Industrial Automation / Industrial Networking

Tech Note 14 RAMQTT Configuration Guide

Abstract:

The RAMQTT Client allows the Red Lion RAM® device to publish data to IoT clouds using the MQTT protocol.

Products:

Sixnet® Series RAM 6000 RTU

Sixnet® Series RAM 9000 RTU

Sixnet® Series IndustrialPro® 6000

Use Case: Short Description

This user guide describes different messages the RAMQTT Client can publish, how to setup the RAMQTT Client, and basic setup on a supported IoT cloud provider.

RAMQTT Supported IoT Clouds:

AT&T M2X
Autodesk Fusion Connect
Amazon AWS IoT
Telenor Cloud Connect

Required Firmware:

Version 4.24 or higher

1.1 Overview

The RAMQTT Client allows the Red Lion RAM device to publish data to IoT clouds using the MQTT protocol.

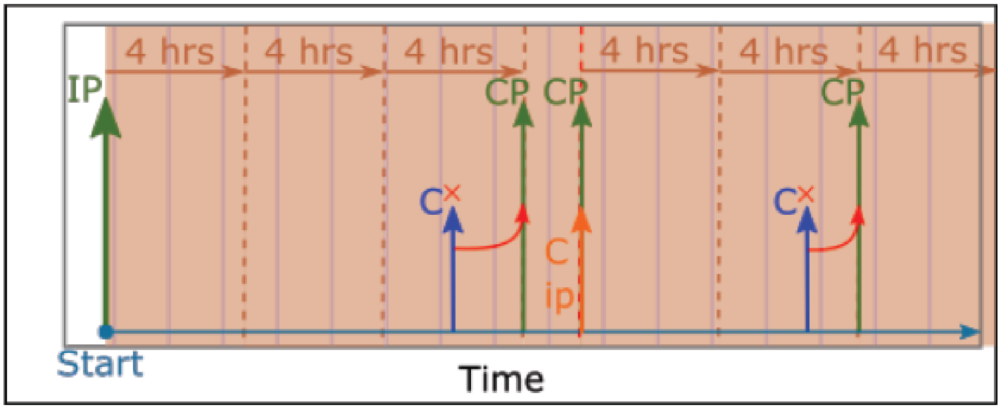
This user guide describes different messages the RAMQTT Client can publish, how to setup the RAMQTT Client, and basic setup on a supported IoT cloud provider.

Connecting the Red Lion device to the IoT cloud is only supported on RAM 6000 and RAM 9000 devices with a firmware version of 4.24 or higher.

1.2 Message Publishing

1.2.1 Device Information Publishing

Information about the Device can be published to the cloud by selecting either "Basic" (less detailed) or "Full" (more detailed) for the Device Info Message option. If "None" is selected, no Device Information message is sent.



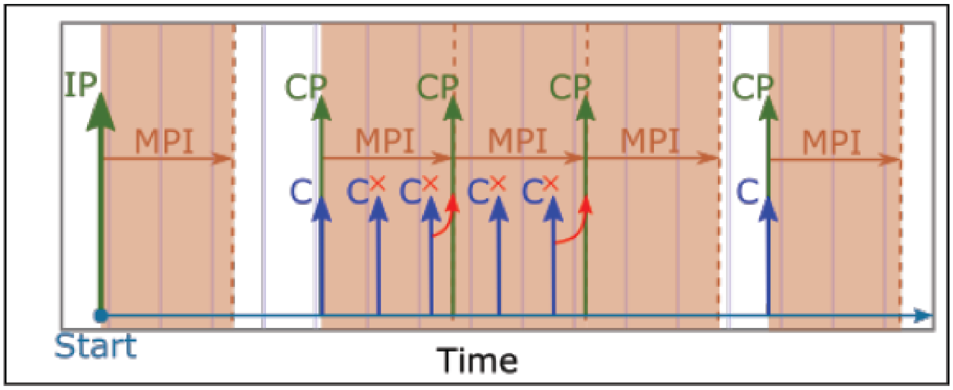
Definitions: **IP** - Initial Publish, **CP** - Change Publish, **c**- Change in Device Info, **start** - Start of RAMQTT, **x** - Unpublished value**, cip** - Change in one or more IP addresses.

The complete Device Information message is sent when the RAMQTT client starts. Afterwards, only changes in the data points are updated. The frequency of updates depends on the value set for Device Info Publish Interval. In the example above, the Device Info Publish Interval is set to 4 hours. The only exception is that if any IP address changes, the message is published immediately and will reset the publish timer.

1.2.2 IODB Publishing

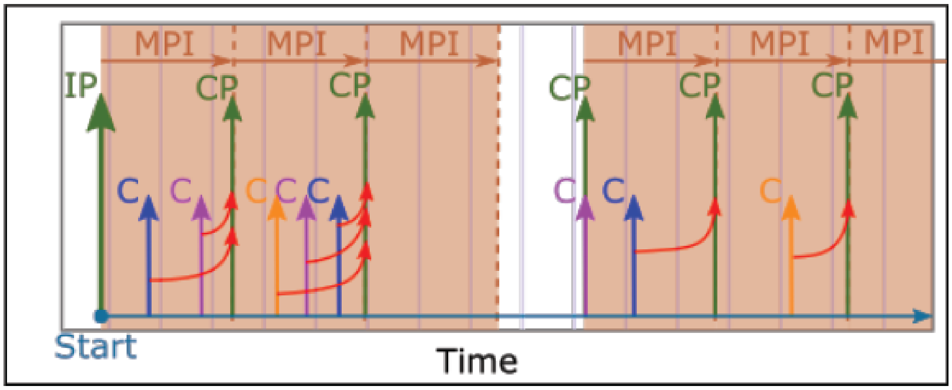
When RAMQTT starts, it publishes an initial IODB message containing the current values of all IODB Tags specified in the Points section. Once the initial IODB message is sent, RAMQTT only publishes the changed values of IODB Tags. This helps reduce data usage while still recording activity. To further enhance data usage efficiency, RAMQTT only publishes changes after a set amount of time from the last published message. The amount of time depends on the value set for the Minimum Publish Interval (MPI). The MPI helps to reduce the number of messages sent when publishing IODB Tag values that change frequently. Once the changed IODB Tag values are sent, the next message containing changes won't be published until after the MPI.

Single IODB Value



Definitions: **IP** - Initial Publish, **CP** - Change Publish, **MPI** - Minimum Publish Interval, **C** - Change in IODB value, **start** - Start of RAMQTT, **x** - Unpublished value.

Multiple IODP Values



Definitions: **IP** - Initial Publish, **CP** - Change Publish, **MPI** - Minimum Publish Interval, **C** - Change in IODB value, **start** - Start of RAMQTT.

The illustration above demonstrates when multiple IODB values change. All changes in IODB values will be published not at the instance the change happened, but at the MPI.

1.3 Message Definitions

RAMQTT has two types of messages that can be published to the cloud:

- Device Information Message - Contains information about the device such as the RSSI or IMEI values. This message comes in two forms, "Basic" (less detailed) and "Full" (more detailed).
- IODB Message - Contains IODB Tag values from system tags and or user created tags.

All published and received messages are formatted into JSON (JavaScript Object Notation). This is a standardized way of formatting information that is understandable by multiple cloud services and applications. The actual organization and structure of the message may vary from cloud to cloud.

1.3.1 Publish Messages

Device Information Message

Device information is sent as a separate message. This message covers general information about the device**.**

The device information message is sent after initial connection and on a specified interval known as the Device Information Publish Interval. The table below contains all the information that is stored within a Device Information message**.**

Field	Description	Type	Units	Basic/Fill
unitName	User defined name of the unit	string		basic
serialNumber	Device serial number	string		basic
model	Device model number	string		basic
version	Device firmware version number	string		basic
cellIp	Cellular IP address	string		basic
upTime	Device uptime in seconds	number	Sec	basic
versionLong	Device firmware version number with build numbers	string		Full
pwr	Device power. If device has more than one power supply, this will read power1.	number	V	full
unitTemp	Device temperature	number	C	full
hostName	Host name	string		full
intInfo	Interface Information. All active ip addresses on the device in following format: <InterfaceName>=<Ip address>;<InterfaceName>=<Ip address>; Example: eth0=192.168.10.10;usb0=192.168.111.1;	string		full
cellFirmVer	Cellular module firmware version	string		full
cellFirmNum	Cellular module firmware number	string		full
imei	IMEI (International Mobile Equipment Identity)	string		full
mdn	MDN (Mobile Directory Number)	string		full
simID	Sim Card Identification Number. It is also known as the ICCID (Integrated Circuit Card Identifier).	string		full
ismi	ISMI (International Mobile Subscriber Identity)	string		full
cellServType	Cellular Service Type	string		full
plmn	PLMN (Public Land Mobile Network)	string		full
cellChan	Cellular Channel	number		full
wsSig	Wireless Signal • NO_SERVICE 0x09 • NO_SIGNAL 0x00 • POOR_SERVICE 0x01 • FAIR_SERVICE 0x03 • GOOD_SERVICE 0x07	number		full

Field	Description	Type	Units	Basic/Fill
	• EXEL_SERVICE 0x0F • DECODE_OOM 0x10 • DECODE_UP 0x11 • DECODE_DOWN 0x12 • DECODE_INOUT 0x13 • DECODE_TOGGLE 0x14 • DECODE_OUTIN 0x15			
rssi	Current RSSI (Received Signal Strength Indicator)	number	dBm	full
ecio	Current ECIO - Also known as Ec/Io, which is the ratio of the received energy per chip and the interference level.	number	dB	full
rsrp	Current RSRP (Reference Signal Receive Power)	number	dBm	full
rsrq	Current RSRQ (Reference Signal Received Quality)	number	dBm	full
cellUpTime	Cellular module up time	number	Sec	full
cellModTemp	Cellular module temperature	number	C	full
apn	Current APN (Access Point Name)	string		full
dataDay	Today's data usage in kb on wwan0 (cell)	number	KiB	full
dataMonth	This month's data usage in kb on wwan0 (cell)	number	KiB	full
gpsAltitude	GPS Altitude	number	dm	full
gpsTime	GPS Time	number	Sec	full
gpsNumOfSat	GPS Number of satellites	number		full
gpsFtFromCp	GPS Feet From Center Point	number	ft	full
gpsSpeed	GPS Speed	number	knots	full
gpsCourse	GPS Course/Heading	number		full

GPS Location

The GPS Latitude and Longitude values are included in the message. Please note, that visual display of these values will differ between the IoT Cloud providers and may not be in the same area with the rest of device information details. Please refer to IoT Cloud provider documentation for details on where to look for GPS location of the device.

IODB Messages

The fields of an IODB message contain the name of the IODB register, known as the Tag Name, and the value of the IODB register. If the IODB register does not have a system or user defined Tag Name, the tag name will be in following format: <IODB Type>_<IODB Address> where IODB Address is in zero based address.
For example: AO_3232.

1.3.2 Subscribe Messages

Message format and topics are specific to each IoT cloud environment.

The RAMQTT client subscribes to certain Cloud specific topics to receive following message types:

- **IODB Write - update IODB registers**
- **Firmware Update* - update the device firmware**
- **Package Install* - install a package to the device**
- **Configuration Update* - update configurations on the device**
- **Configuration Fetch* - fetch current configurations from the device and send them to the cloud**
- **Reboot* - reboot the device**

*Availability of these message types may differ between IoT Cloud providers.

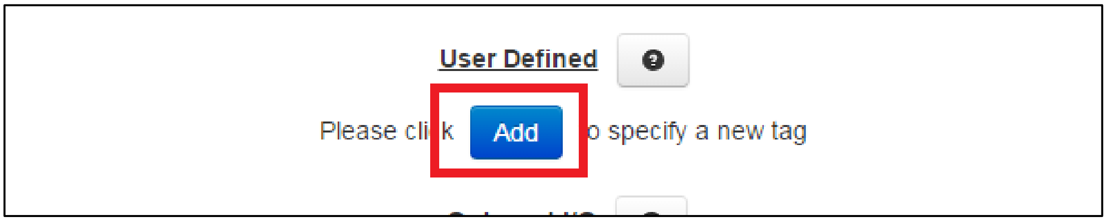
1.4 Device Quick Setup Guide

1.4.1 Setting up IODB Tags for particular registers.

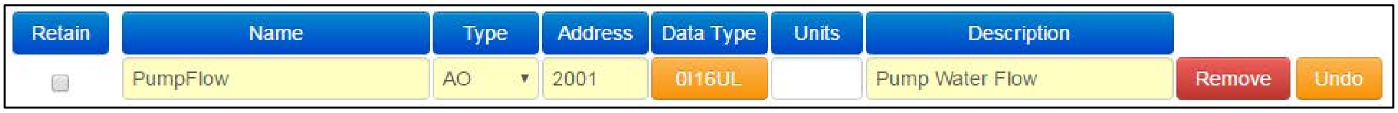
Step 1. Navigate to: Automation>Tags

From device web interface, navigate to: **Automation>Tags**

Step 2. Click **Add** button to add new tag definition.



Step 3. Fill out Tag definition fields:

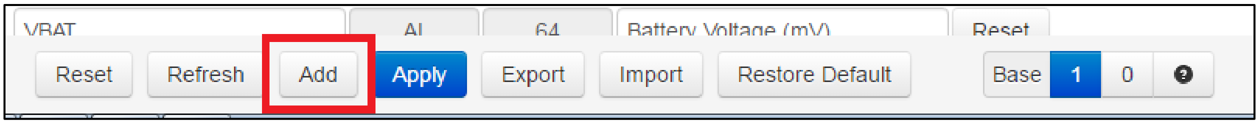


Retain	Name	Type	Address	Data Type	Units	Description		
☐	PumpFlow	AO ▾	2001	0I16UL		Pump Water Flow	Remove	Undo

- **Name** - Enter Tag name without spaces
- **Type** - Select Register type
- **Address** - Enter Register address
- **Units** - Optional, enter units associated with the tag
- **Description** - Optional, enter description for the tag

Step 4. Add more Tags

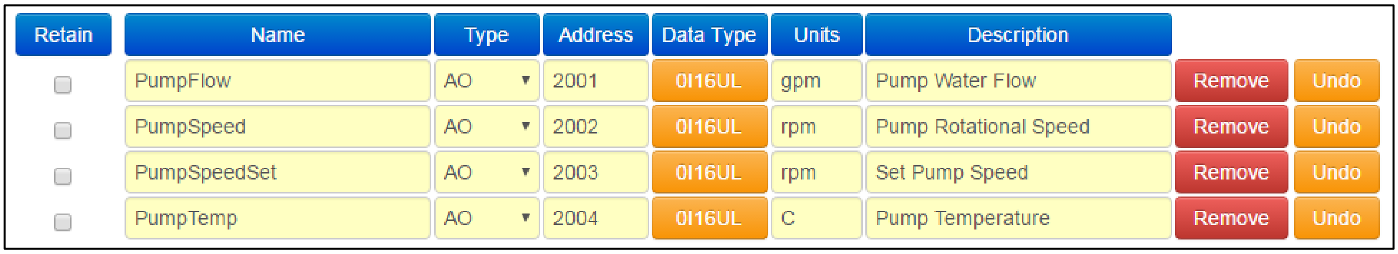
To add more tags, Click Add button at the bottom of the page.



