLog plus** can be changed through the software SITRAD®, which can be acessed through the internet (computer/iOS/Android). This software is also used to retrieve the data stored in its datalogger.

The **PhaseLog plus** allows you to configure the RS-485 communication port for the MODBUS-RTU protocol. For more information about the implemented commands and the registration table, contact Full Gauge Controls.

*True RMS: Real voltage value (Root Mean Square), values evaluated taking into consideration the contribution of the high frequency noise on the network (harmonic distortion). That's the real voltage being perceived by the connected load (i.e. motors, compressors, etc). Using this method, it is possible to accurately measure the voltage at any waveform, whereas the traditional methods are only able to measure correctly pure sine waveforms.
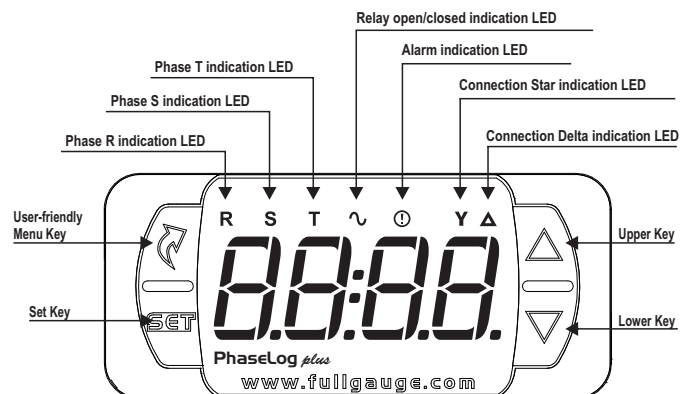
2. APPLICATION

• Energy quality monitoring
• Motors protection
• Electrical panels protection
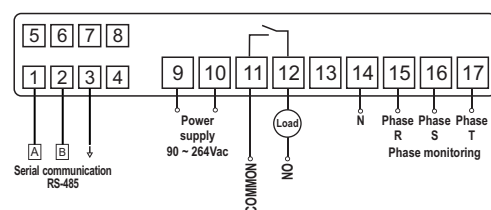• Other multiphase equipments protection

3. TECHNICAL SPECIFICATIONS

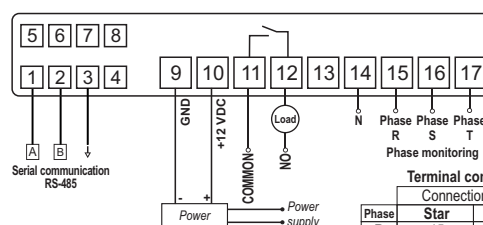|	
Power supply	Phaselog : 90~240Vac (50/60 Hz) Phaselog L: 12Vdc/350mA ± 10%
Monitoring voltage range	90 to 600 VRMS (phase voltages) 90 to 600 VRMS (line voltages)
Monitoring frequency range	35 to 80 Hz
Frequency of sampling	7 Khz
Error (25ºC)	< 1% of full scale range
Resolution	1 Vac in all range
Maximum Current	3A / 250Vac
Operational Temperature	0 to 50°C
Operational Humidity	10 to 90% UR (without condensation)
Minimum delay to open load output relay in case of failure	1 s
Dimensions	76 x 34 x 77 mm - 2,99" x 1,34" x 3,03" (WxHxD)
Dimensions of the clipping for fixing of the instrument	71 ± 0,5 x 29 ± 0,5 mm - 2,79"±0,02 x 1,14"±0,02

4. INDICATIONS AND KEYS

- Relay open/closed indication LED
- Phase T indication LED
- Alarm indication LED
- Phase S indication LED
- Connection Star indication LED
- Phase R indication LED
- Connection Delta indication LED
- User-friendly Menu Key
- Upper Key
- Set Key
- Lower Key

R S T ∿ ⊙ Y △

PhaseLog plus
www.fullgauge.com

5. INSTALLATION - ELECTRICAL CONNECTIONS

Connection 90 ~ 264V

Serial communication RS-485
Power supply 90 ~ 264Vac
COMMON
NO
Load
N
Phase R Phase S Phase T
Phase monitoring

Connection 12Vdc

Serial communication RS-485
GND
+12 VDC
COMMON
NO
Load
Power supply
N
Phase R Phase S Phase T
Phase monitoring

