LVM G3 HYBRID GL0 INSTALLATION MANUAL

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Scope

This document is a guide for the installation of the Low Voltage Manager Concentrator, called LVM G3 HYBRID GL0 (from now on simply “Concentrator”) with Overvoltage Category IV. It is used for the Remote Management of Electronic Meters (EM) that populate the “electrical network” connected to the low voltage transformer installed in the secondary substation.

In particular, the document describes the installation methods of the Concentrator itself and its components; it also provides a description of the connections relating to the related accessories.

Acroyms

- LVM : Low Voltage Manager;
- LV : Low Voltage;
- MV : Medium Voltage;
- TR : Transformer MV/BV;
- PLC : Power Line Communication;
- RF : Radio Frequency;
- AMM : Automatic Meter Manager (Central System);
- EM : Electronic Meters.

Multi Service Concentrator

Low Voltage Manager G3 Hybrid GL0, overvoltage category IV data concentrator, is the Gridspertise device used for mass market electricity and/or GAS meter reading system. It is designed for indoor installation (MV/LV substation), for outdoor or pole installation a suitable enclosure must be adopted.

Each LVM concentrator communicates with the control server (AMM) via public telecommunication networks (GPRS, 3G, 4G, etc.) and by G3 Hybrid PLC/RF communication with smart meters.

The Concentrator (Figure 1) has three main functions:

1. Collection of data from the EMs and their subsequent forwarding to the AMM – at pre-established intervals.

Collection and transfer to the AMM of the following alarms:

- Tampering;
- EMs failures;
- Communication;
- etc.

2. Execution of internal procedures for the management of EMs without the involvement of the AMM.

Communication between the Concentrator and the AMM can be established through the GSM, GPRS, 3G, 4G telecommunications network. In each of these cases it can be established by both participants. The telecommunications devices (GSM, GPRS, 3G, 4G) are not part of the Concentrator kit but are supplied by third parties. The Concentrator only provides ports to which they can be connected.

Communication between the Concentrator and the underlying CEs occurs according to the methods provided by the G3 Hybrid protocol, which provides for HYBRID PLC and RF communication.

In particular, the Concentrator supports the following types of communication:

- Communicates with AMM using TCP/IP protocols through a standard GSM/GPRS/3G/4G modem
- Communicates with the underlying EMs using two possible methods:
  - PLC communication on low voltage lines, with OFDM modulation and CENELEC A (35-90 kHz) or FCC (155-488 kHz) frequency band, depending on the specific installation;
  - RF communication with 2-FSK modulation at frequency 863-869.65 MHz and 915-928 MHz, depending on the specific installation. The RF module is integrated into the Concentrator.

Manufacturers must refer to the most recent editions of international standards and to the internal Gridspertise specifications, listed below:

CEI EN 62056-21: 2023	Data exchange for meter reading, tariff and load control - Direct local data exchange
EN IEC 62368-1:2020 +A11:2020	Audio/video, information and communication technology equipment Part 1: Safety requirements
CEI EN 50065-1: 2012	Signalling on low voltage electrical installations in the frequency range 3kHz to 148,5 kHz – Part 1
CEI EN 55032: 2015 + A1:2020 + A11:2020	Electromagnetic compatibility of multimedia equipment – Emission requirements
CEI EN 55035: 2017 + A11:2020	Electromagnetic compatibility of multimedia equipment – Immunity requirements
CEI EN 62054 – 21: 2005	Particular requirements for time switches – Part 21
EN 61000-3-2: 2014	Electromagnetic compatibility (EMC) Part 3-2: Limits–Limits for harmonic current emissions (equipment input current=16A per phase)
EN 61000-3-3: 2013	Electromagnetic compatibility (EMC) Part 3-3: Limits-Limitation of voltage changes, voltage fluctuation and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16A per phase and not subject to conditional connection
ETSI EN 300 220-1 V3.1.1 (2017)	Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 1: Technical characteristics and methods of measurement
ETSI EN 300 220-2 V3.2.1 (2018)	Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2: Harmonised Standard for access to radio spectrum for non-specific radio equipment
ETSI EN 301 489-3 V2.3.2 (2023)	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised Standard for ElectroMagnetic Compatibility
ETSI EN 301 489-1 V2.2.3 (2017)	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility

European Directive 2014/53/EU (Radio Equipment Directive – RED)

Note: Compliance with the RED Directive includes compliance with the European Directive 2014/30/EU (Electromagnetic Compatibility – EMC) and the European Directive 2014/35/EU (Low Voltage Directive – LVD)

FCC Rules-Code of Federal Regulations (CFR) no. 47:

- Part 15 Subpart B
- Part 15 Subpart C

SOFT-COPY OF EU DECLARATION OF CONFORMITY

The manufacturer, Gridpsertise S.r.L., declares that the LVM G3 Hybrid GL0 complies with Directive 2014/53/EU.
The full text of the EU declaration of conformity is available at the following Internet address:
https://www.gridspertise.com/content/dam/gridspertise/documenti/solutions/dichiarazione-conformita-red-LVMG3HYBRID.pdf.

