# 42.**IIoT**

This chapter explains how to use IIoT protocols.

42.1.	MQTT	12-2
42.2.	OPC UA Server	2-30



#### 42.1. MQTT

#### 42.1.1. Overview

MQTT object can publish messages to an MQTT server, or subscribe to topics to receive messages from an MQTT server. HMI can serve as an MQTT server as well. When HMI serves as an MQTT server, it does not send message to another MQTT server.

#### 42.1.2. Configuration



Click [Object] » [IIoT] » [MQTT] in the menu to open the settings dialog box.

MQTT	
Enable	
* Supported OS version : 20150923 or later	Exit



#### 42.1.2.1. Server Settings

#### **General Tab**

	TLS/SSL System To	opic				
Comment :						
Cloud service :	Generic	. 0				
Protocol :	MQTT v3.1.1 -					
	Customize length	n for clie	nt ID/	Jsei	rname/pa	ssword
	Client ID	: 20		-	words	
	Username/password	: 16		*	words	
IP :	127 . 0		0		1	🗌 🗌 Use domain name
Port :	1883					
Client ID :	%2					<b>≓</b> u (d
	Authentication					
Keep alive time :	10 🔄 seco	nd(s)				
Timestamp :	UTC Time			2.00		1
	in [Time Sync./DST	] page	of [Sys	ster	n Parame	ck your time zone setting ters] dialog.
	🕝 Clear message bu	uffer wh	en dis	con	necting g	racefully.
	Close inactive MC	QTT cor	nectio	on a	utomatic	ally

Setting	Description
Cloud service	Generic
	Use general MQTT publish-subscribe service.
	AWS IOT
	Use AWS IoT as a Broker, and use Thing Shadows service.
	For more information, please find "AWS IoT User
	Manual".
	Sparkplug B
	Sparkplug B is a specification designed based on the
	characteristic features of IoT applications. It helps define
	topics and messages that are not specified by standard
	MQTT, and allows non-MQTT terminal devices to transfer
	data with MQTT Server through Edge of Network, which
	can be HMIs in this architecture. Please see "Sparkplug B
	Quick Start Guide" for more information.



#### Azure IoT Hub

Use Microsoft Azure IoT Hub as a Broker. Using this service can simplify setting step to entering a Connection String. The Connection String can be found in Microsoft Azure > IoT devices.

	MQTT Server
	General Address TLS/SSL
	Comment :
	Cloud service : Azure Io T Hub
	Connection String : Port: 8883
Protocol	Supports MOTT v3.1, v3.1.1, and v5, (v5 is supported only
	for cMT / cMT X Series)
Customize length	
for Client ID/	Client ID: The upper limit is 128 words.
username/password	Username/Password: The upper limit is 256 words.
IP	Enter the MQTT Server IP address for receiving the
	message. If 127.0.0.1 is entered, HMI will run a MQTT
	server locally.
Use domain name	A domain name can be used as MQTT server's IP address.
Port	Enter the MQTT Server port number for receiving the
	message.
Client ID	Enter the Client ID. Variables can be used for Client ID, for
	example, entering %0 will make the HMI Name to be the
	Client ID.
Authentication	If selected, connecting MQTT Server will require
	[Username] and [Password].
Username	Enter the username for connecting MQTT Server.
Password	Enter the password for connecting MQTT Server.
Keep alive time	When MQTT Server does not receive the message from
	HMI passing the specified time, the HMI will be identified
	as disconnected.
	Note: When running simulation, the message may be
	delayed, but the delay will not exceed the [Keep alive
	time]. The message from the HMI will be sent
	immediately.



	Use local HMI time for timestamp.
	UTC time
	Use UTC+0 (coordinated universal time) for timestamp.
	When the timestamp is shown incorrectly, please go to
	[System Parameters] » [Time Sync. / DST] tab to set the
	time zone.
Clear message	This option is selected by default. With it selected, when
buffer when	disconnecting gracefully (by entering 2 for the command
disconnecting	in MQTT's control addresses), message buffer will be
gracefully	cleared. Messages in the buffer will be retained when this
	option is not selected.
Close inactive MQTT	In this mode, the connection will be automatically
connection	terminated if there's no data update for a specified
automatically	period of time. The connection will resume once any data
	update occurs.
	The user can choose to publish initial values / topic list
	only at the first connection.
	In this mode, the start and stop commands are disabled.



#### Address Tab

eneral Add	ress TLSASSL S	ystem Topic		
Status addres	s			
Device :	Local HMI		•][	
Address :	LW	➡ 100		6-bit Unsigned
				Usage.
🔽 Buffer us	a se address			COAL-CARGO
Device :	Local HMI			<u> </u>
Address :	LW	• 0		6-bit Unsigned
	(		1	IIeeee
				0.3826.
🔽 Control a	ddress ————			
Device :	Local HMI		•][	- G (G
Address :	LW	▼ 200		6-bit Unsigned
				Usage.

Setting

#### Description

Status address

### LW-n: Displays the connection status to MQTT

Server.	

Value	Description
0	Not attempting to connect to MQTT
	Server.
1	Disconnected and can't connect to
	MQTT Server.
2	Connection succeeded.

