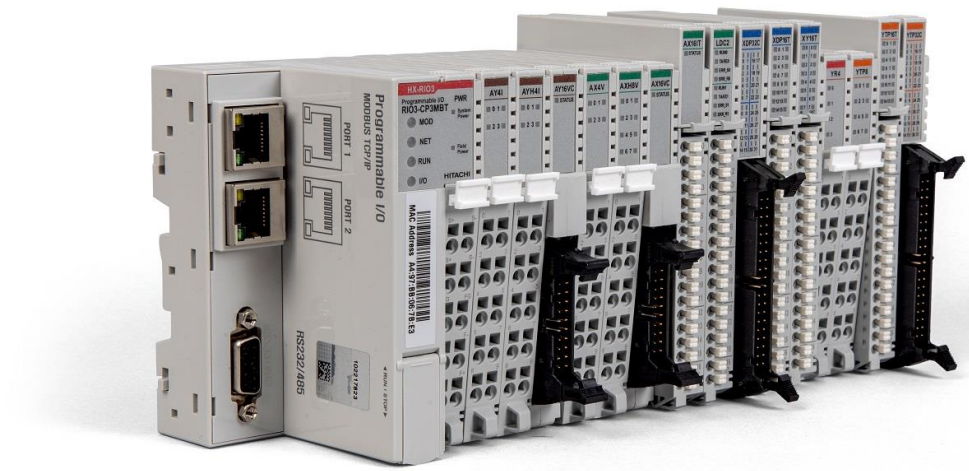
Special I/O Module

RIO3-RS232 & RIO3-RS485
User Manual



Version 1.00

HITACHI
Inspire the Next

REVISION HISTORY				
REV	**PAGE**	**REMARKS**	**DATE**	**EDITOR**
1.00		New Document	Nov 2020	(OPR), (PF)
1.00	35	Remove product list table and add a reference	Aug 2021	Faber
1.01	29, 30 14, 15	Added new section 4.3.6 & 4.3.7 “instructions to change I/O data size in xml” Added “Precautions for use” to RS232 & RS485 sections	May 2023	Lankala

Table of Contents

1 Important Notes

Solid state equipment has operational characteristics differing from those of electromechanical equipment.

Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls describes some important differences between solid state equipment and hard-wired electromechanical devices.

Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will HITACHI be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, HITACHI cannot assume responsibility or liability for actual use based on the examples and diagrams.

Warning!

- ✓ **If you don't follow the directions, it could cause a personal injury, damage to the equipmentor explosion**
- ✓ Do not assemble the products and wire with power applied to the system. Else it may cause an electric arc, which can result into unexpected and potentially dangerous action by field devices. Arching is explosion risk in hazardous locations. Be sure that the area is non-hazardous or remove system power appropriately before assembling or wiring the modules.
- ✓ Do not touch any terminal blocks or IO modules when system is running. Else it may cause the unit to an electric shock or malfunction.
- ✓ Keep away from the strange metallic materials not related to the unit and wiring works should be controlled by the electric expert engineer. Else it may cause the unit to a fire, electric shock or malfunction.

Caution!

- ✓ **If you disobey the instructions, there may be possibility of personal injury, damage to equipment or explosion. Please follow below Instructions.**
- ✓ Check the rated voltage and terminal array before wiring. Avoid the circumstances over 50℃ of temperature. Avoid placing it directly in the sunlight.
- ✓ Avoid the place under circumstances over 85% of humidity.
- ✓ Do not place Modules near by the inflammable material. Else it may cause a fire.
- ✓ Do not permit any vibration approaching it directly.
- ✓ Go through module specification carefully, ensure inputs, output connections are made with the specifications. Use standard cables for wiring.
- ✓ Use Product under pollution degree 2 environment.

1.1 Safety Instruction

1.1.1 Symbols

DANGER 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death property damage, or economic loss
IMPORTANT	Identifies information that is critical for successful application and understanding of the product
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury, property damage, or economic loss. Attentions help you to identity a hazard, avoid a hazard, and recognize the consequences

1.1.2 Safety Notes

DANGER 	The modules are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the modules, ensure that the environment (persons, workplace and packing) is well grounded. Avoid touching conductive components, RBUS Pin.

1.1.3 Certification

UL Listed Industrial Control Equipment, certified for U.S.

