NexCOBOT Co., Ltd.

IoT Automation Solutions Business Group

EtherCAT Slave Module

NEIO Series

User Manual

NexCOBOT Co., Ltd.
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PREFACE

Copyright

Disclaimer

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Acknowledgements

The NEIO series is a trademark of Nexcobot Co., Ltd. All other product names mentioned herein are registered trademarks of their respective owners.

Regulatory Compliance Statements

This section provides the FCC compliance statement for Class B devices and describes how to keep the system CE compliant.

Declaration of Conformity

FCC

This equipment has been tested and verified to comply with the limits for a Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area (domestic environment) is likely to cause harmful interference, in which case the user will be required to correct the interference (take adequate measures) at their own expense.

CE

The product(s) described in this manual complies with all applicable European Union (CE) directives if it has a CE marking. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques.

RoHS Compliance

NexCOBOT RoHS Environmental Policy and Status Update

NexCOBOT is a global citizen for building the digital infrastructure. We are committed to providing green products and services, which are compliant with European Union RoHS (Restriction on Use of Hazardous Substance in Electronic Equipment) directive 2011/65/EU, to be your trusted green partner and to protect our environment.

RoHS restricts the use of Lead (Pb) < 0.1% or 1,000ppm, Mercury (Hg) < 0.1% or 1,000ppm, Cadmium (Cd) < 0.01% or 100ppm, Hexavalent Chromium (Cr6+) < 0.1% or 1,000ppm, Polybrominated biphenyls (PBB) < 0.1% or 1,000ppm, and Polybrominated diphenyl Ethers (PBDE) < 0.1% or 1,000ppm.

In order to meet the RoHS compliant directives, NexCOBOT has established an engineering and manufacturing task force in to implement the introduction of green products. The task force will ensure that we follow the standard NexCOBOT development procedure and that all the new RoHS components and new manufacturing processes maintain the highest industry quality levels for which NexCOBOT are renowned.

The model selection criteria will be based on market demand. Vendors and suppliers will ensure that all designed components will be RoHS compliant.

How to recognize NexCOBOT RoHS Products?

For existing products where there are non-RoHS and RoHS versions, the suffix "(LF)" will be added to the compliant product name.

All new product models launched after January 2013 will be RoHS compliant. They will use the usual NexCOBOT naming convention.

Warranty and RMA

NexCOBOT Warranty Period

NexCOBOT manufactures products that are new or equivalent to new in accordance with industry standard. NexCOBOT warrants that products will be free from defect in material and workmanship for 2 years, beginning on the date of invoice by NexCOBOT.

NexCOBOT Return Merchandise Authorization (RMA)

- Customers shall enclose the "NexCOBOT RMA Service Form" with the returned packages.
- Customers must collect all the information about the problems encountered and note anything abnormal or, print out any on-screen messages, and describe the problems on the "NexCOBOT RMA Service Form" for the RMA number apply process.
- Customers can send back the faulty products with or without accessories (manuals, cable, etc.) and any components from the card, such as CPU and RAM. If the components were suspected as part of the problems, please note clearly which components are included. Otherwise, NexCOBOT is not responsible for the devices/parts.
- Customers are responsible for the safe packaging of defective products, making sure it is durable enough to be resistant against further damage and deterioration during transportation. In case of damages occurred during transportation, the repair is treated as "Out of Warranty."
- Any products returned by NexCOBOT to other locations besides the customers' site will bear an extra charge and will be billed to the customer.

Repair Service Charges for Out-of-Warranty Products

NexCOBOT will charge for out-of-warranty products in two categories, one is basic diagnostic fee and another is component (product) fee.

System Level

- Component fee: NexCOBOT will only charge for main components such as SMD chip, BGA chip, etc. Passive components will be repaired for free, ex: resistor, capacitor.
- Items will be replaced with NexCOBOT products if the original one cannot be repaired. Ex: motherboard, power supply, etc.
- Replace with 3rd party products if needed.
- If RMA goods can not be repaired, NexCOBOT will return it to the customer without any charge.

Board Level

- Component fee: NexCOBOT will only charge for main components, such as SMD chip, BGA chip, etc. Passive components will be repaired for free, ex: resistors, capacitors.
- If RMA goods can not be repaired, NexCOBOT will return it to the customer without any charge.

Warnings

Read and adhere to all warnings, cautions, and notices in this guide and the documentation supplied with the chassis, power supply, and accessory modules. If the instructions for the chassis and power supply are inconsistent with these instructions or the instructions for accessory modules, contact the supplier to find out how you can ensure that your computer meets safety and regulatory requirements.

Cautions

Electrostatic discharge (ESD) can damage system components. Do the described procedures only at an ESD workstation. If no such station is available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the computer chassis.

Safety Information

Before installing and using the device, note the following precautions:

- Read all instructions carefully.
- Do not place the unit on an unstable surface, cart, or stand.
- Follow all warnings and cautions in this manual.
- When replacing parts, ensure that your service technician uses parts specified by the manufacturer.
- Avoid using the system near water, in direct sunlight, or near a heating device.
- The load of the system unit does not solely rely for support from the rackmounts located on the sides. Firm support from the bottom is highly necessary in order to provide balance stability.
- The computer is provided with a battery-powered real-time clock circuit. There is a danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Installation Recommendations

Ensure you have a stable, clean working environment. Dust and dirt can get into components and cause a malfunction. Use containers to keep small components separated.

Adequate lighting and proper tools can prevent you from accidentally damaging the internal components. Most of the procedures that follow require only a few simple tools, including the following:

- A Philips screwdriver
- A flat-tipped screwdriver
- A grounding strap
- An anti-static pad

Using your fingers can disconnect most of the connections. It is recommended that you do not use needle-nose pliers to disconnect connections as these can damage the soft metal or plastic parts of the connectors.

Safety Precautions

1. Read these safety instructions carefully.

2. Keep this User Manual for later reference.

3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.

4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.

5. Keep this equipment away from humidity.

6. Put this equipment on a stable surface during installation. Dropping it or letting it fall may cause damage.

7. The openings on the enclosure are for air convection to protect the equipment from overheating. DO NOT COVER THE OPENINGS.

8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.

9. Place the power cord in a way so that people will not step on it. Do not place anything on top of the power cord. Use a power cord that has been approved for use with the product and that it matches the voltage and current marked on the product's electrical range label. The voltage and current rating of the cord must be greater than the voltage and current rating marked on the product.

10. All cautions and warnings on the equipment should be noted.

11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.

12. Never pour any liquid into an opening. This may cause fire or electrical shock.

13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.

14. If one of the following situations arises, get the equipment checked by service personnel:
    a. The power cord or plug is damaged.
    b. Liquid has penetrated into the equipment.
    c. The equipment has been exposed to moisture.
    d. The equipment does not work well, or you cannot get it to work according to the user's manual.
    e. The equipment has been dropped and damaged.
    f. The equipment has obvious signs of breakage.

15. Do not place heavy objects on the equipment.

16. The unit uses a three-wire ground cable which is equipped with a third pin to ground the unit and prevent electric shock. Do not defeat the purpose of this pin. If your outlet does not support this kind of plug, contact your electrician to replace your obsolete outlet.

17. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER. DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.

Technical Support and Assistance

1. For the most updated information of NexCOBOT products, visit NexCOBOT's website at www.nexcobot.com.

2. For technical issues that require contacting our technical support team or sales representative, please have the following information ready before calling:
   - Product name and serial number
   - Detailed information of the peripheral devices
   - Detailed information of the installed software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wordings of the error messages

Warning!

1. Handling the unit: carry the unit with both hands and handle it with care.

2. Maintenance: to keep the unit clean, use only approved cleaning products or clean with a dry cloth.

Conventions Used in this Manual

Warning:
Information about certain situations, which if not observed, can cause personal injury. This will prevent injury to yourself when performing a task.

Caution:
Information to avoid damaging components or losing data.

Note:
Provides additional information to complete a task easily.

Global Service Contact Information

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Chapter 1: Product Introduction

1.1 Overview

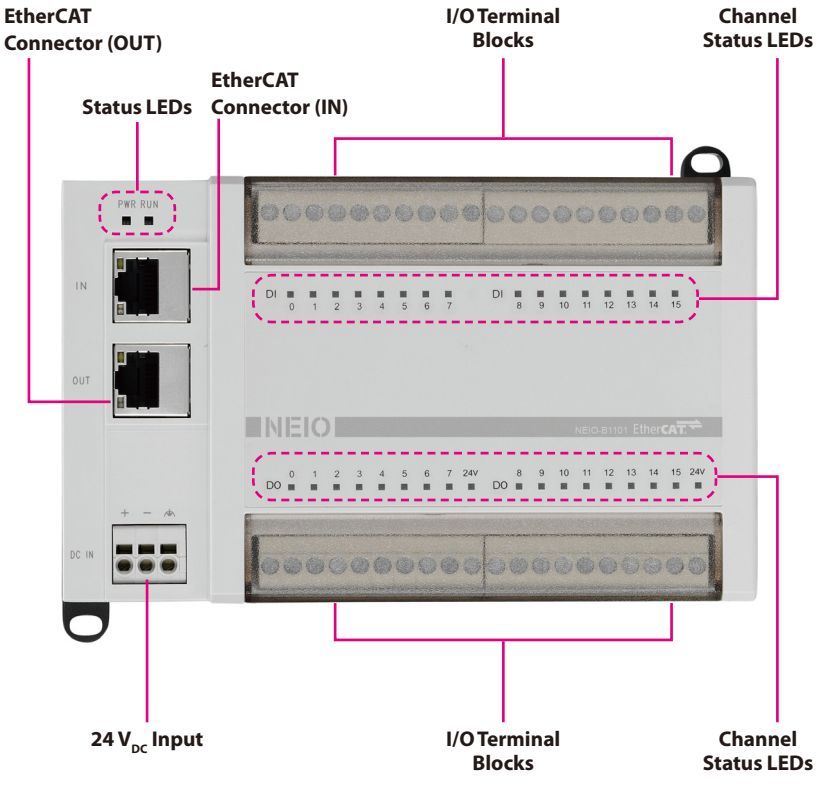
Introduction

NEIO is a series of EtherCAT slave I/O modules for distributed industrial applications. Each module is equipped with high density I/O (up to 32 points) and powerful features in a compact size. DIN-rail design and daisy-chain wiring powered by EtherCAT technology make it easy to install NEIO modules in the field. NEIO provides a wide variety of I/O combinations with standard ESI file so that users can always find suitable I/O modules for their high-speed EtherCAT-based applications.

Highlights

- High-density I/O Points
- Ease-of-maintenance
- State-of-art Design
- Standard EtherCAT Slaves
- Rich I/O Selections

1.2 Product Appearance



Status LEDs

Indicates the status of power and communication.

EtherCAT Connector (IN)

Used to connect an EtherCAT master system or the previous slave module.

EtherCAT Connector (OUT)

Used to connect the next slave module.

24 V_{DC} Input

Used to wire power cable.

I/O Terminal Blocks

Used to connect I/O signals.

Channel Status LEDs

Indicates the status of I/O channels.

1.3 Key Features

Finger-safe Wiring Cover
Smart latch design for easy opening/closing

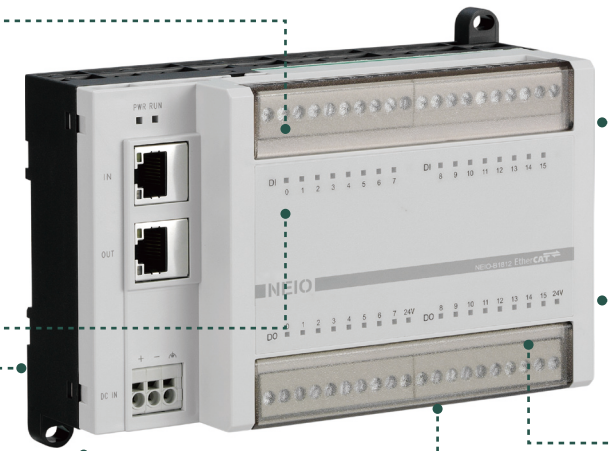
- Flexibility to be installed in control cabinets
- Safe operation when connecting to I/O circuits

On-module LED indicators
LEDs for module status and I/O information

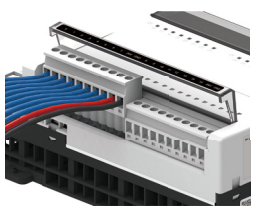
- Clear I/O status indication
- Quickly diagnose faults with multiple LEDs

Multiple mounting methods
DIN-rail mounting and wall mounting

- Works with standard DIN-rail
- Easy to install in most applications

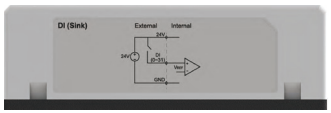


Detachable screw terminals
Secure screw connection technology



- Flexible wiring to terminals on-module or off-module
- Easy to switch modules while keeping existing wiring

User-friendly wiring labels
Professional wiring instructions

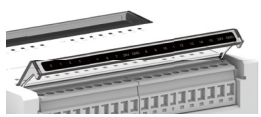


- Detailed wiring diagram
- Instantly operate the I/O module with the given wiring information

QR code for ESI file
QR code sticker on module

- Quick access to ESI download link
- Also link to related product information

Rotational pin-assignment marks
Self-explanatory pin-assignment information



- No blind spots when checking pin assignments
- Easy maintenance even when the module is installed in a cabinet

1.4 Model Designation

Digital Input Module

Model Name	Channels	Wiring Type	Description	Ordering Information
NEIO-B1101	32-ch	PNP	24 V_{DC}, filter 3 ms (IEC 61131-2 type 1/2/3)	10J80110100X0
NEIO-B1102	32-ch	PNP/NPN	24 V_{DC}, filter 1 ms	10J80110200X0

Digital Output Module

Model Name	Channels	Wiring Type	Description	Ordering Information
NEIO-B1201	32-ch	NPN	24 V_{DC}, output current 0.5 A	10J80120100X0
NEIO-B1202	32-ch	PNP	24 V_{DC}, output current 0.5 A	10J80120200X0

Mixed Digital Input/Output Module

Model Name	Channels	Wiring Type	Description	Ordering Information
NEIO-B1811	32-ch	DI: PNP DO: NPN	16-ch DI, 24 V_{DC}, filter 3 ms (IEC 61131-2 type 1/2/3) 16-ch DO, 24 V_{DC}, output current 0.5 A	10J80181100X0
NEIO-B1812	32-ch	DI: PNP/NPN DO: PNP	16-ch DI, 24 V_{DC}, filter 1 ms 16-ch DO, 24 V_{DC}, output current 0.5 A	10J80181200X0

Communication Module

Model Name	Channels	Description	Ordering Information
NEIO-B1603	4-ch	24 V_{DC}, 1 x RS-232/422/485, 3 x RS-422/485	10J80160300X0

Mixed Analog Input/Output Module

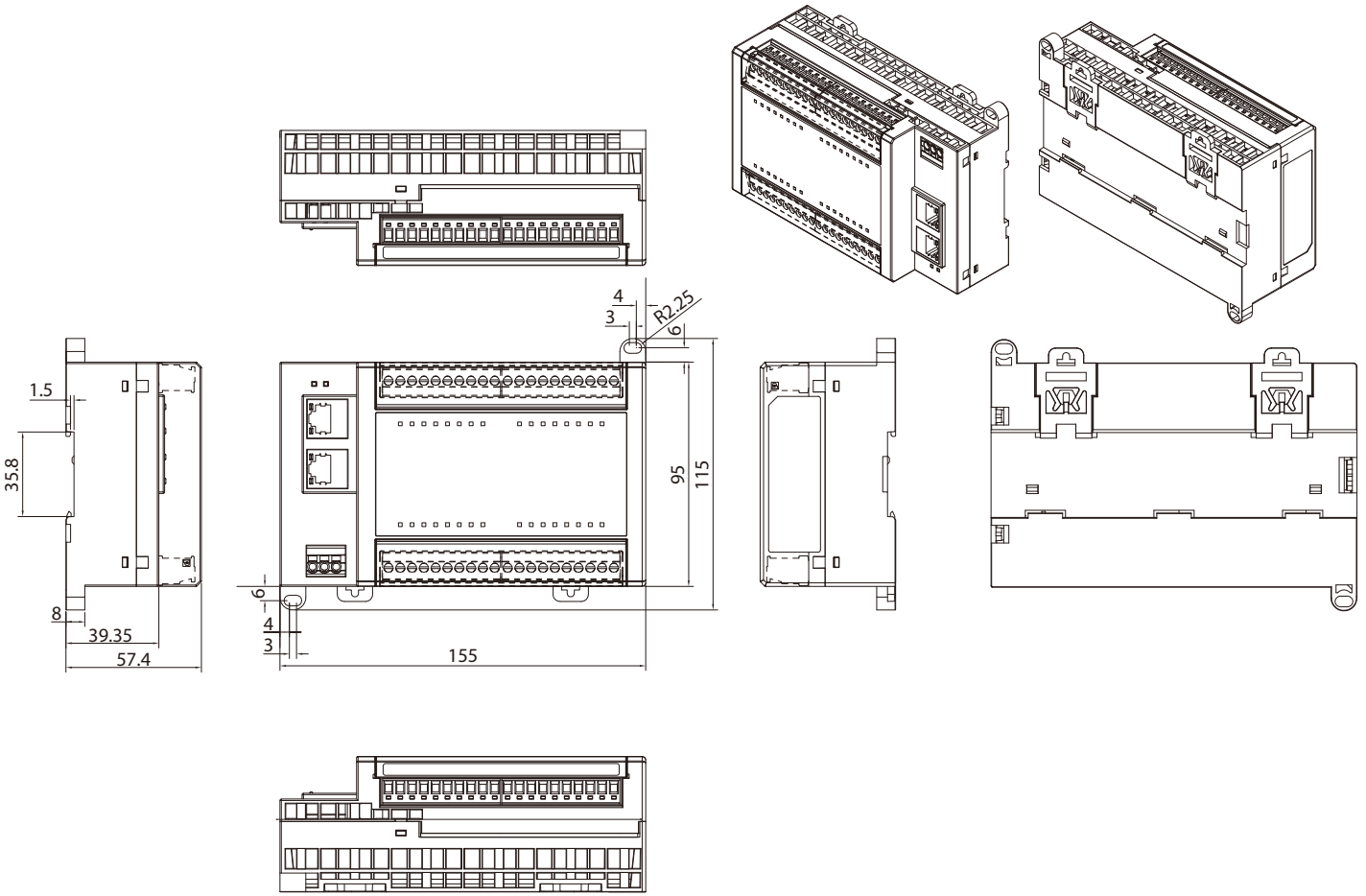
Model Name	Channels	Wiring Type	Description	Ordering Information
NEIO-B1841	8-ch AI, 2-ch AO 8-ch DI, 8-ch DO	AI: single-ended DI: PNP/NPN DO: PNP	8-ch AI, 16-bit, voltage, current (single-ended) 2-ch AI, 16-bit, voltage, current 8-ch DI, 24 V_{DC}, filter 1 ms 8-ch DO, 24 V_{DC}, output current 0.5 A	10J80184100X0

Model Name	Channels	Wiring Type	Description	Ordering Information
NEIO-B1842	4-ch AI, 2-ch AO 8-ch DI, 8-ch DO	AI: differential DI: PNP/NPN DO: PNP	4-ch AI, 16-bit, voltage, current (differential) 2-ch AI, 16-bit, voltage, current 8-ch DI, 24 V_{DC}, filter 1 ms 8-ch DO, 24 V_{DC}, output current 0.5 A	10J80184200X0

1.5 General Specifications

General Specifications	
Dimensions (WxHxD)	155 x 95 x 57.4 mm
Weight	324 g ± 20%
Mounting	DIN-Rail (35 mm) / wall mount
Operating Temperature	0 ~ +55 °C
Storage Temperature	-40 ~ +85 °C
Relative Humidity	5~95 %, no condensation
Ingress Protection Ratings	IP 20
Vibration Resistance	IEC 60068-2-6 (2 G, 10~500 Hz, Sine, Operating) IEC 60068-2-64 (2 Grms, 10~500 Hz, Random, Operating)
Shock Resistance	IEC 60068-2-27 (25 G @ Din-rail, Half Sine, 11 ms, Operating)
Drop Resistance	IEC 60068-2-32 (Gross weight: 324 g, falling height 97 cm)
EMC Immunity/Emission	Conforms to EN 61000-6-2 / EN 61000-6-4
Certifications	CE/FCC Class A

1.6 Mechanical Dimensions



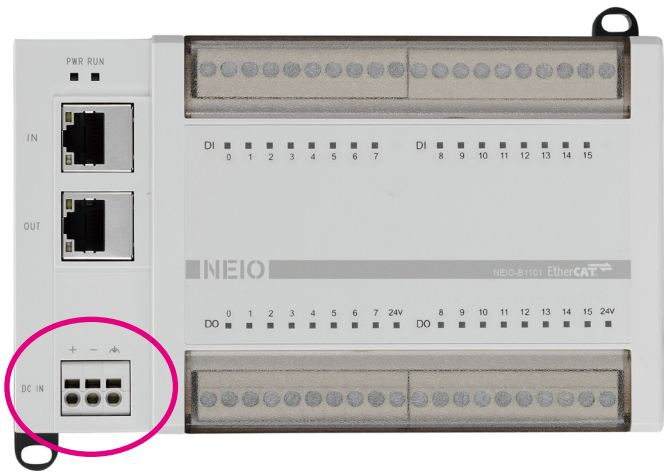
1.7 Hardware Installation Guidelines

This section includes information about how to wire and mount NEIO modules.

1.7.1 Wiring Instructions

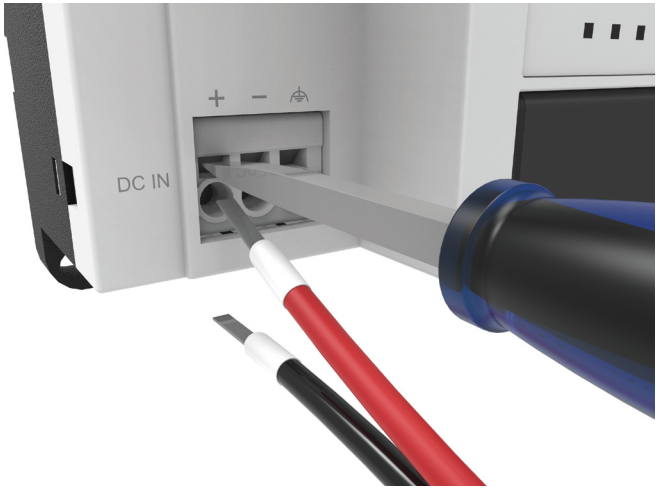
- **Wiring the 24 V_{DC} Power**

1. The 3-pin connector on the bottom left side of the module is the connector for 24 V_{DC} input.



2. Insert a flat-tipped screw driver vertically into the square hole to open the spring inside the terminal block.

3. Insert wires into the circular hole and confirm they are in the correct position.

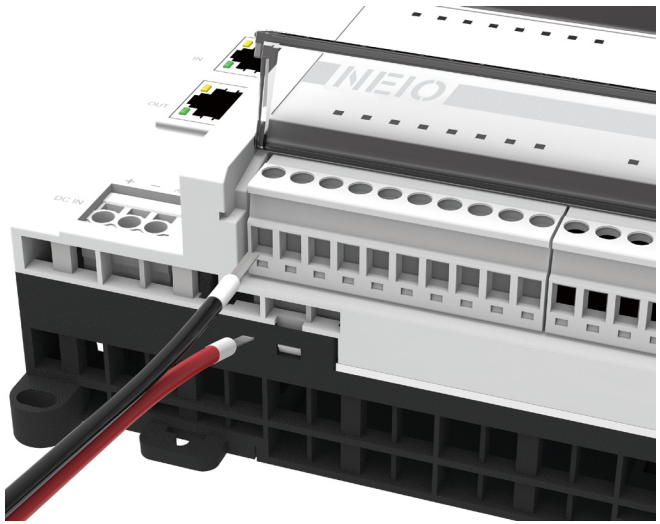


4. Remove the flat-tipped screw driver from the square hole, and check that the wires are clamped firmly.

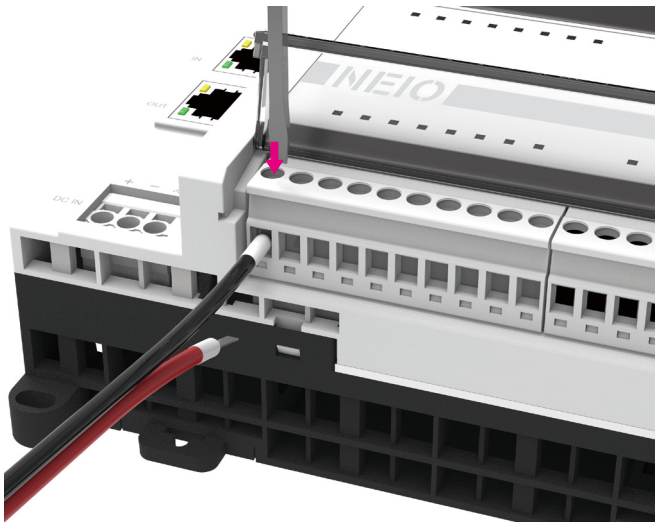
- The terminal block for power connector is spring type with 5 mm pitch (3-pin).
- The recommended wire size is AWG 26 ~12 (0.2~2.5 mm^2), and the suggested wire stripping length is around 9~10 mm.
- The recommended tool is 0.5 x 3.0 mm flat-tipped screw driver.

