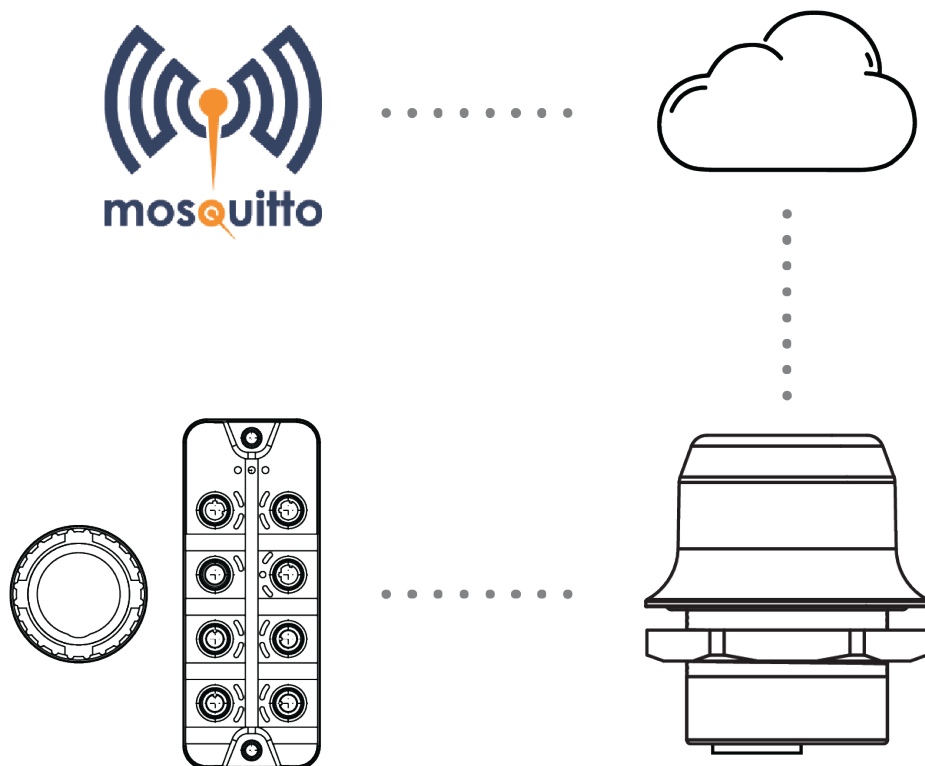


# Anybus<sup>®</sup> Wireless Bolt IoT<sup>™</sup>

Set Up IO-Link Master and Bolt IoT with MQTT

## APPLICATION NOTE

SCM-1202-174 1.0 en-US ENGLISH



---

# Important User Information

## Disclaimer

The information in this document is for informational purposes only. Please inform HMS Networks of any inaccuracies or omissions found in this document. HMS Networks disclaims any responsibility or liability for any errors that may appear in this document.

HMS Networks reserves the right to modify its products in line with its policy of continuous product development. The information in this document shall therefore not be construed as a commitment on the part of HMS Networks and is subject to change without notice. HMS Networks makes no commitment to update or keep current the information in this document.

The data, examples and illustrations found in this document are included for illustrative purposes and are only intended to help improve understanding of the functionality and handling of the product. In view of the wide range of possible applications of the product, and because of the many variables and requirements associated with any particular implementation, HMS Networks cannot assume responsibility or liability for actual use based on the data, examples or illustrations included in this document nor for any damages incurred during installation of the product. Those responsible for the use of the product must acquire sufficient knowledge in order to ensure that the product is used correctly in their specific application and that the application meets all performance and safety requirements including any applicable laws, regulations, codes and standards. Further, HMS Networks will under no circumstances assume liability or responsibility for any problems that may arise as a result from the use of undocumented features or functional side effects found outside the documented scope of the product. The effects caused by any direct or indirect use of such aspects of the product are undefined and may include e.g. compatibility issues and stability issues.

---

# Table of Contents

Page

|          |                                            |           |
|----------|--------------------------------------------|-----------|
| <b>1</b> | <b>Preface .....</b>                       | <b>3</b>  |
| 1.1      | About This Application Note .....          | 3         |
| 1.2      | Target Audience.....                       | 3         |
| 1.3      | Trademarks.....                            | 3         |
| <b>2</b> | <b>Preparation .....</b>                   | <b>4</b>  |
| 2.1      | Required Equipment.....                    | 4         |
| 2.2      | Support and Resources .....                | 4         |
| <b>3</b> | <b>Connecting the Devices.....</b>         | <b>5</b>  |
| <b>4</b> | <b>IO-Link Configuration .....</b>         | <b>6</b>  |
| 4.1      | Installing the LR DEVICE Application ..... | 6         |
| 4.2      | Load Data From IO-Link Master .....        | 7         |
| 4.3      | IO-Link Master Configuration .....         | 8         |
| 4.4      | Ifm Pushbutton Configuration .....         | 9         |
| <b>5</b> | <b>Wireless Bolt IoT Setup.....</b>        | <b>10</b> |
| <b>6</b> | <b>Computer IP Configuration .....</b>     | <b>14</b> |
| <b>7</b> | <b>Publish Data From IO-Link .....</b>     | <b>15</b> |
| <b>8</b> | <b>Verify Communication .....</b>          | <b>18</b> |

