GIoE

(Gateway for Internet of Everything)

Gateway/Hub/Edge Computer

MADE IN ITALY

Short manual – v. 2.1b

TERA Srl

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1 Introduction

GIoE is an electronic control unit, developed by TERA, classifiable as Gateway/Edge Computer, designed for IoT ecosystems. It is based on LINUX Embedded platform, which allows implementing software solutions which can run in a standalone mode or interfaced to remote web services. The use of standardized protocols and communication interfaces allows full configurability, modularity and scalability of GIoE, whose embedded SW can be upgraded remotely (OTA). This feature is relevant for the maintenance and upgrading of the GIoE, in particular, to ensure that the number of devices and protocols supported are compatible and aligned with the market evolutions.

It can be used in combination with third party software systems, for the implementation of an integrated management and control systems, in applications like Smart Building (BMS, BEMS, Security, Comfort, Automation), Smart Metering, Smart Energy, Industry 4.0.

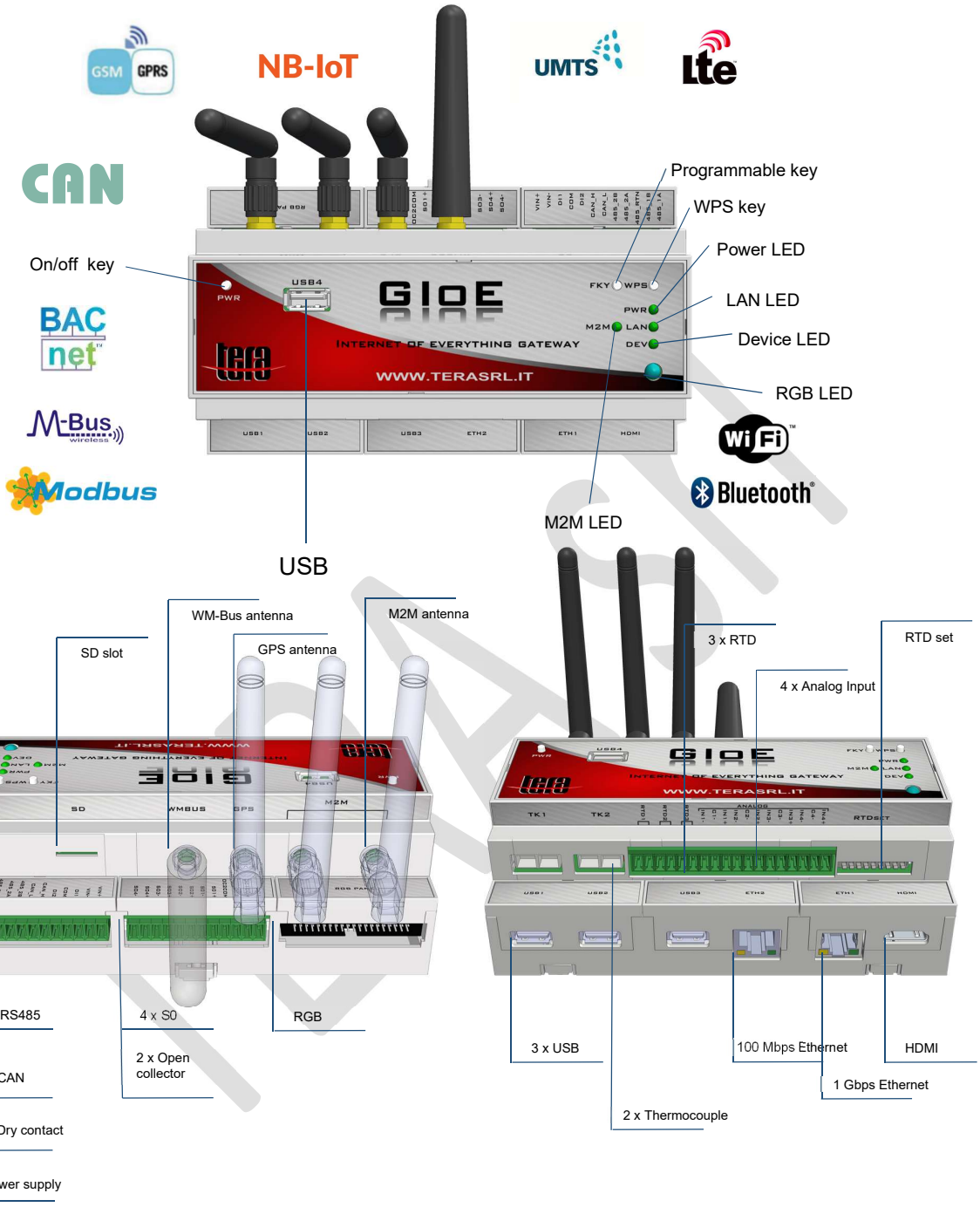
2 Main features and peripherals

GIoE edge computer is one of a kind in terms of features, performances and communication interfaces: it can be customized for different applications, configuring its equipment from the top of the range up to ad-hoc versions (outfittings).
It is based on ARM Cortex A7 1 GHz clock processor, with up to 2 GB RAM, 8 GB onboard (soldered) Flash memories and 2 x 128 GB SD card, several embedded IoT wireless modules (WiFi, Bluetooth, NB-IoT or alternatively 2G/3G/4G -with or without GPS and with or without SIM card- w-MBus 169 MHz or, alternatively, w-Mbus 868MHz) and wired connectivity like RS485 (e.g. Modbus, BACnet) - master or, optionally, slave with software interface development, CANbus, Ethernet.

Moreover the additional 4 USB ports can be used to easily expand the GIoE control unit to include modules like Zwave, KNX, EnOcean and others.

Finally the available I/Os (digital and analog) make it possible also to get data from sensors, directly or to drive external load (through relay modules).