See UL File E196687

CE Certificate

EN 61000-6-2; Industrial Immunity

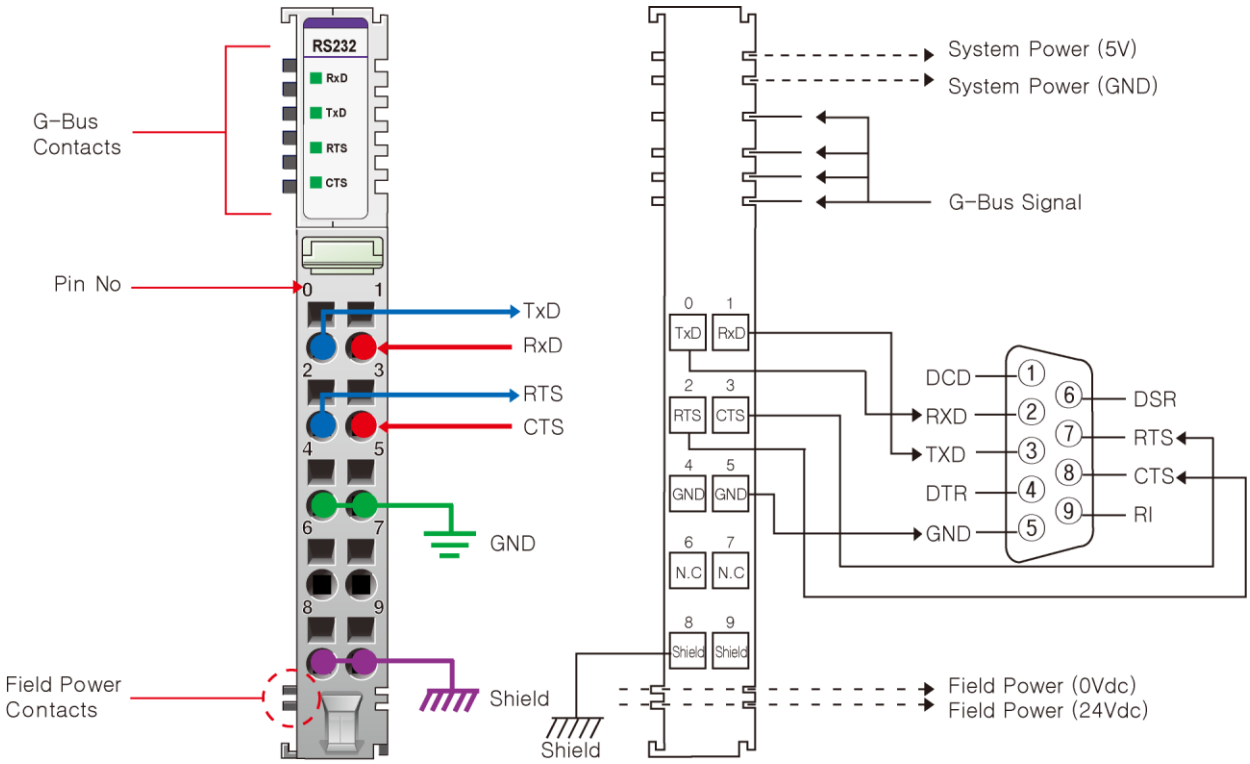
EN 61000-6-4; Industrial Emissions

Reach, RoHS (EU, CHINA), EAC

2 Specification

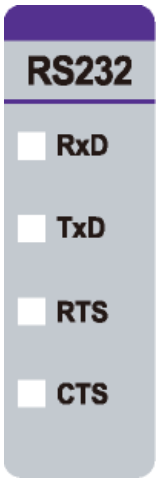
2.1 RIO3-RS232

2.1.1 Wiring Diagram



Pin No.	Signal Description	Signal Description	Pin No.
0	TxD	RxD	1
2	RTS	CTS	3
4	Common (GND)	Common (GND)	5
6	N.C	N.C	7
8	Shield	Shield	9

2.1.2 LED Indicator



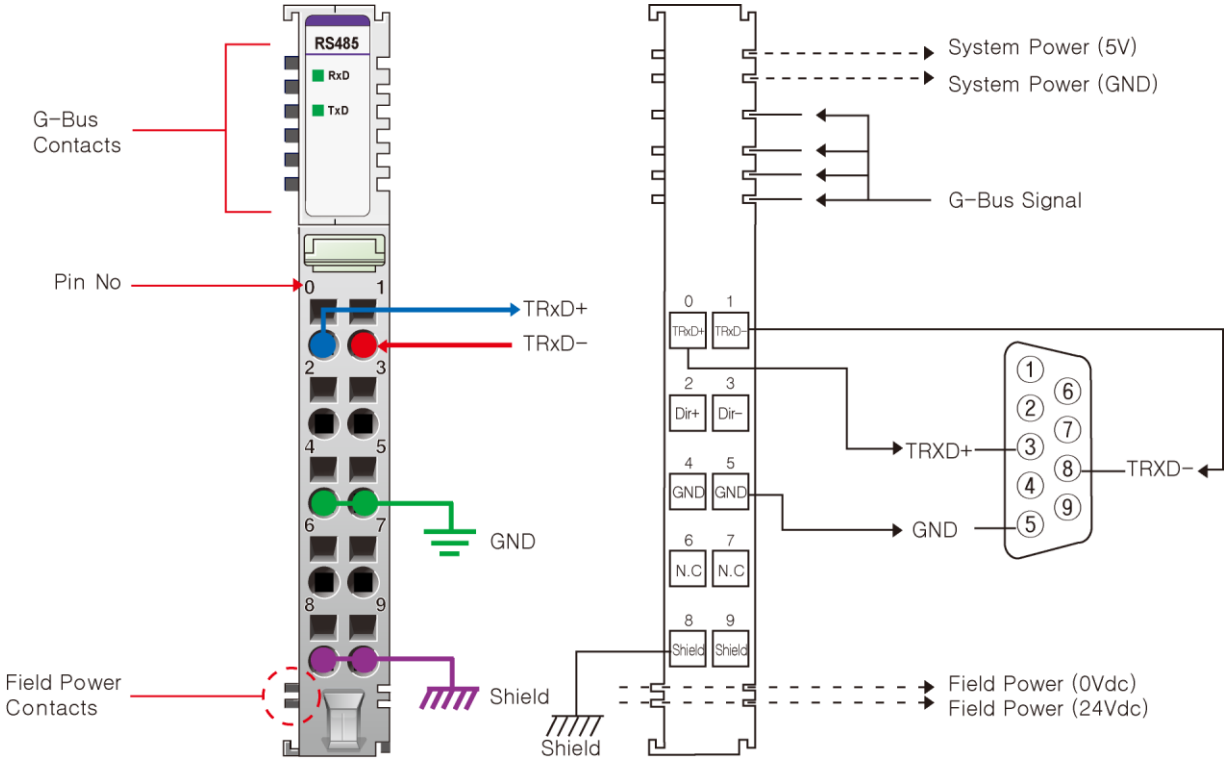
LED No.	LED Function / Description	LED Color
RxD	Received Data	Green
TxD	Transmit Data	Green
RTS	Request-to-send	Green
CTS	Clear-to-send	Green

2.1.3 Channel Status LED

LED	Color	Status
RxD	GREEN	Received Data
TxD	GREEN	Transmit Data
RTS	GREEN	Request-to-send
CTS	GREEN	Clear-to-send

2.2 RIO3-RS485

2.2.1 Wiring Diagram



Pin No.	Signal Description	Signal Description	Pin No.
0	RS485+	RS485-	1
2	DIR+	DIR-	3
4	Common (GND)	Common (GND)	5
6	N.C	N.C	7
8	Shield	Shield	9

2.2.2 LED Indicator

LED No.	LED Function / Description	LED Color
RxD	Received Data	Green
TxD	Transmit Data	Green

