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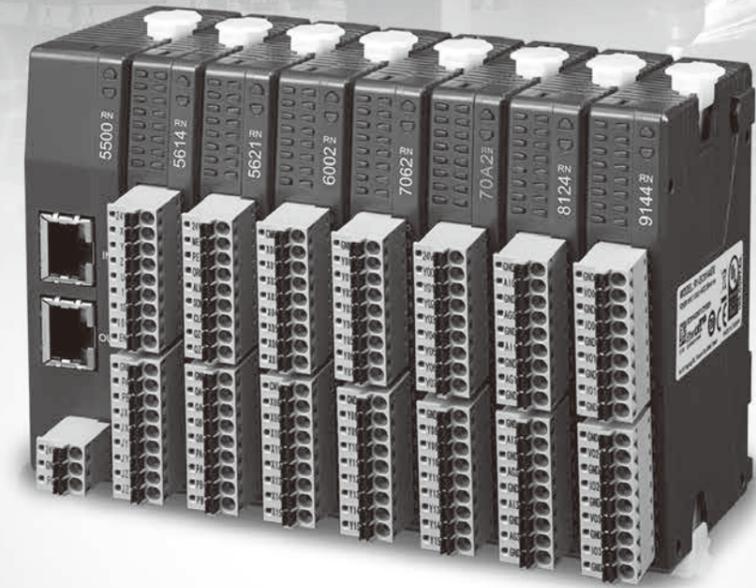
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Delta EtherCAT Gateway Slave Module R1-EC5614 MPG Module User Guide

Preface

Thank you for purchasing this product. This user guide provides information about the R1-EC5614 EtherCAT remote control MPG input expansion module.

This user guide includes:

- Product inspection and model explanation
- Specifications and product interface
- Wiring
- CiA404 Drive Profile
- Object Dictionary
- SDO Error Message Abort Code

Product features of the EtherCAT remote control expansion module

R1-EC5614 MPG input expansion module supports the EtherCAT (Ethernet Control Automation Technology) protocol, which makes this module a high-performance distributed I/O system.

The MPG input module provides a standard 4-axis (or maximum 6-axis) MPG input reading and controlling interface. With the E-Bus power module, this MPG input module can provide remote digital signal control of the EtherCAT master, which can instantly acquire the data (within 1 ms) of the load status for multiple sets of slave modules.

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 reading the multi-point load status. It is easy to assemble with better stability and scalability. This is the one and only choice for industrial upgrading.

How to use this user guide

You can use this user guide as a reference while using the R1-EC5614 series EtherCAT remote control MPG input 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

Consult your Delta equipment distributors or Delta Customer Service Center if you encounter any problems.



EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

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SDO Error Message Abort Code

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Product Inspection and Model Explanation

1

This chapter includes the product inspection, model explanation, and instructions for the R1-EC5614 expansion module.

1.1	Product inspection	1-2
1.2	Model explanation	1-2
1.3	Product instructions	1-2

1.1 Product inspection

Check the following items after receiving the product:

1. Packaging: make sure the product's packaging is not damaged.
2. Bubble wrap: for protection of the product. Make sure the stickers are firmly attached to the bubble wrap.
3. R1-EC5614: check the product for damage and all accessories are included.
4. Product installation instructions: make sure there is an instruction sheet.

1.2 Model explanation

$$\begin{array}{ccccccc} \underline{R} & \underline{1} & - & \underline{EC} & - & \underline{5} & \underline{6} & \underline{1} & \underline{4} \\ (1)(2) & & (3) & & (4)(5) & & (6) & & \end{array}$$

No.	Item	Description
(1)	Product type	R: remote
(2)	Product category	1: type 1 – slim
(3)	Bus type	EC: EtherCAT
(4)	Module type	5: gateway module
(5)	Module subtype 1	6: counter / encoder / motion control
(6)	Module subtype 2	14: 6-axis MPG receiving module

1.3 Product instructions

This series of product must be used with Delta's R1-EC5500 series product.

Specifications and Product Interface

2

This chapter introduces the product specifications of the R1-EC5614 module, including electrical specifications, product diagram, dimensional specifications, and definitions of the ports and indicators.

