TELECON 3010 RI DATA CONCENTRATOR

Technical specification

Powered by
Elsewedy Electrometer Group

1. Introduction

Fig.1 TELECON 3010-RI data concentrator

Telecon Devices are one of the brands of ElSewedy Electrometer Group.

1.1 General description of a remote management system

The implementation of a remote management system constitutes an unprecedented leap forward for the management of an electrical energy distribution company, providing intelligence to all the elements of the electrical system and allowing not only the automatic reading of the measurements and consumption at the meters, but also total, integrated management of all the assets of the distribution system, whether in urban or rural environments.
PRIME ALLIANCE (PoweRline Intelligent Metering Evolution) is geared towards the development of a new telecommunications' system which is open, public, and non-proprietary, capable of supporting both Smart Metering (Smart Metering) and progress towards a new integral concept for a smart electrical system.

The communications via the electrical system (PLC) are the most appropriate, natural technology to afford the performance and robustness required for deployment of the system on all networks, even on electrical networks underground connections which are highly complex and in rural environment.
Interoperability with different meter manufacturers PRIME facilitates present and future integration into remote management with TL-30xx concentrators.

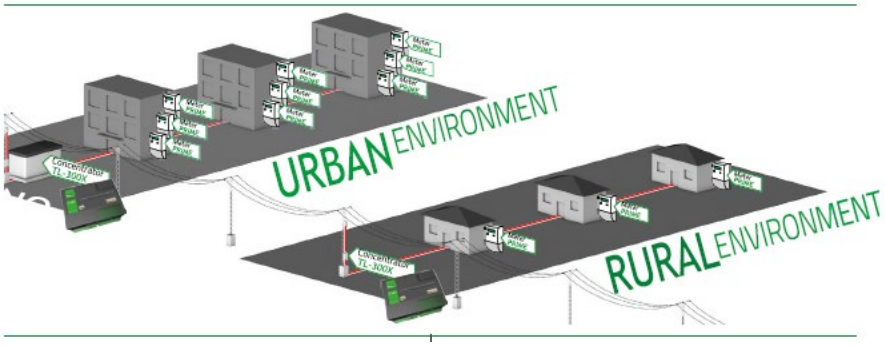


Fig.2: **Typical deployment of a smart metering network in the urban and rural environments**.

The automatic metering system comprises the following elements:

• PRIME Meters – communicate with the concentrator via the electrical system (PLC).
• Data concentrator – essential remote management network element. It is situated between the meter and the monitoring, management and control system. It communicates with the single-phase and three-phase meters via a PLC network with PRIME technology and with the management system via any fixed or wireless communications' network (GPRS, Ethernet, fiber optics, radio, etc.) in view of the fact that it is endowed with the interface required for their integration. The concentrator is usually located at the transformation center and besides managing the collection of consumption and setting metering, it also allows the door to be opened to advanced monitoring functions and automation of the electrical company's distribution system. It is made up of the following elements:
• PRIME base node – administrates communications via the PLC network.
• PRIME injection node – a PRIME modem for each phase allows data to be received and transmitted via the PLC network
• Internal database – manages the meter information.
• Remote management system – allows the administration of the data concentrator. There are two types of access:
  - Web interface – directly via a web browser.
  - Remote management system – this facilitates integration with remote management systems via standard web services.

1.2 PRIME Standard

The PRIME standard describes the PLC communication system PLC. Two roles are defined therein:

• Base node (BN) – concentrator.
• Service nodes (SN) – meters.

The service nodes can be found in one of the following statuses:

• Disconnection – cannot exchange information with the base node.
• Terminal – the node is capable of transmitting/receiving information but not of forwarding traffic from other nodes.
• Switch – as well as transmitting/receiving information, it is capable of forwarding traffic from other nodes.

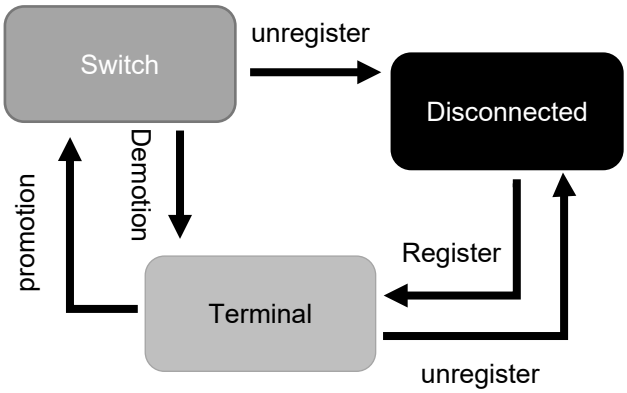


Fig.3: Meter status diagram on the PRIME network.

The status diagram of a meter is shown in Figure 3. All meters start in the "Disconnected" status when connected to the network for the first time.

Once the network topology has converged, a tree is for- med whose roots correspond to the base node. The standard establishes up to 7 topology levels (Figure 4). By means of the web interface of the concentrator a visual check can be carried out on the network topology.

