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Temperature Controller

TM-XGT (RS485)

Solution Guide

TM Series

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Preface

Thank you very much for selecting Autonics products.

Please familiarize yourself with the information in this manual and in the product manuals before using them.

This solution guide contains information about a specific architecture solution and does not replace any specific product documentation.

This document does not attempt to describe the entire solution architecture and configuration but only introduce some basics procedures. Customization of this solution can be made by the users in respect of safety laws and regulations.

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Document Guide

- This manual provides procedure steps for a particular solution architecture. It does not offer any guarantee concerning matters beyond the scope of this manual.
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- We contrived to describe this manual the easiest and more accurate way. However, if there are any corrections required or questions, please notify us these remarks on our homepage.

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Document Symbols

Symbol	Description
Note	Additional information about a particular feature.
Warning	Failure to follow instructions can result in serious injury or death.
Caution	Failure to follow instructions can lead to a minor injury or product damage.
Ex.	An example of the concerned feature's use.
※1	Annotation mark.

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Document Version History

Date	Version	Author	Description
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November 17th 2017	v2.0	기술지원팀 - GTE	Document revision, template update Add several sections, change example

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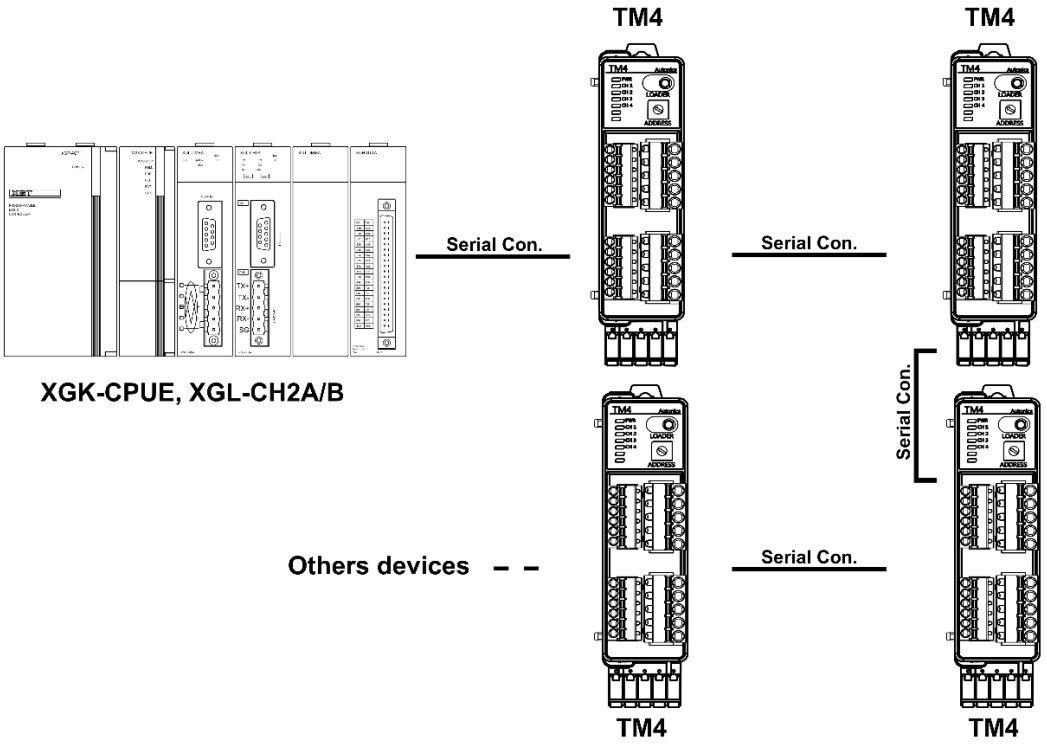
1 Solution Overview

1.1 Solution description

Autonics TM4 device from the TM series is a multi-channel PID temperature controller, capable of controlling various type of power controllers thanks to its build-in SSR driver or relay output and simultaneously controlling up to 4 elements, (up to 2 elements for the TM2 type). It has also build-in serial Modbus connection through RS-485 pins.

Thanks to its characteristic, the TM device can be added in any existing automation architecture with Modbus connection and device parameters or statuses, values limits and Present Value can be monitored or set, allowing remote access to key-data.



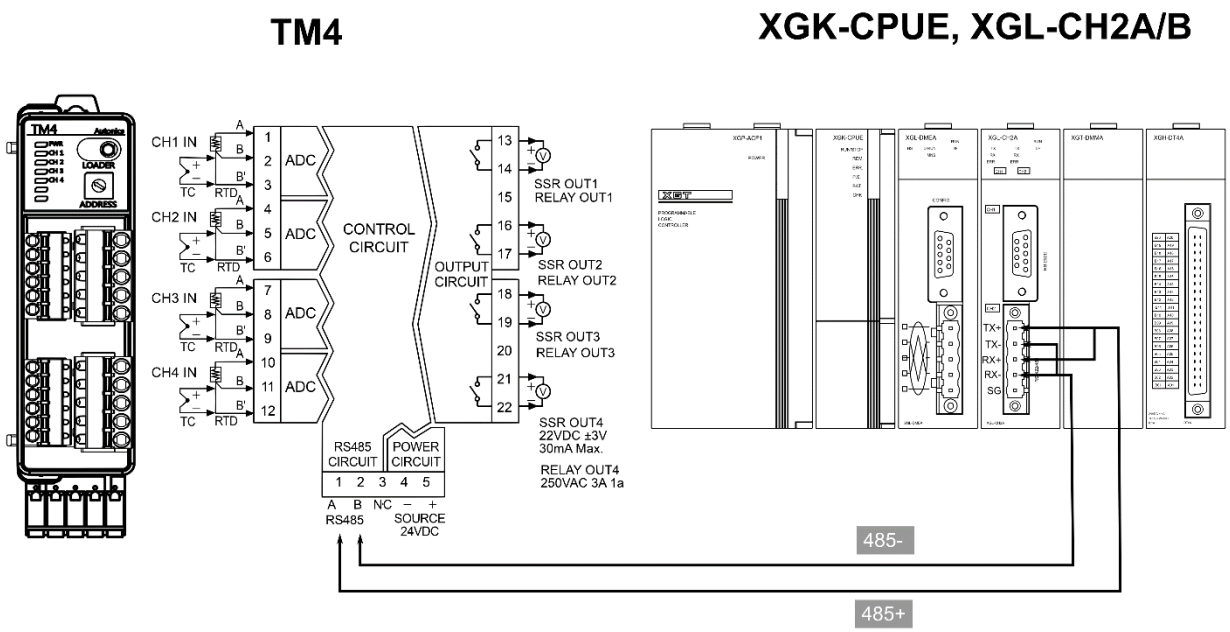
This solution brings the following benefits to your current installation:

- Allows to monitor in real time several TM devices status and feedback values
- Allows settings of several TM devices parameters like setting values or PID parameters from only 1 device
- Allows data exchange between different device types

1.2 Solution components and version

Hardware / Software	Version	Note
MS Windows	Win 7	
TM4-N2RB		Autonics product.
XG-5000	v4.22	LS product. Release 2017.09.29
XGT Series(Cnet)		LS product

1.3 Solution architecture



Note

Bridges should be addded between the “Tx+“ and “Rx+“ pins and between the “Tx-“ and “Rx-“ pins of the XGL communication module.