Terminal connections

Phase	Connection Types	
	Star	Delta
R	15	15
S	16	16
T	17	17
N	14	-
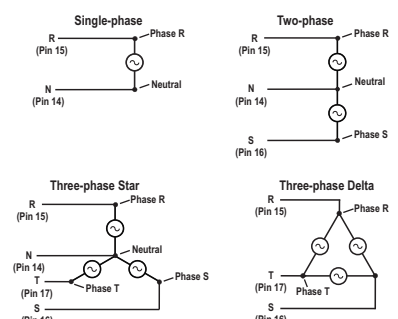
5. INSTALLATION - ASSEMBLING

Panel (Side View)

71 ± 0,5 mm
29 ± 0,5 mm

Dimension of the clipping for fixing of the instrument in panel

Panel (Front View)
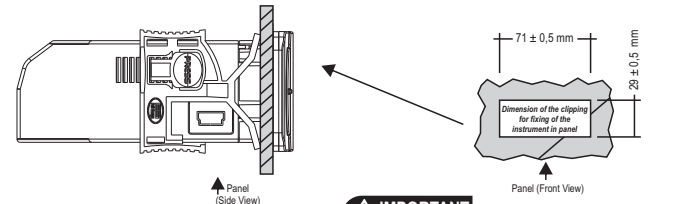
⚠ ATTENTION
FOR INSTALLATIONS WHERE A SEALING IS REQUIRED TO AVOID LIQUID CONTACT, THE CUT FOR THE CONTROLLER MUST BE OF 70,5x29mm MAXIMUM. THE SIDE LOCKS MUST BE FIXED SO IT PRESSES THE RUBBER SEALING AVOIDING INFILTRATION BETWEEN THE CUT AND THE CONTROLLER.
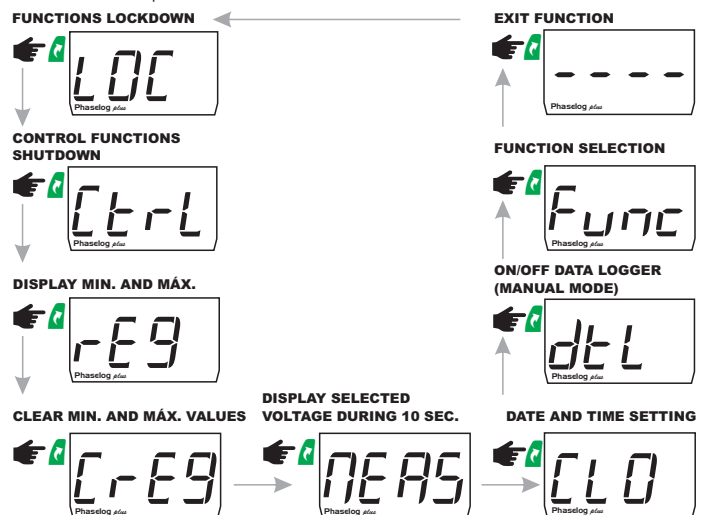
⚠ IMPORTANT
THE USE OF APPROPRIATE TOOLS IS ESSENTIAL TO AVOID DAMAGE IN THE CONNECTION AT INSTRUMENT TERMINALS:
⊖ SCREWDRIVER SLOT 3/32"(2.4mm) FOR ADJUSTMENTS IN THE SIGNAL TERMINALS;
⊕ SCREWDRIVER PHILLIPS #1 FOR ADJUSTMENTS IN THE POWER TERMINALS;

6. OPERATIONS

6.1 Quick access menu map

By pressing 🔄 , it is possible to navigate through the function menus. For more details, see chapter 6.3. See the functions map below:

FUNCTIONS LOCKDOWN
LOC

EXIT FUNCTION

CONTROL FUNCTIONS SHUTDOWN
CtrL

FUNCTION SELECTION
Func

DISPLAY MIN. AND MÁX.
rEg

ON/OFF DATA LOGGER (MANUAL MODE)
dtL

CLEAR MIN. AND MÁX. VALUES
CrEg

DISPLAY SELECTED VOLTAGE DURING 10 SEC.
MEAS

DATE AND TIME SETTING
CLO

6.2 Quick access keys map

When the controller is displaying the voltages, it is possible to access the some controller functions by quickly pressing the folowing keys:

▽	Quick touch: Measures display
△	Quick touch: Display of minimum and maximum voltages of each voltage
SET	Hold down for 2 seconds: The current day, month, year, hour, and minute will be shown in sequence on the display.
△ and ▽	Hold for 1 second to access the main menu

6.3 Basic operations
6.3.1 Functions Lockdown

For safety reasons, this controller provides the ability to lock the function adjustment. With this feature activated, the parameters are protected against tampering; however they can still be visualized.

