

Project Documentation

File: TvillingRobotProgram.ecp

Date: 5/29/2023

Profile: e!COCKPIT

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1 Device: Controller

Users and Groups

Users:

Groups

Access Rights

View

Modify

Execute

Add/remove children

Symbol Rights

Parameters

Parameters:

Name:	Type:	Value:	Default Value:	Unit:	Description:
Processor Load Lower Limit	DWORD	80	80		
Processor Load Upper Limit	DWORD	90	90		
Processor Load Processor Share	DWORD	90	90		
Processor Load Should Throw ProcessorLoadWatchdog_Exception	bool	FALSE	FALSE		

Information

Name: 750-8214 PFC200 G2 2ETH RS CAN
Vendor: WAGO
Categories: PLCs
Type: 4096
ID: 1006 120a
Version: 5.17.3.10
Order number: 0750-8214
Description: Programmable Ethernet fieldbus coupler

1.1 PLC Logic: Plc Logic

1.1.1 Application: Application

1.1.1.1 Folder: FunctionBlocks

1.1.1.1.1 POU: Modbus_To_MQTT

```
1      FUNCTION_BLOCK Modbus_To_MQTT
2      VAR_INPUT
3          Modbus      : WORD ;
4          MaxInn      : REAL ;
5          MinInn      : REAL ;
6          MaxOut      : REAL ;
7          MinOut      : REAL ;
8      END_VAR
9      VAR_OUTPUT
10         MQTT      : STRING ;
11         UR10      : INT ;
12     END_VAR
13     VAR
14         MQTT_L      : REAL ;
15         Modbus_L      : REAL ;
16         UR10_L      : REAL ;
17     END_VAR
18
```

```
1      Modbus_L      := WORD_TO_REAL ( Modbus ) ;
2
3      MQTT_L      := ( Modbus_L * ( ( MaxOut - MinOut ) / ( MaxInn - MinInn ) ) ) ;
4      UR10_L      := ( Modbus_L * ( ( MaxOut - MinOut ) / ( MaxInn - MinInn ) ) ) ;
5
6
7      MQTT      := REAL_TO_STRING ( MQTT_L - 360 ) ;
8      UR10      := REAL_TO_INT ( UR10_L - 360 ) ;
9
```

1.1.1.1.2 POU: MQTT_Pub

```
1  FUNCTION_BLOCK MQTT_Pub
2  VAR_INPUT
3      Messege : STRING ;
4      Topic   : STRING ( 255 ) ;
5      xTrigger : BOOL ;
6  END_VAR
7  VAR_OUTPUT
8  END_VAR
9  VAR
10     sPub : STRING := 'TESTSjur' ;
11     FB_Pub : WagoAppCloud . FbPublishMQTT ;
12     aData : ARRAY [ 0 .. 100 ] OF BYTE ;
13     xError_Pub : BOOL ;
14 END_VAR
15
16 wagoSysPlainMem . MemCopy ( pDest := ADR ( aData ) , pSource := ADR ( Messege ) ,
17                             udiSize := LEN ( Messege ) ) ;
18
19
20
21
22 FB_Pub (
23     sTopic := Topic ,
24     eQualityOfService := ,
25     xRetain := ,
26     dwSize := LEN ( Messege ) ,
27     aData := aData ,
28     xTrigger := xTrigger ,
29     xBusy => ,
30     xError => xError_Pub ,
31     oStatus => ) ;
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```

1.1.1.1.3 POU: MQTT_Sub

```
1  FUNCTION_BLOCK MQTT_Sub
2  VAR_INPUT
3      Topic : STRING ( 255 ) ;
4  END_VAR
5  VAR_OUTPUT
6      Messege : INT ;
7  END_VAR
8  VAR
9      FB_Sub : WagoAppCloud . FbSubscribeMQTT ;
10     xSubscribe : BOOL := TRUE ;
11
12     aPayloadData : ARRAY [ 0 .. 100 ] OF BYTE ;
13     xError_Sub : BOOL ;
```

1.1.1.1.3 POU: MQTT_Sub

```
14      xDataReceived : BOOL ;
15      dwReceivedBytes : DWORD ;
16      sSub : STRING ( 255 ) ;
17  END_VAR
18
```

```
1  FB_Sub (
2      xSubscribe := xSubscribe ,
3      sTopic := Topic ,
4      eQoS := ,
5      aPayloadData := aPayloadData ,
6      xBusy => ,
7      xError => xError_Sub ,
8      oStatus => ,
9      xDataReceived => xDataReceived ,
10     dwRxNBytes => dwReceivedBytes ,
11     xDataTruncated => ,
12     sReceivedTopic => ) ;
13     wagoSysPlainMem . MemCopySecure ( pDest := ADR ( sSub ) , udiDestSize := 255 ,
14     pSource := ADR ( aPayloadData ) , udiSourceSize := dwReceivedBytes , bPadding := 0 ) ;
15
16     Messege := STRING_TO_INT ( sSub ) ;
```

1.1.1.1.4 POU: MQTT_To_Modbus