▪ Wiring the I/O Signal

1. Insert wires into the terminal block in the correct positions. You can find the pin-assignments on the wiring covers, and you can refer to the wiring label on the side of the module for more information about the wiring diagram.



2. Use a flat-tipped screw driver to tighten the wires.



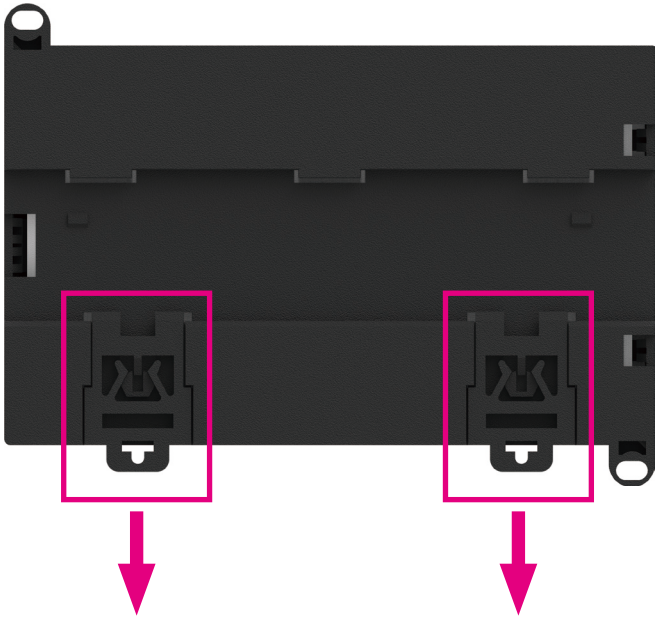
3. Check that the wires are clamped firmly.

- The terminal block is a detachable screw terminal with 5 mm pitch, 10-pin, and 90-degree.
- The recommended wire size is solid wire AWG 28 ~12 (0.2~4 mm^2) or stranded wire AWG 30 ~12 (0.2~2.5 mm^2), and the suggested wire stripping length is around 7~8 mm.
- The recommended tool is 0.6 x 3.5 mm flat-tipped screw driver.

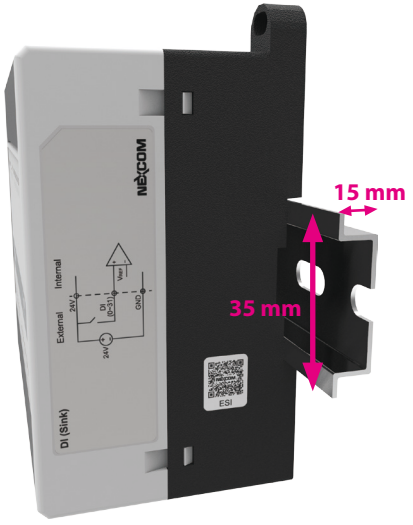
1.7.2 Mounting Instructions

- **DIN-Rail Mounting**

1. Turn over the module and slide down the two mounting clips on the bottom side.

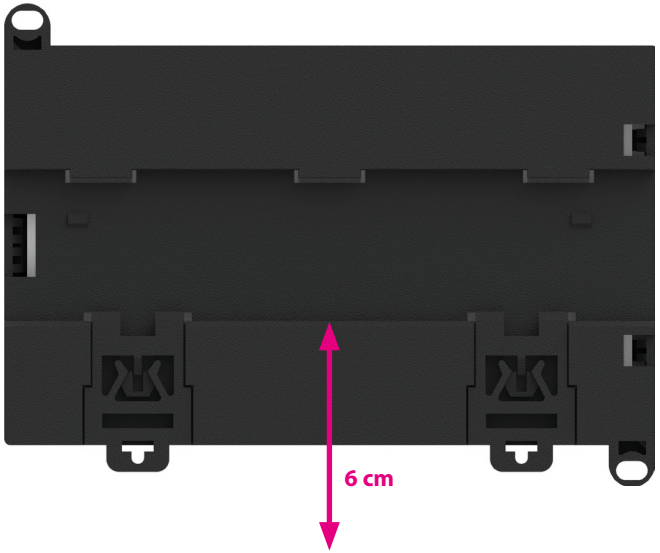


2. Place the module on the mounting rail at a tilted angle. (DIN-rail size: 35 x 15 mm).



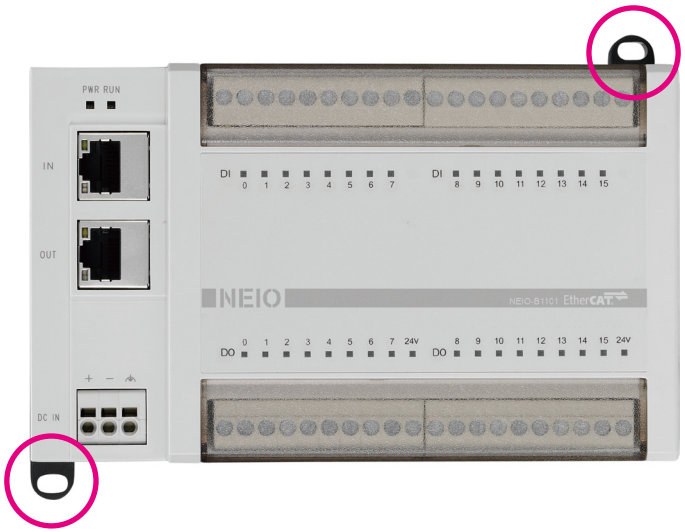
3. Slide up the two clips to lock the module.

4. The minimum mounting distance from the DIN-rail to the bottom of the module is 6 cm.



- **Wall Mounting**

1. Each module has two mounting-screw holes on the top and bottom as shown below.



2. Mount the module with M4 screws.

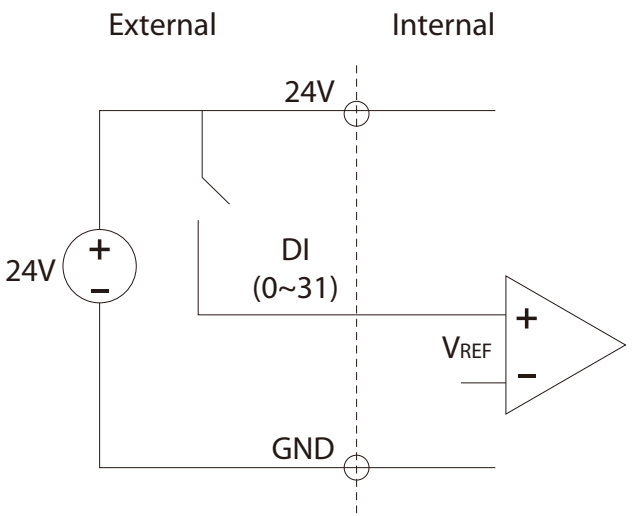
Chapter 2: Digital Input Module

2.1 NEIO-B1101 32-ch Digital Input EtherCAT Slave Module (PNP)

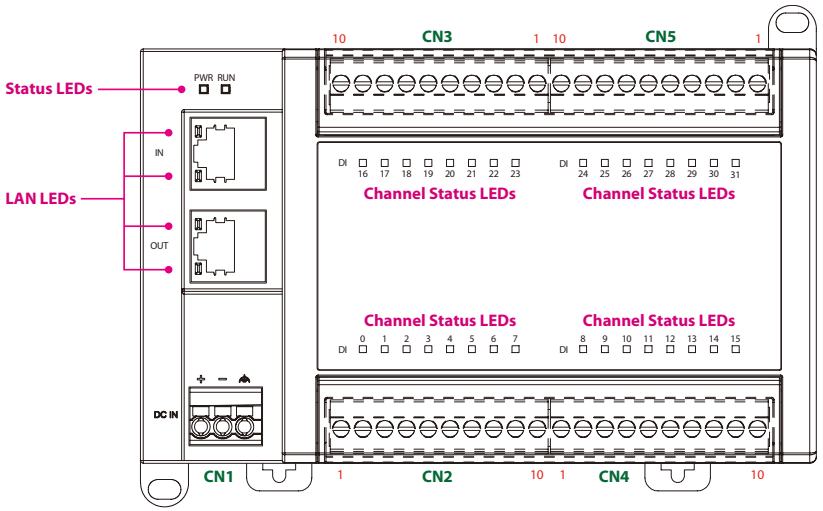
2.1.1 Introduction

NEIO-B1101 is a 32-channel PNP type digital input EtherCAT slave module. The voltage input of NEIO-B1101 is 24 V_{DC} which complies with IEC-61131-2 Standard. All of the NEIO modules are provided with high isolation protection, and verified by the EtherCAT conformance test tool. Therefore NEIO is a reliable module to implement in your applications.

2.1.2 Wiring Diagram



2.1.3 Pin Assignments



CN1: Power

Pin	Description
1	V +
2	V -
3	GND

CN2: Digital Input

Pin	Description
1	DI 0
2	DI 1
3	DI 2
4	DI 3
5	DI 4
6	DI 5
7	DI 6
8	DI 7
9	24V
10	GND

CN3: Digital Input

Pin	Description
1	GND
2	24V
3	DI 23
4	DI 22
5	DI 21
6	DI 20
7	DI 19
8	DI 18
9	DI 17
10	DI 16

CN4: Digital Input

Pin	Description
1	DI 8
2	DI 9
3	DI 10
4	DI 11
5	DI 12
6	DI 13
7	DI 14
8	DI 15
9	24V
10	GND

CN5: Digital Input

Pin	Description
1	GND
2	24V
3	DI 31
4	DI 30
5	DI 29
6	DI 28
7	DI 27
8	DI 26
9	DI 25
10	DI 24

2.1.4 LED Indicators

Status LEDs

LED	Status	Color	Description
PWR	On	Green	Power on (power input range: 24 V_{DC}, ±20%).
	Off	-	Power off.
RUN	On	Green	The module is in the Operational state.
	Single Flash	Green	The module is in the Safe-operational state.
	Blinking	Green	The module is in the Pre-operational state.
	Off	-	The module is in the Initial state.

LAN LEDs

LED	Communication Speed	Link	Act
	0	Off	Off
	10 Mbps	Off	Blinking (Yellow)
	100 Mbps	On (Green)	Blinking (Yellow)

Channel Status LEDs

LED	Status	Color	Description
DI 0 ~ DI 31	On	Green	On-state voltage: 11 ~ 30 V_{DC}
DI 0 ~ DI 31	Off	-	Off-state voltage: 0 ~ 5 V_{DC}

2.1.5 Hardware Specifications

Power Input	
Power Input Range	24 V_{DC} (±20%)
Power Consumption	2 W
Electrical Isolation	2.5 kV
Terminal Block	Spring type (3P, 5.00 mm)
Cross Sections	0.2~2.5 mm² / AWG 26 ~ 12
Digital Input	
Channels	32
Input Type	24 V_{DC} (PNP)
Input Filter	3 ms
On-state Voltage, "1"	15 ~ 30 V_{DC} (IEC 61131-2 type 1) 11 ~ 30 V_{DC} (IEC 61131-2 type 2/3)
Off-state Voltage, "0"	0 ~ 5 V_{DC} (IEC 61131-2 type 1/2/3)
Input Current	<6 mA /ch
Electrical Isolation	2.75 kV
Terminal Block	Detachable screw terminals (90°, 10P, 5.00 mm)
Cross Sections	Solid wire: 0.2 ~ 4 mm² / AWG 28 ~ 12 Stranded wire: 0.2 ~ 2.5 mm² / AWG 30 ~ 12

2.1.6 Object Dictionary

The following table describes the Process Data Objects (PDOs) of NEIO-B1101. The PDOs are used to transmit the cyclic communication data which are also defined in the ESI File.

Index	Mapping Index	Bit Length	Description	Data Type
0x1a00	0x6000:01	1	Channel 0	BOOL
0x1a01	0x6000:02	1	Channel 1	BOOL
0x1a02	0x6000:03	1	Channel 2	BOOL
0x1a03	0x6000:04	1	Channel 3	BOOL
0x1a04	0x6000:05	1	Channel 4	BOOL
0x1a05	0x6000:06	1	Channel 5	BOOL
0x1a06	0x6000:07	1	Channel 6	BOOL
0x1a07	0x6000:08	1	Channel 7	BOOL
0x1a08	0x6000:09	1	Channel 8	BOOL
0x1a09	0x6000:10	1	Channel 9	BOOL
0x1a0a	0x6000:11	1	Channel 10	BOOL
0x1a0b	0x6000:12	1	Channel 11	BOOL
0x1a0c	0x6000:13	1	Channel 12	BOOL
0x1a0d	0x6000:14	1	Channel 13	BOOL
0x1a0e	0x6000:15	1	Channel 14	BOOL
0x1a0f	0x6000:16	1	Channel 15	BOOL

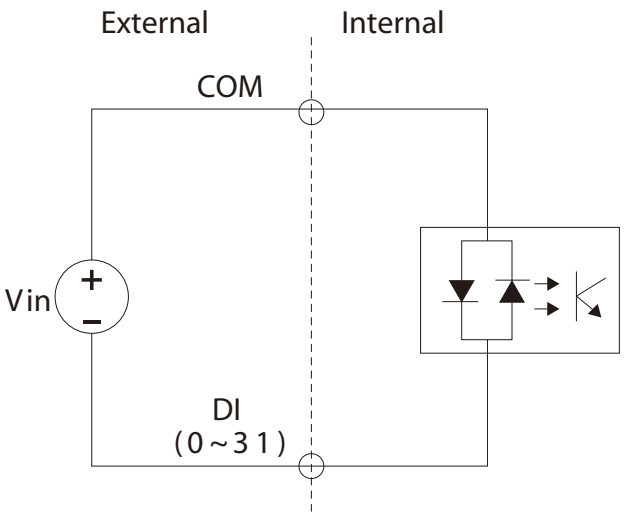
Index	Mapping Index	Bit Length	Description	Data Type
0x1a10	0x6000:17	1	Channel 16	BOOL
0x1a11	0x6000:18	1	Channel 17	BOOL
0x1a12	0x6000:19	1	Channel 18	BOOL
0x1a13	0x6000:20	1	Channel 19	BOOL
0x1a14	0x6000:21	1	Channel 20	BOOL
0x1a15	0x6000:22	1	Channel 21	BOOL
0x1a16	0x6000:23	1	Channel 22	BOOL
0x1a17	0x6000:24	1	Channel 23	BOOL
0x1a18	0x6000:25	1	Channel 24	BOOL
0x1a19	0x6000:26	1	Channel 25	BOOL
0x1a1a	0x6000:27	1	Channel 26	BOOL
0x1a1b	0x6000:28	1	Channel 27	BOOL
0x1a1c	0x6000:29	1	Channel 28	BOOL
0x1a1d	0x6000:30	1	Channel 29	BOOL
0x1a1e	0x6000:31	1	Channel 30	BOOL
0x1a1f	0x6000:32	1	Channel 31	BOOL

2.2 NEIO-B1102 32-ch Digital Input EtherCAT Slave Module (PNP/NPN)

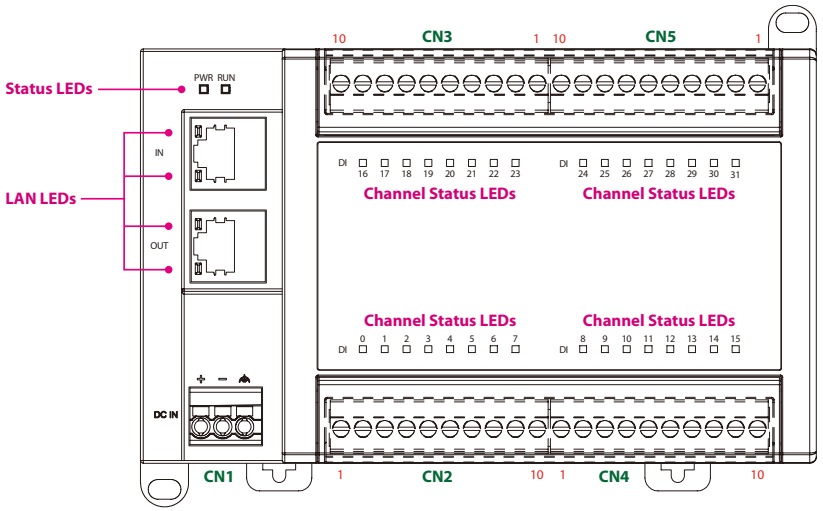
2.2.1 Introduction

The NEIO-B1102 is a 32-channel PNP/NPN type digital input EtherCAT slave module. The input filter of NEIO-B1102 is 1 ms, and its normal input voltage is 24 V_{DC}. All of the NEIO modules are provided with high isolation protection, and verified by the EtherCAT conformance test tool. Therefore NEIO is a reliable module to implement in your applications.

2.2.2 Wiring Diagram



2.2.3 Pin Assignments



CN1: Power

Pin	Description
1	V +
2	V -
3	GND

CN2: Digital Input

Pin	Description
1	DI 0
2	DI 1
3	DI 2
4	DI 3
5	DI 4
6	DI 5
7	DI 6
8	DI 7
9	COM
10	COM

CN3: Digital Input

Pin	Description
1	COM
2	COM
3	DI 23
4	DI 22
5	DI 21
6	DI 20
7	DI 19
8	DI 18
9	DI 17
10	DI 16

CN4: Digital Input

Pin	Description
1	DI 8
2	DI 9
3	DI 10
4	DI 11
5	DI 12
6	DI 13
7	DI 14
8	DI 15
9	COM
10	COM

CN5: Digital Input

Pin	Description
1	COM
2	COM
3	DI 31
4	DI 30
5	DI 29
6	DI 28
7	DI 27
8	DI 26
9	DI 25
10	DI 24

2.2.4 LED Indicators

Status LEDs

LED	Status	Color	Description
PWR	On	Green	Power on (power input range: 24 V_{DC}, ±20%).
	Off	-	Power off.
RUN	On	Green	The module is in the Operational state.
	Single Flash	Green	The module is in the Safe-operational state.
	Blinking	Green	The module is in the Pre-operational state.
	Off	-	The module is in the Initial state.

LAN LEDs

LED	Communication Speed	Link	Act
	0	Off	Off
	10 Mbps	Off	Blinking (Yellow)
	100 Mbps	On (Green)	Blinking (Yellow)

Channel Status LEDs

LED	Status	Color	Description
DI 0 ~ DI 31	On	Green	On-state voltage: 9~24 V_{DC}
DI 0 ~ DI 31	Off	-	Off-state voltage: 0~8 V_{DC}

2.2.5 Hardware Specifications

Power Input	
Power Input Range	24 V_{DC} (±20%)
Power Consumption	2.5 W
Electrical Isolation	2.5 kV
Terminal Block	Spring type (3P, 5.00 mm)
Cross Sections	0.2~2.5 mm² / AWG 26 ~ 12
Digital Input	
Channels	32
Input Type	24 V_{DC} (PNP/NPN)
Input Filter	1 ms
On-state Voltage, "1"	9 ~ 24 V_{DC}
Off-state Voltage, "0"	0 ~ 8 V_{DC}
Input Current	<6 mA /ch
Electrical Isolation	2.5 kV
Terminal Block	Detachable screw terminals (90°, 10P, 5.00 mm)
Cross Sections	Solid wire: 0.2 ~ 4 mm² / AWG 28 ~ 12 Stranded wire: 0.2 ~ 2.5 mm² / AWG 30 ~ 12

2.2.6 Object Dictionary

The following table describes the Process Data Objects (PDOs) of NEIO-B1102. The PDOs are used to transmit the cyclic communication data which are also defined in the ESI File.

Index	PDO Mapping Index	Bit Length	Description	Data Type
0x1600	0x3001:01	8	Byte 0	BITARR8
0x1601	0x3001:02	8	Byte 1	BITARR8
0x1602	0x3001:03	8	Byte 2	BITARR8
0x1603	0x3001:04	8	Byte 3	BITARR8

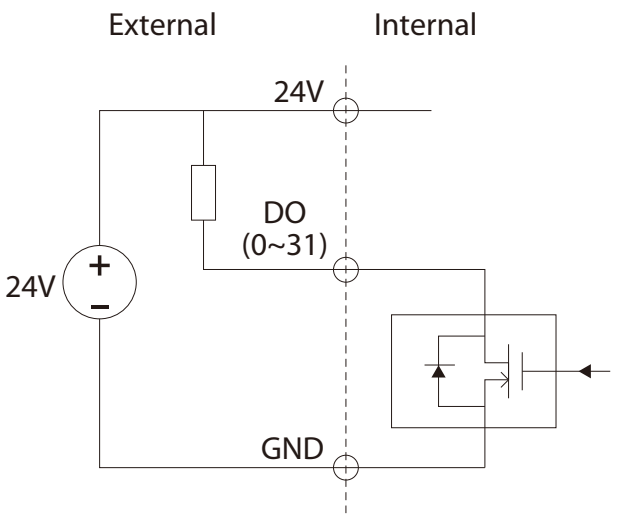
Chapter 3: Digital Output Module

3.1 NEIO-B1201 32-ch Digital Output EtherCAT Slave Module (NPN)

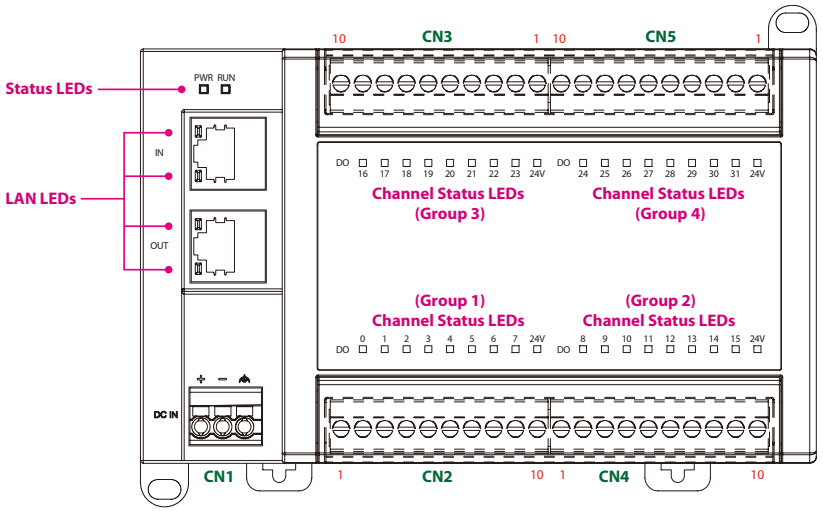
3.1.1 Introduction

The NEIO-B1201 is a 32-channel NPN type digital output EtherCAT slave module. Its normal output voltage is 24 V_{DC}, and it supports resistive, inductive types of loads. All of the NEIO modules are provided with high isolation protection, and verified by the EtherCAT conformance test tool. Therefore NEIO is a reliable module to implement in your applications.

