REDZ
SMART COMMUNICATION

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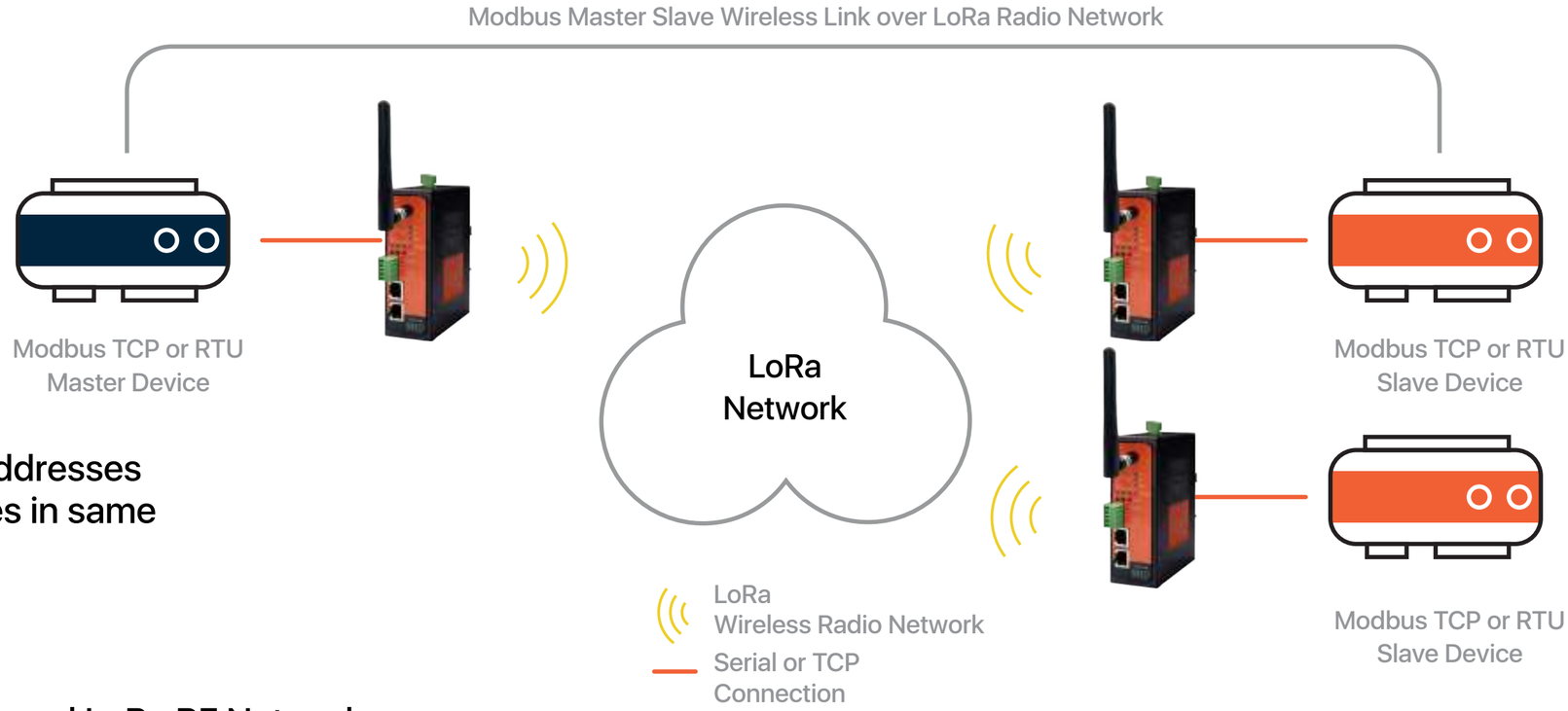
TLM Series LoRa Radio Modems

Transparent Gateway between Field TCP Server/TCP Client/ RS232 or RS485 Serial devices and LoRa RF Network
Modbus TCP to RTU Conversion Gateway for RS232 and RS485 Serial Devices for Messages over LoRa RF Network
LoRa Repeater

with 2 × 10/100Base-T(x) Ports,
1 × RS232 and 1 × RS485 Serial Ports
and option for BPL (Broadband Power Line Link)

