

# RUT950 Modbus (legacy WebUI)

[Main Page](#) > [RUT Routers](#) > [RUT950](#) > [RUT950 Manual](#) > [RUT950 Legacy WebUI](#) > [RUT950 Services section \(legacy\)](#) > **RUT950 Modbus (legacy WebUI)**

The information in this page is updated in accordance with firmware version [RUT9XX\\_R\\_00.06.09.5](#).

**Note:** this user manual page is for RUT950's old WebUI style available in earlier FW versions. [Click here](#) for information based on the latest FW version.

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## Contents

- [1 Summary](#)
- [2 Modbus TCP](#)
  - [2.1 Get Parameters](#)
  - [2.2 Set Parameters](#)
- [3 Modbus TCP Master](#)
  - [3.1 Slave device configuration](#)
  - [3.2 Requests configuration](#)
  - [3.3 Alarm configuration](#)
- [4 Modbus Data to Server](#)
  - [4.1 Data sender configuration](#)
- [5 MQTT Gateway](#)
  - [5.1 Request messages](#)
  - [5.2 Response messages](#)
  - [5.3 Examples](#)
- [6 See also](#)

## Summary

**Modbus** is a serial communications protocol. Simple and robust, it has become a de facto standard communication protocol and is now a commonly available means of connecting industrial electronic devices.

This chapter of the user manual provides an overview of the Modbus page for RUT950 devices.

## Modbus TCP

**Modbus TCP** provides users with the possibility to set or get system parameters. The Modbus daemon acts as slave device. That means it accepts connections from a master (client) and sends out a response or sets some system related parameter in accordance with the given query.

The figure below is an example of the Modbus TCP window section and the table below provides information on the fields contained in that window:



| Field                        | Value                                      | Description   |
|------------------------------|--|---|
| Enable                       | yes   no; default: <b>none</b>             | Turns Modbus TCP on or off.   |
| Port                         | integer [0..65535];<br>default: <b>502</b> | TCP port used for Modbus communications.  |
| Device ID                    | integer [0..255];<br>default: <b>1</b>     | The device's Modbus slave ID. When set to 0, it will respond to requests addressed to any ID.                                 |
| Allow Remote Access          | yes   no; default: <b>no</b>               | Allows remote Modbus connections by adding an exception to the device's firewall on the port specified in the field above.    |
| Keep persistent connection   | yes   no; default: <b>no</b>               | If enabled, the connection will not be closed after each completed Modbus request.  |
| Connection timeout           | integer [1..60]; default:<br><b>0</b>      | Timeout in seconds after which the connection will be closed. Use <b>0</b> to use default value provided by Operating System. |
| Enable custom register block | yes   no; default: <b>no</b>               | Allow custom register block   |

## Get Parameters

Modbus parameters are held within **registers**. Each register contains 2 bytes of information. For simplification, the number of registers for storing numbers is 2 (4 bytes), while the number of registers for storing text information is 16 (32 bytes). The register numbers and corresponding system values are described in the table below:

|  | required value | register address | register number | number of registers | representation          |
|--|----------------|------------------|-----------------|---------------------|-------------------------|
| System uptime                          |                | 1                | 2               | 2                   | 32 bit unsigned integer |
| Mobile signal strength (RSSI in dBm)   |                | 3                | 4               | 2                   | 32 bit integer          |
| System temperature (in 0.1 °C)         |                | 5                | 6               | 2                   | 32 bit integer          |
| System hostname                        |                | 7                | 8               | 16                  | Text                    |
| GSM operator name                      |                | 23               | 24              | 16                  | Text                    |
| Router serial number                   |                | 39               | 40              | 16                  | Text                    |
| LAN MAC address                        |                | 55               | 56              | 16                  | Text                    |
| Router name                            |                | 71               | 72              | 16                  | Text                    |
| Currently active SIM card slot         |                | 87               | 88              | 16                  | Text                    |
| Network registration info              |                | 103              | 104             | 16                  | Text                    |
| Network type                           |                | 119              | 120             | 16                  | Text                    |
| Current WAN IP address                 |                | 139              | 140             | 2                   | 32 bit unsigned integer |
| Mobile data received today (SIM1)      |                | 185              | 186             | 2                   | 32 bit unsigned integer |
| Mobile data sent today (SIM1)          |                | 187              | 188             | 2                   | 32 bit unsigned integer |
| Mobile data received this week (SIM1)  |                | 189              | 190             | 2                   | 32 bit unsigned integer |
| Mobile data sent this week (SIM1)      |                | 191              | 192             | 2                   | 32 bit unsigned integer |
| Mobile data received this month (SIM1) |                | 193              | 194             | 2                   | 32 bit unsigned integer |
| Mobile data sent this month (SIM1)     |                | 195              | 196             | 2                   | 32 bit unsigned integer |
| Mobile data received last 24h (SIM1)   |                | 197              | 198             | 2                   | 32 bit unsigned integer |
| Mobile data sent last 24h (SIM1)       |                | 199              | 200             | 2                   | 32 bit unsigned integer |
| Active SIM card                        |                | 205              | 206             | 1                   | 32 bit unsigned integer |
| Mobile data received last week (SIM1)  |                | 292              | 293             | 2                   | 32 bit unsigned integer |
| Mobile data sent last week (SIM1)      |                | 294              | 295             | 2                   | 32 bit unsigned integer |
| Mobile data received last month (SIM1) |                | 296              | 297             | 2                   | 32 bit unsigned integer |
| Mobile data sent last month (SIM1)     |                | 298              | 299             | 2                   | 32 bit unsigned integer |
| Mobile data received today (SIM2)      |                | 300              | 301             | 2                   | 32 bit unsigned integer |
| Mobile data sent today (SIM2)          |                | 302              | 303             | 2                   | 32 bit unsigned integer |
| Mobile data received this week (SIM2)  |                | 304              | 305             | 2                   | 32 bit unsigned integer |
| Mobile data sent this week (SIM2)      |                | 306              | 307             | 2                   | 32 bit unsigned integer |
| Mobile data received this month (SIM2) |                | 308              | 309             | 2                   | 32 bit unsigned integer |
| Mobile data sent this month (SIM2)     |                | 310              | 311             | 2                   | 32 bit unsigned integer |
| Mobile data received last 24h (SIM2)   |                | 312              | 313             | 2                   | 32 bit unsigned integer |
| Mobile data sent last 24h (SIM2)       |                | 314              | 315             | 2                   | 32 bit unsigned integer |
| Mobile data received last week (SIM2)  |                | 316              | 317             | 2                   | 32 bit unsigned integer |
| Mobile data sent last week (SIM2)      |                | 318              | 319             | 2                   | 32 bit unsigned integer |
| Mobile data received last month (SIM2) |                | 320              | 321             | 2                   | 32 bit unsigned integer |
| Mobile data sent last month (SIM2)     |                | 322              | 323             | 2                   | 32 bit unsigned integer |

|   |     |     |    |                         |
|---|-----|-----|----|-------------------------|
| Digital non-isolated input (4 PIN connector)    | 324 | 325 | 1  | 32 bit unsigned integer |
| Digital open collector output (4 PIN connector) | 325 | 326 | 1  | 32 bit unsigned integer |
| IMSI  | 348 | 349 | 16 | Text                    |