```
1  FUNCTION_BLOCK MQTT_To_Modbus
2  VAR_INPUT
3      MQTT : INT ;
4      MaxInn : REAL ;
5      MinInn : REAL ;
6      MaxOut : REAL ;
7      MinOut : REAL ;
8      Offset : REAL ;
9  END_VAR
10 VAR_OUTPUT
11     RealTimeSim : STRING ;
12     Modbus : WORD ;
13 END_VAR
14 VAR
15     Sim_L : REAL ;
16     MQTT_L : REAL ;
17     Modbus_L : REAL ;
18 END_VAR
19
```

```
1  MQTT_L := INT_TO_REAL ( MQTT ) ;
2
3  Modbus_L := ( ( MQTT_L + offset ) * ( ( MaxOut - MinOut ) / ( ( MaxInn + offset ) - (
    MinInn + offset ) ) ) ) ;
```

```
4
5 RealTimeSim := REAL_TO_STRING ( MQTT_L );
6 Modbus      := REAL_TO_WORD ( Modbus_L );
7
```

1.1.1.2 Global Variable List: GVL

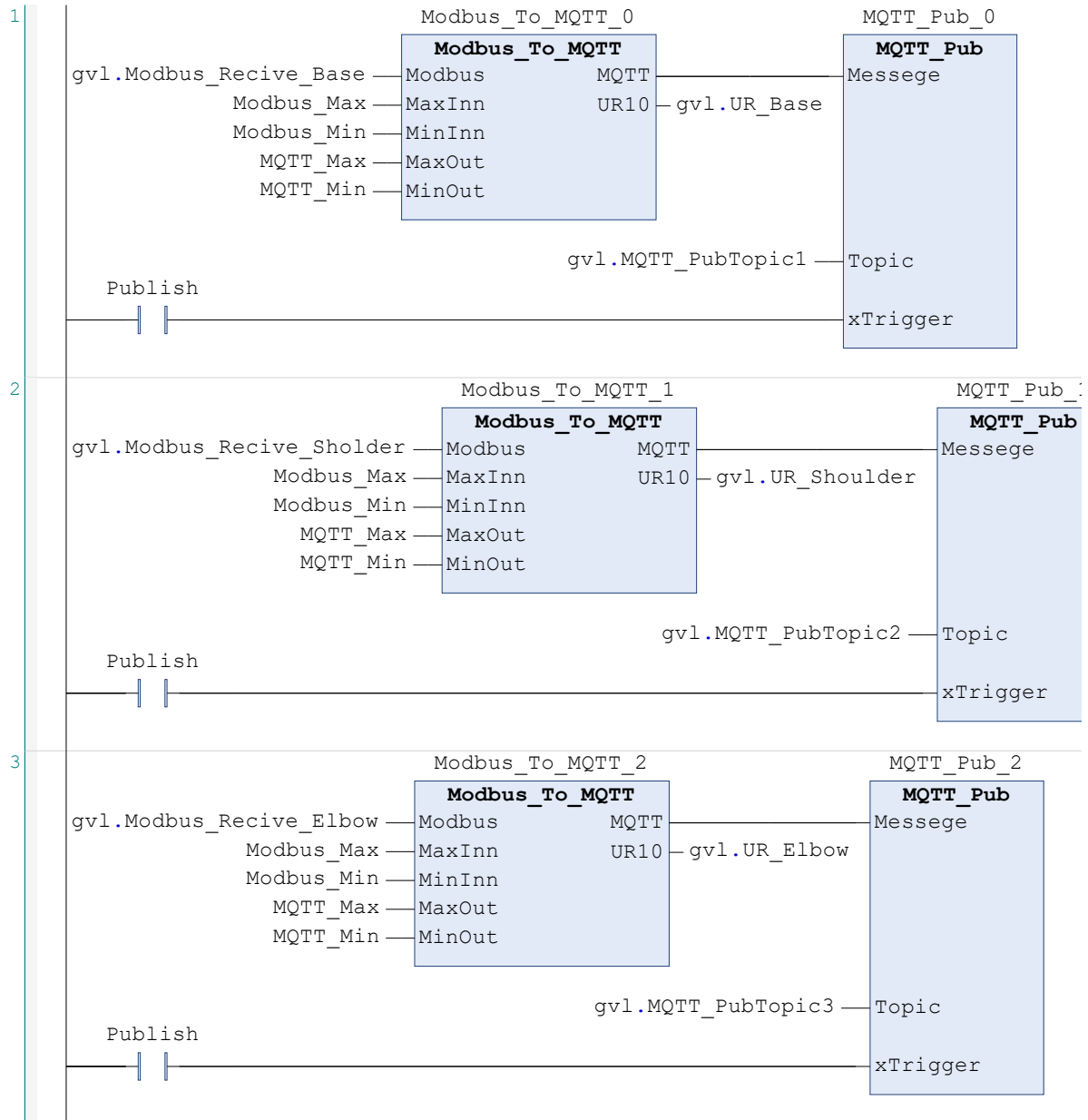
```
1 {attribute 'qualified_only'}
2 VAR_GLOBAL
3   Trigger : BOOL ;
4   // Variabler for å subscribe til MQTT
5   MQTT_SubTopic1 : STRING ( 255 ) := 'triplet/fromArduino/base' ;
6   MQTT_SubTopic2 : STRING ( 255 ) := 'triplet/fromArduino/shoulder' ;
7   MQTT_SubTopic3 : STRING ( 255 ) := 'triplet/fromArduino/elbow' ;
8   MQTT_SubTopic4 : STRING ( 255 ) := 'triplet/fromArduino/wrist1' ;
9   MQTT_SubTopic5 : STRING ( 255 ) := 'triplet/fromArduino/wrist2' ;
10  MQTT_SubTopic6 : STRING ( 255 ) := 'triplet/fromArduino/wrist3' ;
11
12  MQTT_V_Base : INT ;
13  MQTT_V_Shoulder : INT ;
14  MQTT_V_Elbow : INT ;