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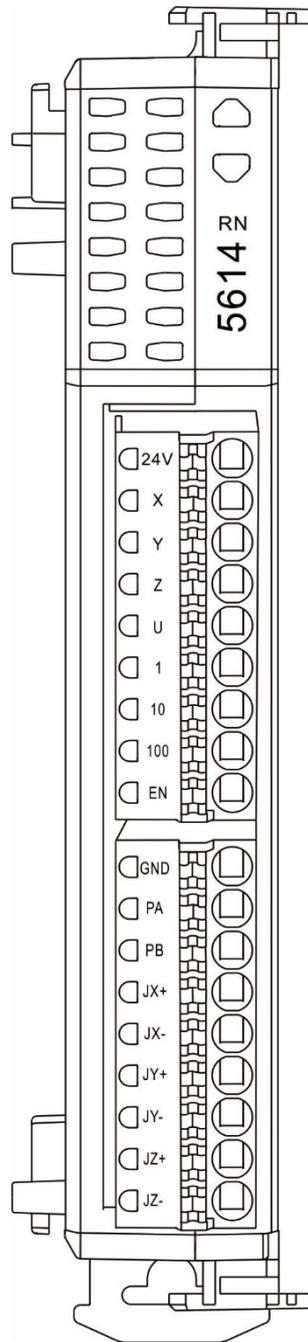
2.1 Electrical specifications

Item	Description
Standard number of controlled axis (maximum)	4 axes (6 axes)
Module control power	Supplied by E-Bus
Magnification selection	X1 / X10 / X100
Jog input	3 sets
Sampling frequency	40 kHz
External I/O power supply	24 V _{DC} (-15% to +20%)
FIFO length	30 sets
Communication time	500 μs - 3276800 μs
Active level (On > Off)	< 8 V _{DC}
Active level (Off > On)	> 16.5 V _{DC}
E-Bus current consumption	180 mA
Electrical isolation	500 V _{rms} (E-Bus / signal voltage)
Weight	55 g (0.12 lb)
Operating environment	Operating temperature: 0°C to 50°C (32°F to 122°F) Storage temperature: -20°C to +70°C (-4°F to +158°F)
Mounting type	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
Certification	 