#### LW-n+1: Error indicator.

Value	Description
0	No error
1	Unknown error
2	Failed to connect
3	Access denied
4	Not allowed port number for built-in
	MQTT server



	5	Unresolvable domain name
	6	Buffer overflowed
	32	Incorrect client ID
	48	Failed to verify certificate
	256	Still connecting
Buffer usage	Message	es that have not been sent are stored in the
address	buffer. T	he maximum buffer capacity is 10000
	message	s. The buffer capacity is measured in
	percenta	age (%), rounded up.
	LW-n: Sh	ows buffer usage.
Control address	LW-n: Co	ontrols the operation of MQTT Server.
	Value	Description
	0	Ready
	1	Start
	2	Stop
	3	Update
	LW-n+1:	Sets the IP address of MQTT Server.
	LW-n+5:	Sets the port number of MQTT Server.
	LW-n+6:	Sets the Client ID for connecting MQTT
	Server.	
	LW-n+26	: Enables / Disables authentication.
	Value	Description
	0	Disable
	1	Enable
	LW-n+27	': Sets the username for connecting MQTT
	Server.	Sots the password for connecting MOTT
	Server.	. Sets the password for connecting MQT
	LW-n+59	: Sets the domain name for connecting
	MQTT Se	erver.
	When Az	zure IoT Hub is used, the control addresses
	are as be	elow:
	LW-n: Co	ontrols the operation of MQTT Server.
	Value	Description
	0	Ready
	1	Start
	2	Stop
	3	Update

#### LW-n+1: Sets the Connection String (128 words).

#### TLS/SSL Tab

The second se	ASSL System Topic
V Enable	
Version : TL	S12 V
Server verification	n
Use certificate	on HMI first (if existed). Otherwise, use imported files below.
CA certificate : N	None
	Import_
V Server name m	ust match certificate's mormation
Client verification	
ER II. CT. I	
Gentificate	on rivit first (if existed), otherwise, use imported files below.
Certificate . I	vone
	Import
🖉 Use private key	/ on HMI first (if existed). Otherwise, use imported files below.
Private key : N	None
10 C C C C C C C C C C C C C C C C C C C	Import
[	
[	
(	
(	
(	

Setting	Description		
Enable	Enable TLS/SSL authentication. TLS version can be		
	selected from: TLS 1.0, TLS 1.1, and TLS 1.2.		
	To use TLS 1.1 and TLS 1.2, HMI OS version must be		
	20180323 or later.		
Server verification	Enable		
	Verify whether the server certificate is signed by CA		
	(Certificate Authority). Server certificate is sent from		
	server during connection.		
	Server name must match certificate's information		
	Verify whether the server's domain name or IP		
	matches the records in the server certificate.		
	Domain name and IP records are stored in Subject		
	Alternative Name of the certificate.		
<b>Client verification</b>	Private key and client certificate is required for		
	server to authenticate the client.		

#### System Topic

Several system topics can be enabled for HMI to publish. When a system topic is enabled for an



HMI, the subscribers of that topic can view the list of available topics and connection status of that HMI.

	New MQTT Server Object
	General Address TLS/SSL System Topic
	Topic List Birth Topic Close Topic Lest Will
	✓ Enable Topic : bt-2/type/mt/id/%1/evt/topics_update/fmt/json Default %0 : HMI name %1 : Client ID for server %% : Character % ✓ Retain message QoS : 2 ▼ Content format : JSON (Default) ▼ Reset
Setting	Description
Topic List	List of topic sent from HMI to the server upon
	connection.
Birth Topic	The message sent from the HMI after it is connected
	to the server.
Close Topic	The last message sent from the HMI before it
	disconnects knowingly from the server.
Last Will	The message received by the subscriber to Last Will
	when connection between HMI and server is lost
	ungracefully. HMI updates its Last Will message
	when it connects to the server.
Торіс	The actual topic name of the system topic.
Retain Messag	e When this checkbox is selected, the MQTT server
	will save the latest message.
QoS	MQTT provides three levels of reliability, which are
	known as quality of service (QoS). The reliability of
	the message determines the persistence of the
	message.
	QoS 0: At most once, messages are not persistent.
	QoS 1: At least once.
	QoS 2: Exactly once.
Content Forma	It JSON (Default): Use default content. The following
	are the defaults of each system topic. Actual
	context-dependent values are shown in red:



(

lloT

```
Topic list:
{
    "d" : {
       "topics" : [
           {
               "compression" : "Compression Type",
               "nickname" : "Topic Name",
               "topic" : "Topic"
           },
           {
               "compression" : "Compression Type",
               "nickname" : "Topic Name",
               "topic" : "Topic"
           }
       ]
   },
    "ts" : " Current Time "
}
```

Contents in the topics vary according to the actual topic settings. The above is an example for the case of two topics.

```
Birth Topic:
{
    "d":{
        "connected":true
    },
    "ts":"Current Timestamp"
}
Close Topic:
{
    "d":{
        "d":{
        "connected":false
    },
    "ts":"Current Timestamp"
```





Please note that System Topics tab is not supported when using Sparkplug B and Azure IoT Hub cloud services.

Click the icon to watch the demonstration film. Please confirm your internet connection before playing the film.

#### 42.1.2.2. MQTT Topic Publisher

Enable					
Server	IP/Domain nar	ne : 127.0.0.1, I	Port : 1883		
Fopic MQTT Topic Pu	blisher \ MQTT T	opic Subscriber	2		

Click [New] to open General and Address settings, or click [Import] / [Export] to import or export an existing \*.csv file. The maximum allowable number of topics is 255.



#### **General Tab**

eneral Address S	ecurity
Nickname :	topic 1
Topic :	iot-2/type/cMT2078X/id/%0/evt/topic 1/fmt/json Generate
	%0 : HMI name
	%1 : Client ID for server
	%(DINAMIC) : Dynamic sning %% : Character "%"
	4994999387938793879389939
Sending mode :	Address (Auto.)
📝 Value-trigger-ba	hee
Time head	300
1 Inte-Dased	-
Min. time between n	iessages : U 🔄 ms
Compression type :	None 🔻
0-8.	
QUA .	
	Retain message
Content format :	JSON (Simple)
	✓ Include timestamp
	I lise ton-level key "d" for all addresses
	Se op-level key a fol all addlesses

Setting	Description
Nickname	Enter the nickname of the MQTT Topic for easier reference.
Торіс	Specify the format of the message topic sent to MQTT Server.
	Variables can be used for Topic. Entering %(DYNAMIC) in the Topic
	field opens Dyanmic String group box for designating a word
	address. %(DYNAMIC) can include multiple topic levels. For example:

myhome/groundfloor.

