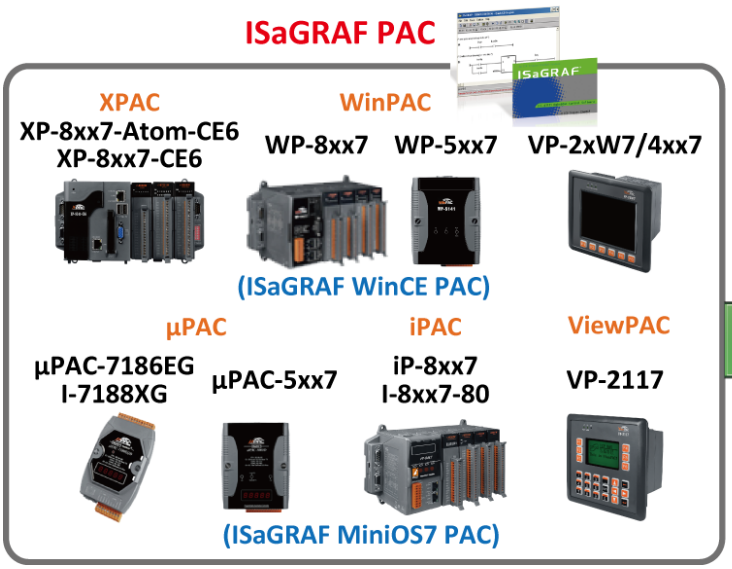
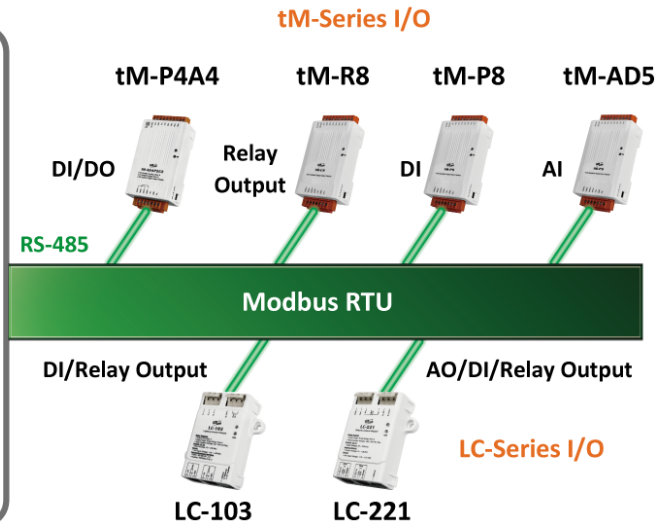
How to use the ISaGRAF PAC to control the tM-series and LC-series Modbus I/O Modules?





ICP DAS ISaGRAF PACs support Modbus RTU protocol that allows the tM-series and LC-series I/O modules control through RS-485 serial bus. The tM-series tiny RS-485 I/O modules support various I/O types, like photo-isolated digital input, relay contact, photoMOS relay, and open-collector output, etc. The LC-series I/O modules are lighting control modules.

Please refer to the website for more information about tM-series and LC-series I/O modules:

www.icpdas.com > Product > Solutions > Remote I/O... > tM Series Modules

www.icpdas.com > Product > Solutions > Remote I/O... > LC Series Modules

Note: **Recommended that No connect more than 12 Modbus I/O modules via one Modbus RTU Port to reduce the scan time. It's better to enable two or more Modbus RTU Port of the ISaGRAF PAC for connecting many Modbus I/O modules.**

For more about the ways to enable the Modbus RTU Master Port, please refer to www.icpdas.com > Soft PLC ISaGRAF... > ISaGRAF > Manual > "ISaGRAF User's Manual" Chapter8 or www.icpdas.com > Support > FAQ > ISaGRAF Soft-Logic PAC FAQ-47, 75, 113, 161

1.1. Download Demo Programs and Documents

The following ISaGRAF driver versions support the tM-series and LC-series I/O modules.

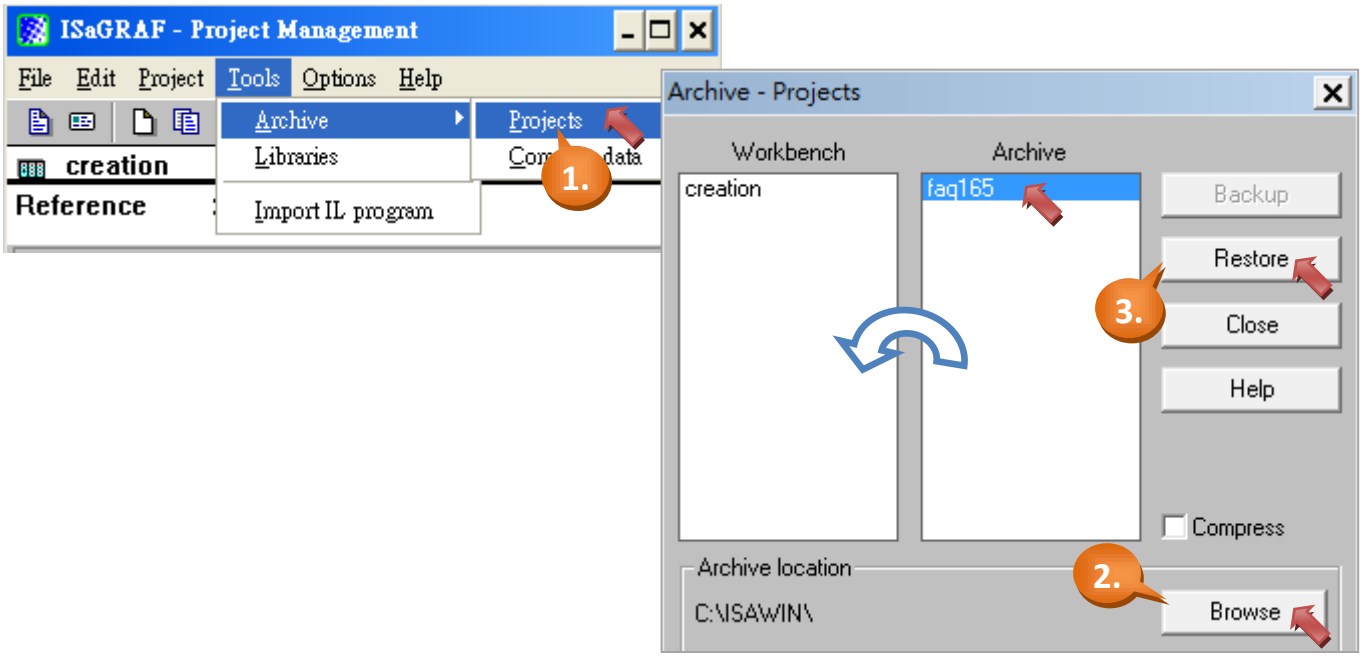
ISaGRAF PAC	ISaGRAF Driver Version	ISaGRAF PAC	ISaGRAF Driver Version
WinCE PAC:		***MiniOS7 PAC:***	
XP-8xx7-CE6	Ver. 1.37 or later	µPAC-7186EG	Ver. 1.20 or later
XP-8xx7-Atom-CE6	Ver. 1.01 or later	I-7188XG	Ver. 3.18 or later
WP-8xx7	Ver. 1.57 or later	µPAC-5x07	Ver. 1.01 or later
WP-5147	Ver. 1.03 or later	iP-8xx7	Ver. 1.17 or later
VP-2xW7/4xx7	Ver. 1.43 or later	I-8xx7-80	Ver. 4.22 or later
		VP-2117	Ver. 1.01 or later

Download the ISaGRAF Driver:
If your driver version is the earlier one, you may download the new ISaGRAF Driver from www.icpdas.com > Soft PLC ISaGRAF... > Driver and then follow the attached document to update it to your ISaGRAF PAC.

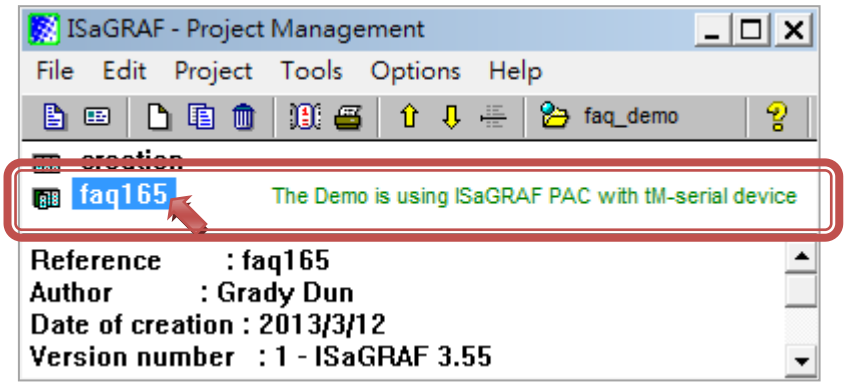
Download the ISaGRAF Demo Project:
This paper is the ISaGRAF FAQ-165. User can download the document and ISaGRAF demo (faq165.pia) from www.icpdas.com > Support > FAQ > ISaGRAF Soft-Logic PAC **> 165**

1.2. Restore Demo Program

Restore the ISaGRAF Demo Program:
After downloading the ISaGRAF demo program (faq165.pia), users need to restore it to the PC/ISaGRAF. Please follow the instructions as below:



(Mouse double-click the “faq165” to open this program.)

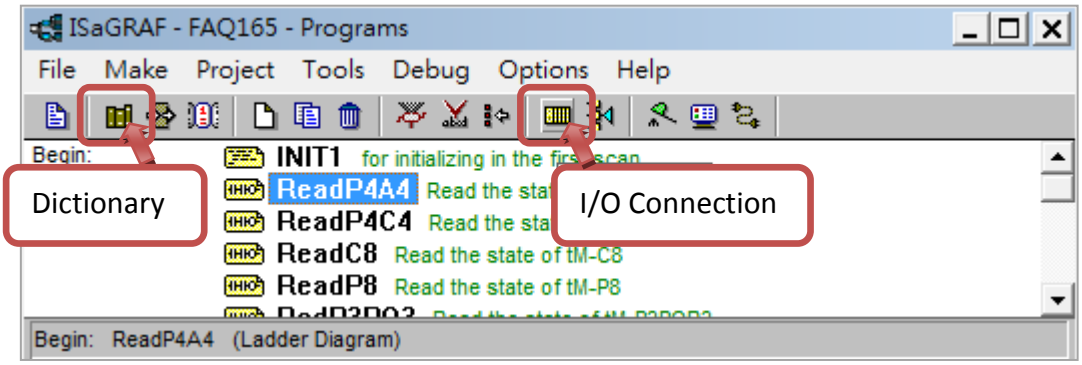


1.3. Description of ISaGRAF Program

This demo program (faq165.pia) provides read/write functions for various I/O modules. It allows the ISaGRAF PAC to control the tM-series and LC-series I/O modules via COM3 (RS-485).