The TLM Series LoRa Radio Modems empowers users to construct a private and efficient wireless network infrastructure. These versatile modems bridge the connectivity gap for field devices by supporting both RS232, RS485 serial and Ethernet communications. By utilizing the LoRa standard, the TLM Series ensures reliable and long-range data transfer over a dedicated radio frequency network, offering a robust solution for challenging operational environments. TLM offers auto network discovery feature to gather signal levels, addresses and configuration/connection lists of all TLM devices in same LoRa RF Network which makes installation easier.



TLM Series LoRa Based RF Modems can act as:

-Transparent Gateway Between TCP Client Devices and LoRa RF Network
-Transparent Gateway Between TCP Server Devices and LoRa RF Network
-Transparent Gateway Between RS232/RS485 Serial Devices and LoRa RF Network
-Modbus TCP to RTU Conversion Gateway for RS232/RS485 Serial Devices for messages over LoRa RF Network
-LoRa Repeater

Typical applications: Automated Meter reading, Wireless networks, Home – Building – Industrial Automation, Remote Control, Wireless Sensors, Telemetry, Wireless Alarm and Security Systems...

TLM models with Broadband Power Line (BPL) link can communicate with full transparent TCP/IP standard over Low Voltage power lines and allows easy connection between TCP/IP based terminals without use of extra cables.

Main Features

- Supports 2 x 10/100Base-T(X) ports
- Supports 1 x RS232 and 1 x RS485 Serial Connection up to 460800 Baud
- Embedded web interface for ease of use
- **1 Device with 5 different Gateway Operating Modes:**
  Transparent Gateway Between TCP Client Devices and LoRa RF Network
  Transparent Gateway Between TCP Server Devices and LoRa RF Network
  Transparent Gateway Between RS232/RS485 Serial Devices and LoRa RF Network
  Modbus TCP to RTU Conversion Gateway for RS232/RS485 Serial Devices for messages over LoRa RF Network
  LoRa Repeater
- **Creates Radio Network:**
  Point to point
  Point to multi point - Broadcast
  Point to multi point - TCP Socket to target address mapping based data transfer
- **Auto Discovers the TLM devices in LoRa Network that can be communicated and lists signal levels, addresses and configuration/connection details**
- **868MHz or 2.4GHz LoRa based Radio Frequency (RF) Communication**
- **128 bit AES Encryption and Decryption on over the air communication**
- **868MHz Version:**
  LoRa Signal Bandwidth Configurable: 125, 250, 500 kHz
  LoRa Radio Power Configurable between 5dBm (~3mW) to 20dBm (100mW)
  LoRa or FSK Selectable Modulation Options
- **2.4GHz Version:**
  LoRa Signal Bandwidth Configurable: 200, 400, 800, 1600 kHz
  LoRa Radio Power Configurable between -18dBm (~0,02mW) to 13dBm (~20mW)
  LoRa or FLRC Selectable Modulation Options
- **LoRa Rx Group Address and Device Address Configurable**
- **LoRa Tx Group Address and Device Address Configurable**
- Up to 10 client connection in Server Mode
- DHCP Server Capability
- Easy to follow LoRa data packages on web interface
- Easy to follow Device Status on web interface
- Black List and White List based LoRa package filter
- Firmware Upgrade over Web
- 2 firmware storage capability on same device (1 active only)
- AC or DC wide range power options
- Wide operating temperature range from
  -25 to 70 °C AC and -40 to 85 °C DC power input versions
- Rugged Metal IP-40 housing design
- DIN-Rail mounting

Extra Features for Models with BPL (Broadband Powerline)

- Supports 2 x 10/100Base-T(X) ports + 1 x BPL link
- Wide range 3 phase AC input
- Supports up to 30Mbps PHY rate on BPL with
  Up to 10 hops and 1000 nodes
- Up to 432 sub-carriers from 2 to 28MHz analog bandwidth
- Support LDPC-C FEC with 128-bit AES core
- Plug and play with Master/Slave selection via web interface