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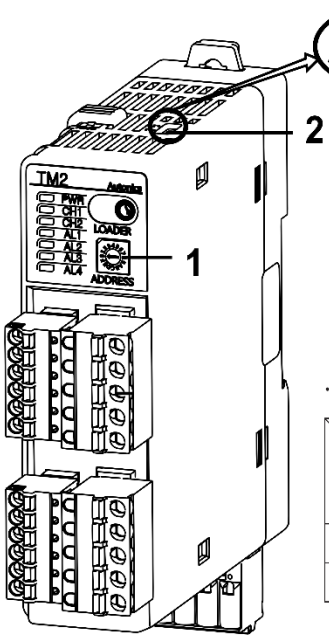
2 TM4 Communication Settings

Devices from the TM series do not have graphic interface; To change the devices' settings, we need to use the device management program from Autonics: DAQMaster.

1st Set the desired Modbus address thanks to the 'Communication address' switches, this address should be unique on the network:



1. Communication address setting switch (SW1):
The device communication address can be set from:
- 1 to 15: if SW2 set to +0
- 16 to 31: if SW2 set to +16

2. Communication address group switch (SW2):
Increases value of the SW1 communication address dial switch of +16 or +0.

• Set the communication address using SW1 and SW2.
Setting range is 01 ~ 31. (※ In case setting 00, communication is not available.)

※ Default: SW1 : 1, SW2 : +0

SW2 \ SW1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
+0	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
+16	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

2nd Connect the TM device to DAQMaster

Note

Please follow the procedure in annex part of this document to connect a TM device to the DAQMaster program and have access to its parameters.

3rd In the DAQ Master 'Property' window, set the parameters of the 'Communication Setting' group as following:

Parameter	DAQ Master setting name	Value range	Note
Comm. speed	Baudrate	Multiple choice	User setting, same than the PLC parameter
Comm. Parity bit	Parity Bit	None	Fixed
Comm. Stop bit	Stop Bit	2	User setting
Comm. Response waiting time	Response waiting Time	20	User setting
Comm. writing	Communication Write	Enable	Fixed
Device address	*Not available*	*1 to 31*	*User setting by switch dials, should be unique on the network*

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4th **The TM temperature controller has been properly set.**

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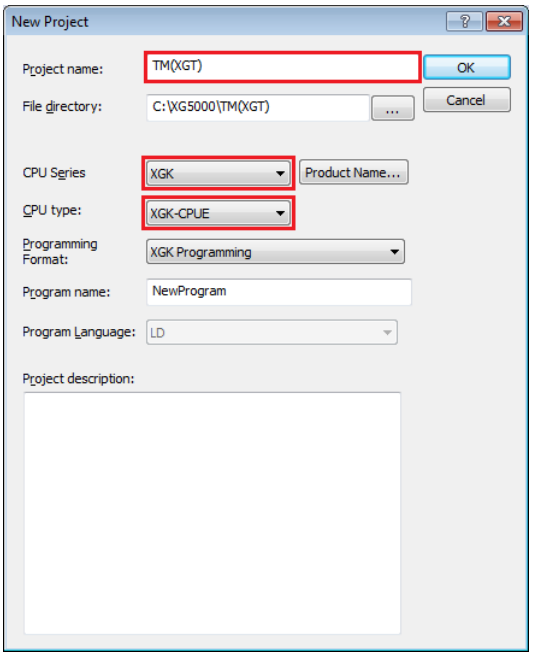
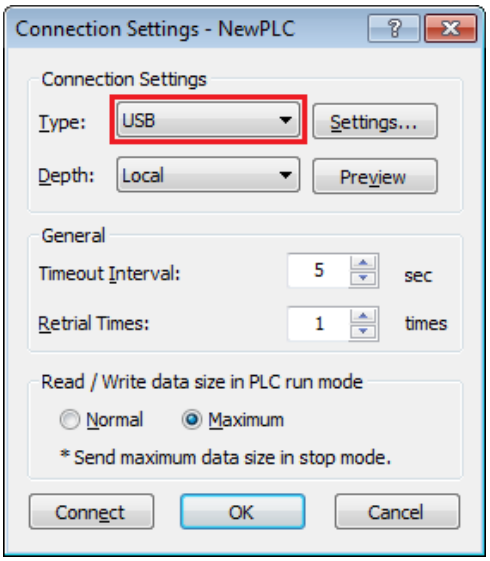
3 XGT Project Settings

1st Run XG5000 and select [Project] – [New Project] in the menu bar. Enter project name and select CPU type 'XGK'-'XGK-CPUE' in the 'New Project' dialog box. Click 'OK'.



2nd Set connection method at [Online] – [Connection Settings]. This example is connection via USB, select connection type as 'USB' and click 'OK'.



3rd Start connection at [Online] – [Connect].

4th To synchronize the modules information, stop the PLC processing by selecting [Online] – [Change Mode] – [Stop]. If you cannot stop the PLC with this method, change the 'RUN/STOP' switch of the PLC CPU from 'RUN' to 'STOP'.

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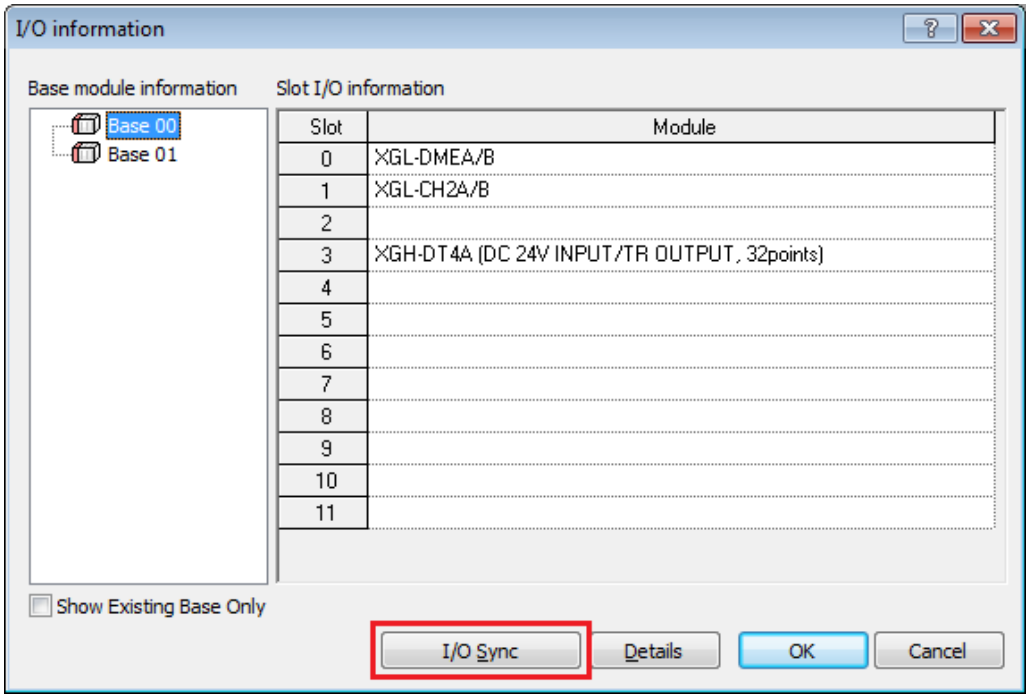
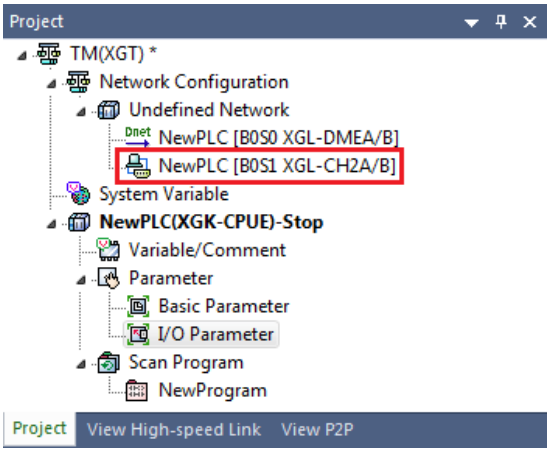
5th Then enter [Online] – [Diagnosis] – [I/O Information] and click [I/O Sync]. Click 'OK' if necessary to finish the synchronization then click 'OK' to close the 'I/O information' window.



