SETUP AND OPERATION

CHAPTER 2

In This Chapter...

Getting Started2-2
Setup Network Connection2-3
Setup Modbus Communications Channel2-4
Setup Modbus Devices
Configure Modbus Device2-6
Configure Modbus Variables2-7
Configure MQTT Topics2-8
Configure MQTT Broker
Other Options
Date & Time
Import/Export Configuration2-14
Change Password2-15
Logout
Maintenance
Recovery Mode2-18
Maintenance
Firmware Upgrade2-19
Reboot and Return to Normal Mode2-19

Getting Started

Before you begin setting up the MQTT gateway, please make sure the following conditions are met:

- 1. The hardware is installed as described in the Mounting and Wiring sections of Chapter 1.
- 2. You have the necessary connection information on hand to connect to your MQTT broker.
- 3. You have a device on hand with a web browser and the ability to connect to the MQTT gateway via its RJ-45 Ethernet port, either over a LAN or directly with a crossover cable.

The device is configured through its web interface. The web interface uses the HTTP (unsecure) protocol on port 80. To begin, connect to the device via an Internet browser. The default Ethernet configuration is:

- IP address : 192.168.1.100
- Subnet Mask : 255.255.255.0
- Default Gateway: 192.168.1.1
- User Name: admin
- Password: password

Setup Network Connection

To change the network parameters, select **Network interfaces** from the **More Options** (**:**) menu in the upper right corner of the web UI.

SGW-MQ1611-WF		ŧ	
HM: 2.1.1-W FN: 1.7.3-W			📩 Network interfaces
CHANNELS	DEVICES	MQTT	C Date & time
			↑↓ Import/export configuration
			Change password
			A Maintenance
			→ Logout

Enter the desired network parameters and click SAVE, then CONFIRM the changes.

	2
Subnet mask * 255.255.255.0	
Alternate DNS	
× 8.8.4.4	×
	Subnet mask* 255.255.255.0 Alternate DNS × 8.8.4.4

To verify the settings, reopen the **Network interfaces** screen and click **TEST INTERNET CONNECTION**.

Setup Modbus Communications Channel

The gateway can communicate over both RS-485 and Ethernet. Before setting up a Modbus device in the gateway, you must configure the RS-485 or Ethernet communications channel.

Click on the CHANNEL tab to define the Modbus communications parameters.

SGW-MQ1611		:
CHANNELS	DEVICES	MQTT
		SORT BY 🗸
	No channels have been configured yet.	
	+	

Click the "+" icon to add a new channel, or click on an existing channel to edit it.

Channel 1						×
Name Channel 1			Communication protoco Modbus RTU	4		•
Baud Rate	Data bits • 8	*	Stop bits 1	*	Parity None	*
Timeout (ms) 1000						
Queue delay (ms) 20			Device delay (ms) 1000			
						SAVE

- Enter a **Name** for the channel
- Select the **Communications protocol**. You can create one Modbus RTU channel, and one or more Modbus TCP or Modbus RTU over TCP channels.
- For Modbus RTU, enter the **Baud Rate**, **Data bits**, **Stop bits**, and **Parity**.
- For Modbus TCP or RTU over TCP, enter the IP address and TCP Port of the Modbus device.
- Enter the **Timeout** value (the maximum time in ms within which a valid response must be received from the Modbus device).
- Enter the Queue delay (the time in ms to wait between two Modbus requests)
- Enter the **Device delay** (the time in ms to wait between querying two Modbus devices)

Click **SAVE** when finished configuring the channel.

Setup Modbus Devices

The gateway can communicate with up to 32 Modbus RTU Slaves via RS-485 and up to eight Modbus TCP Servers or Modbus RTU over TCP Servers via Ethernet. After the communications channels are defined, you can configure the connection and variables for each Modbus device.

Configure Modbus Device

Click on the **DEVICES** tab to define the Modbus devices to be queried.



Click the "+" icon to add a new device, or click on an existing device to edit it.

		×
		Generic
	Channel	
Name*	None	~
Block sampling	+	
		SAVE

- Enter a **Name** for the device.
- Select an existing **Channel** for the device.
- Enter the device **Address (Unit ID)**.
- Check **Block sampling** to combine contiguous variables into one query

Configure Modbus Variables

Add each variable to be read from or written to the Modbus device by clicking the "+" icon.