Note: If the PAC’s COM3 is not a RS-485 port, please modify the ISaGRAF program to use other RS-485 port. For example, the COM2 of WP-5147.

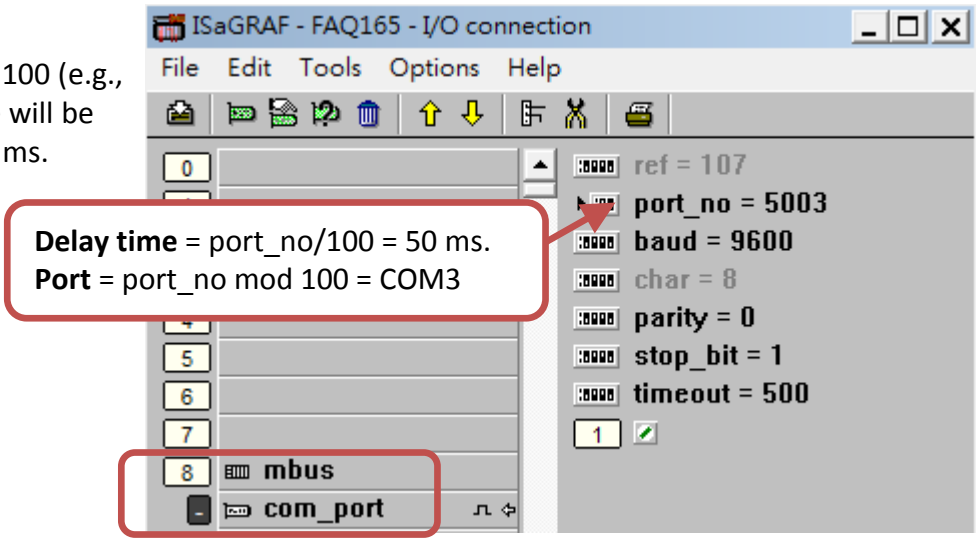
1.3.1. "I/O Connection" & ISaGRAF Variables :



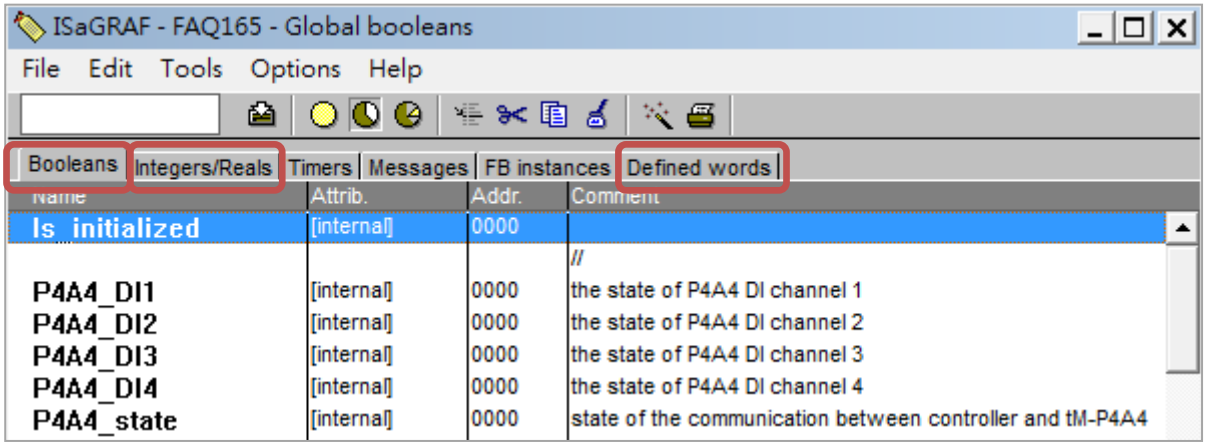
1. Click "I/O Connection" to see the I/O feature.

2. Using the "mbus" feature to enable the Modbus Master Port. In this example, the ISaGRAF PAC uses COM3, the delay time between two Modbus commands is 50 ms and the baud rate is 9600.

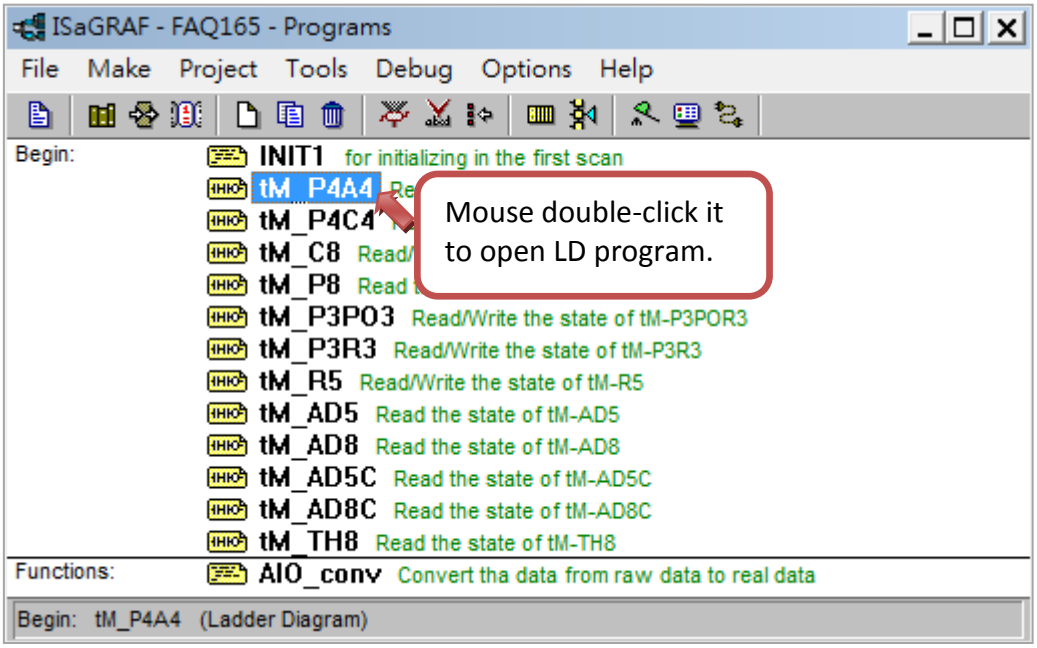
Note:
If the "port_no" is less than 100 (e.g., port_no = 2), the delay time will be set as the default value 100 ms.



3. Click "Dictionary" (figure 1) to see the ISaGRAF Variables in this program.



1.3.2. Demo program (faq165.pia):



LD program:

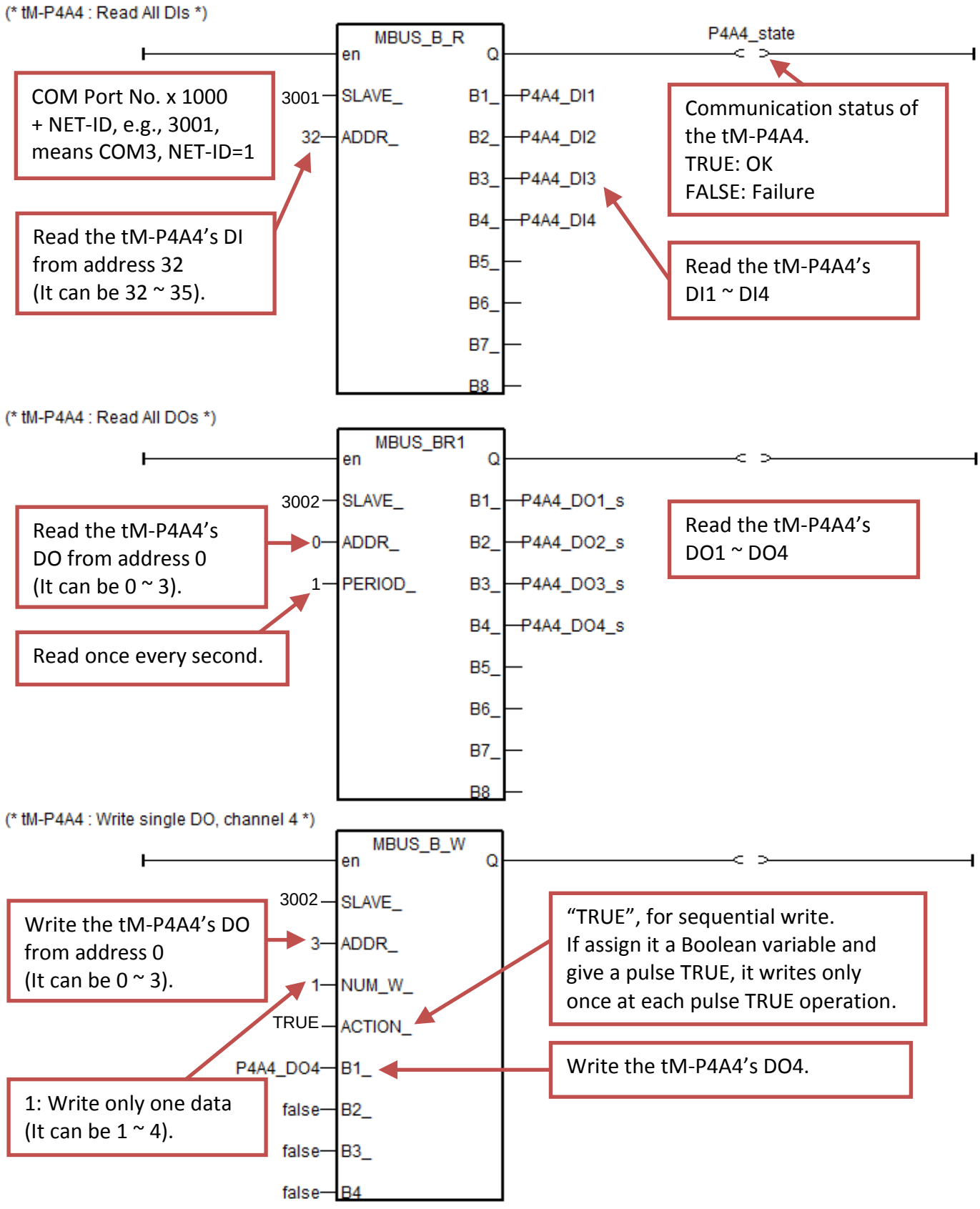
This program (faq165.pia) provides the read/write functions for various I/O modules. Users can open each program to see the detailed content.

tM-series and LC-series I/O modules :

