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Delta EtherCAT Gateway Slave Module R1-EC70X2 Digital Output Module Series User Guide

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Preface

Thank you for purchasing this product. This user guide provides information about the R1-EC70X2 series EtherCAT remote control 16-channel DO expansion module.

This user guide includes:

- Product inspection and model explanation
- Specifications and product interface
- Wiring
- CiA401 drive profile
- Object dictionary
- SDO error message abort code

Product features of the EtherCAT remote control expansion module

The R1-EC70X2 series DO module supports EtherCAT (Ethernet Control Automation Technology) protocol, which can be a high-performance distributed I/O system. The DO module provides output load control interface for NPN and PNP. With the E-Bus power module, it can control the EtherCAT master station remote digital signal, which can instantly update the control load switch for multiple sets of slave modules within 1 ms.

The EtherCAT series products have a number of modules with different functions and features to meet different remote automation control requirements. This product is the optimal integration platform for controlling the multi-point load switch. It is easy to assemble with better stability and scalability. This is the one and only choice for industrial upgrading.

How you use this user guide

You can use this user guide as a reference while using the R1-EC70X2 series EtherCAT 16-channel DO expansion module, which contains the information related to the product installation, setting, as well as instructions on how to use and maintain this product.

Delta technical services

Please consult your Delta equipment distributor or Delta Customer Service Center if you encounter any problems.

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1 Product Inspection and Model Explanation

This chapter provides the overview of the product inspection, model description, and instructions for using the R1-EC70X2 series product.

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1.2 Model name explanation ····· 1-2
1.3 Product instructions ····· 1-2

1

1.1 Product inspection

Please check the following once you receive the product:

1. Packaging: make sure the product's packaging is intact.
2. Bubble wrap: for protection of the product; make sure the stickers are securely attached to the bubble wrap.
3. R1-EC70X2: check if the product appearance is intact and all accessories are included.
4. Product installation instructions: check if an instruction sheet is included.

1.2 Model name explanation

R1 - EC – 70X2
(1)(2) (3) (4)(5)(6)(7)

No.	Item	Description
(1)	Product type	R: remote
(2)	Product category	1: type 1 – slim
(3)	Product name	EC: EtherCAT
(4)	Module type	7: gateway digital output module
(5)	Module subtype 1	0: 3.50 mm terminal connector
(6)	Module subtype 2	6: NPN type / 24 V_{DC} / 0.25 A
		A: PNP type / 24 V_{DC} / 0.25 A
		E: NPN type / 24 V_{DC} / 0.25 A, with non-volatile mode
		F: NPN type / 24 V_{DC} / 0.25 A, with non-volatile mode
(7)	DI	2: 16 sets

1.3 Product instructions

- This series of products must be used with Delta's R1-EC5500 series product.
- When the serial connected module exceeds the maximum current limit (2A) of R1-EC5500, it can be used with Delta's R1-EC5512 series product instead.

Specifications and Product Interface 2

This chapter introduces the product specifications of the R1-EC70X2 series product, including electrical specifications, product diagram, dimensional specifications, and other detailed descriptions.

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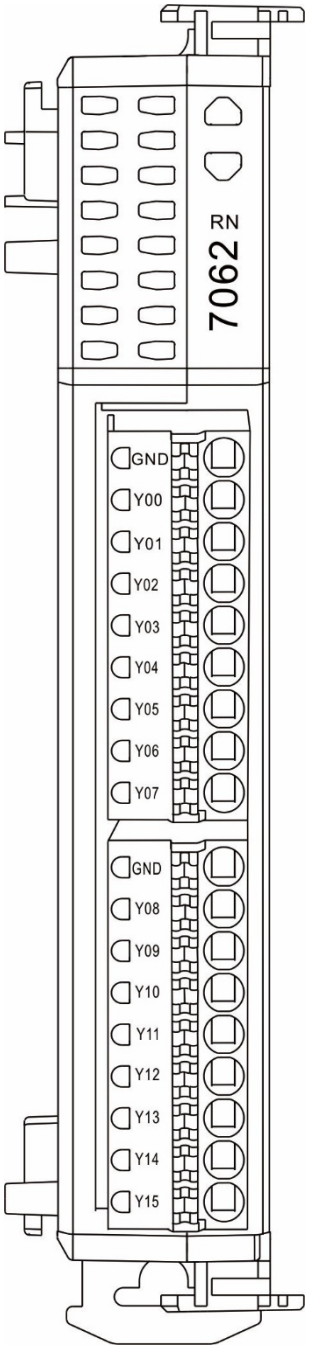
2.1 Electrical specifications

Item	R1-EC7062	R1-EC70E2	R1-EC70A2	R1-EC70F2
Circuit type	Transistor			
Signal type	SINK		SOURCE	
Power usage	24 V_{DC}			
Retain output status when communication is cut off	X	O	X	O
Port output current	0.25 A (Max)			
Reaction time / Operation frequency	1 KHz			
Active (Off > On)	140 us		160 us	
Active (On > Off)	150 us		110 us	
E-Bus current consumption	120 mA	200 mA	120 mA	200 mA
Galvanic isolation	500 Vrms (E-Bus / signal voltage)			
Weight	55 g (0.12 lb)			
Operating environment	Operating temperature：0℃ ~ 50℃; storage temperature：-20℃ ~ 70℃			
Installation	Sliding rail type			
Vibration resistance / Shock resistance	Conforms to EN 60068-2-6 / EN 60068-2-27/29			
Electromagnetic compatibility / Noise immunity	ESD (IEC 61131-2, IEC 61000-4-2) EFT (IEC 61131-2, IEC 61000-4-4) RS (IEC 61131-2, IEC 61000-4-3)			
Protection level	IP20			
Approvals	CE UL CERTIFIED SAFETY US-CA E206327 IND. CONT. EQ.			

