

Mini RTU

General

The Mini Remote Terminal Unit (Mini RTU), shall be installed at Ring Main Unit (RMU) & Power stations to collect process information and control the (RMU & Substation) equipment's. The supplied Mini RTUs shall be interfaced to field devices such as (Transducers, IEDs, Metering Unit...etc.) using different interfaces and communicate to master station via different protocols as described in the specification though General Packet Radio Service (GPRS) modem.

Hardware Components

- CPU & Power Supply

The Mini RTU shall include one CPU which is responsible for the main processing tasks and for the communication. The main tasks of the CPU are managing and controlling associated actions of I/O.

The CPU shall have the following minimum number of communication ports:

1. Two serial ports over for RS-485 communications.
2. Two Ethernet ports for communication with master station and IEDs, which also can be used for configuration purposes.

- Input / Output Units

The Mini RTU shall be equipped with modules (DI & DO) to deal with different data types from field devices.

For commands there should be a 1 out of n check, to ensure that only one command will be activated at a time. All events shall be time stamped with 1ms accuracy.

Communication Protocols

1. Master Station Communication Protocols

The Mini RTU shall be capable of communicating with master station using following tele-control communication protocols

- DNP3.0 serial and Ethernet
- Modbus RTU and TCP
- IEC 61850
- IEC 60870-5-101/104

2. Communication Protocol between RTU & IEDs

The Mini RTU shall also provide serial / Ethernet interfaces for the communication with subordinated devices like intelligent electronic devices (IEDs). Digital protection relays, metering devices..etc. Following protocols are shall be supported at least

- DNP3.0 serial and Ethernet
- Modbus RTU and TCP
- IEC 60870-5-101/104
- IEC 61850

Communication Modem:

The supplier shall include a ROBUSTEL - R3000 Lite (L4L communication modem to perform the communications tasks between the mini RTU and the Control Center.

The modem must contain the following accessories:

- Wall Mounting Kit.
- Power supply.
- one antenna (3G/4G).
- one magnet antenna (3G/4G) (3meters).
- 3x1 pin pluggable terminal block for power supply.
- Ethernet cable.

Documentation :

Comprehensive RTU documentation is required such as:

- Data Sheets
- RTU tool User's Guide
- Communication Interfaces (towards Host and Sub- devices)
- Signal lists in EXCEL

Cyber Security

Cyber security features and mechanisms according to attached cyber security requirements. In addition, the following features shall be possible:

- The mini RTU shall have different levels of passwords in order to provide different benefits according to the user type.

- The mini RTU service application shall enforce a high complexity of passwords.
- The mini RTU shall ensure Secured Encrypted communications: SSH, HTTPS, etc.

Mini RTU Functions

As a minimum, the Mini RTUs shall be capable of performing the following functions:

- 1- Data gathering, the mini RTU shall collect digital inputs, and information points from devices relays and/or IEDs.
- 2- The mini RTU shall receive, process and perform the digital control commands received from the Control Center.
- 3- Mini RTU shall support Sequence of Events feature (SOE)
- 4- The mini RTU shall have internal battery backup for memory and date/time.
- 5- Mini RTU shall be capable to communicate simultaneously on all communications ports.
- 6- The Mini RTU shall support the use of a different communication data exchange rate (bits per second) and scanning cycle on each port.
- 7- Mini RTU shall have the capability of automatic re-start after a power outage without manual intervention.
- 8- Mini RTU modules, shall have light emitting diodes (LEDs) to indicate errors or operating modes
- 9- A special tool (webserver application, special software...etc.) should be used in order to configure the mini RTU, read RMU measurements, indications, events and alarms.