6th When I/O synchronizing is completed, communication modules will be added under [Network Configuration] – [Undefined Network] in the project tree. Double-click on the 'XGL-CH2A/B' communication module.



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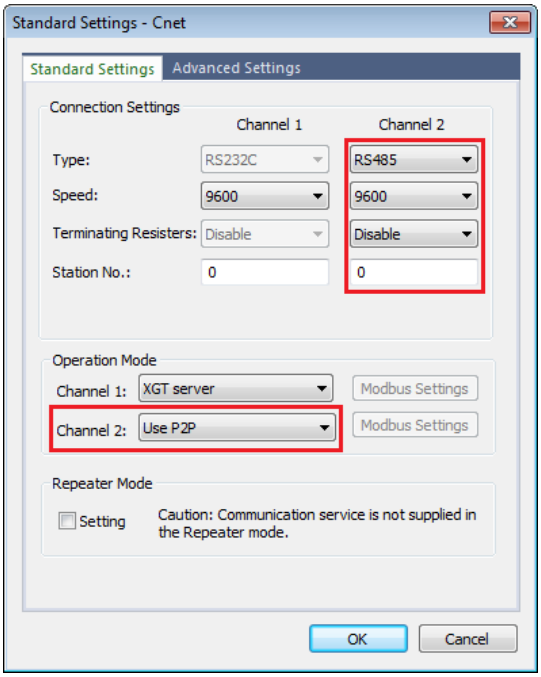
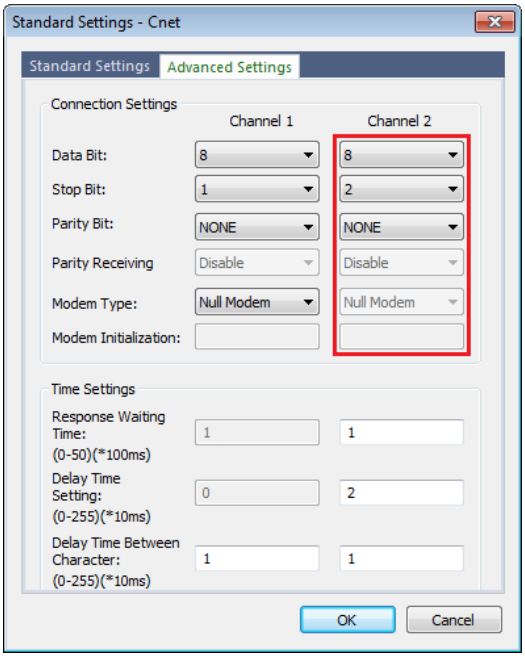
7th In ‘Standard Settings - Cnet’ dialog box appears. Set ‘Standard Settings’ tab as below.

Item		Setting	Note
Standard settings Channel 2	Communication type	RS485	Fixed
	Communication speed	Same that TM	User setting
	Terminating resistances	Disable	Fixed
	Station No.	Multiple choice	User setting, should be unique on the network
Operation mode	Channel 2	Use P2P	Mandatory

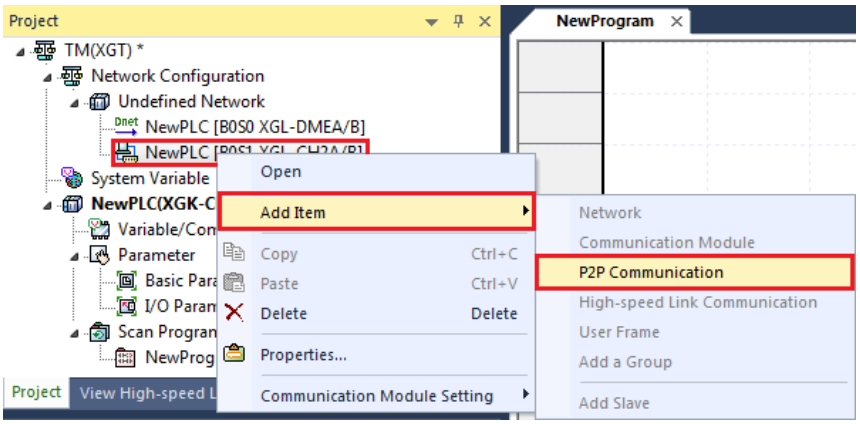


8th In ‘Advanced Settings’ tab set as below, then click ‘OK’.

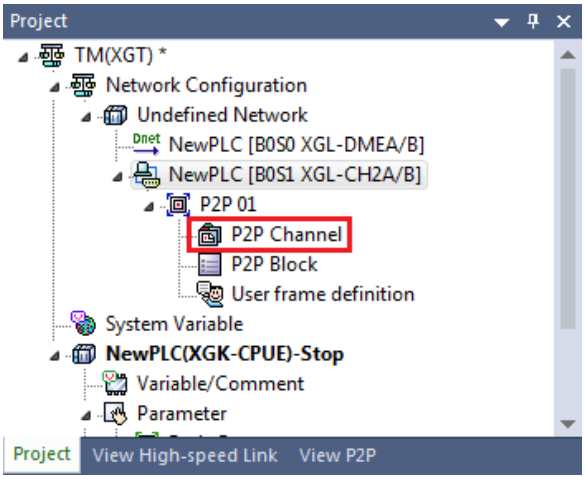
Item		Channel 2
Advanced settings	Data bit	8
	Stop bit	2
	Parity bit	NONE



9th In the project tree, right click on the 'XGL-CH2A/B' communication module, and select [Add Item] – [P2P Communication]. Select '1' and click 'OK'



10th In the project tree, double click on the newly created 'P2P Channel' under communication module – [P2P 01].



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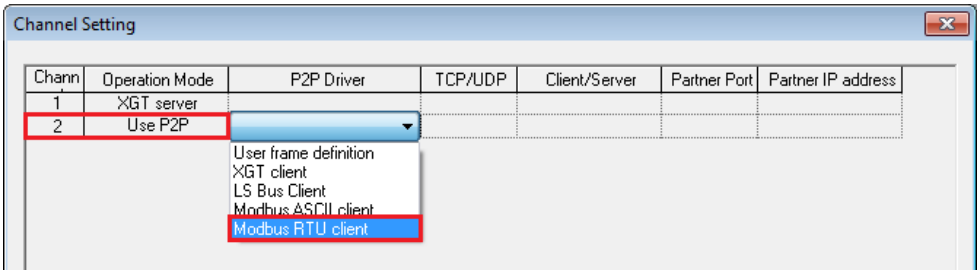
11th Set the ‘P2P Driver’ of the channel 2 to ‘Modbus RTU client’ and click ‘OK’.



12th **The project has been properly set. Then you need to create your own ‘P2P block’ depending on the desired point in the TM device and your own PLC program and download the complete project to the XGT device by selecting [Online] – [Write], then clicking ‘OK’.**

Note

Please refer to the XG5000 documentation for procedures on Ladder program creation and other method to write project to a XGT device.

Please refer to the TM documentation for the complete list of Modbus registers and information on Modbus functions.