If a user tries to change a parameter value while the functions lockdown is active, the message ⌐LOC⌐ will appear on the display. To enable the functions lockdown, the function " ⌐F21⌐ - **Time for functions lockdown**" must be set to a value greater than 14 (if the user tries to decrease it to a value smaller than 15, the message ⌐no⌐ will be displayed, indicating that this feature will be disabled. Once the functions lockdown is enabled, to activate it the user must press the key 🔄 (short touch) and select ⌐LOC⌐ , press SET (short touch) to confirm, then hold the key ▽ until the message ⌐LOC⌐ appears. When the key is released, the message ⌐On⌐ will be shown on the display.

To unlock, turn off the controller and turn it back on while holding the key ▽ . Keep the key pressed until the message ⌐LOC⌐ appears. When the key is released, the message ⌐OFF⌐ will be shown on the display.

Single-phase
R (Pin 15) — Phase R
N (Pin 14) — Neutral

Two-phase
R (Pin 15) — Phase R
N (Pin 14) — Neutral
S (Pin 16) — Phase S

Three-phase Star
R (Pin 15) — Phase R
N (Pin 14) — Neutral
T (Pin 17) — Phase T
S (Pin 16) — Phase S

Three-phase Delta
R (Pin 15) — Phase R
T (Pin 17) — Phase T
S (Pin 16) — Phase S

6.3.2 Control functions shutdown

If the Control Function Lockdown is active, the controller will operate only as a voltage indicator, while leaving the output relay off.

This feature is managed by the function " `F22` - **Control function shutdown**":

`no` Control functions shutdown disabled
`1` Control functions shutdown enabled if the functions lockdown is not active
`2` Control functions shutdown always enabled

After the Control Functions Shutdown has been enabled, to activate it, the user must use the Quick menu key and navigate it to `Ctrl`, then confirm the selection with the set key. After the user confirmed the selection, the messages `Ctrl` `OFF` are shown on the display. While the Control Functions Lockdown is active, the controller will alternate the voltages of each phase with the message `OFF`.

To deactivate the Control Functions Shutdown, the user needs to use the same procedure as to activate this feature: use the Quick menu key and navigate to `Ctrl`, then confirm the selection with the set key.

After the selection confirmation, the messages `Ctrl` `On` are shown on the display.

Note: After the Control Functions Shutdown deactivation (control functions re-enabled), the Phaselog _plus_ will respect the delays set in the functions " `F13` - Delay to enable load output during controller startup" and " `F14` - Minimum time to reactivate load output.

6.3.3 Minimum and maximum voltages visualisation

To visualize minimum and maximum voltages of each phase, press the key ▲ (short touch). First the message `Uo-r` is shown, afterwards its minimum and maximum voltages will be displayed. The same applies to the voltages on phase S (`Uo-S` -> Min voltage -> Max voltage) and phase T (`Uo-t` -> Min voltage -> Max voltage)

6.3.4 Voltages measured visualisation

To switch between the visualisation of the phase R, phase S or phase T, press ▼ until the desired information appears on the display. The selected voltage will be shown on the display for 15 seconds; after this period the preferential indication will be exhibited (as adjusted in parameter `F21`).

6.4 Advanced operations

6.4.1 Access to main menu

To access the main menu, press the keys ▲ and ▼ simultaneously. When the keys are released, the following options will be displayed:

`CodE` -Access code input
`Func` -Advanced parameters adjustment
`CLO` - Display/Adjust current date and time

6.4.2 Access code

To enter the access code, use the keys ▲ and ▼ ; to confirm press the key ⊡ . To change any parameter or to adjust the date and time, use the access code `123` .

NOTE: If the functions lockdown is active, the message `LOC` will be displayed when the user tries to insert the access code using the keys ▲ or ▼ .

6.4.3 Advanced parameters adjustment

To select the desired function, use the ▲ and ▼ keys. After selecting the function, press the ⊡ key (short touch), to visualize its current value. If the correct access code has been entered, the user can adjust the parameter value using the keys ▲ and ▼ ; to store the value and return to the previous menu, press the key ⊡ (short touch). To return to the previous menu without saving, press and hold the key ⊡ until the message `- - - -` is shown. In either case, to exit this menu and return to normal operation (voltage indication), press and hold/until `- - - -` appears.

