

GradiLux™

Lighting Dimmer-Stabilizer *Installation Manual Ed. 01*



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1. Introduction

We would like to thank you in advance for the trust you have placed in us by purchasing this product. Read this instruction manual carefully before starting up the equipment and keep it for future reference.

We remain at your entire disposal for any further information or any query you should wish to make.

Yours sincerely,
GE

- The equipment described here can suffer damage due to improper handling. This is why the installation, maintenance and/or fixing of the equipment must be done by our staff or specifically authorised technicians.
- According to our policy of ongoing improvement, we reserve the right to modify the specifications in part or in whole without forewarning.
- All reproduction or third party concession of this manual is prohibited without the previous written authorization of our company.

Using this manual

The aim of this manual is to give explanations and procedures for the installation and operation of the equipment. This manual has to be read carefully before installing and operating it. Keep this manual for future reference.

This equipment must only be installed by qualified staff and also with the guidance of this manual. It can not be used by personnel without specific training.

Used symbols and conventions.



«Warning» symbol. Carefully read the indicated paragraph and take the stated prevention measures.



«Danger of electrical discharge» symbol. Pay special attention to it, both in the indication on the equipment and in the paragraph referred to this user's manual.



«Main protective earthing terminal» symbol. Connect the earth cable coming from the installation to this terminal.



«Earth bonding terminal» symbol. Connect the earth cable coming from the installation to this terminal.



«Notes of information» symbol. Additional topics that complement the basic procedures.



Preservation of the environment: The presence of this symbol on the product or in their associated documentation requires that, when its useful life is expired, it will not be disposed together with the domestic waste. In order to avoid possible harm to the environment, separate this product from other waste and recycle it suitably. The users can contact with their provider or with the pertinent local authorities to be informed on how and where they can take the product to be recycled and/or disposed of correctly.

2. Safety

2.1. Declaration

Our target is the client's satisfaction, therefore GE Energy - Industrial Solutions has decided to establish a Quality and Environmental policy, by means of installation a Quality and Environmental Management System that enables us to comply with the requirements demanded by the standard **ISO 9001** and **ISO 14001** and by our clients and concerned parts also.

GE Energy - Industrial Solutions is committed to the development and improvement of the Quality and Environmental Management System, through the importance of satisfaction of the client's requirements and with regard to legal and regulatory requirements.

2.2. Standards

GradiLux is designed, manufactured and commercialized in accordance with the standard **ISO 9001:2008** of Quality Assurance. The **CE** marking shows the conformity to the EEC Directive by means of the application of the following standards

- **2006/95/EC** Low voltage directive.
- **2004/108/EC** Electromagnetic Compatibility directive (EMC)

Norms as reference:

- **UNE-AENOR EA0032-2007:** Test report for lighting flow dimmer stabilizers equipments at headline. General and safety requirements of the central laboratory of electrotechnic (LCOE).
- **IEC 62041:** Safety of transformers, reactors, power supply units and combinations thereof - EMC requirements.
- **UNE-AENOR EA0033-2007:** Test report for lighting flow dimmer stabilizers equipments at headline. Operating requirement from official central laboratory of electrotechnic (LCOE).



The product Declaration of Conformity (CE) is held at our company headquarters and is available to customers for inspection, upon request.

2.3. Environment

This product has been designed to respect the environment and has been manufactured in accordance with the standard **ISO 14001:2004**.

Recycling equipment at the end of its useful life

Our company commits to use the services of authorised organisations and according to the regulations, in order to treat the recovered product at the end of its useful life.

Packaging

To recycle the packaging, follow the legal regulations in force.

2.4. Safety instructions

The "Safety Instructions" are regarding the equipment you are commissioning. Compliance with the safety instructions stated in this document are obligatory and observance of this is legally the user's responsibility. Read them carefully and follow the required steps in the correct sequence and retain the instructions for future reference. The local electrical standards and different restrictions of the end user city may invalidate some of the recommendations given in the manuals. In case of discrepancies, the user must comply with the pertinent local standards. It is possible to come across equipment where the distribution of the connecting terminals and/or commands do not line up with the manual's illustrations. However, the simplicity of the operation together with the correct labelling, permits the easy understanding in an intuitive way.

- Do not install the machine in a corrosive or dusty atmosphere, and never outdoors.
- Do not obstruct the ventilation outlets nor introduce objects through these or other orifices. Check the minimum free space needed around the machine for ventilation and air circulation (see Section 4.3).
- The location must be spacious, airy, away from heat sources and easily accessible. After sales service must be able to access the equipment to carry out scheduled maintenance. Keep a minimum of 50mm clear in front of the unit. Do not place materials on top of the machine or objects which would obstruct a correct visualisation of the synoptic reading.
- Do not clean equipment with abrasive, corrosive, liquid or detergent products. To clean the equipment, use a humid cloth and dry immediately after. Avoid splashes or spills which might get into the ventilation slits or grills.
- Avoid exposure to direct sunlight.
- Place the equipment as close as possible to the wall inlet and outlet wall feeds.
- Do not install or service the equipment during electrical lightning storms as there is a risk of electrical shock.
- Note this equipment has two independent voltage sources. Care to be exercised when installing or servicing the equipment.
- All equipment connections including those of the control, should be done without the presence of the mains supply and with the switches turned off, position «O» or «Off» respectively.
- Special attention should be given to the labelling on the equipment warning about the «Risk of electric shock» and indicators like (⚠). Hazardous live parts inside the equipment, do not remove the cover. Reserve servicing to qualified service personnel. For maintenance or repair service, contact your nearest GE Energy - Industrial Solutions After Sales Service.
- It is compulsory to connect the protection earth, making sure that this is done before powering up the input to the equipment.
- The user should make sure that the wall outlet's voltage corresponds to the type delivered, properly grounded and connected to the local protection earth. For equipment fitted with terminals, the licensed wirer should connect the earth wire to the terminal identified as (PE).
- The installation of hard wired equipment should be done by personnel qualified in electrical low voltage installations.
- The cross section of the power supply and output cables to the loads should be determined according to the rated current given on the equipment's specifications plate and complying with the Local Low Voltage Electrotechnical Regulations.
- The power supply cables to the equipment as well as to the loads, interfaces, etc. should be fixed to non movable parts as otherwise they will be exposed to being pulled.
- Please have in mind that if the equipment incorporates a bypass with mains power available the same will supply output voltage even if the equipment is not turned on. Place warning notices and/or emergency switches in accordance with local safety regulations.
- The voltage stabilisers and line conditioners should be considered as transformers or distribution lines from the point of view of the installation and of the electrical safety. These equipment are «transparent» to the input voltage.
- The Neutral input supply must always be connected to the three phase equipment input neutral terminal.
- On the three phase voltage stabiliser and line conditioners with independent phase regulation existing unbalanced voltage from the three phase input supply on the loads, the phase to phase voltage at the output may not be the same, however the phase to neutral regulation will be kept.
- Devices mounted on CHASSIS are foreseen for the installation on predetermined assembly unit to be done by professionals.
 - Your installation should be projected and carried out by qualified personnel, who will be responsible of applying the safety and EMC legislation and standards regulating the specific installation where the product will be destined.
 - Chassis mounted equipment have neither enveloping protection nor connecting terminals.
- Do not locate the equipment in areas exposed to floods.

3. Presentation

3.1. Design and legends

3.1.1 All formats of the equipment

Figures 1 to 5 show the views of **GradiLux** in its different formats:

- Figures 1 and 2, single phase modules in modular (M) format. Three phase systems are based on three identical single phase modules. For this reason the terminals are labelled R, S and T which relate to the three independent modules.
- Figures 3 and 4 correspond to stand-alone unit in horizontal (H) format.

- Figure 5, stand-alone unit in vertical (V) format.

Figures 1 to 5 illustrate all the connection, manoeuvring and signalling parts that the installer and/or end user must be aware of and/or handle for the correct installation and operation of the equipment (startup, shutdown, manual bypass, ...). Description of references stated in the figures can be seen in section 3.1.2.

Fig. 1. Single phase modular unit - front views of (M) format, with and without LCD panel / front cover (Tm).

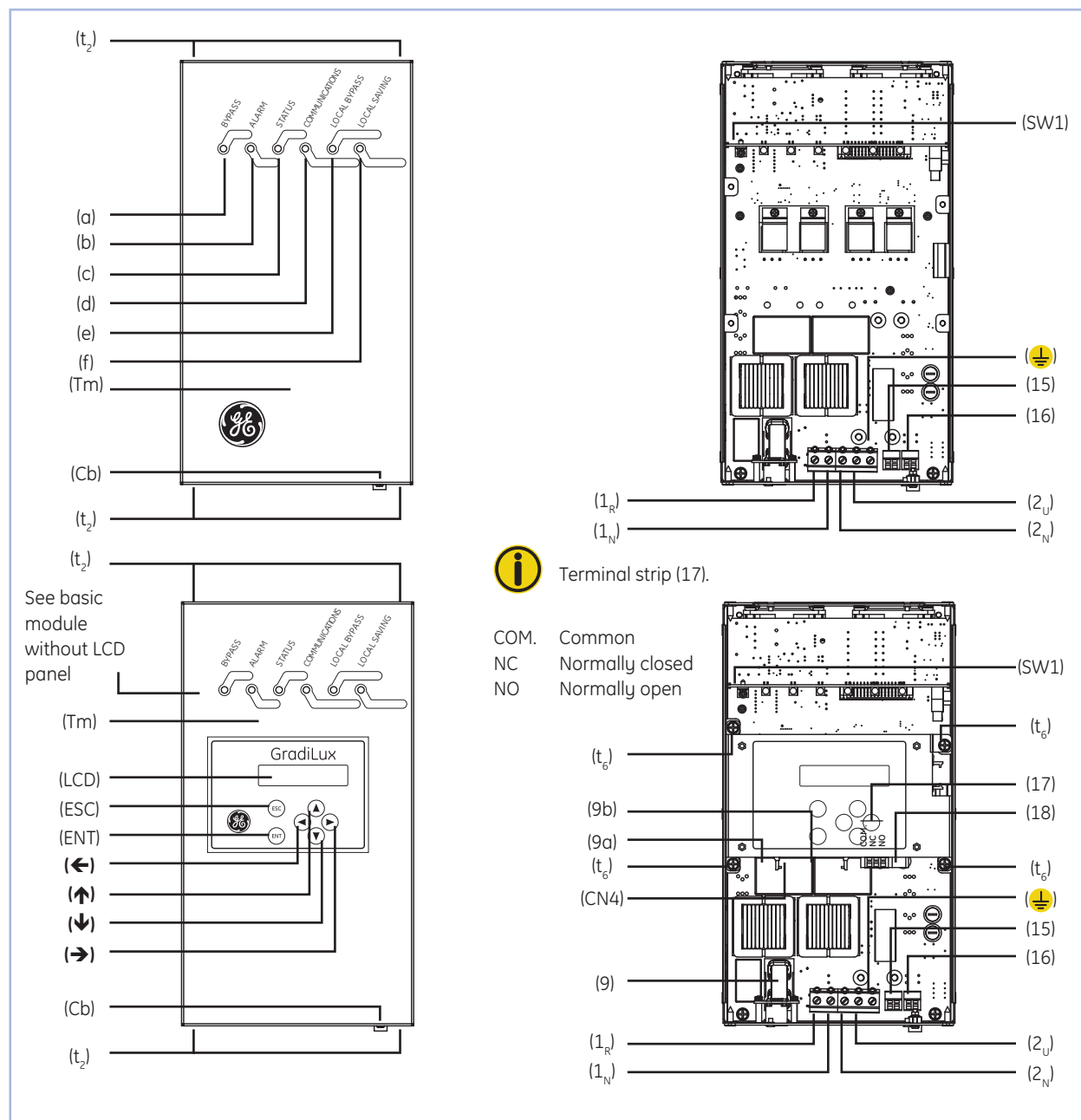
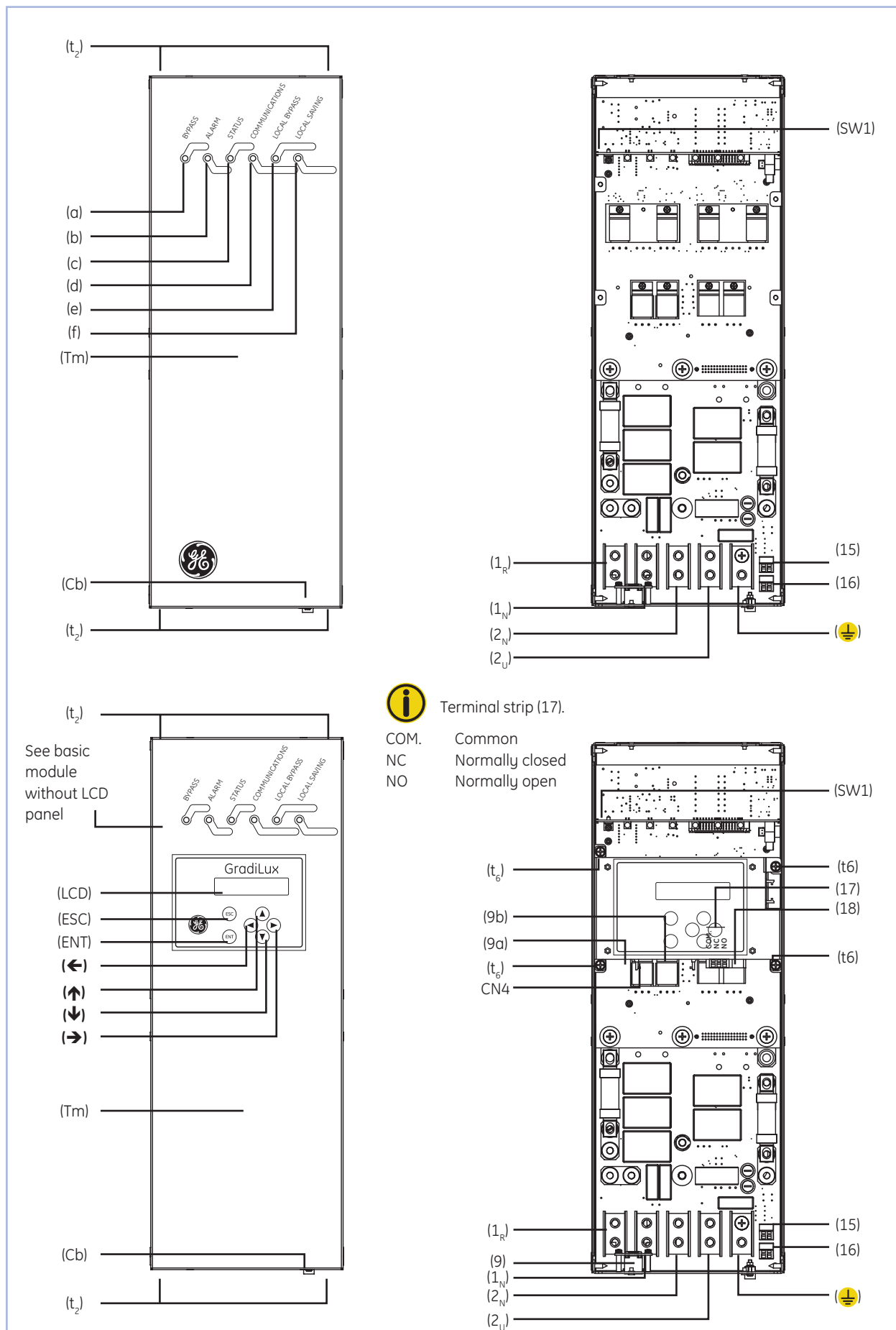


Fig. 2. Single phase modular unit - front views of (M) format, with and without LCD panel / front cover (Tm).



Technical drawing of a three-phase medium-voltage switchgear (10 kV) showing front, side, and bottom views with various components and labels.

Front View Labels:

- (t₂)
- See detail "A"
- (12)
- (T_m)
- (t₂)
- (t₁)
- (T_b)
- (t₄)
- (T_{SL})
- (10_{SL})
- (7)
- (4)
- (t₁)

Side View Labels:

- (t₂)
- (t₁)

Bottom View Labels:

- (phase R) - (0_R)
- (phase S) - (0_S)
- (phase T) - (0_T)
- (11)

Detail "A" Labels:

- (a)
- (b)
- (c)
- (d)
- (e)
- (f)
- BYPASS
- ALARM
- STATUS
- COMMUNICATIONS
- LOCAL BYPASS
- LOCAL SWING

Detail "A" Caption: Detail "A"

Fig. 4. Three phase stand-alone unit - views of horizontal (H) format, without the terminals cover (Tb) in place.

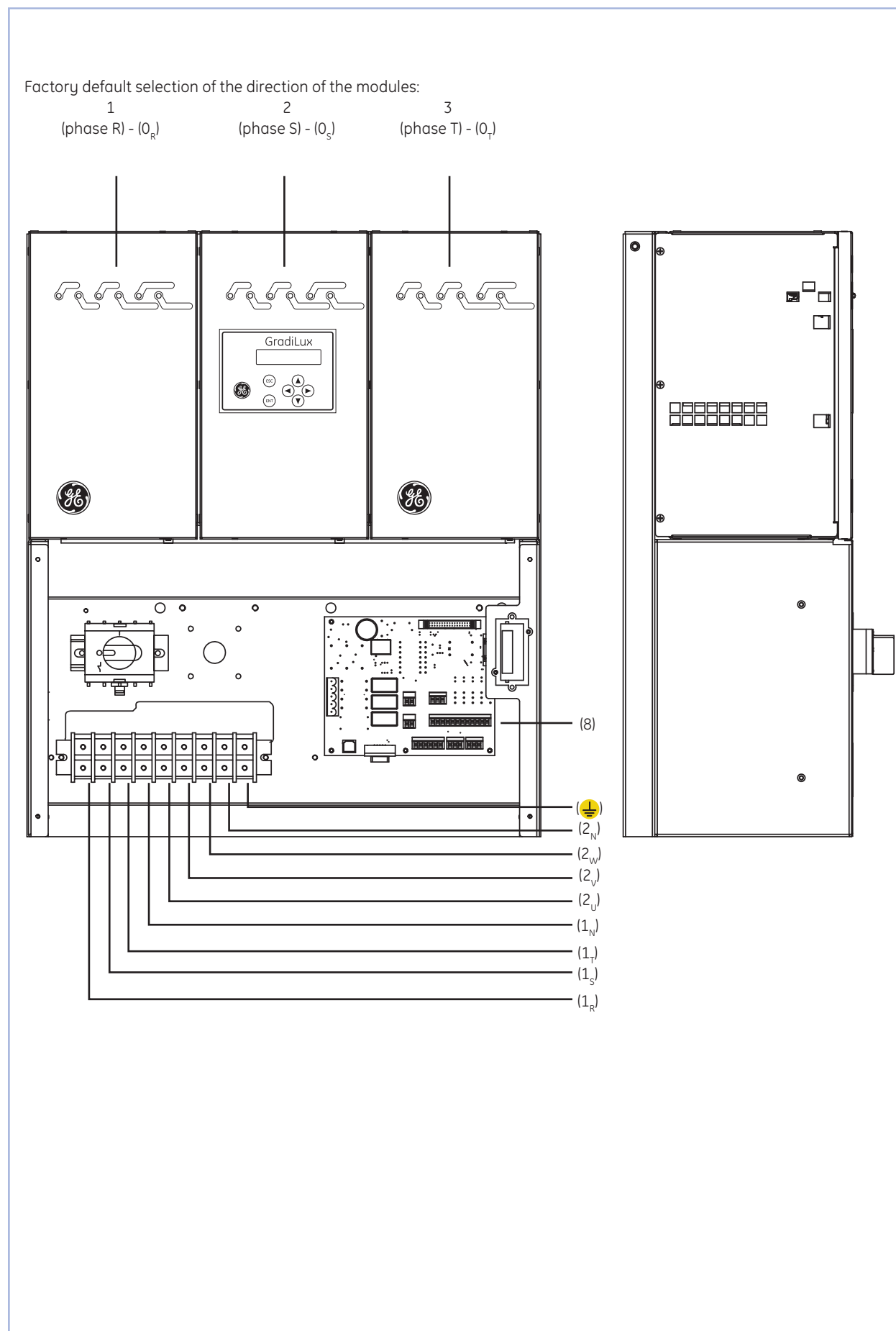
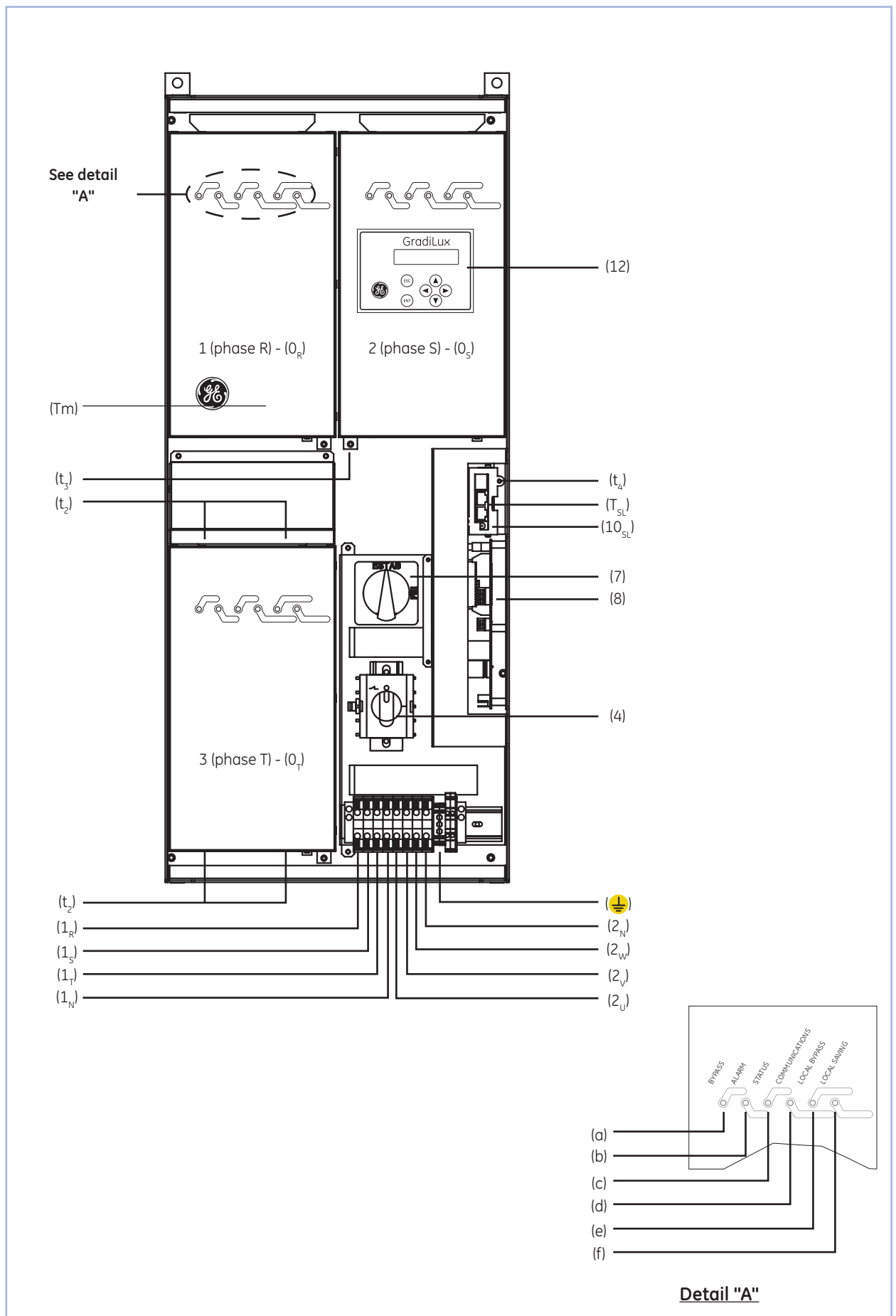









Fig. 5. Three phase stand-alone unit - front view of vertical (V) format.