15  MQTT_V_Wrist1 : INT ;
16  MQTT_V_Wrist2 : INT ;
17  MQTT_V_Wrist3 : INT ;
18
19  // Variabler for å publisere til MQTT "Tvilling"
20  MQTT_Sim_Topic1 : STRING ( 255 ) := 'triplet/simulator/base' ;
21  MQTT_Sim_Topic2 : STRING ( 255 ) := 'triplet/simulator/shoulder' ;
22  MQTT_Sim_Topic3 : STRING ( 255 ) := 'triplet/simulator/elbow' ;
23  MQTT_Sim_Topic4 : STRING ( 255 ) := 'triplet/simulator/wrist1' ;
24  MQTT_Sim_Topic5 : STRING ( 255 ) := 'triplet/simulator/wrist2' ;
25  MQTT_Sim_Topic6 : STRING ( 255 ) := 'triplet/simulator/wrist3' ;
26
27  // Variabler for å publishe til MQTT
28  MQTT_PubTopic1 : STRING ( 255 ) := 'triplet/controller/base' ;
29  MQTT_PubTopic2 : STRING ( 255 ) := 'triplet/controller/shoulder' ;
30  MQTT_PubTopic3 : STRING ( 255 ) := 'triplet/controller/elbow' ;
31  MQTT_PubTopic4 : STRING ( 255 ) := 'triplet/controller/wrist1' ;
32  MQTT_PubTopic5 : STRING ( 255 ) := 'triplet/controller/wrist2' ;
33  MQTT_PubTopic6 : STRING ( 255 ) := 'triplet/controller/wrist3' ;
34
35  // Variabler til UR10 (Modbus)
36  Modbus_Send_Base : WORD ;
37  Modbus_Send_Shoulder : WORD ;
38  Modbus_Send_Elbow : WORD ;
39  Modbus_Send_Wrist1 : WORD ;
40  Modbus_Send_Wrist2 : WORD ;
41  Modbus_Send_Wrist3 : WORD ;
42
43  // Variabler fra UR10 (Modbus)
44  Modbus_Recive_Base : WORD ;
```

