

Managed Machine Network



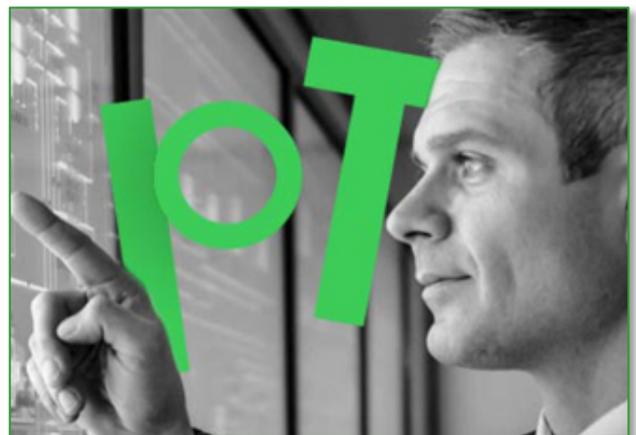
JUNE 2020

Integration with
Machine Expert &
M262 MQTT

MMN
MANAGED MACHINE NETWORK

Preface

In this document we will be talking about the Schneider Electric's Machine Expert MQTT protocol in combination with the M262 and Node-RED, how to establish a proper connection between the M262 and Node-RED using MQTT followed by a conclusion.



EcoStruxure Machine Expert



What is EcoStruxure Machine Expert?

Software for developing, configuring and commissioning the entire machine in a single software environment, formerly known as SoMachine.

EcoStruxure Machine Expert saves engineering time through intuitive machine programming with one of the most modern and powerful tool-based software concepts on the market.

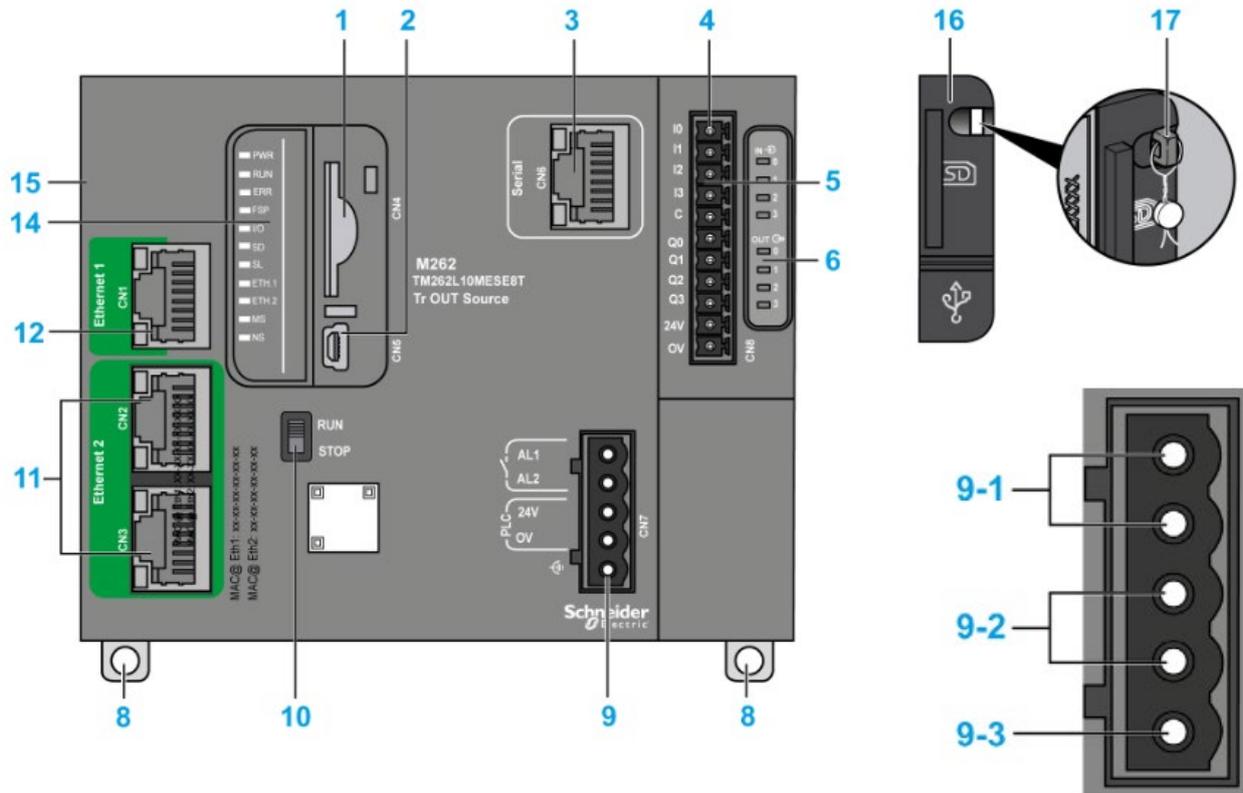
Why Machine Expert?