3.1.2. Corresponding legends to the equipment views

- (0) Single phase module **GradiLux** In three phase equipments there is one per phase (**0_R**), (**0_S**) and (**0_T**)
- (1_N) Neutral input terminal N
- (1_R) Phase input terminal R
- (1_S) Phase input terminal S
- (1_T) Phase input terminal T
- (2_N) Neutral output terminal N
- (2_U) Phase output terminal U
- (2_V) Phase output terminal V
- (2_W) Phase output terminal W
- () Main earthing protection terminal
- (4) Four poles input switch (Positions: 0 and 1)
- (7) Manual bypass switch make before break (optional)
 - Position «1», lighting supplied by mains (bypass)
 - Position «2», lighting supplied by GradiLux
- (8) Control card, AC/DC power supply GLIOA or I/O digital GLIOC (optional)
- (9) RJ connector from control panel for RS-232, located at the bottom of the module.
- (9a) RJ connector from control panel for RS-485, located in the display panel card (option)
- (9b) DB9 connector from control panel for RS-232, located in the display panel card (option)
- (10_{sl}) Slot for ComiTEQ card
- (10_{sc}) ComiTEQ card (Option)
- (11) Fans, forced cooling
- (12) Control panel:
 - (LCD) Display panel
 - () Key «ENTER»
 - () Key «ESC»
 - () Key move up
 - () Key move down
 - () Key move to right
 - () Key move to left
- (13) LED indications
 - (a) Red LED indicator for «Bypass»
 - (b) Red LED indicator for «Alarm»
 - (c) Green LED indicator for «Status»
 - (d) Yellow LED indicator for «Communications»
 - (e) Yellow LED indicator for «Local bypass»
 - (f) Yellow LED indicator for «Local saving»
- (15) Terminal strip for saving order in module «Save On»
- (16) Terminal strip for bypass order in module «Bypass On»
- (17) Terminal strip for ON/OFF manoeuvring, headline contactor
- (18) Jack connector for control panel power supply
- (Cb) Communication bus connector of each module
- (CN4) Digital I/O communication connector
- (Fc) Cable of 10 pins for communication between modules
- (Sp-A) Support with "Z" shape for module(s) (**M**)
- (Sp-B) Upper support as "hanger" mode for three phase modules system (**M**)
- (SW1) Dipswitch to set the module address
- (Tb) Cover for connecting parts format (**H**)
- (Tm) Cover for connecting parts format (**M**)
- (T_{sl}) Slot cover for ComiTEQ card
- (t₁) Fixing screws for cover (**Tb**)
- (t₂) Fixing allen screws for module front cover (**Tm**)
- (t₃) Fixing screws module/s (fixing for supports (**Sp-A**) and (**Sp-B**))
- (t₄) Fixing screws for slot cover for ComiTEQ card (**T_{sl}**)
- (t₅) Fixing screws for options ComiTEQ card, GPRS, ...
- (t₆) Fixing screws for control panel (**12**)



Connectors **(9a)** and **(9b)** are incompatible with GLIOC (Digital I/O), because in order to have one of them it is not possible to assemble **(CN4)** connector, which is essential to communicate with digital I/O card. One equipment can have **(9)** and **(9b)** connectors of RS-232, but they will not be able to be used at the same, because this is not a multiconnection channel.

3.1.3. Control card LTIOA, AC/DC power supply or optional control card with digital I/O (LTIOC) or digital I/O version boxed (LTIOB).

There are three versions as follows:

- a) A basic one and as simple AC/DC power supply that allows feeding the LCD panel and ComiTEQ card option. This version is standard in all units with formats (**H**), (**V**) and it is integrated in the equipment (see figure 6).
- b) Optional alternative board (LTIOC) with additional digital I/O functionality that replaces the basic board in formats (H) and (V). As well as being a AC/DC power supply, it has ports that enable the GradiLux to monitor the environment (see figure 7).
- c) Optional boxed version (LTIOB) of the digital I/O board (LTIOC) is available and for use with the OEM equipment.

Among the available connections there are

- (CN1) AC power supply connector, single phase (R-N), or three phase (R-S-T-N) (taken before the headline contactor)
- (CN2) Communication connector with control panel
- (CN4) ComiTEQ power supply connector
- (CN5) Terminal strip relay RL1. ON/OFF contactor control. Terminals 1-2-3, corresponding to relay contact (CM-NC-NO). In equipments with digital I/O, the headline contactor control is done through these terminals instead of the usual connection over the control panel.
- (CN6) 4 digital output terminal strip. Each one of this outputs supply a dry contact (CM-NC-NO), which are associated with a programmable relay that can be set to indicate the equipment status or an alarm condition, by means of the control panel (see section 6.2.3). By default they are:
 - Relay RL2. Overload, terminals 1-2-3
 - Relay RL3. Overtemperature, terminals 4-5-6
 - Relay RL4. Bypass, terminals 7-8-9
 - Relay RL5. Output voltage fault, terminals 10-11-12
- (CN7) Not used connector
- (CN8) Terminal strip with two analog inputs 4 - 20mA
 - Earth leakage sensor, terminal 1
 - Light sensor, terminal 2
 - Common GND, terminal 3



Fig. 6. Standard control card GLIOA, AC/DC power supply (basic for **(H)** and **(V)** format).

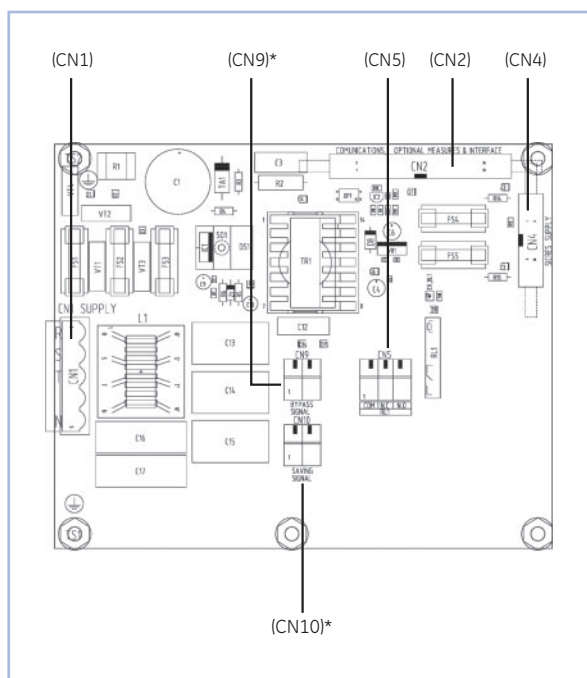
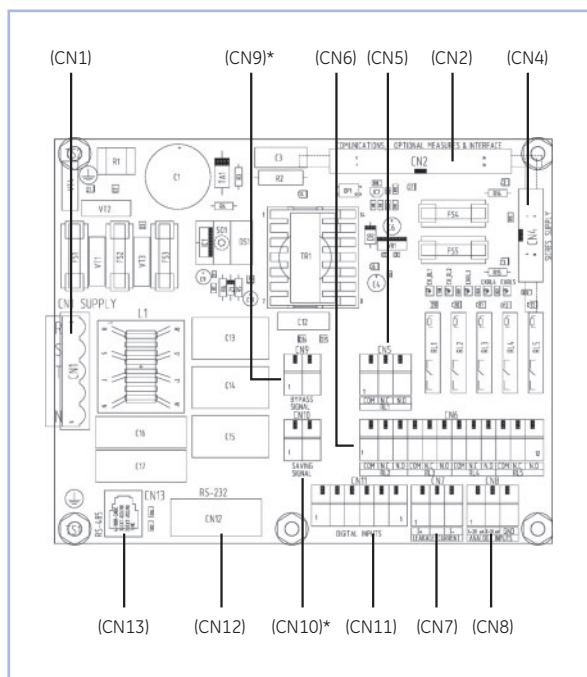


Fig. 7. Control card GLIOC, with digital I/O (optional).



(*) CN9 and CN10. Order to force to bypass and/or saving (use a dry contact to close the circuit **DO NOT APPLY VOLTAGE**).

(CN9) Terminal strip to force the unit to bypass «Bypass order».

(CN10) Terminal strip to force the unit to saving «Saving order».

(CN11) Five digital inputs preset by default from factory, to the following terminal strips:

- Digital input 1. It means that the circuit breaker from outgoing distribution sector 1 has been tripped, terminal 1.
- Digital input 2. It means that the circuit breaker from outgoing distribution sector 2 has been tripped, terminal 2.
- Digital input 3. It means that the circuit breaker from outgoing distribution sector 3 has been tripped, terminal 3.
- Digital input 4. It means that the circuit breaker from outgoing distribution sector 4 has been tripped, terminal 4.
- Digital input 5. It means that the circuit breaker from outgoing distribution sector 5 has been tripped, terminal 5.
- GND common, terminal 6.

(CN12) RS-232 via DB9 connector.

In module control panel, as standard, is available the same communication port but with RJ connector **(9)**. Connection of this RJ connector is basic with three wires (PC, terminal, ...) and the one supplied with DB9 in the control PCB, like the option DB9 in control PCB **(9b)**, has extended communications for modem. Conceptually, a RS-232 channel is not multiconnection, so only one connection can be used at the same time.

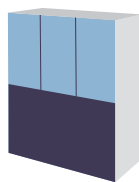
(CN13) RS-485 via RJ connector.

It is possible to use both connections RS-485 and RS-232 at the same time.



This PCB is supplied from an independent power source which is not disabled by switching off the manual switch which isolates the GradiLux modules. Always measure to confirm no voltage present on control card, before handling.

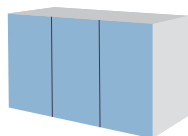
3.1.4. Nomenclature stand-alone units



		HORIZONTAL		VERTICAL	
		WITHOUT MANUAL BYPASS	WITH MANUAL BYPASS	WITHOUT MANUAL BYPASS	WITH MANUAL BYPASS
	Power (kVA)*	Cat. No.	Cat. No.	Cat. No.	Cat. No.
Standard	7.5	GLIX07HS	GLIX07HS-B	GLIX07VS	GLIX07VS-B
With communication card		GLIX07HCC	GLIX07HCC-B	GLIX07VCC	GLIX07VCC-B
With I/O card		GLIX07HIC	GLIX07HIC-B	GLIX07VIC	GLIX07VIC-B
With communication & I/O cards		GLIX07HCIC	GLIX07HCIC-B	GLIX07VCIC	GLIX07VCIC-B
Standard	10.5	GLIX10HS	GLIX10HS-B	GLIX10VS	GLIX10VS-B
With communication card		GLIX10HCC	GLIX10HCC-B	GLIX10VCC	GLIX10VCC-B
With I/O card		GLIX10HIC	GLIX10HIC-B	GLIX10VIC	GLIX10VIC-B
With communication & I/O cards		GLIX10HCIC	GLIX10HCIC-B	GLIX10VCIC	GLIX10VCIC-B
Standard	15	GLIX15HS	GLIX15HS-B	GLIX15VS	GLIX15VS-B
With communication card		GLIX15HCC	GLIX15HCC-B	GLIX15VCC	GLIX15VCC-B
With I/O card		GLIX15HIC	GLIX15HIC-B	GLIX15VIC	GLIX15VIC-B
With communication & I/O cards		GLIX15HCIC	GLIX15HCIC-B	GLIX15VCIC	GLIX15VCIC-B
Standard	20	GLIX20HS	GLIX20HS-B	GLIX20VS	GLIX20VS-B
With communication card		GLIX20HCC	GLIX20HCC-B	GLIX20VCC	GLIX20VCC-B
With I/O card		GLIX20HIC	GLIX20HIC-B	GLIX20VIC	GLIX20VIC-B
With communication & I/O cards		GLIX20HCIC	GLIX20HCIC-B	GLIX20VCIC	GLIX20VCIC-B
Standard	25	GLIX25HS	GLIX25HS-B	GLIX25VS	GLIX25VS-B
With communication card		GLIX25HCC	GLIX25HCC-B	GLIX25VCC	GLIX25VCC-B
With I/O card		GLIX25HIC	GLIX25HIC-B	GLIX25VIC	GLIX25VIC-B
With communication & I/O cards		GLIX25HCIC	GLIX25HCIC-B	GLIX25VCIC	GLIX25VCIC-B
Standard	30	GLIX30HS	GLIX30HS-B	GLIX30VS	GLIX30VS-B
With communication card		GLIX30HCC	GLIX30HCC-B	GLIX30VCC	GLIX30VCC-B
With I/O card		GLIX30HIC	GLIX30HIC-B	GLIX30VIC	GLIX30VIC-B
With communication & I/O cards		GLIX30HCIC	GLIX30HCIC-B	GLIX30VCIC	GLIX30VCIC-B
Standard	45	GLIX45HS	GLIX45HS-B	GLIX45VS	GLIX45VS-B
With communication card		GLIX45HCC	GLIX45HCC-B	GLIX45VCC	GLIX45VCC-B
With I/O card		GLIX45HIC	GLIX45HIC-B	GLIX45VIC	GLIX45VIC-B
With communication & I/O cards		GLIX45HCIC	GLIX45HCIC-B	GLIX45VCIC	GLIX45VCIC-B

Note: Take into consideration the Power Curves and Overload Capacity (Section 3.1.7) applicable for all formats, sizing (Section 3.2.6) and cooling (Section 4.3).

3.1.5. Nomenclature modular units



		HORIZONTAL
		WITHOUT MANUAL BYPASS
Input	Power (kVA)	Cat. No.
1ph	3.5	GLIN03KS
1ph	6.7	GLIN06KS
1ph	10	GLIN10KS
1ph	15	GLIN15KS
1ph	10.5	GLIX10HS
3ph	7.5	GLIX07KS
3ph	10.5	GLIX10KS
3ph	15	GLIX15KS
3ph	20	GLIX20KS
3ph	25	GLIX25KS
3ph	30	GLIX30KS
3ph	45	GLIX45KS

3.1.6. Nomenclature options

Option	Input	Power (kVA)	Cat. No.
ComiTEQ box	1 and 3ph	3.5 - 45kVA	GLCB
I/O digital box	1 and 3ph	3.5 - 45kVA	GLIOB
Modem GSM/GPRS	1 and 3ph	3.5 - 45kVA	GLCMDM



ComiTEQ box



I/O digital box

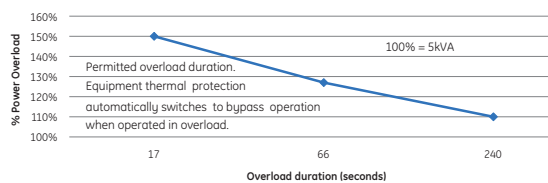


Modem GSM/GPRS

Note: Take into consideration the Power Curves and Overload Capacity (Section 3.1.7) applicable for all formats, sizing (Section 3.2.6) and cooling (Section 4.3).

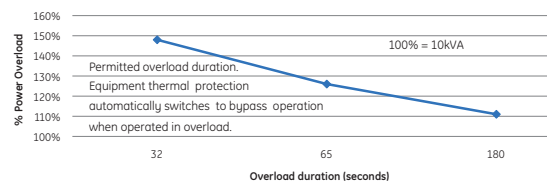
3.1.7. Power curves and overload capacity for ALL formats

5kVA short term overload capability



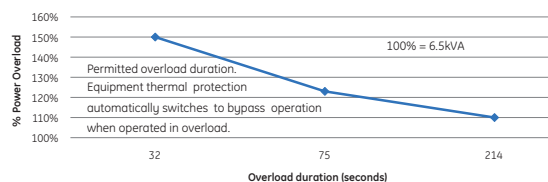
5kVA	
Duration (s)	Overload
17	150%
66	127%
240	110%

10kVA short term overload capability



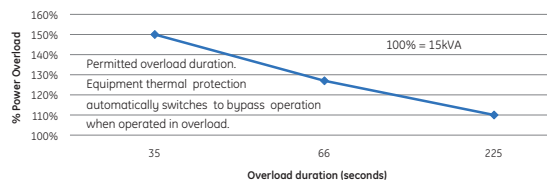
10kVA	
Duration (s)	Overload
32	148%
65	126%
180	111%

6.5kVA short term overload capability



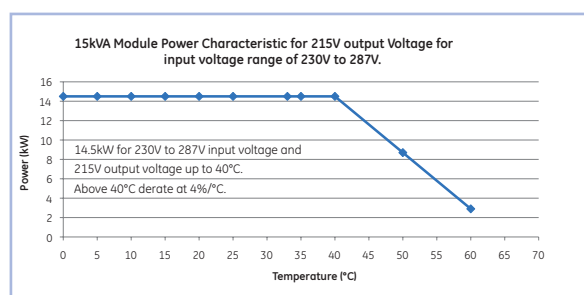
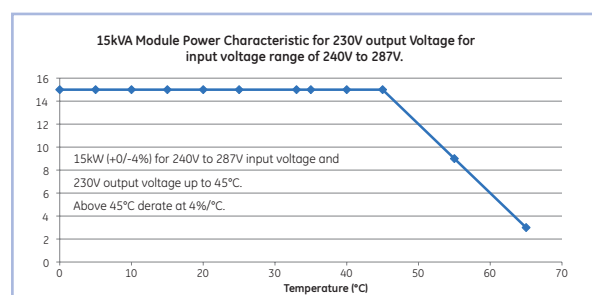
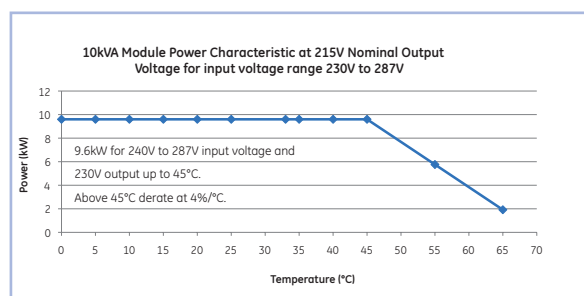
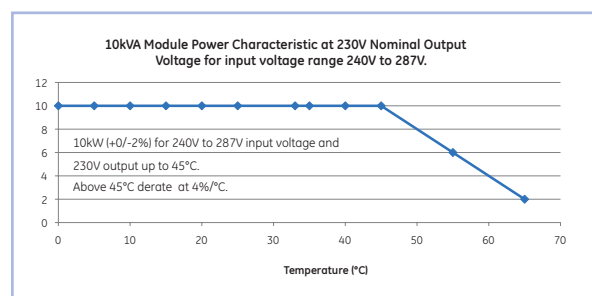
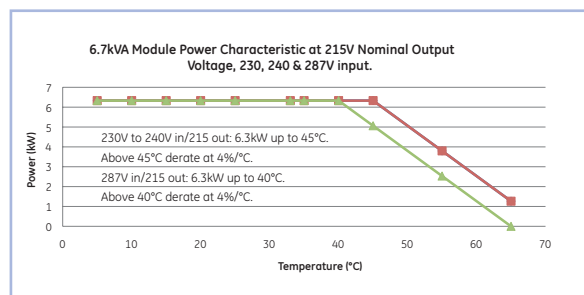
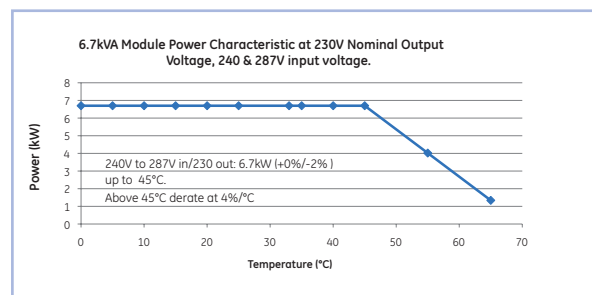
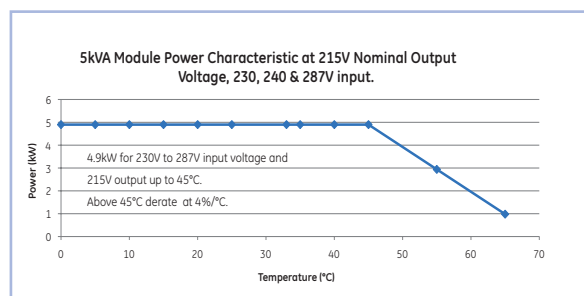
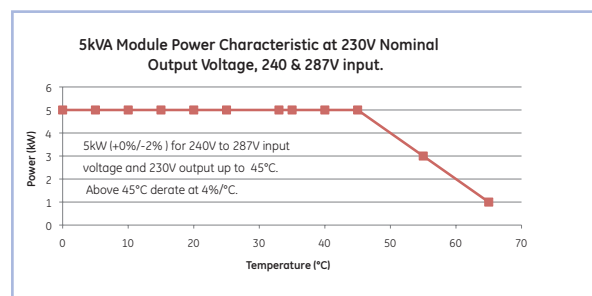
6.5kVA	
Duration (s)	Overload
32	150%
75	123%
214	110%

15kVA short term overload capability



15kVA	
Duration (s)	Overload
35	150%
66	127%
225	110%

Module Power versus temperature characteristic



	Output	230V ⁽¹⁾		215V		
	Input	240V	287V	230V	240V	287V
Three Phase Power ⁽²⁾ (kVA)	15	5kVA (+0/-2%) to 45°C		4.9kVA to 45°C		
	20	6.7kVA (+0/-2%) to 45°C		6.3kVA to 45°C		6.3kVA to 40°C
	30	10kVA (+0/-2%) to 45°C		9.6kVA to 45°C		
	45	15kVA (+0/-4%) to 45°C		14.5kVA to 40°C		

(1) Rated power operation is as stated for 230V out at the stated tolerances.

(2) Example: 15kVA three phase module consists of three 5kVA modules.

3.2. Description of the system

3.2.1. Introduction

GradiLux is an electronic dimmer-stabilizer system of alternating voltage to control and dim the lighting flow in lighting installations. The control of lighting flow allows obtaining both an energy saving and high comfort in the street lighting. Also, by just only stabilizing the power supply of the lighting, the lamp lifetime is prolonged notably, because in normal conditions they are exposed to mains fluctuations and indirectly, there is a saving in the electrical energy when the power supply to the lamps is stabilized.

GradiLux is a chopper power converter. By doing a Duty Cycle, there will be a concrete alternating voltage level at the output without needing to modulate the cycle to get a sinewave voltage, because there is not any rectifier and conversion to direct current.

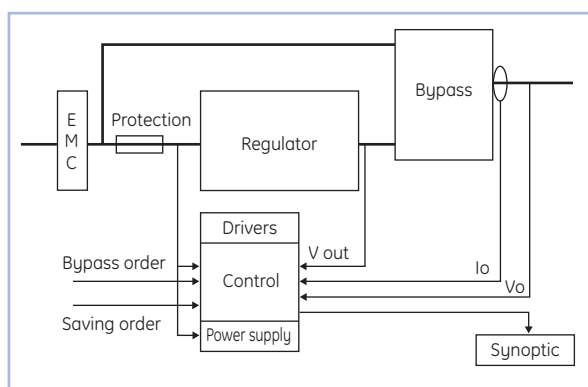
The converters of those stabilizers are bi-directional, and they are provided with parts to recover the reactive current feedback to mains, because the typical lighting installation (with discharge lamps of mercury or sodium vapour gas) are always reactive (leading or lagging depending on the compensated degree of power factor and operating voltage), and non-linear with harmonic currents.

All converters will be both semiconductor devices managed through switching and bi-directionals.

In three phase dimmer-stabilizers, each module that make up **GradiLux** works in an independent way, one per each phase, so each one will correct the fluctuations of that phase only.

3.2.2. System block diagram

Fig. 8. GradiLux single line diagram.



3.2.3. Constructive blocks

EMI INPUT FILTER

The equipment has an EMI filter at the input to avoid reinjecting the electrical noise generated by its switching to the mains. The filtered voltage is taken from both bypass directly and from a fuse to the converter.

VARISTORS PROTECTION (MOV)

The equipment has varistors at both input and output to avoid transient voltages that could damage the unit. Those varistors are protected by fuses to avoid their destruction by high or prolonged input overvoltages.

REGULATOR WITH BUCK AC CONVERTER

Basically, the differences as regard a Buck converter in DC systems is to replace the single direction switching parts by bi-directional parts and to establish strategies or methods of triggering that allow managing lagging-leading currents phase shifted with voltage. In AC systems with inductive or capacitive loads, there are currents that flow from mains to load and from load to mains through the equipment, so it has to allow the flow in both directions. This is why diodes can't be used as switching parts; they have to be replaced by IGBTs, which make to define a triggering system suitable to the voltage polarity at each moment.