- 10- The Mini RTU shall provide remote diagnostics capabilities. It shall be possible to connect to the Mini RTU from a remote computer in order to analyze the system and error status, check-up of the configuration or signal values of the RTU remotely, e.g. by means of a Web-Server via LAN/WAN.
- 11- The Mini RTU shall be equipped with Cyber Security Features
- 12- The Mini RTU shall support time synchronized by external GPS equipment or from the control center

Environmental Condition

Climatic conditions according IEC 60870-2-2:

Temperature: -25°C...+55°C (Class C2)

Relative Humidity: 5...95%, non condensing
(Class C1)

Atmospheric pressure 70 to 106 kPa

Altitude (operation) up to 3000 m

| Item | Standard | Test Level |
|------|---|------------|
| 1 | Low Temperature (IEC 60068-2-1) | -25°C |
| 2 | High Temperature (IEC 60068-2-2) | +70°C |
| 3 | Temperature-Humidity (IEC 60068-2-30, cyclic test) | 95% |

| | | |
|---|---|--------------------|
| 4 | Vibration response test, sinusoidal: IEC 60068-2-6 IEC 60255-21-1 Class 1 0,5g (10 – 150 Hz) | 0,5g (10 – 150 Hz) |
|---|---|--------------------|

| Item | Standard | Test Level |
|------|---|---------------------------|
| 5 | Vibration seismic test, sinusoidal: IEC 60068-2-6 IEC 60255-21-3 Class 1: 3,5mm (1 – 9 Hz) IEC 60870-2-2 Class Bm: 3mm (2 – 9 Hz) | 3mm (2-9 Hz) |
| 6 | Vibration endurance test, sinusoidal: IEC 60068-2-6 IEC 60255-21-1 Class 1: 0,5g (10 – 150 Hz) IEC 60870-2-2 Class Bm: 1g (9 – 200 Hz) | 1g (9 – 200 Hz) |
| 7 | Vibration high frequency test, sinusoidal: IEC 60068-2-6 IEC 60870-2-2 Class Bm: 1,5g (200 – 500 Hz) | 1,5g (200 – 500 Hz) |
| 8 | Shock (half sine) IEC 60068-2-27 IEC 60255-21-2 CL1 (15g / 11ms) IEC 60870-2-2 (10g / 11ms) | 15g / 11ms and 25g / 10ms |
| 9 | Bump (half sine) IEC 60068-2-29 IEC 60870-2-2 Class 1: 10g / 16ms / 1000 pulses | 10g / 16ms / 1000 pulses |

Insulation, EMC Immunity and CE Declaration

Insulation

| Item | Standard | Test Level |
|------|---|--------------------|
| 1 | Insulation resistance according IEC 60255-5 | >100MOhm / 500V DC |
| 2 | Insulation dielectric withstand voltages according IEC 60255-5 (IEC 60870-2-1 class VW3, ANSI/IEEE C37.90-1989, 1,5kV) | 2,5kV, 50Hz, 1min |

| | | |
|---|--|----------------|
| 3 | Insulation impulse voltage withstand test IEC 60255-5 (IEC 60870-2-1 class VW3) | 5kV (1,2/50µs) |
|---|--|----------------|

EMC Immunity Tests

| Item | Standard | Test Level |
|------|--|-----------------------------------|
| 1 | Electro static discharge immunity IEC 61000-4-2 level 4 (IEC 60870-2-1 A3.1 level 4) (IEC61000-6-2 8/6kV) (IEC 60255-22-2 8/6kV) (ANSI/IEEE C37.90.3-2001, 8kV) | Cubicle: 15/8kV Modules: 8/6kV |
| 2 | Radiated electromagnetic field IEC 61000-4-3 (IEC 60870-2-1 A5.1 level 3) (IEC61000-6-2 10V/m) (IEC 60255-22-3 10V/m) | 10V/m level 3 |
| 3 | Electrical Disturbances 1 MHz Burst IEC 60255-22-1 IEC61000-4 IEC61000-18 | 2.5KV CM, 1.0KV DM |
| 4 | Fast Transient Burst Immunity IEC 61000-4-4 (IEC 60870-2-1 A2.3 level 4) (IEC61000-6-2 A/D=2kV, S=1kV) (IEC 60255-22-4 4kV) (ANSI/IEEE C37.90.1-2002, 4kV) | 4kV Level 4 |
| 5 | Surge Immunity IEC 61000-4-5 (IEC 60870-2-1 A2.2 level 3) (IEC61000-6-2 A=1/2kV, S=1kV) (IEC 60255-22-3 2kV) feeder distributed RTU equipment IEC 61000-4-5 (IEC 60870-2-1 A2.2 level 4) (IEC61000-6-2 A=1/2kV, S=1kV) (IEC 60255-22-3 2kV) | 2kV Class 3 4kV Class 4 |
| 6 | Conducted RF Disturbance Immunity IEC 61000-4-6 (IEC61000-6-2 10V) (IEC 60255-22-6 10V) | 10V Level 3 |