3.1.2 Wiring Diagram



3.1.3 Pin Assignments



CN1: Power

Pin	Description
1	V +
2	V -
3	GND

CN2: Digital Output

Pin	Description
1	DO 0
2	DO 1
3	DO 2
4	DO 3
5	DO 4
6	DO 5
7	DO 6
8	DO 7
9	24V
10	GND

CN3: Digital Output

Pin	Description
1	GND
2	24V
3	DO 23
4	DO 22
5	DO 21
6	DO 20
7	DO 19
8	DO 18
9	DO 17
10	DO 16

CN4: Digital Output

Pin	Description
1	DO 8
2	DO 9
3	DO 10
4	DO 11
5	DO 12
6	DO 13
7	DO 14
8	DO 15
9	24V
10	GND

CN5: Digital Output

Pin	Description
1	GND
2	24V
3	DO 31
4	DO 30
5	DO 29
6	DO 28
7	DO 27
8	DO 26
9	DO 25
10	DO 24

3.1.4 LED Indicators

Status LEDs

LED	Status	Color	Description
PWR	On	Green	Power on (power input range: 24 V_{DC}, ±20%).
	Off	-	Power off.
RUN	On	Green	The module is in the Operational state.
	Single Flash	Green	The module is in the Safe-operational state.
	Blinking	Green	The module is in the Pre-operational state.
	Off	-	The module is in the Initial state.

LAN LEDs

LED	Communication Speed	Link	Act
	0	Off	Off
	10 Mbps	Off	Blinking (Yellow)
	100 Mbps	On (Green)	Blinking (Yellow)

Channel Status LEDs

LED	Status	Color	Description
DO 0 ~ DO 31	On	Green	Digital output signal is set.
	Off	-	No digital output signal.
24V	On	Orange	24 V_{DC} external power supply for each DO group is connected.
	Off	-	24 V_{DC} external power supply for each DO group is not connected.

Note: The NEIO series digital output modules all require a 24 V_{DC} external power supply for each DO channel group. With the DO 24 V_{DC} LEDs you can diagnose the status of external power supply.

3.1.5 Hardware Specifications

Power Input	
Power Input Range	24 V_{DC} (±20%)
Power Consumption	2 W
Electrical Isolation	2.5 kV
Terminal Block	Spring type (3P, 5.00 mm)
Cross Sections	0.2~2.5 mm² / AWG 26 ~ 12
Digital Output	
Channels	32
Output Type	24 V_{DC} (NPN)
Load Type	Resistive, Inductive
Output Current	Maximum: 500 mA/ch
Switching Time	OFF to ON: 100 us ON to OFF: 150 us
Output Protection	Over Current Limit Over Voltage Protection: 45 V
Terminal Block	Detachable screw terminals (90°, 10P, 5.00 mm)
Cross Sections	Solid wire: 0.2 ~ 4 mm² / AWG 28 ~ 12 Stranded wire: 0.2 ~ 2.5 mm² / AWG 30 ~ 12

3.1.6 Object Dictionary

The following table describes the Process Data Objects (PDOs) of NEIO-B1201. The PDOs are used to transmit the cyclic communication data which are also defined in the ESI File.

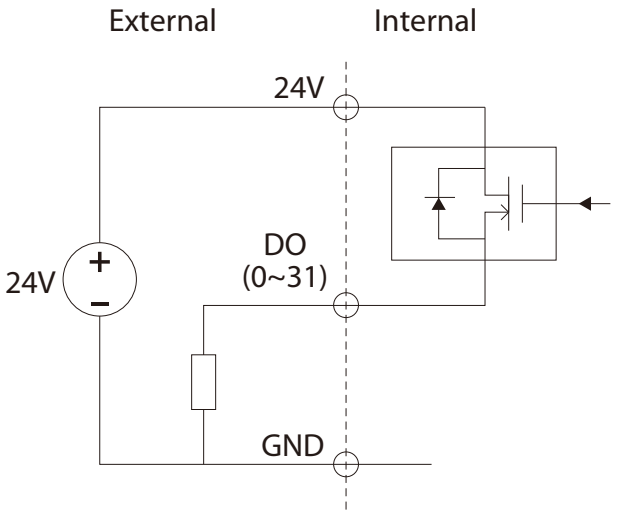
Index	Mapping Index	Bit Length	Description	Data Type
0x1a00	0x3101:01	8	Byte 0	BITARR8
0x1a01	0x3101:02	8	Byte 1	BITARR8
0x1a02	0x3101:03	8	Byte 2	BITARR8
0x1a03	0x3101:04	8	Byte 3	BITARR8

3.2 NEIO-B1202 32-ch Digital Output EtherCAT Slave Module (PNP)

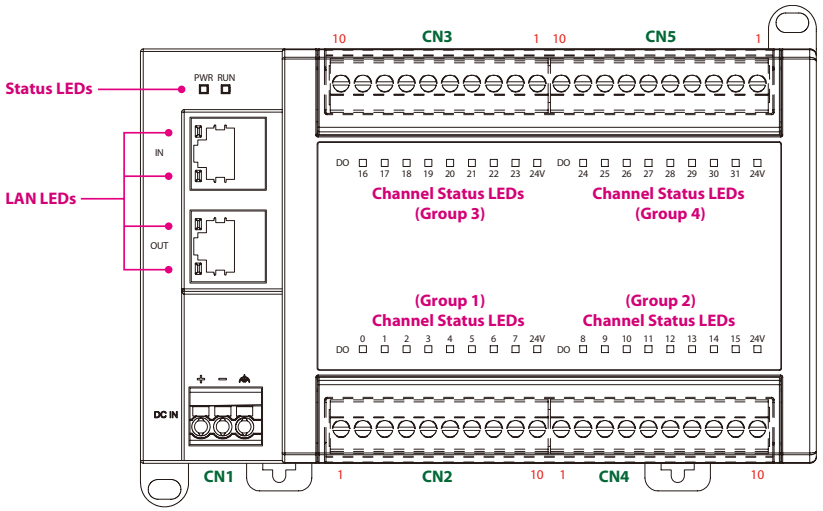
3.2.1 Introduction

The NEIO-B1202 is a 32-channel PNP type digital output EtherCAT slave module. Its normal output voltage is 24 V_{DC}, and it supports three types of loads - resistive, inductive and capacitive. All of the NEIO modules are provided with high isolation protection, and verified by the EtherCAT conformance test tool. Therefore NEIO is a reliable module to implement in your applications.

3.2.2 Wiring Diagram



3.2.3 Pin Assignments



CN1: Power

Pin	Description
1	V +
2	V -
3	GND

CN2: Digital Output

Pin	Description
1	DO 0
2	DO 1
3	DO 2
4	DO 3
5	DO 4
6	DO 5
7	DO 6
8	DO 7
9	24V
10	GND

CN3: Digital Output

Pin	Description
1	GND
2	24V
3	DO 23
4	DO 22
5	DO 21
6	DO 20
7	DO 19
8	DO 18
9	DO 17
10	DO 16

CN4: Digital Output

Pin	Description
1	DO 8
2	DO 9
3	DO 10
4	DO 11
5	DO 12
6	DO 13
7	DO 14
8	DO 15
9	24V
10	GND

CN5: Digital Output

Pin	Description
1	GND
2	24V
3	DO 31
4	DO 30
5	DO 29
6	DO 28
7	DO 27
8	DO 26
9	DO 25
10	DO 24

3.2.4 LED Indicators

Status LEDs

LED	Status	Color	Description
PWR	On	Green	Power on (power input range: 24 V_{DC}, ±20%).
	Off	-	Power off.
RUN	On	Green	The module is in the Operational state.
	Single Flash	Green	The module is in the Safe-operational state.
	Blinking	Green	The module is in the Pre-operational state.
	Off	-	The module is in the Initial state.

LAN LEDs

LED	Communication Speed	Link	Act
	0	Off	Off
	10 Mbps	Off	Blinking (Yellow)
	100 Mbps	On (Green)	Blinking (Yellow)

Channel Status LEDs

LED	Status	Color	Description
DO 0 ~ DO 31	On	Green	Digital output signal is set.
	Off	-	No digital output signal.
24V	On	Orange	24 V_{DC} external power supply for each DO group is connected.
	Off	-	24 V_{DC} external power supply for each DO group is not connected.

Note: The NEIO series digital output modules all require a 24 V_{DC} external power supply for each DO channel group. With the DO 24 V_{DC} LEDs you can diagnose the status of external power supply.

3.2.5 Hardware Specifications

Power Input	
Power Input Range	24 V_{DC} (±20%)
Power Consumption	2 W
Electrical Isolation	2.5 kV
Terminal Block	Spring type (3P, 5.00 mm)
Cross Sections	0.2~2.5 mm² / AWG 26 ~ 12
Digital Output	
Channels	32
Output Type	24 V_{DC} (PNP)
Load Type	Resistive, Inductive and Capacitive
Output Current	Maximum: 500 mA/ch
Switching Time	OFF to ON: 100 us ON to OFF: 150 us
Output Protection	Over Current Limit Short Circuit Protection Reverse Voltage Protection
Short Circuit Protection	1.9 A/ Per Channel
Terminal Block	Detachable screw terminals (90°, 10P, 5.00 mm)
Cross Sections	Solid wire: 0.2 ~ 4 mm² / AWG 28 ~ 12 Stranded wire: 0.2 ~ 2.5 mm² / AWG 30 ~ 12

3.2.6 Object Dictionary

The following table describes the Process Data Objects (PDOs) of NEIO-B1202. The PDOs are used to transmit the cyclic communication data which are also defined in the ESI File.

Index	PDO Mapping Index	Bit Length	Description	Data Type
0x1a00	0x3101:01	8	Byte 0	BITARR8
0x1a01	0x3101:02	8	Byte 1	BITARR8
0x1a02	0x3101:03	8	Byte 2	BITARR8
0x1a03	0x3101:04	8	Byte 3	BITARR8

Chapter 4: Mixed Digital Input/Output Module

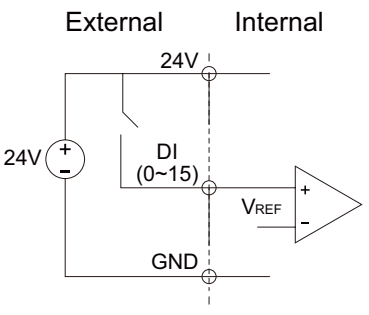
4.1 NEIO-B1811 32-ch Digital Input/Output EtherCAT Slave Module

4.1.1 Introduction

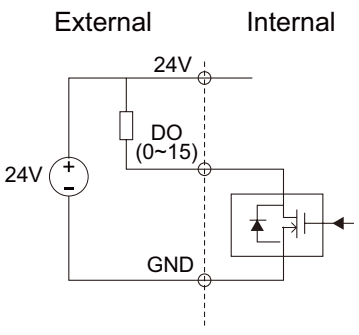
NEIO-B1811 is a 16-ch digital input/16-ch digital output EtherCAT slave module. The voltage input of NEIO-B1811 is 24 V_{DC} which complies with IEC-61131-2 Standard. Its normal output voltage is 24 V_{DC}, and it supports resistive, inductive types of loads. All of the NEIO modules are provided with high isolation protection, and verified by the EtherCAT conformance test tool. The mixed I/O module is usually used for fewer DI/O channels needed automation equipment. Mixed DI/O modules along with pure DI or DO modules provide more flexible module selection for users' applications.

4.1.2 Wiring Diagrams

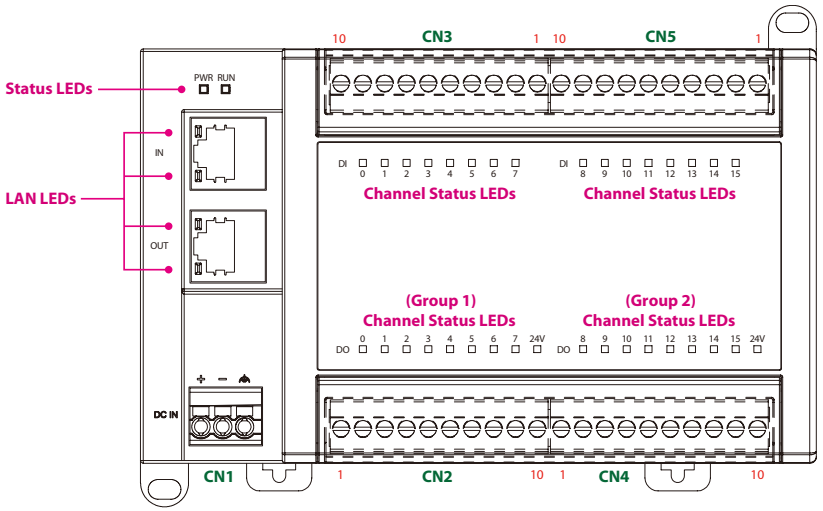
DI (PNP)



DO (NPN)



4.1.3 Pin Assignments



CN1: Power

Pin	Description
1	V +
2	V -
3	GND

CN3: Digital Input

Pin	Description
1	GND
2	24V
3	DI 7
4	DI 6
5	DI 5
6	DI 4
7	DI 3
8	DI 2
9	DI 1
10	DI 0

CN5: Digital Input

Pin	Description
1	GND
2	24V
3	DI 15
4	DI 14
5	DI 13
6	DI 12
7	DI 11
8	DI 10
9	DI 9
10	DI 8

CN2: Digital Output

Pin	Description
1	DO 0
2	DO 1
3	DO 2
4	DO 3
5	DO 4
6	DO 5
7	DO 6
8	DO 7
9	24V
10	GND

CN4: Digital Output

Pin	Description
1	DO 8
2	DO 9
3	DO 10
4	DO 11
5	DO 12
6	DO 13
7	DO 14
8	DO15
9	24V
10	GND

4.1.4 LED Indicators

Status LEDs

LED	Status	Color	Description
PWR	On	Green	Power on (power input range: 24 V_{DC}, ±20%).
	Off	-	Power off.
RUN	On	Green	The module is in the Operational state.
	Single Flash	Green	The module is in the Safe-operational state.
	Blinking	Green	The module is in the Pre-operational state.
	Off	-	The module is in the Initial state.

LAN LEDs

LED	Communication Speed	Link	Act
	0	Off	Off
	10 Mbps	Off	Blinking (Yellow)
	100 Mbps	On (Green)	Blinking (Yellow)

Channel Status LEDs

LED	Status	Color	Description
DI 0 ~ DI 15	On	Green	On-state voltage: 11~30 V_{DC}
	Off	-	Off-state voltage: 0~5 V_{DC}
DO 0 ~ DO 15	On	Green	Digital output signal is set.
	Off	-	No digital output signal.
24V	On	Orange	24 V_{DC} external power supply for each DO group is connected.
	Off	-	24 V_{DC} external power supply for each DO group is not connected.

Note: The NEIO series digital output modules all require a 24 V_{DC} external power supply for each DO channel group. With the DO 24 V_{DC} LEDs you can diagnose the status of external power supply.

4.1.5 Hardware Specifications

Power Input	
Power Input Range	24 V_{DC} (±20%)
Power Consumption	2.2 W
Electrical Isolation	2.5 kV
Terminal Block	Spring type (3P, 5.00 mm)
Cross Sections	0.2~2.5 mm² / AWG 26 ~ 12
Digital Input	
Channels	16
Input Type	24 V_{DC} (PNP)
Input Filter	3 ms
On-state Voltage, "1"	15~30 V_{DC} (IEC 61131-2 type 1) 11~30 V_{DC} (IEC 61131-2 type 2/3)
Off-state Voltage, "0"	0~5 V_{DC} (IEC 61131-2 type 1/2/3)
Input Current	<6 mA/ch
Electrical Isolation	2.75 kV
Terminal Block	Detachable screw terminals (90°, 10P, 5.00 mm)
Cross Sections	Solid wire: 0.2 ~ 4 mm² / AWG 28 ~ 12 Stranded wire: 0.2 ~ 2.5 mm² / AWG 30 ~ 12
Digital Output	
Channels	16
Output Type	24 V_{DC} (NPN)
Load Type	Resistive, Inductive

4.1.5 Hardware Specifications Cont.

Digital Output	
Output Current	Maximum: 500 mA/ch
Switching Time	OFF to ON: 100 us ON to OFF: 150 us
Output Protection	Over Current Limit Over Voltage Protection: 45 V
Terminal Block	Detachable screw terminals (90°, 10P, 5.00 mm)
Cross Sections	Solid wire: 0.2~4 mm² / AWG 28 ~ 12 Stranded wire: 0.2~2.5 mm² / AWG 30 ~ 12

4.1.6 Object Dictionary

The following table describes the Process Data Objects (PDOs) of NEIO-B1811. The PDOs are used to transmit the cyclic communication data which are also defined in the ESI File.

Index	Mapping Index	Bit Length	Description	Data Type
0x1600	0x7000	8	RxPdo Byte 1	BITARR8
0x1601	0x7010	8	RxPdo Byte 2	BITARR8
0x1a00	0x6000	8	TxPdo Byte 1	BITARR8
0x1a01	0x6010	8	TxPdo Byte 2	BITARR8

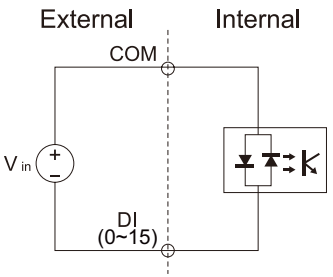
4.2 NEIO-B1812 32-ch Digital Input/Output EtherCAT Slave Module

4.2.1 Introduction

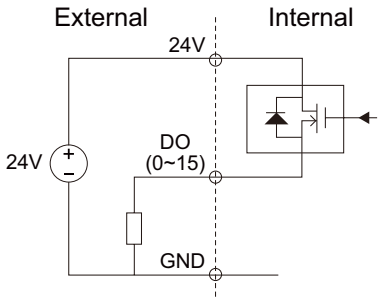
NEIO-B1812 is a 16-ch digital input/16-ch digital output EtherCAT slave module. The input filter of NEIO-B1812 is 1 ms, and its normal input voltage is 24 V_{DC}. Its normal output voltage is 24 V_{DC}, and it supports three types of loads - resistive, inductive and capacitive. All of the NEIO modules are provided with high isolation protection, and verified by the EtherCAT conformance test tool. The mixed I/O module is usually used for fewer DI/O channels needed automation equipment. Mixed DI/O modules along with pure DI or DO modules provide more flexible module selection for users' applications.

4.2.2 Wiring Diagrams

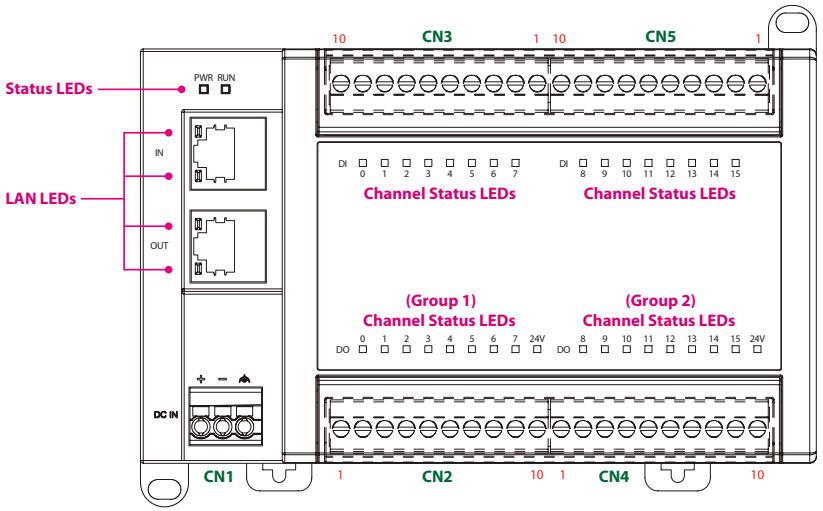
DI (PNP/NPN)



DO (PNP)



4.2.3 Pin Assignments



CN1: Power

Pin	Description
1	V +
2	V -
3	GND

CN3: Digital Input

Pin	Description
1	COM
2	COM
3	DI 7
4	DI 6
5	DI 5
6	DI 4
7	DI 3
8	DI 2
9	DI 1
10	DI 0

CN5: Digital Input

Pin	Description
1	COM
2	COM
3	DI 15
4	DI 14
5	DI 13
6	DI 12
7	DI 11
8	DI 10
9	DI 9
10	DI 8

CN2: Digital Output

Pin	Description
1	DO 0
2	DO 1
3	DO 2
4	DO 3
5	DO 4
6	DO 5
7	DO 6
8	DO 7
9	24V
10	GND

CN4: Digital Output

Pin	Description
1	DO 8
2	DO 9
3	DO 10
4	DO 11
5	DO 12
6	DO 13
7	DO 14
8	DO15
9	24V
10	GND

4.2.4 LED Indicators

Status LEDs

LED	Status	Color	Description
PWR	On	Green	Power on (power input range: 24 V_{DC}, ±20%).
	Off	-	Power off.
RUN	On	Green	The module is in the Operational state.
	Single Flash	Green	The module is in the Safe-operational state.
	Blinking	Green	The module is in the Pre-operational state.
	Off	-	The module is in the Initial state.

LAN LEDs

LED	Communication Speed	Link	Act
	0	Off	Off
	10 Mbps	Off	Blinking (Yellow)
	100 Mbps	On (Green)	Blinking (Yellow)

Channel Status LEDs

LED	Status	Color	Description
DI 0 ~ DI 15	On	Green	On-state voltage: 9~24 V_{DC}
	Off	-	Off-state voltage: 0~8 V_{DC}
DO 0 ~ DO 15	On	Green	Digital output signal is set.
	Off	-	No digital output signal.
24V	On	Orange	24 V_{DC} external power supply for each DO group is connected.
	Off	-	24 V_{DC} external power supply for each DO group is not connected.

Note: The NEIO series digital output modules all require a 24 V_{DC} external power supply for each DO channel group. With the DO 24 V_{DC} LEDs you can diagnose the status of external power supply.

4.2.5 Hardware Specifications

Power Input	
Power Input Range	24 V_{DC} (±20%)
Power Consumption	2.2 W
Electrical Isolation	2.5 kV
Terminal Block	Spring type (3P, 5.00 mm)
Cross Sections	0.2~2.5 mm² / AWG 26 ~ 12
Digital Input	
Channels	16
Input Type	24 V_{DC} (PNP/NPN)
Input Filter	1 ms
On-state Voltage, "1"	9~24 V_{DC}
Off-state Voltage, "0"	0~8 V_{DC}
Input Current	<6 mA/ch
Electrical Isolation	2.5 kV
Terminal Block	Detachable screw terminals (90°, 10P, 5.00 mm)
Cross Sections	Solid wire: 0.2~4 mm² / AWG 28 ~ 12 Stranded wire: 0.2~2.5 mm² / AWG 30 ~ 12
Digital Output	
Channels	16
Output Type	24 V_{DC} (PNP)

4.2.5 Hardware Specifications Cont.

Digital Output	
Load Type	Resistive, Inductive and Capacitive
Output Current	Maximum: 500 mA/ch
Switching Time	OFF to ON: 100 us ON to OFF: 150 us
Output Protection	Over Current Limit Short Circuit Protection Reverse Voltage Protection
Short Circuit Protection	1.9 A/ Per Channel
Terminal Block	Detachable screw terminals (90°, 10P, 5.00 mm)
Cross Sections	Solid wire: 0.2~4 mm² / AWG 28 ~ 12 Stranded wire: 0.2~2.5 mm² / AWG 30 ~ 12

4.2.6 Object Dictionary

The following table describes the Process Data Objects (PDOs) of NEIO-B1812. The PDOs are used to transmit the cyclic communication data which are also defined in the ESI File.