2.2 Product diagram and dimensions

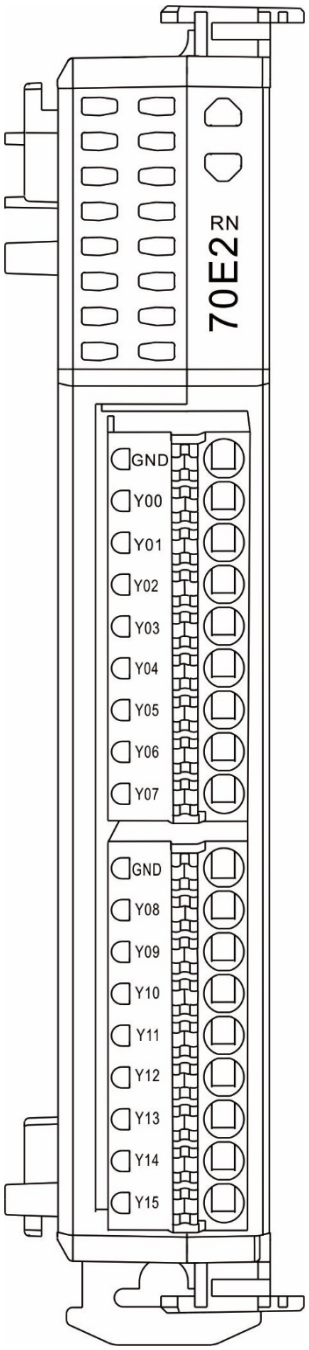
2.2.1 Product diagram

- Front view of R1-EC7062 module panel

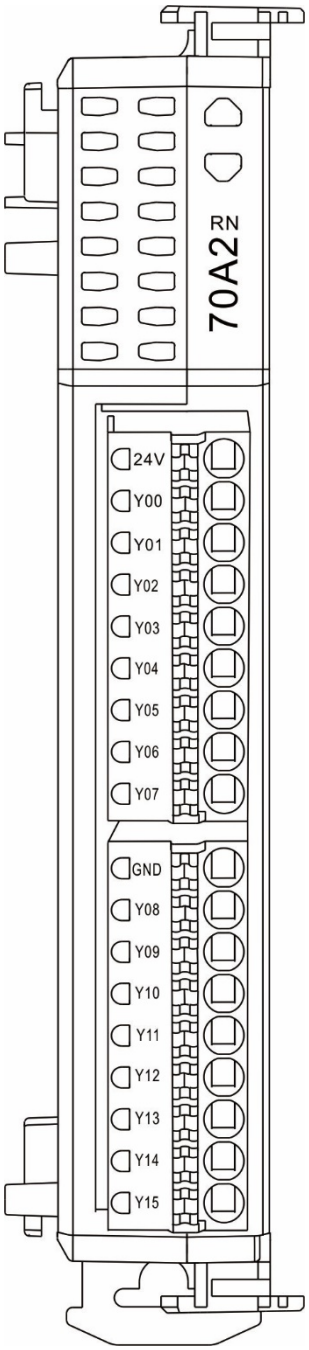


2

- Front view of R1-EC70E2 module panel

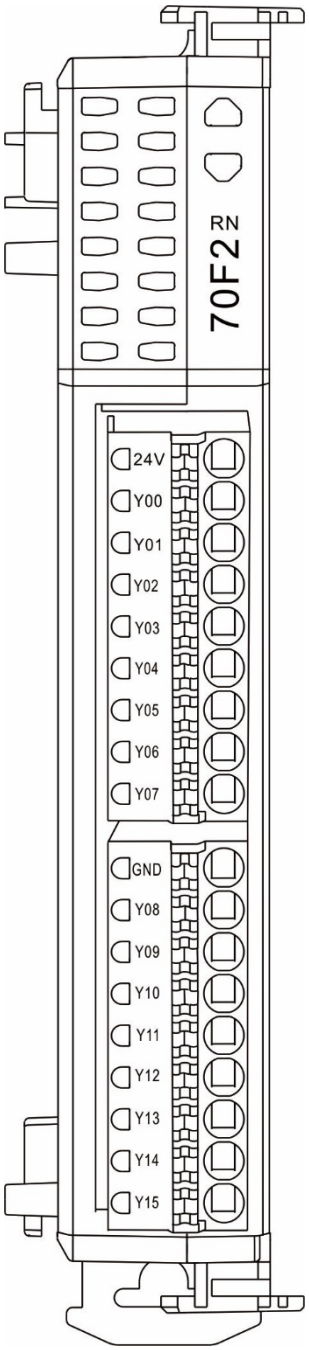


- Front view of R1-EC70A2 module panel



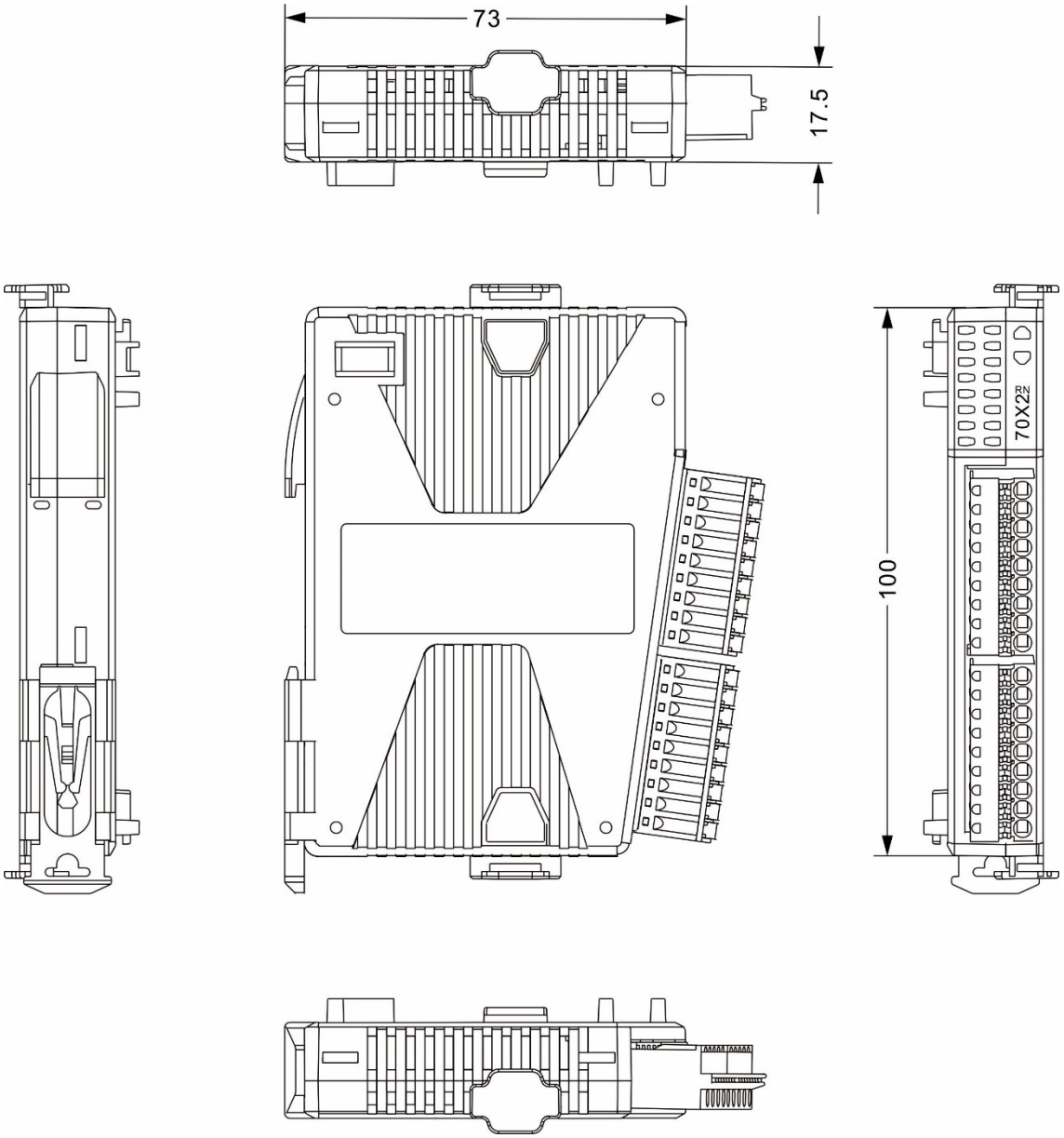
2

- Front view of R1-EC70F2 module panel



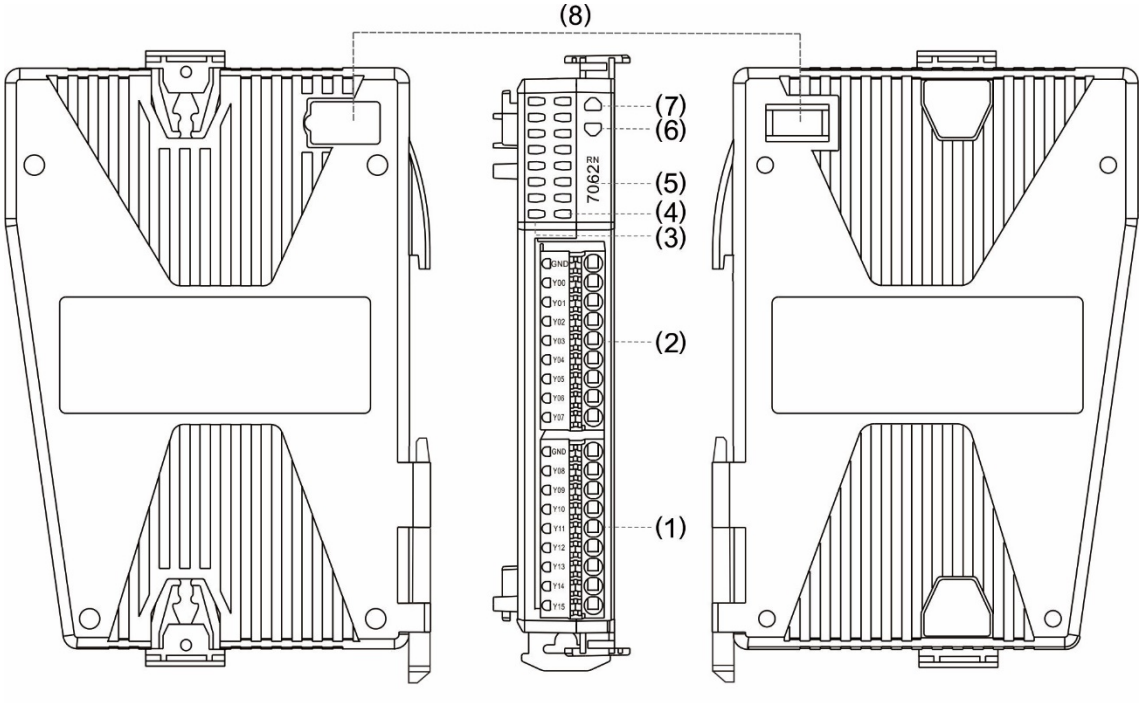