FCC STATEMENT

The manufacturer, Gridpsertise S.r.L., declares that:

- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

- This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
    - Reorient or relocate the receiving antenna.
    - Increase the separation between the equipment and receiver.
    - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
    - Consult the dealer or an experienced radio/TV technician for help.

- This product complies with FCC radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated with minimum distance of 20 cm between the radiator and your body.

- This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

- This radio transmitter has been approved to operate with the antenna types listed in the FCC filing.

- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

SAFETY WARNING

	The installation and use operations of the device could also be carried out on a live BT electrical network (400/230Vac). Consequently, depending on the type of work, all the PPE required by current legislation and in compliance with the employer's requirements (Legislative Decree 81/2008 and CEI standard 11-27) must be adopted.

	Gridspertise S.r.l. carried out a risk assessment associated with the use of the LVM G3 Hybrid GL0 device, which have been eliminated or reduced as much as possible. The user is informed that it has not been possible to completely eliminate some risks and that, therefore, it is necessary to take the necessary protective measures in relation to them. Failure to apply the protective measures defined for use of the instrument could also lead to the persistence of certain risks.

LVM G3 Hybrid GL0 features

The Concentrator implements a complete set of functions and procedures aimed at managing the EMs connected to the LV network. The main functions are listed below:

- Continuous monitoring of the status of the connections and the reachability of the underlying EMs;
- Continuous updating of the communication paths between the Concentrator and the EM, also considering the use of repeaters;
- Detection, by means of dedicated procedures, of any faults on the LV network (e.g. opening of a LV line);
- Management of spontaneous messages from the EMs and directed to the AMM;
- Periodic verification of the time reference of the EMs and possible re-synchronization;
- Cyclic interrogation of all the meters powered by the same MV/LV transformer, in order to collect billing data and/or any diagnostics;
- Collection of consumption data;
- Self-diagnostics aimed at improving the functionality of the device and reporting any anomalies.

Figura 1 LVM G3 Hybrid GL0

The LEDs on the Concentrator cover indicate specific conditions, based on their status.
The operator, following the installation in the secondary substation of the Concentrator and the attached devices, must check the status of all the LEDs. The installer must carefully read the table below:

Description	Power	Alarm	R-Phase	S-Phase	T-Phase
Normal operation	ON	OFF	OFF	OFF	OFF
Concentrator starting	ON	ON	ON	ON	ON
		FLASHING 5 sec after boot ok			
Connection: R phase inverted with N	ON	FLASHING	FLASHING	ON	ON
Connection: S phase inverted with N	ON	FLASHING	ON	FLASHING	ON
Connection: T phase inverted with N	ON	FLASHING	ON	ON	FLASHING
Connection: No R phase	ON	FLASHING	FLASHING	OFF	OFF
Connection: No S phase	ON	FLASHING	OFF	FLASHING	OFF
Connection: No T phase	ON	FLASHING	OFF	OFF	FLASHING
Sequence of phases inverted R-S-T	ON	OFF	ROTATING FLASH		
Internal Allarm	ON	ON	OFF	OFF	OFF

Note 1: If more than one phase is not connected, the LEDs relating to those phases flash.
Note 2: The COMM LED flashes when communication with the meters is in progress.