GIoE allows full IoT interoperable, modular and scalable solutions thanks to the following features:

- Multiprotocol
- OTA upgradable
- Interoperable with off-the-shelf devices
- Linux based



Trough USB

Z-WAVE KNX LoWPAN ZigBee LoRaWAN dlms device language message specification ... *and others*

The GIoE is able to receive and store the data provided by the smart meters "2G" installed in Italy by e-distribuzione via Power Line, connected via USB port:

- in "A" band, when connected to devices such as the e-distribuzione "Smart Info" (or other devices equipped with an e-distribution "MOME" card, such as the Beeta Power in the MOME version with a “special modified special cable”), with the first generation counters (also called "1G", for example GEM, GEMIS) or even with 2G generation meters (2.1), enabled to send data on band "A";

- in “C” band, when connected with devices such as the Beeta Power "2G" version, in this case communicates only with the "second generation" meters, or "2.0 electronic meters" or "smart meter 2.0", or simply "2G" (eg models CEG2, CE2G, "gen2") and requires a “special modified cable”; it should be noted that, for those of the second generation, new features will be activated which are currently being tested.

Beeta Power, a device developed by TERA, is a power converter (Input: 230Vac, plug for wall-sockets, Output 5Vdc, 2.5A), equipped with integrated PLC modem; together with Beeta Box, it is a plug&play solution that allows the reading of the general electricity consumption of the meter by inserting the single plug into an electrical socket.

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3 GIoE technical specification – *full outfitting*

General features	
	ARM Cortex A7 dual core @1GHz processor
	1 (up to 2) GB DDR3 RAM
	8 (up to 32) GB onboard Flash eMMC
	up to 128 GB microSDHC internal memory
	up to 128 GB microSDHC externally accessible (without removing enclosure)
	Real Time Clock (72 hours backup)
	Linux Embedded & JVM, OTA upgrade capable, compliant to OSGi, FIN ™ FRAMEWORK and other software package
	MQTT publication/subscription
	Web Server on board for a local interaction for: - gateway/hub/edge computer configuration - local device configuration - data monitoring