General	Address
Nie	:kname : topic 1
0	Topic : %(DYNAMIC)
	%0 : HMI name
	%1 : Client ID for server
	%(DYNAMIC) : Dynamic string
	%% : Character %
Dynan	nic string
Dev	ice : Local HMI 🗾 🗸 Settings
Add	ress T INT 0 20 word (s)

When Azure IoT Hub is used, users can only specify the last topic

level.



	MQTT Topic Publisher					
	General Address					
	Nickname : topic 1					
	Topic : devices/ <deviceid>/messages/events/ topic 1 Generate</deviceid>					
Sending mode	Address (Auto.)					
	Value-trigger-based:					
	Sends MQTT message when any value changes.					
	Time-based:					
	Sends MQTT message in a time-based manner.					
	Min. time between messages:					
	Sends MQTT message in a specified time interval. When the value					
	changes within a period of time shorter than the specified time					
	interval, the message will be stored in the buffer and then sent after					
	the set wait time. This prevents the publisher from sending					
	messages too frequently.					
	Address (Bit trigger)					
	Sends MQTT message when a designated bit is triggered.					
	Event (Alarm) Log					
	The topic source can be an Event Log. MQTT message can be sent					
	when a single event or any event in a specific category occurs.					
Compression	The message will be compressed before being sent, and					
type	decompression is needed before reading the message. Messages in					
	MQTT can be compressed / decompressed in zlib, gzip, or with					
	DEFLATE algorithm.					
Retain message	If selected, the MQTT server will save the latest message.					
Include	This option is available only when the format used is [JSON (simple)].					
timestamp	Selecting this option can include timestamp in the message.					
Use top-level	This option is available only when the format used is [JSON (simple)].					
key "d" for all	When selected, the message format is as below:					
addresses	<pre>{     "d": {         "addressName1":,         "addressName2":     },     "ts": }</pre>					

When not selected, the message format is as below:





	<pre>{     "addressName1":,     "addressName2":,     "ts": }</pre>			
	As shown in the above figure, when this option is not selected, ts			
	and address names become keys of the same level. Therefore,			
	please avoid using ts as an address name in this case.			
QoS	MQTT provides three levels of reliability, which are known as quality			
	of service (QoS). The reliability of the message determines the			
	persistence of the message.			
	0: At most once, messages are not persistent.			
	1: At least once.			
	2: Exactly once.			
Content Format	The supported formats are:			
	Raw Data: Data in bytes.			
	JSON (Simple): JSON format with all data put in JSON member "d".			
	JSON (Advanced): JSON format with flexible JSON structure.			

#### Address Tab

The following explains the address settings for [Raw Data] and [JSON (Simple)] content formats.



Jeneror	Address	Security			
N	ame	Device name	Address	Address format	Address element coun
Va	lue	Local HMI	LW-0	String	1
Va	lue (2)	Local HMI	LB-0	Bit	1
va	lue (3)	Local HMI	LW-1	16-bit Unsigned	1
*					
-	ew	Delete	Settings.	22	

Setting	Description	
New	Add the source of the topic. The length of each	
	address can be specified respectively.	
Delete	Delete the address.	
Setting	Change the name and address.	

Type/Address	Type/Address
Name : value (3) Type Bit  Word Address Device : Local HMI Address : LW 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library.	Name : value (3) Type Bit  Word Address Device : Local HMI Address : LW I String (1) * You can scale/convert data with conversion tag in Tag Library.
Include in all messages sent  Enable number of digits to the right of the decimal point  4	<ul> <li>✓ Include in all messages sent</li> <li>✓ Remove JSON array bracket '[ and ']'</li> <li>✓ Auto escape special characters</li> </ul>

Setting	Description
Include in all	When the value from one of the source addresses
messages sent	changes, the data in this address can be included in



	all the messages sent. This option is available when
	the content format is [ISON (Simple)] or [ISON
	(Advanced)].
Remove JSON array	For JSON formatted messages, selecting this option
bracket "[" and "]"	can remove bracket "[" and "]". This option is
	available when the content format is [JSON
	(Simple)].
Enable number of	When data type is Float, the number of digits after
digits to the right	the decimal point can be specified. This option is
of the decimal	available when the content format is [JSON (Simple)]
point	or [JSON (Advanced)].
Auto escape special	This option is available when the data type is String,
characters (cMT /	and the content format is [JSON (Simple)]. JSON
cMT X Series)	formatted messages may contain special characters
	(e.g. " and \) which can lead to JSON parsing errors.
	With this option selected, special characters in a
	string can be escaped (e.g. change from " to \" and
	change from \ to \\) for successful message parsing.



Maximum tag length: 255 words.



#### Security Tab

and 1 411 Committee	
General Address Security	
- Enable/Disable	
Device . Local HMI	
Enable if bit is : ON 💌	
Action : Do nothing when disabled	
ACION . Do no mile when disabled	

Messages will be published only when the state of the designated address meets the set condition. As shown above, the message will be published when LB-0 is ON.

#### Address Tab [JSON (Advanced)]

The following explains address settings for [JSON (Advanced)] content format. This is a nested format that allows using objects or arrays, and customizing timestamp and data name. Using this format provides a more flexible way of using MQTT.