2.2.2 Dimensions

- R1-EC70X2 series: 100 mm x 73 mm x 17.5 mm



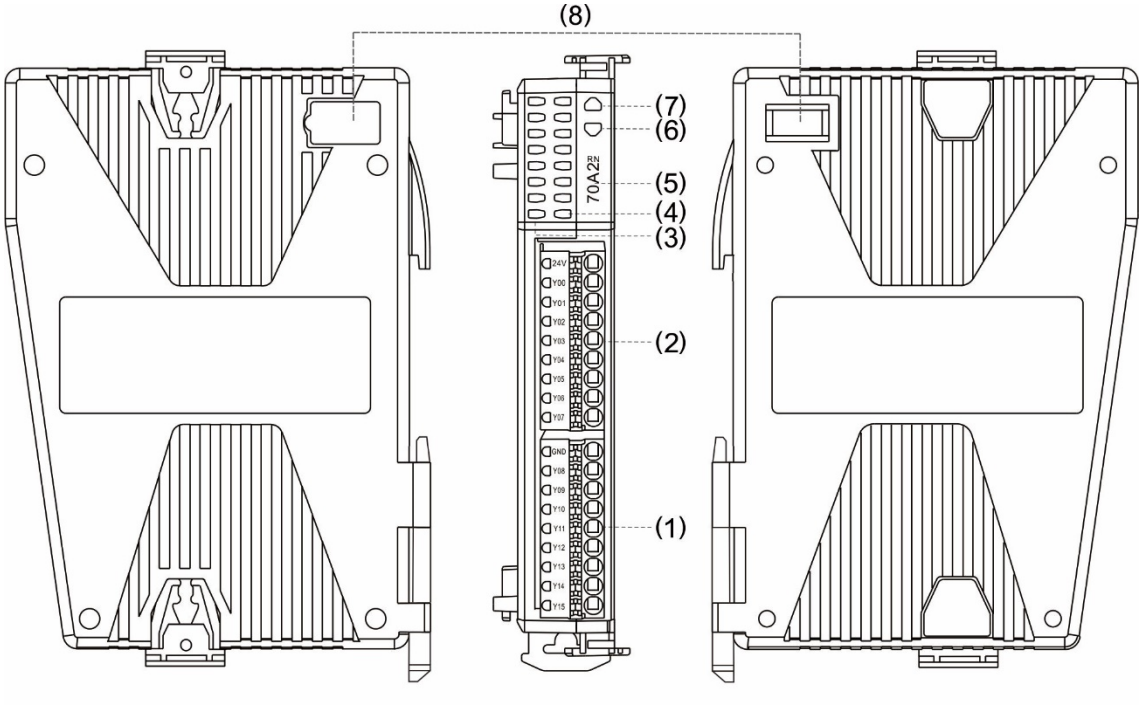
2.3 Product interface description

■ Product interface of R1-EC7062 / R1-EC70E2



No.	Description
(1)	Port 1
(2)	Port 0
(3)	Y00 – Y07 I/O signal display for Port 0 (from top to bottom)
(4)	Y08 – Y15 I/O signal display for Port 1 (from top to bottom)
(5)	Product number
(6)	Status indicator
(7)	Power indicator
(8)	E-Bus transmission port