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4 Data Exchange Example

4.1 Solution overview

4.1.1 Communication objective

In this example, we will access the TM registers from the XGT PLC to:

- Read:
  - The present values measured by the temperature controller for CH1 and CH2
  - The unit settings for CH1 and CH2
- Write:
  - The setting values of the temperature controller for CH1 and CH2
  - The activation flag of the Auto-Tuning function for CH1 and CH2

4.1.2 TM4 – XGT connection

Point description		TM4		XGT	
Variable name	Read / Write function	Bit	Word	Bit	Word
Present Value CH1	Read	-	0x303E8	-	D110
PV unit CH1	Read		0x303EA		D111
Present Value CH2	Read	-	0x303EE	-	D112
PV unit CH2	Read		0x303F0	-	D113
Setting Value CH1	Write	-	0x40000	-	D114
Auto-Tuning CH1	Write	-	0x40064	-	D115
Setting Value CH2	Write	-	0x403E8	-	D116
Auto-Tuning CH2	Write	-	0x4044C	-	D117

In this example, we will set the communication address:

- of the XGT device to 0

- of the TM4 device to 1

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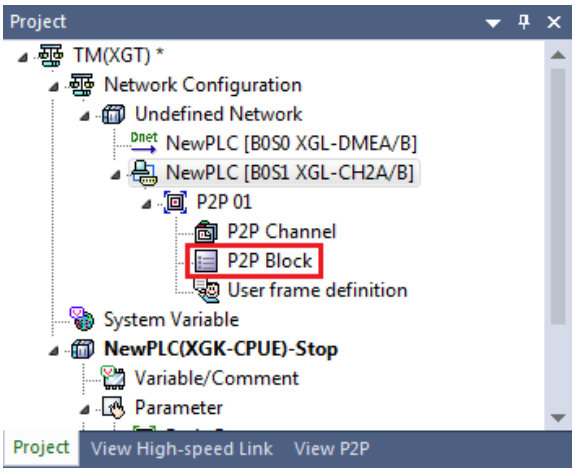
4.2 XG5000 program

4.2.1 P2P Block definition

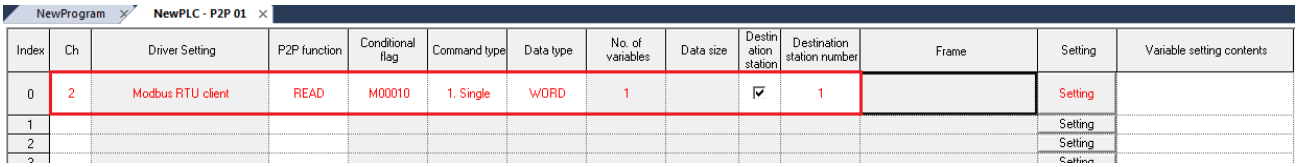
We will define 1 P2P block for each value that we want to transfer following the previously table, and associate a specific conditionnal action flag to the different elements (for read or write).

1st In the project tree, double click on ‘P2P Block’ under communication module – [P2P 01].



2nd Set the different table elements for the first line as following:

Item	Setting	Note
Ch	2	XGT Channel number
Driver Setting	Mod. RTU Clt	fixed
P2P function	READ	Read or Write function
Conditional flag	M10	Flag to trigger the communication
Command type	1. Single	Select 2. if want to read several word registers in 1 command
No. of variables	1	fixed
Data size		Enter value if read several word registers in 1 command
Destination station	Enable	To define Modbus ID
Destination station number	1	Modbus ID of the targeted device



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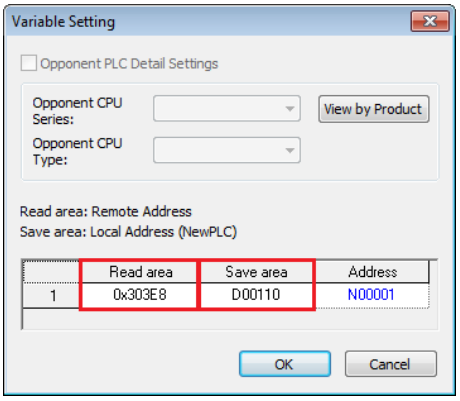
3rd Click on ‘Setting’ button and set as following, then click ‘OK’.

Item	Setting	Note
Read area	0x303E8	TM register to read/write data
Save area	D110	XGT register to save/read data
Address	*Auto filled*	Fixed by XG5000



4th Set the other table elements as following:

NewProgram | NewPLC - P2P 01

Index	Ch	Driver Setting	P2P function	Conditional flag	Command type	Data type	No. of variables	Data size	Destination station	Destination station number	Frame	Setting	Variable setting contents
0	2	Modbus RTU client	READ	M00010	1. Single	WORD	1		☑	1		Setting	Number:1 READ1:0x303E8,SAVE1:D00110
1	2	Modbus RTU client	READ	M00011	1. Single	WORD	1		☑	1		Setting	Number:1 READ1:0x303EA,SAVE1:D00111
2	2	Modbus RTU client	READ	M00012	1. Single	WORD	1		☑	1		Setting	Number:1 READ1:0x303EE,SAVE1:D00112
3	2	Modbus RTU client	READ	M00013	1. Single	WORD	1		☑	1		Setting	Number:1 READ1:0x303F0,SAVE1:D00113
4	2	Modbus RTU client	WRITE	M00014	1. Single	WORD	1		☑	1		Setting	Number:1 READ1:D00114,SAVE1:0x40000
5	2	Modbus RTU client	WRITE	M00015	1. Single	WORD	1		☑	1		Setting	Number:1 READ1:D00115,SAVE1:0x40064
6	2	Modbus RTU client	WRITE	M00016	1. Single	WORD	1		☑	1		Setting	Number:1 READ1:D00116,SAVE1:0x403E8
7	2	Modbus RTU client	WRITE	M00017	1. Single	WORD	1		☑	1		Setting	Number:1 READ1:D00117,SAVE1:0x4044C