2.2 Product diagram and dimensions

2.2.1 Product diagram

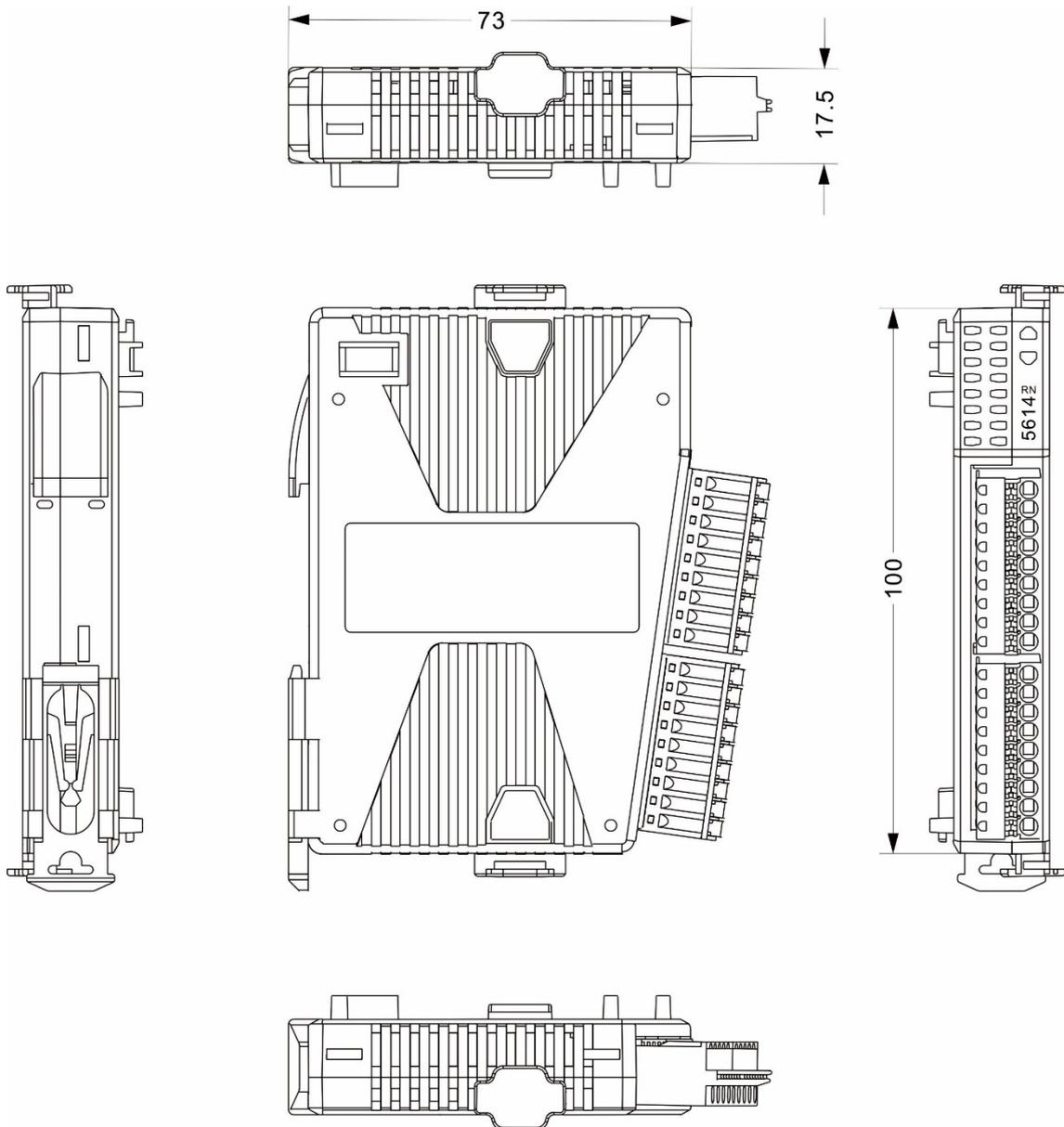
- Front view of module panel



2.2.2 Dimensions

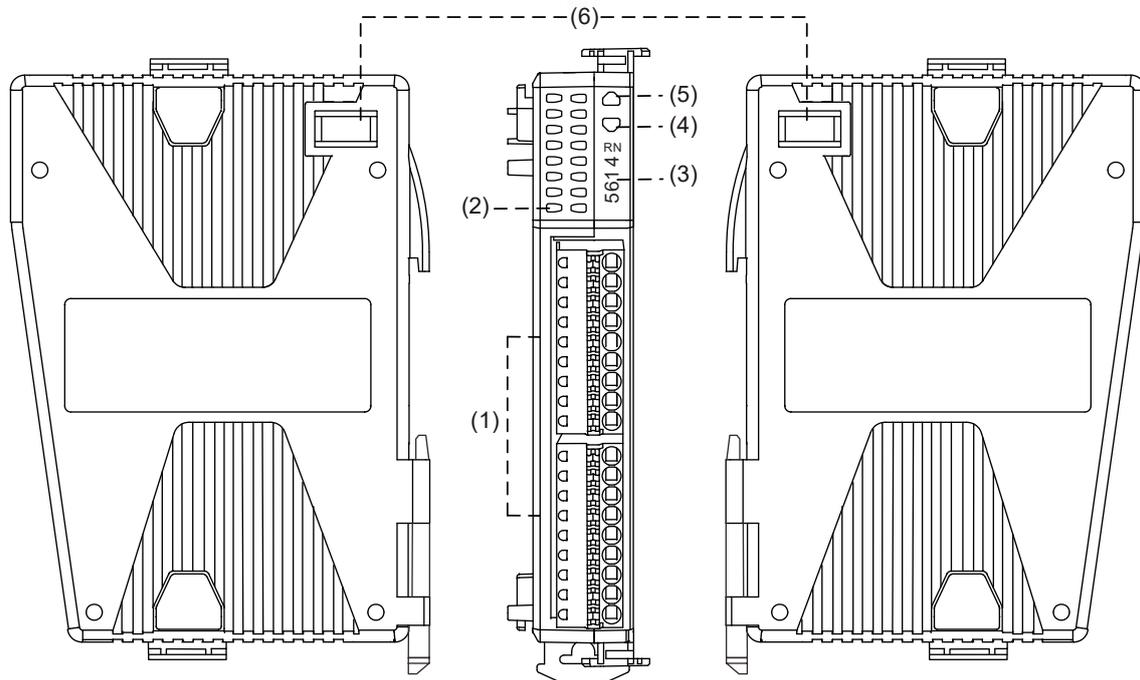
R1-EC5614 module: 100 mm x 73 mm x 17.5 mm