■ Product interface of R1-EC70A2 / R1-EC70F2



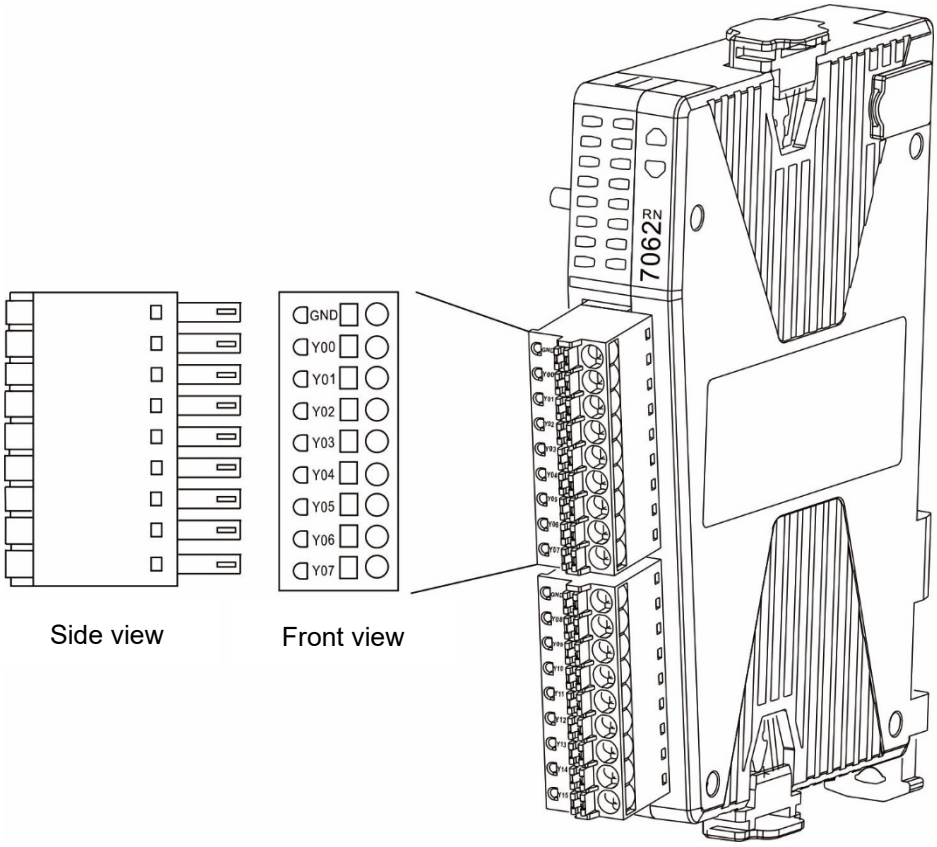
No.	Description
(1)	Port 1
(2)	Port 0
(3)	Y07 - Y00 signal display for Port 0 (from left to right)
(4)	Y15 - Y08 signal display for Port 1 (from left to right)
(5)	Product number
(6)	Status indicator
(7)	Power indicator
(8)	E-Bus transmission port

2.4 R1-EC70X2 series port description

2.4.1 R1-EC7062 / R1-EC70E2 Port 0

2

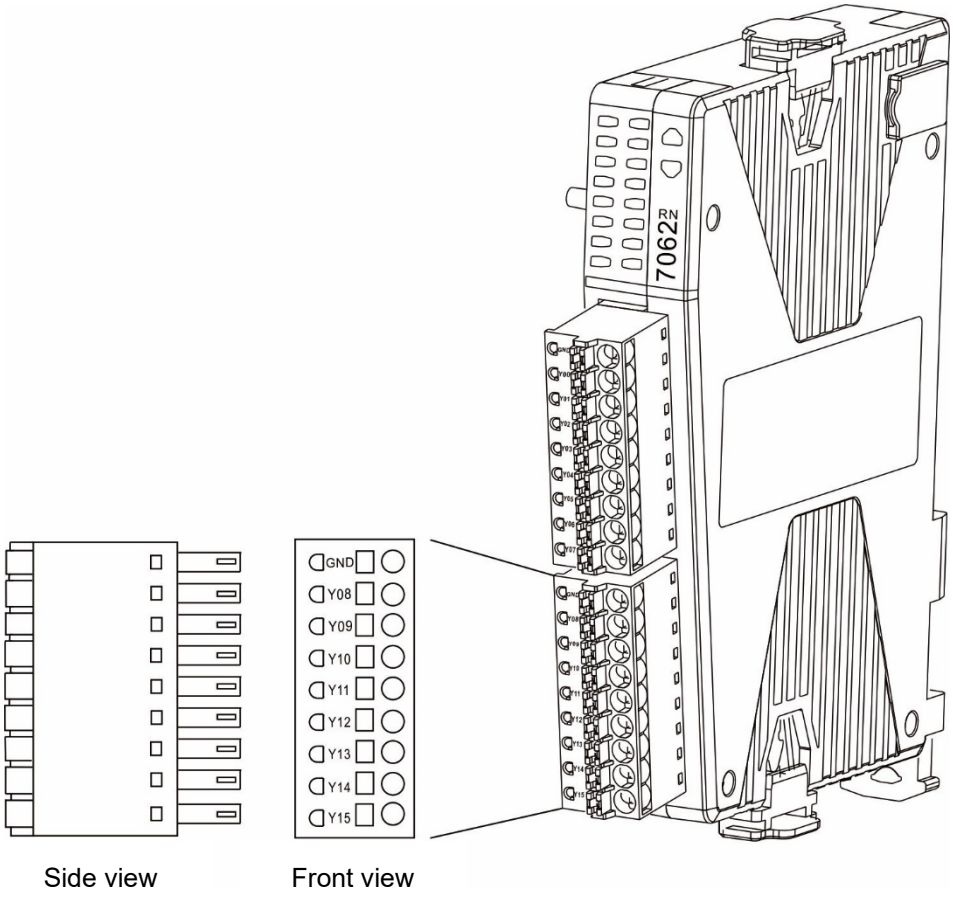
- Port 0 pin assignment of R1-EC7062 / R1-EC70E2



Mark	Description
GND	Power ground of Port 0
Y00	1st set of output of Port 0
Y01	2nd set of output of Port 0
Y02	3rd set of output of Port 0
Y03	4th set of output of Port 0
Y04	5th set of output of Port 0
Y05	6th set of output of Port 0
Y06	7th set of output of Port 0
Y07	8th set of output of Port 0