2.2.3 Channel Status LED

LED	Color	Status
RxD	GREEN	Received Data
TxD	GREEN	Transmit Data

2.3 Specification

Items	RIO3-RS232	RIO3-RS485
Specifications		
Transfer Channels	TxD, RxD, Full Duplex	TxD, RxD, Half Duplex
Transfer Rate	1.200bps ~ 115.200bps	
Data Bit	8 bit	
Parity Bit	None, Odd, Even (*Default: None)	
Stop Bit	1bit, 2bit (*Default: 1bit)	
Flow Control	RTS, CTS	-
Bit Distortion	<1.6%	-
Connection	10 RTB	
Cable Type	Shield Cable Recommended	
Cable Length	Max. 15m	1km Twisted Pair
Low Signal Voltage	-18V ~ -3V	-
High Signal Voltage	3V ~ 18V	-
Data Buffer	IO size changed Max. 63 bytes	
	IO User data 14 bytes (* Default) @Max. 61 Bytes	
	Control/Status 1 byte, Rx/Tx Length 1 byte	
RXD Buffer	1024 bytes	
TXD buffer	1024 bytes	
Line Impedance	-	120 Ω
Input Image Size	16bytes (*Default) @ Max 63 bytes	
Output Image Size	16 bytes (*Default) @ Max. 63 bytes	
General Specification		
Power dissipation	Max. 85mA @ 5Vdc	
Isolation	I/O to Logic: Isolation Logic to Field power: Isolation (Not used) Logic to System Power: Non-isolation	
UL field power	Supply Voltage: 24Vdc nominal, Class 2	
Field Power	Not used, Field power bypass to next expansion module	
Wiring	I/O Cable Max. 2.0mm^2 (AWG 14)	
Torque	0.8Nm (7lb-in)	
Weight	57g	
Module size	12mm x 99mm x 70mm	
Environment Condition	**Refer to 'Environment Specification'**	

3 Environment Specification

Environmental Specification	
Operation Temperature	-40℃ ~ 70℃
UL Temperature	-20℃ ~ 60℃
Non-Operating Temperature	-40℃ ~ 85℃
Relative Humidity	5% ~ 90% Non-condensing
Mounting	DIN rail
General Specification	
Shock Operating	IEC 60068-2-27: 2008/15g, 11ms
Vibration Resistance	Based on IEC 60068-2-6 DNVGL-CG-0039: Vibration Class B, 4g
Industrial Emissions	EN61000-6-4: 2007 +A1: 2011
Industrial Immunity	EN61000-6-2: 2005
Installation Position	Vertical and horizontal installation is possible
Product Certifications	CE, UL, EAC

4 Configuration and Operation Function

4.1 RIO3-RSxxx (Series) Mapping data into the image table

Input image data

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status	TPA	FTA	FRA	RE	RBO	RR	TA	IA

- **IA:** Initialization Acknowledge
- **TA:** Transmit Acknowledge
- **RR:** Receive Request
- **RBO:** RxD Buffer Overrun
- **RE:** RxD Exist (Remained)
- **FRA:** Flush RxD buffer Acknowledge
- **FTA:** Flush TxD buffer Acknowledge
- **TPA:** Transmit Processing Acknowledge

Output image data

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control	TPR	FT	FR	----	----	RA	TR	IR

- **IR:** Initialization Request (rising edge active)
- **TR:** Transmit Request (both edge active)
- **RA:** Receive Acknowledge (both edge active)
- **FR:** Flush RxD buffer Request (rising edge active)
- **FT:** Flush TxD buffer Request (rising edge active)
- **TPR:** Transmit Processing Request (both edge active)

RIO3-RS232, RIO3-RS485 image data (Input, Output Data Size: Default, 16Byte)

IO Input		IO Output	
Byte#0	Status	Byte#0	Control
Byte#1	RxLength	Byte#1	TxLength
Byte#2	RxData#0	Byte#2	TxData#0
Byte#3	RxData#1	Byte#3	TxData#1
Byte#4	RxData#2	Byte#4	TxData#2
Byte#5	RxData#3	Byte#5	TxData#3
Byte#6	RxData#4	Byte#6	TxData#4
Byte#7	RxData#5	Byte#7	TxData#5
Byte#8	RxData#6	Byte#8	TxData#6
Byte#9	RxData#7	Byte#9	TxData#7
Byte#10	RxData#8	Byte#10	TxData#8
Byte#11	RxData#9	Byte#11	TxData#9
Byte#12	RxData#10	Byte#12	TxData#10
Byte#13	RxData#11	Byte#13	TxData#11
Byte#14	RxData#12	Byte#14	TxData#12
Byte#15	RxData#13	Byte#15	TxData#13
-------	-------	-------	-------
-------	-------	-------	-------
-------	-------	-------	-------
-------	-------	-------	-------
Byte#62	RxData#60	Byte#62	TxData#60

- The input and output data size can be changed via parameter data. (IO data size **MAX 63Byte**)
- **Default** Input, output data size: 16Byte

4.2 Configuration Parameter Data

4.2.1 1-Channel Module Parameter Data (RIO3-RS232)

Precautions for use: if you changed Parameter setting, you must power reset Module

Byte#0	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0
	* Note 1	Stop bit	Parity Bit		Baudrate			
	TxD Process	0 : 1bit	00 : No		0000 : 115200bps			
	0 : Disable	1 : 2bit	01 : Odd		0001 : 1200bps			
	1 : Enable		10 : Even		0010 : 2400bps			
					0011 : 4800bps			
					0100 : 9600bps			
					0101 : 19200bps			
					0110 : 38400bps			
					0111 : 57600bps			
					1000 : 115200bps			
					Others : 115200bps			
Byte#1	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0
	IO data size						Flow Control	
	16~63						00 : RTS/CTS Disable	
							01 : RTS Enable	
							10 : CTS Enable	
							11 : RTS/CTS Enable	
Byte#2	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0
	Not Used							
Byte#3	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0
	Not Used							

- byte#0~1 for ch#0, byte#2~3 not used

*** Note 1:**

- Disable: Transmit immediately Output data

- Enable: Store the value of Output Data continually at TxD Buffer of Serial Interface Module, when TPA bit and TPR bit of Control Byte and Status Byte are different, transmit all Data that saved at TxD Buffer

4.2.2 1-Channel Module Parameter Data (RIO3-RS485)

Precautions for use: if you changed Parameter setting, you must power reset Module