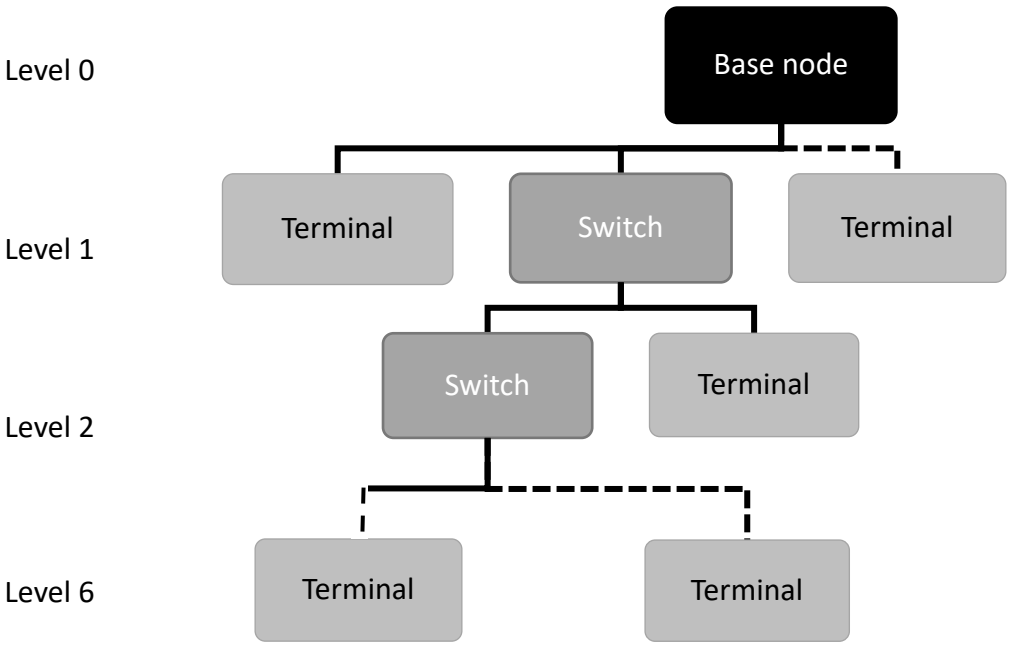


Fig.4: PRIME network topology.

The main benefits of the PRIME system are:

- Automatic collection of consumption and integration of the billing process: the remote management system allows the automatic reading of meters and the integration of the readings with the management and billing systems, allowing the elimination of errors and cutting the costs associated with these processes which, up until now, had been carried out manually.
- Technical management of network installations: the platform allows monitoring and control of the distribution system, from the meter to the Transformation Centre, optimizing, cut-off, tariff modification and reconnection processes as well as the remote analysis of the technical set- tings throughout the network.
- Integrated demand management: the integration of all consumption measurements at user level and the Transformation Centre allows you to make an estimate both of demand and the quality of supply, optimizing investments and the generation capacity of the distribution company.
- Loss detection on the distribution network: the centralized monitoring of the measure's consumptions

at the different network levels allows the carrying out of an exhaustive analysis of technical losses in the system and fraud detection, thereby improving the efficiency of the company's operations.

1.3 PRIME Hybrid Solution

PRIME's telecommunications story begins in 2009 with ideas for powerline communications (PLC) to support smart energy and grid technologies. By standardizing the open powerline with a single specification, PRIME allows for full multi-vendor interoperability and global compatibility.
Using the complementary advantages of PLC and radio frequency (RF) technologies, PRIME has forged both together to offer a hybrid solution. The new technology increase reliability, coverage, and security, shielding from communication impairments of the PLC and RF mediums. In addition, the new technology allows PRIME to be extended to new applications by being able to connect RF-only nodes such as gas meters, water meters or IoT devices to the network.

PLC and RF physical (PHY) signals are integrated into the same medium access control (MAC) layer, allowing the two technologies to work harmoniously. As a result, PRIME's hybrid solution is fully backward compatible with PLC-only or RF-only devices resulting in extended network coverage, provided existing PLC, or RF links are already deployed. Lastly, this open standard protocol ensures the smart grid's robustness, reliability, and efficiency while setting a solid foundation toward the integration with the ecosystem of smart cities applications.

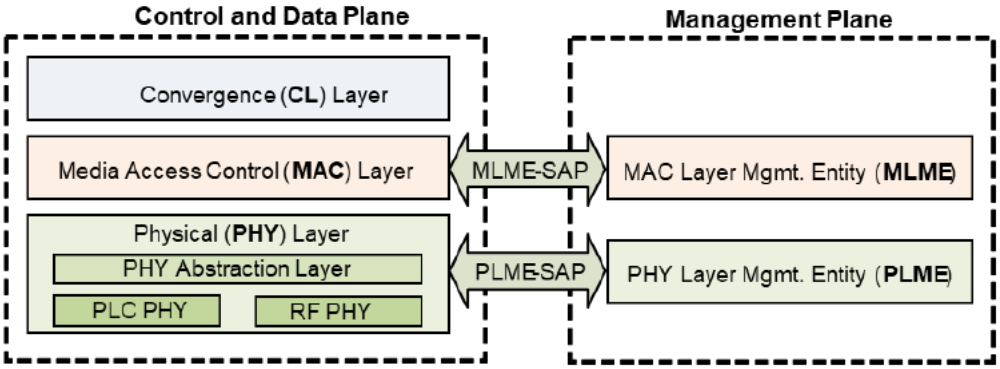


Fig.5: PRIME network topology.

- PRIME network is a beacon enabled, with proactive routing and topology tree structure
- BN select the best PLC or RF medium to communicate to SN in every point-to-point connection
- MAC layer of PRIME uses selected PLC or RF medium in every point-to-point connection.
- MAC layer uses slotted version of the CSMA-CA defined on IEEE Std 802.15.4-2015 on the SCP
- The PHY Abstraction Layer will provide to MAC Layer all PHY Data plane primitives.
- SUN FSK PHY willbemandatoryand863–870MHzfrequencybandSHALLbesupported.
- All PRIME devices comprise at least one PHY, (PLC or RF).
- BN selects the best PLC or RF medium to communicate to SN in every point-to-point connection.

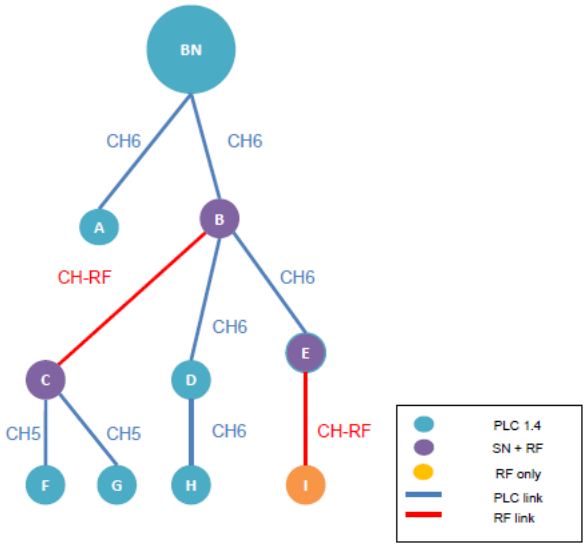


Fig.6: PRIME network topology.