	3 push buttons (Power On/off, programmable function key, WPS)
	1 cold reset button
	1 RGB LED for smart visualization programmable events
	4 status LED: 1 power state (power on/battery low), LAN/Internet, LDN (Local Device Network), M2M connection
	1x RGB 40 pin connector for external RGB touch panel (custom adapter needed)
	1x HDMI 1.4 port
Connectivity	
Wired	1x Gbit Ethernet (RJ-45) + 1x Fast Ethernet [10/100 Mbps] (RJ-45)
	2x isolated (5kV) RS485 ports (female socket - mating with pluggable terminal block- screw type)
	1x CAN Bus
	4x USB 2.0 Host Ports *Note: one of this can be used to communicate with electricity smart meters 1G by e-distribuzione, by means of "Smart-Info", or also smart meters 2G using Beeta Power with custom cable; in case of 2G "chain2" (Band C, by e-distribuzione with the following features: C Band, Interface: H1, compliant with CEI CEN / CLC / ETSI / TR 50572 standards; EN 62056-7-5 (updateable for two-way mode); application layer compliant with the DLMS standard COSEM IEC 62056-5-3; data model compliant with the DLMS COSEM standard (IEC 62056-6-1 obis, classes of interfaces compliant with the IEC 62056-6-2 standard).*
Wireless	Embedded Wi-Fi 802.11b/g/n with internal antenna (alternatively, optional, ipex connector for external antenna) optional 802.11ac
	Embedded Bluetooth 2.1/3.0 EDR/4.2 BLE with internal antenna (alternatively, optional, ipex connector for external antenna)
	Embedded NB-IoT (cat NB1) or alternately 2G/3G/4G with SMA side connector; optional GPS inside
	Embedded 169MHz WM-Bus with SMA side connector
Input/output	
Input	4xS0 female socket (mating with pluggable terminal block- screw type)
	2x Dry Contact inputs (internal pullup/down) female socket (mating with pluggable terminal block- screw type)

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	4x programmable ADC inputs (free combination programmable through software: 0-4 mA, 0-20 mA, 0-5 V, 0-10 V)
	3x RTD sensors inputs (PT100 or PT1000 selectable by DIP-switch)
	2x K thermocouple connectors
Output	2x Open Collector (max 80 Vdc and 80 mA) 3,75 kVrms optical isolation, PWM capable (up to 4 kHz) female socket (mating with pluggable terminal block-screw type)
Environment	
Operating	Temperature Range -40÷85 °C (or 0-50°C if battery operated), RH range 5%-55% not condensing
Storage	Temperature Range -40 ÷ 85 °C (or 0-55°C if battery operated), RH range 5%-90% not condensing
Power	
	5,5 ~ 24 Vdc input power (external 12 V with battery backup suggested; 3,8 A rated), female socket (mating with pluggable terminal block)
	Internal Optional Battery: 3,7 V 2000 mAh LiPo battery (battery life: 6hrs @1GHz (18hrs @350 MHz) without external devices connected and with not M2M connection)
Case	
	Plastic (ABS or optionally other) 9M DIN-RAIL mount and screws wall mount
	Dimensions: 159mm x 90mm x 58mm (without external antennas); weight 0,5 kg

As a powerful edge computer, there are several options in using GIoE:

a. without SW: customer installs Linux and other SW tools;
b. equipped with pre-installed Linux arranged and tuned by Tera (ArmBian); several open source software protocols, tools and frameworks can be used, like NodeRed, Home Assistant etc.; it is also possible to use some OPC-UA compliant tools.
c. equipped with pre-installed Linux arranged and tuned by Tera (ArmBian) plus a middleware (OSGI compliant) customized by TERA and some "drivers" developed by Tera;

d. equipped with pre-installed Linux arranged and optimized by Tera (ArmBian) plus some middleware (OSGI compliant) customized by TERA and some "drivers" developed by Tera, including MQTT configured to send data to an MQTT broker (a sort of "IoT" platform " that some potential partners have);
e. equipped with pre-installed Linux arranged and optimized by Tera (ArmBian) **plus "FIN FRAMEWORK" (by J2 Innovation- A Siemens Company**); thanks to FIN framework is compliant with the open source initiative Project Haystack to streamline working with data from the Internet of Things.

