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cMT-G01 with OPC UA Server and Modbus Gateway

Introduction:

Industrial IT Technology has quickly advanced with the integration of plantfloor data, supervisory control demand, ERP, and even new cloud-based applications. Integrating legacy and different brands of factory machines has never been an easy task since the controllers in a factory use different communication protocols. To facilitate integration of numerous proprietary protocols, Weintek has developed the first Gateway protocol converter: cMT-G01. The cMT-G01 gateway provides the necessary IIoT connectivity to retrofit existing machines into a single protocol.

This document discusses how to utilize the cMT-G01 to build an OPC UA server, which is a standard protocol for IIoT systems, and allows OPC UA client to access data.

Benefits of cMT-G01

- Supports OPC UA for Integration of SCADA or ERP systems
- Supports MQTT and has built-in broker for publish-subscribe messaging protocol
- Connectivity to AWS, Azure, and IBM IoT platforms via MQTT
- Supports MQTT Sparkplug B specification
- Supports Modbus gateway
- Supports Protocol conversion
- Additional Data logger and event detector
- SQL synchronization capability to MySQL and MS SQL database server for data log and event log
- EasyAccess2.0(Optional) Remote access factory equipment

Equipment & software:

- 1. HMI
- 2. Arduino board
- 3. iR-ETN remote IO
- 4. cMT-G01

Note: In this demonstration, Easybuilder pro version 6.01.02 is used.

Wiring diagram:

Before configuration-

The HMI communicates with the Arduino board via Modbus RTU protocol. The HMI communicates with the iR-ETN remote IO via Modbus TCP protocol.



After configuration-

In this way, the HMI program is changed because the HMI uses Modbus TCP Master protocol to query the cMT-G01. The cMT-G01 acts as a ModbusTCP-to-ModbusRTU bridge, which is a Modbus gateway. It saves the cost of purchasing an extra communication module of the PLC.



Hardware configuration:

I/O ports of cMT-G01 -

1		
	Port Name	Connecting to
	LAN2	Machine network
Ā	LAN1	Company or factory network
ii≌ Ø	COM	Serial-based controller

Software configuration:

Launch Easybuilder Pro and select cMT-G01 Gateway.

New Open	New Project Model : MT8102iE (1024 x 600) MT8103iE (1024 x 600) MT8090XE/MT8091XE (1024 x 768) MT8090XE/MT8091XE (1024 x 768) MT8090XE/MT8150XE (1024 x 768) MT8121XE/MT8150XE (1024 x 768) MT8121XE/MT8150XE (1024 x 768) MT8121XE/MT8150XE (1024 x 768) MT8121XE/MT8150XE (1024 x 768) MTS102 (1024 x 600) cMT3103 (1024 x 600) cMT3103 (1024 x 768) cMT-SVR (1024 x 748) cMT-FVR (1024 x 768) cMT-FOUG (ateway cMT-G04 Gateway (Built-in Wifi) cMT-G04 Gateway (Ethernet Bridge) mTV-100 (1280 x 720) V Use template (template_G01.cmtp)	cMT-G01 Gateway

The popup window will be displayed as shown. Click [New Device] to select drivers of the controllers.

System P	aramete	r Settings											×
Device	Model	General	System Se	tting	Remote	Sec	urity	Tim	e Sync./DST	e-Mail			
Device	e list:											What's m	y IP?
		Name	Location	Devi	се Туре		Interf	ace	I/F Protocol	Station	No.		
Lo	cal HMI	Local HMI	Local	cMT	-G01 Gate	way	-		-	0			
	New H	IMI		New	Device				Delete			Settings	

Add this driver "Modbus TCP/IP" into [Device list]. Enter the IP address of the iR-ETN.

Thume T	R-EIN remoteIO
	Oevice
Location :	Local \checkmark Settings
⁵ Select Local for a HMI.	device connected to this HMI, or Remote for a device connected through anothe
Device type :	MODBUS TCP/IP
	Device ID : 58, V.2.30, MODBUS_TCPIP.e30
I/F:	Ethernet V Open Device Connection Guide
Support off-line si	mulation on HMI (use LB-12358)

Add this driver "Modbus RTU, RTU over TCP" into [Device list]. Enter the communication parameters of COM port.