Set variable		×
Read-only		
Format 16 bit (INT)	🚽 🔽 Unsigned	
Variable name *	Address *	
Function Code (read) *	*	
Conversion		
Measured value 1 0	Engineering value 1 0	
Measured value 2 1	Engineering value 2 1	
Validity		
Function Code (read) *	Address *	
Operator *	Value* ▼ 0	
		ОК

- Uncheck **Read-only** to make the variable writable, if desired.
- Select the Format for the variable, and check Unsigned if necessary. Available variable formats are:

Modbus Variable Formats			
Category	Format		
Digital	1 bit		
Integer	16 bit (INT) signed or unsigned		
	32 bit (INT) Big endian signed or unsigned		
	32 bit (INT) Little endian signed or unsigned		
Floating Point	32 bit (FP) Big endian		
	32 bit (FP) Little endian		

- Enter a **Variable name**.
- Enter the Modbus **Address** for the variable.
- Select the Modbus **Function Code** to read the variable and to write the variable if not read-only. Valid function codes for each variable type are shown below.

Modbus Read Function Codes				
Variable Type	Read Function Codes	Write Function Codes		
1 hit	01 - Read Coil Status	05 - Force Single Coil		
	02 - Read Input Status	15 - Force Multiple Coils		
16 bit (INT)		06 - Preset Single Register		
		16 - Preset Multiple Registers		
32 bit (INT) Big endian	03 - Read Holding Registers			
32 bit (INT) Little endian	04 - Read Input Registers	16 Droppt Multiple Degisters		
32 bit (FP) Big endian		ro - Preser multiple Registers		
32 bit (FP) Little endian				

- To linearly scale the values, if desired, define two raw measured values, **Measured value 1** and **Measured value 2**, and enter the desired final values for each, respectively, as **Engineering value 1** and **Engineering value 2**.
- If **Validity** is checked, set an additional **Address** to be compared to a preset **Value** to determine current validity of the variable's data.

Configure MQTT Topics

Enable the checkbox by each variable to be sent via MQTT or controlled via MQTT, and enter the MQTT message parameters.



NOTE: The MQTT Gateway allows arbitrary naming of message topics. Your MQTT broker may require that topic names have a particular structure.

RW Relay1			1
Topic (PUB)		QoS	
BX-MBIO/BX-MBIO_1/Relay1		\mathbf{O}	🚽 🔝 Retain
Publish	Threshold (inclusive)		
On value change	▼ 0		
Topic (SUB)		QoS	
BX-MBIO/BX-MBIO_1/write/Relay1		• 0	*
	÷		
			SAVE

- If the variable read is to be published to your MQTT broker:
 - Enter an MQTT Topic (PUB). The circle arrow icon to the right of the Topic name will
 reset the name to the default <DEVICE_NAME>/get/<VARIABLE_NAME>, where
 <DEVICE_NAME> and <VARIABLE_NAME> will automatically populate from the values
 defined for the device.
 - Select whether the topic should be published **On value change** or **At a fixed frequency**, and enter the **Threshold** amount of change to trigger a publish event or the time interval (**Every (s)**) at which to publish, respectively.
 - Enter the Quality of Service level (**QoS**).

MQTT Quality of Service Levels			
QoS	Description		
0	Does not include confirmation of receipt		
1	Guarantees the delivery of the message at least once to a receiver		
2	Guarantees the delivery of the message once and only once to a receiver		

- If **Retain** is checked, the MQTT broker will hold the most recently published message in this topic to sent in reply to future client Subscribe requests.
- If the variable is to be written based on a subscribed MQTT topic:
 - Enter an MQTT Topic (SUB). The circle arrow icon to the right of the Topic name will
 reset the name to the default <DEVICE_NAME>/set/<VARIABLE_NAME>, where
 <DEVICE_NAME> and <VARIABLE_NAME> will automatically populate from the values
 defined for the device.
 - Enter the Quality of Service level (QoS), as defined for the publish case above.
- Click **SAVE** when finished defining all variables and MQTT topics.

After a device has been added to the channel, the simulated LED to the right of the device on the DEVICES tab and the channel name on the CHANNELS tab will turn green if communication is successful and red while the channel is in an error state. The clipboard icon on each channel will open a real-time log of communications on that channel.



Configure MQTT Broker

Check your MQTT broker for the settings it requires prior to configuring your gateway.

Click on the MQTT tab to define the connection to an MQTT broker.

CHANNELS	DEVICES	MQTT	
	MQTT has not been configured yet		
Broker Address *		Broker Port * 1883	
ClientId *	Keep Alive (s) * 60	✓ Clean session	
Username	Password		0
Enable TLS/SSL			
Payload structure		EDIT	
Messages queue		EDIT	
Diagnostic messages		EDIT	
Log			Ê
DISCARD		SA	VE

- Set the Broker Address and Broker Port.
- Set the **ClientId** as required by your MQTT broker.
- Set the Keep Alive frequency (in seconds).
- Select **Clean session** if desired, to require renewal of subscriptions to the topics each time the client reconnects to the broker.
- Set the Username and Password for the broker if necessary.
- Select EnableTLS/SSL and upload a certificate, private key, or CA certificate if necessary.

