

TITAN

Application Note 55

Reading Modbus Devices and Sending the Data to an
MQTT Broker and Occasionally to a Modbus TCP-RTU
Remote Gateway

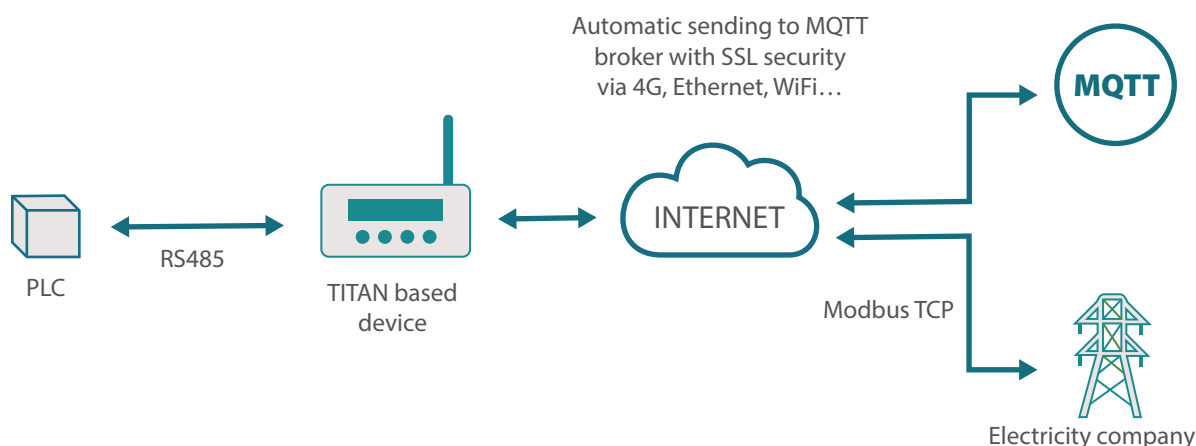
Reading Modbus devices and Sending the Data to an MQTT Broker and Occasionally to a Modbus TCP-RTU Remote Gateway

1. Scenario Details

TITAN-based devices have all the typical functionalities of 4G/3G/2G routers, as well as a series of added features that make them one of the most feature-packed routers on the market. One of the added features is the ability to autonomously interrogate Modbus RTU and TCP devices and subsequently to send the data to a WEB, FTP or MQTT server, together with the ability to establish an occasional Modbus TCP-RTU remote gateway. As always, this capability will be illustrated using a simple example.

2. Description of the Example

- We have a PLC with an RS485 serial port configured to 9600.8;N.1.
- The PLC has Modbus communications in SLAVE mode and Modbus registers 10,11,12,13 and 14 need to be read from it.
- The device must be configured to read the PLC's Modbus registers every minute. After reading the PLC registers, the TITAN-based device must store the values in its internal memory and, if 4G coverage is available, send the data to an MQTT broker in a JSON object.
- The PLC allows its own firmware to be updated via Modbus TCP. For this reason, the TITAN-based device must be configured to establish a Modbus TCP - Modbus RTU gateway on port 502 via 4G.
- When a connection is made on TCP port 502 of the TITAN-based device, a Modbus TCP - Modbus RTU gateway will be established that will allow remote and direct access to the PLC to update the PLC firmware. When said gateway is established, the Titan device's autonomous communication to read the Modbus registers must be interrupted. When the connection through TCP port 502 is terminated (the PLC FW upgrade is complete), autonomous communication should be re-established.



3. Configuring the Serial Port of the TITAN-based Device to Which the Modbus Devices will be Connected

Let's imagine that the PLCs, which have an RS485 port, have the following serial port configuration: 9600,8,N,1. First we must configure the Serial Port2-RS485 section of the TITAN-based device. We will configure it as shown below:



webdyn
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- Mobile
 - Status
 - Basic Settings
 - Keep Online
- Ethernet
 - Basic Settings
- Firewall
 - Authorized IPs
- Serial Settings
 - Serial Port1-RS232
 - Serial Port2-RS485**
 - SSL Certificates
- External Devices
 - Logger configuration

Serial Gateway ▶ Com2 Settings

Baudrate:	9600	Baudrate of serial port
Data bits:	8	Number of data bit
Parity:	none	Parity
Stop bits:	1	Number of stop bits
Timeout ms:	0	msec without serial data before sending (default: 50)

☐ Allow local embedded AT commands Ex.: <MTXTUNNEL>AT</MTXTUNNEL>

☐ Allow remote embedded AT commands Ex.: <MTXTUNNELR>AT</MTXTUNNELR>

☐ Allow incoming GSM call (CSD Data Call) Only TCP Server and TCP Client functions or Nothing

In the lower area of the same screen, we must also select the option “Function: Serial – IP Gateway (Modbus TCP / Modbus RTU)”.

