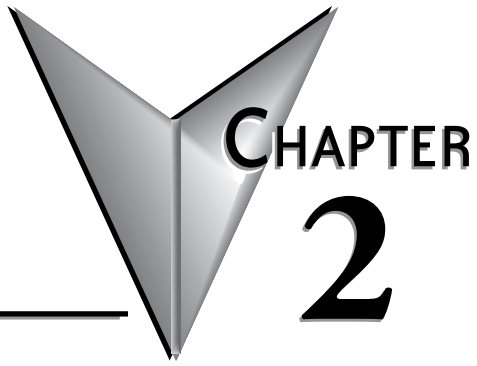
Setup and Operation



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Getting Started

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

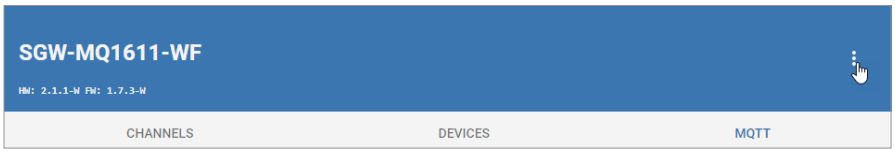
1. The hardware is installed as described in the Mounting and Wiring sections of Chapter 1.
2. You have the necessary connection information on hand to connect to your MQTT broker.
3. You have a device on hand with a web browser and the ability to connect to the MQTT gateway via its RJ-45 Ethernet port,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

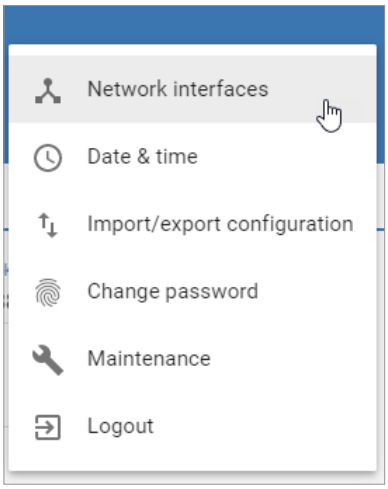
The device is configured through its web interface. The web interface uses the HTTP (unsecure) protocol on port 80. To begin, connect to the device via an Internet browser. The default Ethernet configuration is:

- 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

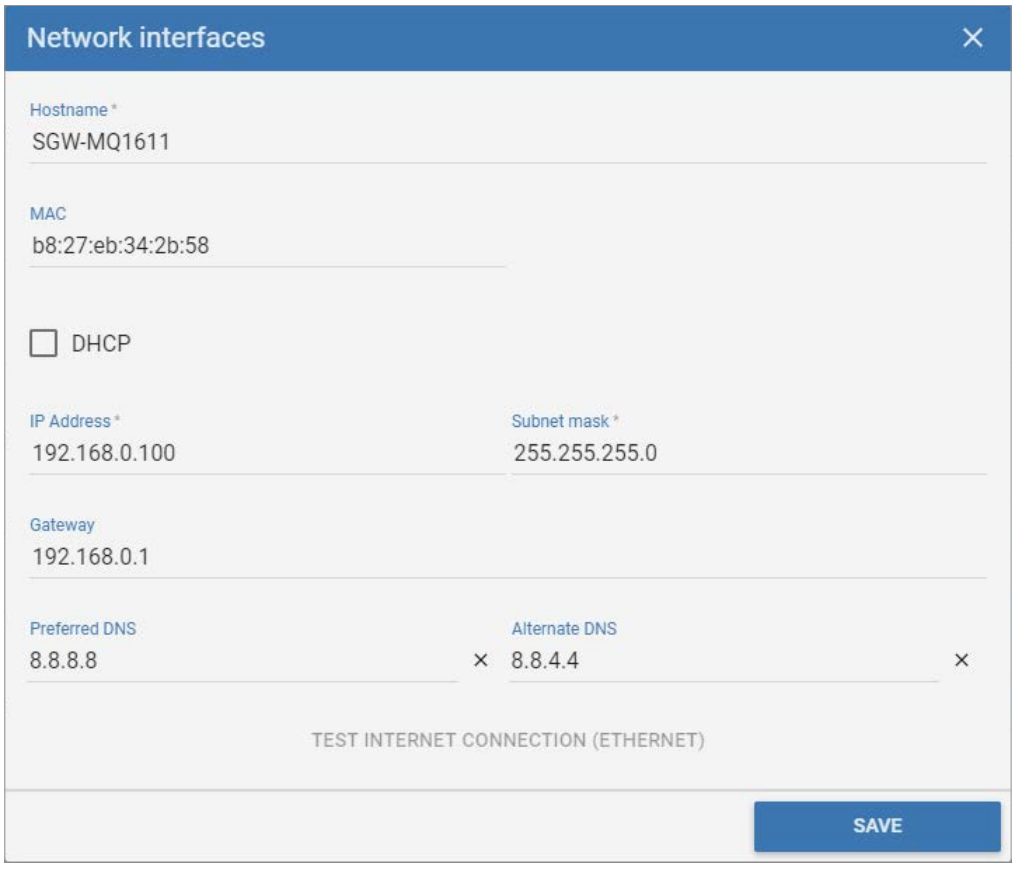
To change the network parameters, select **Network interfaces** from the **More Options** (⋮) menu in the upper right corner of the web UI.





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

NOTE: *The gateway will always use its permanent default IP address when in recovery mode.*

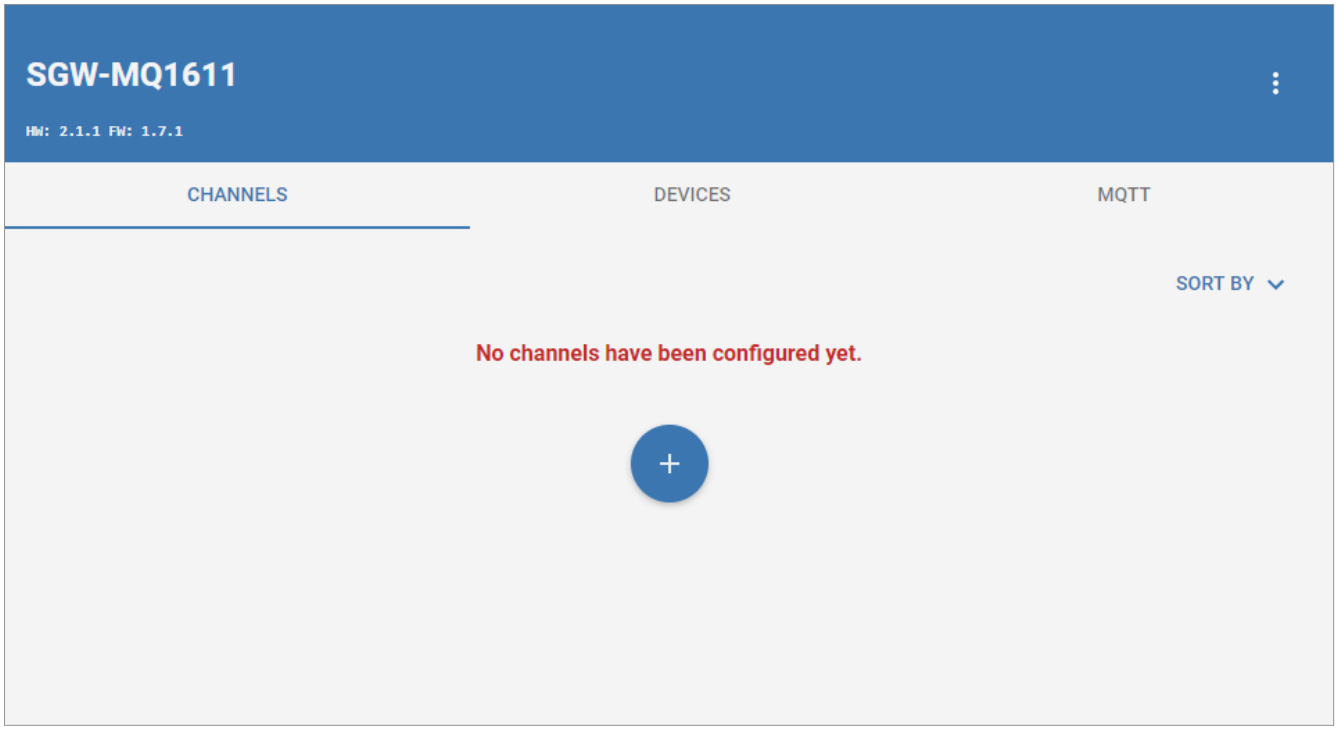


To verify the settings, reopen the **Network interfaces** screen and click **TEST INTERNET CONNECTION**.