So far, we have referred to a single phase stabilizer for AC. In case of a three phase device, it is compulsory to treble the required parts, less the LCD panel and communication card because they are common for all phases.

In lighting of big centers, like streets, car parks or highways, the energy distribution is usually done in three phases. The **GradiLux** equipments, starting from single phase devices and thanks to its modular structure, can be easily built in three phase stabilizers, that are made of three independent modules connected in star configuration. That way, one, two or three phases can operate at different levels if required.

POWER SUPPLY

The power supply of the control of the equipment is fed from input. It is a flyback power supply with multiple output windings that supply all control parts and front LEDs. It is also a multivibrator, which feeds several feedforward transformers of ferrite to create the needed voltage for the IGBT drivers.

CONTROL

The control has a last generation microprocessor that uses digital control techniques to achieve an output voltage with good accuracy and response time. Also the control acquire measurements, generates the PWM signal for controlling the output voltage, manages the overloads and wrong situations, controls the bypass, controls the synoptic and serial communications. Also there are some LEDs to display the status of the regulator in an easy way.

BYPASS

In normal conditions, the output of the regulator is supplied from converter output or in case of faults or overloads it is fed from input voltage. The bypass technology is based on a hybrid switching technology plus a solid state switch (IGBT), which gives robustness to the manoeuvring, with no transfer time and no looping currents to guarantee the lack of transients and overcurrents during the switching.

Bypass is active by default, so if the control doesn't turn it off, it will still be connected. Also it can be set to automatic or manual through an external input because we can force it through it. Furthermore it is reversible, so when the cause that activated it is cancelled the unit will return back to normal operating.

Conditions to force the automatic shifting to bypass are:

- Overtemperature, detected by internal sensors
- Output overload
- Faulty IGBTs
- Output voltage fault
- Manual activation

DRIVERS

Drivers trigger the IGBTs of the voltage regulator and they have an individual protection system for each IGBT by monitoring the saturation voltage of the transistor and taking the required actions in consequence.

LED INDICATORS AND SYNOPTIC WITH LCD PANEL

All modules have six LED light indicators, which are turned on when its function or alarm is triggered. Also, each system, regardless of whether it is single phase or three phase, has a synoptic with LCD panel. This control panel is common and unique for the three modules that make the three phase system and it is completely integrated in one of them. By means of this control with LCD panel the status of the equipment, variable measurements, active alarms, data logger (list of the last 200 events), status and parameter setting, relay interface programming, setting and activation of time scheduler and astronomical clock, operating time by means of the energy counters, and the control of external sensors are displayed.

CONTROL CARD

This card is not shown in the single line diagram of figure 9. There are three versions depending on their functionality:

- A basic (GLIOA) one that is standard in formats (H) and (V) and is integrated in the equipment.

AC/DC power supply, due to its power allows supplying until the LCD panel and the communication ComiTEQ (slot preconnections ComiTEQ card).

- 1 input for bypass order.
- 1 input for saving order.
- Power supply of the contactor coil.

Modular format (**M**), is provided with an AC/DC power supply instead, for feeding the LCD panel and another one for feeding the ComiTEQ box. These power supplies have to be connected to AC outlets directly and to the female DC jack connector of synoptic and ComiTEQ respectively.

- **Optional** with digital I/O (GLIOC) that replaces the basic one in formats (**H**) and (**V**). In addition to the benefits of the **basic card** it has the available ports to communicate **GradiLux** with the environment, where there are:
 - 1 RS232 communication channel.
 - 1 RS485 RS232 communication channel.
 - 5 digital inputs.
 - 5 dry contacts (including headline contactor control).

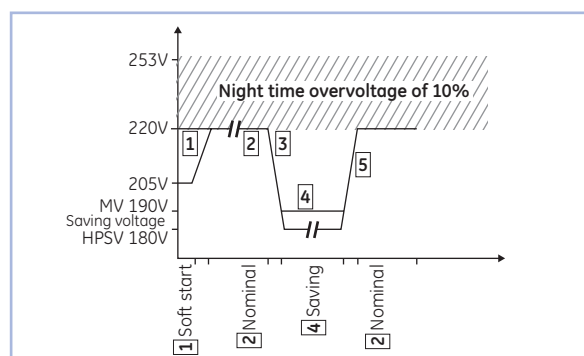
Version with communication channels can be implemented from factory or in the future if required. In this last case, you can choose by leaving the headline contactor control connections where they are, over the control with LCD panel directly or modify them by connecting the headline contactor over the respective terminal strip in the digital or modular format (**M**) and Due to its structure, you have to make sure the communication card will be located next to the module and inside its enclosure or under an IP20 protection degree as minimum

- A boxed (GLIOB) version of GLIOC. Modular format uses the boxed version.

3.2.4. Operating principle

Dimmer stabilizer is installed at the beginning of the lighting line, either in the feeder pillar or in separate case, it is not needed any additional control wiring till the lamps (see fig. 13 and 14 «Circuit diagram of typical installation», as an example they show two three phase installation differentiated by the equipment format and therefore by the control card built in).

Fig. 9. GradiLux operating cycle.



- 1 Soft start
- 2 Nominal
- 3 Soft decrease from nominal voltage to saving level
- 4 Saving
- 5 Soft increase from saving level to nominal voltage

When the equipment receives voltage, it starts the daily duty cycle (see fig. 9), doing a "soft start" of the installation, and starting from 205 V and keeping this level for 2' 30" (see note). When the soft start has finished the voltage ramps until it reaches the 220 V nominal. During this start process, the voltage is stabilized at its corresponding values. The values of voltage, time and speed ramp can be set.

Once the start up process is ended, the equipment will keep supplying stabilized voltage to the installation at nominal level, meanwhile the saving order is not activated. This order will come from an external device (timer, astronomical clock, remote control, manual activation, ...) which will be connected to the stated terminal strip of the equipment labelled as «Remote control». Afterwards, a procedure of «saving in soft ramp» is started that takes approx. 10 minutes till the saving voltage.

This procedure can be repeated as many times as it were set, as well as there were mains blackouts or power failures.

Relationship between soft start duration and ramp rate.

Ramp rate (volts/minute)	Soft start duration (minutes/seconds)
1	13"
2	6'30"
3	4'20"
4	3'15"
5	2'36"
6	2'10"

"Ramp rate" can be manually entered via the display keypad. It must be between 1 and 6 Volts per minute.

Soft start duration also varies when the ramp rate is varied as tabulated.

3.2.5. Formats

GradiLux Colour Scheme

Panels painted in Epoxy coat of NCS S 3020 R90B and base of equipment in painted in NCS S 7010 R70B. For serigraphy the colours are NCS S 0300-N (white), Pantone Black 6 (black) Pantone 7455ck (blue).



GradiLux is available in **three formats**.

Most basic one is modular format (M).

- Modular format (M) - original equipment manufactured -
- Protection degree IP20. Assembled in galvanized sheet steel. Designed to make its adaptation in control centers more flexible. Basic format is one module with LED to control one phase, so a three phase system is based on three modules modular format (M). Nevertheless one of the three modules of the three phase system has LCD panel as interface between the equipment and user, like the single module for single phase installations.

Modular format (M) module(s) will be fixed in vertical position with the supplied supports:

- Directly to the wall.
 - Inside of a metallic or plastic (like polyester) enclosure.
- Each modular format (M) module is supplied in single packaging without auxiliary parts (supports or AC/DC power supply), because they are supplied in an independent packaging labelled as **(GLKIT)**. When requesting a single or three phase unit in this format, it will be supplied respectively, based on the following, material (see figure A):

1. Format 1: Modular single phase:

- **Modular format (M)** module with control with LCD panel.
- **GLKIT1**
 - a) Transformer with AC/DC power supply for control with LCD panel.
 - b) 2 galvanized supports of steel **(Sp-A)**, for module vertical fixing with "Z" shape. Upper and lower supports.
 - c) CD with all documentation and warranty.

2. Format 2: Modular three phase:

- One **modular format (M)** module with control with LCD panel.
- 2 modules without control panel.
- **GLKIT3**
 - a) Transformer with AC/DC power supply for control with LCD panel.
 - b) 1 galvanized support of steel **(Sp-B)**, to fix the three modules in vertical position as "hang" mode. Upper support.
 - c) 3 galvanized supports of steel **(Sp-A)**, for vertical fixing for each module in "Z" shape. Lower supports.
 - d) "Communication bus" cable **(Fc)** among modules, with three connectors of 10 pins.

e) CD with all documentation and warranty.

All options for this format, will be supplied as independent parts to be installed by the end-user.

Please keep in mind section 4.3 regarding cooling.

3. Format 3: Stand-alone formats vertical **(V)** and horizontal **(H)** with protection degree IP20.

- Standard configuration for a three phase equipment:
- Three modular format (M) modules, two with LEDs and one with LCD panel.
- Four poles input switch.
- Terminal strip,
- One control card LTIOA used as AC/DC power supply.
- A metallic subchassis made of galvanized steel with covers. It is used as metallic protection enclosure, over it the modules and parts are fixed.
- CD with all the information (manuals, warranty, ...).

Dedicated to be installed in the own distribution, protection and control panel, over the floor or pedestal, or hung up with the right mediums, but never outdoors.

In any case, the cooling air volume (stated in table 5) has to be respected for each power, considering that the forced air cooling is taken from front and canalized till its exhausting through the top cover.

The cooling air of the equipment can't be feedback when it is installed inside the feeder pillar, because the internal temperature would increase till block it and leave it out of service. It is essential to leave the same cross cable section for inlet and outlet air in the feeder pillar.



Enclosures like feeder pillars, will have openings for GradiLux forced cooling, without endangering the standard meeting regarding protection degree.

Outdoor installation should only be with the GradiLux equipment within a minimum IP54 rated enclosure which also respects the cooling requirements of Section 4.3.



Do not locate the equipment in areas exposed to floods.

Any option installed in the **GradiLux** increases notably its quality performances, by keeping the own functions and incorporating new ones.

Different functionalities for each format are shown in tables 1 to 3, according to the options that the equipment has or can have.

Figure A. Representative example of provided material for modular format (M) equipments.



Single phase modular format (M).

Three phase modular format (M).

3.2.6. Sizing

There is a series of factors to take into account when we have the total power in lamps and would like to correctly proportion a dimmer-stabilizer:

Factors that affect the sizing

1. Losses in the associated elements (P)

These are larger in lamps of lower power and can vary from 4 to 21%. The loss factor will be between 1.04 and 1.21 'P'.

2. Harmonics (H)

There is a distortion of the current due to its form as a non-sine curve. This means that the power factor is not 1 even if it is corrected by capacitors. Measurements should be made of the real RMS value. RMS of the current divided by the average value $ARM = RMS/AV = 1.057$

3. Potentially high supply voltage (T)

7% overvoltage represents an overload of 14.5%. The device is stabilized and permits a maximum overvoltage of 1% (output tolerance) and therefore a maximum overvoltage of 2%. $(1.01)^2 = 2\%$, $T = 1.02$

4. COS φ , reactive currents or phase (C) lag between voltage and current

In case of failure of a compensation capacitors, the COS φ of the installation may not be equal to 1. Factor should not be less than 1.1.

5. Start-up current of the lamps

Depending on the type of lamps and their power, the overvoltage may reach up to 70%. Because the GradiLux starts up at 205 V, it greatly reduces this problem, which usually lasts for some 2'30" until the optimal temperature is reached in the lamps. This prevents the tripping of the magnetothermic protections.

Summary

$$Q = H \times T \times C$$

$$K = P \times Q = P \times H \times T \times C$$

$$\text{Power of light} = \text{No. lamps} \times \text{lamp power}$$

This means that on installation, the power of the GradiLux can be expressed as:

$$\text{Power GradiLux} = Q \times P \times \text{No. lamps}$$

$$\text{Power lamps} = K \times \text{No. lamps} \times \text{Power lamps}$$

And if we add numbers to the example, we can see that $K \approx 1.5$.

Notes

1. If care is taken with the COS φ of the installation and the lamps are high in power (> 400 W), K can be taken to be ≥ 1.3 .

Warning: do not confuse this with the stipulations of the ELECTRONIC LOW VOLTAGE REGULATION for conductors:

"for power supply networks for lighting points with discharge lamps or tubes, the minimum anticipated HV charge will be 1.8 times the power in Watts of the discharge lamps or tubes to which power is supplied."

2. If the total current in real charge is known, the device can be proportioned with **K = 1.2**.

3.3. Optional

3.3.1. Lightning arrestor of 6.5 kA for input or input and output

After the varistors (MOV) already installed at the input and output in each module, it is the top level in lightning arrestor protection. Also it can have LED indicators when it is activated and auxiliary contacts for its telemanagement.

Depending on the model and brand of the requested lightning arrestor or in stock and if it has the parts like indicators and/or auxiliary contacts, the physical location in the same equipment model can be different depending on it.

3.3.2. Manual bypass switch

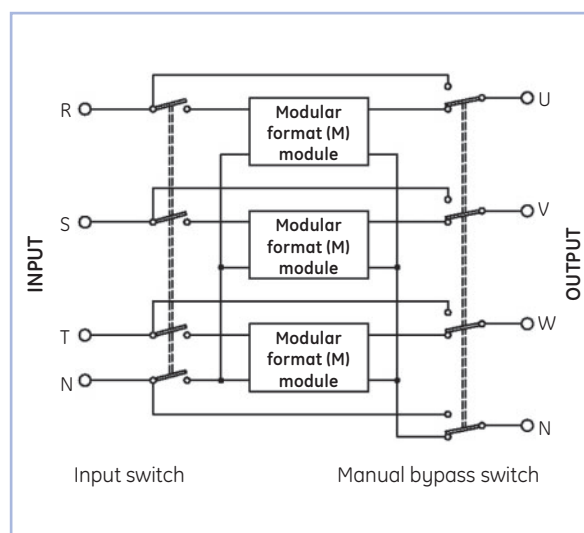
Internal manual bypass or external manual bypass panel switch of 2 positions can be supplied with no break, which allows to select to feed the **loads from mains directly (position 1)**, or through the GradiLux **(position 2)**.

The switch is make before break, so there will not be any break in the loads during the changing in the position of the switch.

This switch, two poles for single phase units or four poles for three phase units, makes easier the maintenance tasks, so in indoor or tunnels installations any type of maintenance can be done without turning off the lighting.

The user can install an external manual bypass make before break or break before make depending on his requirements, although the first one is the most advisable (see figure 10).

Fig. 10. Bypass manual connection diagram.



Do not fix any options or accessories to the metallic structure of the module or modules, because it will automatically void the warranty of the equipment and it could cause serious damages to the internal electronics.

3.3.3. Control cards GLIOB/C, digital I/O

This card concentrates all communication and control connections like:

- RS-232 (there will be two RS-232 connectors physically, one in DB9 and the other one in RJ, but only one can be used).
- RS-485.
- Relay interface of alarm and events, programmable via control panel with LCD.
- Digital inputs.
- Analog inputs of 4 - 20 mA.

This card can be supplied by default from factory or purchased later on, but in both cases it will be supplied as a separate item from the own **GradiLux**, in a box with protection degree IP20 in **modular format (M)** equipments. Nevertheless, (H) and (V) equipments, this card will replace the one that the equipment has by default as power supply GLIOA of the control panel and ComiTEQ slot.

Table 1: Modular format (M) configuration without digital I/O (GLIOB)			
CONFIGURATION	OPTIONALS	FUNCTIONALITIES	COMMUNICATIONS
Modular format + 2 basic modules (three phase equipments only) + 1 module with LCD + AC/DC power supply for LCD panel	+ ComiTEQ box communication with its AC/DC power supply	Lighting flow regulation and saving + Measurement, alarms and data logger visualization + Parameter programming in the equipment + Time scheduler and astronomical clock + Energy meters + Control over the headline contactor + Saving and bypass orders + Own communications of the equipment + Manual bypass (option)	+ RS-232 with complete three phase ModBus map
			+ RS-232 with complete three phase ModBus map + Ethernet TCP/IP communication (web server in ComiTEQ)
	+ ComiTEQ box communication with its AC/DC power supply + GPRS modem with its antenna and AC/DC power supply		+ RS-232 with complete three phase ModBus map + Ethernet TCP/IP communication (web server in ComiTEQ) + GPRS remote communication through internet via web from FIM card or ComiTEQ Control Centre
Modular format (M) configuration with digital I/O (GLIOB)			
CONFIGURATION	OPTIONALS	FUNCTIONALITIES	COMMUNICATIONS
Modular format + 2 basic modules (three phase equipments only) + 1 module with LCD + AC/DC power supply for LCD panel	+ Digital I/O card GLIOC, in separate case	Lighting flow regulation and saving + Measurement, alarms and data logger visualization + Parameter programming in the equipment + Relay programming + Time scheduler and astronomical clock + Energy meters + External sensor assistance + Control over the headline contactor + Saving and bypass orders + Own communications of the equipment + Manual bypass (option)	+ RS-232 with complete three phase ModBus map + RS-485 + Relay interface + Digital inputs
	+ ComiTEQ box communication with its AC/DC power supply + Digital I/O card GLIOC, in separate case		+ RS-232 with complete three phase ModBus map + Ethernet TCP/IP communication (web server in ComiTEQ) + RS-485 + Relay interface + Digital inputs
	+ ComiTEQ box communication with its AC/DC power supply + GPRS modem with its antenna and AC/DC power supply + Digital I/O card GLIOC, in separate case		+ RS-232 with complete three phase ModBus map + Ethernet TCP/IP communication (web server in ComiTEQ) + GPRS remote communication through internet via web from FIM card or ComiTEQ Control Centre + RS-485 + Relay interface + Digital inputs



GradiLux in (H) and (V) format has a protection degree of IP20, so never install it outdoors. However the user may fit all formats with the use of enclosures with minimum protection degree IP54.

Note: Cooling requirements as specified in Section 4.3 must be respected.

Table 2: Stand-alone format (H/V) configuration without digital I/O card (GLIOC)			
CONFIGURATION	OPTIONALS	FUNCTIONALITIES	COMMUNICATIONS
Stand-alone format Base plate (H) + Terminal strip + Four poles switch + 2 basic modules + 1 LCD module + AC/DC power supply through card GLIOA + Slot for ComiTEQ card + ComiTEQ card	+ Manual bypass switch	Lighting flow regulation and saving + Measurement, alarms and data logger visualization + Parameter programming in the equipment + Time scheduler and astronomical clock + Energy meters + Control over the headline contactor + Saving and bypass orders + Own communications of the equipment + Manual bypass (option)	+ RS-232 with complete three phase ModBus map
	+ Manual bypass switch + ComiTEQ card communications		+ RS-232 with complete three phase ModBus map + Ethernet TCP/IP communication (web server in ComiTEQ)
	+ Manual bypass switch + ComiTEQ card communications + GPRS modem with its antenna and AC/DC power supply (for external installation of equipment)		+ RS-232 with complete three phase ModBus map + Ethernet TCP/IP communication (web server in ComiTEQ) + GPRS remote communication through internet via web from ComiTEQ card or ComiTEQ Control Centre
Stand-alone format (H/V) configuration with digital I/O card (GLIOC)			
CONFIGURATION	OPTIONALS	FUNCTIONALITIES	COMMUNICATIONS
Stand-alone format Base plate (H) + Terminal strip + Four poles switch + 2 basic modules + 1 LCD module + Digital I/O card GLIOC + Slot for ComiTEQ card	+ ComiTEQ card communications	Lighting flow regulation and saving + Measurement, alarms and data logger visualization + Parameter programming in the equipment + Relay programming + Time scheduler and astronomical clock + Energy meters + External sensor assistance + Control over the headline contactor + Saving and bypass orders + Own communications of the equipment + Manual bypass (option)	+ RS-232 with complete three phase ModBus map + RS-485 + Relay interface + Digital inputs
			+ RS-232 with complete three phase ModBus map + RS-485 + Relay interface + Digital inputs + Ethernet TCP/IP communication (webserver in ComiTEQ)
	+ ComiTEQ card communications + GPRS modem with its antenna and AC/DC power supply (for external installation of equipment)		+ RS-232 with complete three phase ModBus map + RS-485 + Relay interface + Digital inputs + Ethernet TCP/IP communication (web server in ComiTEQ) + GPRS remote communication through internet via web from ComiTEQ card or ComiTEQ Control Centre

3.3.4. ComiTEQ card / box communications

ComiTEQ communication card is able to provide a communication interface for Ethernet networks with TCP/IP and SNMP, GPRS modem, RTC modem,... through the RS-232 port.

RS-232 is not multiconnection, so if this channel is going to be used for any purpose, it will not be possible to make additional connections although the other connectors were available.

ComiTEQ communication card can be supplied in two formats, depending on its application:

- **ComiTEQ box for modular format (M):**
ComiTEQ box is supplied inside a small box, where there is a jack for DC power supply and communication ports. It is better to fix it to the wall or over any fix solid support, do not fix it over the own module(s).
This card communicates with the **GradiLux** across the port RS-232, given in a connector RJ and next to the panel of control with display LCD. His power supply will be realized by means of the source given AC/DC and through the foreseen jack.
- **ComiTEQ card for stand-alone (H) and (V) formats:**
Equipment with slot for ComiTEQ card. Just remove the protection cover and insert the communication card into the slot and it will run.

3.3.5. GPRS modem

It is in charge of doing the remote transmission of the parameters managed by ComiTEQ card.

GPRS modem connection is used to have remote access to the equipment.

Depending on the contracted service, there will be access to the monitor or to control the number of equipments installed (telemaintenance).

- In **modular format (M)**, is better to fix it to the wall or over any solid immovable support, never over the own equipment.
- **Stand-alone** formats **(H)** and **(V)** have a M2 drill in the side of the structure, close to the ComiTEQ card slot, to fix the GPRS modem.
- GPRS modem has a female jack to feed itself through a DC power supply already supplied with the option.

Table 3: Option compatibility depending on the format.

OPTIONALS \ FORMATS	Modular		Stand-alone			
	(M)		Horizontal (H)		Vertical (V)	
	I	E	I	E	I	E
Lightning arrestors 6.5 kA	-	X	X	-	X	-
Manual bypass	-	X	X	-	X	-
Manual bypass panel	-	X	-	X	-	X
Digital (I/O) GLIOC	-	X	X	-	X	-
ComiTEQ box + power supply AC/DC	-	X	-	-	-	-
ComiTEQ card	-	-	X	-	X	-
GPRS (antenna included) + power supply AC/DC	-	X	-	X	-	X



I = For internal application.
E = For external application.

4. Installation

4.1. Important safety instructions

- Check chapter 2.4 - "Safety instructions".
- Unpack the equipment by following the procedure in section 4.2.
- Check the data in the nameplate of the packing is the required by the installation.
- **Never make the connection tasks or manoeuvring of the cables that have risk of electrical discharge with voltage present.**
- Depending on the format of the equipment to install, there will or will not be available parts like input switch (4). When it happens, omit any action, notes or warning related with it and proceed with the next step.
- The equipment is designed to work vertical orientated with air inlet at the base and air outlet at the top. Do not mount the equipment in a horizontal way with the air inlet and outlet at the sides as this may impact adversely on cooling efficiency and cause overheating.
- It is necessary to fix the equipment as described, before proceeding with the installation. Each format has a determined way for fixing, either by using supports that are fixed previously or directly through the foreseen fixing orifices (see figures 11 and 12):
 - Together with the **modular format (M)**, the respective **modular format kit (GLKIT1 or GLKIT3)** is supplied for the single or three phase equipment, configured with two or three supports (**Sp-A**) respectively with "Z" shape and particular support (**Sp-B**) for three phase equipment.
 - Both supports (**Sp-A**) for single phase equipments will be fixed with M4 bolts (**t₂**) in the rear side of the module.
 - In three phase equipments, each one will be fixed to one of the three supports (**Sp-A**) in "Z" shape, in the bottom part of the rear side of each module.
 - Finally mechanize the wall or bottom of the case that will house the module or modules (see figure 11):
 - For single phase **modular format (M)** equipment, fix the module with bolts through the drills located in the supports (**Sp-A**).
 - For three phase **modular format (M)** equipments, fix the support (**Sp-B**) in the wall or bottom of the case, hang the three modules in that support and fix each module with bolts, through the drills located in the supports (**Sp-A**).
- Stand-alone horizontal formats (**H**) have 4 holes of M8 for fixing it to a solid and levelled base (see figure 12). It is obligatory to make this mechanical operation before proceeding with the installation.
- Stand-alone vertical formats (**V**) have 4 holes of M8 for fixing it to a solid and levelled base, and other 2 additional holes of Ø10 mm in the frontal face (see figure 12).