2.4.2 R1-EC7062 / R1-EC70E2 Port 1

- Port 1 pin assignment of R1-EC7062 / R1-EC70E2

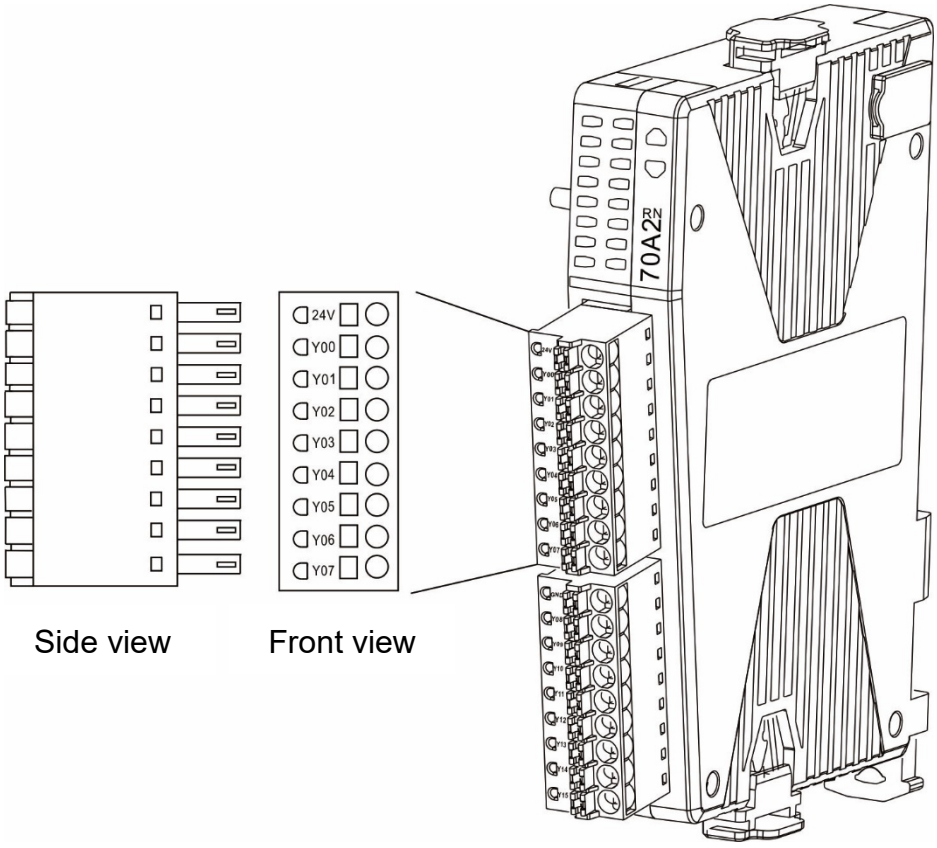


Mark	Description
GND	Power ground of Port 1 (EGND)
Y08	1st set of output of Port 1
Y09	2nd set of output of Port 1
Y10	3rd set of output of Port 1
Y11	4th set of output of Port 1
Y12	5th set of output of Port 1
Y13	6th set of output of Port 1
Y14	7th set of output of Port 1
Y15	8th set of output of Port 1

2

2.4.3 R1-EC70A2 / R1-EC70F2 Port 0

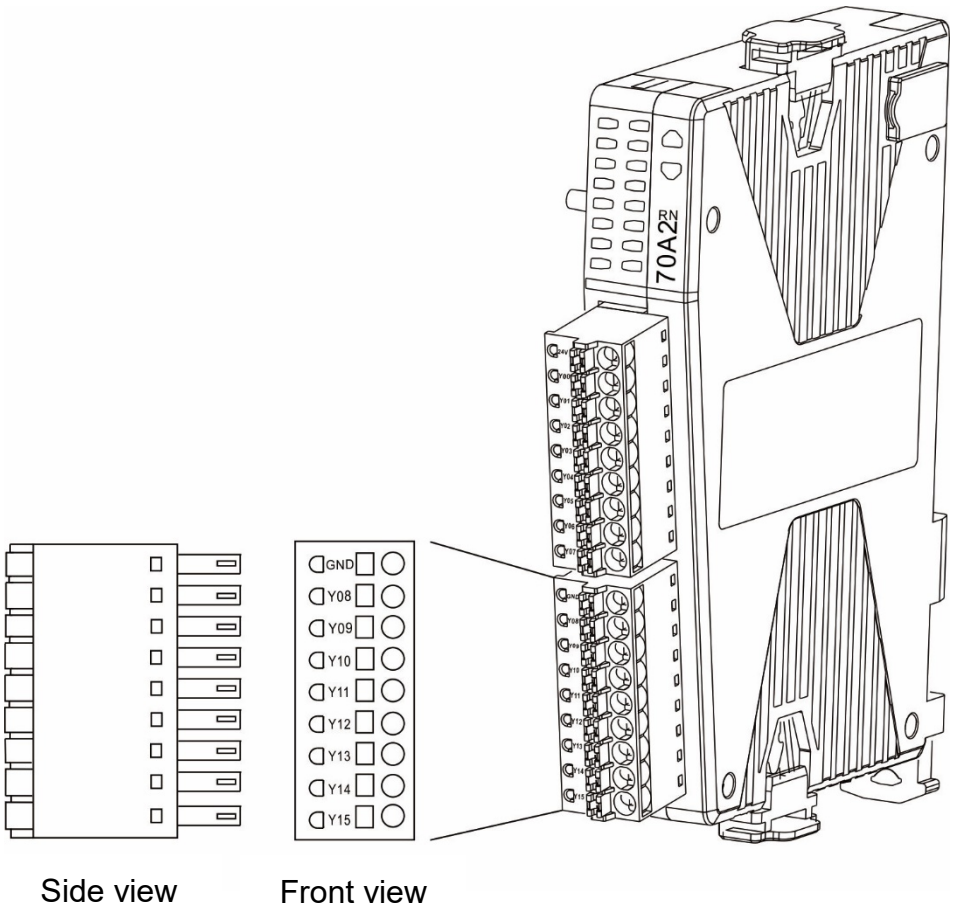
- Port 0 pin assignment of R1-EC70A2 / R1-EC70F2



Mark	Description
24V	24V power input of Port 0 (VCCIO)
Y00	1st set of output of Port 0
Y01	2nd set of output of Port 0
Y02	3rd set of output of Port 0
Y03	4th set of output of Port 0
Y04	5th set of output of Port 0
Y05	6th set of output of Port 0
Y06	7th set of output of Port 0
Y07	8th set of output of Port 0

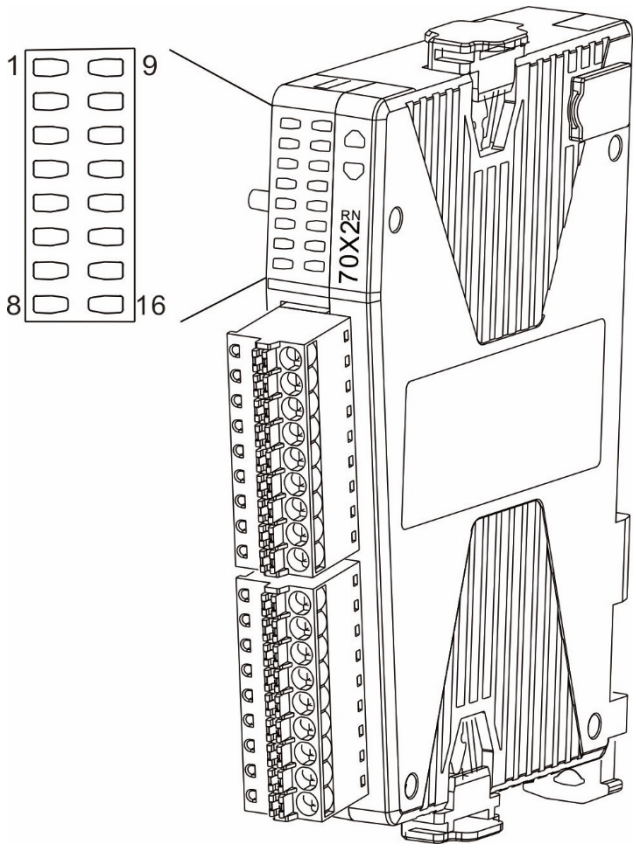
2.4.4 R1-EC70A2 / R1-EC70F2 Port 1

- Port 1 pin assignment of R1-EC70A2 / R1-EC70F2



Mark	Description
GND	Power ground of Port 1
Y08	1st set of output of Port 1
Y09	2nd set of output of Port 1
Y10	3rd set of output of Port 1
Y11	4th set of output of Port 1
Y12	5th set of output of Port 1
Y13	6th set of output of Port 1
Y14	7th set of output of Port 1
Y15	8th set of output of Port 1

2.4.5 R1-EC70X2 indicator light



Indicator mark	Description	Indicator mark	Description
1	Y00	9	Y08
2	Y01	10	Y09
3	Y02	11	Y10
4	Y03	12	Y11
5	Y04	13	Y12
6	Y05	14	Y13
7	Y06	15	Y14
8	Y07	16	Y15

Wiring 3

This chapter provides wiring instructions for the R1-EC70X2 series product, including wiring examples of the output port.