Byte#0	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0
	* Note 1	Stop bit	Parity Bit		Baudrate			
	TxD Process	0 : 1bit	00 : No		0000 : 115200bps			
	0 : Disable	1 : 2bit	01 : Odd		0001 : 1200bps			
	1 : Enable		10 : Even		0010 : 2400bps			
					0011 : 4800bps			
					0100 : 9600bps			
					0101 : 19200bps			
					0110 : 38400bps			
					0111 : 57600bps			
					1000 : 115200bps			
					Others : 115200bps			
Byte#1	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0
			IO data size					
			16~63					
Byte#2	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0
	Not Used							
Byte#3	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0
	Not Used							

- byte#0~1 for ch#0, byte#2~3 not used

*** Note 1:**

- Disable: Transmit immediately Output data

- Enable: Store the value of Output Data continually at TxD Buffer of Serial Interface Module, when TPA bit and TPR bit of Control Byte and Status Byte are different, transmit all Data that saved at TxD Buffer

4.3 Example

4.3.1 Example of Transmitting data

Transmit data: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z (26 byte)

Input, Output data Size: 16byte

Configuration Parameter

Parameter	Description	Value
Data Bit	8 Data Bit	Not used
Parity Bit	No Parity	Default Value
Baud rate	115200bps	Default Value
Stop Bit	1 Bit	Default Value
RTS/CTS Flow Control	RTS/CTS Disable	Default Value
TxD Process	Disable	Default Value

- Step#0

TR inverting (TR≠TA)

Output Length = 14byte (0x0E)

Output Data = “A, B, C, D, E, F, G, H, I, J, K, L, M, N”

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	0	0	0	0	0

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	0	1	0
Tx Length #1	‘ 0E’(14byte)							
Output Byte #2	‘A’ (0x41:ASCII code)							
Output Byte #3	‘B’ (0x42)							
Output Byte #4	‘C’ (0x43)							
Output Byte #5	‘D’ (0x44)							
Output Byte #6	‘E’ (0x45)							
Output Byte #7	‘F’ (0x46)							
Output Byte #8	‘G’ (0x47)							
Output Byte #9	‘H’ (0x48)							
Output Byte #10	‘I’ (0x49)							
Output Byte #11	‘J’ (0x4A)							

Output Byte #12	‘K’ (0x4B)
Output Byte #13	‘L’ (0x4C)
Output Byte #14	‘M’ (0x4D)
Output Byte #15	‘N’ (0x4E)

- Step#1

Check TA bit value in Status Byte.

TR=TA: transmit complete.

	bit#7	**bit#6**	**bit#5**	**bit#4**	**bit#3**	**bit#2**	**bit#1**	**bit#0**
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	0	0	0	1	0

- Step#2

TR inverting (TR≠TA)

Output Length = 12byte (0x0C)

Output Data = “O, P, Q, R, S, T, U, V, W, X, Y, Z”

	bit#7	**bit#6**	**bit#5**	**bit#4**	**bit#3**	**bit#2**	**bit#1**	**bit#0**
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	0	0	0
Tx Length #1	‘ 0C’(12byte)							
Output Byte #2	‘O’ (0x4F:ASCII code)							
Output Byte #3	‘P’ (0x50)							
Output Byte #4	‘Q’ (0x51)							
Output Byte #5	‘R’ (0x52)							
Output Byte #6	‘S’ (0x53)							
Output Byte #7	‘T’ (0x54)							
Output Byte #8	‘U’ (0x55)							
Output Byte #9	‘V’ (0x56)							
Output Byte #10	‘W’ (0x57)							
Output Byte #11	‘X’ (0x58)							
Output Byte #12	‘Y’ (0x59)							
Output Byte #13	‘Z’ (0x5A)							
Output Byte #14	0x00							
Output Byte #15	0x00							

- Step#3

Check TA bit value in Status Byte.

TR=TA: transmit complete.

	bit#7	**bit#6**	**bit#5**	**bit#4**	**bit#3**	**bit#2**	**bit#1**	**bit#0**
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	0	0	0	0	0

4.3.2 Example of Receiving data

Receive data: "Company: HitachiHX-RIO3" (22byte)

Input, Output data Size: 16byte

Configuration Parameter

Parameter	Description	Value
Data Bit	8 Data Bit	Not used
Parity Bit	No Parity	Default Value
Baud rate	115200bps	Default Value
Stop Bit	1 Bit	Default Value
RTS/CTS Flow Control	RTS/CTS Disable	Default Value
TxD Process	Disable	Default Value

- Step#0

RR=RA

RE: RxD Exist (Remained)

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	1	0	0	0	0

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	0	0	0

- Step#1

RA inverting (RA≠RR)

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	1	0	0

- Step#2

Check RR bit value in Status Byte

RA=RR: receive complete

Input Length = 14byte

Input Data = "Company: Hitachi"

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	1	0	1	0	0
RX Length #1	' 0E'(14byte)							
Input Byte #2	'C' (0x43:ASCII code)							
Input Byte #3	'o' (0x6F)							
Input Byte #4	'm' (0x6D)							
Input Byte #5	'p' (0x70)							
Input Byte #6	'a' (0x61)							
Input Byte #7	'n' (0x6E)							
Input Byte #8	'y' (0x79)							
Input Byte #9	':' (0x3A)							
Input Byte #10	'H' (0x48)							
Input Byte #11	'i' (0x69)							
Input Byte #12	't' (0x74)							
Input Byte #13	'a' (0x61)							
Input Byte #14	'c' (0x63)							
Input Byte #15	'h' (0x68)							

- Step#3

RA inverting (RA≠RR)

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	0	0	0

- Step#4

Check RR bit value in Status Byte

RA=RR: receive complete

Input Length = 8byte

Input Data = "**iHX-RIO3**"

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	0	0	0	0	0
RX Length #1	' 08'(8byte)							
Input Byte #2	'i' (0x69:ASCII code)							
Input Byte #3	'H' (0x48)							
Input Byte #4	'X' (0x58)							
Input Byte #5	'-' (0x2D)							
Input Byte #6	'R' (0x52)							
Input Byte #7	'I' (0x49)							
Input Byte #8	'O' (0x4f)							
Input Byte #9	'3' (0x33)							
Input Byte #10	0x00							
Input Byte #11	0x00							
Input Byte #12	0x00							
Input Byte #13	0x00							
Input Byte #14	0x00							
Input Byte #15	0x00							