EcoStruxure Machine Expert is a unique solution software for developing, configuring and commissioning the entire machine in a single software environment, including logic, motion control, robotics/mechatronics, simulation, diagnostics, intelligent motor and load management and drives, HMI (Vijeo Designer), IIoT and related network automation functions.

Thanks to many predefined templates in EcoStruxure Machine Expert you save engineering time by applying complete libraries or even a new machine module. Machine Expert also provides IIoT libraries for machines (OPC UA, MQTTs, HTTPs and web API calls, JSON, SQL/Database, FTP Client/Server, email receiving/sending with attachment).

M262 Concept

The Modicon M262 Logic/Motion controller is especially made for performance demanding machines. The M262 controllers are IIoT-ready (MQTT, HTTP, OPC UA, TLS, etc.).



- | | |
|--------------------------------------|---|
| 1. SD card slot | 9-2. 24 Vdc power supply |
| 2. USB mini-B programming port | 9-3. Functional Earth (FE) grounding connection |
| 3. Serial line port / type RJ4 | 10. Run/Stop switch |
| 4. Inputs/outputs terminal connector | 11. Dual port Ethernet switch |
| 5. TM3 bus connector | 12. Ethernet port 1 |
| 6. I/O status LEDs | 13. Status LEDs |
| 7. Clip-on lock for 35 mm | 14. TMS bus connector |
| 8. Alarm relay terminal connector | 15. Protective cover |
| | 16. Locking hook |

Message Queuing Telemetry Transport (MQTT)

What is MQTT?

MQTT is an open OASIS and ISO standard lightweight, publish-subscribe network protocol that transports messages between devices. The protocol usually runs over TCP/IP. However, any network protocol that provides ordered, lossless, **bi-directional** connections can support MQTT.

M262 Secure MQTT

The M262 is suited with the MQTT as well as MQTTs protocol. MQTTs means that it is using a secure connection which requires certificates. A certificate that needs to be downloaded into the M262 to secure the connection. Certificates need to be signed by an Certificate Authority and need to be replaced/updated every 2 years. A Certificate Authority is an organization that verifies domain ownership and signs your certificate. A signed certificate costs about 60 dollar per year.

Mosquitto MQTT Broker

[Mosquitto.org](https://mosquitto.org) is an organization that provides a free MQTT server that can be installed on your Windows computer.

MANAGED MACHINE NETWORK

An example

This is an example of an MQTT configuration panel we created on the M262. This example is provided as an example project in Machine Expert. This example makes it easy to test a MQTT(s) connection:

Connection Settings	Will Message	Credentials	Server Parameters
Client ID: M262Controller	Data: Disconnected	Username: Admin	Server IP: 167.172.38.180
Keep Alive: 0	Topic: M262	Password: Admin	Server Port: 1883
	Retain	<input checked="" type="checkbox"/> Tls Used	

MQTT client connected to server. Ready to publish and subscribe.

Here you must enter your Client ID and your server connection parameters. Username and password are not required with MQTT, only with MQTTs. You will also need to disable the TLC encryption if MQTTs isn't used.in

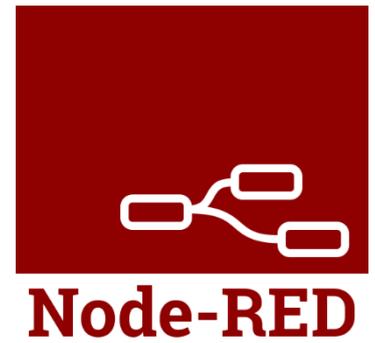
In the Publish tab,you can enter the data you want to send from your PLC.

The tab will look like this

Publishe		
Quality Of Service		
QoS1	Publish Topic: topic1	Data: {"M262":{"id":0,"temp":220}}
Retain	Length Of Pub Data: 50	Length Of PubTopic: 50
Execute Publish		
Wait for execute		

Here you are able to select the Topic where any outside gateway will subscribe to in order to receive the PLC's messages and the Quality of Service.