2



2.3 Product interface description

- Interface and configuration for the R1-EC5614 model



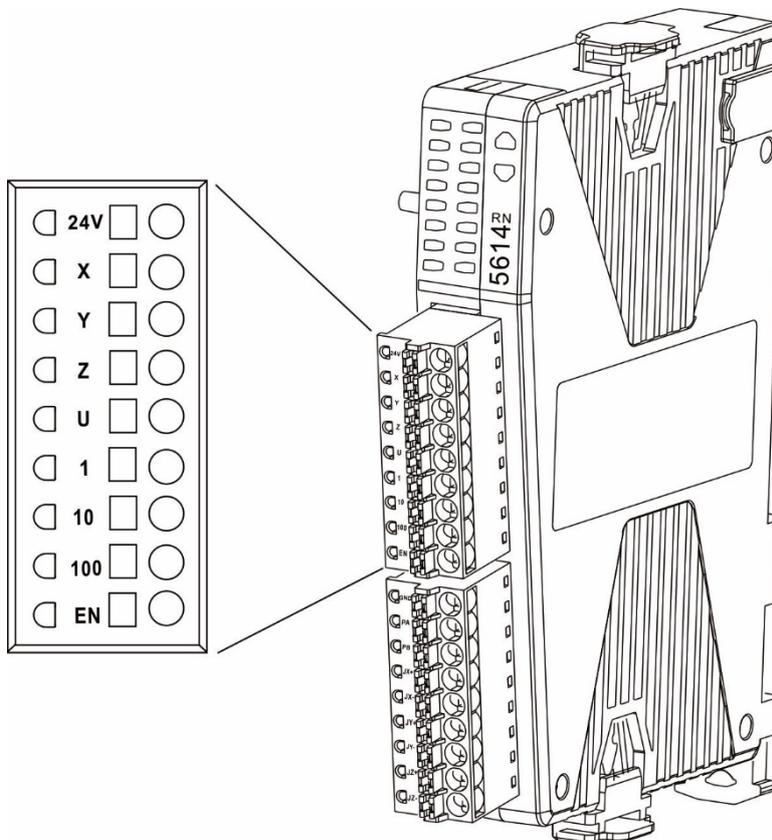
No.	Description
(1)	I/O points for single axis
(2)	I/O signal LED indicators for single axis
(3)	Model number
(4)	Communication status indicator
(5)	Power indicator
(6)	E-Bus transmission ports

2

2.4 Port description

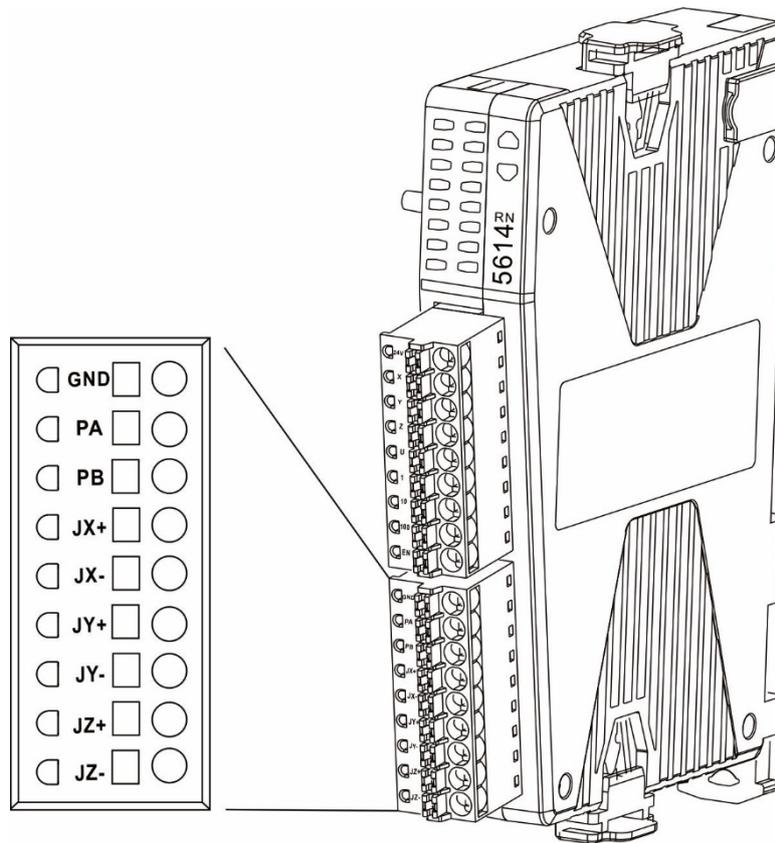
2.4.1 I/O signals for single axis

- I/O Port 0 pin definition for single axis



Pin	Description
24V	External power input
X	X-axis signal (24 V _{DC} common anode, single-ended contact)
Y	Y-axis signal (24 V _{DC} common anode, single-ended contact)
Z	Z-axis signal (24 V _{DC} common anode, single-ended contact)
U	U-axis signal (24 V _{DC} common anode, single-ended contact)
1	Pulse magnification X1 (24 V _{DC} common anode, single-ended contact)
10	Pulse magnification X10 (24 V _{DC} common anode, single-ended contact)
100	Pulse magnification X100 (24 V _{DC} common anode, single-ended contact)
EN	Motion / setting execution (24 V _{DC} common anode, single-ended contact)