2. Basic description of the device

2.1. A general description

The data concentrator (hereinafter also referred to as TELECON DCU) is a fully programmable device used in automated meter control (AMM) systems and used to collect meter data. The control core is based on an industrial single-board computer with the Linux operating system. Through its communication interface, the concentrator ensures connection to electricity meters, reads data from them, and controls them. Data collection tasks are programmed and run automatically according to the internal calendar. The obtained data are processed, stored in the internal storage, and passed to the superior system - HES. The key functionality is the support of direct HES access to individual electricity meters.

The data concentrator can communicate with hundreds of electricity meters. Their specific number determines the scope of data collection and the communication technology used.

TELECON DCU in communication with electricity meters provides, for example:
- reading of electricity meter registers,
- reading of alarms and electricity meter events,
- transmission of orders to the electricity meter,
- transmission of parameterization data to the electricity meter,
- firmware change in the meter.

TELECON DCU in communication with HES provides:
- transfer of read data,
- transmission of alarms and events reported by the electricity meters and the data concentrator,
- transmission of data related to successful communication, as well as communication records,
- receiving commands for meter parameterization
- reception of a new data concentrator and meter firmware.

Optionally, the TELECON DCU can include an LV balance meter for monitoring the energy consumed from a substation.

2.2. Block diagram

The Telecon TL-300X concentrator family provides multiple configuration options, including the management and collection of meter measurements, low voltage supervision, digital control outputs, Cellular connectivity and integration with management systems with a view to affording maxi- mum flexibility and ensuring the availability of the most suitable product for each environment and for each installation.

The device is fitted with an accessible, user-friendly web interface for access to all functionalities and integrated protocols for automatic communication with the centralized remote management systems

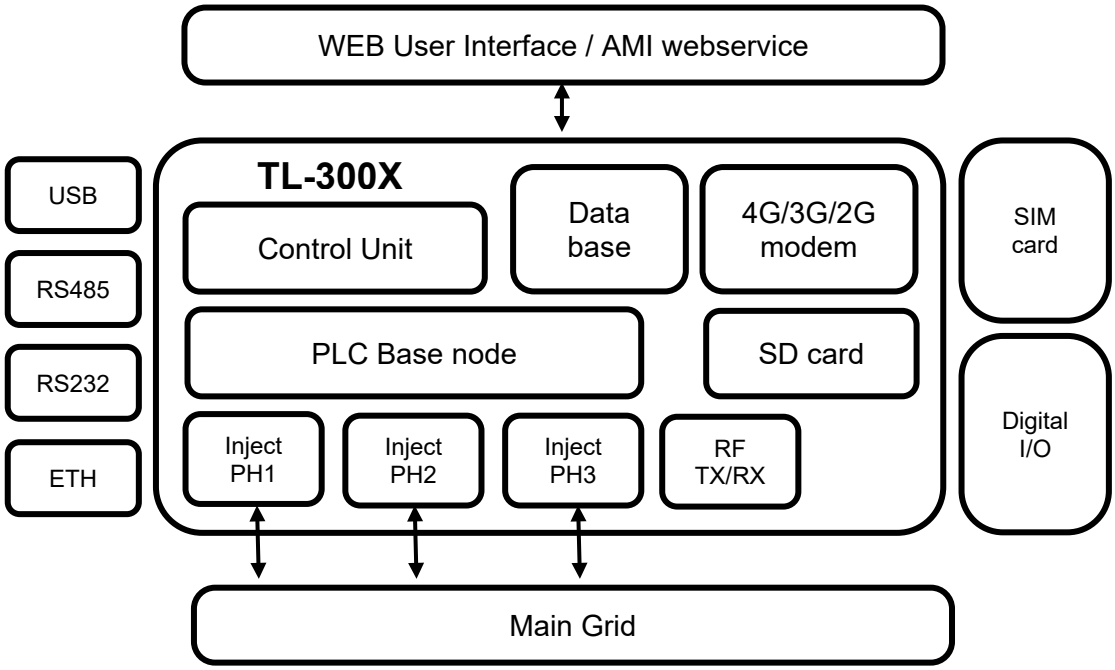


Fig.7 Block diagram

2.2.1. Mains supply

The power supply of the data concentrator is optimized for power supply with a three-phase voltage of 3 x 220V – 380V phase to phase. The middle conductor N must always be connected. The data concentrator provides full functionality even when supplied with a voltage of 0.7 Un or 1.3 Un.
Power supply from only one phase is possible. The overvoltage resistance of the power supply according to EN 61000-4-5 reaches a minimum voltage of 4 kV with a functional criterion of at least level B, typically A.

2.2.2. PLC PRIME communication

This is mains communication. The PRIME standard is based on OFDM modulation in the CENELEC A and FCC frequency bands, which are intended primarily for energy companies.
The frequency band is defined from 41.992 kHz to 471.6796875 kHz as shown in below figure:

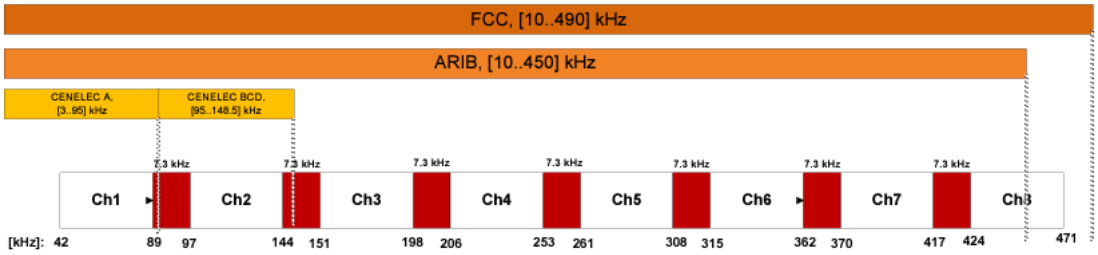


Fig.8 PRIME v1.4 FCC / ARIB frequency band extension

Using this technology, the data concentrator communicates with electricity meters. The communication part is designed according to the PRIME alliance standards, see http://www.prime-alliance.org. The DLMS protocol is used at the application layer of the OSI model. The data concentrator has implemented communication for both PRIME version 1.3.6 and version 1.4. The PLC signal can be injected into any phase as well as into all three phases simultaneously (recommended).