| | | |
|------|---|--------------------------------|
| 7 | Pulse Magnetic Field Immunity IEC 61000-4-9 | 1000A Level 5 |
| | | |
| Item | Standard | Test Level |
| 8 | Damped Oscillatory Waves IEC 61000-4-12 (IEC 60870-2-1 A2.5 level 3-4) (ANSI/IEEE C37.90.1-2002, 2,5kV) | 2,5kV / 1kV Level 3 |
| 9 | Ring Wave IEC 61000-4-12 (IEC 60870-2-1 A2.4 level 3) (ANSI/IEEE C37.90.1-2002, 2,5kV) | 2,5kV Level 4 |
| 10 | Power Frequency Interference 50Hz IEC 61000-4-16 level 4 | 30V cont. 300V / 10s |
| 11 | AC Ripple on DC Supply IEC 60870-2-1 A1.4 level 2 IEC 61000-4-17 level 3 | 12% |
| 12 | Voltage Dips DC IEC 61000-4-29 (IEC 60870-2-1 A1.5 level 1 30% 0,5s) | -30% for 0,1s -60% for 0,1s |
| 13 | Voltage Interruption DC IEC 61000-4-29 (IEC 60870-2-1 A1.5 level 1 | -100% for 10ms |
| | | |

EMC Emission Tests

| Item | Standard | Test Level |
|------|---|---|
| 1 | Enclosure: Radio Interference Field Strength IEC/CISPR 11 / EN50011 | 30dB (30 – 230MHz) 37dB (230 – 1000MHz) |
| 2 | Power Supply: Radio Interference Voltage IEC/CISPR 11 / EN50011 | 79dB (0,15 – 0,5MHz) 73dB (0,5 – 30MHz) |
| | | |

Appendix

Schedule A: Specifications: -

| | | | |
|------------------------------|--|---|--|
| | Mini RTU | | |
| | Number of RTUs | 1 | |
| Supply Voltage | | | |
| | Supply Voltage Value | 110 | |
| | Embedded | Yes | |
| | Permissible variation in voltage level | +/- 10 | |
| General Specification | | | |
| | Time synchronization method | NTP/external GPS or through IEC104 | |
| | Time synchronization period | 1ms | |
| | Communication protocol | IEC 60870-5-104 IEC 60870-5-101 Modbus Serial & TCP/IP DNP3 over TCP/IP IEC 61850 | |
| | Diagnostic LED | Yes | |
| | Operating Temperature | -25°C-+70°C | |
| | Real time clock resolution | 1 ms | |
| | Execution cycle time | 1 ms | |
| | Number of serial ports | 2 | |
| | Baud rate supported | Min. 9600 bit/s (adjustable) or above | |
| | Number of Ethernet Port | 2 | |
| | CPU Watchdog | Yes | |
| | Availability of events time stamping | Yes | |
| | Time resolution for SOE events | 1 ms | |
| | Dimensions | | |

| | | | |
|----------------------------|--|-----------------------------|--|
| | IP | 65 | |
| | Manufacturer | | |
| | Origin | | |
| DI module | | | |
| | Minimum Number of input points for each mini RTU | 60 | |
| | Nominal input voltage | 110 | |
| | Max. Input voltage | | |
| | Galvanic isolation (KV AC for 1 min) | ≥ 1 KV | |
| | Impulse withstand (KV DC for 50 ms) | ≥ 5 KV | |
| | Short Circuit Protection | Yes | |
| | Filter | Yes | |
| DO module | | | |
| | Number of output points for each RTU | 12 | |
| | Type of contact | | |
| | Max. switching voltage | | |
| | Galvanic isolation (KV AC for 1 min) | ≥ 1 KV | |
| | Impulse withstand (KV DC for 50 ms) | ≥ 5 KV | |
| | Output closure time range | 0.5ms – 30s | |
| | Short Circuit Protection | Yes | |
| | Filter | Yes | |
| Communication Modem | | | |
| | Brand | ROBUSTEL - R3000 Lite (L4L) | |
| | Quantity | 1 | |
| | Operating temperature | -40- +75C° | |