**This page intentionally left blank**

# 1 Preface

## 1.1 About This Application Note

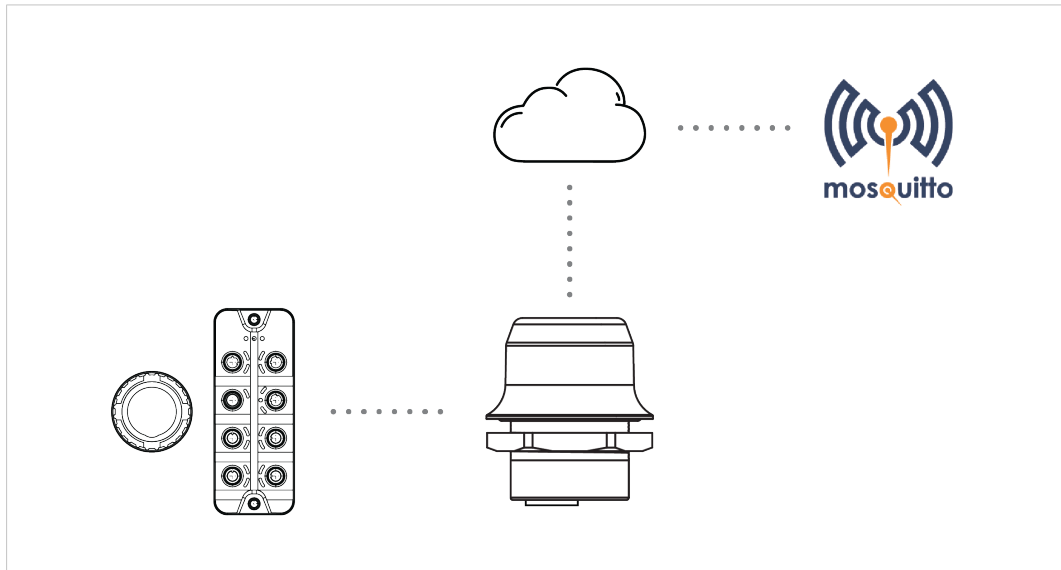


Fig. 1

In this application note, we describe how to connect a ifm pushbutton to an IO-Link Master using the Modbus TCP interface with a Wireless Bolt IoT by pushing the data from the push-button to a MQTT-server/broker on the internet via the Wireless Bolt IoT.

## 1.2 Target Audience

It is recommended that the reader is familiar with the equipment and have a good knowledge of wireless communication and network technology.

## 1.3 Trademarks

Anybus® is a registered trademark of HMS Networks AB.

All other trademarks are the property of their respective holders.

## 2 Preparation

### 2.1 Required Equipment

In this application note we use the following equipment:

| Equipment                                                          | Article Number | Version                 | Type                                |
|--------------------------------------------------------------------|----------------|-------------------------|-------------------------------------|
| ifm IO-Link master with Modbus TCP interface                       | AL1340         | AL1x4x_fw_mo_f7_v2.3.23 | N/A                                 |
| ifm Capacitive illuminated pushbutton                              | KT6101         | N/A                     | N/A                                 |
| ifm USB Stick with IO-Link parameter setting software, LR DEVICE   | QA0011         | N/A                     | N/A                                 |
| ifm Power supply, 24 VDC with M12 connector                        | N/A            | N/A                     | N/A                                 |
| ifm Connection Cable                                               | E12490         | N/A                     | 0.5 m PVC-Cable; M12/RJ45 connector |
| Anybus Wireless Bolt IoT black, NB-IoT, LTE-M/CAT-M1, 2G GPRS/EDGE | AWB1000        | N/A                     | N/A                                 |
| IoT SIM-card Netmore M2M                                           | SP2824         | N/A                     | N/A                                 |
| Netgear ProSafe 5-Port Gigabit Switch                              | GS105v4        | N/A                     | N/A                                 |
| Power adapter, 12VDC                                               | N/A            | N/A                     | N/A                                 |
| 2 Ethernet Cables                                                  | N/A            | N/A                     | N/A                                 |

#### Optional equipment

This kit can be used as an option to the AL1340, Ifm IO-Link master with Modbus TCP interface:

| Equipment                                  | Article Number |
|--------------------------------------------|----------------|
| ifm IO-Link master starter kit - MQTT JSON | ZZ1350         |

### 2.2 Support and Resources

For additional documentation and software downloads, FAQs, troubleshooting guides and technical support, please visit [www.anybus.com/support](http://www.anybus.com/support) and [ifm.com](http://ifm.com).



*Have the product article number available, to search for the product specific support web page. You find the product article number on the product cover.*

### 3 Connecting the Devices

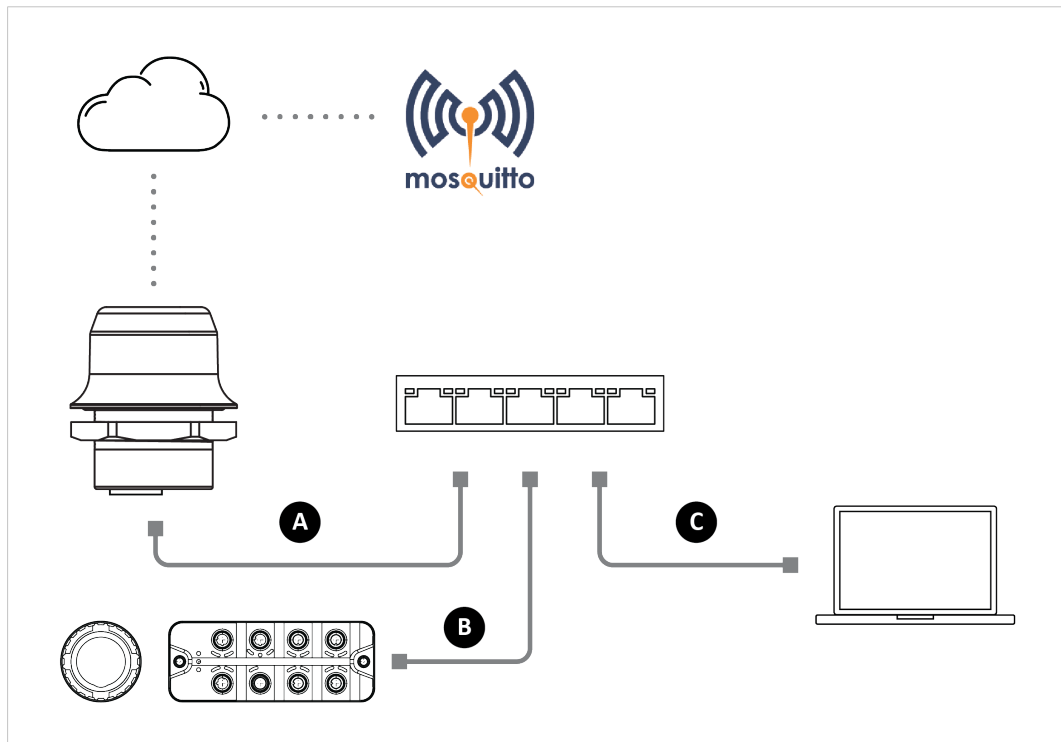


Fig. 2

#### IP settings

The IP address of the IO-Link master needs to be configured before it can start to communicate with the Wireless Bolt IoT, refer to [IO-Link Configuration, p. 6](#).