Repeat **Step 3**.

Repeat **Step 4** as many times as needed to add desired amount of tags.

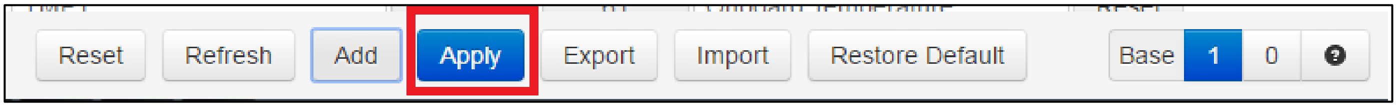
After completing adding tags, user defined tags might look something like this:



Retain	Name	Type	Address	Data Type	Units	Description		
□	PumpFlow	AO ▾	2001	0I16UL	gpm	Pump Water Flow	Remove	Undo
□	PumpSpeed	AO ▾	2002	0I16UL	rpm	Pump Rotational Speed	Remove	Undo
□	PumpSpeedSet	AO ▾	2003	0I16UL	rpm	Set Pump Speed	Remove	Undo
□	PumpTemp	AO ▾	2004	0I16UL	C	Pump Temperature	Remove	Undo

Step 5. Click **Apply**

When finished adding all user tags, click **Apply** to save all changes.



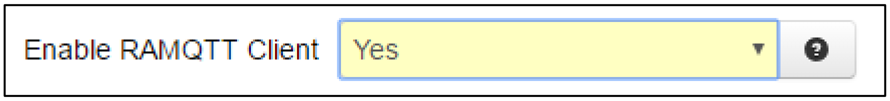
Please note that if IODB tag name is changed after it was selected on RAMQTT page, RAMQTT Client will need to be restarted to get tag name changes into effect.

1.4.2 Enabling and configuring the RAMQTT Client.

RAMQTT Client is located under Service>RAMQTT Client.

Step 1. Enable RAMQTT Client

By default, RAMQTT Client is disabled and must be enabled in order to use it.



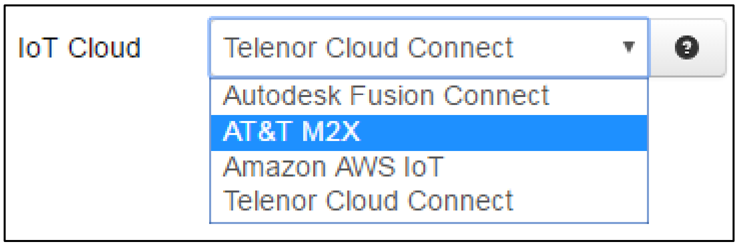
Enable RAMQTT Client: Yes ▾

To Enable RAMQTT Client, select **Yes** from "Enable RAMQTT Client"

Enabling RAMQTT does not automatically start the client. The **Blue** Apply button must be clicked.

Step 2. Select IoT Cloud

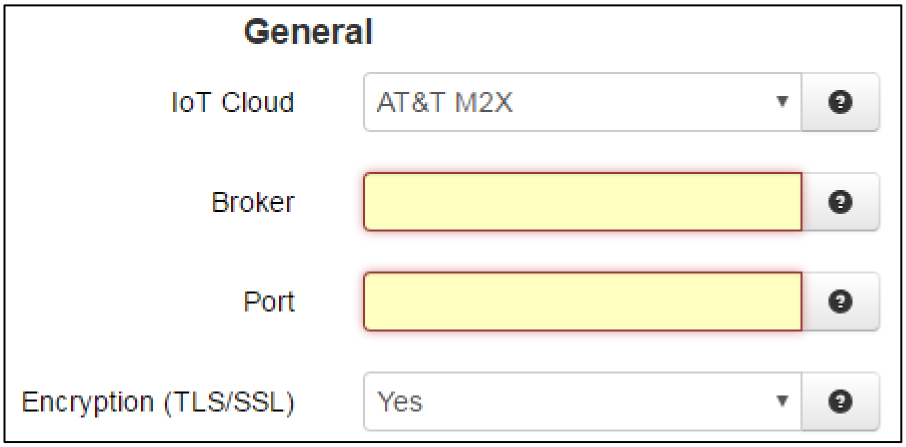
Select which cloud provider for RAMQTT Client to connect to.



IoT Cloud: Telenor Cloud Connect

Step 3. Enter general settings.

General settings are the minimum settings required to configure the RAMQTT Client to connect the device to the IoT cloud provider. Each cloud provider may have different set of general settings.



General

IoT Cloud: AT&T M2X

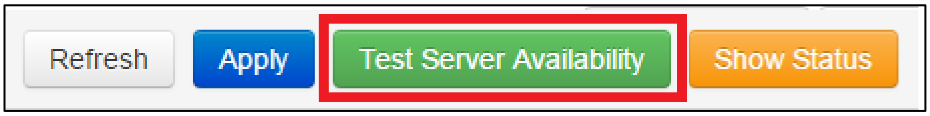
Broker:

Port:

Encryption (TLS/SSL): Yes

- Enter IoT MQTT broker IP adders or URL address
- Enter appropriate port
- Select if using encryption
- Select if authentication will be used
  - If Use Authentication is set to **Yes**, enter User Name and Password for the MQTT server.
- Other fields may be specific to various IoT Cloud providers. See:
- IoT Cloud Specific Information

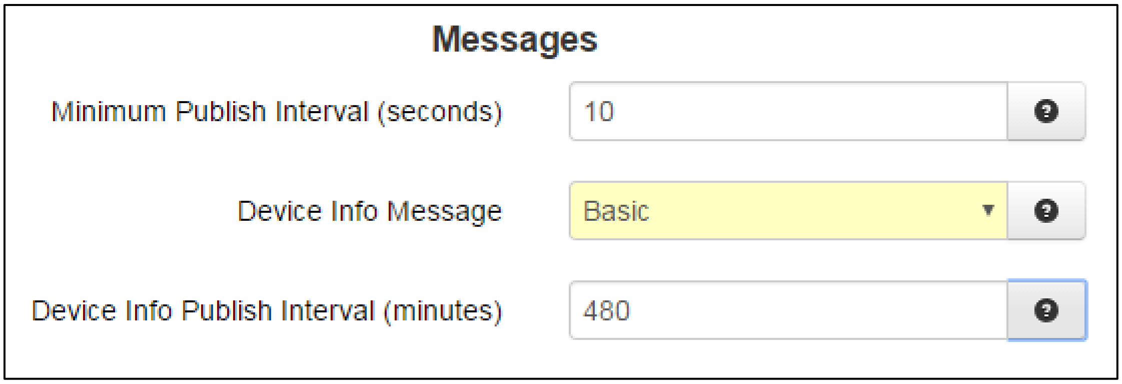
Step 3.1. Testing connection



Once the Broker and Port are entered, it is possible to test the connection. To do this, press green **Test Server Availability** button at the bottom of the page. A message box appears indicating if a RAMQTT can connect to broker with given configurations.

Step 4. Enter message settings

Message settings are configured to manage the frequency of messages sent to the cloud.



Messages

Minimum Publish Interval (seconds): 10

Device Info Message: Basic

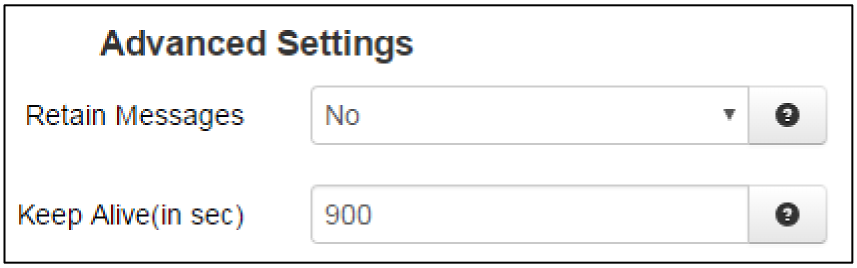
Device Info Publish Interval (minutes): 480

- Specify **Minimum Publish Interval**
- Select what type of **Device Info Message** (information) to be sent.
  - If Device message is selected to "Basic" or "Full", enter **Device Info Publish Interval**.

Please note, Device Information, when Basic or Full is selected, will publish in its entirety on RAMQTT startup. Then on every next device publish interval, only changed values are published, if any. IP address changes are published as soon as they happen.

Step 5. Enter advanced settings

Changing Advanced Settings is not recommended unless deep knowledge of MQTT is understood.



Advanced Settings

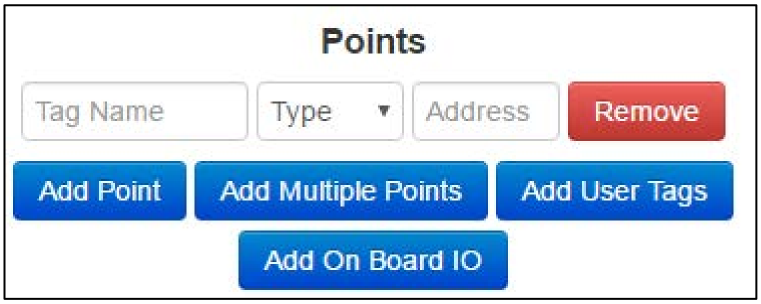
Retain Messages: No

Keep Alive(in sec): 900

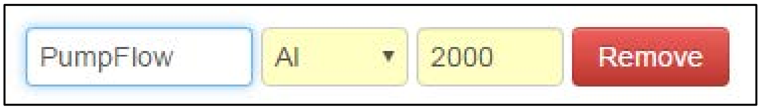
Step 6. Select data points

To add a single data point:

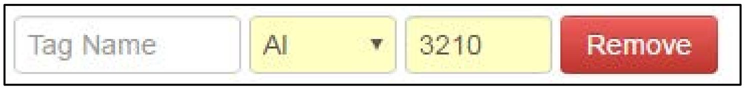
1. Click on the **Add Point** blue button.



2. A single row appears to enter point data. Enter tag name in Tag Name box.


PumpFlow AI 2000

3. If adding an IODB point that does not have a tag, simply select Type and enter the address.

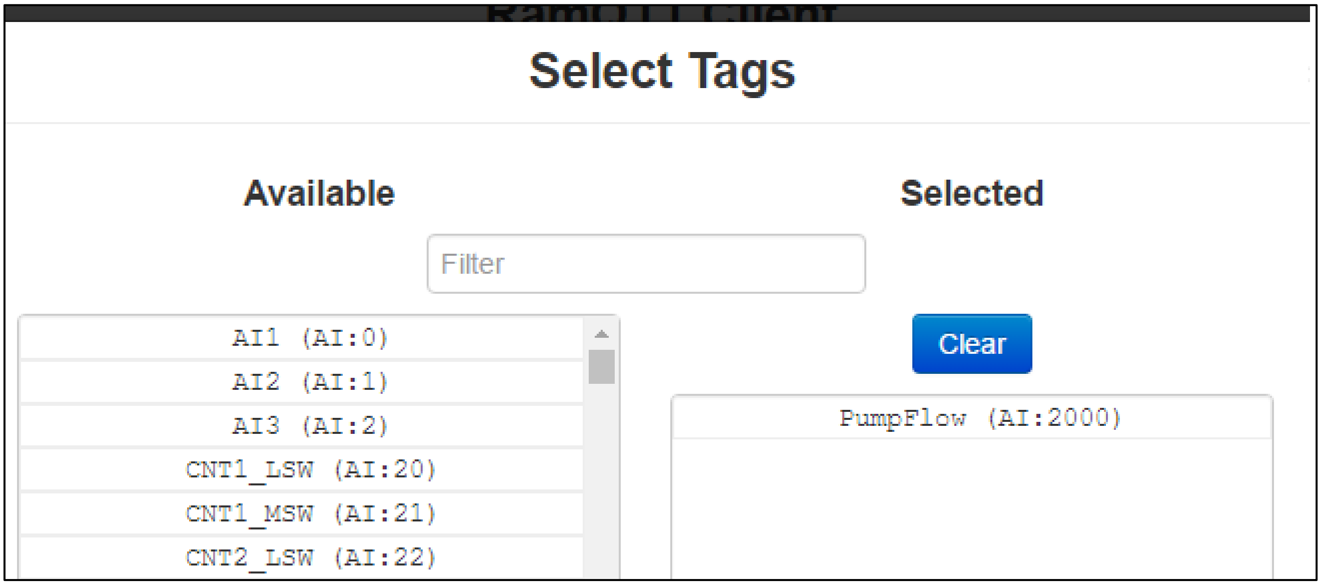

AI 3210

To add all User Tags:

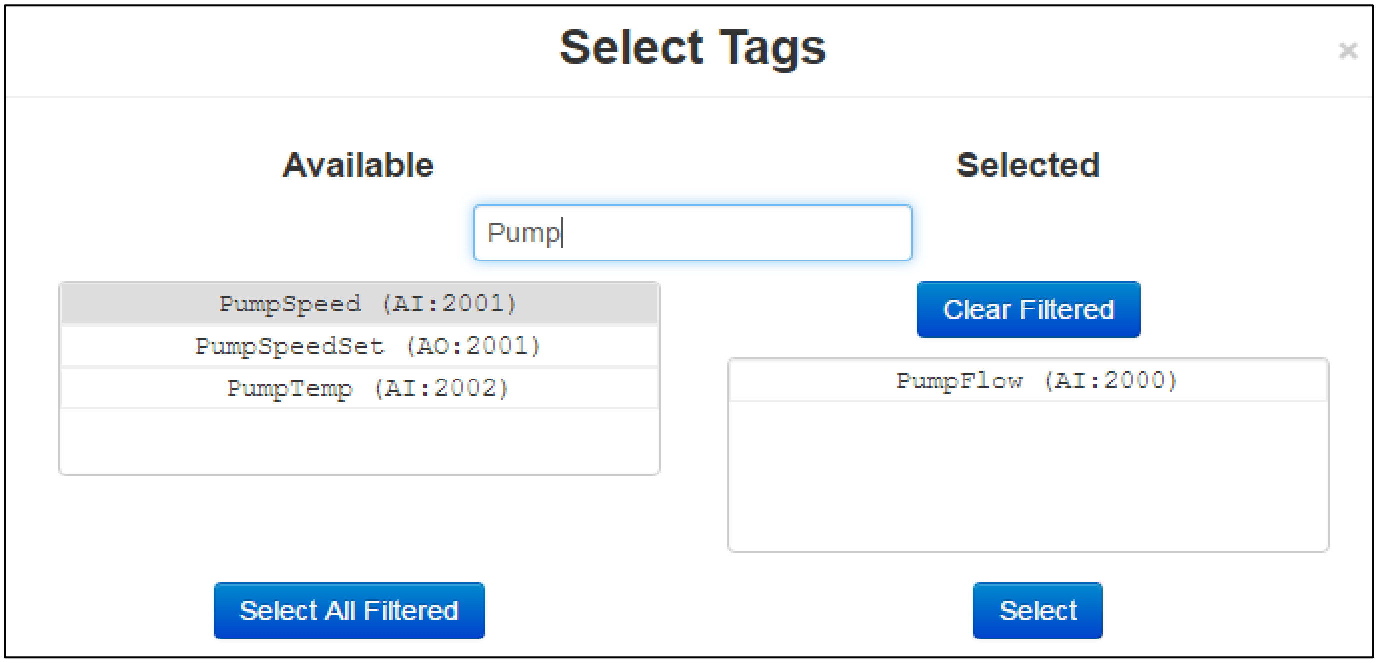
1. To add all user tags, simply click on **Add User Tags** button. All user tags defined on Tags page will be added.

To add multiple points:

1. Click on the blue **Add Multiple Points** button. A Select Tags dialog will appear.



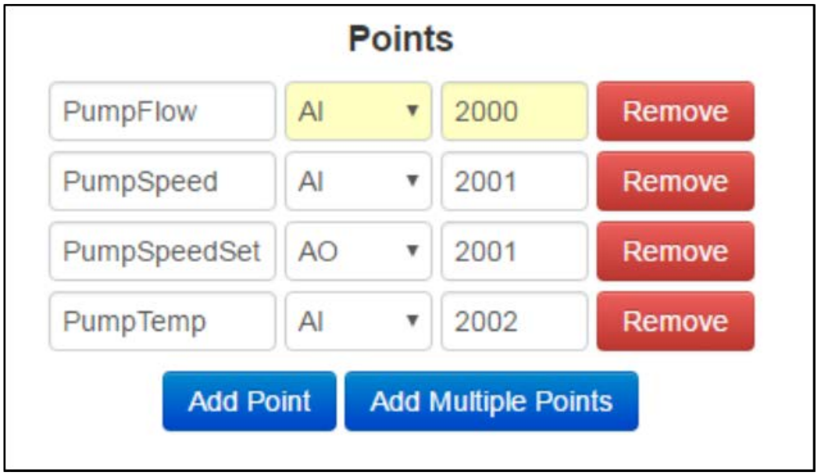
2. If desired, enter filter test in Filter box to limit number of available tags.



3. Select desired tags from the left by clicking on them.
4. Once all desired tags have been selected, Click blue **Select** Button. Selected tags will appear on RAMQTT page.

To remove a point:

To remove an IODB point from the list, simply click on the red **Remove** button of the desired point to be removed.

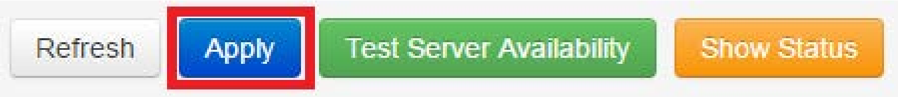


Points

PumpFlow	AI	2000
PumpSpeed	AI	2001
PumpSpeedSet	AO	2001
PumpTemp	AI	2002

Step 7. Start RAMQTT Client

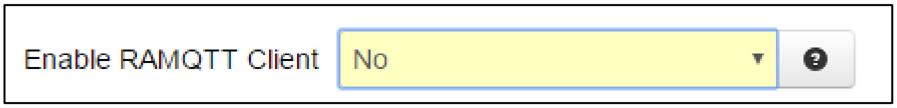
Once all settings have been set, RAMQTT client is ready to be started.
Click on the **Apply** button to save and to start/restart the client.



Step 8. Stopping RAMQTT Client

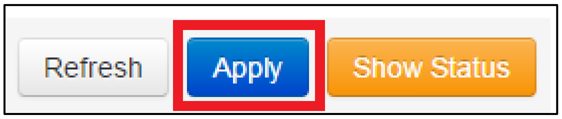
Stopping RAMQTT Client can be done in two simple steps.

1. Select No from Enable RAMQTT Client.



Enable RAMQTT Client: No

2. Click **Apply** button to stop the client.



Stopping RAMQTT client does not change any configuration. All configurations will be saved.

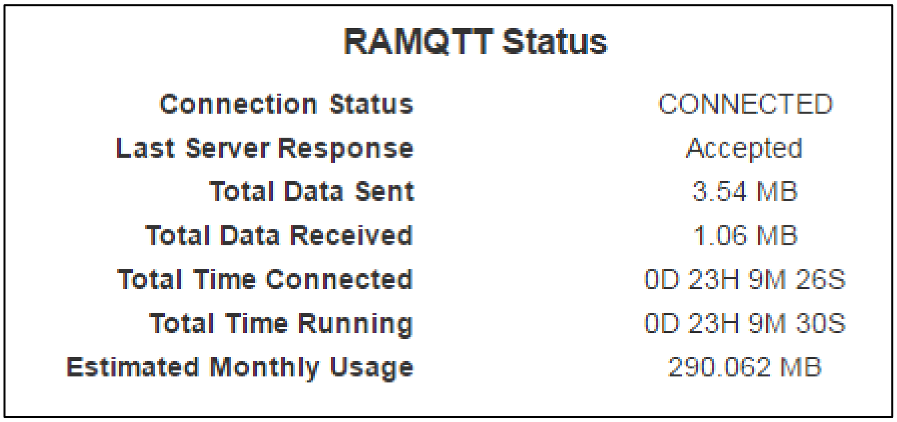
1.4.3 Checking RAMQTT Client status

It is possible to check current status. RAMQTT Status Page has 3 sections: RAMQTT Status, Last Message Sent and Last Message Received.

RAMQTT Status

RAMQTT Status offers a quick look at what RAMQTT Client is currently doing. It provides the following information:

- Connection Status: Status of what RAMQTT is currently doing:
    - CONNECTED - RAMQTT is connected to the broker and publishing data.
    - CONNECTING - RAMQTT is trying to connect to the broker. This can mean one of two things: the broker information (IP/URL/Port) is incorrect, or there is no connection to the broker and RAMQTT is trying to connect.
    - RECONNECTING - RAMQTT is trying to reconnect to the broker when a connection has been lost.
    - REGISTERING - RAMQTT is registering itself and all data points with the IoT Cloud.
    - STOPPED - RAMQTT is not running.
    - UPDATING FIRMWARE - RAMQTT is attempting to update device firmware.
    - BAD CONFIG - RAMQTT has encountered a corrupt config file.
- Last Server Response - During registration and when Track Errors is enabled, this field displayed last response from the server.
- Total Data Sent - Total data sent to the IoT Cloud.
- Total Date Received - Total data received from the IoT Cloud.
- Total Time Connected - Total time connected to the broker.
- Total Time Running - Total time RAMQTT is running regardless of being connected to the broker.
- Estimated Monthly Usage - Estimated monthly data usage. More accurate numbers are after sometime RAMQTT has been publishing.
- Initial numbers can be off due to initial publishing and registration.



RAMQTT Status

Connection Status	CONNECTED
Last Server Response	Accepted
Total Data Sent	3.54 MB
Total Data Received	1.06 MB
Total Time Connected	0D 23H 9M 26S
Total Time Running	0D 23H 9M 30S
Estimated Monthly Usage	290.062 MB

Last Message Sent

Last Message Sent provides details of when and what was published last. It provides the following information:

- Topic - A topic on which the message was published
- Date and Time when the message was published
- Message that was last published. It is displayed in nice JSON format. The actual sent message is unformatted to save data.

Last Message Received

Last Message Received provides details of when and what was received last. It provides the following:

- Topic - A topic on which the message was received
- Date and Time when the message was received
- Message that was last received. It is displayed in a non-minified JSON format. The actual sent message is minified save data by removing white-space characters such as newlines and tabs.

Viewing RAMQTT Client status

To view RAMQTT Client status, click **Show Status** button. RAMQTT Client status page is shown.

Returning back to configurations

To return back to configurations, click **Show Config** button. RAMQTT Client configuration is shown.

IoT Cloud Specific Information

2.1 IoT Cloud Specific Information

Following are supported IoT Clouds:

IoT Cloud	Version Added	IoT Cloud Information Website
Autodesk Fusion Connect	4.24	http://autodeskfusionconnect.com/
AT&T M2X	4.25	https://m2x.att.com/
Amazon AWS IoT	4.25	https://aws.amazon.com/iot/
Telenor Cloud Connect	4.25	http://www.telenorconnexion.com/services/cloud-connect

IoT Cloud Specific User Guides

- **RAMQTT – Autodesk Fusion Connect**
- **RAMQTT – AT&T M2X**
- **RAMQTT – AMAZON AWS**
- **RAMQTT - Telenor Cloud Connect**

RAMQTT – Autodesk Fusion Connect

2.2 IoT Cloud Specific Information

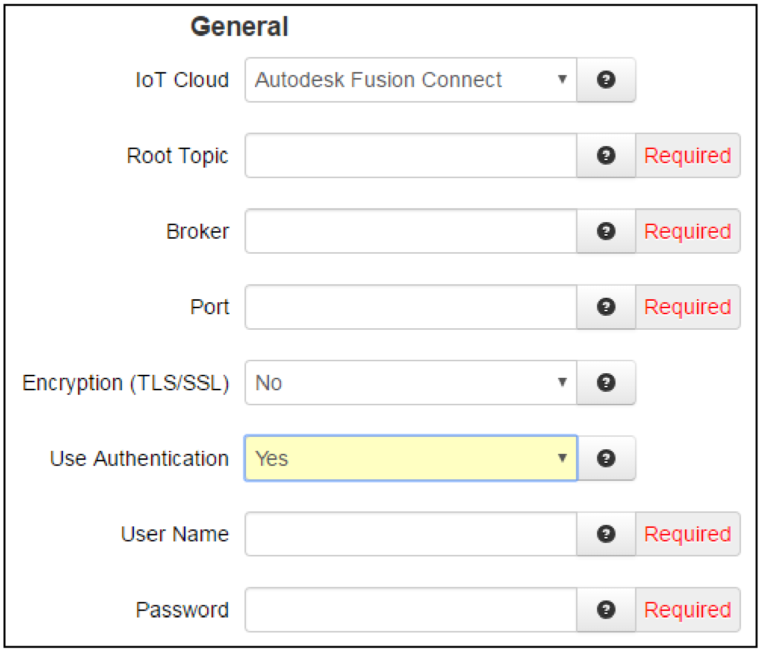
This walk-through uses a sample scenario to demonstrate the process of setting up the Red Lion device connection to the Fusion Connect cloud.

2.2.1 The Scenario

This scenario uses a single Red Lion device that is monitoring its cellular connection by observing it's RSSI value. The RSSI value is sent from the Red Lion device to the Fusion Connect cloud through the RAMQTT service. Once the Fusion Connect cloud receives the message, the Fusion Connect's virtual representation of the data is updated to show the Red Lion device's current RSSI value.

It is recommended to complete the Red Lion device side setup before completing the Fusion Connect cloud setup. Make sure that the User Name is the same as the Root Topic during the RAMQTT device side setup.

2.3 Device Setup



General

IoT Cloud	Autodesk Fusion Connect	
Root Topic		Required
Broker		Required
Port		Required
Encryption (TLS/SSL)	No	
Use Authentication	Yes	
User Name		Required
Password		Required

1) Select Autodesk Fusion Connect from IoT Cloud
2) Enter Root Topic provided by Fusion Connect into Root Topic field
3) Enter Fusion Connect broker address into Broker field
4) Enter Port number into Port field

5) Select if Encryption is to be used from Encryption (TLS/SSL) drop down field
6) Select if Authentication to be used from Use Authentication drop down field. When Use Authentication is set to "Yes", User Name and Password field will become visible.

a) Enter User the user name. Typically for Fusion Connect, it will be the same as the root topic
b) Enter the password

2.4 Cloud Setup Guide

This walk-through provides the following steps to complete the Fusion Connect cloud provider setup.