```
45      Modbus_Recive_Sholder : WORD ;
46      Modbus_Recive_Elbow  : WORD ;
47      Modbus_Recive_Wrist1 : WORD ;
48      Modbus_Recive_Wrist2 : WORD ;
49      Modbus_Recive_wrist3 : WORD ;
50
51      // UR10 Joints
52      UR_Base : INT ;
53      UR_Shoulder : INT ;
54      UR_Elbow : INT ;
55      UR_Wrist1 : INT ;
56      UR_Wrist2 : INT ;
57      UR_Wrist3 : INT ;
58  END_VAR
59
```

1.1.1.3 POU: Modbus_MQTT

```
1  PROGRAM Modbus_MQTT
2  VAR
3      Publish : BOOL ;
4      MQTT_Max : REAL := 720 ;
5      MQTT_Min : REAL := 0 ;
6      Modbus_Max : REAL := 12660 ;
7      Modbus_Min : REAL := 0 ;
8      UR_Max : REAL := 720 ;
9      UR_Min : REAL := 0 ;
10     MQTT_Pub_0 : MQTT_Pub ;
11     MQTT_Pub_1 : MQTT_Pub ;
12     MQTT_Pub_2 : MQTT_Pub ;
13     MQTT_Pub_3 : MQTT_Pub ;
14     MQTT_Pub_4 : MQTT_Pub ;
15     MQTT_Pub_5 : MQTT_Pub ;
16     Modbus_To_MQTT_0 : Modbus_To_MQTT ;
17     Modbus_To_MQTT_1 : Modbus_To_MQTT ;
18     Modbus_To_MQTT_2 : Modbus_To_MQTT ;
19     Modbus_To_MQTT_3 : Modbus_To_MQTT ;
20     Modbus_To_MQTT_4 : Modbus_To_MQTT ;
21     Modbus_To_MQTT_5 : Modbus_To_MQTT ;
22     BLINK_0 : BLINK ;
23 END_VAR
24
```

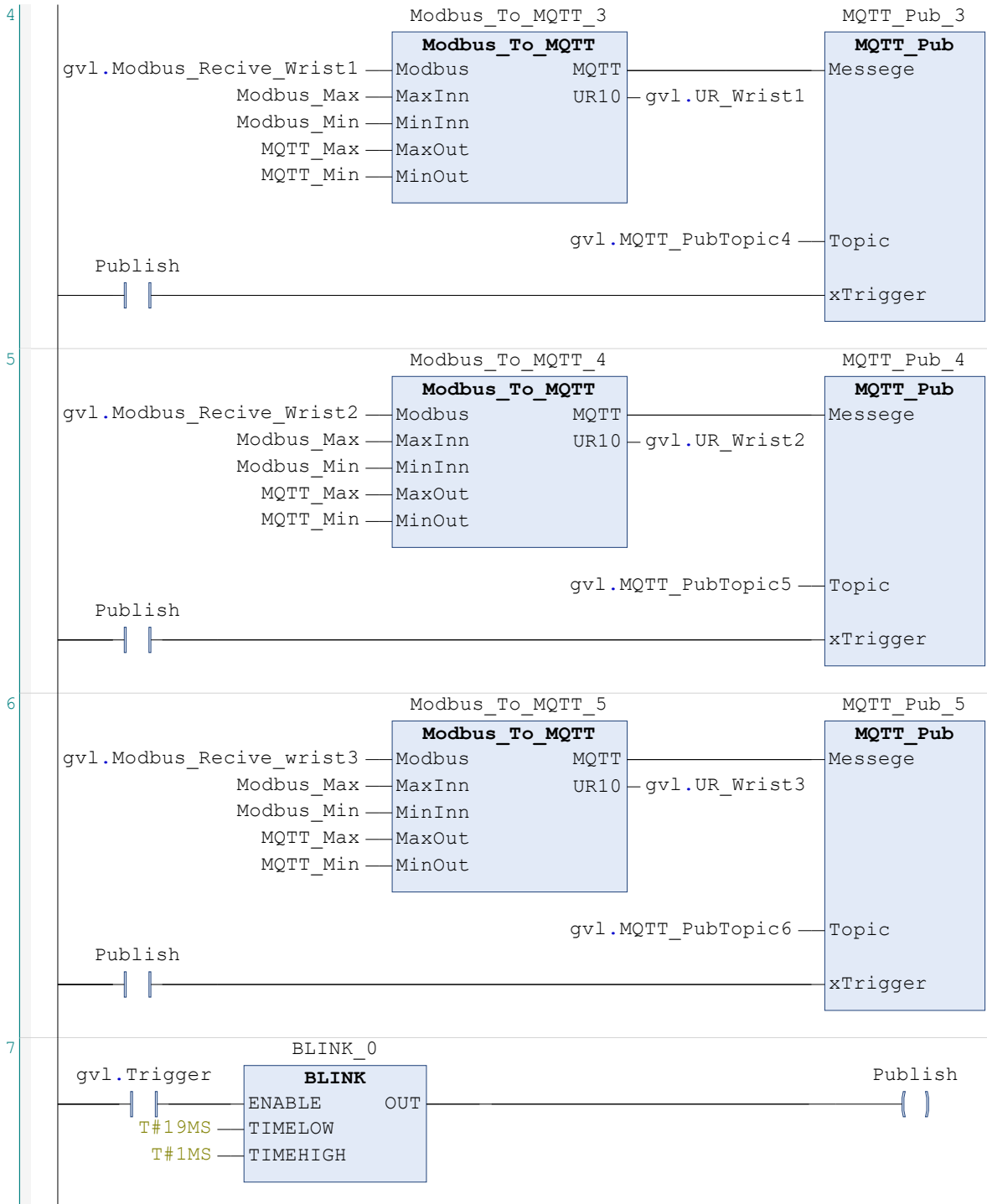
1.1.1.3 POU: Modbus_MQTT



1



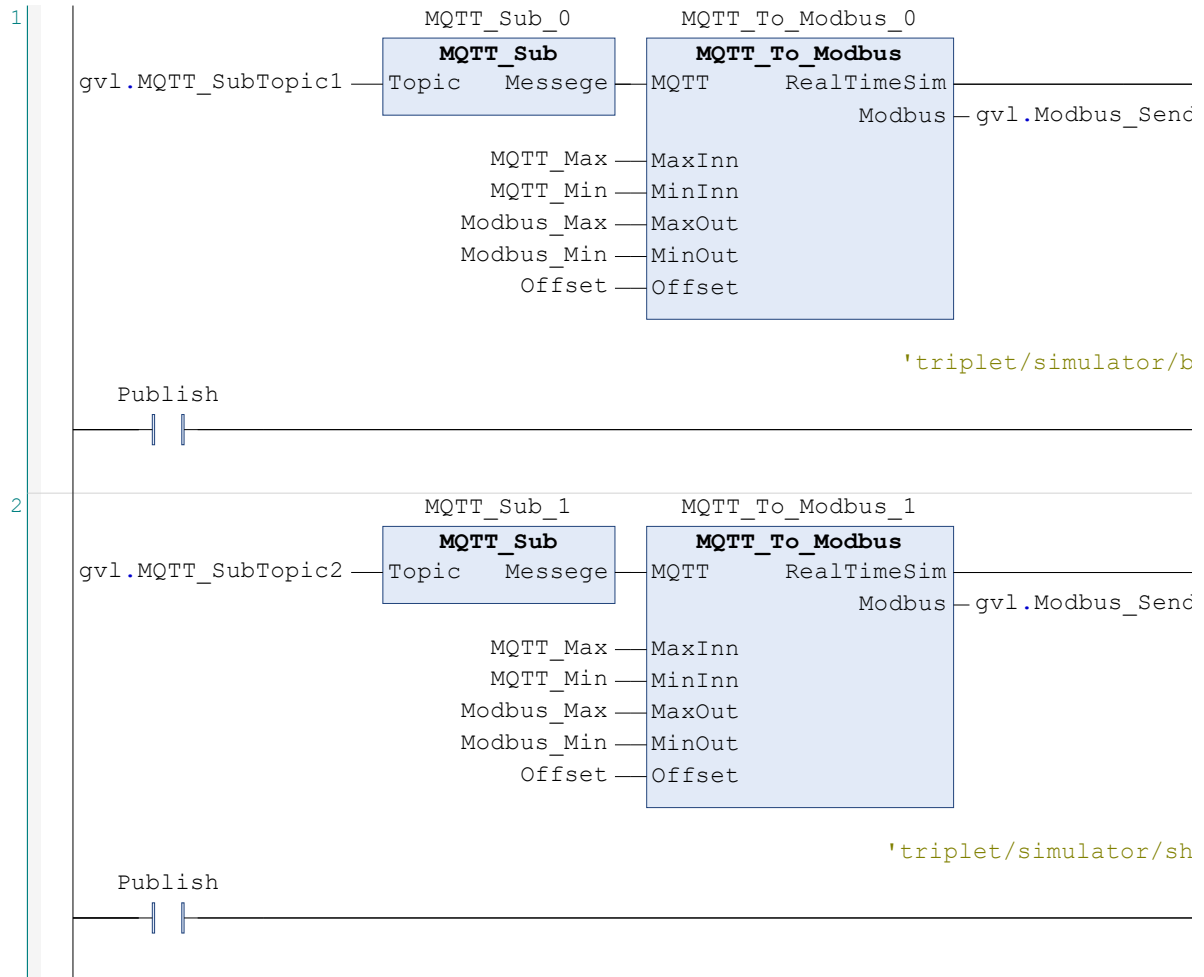
1.1.1.3 POU: Modbus_MQTT

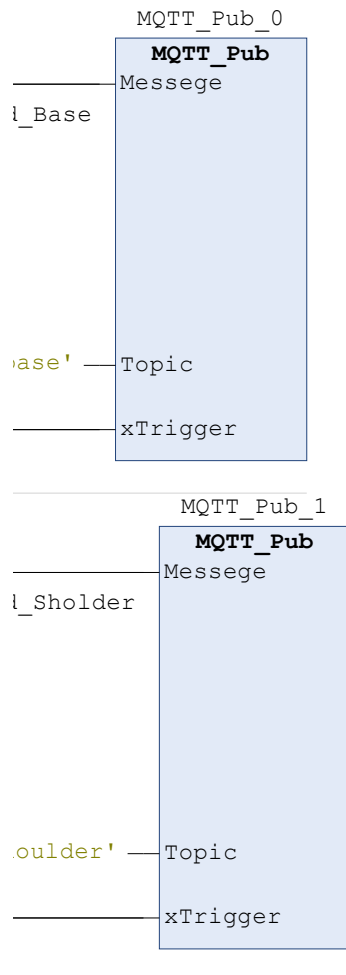


1.1.1.4 POU: MQTT_Modbus

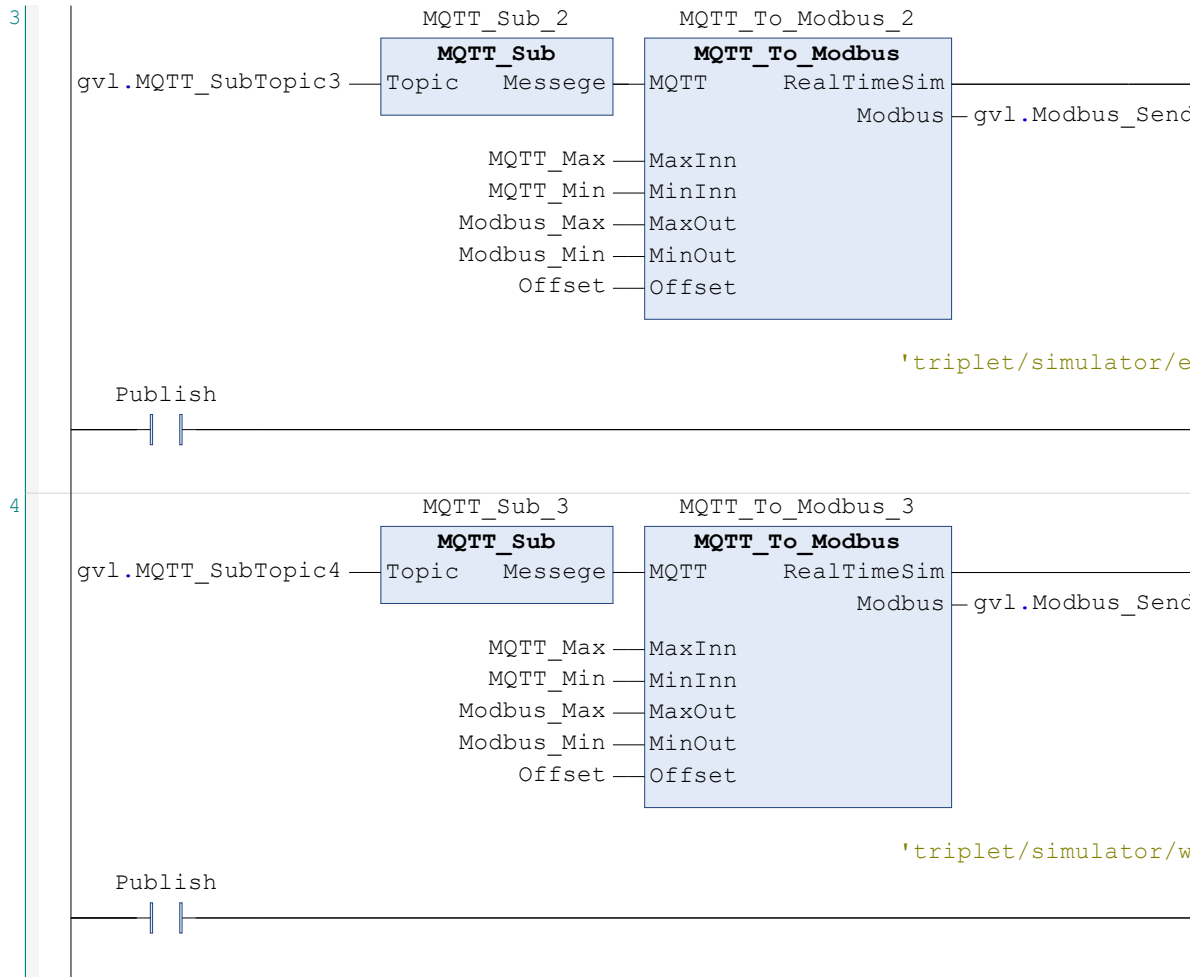
```
1  PROGRAM MQTT_Modbus
2  VAR
3      MQTT_Max : REAL := 360 ;
4      MQTT_Min : REAL := -360 ;
5      Modbus_Max : REAL := 12660 ;
6      Modbus_Min : REAL := 0 ;
7      Offset : REAL := 360 ;
8      MQTT_PUB_Max : REAL := 360 ;
9      MQTT_PUB_Min : REAL := -360 ;
10     MQTT_Sub_0 : MQTT_Sub ;