3.1 Output port wiring example ····· 3-2

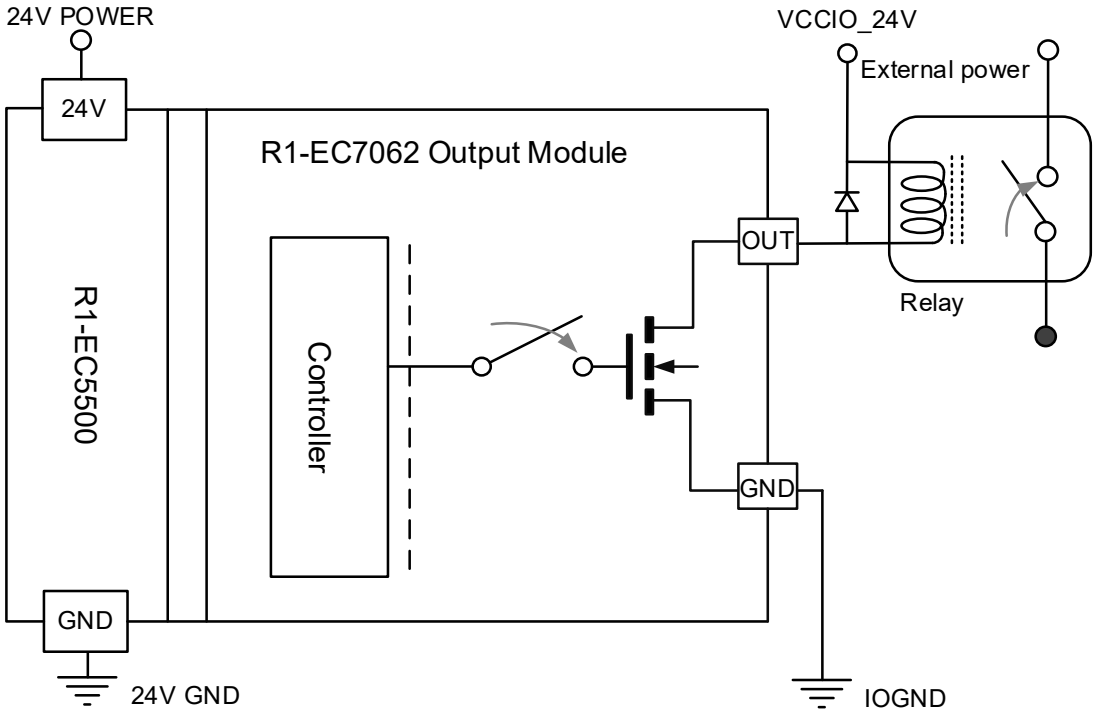
3.1 Output port wiring example

■ R1-EC7062 / R1-EC70E2 is connected to NPN (SINK) type load

3

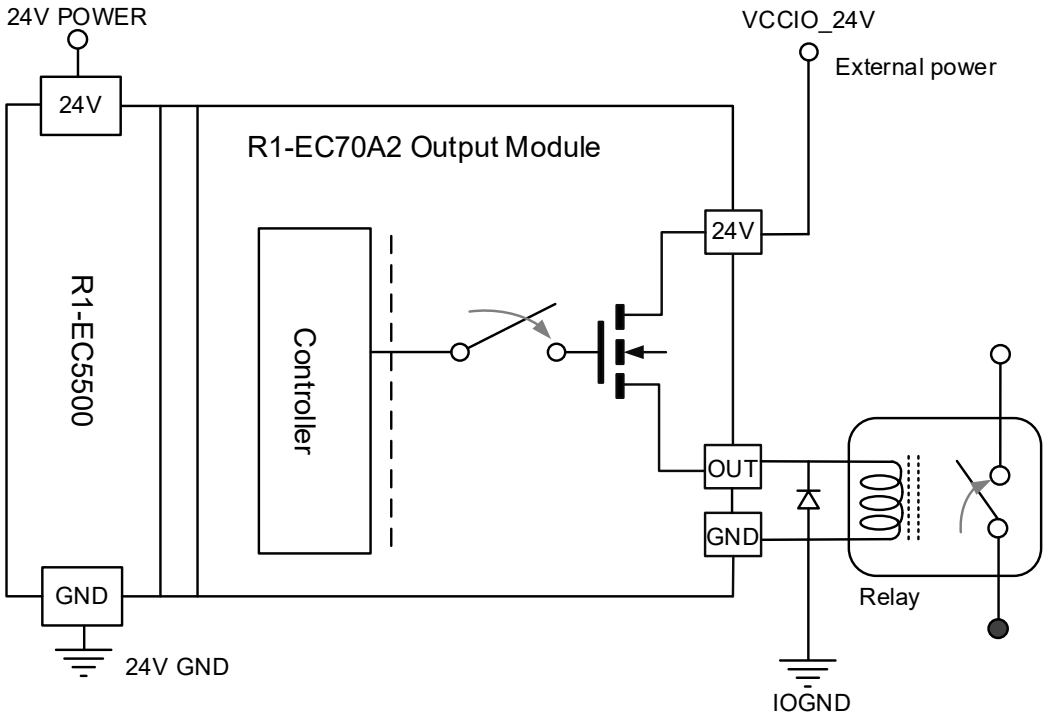
VCCIO_24V / IOGND and 24V_POWER / 24VGND should be isolated power-supply circuits. The example below shows a single point (Y00) output schematic, and the other 15 sets (Y01 - Y15) have the same output structure.

GND of Port 0 and Port 1 must be connected to IOGND to avoid abnormal output status.



■ R1-EC70A2 / R1-EC70F2 is connected to PNP (SOURCE) type load

VCCIO_24V / IOGND and 24V_POWER / 24VGND should be isolated power-supply circuits. The example below shows a single point (Y00) output schematic, and the other 15 sets (Y01 - Y15) have the same output structure.