## Set Parameters

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The Modbus daemon can also set some device parameters. These parameters and explanations on how to use them are described in the table below:

| value to set                            | register address | register number | register value | description  |
|---|------------------|-----------------|----------------|--|
| Hostname                                | 7                | 8               | Hostname       | Changes hostname   |
| Device name                             | 71               | 72              | Device name    | Changes device name  |
| Switch WiFi (ON/OFF*)                   | 203              | 204             | 1   0          | Turns WiFi ON or OFF   |
| Switch mobile data connection (ON/OFF*) | 204              | 205             | 1   0          | Turns mobile data connection ON or OFF   |
| Switch SIM card                         | 205              | 206             | 1   2   0      | Changes the active SIM card slot<br><ul style="list-style-type: none"> <li>• 1 - switch to SIM1</li> <li>• 2 - switch to SIM2</li> <li>• 0 - switch from the the SIM card opposite of the one currently in use (SIM1 → SIM2 or SIM2 → SIM1)</li> </ul>   |
| Reboot                                  | 206              | 207             | 1              | Reboots the router   |
| Change APN                              | 207              | 208             | APN code       | Changes APN.<br>The number of input registers may vary depending on the length of the APN, but the very first byte of the set APN command denotes the number of the SIM card for which to set the APN. This byte should be set to:<br><ul style="list-style-type: none"> <li>• 1 - to set APN for SIM1</li> <li>• 2 - to set APN for SIM2</li> </ul> |
| Switch PIN4 state (ON/OFF*)             | 325              | 326             | 1   0          | Turns PIN4 state ON or OFF   |

\* All ON/OFF commands only accept **0** and **1** values, which represent the following:

- 1 - ON
- 0 - OFF

## Modbus TCP Master

A Modbus **master** device can request data from Modbus slaves. The Modbus TCP Master section is used to configure Modbus TCP slaves. You can create a maximum of 10 slave configurations.

### Slave device configuration

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The figure below is an example of the **Slave device configuration** and the table below provides information on the fields contained in that section:



| Field      | Value                                  | Description  |
|------------|--|--|
| Enabled    | yes   no; default: <b>no</b>           | Turns communication with the slave device on or off.   |
| Name       | string; default: <b>none</b>           | Slave device's name, used for easier management purposes.  |
| Slave ID   | integer [0..255]; default: <b>none</b> | Slave ID. Each slave in a network is assigned a unique identifier ranging from 1 to 255. When the master requests data from a slave, the first byte it sends is the Slave ID. When set to 0, the slave will respond to requests addressed to any ID. |
| IP address | ip; default: <b>none</b>               | Slave device's IP address.   |

|         |  |  |
|---------|--|--|
| Port    | integer [0..65535]; default: <b>none</b> | Slave device's Modbus TCP port.                          |
| Period  | integer [1..6400]; default: <b>60</b>    | Interval at which requests are sent to the slave device. |
| Timeout | integer [1..30]; default: <b>5</b>       | Maximum response wait time.                              |

## Requests configuration

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A Modbus **request** is a way of obtaining data from Modbus slaves. The master sends a request to a slave specifying the function code to be performed. The slave then sends the requested data back to the Modbus master. You can create a maximum of 64 request configurations for each slave device.

**Note:** Modbus TCP Master uses *Register Number* instead of *Register Address* for pointing to a register. For example, to request the *Uptime* of a device, you must use **2** in the *First Register* field.

The figure below is an example of the Requests configuration section and the table below provides information contained in the fields of that section:



| Field               | Value  | Description  |
|---------------------|--|--|
| Name                | string; default: <b>Unnamed Parameter</b>  | Request name. Used for easier management purposes.   |
| Data type           | Hex   Ascii   8bit INT   8bit UINT   16bit INT, high byte first   16bit INT, low byte first   16bit UINT, high byte first   16bit UINT, low byte first   32bit float, Byte order 1,2,3,4   32bit float, Byte order 4,3,2,1   32bit float, Byte order 2,1,4,3   32bit float, Byte order 3,4,1,2; default: <b>16bit INT, high byte first</b> | How read data will be stored.  |
| Function            | 1   2   3   4   5   6   15   16; default: <b>3</b>   | <p>A function code specifies the type of register being addressed by a Modbus request. The codes represent these functions:</p> <ul style="list-style-type: none"> <li>• <b>1</b> - read Coil Status</li> <li>• <b>2</b> - read Input Status</li> <li>• <b>3</b> - read Holding Registers</li> <li>• <b>4</b> - read Input Registers</li> <li>• <b>5</b> - force Single Coil</li> <li>• <b>6</b> - preset Single Register</li> <li>• <b>15</b> - force Multiple Coils</li> <li>• <b>16</b> - force Multiple Registers</li> </ul> |
| First Register      | integer [1..65536]; default: <b>1</b>  | <p>First Modbus register number from which data will be read.</p> <p><b>Note</b> - RUT9XX Modbus Master uses register numbers, which value is +1 higher than address value.</p>  |
| Number of Registers | integer [1..2000]; default: <b>none</b>  | Number of Modbus registers that will be read during the request.   |
| Enabled             | yes   no; default: <b>no</b>   | Turns the request on or off.   |