The FCC band supports 6 channels from 3 to 8 that could be configured for each device.
The Base node inside the concentrator is based on the PRIME standard that makes use of the narrow band data transmission system based on OFDM modulations. Differential modulations are used, with one of three possible constellations: DBPSK, DQPSK or D8PSK. Also, a robust modulation scheme is available as part of PRIME 1.4, which is either DBPSK_CC, DBPSK_R or DQPSK_R.

For more technical details please refer to the following link:
https://www.prime-alliance.org/wp-content/uploads/2021/12/PRIME-Spec_v1.420210914.pdf

2.2.3. RF PRIME Communication

The RF modem works over radio frequency in the band 863-870MHz. It uses the PRIME protocol stack to send or receive the data. 868MHz is planned frequency to be used. It supports FSK. OFDM, QPSK modulations. The output power of the modem is configurable that could be limited to not exceed the 20 mW. RF Data Transmission Rate 50 – 2400 Kbit/s.

The modem has a built-in antenna which is part of the modem that grantee a good working of the modem to connect with the nearby devices.

2.2.4. Battery

The terminals marked ACCU +/- 12 VDC are used to connect a 12 V lead-acid battery. The battery can be used to back up the concentrator operation in the event of a mains power failure. Only a 12 V maintenance-free battery (VRLA / SLA) can be connected to the terminals. It is used only as a power supply backup and the concentrator cannot be powered from it permanently. After connecting the battery, it is charged and maintained if the mains supply is present and the concentrator is in normal operating mode. The use of a backup battery requires software support from the data concentrator, this function is implemented during production according to the customer's requirements.

2.2.5. LAN / Ethernet (RJ-45 connector)

10 / 100M communication port for connection to a LAN network. The port is mainly used for connection to the parent system. The LAN interface supports the automatic connection / reconnection feature. The Ethernet line must not be routed directly outside the building in which the CR is installed. The standard uses standard protection typical for house installations and according to the specific application it is necessary to assess the suitability of using external surge protection. In environments with strong interference, it is necessary to follow the usual wiring rules typical for these environments. To achieve maximum service life, it is recommended to provide surge protection or galvanic isolation.

2.2.6. RS 485 (RJ-11)

Under ideal conditions, up to 256 devices can be connected to the bus and a maximum communication speed of 250 kbit / s can be achieved. However, the RS-485 interface is intended for communication with meters, and they usually communicate at a significantly lower speed. The overvoltage protection of the interface is in accordance with EN 61000-4-5 and reaches a voltage of up to 2 kV with a functional criterion of at least level B. The data concentrator supports half-duplex communication, i.e. Only one device can always transmit on the bus, the others only receive. The concentrator acts as a control unit (Master).

2.2.7. RS 232 (RJ-11)

RS-232 is an interface for short-distance information transmission. In the case of a concentrator, a maximum line length of up to 2.9 meters is calculated. The interface is primarily intended for connecting RS-232 Master converters. The RS-232 interface does not provide supply voltage and is electrostatically sensitive.

2.2.8. USB

USB is a host port for extended features of the concentrator. It could be used to connect external modems or optical probes; any added device will need to update the software inside the concentrator to be able to operate and communicate with the device.

2.2.9. GSM / LTE communication, antennas, SIM card

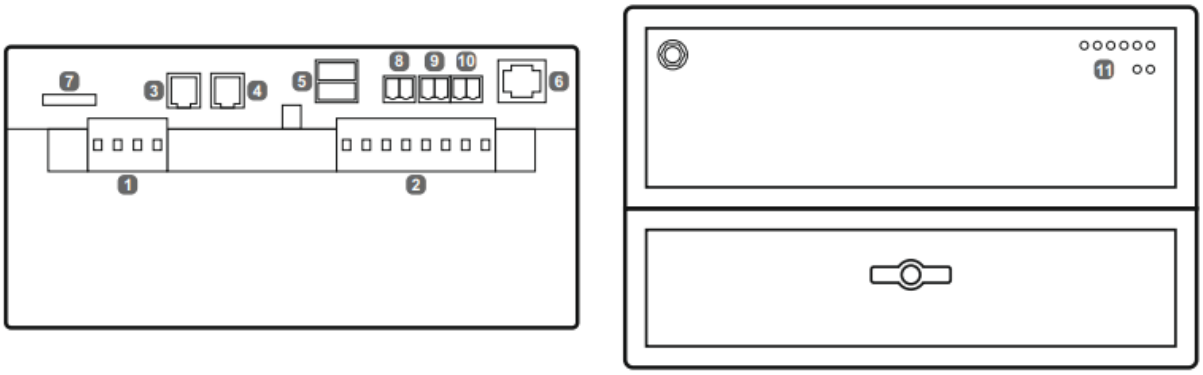
The data concentrator can be equipped with GSM / LTE communication. Simultaneously with GSM / LTE communication, the GPS receiver can be activated (depending on the TELECON 3010-RI version). The GSM / LTE modem enables GSM / GPRS / EDGE communication in the B3 / B8 bands, LTE communication in the B1 / B3 / B5 / B7 / B8 / B20 and UMTS / HSPA + bands in the B1 / B5 and B8 bands. Antennas terminated with an SMA type connector are used for reception and transmission.

TELECON 3010-RI can be equipped with up to three external antennas - GSM / LTE main antenna, LTE auxiliary antenna, GPS antenna. The goal of external antennas is to place them in a place with sufficient signal quality. This is especially important in larger transformer substations, in cabinets with metal housing and in places with strong interference. To ensure optimal conditions, GSM / LTE communication can provide data reception at speeds of up to 10 Mbit / s (LTE CAT1), 42 Mbit / s (HSPA +), 384 kbit / s (UMTS), 236.8 kbit / s (EDGE), 85 , 6 kbit / s (GPRS) and data transmission speeds of up to 5 Mbit / s (LTE CAT1), 5.76 Mbit / s (HSPA +), 384 kbit / s (UMTS), 236.8 kbit / s (EDGE), 85.6 kbit / s (GPRS).