#### Connect and configure one device at a time

Connect one device at a time to the switch and configure it, before continuing with the next device and so on.

#### Connecting cables

- Connect the Wireless Bolt IoT to the switch with an ethernet cable (A).
- Connect the IO-Link master to the switch with the ifm connection cable (E12490) (B).
- Connect your computer to the switch with an ethernet cable (C).

#### IO-Link master ports used

- Connect the ifm connection cable (E12490) to port X23.
- Connect the ifm power supply to port X31.
- Connect the ifm pushbutton to port X01.

#### ifm power supply

Connect all the devices to the ifm power supply.

## 4 IO-Link Configuration

### 4.1 Installing the LR DEVICE Application

To configure the IO-Link master parameter settings, you need to install the LR DEVICE application on your computer.

#### Procedure

1. Plug in the ifm USB-stick to your computer and download the LR DEVICE installation exe file.
2. Run the LR DEVICE installation exe file and follow the instructions on the screen.

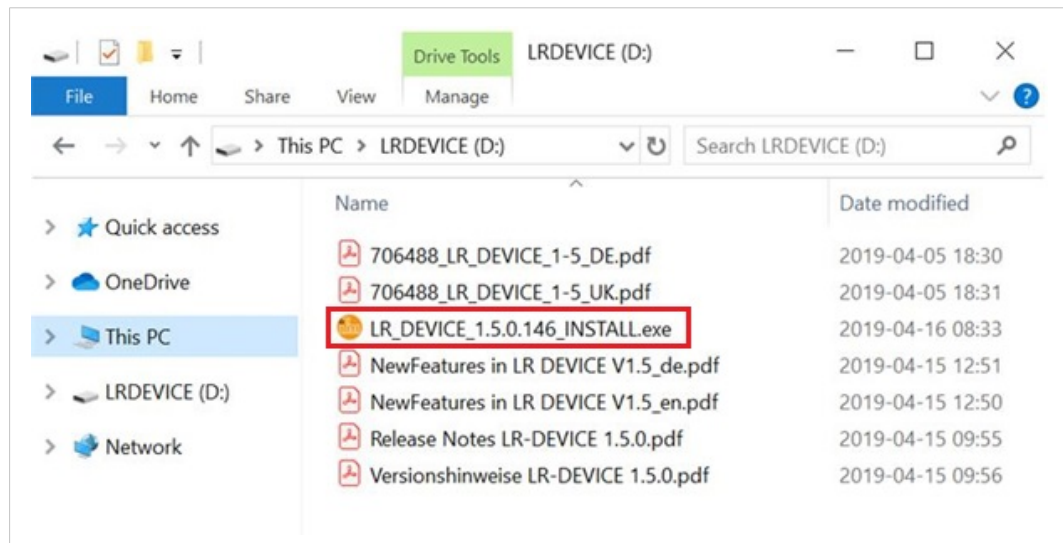


Fig. 3

3. Navigate to the folder where the LR DEVICE was installed and start the application.  
→ The LR DEVICE start screen opens.

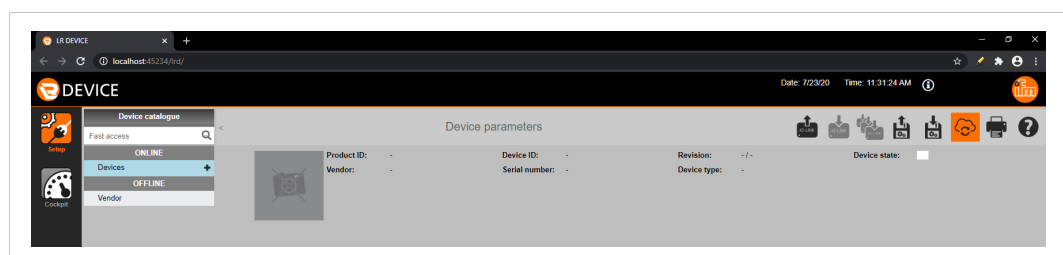


Fig. 4



## 4.2 Load Data From IO-Link Master

### Before You Begin

The IO-Link master factory default IP address starts with 169.254.

When the DHCP client of the IO-Link master is enabled, the IO-Link master is assigned the IP address 192.168.0.144 by the Wireless Bolt IoT.

### Procedure

- To search for IO-Link master, click **Read from device** in the top right menu.
  - The **Finding devices** pop-up window appears. Wait until a Found device appears, showing the IO-Link master article number and IP address.

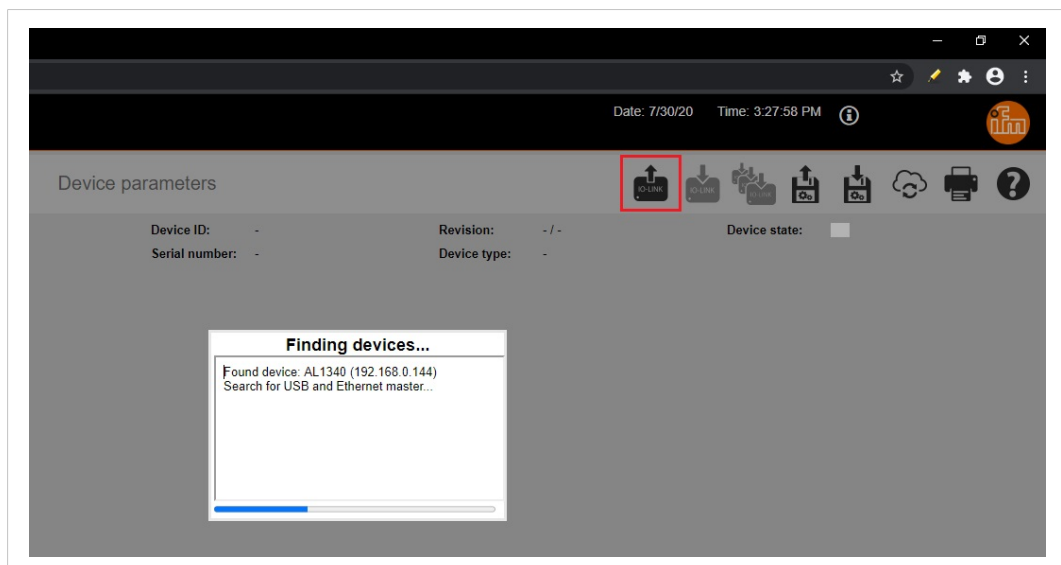


Fig. 5

- To load data from the IO-Link master to the LR DEVICE application, click **AL1340A** in the **ONLINE** menu.
  - The **Reading data from device** pop-up window appears. Wait until all the data has been loaded from the IO-Link master.