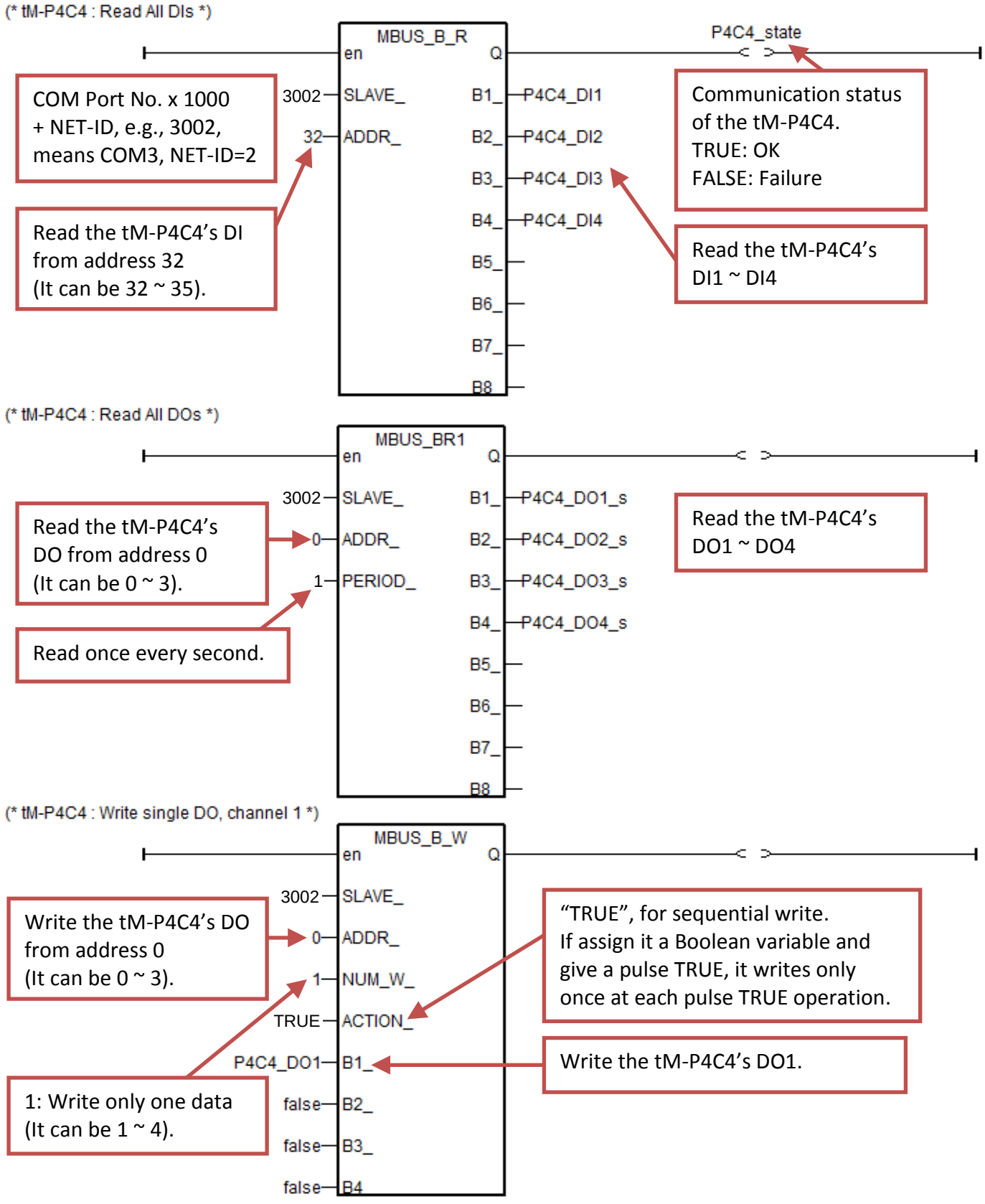
www.icpdas.com > Product > Solutions > Remote I/O... > tM series Modules/ LC series Modules

Model	AI	AO	DI	DO	Relay Output
	Channels (Corresponding Address)				
tM-P4A4	-	-	4 (Addr. 32~35)	4 (Addr. 0~3)	-
tM-P4C4			4 (Addr. 32~35)	4 (Addr. 0~3)	
tM-C8			-	8 (Addr. 0~7)	
tM-P8			8 (Addr. 32~39)	-	
tM- P3POR3			3 (Addr. 32~34)	-	3 (Addr. 0~2)
tM-P3R3			3 (Addr. 32~34)		3 (Addr. 0~2)
tM-R5			-		5 (Addr. 0~4)
tM-AD5	5 (Addr. 0~4)	-	-	-	-
tM-AD8	8 (Addr. 0~7)				
tM-AD5C	5 (Addr. 0~4)				
tM-AD8C	8 (Addr. 0~7)				
tM-TH8	8 (Addr. 0~7)				
LC-103	-	-	1	-	3 (Addr. 0~2)
LC-221	-	1 (Addr. 32)	1	-	1 (Addr. 0)

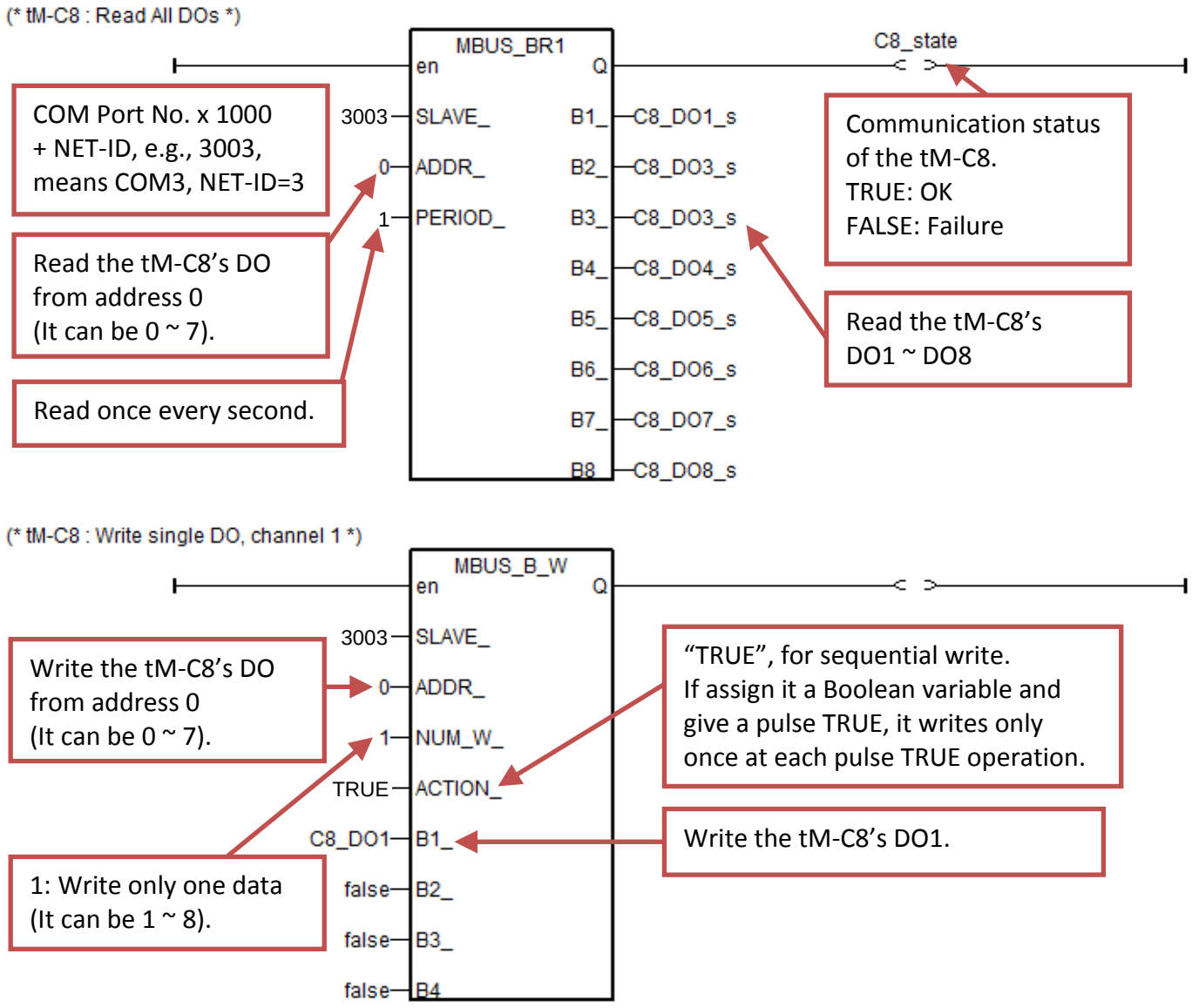
tM_P4A4 (4 DI, 4 DO)



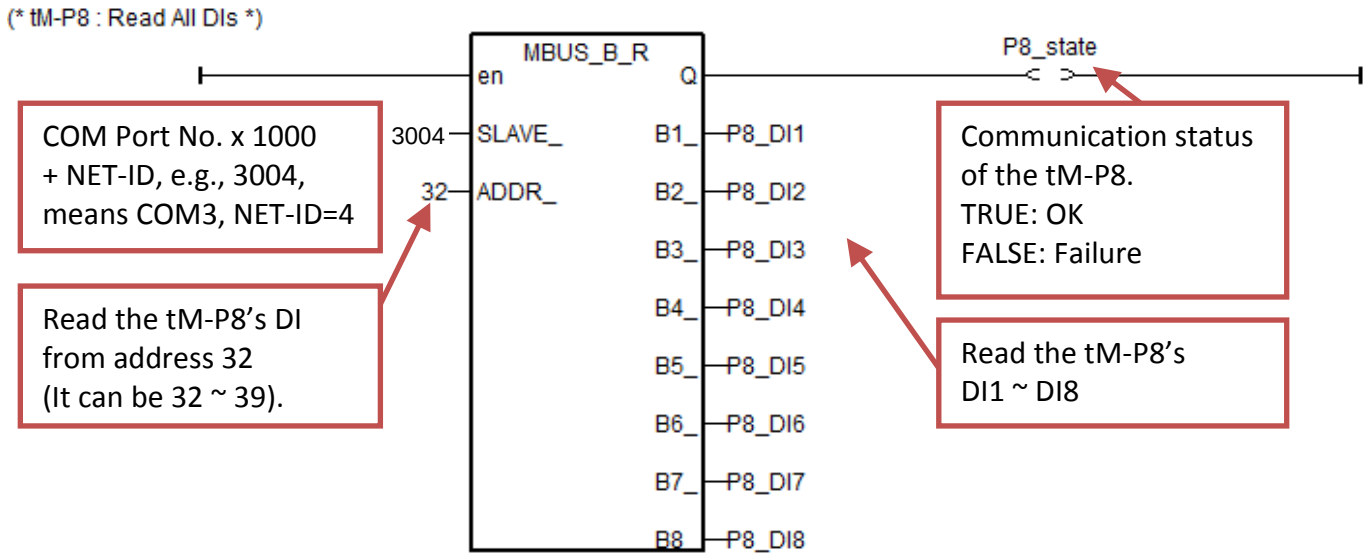
tM_P4C4 (4 DI, 4 DO)