Enable TLS/SSL	•
Certificate	UPLOAD CERTIFICATE
Private Key	UPLOAD PRIVATE KEY
CA Certificate	UPLOAD CA CERTIFICATE

• The **Payload structure** allows you to customize the payload structure and provides a preview of the message for valid and invalid values.

Paylo	ad editor		×
Select	the information embedded in each MQTT message:		
V	number Sampled value value		
	boolean Validity of the sampled value valid		
	string Sampler device name device		i
	^{number} Date of sampling (Unix time [ms]) timestamp		1
	string Date of sampling (ISO-8601) datetime		i
	boolean Device's communication issues communicationKO		ľ
		PREVIEW	ОК

- Select all the information to be included in the message. Each field can be edited to customize the message payload by clicking the pencil icon to the right of the selection. The information to be returned by each field can be edited. For the Sampled value a custom value to return when invalid or when the device has communications problems can also be specified. For each entry, the circular arrow icon will reset the value to its default.
- The **PREVIEW** link will show you a sample of the messages for both valid and invalid states.



The Messages queue can be enabled to batch transmission of messages. When the queue is disabled, each MQTT message is sent as soon as it is ready to be delivered. Some IoT web services (i.e.: Ubidots) also ignore incoming messages if the incoming frequency is higher than a prescribed number of messages per second.

Enabling the message queue will store the outgoing MQTT messages into a buffer. This makes it possible to control the outgoing message frequency.

If the message queue is enabled, the gateway will collect messages in a queue to send as a batch once the minimum delay or maximum queue length has been reached. Unsent messages can be set to expire after a time interval

Messages queue	×
Enable MQTT queue	
Minimum delay between messages [ms]	1000
Maximum queue length	100
Discard messages older than	Never 💌
	ок

• **Diagnostic messages** can be enabled to create a topic containing status information on your channels, devices and MQTT connection.

Diagnostic message	es		×
Enable diagnostic	messages		
Торіс			
sgw/sgw-mq1611/ <h0< td=""><td>STNAME></td><td></td><td></td></h0<>	STNAME>		
Transmission period [s]	QoS		
60	0	👻 🗌 Retain	
			ОК

- Click **SAVE** when finished configuring the MQTT connection.
- The simulated LED to the right of the Broker Port will turn green if communication with the broker is successful and red while the connection is in an error state. The clipboard icon will open a real-time log of communications between the gateway and the MQTT broker.

CHANNELS	DEVICES	MQTT	
Broker Address * test.mosquitto.org		Broker Port * 1883	•

Other Options

Secondary settings and functions are accessed via the More Options icon in the upper right corner of the web UI. The Network interfaces settings were covered in "Setup Network Connection" on page 2-3. The remaining features under this menu are discussed below.

SOW MO1611-WE				
HN: 2.1.1-N FN: 1.7.3-N		i	*	Network interfaces
CHANNELS	DEVICES	MQTT	0	Date & time
			↑Ļ	Import/export configuration
			Ĩ	Change password
			٩	Maintenance
			€	Logout

Date & Time

Enter the date and time manually, or click Enable NTP and enter the address of an internet time server.

Date & time		×
System date		
25/06/2019 14:24		
Time zone		
Etc/UTC		×
Enable NTP Date (dd/MM/yyyy)	Time (HH:mm)	
25/06/2019	14:24	
		SAVE

Import/Export Configuration

The full configuration of all channels, devices, and MQTT connection can be exported as a JSON file, and imported to another gateway.



Change Password

The password to log into the gateway web UI can be changed. Note that the user name is not editable.

Change password	×
 Password must be at least 8 characters. Password can contain letters, numbers and the following characters: ! # \$ % ^ 8 New password must be different from the old one. New password must be different from the default one. 	ž
Old password	
New password	
Confirm password	
SAVI	E

Logout

The connected session to the gateway web UI will time out after several minutes of inactivity. To log out immediately, click **Logout** from the More Options menu.

Maintenance

The Maintenance dialog provides the ability to update firmware, download a system log, or restart the device.

Maintenance		×
Ŧ		Ċ
Firmware upgrade	System log	Restart

System Log

Click **System log** to download a log file to your PC. Note that the file is a tar.gz archive and will require an unarchive utility such as WinZip or 7-Zip if you need to open it on a Windows PC.

Restart

Click **Restart** then click **Confirm** to reboot the gateway.

Firmware

New firmware will be announced on our web site at <u>https://support.automationdirect.com/firmware</u>. We strongly recommend you subscribe to AutomationDirect's firmware notification service at <u>https://notify.automationdirect.com/firmware</u>. To update the device firmware, download the firmware file to your PC and unzip it, then select **More Options** > **Maintenance** > **Firmware upgrade** and proceed as follows.

Click BROWSE, select your firmware file (.swu extension) and click Open.