4.3.3 Example of Transmitting data and Receiving data

Transmit data: "HITACHI" (7byte) _Receive data : "HITACHI" (7byte)

Input, Output data Size: 16byte

Configuration Parameter

Parameter	Description	Value
Data Bit	8 Data Bit	Not used
Parity Bit	No Parity	Default Value
Baud rate	115200bps	Default Value
Stop Bit	1 Bit	Default Value
RTS/CTS Flow Control	RTS/CTS Disable	Default Value
TxD Process	Disable	Default Value

- Step#0 (Transmit)

TR inverting (TR≠TA)

Output Length = 7byte

Output Data = “HITACHI”

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	0	1	0
Tx Length #1	‘07’(7byte)							
Output Byte #2	‘H’ (0x48:ASCII code)							
Output Byte #3	‘I’ (0x49)							
Output Byte #4	‘T’ (0x54)							
Output Byte #5	‘A’ (0x41)							
Output Byte #6	‘C’ (0x43)							
Output Byte #7	‘H’ (0x48)							
Output Byte #8	‘I’ (0x49)							
Output Byte #9	0x00							
Output Byte #10	0x00							
Output Byte #11	0x00							
Output Byte #12	0x00							
Output Byte #13	0x00							
Output Byte #14	0x00							
Output Byte #15	0x00							

- Step#1

Check TA bit value in Status Byte.

TR=TA: transmit complete.

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	0	0	0	1	0

- Step#2 (Receive)

RR=RA

RE: RxD Exist (Remained)

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	1	0	0	0	0

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	0	0	0

- Step#3

RA inverting (RA≠RR)

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	1	0	0

- Step#4

Check RR bit value in Status Byte

RA=RR: receive complete

Input Length = 7byte

Input Data = "HITACHI"

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	0	0	1	0	0
RX Length #1	' 07'(7byte)							
Input Byte #2	'H' (0x48:ASCII code)							
Input Byte #3	'I' (0x49)							
Input Byte #4	'T' (0x54)							
Input Byte #5	'A' (0x41)							
Input Byte #6	'C' (0x43)							
Input Byte #7	'H' (0x48)							
Input Byte #8	'I' (0x49)							
Input Byte #9	0x00							
Input Byte #10	0x00							
Input Byte #11	0x00							
Input Byte #12	0x00							
Input Byte #13	0x00							
Input Byte #14	0x00							
Input Byte #15	0x00							

4.3.4 TPR and TPA Example

Transmit data: ”HITACHI”(7byte)

Input, Output data Size: 16byte

Configuration Parameter

Parameter	Description	Value
Data Bit	8 Data Bit	Not used
Parity Bit	No Parity	Default Value
Baud rate	115200bps	Default Value
Stop Bit	1 Bit	Default Value
RTS/CTS Flow Control	RTS/CTS Disable	Default Value
TxD Process	**Enable**	Default Value(Disable)

- Step#0

TxD Process data in Configuration Parameter set to “1” (Enable)

- Step#1

TR inverting (TR≠TA)

Output Length = 4

Output Data = “HITA”

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	0	0	0	0	0
	bit#7	**bit#6**	**bit#5**	**bit#4**	**bit#3**	**bit#2**	**bit#1**	**bit#0**
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	0	1	0
Tx Length #1	‘ 04’(4byte)							
Output Byte #2	‘H’ (0x48:ASCII code)							
Output Byte #3	‘I’ (0x49)							
Output Byte #4	‘T’ (0x54)							
Output Byte #5	‘A’ (0x41)							
Output Byte #6	0x00							
Output Byte #7	0x00							
Output Byte #8	0x00							
Output Byte #9	0x00							
Output Byte #10	0x00							
Output Byte #11	0x00							
Output Byte #12	0x00							
Output Byte #13	0x00							
Output Byte #14	0x00							
Output Byte #15	0x00							

- Step#2

Check TA bit value in Status Byte.

TR=TA: transmit complete.

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	0	0	0	1	0

TxD Buffer

Offset	TxD Buffer Data
Output Byte #0	'H' (0x48:ASCII code)
Output Byte #1	'I' (0x49)
Output Byte #2	'T' (0x54)
Output Byte #3	'A' (0x41)
Output Byte #4	0x00
Output Byte #5	0x00
Output Byte #6	0x00
Output Byte #7	0x00
Output Byte #8	0x00
. . . . .	. . . . .
Output Byte #252	0x00
Output Byte #253	0x00
Output Byte #254	0x00
Output Byte #255	0x00

- Step#3

TR inverting (TR ≠ TA)

Output Length = 3

Output Data = “CHI”

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	0	0	0
Tx Length #1	‘ 03’(3byte)							
Output Byte #2	‘C’ (0x43 ASCII code)							
Output Byte #3	‘H’ (0x48)							
Output Byte #4	‘I’ (0x49)							
Output Byte #5	0x00							
Output Byte #6	0x00							
Output Byte #7	0x00							
Output Byte #8	0x00							
Output Byte #9	0x00							
Output Byte #10	0x00							
Output Byte #11	0x00							
Output Byte #12	0x00							
Output Byte #13	0x00							
Output Byte #14	0x00							
Output Byte #15	0x00							

- Step#4

Check TA bit value in Status Byte.

TR=TA: transmit complete

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	0	0	0	0	0

TxD Buffer

Offset	TxD Buffer Data
Output Byte #0	‘H’ (0x48:ASCII code)
Output Byte #1	‘I’ (0x49)
Output Byte #2	‘T’ (0x54)
Output Byte #3	‘A’ (0x41)
Output Byte #4	‘C’ (0x43)
Output Byte #5	‘H’ (0x48)
Output Byte #6	‘I’ (0x49)
Output Byte #7	0x00
Output Byte #8	0x00
. **.** **.**	**.** **.** **.**
Output Byte #252	0x00
Output Byte #253	0x00
Output Byte #254	0x00
Output Byte #255	0x00

- Step#5

TPR inverting (TPR≠TPA)

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	1	0	0	0	0	1	0	0

Transmit all TxD Buffer data (TxD Buffer empty)

Offset	TxD Buffer Data
Output Byte #0	0x00
Output Byte #1	0x00
Output Byte #2	0x00
Output Byte #3	0x00
Output Byte #4	0x00
Output Byte #5	0x00
Output Byte #6	0x00
Output Byte #7	0x00
Output Byte #8	0x00
. . . . .	. . . . .
Output Byte #252	0x00
Output Byte #253	0x00
Output Byte #254	0x00
Output Byte #255	0x00

- Step#6

Check TPA bit value in Status Byte.