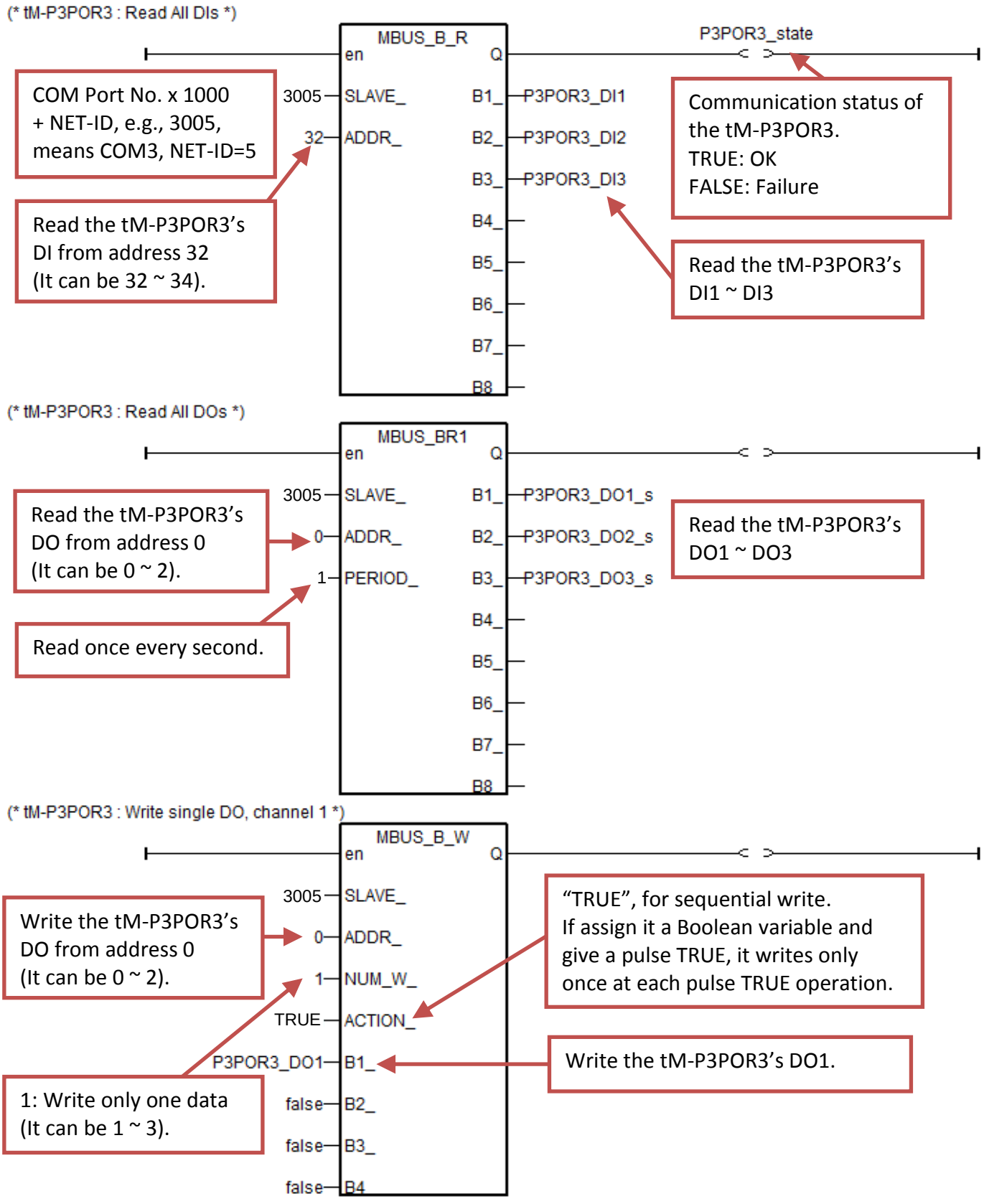
tM_C8 (8 DO)


(* tM-C8 : Read All DOs *)
MBUS_BR1
en
Q
C8_state
3003
SLAVE_
0
ADDR_
1
PERIOD_
B1_
C8_DO1_s
B2_
C8_DO3_s
B3_
C8_DO3_s
B4_
C8_DO4_s
B5_
C8_DO5_s
B6_
C8_DO6_s
B7_
C8_DO7_s
B8
C8_DO8_s
COM Port No. x 1000 + NET-ID, e.g., 3003, means COM3, NET-ID=3
Read the tM-C8's DO from address 0 (It can be 0 ~ 7).
Read once every second.
Communication status of the tM-C8. TRUE: OK FALSE: Failure
Read the tM-C8's DO1 ~ DO8
(* tM-C8 : Write single DO, channel 1 *)
MBUS_B_W
en
Q
3003
SLAVE_
0
ADDR_
1
NUM_W_
TRUE
ACTION_
C8_DO1
B1_
false
B2_
false
B3_
false
B4
Write the tM-C8's DO from address 0 (It can be 0 ~ 7).
1: Write only one data (It can be 1 ~ 8).
"TRUE", for sequential write. If assign it a Boolean variable and give a pulse TRUE, it writes only once at each pulse TRUE operation.
Write the tM-C8's DO1.

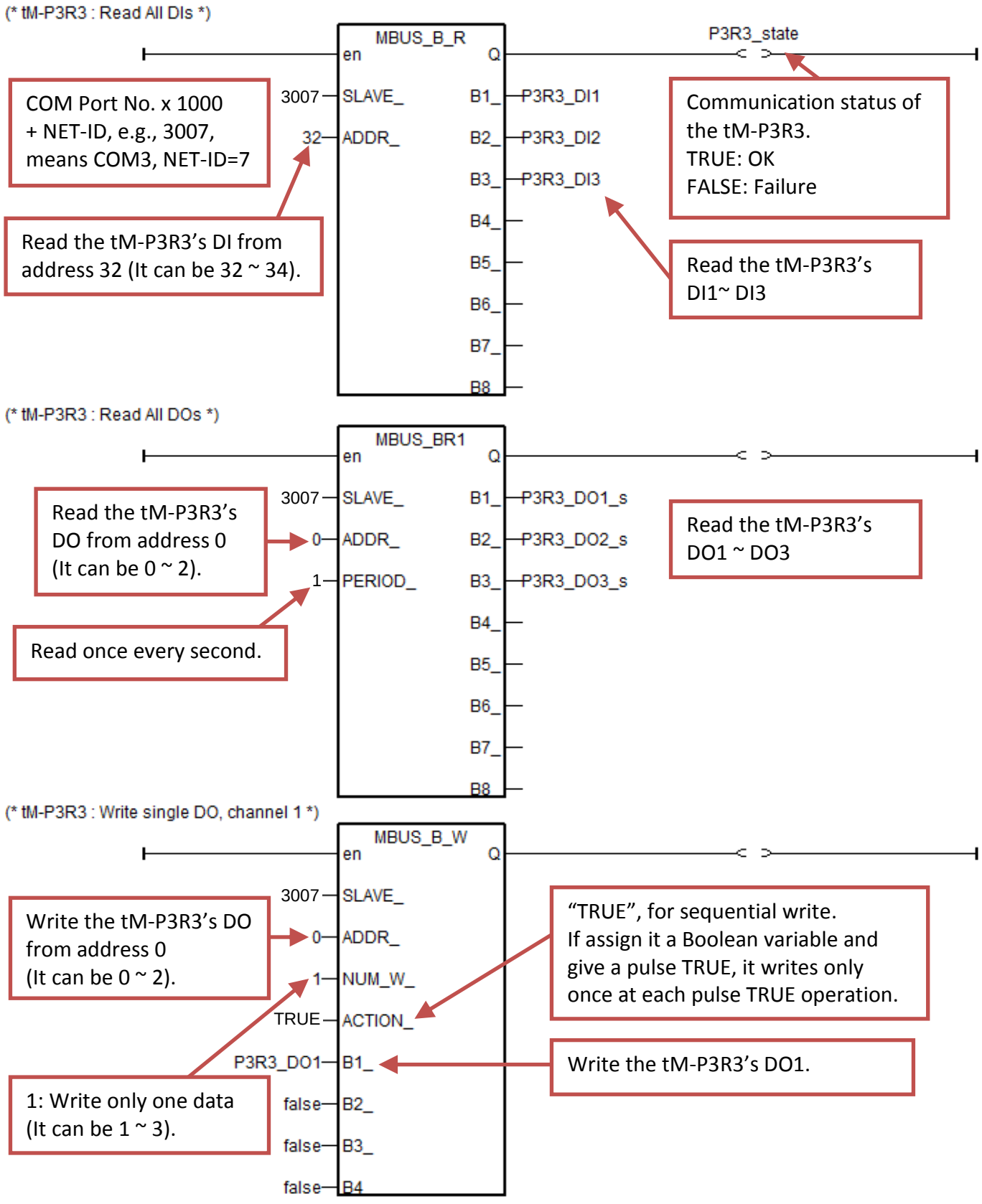
tM_P8 (8 DI)


(* tM-P8 : Read All DIs *)
MBUS_B_R
en
Q
P8_state
3004
SLAVE_
32
ADDR_
B1_
B2_
B3_
B4_
B5_
B6_
B7_
B8
P8_DI1
P8_DI2
P8_DI3
P8_DI4
P8_DI5
P8_DI6
P8_DI7
P8_DI8
COM Port No. x 1000 + NET-ID, e.g., 3004, means COM3, NET-ID=4
Read the tM-P8's DI from address 32 (It can be 32 ~ 39).
Communication status of the tM-P8. TRUE: OK FALSE: Failure
Read the tM-P8's DI1 ~ DI8