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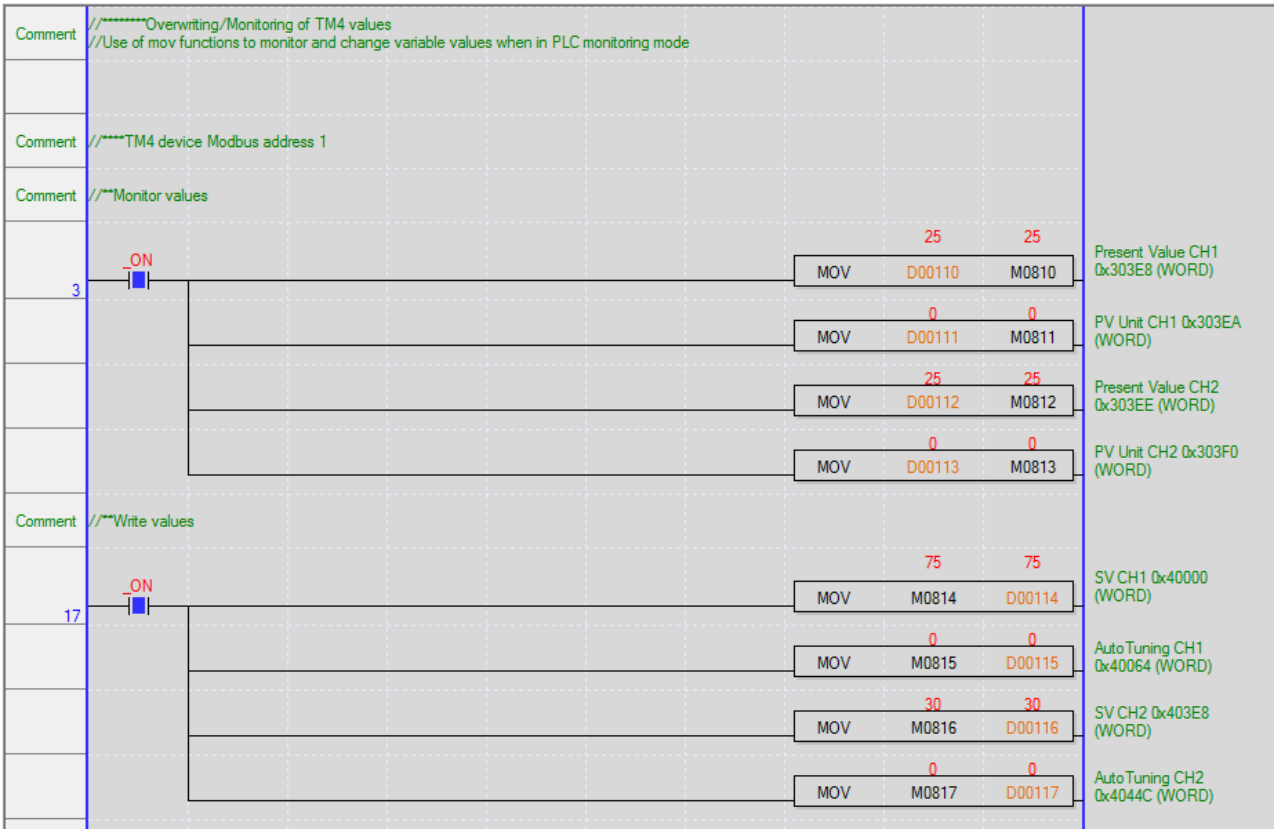
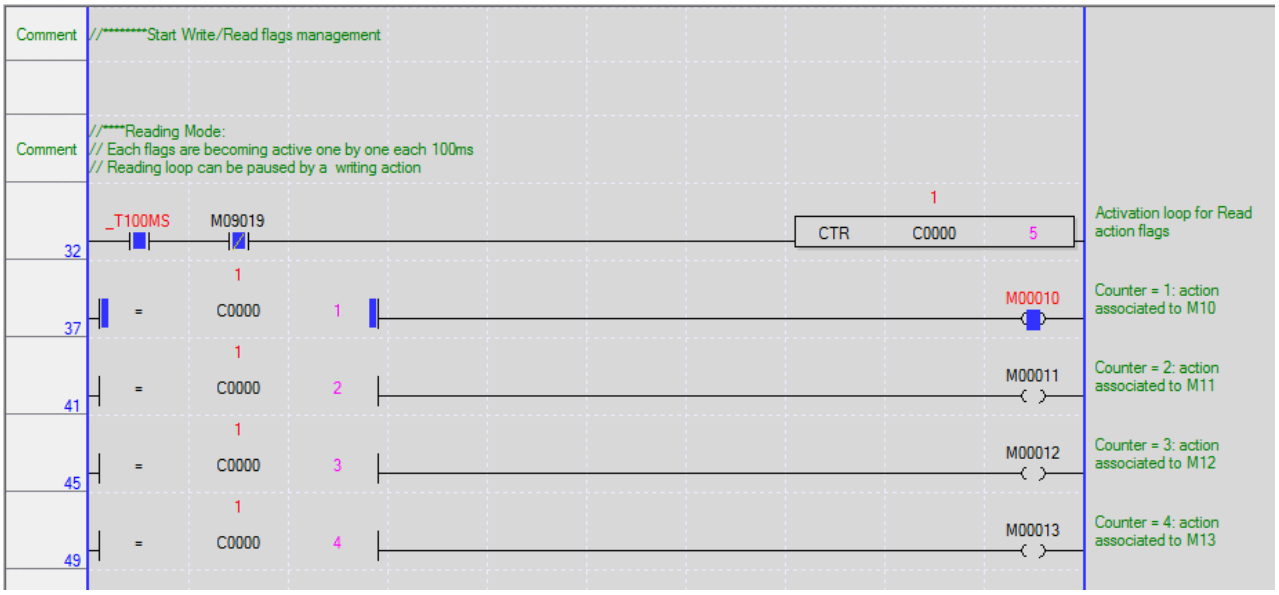
4.2.2 Ladder program

1st Create the following ladder program:

To set and monitor values:



To manage reading flags:



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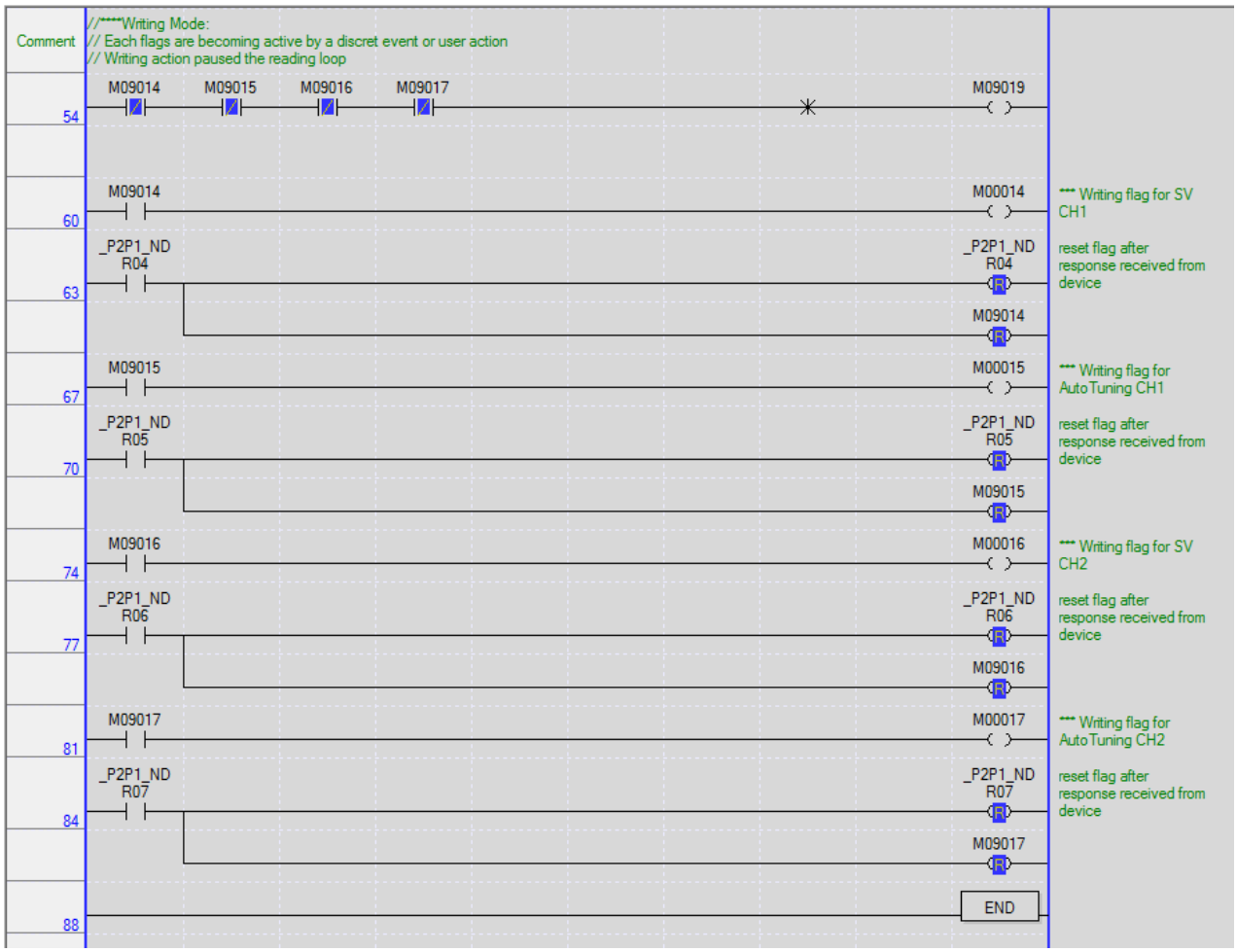
To manage writing flags:



Note

We will not describe how to create a Ladder program under XG 5000 in this document. Please refer to the XG 5000 documentation for more information.