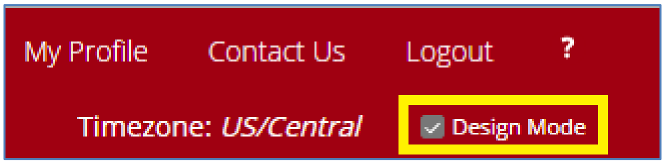
1. **Create a Resource Type to define the attributes for your monitored "thing".**
2. **Create a resource to connect a device to.**
3. **Create a device profile to represent the attributes being collected from your Red Lion device.**
4. **Create the message content within the device profile.**
5. **Add the actual devices corresponding to your physical red lion devices.**
6. **Create routines based on the resources you created, based on and triggered by your Red Lion incoming message content.**
7. **Track and Observe messages sent from the Red Lion device.**

For additional support with Fusion Connect see the SeeControl_IoT_User_Guide.pdf

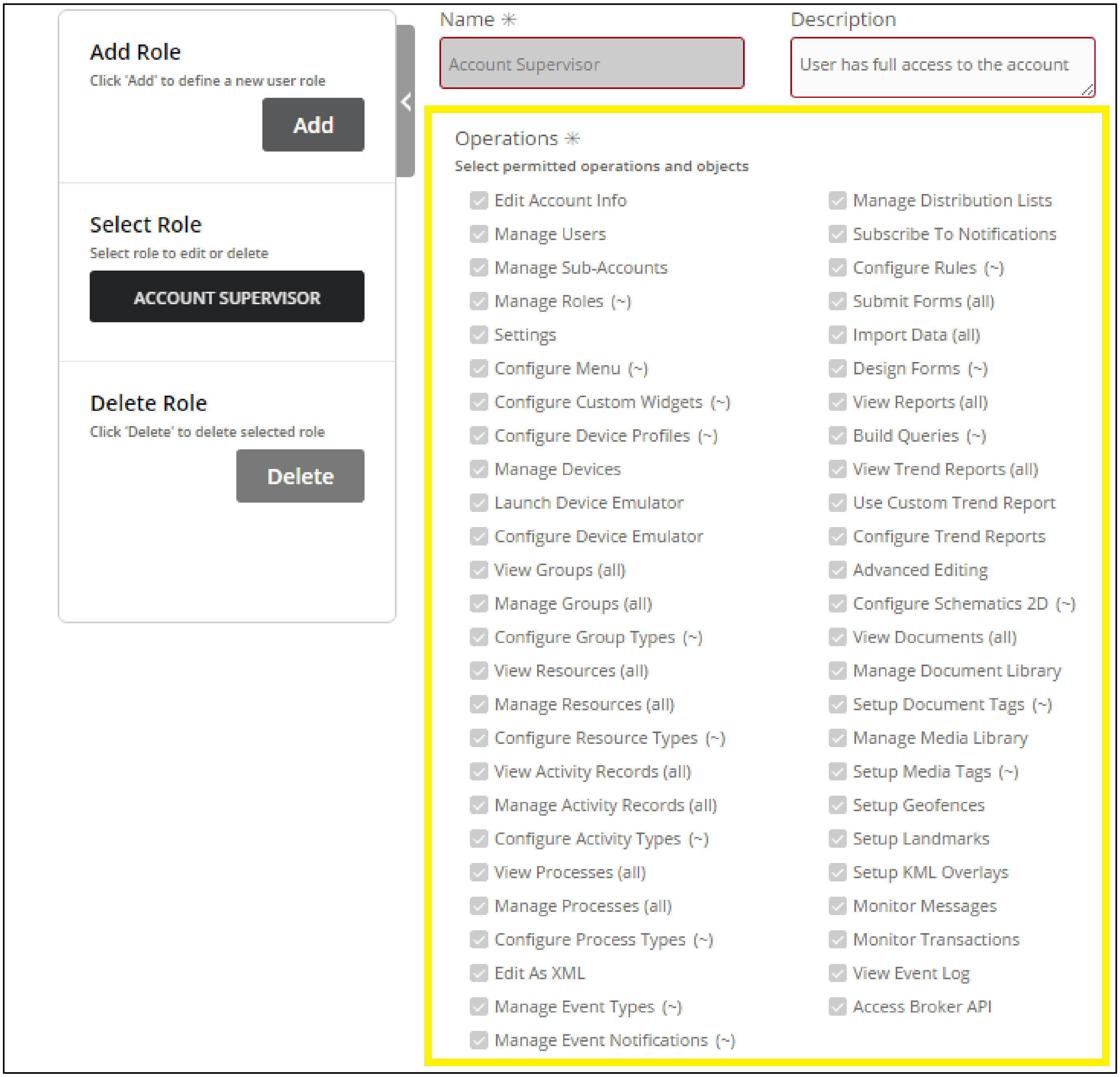
Getting Started

Before completing the steps below, make sure to check the following:

- After logging into the Fusion Connect cloud instance, make sure that the design mode box is checked. This will enable the ability to edit and create what is needed for this setup.



- Once the Design Mode box is checked, the screen displays the Account Center page. A single account can have different Users. Make sure that the User Role being used contains the ability to create, edit, or delete Devices, Resources, etc. To check this:
  - Navigate to the **Admin Users** page.
  - Find the **User** entry being used and look at the **Roles** column.
  - Now navigate to the **Admin User Roles** page.
  - Select the **Role** that matches the one found on the previous page.
  - Make sure that all the boxes are checked.



Add Role

Click 'Add' to define a new user role

Select Role

Select role to edit or delete

Delete Role

Click 'Delete' to delete selected role

Name ✳: Account Supervisor

Description: User has full access to the account

Operations ✳

Select permitted operations and objects

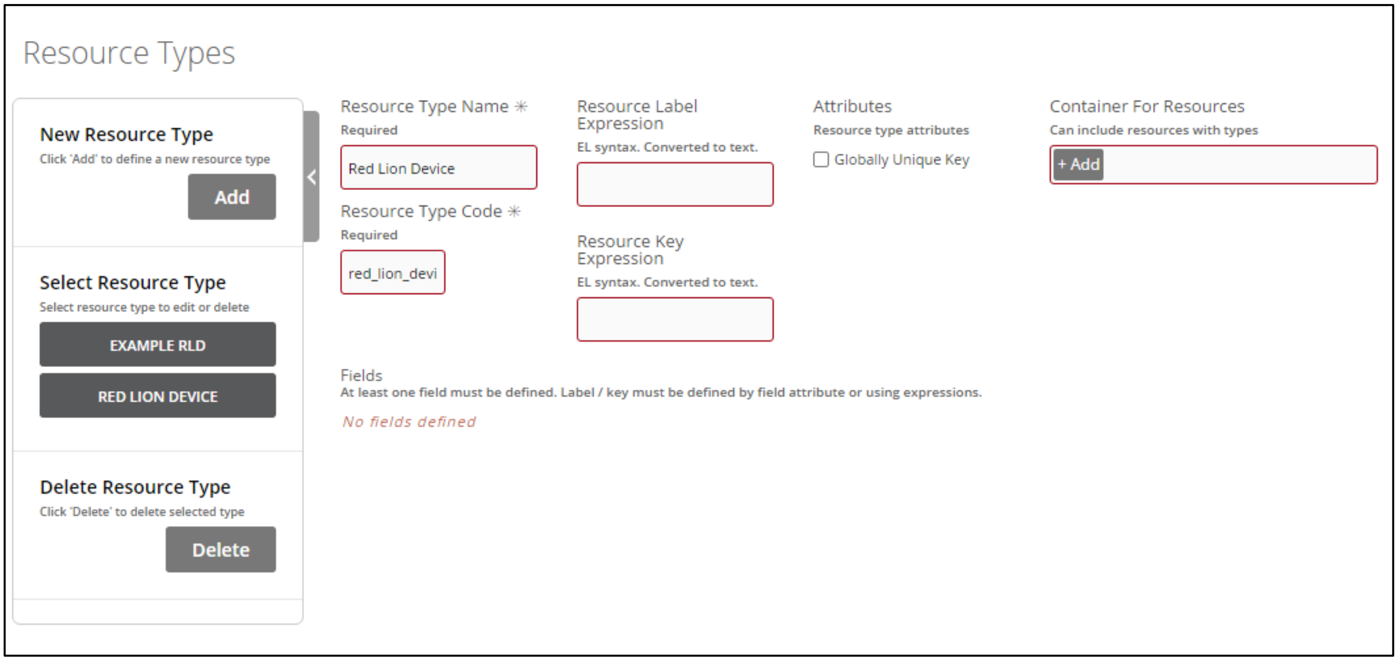
- ☑ Edit Account Info
- ☑ Manage Users
- ☑ Manage Sub-Accounts
- ☑ Manage Roles (~)
- ☑ Settings
- ☑ Configure Menu (~)
- ☑ Configure Custom Widgets (~)
- ☑ Configure Device Profiles (~)
- ☑ Manage Devices
- ☑ Launch Device Emulator
- ☑ Configure Device Emulator
- ☑ View Groups (all)
- ☑ Manage Groups (all)
- ☑ Configure Group Types (~)
- ☑ View Resources (all)
- ☑ Manage Resources (all)
- ☑ Configure Resource Types (~)
- ☑ View Activity Records (all)
- ☑ Manage Activity Records (all)
- ☑ Configure Activity Types (~)
- ☑ View Processes (all)
- ☑ Manage Processes (all)
- ☑ Configure Process Types (~)
- ☑ Edit As XML
- ☑ Manage Event Types (~)
- ☑ Manage Event Notifications (~)
- ☑ Manage Distribution Lists
- ☑ Subscribe To Notifications
- ☑ Configure Rules (~)
- ☑ Submit Forms (all)
- ☑ Import Data (all)
- ☑ Design Forms (~)
- ☑ View Reports (all)
- ☑ Build Queries (~)
- ☑ View Trend Reports (all)
- ☑ Use Custom Trend Report
- ☑ Configure Trend Reports
- ☑ Advanced Editing
- ☑ Configure Schematics 2D (~)
- ☑ View Documents (all)
- ☑ Manage Document Library
- ☑ Setup Document Tags (~)
- ☑ Manage Media Library
- ☑ Setup Media Tags (~)
- ☑ Setup Geofences
- ☑ Setup Landmarks
- ☑ Setup KML Overlays
- ☑ Monitor Messages
- ☑ Monitor Transactions
- ☑ View Event Log
- ☑ Access Broker API

Step 1: Creating the "Red Lion Device" Resource Type

A Resource Type is like a blueprint. It contains all the attributes and information of a particular "thing" needed to create a virtual instance of that Resource Type.

To create a Resource Type:

- Navigate to **Model Resource Types**.
- Fill in the **Resource Type Name** box, to give a name to the Resource Type.
- The **Resource Type Code** will automatically be filled out based on what was typed into the Resource Type Name box. This code is used for the Cloud to identify the Resource Type. The generated code is only a suggestion and can be edited to be something else.
- The **Resource Label Expression / Resource Key Expression** boxes are only needed for advanced functionality and can be skipped for this walk-through.
- Under **Attributes**, leave the **Globally Unique Key** box unchecked.
- The **Container for Resources** box is used for situation where there can be "sub blueprints". For this walk-through, it is not needed and can be left blank.



Resource Types

New Resource Type
Click 'Add' to define a new resource type

Select Resource Type
Select resource type to edit or delete

Delete Resource Type
Click 'Delete' to delete selected type

Resource Type Name ✳
Required
Red Lion Device

Resource Type Code ✳
Required
red_lion_devi

Resource Label Expression
EL syntax. Converted to text.

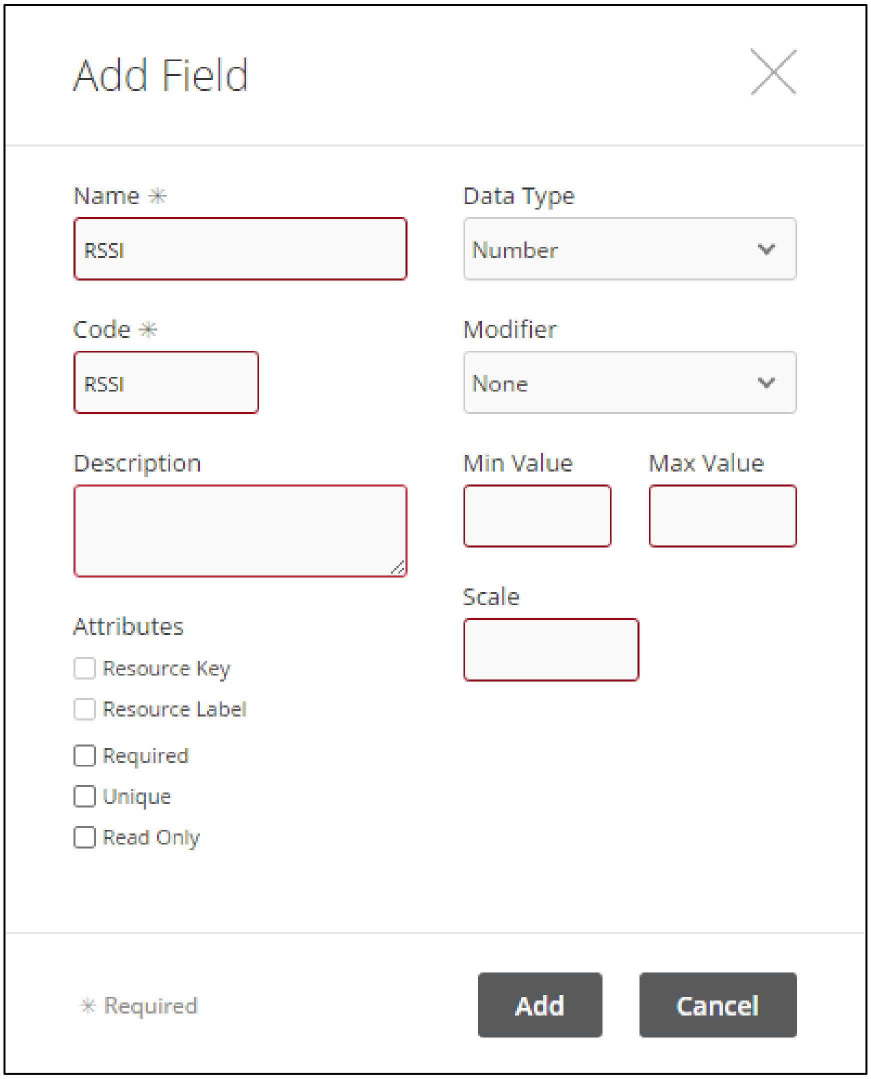
Resource Key Expression
EL syntax. Converted to text.

Attributes
Resource type attributes
□ Globally Unique Key

Container For Resources
Can include resources with types

Fields
At least one field must be defined. Label / key must be defined by field attribute or using expressions.
No fields defined

The next step is to add a field. Each field acts as an attribute or information about the "thing". For this walk-through, that "thing" is a Red Lion Device. To add a field, click the button. This brings up a window like the one below.