NOTE: If the functions lockdown is active or if the incorrect access code has been inserted, the message `LOC` will be displayed when the user tries to adjust the value of any advanced parameter using the keys ▲ or ▼ .

6.4.4 Setting date and time

When you select the `CLO` menu, if the access code `123` has been inserted, the controller enters the date and time adjustment mode. To change a value, use the keys ▲ and ▼ ; when ready press ⊡ to store the desired value. If the date inserted is invalid, the message `ECLO` will be displayed. You can also set the date and time using the provided menu. In this case, it is not necessary to enter the access code.

Example 1 (Correct access code has been inserted):
`00d` - day `00n` - month `004` - year `00:00`
hour ↙ ↘ minute
flashing

NOTICE:
The controller is equipped with a an auxiliary internal power supply in order to keep its date and time in the case of an energy shortage. A fully charged battery can provide enough energy to keep the time and date running for some weeks. If the controller remains turned off for a prolonged period of time, it will display the message `ECLO` ; in this case the controller's date and time has been lost due to low battery and the user must adjust it again. To completely recharge a dischaged battery, keep the controller turned on for at least 5 hours.

6.5 Parameters table

Fun	Description	Min	Max	Unit.	Standard
`F01`	Number of phases in operation	1	4	-	4
`F02`	Enables the detection of phase inversion	0-no	1-yes	-	1-yes
`F03`	Angular asymmetry sensitivity	0	100	-	80
`F04`	Time to validate angular asymmetry	0	30	sec.	5
`F05`	Modular asymmetry sensitivity	0	100	-	80
`F06`	Time to validate modular asymmetry	0	30	sec.	5
`F07`	Minimum operating voltage	90	600	Vac	90
`F08`	Maximum operating voltage	90	600	Vac	600
`F09`	Time for validation of out of range voltage	0	30	sec.	5
`F10`	Offset of R voltage indication	-20	20	Vac	0
`F11`	Offset of S voltage indication	-20	20	Vac	0
`F12`	Offset of T voltage indication	-20	20	Vac	0
`F13`	Delay to energize the controller	0	999	sec.	0
`F14`	Minimum time to reactivate load output	0	999	sec.	180
`F15`	Datalogger operating mode	0	2	-	1
`F16`	Time between each sample in memory	5	999	sec.	300
`F17`	Voltage variation (voltage peak) to force data recording	3	`OFF`	Volts	`OFF`
`F18`	Variation in output state (relay activation) to force data logging	0-no	1-yes	-	0-no
`F19`	Overwrite the old data from the data logger	0-no	1-yes	-	1-yes
`F20`	Preferential indication on the display	0	3	-	3
`F21`	Time for functions lockdown	no	60	sec.	no
`F22`	Control functions shutdown	no	2	-	no
`F23`	Address in RS-485 network	1	247	-	1

Legend: `YES` = yes
`no` = no

6.5.1 Parameters description

`F01` - **Number of phases in operation:**
This parameter configures which phases will be monitored by the instrument:
`1` - Only the R phase (used in single-phase connections)
`2` - R and S phases (used in two-phase connections)
`3` - R, S and T phases (used in three-phase star connections)
`4` - R, S and T phases (used in three-phase triangle connections)

`F02` - **Detection of phase inversion:**
This parameter enables/disables the phase sequence monitoring. If this function is enabled and a phase has been inverted, the output relay will remain open and an alarm will be set, thereby protecting the load against possible phase inversions.
Note: Protection against phase inversion is only available if `F01` is set to the value 3 or 4.

`F03` - **Angular asymmetry sensitivity:**
This parameter adjusts the sensitivity with which the **Phaselog** _plus_ will detect phase angle asymmetries. The higher the value of this parameter, the lower will be the tolerance against this error. If you wish to disable this monitoring, simply set the function with the value 0.
The equation to determine the detection limits of the alarm is presented in chapter 8.2 - Detection of angular / modular asymmetry alarms. It should be noted that the limits to indicate angular asymmetry error are given by "mean of the lags + tolerance" and "mean of the lags - tolerance". In this way, it is important to note that the alarm detection limit depends on the current values of each measured phase. To illustrate, knowing that the phase difference between two voltage phases in a three-phase system is ± 120 ° and the total sum of the phase-shifts is equal to 360 °, if the function is set to the value `F03` = 80, then we have:
- Upper limit: the alarm will be triggered when the angular mismatch is greater than 144º.
- Lower limit: the alarm will be triggered when the angular mismatch is less than 96º.