For this powerful combination, GIoE and FIN Framework, see functionalities on https://www.j2inn.com/videos

4 Manufacturing process

GIoE is a full "Made in Italy" product: coinceived in Italy, designed in Italy, manufactured and tested in Italy. The electronic manufacturing activities are located in Italian factories which are committed in an international high-quality production scenario, compliant with the following standards:

- ISO 9001;
- ISO14001;
- IATF 16949;
- IPC Membership;

Manufacturing processes are oriented to high quality in the whole supply chain: electronic devices provisioning, storage, soldering preparation, picking and placing, soldering, testing and packaging.
Reliability test carried out in our production plants shows MTBF of 70.000 hrs @ 50°C and 50% RH. For specific info about the variation of reliability performances depending on temperature and other conditions, please contact TERA.

5 Embedded SW features – *standard outfitting*

If requested, GIoE has a Linux Embedded operating system. In the standard outfitting, the management software consists of various modules integrated within an OSGi framework that uses a Java Virtual Machine (JVM).GIoE integrates the following embedded SW functionalities and modules:

1. Webserver for configuration, device connection, data visualization, WiFi Lan connection;
2. Internal DB;
3. Basic functionalities (backend services) for communication with external services/cloud. The GiOE control unit basic functionalities are MQTT and REST communication. Additional communication protocols can be implemented based on customer requests

GIoE is able to work interoperating with third parties cloud infrastructures, as well as ad-hoc servers, so that flexibility is a global must, from the field to the highest software levels: final applications can by a hybrid solution to be packaged at will, running on-premise and/or cloud IaaS/PaaS/SaaS.

5.1 Webserver

The GIoE web server provides users with functionalities to configure the gateway/Hub/edge computer funciontalities, to connect devices to GIoE, to check and download warning and error logs of the embedded SW, to connect GIoE to the WiFi Lan. More info about Webserver functionalities are available in the GIoE user manual.

5.2 MQTT Communication

- Remote server: Mqtt Broker (Mosquitto, etc…)
- Locally:

GIoE/device sends and receives **data** to/from a **topic.** The **topic** is built based on device/attribute features (e.g. position or device type):
for example: *<IP address>:house/box/multisensor/temperature*
where:

- **house** is the location
- **box** is the position into the location
- **multisensor** is the device type
- **temperature** is the attribute

The **data** related to the attribute (temperature in the example) contains the value and related metadata if necessary. For instance if temperature measured is 70 °F to the address specified above can be sent:

1. Just the data: *"{temp: 70}"* even in unformatted version *"70"*
2. Or data plus metadata like measurement unit: "*{temp: 70, unit: "F"}"*

The data model depends from the sensor features (e.g. temperature, lighting, presence, contact etc…) and related user needs.

5.3 REST Communication

- Remote server: Web Server (Apache, etc…)
- Locally:

GIoE/device sends and reads **data** to/from a **url. The url** is built based on device/attribute features (e.g. position or device type):

for example: *<IP address>/house/box/multisensor/temperature*

The **data** could be read from the url with a GET request and it could be set/send with a PUT/POST request in different formats (json preferred).

The data model depends from the sensor features (e.g. temperature, lighting, presence, contact etc…) and related user needs.

5.4 OSGi compliant framework

The OSGi technology facilitates the componentization of software modules and applications and assures remote management and interoperability of applications and services over a broad variety of devices. Building systems from in-house and off-the-shelf OSGi modules increases development productivity and makes them much easier to modify and upgrade.