2nd **The project has been properly created, we need then to download the complete project to the XGT device by selecting [Online] – [Write], then clicking 'OK'.**

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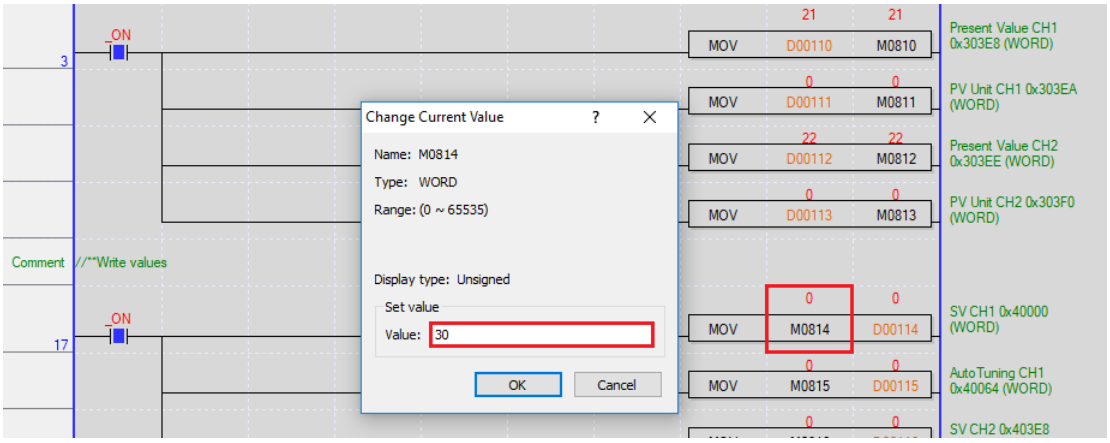
4.3 Data exchange test

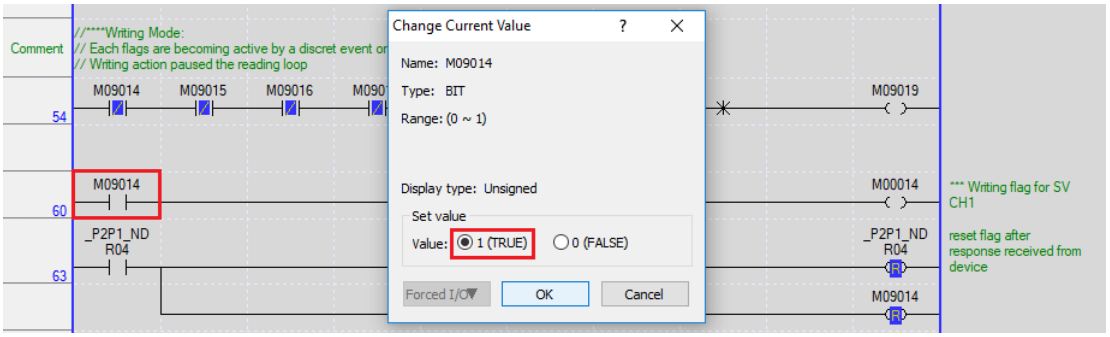
➢ Set the CH1 and CH2 SV (M0814=D114=0x40000 and M0816=D116=0x403E8):

1st Double click on the ‘M0814’ variable in the ‘//write values’ section, set to desired CH1 SV and click ‘OK’:



2nd Set the same way the CH2 SV (M816).

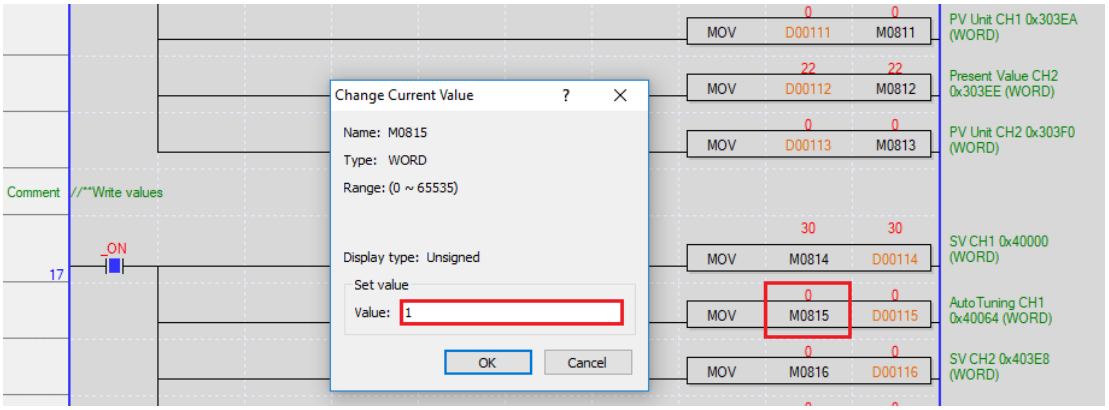
3rd In the ‘//****Writing Mode’ section, double click on the variable associated to the CH1 SV writing flag: ‘M9014’, set to ‘TRUE’ and click ‘OK’:



4th Using the same process, write the new CH2 SV value to the TM device (M9016).

➢ Activate the CH1 Auto-Tuning function (M0815=D115=0x40064 = 1):

5th In the ‘//write values’ section, double click on the ‘M0815’ variable, set to ‘1’ to start the function or ‘0’ to stop it, and click ‘OK’:



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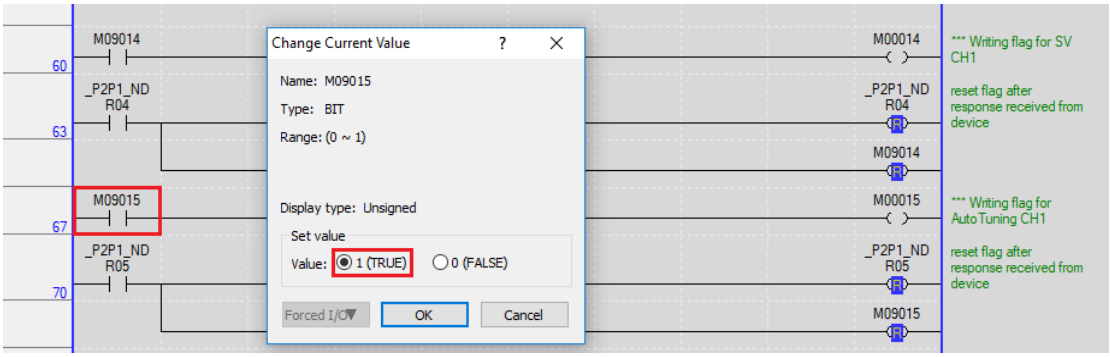
6th In the '//****Writing Mode' section, double click on the variable associated to the CH1 AT function writing flag: 'M9015', set to 'TRUE' and click 'OK':



➢ Result for a temperature controller set to 'Heat' mode:

- The CH1 or/and CH2 LED indicator will turn on if PV is lower than SV.
- The CH1 or/and CH2 LED indicator will flash with 1 sec period if the Auto Tuning function has been activated.