- Location needs to be cooled and easily accessible. **Never** install the **modular format (M)** or **stand-alone formats (H) and (V)** in outdoor conditions. Keep in mind the following statement:



The enclosures for switchgear panels, needs holes for convection cooling of **GradiLux**, without breaking the standards regarding protection degrees.

Regarding cooling, respect the indications and recommendations in section 4.3.

Do not block the cooling holes.

Input switch (4) of the equipment, has to be in position "0" or "OFF".

To access connection parts, open front door and/or remove the protection cover of the connection parts depending on the format of the equipment:

Modular format (M)

- Remove four allen screws (**t₂**) that fix the module cover (**Tm**).
- Pull slightly from the cover (**Tm**) of the module to outside. It could be slightly fitted with the module chassis, to free it use a flat screwdriver, making lever between the cover and the own chassis.
- Connection terminal strip will be in front.
- After finalising the connection tasks, leave the module with its cover (**Tm**) back and fixed with the screw (**t₂**).

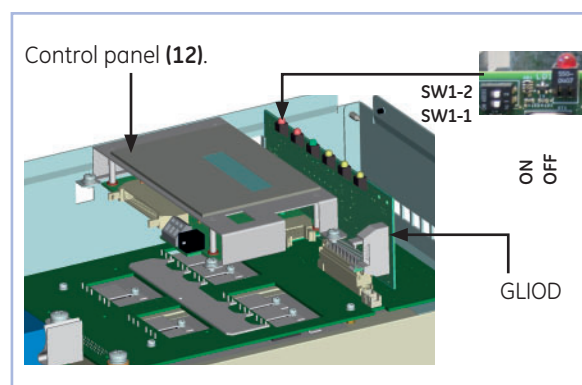


Modular format (M) for three phase connection.

- Remove four allen screws (**t₂**) that fix the module cover (**Tm**).
- Pull from the cover (**Tm**) of the module to outside. It could be slightly fitted with the module chassis, to free it use a flat screwdriver, making lever between the cover and the own chassis
- Connection terminal strip will be in front.
- Proceed in the same way with the rest of modules.

Address	Phase	SW1-1	SW1-2
1	R	OFF	OFF
2	S	ON	OFF
3	T	OFF	ON

Table 4: SW1 dip-switch to set module address.



- All modules are preset from factory to work as single phase units, so the assigned address is **-1-**, whether the control panel has an LCD or not.
- Before connecting the three modules in three phase, it will be **essential** to set this address in both of them, by acting over the dip-switch (**SW1**) from card GLIOD according to table 4, otherwise the control panel with LCD will only be able to communicate with the module that has it.
- Besides, it is **essential** to make the communication bus connection as it is described in section 4.8, to establish the communications among the modules of each phase with the control panel.
- It is recommended to adopt the convention suggested in figure 21, where the module with LCD panel is located in the centre and the order of the phases from left to right is established as R-S-T, corresponding to the addresses 1-2-3.
- Connect the three modules as it is stated in section 4.6.
- When finalising the connection tasks, leave each module with its own cover (**Tm**) and fixed by the screws (**t₂**).

Stand-alone formats (H) and (V).

- Remove screws (**t₁**) that fix cover (**Tb**).
- Remove cover (**Tb**).
- Connection terminal strip will be in front.
- After finalising the connection tasks, leave the cover (**Tb**) back and fixed with the screws (**t₁**).



Vertical format (V) does not have a cover (Tb) or screws (t₁).

Modular format (M) have a slot in bottom side to enter the connection cables.

- Use cables with suitable cross section for input, output and earth (see table 6).
- **GradiLux** connection will be done at the headline of the installation. Figures 13 and 14, as an example, show a typical three phase installation diagram with more standard options. For single phase equipments, simplify the connection disregarding the other phases.
- **GradiLux** doesn't have circuit breakers nor differential protections and it depends of the installation external protections. Make sure about this compliance.
- Nevertheless format (**H**) has a general switch that breaks the power supply to the equipment.
- In case of requiring an external manual bypass, follow the following recommendations:

Bypass has to avoid the voltage feedback through the output of the equipment, in order to avoid both damages to itself (the equipment is not protected against voltage connected at the output) and to manoeuvre the output terminals with no voltage and no risk. Therefore, manual bypass has to disconnect the **GradiLux** output when it is activated.

Best option is a rotatory switch with two positions with its common pin connected to the load, one of its input pins connected to the output of the equipment and the other input pin to the alternative line for fault cases, with or without overlapping depending on the type of installation (see figure 10).

4.2. Reception of the equipment

4.2.1. Unpacking and content checking

- When doing the reception of the equipment, check the equipment condition to ensure that there has not been any incident during transport. Otherwise, make the appropriate claims to your provider or to GE Energy - Industrial Solutions. Also check that the data in the nameplate adhered in the packaging of the equipment are the same as the stated in the purchase order. Otherwise, as soon as possible make the nonconformity, quoting the serial number of the equipment and references in the delivery note.
- Once the reception is done, keep the equipment in its original packaging till its commissioning in order to protect it against mechanical dents, dust, dirt, etc.
- Packaging of the equipment has:

Modular format (M).

- Cardboard case, corners of expanded polystyrene (EPS) or polystyrene foam (PE), polyethylene bag. All parts are recyclable, so if they are gone to be disposed, do it in accordance with the current regulations. It is recommended to keep the packing in case it were needed in future.

Stand-alone formats (H) and (V).

- Wooden pallet, cardboard or wooden (under request only) case, expanded polystyrene (EPS) or polystyrene foam (PE), polyethylene bag and polyester strips. All parts are recyclable, so if they are gone to be disposed, do it in accordance with the current regulations. It is recommended to keep the packaging in case it were needed in future.
- Following steps for a correct unpacking of the equipment for indoor format (**H**) and (**V**):
- Cut the polyester strips that wrap the cardboard packaging.
- Open the flaps of the cardboard packaging.
- Take out the documentation.
- Remove both corners and/or expanded polystyrene (EPS) plate or polystyrene foam (PE).
- Take out the cardboard packaging by pulling it up.
- Remove the plastic bag of polystyrene that wraps the equipment.
- Download the equipment from the pallet.
- Regarding the **modular format (M)**, as it doesn't bring polyester strip and pallet, its unpacking is more simple. Proceed as follows:
- Remove the adhesive strip.
- Take out the staples.
- Open the flaps of the cardboard packaging.
- Take out the equipment from inside of the cardboard packaging and remove the plastic bag of polystyrene (PE).
- In formats (**H**) and (**V**), meanwhile the equipment is not in its final installation place, it is recommended to not download the equipment from the wooden pallet in order to make easy its mobility.

4.2.2. Storage

Make sure to only store the equipment in places free of dust, humidity, chemical agents or high temperatures.



In case of piling up, do not exceed more than two units of height for stand-alone formats **(H)** and **(V)**, because packaging is not built to support higher compression.

Regarding **modular format (M)**, **never** pile up more than five units of height and in case of piling it up **always** do it with the equipment arranged in horizontal way, as indicated on the packaging.

4.2.3. Location

Due to their protection degree IP20, both indoor formats (H) and (V) and the modular format (M), need to be placed inside the existing control centre, considering that for its correct cooling is needed to have the suitable airflow depending on the model and stated in table 5. **Never install the indoor or modular format (M) units in outdoor places.**

Whatever the place is, equipments are **obligatory to be fixed to the wall, inside of the enclosure or floor with parts that guarantee a total and permanent strength**, using the respective supports or holes made in its base, see figures 11 and 12.



The forced air cooling flow of the unit is foreseen in upward way from base toward the highest part. Leave the needed space to make possible the air circulation, taking care of the stated parameters.

4.3. Cooling

Cooling of equipment with stand-alone formats (H) and (V)

Lighting flow stabilizer for headline in street lighting is a unit of power conversion, so it has heat losses, although they are very low (<5%), they have to be kept in mind for their location inside enclosures. Heat losses due to an efficiency lower than 100%, create heat that has to be dissipated out from the equipment. This is why, the enclosure where the equipment is located, has to allow a flow air cooling that allows the correct cooling of the equipment. These air volumes are stated in table 5 for each power.

The ideal is that the enclosure allows an air inlet through the bottom and air exhausting through the top. Usually this air exhausting needs to be forced by fans in order to create an air depression inside the cabinet. Depending on the closed that the cabinet is and for 45kVA equipments 2 fans of 120x120 supplied at $U_{nominal}$ are enough.

Cooling of equipment with modular format (M)

In case of assembling one module over the other one, keep in mind that the hot air from the lower module does not go inside to the module on top, but it takes fresh air coming from outside of the cabinet. Sometimes, to do it is needed air flow deflectors that modify the hot air flow of one module and avoid heating the other module.

Modules are designed to assemble them in vertical position guiding the air flow from fans upwards and terminal strip to down. Cooling air volume and heat losses depending on the model.

Table 5: Cooling air volume and heat losses per model.

POWER (kVA)	INDOOR / OUTDOOR	
	Air volume to exhaust m ³ /h / CFM	Heat losses (W)
Single phase - Modular format (M)		
3.5	35 / 21	175
6.7	35 / 21	325
10	75 / 44	500
15	110 / 65	750
Three phase - Modular format (M)		
7.5	100 / 59	375
10	100 / 59	500
15	100 / 59	750
20	220 / 130	1000
25	220 / 130	1250
30	220 / 130	1500
45	320 / 188	2250

When considering cooling, bare in mind both module derating characteristics and module sizing (see section 3.1.7). For the purposes of establishing power capacity where the equipment is operated at elevated temperatures and derating may be required, **inlet air temperature actually entering into the inlet port of the module must always be used.**



4.4. Assembling of the different formats and versions

This section shows the different GradiLux formats and the fixing or anchoring points. See consecutive figures 11 and 12.

- Considering the module mounted vertically;
- 1) Leave a minimum free space (**at least 5cm**) at the terminal strip side (below module) to allow the entrance of the cables together with the cooling air.
 - 2) At the fan side (above module) to ensure correct air exhausting and to prevent possible turbulence that interrupts the fan, leave **at least 10cm**.
 - 3) The stated module power performance is based on characterisation carried out with a clearance of 50cm in front of the modules.

Fig. 11. Fixing diagram for single or three phase module.

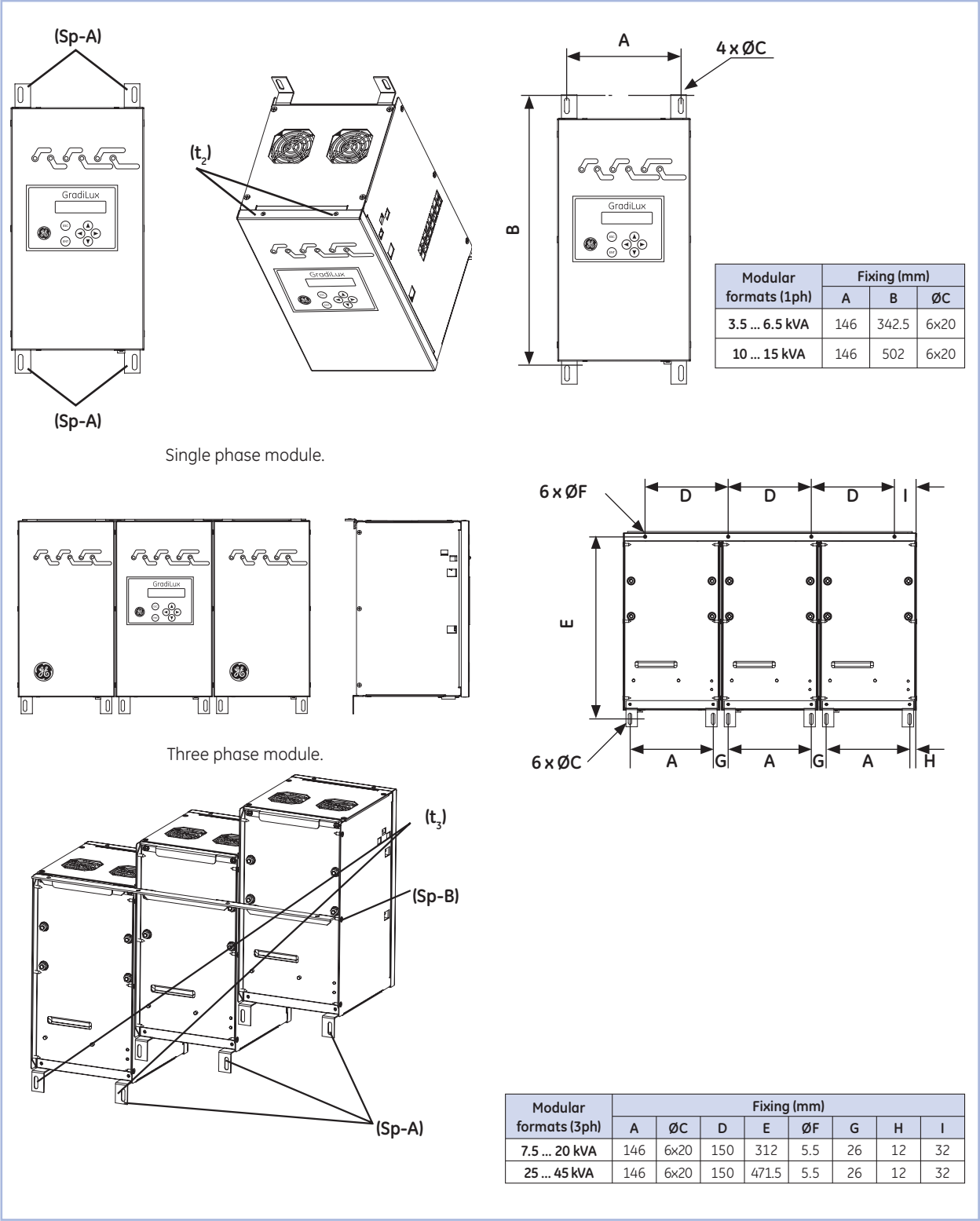
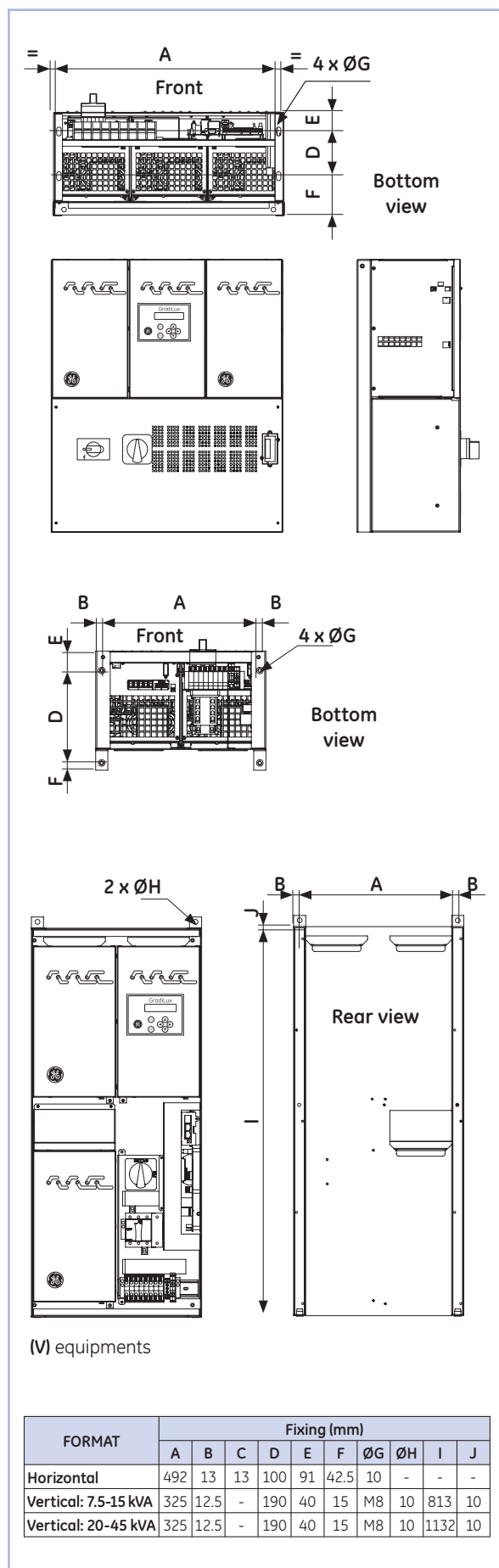


Fig. 12. Fixing diagram for indoor (H) and (V) formats.



4.5. Recommended protections and cross cable sections

4.5.1. Recommended protections

Install protections against overcurrents (overloads and short-circuits), against earth leakage current and overvoltages in accordance with the local regulations. Regarding transient voltages, although the equipment is protected with varistors, it is recommended to use other methods of protection (like lightning arrestors) if the environment conditions require it.

At the equipment input:

It is recommended a suitable circuit breaker and earth leakage breaker protections (see table 6) at the equipment input. It is advisable that the earth leakage protections are with automatic rearmament to avoid unexpected tripping, due to inrush currents made by storms. The recommended circuit breaker at the input of **GradiLux** is K characteristic with 4 poles and sizes, stated in table 6.

The earth leakage current of **GradiLux** is lower than 16 mA (15 kVA module or three phase equipment of 45 kVA). This current can be increased if there were interferences of high frequency or high harmonic tax in mains.

In accordance with local regulations, the current by default, the disconnection threshold of the earth leakage switches, which could be with automatic rearmament, will be of 300 mA as maximum and the earth resistance, measured when commissioning the equipment, will be 30Ω as maximum. Nevertheless, earth leakage breakers with maximum current of 500 mA or 1 A will be allowed whenever the measured resistance of the earth when commissioning is lower or equal to 5Ω and 1Ω, respectively.

4.5.2. Recommended cross cable sections

Whatever the installation is (indoor or outdoor), it is recommended to consult the Low Voltage Regulations:

Recommended cross cable section:

To connect the equipment, use cables with minimum and maximum cross cable sections per each power stated in table 6. Those cables will be connected to the terminals of the equipment by using terminal type DIN 46234.

At the equipment output:

It is recommended to protect the output lines by dividing the loads. This way, in case there was a problem in one sector, it will not affect the total installation. It is strongly recommended to protect them individually, both against overcurrents (overloads and short-circuits), and earth leakage breaker.

GradiLux has 40 kA varistors as transient voltage surge suppressors at the input and output. Nevertheless, in some places, with high incidence of lightning, it is recommended to use additional protection like surge arresters (alone or combined with varistors).

Table 6: Recommended protections, cross cable sections and connection terminals, for single phase mains of 220/230/240 V or three phase of 3x380/3x400/3x415 V at maximum power (100% load)

Single phase formats

Description	Characteristics	GLIN03KS	GLIN06KS	GLIN10KS	GLIN15KS
Input earth leakage breaker	Sensitivity of 300mA; type A	16 A	32 A	50 A	80 A
Input circuit breaker	2 or 4 poles K charact.	16 A	32 A	50 A	80 A
Headline contactor	2 or 4 poles (AC1/AC3) 400 V - coil 230 V ac	16 A	32 A	50 A	80 A
Minimum cross cable section of input mains	RZ1-K	4 mm ²	10 mm ²	16 mm ²	25 mm ²
Maximum cross cable section of input mains	RZ1-K	35 mm ²	35 mm ²	35 mm ²	70 mm ²
Terminals for input cables	Ring terminal DIN 46234	D 6-4 to D 6-35	D 6-10 to D 6-35	D 6-16 to D 6-35	D 8-25 to D 8-70
	For screw	M6	M6	M6	M8
Minimum cross cable section of output mains	RZ1-K	4 mm ²	10 mm ²	16 mm ²	25 mm ²
Maximum cross cable section of output mains	RZ1-K	35 mm ²	35 mm ²	35 mm ²	70 mm ²
Terminals for output cables	Ring terminal DIN 46234	D 6-4 to D 6-35	D 6-10 to D 6-35	D 6-16 to D 6-35	D 8-25 to D 8-70
	For screw	M6	M6	M6	M8
Minimum cross cable section of control line	RZ1-K	2.5 mm ²	2.5 mm ²	2.5 mm ²	2.5 mm ²

Three phase formats

Description	Characteristics	GLIX07KS	GLIX10KS	GLIX15KS	GLIX20KS	GLIX25KS	GLIX30KS	GLIX45KS
Input earth leakage breaker	Sensitivity of 300mA; type A	16 A	16 A	25 A	32 A	40 A	50 A	80 A
Input circuit breaker	2 or 4 poles K charact.	16 A	16 A	25 A	32 A	40 A	50 A	80 A
Headline contactor	2 or 4 poles (AC1/AC3) 400 V - coil 230 V ac	16 A	16 A	25 A	32 A	40 A	50 A	80 A
Minimum cross cable section of input mains	RZ1-K	4 mm ²	4 mm ²	6 mm ²	10 mm ²	10 mm ²	16 mm ²	25 mm ²
Maximum cross cable section of input mains	RZ1-K	35 mm ²	35 mm ²	35 mm ²	35 mm ²	35 mm ²	35 mm ²	70 mm ²
Terminals for input cables	Ring terminal DIN 46234	D 6-4 to D 6-35	D 6-4 to D 6-35	D 6-6 to D 6-35	D 6-10 to D 6-35	D 6-10 to D 6-35	D 6-16 to D 6-35	D 8-25 to D 8-70
	For screw	M6	M6	M6	M6	M6	M6	M8
Minimum cross cable section of output mains	RZ1-K	4 mm ²	4 mm ²	6 mm ²	10 mm ²	10 mm ²	16 mm ²	25 mm ²
Maximum cross cable section of output mains	RZ1-K	35 mm ²	35 mm ²	35 mm ²	35 mm ²	35 mm ²	35 mm ²	70 mm ²
Terminals for output cables	Ring terminal DIN 46234	D 6-4 to D 6-35	D 6-4 to D 6-35	D 6-6 to D 6-35	D 6-10 to D 6-35	D 6-10 to D 6-35	D 6-16 to D 6-35	D 8-25 to D 8-70
	For screw	M6	M6	M6	M6	M6	M6	M8
Minimum cross cable section of control line	RZ1-K	2.5 mm ²	2.5 mm ²	2.5 mm ²	2.5 mm ²	2.5 mm ²	2.5 mm ²	2.5 mm ²

Fig. 13. Installation diagram for three phase equipment with modular (M) formats.