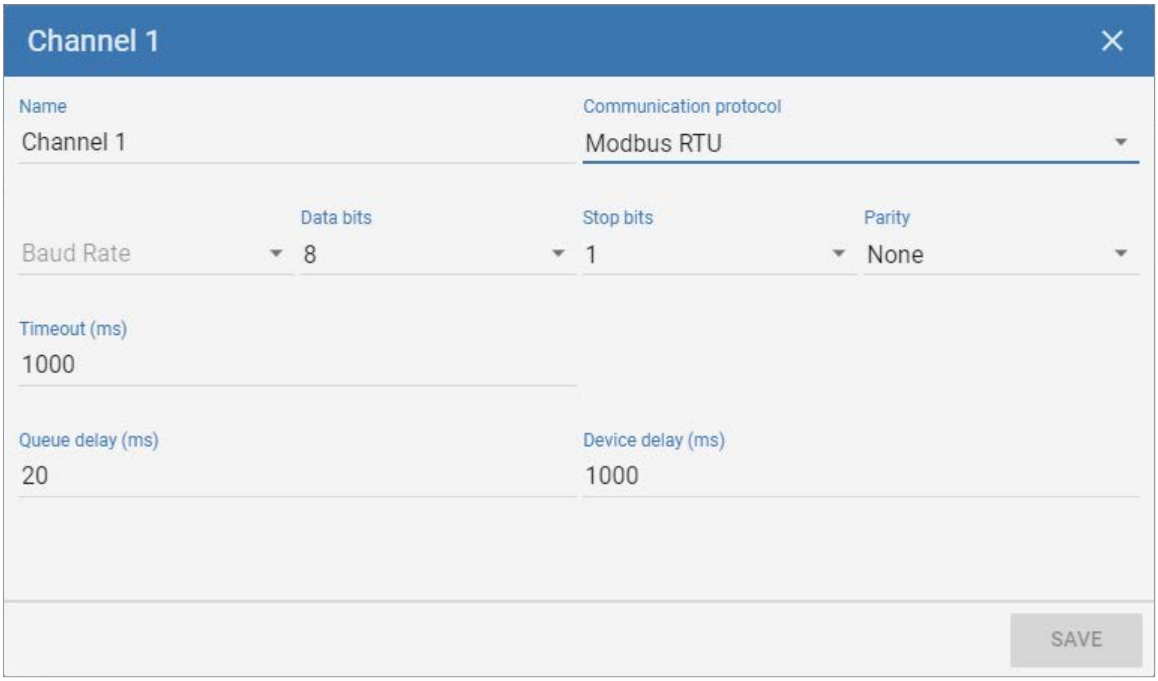
Setup Modbus Communications Channel

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.



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



- 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)

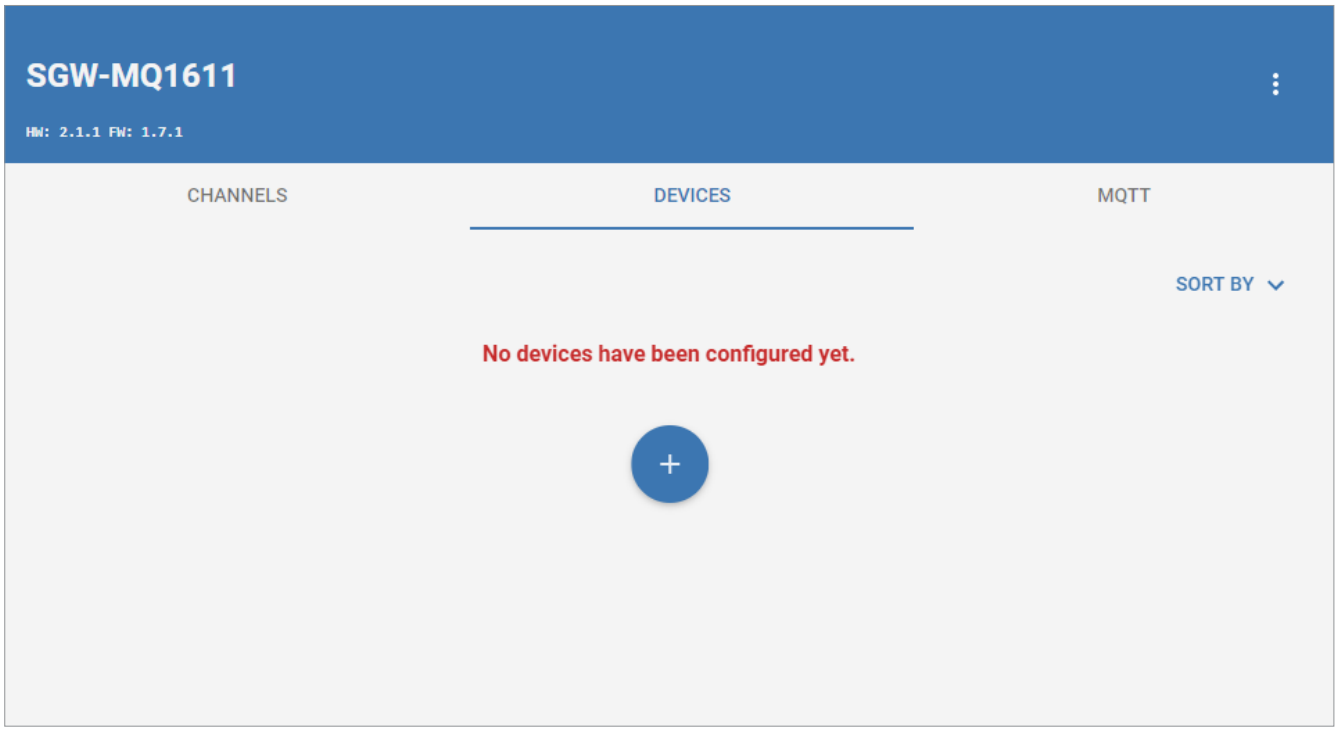
Click **SAVE** when finished configuring the channel.