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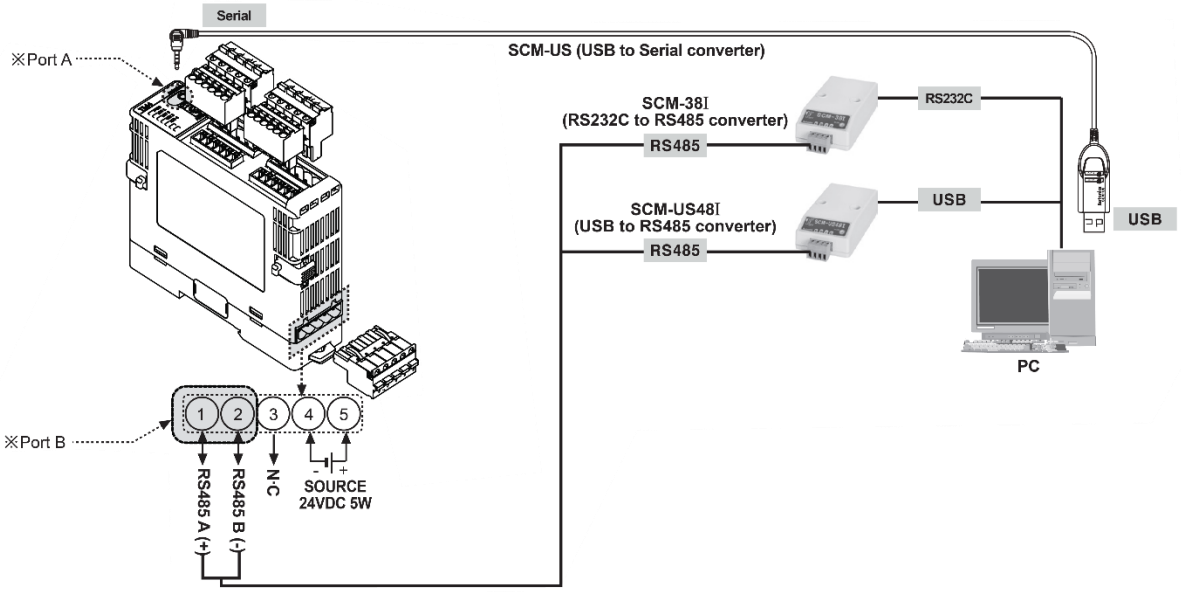
5 Appendix

5.1 TM device connection to DAQ Master

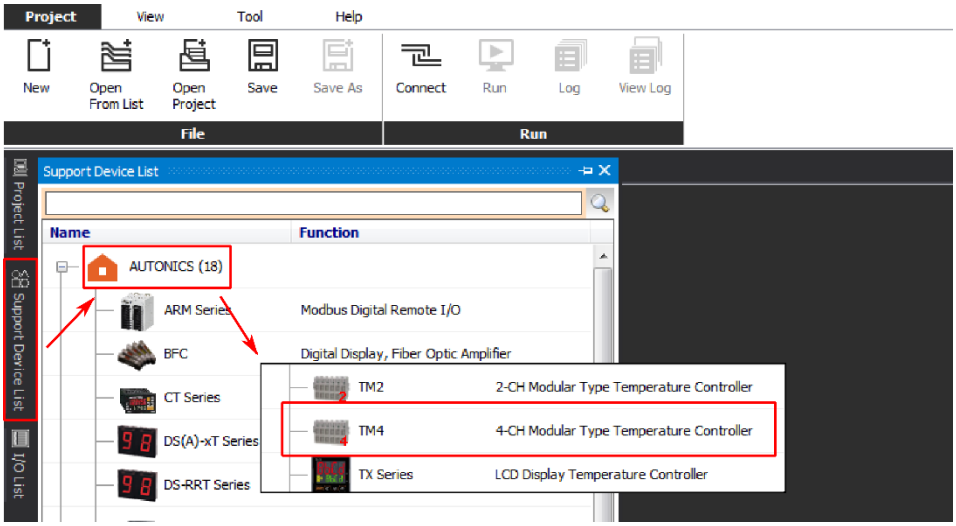
There are severals ways to connect a TM device to the DAQ Master software:

- using the PC loader port of the TM device and the USB port of the PC
- using serial connection RS-485 of the TM device and the RS-232 port of the PC
- using serial connection RS-485 of the TM device and the USB port of the PC.

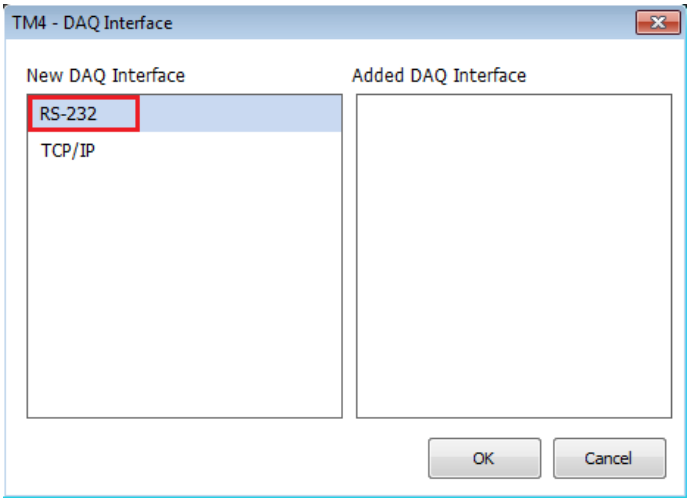


For each configuration, the procedure under DAQ Master is the same:

1st Start DAQ Master and select TM4 device (or TM2 depending of your model) under [Support Device List] - [AUTONICS] in the left tab menu.

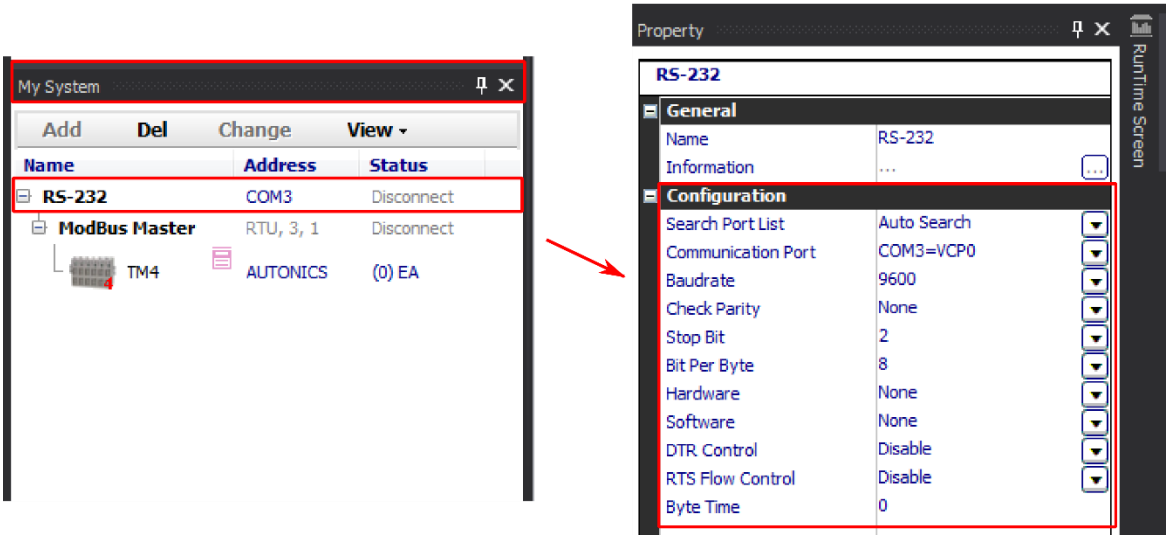


2nd Select the ‘RS-232’ DAQ interface and click ‘OK’.



3rd Once the communication interface has been created, select this RS-232 interface in the ‘My System’ menu and set the PC communication port connected to the TM device. Then the different communication settings can be configure to match the TM device settings.