;		×
		_
Value	Address	
JSON Enhanced		
	LW-0 LW-1 LW-2	
	LW-10 LW-11 LW-12 LW-14	
Timestamp		

<b>D</b> 1 1	~.	10100	
<ul> <li>Payload Topic Na</li> <li>object LW-: LW-: LW-:</li> <li>anay</li> <li>[0]</li> <li>[1]</li> <li>[2]</li> <li>[3]</li> <li>timestam</li> </ul>	Object (4) me String Object (3) Number Number Anray (4) Number Number Number Number String p String	JSON Enhanced Timestamp	LW-0 LW-1 LW-2 LW-10 LW-11 LW-12 LW-14
timestam	p String	Timestamp	
			4
•			4
New Object	III New Array 🔹 New	v Value) Delete	Settings

MQTT Topic Publisher Object's Propertie

General Address

When configure the settings as shown in the above screenshot, the received MQTT message by the subscriber is as below.

```
Topic Name" : "JSON Enhanced",
          'Object" :
                     ł
            LW-0"
                  :[1],
            "LW-1" : [ 2 ],
         "Array" : [ [ 4 ], [ 5 ], [ 6 ], [ "AABBCCDD" ] ],
         "timestamp" : "2019-02-19T06:52:13.846038"
Setting
                          Description
New Object
                          Add a new object. The name, type and value of each
                          item under the object can be configured. Items
                          under the object are enclosed in curly brackets { }.
New Array
                          Add a new array. An array may contain multiple
                          items but the name of the item is automatically
                          generated and is unchangeable. Items under the
                          array are enclosed in square brackets [].
New Value
                          Add a new number, string, or timestamp. When the
```



A			
	new value is a number or a string, fixed value can be		
	selected, or an address can be designated as the		
	data source.		
Delete	Delete the selected item.		
Settings	Configure the selected item. When the selected item		
	is an object or an array, the user may only change its		
	name. When the selected item is contained in an		
	object or an array, its parameters can be configured.		
Сору	Copy the selected item.		
Paste	Paste the copied item to the selected row.		
Template	By pasting JSON string into the window, the system		
	will automatically adjust the data structure setting		
	according to JSON structure, saving time for users.		
	Create from JSON Template		
	Paste JSON text here.		
Preview	Preview the JSON data in a reader-friendly format.		

## Note

Maximum number of nodes for a Topic is 512 (payload included). Maximum tag length is 255 words.

#### 42.1.2.3. MQTT Topic Subscriber

Server Settings IP/	Domain name : 127.0.			
Jecungs	Donnalli Haille . 12/.0.	0 1 Dort • 1992		
Topic		,		
MQTT Topic Publishe	r MQTT Topic Subscrit	ber		
		11		

Click [New] to open General and Address settings, or click [Import] / [Export] to import or



export an existing \*.csv file. The maximum allowable number of topics is 255.

#### **General Tab**

The following explains the address settings for [Raw Data] and [JSON (Simple)] content formats.

neral Address S	ecurity	
Nickname :	topic 1	
Topic :	2/type/cMT3072XH/id/device_id/evt/topic 1/fmt/json	Generate
	%(DYNAMIC) : Dynamic string %% : Character "%"	
Compression type : QoS :	None	
Content format :	JSON (Simple) ▼ ▼ Verify timestamp ▼ Use top-level key "d" for all addresses	
Operation Mode : Manual Operation	Manual 🔹	
Device : Loca	I HMI	<u>_</u>
Address : LW	• 0	oit Unsigned
	Command : LW-0	
	(1 : handle next message in queue	
	2 : handle last message in queue and clear Double I W 1	r all)
	Result : LW-1 (D.None 1 · Success 2 · Block by Interla	uck)
Number of unhan	dled messages : LW-2	

Setting	Description
Nickname	Enter the nickname of the MQTT Topic for easier
	reference.
Торіс	Subscribe to a topic in MQTT Server. The topic name
	can be dynamic.
	Entering %(DYNAMIC) in the Topic field opens Dynamic
	String group box for designating a word address.
	%(DYNAMIC) can include multiple topic levels. For
	example: myhome/groundfloor.



MQTT Topic Sub	scriber	×
General Address		
Nickname :	topic 1	
Topic :	%(DYNAMIC) Genera	te
	%(DYNAMIC) : Dynamic string %% : Character %	
Dynamic string		
Device : L	ocal HMI 🔹 Settings	
Address : L	.W - 0 20 word (s)	

When Azure IoT Hub is used, users can only specify the last topic level, and the topic level should be the same as in MQTT Topic Publisher.

	MQTT Topic Subscriber
	General Address
	Nickname : topic 1
	Topic : devices/ <deviceid>/messages/devicebound/ topic 1 Generate %(DYNAMIC) : Dynamic string %% : Character %</deviceid>
Compression type	Configure with the same setting as MQTT Topic
	Publisher.
Verify timestamp	When timestamp is included in the message, selecting
	this option will verify whether the timestamp is
	increasing, and update will occur when the timestamp
	does increase; otherwise, the message will be treated
	as expired message and update will not occur.
Use top-level key	When selected, the message format is as below:
"d" for all	
addresses	<pre> {     "d": {         "addressName1":,         "addressName2":     },     "ts": } </pre>
	When not selected, the message format is as below:
	<pre>{     "addressName1":,     "addressName2":,     "ts": }</pre>
	Please use appropriate setting according to the data
	source.
QoS	MQTT provides three levels of reliability, which are
	known as qualities of service (QoS). The reliability of
	the message determines the persistence of the
	message.