Setup Modbus Devices

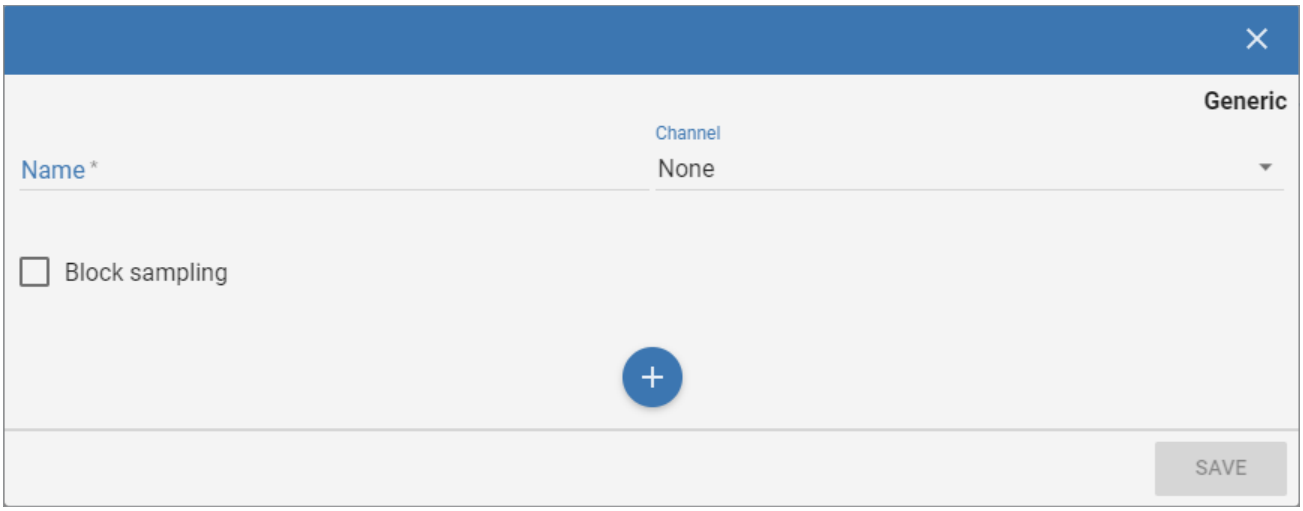
The gateway can communicate with up to 32 Modbus RTU Slaves via RS-485 and up to eight Modbus TCP Servers or Modbus RTU over TCP Servers via Ethernet. After the communications channels are defined, you can configure the connection and variables for each Modbus device.

Configure Modbus Device

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



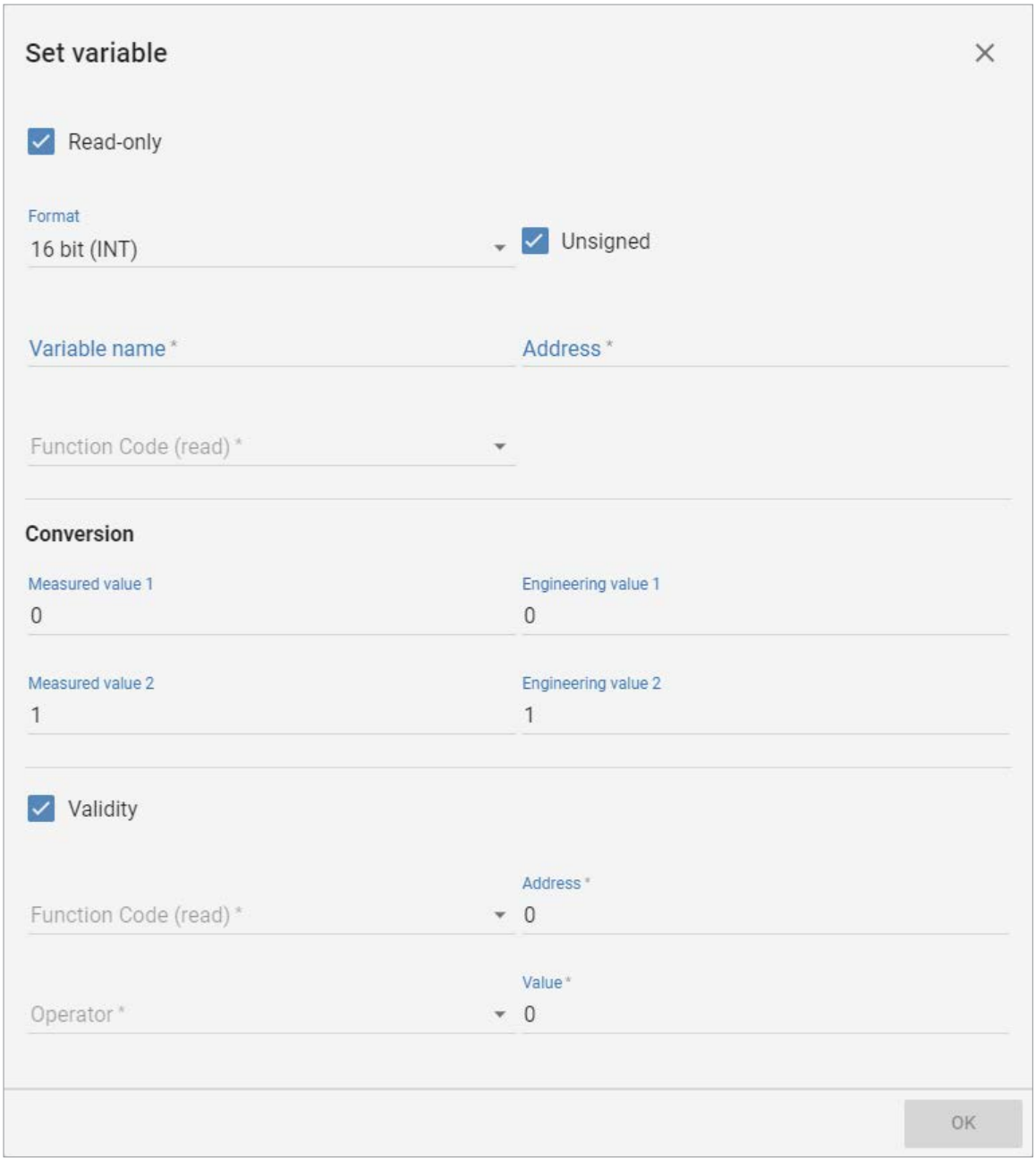
Click the "+" icon to add a new device, or click on an existing device to edit it.



- 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.



- 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.

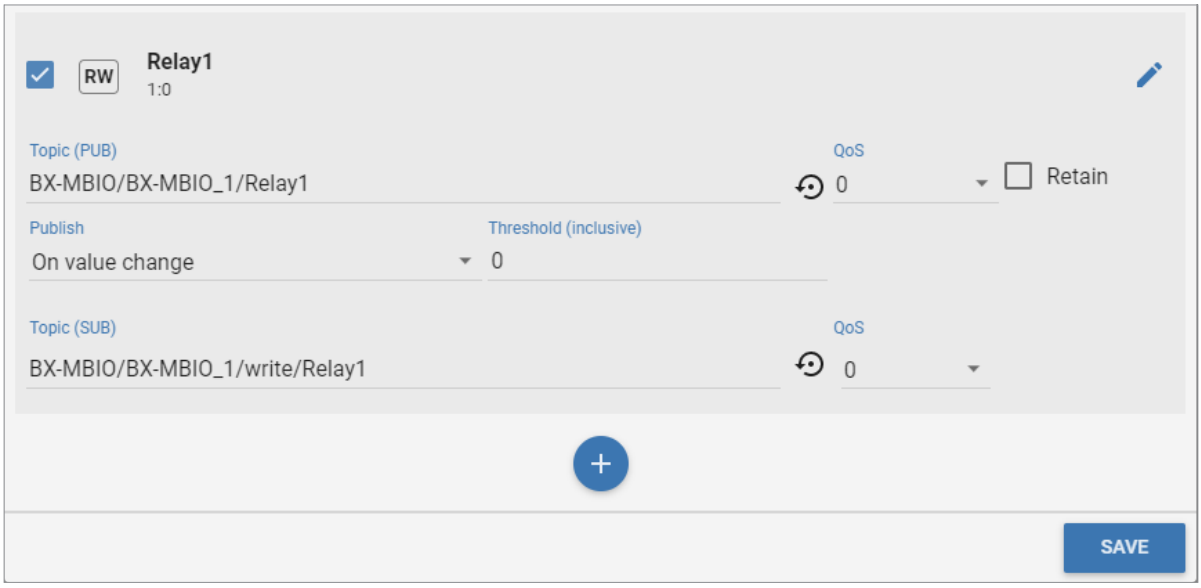
Modbus Read Function Codes		
Variable Type	***Read Function Codes***	***Write Function Codes***
1 bit	01 - Read Coil Status 02 - Read Input Status	05 - Force Single Coil 15 - Force Multiple Coils
16 bit (INT)	03 - Read Holding Registers 04 - Read Input Registers	06 - Preset Single Register 16 - Preset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

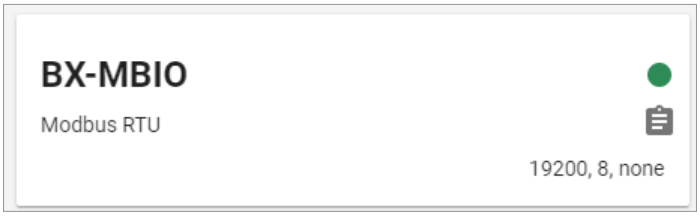


- If the variable read is to be published to your MQTT broker:
  - Enter an MQTT **Topic (PUB)**. The circle arrow icon to the right of the Topic name will reset the name to the default <DEVICE_NAME>/get/<VARIABLE_NAME>, where <DEVICE_NAME> and <VARIABLE_NAME> will automatically populate from the values 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.