- Firmware Upgrade
- Reboot
- Logout

● **Function: Serial – IP Gateway (ModBus TCP / ModBus RTU)**

TCP Local Port:	502	Listening TCP Port (1 ... 65535). Normally 502
SSL/TLS enabled	☐	SSL/TLS Enabled (SSL Certs needed)

4. Configuring the TITAN to Read Modbus Devices

To do this, click on the link: “External Devices > Modbus Devices” and configure it as shown below:

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- Mobile
 - Status
 - Basic Settings
 - Keep Online
- Ethernet
 - Basic Settings
- Firewall
 - Authorized IPs
- Serial Settings
 - Serial Port1-RS232
 - Serial Port2-RS485
 - SSL Certificates
- External Devices
 - Logger configuration
 - ModBus Devices**
 - Generic Serial Device
 - Temperature Sensor
 - IEC102 Meter
 - W-MBus
- Other
 - AT Command
 - DynDns
 - Private DynDns
 - Sms control
 - Periodic Autoreset
 - Time Servers
 - Remote Console

External Devices > ModBus RTU / TCP

Enabled: ☒

Serial Port: Serial Port 2

Logger: ☒

Enable Modbus Devices

Select the connected serial port if needed

Check if logger must be used

Please, configure logger before using this option

SAVE CONFIGVIEW LOG

Dev. name / ID	Addr.	Command	Start @	Num word/bit	Reg Type	Period		
1	1	0x03	10	5	WORD	1	Del	Test

Device name / ID:

Address:

Command: 0x01

Start:

Number Words / Bits:

Reg Type: WORD

Period: 1

Insert the device name or ID

Modbus RTU address or IP:port address

Modbus read command

Address of the first register

Words for command 0x03/0x04. Bits for 0x01/0x02

Type of registers for command 0x03/0x04

Read period (minutes)

We want to read registers 10,11,12,13,14 from the PLC. Simply enter register 10 in the “Start” field and 5 in the “Number Words” field (as we want to read 5 records, from 10 to 14).

5. Configuring the Logger (communication with the MQTT server)

The next step is to configure the Logger. This is the system in the TITAN-based device that stores the data and sends it. In this example we are going to configure the device to send the data to an MQTT broker.

For the MQTT broker we will use the HiveMQ test broker and the client <http://www.hivemq.com/demos/websocket-client/>. The data will be sent in JSON format after each read (timestamp, device ID, etc.).

As seen in the following figure, we will use the “External Devices > Logger Configuration” menu to configure the section as shown below:

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flexitron group

External Devices > Logger

ID: Optional. Device identification

Send mode: Send mode (normally FIFO)

Time format: Time format used in timestamp logger data

Use script: ☐ Check for customized json using 'Json Transformer Script' in [Script section](#).

Use array: ☐ Check if you want to send more than one JSON per transmission.

Communication mode: MQTT

Enabled: ☒ Communication mode MQTT enabled

MQTT Topic: MQTT Topic. Example: [IMEI]/logger

Note: Other > MQTT menu must be configured

In this screen we have activated MQTT mode. All data collected by the TITAN-based device will be published in the [IMEI]/logger topic. Note that the device will replace the [IMEI] tag with your actual IMEI. This means that, if the device's IMEI is 357299070082380 (the IMEI can be found in the Mobile > Status menu), the topic used by the TITAN-based device to publish the collected Modbus data will be: 357299070082380/logger.

Conversely, if we activate logger mode, we must configure the MQTT client in the “Other -> Mqtt” section.

- Serial Port2-RS485
- SSL Certificates
- External Devices
 - Logger configuration
 - ModBus Devices
 - Generic Serial Device
 - Temperature Sensor
 - IEC102 Meter
 - W-MBus
- Other
 - AT Command
 - DynDns
 - Private DynDns
 - Sms control
 - Periodic Autoreset
 - Time Servers
 - Remote Console
 - Snmp
 - Tacacs+
 - Mqtt**
 - Http / Https
 - User Permissions
 - Passwords Web UI
 - CA Certificates
 - Email Config
 - ModBus Slave
 - Titan Scripts
 - Connectivity tools
 - Digital I/O
 - Custom Skin
 - Led Config
 - Syslog
 - Backup / Factory
 - Firmware Upgrade
 - Reboot
 - Logout