	0: At mo	st once, messages are not persistent.				
	1: At leas	st once.				
	2: Exactl	y once.				
Content Format	Raw Dat	Raw Data: Unformatted raw data.				
	JSON (Si	JSON (Simple): Single layer JSON format.				
	JSON (Ad	dvanced): JSON format with user-defined JSON				
	structure	2.				
<b>Operation Mode</b>	Operation mode for subscribing topics can be selected.					
	Process	immediately: Write the value to the designated				
	address	immediately after receiving subscribed data.				
	Manual:	Manual: Place the subscribed data in a queue before				
	processing the data manually. The queue can hold 100					
	records.	records.				
	Control	Control address (Manual)				
	LW-n: Co	ommand				
	Value	Description				
	1	Write the oldest data in the buffer to				
		the designated address. If there are				
		10 records in the buffer, the user can				
		enter command 1 for ten times to				
		write the data to the address				
		sequentially.				
	2	Write the latest data in the buffer to				
		the designated address, and then				
		clear all data in the buffer.				
	LW-n+1:	Execution Result				
	Value	Description				
	0	The buffer is currently empty.				
	1	The command is executed				
		successfully.				
	2	The topic subscription is blocked so				
		command execution failed. (See				
		Security tab in this chapter.)				
		Number of unbandled messages				

Displays the number of messages in the buffer.



#### Address Tab

	Name	PLC name	Address	Address format	Address element count
	L.W80	Local HMI	LW-80	32-bit Float	2
	LW40	Local HMI	LW-40	16-bit Unsigned	2
Þ	LB94	Local HMI	LB-94	Bit	4
			Α	.ddress list	

Setting	Description
New	Add the destination address of the subscribed topic.
	The length of each address can be specified
	respectively.
Delete	Delete the address.
Setting	Change the name and address.

Type/Address	Type/Address
Name: value Type ③ Bit	Name : value Type Bit  Word
Address Device : Local HMI Address : LW  Vou can scale/convert data with conversion tag in Tag Library.	Address Device : Local HMI Address : LW  * You can scale/convert data with conversion tag in Tag Library.
☑ Required for incoming messages ☑ Remove JSON array bracket '[ and ]'	☑ (Ending string) Permit data smaller than the preset size
Accept null     OK Cancel	OK Cancel



Setting	Description
Required for	When the value from one of the destination
incoming messages	addresses changes, the data in this address must be
	included in all the messages received. This option is
	available when the content format is [JSON (Simple)]
	or [JSON (Advanced)].
Remove JSON array	For JSON formatted messages, selecting this option
bracket "[" and "]"	can remove bracket "[" and "]". This option is
	available when the content format is [JSON
	(Simple)].
Accept null	Null can be accepted. This option is available when
	the content format is [JSON (Simple)] or [JSON
	(Advanced)].
(Ending string)	A string that has a length shorter than the preset
Permit data smaller	length can be accepted. This setting is effective only
than the preset size	for the ending string, and it will not be effective
	when the string is followed by other values or bit
	data. This option is available when the content
	format is [Raw data].



#### Security Tab

General Address Security	
Enable/Disable	
Vse register status/value	
Device : Local HMI	
Address: LB 👻 0	
Enable if bit is : ON 🔹	
Action : Do nothing when disabled	•]
Holden . (Do holding when appendix	

Messages will be subscribed only when the state of the designated address meets the set condition. As shown above, the message will be subscribed when LB-0 is ON.

#### Address Tab [JSON (Advanced)]

The following explains address settings for [JSON (Advanced)] content format. This is a nested format that allows using objects or arrays, and customizing timestamp and data name. Using this format provides a more flexible way of using MQTT.



lloT



Mama	Time	Value	() d d man	
Name Payload Topic Name object LW-0 LW-1 LW-2 array [0] [1] [2] [3] timestamp	1ype Object (4) String Object (3) Number Number Array (4) Number Number Number String String	v arue Timestamp	Address LW-0 LW-1 LW-2 LW-10 LW-11 LW-12 LW-14	
				•
New Object     New	III W Amay 👻 New	Value Dek	• te Settin	 gs
				-

Setting	Description
New Object	Add a new object. The name, type and value of each
	item under the object can be configured. Items
	under the object are enclosed in curly brackets { }.
New Array	Add a new array. An array may contain multiple
	items but the name of the item is automatically
	generated and is unchangeable. Items under the
	array are enclosed in square brackets [].
New Value	Add a new number, string, or timestamp. When the
	new value is a number or a string, fixed value can be
	selected, or an address can be designated as the
	data source.
Delete	Delete the selected item.
Settings	Configure the selected item. When the selected item
	is an object or an array, the user may only change its
	name. When the selected item is contained in an
	object or an array, its parameters can be configured.
Сору	Copy the selected item.
Paste	Paste the copied item to the selected row.



#### Template

By pasting JSON string into the window, the system will automatically adjust the content according to JSON structure, saving time for users.

Create from JSON Template	×
Paste JSON text here.	



- Amazon Web Service (AWS) IoT Core supports standard MQTT protocol. However, please note the following restrictions:
  - 1. The maximum number of layers in a topic is 8 (iot-2/type equals to 2 layers).
  - 2. Authentication in General tab is not supported, please use TLS/SSL.
  - 3. Supports only Qos 0 and Qos 1.
  - 4. Retaining the latest message in MQTT server is not supported.