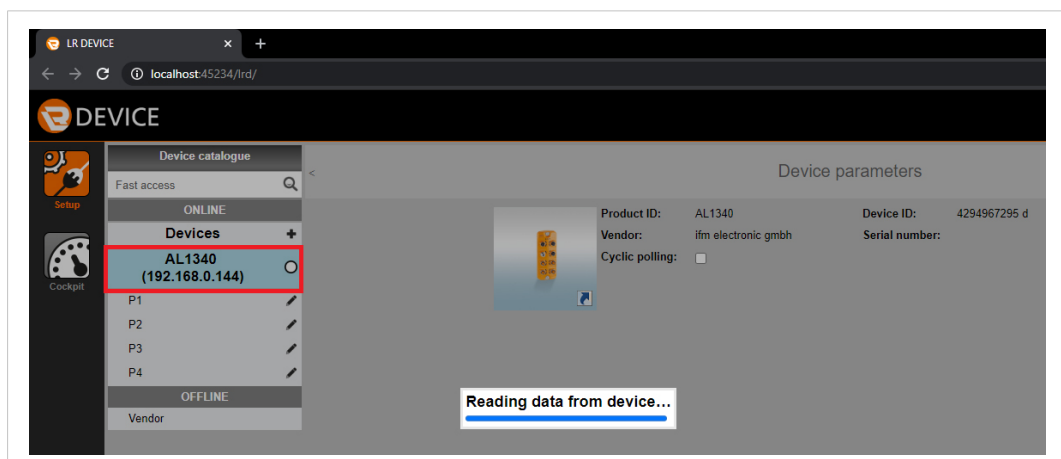


Fig. 6

## 4.3 IO-Link Master Configuration

In this section, we configure the IO-Link master IP address, Subnet mask and the Default gateway IP address.

### Before You Begin

#### DHCP server

Ensure that there is a DHCP server available on the network, where the IO-Link master is connected.

If there is no DHCP server available when you reboot the IO-Link master, the device connected to the IO-Link master will not be able to find it.

#### Static IP address

If the IO-Link master uses a static IP address:

- and is connected to a network with DHCP mode enabled, the IO-Link master will not be configurable.
- ensure that the IP address is in the same subnet as the device connected to it.

#### IO-Link master factory default settings

|                    |             |
|--------------------|-------------|
| IP address         | 169.254.x.x |
| Subnet mask        | 255.255.0.0 |
| Gateway IP address | 0.0.0.0     |

### Procedure

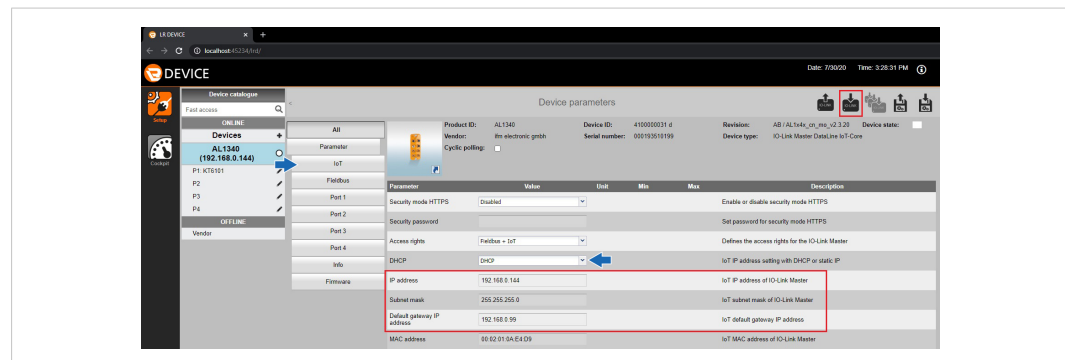


Fig. 7

To configure the IO-Link master:

1. In the **ONLINE** menu, click **AL1340**.
2. Select the **IoT** tab, where the IO-Link master IoT parameters are listed.
3. Select **DHCP** from the **DHCP** drop-down menu.
4. To finish the configuration, click **Write to device** in the top right menu.

To make the changes take effect, you need to reboot the IO-Link master:

5. Disconnect the IO-Link master from power and then reconnecting it again.

### Result

→ The IP address, Subnet mask and the Default gateway IP address are updated.

## 4.4 Ifm Pushbutton Configuration

When the capacitive illuminated ifm pushbutton is connected to the IO-Link master, it appears in the ONLINE menu.

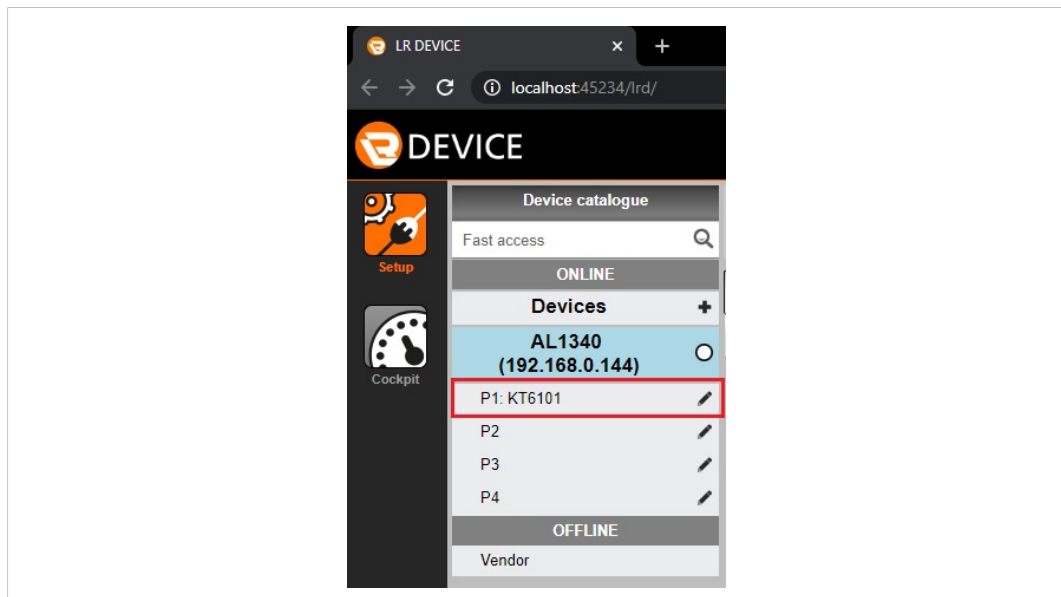


Fig. 8

### Procedure

To configure the ifm pushbutton settings:

1. Click on **KT6101**.  
→ The LR DEVICE reads and shows the ifm pushbutton parameter values.
2. Configure the desired parameters.
3. To make the changes take effect, reboot the IO-Link master.