Add Field

Name ✳: RSSI

Data Type: Number

Code ✳: RSSI

Modifier: None

Description:

Min Value:

Max Value:

Scale:

Attributes

□ Resource Key
□ Resource Label
□ Required
□ Unique
□ Read Only

✳ Required

- Give the field a name by filling out the **Name** box.
- The **Data Type** box determines what kind of data the field will store. In the image above, the RSSI field is a number.
- The **Code** box value will be how the cloud will identify the field for that Resource Type. This code must be unique.

A field entry must be made for each field in the "Device Info" and "IODB Message" sections found in the RAMQTT – AMAZON AWS page.
Click the **Add** button to finish the creation of a field. Make sure to click the **Add** button on the main Resource Type page when all the fields have been added. Once this process is finished then the Resource can be created.

Step 2: Create Resource Associated with Red Lion Device

Now that the Resource Type is created, a Resource is made by:

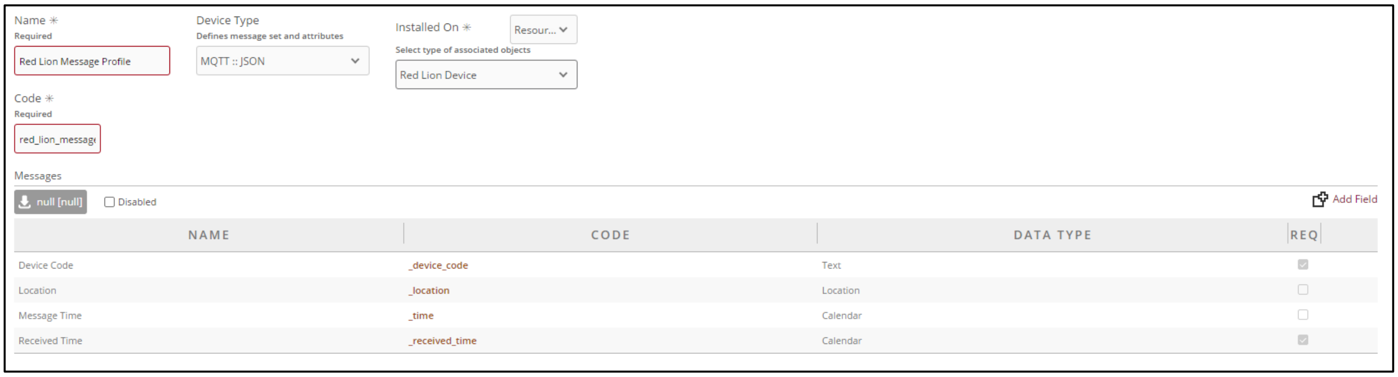
- Navigate to the **Edit Resources** page.
- Select the **Resource Type** name from the **Resource Type** drop down list. If the resource type was named "Red Lion Device", then select that name.
- Click the **Add** button to create the Resource. This will pop up a window with a list of the attributes specified in the Resource Type.
- Fill out any identifying information such as a Serial Number, and any fields with an asterisk next to them.
- All other fields can be left blank as they will be populated later by the Device Info and IODB Message messages and Routines. Each Resource created refers to a single Red Lion Device.

Step 3: Create the Red Lion Device Profile

Once the Resources are added, a Device Profile must be created to allow the cloud to know what device it is talking to, and what protocol it is using.

To create a Device Profile:

Navigate to **Connect Device Profiles**.
Under **New Profile**, click **Add**. This pops up a window like the one shown below.
Fill out the **Name** for the Device Profile.
For the **Device Type**, make sure to select **MQTT::JSON**. This represents how the message will be interpreted by the cloud.
For **Installed On**, select Resource, and then select the Red Lion Device Resource Type, or the name chosen for the Resource Type created earlier.
The **Code** again is used by the cloud to identify this Device Profile. Like the Resource Type, the Device Profile is like a blueprint, but for the Device connection itself. If you see the null[null] grey button it means an error has occurred.



Name ✳ Required: Red Lion Message Profile

Device Type – Defines message set and attributes: MQTT :: JSON

Installed On ✳: Resour...

Select type of associated objects: Red Lion Device

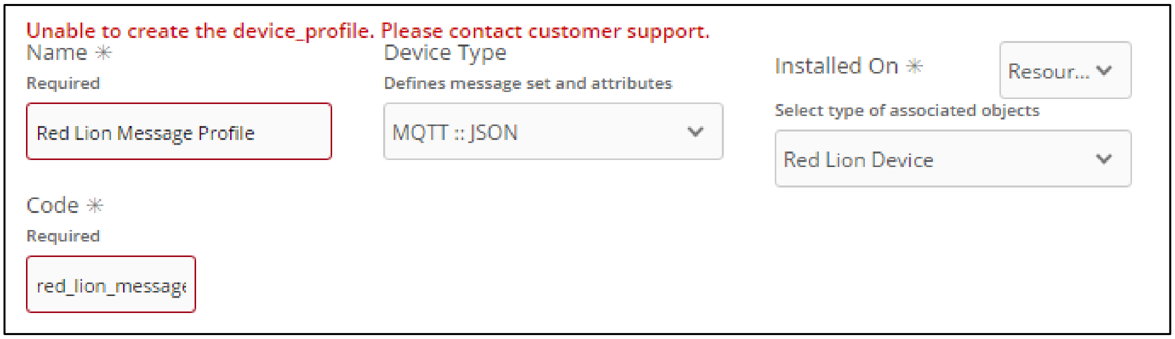
Code ✳ Required: red_lion_message

Messages

null [null] □ Disabled

NAME	CODE	DATA TYPE	REQ
Device Code	_device_code	Text	☑
Location	_location	Location	□
Message Time	_time	Calendar	□
Received Time	_received_time	Calendar	☑

If you try to add the Message Profile when it has the null[null] grey button then you will get an image similar to the one below. Try re-logging into Fusion Connect and try the process again.



Unable to create the device_profile. Please contact customer support.

Name ✳ Required: Red Lion Message Profile

Device Type — Defines message set and attributes: MQTT :: JSON

Installed On ✳: Resour... — Select type of associated objects: Red Lion Device

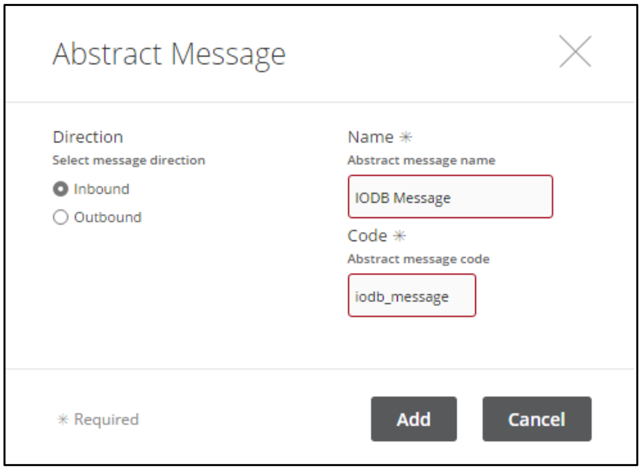
Code ✳ Required: red_lion_message

Before clicking **Add** to fully create the Device Profile, proceed to Step 4 to create the two Messages needed for the Device Profile.

A Device Profile must have at least one message with at least one field before it can be created.

Step 4: Create the "Device Info" and "IODB Message" Messages

Before clicking **Add**, click the **Add Message** button. A window like the one below pops up.



Abstract Message

Direction — Select message direction
● Inbound
○ Outbound

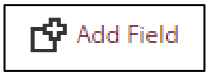
Name ✳ — Abstract message name: IODB Message

Code ✳ — Abstract message code: iodb_message

✳ Required

Two Messages must be created; The "Device Info" message and the "IODB Message". For both, under the Direction section, select **Inbound**. For the name, type “IODB Message” and “Device Info”. For the Codes, put iodb_message, and device info. Click the **Add** button to create the message. Then, as in the create Resource process, click the button. Make sure that each field in the message matches the descriptions in the RAMQTT – AMAZON AWS

.



The Code value for each field must match the Tag name set up in the Red Lion Device Side Setup walk-through. If the desired register to send is the RSSI register, then the Code value must be RSSI, as that is the RSSI Tag name.

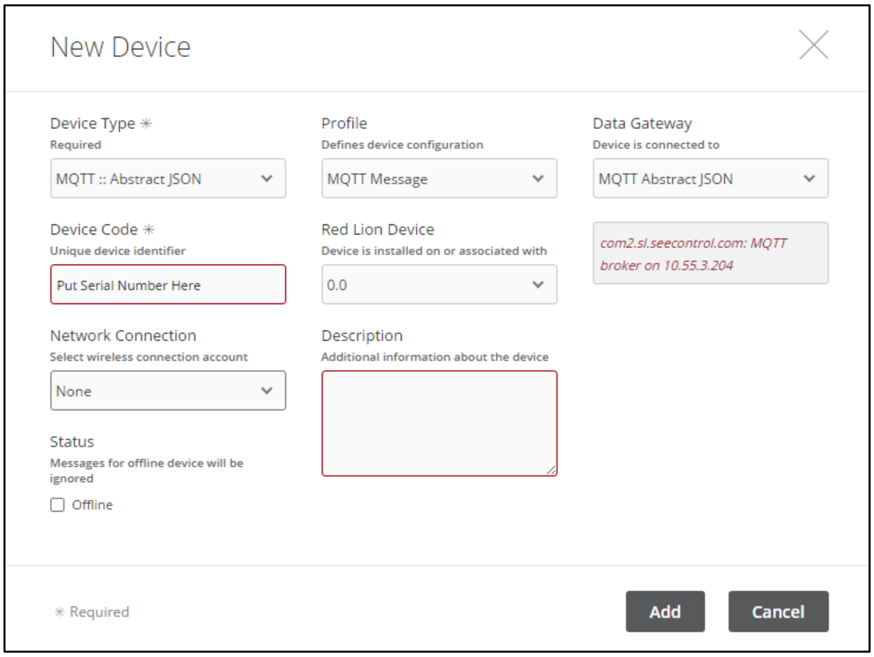
If the Tag name and the Code for the field do not match then the values from that register will be ignored!

Step 5: Create the Red Lion Device

Now that the Device Profile is created, it is time to create the Device(s).

1. Navigate to the **Connect Devices** page.
2. Like the creation of Resources, click the **Add** button. This brings up a window like the one below.
3. For the **Device Type**, select MQTT :: Abstract JSON from the list.
4. For the **Profile**, select the name of the Device Profile set up in the previous steps.
5. For the **Data Gateway**, select MQTT Abstract JSON.
6. Put the serial number of the physical device that this virtual device corresponds to for the **Device Code**.
7. For the **Red Lion Device**, or the name used for the Resource Type, select the created resource that corresponds to the physical devices. For example, if you have a Physical Device with a serial number, then you will have a Device with a device code with that serial number and have a Resource that has a serial number field containing that serial number.
8. For this walk-through, leave **Network Connection** blank and **Status** unchecked.
9. Once this process is complete click **Add**.

A Device must be created for each physical device. Repeat the instructions for this step for each physical device.



New Device

Device Type ✳ Required: MQTT :: Abstract JSON

Profile Defines device configuration: MQTT Message

Data Gateway Device is connected to: MQTT Abstract JSON

com2.sl.seecontrol.com: MQTT broker on 10.55.3.204

Device Code ✳ Unique device identifier: Put Serial Number Here

Red Lion Device Device is installed on or associated with: 0.0

Network Connection Select wireless connection account: None

Description Additional information about the device:

Status Messages for offline device will be ignored

☐ Offline

✳ Required

Step 6: Create the Routines

Messages at this point in the process will be received by the cloud, but will not be processed, and the resource fields will not be updated. A Routine must be created to respond to the messages received, get the message's values, and update the resource fields. These Routines are highly customizable and can be created at the Configure Routines page.

Step 7: Track and Observe

To observe the messages being received, navigate to the Monitor Device Messages page. There will be dials to display various statistics about the messages sent and received. Click the Inbound tab and a list of message records will be displayed.

2.5 Message Definitions

2.5.1 Publish Messages

Default message values

Following fields are included in all the messages that are included by default for all Fusion Connect messages.

- Code - Unique message ‘code’ value that is used by the device adapter to identify the correct message definition used to process this message.
- Time - Time when message is sent
- Location - GPS location if GPS information is available on the device. Location is part of Device Information Message only.

Device Information Message

This is a device information message that could be sent on startup and on a specified interval. Message code is: **device_info**. Device message is sent as a basic list or full list of variables.

Device Info Message

```
{
         "code": "device_info",
         "time": "2016-06-03T12:35:30Z", "location":
         {
                  "latitude":     25.123456,
                  "longitude":    -90.123456
         },
          "values":      {
                 "unitName":     "",
                 "serialNumber": "6821-12345678901",
                 "model":        "RAM-6921",
                 "version":      "4.24",
                  "cellIp":       "166.155.155.155",
                  "upTime":       79181,
                  "versionLong":  "4.24.108.0",
                  "pwr":  12.080000,
                  "unitTemp":     38.250000,
                  "hostName":     "SNgateway-v4_24_BETA-108", "intInfo":
"eth0=192.168.10.10;lo=127.0.0.1;usb0=192.168.111.1;wwan0=166.155.155.155; ",
                  "cellFirmVer":  "SWI9X15C_05.05.58.00 r27038 carmd-fwbuild1
2015/03/04 21:30:23",
                  "cellFirmNum":  "05.05.58.00",
                  "imei": "123456789012345",
                  "mdn":  "12345678901",
                  "simID":        "12345678901234567890",
                  "ismi": "123456789012345",
                  "cellServType": "LTE",
                  "plmn": "123456",
                  "cellChan":     123,
                  "wsSig":        7,
                  "rssi": -75,
                  "ecio": 0,
                  "rsrp": -104,
                  "rsrq": -12,
                  "cellUpTime":   78989,
                  "cellModTemp":  34,
                  "apn":  "",
                  "dataDay":      719,
                  "dataMonth":    8044,
                  "gpsAltitude":   195.399994,
                  "gpsTime":      123519,
                  "gpsNumOfSat":  21,
                  "gpsFtFromCp":  12,
                  "gpsSpeed":     0,
                  "gpsCourse":    11
         }
}
```

IODB Message

IODB Message publishes user selected iodb registers. The Message code is: **iodb_message**. The message is in the following format:

IODB Message format

```
{
           "code": "iodb_message",
           "time": "2016-06-01T03:21:13Z",
           "values":         {
                   "<Tag Name>": <value>,
       "<Tag Name>": <value>
           }
}
```

This is an example of IODB Message:

```
{
      "code": "iodb_message",
      "time": "2016-06-01T03:21:11Z",
      "values": {
              "AI1": 23,
              "AI_2676": 21,
              "DI1": 0,
              "DI2": 0,

              "DO1": 0,
              "DO2": 0,
              "TMP1": 49,
              "PWR1": 11980,
              "VBAT": 0
      }
}
```

2.5.2 Subscribe Messages

All messages to be received by RAMQTT Client are to be sent to <root topic>/<device serial number>/directive topic.