#### 42.1.2.4. Sparkplug B

General settings and Device settings for cloud service Sparkplug B are as shown below.



lloT

#### **General Tab**

MQTT	
🔽 Enable	
Server	
Settings IP : 127	0.0.1, Port : 1883
Sparkplug B	
General Device	
Group ID :	MT Group
Edge node ID :	MT EoN
DDATA min. time :	ms 🚔 Minimal waiting time before sending a new DDATA (Deivice DATA) message (if data changes are detected)
QoS : [	· · · · ·
* Supported OS version :	1015023 or later Fvit
Setting	Description
Group ID	The group ID that identifies the group in which the
	Edge of Network Nodes belong to.
Edge ID	The ID that identifies a specific Edge of Network
U	Node.
DDATA min.	time The minimum-wait-time duration before a new
22/11/11	DDATA (Device DATA) message is sent when data
	change is detected
0	
Qos	MQTT provides three levels of reliability, which are
	known as qualities of service (QoS). The reliability of
	the message determines the persistence of the
	message.
	0: At most once, messages are not persistent.
	1: At least once.
	2: Exactly once.



#### **Device Tab**

nable rver Settings IP : 127	7.0.0.1, Port : 18	83		
arkplug B General Device				
Name	Address	Address Format	Address Element Count	New Group
Local Hour     Hour     Hour     Second     Tag0     Tag4	LW-9019 LW-9018 LW-9017 LB-0 LW-0	16-bit Unsigned 16-bit Unsigned 16-bit Unsigned 位元 16-bit Unsigned	1 1 1 1	New Tag Delete Settings
pported OS version	: 20150923 or lat	ter		
pported OS version	: 20150923 or lat	er Descri	ption	E
pported OS version Setting New Group	. 20150923 or lat	er Descri Add a	ption group to manage the tags.	
pported OS version : Setting New Group New Tag	: 20150923 or lat	er Descri Add a Add th engine be bla	ption group to manage the tags. he tags of this EoN node mo e. Please note that the Nam nk.	Donitored by MQTT ne field should not
pported OS version : Setting New Group New Tag Delete	: 20150923 or lat	er Descri Add a Add th engine be bla Delete	ption group to manage the tags. he tags of this EoN node mo e. Please note that the Nam nk. e an existing group or tag.	onitored by MQTT ne field should not

Click the icon to download the demo project. Please confirm your internet connection before downloading the demo project.

#### 42.2.1. Overview

OPC UA (Unified Architecture) is a communication technology often used in industrial automation fields. OPC UA features cross-platform interoperability, unified access, standardized communication, and security. In this architecture, cMT / cMT X Series HMI models with built-in OPC UA server play a key role as Communication Gateway, and allow OPC UA clients to access HMI or PLC data by subscribing to tags to receive real-time updates. This new architecture can help you achieve vertical integration.

Hardware & Software requirements:

- HMI Model: cMT / cMT X Series models. \*A license must be loaded for cMT-SVR / cMT-SVR-200 and cMT-HDM / cMT-FHD / cMT-FHDX.
- Software: EasyBuilder Pro V5.06.01 or later
- Recommended OPC UA Client: Unified Automation UaExpert

#### 42.2.2. Configuration



Click [Object] » [IIoT] » [OPC UA Server] in the menu to open the settings dialog box.





#### **General Tab**

General User Authentica	ation   Discovery			
IA Server Comment :	[			
CPC TCP				
opc.tcp:// <hmi ip="">:48</hmi>	:40/			
Port :	4840			
Server name :	1			
	Automatically trus	all client certificates		
Security policy :	Vone .			
	Regist 222 million	Cim. Cim & Enamet		
	Basic 256	Sign, Sign & Encrypt		
	Dasic200	Sign; Sign & Encrypt		
	Basic256Sha256	Sign; Sign & Encrypt	•	
You can use the follow	/ing OPC UA system to	gs: /0		
L W 11425 (16bit) :	OPC UA Server status	(O. stopped, I. running) oda (D. maaam 1 ar mam		
LW-11430 (16bit) :	OPC IIA Server control OPC IIA Server control	l command (1): none, 1: st	art. 2: ston)	
* If timestamp in OPC page of [System Param	UA is incorrect, please eter Settings] dialog.	check your time zone setti	ng in [Time Sync./DST]	
				Exit

Setting	Description
Comment	The description about the OPC UA Server.
ОРС ТСР	The URL of the server.
Port	The port number for the clients to connect with OPC
	UA Server. The default port number is 4840.
Server name	The server name, this field is allowed to remain blank.
	[Automatically trust all client certificates]
	This option is enabled by default, but may be toggled
	for cMT Gateway series only. When this option is
	disabled, all OPC UA clients will be refused connection
	unless their corresponding client certificates have
	been trusted in the OPC UA web interface like shown
	below:





#### **User Authentications Tab**

ſ	OPC UA Server	
OPC UA Server	General       User Authentication       Discovery         Methods       Image: Second	oup ag ete gs prt
	OK Cancel Help	Exit



Setting	Description		
Methods	Anonymous		
	Grant Browse, Read, Write permissions to		
	anonymous login by selecting the checkboxes.		
	User name & password		
	Use the same user name and password as HMI. The		
	permissions are granted to the security classes		
	specified in System Parameter Settings » Security.		
	Certificate		
	This option is available only for cMT Gateway series		
	OPC UA client may use certificates as authenticatio		
	method instead of username-and-password metho		
	to login. Use web interface to configure		
	trusted /untrusted user cortificates, as shown below		
	OPC UA		
	OPC UA Server Status : Running		
	Server Settings Edit node Certificates Discovery Advanced		
	Trusted Users - O		
	Name Valid From Valid to Organization OrganizationUnit		
	X Untrusted UaExperti@MAO-LAPTOP 2019/12/10 2024/12/08 org		
	Trust Remove Certificate Import Certificate Export Certificate		

### Note

- OPC UA security layers can be split into
  - (1) communication layer (e.g. SecurityPolicy)
  - (2) application layer, as shown in the image below:





Security Layers (from <a href="http://wiki.opcfoundation.org/index.php/File:SecurityLayers.jpg">http://wiki.opcfoundation.org/index.php/File:SecurityLayers.jpg</a>)

- Client certificate is at communication layer and its use is required when using SecurityPolicy other than None.
- User certificate is at application layer and using it is one of the ways for authentication.