Firmware upgrade	×
To upgrade the device's firmware:	
1. Download the firmware, save it on your PC and, eventually, unzip it.	
2. Click Browse, select the firmware on your PC and click Open.	
3. Once it has been uploaded and verified, click Upgrade and then Confirm.	
This operation will take approximately 3 minutes.	
DO NOT POWER OFF THE DEVICE! Interrupt this operation might corrupt your device!	
 In case of failure, restart the device in "Recovery Mode" and repeat the firmware upgrade. 	
No file selected BROWSE	
UPGRADE	

The file will be uploaded and verified.

Firmware upgrade	×
To upgrade the device's firmware:	
1. Download the firmware, save it on your PC and, eventually, unzip it.	
2. Click Browse, select the firmware on your PC and click Open.	
3. Once it has been uploaded and verified, click Upgrade and then Confirm .	
 This operation will take approximately 3 minutes. 	
DO NOT POWER OFF THE DEVICE! Interrupt this operation might corrupt your device!	
 In case of failure, restart the device in "Recovery Mode" and repeat t upgrade. 	he firmware
SGW-MQ1611_1.7.3.swu	BROWSE
	Verified
	UPGRADE

Once the file is verified, click UPGRADE then click CONFIRM.

Firmware upgrade	×
To upgrade the device's firmware:	
1. Download the firmware, save it on your PC and, eventually, unzip it.	
2. Click Browse, select the firmware Firmware upgrading en.	
3. Once it has been uploaded and verified, click Upgrade and then Confirm.	
This operation will take approximately 3 minutes.	Q
DO NOT POWER OFF THE DEVICE! <u>Interrupt this operation might corrupt your device!</u>	
 In case of failure, restart the decce in "Recovery Mere" and repeat th upgrade. 	e firmware
SGW-MQ1611_1.7.3.swu Do not power off the device!	BROWSE
	Verified
	UPGRADE

After the firmware is updated, the gateway will reboot.

If for any reason the firmware update is unsuccessful, restart the gateway in Recovery Mode, as discussed in the next section, and repeat the firmware upgrade.

Recovery Mode

The device can be booted into a Recovery Mode to reset portions of the configuration to default or to perform system maintenance and firmware updates.

To enter Recovery Mode, press and hold the recessed reset button on the front of the gateway while cycling power. Continue to hold the reset button until the ERR light stops blinking (about 5 seconds after applying power). The gateway will start in Recovery Mode, using the default Ethernet configuration:

• IP address = 192.168.1.100

Reset

From the Reset tab, you can selectively reset the Hostname, Network interface, Date & time, Login credentials, or Configuration to their default settings.

SGW-MQ1611		
MAINTENANCE	RESET	FIRMWARE UPGRADE
Reset all		
Hostname Restore the default hostname: SGW-MQ1611		
Network interface Restore the default network interface settings: 192.168.1.100/24		
Date & time Restore the default date & time settings.		
Login credentials Restore the default credentials: username = admin password = password		
Configuration Clean the Modbus, MQ	TT and devices configurations.	
		RESET

Maintenance

From the Maintenance tab, you can check for file system errors, download stored logs and clean temporary files. Note that downloaded log files are tar.gz archives and will require an unarchive utility such as WinZip or 7-Zip if you need to open them on a Windows PC.

SGW-MQ1611		
HW: 2.1.1 Recovery: 1.0.6		
MAINTENANCE	RESET	FIRMWARE UPGRADE
Check and correct file system en	rors	СНЕСК
Download the stored logs		
Download the stored logs		BOWNEOAD
Clean temporary files, logs, etc		CLEAN

Firmware Upgrade

Upgrading firmware from within the Recovery Mode UI follows the same steps as performing a firmware upgrade in normal operating mode, as described in "Firmware" on page 2-16.

It may occasionally be necessary to upgrade the firmware from Recover Mode if a firmware upgrade was unsuccessful in the normal operating mode.

SGW-MQ1611				
HW: 2.1.1 Recovery: 1.0.6				
MAINTENANCE	RESET	FIRMWARE UPGRADE		
To upgrade the device's firmware:				
 Download the firmware, save it on your PC and, eventually, unzip it. Click Browse, select the firmware on your PC and click Open. 				
3. Once it has been uploaded and verified, click Upgrade and then Confirm .				
This operation will take approximately 3 minutes.				
DO NOT POWER OFF THE DEVICE! Interrupt this operation might corrupt your device!				
 In case of failure, rebooupgrade. 	ot the device in " Recovery Mo	de " and repeat the firmware		
No file selected		BROWSE		

Reboot and Return to Normal Mode

To reboot the gateway and return to normal mode, click the **More Options** icon in the upper right, then click **Reboot**. Upon reboot the device will use its configured network settings.