## 5 Wireless Bolt IoT Setup

### Procedure

Connect the Wireless Bolt IoT to internet:

#### 1. Insert SIM card

Insert a cellular SIM card in the Wireless Bolt IoT SIM card holder.

Ensure that the SIM card contact surface is facing towards the Ethernet port.

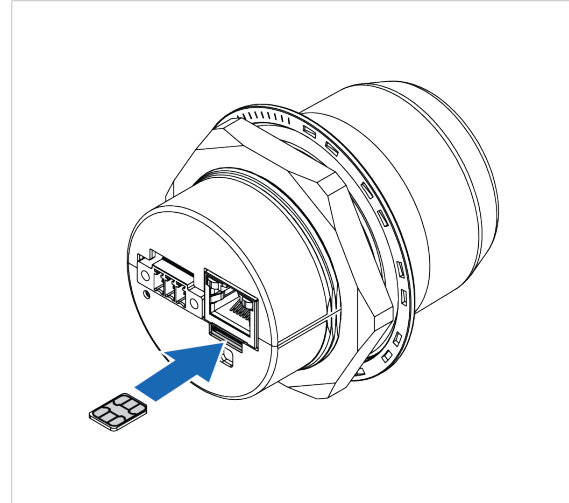


Fig. 9

#### 2. Connect to Computer and Power

- a. Connect the Wireless Bolt IoT Ethernet port to your computer.
- b. Connect the Wireless Bolt IoT Power connector to a power supply.

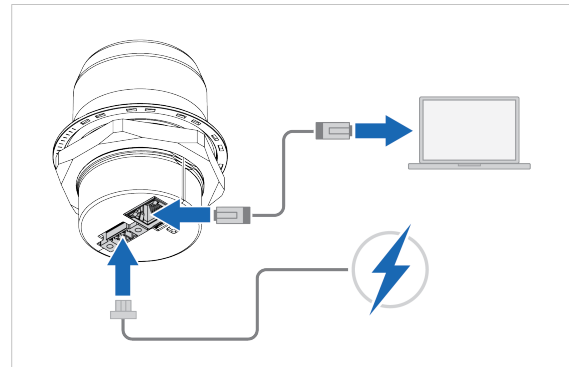


Fig. 10

#### 3. Wireless Bolt IoT IP settings

To access the Wireless Bolt IoT built-in web interface, ensure that the Wireless Bolt IoT IP address and your computer IP address are within the same IP address range.

The default IP address is 192.168.0.98.



Fig. 11

#### 4. Access the Wireless Bolt IoT built-in web interface

The Wireless Bolt IoT default username is **admin**. Written in lowercase letters.

You find the default password on the Wireless Bolt IoT product housing.

- Enter the Wireless Bolt IoT IP address in your web browser and click **Enter**.
- Login to the Wireless Bolt IoT built-in web interface.

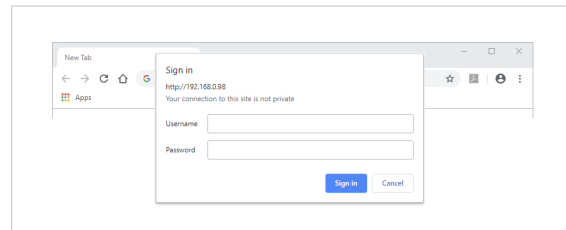


Fig. 12

#### 5. Ethernet Settings

On the Ethernet Settings page, configure the **IP Settings**:

- IP Address
- Internal DHCP Server, select **Enabled**.

Fig. 13 IP Settings example

#### 6. APN Settings

On the **Cellular Settings** page, configure the **APN Settings**.

Fig. 14 APN Settings example

#### 7. Save and Reboot

In the left sidebar menu, click **Save and Reboot**.

- The Wireless Bolt IoT automatically reboots, for the settings to take effect.

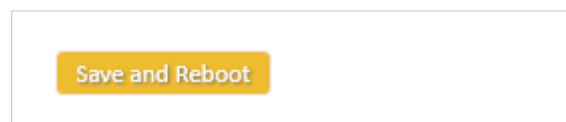


Fig. 15

Verify the configuration:

### 8. Verify the Wireless Bolt IoT IP address

To verify that the Wireless Bolt IoT IP address is configured.

The default IP address is 192.168.0.98.