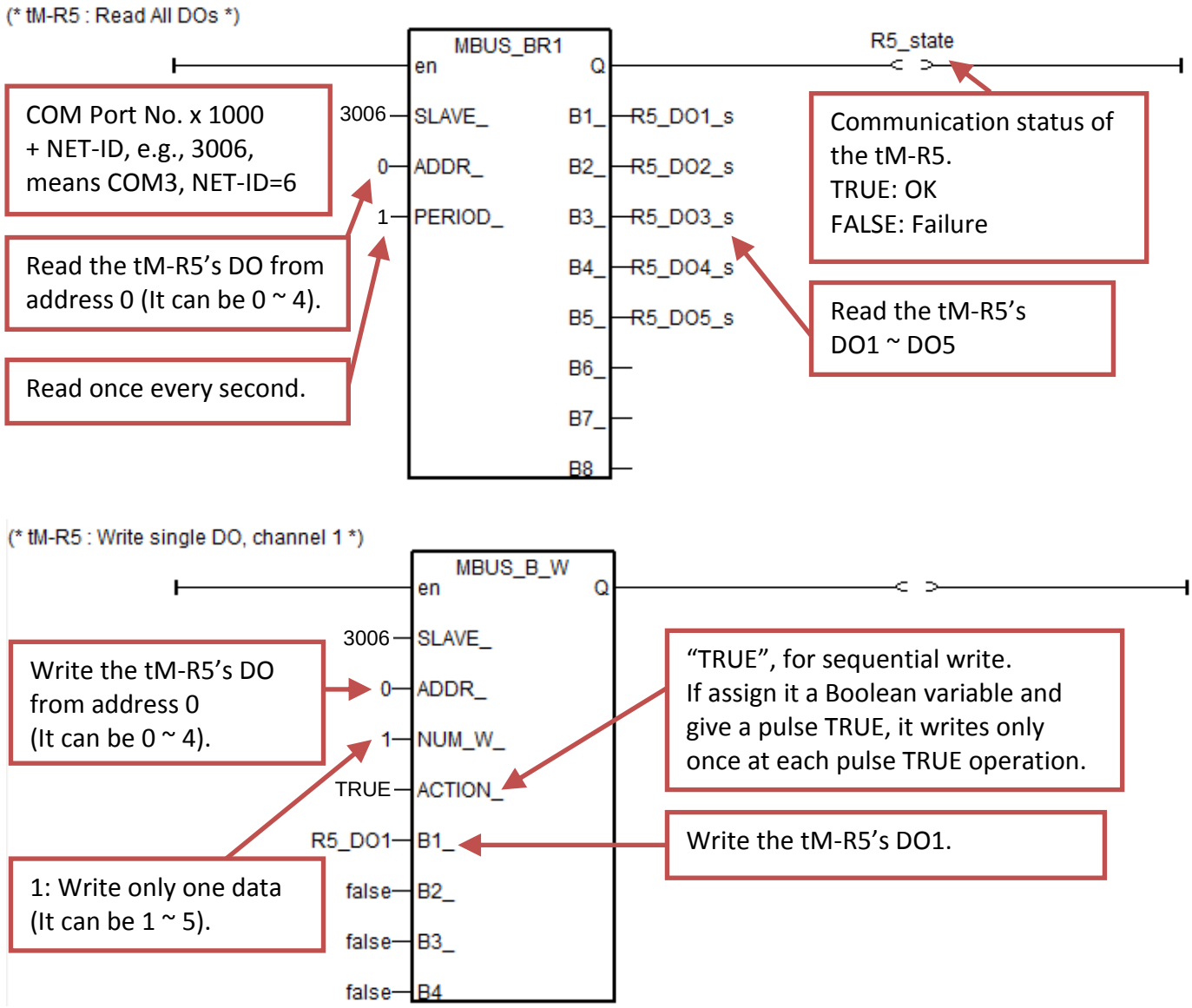
tM_P3POR3 (3 DI, 3 Relay Output)



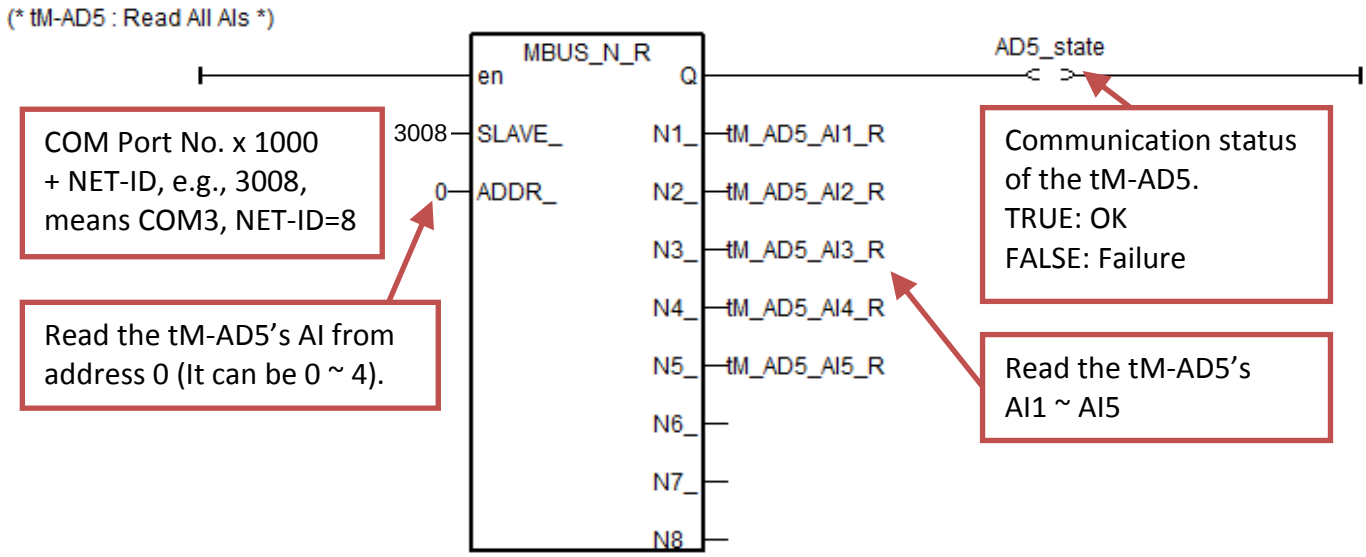
tM_P3R3 (3 DI, 3 Relay Output)



tM_R5 (5 Relay Output)



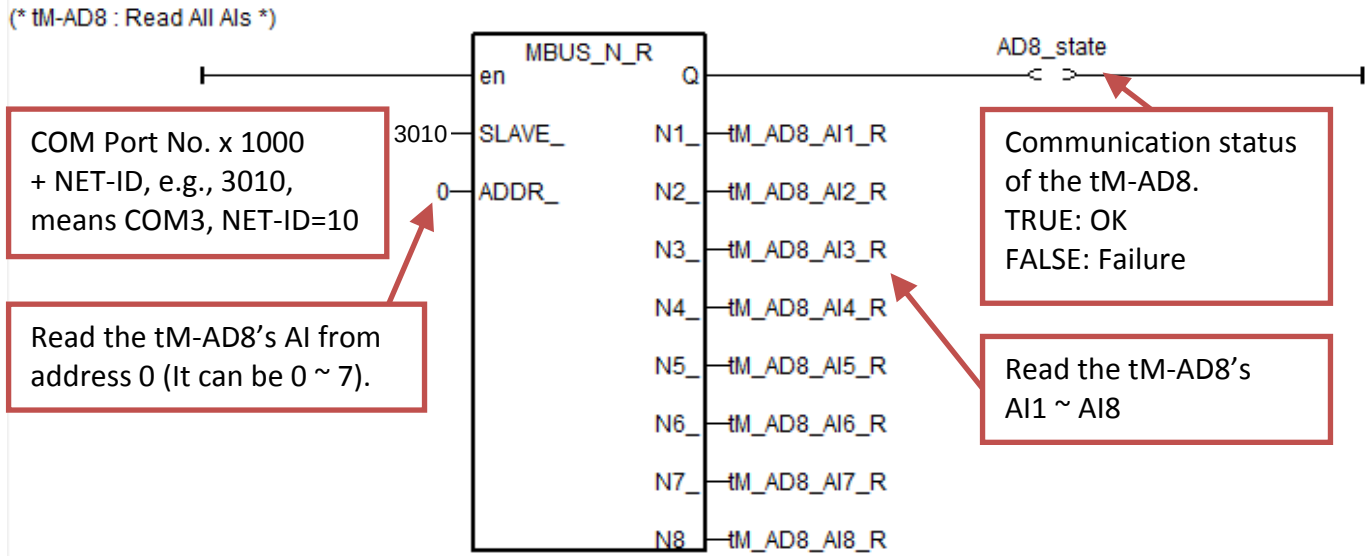
tM_AD5 (5 AI)



The AI values read from the tM-AD5 is associated with the "Type Code" and "Data Format" ("Engineering or 2's Complement") settings, please refer to section 1.4 Configure Information.

For example, if users set the tM-AD5's "Type Code" as "8" and set the data format as "Engineering", the AI values on the right side of the "MBUS_N_R" is -10000 ~ 10000 (means "-10 V ~ +10 V").

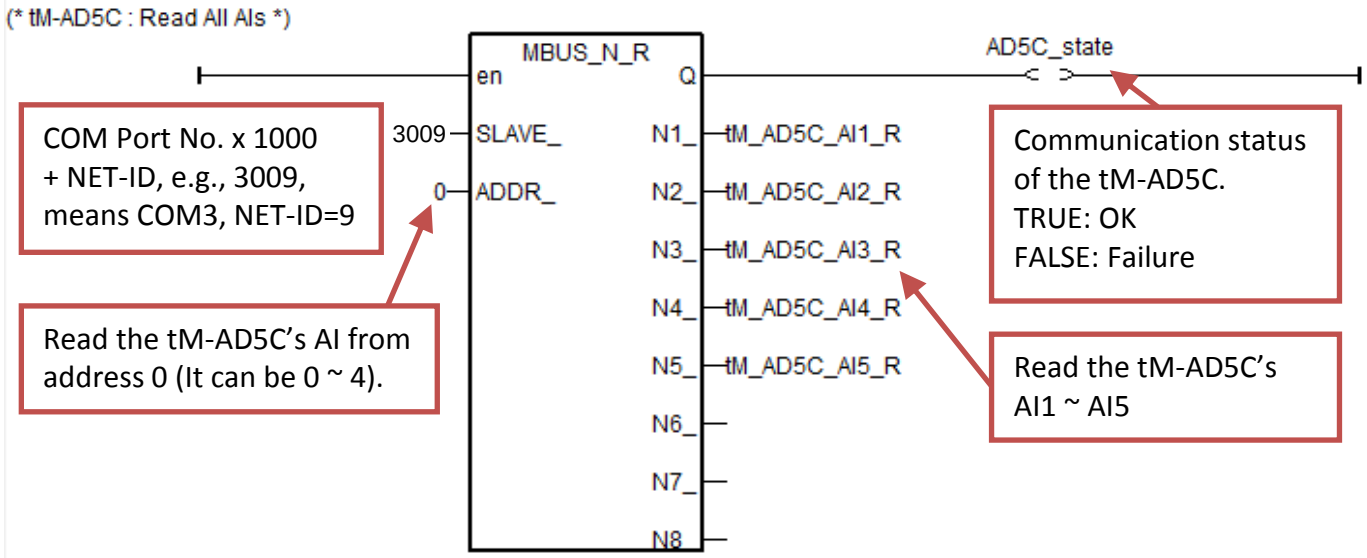
tM_AD8 (8 AI)



The AI values read from the tM-AD8 is associated with the "Type Code" and "Data Format" ("Engineering or 2's Complement") settings, please refer to section 1.4 Configure Information.