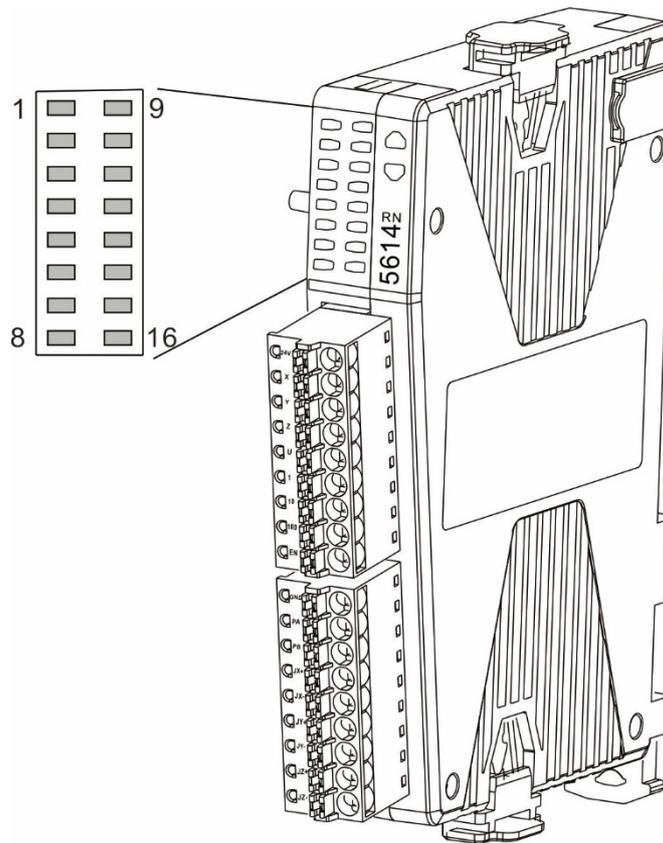
■ I/O Port 1 pin definition for single axis



Pin	Description
GND	External power ground (GND) (24 V _{DC} common anode, single-ended contact)
PA	MPG pulse phase A input (24 V _{DC} common anode, single-ended contact)
PB	MPG pulse phase B input (24 V _{DC} common anode, single-ended contact)
JX+	X-axis jog signal (+) (24 V _{DC} common anode, single-ended contact)
JX-	X-axis jog signal (-) (24 V _{DC} common anode, single-ended contact)
JY+	Y-axis jog signal (+) (24 V _{DC} common anode, single-ended contact)
JY-	Y-axis jog signal (-) (24 V _{DC} common anode, single-ended contact)
JZ+	Z-axis jog signal (+) / W-axis selection signal (24 V _{DC} common anode, single-ended contact)
JZ-	Z-axis jog signal (-) / V-axis selection signal (24 V _{DC} common anode, single-ended contact)

2.4.2 Definitions of indicators

2



Indicator mark	Description	Indicator mark	Description
1	X-axis indicator	9	PA encoder input
2	Y-axis indicator	10	PB encoder input
3	Z-axis indicator	11	JX+
4	U-axis indicator	12	JX-
5	Pulse magnification X1	13	JY+
6	Pulse magnification X10	14	JY-
7	Pulse magnification X100	15	JZ+ / W-axis indicator
8	EN (enable)	16	JZ- / V-axis indicator

This chapter provides wiring instructions for the R1-EC5614 module, including the wiring example of the MPG signal input port.