11     MQTT_Sub_1 : MQTT_Sub ;
12     MQTT_Sub_2 : MQTT_Sub ;
13     MQTT_Sub_3 : MQTT_Sub ;
14     MQTT_Sub_4 : MQTT_Sub ;
15     MQTT_Sub_5 : MQTT_Sub ;
16     MQTT_To_Modbus_0 : MQTT_To_Modbus ;
17     MQTT_To_Modbus_1 : MQTT_To_Modbus ;
18     MQTT_To_Modbus_2 : MQTT_To_Modbus ;
19     MQTT_To_Modbus_3 : MQTT_To_Modbus ;
20     MQTT_To_Modbus_4 : MQTT_To_Modbus ;
21     MQTT_To_Modbus_5 : MQTT_To_Modbus ;
22     MQTT_To_Modbus_6 : MQTT_To_Modbus ;
23     MQTT_Pub_0 : MQTT_Pub ;
24     MQTT_Pub_1 : MQTT_Pub ;
25     MQTT_Pub_2 : MQTT_Pub ;
26     MQTT_Pub_3 : MQTT_Pub ;
27     MQTT_Pub_4 : MQTT_Pub ;
28     MQTT_Pub_5 : MQTT_Pub ;
29     BLINK_0 : BLINK ;
30     Publish : BOOL ;
31     BLINK_1 : BLINK ;
32 END_VAR
33
```

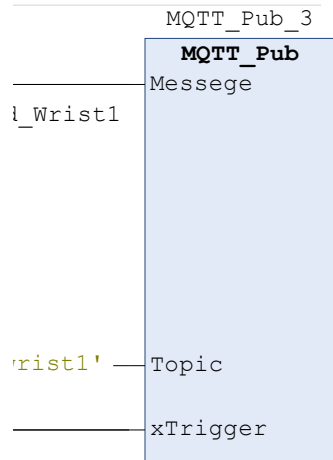
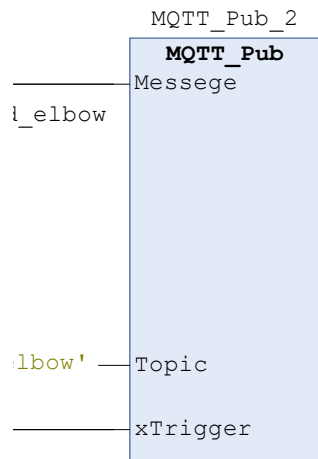
1.1.1.4 POU: MQTT_Modbus



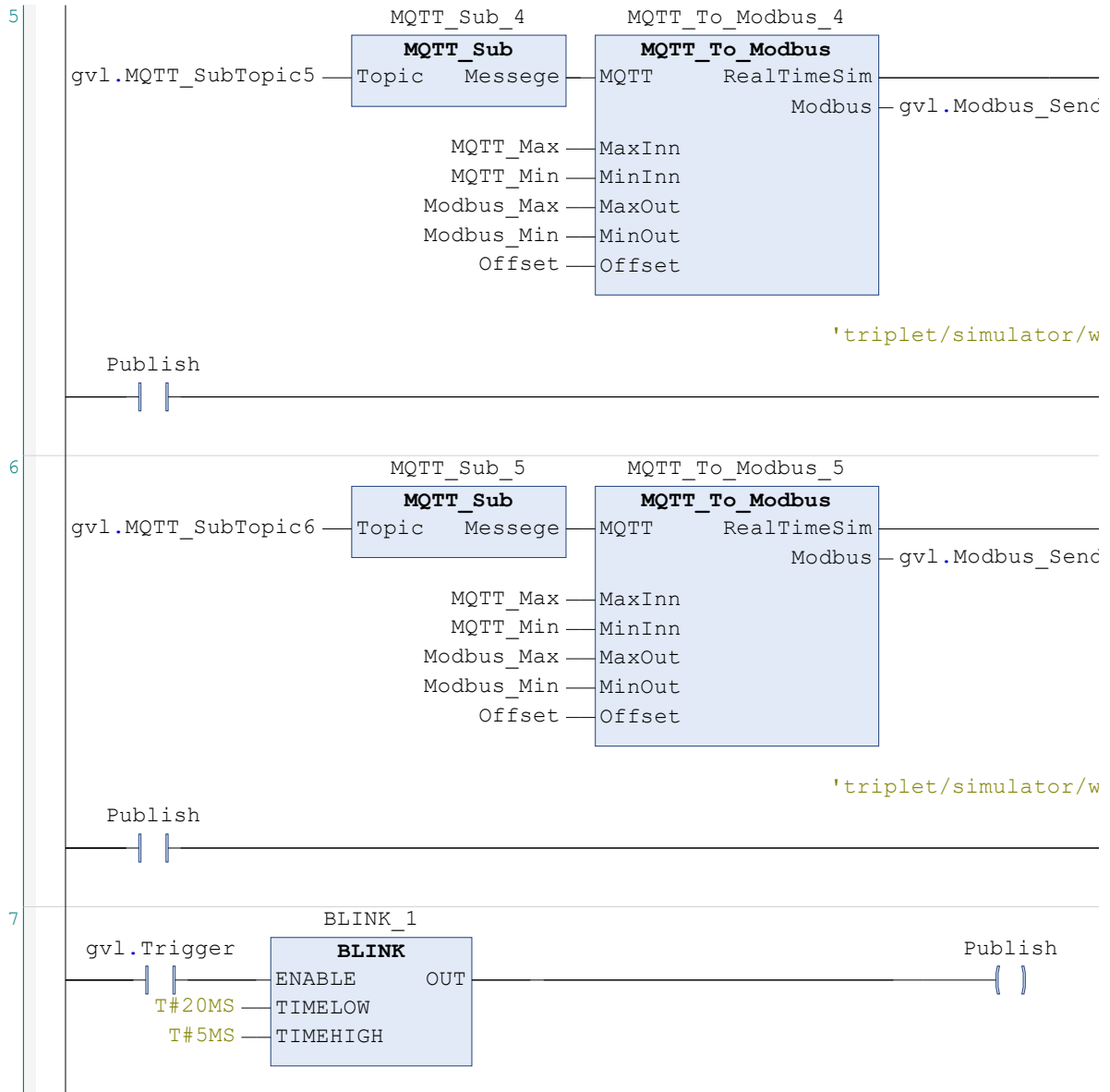


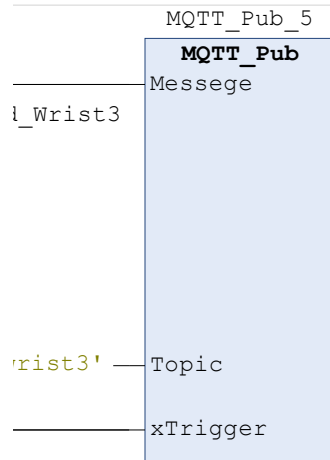
1.1.1.4 POU: MQTT_Modbus





1.1.1.4 POU: MQTT_Modbus





1.1.1.5 Task Configuration: Task configuration

Max. number of tasks: 15
Max. number of cyclic tasks: 15
Max. number of freewheeling tasks: 15
Max. number of event tasks: 15
Max. number of external event tasks: 8
Max. number of status tasks: 15

System Events:

1.1.1.5.1 Task: PLC_Task

Priority: 15
Type: Cyclic
Interval: t#50ms Unit: ms
Watchdog: Inactive
POUs: MQTT_Modbus

1.1.1.5.1.1 Program Call: MQTT_Modbus

1.2 Device: Kbus

K-BUS Parameters

Parameters:

Name:	Type:	Value:	Default Value:	Unit:	Description:
k-bus cycle time	UINT(1..50)	10	10		cycle time in [ms]
k-bus event control 1					cycle offset and cycle number
offset	USINT	0	0		offset in number of cycles