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CiA401 Drive Profile

4

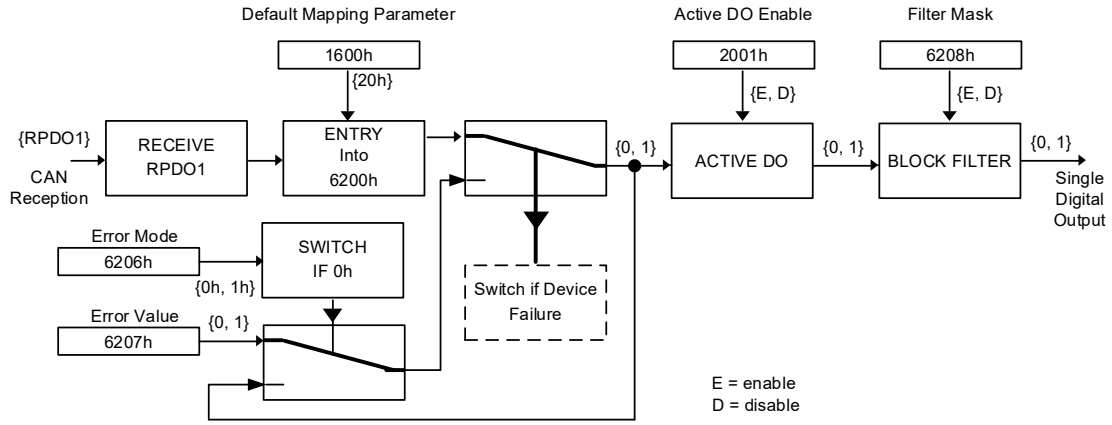
This chapter introduces the operation and related objects of the output module according to the CiA401 protocol used by R1-EC70E2 / R1-EC70F2.

4.1 Operation mode ····· 4-2
4.1.1 Related objects ····· 4-2

4.1 Operation mode

4

You can use the objects Digital Output Setting Value and Active DO Enable to control the digital output status or use the Filter Mask parameters to designate the output channel. When there is a connection error, you can use the objects Error Mode Enable and Error Mode Output Value to set the output status. The diagram below is the control flow graph.



4.1.1 Related objects

The descriptions below detail the names and setting properties of the related objects.

Index	Sub	Name	Access	PDO Mapping	Units	Type
2000h	-	Read Actual Output Value	-	-	-	-
	1	Ch 1 - 8 Read Actual Output Value	RO	YES	-	USINT
	2	Ch 9 - 16 Read Actual Output Value	RO	YES	-	USINT
2001h	-	Active DO Enable			-	
	1	Ch 1 - 8 Active DO Enable	RW	NO	-	USINT
	2	Ch 9 - 16 Active DO Enable	RW	NO	-	USINT
6200h	-	Digital Output Setting Value	-	-	-	-
	1	Ch 1 - 8 Digital Output Setting Value	RW	YES	-	USINT
	2	Ch 9 - 16 Digital Output Setting Value	RW	YES	-	USINT
6206h	-	Error Mode Enable	-	-	-	-
	1	Ch 1- 8 Error Mode Enable	RW	NO	-	USINT
	2	Ch 9 - 16 Error Mode Enable	RW	NO	-	USINT
6207h	-	Error Mode Output Value	-	-	-	-
	1	Ch 1- 8 Error Mode Output Value	RW	NO	-	USINT

Index	Sub	Name	Access	PDO Mapping	Units	Type
	2	Ch 9 - 16 Error Mode Output Value	RW	NO	-	USINT
6208h	-	Filter Mask	-	-	-	-
	1	Ch 1 - 8 Filter Mask	RW	NO	-	USINT
	2	Ch 9 - 16 Filter Mask	RW	NO	-	USINT

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Object Dictionary

5

This chapter introduces the objects for R1-EC70E2 / R1-EC70F2 with the descriptions and applications.

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5.1 Object list

Object Dictionaries		Reference
General Objects	Device Type (1000h)	5.2.1
	Error Register (1001h)	5.2.2
	Manufacturer Device Name (1008h)	5.2.3
	Manufacturer Software Version (100Ah)	5.2.4
	Identity Object (1018h)	5.2.5
PDO Mapping Objects	Receive PDO Mapping (1600h)	5.3.1
	Transmit PDO Mapping (1A00h)	5.3.2
Sync Manager Communication Objects	Sync Manager Communication Type (1C00h)	5.4.1
	Sync Manager PDO Assignment (1C12h, 1C13h)	5.4.2
	Sync Manager Synchronization (1C32h, 1C33h)	5.4.3
Manufacturer Specific Objects	Read Actual Output Value (2000h)	5.5.1
	Active DO Enable (2001h)	5.5.2
Device Control	Digital Output Setting Value (6200h)	5.6.1
	Error Mode Enable (6206h)	5.6.2
	Error Mode Output Value (6207)	5.6.3
	Filter Mask (6208)	5.6.4

5.2 General objects

5.2.1 Device Type (1000h)

This object describes the type of the device and its functionality.

Index	Sub	Name	Type	Access	PDO Mapping	Value
1000h	0	Device Type	UDINT	RO	No	0x00020191

General information (bit0 - 15): 0191 (DS401)

Additional information (bit16 - 31): 0002 (Digital Output)

5.2.2 Error Register (1001h)

This object is an error register for the device. The value of this object is stored in the emergency message.

Index	Sub	Name	Type	Access	PDO Mapping	Value
1001h	0	Error Register	USINT	RO	No	0x00

Bit definition:

Bit	Meaning
0	Generic error
1	Current
2	Voltage
3	Temperature
4	Communication error (overrun, error state)
5	Device profile specific
6	Reserved (always 0)
7	Manufacturer specific

5.2.3 Manufacturer Device Name (1008h)

This object acquires the device name of R1-EC70E2.

Index	Sub	Name	Type	Access	PDO Mapping	Value
1008h	0	Manufacturer Device Name	STRING	RO	No	R1-EC70E2

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5.2.4 Manufacturer Software Version (100Ah)

This object acquires the information about the software version of R1-EC70E2.

Index	Sub	Name	Type	Access	PDO Mapping	Value
100Ah	0	Manufacturer Software Version	STRING	RO	No	-

5.2.5 Identity Object (1018h)

This object acquires the general information about the device.

Index	Sub	Name	Type	Access	PDO Mapping	Value
1018h	0	Number of entries	USINT	RO	No	4
	1	Vendor ID	UDINT	RO	No	0x000001DD
	2	Product code	UDINT	RO	No	0x000070E2
	3	Revision number	UDINT	RO	No	0x00100000
	4	Serial number	UDINT	RO	No	0x00000000

5.3 PDO mapping objects

With the EtherCAT protocol, you can use the PDO Mapping Objects to have the data updated periodically.