6 A lot of IoT Devices (sensors and actuators) for final applications

The interoperability of GIoE with off-the-shelf devices allow it to be the right solution to implement an IoT platform that can be used for monitoring of environmental conditions, appliances, specific loads or to control actuators. The powerful processing unit allow to execute locally algorithms for controlling and monitoring devices, machines and buildings.
In the following a list of sensors and actuators already tested to be integrated GIoE control unit. The list is continuously integrated with new devices, therefore contact TERA to have updated info on the list of compatible devices

ID	Type of sensor/actuator	Model	Manufacturer	Comm.
1	Smoke Sensor	FGSD-002 (Through module ZMEEUZB1)	Fibaro	Zwave
2	Flood sensor	ST812 (Through module ZMEEUZB1)	Everspring	Zwave
3	Radiator Thermostat	ES-42-DAN_LC13_014G0013 (Through module ZMEEUZB1)	Danfoss	Zwave
4	The Button (Panic button)	FGPB-101-1 (Through module ZMEEUZB1)	Fibaro	Zwave
5	Thermostatic Radiator Valve	POPE010101 (Through module ZMEEUZB1)	POPP	Zwave
6	Relay	TZ78 (Through module ZMEEUZB1)	TKB HOME	Zwave
7	Relay with power meter	TZ79 (Through module ZMEEUZB1)	TKB HOME	Zwave
8	Roller shutter	FGR 221 (Through module ZMEEUZB1)	Fibaro	Zwave

9	Smart Plugs	AN159 (Through module ZMEEUZB1)	EverSpring	Zwave
10	Smart Plugs	TZ88 (Through module ZMEEUZB1)	TBK	Zwave
11	Multisensor	Aeotech ZW100-A (Through module ZMEEUZB1)	Aeotec	Zwave
12	Electrical ON/OFF Actuator	ZME_05436 (Through module ZMEEUZB1)	ZWaveMe	Zwave
13	Door Sensor	FGK-101 (Through module ZMEEUZB1)	Fibaro	Zwave
14	Smart Plugs	PHI_PAN11 (Through module ZMEEUZB1)	Philio	Zwave
15	Smart Plug Switch	DSC06106-ZWUS (Through module ZMEEUZB1)	Aeotec	Zwave
16	Multisensor (Motion, Door/Window, Illumination,Temperature)	PHI_PST02-1A (Through module ZMEEUZB1)	Philio	Zwave
17	Radiator Thermostat	ES-42-EUR_Stellaz (Through module ZMEEUZB1)	Eurotronic	Zwave
18	Multisensor	AEOEZW100 (Through module ZMEEUZB1)	Aeotec	Zwave
19	Range Extender	AEOEZW117 (Through module ZMEEUZB1)	Aeotec	Zwave
20	Motion Sensor	FIBEFGSM-001-ZW5 (Through module ZMEEUZB1)	Fibaro	Zwave
21	Smart plug	PAN11-1B (Through module ZMEEUZB1)	GemPower	Zwave
22	Sensor T,Hr	EVR_ST814 (Through module ZMEEUZB1)	EverSpring	Zwave
23	Smart Plug	ZW096 (Through module ZMEEUZB1)	Aeotec	Zwave
24	Energy meter	ZW095 C1A60 (Through module ZMEEUZB1)	Aeotec	Zwave
25	Flood Water sensor 6	ZW122 (Through module ZMEEUZB1)	Aeotec	Zwave
26	Smart Plug	FGWP-102 (Through module ZMEEUZB1)	Fibaro	Zwave
27	Door/Window Sensor	FGK-106-ZW5 (Through module ZMEEUZB1)	Fibaro	Zwave
28	Energy meter	ZW095C3A100 (Through module ZMEEUZB1)	Aeotec	Zwave
29	Flush 1D relay	ZMNHAD1 (Through module ZMEEUZB1)	Qubino	Zwave
30	Smart Plug	AN180 (Through module ZMEEUZB1)	EverSpring	Zwave