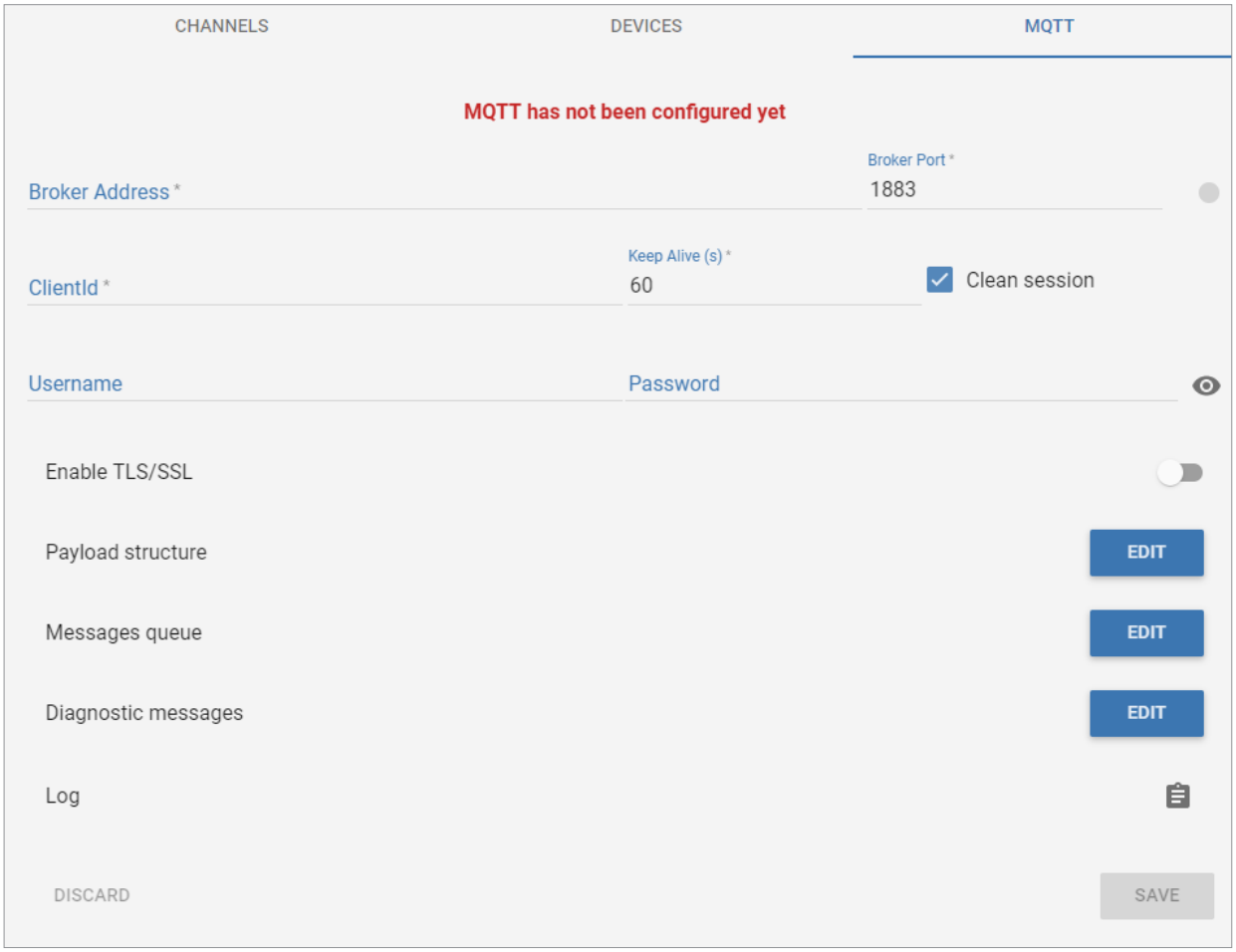
After a device has been added to the channel, the simulated LED to the right of the device on the DEVICES tab and the channel name on the CHANNELS tab will turn green if communication is successful and red while the channel is in an error state. The clipboard icon on each channel will open a real-time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