Device Settings		×
Name :	Arduino board	
	Device	
Location :	Local V Settings	
* Select Local for a HMI.	device connected to this \ensuremath{HMI} , or Remote for a device connected through another	
Device type :	MODBUS RTU, RTU over TCP	
	Device ID : 4, V.3.40, MODBUS_RTU.e30	
I/F :	RS-232 V Open Device Connection Guide	
* Support off-line sir	nulation on HMI (use LB-12358)	
* Support communic	ations between HMI and device in pass-through mode	
* Set LW-9903 to 2	to enhance the speed of download/upload device program in pass-through mode	
COM :	COM1 (9600,N,8,1) Settings	

[Device List] includes two drivers to communicate with the iR-ETN and the Arduino board. Double [Local HMI] to change the name of the cMT-G01.

mic	0.14	1-1	C	1 4			Deserte	C	Time Co	- (DCT	- NA-11			
evic	Noc	iei	Genera	ai :	system s	etting	Remote	Security	Time syr	nc./DST	e-iviali			
Devi	ice list:												<u>What's r</u>	my
				Nar	ne		Location	Device Ty	pe		Interfa	ce		
~	Local H	ML		cM	[-G01		Local	cMT-G01	Gateway		-			
	Loca	al De	vice 4	iR-E	TN rem	otelO	Local	MODBUS	TCP/IP		Ethern	et (IP=192	.168.1.212, 1	Por
	Loca	al De	vice 1	Ard	uino bo	ard	Local	MODBUS	RTU, RTU	over TCF	COM 1	(9600.N.8	8.1)	

Click [OK] to close [System Parameter Settings].

You can see the three main steps on the main screen to complete this project.

- Step 1. Add a driver into Device List in the project. (This step is completed)
- *Step 2.* Enable OPC UA Server and designate PLC addresses.
- *Step 3.* Download this project to cMT-G01.



Step2. -

Click [OPC UA] button on the main screen or go to [IIoT/Energy] » [OPC UA Server] on the toolbar, and check [Enable] checkbox to enable OPC UA server.

OPC UA Server	
Server Settings	
Tag - Tags - R-ETN remoteIO - R-duino board - Tags - Tag	New group New Tag Delete Settings Import Export

Click [Tags] within [IR-ETN remoteIO](Controller name) and then click [New Tag] to add OPC UA tags.

For example, add a tag for the output of the iR-ETN.

[Name]: Enter a tag name.
[Type]: Data type is **Bit**.
[Address]: Enter **Modbus function code + register number (Decimal).**[Type]: data is readable and writable.
Click [OK] to exit.

:	Settings	
,		
	dMT-G01	New group.
þ	iR-ETN remoteIO	New Tag
	Tags	Delete
	Settings X	Settings
	Name : Actuator	Import
	Туре	Export
	●Bit ○ Word	
	Address	
	Device : IR-ETN remoteIO V Settings	
	Address: 0x v 1	

Click [Tags] within [Arduino board](Controller name) and then click [New Tag] to add OPC UA tags.

For example, add a tag for the analog input of the Arduino board.