Index	PDO Mapping Index	Bit Length	Description	Data Type
0x1600	0x7000	8	RxPdo Byte 1	BITARR8
0x1601	0x7010	8	RxPdo Byte 2	BITARR8
0x1a00	0x6000	8	TxPdo Byte 1	BITARR8
0x1a01	0x6010	8	TxPdo Byte 1	BITARR8

Chapter 5: Communication Module

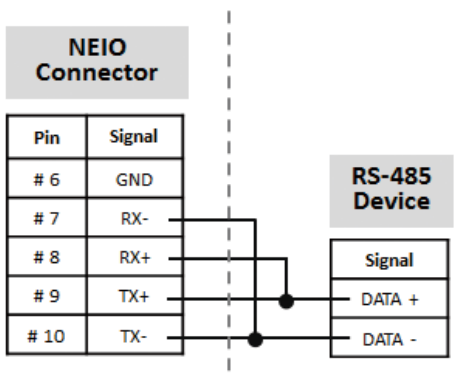
5.1 NEIO-B1603 4-ch COM Port EtherCAT Slave Module

5.1.1 Introduction

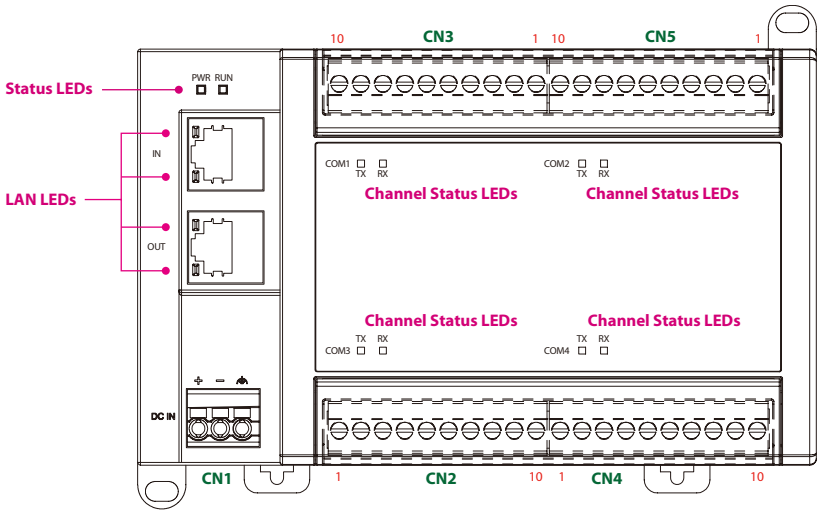
NEIO-B1603 is an EtherCAT to serial conversion module which supports Half-Duplex and Full-Duplex communication modes. It offers one RS-232/422/485 and three RS-422/485 interfaces. The transmission speed on the NEIO-B1603 module is up to 115.2 kbps. NEIO-B1603 can automatically detect the communication mode without setting any jumper and switch. Users can easily and quickly use this module to bridge their existing serial devices to the EtherCAT control network. All of the NEIO modules are provided with high isolation protection, and verified by the EtherCAT conformance test tool. Therefore NEIO is a reliable module to implement in your applications.

5.1.2 Wiring Diagram for RS-485

Please refer to the wiring instructions below for RS-485 mode operation of COM 2, COM 3 and COM 4.



5.1.3 Pin Assignments



CN1: Power

Pin	Description
1	V +
2	V -
3	GND

CN3: COM 1

Pin	RS-232	RS-422	RS-485
1	-	-	-
2	RI	-	-
3	CTS	-	-
4	RTS	-	-
5	DSR	-	-
6	GND	GND	-
7	DTR	RX-	-
8	TXD	RX+	-
9	RXD	TX+	DATA+
10	DCD	TX-	DATA-

CN5: COM 2

Pin	RS-422/485
1	-
2	-
3	-
4	-
5	-
6	GND
7	RX-
8	RX+
9	TX+
10	TX-

CN2: COM 3

Pin	RS-422/485
1	-
2	-
3	-
4	-
5	-
6	GND
7	RX-
8	RX+
9	TX+
10	TX-

CN4: COM 4

Pin	RS-422/485
1	-
2	-
3	-
4	-
5	-
6	GND
7	RX-
8	RX+
9	TX+
10	TX-

5.1.4 LED Indicators

Status LEDs

LED	Status	Color	Description
PWR	On	Green	Power on (power input range: 24 V_{DC}, ±20%).
	Off	-	Power off.
RUN	On	Green	The module is in the Operational state.
	Single Flash	Green	The module is in the Safe-operational state.
	Blinking	Green	The module is in the Pre-operational state.
	Off	-	The module is in the Initial state.

LAN LEDs

LED	Communication Speed	Link	Act
	0	Off	Off
	10 Mbps	Off	Blinking (Yellow)
	100 Mbps	On (Green)	Blinking (Yellow)

Channel Status LEDs

LED	Status	Color	Description
Tx	On	Green	Tx Data Transmitting
	Off	-	Tx No Data Transmitting
Rx	On	Green	Rx Data Receiving
	Off	-	Rx No Data Receiving

5.1.5 Hardware Specifications

Power Input	
Power Input Range	24 V_{DC} (±20%)
Power Consumption	6 W
Electrical Isolation	2.5 kV
Terminal Block	Spring type (3P, 5.00 mm)
Cross Sections	0.2~2.5 mm² / AWG 26 ~ 12
Communication	
Channels	4
Bus Interface	1 x RS-232/422/485 3 x RS-422/485
Data Bits	5, 6, 7, 8
Stop Bits	1, 1.5, 2
Parity	None, Even, Odd, Space, Mark
Flow Control	RTS/CTS and DTR/DSR (RS-232 only), XON/XOFF
Data Transfer Rates	300, 600, 1200, 2400, 4800, 9600, 19.2k, 38.4k, 57.6k, 115.2k (bps)
Terminal Block	Detachable screw terminals (90°, 10P, 5.00 mm)
Cross Sections	Solid wire: 0.2 ~ 4 mm² / AWG 28 ~ 12 Stranded wire: 0.2 ~ 2.5 mm² / AWG 30 ~ 12

Note: The factory default settings of the NEIO-B1603 is:

- Baud rate: 9600 bps
- Data frame: 8/N/1 (8 data bits, no parity, 1 stop bit)
- Operation mode: RS-422
- No flow control

Users can set the default value with object 0x80n0, more detailed information can be found in chapter 5.1.6.3.

5.1.6 Operation Principle

- **Parameter Setting**

Parameters for serial communication, such as baud rate and data frame can be set through SDO objects.
Please follow operation steps below to configure communication settings.

Step 1. Configure parameters by changing object of index 0x80n0 as shown in the table below.

Index 0x80n0 COM Settings for COM1(n = 0), COM2(n = 1), COM3(n = 2), COM4(n = 3)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x80n0	0	Number of entries	U8_T	RO	No	6	
0x80n0	1	Series type	U8_T	RO	No	0x02 / 0x03	bit 0: RS-232 (only for COM1) bit 1: RS-422/485 *COM1: 0x03 (RS-232/422/485) *COM2: 0x02 (RS-422/485) *COM3: 0x02 (RS-422/485) *COM4: 0x02 (RS-422/485)
0x80n0	2	Baud rate	U8_T	RW	No	6	1: 300 bps 2: 600 bps 3: 1200 bps 4: 2400 bps 5: 4800 bps 6: 9600 bps 7: 14400 bps 8: 19200 bps 9: 28800 bps 10: 38400 bps 11: 57600 bps 12: 115200 bps
0x80n0	3	Flow control setting	U8_T	RW	No	0	0: No flow control 1: Enable RTS/CTS (only used for COM1) 2: Enable XON/XOFF supported Tx data 4: Enable XON/XOFF supported Rx data 6: Enable XON/XOFF supported Tx & Rx data (the other values are invalid)

0x80n0	4	Data frame	U8_T	RW	No	0x30	bit 0: Stop bits (0→1 bit, 1→2 or 1.5 bits) bit 3-1: Parity (0→No parity, 1→Odd, 2→Even, 3→Mark, 4→Space) bit 5-4: Data bits (0→5 bits, 1→6 bits, 2→7 bits, 3→8 bits)
0x80n0	7	Operation mode	U8_T	RW	No	1	1: RS-422 full duplex 2: RS-485 half duplex 3: RS-232 (only for COM1)
0x80n0	8	Terminal resistor enable	U8_T	RW	No	0	0: Disable terminal resistor 1: Enable terminal resistor

Step 2. Initiate parameter changes by setting ***Init request*** (Sub 1, bit 2 of object indexed 0x70n0) to 1.

Index 0x70n0 COM Outputs for COM1(n = 0), COM2(n = 1), COM3(n = 2), COM4(n = 3)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x70n0	0	Number of entries	U8_T	RO	No	23	
0x70n0	1	Control word	U16_T	RO	Yes	0	bit 0: Transmit request bit 1: Receive accepted bit 2: Init request: 0: The terminal prepare for serial data exchange. 1: TxRx blocked and FIFO reset, Rx object clear, accept new configuration. bit 8 ~ 15 Output length
0x70n0	2	Data out 0	U8_T	RO	Yes	0	
.....	.....	.....	.....	.....	.....	.....	.....
0x70n0	23	Data out 21	U8_T	RO	Yes	0	

Step 3. Check ***Init accepted*** (Sub 1, bit 2 of object indexed 0x60n0). If the value is 1, the parameters configured in Step 1 are set successfully.

Index 0x60n0 COM Inputs for COM1(n = 0), COM2(n = 1), COM3(n = 2), COM4(n = 3)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x60n0	0	Number of entries	U8_T	RO	No	23	
0x60n0	1	Status word	U16_T	RO	Yes	0	bit 0: Transmit accepted bit 1: Receive request bit 2: Init accepted bit 3: Receive buffer full bit 4: Overrun error has occurred bit 5: Parity error has occurred bit 6: Framing error has occurred bit 7: Line Break has occurred bit 8~15: Input length
0x60n0	2	Data in 0	U8_T	RO	Yes	0	
.....	.....	.....	.....	.....	.....	.....	.....
0x60n0	23	Data in 21	U8_T	RO	Yes	0	

Step 4. Set ***Init request*** (Sub 1, bit 2 of object indexed 0x70n0) back to 0, so that the NEIO module is ready for serial data exchange.

- **Save parameters**

The settings in the previous chapter are all saved in the register, when the module is power-off the settings will restore to the factory default settings. If users want to keep the current setting after power-off, they can write the value '0x65766173' to the object 0x1010:1 to save parameters setting.

Index 0x1010 Save parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1010	0	Number of entries	U8_T	RO	No	1	
	1	Save parameters	U32_T	RW	No	0	Set 0x65766173 to save COM port setting parameter

- **Restore to Factory Default Settings**

Write the value '0x64616F6C' to the object 0x1011:1 to restore parameters to factory default settings.

Index 0x1011 Restore default parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1011	0	Number of entries	U8_T	RO	No	1	
	1	Restore default parameters	U32_T	RW	No	1	Set 0x64616F6C to restore COM port setting parameter to delivery state

- **Transmit Data (Data from Master to Slave)**

Step 1. Set ***Output length*** (Sub 1, bit 8 ~ bit 15 of object indexed 0x70n0). If users want to transmit 5 bytes of data, users need to set '0x0101' into bit 8 to bit 15.

Step 2. Fill ***Data out*** (Sub 2 ~ Sub 23 of object indexed 0x70n0) with user data. The length of per data is one byte. There are 22 bytes of user data. If users want to transmit 5 bytes of data, users need to fill user data into ***Data Out 0*** to ***Data Out 4***.

Step 3. Change the state of ***Transmit request*** (Sub1, bit 0 of object indexed 0x70n0), the default value is 0. By changing the state of this bit to inform the slave module receive data.

Step 4. Check the state of ***Transmit accepted*** (Sub1, bit 0 of object indexed 0x60n0). If the value is changed, that means the slave module accepts the transmit request (the default value is 0), the data will be transmitted.

Index 0x70n0 COM Outputs for COM1(n = 0), COM2(n = 1), COM3(n = 2), COM4(n = 3)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x70n0	0	Number of entries	U8_T	RO	No	23	
0x70n0	1	Control word	U16_T	RO	Yes	0	bit 0: Transmit request bit 1: Receive accepted bit 2: Init request: 0: The terminal prepare for serial data exchange. 1: TxRx blocked and FIFO reset, Rx object clear, accept new configuration. bit 8 ~ 15 Output length
0x70n0	2	Data out 0	U8_T	RO	Yes	0	
.....	.....	.....	.....	.....	.....	.....	.....
0x70n0	23	Data out 21	U8_T	RO	Yes	0	

- **Receive Data (Data from Slave to Master)**

Step 1. Change the state of ***Receive request*** (Sub 1, bit 1 of object indexed 0x60n0) to start receiving data.

Step 2. Check the ***Input length*** (Sub 1, bit 8 ~ bit 15 of object indexed 0x60n0) to know the length of data received. The contents of data are written in ***Data in*** (Sub 2 ~ Sub 23 of object indexed 0x60n0).

Step 3. When the master completes accepting data, change the state of ***Receive accepted*** (Sub 1, bit 1 of object indexed 0x70n0) to inform the slave the data is received successfully (the default value is 0).

Index 0x60n0 COM Inputs for COM1(n = 0), COM2(n = 1)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x60n0	0	Number of entries	U8_T	RO	No	23	
0x60n0	1	Status word	U16_T	RO	Yes	0	bit 0: Transmit accepted bit 1: Receive request bit 2: Init accepted bit 3: Receive buffer full bit 4: Overrun error has occurred bit 5: Parity error has occurred bit 6: Framing error has occurred bit 7: Line Break has occurred bit 8~15: Input length
0x60n0	2	Data in 0	U8_T	RO	Yes	0	
.....	.....	.....	.....	.....	.....	.....	.....
0x60n0	23	Data in 21	U8_T	RO	Yes	0	

5.1.6 Object Dictionary

All slave modules must be provided with an object dictionary, which mainly defines the configuration of the device. Users can access the module through either Service Data Objects (SDOs) or Process Data Objects (PDOs). SDOs are used to access device parameters. PDOs are used to transmit cyclic communication data, and it includes Transmit PDO (TxPDO) and Receive PDO (RxPDO).

Users need to configure the PDO mapping information first, and the master will follow the mapping table's information to access data. Via the 'control word' and 'status word', we can check the input and output status from master and slave. The following section describes the detailed information about the PDO mapping and related parameter settings.

5.1.6.1 PDO Mapping

PDO mapping is the mapping of application objects (real time process data) from the object dictionary to the PDOs. The mapping tables as shown below.

COM1 (RS-232/422/485)

RxPDO (0x1600)	Control word (0x7000)
TxPDO (0x1A00)	Status word (0x6000)

COM2 (RS-422/485)

RxPDO (0x1601)	Control word (0x7010)
TxPDO (0x1A01)	Status word (0x6010)

COM3 (RS-422/485)

RxPDO (0x1602)	Control word (0x7020)
TxPDO (0x1A02)	Status word (0x6020)

COM4 (RS-422/485)

RxPDO (0x1603)	Control word (0x7030)
TxPDO (0x1A03)	Status word (0x6030)

5.1.6.2 Object Data Type

Code	C/C++ Type	Description	Size (Byte)	Range
USINT	U8_T	Unsigned char	1	0 ~ 255
UINT	U16_T	Unsigned short	2	0 ~ 65535
UDINT	U32_T	Unsigned int	4	0 ~ 4294967295
STRING	N/A	String value	-	Depend on string length

5.1.6.3 Object Description

Index 0x1000 Device type

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1000	0	Device type	U32_T	RO	No	0x02581389	Modular device profile

Index 0x1008 Device name

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1008	0	Device name	STRING(10)	RO	No	NEIO-B1603	Name of the EtherCAT slave

Index 0x100A Software version

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x100A	0	Software version	STRING(9)	RO	No	0.2.2.001	Firmware version of the device

Index 0x1010 Save parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1010	0	Number of entries	U8_T	RO	No	1	
	1	Save parameters	U32_T	RW	No	0	Set *0x65766173* to save COM port setting parameter

Index 0x1011 Restore default parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1011	0	Number of entries	U8_T	RO	No	1	
	1	Restore default parameters	U32_T	RW	No	1	Set *0x64616F6C* to restore COM port setting parameter to delivery state

Index 0x1018 Identity

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1018	0	Number of entries	U8_T	RO	No	4	Identity
	1	Vendor ID	U32_T	RO	No	0x00000752	Vendor ID
	2	Product code	U32_T	RO	No	0x00001603	Product code of the EtherCAT slave
	3	Revision number	U32_T	RO	No	0x00000001	Revision number of the device

Index 0x1600 RxPDO0-Map for COM1

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1600	0	Number of objects in this PDO	U8_T	RO	No	23	COM1 RxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x70000110	PDO Mapping entry (object 0x7000 entry 0x01 : Control word)
	2	Mapping entry 2	U32_T	RO	No	0x70000208	PDO Mapping entry (object 0x7000 entry 0x02 : Data out 0)
	3	Mapping entry 3	U32_T	RO	No	0x70000308	PDO Mapping entry (object 0x7000 entry 0x03 : Data out 1)
	4	Mapping entry 4	U32_T	RO	No	0x70000408	PDO Mapping entry (object 0x7000 entry 0x04 : Data out 2)
	5	Mapping entry 5	U32_T	RO	No	0x70000508	PDO Mapping entry (object 0x7000 entry 0x05 : Data out 3)
	6	Mapping entry 6	U32_T	RO	No	0x70000608	PDO Mapping entry (object 0x7000 entry 0x06 : Data out 4)
	7	Mapping entry 7	U32_T	RO	No	0x70000708	PDO Mapping entry (object 0x7000 entry 0x07 : Data out 5)
	8	Mapping entry 8	U32_T	RO	No	0x70000808	PDO Mapping entry (object 0x7000 entry 0x08 : Data out 6)
	9	Mapping entry 9	U32_T	RO	No	0x70000908	PDO Mapping entry (object 0x7000 entry 0x09 : Data out 7)
	10	Mapping entry 10	U32_T	RO	No	0x70000A08	PDO Mapping entry (object 0x7000 entry 0x0A : Data out 8)
	11	Mapping entry 11	U32_T	RO	No	0x70000B08	PDO Mapping entry (object 0x7000 entry 0x0B : Data out 9)
	12	Mapping entry 12	U32_T	RO	No	0x70000C08	PDO Mapping entry (object 0x7000 entry 0x0C : Data out 10)
	13	Mapping entry 13	U32_T	RO	No	0x70000D08	PDO Mapping entry (object 0x7000 entry 0x0D : Data out 11)
	14	Mapping entry 14	U32_T	RO	No	0x70000E08	PDO Mapping entry (object 0x7000 entry 0x0E : Data out 12)
	15	Mapping entry 15	U32_T	RO	No	0x70000F08	PDO Mapping entry (object 0x7000 entry 0x0F : Data out 13)
	16	Mapping entry 16	U32_T	RO	No	0x70001008	PDO Mapping entry (object 0x7000 entry 0x10 : Data out 14)
	17	Mapping entry 17	U32_T	RO	No	0x70001108	PDO Mapping entry (object 0x7000 entry 0x11 : Data out 15)
	18	Mapping entry 18	U32_T	RO	No	0x70001208	PDO Mapping entry (object 0x7000 entry 0x12 : Data out 16)

0x1600	19	Mapping entry 19	U32_T	RO	No	0x70001308	PDO Mapping entry (object 0x7000 entry 0x13 : Data out 17)
	20	Mapping entry 20	U32_T	RO	No	0x70001408	PDO Mapping entry (object 0x7000 entry 0x14 : Data out 18)
	21	Mapping entry 21	U32_T	RO	No	0x70001508	PDO Mapping entry (object 0x7000 entry 0x15 : Data out 19)
	22	Mapping entry 22	U32_T	RO	No	0x70001608	PDO Mapping entry (object 0x7000 entry 0x16 : Data out 20)
	23	Mapping entry 23	U32_T	RO	No	0x70001708	PDO Mapping entry (object 0x7000 entry 0x17 : Data out 21)

Index 0x1601 RxPDO1-Map for COM2

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1601	0	Number of objects in this PDO	U8_T	RO	No	23	COM2 RxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x70100110	PDO Mapping entry (object 0x7010 entry 0x01 : Control word)
	2	Mapping entry 2	U32_T	RO	No	0x70100208	PDO Mapping entry (object 0x7010 entry 0x02 : Data out 0)
	3	Mapping entry 3	U32_T	RO	No	0x70100308	PDO Mapping entry (object 0x7010 entry 0x03 : Data out 1)
	4	Mapping entry 4	U32_T	RO	No	0x70100408	PDO Mapping entry (object 0x7010 entry 0x04 : Data out 2)
	5	Mapping entry 5	U32_T	RO	No	0x70100508	PDO Mapping entry (object 0x7010 entry 0x05 : Data out 3)
	6	Mapping entry 6	U32_T	RO	No	0x70100608	PDO Mapping entry (object 0x7010 entry 0x06 : Data out 4)
	7	Mapping entry 7	U32_T	RO	No	0x70100708	PDO Mapping entry (object 0x7010 entry 0x07 : Data out 5)
	8	Mapping entry 8	U32_T	RO	No	0x70100808	PDO Mapping entry (object 0x7010 entry 0x08 : Data out 6)
	9	Mapping entry 9	U32_T	RO	No	0x70100908	PDO Mapping entry (object 0x7010 entry 0x09 : Data out 7)
	10	Mapping entry 10	U32_T	RO	No	0x70100A08	PDO Mapping entry (object 0x7010 entry 0x0A : Data out 8)
	11	Mapping entry 11	U32_T	RO	No	0x70100B08	PDO Mapping entry (object 0x7010 entry 0x0B : Data out 9)
	12	Mapping entry 12	U32_T	RO	No	0x70100C08	PDO Mapping entry (object 0x7010 entry 0x0C : Data out 10)

0x1601	13	Mapping entry 13	U32_T	RO	No	0x70100D08	PDO Mapping entry (object 0x7010 entry 0x0D : Data out 11)
	14	Mapping entry 14	U32_T	RO	No	0x70100E08	PDO Mapping entry (object 0x7010 entry 0x0E : Data out 12)
	15	Mapping entry 15	U32_T	RO	No	0x70100F08	PDO Mapping entry (object 0x7010 entry 0x0F : Data out 13)
	16	Mapping entry 16	U32_T	RO	No	0x70101008	PDO Mapping entry (object 0x7010 entry 0x10 : Data out 14)
	17	Mapping entry 17	U32_T	RO	No	0x70101108	PDO Mapping entry (object 0x7010 entry 0x11 : Data out 15)
	18	Mapping entry 18	U32_T	RO	No	0x70101208	PDO Mapping entry (object 0x7010 entry 0x12 : Data out 16)
	19	Mapping entry 19	U32_T	RO	No	0x70101308	PDO Mapping entry (object 0x7010 entry 0x13 : Data out 17)
	20	Mapping entry 20	U32_T	RO	No	0x70101408	PDO Mapping entry (object 0x7010 entry 0x14 : Data out 18)
	21	Mapping entry 21	U32_T	RO	No	0x70101508	PDO Mapping entry (object 0x7010 entry 0x15 : Data out 19)
	22	Mapping entry 22	U32_T	RO	No	0x70101608	PDO Mapping entry (object 0x7010 entry 0x16 : Data out 20)
	23	Mapping entry 23	U32_T	RO	No	0x70101708	PDO Mapping entry (object 0x7010 entry 0x17 : Data out 21)