IODB Write

The IODB write message must have following two fields**:**

- message **code** must be: **iodb_write**,
- **values**: a list of values to be updated. Must have at least one value field. Format of every value field is: <Tag>_<Value>

- If the value is set to be written to an IODB register that is read only (system information values), the update value is ignored.
- If a Tag is not found in the list of configured tag points on the RamQTT Client page, the update value is ignored.

Sample IODB write message:

```
{
  "target":"RedLion/1234-98765432101",
  "code":"iodb_write",
  “time":"2016-06-24T02:12:20Z",
  "values":{
      "PumpSpeedSet":1432,
      "AO_2002":544
  }
}
```

IODB Write Response Messages

IODB Response Messages will be sent back with information regarding a successful response or an unsuccessful response. The **id** field has a value of **null** for each IODB Write response message. This is because this command does not use a command id. The result of the command will be shown in the **response** field if successful, or in the **reason** section if unsuccessful. The **reason** section contains any causes to unsuccessful write to an IODB register in the form of <"**tag_name":"reason explaining error**">.

Sample Successful IODB Write Response Message:

Successful IODB Write Response Message

```
{
   "code": "command_response",
   "time": "2016-11-29T05:14:59Z",
   "values": {
    "id": null,
    "response": "successful"
   }
}
```

A success message like the one above will only be sent if all writes to IODB were successful.

Sample Unsuccessful IODB Write Response Message:

Unsuccessful IODB Write Response Message

```
{
   "code": "command_response",
   "time": "2016-11-29T05:29:21Z",
   "values": {
    "id": null,
    "reason": {
     "AO_3001": "The value is non numeric.",
     "AO_4000": "AO_4000 does not exist"
    }
   }
}
```

Only failed writes to IODB will be included in the response message under the reason section.

Commands

RAMQTT Client can process the commands listed below:

Message Code	Version Added	Description
firmware_update	4.25	Update firmware of the device
package_install	4.25	Installs/update a custom package to the device
config_update	4.25	Update configuration with XML file
reboot	4.25	Reboots the device

Command message format is shown below:

Command Message Format

```
{
   "target": "<root topic>/<device serial number>",
   "code": "<firmware_update | config_update | package_install | reboot>",
   "time": "2016-06-24T02:12:20Z",
   "values": {
       "id": "<custom_command_id>",
       "<document_key | full_url>": "<key | url_path_to_download_a_file>"
    }
}
```

- **document_key** is supplied by Fusion Connect under Manage Library Documents
- **full_url** is a custom url path for file to be downloaded

- **id** is a custom id for the message. This id is used to identify the response message receiving from the device. For example, if the id field is "Test1234", then a response message from the device has the id field set to "Test1234".

Once a command is processed, a response is sent to <**root topic**>/<**device serial number**> topic stating if a command was successfully processed or rejected. If a command response is a rejected, a reason why it was rejected is also in the message. The reboot command will send a reason of "Device is rebooting".

Command Response Format

```
{
    "code": "command_response",
    "time": "2016-11-10T19:58:16Z",
    "values": {
         "id": "<custom_command_id>",
         "response": "<successful | reject reason>"
     }
}
```

RAMQTT – AT&T M2X

3.1 Overview

When using AT&T M2X, RAMQTT Client can auto register the device to the M2X cloud. There are a few methods that can be used to establish initial connection.

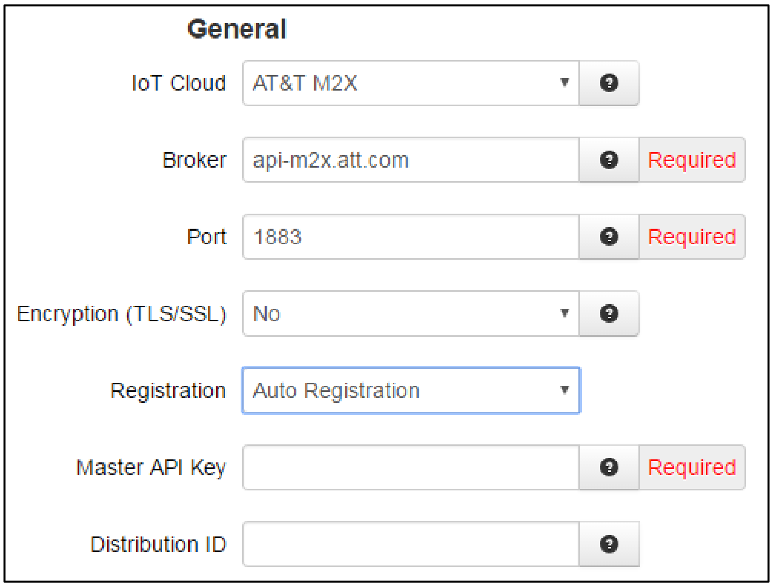
1. **Device is not registered with M2X.** If the device is not registered with M2X, a Master API Key is needed to enable auto registration. The device does the following in this case:
    a. Device registers itself with M2X using the provided Master API Key
    b. RAMQTT Configuration is updated to include the obtained Device API Key and Device ID
    c. The Master API Key is removed from the device for security
    d. RAMQTT registers all IO points (streams)
    e. Start publishing IO data

2. **Device is registered; No Device API Key or Device ID is available.** If the device has been registered, but for some reason the Device API Key and/or Device ID has been lost or removed, a Master API Key is required. In this Case the device performs the following:
    a. Check the M2X to see if the device has been previously registered. RAMQTT Client sends a check device message with its serial number and if this serial number is found among registered devices on the cloud, it will get that Device API Key and Device ID.
    b. Remove Master API Key from the device for security
    c. Verify that selected IO points are all setup as streams on the cloud. For any missing or not matching streams, new streams are registered.
    d. Start publishing IO data

3. **Device is registered; streams are not setup.** If the device has previously registered itself with M2X or a user has created a device on M2X and Device API Key and Device ID is known, the RAMQTT performs the following.
    a. Verify that selected IO points are all setup as streams on the cloud. For any missing or not matching streams, new streams are registered.
    b. Start publishing IO data.

4. **Device is registered, streams are setup.**
    a. Verify that selected IO points are all setup as streams on the cloud. For any missing or not matching streams, new streams are registered.
    b. Start publishing IO data

3.2 Device Setup



General

IoT Cloud	AT&T M2X ▾	
Broker	api-m2x.att.com	Required
Port	1883	Required
Encryption (TLS/SSL)	No ▾	
Registration	Auto Registration ▾	
Master API Key		Required
Distribution ID		

To setup RAM device for AT&T M2X' do the following steps:

1. Select AT&T M2X from IoT Cloud
2. Enter M2X broker address into Broker field
3. Enter Port number into Port field
4. Select if Encryption is to be used from Encryption (TLS/SSL) drop down field
5. Select Registration type:
   a. Auto Registration: Select Auto Registration to auto register the device with the cloud.
      1) Enter Master API Key – required
      2) Enter Distribution ID to register the device with to a distribution.
   b. Already Registered: Select Already registered if a device has been previously registered with the cloud.
      1) Enter Device API Key and Device ID

Note: If the device has been previously registered, but device API key or ID is not available, do Auto Registration and enter Master API key, Device API Key and Device ID will be recovered.

Note: If Master API Key was entered and Device API Key was entered, RAMQTT will ignore entered Device API key, but will update Master API Key from the cloud.

3.3 Cloud Setup

There are three different methods to setup a RAM device with M2X:

- Complete Self Registration
- User creates the device, Streams auto-registers
- User creates the device and setup all streams

Red Lion Controls highly recommends using the first method of Complete Self Registration to avoid error or conflicts.

3.3.1 Complete Auto Registration

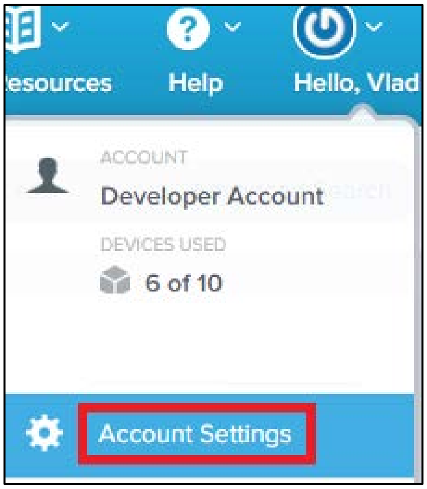
AT&T M2X provides two options to automatically register the physical device on the cloud.

Performing auto registration requires the use of the Master API Key. If RAMQTT is given a Master API Key, then it will use it over the other Device API Key and Device ID to obtain its identity from the cloud and complete auto registration. This is a safety mechanism for using auto registration in which the same Device API Key and Device ID are assigned to multiple devices which could cause a conflict. If using auto registration, the Device API Key and Device ID should not be included in the configuration.

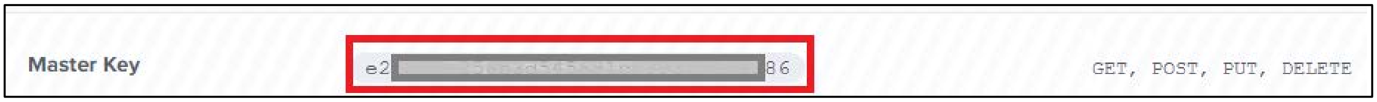
Register Device Based on RAMQTT Settings

The only piece of information needed for this method is the Master API Key.

1. From your M2X page, go to Account Settings page

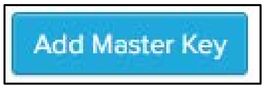


2. On the Account Setting page, there is a list of all Master and Primary Key. Select a Master Key that you would like to use with RAMQTT Client.



Master Key e2[redacted]86 GET, POST, PUT, DELETE

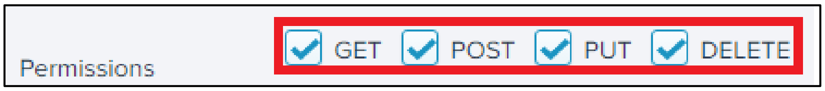
3. If you decide to create a new Master API Key for use with RAMQTT Client, Click button.



Note: A secondary Master Key is recommended. This is beneficial since you can set various limitations like expiry date, filter on allowed IP addresses and various permissions.

4. Fill out the information as desired.

5. Please make sure that following permissions are selected: **GET**, **POST**, **PUT**, and **DELETE.**



Permissions ☑ GET ☑ POST ☑ PUT ☑ DELETE

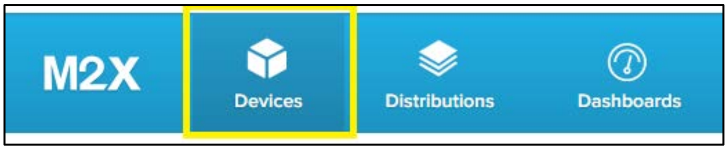
6. Click **Save**.

Enter the Master API Key in RAMQTT Client page and click **Apply**. After a short time, the newly created device(s) appear on the main page under devices.

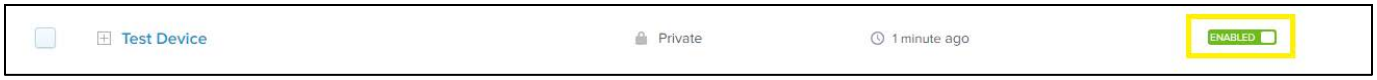
Register Device as Part of a Distribution

In order to register the device as part of a distribution, the account must be upgraded to the pro account to have access to the Distributions feature. If using a device a basis for setting up the Distribution, that device must already be created on the cloud.

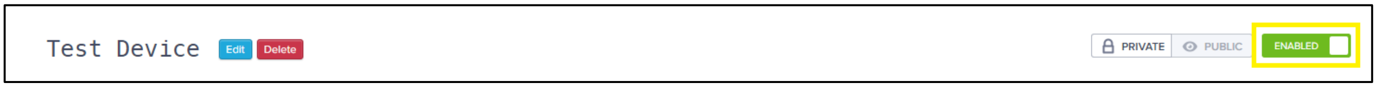
1. Go to the Devices tab on the main screen.



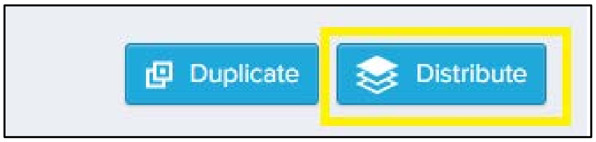
2. Find the device to be distributed. Make sure the device is **ENABLED**.



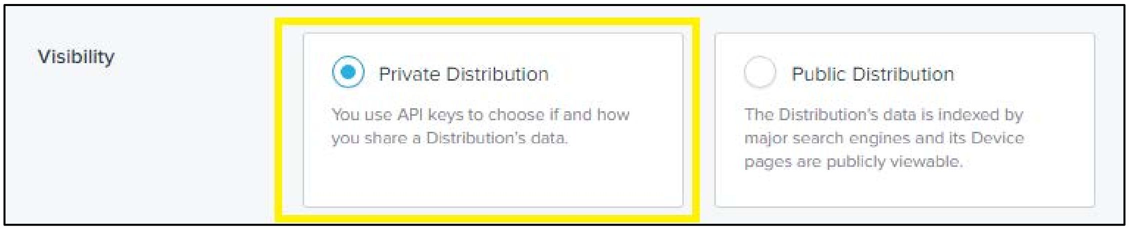
3. Click the device entry and check to see if the device is still enabled. If not, toggle it to **ENABLED**.