Node-RED integration



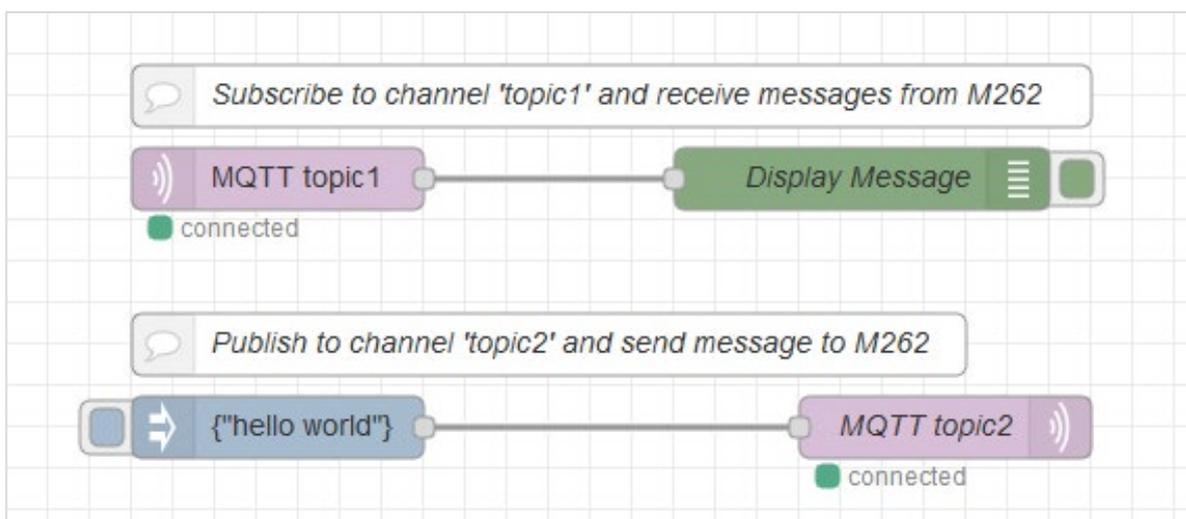
What is Node-RED?

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways.

It provides a browser-based editor that makes it easy to wire flows together using the wide range of nodes in the palette that can be deployed to its runtime in a single click.

MQTT Node-RED configuration

An example of an MQTT connection to read/write from and to a PLC in Node-RED



MANAGED MACHINE NETWORK

The MQTT node's properties are configured as followed.

Server

The MQTT broker you're connecting to. In this case, our server is called "mqtt" with default port 1883.

Topic

The topic you are subscribing to, to receive messages from.

QoS

The **Q**uality of **S**ervice level is an agreement between the sender of a message and the receiver of a message that defines the guarantee of delivery for a specific message.