3.1	Input port wiring example	3-2
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3

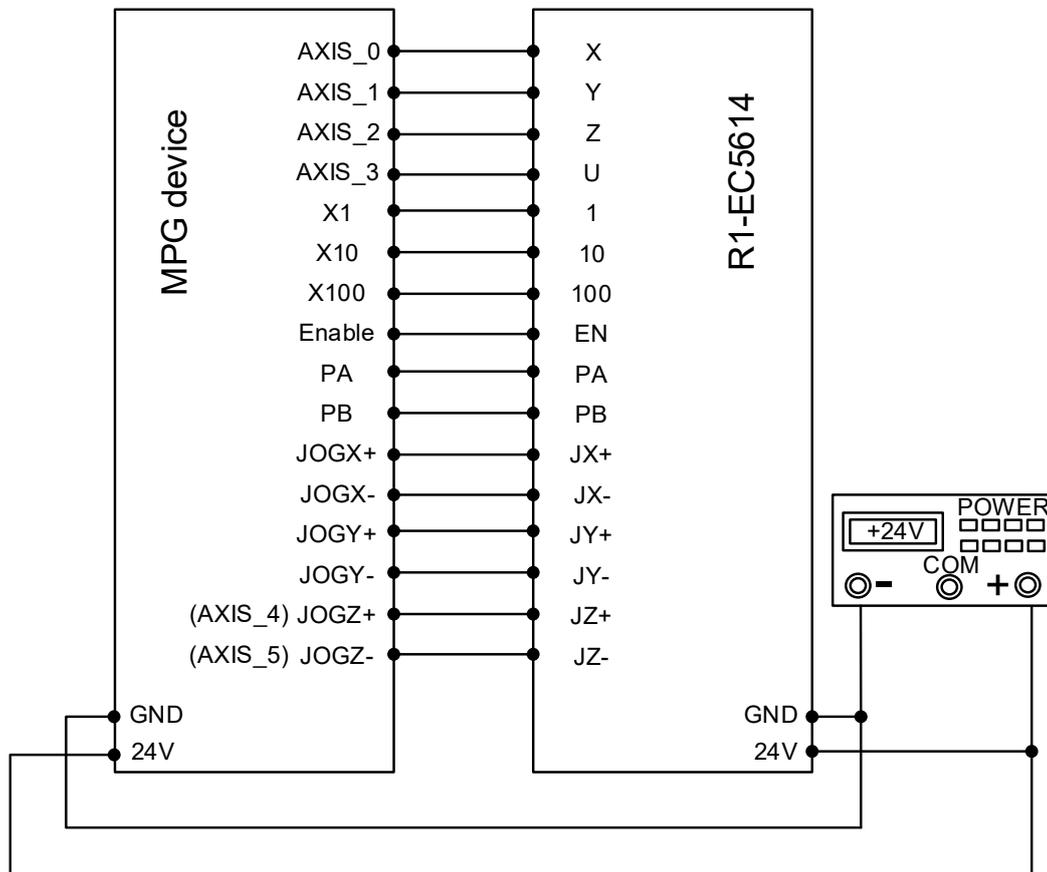
3.1 Input port wiring example

■ MPG device wiring example

The operating voltage of each contact of the R1-EC5614 MPG module is a 24 V_{DC} single-ended transmission signal. The signal level of a general differential type MPG device is below 5 V_{DC}, so it cannot be used with the MPG module. When selecting MPG devices, make sure the applied voltage meets the requirements.

When the external power is supplied, the MPG module and the MPG device should share the same power supply and ground wire. The function signals of the MPG device should be directly input to the MPG module.

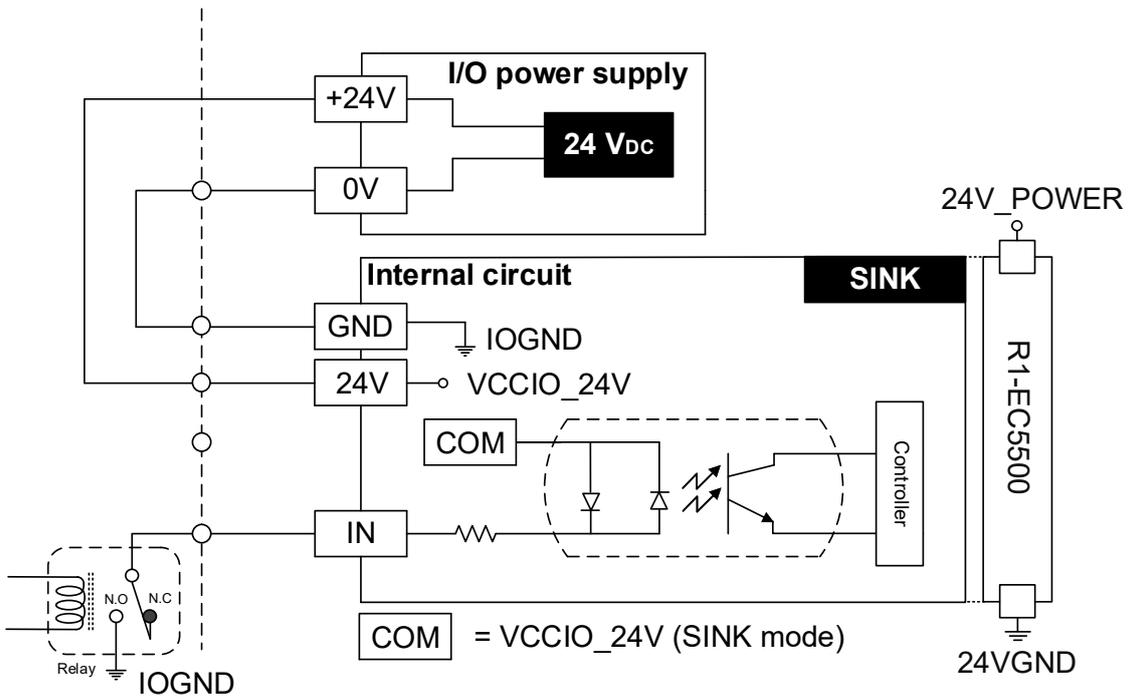
If the MPG device is expanded to 6 axes, only 2 sets of Jog input can be used. Connect AXIS_4 and AXIS_5 of the MPG device to the JZ+ and JZ- contacts of the R1-EC5614 module respectively. (The activation of the Jog function requires the MPG setting in the software. Refer to Section 5.5.1 for more information.)