4. Review the device overview. Make sure the device is exactly as desired. Click the **Distribute** button at the top right.



5. Fill out the fields and review the Device Attributes to make sure they are as desired.
6. RAMQTT supports the Private Distribution option only. Make sure the **Private Distribution** option is selected.



Visibility

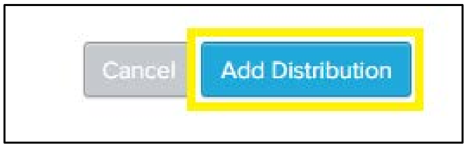
● Private Distribution

You use API keys to choose if and how you share a Distribution's data.

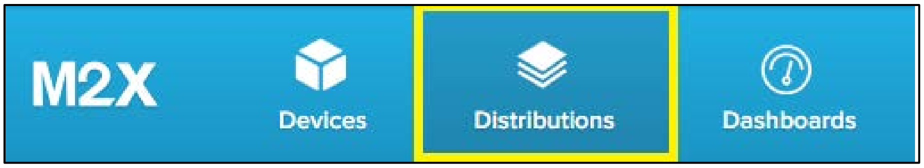
○ Public Distribution

The Distribution's data is indexed by major search engines and its Device pages are publicly viewable.

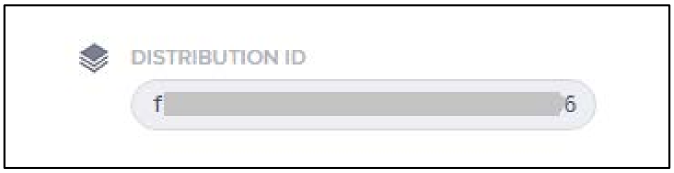
7. After filling out the information, click the **Add Distribution** button.



8. Once created, the newly created Distribution can be viewed under the **Distribution** tab.



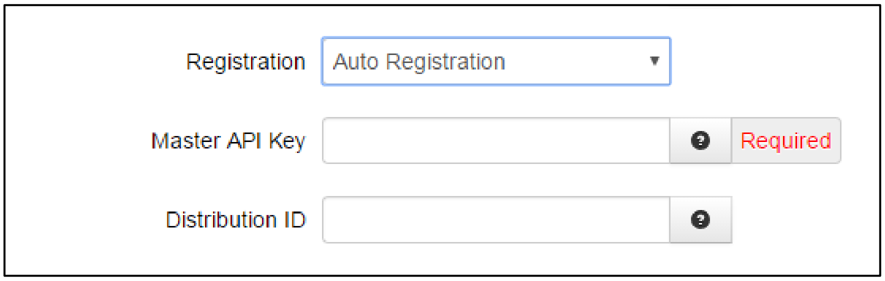
9. Copy the DISTRIBUTION ID from the newly created Distribution. It will be labeled with name provided in Step 6.



DISTRIBUTION ID

f[redacted]6

10. Obtain the Master API Key from the steps provided in **Register Device Based on RAMQTT Settings.**
11. Select Auto Registration from the Registration drop down menu. Enter the Master API Key and Distribution ID into the RAMQTT Client page and click **Apply**.



Registration: Auto Registration ▾

Master API Key: Required

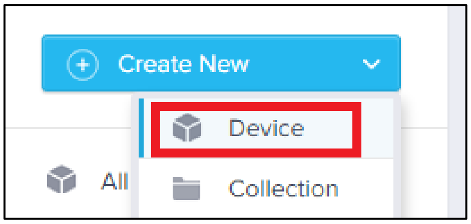
Distribution ID:

12. After a short time, the newly created device(s) will appear on the main page under devices.

3.3.2 User creates a device, Streams auto registered

In this method, a user creates the device(s) but does not setup streams for IO points.

1. From device page of your account, Click on **Create New** and select **Device.**

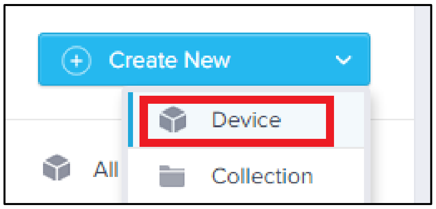


2. Fill out all the fields as desired. It is not required, but is highly recommended to enter the device serial number into Serial Number field. This becomes useful in case Device API key or id gets corrupted. Using the Master API key, the device will auto reconnect to the device instance in the cloud with its serial number.
3. Click **Create** button.
4. Newly created device should open. Copy Device API Key and Device ID.

Now enter the Device API Key and Device in RAMQTT Client page and click apply. After a short time, the created the stream(s) appear on the device page (may need page refresh).

3.3.3 User creates the device and setup all streams

1. From device page of your account, Click on **Create New** and select **Device**.



2. Fill out all the fields as desired. It is not required, but is highly recommended to enter the device serial number into Serial Number field. This becomes useful in case the Device API key or id gets corrupted. Using Master API key, the device will auto reconnect to the device instance in the cloud with its serial number.
3. Click **Create** button.
4. Newly created device should open. Copy the Device API Key and Device ID and post Device API Key and ID into appropriate fields in the RAMQTT Client page.
5. For each Data Point create a stream:
    a. Click **Add Stream** button

    b. Fill out all the information needed. Please make sure that **Stream ID** field has the same name as the name of the tag for the IO point in the RAMQTT Client page. If there is no tag defined for the stream id must be in the format <type>_<register>, the register is zero based value.
    c. Click **Save** button.

3.4 Message Definitions

3.4.1 Publish Messages

RAMQTT publishes both IODB values and Device Information messages with similar formats. Both messages are published as Single Values to Multiple Streams. For more details of message formats please refer to M2X API documentations https://m2x.att.com/developer/documentation/v2/ .

3.4.2 IODB messages

All IODB messages are published with "**id**" equal to "**iodb_message**".

All messages include the **timestamp** (time on the device) when the message was sent.

Sample IODB Message

```
{
   "id": "iodb_message",
   "method": "POST",
   "resource":v2/devices/9abcd2900c32fed1234a62201fb37896/update",
   "body": {
        "timestamp": "2016-10-14T14:22:54Z",
        "values": {
             "AI1": 14945,
             "AI2": 8971,
             "Time_Min": 22,
             "Time_Second": 53,
             "Uptime_Minutes": 34,
             "Uptime_Seconds": 59,
             "GPS_Time_MM": 22,
             "GPS_Time_SS": 48,
             "AO_3000": 101
        }
    }
}
```

Device Information Messages

The Device Information message is almost identical to the IODB message with following differences:

- id: **device_message**
- Includes GPS location of the device

Sample Full Device Information Message

```
{
    "id": "device_message",
    "method": "POST",
    "resource": "/v2/devices/9abcd2900c32fed1234a62201fb37896/update",
    "body": {
        "timestamp": "2016-10-14T14:43:44Z",
        "Location": {
            "latitude": 12.345678,
            "longitude": -98.765432,
            "elevation": 209.600006
        },
        "values": {
             "unitName": "",
             "serialNumber": "1234654796325847",
             "model": "RAM-9931",
             "version": "4.25",
             "cellIp": "12.12.12.12",
             "upTime": 68150,
             "versionLong": "4.25.75.0",
             "pwr": 11.96,
             "unitTemp": 43.43,
             "hostName": "SNgateway-v4_25_BETA-75",
             "intInfo":
"lo=127.0.0.1;eth0=192.168.1.2;eth1=192.168.1.1;usb0=192.168.111.1;wwan0=1
2.12.12.12;",
             "cellFirmVer": "SWI9X15C_05.05.58.00 r27038 carmd-fwbuild1
 2015/03/04 21:30:23",
             "cellFirmNum": "05.05.58.00",
             "imei": "123456789123456",
             "mdn": "123456789321",
             "simID": "89011234567898765432",
             "ismi": "8901123456789876543",
             "cellServType": "LTE",
             "plmn": "123456",
             "cellChan": 675,
             "wsSig": 7,
             "rssi": -73,
             "ecio": 0,
             "rsrp": -104,
             "rsrq": -13,
             "cellUpTime": 68002,
             "cellModTemp": 42,
              "apn": "i2gold",
              "dataDay": 0,
              "dataMonth": 37362,
              "gpsAltitude": 209.600006,
              "gpsTime": 144343,
              "gpsNumOfSat": 20,
              "gpsFtFromCp": 3005,
              "gpsSpeed": 0,
              "gpsCourse": 182}
         }
     }
}
```

3.4.3 Subscribe Messages – Commands

To receive commands, RAMQTT is subscribed to commands topic. For RAMQTT to receive a command, a command message needs to be published to M2X cloud. For detail on M2X commands, please refer to M2X API documentations https://m2x.att.com/developer/documentation/v2/commands and https://m2x.att.com/developer/documentation/v2/mqtt.

Each command listed below and has an example of the command that is sent to the cloud. M2X will then generate a device specific message that is sent to the devices.

For all received commands, a response message is sent A process command response message is sent if the command successfully completes. If for some reason the command was not able to fully complete, a reject command response message is sent. Each reject command response message contains the reason in the body.

RAMQTT Client can process the commands listed below:

Command Name	Version Added	Description
iodb_write	4.25	Update an IODB value on the device
firmware_update	4.25	Update firmware of the device
package_install	4.25	Installs/update a custom package to the device
config_update	4.25	Update configuration with XML file
config_fetch	4.25	Upload device configurations to the cloud (specified location)
reboot	4.25	Reboots the device

IODB Write

The IODB Write command must have "**iodb_write**" in the name field.

All values in the data are string types and are in lowercase. This will match against IODB Tags, case insensitive. Data contains the list for all of the IODB values to be updated.

After an IODB Write command is received, RAMQTT verifies that it can update the IODB value. If for some reason it cannot update one or more of the values, it responds with reject command response. If RAMQTT was able to update all IODB values, it sends a process command response.

Sample IODB Write Command

```
{
    "method": "POST",
    "resource": "/v2/commands",
    "body": {
        "name": "iodb_write",
        "data": {
            "ao_3000": "121",
   "ao_3001": "101"
        },
        "targets": {
            "devices": [
                "9abcd2900c32fed1234a62201fb37896"
            ]
        }
   }
}
```

Firmware Update

The Firmware Update command must have "**firmware_update**" in the name field.

The **data** must contain "**path**" field with a path to the Firmware update zip package.

After a Firmware Update command is received, and the package is validated to be a valid firmware update package, RAMQTT stops and the firmware update will take place. If the downloaded package is invalid, a reject command response is sent.

Sample Firmware Update Command

```
{
    "method": "POST",
    "resource": "/v2/commands",
    "body": {
        "name": "firmware_update",
        "data": {
            "path": "ftp://ftp.mysite.com/firmware/4.25_DEV_sn_reflash.zip"
        },
        "targets": {
            "devices": [
                "9abcd2900c32fed1234a62201fb37896"
            ]
        }
    }
}
```

Package Install

The Package Install command must have "**package_install**" in the name field**.**

The **data** must contain "**path**" field with a path to the package to be installed.

After a Package Install command is received, and the package is validated to be a valid zip package, an attempt to install the package will take place. If a package was not able to successfully install, a reject command response message is sent.

Sample Package Install Command

```
{
    "method": "POST",
    "resource": "/v2/commands",
    "body": {
        "name": "package_install",
        "data": {
            "path": "ftp://ftp.mysite.com/packages/customPackage.zip"
        },
        "targets": {
           "devices": [
               "9abcd2900c32fed1234a62201fb37896"
           ]
        }
    }
}
```

Configuration Update

The Configuration Update command must have "**config_update**" in the name field.

The **data** must contain "**path**" field with a path to the configuration file to be installed.

After a Configuration Update command is received, an attempt to update configurations with given configuration xml file will take place. If a configuration update was not able to successfully complete, a reject command response message is sent.

Sample Configuration Update Command

```
{
    "method": "POST",
    "resource": "/v2/commands",
    "body": {
        "name": "config_update",
        "data": {
            "path": "ftp://ftp.mysite.com/configs/myconfigs.xml"
        },
        "targets": {
            "devices": [
                "9abcd2900c32fed1234a62201fb37896"
             ]
        }
    }
}
```

Configuration Fetch (Not Available in 4.25 release)

The Configuration Fetch command must have "**config_fetch**" in the name field.

The **data** must contain "**path**" field with a path where to send the configurations from the device.

After a Configuration Fetch command is received, an attempt is made to send device configuration to the specified path. If a RAMQTT was not able to successfully send device configurations, a reject command response message is sent.

Sample Configuration Fetch Command

```
{
    "method": "POST",
    "resource": "/v2/commands",
    "body": {
        "name": "config_fetch",
        "data": {
            "path": "ftp://ftp.mysite.com/configs/configs.xml"
        },
        "targets": {
            "devices": [
                "9abcd2900c32fed1234a62201fb37896"
             ]
        }
    }
}
```

Reboot

The Reboot command must have "**reboot**" in the name field.

Sample Reboot Command

```
{
    "method": "POST",
    "resource": "/v2/commands",
    "body": {
         "name": "reboot",
         "targets": {
             "devices": [
                 "9abcd2900c32fed1234a62201fb37896"
              ]
         }
    }
}
```

Command Responses

RAMQTT sends a command response message to the cloud after attempting to perform the action requested by the command. In order to let the cloud know how the requested action went, either a rejected message (action failed) or a processed message (action succeeded) is sent back. If the message sent failed, the command response message contains a section explaining the reason to why it failed.

Command Response Message Format

```
{
    "method": "POST",
       "resource": "/v2/devices/<device_id>/commands/<command_id>/<"reject" or
"process">"
 "body":
 {
  "reason":"<explanation of why it failed>"
 }
}
```

RAMQTT – AMAZON AWS

4.1 Overview

4.1.1 Device Name

RAMQTT uses device serial number as a Device Name.