Index 0x1602 RxPDO2-Map for COM3

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1602	0	Number of objects in this PDO	U8_T	RO	No	23	COM3 RxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x70200110	PDO Mapping entry (object 0x7020 entry 0x01 : Control word)
	2	Mapping entry 2	U32_T	RO	No	0x70200208	PDO Mapping entry (object 0x7020 entry 0x02 : Data out 0)
	3	Mapping entry 3	U32_T	RO	No	0x70200308	PDO Mapping entry (object 0x7020 entry 0x03 : Data out 1)
	4	Mapping entry 4	U32_T	RO	No	0x70200408	PDO Mapping entry (object 0x7020 entry 0x04 : Data out 2)
	5	Mapping entry 5	U32_T	RO	No	0x70200508	PDO Mapping entry (object 0x7020 entry 0x05 : Data out 3)
	6	Mapping entry 6	U32_T	RO	No	0x70200608	PDO Mapping entry (object 0x7020 entry 0x06 : Data out 4)

0x1602	7	Mapping entry 7	U32_T	RO	No	0x70200708	PDO Mapping entry (object 0x7020 entry 0x07 : Data out 5)
	8	Mapping entry 8	U32_T	RO	No	0x70200808	PDO Mapping entry (object 0x7020 entry 0x08 : Data out 6)
	9	Mapping entry 9	U32_T	RO	No	0x70200908	PDO Mapping entry (object 0x7020 entry 0x09 : Data out 7)
	10	Mapping entry 10	U32_T	RO	No	0x70200A08	PDO Mapping entry (object 0x7020 entry 0x0A : Data out 8)
	11	Mapping entry 11	U32_T	RO	No	0x70200B08	PDO Mapping entry (object 0x7020 entry 0x0B : Data out 9)
	12	Mapping entry 12	U32_T	RO	No	0x70200C08	PDO Mapping entry (object 0x7020 entry 0x0C : Data out 10)
	13	Mapping entry 13	U32_T	RO	No	0x70200D08	PDO Mapping entry (object 0x7020 entry 0x0D : Data out 11)
	14	Mapping entry 14	U32_T	RO	No	0x70200E08	PDO Mapping entry (object 0x7020 entry 0x0E : Data out 12)
	15	Mapping entry 15	U32_T	RO	No	0x70200F08	PDO Mapping entry (object 0x7020 entry 0x0F : Data out 13)
	16	Mapping entry 16	U32_T	RO	No	0x70201008	PDO Mapping entry (object 0x7020 entry 0x10 : Data out 14)
	17	Mapping entry 17	U32_T	RO	No	0x70201108	PDO Mapping entry (object 0x7020 entry 0x11 : Data out 15)
	18	Mapping entry 18	U32_T	RO	No	0x70201208	PDO Mapping entry (object 0x7020 entry 0x12 : Data out 16)
	19	Mapping entry 19	U32_T	RO	No	0x70201308	PDO Mapping entry (object 0x7020 entry 0x13 : Data out 17)
	20	Mapping entry 20	U32_T	RO	No	0x70201408	PDO Mapping entry (object 0x7020 entry 0x14 : Data out 18)
	21	Mapping entry 21	U32_T	RO	No	0x70201508	PDO Mapping entry (object 0x7020 entry 0x15 : Data out 19)
	22	Mapping entry 22	U32_T	RO	No	0x70201608	PDO Mapping entry (object 0x7020 entry 0x16 : Data out 20)
	23	Mapping entry 23	U32_T	RO	No	0x70201708	PDO Mapping entry (object 0x7020 entry 0x17 : Data out 21)

Index 0x1603 RxPDO3-Map for COM4

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1603	0	Number of objects in this PDO	U8_T	RO	No	23	COM4 RxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x70300110	PDO Mapping entry (object 0x7030 entry 0x01 : Control word)
	2	Mapping entry 2	U32_T	RO	No	0x70300208	PDO Mapping entry (object 0x7030 entry 0x02 : Data out 0)
	3	Mapping entry 3	U32_T	RO	No	0x70300308	PDO Mapping entry (object 0x7030 entry 0x03 : Data out 1)
	4	Mapping entry 4	U32_T	RO	No	0x70300408	PDO Mapping entry (object 0x7030 entry 0x04 : Data out 2)
	5	Mapping entry 5	U32_T	RO	No	0x70300508	PDO Mapping entry (object 0x7030 entry 0x05 : Data out 3)
	6	Mapping entry 6	U32_T	RO	No	0x70300608	PDO Mapping entry (object 0x7030 entry 0x06 : Data out 4)
	7	Mapping entry 7	U32_T	RO	No	0x70300708	PDO Mapping entry (object 0x7030 entry 0x07 : Data out 5)
	8	Mapping entry 8	U32_T	RO	No	0x70300808	PDO Mapping entry (object 0x7030 entry 0x08 : Data out 6)
	9	Mapping entry 9	U32_T	RO	No	0x70300908	PDO Mapping entry (object 0x7030 entry 0x09 : Data out 7)
	10	Mapping entry 10	U32_T	RO	No	0x70300A08	PDO Mapping entry (object 0x7030 entry 0x0A : Data out 8)
	11	Mapping entry 11	U32_T	RO	No	0x70300B08	PDO Mapping entry (object 0x7030 entry 0x0B : Data out 9)
	12	Mapping entry 12	U32_T	RO	No	0x70300C08	PDO Mapping entry (object 0x7030 entry 0x0C : Data out 10)
	13	Mapping entry 13	U32_T	RO	No	0x70300D08	PDO Mapping entry (object 0x7030 entry 0x0D : Data out 11)
	14	Mapping entry 14	U32_T	RO	No	0x70300E08	PDO Mapping entry (object 0x7030 entry 0x0E : Data out 12)
	15	Mapping entry 15	U32_T	RO	No	0x70300F08	PDO Mapping entry (object 0x7030 entry 0x0F : Data out 13)
	16	Mapping entry 16	U32_T	RO	No	0x70301008	PDO Mapping entry (object 0x7030 entry 0x10 : Data out 14)
	17	Mapping entry 17	U32_T	RO	No	0x70301108	PDO Mapping entry (object 0x7030 entry 0x11 : Data out 15)
	18	Mapping entry 18	U32_T	RO	No	0x70301208	PDO Mapping entry (object 0x7030 entry 0x12 : Data out 16)

0x1603	19	Mapping entry 19	U32_T	RO	No	0x70301308	PDO Mapping entry (object 0x7030 entry 0x13 : Data out 17)
	20	Mapping entry 20	U32_T	RO	No	0x70301408	PDO Mapping entry (object 0x7030 entry 0x14 : Data out 18)
	21	Mapping entry 21	U32_T	RO	No	0x70301508	PDO Mapping entry (object 0x7030 entry 0x15 : Data out 19)
	22	Mapping entry 22	U32_T	RO	No	0x70301608	PDO Mapping entry (object 0x7030 entry 0x16 : Data out 20)
	23	Mapping entry 23	U32_T	RO	No	0x70301708	PDO Mapping entry (object 0x7030 entry 0x17 : Data out 21)

Index 0x1A00 TxPDO0-Map for COM1

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1A00	0	Number of objects in this PDO	U8_T	RO	No	23	COM1 TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x60000110	PDO Mapping entry (object 0x6000 entry 0x01 : Status word)
	2	Mapping entry 2	U32_T	RO	No	0x60000208	PDO Mapping entry (object 0x6000 entry 0x02 : Data in 0)
	3	Mapping entry 3	U32_T	RO	No	0x60000308	PDO Mapping entry (object 0x6000 entry 0x03 : Data in 1)
	4	Mapping entry 4	U32_T	RO	No	0x60000408	PDO Mapping entry (object 0x6000 entry 0x04 : Data in 2)
	5	Mapping entry 5	U32_T	RO	No	0x60000508	PDO Mapping entry (object 0x6000 entry 0x05 : Data in 3)
	6	Mapping entry 6	U32_T	RO	No	0x60000608	PDO Mapping entry (object 0x6000 entry 0x06 : Data in 4)
	7	Mapping entry 7	U32_T	RO	No	0x60000708	PDO Mapping entry (object 0x6000 entry 0x07 : Data in 5)
	8	Mapping entry 8	U32_T	RO	No	0x60000808	PDO Mapping entry (object 0x6000 entry 0x08 : Data in 6)
	9	Mapping entry 9	U32_T	RO	No	0x60000908	PDO Mapping entry (object 0x6000 entry 0x09 : Data in 7)
	10	Mapping entry 10	U32_T	RO	No	0x60000A08	PDO Mapping entry (object 0x6000 entry 0x0A : Data in 8)
	11	Mapping entry 11	U32_T	RO	No	0x60000B08	PDO Mapping entry (object 0x6000 entry 0x0B : Data in 9)
	12	Mapping entry 12	U32_T	RO	No	0x60000C08	PDO Mapping entry (object 0x6000 entry 0x0C : Data in 10)

0x1A00	13	Mapping entry 13	U32_T	RO	No	0x60000D08	PDO Mapping entry (object 0x6000 entry 0x0D : Data in 11)
	14	Mapping entry 14	U32_T	RO	No	0x60000E08	PDO Mapping entry (object 0x6000 entry 0x0E : Data in 12)
	15	Mapping entry 15	U32_T	RO	No	0x60000F08	PDO Mapping entry (object 0x6000 entry 0x0F : Data in 13)
	16	Mapping entry 16	U32_T	RO	No	0x60001008	PDO Mapping entry (object 0x6000 entry 0x10 : Data in 14)
	17	Mapping entry 17	U32_T	RO	No	0x60001108	PDO Mapping entry (object 0x6000 entry 0x11 : Data in 15)
	18	Mapping entry 18	U32_T	RO	No	0x60001208	PDO Mapping entry (object 0x6000 entry 0x12 : Data in 16)
	19	Mapping entry 19	U32_T	RO	No	0x60001308	PDO Mapping entry (object 0x6000 entry 0x13 : Data in 17)
	20	Mapping entry 20	U32_T	RO	No	0x60001408	PDO Mapping entry (object 0x6000 entry 0x14 : Data in 18)
	21	Mapping entry 21	U32_T	RO	No	0x60001508	PDO Mapping entry (object 0x6000 entry 0x15 : Data in 19)
	22	Mapping entry 22	U32_T	RO	No	0x60001608	PDO Mapping entry (object 0x6000 entry 0x16 : Data in 20)
	23	Mapping entry 23	U32_T	RO	No	0x60001708	PDO Mapping entry (object 0x6000 entry 0x17 : Data in 21)

Index 0x1A01 TxPDO1-Map for COM2

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1A01	0	Number of objects in this PDO	U8_T	RO	No	23	COM2 TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x60100110	PDO Mapping entry (object 0x6010 entry 0x01 : Status word)
	2	Mapping entry 2	U32_T	RO	No	0x60100208	PDO Mapping entry (object 0x6010 entry 0x02 : Data in 0)
	3	Mapping entry 3	U32_T	RO	No	0x60100308	PDO Mapping entry (object 0x6010 entry 0x03 : Data in 1)
	4	Mapping entry 4	U32_T	RO	No	0x60100408	PDO Mapping entry (object 0x6010 entry 0x04 : Data in 2)
	5	Mapping entry 5	U32_T	RO	No	0x60100508	PDO Mapping entry (object 0x6010 entry 0x05 : Data in 3)
	6	Mapping entry 6	U32_T	RO	No	0x60100608	PDO Mapping entry (object 0x6010 entry 0x06 : Data in 4)

0x1A01	7	Mapping entry 7	U32_T	RO	No	0x60100708	PDO Mapping entry (object 0x6010 entry 0x07 : Data in 5)
	8	Mapping entry 8	U32_T	RO	No	0x60100808	PDO Mapping entry (object 0x6010 entry 0x08 : Data in 6)
	9	Mapping entry 9	U32_T	RO	No	0x60100908	PDO Mapping entry (object 0x6010 entry 0x09 : Data in 7)
	10	Mapping entry 10	U32_T	RO	No	0x60100A08	PDO Mapping entry (object 0x6010 entry 0x0A : Data in 8)
	11	Mapping entry 11	U32_T	RO	No	0x60100B08	PDO Mapping entry (object 0x6010 entry 0x0B : Data in 9)
	12	Mapping entry 12	U32_T	RO	No	0x60100C08	PDO Mapping entry (object 0x6010 entry 0x0C : Data in 10)
	13	Mapping entry 13	U32_T	RO	No	0x60100D08	PDO Mapping entry (object 0x6010 entry 0x0D : Data in 11)
	14	Mapping entry 14	U32_T	RO	No	0x60100E08	PDO Mapping entry (object 0x6010 entry 0x0E : Data in 12)
	15	Mapping entry 15	U32_T	RO	No	0x60100F08	PDO Mapping entry (object 0x6010 entry 0x0F : Data in 13)
	16	Mapping entry 16	U32_T	RO	No	0x60101008	PDO Mapping entry (object 0x6010 entry 0x10 : Data in 14)
	17	Mapping entry 17	U32_T	RO	No	0x60101108	PDO Mapping entry (object 0x6010 entry 0x11 : Data in 15)
	18	Mapping entry 18	U32_T	RO	No	0x60101208	PDO Mapping entry (object 0x6010 entry 0x12 : Data in 16)
	19	Mapping entry 19	U32_T	RO	No	0x60101308	PDO Mapping entry (object 0x6010 entry 0x13 : Data in 17)
	20	Mapping entry 20	U32_T	RO	No	0x60101408	PDO Mapping entry (object 0x6010 entry 0x14 : Data in 18)
	21	Mapping entry 21	U32_T	RO	No	0x60101508	PDO Mapping entry (object 0x6010 entry 0x15 : Data in 19)
	22	Mapping entry 22	U32_T	RO	No	0x60101608	PDO Mapping entry (object 0x6010 entry 0x16 : Data in 20)
	23	Mapping entry 23	U32_T	RO	No	0x60101708	PDO Mapping entry (object 0x6010 entry 0x17 : Data in 21)

Index 0x1A02 TxPDO2-Map for COM3

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1A02	0	Number of objects in this PDO	U8_T	RO	No	23	COM3 TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x60200110	PDO Mapping entry (object 0x6020 entry 0x01 : Status word)
	2	Mapping entry 2	U32_T	RO	No	0x60200208	PDO Mapping entry (object 0x6020 entry 0x02 : Data in 0)
	3	Mapping entry 3	U32_T	RO	No	0x60200308	PDO Mapping entry (object 0x6020 entry 0x03 : Data in 1)
	4	Mapping entry 4	U32_T	RO	No	0x60200408	PDO Mapping entry (object 0x6020 entry 0x04 : Data in 2)
	5	Mapping entry 5	U32_T	RO	No	0x60200508	PDO Mapping entry (object 0x6020 entry 0x05 : Data in 3)
	6	Mapping entry 6	U32_T	RO	No	0x60200608	PDO Mapping entry (object 0x6020 entry 0x06 : Data in 4)
	7	Mapping entry 7	U32_T	RO	No	0x60200708	PDO Mapping entry (object 0x6020 entry 0x07 : Data in 5)
	8	Mapping entry 8	U32_T	RO	No	0x60200808	PDO Mapping entry (object 0x6020 entry 0x08 : Data in 6)
	9	Mapping entry 9	U32_T	RO	No	0x60200908	PDO Mapping entry (object 0x6020 entry 0x09 : Data in 7)
	10	Mapping entry 10	U32_T	RO	No	0x60200A08	PDO Mapping entry (object 0x6020 entry 0x0A : Data in 8)
	11	Mapping entry 11	U32_T	RO	No	0x60200B08	PDO Mapping entry (object 0x6020 entry 0x0B : Data in 9)
	12	Mapping entry 12	U32_T	RO	No	0x60200C08	PDO Mapping entry (object 0x6020 entry 0x0C : Data in 10)
	13	Mapping entry 13	U32_T	RO	No	0x60200D08	PDO Mapping entry (object 0x6020 entry 0x0D : Data in 11)
	14	Mapping entry 14	U32_T	RO	No	0x60200E08	PDO Mapping entry (object 0x6020 entry 0x0E : Data in 12)
	15	Mapping entry 15	U32_T	RO	No	0x60200F08	PDO Mapping entry (object 0x6020 entry 0x0F : Data in 13)
	16	Mapping entry 16	U32_T	RO	No	0x60201008	PDO Mapping entry (object 0x6020 entry 0x10 : Data in 14)
	17	Mapping entry 17	U32_T	RO	No	0x60201108	PDO Mapping entry (object 0x6020 entry 0x11 : Data in 15)
	18	Mapping entry 18	U32_T	RO	No	0x60201208	PDO Mapping entry (object 0x6020 entry 0x12 : Data in 16)

0x1A02	19	Mapping entry 19	U32_T	RO	No	0x60201308	PDO Mapping entry (object 0x6020 entry 0x13 : Data in 17)
	20	Mapping entry 20	U32_T	RO	No	0x60201408	PDO Mapping entry (object 0x6020 entry 0x14 : Data in 18)
	21	Mapping entry 21	U32_T	RO	No	0x60201508	PDO Mapping entry (object 0x6020 entry 0x15 : Data in 19)
	22	Mapping entry 22	U32_T	RO	No	0x60201608	PDO Mapping entry (object 0x6020 entry 0x16 : Data in 20)
	23	Mapping entry 23	U32_T	RO	No	0x60201708	PDO Mapping entry (object 0x6020 entry 0x17 : Data in 21)

Index 0x1A03 TxPDO3-Map for COM4

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1A03	0	Number of objects in this PDO	U8_T	RO	No	23	COM4 TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x60300110	PDO Mapping entry (object 0x6030 entry 0x01 : Status word)
	2	Mapping entry 2	U32_T	RO	No	0x60300208	PDO Mapping entry (object 0x6030 entry 0x02 : Data in 0)
	3	Mapping entry 3	U32_T	RO	No	0x60300308	PDO Mapping entry (object 0x6030 entry 0x03 : Data in 1)
	4	Mapping entry 4	U32_T	RO	No	0x60300408	PDO Mapping entry (object 0x6030 entry 0x04 : Data in 2)
	5	Mapping entry 5	U32_T	RO	No	0x60300508	PDO Mapping entry (object 0x6030 entry 0x05 : Data in 3)
	6	Mapping entry 6	U32_T	RO	No	0x60300608	PDO Mapping entry (object 0x6030 entry 0x06 : Data in 4)
	7	Mapping entry 7	U32_T	RO	No	0x60300708	PDO Mapping entry (object 0x6030 entry 0x07 : Data in 5)
	8	Mapping entry 8	U32_T	RO	No	0x60300808	PDO Mapping entry (object 0x6030 entry 0x08 : Data in 6)
	9	Mapping entry 9	U32_T	RO	No	0x60300908	PDO Mapping entry (object 0x6030 entry 0x09 : Data in 7)
	10	Mapping entry 10	U32_T	RO	No	0x60300A08	PDO Mapping entry (object 0x6030 entry 0x0A : Data in 8)
	11	Mapping entry 11	U32_T	RO	No	0x60300B08	PDO Mapping entry (object 0x6030 entry 0x0B : Data in 9)
	12	Mapping entry 12	U32_T	RO	No	0x60300C08	PDO Mapping entry (object 0x6030 entry 0x0C : Data in 10)

0x1A03	13	Mapping entry 13	U32_T	RO	No	0x60300D08	PDO Mapping entry (object 0x6030 entry 0x0D : Data in 11)
	14	Mapping entry 14	U32_T	RO	No	0x60300E08	PDO Mapping entry (object 0x6030 entry 0x0E : Data in 12)
	15	Mapping entry 15	U32_T	RO	No	0x60300F08	PDO Mapping entry (object 0x6030 entry 0x0F : Data in 13)
	16	Mapping entry 16	U32_T	RO	No	0x60301008	PDO Mapping entry (object 0x6030 entry 0x10 : Data in 14)
	17	Mapping entry 17	U32_T	RO	No	0x60301108	PDO Mapping entry (object 0x6030 entry 0x11 : Data in 15)
	18	Mapping entry 18	U32_T	RO	No	0x60301208	PDO Mapping entry (object 0x6030 entry 0x12 : Data in 16)
	19	Mapping entry 19	U32_T	RO	No	0x60301308	PDO Mapping entry (object 0x6030 entry 0x13 : Data in 17)
	20	Mapping entry 20	U32_T	RO	No	0x60301408	PDO Mapping entry (object 0x6030 entry 0x14 : Data in 18)
	21	Mapping entry 21	U32_T	RO	No	0x60301508	PDO Mapping entry (object 0x6030 entry 0x15 : Data in 19)
	22	Mapping entry 22	U32_T	RO	No	0x60301608	PDO Mapping entry (object 0x6030 entry 0x16 : Data in 20)
	23	Mapping entry 23	U32_T	RO	No	0x60301708	PDO Mapping entry (object 0x6030 entry 0x17 : Data in 21)

Index 0x1C00 Sync manager type

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1C00	0	Number of SyncManager channels	U8_T	RO	No	4	Sync manager type
	1	Type of SyncManager 0	U8_T	RO	No	1	Sync manager type Channel 1: Mailbox write
	2	Type of SyncManager 1	U8_T	RO	No	2	Sync manager type Channel 2: Mailbox read
	3	Type of SyncManager 2	U8_T	RO	No	3	Sync manager type Channel 3: Process data write
	4	Type of SyncManager 3	U8_T	RO	No	4	Sync manager type Channel 4: Process data read

Index 0x1C12 RxPDO assign

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1C12	0	Number of RxPDO assignment	U8_T	RO	No	4	SyncManager 2 PDO assignment, Fixed
	1	RxPDO mapping index 1	U16_T	RO	No	0x1600	Fixed, read only
	2	RxPDO mapping index 2	U16_T	RO	No	0x1601	Fixed, read only
	3	RxPDO mapping index 3	U16_T	RO	No	0x1602	Fixed, read only
	4	RxPDO mapping index 4	U16_T	RO	No	0x1603	Fixed, read only

Index 0x1C13 TxPDO assign

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1C13	0	Number of TxPDO assignment	U8_T	RO	No	4	SyncManager 3 PDO assignment, Fixed
	1	TxPDO mapping index 1	U16_T	RO	No	0x1A00	Fixed, read only
	2	TxPDO mapping index 2	U16_T	RO	No	0x1A01	Fixed, read only
	3	TxPDO mapping index 3	U16_T	RO	No	0x1A02	Fixed, read only
	4	TxPDO mapping index 4	U16_T	RO	No	0x1A03	Fixed, read only

Index 0x1C32 SM output parameter

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1C32	0	Number of parameters	U8_T	RO	No	32	Synchronization parameters for the outputs
	1	Synchronization type	U16_T	RO	No	0: No sync (free run)	0: No sync (free run)

Index 0x1C33 SM input parameter

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x1C33	0	Number of parameters	U8_T	RO	No	32	Synchronization parameters for the inputs
	1	Synchronization type	U16_T	RO	No	0: No sync (free run)	0: No sync (free run)

Index 0xF000 Modular device profile

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0xF000	0	Number of entries	USINT	RO	No	2	
	1	Index distance	UINT	RO	No	0x0010	Index distance between two modules ex: 0x6000 for CH0 0x6010 for CH1
	2	Maximum number of modules	UINT	RO	No	4	4 channel