#### **Discovery Tab**

-	10	-				
	URL			Com	ment	
opc.tcp://192	.168.1.141:4840/LD	S-t				
Add	Remove					
IP :	192 .	168	20	1	8	141
Port :	4840					
Server Name :	LDS-test					
Comment :						
						00.000 <b></b> 000
		1.1 1.27.1		rad disca		veris

When configured, OPC UA server will register to the Local Discovery Server (LDS).

OPC UA Discovery service is used to simplify server location maintenance when there are many OPC UA servers in the network. An OPC UA client can access one LDS Server and obtain all registered OPC UA server.

Setting	Description
IP	IP address of the OPC UA client.
Port	Port number used by the OPC UA client.
Server Name	Server name of the OPC UA client.
<b>Comment</b> A memo on the server and will not influence	
	communication.

#### Example 1

The following is an example showing how to set up Discovery service.

 Install Local Discover Server (LDS) on a PC (for example, the PC name is DESKTOP-ABCD). Download the LDS provided by OPC Foundation from the link below: <u>https://opcfoundation.org/developer-tools/developer-kits-unified-architecture/local-discovery-server-lds/</u>



- If the DNS service of router cannot resolve the HMI name to IP address, the HMI name should be changed to the IP address of the HMI. For example: If HMI IP address is 192.168.1.100, then the HMI name should be 192.168.1.100 or 0.0.0.0.
- 3. On the PC with OPC UA LDS installed, please manually copy the certificate from folder "C:\ProgramData\OPC Foundation\UA\pki\rejected\certs" (Folder for rejected certificates) to folder "C:\ProgramData\OPC Foundation\UA\pki\trusted\certs" (Folder for trusted certificates).
- 4. Launch the software of OPC UA Client, enter the name of the PC with OPC UA LDS installed or its IP address to obtain all the registered OPC UA servers.

When Discovery does not work properly, please:

 Open Windows Task Manager » Performance » Resource Monitor » Network » Listening Ports, and find the port number used by opcualds.exe. As shown in the following screenshot, in this example the PC's opcualds.exe uses port 4840.

(Note: Note:						
File Monitor Help						
Overview CPU M	emory Disk	Network				
Processes with Netw	ork Activity					۲
Network Activity	Network Activity 14 Kbps Network I/O 0% Network Utilization					
TCP Connections						•
Listening Ports						
Image	PID	Address	Port	Protocol	Firewall Status	^
opcualds.exe	1976	IPv4 unspecified	4840	TCP	Allowed, not r	
		Con-sector Con	10.0		10000	Ε
		and the second se				
CONTRACTOR OF STREET, STRE		the property of				
and the second second	and a second	and the state of the last			the second second	
						-

 Enter HMI's IP address in the web browser, and enter the password to log in. Open OPC UA settings page and restart OPC UA Server. Please note that OPCUA settings tab is only supported on cMT Gateway Series models.





#### Tag





New	Tag
-----	-----

Name	tag 1		
ype	🖱 String	🔘 Number	Boolean
Address			
Device :	Local HMI		
Address :	LB	▼ 0	
Readable		Writabl	e
🗸 Enable		Sampling in	nterval : 0.5 🔹 s

Add a new tag for the client to monitor or control. The name must be specified, and the address can be Readable or Writeable.

#### History(HDA)

Enable OPC UA HDA.

Apply Structure	Apply Structure         Device : Siemens S7-1200/S7-1500         Structure : PLC.Blocks.HML_Alarm         OK Cancel         Structured node set under a device can be added, only if the device is a symbolic PLC and has structured data type defined.         After clicking OK in the Apply Structure window, a prompt window shows asking whether to create nodes that do not exist in the OPC UA node tree.
	EasyBuilder Pro  Do you want to create nodes defined in the structure, if they haven't existed in the OPC UA node tree?  OK Cancel
Settings	Set an existing group or tag.
Delete	Delete an existing group or tag.
Import	Import a tag file. Applicable import formats include: *.xlsx, *. xls, *.csv, *. xml
Export	Export current tags. Applicable export formats



#### include: Excel format or XML format.

#### Tag – Information Modeling Mode

	V Information modeling mode
Server	
Settings	
Тад	
Dbjects	New Group
E Local HMI	New Tag
Taga	New Object
	Andu Chushum
	Apply Structure
	Settings
	Delete
	Namespace
	Import
	Event
	Laport
Nodes : 1/ 15000, HDA Add	iress : 0 / 50
	Exit
ting	Description
tting w Group	Description
tting w Group	Description
tting w Group	Description          New Group         Name :         group 1
tting w Group	Description          New Group         Name : group 1         Node ID :          String
tting w Group	Description
ting w Group	Description
ting w Group	Description
ting w Group	Description New Group         Name: group 1         Node ID: String         Numeric: 1         Image: Cancel    Add a new group for managing tags. A Node ID car
ting w Group	Description         New Group         Name: group 1         Node ID: String         Numeric         Image: Cancel         Add a new group for managing tags. A Node ID car         ba defined



New Tag

New Tag				×
Name	tag 1			
.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	String		Number	Boolean
Address				
Device :	Local HMI			
Address :	LB		▼ 0	
Туре				
🔽 Readable			🔲 Writable	•
History (HDA)				
Enable				
Node ID				
String				
<ul> <li>Numeric</li> </ul>		1		
				OK Cancel

Add a new tag for the client to monitor or control. Two types of tags can be added: Data Variable and Property.