TPR=TPA: transmit complete

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	1	0	0	0	0	0	0	0

4.3.5 RIO3-RS232 (1ch) RxD Buffer data Overrun Check

For example, if other device transmits 1025 bytes of TxD data, RxD buffer of RIO3-RSxx (Serial) will be overwritten 1 byte.

Other device		**RIO3-RSxx (Serial)**	
Offset	TxD Data	**Offset**	RxD Buffer data
Output Byte #1	0x01	**Input Byte #1**	0x06(Overrun data)
Output Byte #2	0x02	**Input Byte #2**	0x02
Output Byte #3	0x03	**Input Byte #3**	0x03
Output Byte #4	0x04	**Input Byte #4**	0x04
Output Byte #5	0x05	**Input Byte #5**	0x05
Output Byte #6	0x06	**Input Byte #6**	0x06
. . .	. . .	. . .	
Output Byte #1020	0x01	**Input Byte #1019**	0x10
Output Byte #1021	0x02	**Input Byte #1020**	0x01
Output Byte #1022	0x03	**Input Byte #1021**	0x02
Output Byte #1023	0x04	**Input Byte #1022**	0x03
Output Byte #1024 MAX	0x05	**Input Byte #1023**	0x04
Output Byte #1025	0x06(Overrun data)	**Input Byte #1024**	0x05

RE (RxD Exist) bit check

	bit#7	**bit#6**	**bit#5**	**bit#4**	**bit#3**	**bit#2**	**bit#1**	**bit#0**
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	1	0	0	0	0

RA (Receive Acknowledge) bit set

	bit#7	**bit#6**	**bit#5**	**bit#4**	**bit#3**	**bit#2**	**bit#1**	**bit#0**
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	1	0	0

PLEASE CHECK RBO bit in Status Byte in order to prevent overwrite RX buffer.
When the RBO bit is set, it notifies that the RX buffer is full.

	bit#7	**bit#6**	**bit#5**	**bit#4**	**bit#3**	**bit#2**	**bit#1**	**bit#0**
Status Byte #0	TPA	FTA	FRA	RE	RBO	RR	TA	IA
	0	0	0	1	1	1	0	0

If you try to write more than 1024 bytes on RX buffer, 1025rd byte overwrites the first byte on RX buffer. Thus, it is recommended to write less than 1024 bytes.

IR (Initialization Request) bit set

	bit#7	bit#6	bit#5	bit#4	bit#3	bit#2	bit#1	bit#0
Control Byte #0	TPR	FT	FR	----	----	RA	TR	IR
	0	0	0	0	0	0	0	1

RxD Buffer data Reset.

Offset	RxD Buffer Data
Input Byte #1	0x00
Input Byte #2	0x00
Input Byte #3	0x00
Input Byte #4	0x00
Input Byte #5	0x00
Input Byte #6	0x00
. . .	. . .
Input Byte #1021	0x00
Input Byte #1022	0x00
Input Byte #1023	0x00
Input Byte #1024	0x00

4.3.6 How to change I/O Data Size in XML file (I/O Guide Pro)

```
<IOData InputLength="16" OutputLength="16">
    <Input OneChSize="8">
        <Ref TextId="T_Status_Data_00" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Length_Data_00" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_00" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_01" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_02" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_03" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_04" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_05" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_06" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_07" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_08" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_09" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_10" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_11" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_12" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_InData_13" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        Write <Ref TextId="T_Byte_InData_XX" ChannelType="BI" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
    </Input>
    <Output OneChSize="8">
        <Ref TextId="T_Ctrl_Data_00" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Length_Data_00" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_00" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_01" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_02" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_03" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_04" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_05" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_06" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_07" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_08" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_09" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_10" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_11" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_12" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        <Ref TextId="T_Byte_OutData_13" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
        Write <Ref TextId="T_Byte_OutData_XX" ChannelType="BO" DataType="ByteArea" Length="1" Unit="" Visible="true"/>
    </Output>
</IOData>
```

- Step#1

```
<IOData InputLength="16" OutputLength="16">
```

Change InputLength, OutputLength

ex) I/O Data Size: 30Byte
< IOData InputLength=”30” OutputLength=”30”>

-Step#2
Add T_Byte_InData_XX & T_Byte_OutData_XX

ex) I/O Data Size: 18Byte
Add the following to the Write area.

- 1ch Module
Input area
<Ref TextId=”T_Byte_InData_14” ChannelType=”BI” DataType=”ByteArea” Length=”1” Unit=”” Visible=”true”/>
<Ref TextId=”T_Byte_InData_15” ChannelType=”BI” DataType=”ByteArea” Length=”1” Unit=”” Visible=”true”/>

Output area
<Ref TextId=”T_Byte_OutData_14” ChannelType=”BO” DataType=”ByteArea” Length=”1” Unit=”” Visible=”true”/>
<Ref TextId=”T_Byte_OutData_15” ChannelType=”BO” DataType=”ByteArea” Length=”1” Unit=”” Visible=”true”/>