cycle number	USINT	2	2		cycle number (disable event with zero)
k-bus event control 2					cycle offset and cycle number
offset	USINT	1	1		offset in number of cycles
cycle number	USINT	4	4		cycle number (disable event with zero)
k-bus event control 3					cycle offset and cycle number
offset	USINT	3	3		offset in number of cycles
cycle number	USINT	8	8		cycle number (disable event with zero)
k-bus event control 4					cycle offset and cycle number
offset	USINT	7	7		offset in number of cycles
cycle number	USINT	16	16		cycle number (disable event with zero)
program start interlock	BOOL	TRUE	TRUE		locks on configuration error

Information

Name: Kbus
Vendor: WAGO
Categories:
Type: 32778
ID: Wago 750-Series Local Bus Interface
Version: 1.4.0.2
Description: WAGO Kbus Interface

1.3 Connector: MODBUS

MODBUS I/O Mapping

1.3.1 Device: MODBUS

Information

Name: MODBUS
Vendor: WAGO
Categories:
Type: 32777
ID: 1006 0001
Version: 1.1.1.16
Order number: n/a
Description: This device implements master and slave functionality for MODBUS.

1.3.1.1 Device: LocalDeviceModbus

MODBUS Slave Parameters**Parameters:**

Name:	Type:	Value:	Default Value:	Unit:	Description:
OffsetMap	DWORD	0			
OffsetMap	DWORD	32			
OffsetMap	DWORD	16			
OffsetMap	DWORD	48			
OffsetMap	DWORD	64			
OffsetMap	DWORD	80			
OffsetMap	DWORD	2080			
OffsetMap	DWORD	2112			
OffsetMap	DWORD	2096			
OffsetMap	DWORD	2128			
OffsetMap	DWORD	2144			
OffsetMap	DWORD	2160			
Node ID	UINT	1	1		Used as slave address in RTU and as unit identifier in TCP/UDP
PLC stop behaviour	Enumeration of UDINT	0	2		

1.3.1.1 Device: LocalDeviceModbus

Fieldbus error behaviour	Enumeration of UDINT	0	2		
Response Delay	UINT	0	0		Used to delay responses in order to avoid high system load.