`F04` - **Time to validate angular asymmetry:**
Time in seconds that the three-phase monitor waits to validate the angular asymmetry error.

`F05` - **Modular asymmetry sensitivity:**
On this parameter the user can adjust the sensitivity with which **Phaselog** _plus_ will detect the phase asymmetry of the phases set in `F01` . The higher the value of this parameter, easier the controller will detect the error. If you wish to deactivate this monitoring, simply set the function to 00.0.
The equation for determining the detection limits of the alarm is presented in chapter 8.2 - Detection of angular / modular asymmetry alarms. It should be noted that the limits to indicate modular asymmetry error are given by "mean of the voltages + tolerance" and "mean of the voltages - tolerance". In this way, it is important to note that the alarm detection limit depends on the current values of each measured phase.
For example, considering that the function is set to the value `F05` = 80 and that the voltages of the phases R and S are equal to 220 Vrms, then:
- Upper limit: the alarm will be triggered when the phase T voltage is higher than 293 Vrms, because it will be higher than the mean of the measured values (244 Vrms) plus the calculated tolerance (48 Vrms).
- Lower limit: the alarm will be triggered when the phase T voltage is less than 159 Vrms, because it will be less than the average of the measured values (199 Vrms) less the calculated tolerance (39 Vrms).

`F06` - **Time to validate modular asymmetry:**
Time in seconds that the three-phase monitor waits to validate the modular asymmetry error.

`F07` - **Minimum operating voltage:**
Minimum voltage threshold to trigger the out-of-range alarm and open the load relay.

`F08` - **Maximum operating voltage:**
Maximum voltage threshold to trigger the out-of-range alarm and open the load relay.

`F09` - **Time for validation of out of range voltage:**
Time in seconds that the three-phase monitor waits to validate the out of range voltage alarms (`F07` / `F08`).
Note: If there is any error in the voltage reading (`E-t` , `E-r` or `E-S` active), this function is ignored, therefore the output is disabled immediately.

`F10` - **Offset of R voltage indication:**
This parameter lets you adjust the R phase voltage indication offset.

`F11` - **Offset of S voltage indication:**
This parameter lets you adjust the S phase voltage indication offset.

`F12` - **Offset of T voltage indication:**
This parameter lets you adjust the T phase voltage indication offset.

`F13` - **Delay to energize the controller:**
Time in seconds in wish the **Phaselog** _plus_ will wait before triggering its output.

`F14` - **Minimum time to reactivate load output:**
Time in seconds that the **Phaselog** _plus_ will wait before reactivating its load output once it has been deactivated.

`F15` - **Datalogger operating mode:**
This parameter controls the datalogger operating mode:
`0` - Always off
`1` - Always on
`2` - Manual operation

`F16` - **Time between each sample in memory**
Period of time in seconds between each voltage sample stored in the controller's datalogger.

`F17` - **Voltage variation (voltage peak) to force data logging:**
Voltage difference on any of the monitored phases so that **Phaselog** _plus_ forces the data to be recorded in the datalogger, regardless of the sampling time set in `F16` . This functions is evaluated once per second. This function can be set from 3 to 50 volts; to deactivate it, press the ▲ key until the `OFF` message appears on the display.

F18 - **Variation in output state (relay activation) to force data logging::**
Indicates whether the change in output will force data to be logged in the datalogger regardless of the sampling time set in **F16**.

F19 - **Overwrite old data on the Datalogger:**
This parameter controls whether the controller should overwrite the old data in the datalogger once its memory is full. This function prevents that the latest data evaluated by the equipment be lost.

F20 - **Display preferential indication:**
This parameter configures which voltage phase will be shown by default on the display:
- **0** - R Phase voltage
- **1** - S Phase voltage
- **2** - T Phase voltage
- **3** - Alternate the display of all phase voltages

F21 - **Key pressed time to activate the functions lockdown:**
This parameter controls how much time the user must press the ▼ key to activate the functions lockdown. Once activated, this functions protects the parameters against tampering, although the user still will be able to visualize its parameters. To obtain further informations on how to activate/deactivate the functions lockdown, see chapter 6.3.1 - Functions Lockdown.