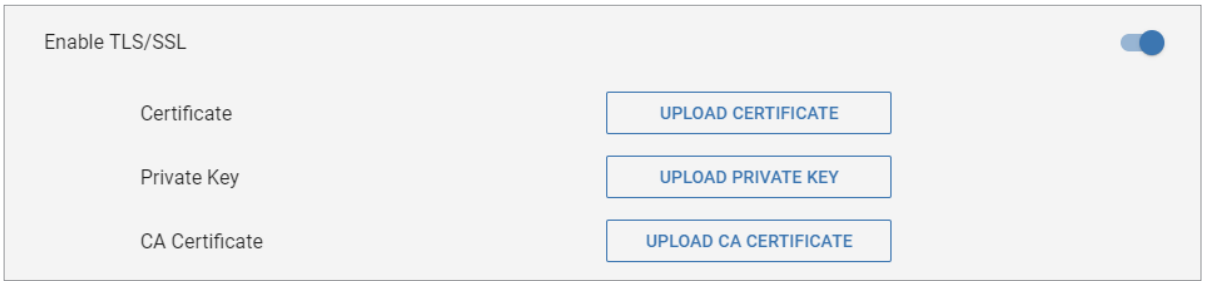
Configure MQTT Broker

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

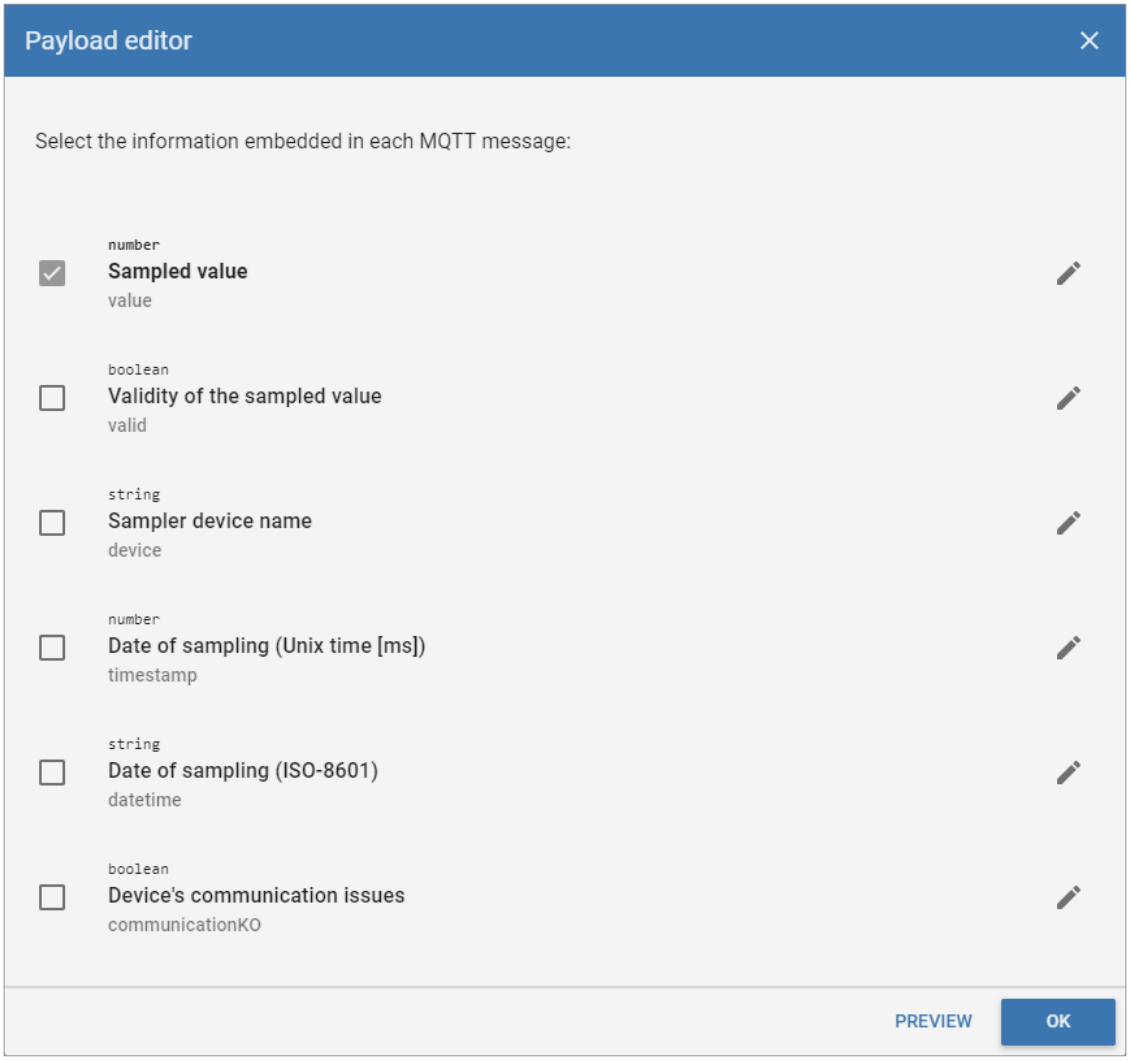
Click on the **MQTT** tab to define the connection to an MQTT broker.



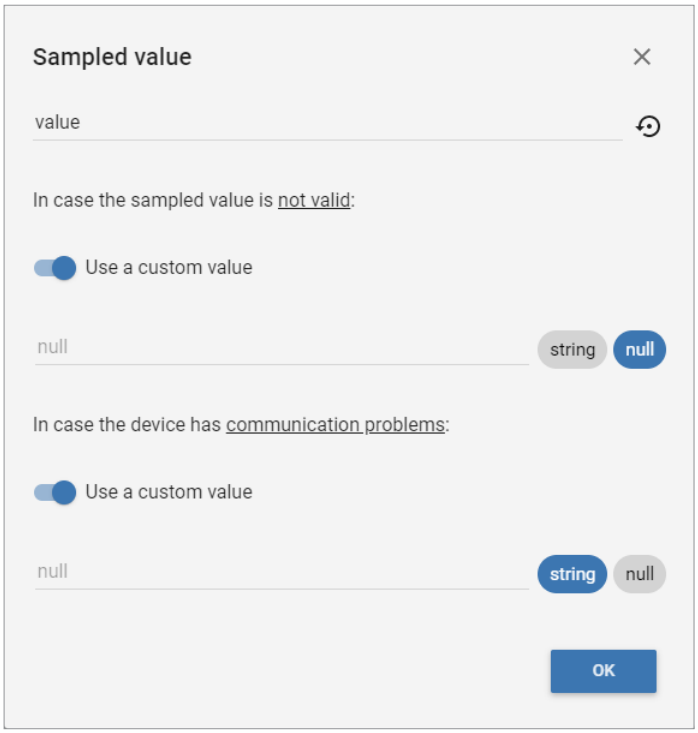
- Set the **Broker Address** and **Broker Port**.
- Set the **ClientId** as required by your MQTT broker.
- Set the **Keep Alive** frequency (in seconds).
- Select **Clean session** if desired, to require renewal of subscriptions to the topics each time the client reconnects to the broker.
- Set the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

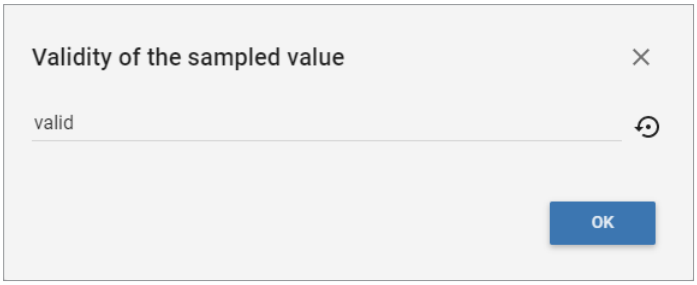


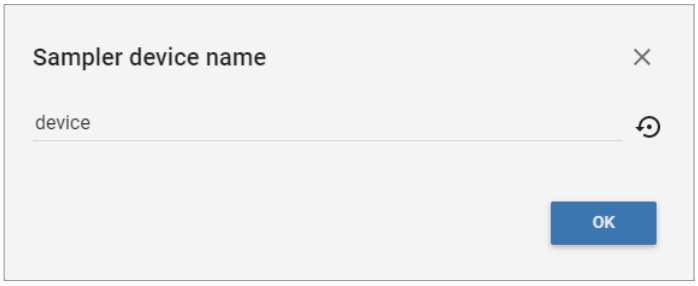
- The **Payload structure** allows you to customize the payload structure and provides a preview of the message for valid and invalid values.



  - 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.

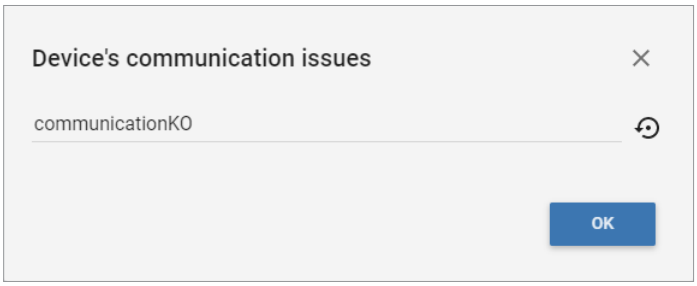

Sampled value
value
In case the sampled value is not valid:
Use a custom value
null
string
null
In case the device has communication problems:
Use a custom value
null
string
null
OK