Technical Characteristics of LVM G3 Hybrid GL0

"LVM G3 Hybrid GL0" TECHNICAL DATASHEET		
Identification Data	Description	Low Voltage Manager G3 Hybrid
	Model	LVM G3 Hybrid
	Type	GL0
	Acronym	LVM G3 Hybrid GL0
	Dimension	331 x 199 x 82 mm (height x width x depth)
	Safety Standard	EN IEC 62368-1:2020 +A11:2020
	Mechanical Installation	Predisposition for wall mounting: Wall anchor dimension: Φ= 6 mm
	Static Meter Interface	PLC and RF: PLC → Band CENELEC A and FCC RF → 863-869.65 MHz for European installation and 915-928 MHz for FCC installation (maximum conducted power of 27 dBm)
Nominal characteristics	Voltage V (three-phase and neutral, connection for power supply)	3N ~ 400/230 V 50-60 Hz 3N ~ 220/127 V 50-60 Hz ΔV_{AC} = ±15% Δf = ±5%
	PLC transmission with Static Meter	CEI EN 50065-1
	Terminals	
	Power supply PLC communication	4 outputs Φ= 1.5 to 6 mm^2 (cable jacket's thickness ⩾ 0.4 mm)
	Transmission with control center (back office)	GSM/GPRS/3G/4G Modem it is possible to connect the modem directly on the device or remotely thanks to an extension of the connection (dummy box and cable). The modem is not part of the Concentrator.
	Modem power supply	+12 V_{DC}, 12 W (provided the appropriate capability to support inrush currents)
	Connector for GSM/GPRS/3G/4G module	16 pin strip pitch 2.54 mm adapter (female) this connector is present directly on the device or by a dummy box it is possible to connect a cable to connect the modem far from the LVM
	Modem Interface	2 Ethernet ports Serial interface RS-232 connected to a serial port RJ 45

	Specified Operating Temperature range	- 25 / +70 °C
	Limit temperature range for storage and transportation	- 40 / +85 °C
	Operating Relative Humidity	25 ¸ 90 % RH @ 50°C (without condensation)
	Relative humidity for Storage	95% RH @ 50 °C (without condensation)
	Local optical interface	CEI EN 62056-21 mode E or CEI EN 61107
	RF module	Module model: CX105-A Applications: IEEE 802.15.4 and G3 Hybrid Frequency: 863-870 MHz or 902-928 MHz according to installation country Modulation 2FSK Pout max Band P (869.4-869.65 MHz) and FCC band (915-928 MHz): 500 mW Type EU Examination Certificate: B2312288 FCC ID: 2ASLRCX105-A
	Self-consumption in idle mode	5.5W
	Average Current consumption in idle mode	50mA
	Self-consumption in PLC trasmission mode	7W
	Average Current consumption in PLC transmission mode	120mA
	Life time	>10 years
	Failure Rate	⩽ 0,3%/year
	Diagnostic	Self-diagnostic of the main functions

LVM G3 HYBRID GL0 INSTALLATION

Installation sites of LVM G3 Hybrid GL0 data concentrator

The LVM G3 Hybrid GL0 data concentrator can be installed in the following substations:

- secondary substation made of brickwork (e.g. in environments created inside buildings);
- Pre-assembled substations (e.g. Figure 2);
- Pole-mounted trasformer (e.g. Figure 3).

Figure 2 - Pre-assembled substations

Figure 3 Pole-mounted trasformer

Note: The Secondary substation are accessible only and exclusively by qualified and dedicated personnel.

Note: For correct management of PLC communication, a Concentrator must be installed for each MV/LV transformer present in the substation.

Label and rating data

The Concentrator on the front side under the transparent protective cover, has a label showing the rating data of the device.
N.B. It is mandatory to disconnect the concentrator from the power supply before removing the transparent protective cover.
When the device is installed in the secondary substation, the FCC ID 2BLES–LVMG3GL0 is visible and immovable.

LVM G3 Hybrid GL0 complies with Part 15 of the FCC rules subject to the following two conditions:
1) This device may not cause harmful interference;
2) This device must accept all interference received, including interference that may cause undesired operation.

The radio module mounted on LVM G3 Hybrid GL0 ("FCC ID: 2ASLRCX105-A") has been tested and found to comply with part 15 requirements for Modular Approval.

Installation procedure

All installation preparation activities and the installation of the Concentrator itself must be carried out by authorized and appropriately trained technical personnel.

To install the concentrator, it is recommended to pre-assemble all the components required on a socket.
The pre-assembly must be carried out knowing in advance the characteristics of the installation site.
Below are listed all the components to carry out the installation of the Concentrator:

- LVM G3 Hybrid GL0;
- Modem GSM/GPRS/3G/4G;
- Valve cutout – fuse Holder 10 x 38 mm "3P+N" with In=32 A, comply with the following standards: IEC269-2-1, 947-3; NFC 63210-63001; VDE 0636-1; UNE 20129- 21103;
- Low voltage network connection cables compliant with current regulations.