■ R1-EC5614 MPG signal input wiring example

Isolate the IO power supply VCCIO_24V / IOGND and bus power supply 24V_POWER / 24VGND circuits. The following example is the single point (X) input diagram for axis selection. The other 15 points, such as axis selection, magnification, enable, encoder, and Jog, have the same input structure.

The MPG device and the MPG module should use the same power circuit (VCCIO_24V / IOGND) to avoid signal noise or interference.



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3

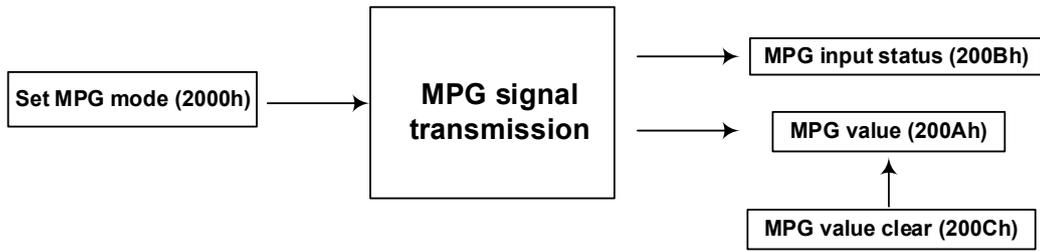
CiA404 Drive Profile

4

This chapter introduces the CiA404 protocol followed by R1-EC5614, including operation mode, related objects, and supported application functions.

4.1	MPG module operation mode	4-2
4.1.1	Related objects	4-2
4.1.2	DC setting time	4-2

4.1 MPG module operation mode



4.1.1 Related objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
2000h	0	Set MPG mode	RW	No	-	USINT
200Ah	0	MPG value	R	Yes	-	DINT
200Bh	0	MPG input status	R	Yes	-	UINT
200Ch	0	MPG value clear	RW	No	-	USINT

4.1.2 DC setting time

The minimum DC setting time is 0x7A120 - 0xC3500000 ns. An error message is returned if the setting is incorrect.

Object Dictionary

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This chapter introduces the objects, including the descriptions and applications, for R1-EC5614.

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5.5.3	MPG input status (200Bh)	5-9
5.5.4	MPG value clear (200Ch)	5-9

5.1 Object list

	Object dictionary	Refer to
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
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Manufacturer specific objects	Set MPG mode (2000h)	5.5.1
	MPG value (200Ah)	5.5.2
	MPG input status (200Bh)	5.5.3
	MPG value clear (200Ch)	5.5.4

5.2 General objects

5.2.1 Device type (1000h)

This object describes the type and function of the device.

Index	Sub	Name	Type	Access	PDO Mapping	Value
1000h	0	Device type	UDINT	RO	No	0x00000194

General information (bit 0 - 15): 0194 (DS404)

Additional information (bit 16 - 31): 0000 (digital signal input device)

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. Currently, all bits are not defined.

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

5.2.3 Manufacturer device name (1008h)

This object acquires the device name of R1-EC5614.

Index	Sub	Name	Type	Access	PDO Mapping	Value
1008h	0	Manufacturer device name	STRING	RO	No	-

5.2.4 Manufacturer software version (100Ah)

This object acquires the information about the software version of R1-EC5614.