Validity of the sampled value
valid
OK


Sampler device name
device
OK


Date of sampling (Unix time [ms])
timestamp
OK

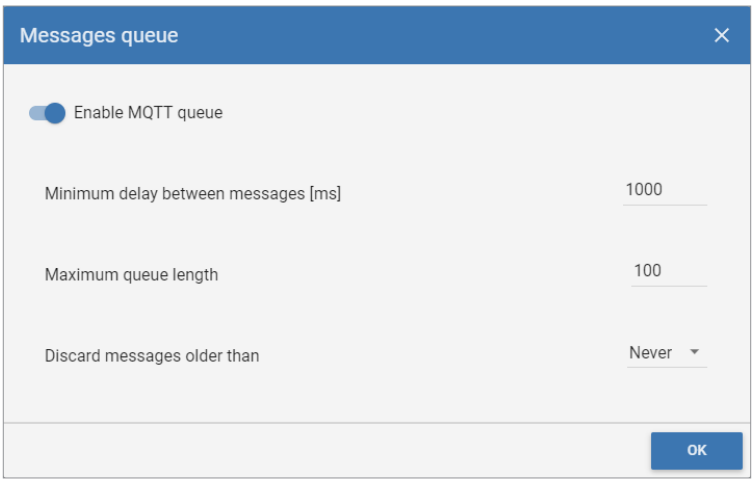

Date of sampling (ISO-8601)
datetime
OK


Device's communication issues
communicationKO
OK

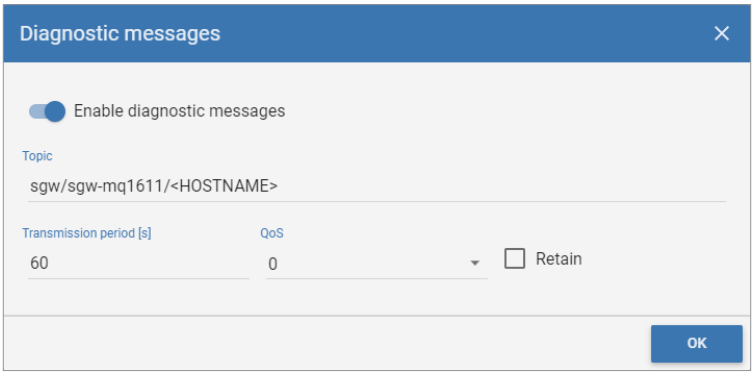
- The **Messages queue** can be enabled to batch transmission of messages. When the queue is disabled, each MQTT message is sent as soon as it is ready to be delivered. Some IoT web services (i.e.: Ubidots) also ignore incoming messages if the incoming frequency is higher than a prescribed number of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

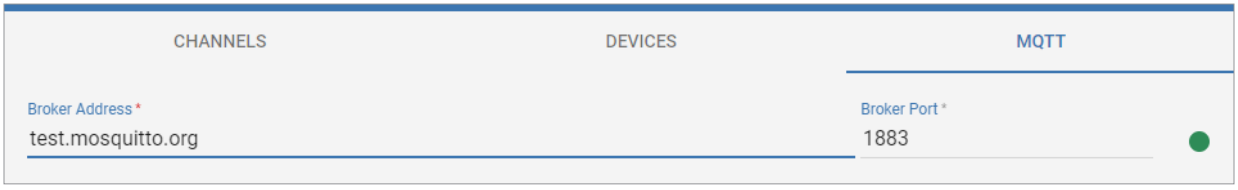
  If the message queue is enabled, the gateway will collect messages in a queue to send as a batch once the minimum delay or maximum queue length has been reached. Unsent messages can be set to expire after a time interval



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

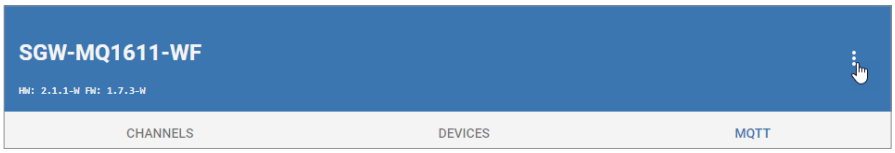


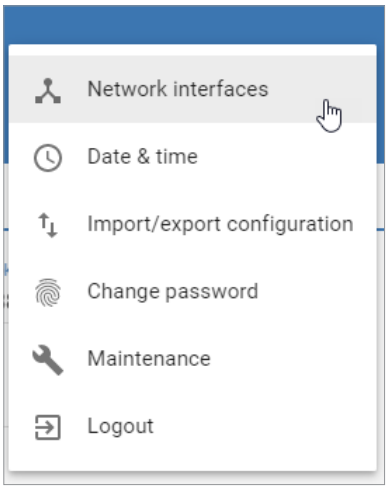
- Click **SAVE** when finished configuring the MQTT connection.
- The simulated LED to the right of the Broker Port will turn green if communication with the broker is successful and red while the connection is in an error state. The clipboard icon will open a real-time log of communications between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



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.



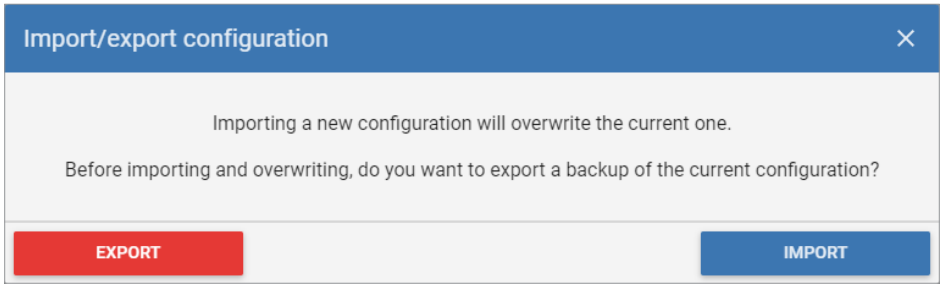


Date & Time

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

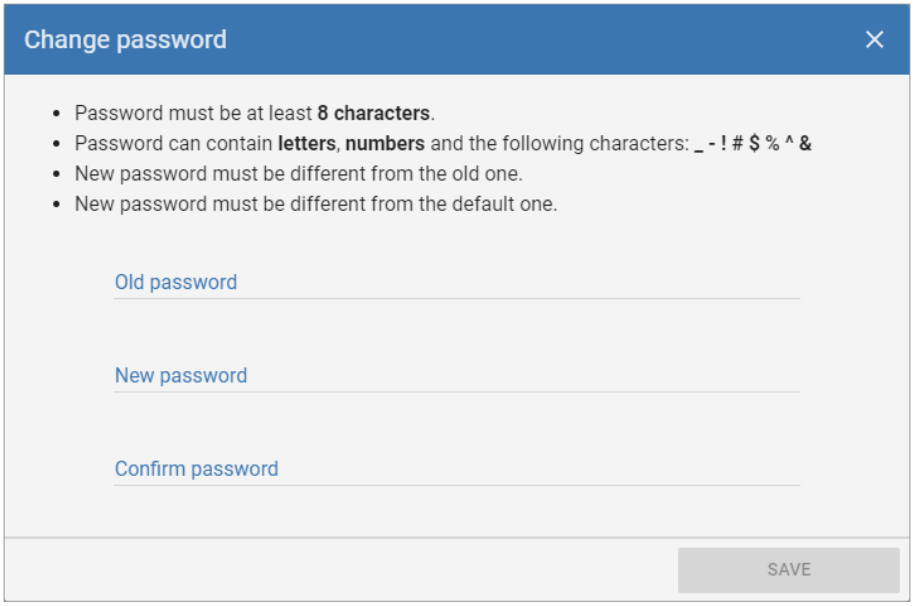
Import/Export Configuration

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.

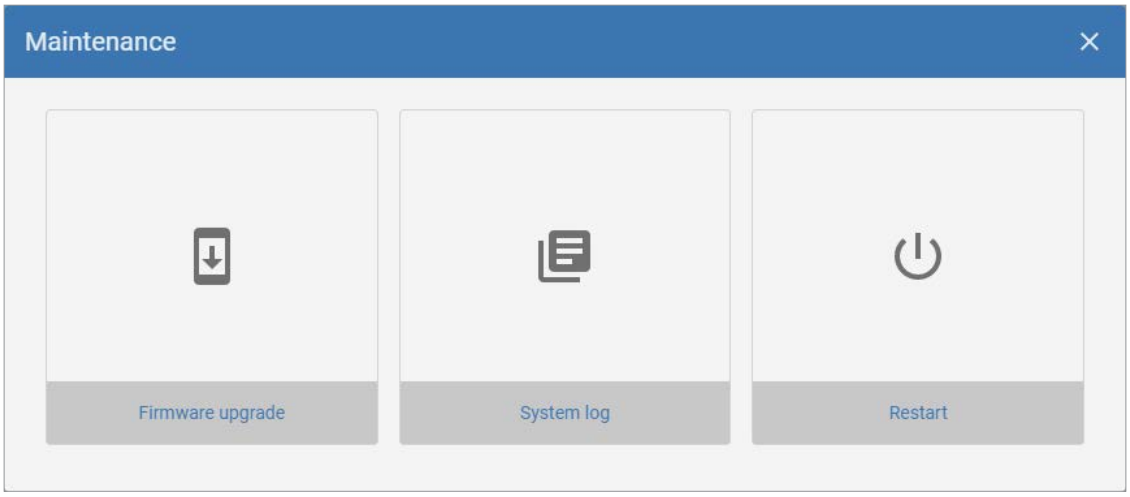


Logout

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.