The Concentrator can be fixed on the socket using the three special holes arranged according to the DIN triangle.
N.B: the concentrator is suitable for mounting at a height $\leqslant$ 2 m.
Figure 4 shows an example of a possible installation.

LVM G3 HYBRID GL0 connections

Once all the components have been assembled, the connections must be wired.
The procedure that considers all the precautions necessary to operate safely (current provisions for the prevention of electrical risk) is shown below:

- Make the connection between the valve cutout and the concentrator power supply terminal block. The four fuses (3P + N) of the "S216653" type (500V, In=2A, breaking capacity 120kA – compliant with IEC 60269-1 -2) are housed in the valve cutout. The minimum tightening torque of the terminal block is 0.5 Nm, max 0.6 Nm - cable 4 x 2.5mm2). In this phase, particular attention is required to the wiring of the individual phases on the terminal blocks of the electrical devices; for PLC communication, it is mandatory to respect the "R-S-T-N" indications printed on the terminal blocks of the electrical devices.

- Connect the serial cable (EIA compliant) to the RS-232 port of the Concentrator Dummy box and to the GSM/GPRS/3G/4G modem. Or connect the Ethernet cable to the external 4G router. The Dummy box also has a connector that allows to power the external modem/router at 12Vdc. This connection will allow data exchange with the Central System.
- Connect antenna for RF communications between Concentrator and EMs.

The connections are shown in Figures 5 and 6.

Please refer to the Installation Notes section for notes regarding the types of cables and modems to use.

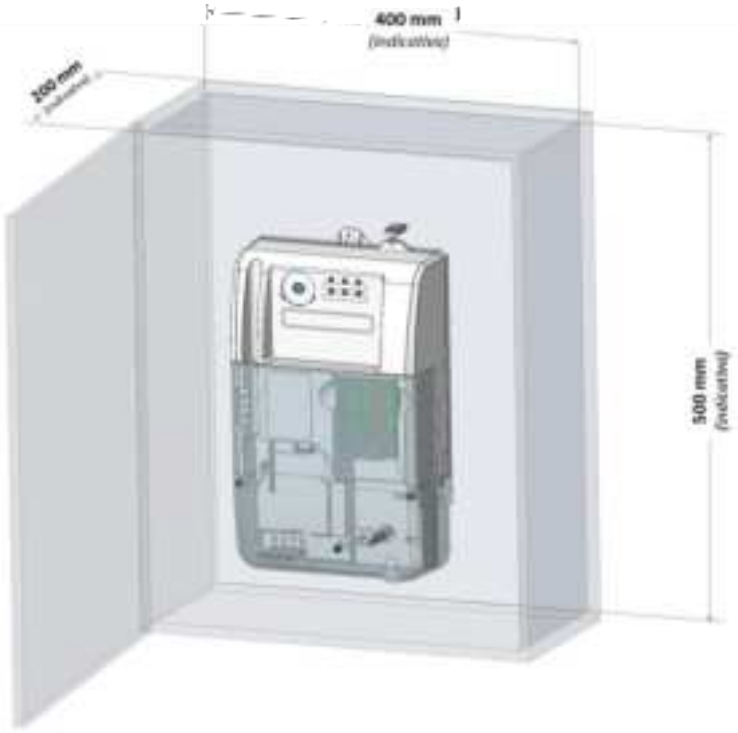


Figure 4 Example of LVM G3 Hybrid installaiton

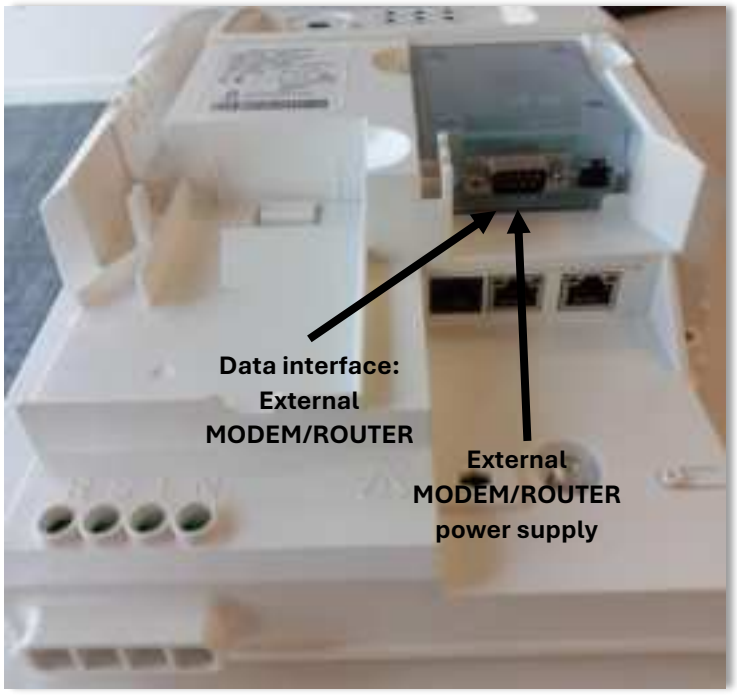


Figure 5 LVM G3 Hybrid GL0 without terminal cover and dummy box interface for connetting modem GSM/GPRS/3G/4G