The CR can be equipped with GSM / LTE communication, enabling the acceleration of LTE communication up to 150 Mbit / s (data reception) and 50 Mbit / s (data transmission). LTE communication uses multipath signal propagation, so two antennas marked MAIN and AUX are always used. The antennas are placed at least 1 m apart and with different polarization. The selected antenna must be optimized for the frequencies used by mobile network operators in specific areas as well as the mobile module used in the data concentrator. Suitable antennas are always supplied as accessories and cannot be changed arbitrarily without consulting the manufacturer.

The SIM card can be inserted into the TELECON 3010-RI after opening the terminal cover. This is an electrostatically sensitive part. To make the operator's mobile network available, it is necessary to configure the APN - APN name for data communication via SIM according to the specification of the mobile network operator. APNs can be used for public purposes; a better option is to use a VPN that is designed specifically for the specific needs of the company.

2.3. TERMINALS AND COMMUNICATION PORTS



1) Power supply/PLC communication connector.
2) Supervision/PLC communication connector (optional).
3) RS485 Connector.
4) RS232 Connector
5) USB Connector.
6) Ethernet Connector.
7) SIM Card (optional).
8) 5V output
9) RTC battery
10) Chargeable Battery

11) LEDs:

Top row left to right:
1.Node activity injection 1.
2.Node activity injection 2.
3.Node activity injection 3.
4.Active Ethernet connection.
5.Alarm.
6.Power supply.

Bottom row:
7.Supervision: active power.
8.Supervision: reactive power.

Fig.9 Terminals and Ports

2.4. Wiring diagram

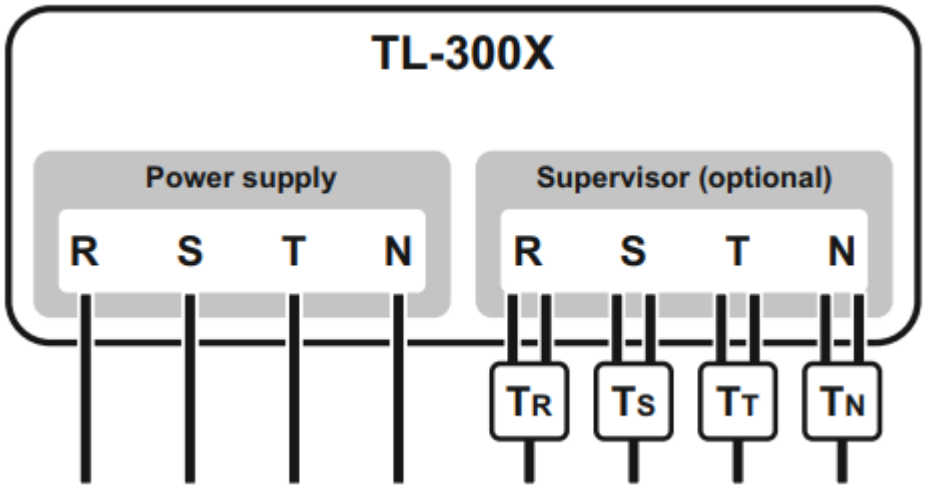


Fig.10 Wiring Diagram

2.5. The user interface

The TELECON 3010-RI data concentrator provides various configuration and integration options with control systems to provide maximum flexibility for each installation.

The device has a user-friendly and intuitive web interface for access to all functions and integrated protocols for automatic communication with centralized remote management systems (STG). The application uses TLS 1.2 security and should work in any browser that supports HTML5, which are currently all the most used browsers in versions released since 2015 (Edge, Firefox, Chrome, Opera, Safari).

The web application allows you to log in to the data concentrator and view or set basic parameters, such as:

- Basic information,
- Status display,
- Viewing events
- Display of readings,
- Display of the number of readings,
- PRIME topology view,
- Restart concentrator,
- Network settings (cellular network modem / Ethernet Port),
- Secure access,
- Display / Time and zone settings,
- Display of reading tasks,
- Reading task settings,
- Status and settings of reading channels (PLC, RS-485, RS-232, USB),
- Status and settings of export channels (FTP, SMTP),
- Changing the password,
- View a list of users
- Firmware replacement,
- Reading service settings,
- And more.

The following are some examples / demonstrations from the web interface:

Fig.11. Description of the picture

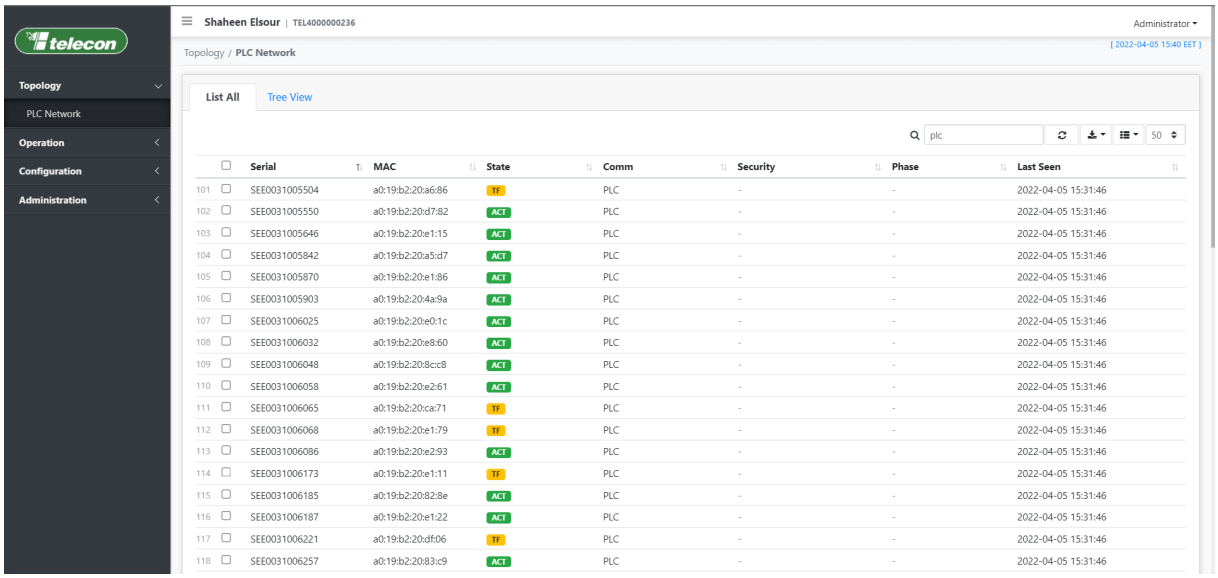


Fig.12. Description of the picture

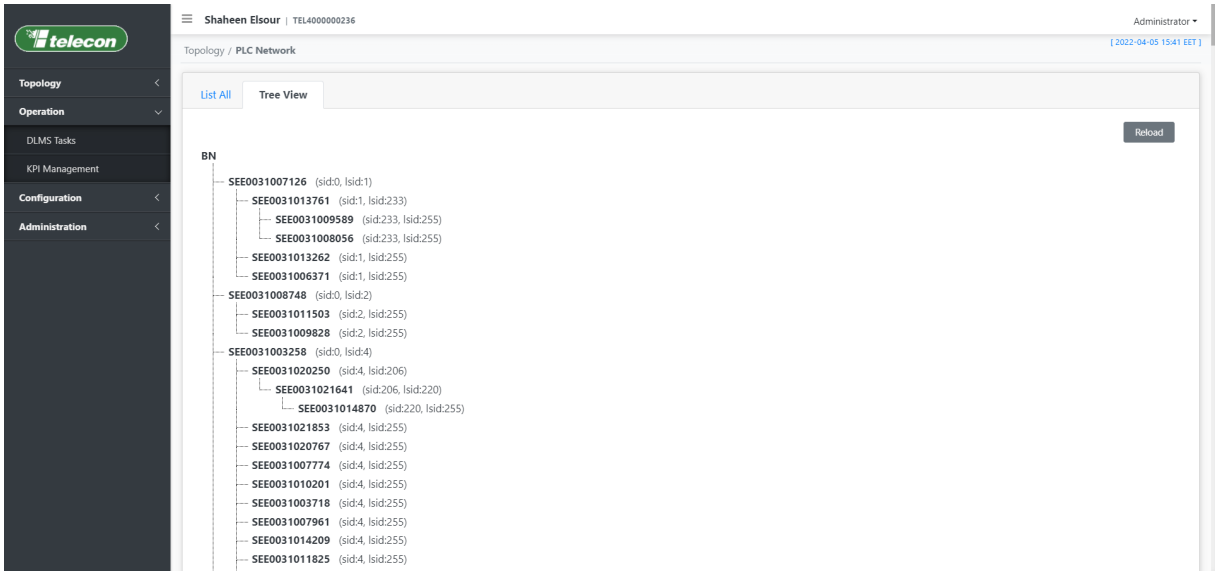


Fig.13. Description of the picture

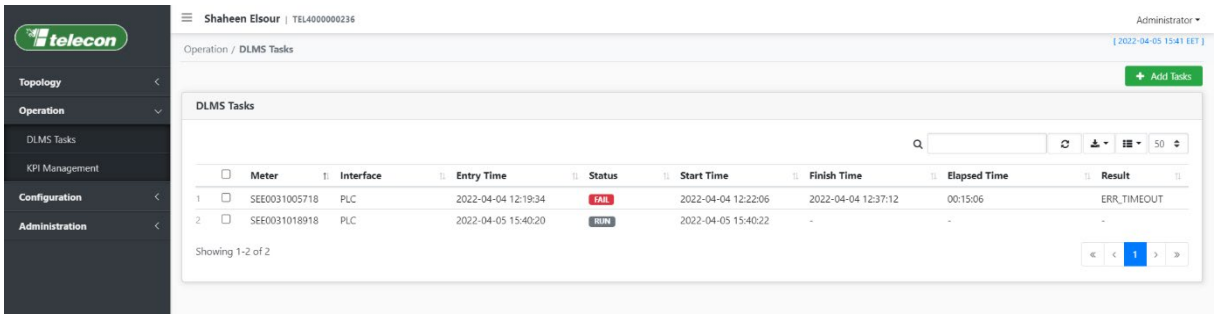


Fig.14. Description of the picture

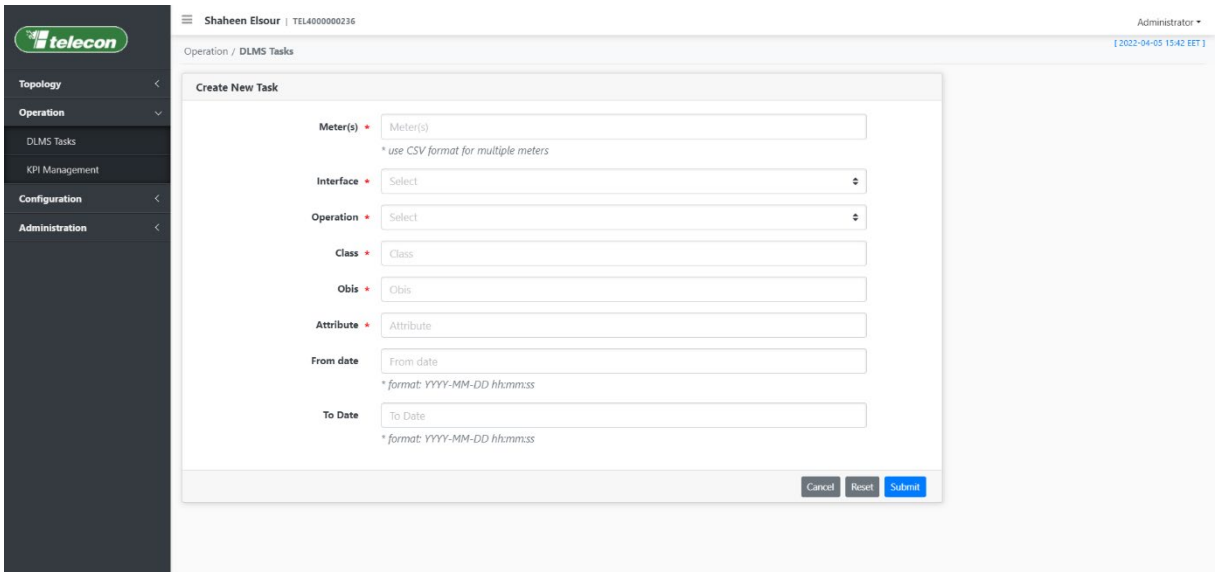


Fig.15. Description of the picture

2.6. Mechanical Dimensions

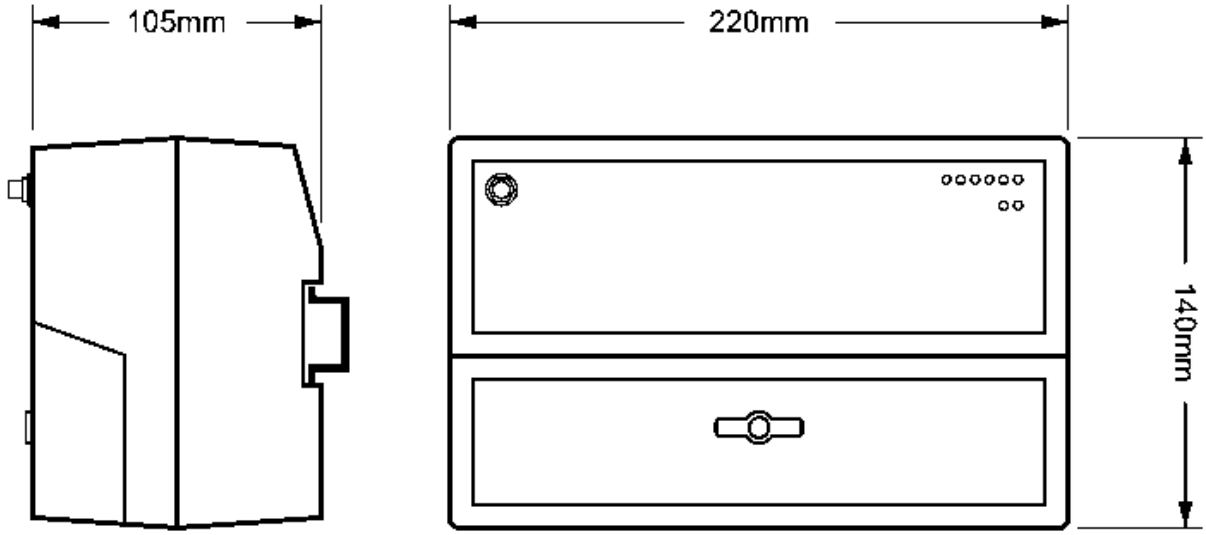


Fig.16. Mechanical dimensions

3. TECHNICAL DATA

Basic Data	
Nominal supply voltage (V_n)	3 x 220/380 V
Operating voltage range	0.7 V_n to 1.3 V_n (±30%)
Own consumption at V_n	Less than 10 W during transmission
Nominal frequency (f_n)	50 Hz, ± 5%
Protection class	2
Electrical insulation input - output	minimum 4 kV/50 Hz/60 s
Power Supply	
Supply terminals L1, L2, L3, N	Supplied by each phase
Backup possibility	½ AA battery for RTC, another chargeable battery for emergency operation
Control Core	
Operating system	Linux OS
Processor	400 MHz ARM9
SDRAM	128 MB
Internal storage	8 GB / 16 GB microSD card
Outputs and Inputs	
Ethernet port/LAN	1 x RJ-45, 10/100 Mbps, MDI-X
RS-232	1 x RJ-11
RS-485	1 x RJ-11
Cellular network - WAN	4G/3G/2G (available bands: GSM900, GSM1800, WCDMA B1, B5, B8, LTE B1, B3, B7, B8, B20, B28, B38, B40, B41)
USB	Connector type B
Ambient Conditions	
Operating temperature	–40 °C to +70 °C
Storage temperature	–40 °C to +70 °C
Operating humidity	≤95% without condensation
IP Code	IP54
Weight, Dimensions and Mounting	