Technical Specifications

Connectors and Ports

SMA Antenna Connector for LoRa	1 Standard SMA female interface, 50 ohm
Console Port	Micro USB or USB Type-C connection for LOG in 115200 baud
10/100T(X) RJ45 Ports	Ethernet Connection on 2 ports
Serial Ports	5 pin wired Terminal Connection Tx, Rx, GND for RS232 A and B for RS485
Reset Buttons	Reset to Client and Reset to Server Operating modes buttons

Ethernet Switch Technology

Ethernet Standards	IEEE 802.3 for 10Base-T IEEE 802.3u for 100Base-T(X) IEEE 802.3x Flow Control
Mac Table	1K MAC address entry
Processing	Store-and-Forward
Memory	448K bits packet buffer memory

BPL (Broadband Powerline) Technology for BPL Models

PHY Data Rate	Up to 240 MHz
MAC Layer Protocol	CSMA/CA
Modulation Technology	OFDM-432
VLAN	IEEE802.1q/ IEEE802.1p/ IEEE802.3d

NTP Time Synchronization

NTP is used to syncronize device time after a manual or system triggered restart and it only takes place if NTP time is available and device time difference from NTP time is + or - 24 Hours.

LoRa Technology – 2.4GHz Version

Based on	Powerful Cortex M3 Pre-Certified according to EN 300 328
Sensitivity	Down to -130 dBm
Output Power level	Up to 13dBm
Link Budget	Up to 142 dB
Communication Distance	Up to 12km (Line of Sight)
Typical Communication Distance Indoor/Urban	>2km
Frequency Range	Min 2 402 000 137 Hz Max 2 479 999 939 Hz
LoRa Bandwidth Options	200 kHz 400 kHz 800 kHz 1600 kHz
Tx Power Level	-18dBm (~0,02mW) to 13dBm (~20mW) Configurable
LoRa Spreading Factor	SF5 SF6 SF7 SF8 SF9 SF10 SF11 SF12
Modulation	LoRa or FLRC Selectable

LoRa Technology - 868MHz Version

Based on	STM32L151CxU6Axx Pre-Certified according to EN 300 328
Sensitivity	Down to -138 dBm
Output Power level	Up to 20 dBm
Link Budget	Up to 156 dB
Communication Distance	Up to 12 km (Line of Sight)
Typical Communication Distance Indoor/Urban	> 2 km
Frequency Range	Min 863Mhz, Max 870MHz
LoRa Bandwidth Options	125 kHz 250 kHz 500 kHz
Tx Power Level	5dBm (~3.16mW) to 20dBm (100mW) Configurable
LoRa Spreading Factor	SF7 SF8 SF9 SF10 SF11 SF12
Modulation	LoRa or FSK Selectable

LoRa Network Auto Discovery

TLM automatically discovers all other TLM devices in same LoRa RF Network and lists communication signal levels, addresses and configuration/connection details. This makes setting up LoRa wireless network much easier.

Led Indicators

Power indicator	Power LED
10/100T(X) Indicators	Activity LEDs: ETH1, ETH2 and TLM (Activity of device itself)
LoRa Indicators	Alive (Blinks during normal operation), Tx and Rx of data LEDs
System Indicators	Status LED, Tx and Rx of data LEDs and Server LED (LED ON: Server Operating Mode, LED OFF: Client Operating Mode)
Console Indicators	Tx and Rx of data LEDs

Power - DC Models

Input Range	5-48V DC wide range Power Input (Allows up to 60 V DC)
Reverse Polarity Protection	Available
Thermal Shutdown and Current Limit Protection	Available

Power – AC Models

Input Range	100 - 240V AC (120 – 370V DC), 50Hz to 60Hz AC input
Isolation	Fully Isolated >4200Vrms, 5mA 1 Min
Insulation	Class II