Index 0xF010 Module list

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0xF010	0	Number of entries	USINT	RO	No	4	Module list
	1	Profile number on channel 1	UDINT	RO	No	0x00000258	0x258 = 600 (serial communication)
	2	Profile number on channel 2	UDINT	RO	No	0x00000258	0x258 = 600 (serial communication)
	3	Profile number on channel 3	UDINT	RO	No	0x00000258	0x258 = 600 (serial communication)
	4	Profile number on channel 4	UDINT	RO	No	0x00000258	0x258 = 600 (serial communication)

Index 0x60n0 COM Inputs for COM1(n = 0), COM2(n = 1), COM3(n = 2), COM4(n = 3)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x60n0	0	Number of entries	U8_T	RO	No	23	
0x60n0	1	Status word	U16_T	RO	Yes	0	bit 0: Transmit accepted bit 1: Receive request bit 2: Init accepted bit 3: Receive buffer full bit 4: Overrun error has occurred bit 5: Parity error has occurred bit 6: Framing error has occurred bit 7: Line break has occurred bit 8~15: Input length
0x60n0	2	Data in 0	U8_T	RO	Yes	0	
0x60n0	3	Data in 1	U8_T	RO	Yes	0	
0x60n0	4	Data in 2	U8_T	RO	Yes	0	
0x60n0	5	Data in 3	U8_T	RO	Yes	0	
0x60n0	6	Data in 4	U8_T	RO	Yes	0	
0x60n0	7	Data in 5	U8_T	RO	Yes	0	
0x60n0	8	Data in 6	U8_T	RO	Yes	0	
0x60n0	9	Data in 7	U8_T	RO	Yes	0	
0x60n0	10	Data in 8	U8_T	RO	Yes	0	
0x60n0	11	Data in 9	U8_T	RO	Yes	0	
0x60n0	12	Data in 10	U8_T	RO	Yes	0	
0x60n0	13	Data in 11	U8_T	RO	Yes	0	

0x60n0	14	Data in 12	U8_T	RO	Yes	0	
0x60n0	15	Data in 13	U8_T	RO	Yes	0	
0x60n0	16	Data in 14	U8_T	RO	Yes	0	
0x60n0	17	Data in 15	U8_T	RO	Yes	0	
0x60n0	18	Data in 16	U8_T	RO	Yes	0	
0x60n0	19	Data in 17	U8_T	RO	Yes	0	
0x60n0	20	Data in 18	U8_T	RO	Yes	0	
0x60n0	21	Data in 19	U8_T	RO	Yes	0	
0x60n0	22	Data in 20	U8_T	RO	Yes	0	
0x60n0	23	Data in 21	U8_T	RO	Yes	0	

Index 0x70n0 COM Outputs for COM1(n = 0), COM2(n = 1), COM3(n = 2), COM4(n = 3)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x70n0	0	Number of entries	U8_T	RO	No	23	
0x70n0	1	Control word	U16_T	RO	Yes	0	bit 0: Transmit request bit 1: Receive accepted bit 2: Init request: 0: The terminal prepare for serial data exchange. 1: TxRx blocked and FIFO reset, Rx object clear accept new configuration. bit 8 ~ 15 Output length
0x70n0	2	Data out 0	U8_T	RO	Yes	0	
0x70n0	3	Data out 1	U8_T	RO	Yes	0	
0x70n0	4	Data out 2	U8_T	RO	Yes	0	

0x70n0	5	Data out 3	U8_T	RO	Yes	0	
0x70n0	6	Data out 4	U8_T	RO	Yes	0	
0x70n0	7	Data out 5	U8_T	RO	Yes	0	
0x70n0	8	Data out 6	U8_T	RO	Yes	0	
0x70n0	9	Data out 7	U8_T	RO	Yes	0	
0x70n0	10	Data out 8	U8_T	RO	Yes	0	
0x70n0	11	Data out 9	U8_T	RO	Yes	0	
0x70n0	12	Data out 10	U8_T	RO	Yes	0	
0x70n0	13	Data out 11	U8_T	RO	Yes	0	
0x70n0	14	Data out 12	U8_T	RO	Yes	0	
0x70n0	15	Data out 13	U8_T	RO	Yes	0	
0x70n0	16	Data out 14	U8_T	RO	Yes	0	
0x70n0	17	Data out 15	U8_T	RO	Yes	0	
0x70n0	18	Data out 16	U8_T	RO	Yes	0	
0x70n0	19	Data out 17	U8_T	RO	Yes	0	
0x70n0	20	Data out 18	U8_T	RO	Yes	0	
0x70n0	21	Data out 19	U8_T	RO	Yes	0	
0x70n0	22	Data out 20	U8_T	RO	Yes	0	
0x70n0	23	Data out 21	U8_T	RO	Yes	0	

Index 0x80n0 COM Settings for COM1(n = 0), COM2(n = 1), COM3(n = 2), COM4(n = 3)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x80n0	0	Number of entries	U8_T	RO	No	6	bit 0: RS-232 (only for COM1) bit 1: RS-422/485 *COM1: 0x03 (RS-232/422/485) *COM2: 0x02 (RS-422/485) *COM3: 0x02 (RS-422/485) *COM4: 0x02 (RS-422/485)
0x80n0	1	Series type	U8_T	RO	No	0x02 / 0x03	1: 300 bps 2: 600 bps 3: 1200 bps 4: 2400 bps 5: 4800 bps 6: 9600 bps 7: 14400 bps 8: 19200 bps 9: 28800 bps 10: 38400 bps 11: 57600 bps 12: 115200 bps
0x80n0	2	Baud rate	U8_T	RW	No	6	0: No flow control 1: Enable RTS/CTS (only used for COM1) 2: Enable XON/XOFF supported Tx data 4: Enable XON/XOFF supported Rx data 6: Enable XON/XOFF supported Tx & Rx data (the other values are invalid)
0x80n0	3	Flow control setting	U8_T	RW	No	0	bit 0: Stop bits (0→1 bit, 1→2 or 1.5 bits) bit 3-1: Parity (0→No parity, 1→Odd, 2→Even, 3→Mark, 4→Space) bit 5-4: Data bits (0→5 bits, 1→6 bits, 2→7 bits, 3→8 bits)
0x80n0	4	Data frame	U8_T	RW	No	0x30	1: RS-422 full duplex 2: RS-485 half duplex 3: RS-232 (only for COM1)
0x80n0	7	Operation mode	U8_T	RW	No	1	0: Disable terminal resistor 1: Enable terminal resistor

0x80n0	8	Terminal resistor enable	U8_T	RW	No	0	bit 0: RS-232 (only for COM1) bit 1: RS-422/485 *COM1: 0x03 (RS-232/422/485) *COM2: 0x02 (RS-422/485) *COM3: 0x02 (RS-422/485) *COM4: 0x02 (RS-422/485)

In general, it is required to set a terminal resistor at each end of the transmission line. The NEIO-B1603 module is built-in with a 120Ω terminal resistor. According to user's application requirements, they can enable/disable the terminal resistor by setting ***Terminal Resistor Enable*** (Sub 8, bit 0 and bit 1 of object 0x80n0).

Index 0xA0n0 COM Diagnostic Data for COM1(n = 0), COM2(n = 1), COM3(n = 2), COM4(n = 3)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0xA0n0	0	Number of entries	U8_T	RO	No	3	
0xA0n0	1	Error status	U16_T	RO	No	0	Bit 0: Receiver overrun error Bit 1: Receiver parity error Bit 2: Receiver framing error Bit 3: Receiver line break Bit 5: Receive buff full
0xA0n0	2	Number of data bytes in the send buffer	U16_T	RO	No	0	
0xA0n0	3	Number of data bytes in the receive buffer	U16_T	RO	No	0	

Index A001 COM Modem Status for COM1

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0xA001	0	Number of entries	U8_T	RO	No	2	
0xA001	1	Modem status	U8_T	RO	No	0	Bit 0: CTS state Bit 1: DSR state Bit 2: RI state Bit 3: DCD state
0xA001	2	Modem status change flag	U8_T		No	0	Write any value to clear the sub index Bit 0: 1→CTS input change state 0→CTS input no change Bit 1: 1→DSR input change state 0→DSR input no change Bit 2: 1→RI input change state(L→H) 0→RI input no change Bit 3: 1→DCD input change state 0→DCD input no change

Index A003 COM Modem Control for COM1

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0xA003	0	Modem control	U8_T	RW	No	0	Bit 0: 1→DTR active Bit 1: 1→RTS active (only could be used without H/W flow control)

5.1.7 Troubleshooting

According to the value of object 0xA0n0:1, users can diagnose the status of error occurred. When the error is excluded, users need to initialize the NEIO module by executing the following steps.

Step 1. Set ***init request*** (Sub 1, bit 2 of object indexed 0x70n0) to 1 to clear the error.
Step 2. Check ***Init accepted*** (Sub 1, bit 2 of object indexed 0x60n0). If the value is 1, the parameters configured in Step 3 are set successfully.
Step 3. Set ***Init request*** (Sub 1, bit 2 of object indexed 0x70n0) back to 0, so that the NEIO module is ready for serial data exchange.

Index 0xA0n0 COM Diagnostic Data for COM1(n = 0), COM2(n = 1), COM3(n = 2), COM4(n = 3)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0xA0n0	0	Number of entries	U8_T	RO	No	3	
0xA0n0	1	Error status	U16_T	RO	No	0	Bit 0: Receiver overrun error Bit 1: Receiver parity error Bit 2: Receiver framing error Bit 3: Receiver line break Bit 5: Receive buff full
0xA0n0	2	Number of data bytes in the send buffer	U16_T	RO	No	0	
0xA0n0	3	Number of data bytes in the receive buffer	U16_T	RO	No	0	

Chapter 6: Mixed Analog Input/Output Module

6.1 NEIO-B1841 8-ch AI, 2-ch AO, 16-ch DI/O EtherCAT Slave Module (Single-ended)

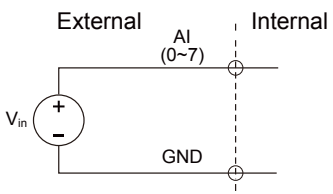
6.1.1 Introduction

NEIO-B1841 is a cost-effective EtherCAT I/O slave module. Each NEIO-B1841 is equipped with 8-ch analog input, 2-ch analog output, 8-ch digital input, and 8-ch digital output. NEIO-B1841 is fitted with adjustable voltage and current input ranges for different application requirements. NEIO-B1841 also provides the Watchdog function; when it is disconnected, the Watchdog function can keep the module in a safe state and restore it to regular operation. All of the NEIO modules are provided with high isolation protection and verified by the EtherCAT conformance test tool.

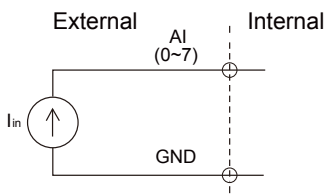
6.1.2 Wiring Diagrams

Analog Input

Voltage Input

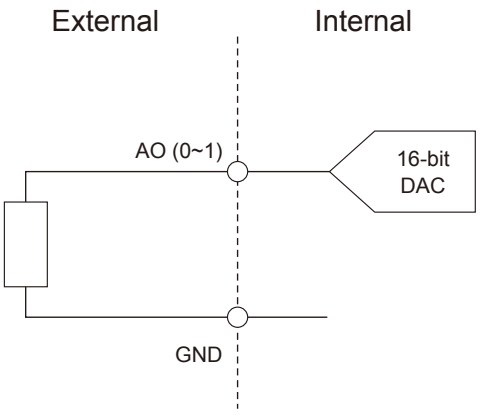


Current Input

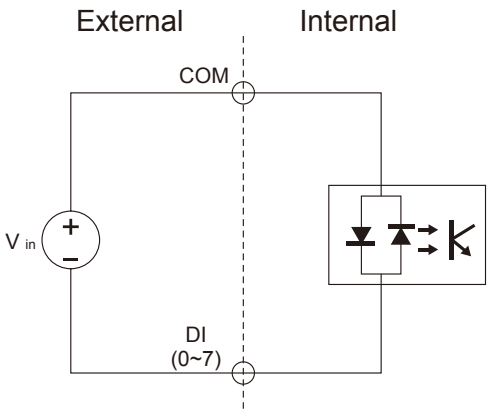


6.1.2 Wiring Diagrams Cont.

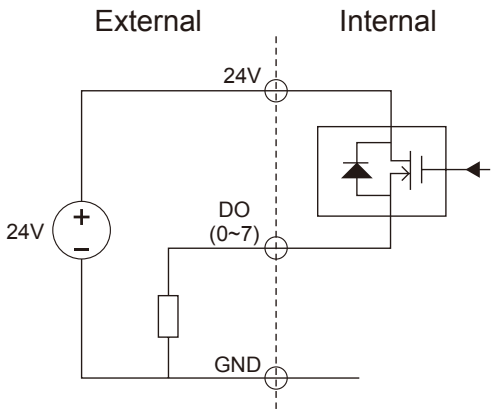
Analog Output



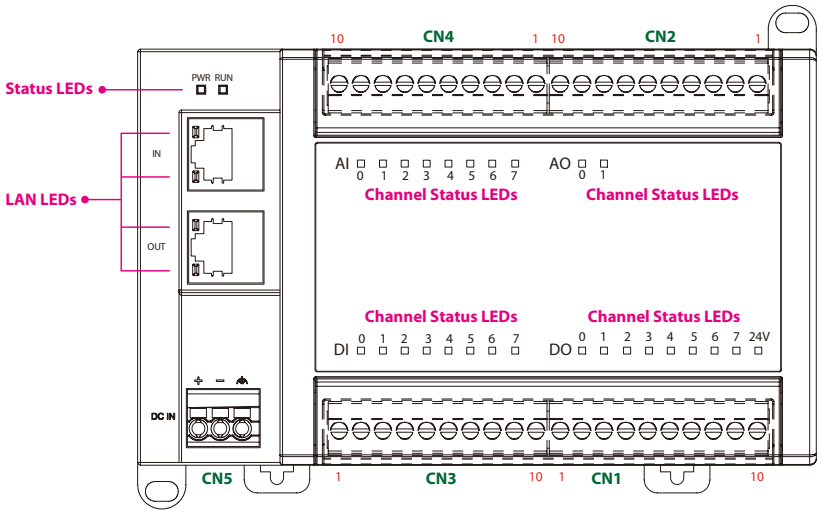
DI (PNP/NPN)



DO (PNP)



6.1.3 Pin Assignments



CN5: Power

Pin	Description
1	V +
2	V -
3	GND

CN4: Analog Input

Pin	Description
1	GND
2	GND
3	AI 7
4	AI 6
5	AI 5
6	AI 4
7	AI 3
8	AI 2
9	AI 1
10	AI 0

CN2: Analog Output

Pin	Description
1	GND
2	AO 1
3	GND
4	AO 0
5	-
6	-
7	-
8	-
9	-
10	-

CN3: Digital Input

Pin	Description
1	DI 0
2	DI 1
3	DI 2
4	DI 3
5	DI 4
6	DI 5
7	DI 6
8	DI 7
9	COM
10	COM

CN1: Digital Output

Pin	Description
1	DO 0
2	DO 1
3	DO 2
4	DO 3
5	DO 4
6	DO 5
7	DO 6
8	DO 7
9	24V
10	GND

6.1.4 LED Indicators

Status LEDs

LED	Status	Color	Description
PWR	On	Green	Power on (power input range: 24 V_{DC}, ±20%).
	Off	-	Power off.
RUN	On	Green	The module is in the Operational state.
	Single Flash	Green	The module is in the Safe-operational state.
	Blinking	Green	The module is in the Pre-operational state.
	Off	-	The module is in the Initial state.

LAN LEDs

LED	Communication Speed	Link	Act
	0	Off	Off
	10 Mbps	Off	Blinking (Yellow)
	100 Mbps	On (Green)	Blinking (Yellow)

Channel Status LEDs

LED	Status	Color	Description
AI 0–AI 7	On	Red	AI limit LED
	Off	-	Normal operation
AO 0–AO 1	On	Red	AO alarm LED
	Off	-	Normal operation
DI 0–DI 7	On	Green	On-state voltage: 9–24 V_{DC}
	Off	-	Off-state voltage: 0–8 V_{DC}
DO 0–DO 7	On	Green	Digital output signal is set.
	Off	-	No digital output signal.
24V	On	Orange	24 V_{DC} external power supply for each DO group is connected.
	Off	-	24 V_{DC} external power supply for each DO group is not connected.

Note1: The AI LED lights up if the input value is over the range.

Note2: The AO LED lights up if the current output load is in open circuit or the IC temperature has exceeded +142°C.

Note3: The NEIO series digital output modules all require a 24 V_{DC} external power supply for each DO channel group. You can diagnose the status of the external power supply with the DO 24 V_{DC} LEDs.

6.1.5 Hardware Specifications

Power Input	
Power Input Range	24 V_{DC} (±20%)
Power Consumption	3 W
Electrical Isolation	2.5 kV
Terminal Block	Spring type (3P, 5.00 mm)
Cross Sections	0.2~2.5 mm² / AWG 26 ~ 12
Analog Input	
Channels	8-ch (Single-ended)
Input Type	Voltage, Current
Input Range	0–5 V, 0–10 V, ±5 V, ±10 V, 0–20 mA, 4–20 mA
Resolution	16-bit
Sampling Rate	1 kHz
Accuracy	< ±0.3% of FSR
Internal Resistance	Voltage: > 1MΩ Current: 300Ω
Terminal Block	Detachable screw terminals (90°, 10P, 5.00mm)
Cross Sections	Solid wire: 0.2–4mm² / AWG 28–12 Stranded wire: 0.2–2.5mm² / AWG 30–12
Analog Output	
Channels	2-ch (Single-ended)
Output Type	Voltage, Current

6.1.5 Hardware Specifications Cont.

Analog Output	
Output Range	0–5 V, 0–10 V, ±5 V, ±10 V, 0–20 mA, 4–20 mA
Resolution	16-bit
Conversation Time	< 100 µs
Accuracy	< ±0.2% of FSR for voltage output < ±0.1% of FSR for current output
Load Impedance	Voltage: ≥ 1kΩ Current: ≤ 300Ω
Terminal Block	Detachable screw terminals (90°, 10P, 5.00mm)
Cross Sections	Solid wire: 0.2–4mm² / AWG 28–12 Stranded wire: 0.2–2.5mm² / AWG 30–12
Digital Input	
Channels	8-ch
Input Type	24 V_{DC} (PNP/NPN)
Input Filter	1 ms
On-state Voltage, "1"	9–24 V_{DC}
Off-state Voltage, "0"	0–8 V_{DC}
Input Current	<6 mA/ch
Electrical Isolation	2.5 kV
Terminal Block	Detachable screw terminals (90°, 10P, 5.00mm)
Cross Sections	Solid wire: 0.2~4mm² / AWG 28–12 Stranded wire: 0.2–2.5mm² / AWG 30–12

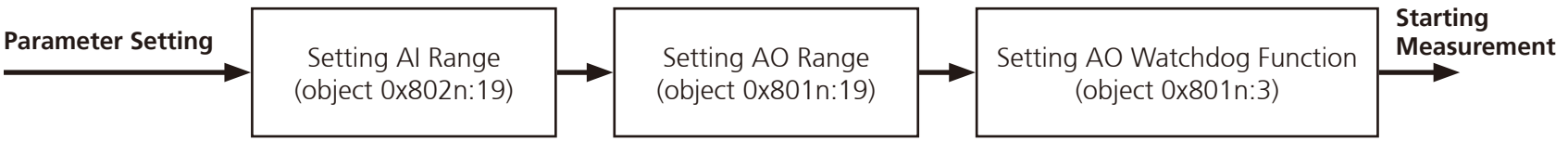
6.1.5 Hardware Specifications Cont.

Digital Output	
Channels	8-ch
Output Type	24 V_{DC} (PNP)
Load Type	Resistive, Inductive and Capacitive
Output Current	Maximum: 500 mA/ch
Switching Time	OFF to ON — Maximum: 100 µs ON to OFF — Maximum: 150 µs
Output Protection	Over Voltage Protection Short Circuit Protection Reverse Voltage Protection Channel Over Temperature Protection Case Over Temperature Protection
Terminal Block	Detachable screw terminals (90°, 10P, 5.00mm)
Cross Sections	Solid wire: 0.2-4mm² / AWG 28-12 Stranded wire: 0.2–2.5mm² / AWG 30–12

6.1.6 Operation Principle

6.1.6.1 Parameter Setting

Before using, you need to set the analog input and analog output measure ranges first, and then you can refer to your application to figure out the behavior of the AO Watchdog Function.



- **Setting the Analog Input Range**

Set up the analog input range by changing the object of index 0x802n (Sub 19). For example, if the measuring range of your sensor is ***0–10 V***, you need to set ***0*** into the object of index 0x802n (Sub 19).

Index 0x802n AI Settings, n = 0–7 (AI Ch1–AI Ch8)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x802n	19	Input type	U16_T	RW	No	0	0: 0–5 V 1: 0–10 V 2: ±5 V 3: ±10 V 4: 0–20 mA 5: 4–20 mA

The following table shows the actual digital input value between different measurement ranges. You can use the formulas below to convert the value.

Measure Range	Analog Input Value	ADC Value	Formulas
0–5 V	5 V	64000	$\text{Analog Input Value} = \text{ADC Value} \times \frac{5\ (\text{Full Scale Range})}{64000\ (\text{Full Value})}$
	0 V	0	
0–10 V	10 V	64000	$\text{Analog Input Value} = \text{ADC Value} \times \frac{10\ (\text{Full Scale Range})}{64000\ (\text{Full Value})}$
	0 V	0	
±5 V	5 V	32000	$\text{Analog Input Value} = \text{ADC Value} \times \frac{10\ (\text{Full Scale Range})}{64000\ (\text{Full Value})}$
	0 V	0	
	-5 V	-32000	
±10 V	10 V	32000	$\text{Analog Input Value} = \text{ADC Value} \times \frac{20\ (\text{Full Scale Range})}{64000\ (\text{Full Value})}$
	0 V	0	
	-10 V	-32000	
0–20 mA	20 mA	51200	$\text{Analog Input Value} = \text{ADC Value} \times \frac{20\ (\text{Full Scale Range})}{51200\ (\text{Full Value})}$
	0 mA	0	
4–20 mA	20 mA	40960	$\text{Analog Input Value} = (\text{ADC Value} \times \frac{16\ (\text{Full Scale Range})}{40960\ (\text{Full Value})}) + 4$
	4 mA	0	

▪ Setting the Analog Output Range

Set up the analog output range by changing the object of index 0x801n (Sub 19). For example, if the output range of your device is ***0–10 V***, you need to set ***1*** into the object of index 0x801n (Sub 19).

Index 0x801n AI Settings, n = 0–7 (AI Ch1–AI Ch8)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x801n	19	Output type	U16_T	RW	No	0	0: 0–5 V 1: 0–10 V 2: ±5 V 3: ±10 V 4: 0–20 mA 5: 4–20 mA

The following table shows the actual digital input value between different measurement ranges. You can use the formulas below to convert the value.