Weight	1.5 kg
Width	220 mm
Height	140 mm
Depth	105 mm
Mounting	35 mm DIN rail
Interface to Meters	
PLC Physical and link layer	PLC PRIME v.1.4 – injection into any /all three phases CENELEC – A band: 41.992 – 150 kHz (CH1 & 2) FCC Band: 150 – 471.6796875kHz (CH3, 4, 5, 6, 7 & 8) Modulation options: DBPSK, DQPSK, D8PSK, DBPSK_CC, DBPSK_R or DQPSK_R. Data Transmission Rate: 21.4 – 128.6 Kbit/s
RF Physical and link layer	PRIME v.1.4 radio frequency band: 863-870MHz (868MHz as a default) Modulation options: FSK. OFDM, QPSK Data Transmission Rate: 50 – 2400 Kbit/s
Physical layer	RS-485, RS-232
Application protocol	DLMS
Data safety	DLMS Security Suite 0, Suite 1 and Suite 2
Interface to HES/MDMS	
Physical and link layer	4G/3G/2G, Ethernet, upgradable to include Fiber optics connection
Network layer	Supported IPv4, IPv6 DLMS, SOAP
Application layer	Any selection of registries or incidents, profiles, consumption, max. data. Data export to HES. Compression is possible. Spontaneous alarms that can also be sent.
Data safety	Secure SOAP webservice, HTTPS, FTPS

NORMS AND STANDARDS:

ELECTROMAGNETIC COMPATIBILITY (EMC) - IMUNITY

EN 50065-2-3 – Signalling on low-voltage electrical installations in the frequency range 3 kHz to 148,5 kHz Part 2-3: Immunity requirements for mains communications equipment and systems operating in the range of frequencies 3 kHz to 95 kHz and intended for use by electricity suppliers and distributors.