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	0x00005614
	3	Revision number	UDINT	RO	No	0x00100000
	4	Serial number	UDINT	RO	No	0x00000000

5.3 PDO mapping objects

Display the used PDO mapping objects in the CoE (CANopen of EtherCAT) protocol.

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	0
	1	Mapping entry 1	UDINT	RW	No	0
	2	Mapping entry 2	UDINT	RW	No	0
	3	Mapping entry 3	UDINT	RW	No	0
	4	Mapping entry 4	UDINT	RW	No	0
	5	Mapping entry 5	UDINT	RW	No	0
	6	Mapping entry 6	UDINT	RW	No	0
	7	Mapping entry 7	UDINT	RW	No	0
	8	Mapping entry 8	UDINT	RW	No	0

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	0x200A0020
	2	Mapping entry 2	UDINT	RW	No	0x200B0010
	3	Mapping entry 3	UDINT	RW	No	0
	4	Mapping entry 4	UDINT	RW	No	0
	5	Mapping entry 5	UDINT	RW	No	0
	6	Mapping entry 6	UDINT	RW	No	0
	7	Mapping entry 7	UDINT	RW	No	0
	8	Mapping entry 8	UDINT	RW	No	0

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 and 1C13h)

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

5.4.3 Sync manager synchronization (1C32h and 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	0x0007
	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 exceeded counter	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	0x0022
	2	Cycle time	UDINT	RW	No	0
	4	Synchronization type supported	UINT	RO	No	0x0007
	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
	12	Cycle exceeded counter	UDINT	RO	No	0
	32	Sync error	BOOL	RO	No	FALSE

5.5 Manufacturer specific objects

5.5.1 Set MPG mode (2000h)

This object sets the number of input axes of the module and the number of sets for Jog input.

Index	Sub	Name	Type	Access	PDO Mapping	Value
2000h	0	Set MPG mode	USINT	RW	No	0 or 1

Bit definition:

Data	Definition
0	Four input axes with three sets of Jog input (default)
1	Six input axes with two sets of Jog input

5.5.2 MPG value (200Ah)

This object displays the input value of the MPG. All input values of the MPG are 4 times the frequency. When the enable (EN) pin is activated (200Bh Bit 9 = On), the MPG value changes.

Index	Sub	Name	Type	Access	PDO mapping	Value
200Ah	0	MPG value	DINT	RO	Yes	Integer32

5.5.3 MPG input status (200Bh)

This object displays the input status of the MPG, such as the selected axis, magnification, enable (EN) pin, and Jog.

Index	Sub	Name	Type	Access	PDO mapping	Value
200Bh	0	MPG input status	UINT	RO	Yes	0 to FFFF

Bit definition:

Data	Definition
Bit 0	Axis X
Bit 1	Axis Y
Bit 2	Axis Z
Bit 3	Axis U
Bit 4	Axis W
Bit 5	Axis C
Bit 6	X1
Bit 7	X10
Bit 8	X100
Bit 9	Enable
Bit 10	JX+
Bit 11	JX-
Bit 12	JY+
Bit 13	JY-
Bit 14	JZ+
Bit 15	JZ-

5.5.4 MPG value clear (200Ch)

This object clears the MPG input value.

Index	Sub	Name	Type	Access	PDO mapping	Value
200Ch	0	MPG value clear	USINT	RW	No	0 or 1

Bit definition:

Data	Definition
0 → 1	Clears the MPG input value.

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5

SDO Error Message Abort Code

6

This chapter introduces the SDO Error Message Abort Code of R1-EC5614.

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6.1 SDO Error Message Abort Code

The following table lists the abort codes for SDO communication errors:

Code	Description
0x05 03 00 00	Toggle bit was not changed.
0x05 04 00 00	SDO protocol timeout.
0x05 04 00 01	Invalid or unknown SDO command.
0x05 04 00 05	Insufficient 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 to 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 long.
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	Parameter value out of range (for write access).
0x06 09 00 31	Value range error: parameter value too big.
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 cannot be transferred or stored to the application.
0x08 00 00 21	Due to local control, data cannot be transferred or stored to the application.
0x08 00 00 22	Due to current device status, data cannot be transferred or stored to the application.
0x08 00 00 23	Dynamic creation error of the object dictionary or the object dictionary does not exist.

6

Revision History

Release date	Version	Chapter	Revision contents
September, 2020	V1.0 (First edition)		

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