Settings Tag	⊡ Enable Server	
Tag Import R.E.TI remoteIO Actuator Sensor Import Export Settings X Name : UNIDITY (%) Type Device : Arduino board Address: Device : Address : Via an scale/convert data with conversion tag in Tag Library. Type You can scale/convert data with conversion tag in Tag Library. Exit	Settings	
eMT-601 New group R.E.TN remoteIO New Tag CAtuator Sensor Sensor Settings Import Export Export Export Vevice : Arduino board Address: 0 Word Address : 4x Device : 4xduino board You can scale/convert data with conversion tag in Tag Library. Exit Type Writable	Tag	
Important Delete Sensor Settings Import Export Export Export Values Import Export Export Exit Word Address: 4x Import Exit Type Readable Writable Mittable	em- cMT-G01	New group
Re-ENTENDED Actuator Setsor Actuator Setsor Import Export Exit Word Address: 4x Import Exit Word Address: 4x Import Exit Word Address: 4x Import Exit Writable OK		New Tag
Actuator Sensor Arduino board Tags ED_TUNER Settings X Name : UMIDITY (%) Type Bit • Word Address Device : Arduino board Address: 4x 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library. Type Readable Writable		211
Sensor Arduino board Import Settings X Name : UMIDITY (%) Type Bit Wood Address Device : Arduino board Address : 4x 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library. Type Readable Writable	Actuator	Delete
Arduino board Tags LED_TUNER Settings X Name : LMIDITY (%) Type Bit Word Address Device : Arduino board Address : 4x 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library. Type Readable Writable OK Cancel	Sensor	Settings
ED_TUNER Export Settings X Name : IMIDITY (%) Type Bit Device : Arduino board Address: Device : Address : 4x 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library. Exit Type Readable Writable OK	Arduino board	Import
Settings X Name : IMIDITY (%) Type Bit Word Address Device : Arduino board Address : 4x 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library. Exit Type Readable Writable		Export
Name : *UMIDITY (%) Type Bit Bit Word Address Device : Device : Arduino board Address : 4x Vu can scale/convert data with conversion tag in Tag Library. Type Exit Type Readable Writable OK	Settings	
Name : UMIDITY (%) Type Bit Word Address Device : Arduino board Settings Address : 4x 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library. Exit Type Readable Writable		
Type Bit • Word Address Device : Arduino board Device : Arduino board Settings Address : 4x 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library. Type Readable Writable	Name : HUMIDITY (%)	
OBit ● Word Address Device : Arduino board Address : 4x Address : 4x You can scale/convert data with conversion tag in Tag Library. Type Readable Writable	Туре	
Address Device : Arduino board Settings Address : 4x 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library. Type Readable Writable OK Cancel	OBit Word	
Device : Arduino board Settings Address : 4x 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library. Exit Type Readable Writable	Address	
Address : 4x 1 32-bit Float (1) * You can scale/convert data with conversion tag in Tag Library. Type Readable Writable OK Cancel	Device : Arduino board V Settings	
You can scale/convert data with conversion tag in Tag Library. Type Readable Writable OK Cancel	Address: 4x v 1 32-bit Float (1)	
Type Exit	* You can scale/convert data with conversion tag in Tag Library.	
Type Readable Writable		Exit
	Type	
OK Cancel	✓] Readable ↓ Writable	
	OK Cancel	

The window as shown includes all tags created in the OPC UA server.

OPC UA Server	
Settings	
	Now group
	New Tag
	Delete
	Settings
	Import
	Export
IIGHT_INTENSITY (Lux) IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	

Modbus gateway configuration -

Click [Settings] button on the main screen or go to [Home] » [System Parameters] on the toolbar, add this driver "Modbus Server" into [Device list]. Check the checkbox within [Modbus TCP/IP Gateway] and go to [Address Mapping Tables].

Device	
Location: Local V Settings	
Local for a device connected to this HMI, or Remote for a device connected through and	the
vice type : MODBUS Server +	
Device ID : 54, V.1.00, MODBUS_SERVER.e30	
I/F: Ethernet V Open Device Connection Guide	
IP : Port = 502 Settings	
Use UDP (User Datagram Protocol)	
Station no. : 1	
Use broadcast command	
How to designate the station no. in object's address?	
TCP/IP Gateway	
Enable Address Mapping Tables	
Enable Address Mapping Tables	

The window "Address Mapping table" will be displayed as shown below. Click [Add] to open table settings for register mapping.

[Address mode]: Data type is **Word**.

[Type]: Select **Read/Write**.

[Modbus address]: Enter Modbus TCP function code + register number (Decimal).