|        |                        |  |
|--------|------------------------|--|
| Test   | - (interactive button) | Generates a Modbus request according to given parameters in order to test the request configuration. You must first save the configuration before you can use the Test button. |
| Delete | - (interactive button) | Deletes the request.   |
| Add    | - (interactive button) | Adds a new request configuration.  |

## Alarm configuration

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**Alarms** are a way of setting up automated actions when some Modbus values meet user specified conditions. The figure below is an example of the Alarm configuration page and the table below provides information on fields that it contains:



| Field                             | Value  | Description  |
|-----------------------------------|--|--|
| Enabled                           | yes   no; default: <b>no</b>   | Turns the alarm on or off  |
| Function code                     | Read Coil Status (1)   Read Input Status (2)   Read Holding Registers (3)   Read Input Registers (4); default: <b>Read Coil Status (1)</b> | Modbus function used in Modbus request.  |
| Register                          | integer [0..65535]; default: <b>none</b>   | Number of the Modbus coil/input/holding register/input register that will be read.   |
| Condition                         | More than   Less than   Equal to   Not Equal to; default: <b>Equal to</b>  | When a value is obtained it will be compared against the value specified in the following field. The comparison will be made in accordance with the condition specified in this field.   |
| Value                             | various; default: <b>none</b>  | The value against which the read data will be compared.  |
| Action                            | <b>SMS</b>   <b>Trigger output</b>   <b>Modbus Request</b> ; default: <b>SMS</b>   | Action that will be taken if the condition is met. Possible actions: <ul style="list-style-type: none"> <li>• <b>SMS</b> - sends an SMS message to a specified recipient(s).</li> <li>• <b>Trigger output</b> - changes the state of a specified output(s).</li> <li>• <b>Modbus Request</b> - sends a Modbus request to a specified slave.</li> </ul> |
| <b>SMS: Message</b>               | string; default: <b>none</b>   | SMS message text.  |
| <b>SMS: Phone number</b>          | phone number; default: <b>none</b>   | Recipient's phone number.  |
| <b>Trigger output: Output</b>     | Open collector output   Relay output   Both; default: <b>Open collector output</b>   | Which output(s) will be triggered.   |
| <b>Trigger output: I/O Action</b> | Turn On   Turn Off   Invert; default: <b>Turn On</b>   | Action that will be taken on the specified output.   |
| <b>Modbus Request: IP address</b> | ip   host; default: <b>none</b>  | Modbus slave's IP address.   |

|   |  |   |
|---|--|---|
| <b>Modbus Request:</b><br>Port                | integer [0..65535]; default: <b>none</b>   | Modbus slave's port.  |
| <b>Modbus Request:</b><br>Timeout             | integer [1..30]; default: <b>5</b>   | Maximum time to wait for a response.  |
| <b>Modbus Request:</b><br>ID                  | integer [1..255]; default: <b>none</b>   | Modbus slave ID.  |
| <b>Modbus Request:</b><br>Modbus function     | Read Coil Status (1)   Read Input Status (2)   Read Holding Registers (3)   Read Input Registers (4)   Force Single Coil (5)   Preset Single Register (6)   Force Multiple Coils (15)   Force Multiple Registers (16); default: <b>Force Single Coil (5)</b> | A function code specifies the type of register being addressed by a Modbus request. |
| <b>Modbus Request:</b><br>First register      | integer [0..65535]; default: <b>none</b>   | Begins reading from the register specified in this field.                           |
| <b>Modbus Request:</b><br>Number of registers | integer [0..65535]; default: <b>none</b>   | The number of registers that will be read from the first register.                  |