5.3.1 Receive PDO Mapping (1600h)

Index	Sub	Name	Type	Access	PDO Mapping	Value
1600h	0	Number of objects in this PDO	USINT	RO	No	2
	1	Mapping entry 1	UDINT	RW	No	0x62000108
	2	Mapping entry 2	UDINT	RW	No	0x62000208

5.3.2 Transmit PDO Mapping (1A00h)

Index	Sub	Name	Type	Access	PDO Mapping	Value
1A00h	0	Number of objects in this PDO	USINT	RO	No	2
	1	Mapping entry 1	UDINT	RW	No	0x20000108
	2	Mapping entry 2	UDINT	RW	No	0x20000208

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5.4 Sync manager communication objects

5.4.1 Sync Manager Communication Type (1C00h)

Index	Sub	Name	Type	Access	PDO Mapping	Value
1C00h	0	Number of used Sync Manager channels	USINT	RO	No	4
	1	Communication type sync manager 0	USINT	RO	No	1: mailbox receive (Master to slave)
	2	Communication type sync manager 1	USINT	RO	No	2: mailbox send (Slave to master)
	3	Communication type sync manager 2	USINT	RO	No	3: process data output (Master to slave)
	4	Communication type sync manager 3	USINT	RO	No	4: process data input (Slave to master)

5.4.2 Sync Manager PDO Assignment (1C12h to 1C13h)

Index	Sub	Name	Type	Access	PDO Mapping	Value
1C12h	0	Number of assigned PDOs	USINT	RW	No	1
	1	PDO Mapping object index ofassigned RxPDO 1	UINT	RW	No	1600h
1C13h	0	Number of assigned PDOs	USINT	RW	No	1
	1	PDO Mapping object index ofassigned TxPDO 1	UINT	RW	No	1A00h

5.4.3 Sync Manager Synchronization (1C32h to 1C33h)

Index	Sub	Name	Type	Access	PDO Mapping	Value
1C32h	0	Number of SM Output Parameter	USINT	RO	No	32
	1	Synchronization Type	UINT	RW	NO	0x0001
	2	Cycle Time	UDINT	RW	NO	0
	4	Synchronization Type Supported	UINT	RO	NO	0x0002
	5	Minimum Cycle Time	UDINT	RO	NO	0x0007A120
	6	Calc and Copy Time	UDINT	RO	NO	0
	8	Get Cycle Time	UDINT	RW	NO	0x0001
	9	Delay Time	UDINT	RO	NO	0
	10	Sync0 Cycle Time	UDINT	RW	NO	0
	11	SM-Event Missed	UDINT	RO	NO	0
	12	Cycle Time Too Small	UDINT	RO	NO	0
	32	Sync Error	BOOL	RO	NO	FALSE
1C33h	0	Number of SM Input Parameter	USINT	RO	No	32
	1	Synchronization Type	UINT	RW	NO	0x0001
	2	Cycle Time	UDINT	RW	NO	0
	4	Synchronization Type Supported	UINT	RO	NO	0x0002
	5	Minimum Cycle Time	UDINT	RO	NO	0x0007A120
	6	Calc and Copy Time	UDINT	RO	NO	0
	8	Get Cycle Time	UDINT	RW	NO	0
	9	Delay Time	UDINT	RO	NO	0
	10	Sync0 Cycle Time	UDINT	RW	NO	0
	11	SM-Event Missed	UDINT	RO	NO	0

Index	Sub	Name	Type	Access	PDO Mapping	Value
	12	Cycle Time Too Small	UDINT	RO	NO	0
	32	Sync Error	BOOL	RO	NO	FALSE

5.5 Manufacturer specific objects

5.5.1 Read Actual Output Value (2000h)

This object reads the actual output value (8 output channels as a set).

Index	Sub	Name	Type	Access	PDO Mapping	Value
2000h	1	Ch 1 - 8 Read Actual Output Value	USINT	RO	YES	0 to 255
2000h	2	Ch 9 - 16 Read Actual Output Value	USINT	RO	YES	0 to 255

5.5.2 Active DO Enable (2001h)

This object sets whether to allow output channels changes (8 output channels as a set). 0 = status change not allowed; 1 = status change allowed.

Index	Sub	Name	Type	Access	PDO Mapping	Value
2001h	1	Ch1 - 8 Active DO Enable	USINT	RW	NO	0 to 255
2001h	2	Ch 9 - 16 Active DO Enable	USINT	RW	NO	0 to 255

5.6 Device control

5.6.1 Digital Output Setting Value (6200h)

This object controls the output setting value (8 output channels as a set).

Index	Sub	Name	Type	Access	PDO Mapping	Value
6200h	1	Ch 1 - 8 Output Setting Value	USINT	RW	YES	0 to 255
6200h	2	Ch 9 - 16 Output Setting Value	USINT	RW	YES	0 to 255

5.6.2 Error Mode Enable (6206h)

This object sets the Error Mode parameter (8 output channels as a set). 0 = remain the original output values; 1 = the setting values of Error Mode Output Value (6207h).

Index	Sub	Name	Type	Access	PDO Mapping	Value
6206h	1	Ch 1 - 8 Error Mode Enable	USINT	RW	NO	0 to 255
6206h	2	Ch 9 - 16 Error Mode Enable	USINT	RW	NO	0 to 255

5.6.3 Error Mode Output Value (6207h)

This object sets the Error Mode Output Value parameters (8 output channels as a set).

Index	Sub	Name	Type	Access	PDO Mapping	Value
6207h	1	Ch 1 - 8 Error Mode Output Value	USINT	RW	NO	0 to 255
6207h	2	Ch 9 - 16 Error Mode Output Value	USINT	RW	NO	0 to 255

5.6.4 Filter Mask (6208h)

This object sets the Filter Mask parameters (8 output channels as a set). 0 = ignore the received setting values and remain the original output values; 1 = the output is the received setting values.

Index	Sub	Name	Type	Access	PDO Mapping	Value
6208h	1	Ch 1 - 8 Filter Mask	USINT	RW	NO	0 to 255
6208h	2	Ch 9 - 16 Filter Mask	USINT	RW	NO	0 to 255

SDO Error Message Abort Code

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This chapter introduces the SDO Error Message Abort Code of R1-EC70E2 / R1-EC70F2.

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6.1 SDO error message abort code

The following table lists the abort code of SDO communication fault:

Code	Description
0x05 03 00 00	Toggle bit not changed
0x05 04 00 00	SDO protocol timeout
0x05 04 00 01	Invalid or unknown SDO command specifier
0x05 04 00 05	Out of memory
0x06 01 00 05	Unsupported access to an object
0x06 01 00 00	Attempt to read an object
0x06 03 00 02	Attempt to write a read-only object
0x06 02 00 00	Object does not exist in the object dictionary
0x06 04 00 41	Object cannot be mapped into the PDO
0x06 04 00 42	The number and length of the objects to be mapped would exceed the PDO length
0x06 04 00 43	General parameter incompatibility
0x06 04 00 47	General internal error in device
0x06 06 00 00	Access failed due to a hardware error
0x06 07 00 10	Data type or length of service parameter does not match
0x06 07 00 12	Data type does not match, length of service parameter too great
0x06 07 00 13	Data type does not match, length of service parameter too short
0x06 09 00 11	Sub-index does not exist
0x06 09 00 30	Value exceeded (for write access)
0x06 09 00 31	Value range error: parameter value too great
0x06 09 00 32	Value range error: parameter value too small
0x06 09 00 36	Maximum value is less than minimum value
0x08 00 00 00	General error
0x08 00 00 20	Data transport error
0x08 00 00 21	Access not possible due to local control
0x08 00 00 22	Access not possible due to current device state
0x08 00 00 23	Dynamic creation error in the object dictionary, or no object dictionary present

Revision History

Release date	Version	Chapter	Revision contents
August, 2018	V1.0 (First edition)		

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