F22 - **Control functions shutdown:**
This parameter enables/disables the load output switching off to perform maintenance. To obtain further informations on how to activate/deactivate the Control functions shutdown, see chapter 6.3.2 - Control functions shutdown.

F23 - **Address in RS-485 network:**
Instrument address on the network to communicate with SITRAD® software.
Note: In the same network, there cannot be more than one instrument with the same address.

7. SIGNALLING

E - r	Error reading R phase voltage.
E - S	Error reading S phase voltage. Obs. 1
E - t	Error reading T phase voltage.
A - 1	R phase voltage out of range alarm.
A - 2	S phase voltage out of range alarm. Obs. 2
A - 3	T phase voltage out of range alarm.
A - 4	Angular asymmetry alarm.
A - 5	Modular asymmetry alarm.
A - 6	Incorrect phase sequence alarm.
ECLO	Date and/or time invalid.
OFF (flashing)	Control functions shutdown active (controller on standby).
AdFL	Datalogger full alarm.
EdtL	Datalogger error. Obs. 3
NEN	Initializing memory.
ENEN	Memory error. Obs. 4
PPPP	Reconfigure the values of the functions.

Obs.1: These errors are triggered if the respective measured voltage is outside the equipment's voltage control range.
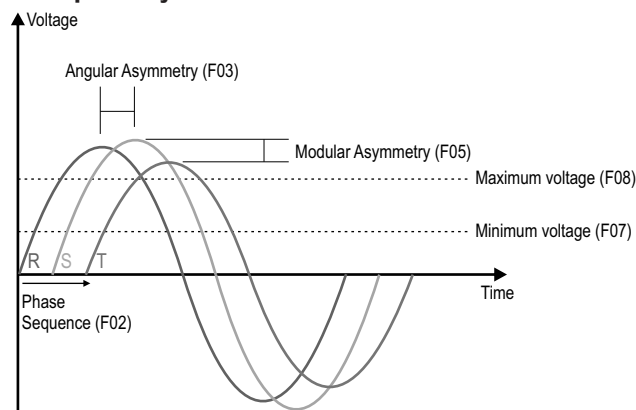**Obs.2:** These alarms are triggered if the respective measured voltage is smaller than the value specified in **F07** or greater than the value specified in **F08**.
Obs.3: Unable to find entry point in the datalogger to start to record data. In this case, it is recommended to download all data from the datalogger before erasing it. To ignore the error and clear all records from the datalogger, use the access code **612**.
Obs.4: Controller's internal memory failed its self-test (send instrument for service).

8. PARAMETERS ANALYZED

8.1 Explanatory chart

Voltage
Angular Asymmetry (F03)
Modular Asymmetry (F05)
Maximum voltage (F08)
Minimum voltage (F07)
R S T
Phase Sequence (F02)
Time

8.2 Detection alarms angular/modular asymmetry

S = Sensibility (0 to 100%)
Modular asymmetry:
$$\text{Tolerance} = (100 - S) \times \frac{(\text{Average Measured voltages})}{100}$$

Angular asymmetry:
$$\text{Tolerance} = (100 - S) \times \frac{(\text{Average Measured phase difference})}{100}$$

Alarm activation condition: (both cases)
Measured value higher than average value + tolerance or Measured value lower than average value - tolerance

9. OPTIONAL ITEMS - Sold Separately

9.1 EasyProg ver. 02

It is an accessory that has as its main function to store the parameters of the controllers. At any time, you can load new parameters of a controller and unload them on a production line (of the same controller), for example. It has three types of connections to load or unload the parameters:

- **Serial RS-485:** It connects via RS-485 network to the controller (only for controllers that have RS-485).

- **USB:** it can be connected to the computer via the USB port, using Sitrad's Recipe Editor. The parameters can be copied, edited and saved in **EasyProg ver. 02**. The USB port can also have the function of electrically feeding the **EasyProg ver. 02** and the controller (when the USB and Serial TTL are used together).

- **Serial TTL:** The controller can be connected directly to **EasyProg ver. 02** by the TTL Serial connection. Thus the **EasyProg ver. 02** may be fed by **Phaselog plus**, or vice versa.

- The Sitrad 4.13.x recipe editor and the EasyProg Editor program do not support PhaseLog E v5. To send recipes via EasyProg to PhaseLog E v5, you must initially load a recipe from one controller and then send the recipe to another controller.