## Modbus Data to Server

The Modbus **Data to Server** function provides you with the possibility to set up senders that transfer data collected from Modbus slaves to remote servers. To add a new data sender, enter the server's address, specify the data sending period and click the "Add" button:



### Data sender configuration

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When you add a new data sender, you will be redirected to its configuration window. The figure below is an example of that window and the table below provides information on the fields that it contains:



| Field         | Value   | Description  |
|---------------|---|--|
| Enabled       | yes   no; Default: <b>no</b>  | Turns the data sender ON or OFF                              |
| Name          | string; Default: <b>none</b>  | Data sender's name. used for easier management purposes      |
| Protocol      | <b>HTTP(S)</b>   <b>MQTT</b> ; Default: <b>HTTP(S)</b>                        | Data sending protocol  |
| JSON format   | json string; Default: <b>{"ID": "%i", "TS": "%t", "ST": "%s", "VR": "%a"}</b> | Provides the possibility to fully customize the JSON segment |
| Segment count | 1   2   3   4   5   6   7   8   9   10   All; Default: <b>1</b>               | Max segment count in one JSON string sent to server.         |

|                                |  |  |
|--------------------------------|--|--|
| URL / Host / Connection string | host   ip; Default: <b>none</b>                                | Address of the server to which the data will be sent.<br><b>Important note:</b> when using HTTPS, remember to add the <b>https://</b> prefix before the URL. |
| Period                         | integer [1..6400]; Default: <b>none</b>                        | Data sending frequency (in seconds)  |
| HTTP(S): Data filtering        | All data   By slave ID   By slave IP; Default: <b>All data</b> | Which data this sender will transfer to the server   |
| HTTP(S): Retry on fail         | yes   no; Default: <b>no</b>                                   | Specifies whether the data sender should retry failed attempts   |
| HTTP(S): Custom header         | string; Default: <b>no</b>                                     | Adds a custom header(s) to HTTP requests   |
| MQTT: Port                     | integer [0..65535]; Default: <b>none</b>                       | Port used to connect to host.  |
| MQTT: Keepalive                | integer [1..640]; Default: <b>none</b>                         | MQTT keepalive period in seconds.  |
| MQTT: Topic                    | string; Default: <b>none</b>                                   | Write topic to which your data will be sent.<br>This field defines the guarantee of delivery for specific message.   |
| MQTT: QoS                      | 0   1   2; Default: <b>0</b>                                   | Possible values are: <ul style="list-style-type: none"> <li>• At most once (0)</li> <li>• At least once (1)</li> <li>• Exactly once (2)</li> </ul>           |
| MQTT: Use TLS                  | yes   no; Default: <b>no</b>                                   | Turns TLS authentication on or off.  |

## MQTT Gateway

The **MQTT Gateway** function is used to transfer Modbus data (send requests, receive responses) over MQTT. When it is enabled, the device (this RUT950) subscribes to a REQUEST topic and publishes on a RESPONSE topic on a specified MQTT broker. It translates received MQTT message payload to a Modbus request and relays it to the specified Modbus TCP slave.

When the MQTT Gateway receives a response from the slave, it translates it to an MQTT message and publishes it on the RESPONSE topic.