4.1.2 Last Will and Testament

The Last Will and Testament (LWT) acts as a way to let other subscribers of a topic receive a message when a device has disconnected ungracefully. Depending on which topic you publish the message to it could end up being ignored. According to Amazon's AWS documentation, if the LWT is published to a “system reserved topic” (Topics starting with a "$", such as $aws/things/...) the message is ignored. However, there is a way around this using an example provided in their documentation which can be found at http://docs.aws.amazon.com/iot/latest/developerguide/thing-shadow-data-flow.html.

4.2 Cloud Setup

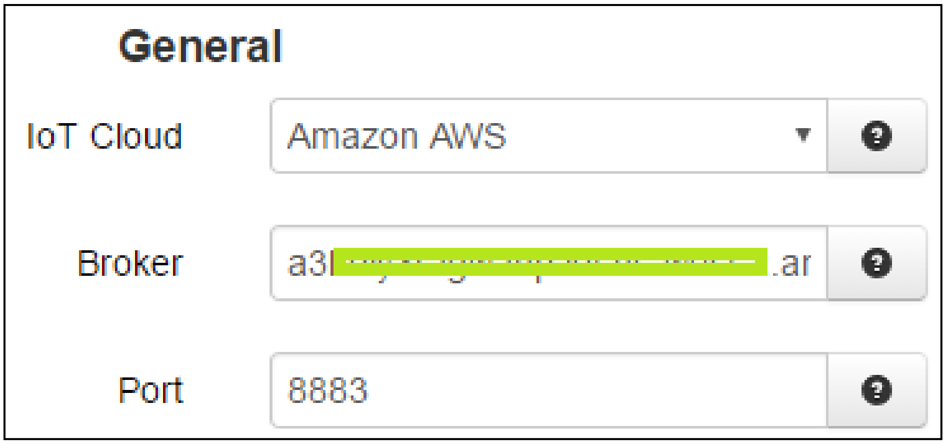
Prior to setting up a device, Device Certificates must be created either on AWS or user created certificates registered with AWS.

Please refer to AWS IoT documentation for more detail how to set up the cloud side.

- AWS IoT Quick Start Guide
- Certificates

4.3 Device Setup

To setup RAM device for Amazon AWS perform the following steps:



General

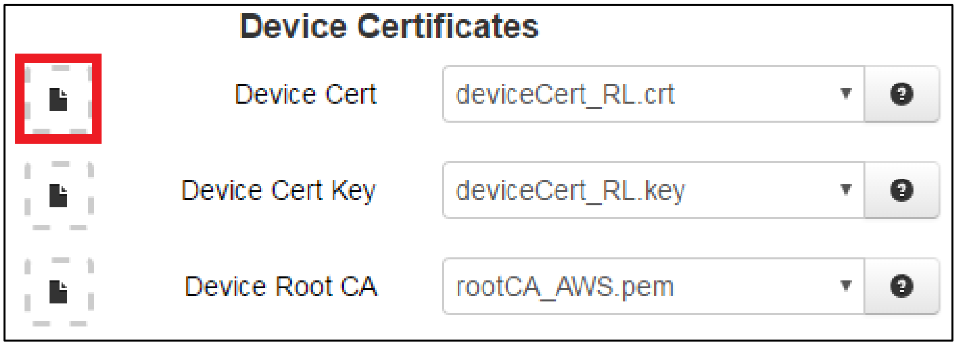
IoT Cloud: Amazon AWS

Broker: a3[redacted].ar

Port: 8883

Fill out General Section:

1. Select Amazon from **IoT Cloud**
2. Enter AWS broker address provided by AWS into **Broker** field.
3. Enter Port number into **Port** field.



Device Certificates

Device Cert: deviceCert_RL.crt

Device Cert Key: deviceCert_RL.key

Device Root CA: rootCA_AWS.pem

Attach Certificates

Attach all 3 certificates.

- If certificates have been previously added with device Certificate manager, just select appropriate certificate from the drop down box.
- Certificates can be also added by clicking on the file icon and selecting the appropriate certificate file.

4.4 Message Definitions

4.5.1 Publish Messages

RAMQTT publishes IODB and Device information messages to Shadow Device topic: **$aws/things/<Device Serial Number>/shadow/update.**

IODB Messages

All IODB points are published inside an "**iodb**" JSON struct which is inside predefined AWS "**reported**" struct.

Sample IODB Message

```
{
    "state": {
        "reported": {
            "iodb": {
                "AO_3000": 0,
                "AO_3001": 0,
                "Firmware_Version": 425
            }
        }
    }
}
```

Device Information

All Device Information is published inside a "**deviceInfo**" and "**location**" JSON structs which is inside predefined AWS "**reported**" struct.

Sample Full Device Information Message

```
{
      "state": {
          "reported": {
              "deviceInfo": {
                  "unitName": "",
                  "serialNumber": "97111234567890",
                  "model": "RAM-9931",
                  "version": "4.25",
                  "cellIp": "",
                  "upTime": 6077,
                  "versionLong": "4.25.60.0",
                  "pwr": 11.98,
                  "unitTemp": 45.119999,
                  "hostName": "SNgateway-v4_25_BETA-60",
                  "intInfo":
"lo=127.0.0.1;eth0=192.168.1.101;eth1=192.168.1.1;usb0=192.168.111.1;",
                  "cellFirmVer": "SWI9X15C_05.05.58.00 r27038 carmd-fwbuild1
 2015/03/04 21:30:23",
                  "cellFirmNum": "05.05.58.00",
                  "imei": "359221234567890",
                  "mdn": "Unavailable",
                  "simID": "Unknown",
                  "ismi": "Unavailable",
                  "cellServType": "UMTS",
                  "plmn": "310410",
                  "cellChan": 0,
                  "wsSig": 7,
                  "rssi": -81,
                  "ecio": -8,
                  "rsrp": 0,
                  "rsrq": -1,
                  "cellUpTime": 0,
                  "cellModTemp": 35,
                  "apn": "usccinternet",
                  "dataDay": 0,
                  "dataMonth": 0,
                  "gpsAltitude": 0,
                  "gpsTime": 0,
                  "gpsNumOfSat": 0,
                  "gpsFtFromCp": 0,
                  "gpsSpeed": 0,
                  "gpsCourse": 0
              },
              "location": {
                 "latitude": 0,
                 "longitude": 0,
                 "elevation": 0
              }
          }
      }
  }
```

4.5.2 Subscribe Messages

IODB Write

For updating IODB values on the device from cloud, RAMQTT is subscribed to **$aws/things/<Device Serial Number>/shadow/update/delta** topic.

Below is the sample desired messaged that is published by others (service, cloud, etc.) on which AWS generated a delta message for the device.

Sample IODB Desired Message

```
{
    "state": {
        "desired": {
            "iodb": {
                "AO_3000": 1234,
                "AO_3001": 122,
            }
        }
    }
}
```

> If a desired message is sent to update an IODB value that is read only, not defined in IODB points list, or is of a string value, RAMQTT sends a message to delete that desired request for that IODB register.

Commands

For receiving commands, RAMQTT is subscribed **aws/things/<Device Serial Number>/commands/requests** topic.

Below is the command type table and definitions. The Type field column tells what must be in the "type" field as identifier for that command**.**

Command	Version Added	Description
firmware_update	4.25	Update firmware of the device
package_install	4.25	Installs/update a custom package to the device
config_update	4.25	Update configuration with XML file
reboot	4.25	Reboots the device

Sending a command requires a special message containing the type of command and a path to download file if needed. RAMQTT supports firmware update, package update/install, config update, and reboot commands. To send a command to RAMQTT, the following message format is used except for the reboot.

Command Message Format

```
{
    "command": "<firmware_update | config_update | package_update >",
    "id": "<custom_command_id>",
    "path": "<url_path_to_download_a_file>" }
}
```

Example of the reboot command:

Reboot Command

```
{
   "command": "reboot>,
   "id": "<custom_command_id>"}
}
```

Once a command is processed, a response is sent to the **aws/things/<Device Serial Number >/commands /responses** topic stating if a command was successfully processed or rejected. If a command response is a rejected, a reason why it was rejected is also in the message. The reboot command sends a reason of "Device is rebooting".

Sample Command Response message

```
{
    "id": "<custom_command_id>",
    "response": "<successful | reject reason>"}
}
```

RAMQTT - Telenor Cloud Connect

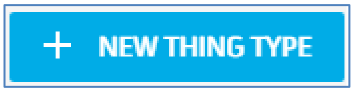
5.1 Overview

Since Telenor Cloud Connect leverages Amazon AWS IoT platform, RAMQTT uses the same underlying methodology to send messages with differences mentioned on this page. Please refer to RAMQTT – AMAZON AWS
for details on RAMQTT user guide with AWS.

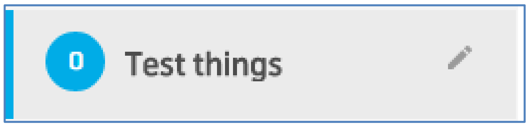
5.2 Cloud Setup

Prior to the RAMQTT device side setup, a device instance must first be created on the cloud side.

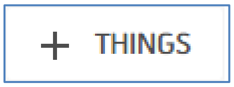
1. From Telenor Cloud Connect Connexion page, click on button.



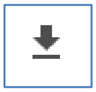
2. Enter desired information and click **Save**
3. Click on newly created thing type



4. Click on the (Add Things) button



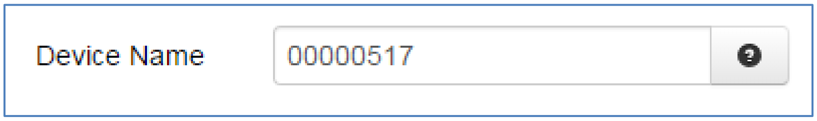
5. Enter number of things to create and domain, and press **Create**
6. Click on thing type again.
7. Scroll down to **Thing Credentials**
8. Click on the download credentials arrow to download credential information for all things created in steps 4 and 5.



9. Save the download file to a known location. This zip archive contains device certificate and key files. The device name is the folder name inside the downloaded zip archive.

5.3 Device Setup

Device setup for Telenor Cloud Connect is the same setup as for Amazon AWS IoT device setup except that Telenor Cloud Connect has an additional Device Name field. The Device Name field is required and must match with the certificates.



Device Name 00000517

5.4 Message Definitions

5.4.1 Publish Messages

All messages are published to $aws/things/<Device Name>/shadow/update topic.

Initial TCXN Message

On connection, RAMQTT publishes an initial message to Telenor Cloud Connect. This message does not contain any IODB points. It contains all RAMQTT supported data for TCXN block and GPS location.

Sample Initial TXCN message

```
{
    "state": {
        "reported": {
            "latlng": "45.6789,-71.2345",
            "tcxn": {
                "connection_status": 2,
                "ip_addr": "123.123.123.123",
                "fw_ver": "4.25.84.13",
                "cellular": {
                    "network_type": "LTE",
                    "rssi": 90,
                    "imsi": "312345678901234",
                    "imei": "398765432109876"
                }
            }
        }
    }
}
```

Last TCXN Message

When RAMQTT publishes a last TCXN message before it disconnects to update the connection status variable on the cloud.

Sample Last TXCN message

```
{
    "state": {
        "reported": {
            "latlng": "42.9049,-73.798",
            "tcxn": {
                "connection_status": 0}
            }
        }
    }
}
```

Device Information Message

Device information message is similar to AWS with the exception that **deviceInfo** sub thing has its type defined as "Device Information" and also includes the TCXN block.

Sample initial TXCN message

```
{
    "state": {
        "reported": {
            "deviceInfo": {
                "unitName": "Ram9000_103",
                "serialNumber": "971100001234567",
                "model": "RAM-9931",
                "version": "4.25",
                "cellIp": "123.123.123.123",
                "upTime": 15821,
                "type": "Device Information"
            },
            "latlng": "42.9049,-73.798",
            "tcxn": {
                "connection_status": 2,
                "ip_addr": "123.123.123.123",
                "fw_ver": "4.25.84.13",
                "cellular": {
                    "network_type": "LTE",
                    "rssi": 90,
                    "imsi": "312345678901234",
                    "imei": "398765432109876"
                }
            }
        }
    }
}
```

IODB Message

IODB message is similar to Amazon AWS with the exception that **iodb** sub thing has its type defined as "IODB Registers".

Sample Initial TXCN message

```
{
    "state": {
        "reported": {
            "iodb": {
                "Time_Min": 17,
                "Time_Second": 8,
                "Uptime_Seconds": 47,
                "type": "IODB Registers"}
            }
        }
    }
}
```

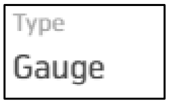
5.4.2 Subscribe messages

IODB Write

IODB Write messages for Telenor Cloud Connect are sent to the same topic as Amazon AWS. RAMQTT subscribes to **$aws/things/<Device Name>/shadow/update/delta** topic for IODB Write messages.

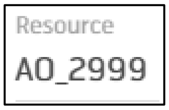
To send an IODB Write message from Telenor Cloud Connect to the RAM device, follow these steps:

1. Add or edit a widget on the dashboard
2. Select the type of the widget to be one of the following: Value, Gauge, Table of Time Series



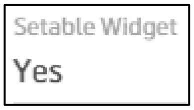
Type
Gauge

3. Select the resource. This is the IODB register sent from the device.



Resource
AO_2999

4. Select "Yes" from **Setable Widget**



Setable Widget
Yes

5. Click the **Done** button.
6. Save your view
7. From the top right corner of the widget, click button below and click **Set**

⋮

8. Enter the desired value and click Set

At this point, Telenor Cloud Connect will set a desired value for the selected resource and the Amazon AWS back-end will send a delta message to the device.

To clear the desired value, from the top right corner of the widget, click the button below and click **Reject**.

⋮

If the desired value is not rejected (cleared), a delta message will continue to be sent every time the device publishes a message.

When RAMQTT starts, it publishes numbers as numbers and strings as strings.
Values from Telenor Cloud Connect are sent as strings. For all received values, RAMQTT preserves the received value type and publishes changes with the same type.
Example: If a value, AO_3000, is received by RAMQTT as a string, a changed value will be sent as a string..

Commands

The following Commands for Telenor Cloud Connect are not available in the 4.25 release due to restrictions in the Telenor Cloud Connect implementation**:**

- Firmware Update
- Config Update
- Package Install
- Reboot