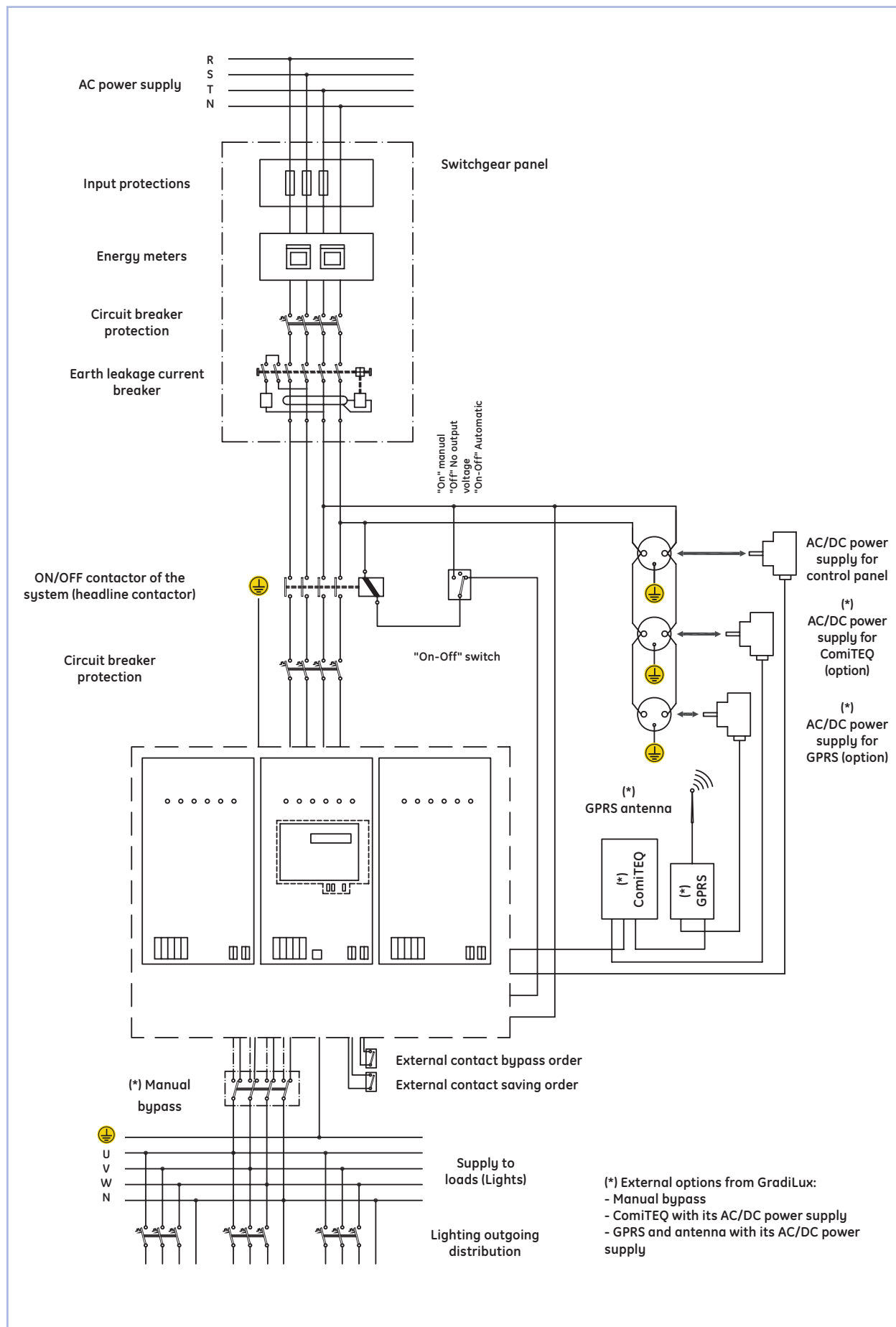
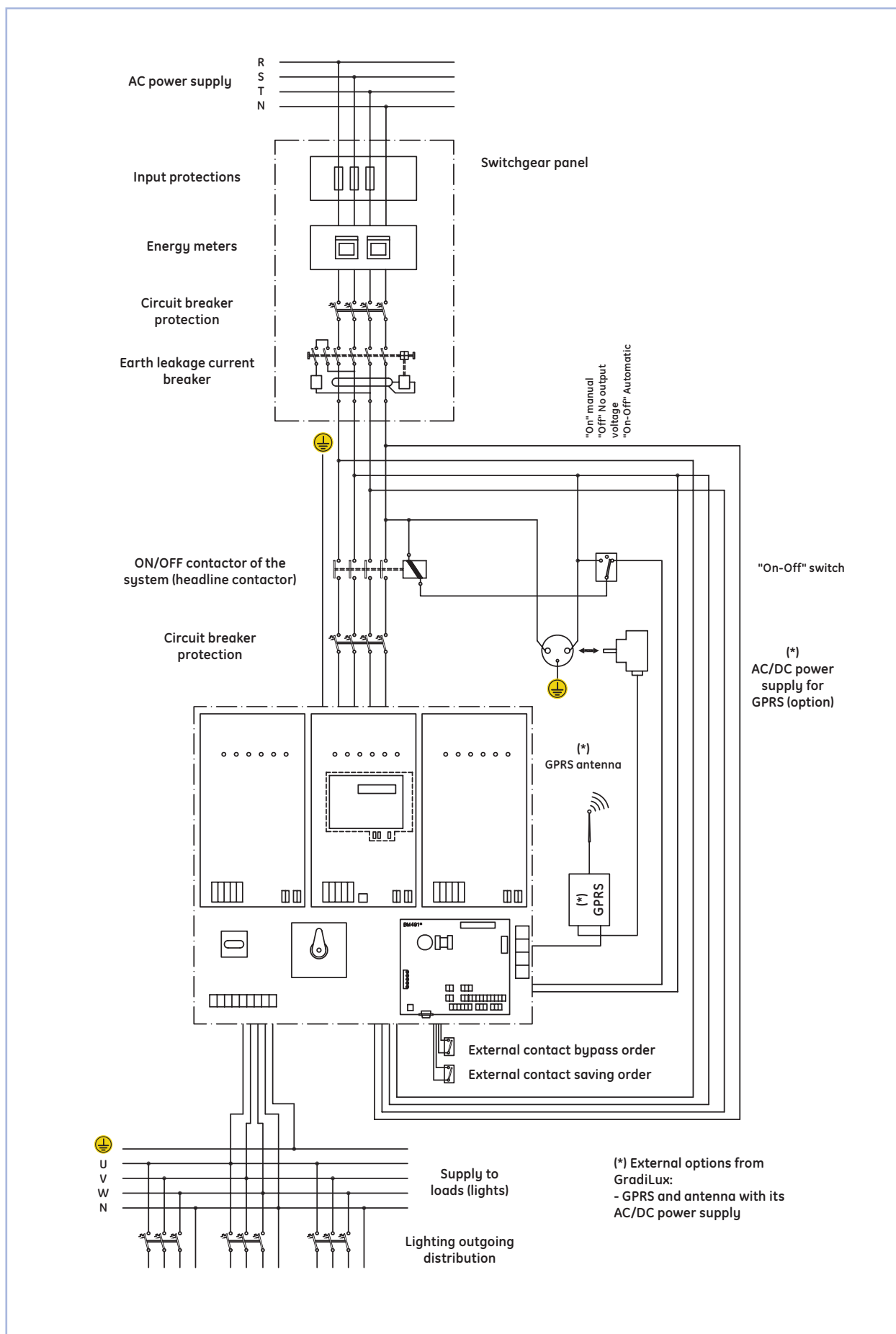


Fig. 14. Installation diagram for three phase equipment with (H) or (V) formats.



4.5.3 Installation diagrams

Figures 13 and 14 show as an example the typical electrical installation of a three phase unit from **GradiLux**

It is important to meet the following conditions, always:

- **GradiLux** has to be **always** installed at the beginning of the lighting line.
- **Manoeuvring, ON / OFF contactor.**
Lighting installations must have a contactor of user's property to manage the turning ON/OFF of the installation. Such contactor has to be fitted at the input of the equipment.
- **GradiLux** always has one of its modules with LCD panel, as interface between user and equipment. This LCD panel can make functions of timer and astronomical clock, by controlling the start up, saving and nominal levels, and the equipment shutdown.
- The start up and shutdown of **GradiLux** is obtained by controlling the contactor coil by means of a relay located in the control panel with LCD. To make it possible, it is necessary to supply the LCD panel with the supplied AC/DC power supply and feed it before the contactor.
- Depending on the format the power supply can be different, as well as the operations to make, which are detailed in the wiring section.
 - **Modular format (M).** Power supply is encapsulated type with plug (similar to a cell phone battery charger). See figures 15 for single phase equipments or 16 for three phase.
 - Stand-alone in **(H)** and **(V)** formats. Card GLIOA is used as power supply, it is a version of the digital I/O card GLIOC. In this format, when the option control card GLIOC is fitted in from factory or later on, the feeding of the control panel will be done through the last one.

Connection between the power supply and LCD panel is already done at the factory.

- **In accordance with local standards:**
If the system to turn on/off the installation is done through timers or photocells, there will be an additional manual switch (to be fitted in and purchased by the user), which allows the system switching, irrespective of the quoted devices.
- It is recommended to install it downstream from lighting contactor, because this way it is guaranteed that it is turned off when lights are turned off too, and the equipment will not have voltage, avoid overheating and unnecessary consumptions.

* In the case of countries other than Spain consult local standards.

4.6. Wiring

Respect strictly the typical connection diagrams of **GradiLux** and the position of protections and auxiliary control switches, that can be seen in figures 13 and 14. For a single phase equipment, simplify the connection by disregarding the other two phases.

To proceed to connect the equipment, it is needed to remove the protection cover of the connecting parts or open the front door, depending on the available format, as it is stated in section 4.1 for each one of them.

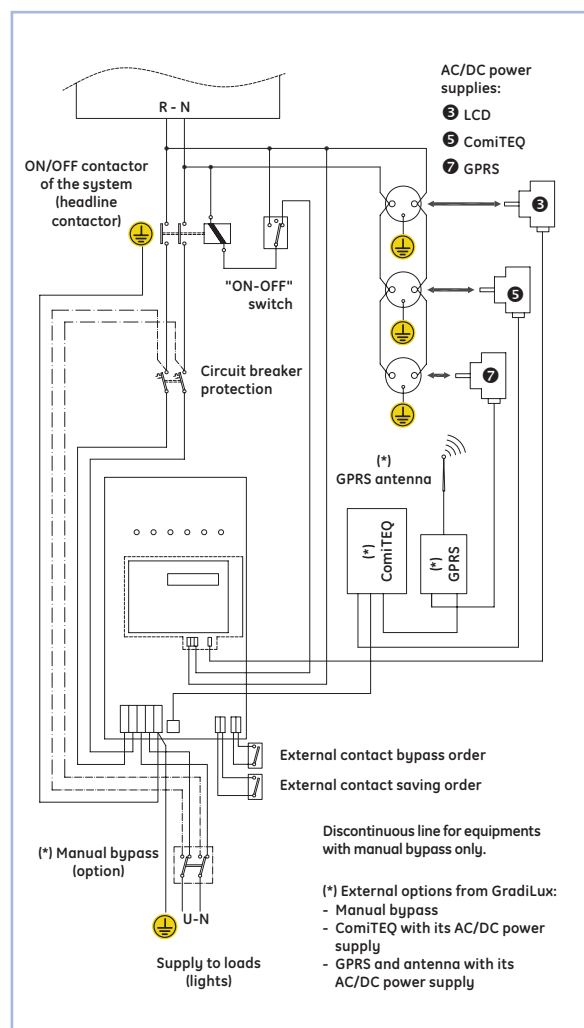


Once the connection labour has been finished it is essential to put back all protection covers and/or close the door until leaving the equipment as it was before starting the process.



Reversing the input and/or output connections will damage the equipment.

Fig. 15. Installation diagram for single phase format (M).



4.6.1. Connecting power supply



It is obligatory to earth the equipment through the terminal labelled as (⏏), making sure that it is done before supplying voltage to the input of the equipment.

Depending on the equipment format and its structure (single or three phase), input cable wiring will be done to a terminals or others:

- **GradiLux (M)** single phase (see figure 15):

Connect the wires coming from the on/off contactor of the system, to the input terminals (**1_R**) and (**1_N**) of the module, by respecting the phase (Ph) and neutral (N) rotation stated in the labelling of the printed circuit and in figures 1 and 2 of this manual.

- **GradiLux (M)** three phase (see figure 16):

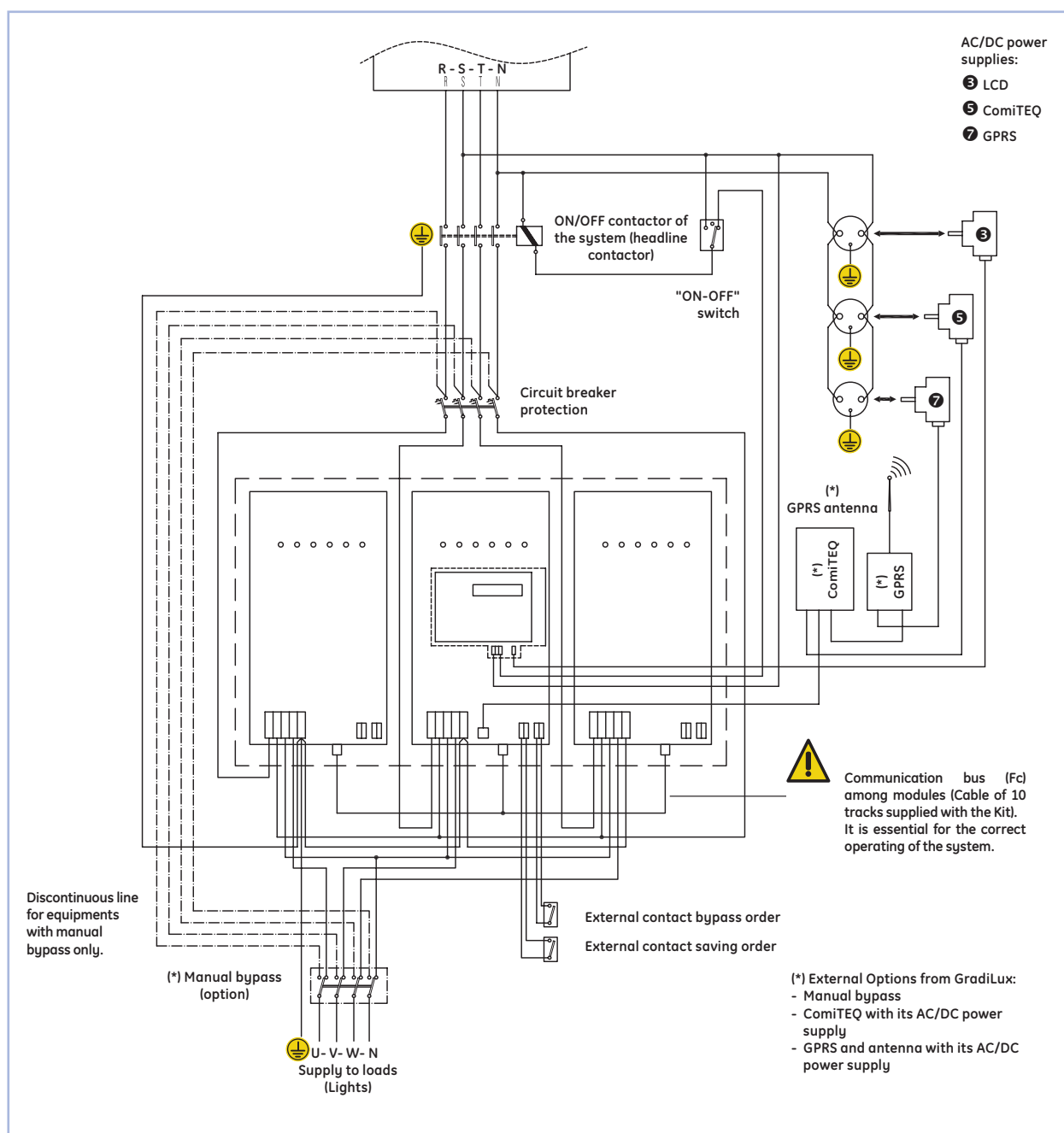
For three phase systems based on three single phase modules. Every module will need to be supplied with one phase (R, S or T) and neutral (N). This phase rotation, will be the one with the modules from left to right.

Connect cables coming from the start up contactor of the system, to input terminals (**1_R**), (**1_S**), (**1_T**) and (**1_N**), by respecting the phases (Ph) and neutral (N) rotation stated in the labelling of the printed circuit of each module and figures 1 and 2 of this manual.



It is essential the connection of the neutral in any three phase star system. Put together the neutral of three modules.

Fig. 16. Installation diagram for three phase format (M)



- In **GradiLux (H)** three phase (see figure 17):
Connect the wires coming from the headline contactor, to terminals **(1_R)**, **(1_S)**, **(1_T)** and **(1_N)** of terminal strip, by respecting the phases (Ph) and neutral (N) rotation stated in the labelling and figure 4 this manual.
- In **GradiLux (V)** three phase (see figure 17):
- Connect the wires coming from the headline contactor, to terminals **(1_R)**, **(1_S)**, **(1_T)** and **(1_N)** of terminal strip, by respecting the phases (Ph) and neutral (N) rotation stated in the labelling and figure 5 this manual.
- Regarding its connection, **(V)** format will be considered identical as **(H)**, because the equipment has the same parts, although at first glance it could seem different due to the different layout of the modules, AC/DC power supply GLIOA, terminals, etc...

4.6.2. Connecting output



It is obligatory to earth the equipment through the terminal labelled as (⏏), making sure that it is done before supplying voltage to the input of the equipment.

- Depending on the equipment format and its structure (single or three phase), input cable wiring will be done to a terminal or others:
 - In **GradiLux (M)** single phase (see figure 15):
Connect the wires going to the distribution lines, to the output terminals **(2_N)** and **(2_N)** of the module, by respecting the neutral (N) and phase (Ph) rotation stated in the labelling of the printed circuit and in figures 1 and 2 of this manual.
 - In **GradiLux (M)** three phase (see figure 16):
For three phase **modular format (M)** systems based on three single phase **modular format (M)** modules. Connect cables going to the distribution lines, to output terminals **(2_V)**, **(2_V)**, **(2_W)** and **(2_N)**, by respecting the phases (Ph) and neutral (N) rotation stated in the labelling of the printed circuit of each module and figures 1 and 2 of this manual.
Both if the lighting installation already existed before installing **GradiLux** or it is new, make sure the correct distribution of the loads in order to avoid the phase unbalancing and to optimise the installation. In any case, it will not affect to the correct operating of the equipment, meanwhile any of the phases are not overloaded.



It is essential the connection of the neutral in any three phase star system. Put together the neutral of three modules.

- In **GradiLux (H)** three phase (see figure 17):
Connect the wires going to the distribution lines, to output terminals **(2_V)**, **(2_V)**, **(2_W)** and **(2_N)** of the terminal strip, by respecting the phase (Ph) and neutral (N) rotation stated in the labelling and figure 4 of this manual.
- In **GradiLux (V)** three phase (see figure 17):
Connect the wires going to the distribution lines, to output terminals **(2_V)**, **(2_V)**, **(2_W)** and **(2_N)** of the terminal strip, by respecting the phase (Ph) and neutral (N) rotation stated in the labelling and figure 5 of this manual.

Regarding its connection, **(V)** format will be considered identical as **(H)**, because the equipment has the same parts, although at first glance it could seem different due to the different layout of the modules, AC/DC power supply GLIOA, terminals, etc...

4.6.3. Connecting remote control, saving order

- This order can be activated both in the terminal strip **(15)** of the **modular format (M)** module or the terminal strip **(CN10)** of the basic card GLIOA or with the digital I/O card GLIOC (option). Both terminal strips are labelled as «Saving order», wherever the order might be activated.
In a three phase system, it will only be needed to act over one of the modules, because through the communication bus **(Fc)** the signals are put together via the connector **(Cb)** and therefore the order will be applied over the three phases.
Use a dry contact like a switch, to be installed by the user, between these terminals to close the circuit and start and remain on saving level.



Never apply voltage to these terminals. Apply dry contacts only.

Although all the equipments have terminals to activate the saving order when it is needed, it is advisable and most efficient for the automation of the process, to use all the functionalities of the control panel with LCD and in particular the own saving order through the internal time scheduler or astronomical clock.

4.6.4. Connecting remote control, bypass order

This order can be activated both in the terminal strip **(16)** of the module or the terminal strip **(CN9)** of the basic card GLIOA or the digital I/O card GLIOC (option). Both terminal strips are labelled as «Bypass order», never mind where the order is activated.
In a three phase system, it will only be needed to act over one of the modules, because through the communication bus **(Fc)** the signals are put together via the connector **(Cb)** and therefore the order will be applied over the three phases.
Use a dry contact like a switch, to be installed by the user, between these terminals to close the circuit and force the equipment to bypass mode meanwhile this circuit is closed.



Never apply voltage to these terminals. Apply dry contacts only.

The diagram illustrates the electrical wiring for a lighting control system. At the top, a three-phase supply (R-S-T-N) enters the system. The main supply line is protected by a circuit breaker. Following the breaker, there is an ON/OFF contactor for the system (headline contactor) and an "ON-OFF" switch. The system is grounded at several points. The main supply lines are connected to a large distribution unit containing three main sections, each with multiple output terminals. These terminals are connected to various loads, including a set of lights (represented by a light bulb symbol) and a terminal block labeled "U-V-W-N Supply to loads (lights)". A GPRS module, labeled "GPRS" with a circled "7", is connected to the system. It is powered by the main supply and has a GPRS antenna connected to it. The GPRS module is also connected to a terminal block labeled "External contact bypass order" and "External contact saving order".

AC/DC power supplies:
 7 GPRS

R-S-T-N

ON/OFF contactor of the system (headline contactor)

"ON-OFF" switch

Circuit breaker protection

(*) GPRS antenna

(*) GPRS

External contact bypass order

External contact saving order

U-V-W-N Supply to loads (lights)

(*) External options from GradiLux:
 - GPRS and antenna with its AC/DC power supply

- Any **GradiLux** has always a control panel with LCD (**12**), in the only module for single phase unit or in one of the three modules in a three phase unit. This control panel with LCD can make the functions of time scheduler and astronomical clock, to control the start up, saving and nominal levels, and equipment shutdown.
Start up and shutdown of **GradiLux** is done by controlling the headline contactor coil by means of a relay located in the control panel. For that purpose, there is a terminal strip (**17**) where you can find the relay contact, which

- To make operative the control panel, the LCD panel has to be fed through the supplied AC/DC power supply and its connection has to be before the contactor, phase to neutral. In three phase equipments, this power supply has to be the same as the central module with control panel (central phase or S) and neutral, less those equipments in **(H)** and **(V)** format.

Depending on the formats, the power supply shape is different, as well as the implicit operating to make.

Power supply is encapsulated type with plug (similar to a cell phone battery charger). Connect the power supply to an AC outlet (phase to neutral, and before the headline contactor) and insert the jack placed in the opposite side of the cable in the connector **(18)** of control panel with LCD (see figures 15 and 16).



It is essential to protect the LCD panel AC/DC power supply and contactor coil, as well as any AC/DC power supply of any option device, with a two poles circuit breaker of 3A with C characteristic.

- Card GLIOA is used as power supply, it is a version of the digital I/O card GLIOC. When the option control card GLIOC is fitted in from factory or later on, the feeding of the control panel will be done through the last one.
- Connection between the power supply and LCD panel is already done at the factory. To feed the power supply, it is essential to supply voltage through four wires (three phases and neutral), till the connector **(CN1)** from GLIOA or GLIOC (option), taking the power supply before the headline contactor (see figure 17).



It is essential to protect the GLIOA card AC/DC power supply and contactor coil, as well as any AC/DC power supply of any option device, with a four poles circuit breaker of 3A with C characteristic.

4.6.6. Options

Accessories from **GradiLux** can be requested together with the equipment or later on.

Their incorporation can be gradual or in just one action.



All connections or actions over any equipment have to be done with no voltage.

4.6.6.1. Manual bypass

- It allows to keep the loads supplied from mains directly during the preventive maintenance tasks or when **GradiLux** is faulty. It is very useful in indoor and/or tunnel lighting, because it can't be turned off, even during the intervention for testing, checking or replacing. The type of bypass is made before break, so there is not any break during **GradiLux** the transference to bypass and viceversa.



When manual bypass switch is turned to **position «2» (bypass mode)**, lamps will always light whatever the position of the input switch of **GradiLux** is. If you don't want that the lamps to light, turn «OFF» the protections of switchgear panel previously.

- Functionality is the same for internal and external manual bypass. In both cases, it is used a two or four poles cam switch of two positions, depending on the equipment if it is single or three phase.
Nevertheless installation works are different. Meanwhile an internal manual bypass in the equipment doesn't require any additional connection, an external manual bypass needs the interlink connections between both parts (see figure 10).
- Connect the terminals that belong to the common of bypass panel to the distribution line that will supply the loads.

- Connect the terminals that belong to one contact of the switch to the output terminals of the **GradiLux**.
- Finally, connect the terminals that belong to the second contact of the switch, to AC mains directly.

4.6.6.2. ComiTEQ box and ComiTEQ card

Communication card ComiTEQ option, will be supplied as separate item from the equipment and the installer will be the one in charge to make the needed actions, depending on the available format of the equipment.

- ComiTEQ **(10_{sc})** for **(M)** equipments: ComiTEQ box.
Fix the ComiTEQ box **(10_{sc})** to solid parts by means of screws, through the available holes.



Do not fix the card over the own module or modules, because there is a high risk of short-circuit during its mechanization and its failure or burning when starting it up.