For example, if users set the tM-AD8's "Type Code" as "8" and set the data format as "Engineering", the AI values on the right side of the "MBUS_N_R" is -10000 ~ 10000 (means "-10 V ~ +10 V").

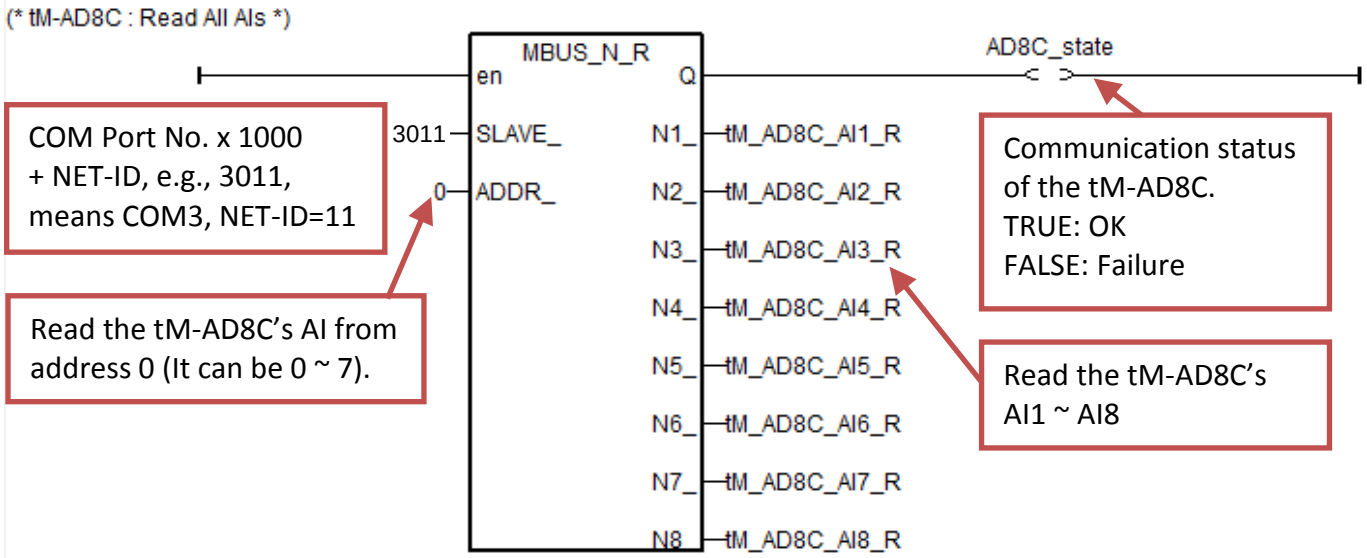
tM_AD5C (5 AI)



The AI values read from the tM-AD5C is associated with the "Type Code" and "Data Format" ("Engineering or 2's Complement") settings, please refer to section 1.4 Configure Information.

For example, if users set the tM-AD5C's "Type Code" as "26" (Hex. = 1A) and set the data format as "Engineering", the AI values on the right side of the "MBUS_N_R" is 0 ~ 20000 (means "0 ~ +20 mA").

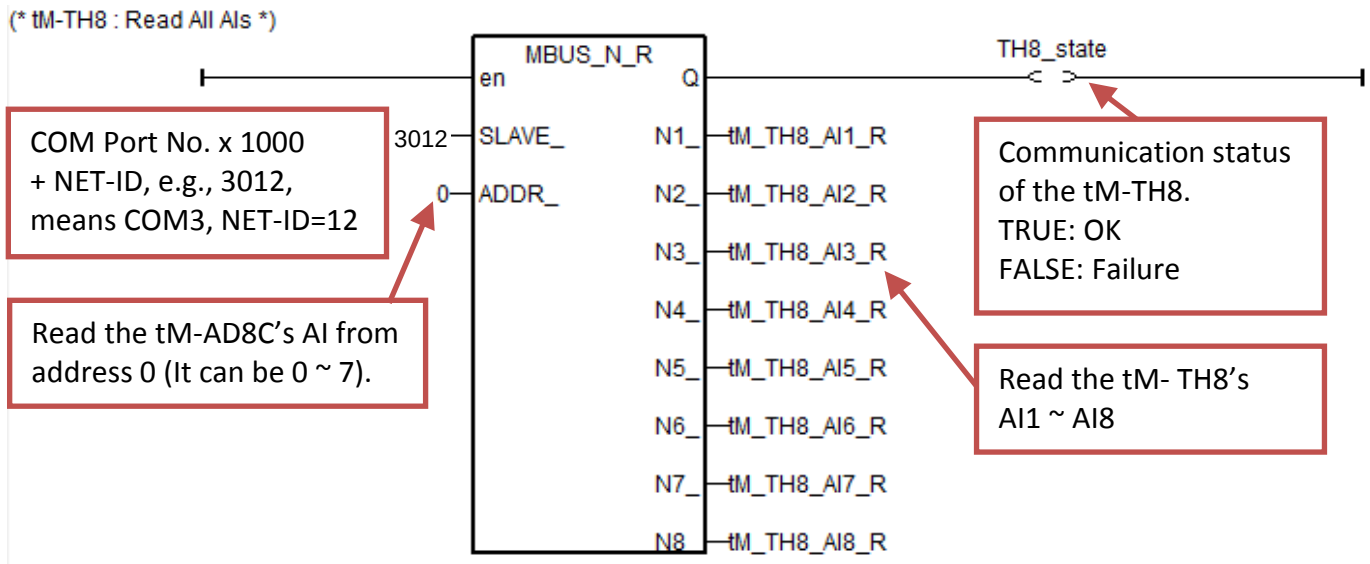
tM_AD8C (8 AI)



The AI values read from the tM-AD8C is associated with the "Type Code" and "Data Format" ("Engineering or 2's Complement") settings, please refer to section 1.4 Configure Information.

For example, if users set the tM-AD8C's "Type Code" as "13" (Hex. = 0D) and set the data format as "Engineering", the AI values on the right side of the "MBUS_N_R" is -20000 ~ 20000 (means "-20 mA ~ +20 mA").

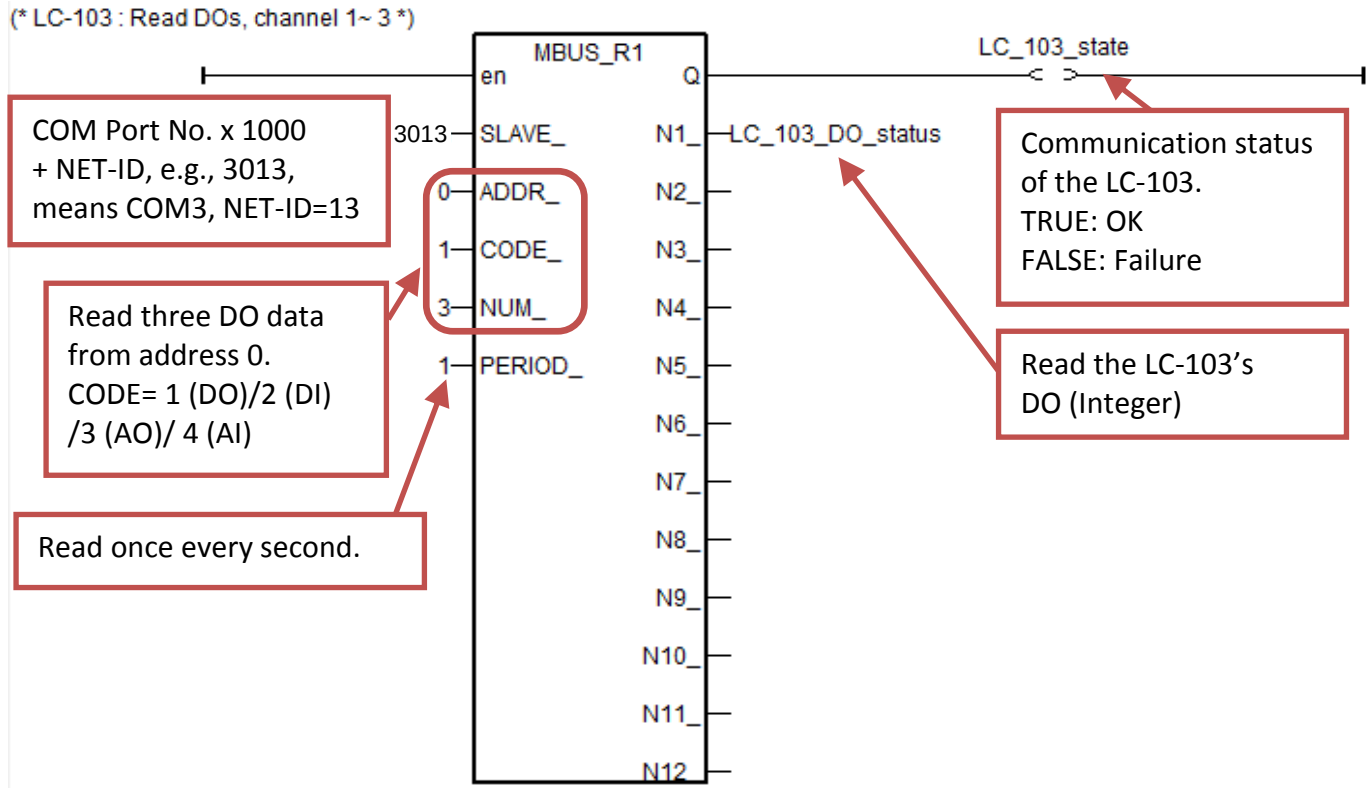
tM_TH8 (8 AI)