4.3.7 How to change I/O Data Size in XML file (CODESYS)

- XML Change location

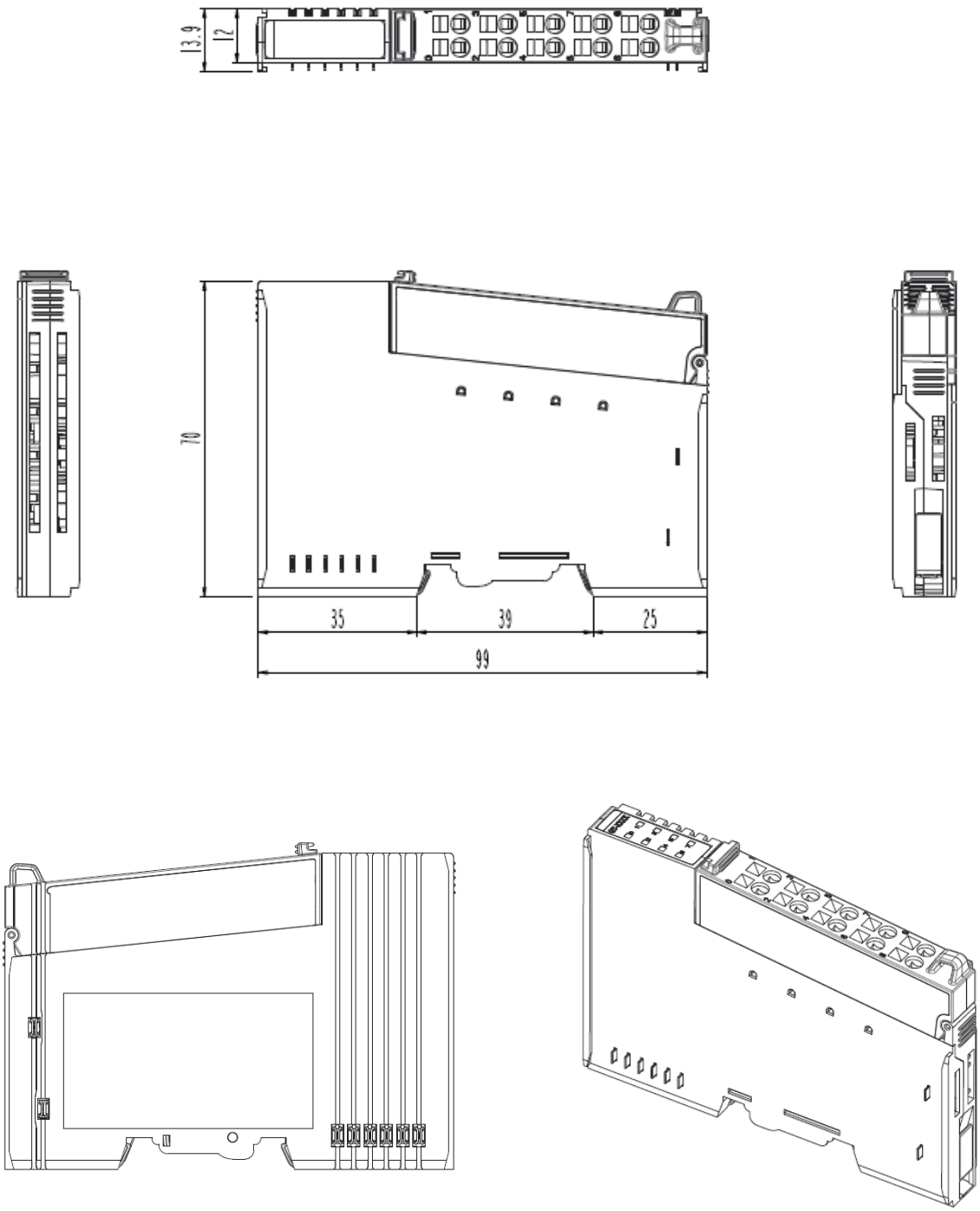
```
<Parameter ParameterId="1000" type="localTypes:ARRAY [0..15] OF TBit1Byte">
  <Attributes channel="input" download="true" functional="false" offlineaccess="read" onlineaccess="read" />
  <Default>0</Default>
  <Name name="local:in0">IN</Name>
</Parameter>

<Parameter ParameterId="2000" type="localTypes:ARRAY [0..15] OF TBit1Byte">
  <Attributes channel="output" download="true" functional="false" offlineaccess="readwrite" onlineaccess="readwrite" />
  <Default>0</Default>
  <Name name="local:out0">OUT</Name>
</Parameter>
```

Change Array range
ex) I/O Data Size : 30Byte
[0..15] → [0..29]

5 Dimension

5.1 10-Pts. Spring Type



Dimensions in mm

6 Mounting

Caution!

Hot surface!

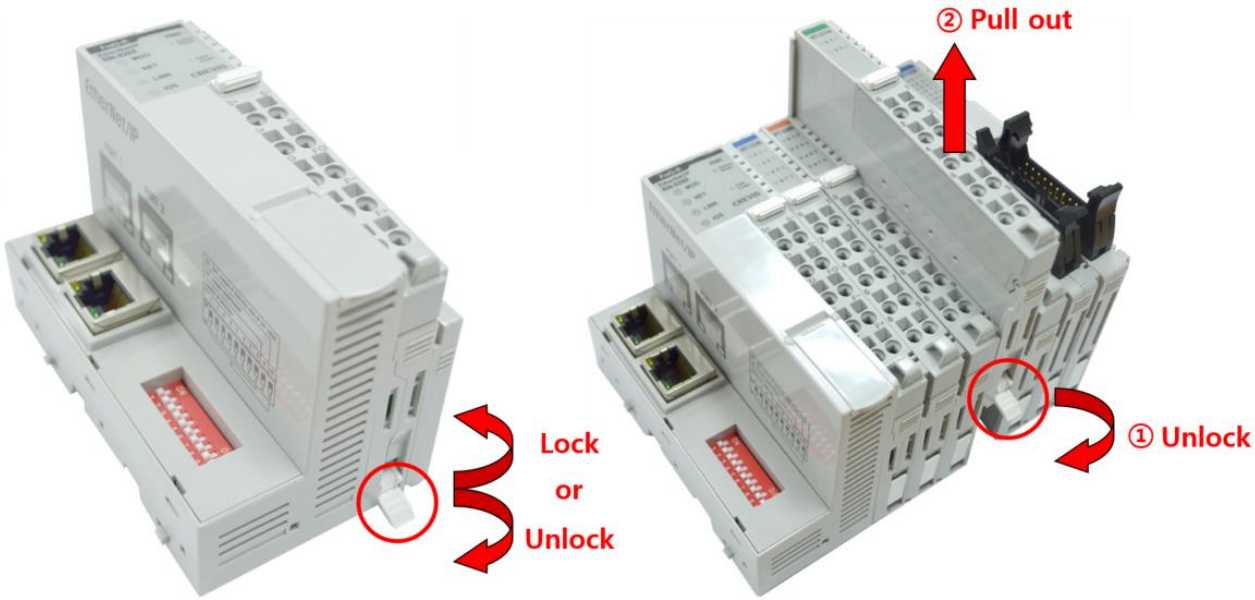
The surface of the housing can become hot during operation. If the device was operated at high ambient temperatures, allow it to cool off before touching it.