Physical & Environmental Characteristics DC Models

Enclosure	Metal, IP 40
Dimensions	43 × 95 × 124 (w × d × h) mm
Weight	~ 400 gr
Storage Temperature	-65 to 150 °C
Operating Temperature	-40 to 85 °C
Operating Humidity	5% to 95% Non-condensing

Physical And Environmental Characteristics AC Models

Enclosure	Metal, IP 40
Dimensions	43 x 95 x 124 (w x d x h) mm
Weight	~400gr
Storage Temperature	-40 to 85 °C
Operating Temperature	-30 to 70 °C
Operating Humidity	10% to 95% Non-condensing

Power - BPL Models

Input Range	3 Phase Input, 110V–240V 50Hz to 60Hz AC input
Power and Data	AC Power supply use L1-N only. Phase 2-3 connections are used for BPL signal transmission.

Physical And Environmental Characteristics BPL Models

Enclosure	Metal, IP 40
Dimensions	43 x 95 x 124 (w x d x h) mm
Weight	~400gr
Storage Temperature	-65 to 150 °C
Operating Temperature	-40 to 85 °C
Operating Humidity	5% to 95% Non-condensing

BPL Models can be purchased in 2 versions:
1. P-N Model: Phase to neutral model (Standart Model). That version gets power from terminal pins 1 and 2 from phase and neutral. It can also transmit data from that pins and other pins usage is optional (Ex: Master can be connected to all phases and slaves can be connected to relevant phases)

2. P-P Model: Phase to phase model. That version also gets power from terminal pins 1 and 2 from phase and neutral. Data transmission only done through terminal pins 3 and 4. Phase to phase connection can be done to data transmission pins for better performance. If phase to phase connection is not avilable then phase and neutral can still be connected for data transmission for terminal pins 3 and 4.

BPL Models can be purchased in DC model as well:
This model will be same as "P-P Model" (Phase to phase model) on data connection and gets 9-36V DC power from terminal pins 1 and 2 to power up device itself. Data transmission only done through terminal pins 3 and 4.

Ordering Information

TLM154: 868MHz LoRa RF Modem, 2x 10/100 T(x) ETH ports, 1 x RS232 & 1 x RS485, 5-48V (max. 60V) DC Power Input

TLM254: 868MHz LoRa RF Modem, 2x 10/100 T(x) ETH ports, 1 x RS232 & 1 x RS485, 100 - 240V AC (120 – 370V DC), 50Hz to 60Hz AC Power Input

TLM655: 868MHz LoRa RF Modem, 2x 10/100 T(x) ETH ports + 1 x BPL (Broadband Power Line) Link, 1 x RS232 & 1 x RS485, 3 Phase AC Power Input, 110V–240V/50-60Hz

TLM194: 2.4GHz LoRa RF Modem, 2x 10/100 T(x) ETH ports, 1 x RS232 & 1 x RS485, 5-48V (max. 60V) DC Power Input

TLM294: 2.4GHz LoRa RF Modem, 10/100 T(x) ETH ports, 1 x RS232 & 1 x RS485, 100 - 240V AC (120 – 370V DC), 50Hz to 60Hz AC Power Input

TLM695: 2.4GHz LoRa RF Modem, 2x 10/100 T(x) ETH ports + 1 x BPL (Broadband Power Line) Link, 1 x RS232 & 1 x RS485, 3 Phase AC Power Input, 110V–240V/50-60Hz

Product Comparison

Model	868MHz LoRa	2.4GHz LoRa	5-48V (max. 60V) DC Power input	100 - 240V AC (120 – 370V DC), 50Hz to 60Hz AC Power Input	3 Phase AC Power input, 110V-240V/ 50-60Hz AC Power Input	2 x 10/100 T(x) ETH ports	1 x RS232 and 1 x RS485 Serial Ports	BPL (Broadband Power Line) Link
TLM154	●		●			●	●	
TLM194		●	●			●	●	
TLM254	●			●		●	●	
TLM294		●		●		●	●	
TLM655	●				●	●	●	●
TLM695		●			●	●	●	●