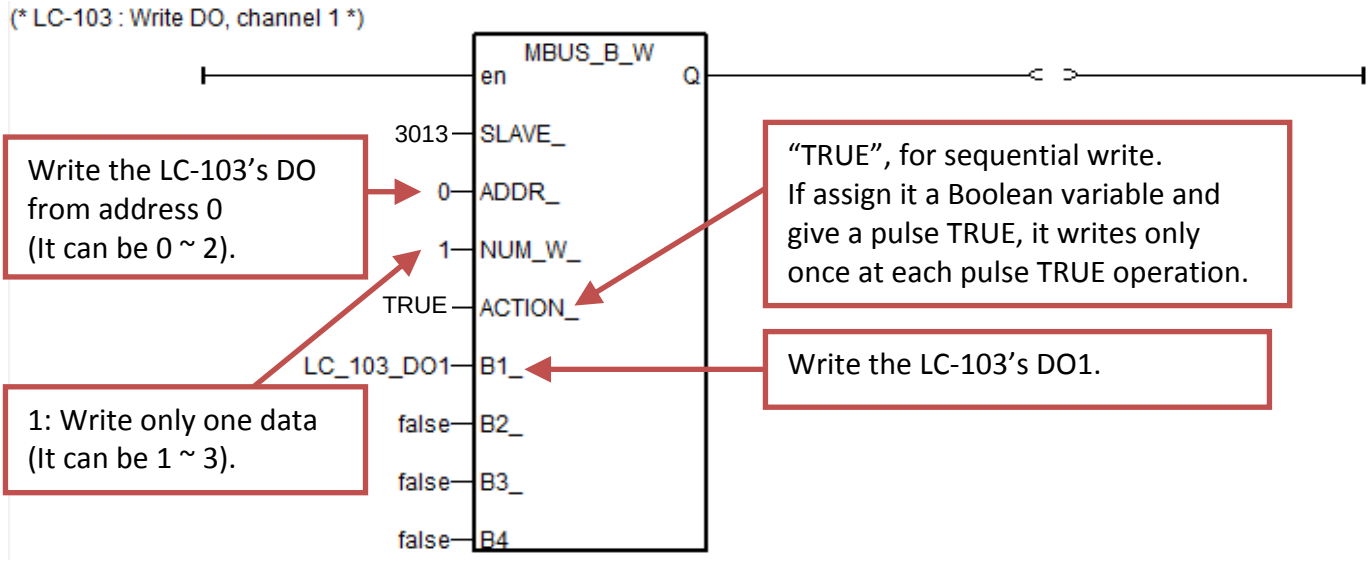


The AI values read from the tM-TH8 is associated with the "Type Code" and "Data Format" ("Engineering or 2's Complement") settings, please refer to section 1.4 Configure Information.

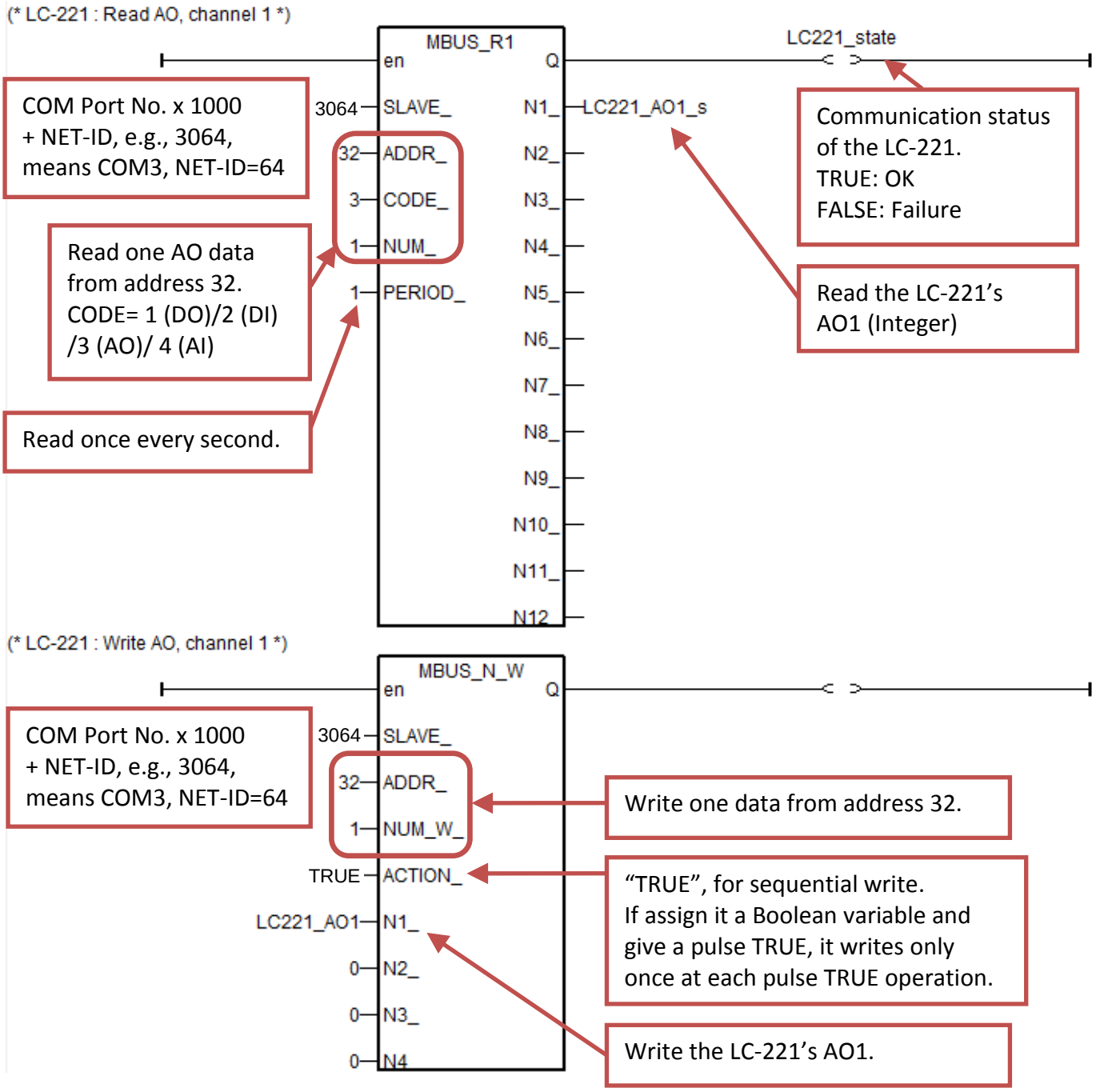
For example, if users set the tM- TH8's "Type Code" as "96" (Hex. = 60) and set the data format as "Engineering", the AI values on the right side of the "MBUS_N_R" is -3000 ~ +24000 (means "-30 ~ 240 °F ").

LC_103 (1 DI, 3 Relay Output)



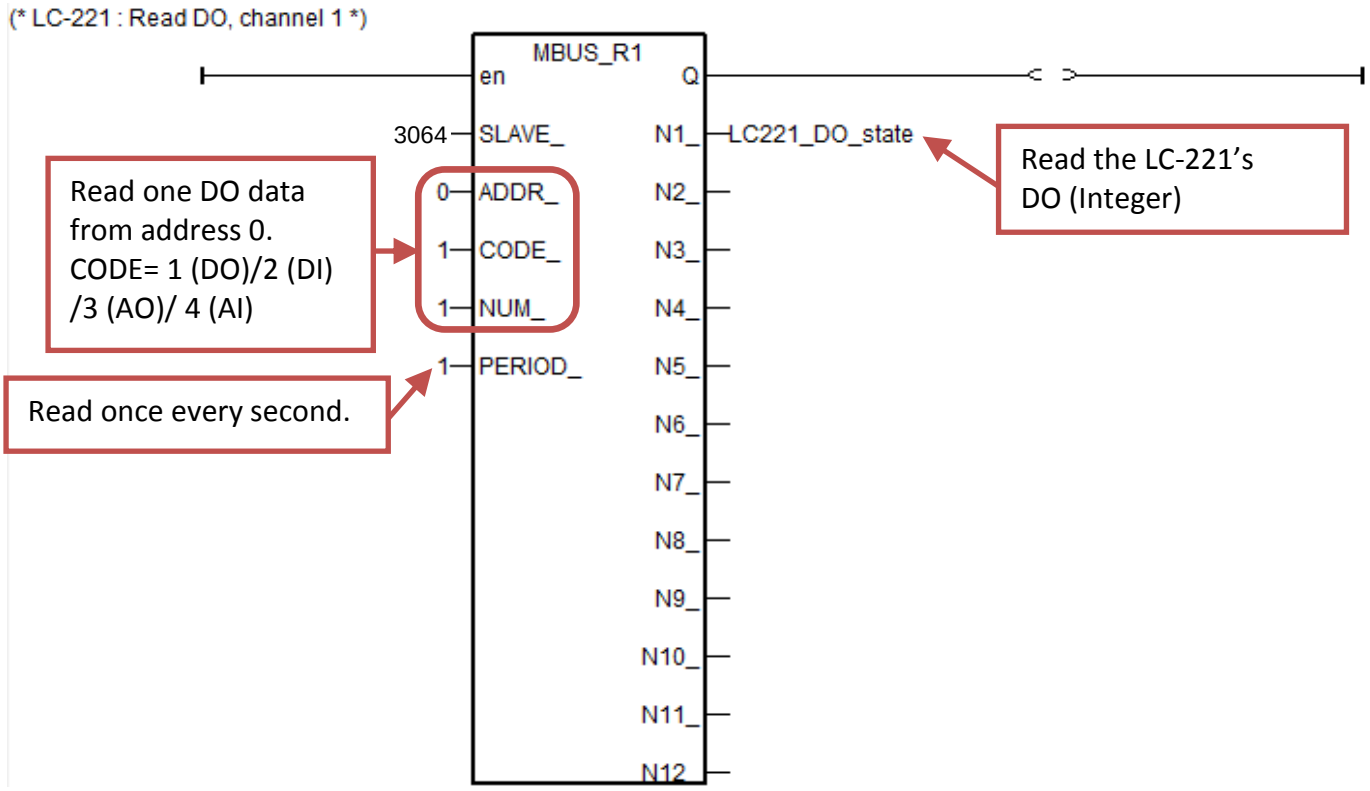


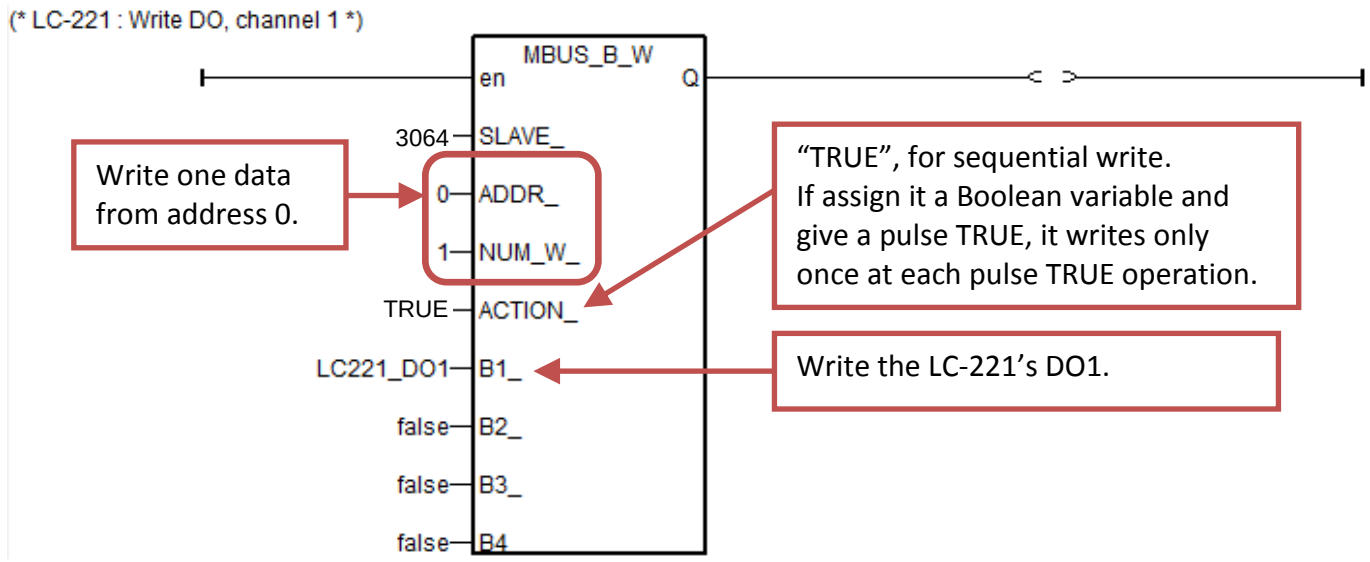
LC_221 (1 AO, 1 DI, 1 Relay Output)