Below is an example of the MQTT Gateway page. Refer to the table for information on MQTT Gateway configuration fields.



| Field         | Value                                    | Description                               |
|---------------|--|---|
| Enable        | off   on; default: <b>off</b>            | Turns MQTT gateway on or off.             |
| Host          | ip   host; default: <b>127.0.0.1</b>     | IP address or hostname of an MQTT broker. |
| Port          | integer [0..65535]; default: <b>1883</b> | Port number of the MQTT broker.           |
| Request topic | string; default: <b>request</b>          | MQTT topic for sending requests.          |

|   |  |
|---|--|
| Response topic string; default: <b>response</b> | MQTT topic for subscribing to responses.   |
| Username string; default: <b>none</b>           | Username for authentication to the MQTT broker. Leave empty if you do not use client authentication. |
| Password string; default: <b>none</b>           | Password for authentication to the MQTT broker. Leave empty if you do not use client authentication. |

## Request messages

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**Note:** MQTT Gateway uses *Register Number* instead of *Register Address* for pointing to a register. For example, to request the *Uptime* of a device, you must use **2** in the *Register Number* field.

Modbus request data sent in the MQTT payload should be generated in accordance with the following format:

**0** <COOKIE> <IP\_TYPE> <IP> <PORT> <TIMEOUT> <SLAVE\_ID> <MODBUS\_FUNCTION>  
<REGISTER\_NUMBER> <REGISTER\_COUNT/VALUE>

Explanation:

- **0** - must be 0, which signifies a textual format (currently the only one implemented).
- **Cookie** - a 64-bit unsigned integer in range [0..2<sup>64</sup>]. A cookie is used in order to distinguish which response belongs to which request, each request and the corresponding response contain a matching cookie: a 64-bit unsigned integer.
- **IP type** - host IP address type. Possible values:
  - **0** - IPv4 address;
  - **1** - IPv6 address;
  - **2** - hostname that will be resolved to an IP address.
- **IP** - IP address of a Modbus TCP slave. IPv6 must be presented in full form (e.g., *2001:0db8:0000:0000:0000:8a2e:0370:7334*).
- **Port** - port number of the Modbus TCP slave.
- **Timeout** - timeout for Modbus TCP connection, in seconds. Range [1..999].
- **Slave ID** - Modbus TCP slave ID. Range [1..255].
- **Modbus function** - Only these are supported at the moment:
  - **3** - read holding registers;
  - **6** - write to a single holding register;
  - **16** - write to multiple holding registers.
- **Register number** - number of the first register (in range [1..65536]) from which the registers will be read/written to.
- **Register count/value** - this value depends on the Modbus function:
  - **3** - register count (in range [1..125]); must not exceed the boundary (first register number + register count ≤ 65537);
  - **6** - register value (in range [0..65535]);
  - **16** - register count (in range [1..123]); must not exceed the boundary (first register number + register count ≤ 65537); and register values separated with commas, without spaces (e.g., *1,2,3,654,21,789*); there must be exactly as many values as specified (with register count); each value must be in the range of [0..65535].

## Response messages

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A special response message can take one of the following forms:

<COOKIE> OK - for functions 6 and 16  
<COOKIE> OK <VALUE> <VALUE> <VALUE>... - for function 3, where <VALUE>  
<VALUE> <VALUE>... are read register values  
<COOKIE> ERROR: ... - for failures, where ... is the  
error description

## Examples

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Below are a few **examples** of controlling/monitoring the internal Modbus TCP Slave on RUT950.

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### Reboot the device

- Request:  
0 65432 0 192.168.1.1 502 5 1 6 206 1
  - Response:  
65432 OK
- 

### Retrieve uptime

- Request:  
0 65432 0 192.168.1.1 502 5 1 3 2 2
  - Response:  
65432 OK 0 5590
- 

If you're using Eclipse Mosquitto (MQTT implementation used on RUT950), Publish/Subscribe commands may look something like this:

### Retrieve uptime

- Request:  
mosquitto\_pub -h 192.168.1.1 -p 1883 -t request -m "0 65432 0  
192.168.1.1 502 5 1 3 2 2"

- Response:

```
mosquitto_sub -h 192.168.1.1 -p 1883 -t response  
65432 OK 0 5590
```

## See also

- [Monitoring via Modbus](#) - detailed examples on how to use Modbus TCP