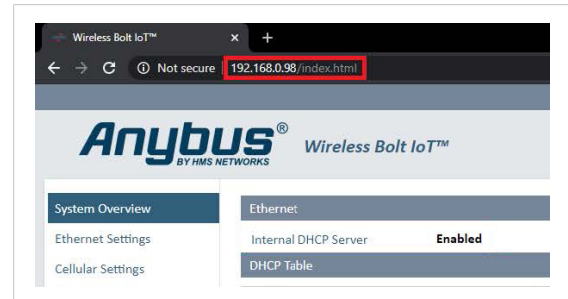


Fig. 16

### 9. Verify the system settings

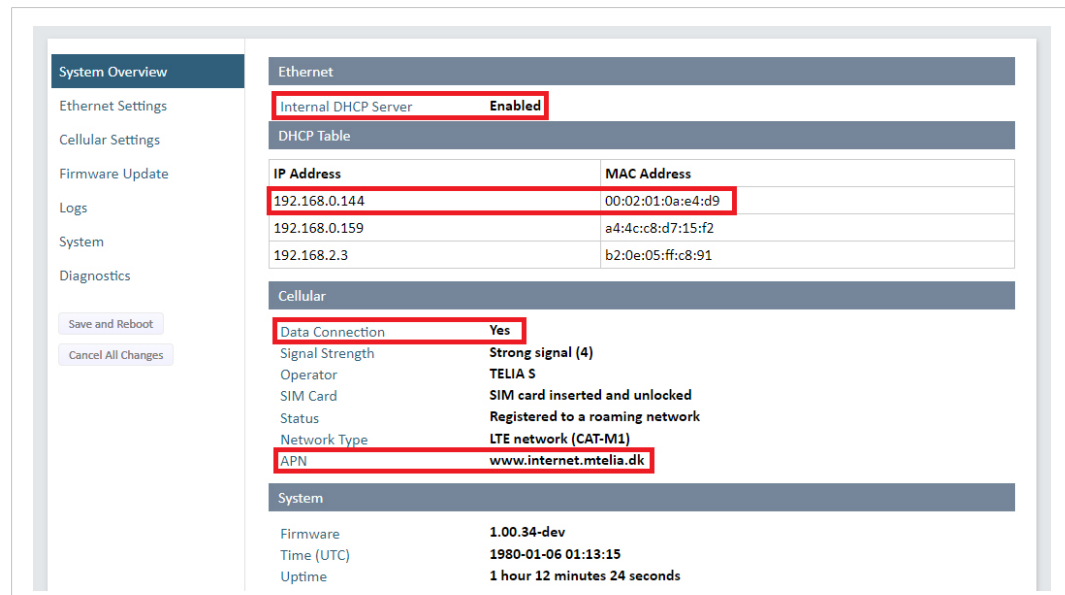


Fig. 17

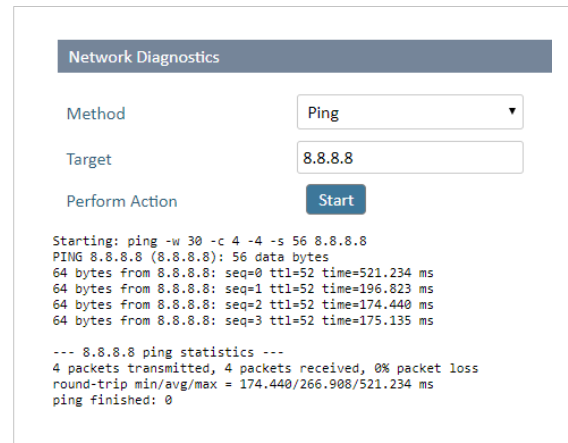
On the **System Overview** page, verify that the:

- c. **Internal DHCP Server** is **Enabled**.
- d. IP address of the IO-Link master is displayed in the **DHCP Table**.
- e. That cellular **Data Connection** has status **Yes**.
- f. **APN** settings are correct.

## 10. Verify internet connection

Verify internet access by sending a ping to *Google Public DNS*:

1. On the **Diagnostics** page, select **Ping** from the **Method** drop-down menu.
2. In the **Target** field, enter the IP address *8.8.8.8*.
3. To **Perform Action**, click **Start**.
  - The ping request is sent.
  - When the ping response return, a message appears.



The screenshot shows a web interface titled "Network Diagnostics". It has a "Method" dropdown menu set to "Ping", a "Target" text input field containing "8.8.8.8", and a "Perform Action" button labeled "Start". Below the form, the terminal output of the ping command is displayed:

```
Starting: ping -w 30 -c 4 -4 -s 56 8.8.8.8
PING 8.8.8.8 (8.8.8.8): 56 data bytes
64 bytes from 8.8.8.8: seq=0 ttl=52 time=521.234 ms
64 bytes from 8.8.8.8: seq=1 ttl=52 time=196.823 ms
64 bytes from 8.8.8.8: seq=2 ttl=52 time=174.440 ms
64 bytes from 8.8.8.8: seq=3 ttl=52 time=175.135 ms

--- 8.8.8.8 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max = 174.440/266.908/521.234 ms
ping finished: 0
```

Fig. 18 Example, Ping response from Target 8.8.8.8

## 6 Computer IP Configuration

The ethernet port on your computer that is connected to the switch must be configured to get IP address settings automatically.

### Procedure

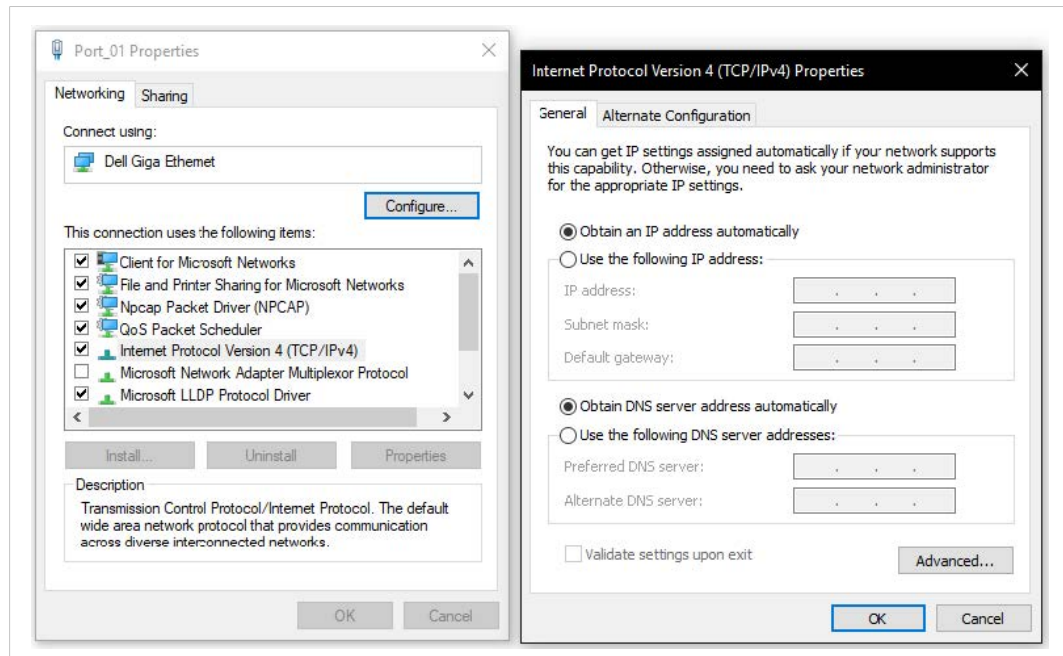


Fig. 19

To change the IP address settings of the ethernet port:

1. Navigate to the **Control Panel** and click **Network Connections**.
2. Right-click the network connected to the switch and click **Properties**.
3. Click **Internet Protocol Version 4 (TCP/IPv4)**.
4. Verify that the **Obtain an IP address automatically** and **Obtain DNS server address automatically** radio buttons are selected.
5. Click **OK**.