The read/write AO values of the LC-221 is associated with the "Type Code" and "Data Format" ("Engineering or 2's Complement") settings, please refer to section 1.4 Configure Information.

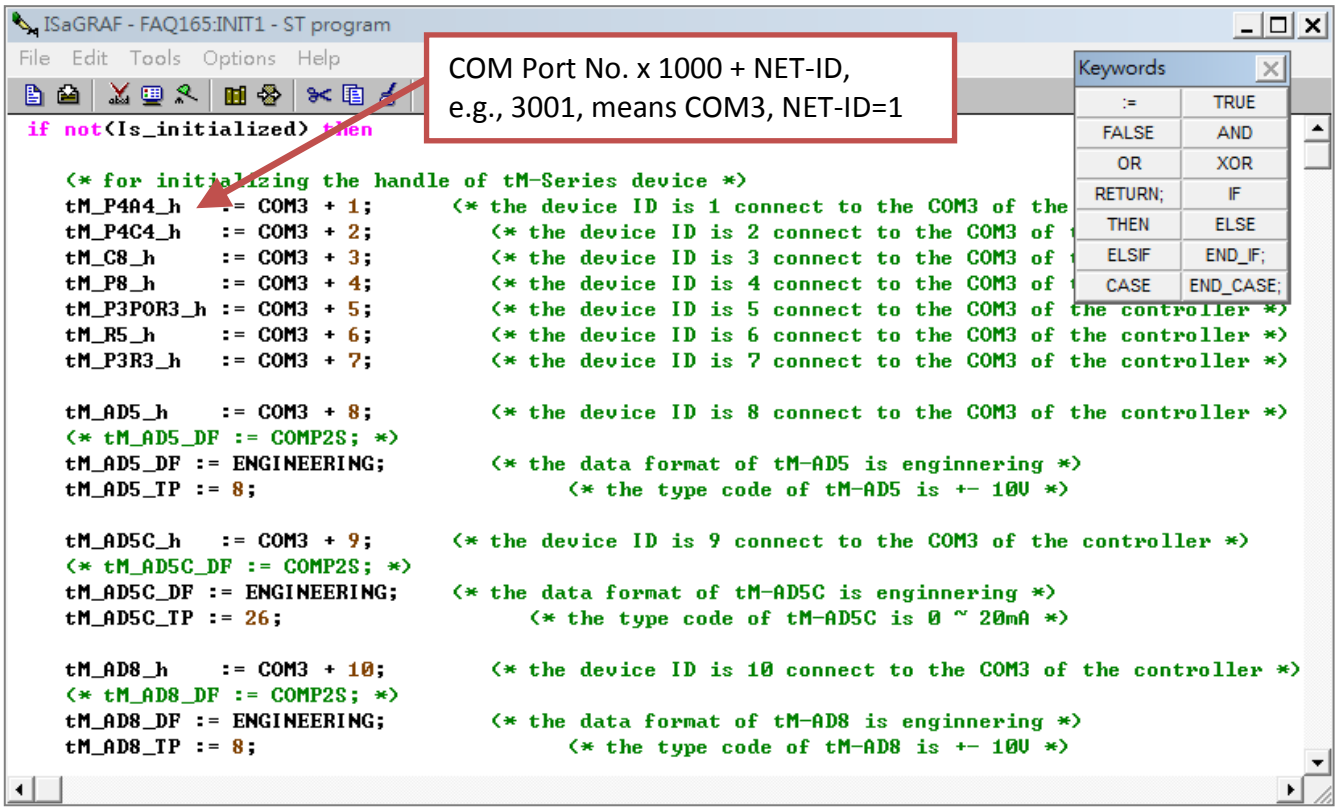
For example, if users set the LC-221's "Type Code" as "2" and set the data format as "Engineering", the AO values on the right side of the "MBUS_N_R", or on the left side of the "MBUS_N_W" is 0 ~ 10000 (means "0 ~ 10 V ").


(* LC-221 : Read DO, channel 1 *)
MBUS_R1
en
Q
3064
SLAVE_
N1_
LC221_DO_state
Read the LC-221's DO (Integer)
Read one DO data from address 0. CODE= 1 (DO)/2 (DI) /3 (AO)/ 4 (AI)
0
ADDR_
1
CODE_
1
NUM_
1
PERIOD_
Read once every second.
N2_
N3_
N4_
N5_
N6_
N7_
N8_
N9_
N10_
N11_
N12


(* LC-221 : Write DO, channel 1 *)
MBUS_B_W
en
Q
3064
SLAVE_
Write one data from address 0.
0
ADDR_
1
NUM_W_
"TRUE", for sequential write.
If assign it a Boolean variable and give a pulse TRUE, it writes only once at each pulse TRUE operation.
TRUE
ACTION_
LC221_DO1
B1_
Write the LC-221's DO1.
false
B2_
false
B3_
false
B4

ST program:

The “INIT1” program defines all the initialization conditions of the tM-series and LC-series I/O modules.



1.4. Configuration Information

LC Series I/O

Please refer to LC-103 or LC-221 User Manual for more configuration information.

www.icpdas.com > Product > Solutions > RS-485 Remote I/O... > LC series Modules > Lighting Control > Manual LC-103 User Manual

www.icpdas.com > Product > Solutions > RS-485 Remote I/O... > LC series Modules > Dimmer Control > Manual LC-221 User Manual

Type Code	Output Range	Data Format	
		Engineering	2's comp (Hex.)
0	0 ~ 20 mA	0 ~ 20000	0000 ~ FFFF
1	4 ~ 20 mA	4000 ~ 20000	0000 ~ FFFF
2	0 ~ 10 V	0 ~ 10000	0000 ~ FFFF
4	0 ~ 5 V	0 ~ 5000	0000 ~ FFFF

tM Series I/O

Please refer to them-AD or TM-DIO series manual for more configuration information.

www.icpdas.com > Product > Solutions > Remote I/O... > tM series Modules > Analog I/O > Manual

www.icpdas.com > Product > Solutions > Remote I/O... > tM series Modules > Digital I/O > Manual

Type Code (Hex.)	Input Type	Data Format	
		Engineering	2's comp (Hex.)
05*1	-2.5 V ~ +2.5 V	-25000 ~ 25000	8000 ~ 7FFF
06*3	-20 mA ~ +20 mA	-20000 ~ 20000	8000 ~ 7FFF
07*3	+4 mA ~ +20 mA	4000 ~ 20000	0000 ~ FFFF
08*1	-10 V ~ +10 V	-10000 ~ 10000	8000 ~ 7FFF
09*1	-5 V ~ +5 V	-5000 ~ 5000	8000 ~ 7FFF
0A*1	-1 V ~ +1 V	-10000 ~ 10000	8000 ~ 7FFF
0B*2	-500 mV ~ +500 mV	-5000 ~ 5000	8000 ~ 7FFF
0D*3	-20 mA ~ +20 mA	-20000 ~ 20000	8000 ~ 7FFF
1A*3	0 ~ +20 mA	0 ~ 20000	0000 ~ FFFF

*1: only available with the tM-AD5 and tM-AD8
*2: only available with the tM-AD8
*3: only available with the tM-AD5C and tM-AD8C.

tM Series Thermistor AI

Please refer to the website for more configuration information on tM-TH8.
http://www.icpdas.com/root/product/solutions/remote_io/rs-485/tm-series/tm-th8.html

Type Code (Hex.)	Thermistor Type	Data Format	
		Engineering	2's comp (Hex.)
60	-30 ~ 240°F PreCon Type III, 10K @ 25°C ;	-3000 ~ +24000	F000 ~ 7FFF
61	-50 ~ 150°C Fenwell U, 2K @ 25°C ;	-5000 ~ +15000	D556 ~ 7FFF
62	0 ~ 150°C Fenwell U, 2K @ 25°C	0 ~ +15000	0000 ~ 7FFF
63	-80 ~ 100°C YSI L Mix, 100 @ 25°C	-8000 ~ +10000	999A ~ 7FFF
64	-80 ~ 100°C YSI L Mix, 300 @ 25°C ;	-8000 ~ +10000	999A ~ 7FFF
65	-70 ~ 100°C YSI L Mix, 1000 @ 25°C	-7000 ~ +10000	A667 ~ 7FFF
66	-50 ~ 150°C YSI B Mix, 2252 @ 25°C	-5000 ~ +15000	D556 ~ 7FFF
67	-40 ~ 150°C YSI B Mix, 3000 @ 25°C	-4000 ~ +15000	DDDE ~ 7FFF
68	-40 ~ 150°C YSI B Mix, 5000 @ 25°C	-4000 ~ +15000	DDDE ~ 7FFF
69	-30 ~ 150°C YSI B Mix, 6000 @ 25°C	-3000 ~ +15000	E667 ~ 7FFF
6A	-30 ~ 150°C YSI B Mix, 10K @ 25°C	-3000 ~ +15000	E667 ~ 7FFF
6B	-30 ~ 150°C YSI H Mix, 10K @ 25°C	-3000 ~ +15000	E667 ~ 7FFF
6C	-10 ~ 200°C YSI H Mix, 30K @ 25°C	-1000 ~ +20000	F99A ~ 7FFF
70 ~ 77	-50 ~ 150°C User-defined	-5000 ~ +15000	D556 ~ 7FFF