Watchdog settings					
Timeout	UINT	0	0	ms	Watchdog reset timeout.
Mode	Enumeration of UDINT	0	0		Selects modbus operation mode.
Explicit Trigger	Enumeration of UDINT	0	0		Enables explicit trigger on command WATCHDOG_START for simple mode.
Trigger on Status	Enumeration of UDINT	0	0		Enables trigger additionally on status register read for simple mode.
TCP connection reset	Enumeration of UDINT	0	0		Enables release of all established Modbus TCP connections when watchdog expires.

MODBUS Slave I/O Mapping

Input Parameters:

Mapping:	Channel:	Address:	Type:	Unit:	Description:
Application.GVL.Modbus_Recive_Base			WORD		
Application.GVL.Modbus_Recive_Elbow			WORD		
Application.GVL.Modbus_Recive_Sholder			WORD		
Application.GVL.Modbus_Recive_Wrist1			WORD		
Application.GVL.Modbus_Recive_Wrist2			WORD		
Application.GVL.Modbus_Recive_wrist3			WORD		

Output Parameters:

Mapping:	Channel:	Address:	Type:	Unit:	Description:
Application.GVL.Modbus_Send_Base			WORD		
Application.GVL.Modbus_Send_Elbow			WORD		
Application.GVL.Modbus_Send_Sholder			WORD		
Application.GVL.Modbus_Send_Wrist1			WORD		
Application.GVL.Modbus_Send_Wrist2			WORD		
Application.GVL.Modbus_Send_Wrist3			WORD		

Information

Name: MODBUS Slave
Vendor: WAGO
Categories:
Type: 32777
ID: 1006 0001
Module ID: Slave
Version: 1.1.1.16
Order number: n/a
Description: A MODBUS Slave responds as server to requests from a set of masters.

1.3.1.1.1 Device: TcpSettings

MODBUS Slave Parameters

Parameters:

Name:	Type:	Value:	Default Value:	Unit:	Description:
TCP Port	UINT	502	502		An TCP Server port to accept connections from a set of masters.