Feed the ComiTEQ box **(10_{sc})** through the AC/DC power supply provided, of encapsulated type with plug (similar to a cell phone battery charger).

The power supply has to be connected to an AC outlet coming from before the headline contactor and insert the other side of the cable with the jack of DC output, into the ComiTEQ box **(10_{sc})** connector and labelled as "POWER".

For communication connections of ComiTEQ box **(10_{sc})** see manual ComiTEQ manual.

- ComiTEQ **(10_{sc})** for **(H)** and **(V)** equipments: ComiTEQ card.
These equipments include a slot to insert the communication ComiTEQ card **(10_{sc})**.
Proceed as follows:
Remove the screw **(t₄)** that fix the cover **(T_{sl})**.
Insert the ComiTEQ card **(10_{sc})** into the slot **(10_{sl})**, there is only one way to fit it and push it till set in with the bottom connector.
Fix the ComiTEQ card **(10_{sc})** by means of the screw **(t₃)**.
For communication connections of ComiTEQ card **(10_{sc})** see ComiTEQ manual.

4.6.6.3. GPRS modem

- Modem will be supplied as separate item from the equipment and always with its communication antenna, which has to be connected to the GPRS. The choice of its location is by the installer, with the only limitation imposed by the own length of the cable.
- GPRS for **modular format (M)**:
- Fix the modem to solid parts by means of screws, through the available holes.



Do not fix the modem over the own module or modules, because there is a high risk of short-circuit during its mechanization and its failure or burning when starting it up.

- Feed the GPRS through the AC/DC power supply provided, of encapsulated type with plug (similar to a cell phone battery charger).
- The power supply has to be connected to an AC outlet coming from before the headline contactor and insert



- the other side of the cable with the jack of DC output, into the modem connector and labelled as "POWER" or DC.
- By means of the supplied cable with RJ connectors in each side, interlink ComiTEQ box (**10_{sc}**) (connector RS-232 B) and GPRS modem.
- GPRS for **(H)** and **(V)** formats:
 - There is only one drill of M3, to fix the modem in **(H)** and **(V)** formats, beside the ComiTEQ slot (**10_{st}**).
 - Feed the GPRS through the AC/DC power supply provided, of encapsulated type with plug (similar to a cell phone battery charger).
 - The power supply has to be connected to an AC outlet coming from before the headline contactor and insert the other side of the cable with the jack of DC output, into the modem connector and labelled as "POWER" or DC.
 - By means of the supplied cable with RJ connectors in each side, interlink ComiTEQ card (**10_{sc}**) (connector RS-232 B) and GPRS modem.

4.6.6.4. Control card with digital I/O GLIOC

For **(H)** and **(V)** formats:

- Digital I/O card GLIOC will replace the AC/DC power supply GLIOA from control panel, when the purchase order of the equipment is done together with this option.
 - When digital I/O is requested after the equipment supplying, the electrical fitter will be the one, who will replace the other one. In this case proceed as follows:
 - Remove all connections that goes to GLIOA card.
 - Remove the screws (**t₁**) that fix the cover (**Tb**) -**(H)** and **(I)** formats only-.
 - Remove the screws (**t₂**) that fix the GLIOA card to the equipment.
 - Replace the AC/DC card GLIOA by the digital I/O card GLIOC.
 - Put the screws (**t₂**) back that fix the card GLIOC to the equipment.
 - Put back all connectors over GLIOC, as they were in the GLIOA.
 - Connectors and pin-out of the control card GLIOC related to the analogical or digital inputs, are described in section 3.1.3 and communication ports RS-232 and RS-485 in section 4.8:
- Make the communication channels connection according to the following requirements:
- CN6. 4 digital outputs.
 - CN8. 2 analog inputs.
 - CN11. 5 digital inputs.
 - CN12. RS-232 port in DB9 .
 - CN13. RS-485 port in RJ connector.
 - Put the screws (**t₁**) that fix the cover (**Tb**) - **(H)** format only -.

4.7. Selector for ON-OFF automatic/start up (ON), manual/output voltage OFF

- If the lighting turning on/off is done with timers and photocells, there will be a manual switch that allows to turn on/off the system, regardless of the quoted devices.
- A switch of three positions with more quality performances than required by the regulations can be observed in figures 13 and 14, to activate the manual function «ON» (manual forcing to start up the contactor), the manual function «OFF» (manual forcing to shutdown the contactor) and automatic function «ON-OFF» (contactor will be activated or deactivated according to the control mechanism itself). This switch is not supplied with the equipment, it will belong to the own user's installation.

4.8. Communication Bus of modules and ports



It is essential for the correct operating of a three phase system in modular format, to connect the communication bus (Fc) -10 pins ribbon cable-, to connectors (Cb) of each module. Without doing this connection the LCD panel will be isolated from the rest of modules and it will not be possible to get both measurements and communication.

- **Module of GradiLux** with LCD panel, has two different possibilities:
 1. As standard with only one RS-232 communication port in control panel through RJ12 or RJ45 connector (**9**) (see figure 18).
 2. As an option a RS-485 communication port, additional to the first one and supplied through RJ4 10 (**9a**) (see figure 19).
- Nevertheless, if it has the control card GLIO*, there is a second RS-232 port through DB9 connector (see figure 20). It is not possible to use both RS-232 connections at the same time because it is not a multiconnection channel.
- Furthermore control card has another RS-485 port, through RJ10 (see figure 19).

Fig. 18. RJ connector for RS-232 control panel (9)

Reference	Nr pins RJ 12	Nr pins RJ 45
GND	1	4
TXD	5	5
RXD	6	6

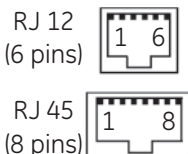


Fig. 19. RJ connector for RS-485 in control panel (9a) or RJ for RS-485 in card GLIOC (digital I/O) (CN13).

Reference	Nr pins RJ 10
EXT-DO/RI	2
EXT-DO/RI	3
100R-GNDC	4

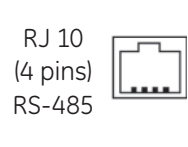


Fig. 20. DB9 connector for RS-232 in card GLIOC (digital I/O) (CN12)

Reference	Nr pins DB9
CD	1
RXD	2
TXD	3
DTR	4
GND	5
RTS	7
CTS	8
RI	9

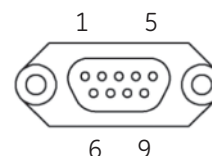
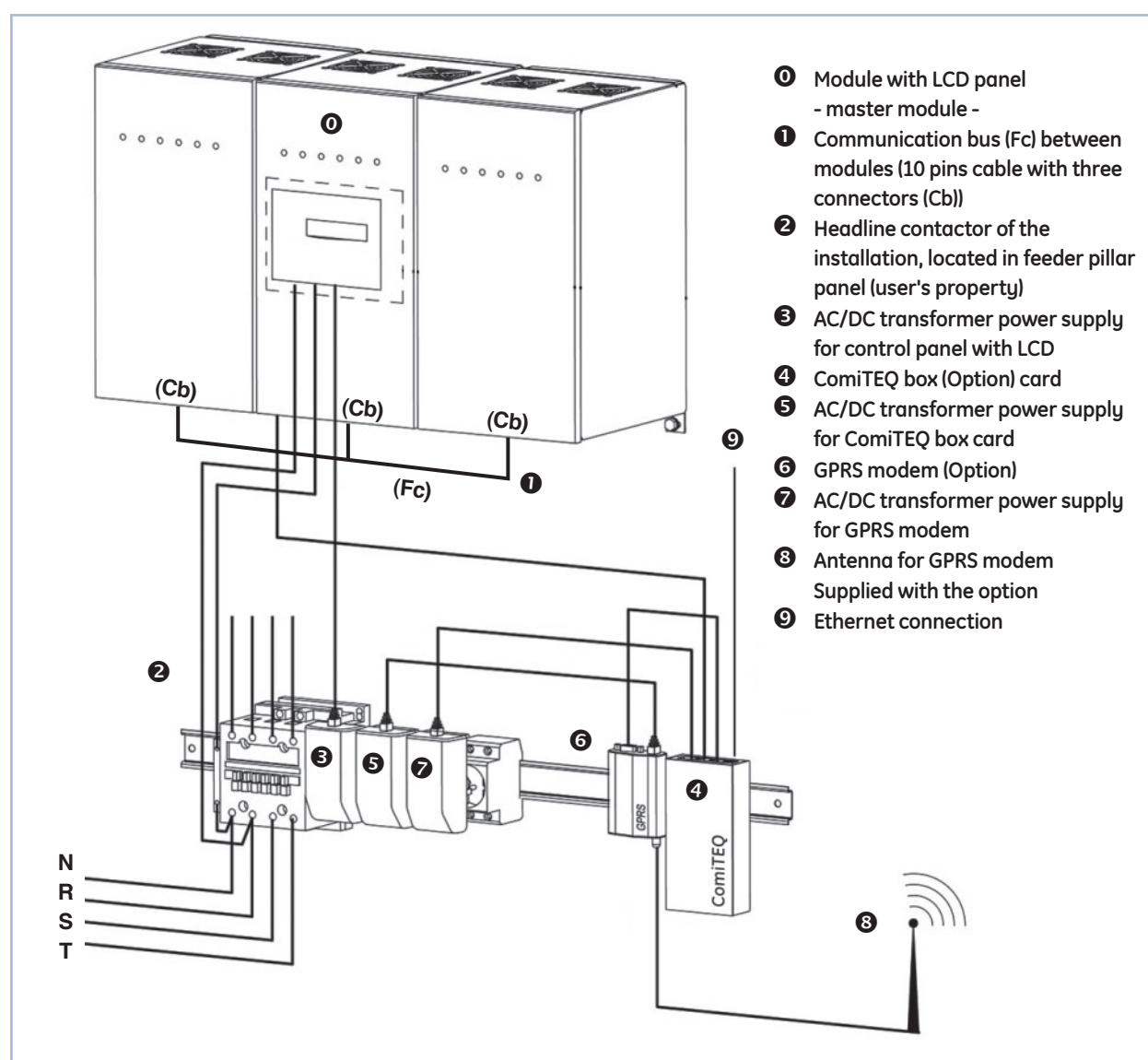


Fig. 21. Three phase equipment simulating connection with ComiTEQ and GPRS options.



The feeding of synoptic through the AC/DC transformer power supply is essential for the correct operating of the LCD panel, the timer and/or the astronomical clock, whatever the equipment is, single or three phase.



For those equipments without the stated options, omit the respective connections. For single phase equipments all connections have to be done relating to the options, as a three phase equipment were (like the above figure) and when it has them.

5. Operating

5.1. Start up and shutdown

5.1.1. Controls before starting up

Before starting up the system, there are some settings and checking that have to be done:

- Check the correct connection of mains and loads, according to the procedures described in sections 4.6.1 and 4.6.2. It is advisable to make the first start up with no load connected.
- In case of any option devices already installed, check connection and settings before proceeding to start up the equipment (see specific user's manuals).
- Check whether the manual selector, located in the switchgear panel of the installation is in "Automatic" position.

5.1.2. Start-up

- The equipment and lighting (if they are connected) start up when the headline contactor is turned on and are shutdown when the contactor is turned off. This contactor can be managed by the equipment itself, through the control of LCD panel or by an external part (photoelectric cell, timer, astronomical clock, switch for manual control, ...)
- Nevertheless the following described start up, is done from the first assumption, being consistent with the diagrams in figures 15 to 17 (control on the contactor through the own control panel of the equipment) and no loads.
- Connect the power supply to the equipment (turn on the input protections of the switchgear panel), with the input switch (4) in «0» or «OFF» position (it is not available in **modular format (M)**) and loads disconnected. Check the voltage of the phase or phases at the input terminals of the contactor. If it is correct, the LCD from control panel will be active.



GradiLux is delivered by default from factory with the time scheduler deactivated to allow its first starting up and check its correct operating.

Check the setting by means of the following instructions:

- Starting from the screen 0.1, press advance key (↓) as many times as needed to access the screen 7.1 «TIME SCHEDULER» and press once key (→), to access to the screen 7.2 «Activate Time scheduler (NO)».
- When time scheduler is activated (with (YES) selected), the equipment will automatically be started up and shutdown depending on its setting. If it is on working timetable, the equipment will turn on the contactor and if it is out from the working timetable, it will be turned off.
- In this situation (with the time scheduler activated but without the start up time being programmed), if we activate the contactor manually by means of the "On-Off" selector, the GradiLux will be supplied but will remain on bypass.
- If the time scheduler is deactivated by selecting (NO), the input contactor will be activated.

- To select (YES) or (NO), by starting from the screen 7.1 «TIME SCHEDULER», press key (ENT) so the indicator (NO) or (YES) will blink and it will be able to be changed through the key (←) to change from (YES) to (NO) and through the key (→) to change from (NO) to (YES) and finally with the (ENT) to validate the selection.

- Turn «ON» the input switch (4) (it is not available in modular format). Check the correct output voltage.
- Activate the time scheduler and make a test setting to check a complete duty cycle (start up, saving order, nominal and shutdown), before entering the final setting and respecting the procedure established in chapter 6 of this manual.



First check that the time indicated in the LCD panel is the current one. Otherwise, amend it.

Enter times close to the current one (include some delay minutes in the settings, enough to close the procedure). Connect the general input switch of the switchgear panel. Wait till the programmed order of start up is activated and the contactor will be turned on.

- Turn off the general switch from switchgear panel and connect the loads.
- Turn on the general input switch from switchgear panel. When time scheduler is activated ((YES) selected), the equipment will be started up and shutdown automatically, according to its programming. If it is on the working timetable, the equipment will turn on the contactor and if it is out from the timetable, it will be turned off, just like the lights.
- Once the test cycle has been finished and checked the correct operating of the system, it is recommended to enter the final setting in the time scheduler or astronomical clock depending on the case. The programmed sequences will be repeated everyday, no additional manual operating will be needed.



Any daily automation can be modified when needed, by changing the position of the required switch in accordance with the low voltage electrotechnical regulation or the suggested switch. For locations other than Spain the applicable local country law should be adhered to.

- A complete and manual shutdown will only have sense for **corrective (faults) or preventive maintenances of the equipment, because in normal conditions the shutdown will be totally automatic and neglected through the headline contactor.**
- Turn «0» or «OFF» the input switch (4) (not available in modular format).
- Turn off the previous circuit breaker to the equipment in case you want to break its power supply.

5.1.3. Manual bypass

- This function, whether it's built in or not, is always the same. It allows continuing supplying the loads from mains directly during the preventive maintenance tasks or when **GradiLux** is faulty. It is very useful in indoor and/or tunnel lighting, because it can't be turned off, even during the intervention for testing, checking or replacing. The type of bypass is made before break, so there is not any break during **GradiLux** the transference to bypass and viceversa.



When manual bypass switch is turned to **position «2» (Bypass mode)**, lamps will always light whatever the position of the input switch of **GradiLux** is. If you don't want that the lamps light, turn «OFF» the protections of switch-gear panel first.



When manual bypass switch is returned back to **position «1» (GradiLux mode)**, lamps will be fed from **GradiLux**, on condition that the input switch is in position «On».

5.2. Optical LED indicators

Figure 22 shows the layout of the optical indicators per phase, and they light when its function is activated.

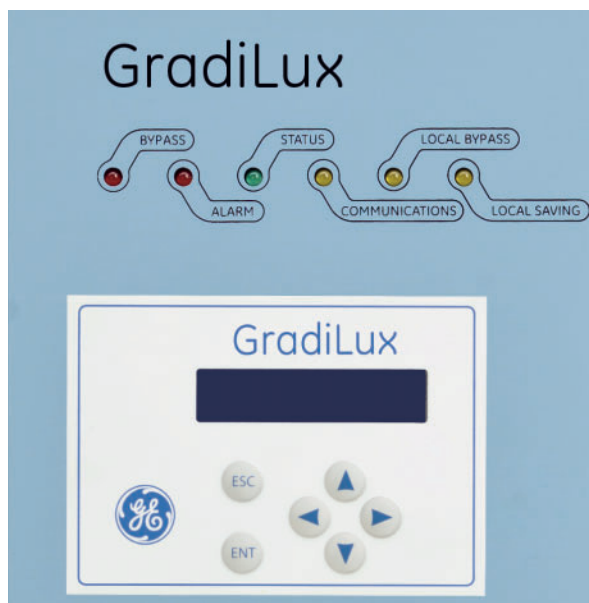
- (a) Red LED indicator «Bypass». It lights when bypass is activated, due to fault, overload, manual or software activation and/or shifting to Manual bypass mode.
- (b) Red LED indicator «Alarm». It lights with any alarm of table 8, whether the equipment has an LCD panel or not, because the alarms do not depend on the own LCD panel, they depend on the control of the equipment.
- (c) Green LED indicator «Status». When nominal to «ON», Saving to «OFF» and equipment on ramp, it blinks.
- (d) Yellow led indicator «Communications». Blinking means it communicates.
- (e) Yellow LED indicator «Local Bypass». It lights when bypass order is activated through the module or through the control card (GLIO*).
- (f) Yellow LED indicator «Local saving». It lights when saving order is activated through the module or through the control card (GLIO*).

5.3. Settings

- Settings for end-user are the **GradiLux** parameters. To check or change the preset values in order to adapt the equipment to the installation, go to screen 11.1 (0000) NORMAL and enter the user password. To do it, proceed as follows:
 - Starting from screen 0.1, press advance key (↓) till reaching screen 11.1.
 - Press (ENT).
 - Characters will blink.
 - Press keys (↓) or (↑) to change the value and keys (←) or (→) to change the character to enter the password (0500).
 - Press (ENT) to confirm.
- Once the entered password is correct, (0500) PROGR., there will be access to change the **GradiLux** parameters. To do it and starting from screen 0.1, press 5 times advance key (↓) till reaching screen 5.1 «GradiLux SETTINGS» (see screen map of LCD in figure 24).
- Press key (→) to go to screen 5.2 «TYPE OF SETTING». From this screen the settings can be selected to (GLOBAL), same setting for all modules or (INDIVIDUAL), different setting for each module.
- To select (GLOBAL) or (INDIVIDUAL) press key (ENT) from screen 5.2 «TYPE OF SETTING», and (GLOBAL) or (INDIVIDUAL) will blink. To change the selection, use key (→) or (←) to jump between them and (ENT) to confirm the selection.
- In case (INDIVIDUAL) was selected, the module to set has to be selected to (1 (R), 2 (S) or 3 (H)). To do it press (ENT) to enter into the selecting phase mode, to select the phase of the module by means of keys (↓) or (↑) and confirm the selection with key (ENT). Change or make the needed settings in the selected module and repeat the procedure and settings for the rest of modules.
- When selecting the type of lamp in screen 5.3., the **GradiLux** will set all the preset parameters from factory for that kind of lamp. Once the type of lamp is selected, any parameter can be changed (start voltage, duration of starting status, nominal voltage, saving voltage 1, saving voltage 2) in order to be customized to the installation.

6. Control panel with LCD

Fig. 22. Optical indicators (LEDs) on control panel with LCD.



LCD panel (see figure 22).

(ENT) Key «ENTER»

(ESC) Key «ESC»

(↑) Key to move up (return)

(↓) Key to move down (advance)

(→) Key to move to right

(←) Key to move to left

Note that three versions of the display are available (GLDSP-FW1/2/3) with different language options.

6.1. Basic functions of keyboard from synoptic

Through keys advance (↓) and return (↑), there is access to all the menus of the LCD panel.

Through keys right (→) or left (←), there is access to the screens of all the submenus of the LCD panel.

- Key (ENT), has different purposes depending on the menu we are:

Submenu entry. Press key (ENT) to activate the function setting, the figures in the screen blink. With keys (→) - (←) the character to set is selected and with keys (↓) - (↑) the value is selected or with keys (→) - (←) the different options are selected. To confirm press (ENT). Next field will blink, to continue doing settings proceed in the same way or press (ESC) to escape.

Validation of measurements or parameters.

- When pressing key (ESC) from any screen of any submenu, we go back to main screen (Screen 0.1), unless we are inside of any screen from «Parameters» menu and changing any of them. Then the first pulsation of key (ESC) will be to stop blinking the value and the second one to go back to main screen.
- Notes related with the screens of figure 24 and related, as an example, with figure 23:
 - Some screens has a determined quantity of «-» characters. Each one of it, means one character so the maximum length of the field will be determined by the quantity of them.
 - Each screen is labelled with a number located in its right bottom corner. It is only included as a mere reference for its next description and explanation.
 - Other note (*1), means the hidden programming screens through the password (0500) in «screen 11.1». This safety level avoids that non-authorised staff can alter or modify any setting.

6.2. Screen description

6.2.1. Main screen «Start»

Screen 0.1

Basic screen, which is displayed when the equipment is started up. It shows the time, date and equipment status. It is also the displayed screen when pressing (ESC) to escape from any menu or submenu of LCD panel.

Screen 0.2

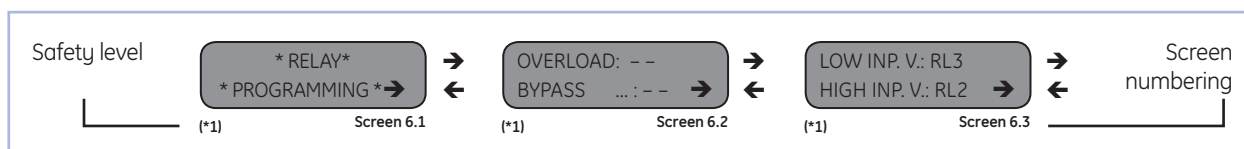
It allows activating or deactivating the Saving and /or Manual shutdown orders, so it modifies the status of the equipment.

Screen 0.3

It displays the status of the communications for each module/phase:

- 0 = no communication
- 1 = communication
- and the quantity of communicated modules is displayed in the right bottom corner.

Fig. 23. Reference notes in the screens.



6.2.2. Menu «Measurements» (Screen 1.1)

To go from main screen press once the advance key (↓). By means of key (→) there is access to all the screens of submenus.

The figure on top right corner of each submenu is the address of the module that they belong to. Each module has determined number: 1 phase R, 2 phase S and 3 phase T.

To display the measurements of that module, press (ENT), select the module address with keys (↓) or (↑) and confirm with (ENT). Next press (ENT) to escape and press (↓) to go back to menu «Measurements».

Screen 1.2

Submenu for input voltage and frequency.

Screen 1.3

Submenu for output voltage and current supplied to the load.

Screen 1.4

Submenu for apparent power (kVA) and active (kW) supplied to the load, as well as its type (Resistive, L = Inductive, C = Capacitive) with its power factor.

Screen 1.5

Submenu for percentage of load and saving, which is done depending on the input and output voltages.

Screen 1.6

Submenu for temperatures of inductor (IND) and heatsink (D).

Screen 1.7

Submenu for firmware version of control module.

Screen 1.8

Submenu internal temperature of the equipment in °C.

6.2.3. Menu «Alarms» (screen 2.1)

To go from main screen press twice the advance key (↓). By means of key (→) the most recent active alarm is displayed, being able to move from one to another inside of the alarm list with the keys (→) or (←).

If there is not any alarm, it will not possible to go forward with key (→).

Figure 24 is showing just only one alarm as an example, but there could be some of them, the active ones and ordered by appearance order. In table7, there are all the possible alarms displayed in the LCD panel.

Screen 2.2

Example: Active alarm and quantity of modules that they have it.

Table 7: Alarm list displayed in the LCD panel.

Representation in LCD panel	Description
OVERLOAD	Output overload alarm
BYPASS	Bypass alarm
LOW INPUT V.	Low input voltage alarm
HIGH INPUT V.	High input voltage alarm
LOW OUTPUT V.	Low output voltage alarm
HIGH OUTPUT V.	High output voltage alarm
HIGH TEMP. 1	High temperature 1 alarm (heatsink)
HIGH TEMP. 2	High temperature inductor alarm
P. DEVICE ERR. 1	High current alarm in IGBTs connected in serial
P. DEVICE ERR. 2	High current alarm in IGBTs connected in parallel
BYPASS FAULT	Bypass fault alarm
BLOCKING ALARM	Equipment blocked alarm
MANUAL BYPASS	Manual bypass alarm
GENERAL ALARM	General alarm
EARTH LEAKAGE CURRENT HIGH	Earth leakage current > than programmed one
DIGITAL ALARM 1 ACTIVATED	Tripping alarm for output switch 1
DIGITAL ALARM 2 ACTIVATED	Tripping alarm for output switch 2
DIGITAL ALARM 3 ACTIVATED	Tripping alarm for output switch 3
DIGITAL ALARM 4 ACTIVATED	Tripping alarm for output switch 4
DIGITAL ALARM 5 ACTIVATED	Tripping alarm for output switch 5

6.2.4. Menu «Data logger» (Screen 3.1)

To go from main screen press three times the advance key (↓). By means of key (→) there is access to all log screens starting from the most recent one (maximum 200 logs) and being able to move from one to another with the keys (→) or (←). In case of no logs, it will not be possible to move forward with key (↓).