EN 61000-6-2 ed. 3 – Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments.

EN 61000-4-2 ed. 2 – Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test.

EN 61000-4-3 – Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radiofrequency, electromagnetic field immunity test.

EN 61000-4-4 – Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test.

EN 61000-4-5 – Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test.

EN 61000-4-6 – Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radiofrequency fields.

EN 61000-4-8 ed. 2 – Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test.

EN 61000-4-11 – Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions, and voltage variations immunity tests.

ELECTROMAGNETIC COMPATIBILITY (EMC) - EMISSION

EN 55032 – Electromagnetic compatibility of multimedia equipment – Emission requirement

EN 50065-1 – Signalling on low-voltage electrical installations in the frequency range 3 kHz to 148,5 kHz. General requirements, frequency bands and electromagnetic disturbances

Electromagnetic Compatibility Selected Standards		
Standard	Level	Criterion (Required/Observed)
EN 61000-4-2	8 kV	B/A
EN 61000-4-3	10 V/m	B/A
EN 61000-4-4	2 kV	B/A
EN 61000-4-5	4 kV	B/A
EN 61000-4-6	3 V (47 - 68 MHz) or 10 V	A/A
EN 61000-4-11	30% for 10 ms 40% for 100 ms 100% for 5 ms	B/A C/A C/A
Emissions		
EN 55022	Class B device	

References

https://www.prime-alliance.org/alliance/specification/

https://www.prime-alliance.org/media/2022/12/PRIME-HYBRID-PLC-RF-SOLUTION.pdf

https://www.smart-energy.com/industry-sectors/energy-grid-management/a-hybrid-world/

https://www.smart-energy.com/industry-sectors/smart-meters/prime-hybrid-solution-combines-plc-and-rf/

whitePaperPrimeV1p4_final.pdf (prime-alliance.org)

MANUFACTURER WARNINGS:

The manufacturer warns of the risk of possible danger resulting from incorrect handling or incorrect use of the product as follows:

- Installation and maintenance must be performed by personnel with the corresponding electro-technical qualification and adequately trained, that shall inform the operator on conditions of safe operation.
- The product shall not be used for purposes other than those it was manufactured for.
- The product shall not be wilfully modified contrary to the type design.
- The product shall not be operated with voltage, current or frequency other than those it was produced or professionally modified for.
- The product shall be located and secured so as to complicate or disable handling by persons with no electrotechnical qualification, especially children.
- Before every new putting to operation, e.g., after repair, maintenance etc., Ingress Protection shall be restored in full, all safety measures taken, and inspection done by a designated electrical inspector.
- During operation, premises where the product is installed, shall be free of danger of fire or explosion in case of development of gases, vapours of inflammable liquids and occurrence of inflammable dust,
- The product shall be handled by a qualified and adequately trained person only, and handling shall be performed without voltage with the exception of measurement by measuring meter with insulated tips.
- The product shall not be operated under conditions or in an environment not ensuring safe operation (e.g., location on flammable base, cover from inflammable material, insufficient protection from penetration of foreign elements, water or other liquids).
- The product shall be located and operated in an indoor environment, i.e., in places providing additional protection against effects of external environment (e.g., inside a building or cabinet).
- The product shall not be operated in an environment with major vibrations and oscillations or under such conditions.

Failure of the user to observe any of the aforesaid warnings renders the manufacturer not being liable for a defect occurring as an incidental consequence of this failure. Non-observance of storage, operation and safety conditions recommended in article Care and Maintenance can have an adverse effect on the product service life.

RESPONSIBILITY

The owner of the product is responsible for ensuring that all persons engaged in working and handling the product:

- Are knowledgeable and qualified as per national regulations.
- Have read and understood corresponding parts of this document.
- Strictly observe safety regulations and operation data stipulated in its individual articles. The owner of the product is further responsible for:
- Protection of persons.
- Prevention of damage to material.
- Personnel training.

SAFETY INSTRUCTIONS

The following safety instructions shall be observed under all circumstances:

- Wires the product is connected to shall be powered neither during installation nor replacement. Powered contacts pose a life threat. For this reason, until the work is finished, the corresponding power supply fuses shall be removed and stored in a place, safeguarding against unnoticed reinstallation by a person holding no responsibility.
- Prior to installation, the product shall be disconnected from the power supply. Simultaneously, undesirable power (re)connection by other parties shall be precluded. Prior to installation, testing or a metering instrument shall prove that no power supply is really present. The same applies for product replacement.
- Local safety regulations shall be observed. The product installation shall be executed solely by qualified and trained personnel.
- During installation, the product shall be firmly held or secured against falling and causing injury,
- Dropped product shall not be installed even if showing no visible signs of damage. They shall be returned for inspection either to designated repair office or directly to manufacturer. Internal damage can cause functional failures or a short circuit,
- The product shall by no means be cleaned under running water or by high-pressure equipment. Water penetration can cause a short circuit. It is necessary to respect ingress protection of the device.

MAINTENANCE AND STORAGE

The product is a maintenance-free product with a specified minimum service life according to the Product Specification. For possible cleaning of the outside surface from dust and other impurities, the manufacturer does not recommend using organic solvents, aggressive chemicals, and abrasive cleaning agents. Prescribed storage temperatures shall be complied with failure to do so can result in shortening of electronic components service life. The product shall be protected against wet and humid conditions. It is designed for internal use, i.e., it may be used only in places providing additional protection against the effects of external environment (e.g., in a building or cabinet). Precipitation, humidity, and liquids containing minerals can cause corrosion of electric circuits if the device becomes wet. The product shall not be placed on and dried by a source of heat or inserted into a source of heat (e.g., microwave oven, classic oven or radiator / heater) as it can overheat and some of its parts explode. It shall not be exposed to excessive heat as it can lead to deformation of case / cover. The product shall not be stored in cold premises, especially with subsequent warming-up (to nominal operation temperature). Humidity can condensate inside and damage electronic components or isolation properties of the product can deteriorate.