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.

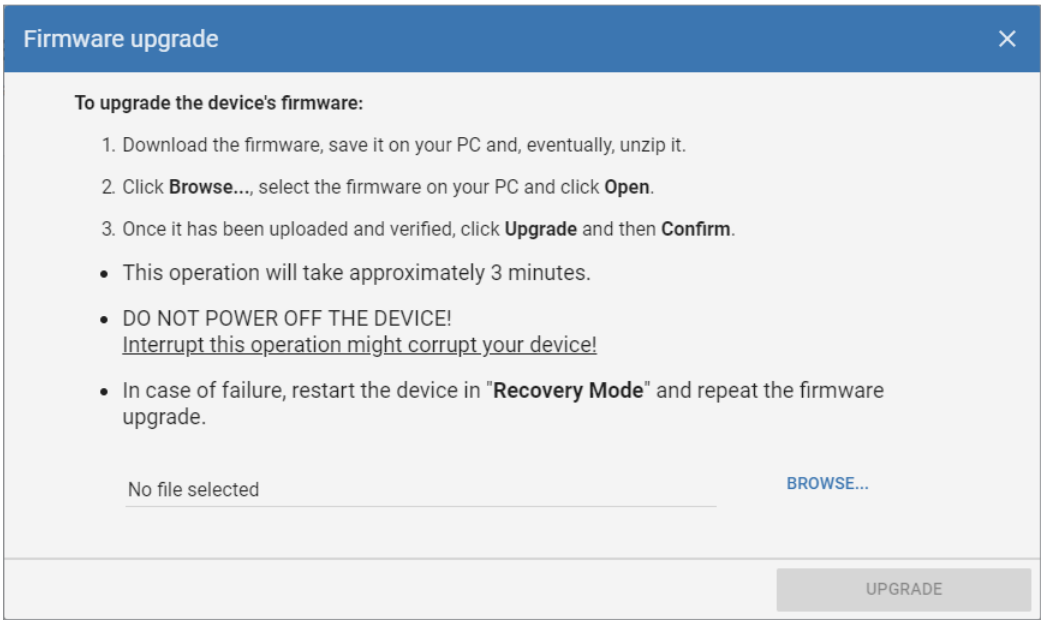
Restart

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

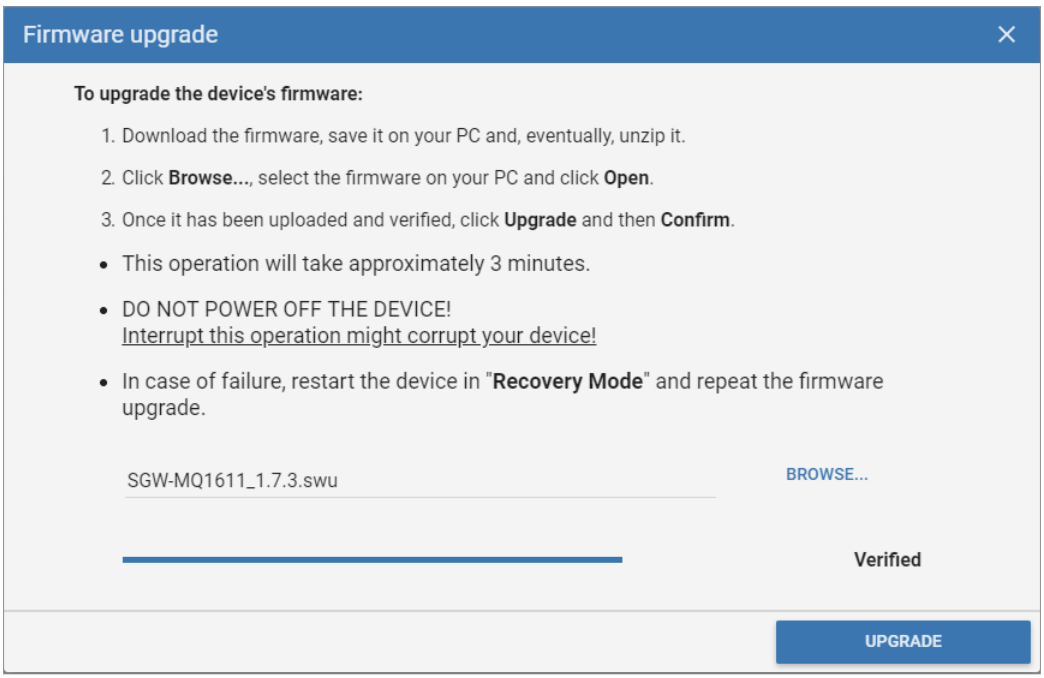
Firmware

New firmware will be announced on our web site at https://support.automationdirect.com/firmware. We strongly recommend you subscribe to AutomationDirect's firmware notification service at https://notify.automationdirect.com/firmware. 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.

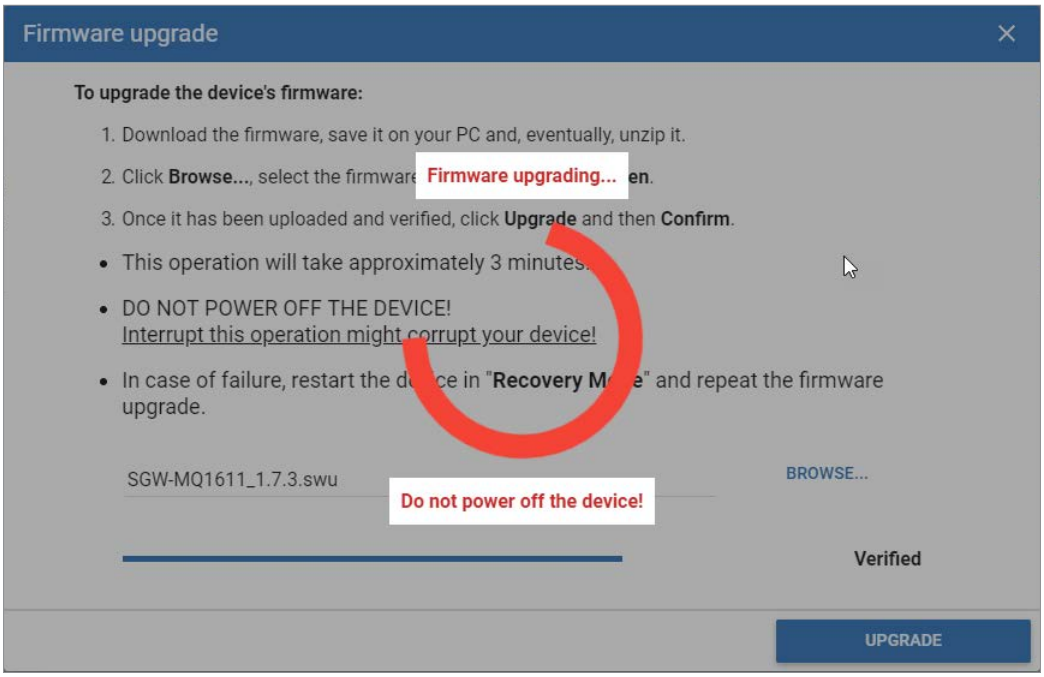
Click **BROWSE**, select your firmware file (.swu extension) and click **Open**.