Screen 3.2

It allows to clear the event data logger.

Screen 3.3

Example of an event log of the equipment: day (mm/yy), if the alarm has been activated or deactivated (ACT/DES), address of the affected module (M:), time of the alarm (hh:mm).

6.2.5. Menu «General parameters» (Screen 4.1)

Some of the screens of this menu are hidden by default and a password has to be entered (0500) in «screen 11.1» to change any setting. This access control restricts unauthorised staff modifying settings.

To go from main screen press four times the advance key (↓). By means of key (→) there is access to all the screens of general parameters.

Screen 4.2

Regarding to the clock of the equipment. It can be set, considering its structure (hh:mm:ss), set the summer time (DST) or out from summer time (--), set the day (dd:mm:yy) and weekday.

In order for the equipment to work automatically with the astronomical clock, the data relating to time and GMT (figure screen 8.4) has to be entered before, during or after the installation procedure, with the technical service intervention, depending on the case.



The system will work in stand-alone when having the reference data, but the summer-winter times will not be changed automatically and vice versa. If the time scheduler is going to be used to start up the equipment, it is needed to update the clock time (summer or winter time).

Screen 4.3

The contrast of the LCD panel can be set for an optimal visualisation.

Screen 4.4

Language settings: Note this depends on which version of the following displays is installed; GLDSPFW1/2/3. See table below for available language options.

Firmware 1 (Default)	Firmware 2
English	English
Spanish	Swedish
French	Finnish
Italian	Portuguese
Dutch	Danish
German	Reserve

Screen 4.5

Regarding communication parameters with **GradiLux** modules.

Screen 4.6

Regarding external communication parameters through RS-232.

Screen 4.7

Regarding external communication parameters through RS-485.

6.2.6. Menu «GradiLux parameters» (Screen 5.1)

All the screens of this menu are hidden by default and a password has to be entered (0500) in «**screen 11.1**» to make any setting. This safety level prevents that non-authorised staff makes any setting or modify any preset values.

To go from main screen press five times the upwards key (↑). By means of key (→) there is access to all the screens of programming parameters of **GradiLux**.

Screen 5.2

AGLOBAL setting can be selected for all the modules together, or INDIVIDUAL, one by one. When GLOBAL setting is selected, it operates over the LCD control panel application, when INDIVIDUAL is selected, it operates over the resident application in each control of each module of the equipment.

Screen 5.3

Preset parameters for each type of lamp (high pressure sodium HP, low pressure sodium LP, high pressure mercury HP, low pressure mercury LP (fluorescents) and metal halide). When selecting any type of lamp a preset value for nominal start voltage and saving voltage is uploaded.

Screen 5.4

Voltage and duration in start status. Any parameter can be set individually, to adapt them to the installation needs.

Screen 5.5

Nominal and saving voltages. Any parameter can be set individually, to adapt them to the installation needs.

Screen 5.6

Saving level (voltage) 2. The parameter can be set to adapt it to the installation needs.

Screen 5.7

Speed of **GradiLux**. The operating normal speed or test fast speed can be selected, in order to avoid the long period time in the status of **GradiLux** to allow making the settings and testing.

Screen 5.8

By means of this screen, the INDIVIDUAL mode of setting can be selected, so it allows to set the parameters per each module independently (1, 2 or 3) corresponding to phases R-S-T:

- Start voltage and duration of itself (Screen 5.9)
- Nominal and saving voltages (Screen 5.10).
- Saving level (voltage) 2 (Screen 5.11)
- GradiLux speed (Screen 5.12).

6.2.7. Menu «Relay setting» (Screen 6.1)

All the screens of this menu are hidden by default and a password has to be entered (0500) in «**screen 11.1**» to make any setting. This safety level allows that non-authorised staff makes any setting or modify any preset values.

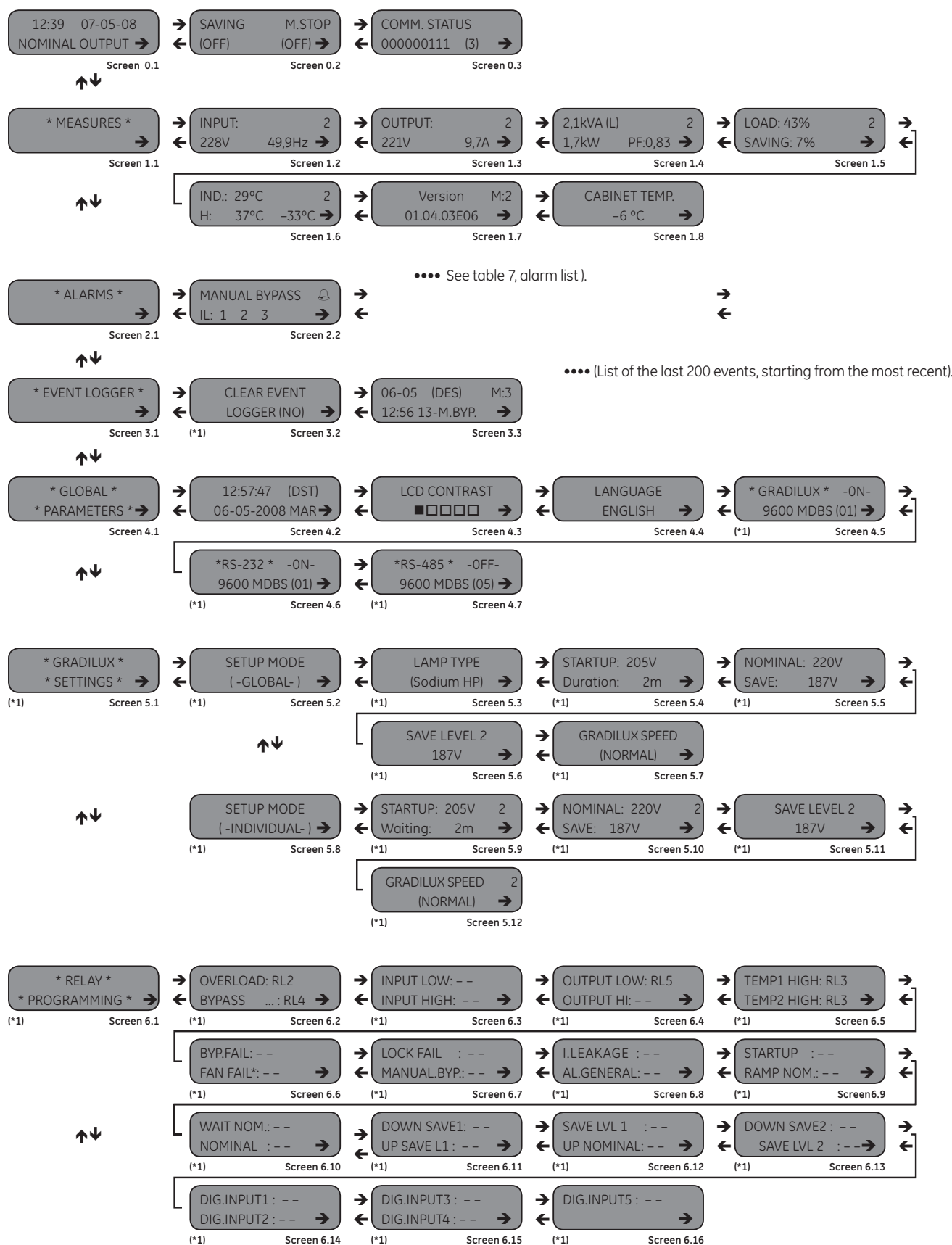
To go from main screen press the upwards key (↑) as many times as it were needed to access to screen 6.1. By means of key (→) there is access to all the screens of relay setting of control card GLIO*, being able to move from one to another with the keys (→) or (←).

Screen 6.2 to 6.16

A relay from card GLIO* can be associated to any alarm or status, so when the alarm or status is active the associated relay is activated too.

Note 'FAN FAIL' is displayed as an navigation option, however is not currently enabled

Fig. 24. Screen map of LCD panel synoptic.

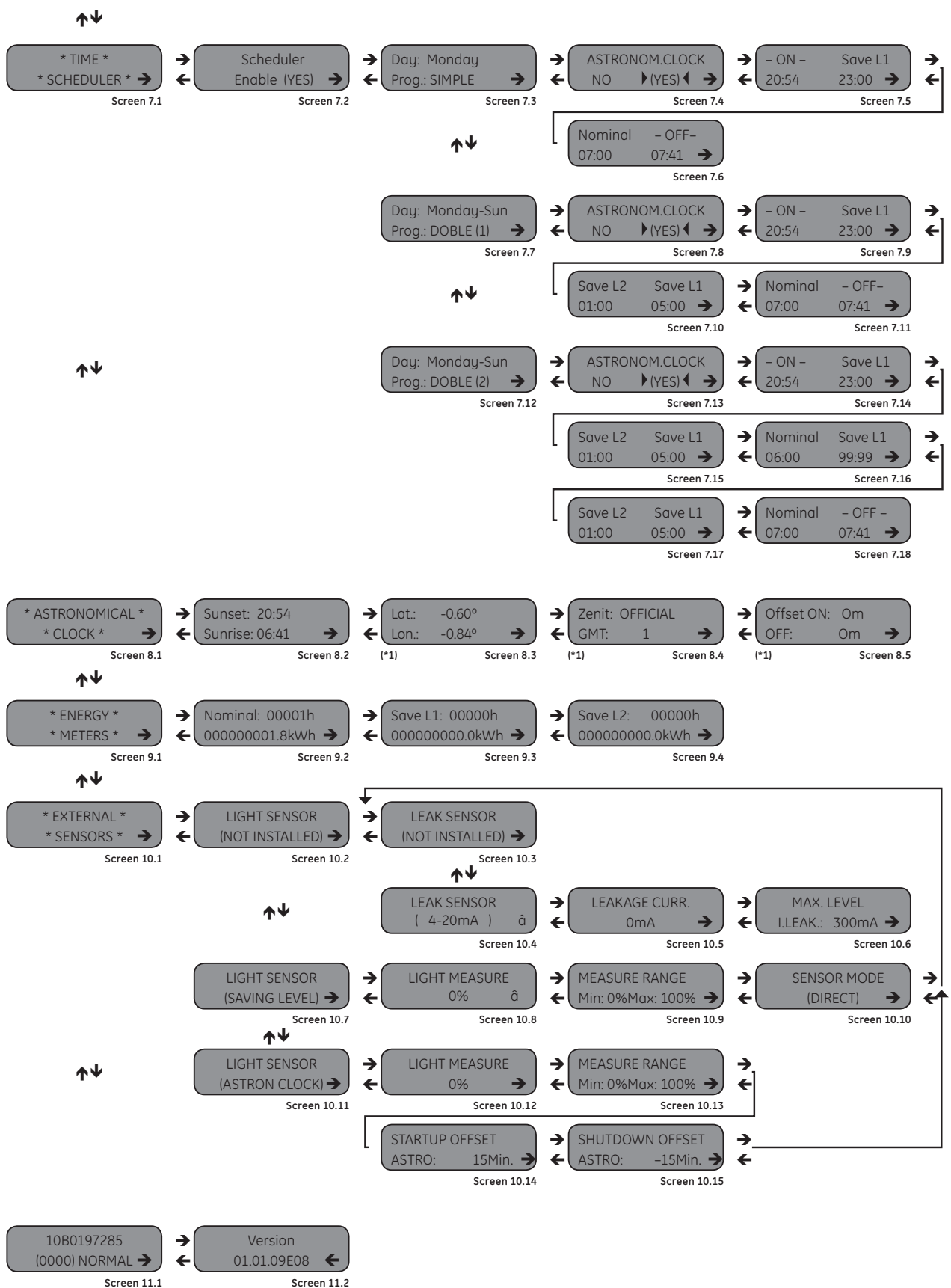


*Note 'FAN FAIL' is displayed as an navigation option, however is not currently enabled.

Continued on the next page (see screen 7.1).



Continued from previous page (see screen 6.1).



Screens with no numbering, are the basic user level.

(*1) It states that they are programming screens, which are hidden by password.



6.2.8. Menu «Time scheduler» (Screen 7.1)

To go from main screen press the upwards key (⬆) as many times as it were needed to access to screen 7.1. By means of key (➡) there is access to all the screens of time scheduler.

Time scheduler can be activated in order to make automatic the daily start up and shutdown, as well as the shifting to saving or nominal. The daily setting can be done for all the weekdays or can be customized for any particular weekday. Also, the start up and shutdown can be selected to be activated by the astronomical clock. This way it will never be a fix time because it will depend on the season of the year (the astronomical clock calculates the sunrise and sunset for each day of the year, depending on geographical coordinates).

All values in the time fields from time scheduler are preset to 99:99 from factory. If later on any programming requires to have disabled any step, all fields from the implicit screens will have to be set to 99:99, except when there is a generic deactivation of the time scheduler.

Screen 7.2

Time scheduler can be selected, by activating (YES) or deselected by activating (NO). When selecting YES, the equipment automatically starts up, shuts down and shifts to saving and nominal.

Screen 7.3

It is possible to select the weekdays with a determined programming: each weekday, from Monday to Friday, Saturday and Sunday, Monday to Sunday, and 10 special days. It can be selected the days and special days that are affected by the programming. Duty cycle is SIMPLE, which means On (start up to nominal) - Saving 1 - Nominal - Off (out of service).

Screen 7.4

Astronomical clock can be activated (YES/NO) in order to make variable the start up and shutdown of the equipment depending on the day duration and according to the season of the year.

Screen 7.5

Time when it will start up (in case the astronomical clock is NOT active) and time when it will shift from Nominal to Saving 1.

Screen 7.6

Time when it will shift from Saving 1 to Nominal and time when it will be shutdown (in case the astronomical clock is NOT active).

Screen 7.7

It is possible to select the weekdays that will act over a determined programming, each weekday, from Monday to Friday, Saturday and Sunday, Monday to Sunday, and 10 special days. It can be selected the days + 10 special days that are affected by the programming. Duty cycle is DOUBLE (1), which means On (start up to nominal) - Saving 1 - Saving 2 - Saving 1 - Nominal - Off (out of service).

Screen 7.8

Astronomical clock can be activated (YES/NO) in order to make variable the start up and shutdown of the equipment depending on the day duration and according to the season of the year.

Screen 7.9

Time when it will start up (in case the astronomical clock is NOT active) and time when it will shift from Nominal to Saving 1.

Screen 7.10

Time when it will shift from Saving 1 to Saving 2 and time that it will shift from Saving 2 to Saving 1.

Screen 7.11

Time when it will shift from Saving 1 to Nominal and time when it will be shutdown (in case the astronomical clock is NOT active)

Screen 7.12

It is possible to select the weekdays that will follow a determined programming, each weekday, from Monday to Friday, Saturday and Sunday, Monday to Sunday, and 10 special days. It can be selected the days and special days that are affected by the programming. Duty cycle is DOUBLE (2), which means to make two consecutive time DOUBLE (1) program without going Off.

Screen 7.13

Astronomical clock can be activated (YES/NO) in order to make variable the start up and shutdown of the equipment depending on the day duration and according to the season of the year.

Screen 7.14

Time when it will start up (in case the astronomical clock is NOT active) and time when it will shift from Nominal to Saving 1.

Screen 7.15

Time when it will shift from Saving 1 to Saving 2 and time that it will shift from Saving 2 to Saving 1.

Screen 7.16

Time when it will shift from Saving 1 to Nominal and time when it will shift from Nominal to Saving 1.

Screen 7.17

Time when it will shift from Saving 1 to Saving 2 and time that it will shift from Saving 2 to Saving 1.

Screen 7.18

Time when it will shift from Saving 1 to Nominal and time when it will be shutdown (in case the astronomical clock is NOT active).



6.2.9. Menu «Astronomical clock» (Screen 8.1)

Some screens in this menu are hidden by default and a password has to be entered (0500) in «**screen 11.1**» to make any setting. This safety level prevents that non-authorized staff makes any setting or modify any preset values.

To go from main screen press the upwards key (⬆) as many times as it were needed to access to screen 8.1. By means of key (➡) there is access to all the screens of astronomical clock.

Screen 8.2

Sunset and sunrise. Data calculated by the astronomical clock, depending on the geographical location that the equipment is installed (entered values in screen 8.3) day of the year and GMT (value in screen 8.4).

Screen 8.3

Geographical location of the city or town where **GradiLux** is installed. The geographical coordinates of latitude and longitude in degrees, tenths and hundredths of a degree can be obtained from a GPS, map, Internet, ... and entered in this screen.

Screen 8.4

Time zone as regards Greenwich Meridian. Select zenith: OFFICIAL, CIVIL, NAUTICAL or ASTRONOMICAL.

GMT (Greenwich Meridian Time): In Spain, for example, the time referred to GMT is GMT+1 / GMT+2 (winter / summer), except for the Canary Islands.

Screen 8.5

Offset (positive or negative delay) to start up «ON» and shutdown «OFF» GradiLux. A value can be entered to put forward or delay some minutes, the start up and/or shutdown of the equipment and thus the lighting.



Relating to zenith: Official, civil, nautical or astronomical.

Generally Sunrise and Sunset are referred to the moment when the solar ring is over the horizon. So, we have to consider the semi-diameter of the sun ring, which has 16 minutes of arch.

So, the sunrise and sunset happen when the sun has an altitude of $-0^{\circ}50'$ ($34'$ for refraction, and plus $16'$ for semi-diameter of the ring). It is the **official twilight**.

Meanwhile the atmosphere reflects the solar light, the sky is not dark instantly during the sunsetting. During the **civil twilight**, there is enough light to make activities outside; it happens meanwhile the altitude of the sun is -6° .

During the **nautical twilight**, there is enough darkness to see the most brilliant stars, but not enough light to see the horizon, activating the browsers to measure the stellar altitudes; it happens meanwhile the altitude of the sun is -12° .

During the **astronomical twilight**, the sky still has too much light to make reliable astronomical observations; it happens meanwhile the altitude of the sun is -18° .

Once the sun is below 18° relating to horizon, we talk about **astronomical darkness**. The same twilight diagram is repeated, to the other way with the sunrise.

In summer, the astronomical twilight is prolonged all night long in those places with a latitude higher than 49° .

Recommendation: For a normal use of **GradiLux** astronomical clock, it is recommended to put the option «Zen» to «OFF» (Official).

6.2.10. Menu «Energy counters» (Screen 9.1)

To go from main screen press the upwards key (⬆) as many times as it were needed to access to screen 9.1. By means of key (➡) there is access to all the screens of energy counters.

This menu allows checking the operating time in each status (Nominal, Saving 1 and Saving 2), as well as the accumulated consumptions in kWh of each one.

Screen 9.2

Number of hours and accumulated kWh with the equipment in Nominal status

Screen 9.3

Number of hours and accumulated kWh with the equipment in Saving 1 status.

Screen 9.4

Number of hours and accumulated kWh with the equipment in Saving 2 status.

6.2.11. Menu «External Sensors» (Screen 10.1)

To go from main screen press the upwards key (⬆) as many times as it were needed to access to screen 10.1. By means of key (➡) there is access to all the screens of external sensors.

Screens 10.2, 10.7 and 10.10

Light sensor selection. Select among Not installed (10.2), Saving level (10.7) or Astronomical clock (10.10).

When selecting saving level, the light sensor will act over the own saving level according to the preset values in the linked screens or it will be done over the astronomical clock if this option has been selected and under the preset values of the linked screens.

Screens 10.3 and 10.4

Earth leakage current selector. Options: Not installed or 4-20 mA (i.e: RMA25 sensor from Afeisa).

The input for the sensor in digital I/O card GLIOB/C, is applied between pins 1 and 3 of connector CN8, considering pin 3 as the negative.

Screen 10.5

Measurement screen of earth leakage current sensor.

Screen 10.6

Screen for setting of alarm level, earth leakage current. By default 300 mA.

Screens 10.8 and 10.12

Light sensor measurement in % (i.e.: FF-LESA13B2 sensor from HONEYWELL Commet from 1000 - 100 000 Lux).

The input for the sensor in digital I/O card GLIOB/C, is applied between pins 2 and 3 of connector CN8, considering pin 3 as the negative.

Screens 10.9 and 10.13

As a total darkness or infinite light can't be achieved, there is a setting to set the actuation of the sensor in %, with a minimum of 0 and maximum of 100, correlational with the analogical output of 4-20 mA respectively.

If **GradiLux** is on Nominal, the sensor will not act because it is the maximum level. If it were in Saving 1 or Saving 2, any of them will be the minimum level depending on the case. Therefore maximum and minimum levels will be Nominal-Saving 1 or Nominal-Saving 2 respectively.

Screen 10.10

Type of actuation can be selected between Direct or Reverse options. This function allows making the needed voltage settings to achieve a higher or lower lighting depending on the measurement of the sensor.

For example, with the Direct option activated, there will be a higher lighting inside a tunnel of the highway network, as much higher is the light outside, reducing the dazzle effect when going in or out from itself. The maximum light will be when lights will be connected to nominal voltage.

With Reverse option activated, it is achieved the contrary effect, so as higher is the measurement of the sensor, the lower will be the voltage that supplies the lighting in order to achieve a contrast effect. The minimum light will be at Saving voltage 2.

Screen 10.14 and 10.15

Offset to start up and shutdown of astronomical clock depending on the measurement of the light sensor. In public lighting, when there is more light, it is interesting to turn on the lights later or to turn them off before. So:

Sunrise ON, enter an offset value with + sign.

Sunset OFF, enter an offset value with – sign.

In case, it were not required both to delay the start up and/or to bring forward the shutdown of the equipment due to the natural, it is able to be entered a fix offset value (screen 8.5) of the same value as the variable one (screens 10.14 and 10.15) but with opposite sign.

6.2.12. Menu «Serial number and Password» (Screen 11.1)

To go from main screen press the upwards key (⬆) as many times as it were needed to access to screen 11.1, where it is stated the serial number of the equipment and it is entered the safety «Password». By means of key (➡) there is access to the next screen of this menu. In order to change anything or to access restricted settings, (screens with reference (*1) stated below of themselves in figure 24), enter the access «Password» (0500).

Screen 11.2

Firmware version of LCD panel.

7. Maintenance, warranty and service

7.1. Basic maintenance guide

Main directives for a correct maintenance are similar to those made by our Service and Technical Support when making the **Preventive** maintenance (see section 7.5).

7.2. Troubleshooting guide (FAQ)

In case of wrong operating of the equipment, and before contacting with GE Energy - Industrial Solutions Service and Technical Support, the user should try to solve the problem with its own means, if the symptoms are one of the followings:

7.2.1. If the equipment doesn't start up

Check:

- Input voltage is correct. Otherwise:
 - Protections of the installation are turned «ON».
 - Headline contactor is turned «ON».
 - Manual-automatic-off switch is not in «OFF» position.
 - Setting in the LCD panel (select time scheduler NO and the equipment should start up).
- Input switch is turned «ON». (Except in **modular format**).

7.2.2. If the equipment is on bypass

Check:

- Forced bypass order is not activated in the terminal strip of any module.
- Forced bypass order is not activated in the terminal strip of the control card GLIO*.
- 'M Shutdown' is not turned 'ON' in the LCD panel.

7.3. Replacing one module from GradiLux set

Before describing the steps to follow for replacing a module in a three phase system, a short mention of input switch and Manual bypass (optional that can be fitted in by default or by the user according to diagram of figure 11), which are not available in modular format, has to be done.

In case of damaging any of them and if it is a single phase or three phase equipment, proceed with the following step described in the procedure. Nevertheless in the event of not having manual bypass, the lamps will not be fed during faults, so the equipment has to be shutdown completely and proceed to replace the module directly, by respecting the other established steps.