Other ▶ MQTT Client

Enabled:	☒	Enable MQTT client
MQTT Broker	tcp://broker.mqttdashboard.com:1883	Destination MQTT Broker. Examples: tcp://test.mosquitto.org:1883 ssl://test.mosquitto.org:8883 (certificate needed) ssl://test.mosquitto.org:8884 (certificates needed)
MQTT Username		MQTT Username (blank if not used)
MQTT Password		MQTT Password (blank if not used)
MQTT ID	[IMEI]	Device identification
MQTT Qos	1	MQTT Quality Of Service (0 ... 2)
MQTT Keepalive	60	Seconds for keepalive (30 ... 3600)
MQTT Persistence	☐	Data persistence
MQTT AT Topic	[IMEI]/AT	This topic will be subscribed for receiving AT Commands (usefull for individual device)
MQTT AT Resp Topic	[IMEI]/ATR	This topic will be used for publishing the AT Command Responses of AT Topic
MQTT AT Topic 2		This topic will be subscribed for receiving AT Commands (usefull for groups)
MQTT AT Resp Topic 2		This topic will be used for publishing the AT Command Responses of AT Topic 2
MQTT AT Topic 3		This topic will be subscribed for receiving AT Commands (usefull for all devices)
MQTT AT Resp Topic 3		This topic will be used for publishing the AT Command Responses of AT Topic 3
MQTT Script Topic 1		When data is received in this topic the 'Topic Script' will be executed.
MQTT Script Topic 2		When data is received in this topic the 'Topic Script' will be executed.

Activate the Enabled field. In the “MQTT Broker” field we will enter: `tcp://broker.mqttdashboard.com:1883`, indicating the URL of the MQTT broker we want to connect to. Enter a unique identifier for our device in MQTT ID (a broker cannot have 2 devices with the same ID as this will cause continuous interruptions). If we want to be able to send AT commands to the TITAN-based device (e.g. to configure it or view the status from a mobile phone which is also connected to the MQTT broker), we must add the MQTT AT Topic and MQTT AT Response Topic fields.

All AT commands sent to the broker, to the MQTT AT Topic, will be executed by the TITAN-based device. Once executed, the result of the AT command will be published by the TITAN-based device in the MQTT AT Response Topic.

6. Other Considerations

- After configuring the TITAN-based device we will need to perform for the new configuration to take effect and start reading and sending.
- Each time the TITAN-based device sends a measurement to the MQTT broker, it does so using a JSON object of the following type:

PLC JSON Example

```
{"IMEI":"357299070082380","TYPE":"MODB","TS":"2022-07-15T10:14:02Z","ID":"1","A":"1","ST":"10","N":"5","V":[10,11,12,0,0],"P":"ID-1234"}
```

Where:

IMEI - indicates a unique identifier for the modem

TYPE: indicates the type of datum (MODB = Modbus reading)

TS: indicates the Timestamp (the time the measurement was read)

ID: name or identifier of the Modbus device

A: Modbus device's address

ST: indicates the address of the first Modbus register read

STX: an array that indicates the address of the first Modbus registers when reading groups of registers

N: indicates the number of words read

NX: an array that indicates the number of words read when reading groups of registers

PX: an array indicating the position of the initial register of each block within V.

V: An array containing the data read

P: indicate the ID field configured in the Logger

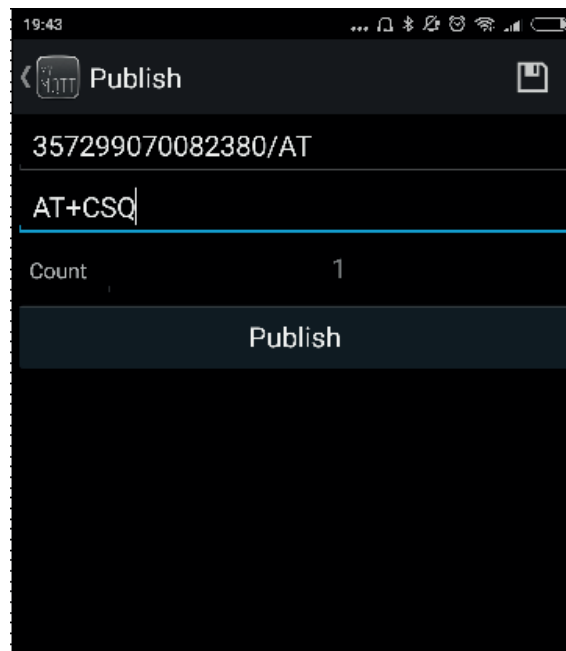
7. Remote Communication with a PLC via Modbus

In previous chapters we configured a Modbus TCP – Modbus RTU gateway on TCP port 502 within the TITAN-based device. Using this we can connect to the PLC both remotely and directly to update its firmware. By establishing a connection with the public IP of the TITAN based device (4G) via TCP port 502, autonomous reading of the Modbus registers will be suspended (to avoid collisions), and the Modbus TCP to Modbus RTU gateway will start operating, so allowing direct connection with the PLC remotely.

8. Communication with TITAN-based Devices Using AT Commands Sent by MQTT

As we mentioned above, we can send AT commands to the TITAN-based device via MQTT. We can use these to change the device's configuration, check conditions such as coverage, reset it, switch a relay, etc.

If we want to check the coverage, we can use the Android myMQTT program, sending the AT+CSQ command to the [IMEI]/AT topic, which in this example is 357299070082380/AT.



Clicking on the “Publish” button, the command will be received by the TITAN-based device and executed. The response will be published by the TITAN-based device in topic 357299070082380/ATR, as configured above.