### Result

→ Now the Wireless Bolt IoT can generate IP addresses to the IO-Link master.



## 7 Publish Data From IO-Link

HTTP/JSON-requests are used to fetch and write data to the IO-Link master and devices connected to the ports on the master.

To publish data from the IO-Link master, a subscribe request must be sent to the IO-Link master via a HTTP/JSON-request.

Before sending subscribe requests the timer must be set on the IO-Link master.

The timer controls the cycle time of when data is pushed on the MQTT publish channel.

### Before You Begin

The most efficient way is to send data from the IO-Link master when data changes.

The approach used in this application note was the best solution at the time it was written.

### Procedure

To set the timer:

1. Visit [curl.haxx.se/download.html](http://curl.haxx.se/download.html) and download curl.
2. When the curl download is finished, open a command prompt on your computer.
3. Write the code from *Example 1* and *Example 2*.
  - "adr": "/timer[1]/interval/setdata" specifies which timer to use, timer[1] or timer[2] .
  - Set the timer[1] to a value between 500 ms and 2147483647 ms.  
Example, the timer is set to 500 ms: "newvalue": 500
  - http://192.168.0.144 is the IP address of the IO-Link master.

### Example 1: Request

```
{
  "code": "request",
  "cid": 4712,
  "adr": "/timer[1]/interval/setdata",
  "data": {
    "newvalue": 500
  }
}
```

### Example 2: Request in curl

```
curl --header "Content-Type: application/json"
--request POST
--data '{
  "code": "request",
  "cid": 4712,
  "adr": "/timer[1]/interval/setdata",
  "data": {
    "newvalue": 500
  }
}'
http://192.168.0.144
```

In Windows, there can be issues with single and double quotes, write the following:

```
curl --header "Content-Type: application/json"
--request POST
--data "{
\"code\": \"request\",
\"cid\": 4712,
\"adr\": \"/timer[1]/interval/setdata\",
\"data\": {
\"newvalue\":500
}
}"
http://192.168.0.144
```

4. Send the request.

→ If the request is successful, the response is according to *Example 3: Response*.

**Example 3: Response**

```
{
"cid": 4712,
"code": 200
}
```

5. Write the code from *Example 4* and *Example 5*.

- The public Mosquitto MQTT broker: <https://test.mosquitto.org/>.
- The Mosquitto brokers IP address: 5.196.95.208
- Port: 1883
- Topic: test.

**Example 4: Subscribe Request**

```
{
"code": "request",
"cid": 4712,
"adr": "timer[1]/counter/datachanged/subscribe",
"data": {
"callback": "mqtt://5.196.95.208:1883/test",
"datatosend": [
"iolinkmaster/port[1]/iolinkdevice/pdin"
]
}
}
```

**Example 5: Subscribe Request in curl**

```
curl --header "Content-Type: application/json"
--request POST
--data '{
"code": "request",
"cid": 4712,
"adr": "timer[1]/counter/datachanged/subscribe",
"data": {
"callback": "mqtt://5.196.95.208:1883/test",
"datatosend": [
"iolinkmaster/port[1]/iolinkdevice/pdin"
]
}
}'
http://192.168.0.144
```

In Windows, there can be issues with single and double quotes, write the following:

```
curl --header "Content-Type: application/json"
--request POST
--data "{
  \"code\": \"request\",
  \"cid\": 4712,
  \"adr\": \"timer[1]/counter/datachanged/subscribe\",
  \"data\": {\"callback\": \"mqtt://5.196.95.208:1883/test\",
  \"datatosend\": [
    \"iolinkmaster/port[1]/iolinkdevice/pdin\"
  ]
}"
http://192.168.0.144
```

6. Send subscribe request to the IO-Link master.

→ If the request is successful, the response is according to *Example 6: Response*:

#### Example 6: Response

```
{
  "cid": 4712,
  "code": 200
}
```

To unsubscribe:



When unsubscribing, always use the same *cid* that was used for subscribing to the event.

7. Write the code according to *Example 7: Unsubscribe Request*.

#### Example 7: Unsubscribe Request

```
{
  "code": "request",
  "cid": 4712,
  "adr": "timer[1]/counter/datachanged/unsubscribe",
  "data": {
    "callback": "mqtt://5.196.95.208:1883/test",
    "datatosend": [
      "iolinkmaster/port[1]/iolinkdevice/pdin"
    ]
  }
}
```

## 8 Verify Communication

To verify that the IO-Link master is sending data from the ifm pushbutton to the Mosquitto broker, there must be an additional device connected that subscribes to the same `topic` that the IO-Link master is publishing to.

As an additional device, we use an MQTT Client.

The devices subscribe to the topic: `test`



Fig. 20

### Procedure

1. Visit [mqttfx.org](http://mqttfx.org) and download the JavaFX based MQTT Client installation file **MQTT.fx**.

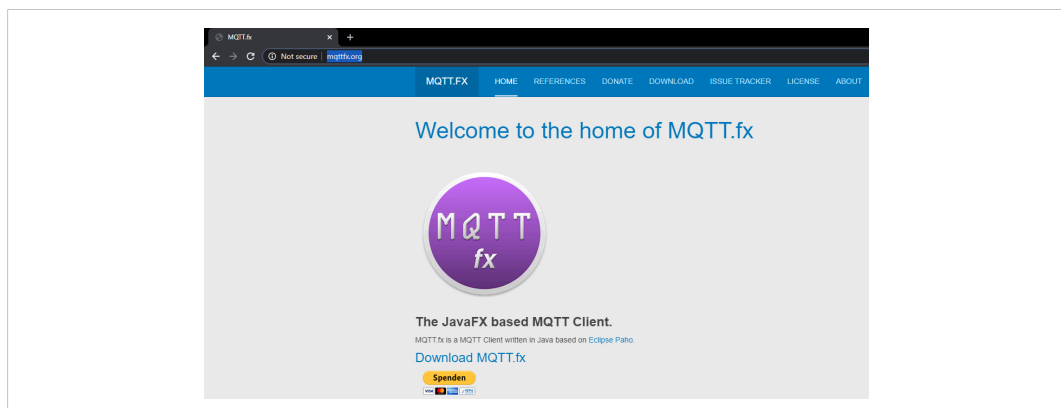


Fig. 21

2. Install the **JavaFX based MQTT Client** on your computer.
3. Start the MQTT Client.
4. Open the **MQTT Broker Profile Settings**.