Next, the actions to make for a three phase **GradiLux** with switch (4) and manual bypass (7) built in, are described. Therefore proceed according to the description of previous paragraph.

7.3.1 To remove a module (0*)

- Put the equipment on maintenance bypass. Switch (7) in «bypass» position.
- Turn «OFF» input switch (4) of the equipment. In those equipments without this switch, the input circuit breaker for **GradiLux** protection has to be turned «OFF», therefore the loads will not be fed (lights).
- Disconnect the communication flat cable and 10 pins (Fc), from connector (Cb) of faulty module (0*) and located in the bottom side of each module.
- Remove the screws (t₁) that fix the cover (Tb) and take the cover out. (equipments with format (H) or (I)).
- Remove the four screws allen (t₂) that fix the cover (Tm) of module to remove.
- Pull from the cover (Tm) of the module to outside. It could be slightly fitted with the module chassis. To free it use a flat screwdriver, making lever between the cover and the own chassis.
- Remove the connection cables from the terminal strip of the affected module (0*).
- Remove screw (t₃) that fix the module:
 - If it is the only single phase module, unscrew both fixing screws (t₃) from top support (Sp-A) and loosen slightly both screws (t₃) from bottom support (Sp-A), and take out the module (0*).
 - For any module that belongs to a three phase system, unscrew both fixing screws (t₃) from bottom support (Sp-A) and take down the module from top support (Sp-B) by lifting it up slightly (about 4 cm), and take it out.

7.3.2. To put back the new module (0*)



It is essential that the specifications of new module (0*) to be fitted instead of the removed one are the same. See nameplate of both modules.

- Check that there is no voltage in the connection cables of module (0*).
- Put back the module (0*) to its position in a reverse way when it was taken out and proceed to fix it.
- Remove the four screws allen (t₂) that fix the cover (Tm) of new module.
- Pull from the cover (Tm) of the module to outside. It could be slightly fitted with the module chassis. To free it use a flat screwdriver, making lever between the cover and the own chassis.
- Connect the connection cables to the terminal strip of the affected module (0*).

- For a single phase equipment it is not needed to make this setting.

In a three phase system, it is needed to check the communication address of the new module to insert. By dip-switch (**SW1**) of card GLIOD (see figure 25), select the correct address as it is described as follows:

The address of each module in a three phase system is established, from left to right as 1-2-3 with the equipment seen from up front, corresponding with phases R-S-T.

For example:

In case of the most right module was faulty (phase T), the new module should have the address 3 (see figure 25) in order to have the correct communication with the rest of the equipment.

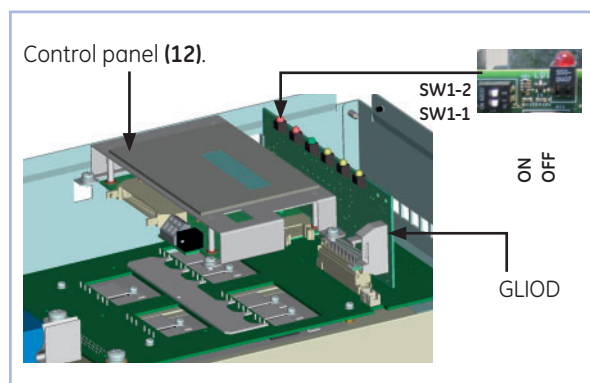


In figure 25, it is shown the central module that incorporates the control panel (**12**) as an example. In any case, it is not relevant, because the dip-switch (**SW1**) is not in the panel (**12**).

- In a three phase system, connect the communication flat cable and 10 pins (**Fc**), from connector (**Cb**) of new module (**0***).

Address	Phase	SW1-1	SW1-2
1	R	OFF	OFF
2	S	ON	OFF
3	T	OFF	ON

Fig. 25. SW1 dip-switch to set module address.



7.3.3. Replacing the control panel with LCD (12)

If the module (**0***) to replace is the one in the center of the LCD panel (**12**) and the LCD panel works properly, the LCD panel can be removed easily (**12**) from the faulty module and put back into the new one, because its modularity allows it.

- Remove the central damaged module as it is stated in section 7.3.1. Remove four screws (**t₆**) that fix the control panel of LCD (**12**) and their connections (connectors and cables), and take it out.
- Take a basic module with identical specifications and remove the front cover (**Tm**).
- Put the control panel with LCD (**12**) in the new basic module, insert the connectors and cables in the same order as the previous module had them.
- Fix the control panel with LCD (**12**) by means of four screws (**t₆**).
- Put the cover (**Tm**) of the new module and fix it through the allen screws (**t₂**).
- Proceed as section 7.3.2 states.
- If the LCD panel has to be replaced (**12**) or the module with LCD panel is completely replaced, then the following parameters have to be selected:

- Number of modules
- Power of the equipment
- Serial number
- Clock setting
- Type of lamps
- Desired **GradiLux** selections: start voltage, nominal, saving, ...
- Astronomical clock setting: coordinates ...
- Time scheduler.

- Turn «ON» input switch (**4**) of the equipment. In those equipments without this switch, the input circuit breaker for **GradiLux** protection has to be turned «ON».
- Check that **GradiLux** starts properly.
- Check the output voltage of the new module (**0***).
- Check the correct operating of the complete set.
- Turn «OFF» input switch (**4**) of the equipment. In those equipments without this switch, the input circuit breaker for **GradiLux** protection has to be turned «OFF», therefore the loads will not be fed (lights).
- Put back cover (**Tm**) of new module and fix it through the screws allen (**t₂**).
- Turn «ON» input switch (**4**) of the equipment. In those equipments without this switch, the input circuit breaker for **GradiLux** protection has to be turned «ON».
- Check that **GradiLux** starts properly.
- In equipments with manual bypass, return it back to the position where the output is supplied from **GradiLux**. Switch (**7**) to position «Stabilizer».

7.4. Warranty conditions

The limited warranty by our company only applies to those products that you acquire for commercial or industrial use in the normal development of your business.

7.4.1. Covered product

Lighting Flow Dimmer-Stabilizer, **GradiLux** model.

7.4.2. GE GradiLux™ warranty

General conditions

The Voltage Dimmer-Stabilizer and accessories from GE, GradiLux Series, are covered by a warranty of 1 year in accordance with the GE Terms and Conditions. During this period, GE guarantees that at the time of delivery the Products shall be free from defects in material, workmanship and title. If a defect should occur for which GE is responsible, GE will correct any defect by, at its option, (i) repairing the defective Products or (ii) making available necessary replacement Products under the same shipment terms that was used in the case of the original shipment; or (iii) refund the price of the Products in question. GE does not warrant the Products or any repaired or replacement Products (i) against normal wear and tear including that due to environment or operation, including excessive operation at peak capability, detrimental air inlet conditions or erosion, corrosion or material deposits from fluids or (ii) which have been involved in an accident. The warranties and remedies set forth herein are further conditioned upon (i) the proper storage, installation, operation, and maintenance of the Products and conformance with the operation instruction manuals (including revisions) provided by GE, as applicable and (ii) repair or modification pursuant to GE's instructions or approval. GE does not warrant any equipment or services of others designated by Buyer when such equipment or services are not normally supplied by GE.

Important: GE cannot provide any compensation for loss of savings in the event of downtime. Warranty claims will not be accepted as a result of

- Improper use of the GradiLux Voltage Dimmer-Stabilizer and its accessories
- Incorrect installation and installation that is not in compliance with applicable standards or installation by unlicensed electricians
- Incorrect operation
- Unauthorized modifications to the GE GradiLux Series and accessories
- Foreign object damage and Acts of God (force majeure)

The other components of your lighting system are not covered by this warranty. In addition, the warranty does not cover any damage to the GE GradiLux Series caused by other system components.

Note: Replacement under warranty may not take place without GradiLux serial number.

7.5. Maintenance and service

When the warranty is expired, and adapted to the customer's needs, GradiLux has several maintenance modalities:

Preventive

It guarantees a higher safety to preserve the correct operating of the equipments with a yearly preventive visit, in which the specialized technicians of our company make several tests and sets in the systems:

- Check and write down the input and output voltages and currents per phase.
- Check the logged alarms (with the option telemanagement pack).
- Check the readings of the LCD panel.
- Digital LCD panel: input/output voltage and current and temperatures.
- Other measurements.
- Check the fan status.
- Check the load level.
- Check the selected language.
- Check the correct location of the equipment.
- General cleaning of the equipment.

This way, the perfect operating is guaranteed and the possible coming faults are avoided.

These supervisions are usually done without shutdown the equipment. In those cases that a shutdown were needed, date and time to do the task will be agreed with the customer. This maintenance modality covers, inside the working timetable, all the journey expenses and manpower.

Corrective


When a fault occurs in the equipment operating, and following a notice to our Service and Technical Support, in which a specialized technician will establish the failure scope and determine a first diagnostic, the corrective action starts.

The necessary visits for its correct resolution are unlimited and they are included inside the maintenance modalities. It means that in case of failure, we will check the equipments as many time as is needed.

8. Annexes

8.1. General technical specifications

Table 8: General technical specifications.

TECHNOLOGY	
Type	Bi-directional converter of high frequency at IGBT's, electronic, static, transformerless and with continuous regulation of the output voltage.
INPUT	
Voltage	Single phase 230 V. Three phase 3x400 V (4 wires: 3 phases + N).
Regulation range	180 - 220 V. + 25% / -7% U_{nominal} + 25% / -17% $U_{\text{saving 1}}$ (HPSV) ⁽¹⁾ . + 25% / -10% $U_{\text{saving 2}}$ (MV) ⁽²⁾ .
Frequency	48 - 65 Hz
Protection of module	Input and output fuses and electronic by temperature, overload, fault and input and output varistors.
Input switch (less formats OEM)	Two poles for single phase unit or four poles for three phase unit.
OUTPUT	
Power of modules / equipments	See table 9 to 12 (see also Section 4.4).
Voltage	Adjustable from 215 V to 230 V (220 V as standard)
Accuracy in regulation	<±1%: Accuracy inside regulation range (input voltage 230V +20% to -3%)
Accuracy at limit of range	±2.5% ±2 V: Applies to output voltage for an input range of -3% to -7% of 230V
Soft start voltage	Preset depending on the type of lamp and adjustable.
Minimum saving level	180V (phase to neutral). Adjustable.
Ramp duration setting	From 1 V / min to 6 V / min.
Output voltage response / against input fluctuation	< 40 ms.
Regulation	Continuous and independent per phase.
Efficiency	> 96 %.
Phase unbalancing	100% permissible.
Saving voltage selection 1 or 2	With Telemangement Pack ComiTEQ, with LCD panel or PC application.
Permissible overload	Nominally 110%, 120% & 150% ⁽³⁾
Permissible power factor	From 0.5 lagging to 0.5 leading.
Total harmonic distortion	Relating to the fundamental reinjected by the equipment < 3 %.
	 Minimum load in the equipment to comply with the harmonics limits of section 6.3 of norm EA 0033:2007 = 20% of nominal power.

BYPASS							
Type	No break.						
Features	Automatic, static and contactor and independent per phase.						
Activation criteria	Overtemperature, overload, fault, output fault, manual activation.						
Rearmament	Automatic by alarm condition disappearing. Quantity of retries: 5 Time between retries: 2 minutes.						
MANUAL BYPASS (OPTIONAL)							
Type	Rotatory switch, two or four poles with 2 positions (1-2), make before break and auxiliary contact.						
COMMUNICATIONS							
Equipment (as standard)	Communication port RS-232 (RJ).						
Equipment (option)	Communication port RS-232 (RJ or DB9) and RS-485 (RJ).						
Equipment with digital I/O GLIOC (option)	Communication port RS-232 (DB9) and RS-485 (RJ).						
OTHER COMMUNICATIONS THROUGH THE DIGITAL I/O CONTROL CARD GLIOC (OPTIONAL)							
Inputs (terminals strip)	1 for saving order. 1 for bypass order. 5 digitals. 2 analog inputs						
Outputs (terminals strip)	4 digital outputs through 4 relays (it is supplied one switched contact per each relay)						
Communication port	RS-485 via DB9 connector. RS-232 via RJ connector.						
Unit of telemangement ComiTEQ (option)	Communication interface for Ethernet networks with TCP-IP and SNMP protocols, GPRS modem, RTC modem.						
ENVIRONMENTALS							
Cooling	Forced, if external housing used (see table 5).						
Operating temperature	-20°C to +55°C (Derating applies at 4%/°C at 40°C or 45°C depending on the module power and working voltage)						
Storage temperature	-40°C to +55°C.						
Relative humidity	Up to 95%, non-condensing.						
Operating altitude	< 2.000 m.a.s.l.						
Mean time between failures (MTBF)	24,000 hours (5kVA & 6.7kVA) 21,682 hours (10kVA & 15kVA)						
Mean time to repair (MTTR)	30 minutes						
Acoustical noise at 1 metre	< 48dBA (with typical load).						
INDICATORS							
Optical (per phase)	<table> <tr> <td>Bypass</td><td>Communications</td></tr> <tr> <td>Alarm</td><td>Local bypass</td></tr> <tr> <td>Status</td><td>Local saving</td></tr> </table>	Bypass	Communications	Alarm	Local bypass	Status	Local saving
Bypass	Communications						
Alarm	Local bypass						
Status	Local saving						

⁽¹⁾ HPSV = High pressure sodium vapour

⁽²⁾ MV = Mercury vapour. Always refer to manufacturer's data sheet to ensure correct operation

⁽³⁾ See Section 3.1.7 for permitted overload duration.

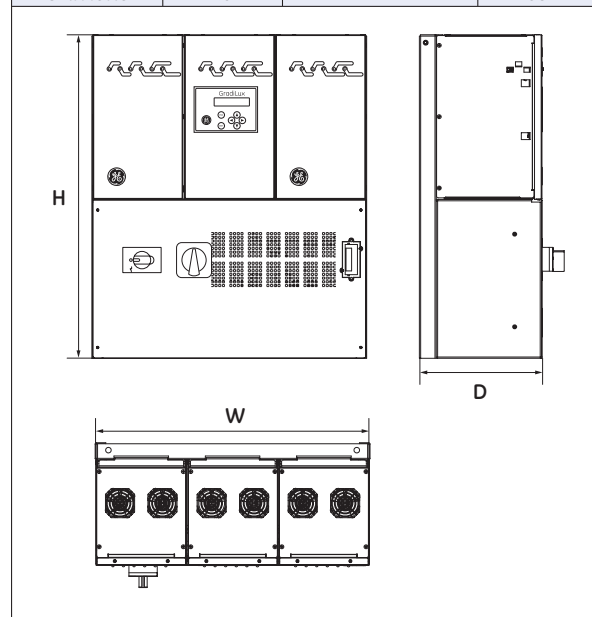
Table 8: General technical specifications continued

FORMATS AND PROTECTION	
Modular format (M)	Equipment to be fitted indoor both as a replacement of one module for a three phase equipment and to be integrated in particular installations. Pay attention to indoor format description (H).
Stand-alone (H) or vertical (V) with protection degree IP20	Equipment to be fitted indoor. Assembled inside a chassis of galvanized sheeted steel with painted covers with epoxy coat colour RAL-7032 and silk-screened, with base of four holes to fix it to the floor of the cabinet where it will built in.
Protection against electrical shocks	Class I
STANDARDIZED OPTIONAL	
To be installed external to the equipment with modular format (M)	Manual bypass or Manual bypass panel. Digital I/O control card GLIOC. Interface for Ethernet networks ComiTEQ box. GPRS modem and its communication antenna.
To be built in equipments with stand-alone format (H) or (V)	Manual bypass. Digital I/O control card GLIOC. Interface for Ethernet networks ComiTEQ card.
To be installed external to the equipment with format (H) or (V)	Manual bypass (optional). GPRS modem and its communication antenna.
STANDARDS	
Safety	UNE AENOR EA 0032-2007
Electromagnetic compatibility (EMC)	IEC 62041
Operating	UNE AENOR EA 0033-2007
Marking	CE
Environmental quality management	ISO 9001 and ISO 14001 TÜV

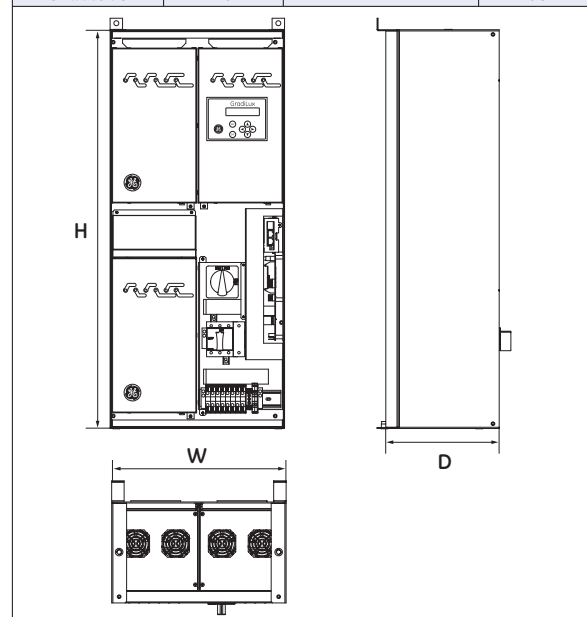
8.2. Dimensions and weights

Table 9: Stand-alone formats (H).

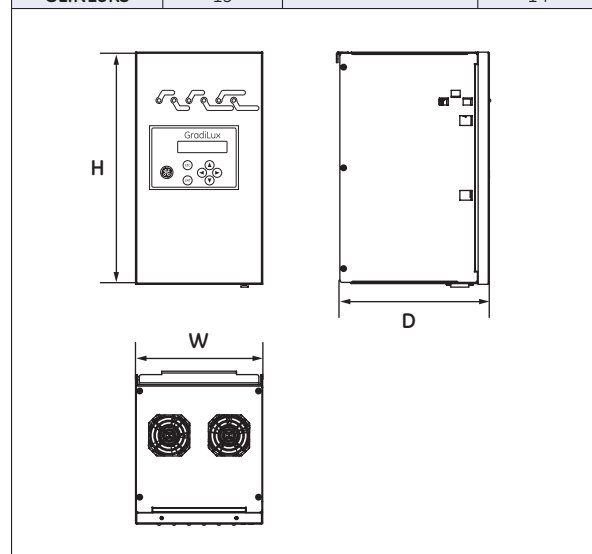
Cat. no.	Power (kVa)	Dimensions (mm) (H x W x D)	Weight (kg)
GLIX07HS	7.5	610 x 520 x 231+35	35
GLIX10HS	10		35
GLIX15HS	15		35
GLIX20HS	20		38
GLIX25HS	25	770 x 520 x 231+35	50
GLIX30HS	30		50
GLIX45HS	45		53


Table 10: Stand-alone formats (V).

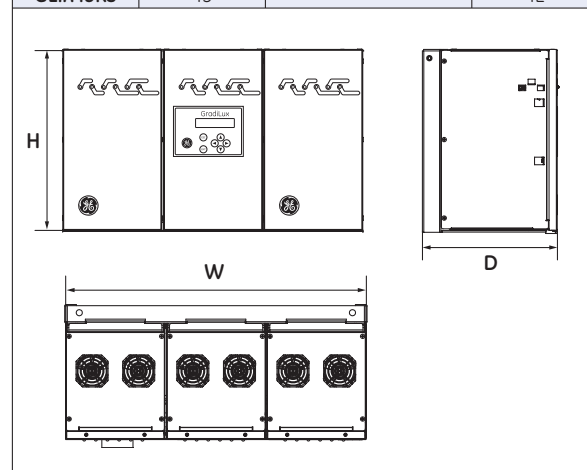
Cat. no.	Power (kVa)	Dimensions (mm) (H x W x D)	Weight (kg)
GLIX07VS	7.5	823 x 350 x 245	35
GLIX10VS	10		35
GLIX15VS	15		35
GLIX20VS	20		38
GLIX25VS	25	1142 x 350 x 245	50
GLIX30VS	30		50
GLIX45VS	45		53


Table 11: Single phase modular format (M).

Cat. no.	Power (kVa)	Dimensions (mm) (H x W x D)	Weight (kg)
GLIN03KS	3.5	346 x 172 x 200	8
GLIN06KS	6.7		9
GLIN10KS	10	470 x 172 x 200	13
GLIN15KS	15		14


Table 12: Three phase modular format (M).

Cat. no.	Power (kVa)	Dimensions (mm) (H x W x D)	Weight (kg)
GLIX07KS	7.5	346 x 516 x 200	24
GLIX10KS	10		24
GLIX15KS	15		24
GLIX20KS	20		27
GLIX25KS	25	470 x 516 x 200	39
GLIX30KS	30		39
GLIX45KS	45		42



Dimensions for single or three phase kit modular format (M) do not include the dimensions of support to hang up the modules.



8.3. Glossary

Astronomical clock

A clock with an algorithm capable of maintaining in its memory, after programming of the latitude and longitude of a set geographical point, the times of sunrise and sunset of every day of the year. This is usually used to switch on and off lights more accurately.

Buck converter

A power converter that outputs a continuous voltage less than that supplied at input. It consists of a switched-mode power supply with two semiconductor devices, an inductor and optionally, a capacitor at output.

Bypass

Allows the power source to be switched to the grid in case of incident and/or fault, providing protection and preventing a complete failure of the lighting. However, this means there will be no energy saving made in the affected phase.

Control panel

Latest microprocessor, which uses digital control technology to regulate output voltage accurately and quickly. The controls also take readings, generate the PWM signal regulating the output voltage and manage surges, faults, the bypass, the synoptics and serial communications. It also features indicator lights to enable quick visualisation of the regulator's status.

Drivers

The drivers control the voltage regulator's IGBTs, each driver featuring an individual protection system for each IGBT which measures voltage saturation of the transistor and reacts accordingly.

Dynamic regulator

Equipment that, to accomplish voltage stabilization and light flow regulation, uses moving, motorised elements or components (motorised variable transformers, brushes, etc.) in the mains or electrical circuit.

Electromagnetic compatibility

Establishes the procedures for evaluating compliance and protection requirements with regard to the electromagnetic compatibility of the equipment, systems and fittings for later merchandising and use of the product.

EMI input filter

Prevents injection of electrical noise, caused by switches, into the grid. Filtered voltage is taken directly to the bypass and through a fuse to the converter.

Harmonic currents

Currents added to the basic frequency of a certain form of sine wave. They are defined as such when these harmonics appear for different reasons to be distorting the form of the original wave.

IP20

Protection against test fingers and solid foreign bodies with diameter greater than 12.5 mm. Liquids, no protection.

Linear voltage regulator

Equipment in which the output voltage varies constantly or by small steps of up to 0.3% of the nominal voltage.

Power supply

The power supply for controlling the equipment is connected to the mains input before the contactor. It consists of a flyback source, with multiple output windings, which feeds all control features and the front LEDs. It also contains an oscillator that feeds several feedforward ferrite transformers, which supply the voltage to the IGBT drivers.

Protective varistors

Protection against destructive overvoltage surges. These varistors are protected by fuses to prevent damage from prolonged input and/or output transient surges that could damage the unit.

Regulator

It is capable of continually regulating the AC output voltage through linear transitions- without sudden jumps in voltage - which could damage the output lights. It is completely electronic, consisting of solid-state bidirectional switches (IGBTs) and does not use transformers to reduce its weight and size.

Soft start

A type of start-up or switch on of the lighting. This is carried out to prevent stress on the lights and the surge which occurs when starting up at nominal voltage.

Solid-state switch

An electronic switch without moving parts based on a silicon chip.

Static regulator

Equipment which, to accomplish voltage stabilization and light flow regulation, only uses static elements or components (thyristors, IGBTs, etc.) in the mains or electrical circuit.

Step voltage regulator

Equipment in which the voltage output varies by steps greater than or equal to 0.3% of the nominal voltage.

Synoptic

This feature is shared by all three phases and indicates on the LCD display the status and readings of the equipment variables. It also features a keypad to enable management of the equipment.

Voltage free contacts

Electrical contacts are controls that switch on or off our receivers (coils, lights, motors, etc.). These contacts are situated in the contact enclosure and are activated by different systems, e.g. buttons, switches, relays, etc.

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GE imagination at work