31	Lamp holder	EVR_AN145 (Through module ZMEEUZB1)	EverSpring	Zwave
32	Energy meter dimmer	ZMNHND1 (Through module ZMEEUZB1)	Qubino	Zwave
33	Actuator	ZMNHDD1 (Through module ZMEEUZB1)	Qubino	Zwave
34	Smart Plug	ZW075 (Through module ZMEEUZB1)	Aeotec	Zwave
35	Siren	ZW080 (Through module ZMEEUZB1)	Aeotec	Zwave
36	Universal binary sensor	FGBS-001 (Through module ZMEEUZB1)	Fibaro	Zwave
37	Energy meter	ZW095C3A60 (Through module ZMEEUZB1)	Aeotec	Zwave
38	IR Remote control extender for air conditioners	ZXT-120 (Through module ZMEEUZB1)	Remotec	Zwave
39	Temperature sensor	ZMNHEA1 (Through module ZMEEUZB1)	Qubino	Zwave
40	Door Sensor	ZW112 (Through module ZMEEUZB1)	Aeotec	Zwave
41	Door Sensor	HSM02 (Through module ZMEEUZB1)	Everspring	Zwave
42	TriSensor	ZWA005 (Through module ZMEEUZB1)	Aeotec	Zwave
43	Dongle USB Zwave	ZMEEUZB1	Z-wave.me	Zwave
44	Occupancy Sensor	WZB-SPM05 (Through module WZB-01 USBR)	Nietzsche (NHR)	ZigBee
45	CO2 Sensor	SG-02-CO2-H1 (Through module WZB-01 USBR)	Nietzsche (NHR)	ZigBee
46	Router	WZB-01 USBR/WZB-01 USBC	Nietzsche (NHR)	ZigBee
47	Control Modules	WZB-03 (Through module WZB-01 USBR)	Nietzsche (NHR)	ZigBee
48	Sensor (T, RH)	STH-03ZB-HB (Through module WZB-01 USBR)	Nietzsche (NHR)	ZigBee
49	Smart Switch Plug	A08 (Through module WZB-01 USBR)	Nietzche (NHR)	ZigBee
50	Smoke Sensor	SG-01-SK-SB (Through module WZB-01 USBR)	Nietzsche (NHR)	ZigBee
51	Air Quality Sensor	SG-02-IAQ-H1 (Through module WZB-01 USBR)	Nietzsche (NHR)	ZigBee
52	EnergyCam	1000, 1003, 1010, 1011	FAST FORWARD AG / Q-loud GmbH	wM-Bus

53	Display	Fire 7	Amazon	WiFi
54	Wi-Fi Camera	DCS-935L	D-Link	WiFi
55	Energy Smart Meter Reader	Utility meter interface device	ENEL	WiFi
56	Bulbs	Hue white A60 9W E27 (trough Philips Hue Bridge 324131201801)	Philips	WiFi
57	Cellular Network Modem	E353 USB dongle HSDPA+	Huawei	USB
58	Cellular Network Modem	BC95 NB-IoT	Quectel	USB
59	Cellular Network Modem	Sara-N2 Series NB-IoT	U-Blox	USB
60	Z-Wave USB Stick	ZMEEUZB1	Z-WAVE.ME	USB
61	Optical blinking sensor	UM1OBR	Terasrl	S0
62	Inverter	PowerOne PowerOne PVI-3.0/3.6/4.2/-TL-OUTD; PVI-5000/6000-TL-OUTD; PVI-10.0-I/12.0-I	ABB	ModBus RS485
63	Energy meter	NEMO D4-LE - MFD4422	IME	ModBus RS485
64	Control Modules	MAMI -100	M.Ig. Electronics	ModBus RS485
65	Module (I/O)	S6116	SHJ Electronic Co., Ltd.	ModBus RS485
66	Calorimeter Contacalorie	IFX-M0-03	Isoil	ModBus RS485
67	Energy Meter	EM210	Carlo Gavazzi	ModBus RS485
68	Energy meter	MIG SDM630	Eastron	ModBus RS485
69	Expansion module (I/O)	S5134	SHJ Electronic Co., Ltd.	ModBus RS485
70	Expansion module (I/O)	S5140	SHJ Electronic Co., Ltd.	ModBus RS485
71	Energy meter	NEMO D4-LE - MFD4421	IME	ModBus RS485
72	External Speaker	DA-E550	Samsung	Bluetooth
73	Fotocellula a Tasteggio	S50-PA-5-C21-NN (Through module ZMEEUZB1)	Datalogic	Analogic