[Mapped device address]: Enter Modbus RTU function code + register number (Decimal).

[Table size]: Total memory size. (Unit: words)

Address Mapping Ta	ble					
Table Description	MODBUS Address	Device Name	Mapped device Address	Table Size	Read/Write	Security
1 TCP TO RTU	4x-1 <	==> Arduino boa	rd 4x-1	10 Word(s)	Read/Write	N/A
		Table Settings				
		Description Address mode	Bit () Word		
		Type Read/	Nrite O Read or	ly	O Write only	
		MODBUS address Device : MO Address : 4x	DBUS Gateway		~	
* Cross-table reading/w	riting not support, i.e. a	Mapped device a	ldress		~ ~	ettings
* LW-9288 indicates the 0 : normal	last communication erro	Address : 4x	~ 1	,		(ctaligon)
1 : read/write undefin 2 : out of read/write r 3 : bad command form	ed registers 5 ange 6 iat 7	Security	tion function			
Add Del	ete Settings]				Cancel
		Table size	10 Wo	ord(s)	ABCD -> CDAB	

The Modbus gateway is added to [Device list] as shown.

yster	n Pa	arameter	Setting	s					:
Devi	се	Model	Gener	al System Setting	Remote	Security	Time Sync./DST	e-Mail	
Dev	vice	list:							What's my IP?
				Name	Location	Device T	уре	Inter	face
~	Loc	cal HMI		cMT-G01	Local	cMT-G01	l Gateway	-	
		Local D	evice 4	iR-ETN remotelO	Local	MODBUS	S TCP/IP	Ethe	rnet (IP=192.168.1.212, Port
		Local D	evice 1	Arduino board	Local	MODBUS	S RTU, RTU over T	CP CON	1 1 (9600,N,8,1)
		Local Se	erver	MODBUS Gateway	Local	MODBUS	S Server	Ether	rnet(IP=Local,Port=502)

Change the HMI program to read and write Modbus TCP registers. The following Modbus function codes are supported.

Modbus Function Code	Definition
1	Read Coil Status
2	Read Input Status
3	Read Holding Registers
4	Read Input Registers
5	Force Single Coil
6	Preset Single Register
16	Preset Multiple Registers

Step3. -

Connect the **LAN1** port of the cMT-G01 and the PC to a router with an Ethernet cable. Click [Download] button on the main screen or go to [Project] » [Download] on the toolbar.

Find the cMT-G01 and click [Download].

Download (PC->HMI)	×
● Ethernet	Password/Port no. of download/upload : Settings
4 IP HMI Name	4
HMI : cMT-G01 Sear Search and Chang	✓ 192.168.0.133 (cMT-G01) tch h All ge IP
Runtime * Necessary if update runtime or	What's my IP? execute download first time.
Reset recipe (RW, RW_A)	Reset event log Reset data sampling
Automatically using current settings to down	nload after compiling
Download Stop	Evit

You can change the **LAN1** IP address of the cMT-G01 by going to [Search and Change IP]. Disable DHCP and then enter IP address as well as subnet mask according to the company/ factory network. Click on [Apply] to finish. The popup window will show "Successfully updated Ethernet settings."

Search and Change IP	>
HMI Name ~ IP HMI Model Mas cMT-G01 192.168.0.133 cMT-G01 Ga 00:0	DHCP : On Off
	IP: 192 . 168 . 0 . 133
	Subnet mask : 255 . 255 . 255 . 0
	Password :
	Blink LED Apply
Refresh	Exit

Change the IP address of the LAN2

Connect the **LAN1** port of the cMT-G01 and the PC to a router with an Ethernet cable. Open a web browser (IE, Chrome, or Firefox) on a PC, and make sure the IP address of the PC has a same subnet IP. Enter the IP address of cMT-G01. For example, 192.168.0.133.

Select an identity and enter its password. The default password is 111111.



Go to [Network] tab. The IP address of the Ethernet1 is the IP address of LAN1 port, and it is changed by the earlier step.