TCP connection watchdog	UINT	200	2000	10ms	The server resets a client connection if no valid request received within this time.
Type of Service settings					
Low Delay	Enumeration of UDINT	1	1		
High Throughput	Enumeration of UDINT	0	0		
High Reliability	Enumeration of UDINT	0	0		
TCP keepalive settings					
Enabled	Enumeration of UDINT	0	0		Activates TCP keepalive for Modbus connections.
Idle Time	UINT	7200	7200	Seconds	Time until keepalive probe starts.
Interval	UINT	1	1	Seconds	Interval between keepalive probes.
Count	UINT	10	10		Number of keepalive probes.

Information

Name: Modbus TCP Slave
Vendor: WAGO
Categories:
Type: 32777
ID: 1006 0001
Module ID: TCP Slave
Version: 1.1.1.16
Order number: n/a
Description: Modbus TCP Slave

2 Device: Generic_Modbus_Master

Information

Name: ThirdParty Modbus Master
Vendor: WAGO
Categories:
Type: 32808
ID: 1007 8211
Version: 1.0.0.1

Order number: GenericModbusMaster
Description: ThirdParty Modbus Master

3 GlobalTextList: GlobalTextList

4 : Licenses

4.1 : Device information

Device information

Device name MAC address Hardware ID
Controller

4.2 : Assigned licenses

Assigned licenses

Device name	Item number	Item description	License key	Serial number
Controller	2759-0213 / 0215-1000	Runtime PLC 300 - Single ...		

4.3 : License requirement

License requirement

Function/library name	Version	Manufacturer	Licensed product	Points/number	Optional
Runtime PLC 300			2759-0213: Runtime PLC 300	1	No

5 : Project Settings

Static Analysis Light:

Unused variables (#33): 0
Overlapping memory areas (#28): 0
Write access from several tasks (#6): 0
Multiple write access on output (#4): 0
Multiple uses of identifiers (#27): 0
Report temporary FunctionBlock instances (#167): 0