The file will be uploaded and verified.



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



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

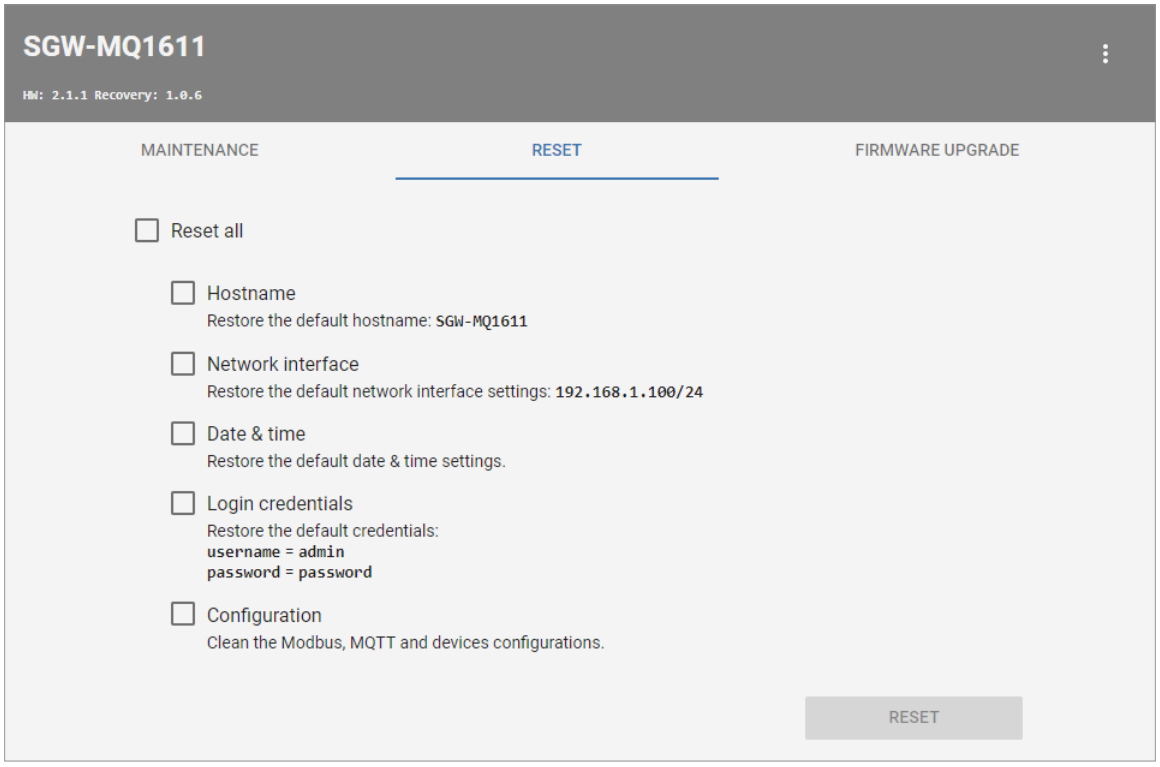
The device can be booted into a Recovery Mode to reset portions of the configuration to default or to perform system maintenance and firmware updates.

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

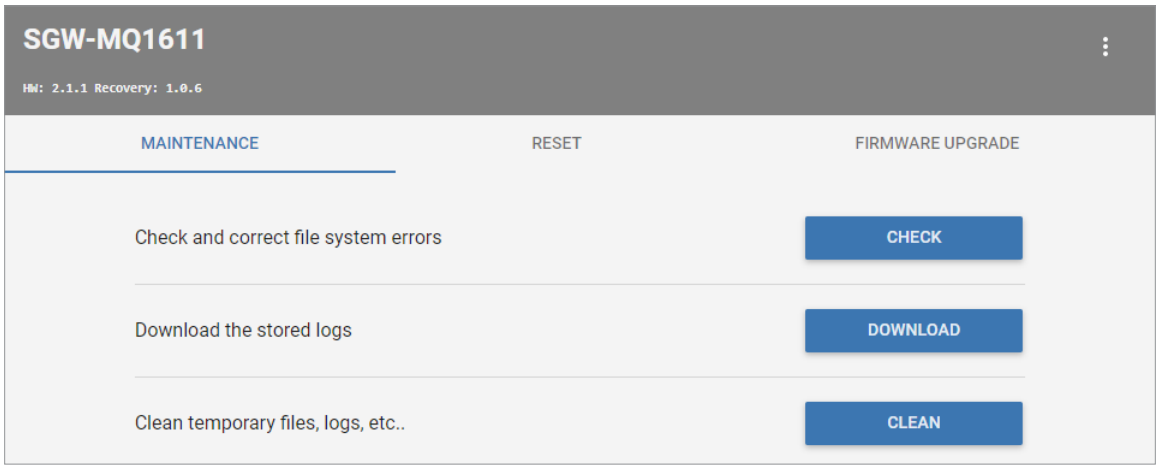
Reset

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



Maintenance

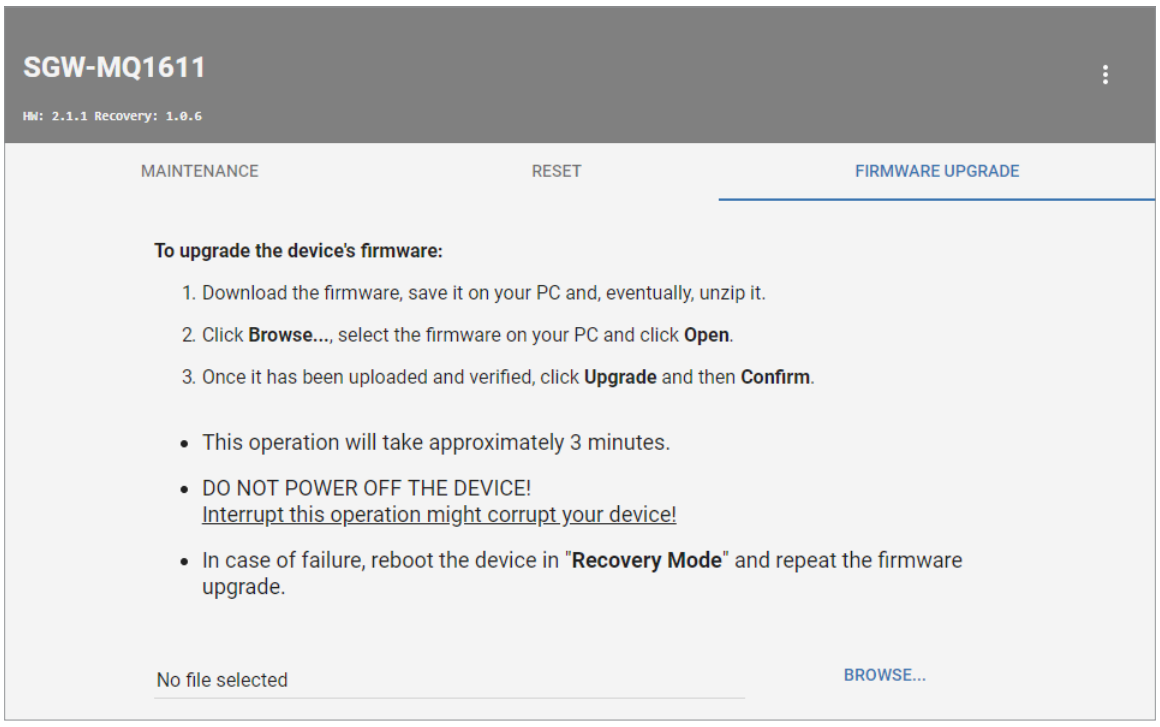
From the Maintenance tab, you can check for file system errors, download stored logs and clean temporary files. Note that downloaded log files are tar.gz archives and will require an unarchive utility such as WinZip or 7-Zip if you need to open them on a Windows PC.



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.



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.