Output Range	Analog Output Value	DAC Value	Formulas
0–5 V	5 V	65535	$DAC\ Value = Analog\ Output\ Value \times \frac{65535\ (Full\ Value)}{5\ (Full\ Scale\ Range)}$
	0 V	0	
0–10 V	10 V	65535	$DAC\ Value = Analog\ Output\ Value \times \frac{65535\ (Full\ Value)}{10\ (Full\ Scale\ Range)}$
	0 V	0	
±5 V	5 V	32767	$DAC\ Value = Analog\ Output\ Value \times \frac{65535\ (Full\ Value)}{10\ (Full\ Scale\ Range)}$
	0 V	0	
	-5 V	-32768	
±10 V	10 V	32767	$DAC\ Value = Analog\ Output\ Value \times \frac{65535\ (Full\ Value)}{20\ (Full\ Scale\ Range)}$
	0 V	0	
	-10 V	-32768	

0–20 mA	20 mA	65535	$DAC\ Value = Analog\ Output\ Value \times \frac{65535\ (Full\ Value)}{20\ (Full\ Scale\ Range)}$
	0 mA	0	
4–20 mA	20 mA	65535	$DAC\ Value = (Analog\ Output\ Value - 4) \times \frac{65535\ (Full\ Value)}{16\ (Full\ Scale\ Range)}$
	4 mA	0	

- **Setting Analog Output Watchdog Function**

  NEIO-B1841 provides four modes of Watchdog function. When disconnection occurs (not in the Operational state), the module can output the value that you preset previously and ensure a normal operation. Please follow the steps below to set the Watchdog function:

  Step 1. Enable the Watchdog function by setting ***Enable Watchdog*** (Sub 2, bit 1 of object indexed 0x801n) to 1.
  Step 2. Configure the status mode by changing ***Watchdog Setting*** (Sub 3, bit 1-bit 2 of object indexed 0x801n).
  Step 3. Configure the output value by changing the ***Default output value*** (Sub 20 of object indexed 0x801n).

  Note: Only when the status is ***0: default watchdog value*** or ***1: watchdog ramp***, configure the value.

  Step 4. Configure the ramp by changing the ***Default output ramp*** (Sub 21 of object indexed 0x801n).

  Note: Only when the status is ***1: watchdog ramp***, configure the value.

  For example:
  - If you set ***0: default watchdog value*** as Watchdog status, when the Watchdog is triggered, AO will output the value of your setting in the ***Default output value***.
  - If you set ***1: watchdog ramp*** as Watchdog status, when the Watchdog is triggered, AO will follow the ramp of your setting in the ***Default output ramp*** and change to the ***Default output value*** smoothly.

    Note: If the ***Default output value*** is set to ***32767***, the ***Default output ramp*** is set to ***10***, the AO voltage should change to ***32767*** in 3.3 seconds. (ramp unit: digital/ms)

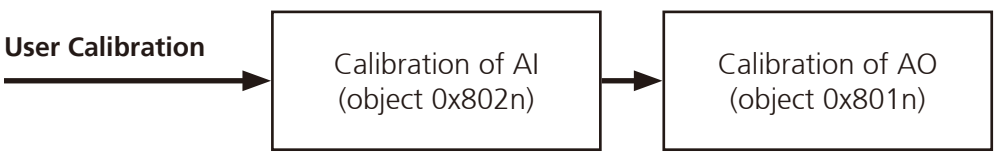
  - If you set ***2: Last output value*** as Watchdog status, when the Watchdog is triggered, AO will keep the last output value.
  - If you set ***3: Zero value*** as Watchdog status, when the Watchdog is triggered, AO will output ***0*** immediately.

Index 0x801n AO Settings, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x801n	2	Enable Watchdog	BIT	RW	No	0	0: Disabling of the Watchdog 1: Enabling of the Watchdog
0x801n	3	Watchdog setting	BIT2	RW	No	0	0: Default Watchdog value 1: Watchdog ramp 2: Last output value 3: Zero value
0x801n	20	Default output value	U32_T	RW	No	0	For Watchdog (-32768–65535)
0x801n	21	Default output ramp	U32_T	RW	No	65535	For Watchdog (unit: digital/ms)

6.1.6.2 User Calibration

Every NEIO-B1841 module is pre-calibrated after production. For different device application requirements, you can follow the steps below to recalibrate the module to increase the accuracy.



- **Calibration of Analog Input**

Step 1. Enable calibration function by setting ***Enable Data Calibration*** (Sub 1, bit 1 of object indexed 0x802n) to ***1***.
Step 2. Configure the offset compensation by setting ***Data Calibration Offset*** (Sub 17 of object indexed 0x802n, use the formula shown on the next page).
Step 3. Configure the gain compensation by setting **Data Calibration Gain** (Sub 18 of object indexed 0x802n, use the formula shown on the next page).

$$AI\ Value = ADC\ Value\ x\ \frac{gain+32768}{65535} + offset$$

$$gain\ value = 65535\ x\ \frac{AI1-AI2}{ADC1-ADC2} - 32768$$

$$offset\ value = \frac{AI2 \times ADC1 - AI1 \times ADC2}{ADC1-ADC2}$$

Note1: AI_1 and AI_2 are the real values of analog input. (Use a precise voltage source to measure the voltage of two AI channels.)
Note2: ADC_1 and ADC_2 are the output values of A/D converter.

Index 0x802n AI Settings, n = 0–7 (AI Ch1–AI Ch8)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x802n	1	Enable data calibration	BIT	RW	No	1	0: Disabling of the data calibration 1: Enabling of the data calibration
0x802n	17	Data calibration offset	I16_T	RW	No	0	Data calibration offset
0x802n	18	Data calibration gain	I32_T	RW	No	32768	Data calibration gain (2^15)

- **Calibration of Analog Output**

Step 1. Enable calibration function by setting ***Enable Data Calibration*** (Sub 1, bit 1 of object indexed 0x801n) to ***1***.
Step 2. Configure the offset compensation by setting ***Data Calibration Offset*** (use the formula shown on the next page).
Step 3. Configure the gain compensation by setting ***Data Calibration Gain*** (use the formula shown on the next page).

$$DAC\ Value = AO\ Value \times \frac{gain+32768}{65535} + offset$$

$$gain\ value = 65535 \times \frac{DAC1-CAC2}{AO1-AO2} - 32768$$

$$offset\ value = \frac{AO2 \times DAC1-AO1 \times DAC2}{AO1-AO2}$$

Note1: AO_1 and AO_2 are the real values of analog output. (Use a precise voltage source to measure the voltage of two AO channels.)
Note2: DAC_1 and DAC_2 are the output values of D/A converter.

Index 0x801n AO Settings, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Comments
0x801n	1	Enable data calibration	BIT	RW	No	1	0: Disabling of the data calibration 1: Enabling of the data calibration
0x801n	17	Data calibration offset	I16_T	RW	No	0	Data calibration offset
0x801n	18	Data calibration gain	I32_T	RW	No	32768	Data calibration gain (2^15)

6.1.6.3 Store and Restore Calibration Parameters

The settings of calibration in the previous chapter are all saved in the register, when the module is power-off, the settings will restore back to the factory default settings. If you want to keep the current setting after power-off, you can write the value ***0x73617665*** to the ***object 0x1010:1*** then save the parameter settings.

Index 0x1010 Store Parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1010	0	Number of entries	U8_T	RO	No	1	
	1	Store parameters	U32_T	RW	No	0	Set **0x73617665** to save parameters in flash ROM.

If you want to restore the calibration settings to factory default, please write the value ***0x72657374*** to the ***object 0x1011:1*** to reset parameters to the factory default settings.

Index 0x1011 Restore Default Parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1011	0	Number of entries	U8_T	RO	No	1	
	1	Restore default parameters	U32_T	RW	No	0	If this object is set to **0x72657374**, all backup objects will be reset to their delivery state.

6.1.7 Object Dictionary

All slave modules must be provided with an object dictionary, which mainly defines the configuration of the device. Users can access the module through either Service Data Objects (SDOs) or Process Data Objects (PDOs). SDOs are used to access device parameters. PDOs are used to transmit cyclic communication data, and it includes Transmit PDO (TxPDO) and Receive PDO (RxPDO).

Users need to configure the PDO mapping information first, and the master will follow the mapping table's information to access data. The section below describes the detailed information about the PDO mapping and related parameter settings.

6.1.7.1 PDO Mapping

PDO mapping is the mapping of application objects (real time process data) from the object dictionary to the PDOs. The mapping tables are shown as below.

Analog Input TxPDO (AI CH1–AI CH8)	Analog Output RxPDO (AO CH1–AO CH2)	Digital Input TxPDO (DI CH1–DI CH8)	Digital Output RxPDO (DO CH1–DO CH8)
0x1A1n (n = 0–7)	0x160n (n = 0–1)	0x1A00 (bit 1)	0x1600 (bit 2)

6.1.7.2 Object Data Type

Code	C/C++ Type	Description	Size (Byte)	Range
USINT	U8_T	Unsigned char	1	0–255
UINT	U16_T	Unsigned short	2	0–65535
UDINT	U32_T	Unsigned int	4	0–4294967295
SINT	I8_T	Char	1	-128–127
INT	I_16	Short	2	-32768–32767
DINT	I_32	Int	4	-2147483648–2147483647
STRING	N/A	String value	-	Depend on string length

6.1.7.3 Object Description

Index 0x1000 Device Type

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1000	0	Device type	U32_T	RO	No	0x00001389	Modular device profile

Index 0x1008 Device Name

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1008	0	Device name	STRING(10)	RO	No	NEIO-B1841	Name of the EtherCAT slave

Index 0x100A Software Version

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x100A	0	Software version	STRING(9)	RO	No	0.1.3.005	Firmware version of the device

Index 0x1010 Store Parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1010	0	Number of entries	U8_T	RO	No	1	
	1	Save parameters	U32_T	RW	No	0	Set *0x73617665* to save COM port setting parameter

Index 0x1011 Restore Default Parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1011	0	Number of entries	U8_T	RO	No	1	
	1	Restore default parameters	U32_T	RW	No	0	If this object is set to *0x72657374*, all backup objects would be reset to their delivery state.

Index 0x1018 Identity

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1018	0	Number of entries	U8_T	RO	No	4	Identity
	1	Vendor ID	U32_T	RO	No	0x00000752	Vendor ID
	2	Product code	U32_T	RO	No	0x00001841	Product code of the EtherCAT slave
	3	Revision number	U32_T	RO	No	0x00000000	Revision number of the device
	4	Serial number	U32_T	RO	No	0x00000000	Serial number of the device

Index 0x1600 RxPDO0-Map: Digital Output

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1600	0	Number of objects in this PDO	U8_T	RO	No	1	DO RxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x70000108	PDO Mapping entry (object 0x7000 entry 0x01 : DO Value)
	2	Mapping entry 2	U32_T	RO	No	0x08	PDO Mapping entry (8 bits align)

Index 0x1601 RxPDO0-Map: Analog Output (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1601	0	Number of objects in this PDO	U8_T	RO	No	1	AO RxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x70100120	PDO Mapping entry (object 0x7010 entry 0x01 : AO Value)
0x1602	0	Number of objects in this PDO	U8_T	RO	No	1	AO RxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x70110120	PDO Mapping entry (object 0x7011 entry 0x01 : AO Value)

Index 0x1A00 TxPDO0-Map: Digital Input

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1A00	0	Number of objects in this PDO	U8_T	RO	No	1	Digital Input TxPDO mapping,
	1	Mapping entry 1	U32_T	RO	No	0x60000108	PDO Mapping entry (object 0x6000 entry 0x01 : DI Value)
	2	Mapping entry 1	U32_T	RO	No	0x08	PDO Mapping entry (8 bits align)

Index 0x1A0n TxPDO0-Map: Analog Output, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1A01	0	Number of objects in this PDO	U8_T	RO	No	6	AO TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x60100101	PDO Mapping entry (object 0x6010 entry 0x01 : Status_Underrange)
	2	Mapping entry 2	U32_T	RO	No	0x60100201	PDO Mapping entry (object 0x6010 entry 0x02 : Status_Overrange)
	3	Mapping entry 3	U32_T	RO	No	0x00000004	PDO Mapping entry (4 bits align)
	4	Mapping entry 4	U32_T	RO	No	0x60100701	PDO Mapping entry (object 0x6010 entry 0x07 : Status_Error)
	5	Mapping entry 5	U32_T	RO	No	0x60100801	PDO Mapping entry (object 0x6010 entry 0x08 : Status_AO alarm)
	6	Mapping entry 6	U32_T	RO	No	0x00000008	PDO Mapping entry (8 bits align)
0x1A02	0	Number of objects in this PDO	U8_T	RO	No	6	AO TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x60110101	PDO Mapping entry (object 0x6011 entry 0x01 : Status_Underrange)
	2	Mapping entry 2	U32_T	RO	No	0x60110201	PDO Mapping entry (object 0x6011 entry 0x02 : Status_Overrange)
	3	Mapping entry 3	U32_T	RO	No	0x00000004	PDO Mapping entry (4 bits align)
	4	Mapping entry 4	U32_T	RO	No	0x60110701	PDO Mapping entry (object 0x6011 entry 0x07 : Status_Error)
	5	Mapping entry 5	U32_T	RO	No	0x60110801	PDO Mapping entry (object 0x6010 entry 0x08 : Status_AO alarm)
	6	Mapping entry 6	U32_T	RO	No	0x00000008	PDO Mapping entry (8 bits align)

Index 0x1A1n TxPDO0-Map: Analog Input, n = 0–7 (AI Ch1–AI Ch8)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1A1n	0	Number of objects in this PDO	U8_T	RO	No	8	AI TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x602n0101	PDO Mapping entry (object 0x602n entry 0x01 : Status_Underrange)
	2	Mapping entry 2	U32_T	RO	No	0x602n0201	PDO Mapping entry (object 0x602n entry 0x02 : Status_Overrange)
	3	Mapping entry 3	U32_T	RO	No	0x00000004	PDO Mapping entry (4 bits align)
	4	Mapping entry 4	U32_T	RO	No	0x602n0701	PDO Mapping entry (object 0x602n entry 0x07 : Status_Error)
	5	Mapping entry 5	U32_T	RO	No	0x00000001	PDO Mapping entry (1 bits align)
	6	Mapping entry 6	U32_T	RO	No	0x00000007	PDO Mapping entry (7 bits align)
	7	Mapping entry 7	U32_T	RO	No	0x602n1001	PDO Mapping entry (object 0x602n entry 0x10 : Status_TxPDO Toggle)
	8	Mapping entry 8	U32_T	RO	No	0x602n1120	PDO Mapping entry (object 0x602n entry 0x11 : AI Value)

Index 0x1C00 Sync Manager Type

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1C00	0	Number of SyncManager channels	U8_T	RO	No	4	Sync manager type
	1	Type of SyncManager 0	U8_T	RO	No	1	Sync manager type Channel 1: Mailbox write
	2	Type of SyncManager 1	U8_T	RO	No	2	Sync manager type Channel 2: Mailbox read
	3	Type of SyncManager 2	U8_T	RO	No	3	Sync manager type Channel 3: Process data write
	4	Type of SyncManager 3	U8_T	RO	No	4	Sync manager type Channel 4: Process data read

Index 0x1C12 RxPDO Assign

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1C12	0	Number of RxPDO assignment	U8_T	RW	No	3	SyncManager 2 PDO assignment, Fixed
	1	RxPDO mapping index 1	U16_T	RW	No	0x1600	DO Value
	2	RxPDO mapping index 2	U16_T	RW	No	0x1601	AO Ch1
	3	RxPDO mapping index 3	U16_T	RW	No	0x1602	AO Ch2

Index 0x1C13 TxPDO assign

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1C13	0	Number of TxPDO assignment	U8_T	RW	No	10	SyncManager 3 PDO assignment
	1	TxPDO mapping index 1	U16_T	RW	No	0x1A00	DI Value
	2	TxPDO mapping index 2	U16_T	RW	No	0x1A01	AO Ch1
	3	TxPDO mapping index 3	U16_T	RW	No	0x1A02	AO Ch2
	4	TxPDO mapping index 4	U16_T	RW	No	0x1A10	AI Ch1
	5	TxPDO mapping index 5	U16_T	RW	No	0x1A11	AI Ch2
	6	TxPDO mapping index 6	U16_T	RW	No	0x1A12	AI Ch3
	7	TxPDO mapping index 7	U16_T	RW	No	0x1A13	AI Ch4
	8	TxPDO mapping index 8	U16_T	RW	No	0x1A14	AI Ch5
	9	TxPDO mapping index 9	U16_T	RW	No	0x1A15	AI Ch6
	10	TxPDO mapping index 10	U16_T	RW	No	0x1A16	AI Ch7
	11	TxPDO mapping index 11	U16_T	RW	No	0x1A17	AI Ch8

Index 0x6000 Digital Inputs (8 Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x6000	0	Number of entries	U8_T	RO	No	1	
0x6000	1	DI Value	U8_T	RO	Yes	0	bit0–7 => DI0–7

Index 0x601n Analog Outputs, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x601n	0	Number of entries	U8_T	RO	No	18	
0x601n	1	Status_Underrange	BIT	RO	Yes	0	Underrange -> The AO value written by user is below the selected lower output range
0x601n	2	Status_Overrange	BIT	RO	Yes	0	Overrange -> The AO value written by user exceeds the selected upper range
0x601n	7	Status_ERROR	BIT	RO	Yes	0	ERROR -> General error bit is set with overrange or under range
0x601n	8	Status AO alarm	BIT	RO	Yes	0	AO alarm -> DAC alarm signal asserted
0x601n	17	AO value	I32_T	RO	Yes	0	Analog output value after calibration
0x601n	18	DAC raw value	U16_T	RO	Yes	0	DAC raw value

Index 0x602n Analog Inputs, n = 0–7 (AI Ch1–AI Ch8)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x602n	0	Number of entries	U8_T	RO	No	18	
0x602n	1	Status_Underrange	BIT	RO	Yes	0	Underrange -> Analog input signal lies under the lower permissible threshold for this terminal
0x602n	2	Status_Overrange	BIT	RO	Yes	0	Overrange -> Analog input signal lies above the upper permissible threshold for this terminal
0x602n	7	Status_ERROR	BIT	RO	Yes	0	ERROR -> General error bit is set with overrange or under range
0x602n	16	Status_TxPDO Toggle	BIT	RO	Yes	0	TxPDO Toggle -> Toggles with each new analog process value
0x602n	17	AI value	I32_T	RO	Yes	0	Analog input data
0x602n	18	ADC raw value	U16_T	RO	Yes	0	ADC raw value

Index 0x7000 Digital Outputs (8 Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x7000	0	Number of entries	U8_T	RO	No	1	
0x7000	1	DO value	U8_T	RO	No	0	bit0–7 => DO0–7

Index 0x701n Analog Outputs, n=0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x7010	0	Number of entries	U8_T	RO	No	1	
0x7010	1	AO value	I32_T	RO	Yes	0	Unipolar output mode: 0–65535 Bipolar output mode: -32768–32767
0x7011	0	Number of entries	U8_T	RO	No	1	
0x7011	1	AO value	I32_T	RO	Yes	0	Unipolar output mode: 0–65535 Bipolar output mode : -32768–32767

Index 0x8000 DO Settings

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x8000	0	Number of entries	U8_T	RO	No	1	
0x8000	1	Enable Watchdog	BIT	RW	No	1	0: Disabling of the watchdog 1: Enabling of the watchdog (Default Value)

Index 0x8001 Watchdog Settings

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x8001	0	Number of entries	U8_T	RO	No	1	
0x8001	1	Watchdog timeout value	U16_T	RW	No	100	Unit: ms Default value is 100ms (the same with ET1100)

Index 0x801n AO Settings, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x801n	0	Number of entries	U8_T	RO	No	21	
0x801n	1	Enable data calibration	BIT	RW	No	1	0: Disabling of the data calibration 1: Enabling of the data calibration
0x801n	2	Enable Watchdog	BIT	RW	No	0	0: Disabling of the Watchdog 1: Enabling of the Watchdog (In an event of a communication failure, the analog output value could be reset to a default value.)
0x801n	3	Watchdog setting	BIT2	RW	No	0	0: Default Watchdog value 1: Watchdog ramp 2: Last output value 3: Zero value
0x801n	17	Data calibration offset	I16_T	RW	No	0	Data calibration offset
0x801n	18	Data calibration gain	I32_T	RW	No	32768	Data calibration gain (2^15)
0x801n	19	Output type	U16_T	RW	No	0	0: 0–5 V 1: 0–10 V 2: ±5 V 3: ±10 V 4: 4–20 mA 5: 0–20 mA
0x801n	20	Default output value	U32_T	RW	No	0	For Watchdog (-32768–65535)
0x801n	21	Default output ramp	U32_T	RW	No	65535	For Watchdog (unit: digits/ms) (1–65535) Ramp for ramping down to the default value in digits/ms.

Index 0x802n AI Settings, n = 0–7 (AI Ch1–AI Ch8)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x802n	0	Number of entries	U8_T	RO	No	19	
0x802n	1	Enable data calibration	BIT	RW	No	1	0: Disabling of the data calibration 1: Enabling of the data calibration
0x802n	17	Data calibration offset	I16_T	RW	No	0	Data calibration offset
0x802n	18	Data calibration gain	I32_T	RW	No	32768	Data calibration gain (2^15)
0x802n	19	Input type	U16_T	RW	No	0	0: 0–5 V 1: 0–10 V 2: ±5 V 3: ±10 V 4: 0–20 mA 5: 4–20 mA

Chapter 7: Mixed Analog Input/Output Module

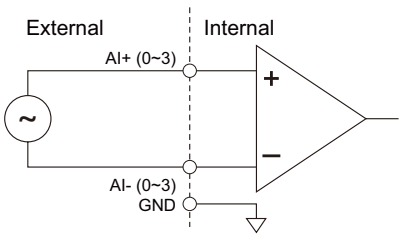
7.1 NEIO-B1842 4-ch AI, 2-ch AO, 16-ch DI/O EtherCAT Slave Module (Differential)

7.1.1 Introduction

NEIO-B1842 is a cost-effective EtherCAT I/O slave module. Each NEIO-B1842 is equipped with 4-ch analog input, 2-ch analog output, 8-ch digital input, and 8-ch digital output. NEIO-B1842 is fitted with adjustable voltage and current input ranges for different application requirements. NEIO-B1842 also provides watchdog function; when it is disconnected, watchdog function can keep the module in a safe state and restore it to regular operation. All of the NEIO modules are provided with high isolation protection and verified by the EtherCAT conformance test tool.