Data Variable: The data collected by the device. New tags, either data variable or property, can be added under a data variable.

Property: The parameters of the device. No new tags can be added under a property.

The name must be specified, the address can be Readable or Writeable, and a Node ID can be defined.

#### History(HDA)

Enable OPC UA HDA.





#### **New Object**



Add an object in the Object Types list. The name must be specified.

#### **Apply Structure** Apply Structure X Device : Siemens S7-1200/S7-1500 -Structure : PLC.Blocks.HMI\_Alarm • OK Cancel Structured node set under a device can be added, only if the device is a symbolic PLC and has structured data type defined. After clicking OK in the Apply Structure window, a prompt window shows asking whether to create nodes that do not exist in the OPC UA node tree. 23 EasyBuilder Pro Do you want to create nodes defined in the structure, if they haven't existed in the OPC UA node tree? OK Cancel Settings Set an existing group or tag. Delete Delete an existing group or tag.





Namespace	Namespace
	0 http://opcfoundation.org/UA/
	1 urn:Janecheng-PC:Weintek:UaServer
	2 weintek_statistics
	3 weintek
	Add Delete Close
	Object types of a device can be added to or deleted
	from this list.
Import	Import a tag file. Applicable import formats include
-	*.xlsx, *. xls, *.csv, *. xml
Export	Export current tags. Applicable export formats
	include: Excel format or XML format

### Note

- When downloading the project file to HMI, please make sure that the HMI time and timezone settings are correct. Otherwise, the client program may not be able to authenticate, and the communication may fail due to authentication error caused by incorrect certificate valid time.
- Changing from Information Modeling Mode back to general mode is possible but please note that the node definition will be lost by doing so.

Click the icon to watch the demonstration film. Please confirm your internet connection before playing the film.

#### 42.2.3. Device Statistics

Device-specific statistical data can be found in "Statistics" node, as shown below:



🛅 Root
🗸 🚞 Objects
🗸 🚞 Local HMI
<ul> <li>Contraction</li> <li>Contract</li></ul>
FailedReads
FailedWrites
MaxPendingReads
MaxPendingWrites
PendingReads
PendingWrites
> 🔘 Reset
SuccessfulReads
SuccessfulWrites

#### Meaning of each node:

U	
Node Name	Description
FailedReads	No. of failed read commands. If it is not zero, there may
	be communication errors.
FailedWrites	No. of failed write commands. If it is not zero, there may
	be communication errors.
MaxPendingReads	Max. no. of pending read commands.
MaxPendingWrties	Max. no. of pending write commands.
PendingReads	No. of pending read commands in the queue. If the
	number stays high for a long time, it means the
	communication module is not able to process all
	commands in time. OPC UA nodes may update slower.
	Under extreme circumstances (e.g. >30), OPC UA node
	may not update in a long time.
PendingWrites	No. of pending write commands. Write commands have
	higher priority than read commands. If PendingWrites
	stays high, it will affect read commands.
Reset	Reset all statistical data.
SuccsessfulReads	No. of successful read commands.
SuccsessfulWrites	No. of successful write commands.

#### 42.2.4. Limitation

The limitation of OPC UA server are listed below:

Item	Description
OPC UA Profile	UA 1.02 Standard UA Server Profile, including but not
	limited to
	* Core Server Facet



	* UA-TCP UA-SC UA-Binary	
	* SecurityPolicy – None	
	* Enhanced DataChange Subscription Server Facet	
	* Standard DataChange Subscription Server Facet	
	* Embedded DataChange Subscription Server Facet	
	* User Token – X509 Certificate Server Facet	
	* User Token – User Name Password Server Facet	
	* Standard DataChange Subscription Server Facet	
	* Embedded DataChange Subscription Server Facet	
	See Profile Reporting Visualization Tool by OPC	
	Foundation for more details.	
Security policies	None	
	Basic128Rsa15	
	Basic256	
	Basic256Sha256	
Number of nodes	15 000	
Max. array size	255	
Read cache	100ms	
	(Cache will be used for 100ms from previous read)	
Max. client sessions	100	
Max. subscription per	64	
session		
Min. publishing interval	100ms	
OPC UA HDA	Supports up to 50 node addresses with each node	
	address can storing up to 10000 HDA data records.	
	What constitutes a node address?	
	Each HDA-enabled node is considered to take up the	
	number of node addresses that is equal to the Element	
	Count setting. If the data type is String, it is the No. of	
	word setting instead.	
	When the remaining space in HMI memory is less than	
	10%, the system will delete the earliest data and store	
	the latest data. The system will stop deleting data when	
	the remaining space increases exceeding 10%.	
Performance (Values may change for different hardware/EBPro version)		
Max. Read/Subscribe	Built-in registers (e.g. LW): 27000 words/second (WPS)	



Throughput	MODBUS RTU@9600bps: 500 WPS
(Security: None)	MODBUS RTU@115200bps: 4000 WPS
	MODBUS TCP/IP: 10000 WPS
	Tested Environment
	EBPro version: V6.02.02.242
	cMT-G02 OS version: 20180917
	Test uses as many as words as possible in one node
	(using array) to optimize reading.

### Note

- Examples showing how to count OPC UA HDA node addresses: If there are 50 nodes (node1, node2...node50) and each node maps to one bit only(Element Count is 1), all the nodes altogether takes up 50 node addresses.
  - If a node maps to a 16-bit unsigned array of size 50 (which is when Element Count is 50), every element in the array takes up a node address, so the number of node addresses taken by this node is 50.
  - If a node maps to a string where No. of word is set to 50, the number of node addresses taken by this node is 50.