Image: 1 million of the second sec	dentity: system Setting			
P Network	Network			
Date/Time	Ethornot			
🖉 HMI Name		C Estar +2 (I ANI)		
History	MAC address : 00:0c:26:0b:8f:78	MAC address : 00:0c:26:0b:89:9c		
🔝 Email				
🖹 Project Management	IP AddressEthernet			
System Password	Obtain IP address automatically	 Use static IP address below(Eth1) 		
Enhanced Security				
EasyAccess 2.0	IP: 192 · 168 · 0 ·	133		
	Mask: 255 · 255 · 255 ·	0		
	Gateway: 192 · 168 · 0 ·	1		
	DNS: 192 · 168 · 0 ·	1		
Current OS version:	Save			

Click [Ethernet2] and then enter the IP address as well as mask for the communication of the machine network.

🦲 🛓 🖏	entity: stem Setting							
P Network	Netwo	rk						
Date/Time	Ethernet							
🖉 HMI Name	C Ethern	et1 (WAN/LAN)	Ethernet2 (I AN)					
History	MAC address : 00:0c:26:0b:8f:78 MAC address : 00:0c:26							
🔝 Email								
🖹 Project Management	IP AddressEthernet							
System Password	Obtain	IP address automatically	Use static IP address below(Eth2)					
Security								
EasyAccess 2.0	IP:	192 · 168 · 1 · 133	1					
	Mask:	255 · 255 · 255 · 0						
	Sav	e						

Testing:

Launch the OPC UA client software UAExpert on a PC to monitor OPC UA tags data.

Munified Automation UaExpert - The OPC Unified Architecture Client - cMT_G01_OPCUA								
File View Server Document Settings Help								
🗋 🥔 🕞 🚺 🗣 🖛 🛇 🗙 🔦 💄 🖹 🕷 🥯								
Project	₽×	E	lata Access View					
 ✓ Ø Project ✓ Ø Servers 		#	Server UaServer	Node Id NS2 String Arduino board ,Tags,HUMIDITY (%)	Display Name HUMIDITY (%)	Value	Datatype Float	
 UaServer@cMT-8F78 - Basic128Rsa15 - Sign (uatcp-uasc-uabinary) Documents 		3	UaServer UaServer	NS2[String]Arduino board .Tags.LED TUNER.P NS2[String]Arduino board .Tags.LED TUNER.P NS2[String]Arduino board .Tags.LED TUNER.S.	PV (Lux)	25	Ulnt16 Ulnt16	
Data Access View		5	UaServer UaServer	NS2 String iR-ETN remotelO.Tags.Actuator NS2 String iR-ETN remotelO.Tags.Sensor	Actuator Sensor	true false	Boolean Boolean	
Address Space	₽×							
😏 No Highlight	•							
🛩 🛅 Tags	^							
> IED TUNER								
> IIGHT_INTENSITY (Lux)								
> TEMPERAUTRE (°C)								
> 💑 Server								
✓								
> Canal Statistics								
V 🛄 lags								
> Sensor								

You can drag and drop tags configured in the OPC UA server to [Data Access View].



The data will be displayed as shown.

#	Server	Node Id	Display Name	Value	Datatype
1	UaServer	NS2 String Arduino board .Tags.HUMIDITY (%)	HUMIDITY (%)	63	Float
2	UaServer	NS2 String Arduino board .Tags.LIGHT INTENS	LIGHT INTENSITY (Lux)	111	UInt16
3	UaServer	NS2 String Arduino board .Tags.LED TUNER .P	PV (Lux)	25	UInt16
4	UaServer	NS2 String Arduino board .Tags.LED TUNER .S	SV (Lux)	25	UInt16
5	UaServer	NS2 String iR-ETN remotelO.Tags.Actuator	Actuator	true	Boolean
6	UaServer	NS2 String iR-ETN remotelO.Tags.Sensor	Sensor	false	Boolean

Reference Link:

Weintek Labs website: http://www.weintek.com



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