74	IR temperature sensor	OPTCSLT15K (Through module ZMEEUZB1)	Optris	Analogic
75	volume soil moisture sensor	MAS-1 (Through module ZMEEUZB1)	DECAGON	Analogic
76	piranometer	PIRSC-I (Through module ZMEEUZB1)	Geoves	Analogic
77	soil water potential	MPS-6 (through SDI-12 converter and I/O module S5134/S5140)	DECAGON	Analogic
78	NTC Sensor	IKE#02XE3000XXXXX (throughI/O module S5140)	Italcoppie	Analogic

7 Product standard and regulation

GIOE is compliant to Directive 2014/53/EU and Directive 2011/65/EU . Below the list of relevant EU legislation/regulation (directives, norms) to which GIoE complies:

EN55032	Electromagnetic compatibility of multimedia equipment - Emission Requirements
EN 61000-4-2	Electrostatic Discharge Immunity
EN 61000-4-3	Radiated, radio-frequency, electromagnetic field immunity
EN 61000-4-4	Electrical Fast Transient / Burst Immunity
EN 61000-4-5	Surge immunity
EN 61000-4-6	Immunity to conducted disturbances, induced by radio-frequency fields
EN 300 220-1 V2.4.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW; Part 1: Technical characteristics and test methods Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive
EN 300 220-2 V2.4.1	
EN 300 328 V.1.8.1	Electromagnetic Compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data Transmission equipment operating in the 2.4GHz ISM band and using wide band modulation techniques
EN301 489-1 V1.9.2	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
EN301 489-3 V1.4.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); 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 40 GHz
EN301 489-17 V2.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment; Part 17: Specific conditions for Broadband Data Transmission Systems
EN60950-1	Safety of information technology equipment

Below the list of frequencies and output power of radio protocol included in GIoE:

Radio Protocol/Standard	Frequency	RF Output Power
802.11b/g/n	2412-2472 MHz	20 dBm max

802.11n	2422-2462 MHz	20 dBm max
Bluetooth	2402-2480 MHz	20 dBm max
WM-bus 169	169.4 – 169.475 MHz	27 dBm max
NB-IoT	832 - 862 MHz, 880 - 915 MHz	24 dBm max 24 dBm max
3G/4G/	FDD B1, B2, B4, B5, B8 832 - 862 MHz , 880 - 915 MHz	23 dBm max

8 Warranty

Italian Product Warranty

The GIoE product is covered by a guarantee for a defined period of time by TERA srl (hereafter simply TERA). The guarantee is not transferable, it is valid only for the first end user of the product. The warranty is valid for 24 months from the date of purchase with receipt or invoice on tax code, 36 months (standard, extensible to 50 months) with invoice on VAT.

This warranty covers each product and ensures that it is free from defects in workmanship, in normal conditions of use and service, for the period of time defined from the date of purchase by the first end user. On the basis of this guarantee, Tera will repair or replace, at its sole discretion, any unit that does not function according to the specifications published by TERA during the warranty period.

The warranty does not cover software not originating from TERA or damage to the product caused by modifications, alterations, incorrect application, improper use or physical abuse of the product, or damage due to repairs or product assistance by anyone not expressly authorized by TERA. This warranty also excludes any damage to the product caused by circumstances beyond the control of TERA, as for lightning or power supply fluctuations (non-exhaustive example).

Should the product prove to be defective within the warranty period, return the product:
- giving advance notice via email to info@terasrl.it and / or by phone call to +390802147776;
- then, waiting for an answer by e-mail about the shipping address of the product and the method of delivery and / or delivery to an expressly authorized center;
- then, carrying out the delivery and waiting for the reply;

TERA srl may, at its discretion, repair or replace the product, depending on how much TERA srl deems necessary to restore the correct functioning of the product, without any charge to the user, if the warranty conditions are met.

If the product has been purchased from a Reseller, contact the Reseller and agree the warranty assistance arrangements with it.
Warranty conditions can be tailored for B2B OEM, special agreements, non-Italian customer.

9 Disclaimer

Tera reserves the right to modify, improve or otherwise change its products and/or Information in this short manual without prior written notice.