Notice!

Perform work on devices only if they are de-energized!

Working on energized devices can damage them. Therefore, turn off the power supply before working on the devices.

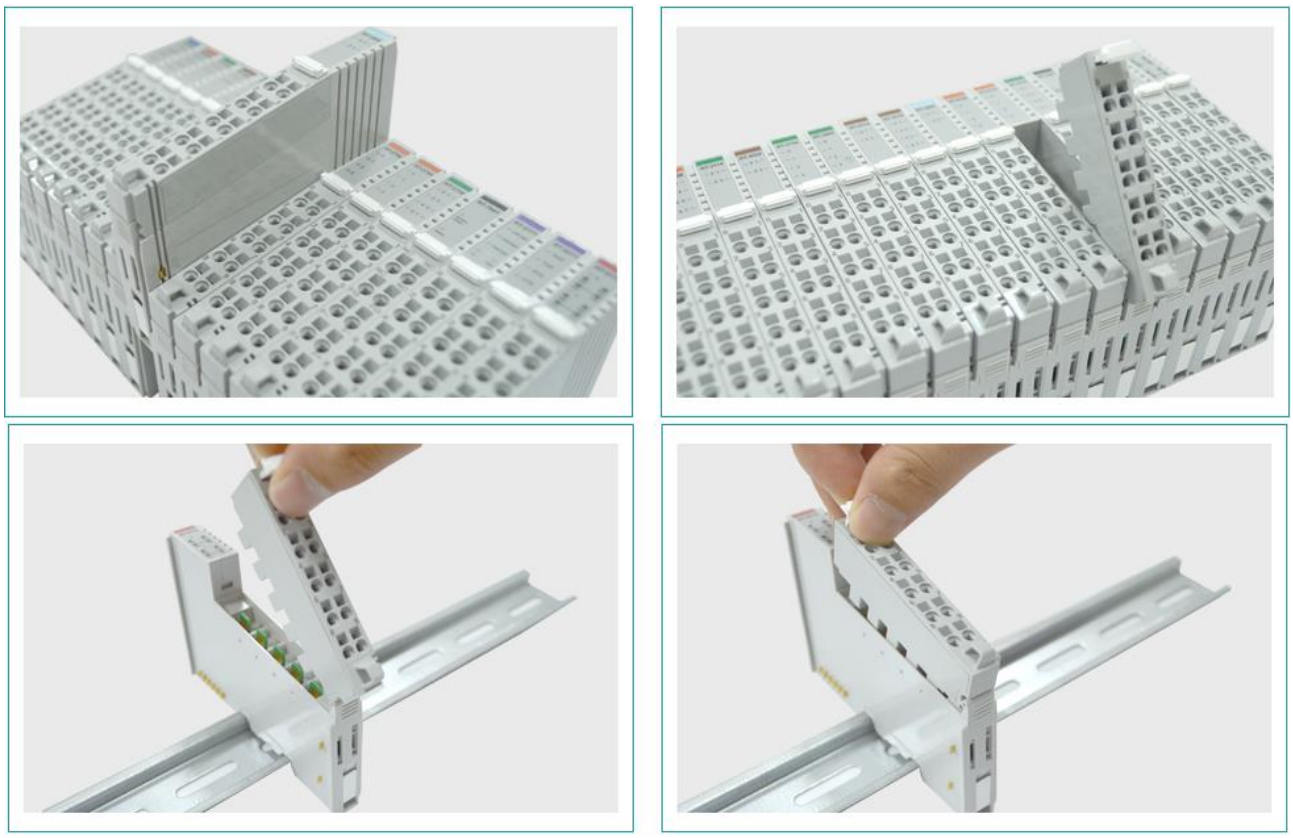
6.1 I/O Inserting and Removing Devices



As above figure in order to safeguard the RIO3-Module from jamming, it should be fixed onto the DIN rail with locking level. To do so, fold on the upper of the locking lever.

To pull out the RIO3-Module, unfold the locking lever as below figure.

6.2 RTB (Removable Terminal Block)



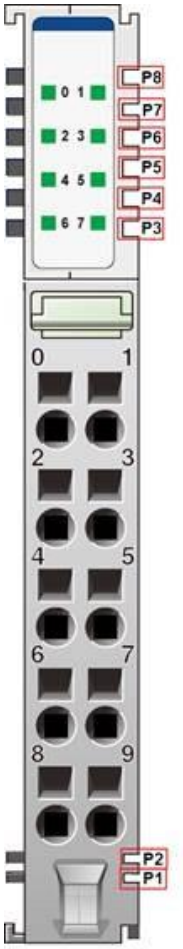
Whole terminal block can be combined and removed for the convenience if its maintenance.

There is a locking switch on the RTB for the easy combination and easy removal.

Easy combination and easy removal for IO modules on the Din rail through One Touch Locking Switch.

7 G-Bus Pin Description

Communication between the Network Adapter and the expansion module as well as system / field power supply of the bus modules is carried out via the internal bus. It is comprised of 6 data pin and 2 field power pin.



*Please refer to the table below regarding the pin description from P1 to P8.

No.	Description
P1	Field Power (VCC)
P2	Field Power (GND)
P3	GBUS CLK
P4	GBUS MISO
P5	GBUS MOSI
P6	GBUS Token
P7	System Power (GND)
P8	System Power (VCC)

DANGER 	Do not touch data and field power pins in order to avoid soiling and damage by ESD noise.

8 APPENDIX A

8.1 Product List

Please refer the separate HX-RIO3 product list document

8.2 Glossary

System Power: The power for starting up CPU.
Field Power: The power for input and output line.
Terminator Resistor: Resistor for prevention reflected wave.
EDS: Electronic Data Sheet.
Sink: The method of in/output power supply if a device has no power source.
Source: The method of in/output power supply if a device has the power source.