Item	Setting	Note
Communication Port	Port name	Port number which is connected to TM device
Baudrate	Comm. speed	Actual TM baudrate can be determine by TM light indicator (see below). **Fixed to 9600 if using SCM-US cable**
Check Parity	None (default) / Odd / Even	Need to try different settings
Stop bit	1 / 2 (default)	Need to try different settings
Bit Per Byte	8	Fixed



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Rem: When power is supplied initially, 1 LED indicator associated to specific communication speed will fash for 5 sec; The device communication speed can be determine following this tables:

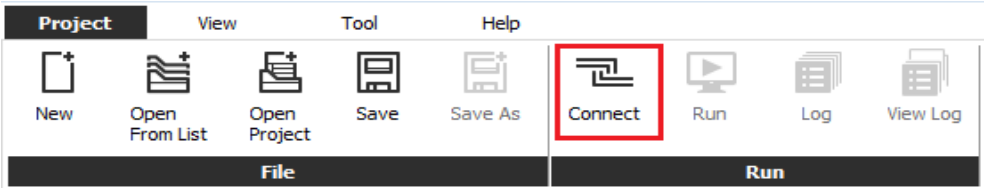
●TM2 Series

Indicator \ Status	Initial power ON※1
PWR (green)※3	ON
CH1 (red)	Flash (2,400bps)
CH2 (red)	Flash (4,800bps)
AL1 (yellow)	Flash (9,600bps)
AL2 (yellow)	Flash (19,200bps)
AL3	Flash (38,400bps)
AL4	—

●TM4 Series

Indicator \ Status	Initial power ON※1
PWR (green)※3	ON
CH1 (red)	Flash (2,400bps)
CH2 (red)	Flash (4,800bps)
CH3 (red)	Flash (9,600bps)
CH4 (red)	Flash (19,200bps)
	Flash (38,400bps)

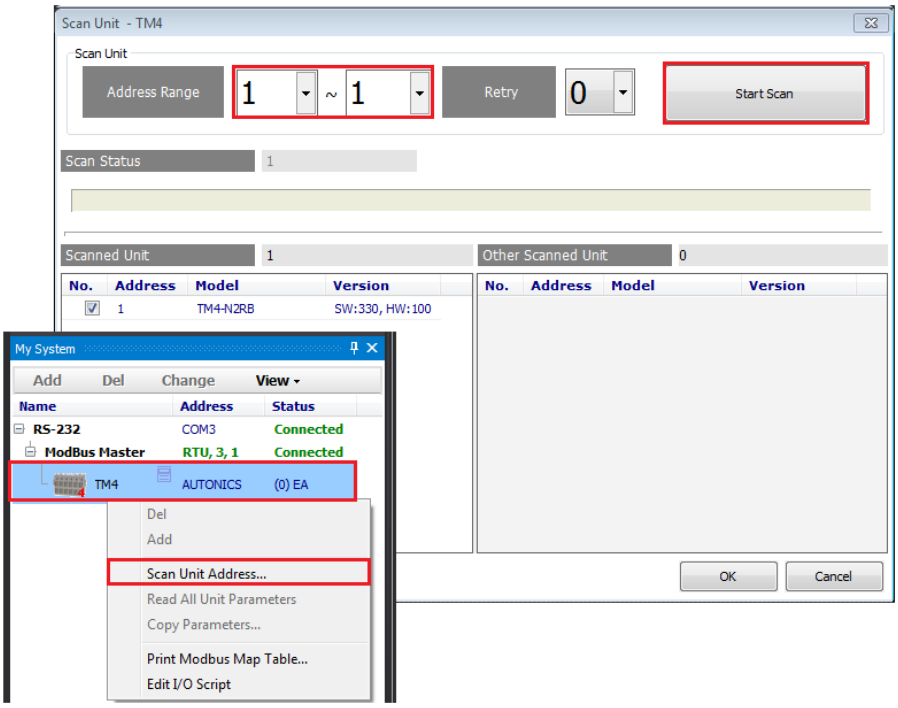
4th Once the communication settings have been set, start the communication interface by clicking the 'Connect' button in the [Project] - [Run] menu from the icon bar.



5th Then find your TM device by doing a right-click on the TM4 icon in the 'My System' archictecture tree and select 'Scan Unit Address…'. Click on 'Start Scan', select your TM device when the search is done and click 'OK'.

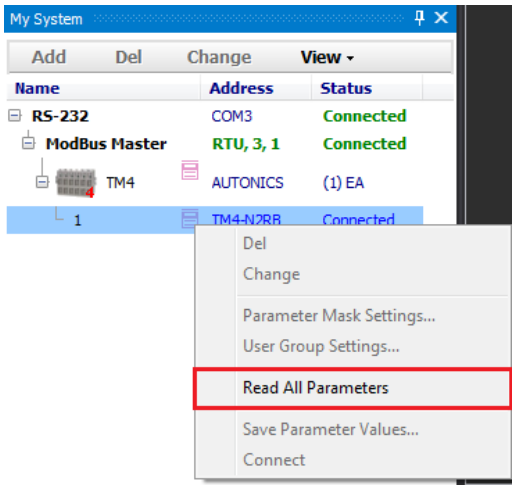
Rem:

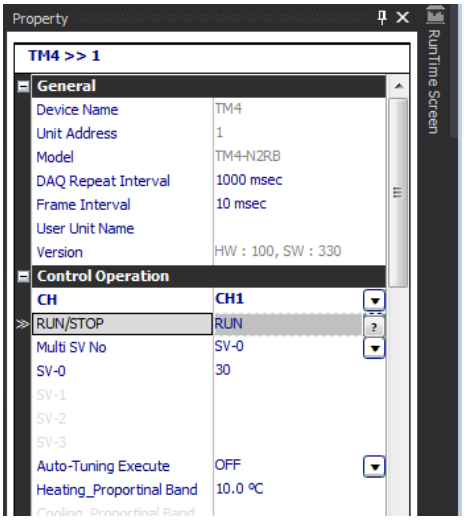
- search time can be reduced by changing searching range according to your device setting
- if using the SCM-US cable, all addresses can be used; set the range to 1~1.



6th Your TM device has been added to the system list. To have access to its parameters, click right on the device in the ‘My System’ architecture and select ‘Read All Parameters’.

When the synchronisation has been done, you can access and customize your device parameters in the ‘Property’ window at the left side of DAQ Master.





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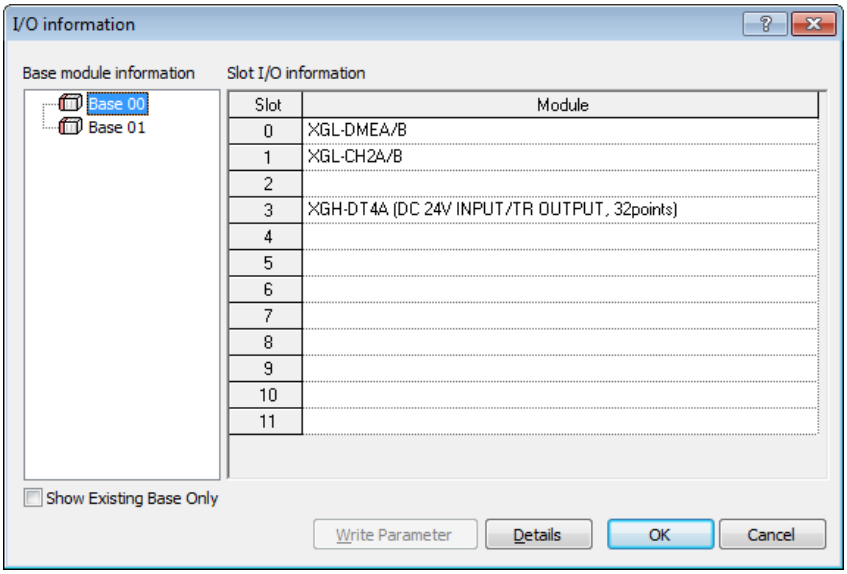
6 Troubleshooting

6.1 XG5000: I/O synchronization

❖ **Problem:**

There is no 'I/O Sync' button in the 'I/O information' window.



➢ **Solution:**

Please, stop the PLC processing by selecting [Online] – [Change Mode] – [Stop].

If you cannot stop the PLC with this method, change the 'RUN/STOP' switch of the PLC CPU from 'RUN' to 'STOP'.

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