QoS levels

- **QoS 0**

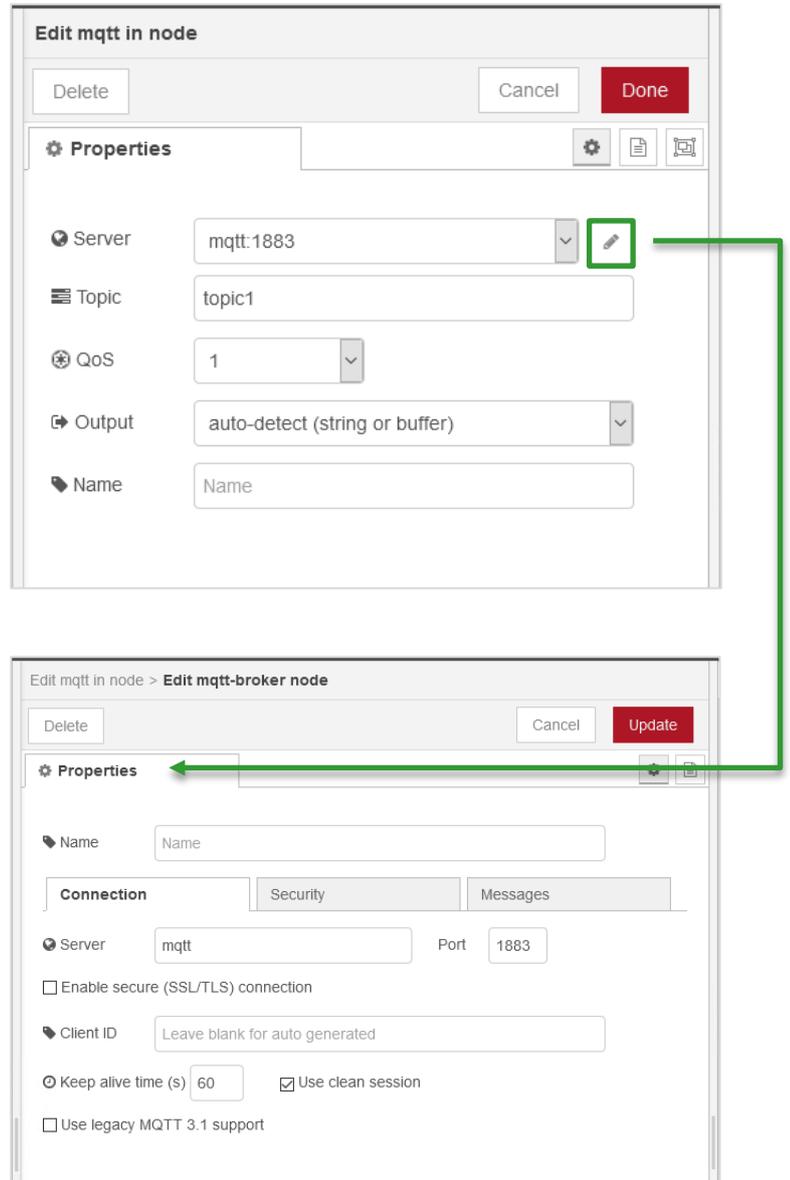
There is no guarantee of delivery.

- **QoS 1**

The sender stores the message until it gets a PUBACK packet from the receiver that acknowledges receipt of the message.

- **QoS 2**

This level guarantees that each message is received only once by the intended recipients. This level type is not yet supported by the M262.



JSON

JSON is a language-independent data format. It was derived from JavaScript, but many modern programming languages include code to generate and parse JSON-format data. The official Internet media type for JSON is application/json. JSON filenames use the extension .json. It is a very common data format with a diverse range of applications. Such as serving as a replacement for XML in AJAX systems.

Let's say you have some data in a pump you would like to put into a dashboard.

```
temperature : 12
pressure : 6
```

You need to add a timestamp and maybe a location and a PLC identifier.

A JSON example as of this data follows

```
{"location": "amsterdam", "datetime": "2020-06-24 12:01:44", "device": "M262", "machine": "pump6", "temperature": 12, "pressure": 6}
```

JSON is the protocol we are communicating with. This makes it very easy to send and/or receive data to/from the M262 using MQTT(s).

Here is an example of a payload we received in Node-RED from the M262 Controller using the protocol MQTT(s)

```
23/06/2020, 14:21:30 node: 5e4194c1.d3eaf4
topic1 : msg : Object
  ▾ object
    topic: "topic1"
    payload: "{\"M262\":{\"id\":0,\"temp\":220}}"
    qos: 0
    retain: false
    _msgid: "5906a913.1bbb28"
```

Notice the topic we subscribed to, it is the topic we used in the MQTT configuration panel in Machine Expert ([see page 6](#)).

Conclusion

Almost any type of data can be transported by using JSON and MQTT. The data could be text or binary. It does not matter as long as the receiving party knows how to interpret it. The QoS level allows a device to publish its data regardless of the state of the subscribing server. The subscribing server can then connect and receive the data when it is able. MQTT is lightweight and therefore ideal for remote monitoring. Especially in machine-to-machine connections that require a small code footprint or where network bandwidth is limited.

Schneider Electric's M262 is the first PLC with support for Secure MQTT. This allows you to send data securely. However, this process does require knowledge of certificates and IT security which is no common OT knowledge.

By using MQTT and the [MMN managed modem](#) a secure encrypted VPN tunnel is created without any IT knowledge. With an MMN modem you can also use old Schneider Electric PLCs with MQTT support for example M241 and M251 in combination with Machine Expert.

Sources

Managed Machine Network	https://machinenetwork.io/
Schneider Electric	https://www.se.com/us/en/
EcoStruxure Machine Expert MQTT Handling Example Guide	https://download.schneider-electric.com/files?p_enDocType=User+guide&p_File_Name=EIO0000003442.00.pdf&p_Doc_Ref=EIO0000003442
Mosquitto	https://mosquitto.org/
Node-RED	https://nodered.org/

Version 1.2