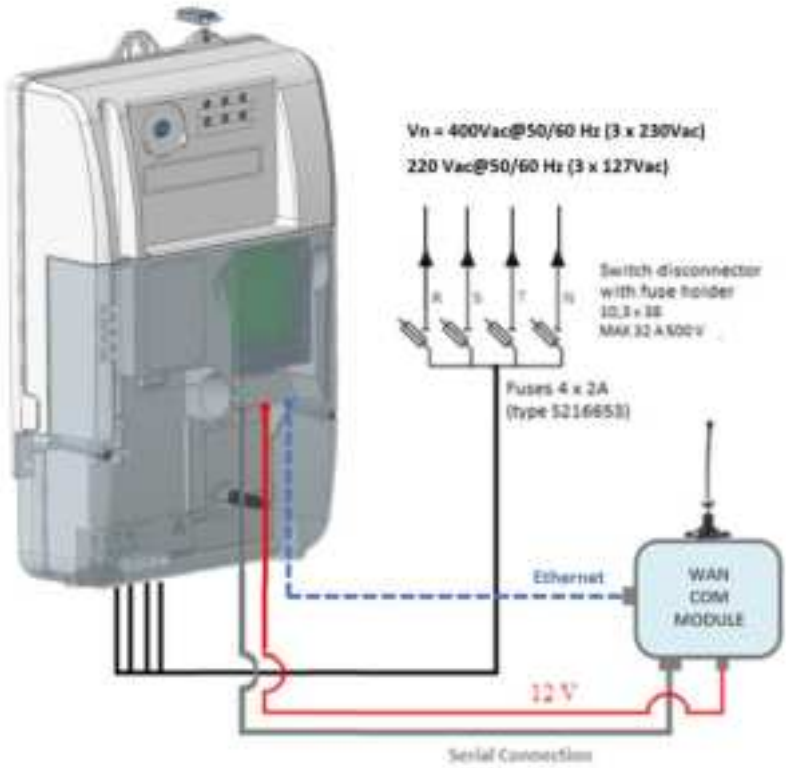
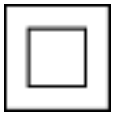


Figure 6 Connection diagram for LVM G3 Hybrid **GL0**

Ground connection

The concentrator is a device with insulation class II (double insulation), so no ground connection is required.



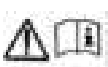
Installation notes

Note 1: The cables used for the electrical connections of the devices must comply with the following characteristics:

- Fire resistance (CEI STANDARD 20/22 II)
- Flame resistance (CEI STANDARD 20-35)
- Low emission of corrosive gases in the event of fire (CEI STANDARD 20-37 I)
- Insulating mixture with high electrical, mechanical and thermal characteristics (CEI STANDARD 20-11, CEI 20-34)
- Rated voltage: 0.6/1 kV
- Test voltage: 4 kVAC
- Max. operating temperature: 90° C
- Max. short circuit temperature: up to 240mm^2 → 250°C, over 240mm^2 → 220°C
- Flexible red copper conductor
- Insulation: high modulus HEPR rubber of G-sette quality
- Sheath: PVC of Rz quality (thickness ≥ 0.4 mm)
- Color: light grey RAL 7001
- Length ≤ 3 meters

All terminations of the cable braids used for connections must be prepared with a special “crimp terminal” (compliant with the RoHS directive) insulated on the conductor itself.

Note 2: The concentrator can be connected to any type of GSM/GPRS/3G/4G modem on the market; all devices used for this purpose must be accompanied, in addition to the technical documentation (datasheet, etc.), by the necessary documentation attesting to their certification and compliance with the Gridspertise specifications and international standards in force at the time of procurement of such devices.

Note 3:  refer to the installation manual.

The end of the stranded conductor must not be consolidated with soft solder at points where the conductor is subjected to contact pressure.