EasyProg ver. 02 →
RS-485

| LEGEND |
|---|
| A - Orange |
| B - Red |
| ⊹ - Brown |
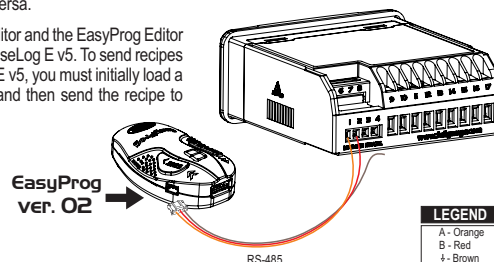
9.2 Ecase

Protective cover for controllers (Evolution line), which prevents the entrance of water and inner moisture. It protects the product when washing is carried out in the location where the controller is installed.
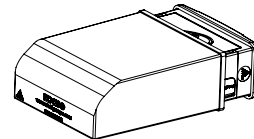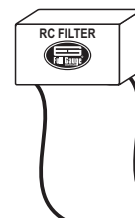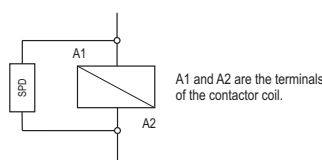

9.3 Extension Frame

The Full Gauge Controls extension frame allows the installation of Evolution / Ri line with measures 76x34x77 mm (dimensions of the clipping for fixing in the extension frame is 71x29mm) in varied situations, since it eliminates precision cut to embed the instrument. Allows customization via a sticker with the brand and the company contact, and accompany two 10A (250 Vac) switches that can trigger internal light, air curtain, on / off system or fan.
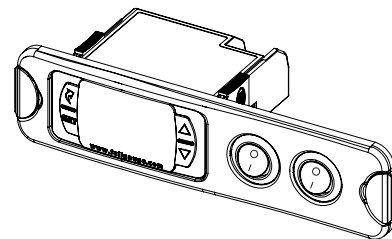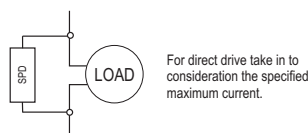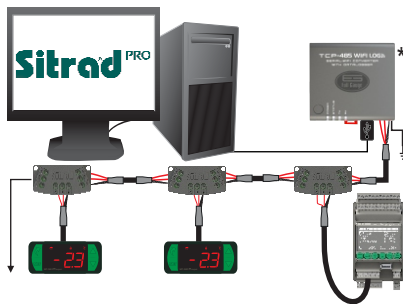

9.4 Surge Protective Device (SPD)

Wiring diagram for instalation of SPD in magnectic contactor

A1
A2
A1 and A2 are the terminals of the contactor coil.

Wiring diagram for instalation of SPD in line with loads

LOAD
For direct drive take in to consideration the specified maximum current.

RC FILTER

INTERFACE SERIAL RS-485
Device used to establish the connection of Full Gauge Controls instruments with Sitrad®.

Full Gauge offers different interface options, including technologies such as USB, Ethernet, Wifi, among others.
For more information, consult Full Gauge Controls.
Sold separately.

MODBUS PROTOCOL
The controller allows you to configure the RS-485 communication port for the MODBUS-RTU protocol. For more information about the implemented commands and the registration table, contact Full Gauge Controls.

Keep Sitrad updated at site: http://www.sitrad.com

CONNECTION BLOCK
It is used to connect more than one controller to the Interface. The wire connections must be made as follows: Terminal **A** of the controller connect to terminal **A** of the connection block, which in turn, must be connected to terminal **A** of the Interface. Repeat the procedure for terminals **B** and ⏚, being ⏚ the cable screen.

The **Phaselog** *plus* allows you to configure the RS-485 communication port for the MODBUS-RTU protocol. For more information about the implemented commands and the registration table, contact Full Gauge Controls.

ENVIRONMENTAL INFORMATION
Packaging:
The materials used in the packaging of Full Gauge products are 100% recyclable. Try to perform disposal through specialized recyclers.

Product:
The components used in Full Gauge controllers can be recycled and reused if disassembled by specialized companies.

Disposal:
Do not incinerate or dispose the controllers that have reached the end of their service as household garbage. Observe the laws in your area regarding disposal of electronic waste. If in doubt, please contact Full Gauge Controls.