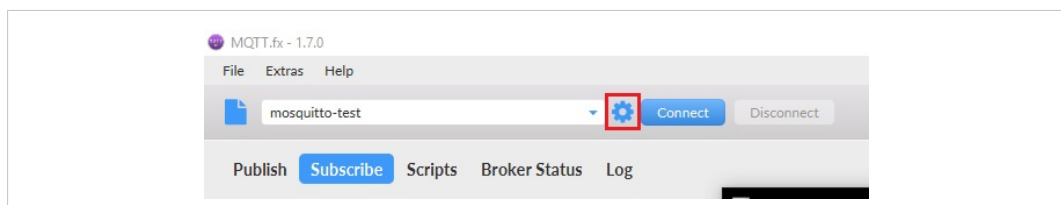


Fig. 22

5. Enter the **Brokers IP address** and the **Broker Port** and then click **OK**.

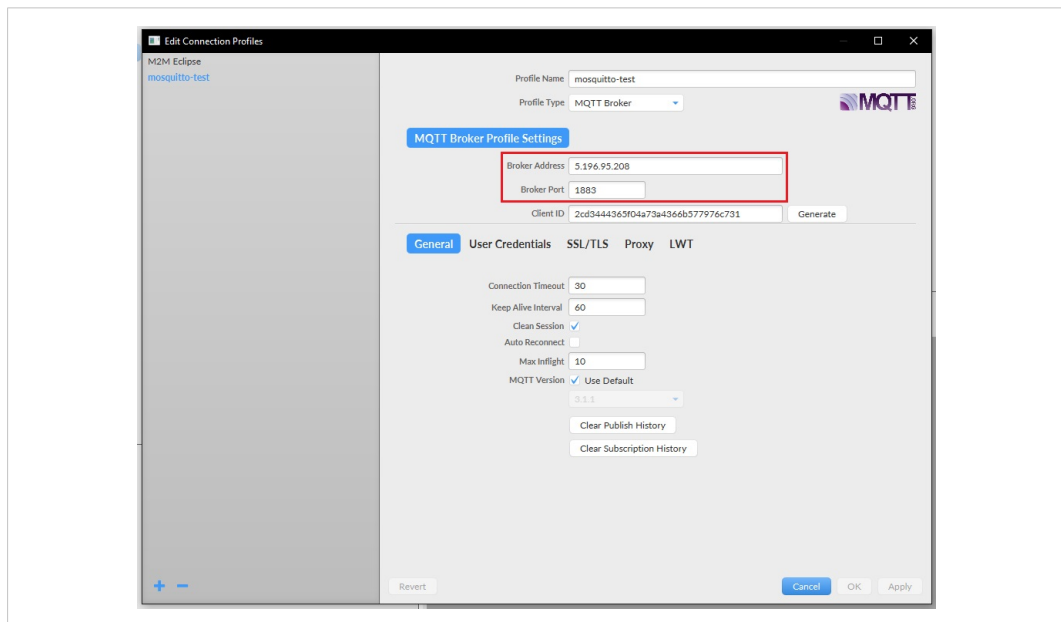


Fig. 23

6. Click **Connect**.

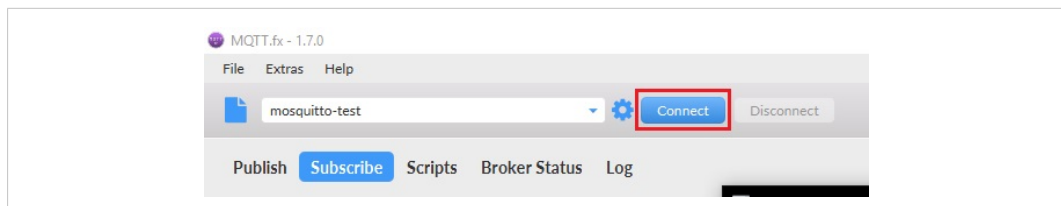


Fig. 24

## Result

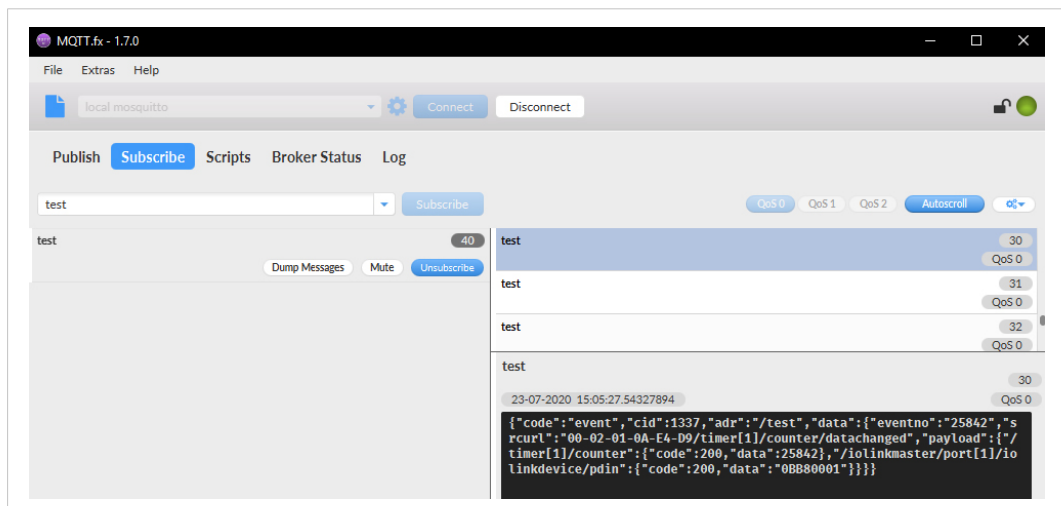


Fig. 25

- The indicator at the top right of the page, turns green.
- The data from the ifm pushbutton connected to the IO-Link master appear in the bottom right corner.