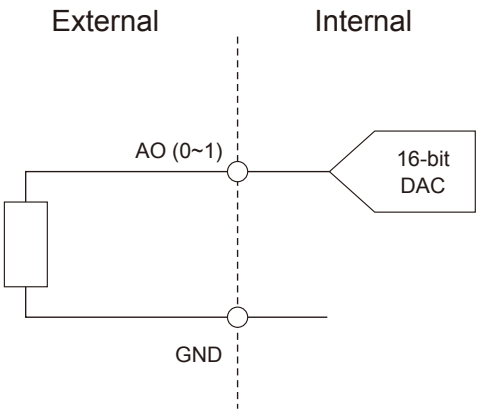
7.1.2 Wiring Diagrams

Analog Input

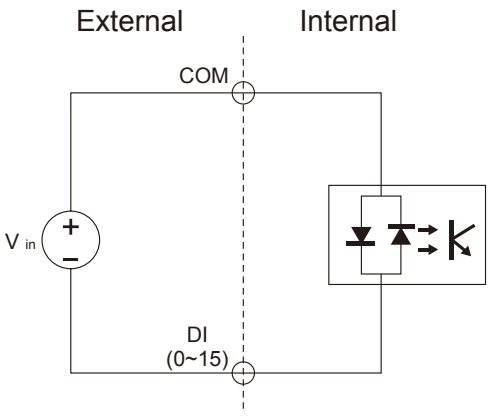


7.1.2 Wiring Diagrams Cont.

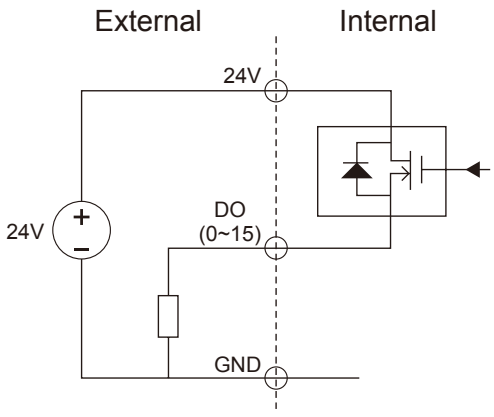
Analog Output



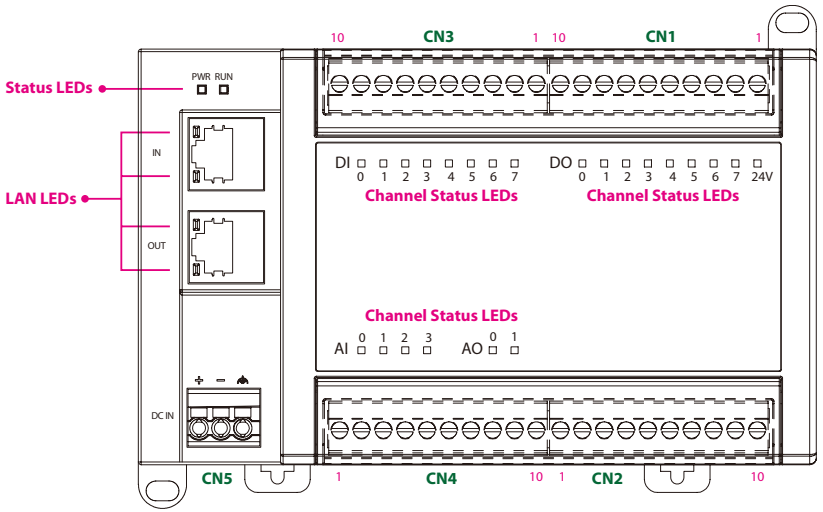
DI (PNP/NPN)



DO (PNP)



7.1.3 Pin Assignments



CN5: Power

Pin	Description
1	V +
2	V -
3	GND

CN3: Digital Input

Pin	Description
1	COM
2	COM
3	DI 7
4	DI 6
5	DI 5
6	DI 4
7	DI 3
8	DI 2
9	DI 1
10	DI 0

CN1: Digital Output

Pin	Description
1	GND
2	24V
3	DO 7
4	DO 6
5	DO 5
6	DO 4
7	DO 3
8	DO 2
9	DO 1
10	DO 0

CN4: Analog Input

Pin	Description
1	AI 0+
2	AI 0-
3	AI 1+
4	AI 1-
5	AI 2+
6	AI 2-
7	AI 3+
8	AI 3-
9	-
10	GND

CN1: Analog Output

Pin	Description
1	-
2	-
3	-
4	-
5	-
6	-
7	AO 0
8	GND
9	AO 1
10	GND

7.1.4 LED Indicators

Status LEDs

LED	Status	Color	Description
PWR	On	Green	Power on (power input range: 24 V_{DC}, ±20%).
	Off	-	Power off.
RUN	On	Green	The module is in the Operational state.
	Single Flash	Green	The module is in the Safe-operational state.
	Blinking	Green	The module is in the Pre-operational state.
	Off	-	The module is in the Initial state.

LAN LEDs

LED	Communication Speed	Link	Act
	0	Off	Off
	10 Mbps	Off	Blinking (Yellow)
	100 Mbps	On (Green)	Blinking (Yellow)

Channel Status LEDs

LED	Status	Color	Description
AI 0–AI 3	On	Red	AI limit LED
	Off	-	Normal operation
AO 0–AO 1	On	Red	AO alarm LED
	Off	-	Normal operation
DI 0–DI 7	On	Green	On-state voltage: 9–24 V_{DC}
	Off	-	Off-state voltage: 0–8 V_{DC}
DO 0–DO 7	On	Green	Digital output signal is set.
	Off	-	No digital output signal.
24V	On	Orange	24 V_{DC} external power supply for each DO group is connected.
	Off	-	24 V_{DC} external power supply for each DO group is not connected.

Note1: The AI LED lights up if the input value is over the range.

Note2: The AO LED lights up if the current output load is in open circuit or the IC temperature has exceeded +150°C.

Note3: The NEIO series digital output modules all require a 24 V_{DC} external power supply for each DO channel group. You can diagnose the status of the external power supply with the DO 24 V_{DC} LEDs.

7.1.5 Hardware Specifications

Power Input	
Power Input Range	24 V_{DC} (±20%)
Power Consumption	4.32 W
Electrical Isolation	2.5 kV
Terminal Block	Spring type (3P, 5.00 mm)
Cross Sections	0.2~2.5 mm² / AWG 26 - 12
Analog Input	
Channels	4-ch (Differential)
Input Type	Voltage, Current
Input Range	±10 V, 0–20 mA
Resolution	16-bit
Sampling Rate	1 kHz
Accuracy	< ±0.1% of FSR
Internal Resistance	Voltage: > 1MΩ Current: 60Ω
Terminal Block	Detachable screw terminals (90°, 10P, 5.00mm)
Cross Sections	Solid wire: 0.2–4mm² / AWG 28–12 Stranded wire: 0.2–2.5mm² / AWG 30–12
Analog Output	
Channels	2-ch (Single-ended)
Output Type	Voltage, Current

7.1.5 Hardware Specifications Cont.

Analog Output	
Output Range	0–5 V, 0–10 V, ±5 V, ±10 V, 0–20 mA, 4–20 mA
Resolution	16-bit
Conversation Time	< 100 µs
Accuracy	< ±0.2% of FSR for voltage output < ±0.1% of FSR for current output
Load Impedance	Voltage: ≥ 1kΩ Current: ≤ 350Ω
Terminal Block	Detachable screw terminals (90°, 10P, 5.00mm)
Cross Sections	Solid wire: 0.2–4mm² / AWG 28–12 Stranded wire: 0.2–2.5mm² / AWG 30–12
Digital Input	
Channels	8-ch
Input Type	24 V_{DC} (PNP/NPN)
Input Filter	1 ms
On-state Voltage, "1"	9–24 V_{DC}
Off-state Voltage, "0"	0–8 V_{DC}
Input Current	<6 mA/ch
Electrical Isolation	2.5 kV
Terminal Block	Detachable screw terminals (90°, 10P, 5.00mm)
Cross Sections	Solid wire: 0.2~4mm² / AWG 28–12 Stranded wire: 0.2–2.5mm² / AWG 30–12

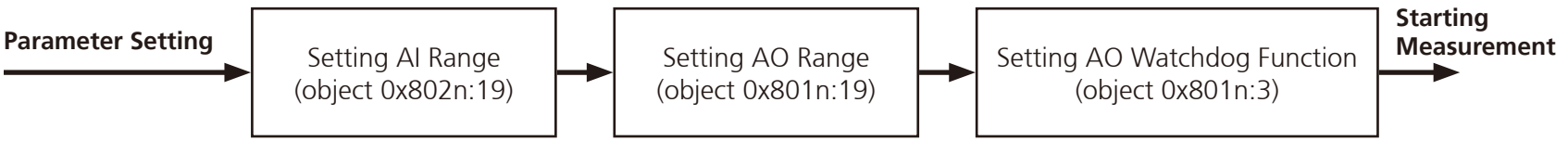
7.1.5 Hardware Specifications Cont.

Digital Output	
Channels	8-ch
Output Type	24 V_{DC} (PNP)
Load Type	Resistive, Inductive and Capacitive
Output Current	Maximum: 500 mA/ch
Switching Time	OFF to ON — Maximum: 100 µs ON to OFF — Maximum: 150 µs
Output Protection	Over Voltage Protection Short Circuit Protection Reverse Voltage Protection Channel Over Temperature Protection Case Over Temperature Protection
Terminal Block	Detachable screw terminals (90°, 10P, 5.00mm)
Cross Sections	Solid wire: 0.2-4mm^2 / AWG 28-12 Stranded wire: 0.2–2.5mm^2 / AWG 30–12

7.1.6 Operation Principle

7.1.6.1 Parameter Setting

Before using, you need to set the analog input and analog output measure ranges first, and then you can refer to your application to figure out the behavior of the AO Watchdog Function.



- **Setting the Analog Input Range**

Set up the analog input range by changing the object of index 0x802n (Sub 19). For example, if the measuring range of your sensor is ***10 V***, you need to set ***0*** into the object of index 0x802n (Sub 19).

Index 0x802n AI Settings, n = 0–3 (AI Ch1–AI Ch3)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x802n	19	Input type	U16_T	RW	No	0	0: ±10 V 1: 0–20 mA

The following table shows the actual digital input value between different measurement ranges. You can use the formulas below to convert the value.

Measure Range	Analog Input Value	ADC Value	Formulas
±10 V	10 V	3355443	$Analog\ Input\ Value = ADC\ Value\ x \frac{20\ (Full\ Scale\ Range)}{6710887\ (Full\ Value)}$
	5 V	1677721	
	0 V	0	
	-5 V	-1677722	
	-10 V	-3355444	
0–20 mA	20 mA	6710886	$Analog\ Input\ Value = ADC\ Value\ x \frac{20\ (Full\ Scale\ Range)}{6710886\ (Full\ Value)}$
	15 mA	5033164	
	10 mA	3355443	
	5 mA	1677721	
	0 mA	0	

▪ Setting the Analog Output Range

Set up the analog output range by changing the object of index 0x801n (Sub 19). For example, if the output range of your device is ***0–10 V***, you need to set ***1*** into the object of index 0x801n (Sub 19).

Index 0x801n AO Settings, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x801n	19	Output type	U16_T	RW	No	0	0: 0–5 V 1: 0–10 V 2: ±5 V 3: ±10 V 4: 4–20 mA 5: 0–20 mA

The following table shows the actual digital AO value between different measurement ranges. You can use the formulas below to convert the value.

Output Range	Analog Output Value	DAC Value	Formulas
0–5 V	5 V	65535	$DAC\ Value = Analog\ Output\ Value \times \frac{65535\ (Full\ Value)}{5\ (Full\ Scale\ Range)}$
	2.5 V	32768	
	0 V	0	
0–10 V	10 V	65535	$DAC\ Value = Analog\ Output\ Value \times \frac{65535\ (Full\ Value)}{10\ (Full\ Scale\ Range)}$
	5 V	32768	
	0 V	0	

±5 V	5V	32767	$DAC\ Value = Analog\ Output\ Value \times \frac{65535\ (Full\ Value)}{10\ (Full\ Scale\ Range)}$
	2.5 V	16384	
	0 V	0	
	-2.5 V	-16384	
	-5V	-32768	
±10 V	10 V	32767	$DAC\ Value = Analog\ Output\ Value \times \frac{65535\ (Full\ Value)}{20\ (Full\ Scale\ Range)}$
	5 V	16384	
	0 V	0	
	-5 V	-16384	
	-10 V	-32768	
0–20 mA	20 mA	65535	$DAC\ Value = Analog\ Output\ Value \times \frac{65535\ (Full\ Value)}{20\ (Full\ Scale\ Range)}$
	10 mA	32768	
	0 mA	0	
4–20 mA	20 mA	65535	$DAC\ Value = (Analog\ Output\ Value - 4) \times \frac{65535\ (Full\ Value)}{16\ (Full\ Scale\ Range)}$
	12 mA	32768	
	4 mA	0	

- **Setting Analog Output Watchdog Function**

  NEIO-B1842 provides four modes of Watchdog function. When disconnection occurs (not in the Operational state), the module can output the value that you preset previously and ensure a normal operation. Please follow the steps below to set the Watchdog function:

  Step 1. Enable the Watchdog function by setting ***Enable Watchdog*** (Sub 2, bit 1 of object indexed 0x801n) to 1.
  Step 2. Configure the status mode by changing ***Watchdog Setting*** (Sub 3, bit 1-bit 2 of object indexed 0x801n).
  Step 3. Configure the output value by changing the ***Default output value*** (Sub 20 of object indexed 0x801n).

  Note: Only when the status is ***0: default watchdog value*** or ***1: watchdog ramp***, configure the value.

  Step 4. Configure the ramp by changing the ***Default output ramp*** (Sub 21 of object indexed 0x801n).

  Note: Only when the status is ***1: watchdog ramp***, configure the value.

  For example:
  - If you set ***0: default watchdog value*** as Watchdog status, when the Watchdog is triggered, AO will output the value of your setting in the ***Default output value***.
  - If you set ***1: watchdog ramp*** as Watchdog status, when the Watchdog is triggered, AO will follow the ramp of your setting in the ***Default output ramp*** and change to the ***Default output value*** smoothly.

    Note: If the ***Default output value*** is set to ***32767***, the ***Default output ramp*** is set to ***10***, the AO voltage should change to ***32767*** in 3.3 seconds. (ramp unit: digital/ms)

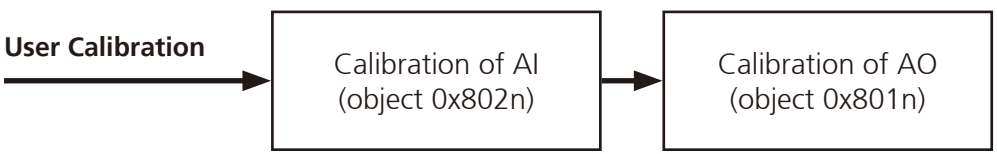
  - If you set ***2: Last output value*** as Watchdog status, when the Watchdog is triggered, AO will keep the last output value.
  - If you set ***3: Zero value*** as Watchdog status, when the Watchdog is triggered, AO will output ***0*** immediately.

Index 0x801n AO Settings, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x801n	2	Enable Watchdog	BIT	RW	No	1	0: Disabling of the Watchdog 1: Enabling of the Watchdog
0x801n	3	Watchdog setting	BIT2	RW	No	0	0: Default Watchdog value 1: Watchdog ramp 2: Last output value 3: Zero value
0x801n	20	Default output value	U32_T	RW	No	0	For Watchdog (-32768–65535)
0x801n	21	Default output ramp	U32_T	RW	No	65535	For Watchdog (unit: digital/ms)

7.1.6.2 User Calibration

Every NEIO-B1842 module is pre-calibrated after production. For different device application requirements, you can follow the steps below to recalibrate the module to increase the accuracy.



- **Calibration of Analog Input**

Step 1. Enable calibration function by setting ***Enable Data Calibration*** (Sub 1, bit 1 of object indexed 0x802n) to ***1***.
Step 2. Configure the offset compensation by setting ***Data Calibration Offset*** (Sub 17 of object indexed 0x802n, use the formula shown on the next page).
Step 3. Configure the gain compensation by setting **Data Calibration Gain** (Sub 18 of object indexed 0x802n, use the formula shown on the next page).

Voltage Mode:

$$AI\ Value = (ADC\ Value \times \frac{gain+0x4000000}{0x8000000} + offset) - 0x800000$$

$$gain\ value = 0x800000 \times \frac{AI1-AI2}{ADC1-ADC2} - 0x400000$$

$$offset\ value = \frac{AI2 \times ADC1-AI1 \times ADC2}{ADC1-ADC2}$$

Current Mode:

$$AI\ Value = ADC\ Value \times \frac{gain+0x4000000}{0x8000000} + offset$$

$$gain\ value = 0x800000 \times \frac{AI1-AI2}{ADC1-ADC2} - 0x400000$$

$$offset\ value = \frac{AI2 \times ADC1-AI1 \times ADC2}{ADC1-ADC2}$$

Note1: AI_1 and AI_2 are the real values of analog input. (Use a precise voltage source to measure the voltage of two AI channels.)
Note2: ADC_1 and ADC_2 are the output values of A/D converter.

Index 0x802n AI Settings, n = 0–7 (AI Ch1–AI Ch8)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x802n	1	Enable data calibration	BIT	RW	No	1	0: Disabling of the data calibration 1: Enabling of the data calibration
0x802n	17	Data calibration offset	I32_T	RW	No	0	Data calibration offset (-4194304–4194304)
0x802n	18	Data calibration gain	I32_T	RW	No	0x400000	Data calibration gain (0–5033164)

- **Calibration of Analog Output**

Step 1. Enable calibration function by setting ***Enable Data Calibration*** (Sub 1, bit 1 of object indexed 0x801n) to ***1***.
Step 2. Configure the offset compensation by setting ***Data Calibration Offset*** (use the formula shown below).
Step 3. Configure the gain compensation by setting ***Data Calibration Gain*** (use the formula shown below).

$$DAC\ Value = AO\ Value \times \frac{gain+32768}{65535} + offset$$

$$gain\ value = 65535 \times \frac{DAC1-DAC2}{AO1-AO2} - 32768$$

$$offset\ value = \frac{AO2 \times DAC1 - AO1 \times DAC2}{AO1-AO2}$$

Note1: AO_1 and AO_2 are the real values of analog output. (Use a precise voltage source to measure the voltage of two AO channels.)
Note2: DAC_1 and DAC_2 are the output values of D/A converter.

Index 0x801n AO Settings, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x801n	1	Enable data calibration	BIT	RW	No	1	0: Disabling of the data calibration 1: Enabling of the data calibration
0x801n	17	Data calibration offset	I16_T	RW	No	0	Data calibration offset
0x801n	18	Data calibration gain	I32_T	RW	No	32768	Data calibration gain (2^15)

7.1.6.3 Store and Restore Calibration Parameters

The settings of calibration in the previous chapter are all saved in the register, when the module is power-off, the settings will restore back to the factory default settings. If you want to keep the current setting after power-off, you can write the value ***0x73617665*** to the ***object 0x1010:1*** then save the parameter settings.

Index 0x1010 Store Parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1010	0	Number of entries	U8_T	RO	No	1	
	1	Store parameters	U32_T	RW	No	0	Set **0x73617665** to save parameters in flash ROM.

If you want to restore the calibration settings to factory default, please write the value ***0x72657374*** to the ***object 0x1011:1*** to reset parameters to the factory default settings.

Index 0x1011 Restore Default Parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1011	0	Number of entries	U8_T	RO	No	1	
	1	Restore default parameters	U32_T	RW	No	0	If this object is set to **0x72657374**, all backup objects will be reset to their delivery state.

7.1.7 Object Dictionary

All slave modules must be provided with an object dictionary, which mainly defines the configuration of the device. Users can access the module through either Service Data Objects (SDOs) or Process Data Objects (PDOs). SDOs are used to access device parameters. PDOs are used to transmit cyclic communication data, and it includes Transmit PDO (TxPDO) and Receive PDO (RxPDO).

Users need to configure the PDO mapping information first, and the master will follow the mapping table's information to access data. The section below describes the detailed information about the PDO mapping and related parameter settings.

7.1.7.1 PDO Mapping

Analog Input TxPDO (AI CH1–AI CH4)	Analog Output RxPDO (AO CH1–AO CH2)	Digital Input TxPDO (DI CH1–DI CH8)	Digital Output RxPDO (DO CH1–DO CH8)
0x1A1n (n = 0–3)	0x160n (n = 0–1)	0x1A00 (bit 1)	0x1600 (bit 2)

7.1.7.2 Object Data Type

Code	C/C++ Type	Description	Size (Byte)	Range
USINT	U8_T	Unsigned char	1	0–255
UINT	U16_T	Unsigned short	2	0–65535
UDINT	U32_T	Unsigned int	4	0–4294967295
SINT	I8_T	Char	1	-128–127
INT	I_16	Short	2	-32768–32767
DINT	I_32	Int	4	-2147483648–2147483647
STRING	N/A	String value	-	Depend on string length

7.1.7.3 Object Description

Index 0x1000 Device Type

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1000	0	Device type	U32_T	RO	No	0x00001389	Modular device profile

Index 0x1008 Device Name

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1008	0	Device name	STRING(10)	RO	No	NEIO-B1842	Name of the EtherCAT slave

Index 0x100A Software Version

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x100A	0	Software version	STRING(9)	RO	No	1.0.4.003	Firmware version of the device

Index 0x1010 Store Parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1010	0	Number of entries	U8_T	RO	No	1	
	1	Save parameters	U32_T	RW	No	0	Set *0x73617665* to save parameters in flash ROM.

Index 0x1011 Restore Default Parameters

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1011	0	Number of entries	U8_T	RO	No	1	
	1	Restore default parameters	U32_T	RW	No	0	If this object is set to *0x72657374*, all backup objects would be reset to their delivery state.

Index 0x1018 Identity

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1018	0	Number of entries	U8_T	RO	No	4	Identity
	1	Vendor ID	U32_T	RO	No	0x00000752	Vendor ID
	2	Product code	U32_T	RO	No	0x00001842	Product code of the EtherCAT slave
	3	Revision number	U32_T	RO	No	0x00000000	Revision number of the device
	4	Serial number	U32_T	RO	No	0x00000000	Serial number of the device

Index 0x1600 RxPDO0-Map: Digital Output

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1600	0	Number of objects in this PDO	U8_T	RO	No	1	DO RxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x70000108	PDO Mapping entry (object 0x7000 entry 0x01 : DO Value)
	2	Mapping entry 2	U32_T	RO	No	0x08	PDO Mapping entry (8 bits align)

Index 0x1601 RxPDO0-Map: Analog Output (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1601	0	Number of objects in this PDO	U8_T	RO	No	1	AO RxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x70100120	PDO Mapping entry (object 0x7010 entry 0x01 : AO Value)
0x1602	0	Number of objects in this PDO	U8_T	RO	No	1	AO RxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x70110120	PDO Mapping entry (object 0x7011 entry 0x01 : AO Value)

Index 0x1A00 TxPDO0-Map: Digital Input

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1A00	0	Number of objects in this PDO	U8_T	RO	No	2	Digital Input TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x60000108	PDO Mapping entry (object 0x6000 entry 0x01 : DI Value)
	2	Mapping entry 1	U32_T	RO	No	0x08	PDO Mapping entry (8 bits align)

Index 0x1A0n TxPDO0-Map: Analog Output, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1A01	0	Number of objects in this PDO	U8_T	RO	No	6	AO TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x60100101	PDO Mapping entry (object 0x6010 entry 0x01 : Status_Underrange)
	2	Mapping entry 2	U32_T	RO	No	0x60100201	PDO Mapping entry (object 0x6010 entry 0x02 : Status_Overrange)
	3	Mapping entry 3	U32_T	RO	No	0x00000004	PDO Mapping entry (4 bits align)
	4	Mapping entry 4	U32_T	RO	No	0x60100701	PDO Mapping entry (object 0x6010 entry 0x07 : Status_Error)
	5	Mapping entry 5	U32_T	RO	No	0x60100801	PDO Mapping entry (object 0x6010 entry 0x08 : Status_AO alarm)
	6	Mapping entry 6	U32_T	RO	No	0x00000008	PDO Mapping entry (8 bits align)
0x1A02	0	Number of objects in this PDO	U8_T	RO	No	6	AO TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x60110101	PDO Mapping entry (object 0x6011 entry 0x01 : Status_Underrange)
	2	Mapping entry 2	U32_T	RO	No	0x60110201	PDO Mapping entry (object 0x6011 entry 0x02 : Status_Overrange)
	3	Mapping entry 3	U32_T	RO	No	0x00000004	PDO Mapping entry (4 bits align)
	4	Mapping entry 4	U32_T	RO	No	0x60110701	PDO Mapping entry (object 0x6011 entry 0x07 : Status_Error)
	5	Mapping entry 5	U32_T	RO	No	0x60110801	PDO Mapping entry (object 0x6010 entry 0x08 : Status_AO alarm)
	6	Mapping entry 6	U32_T	RO	No	0x00000008	PDO Mapping entry (8 bits align)

Index 0x1A1n TxPDO0-Map: Analog Input, n = 0–3 (AI Ch1–AI Ch4)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1A1n	0	Number of objects in this PDO	U8_T	RO	No	8	AI TxPDO mapping
	1	Mapping entry 1	U32_T	RO	No	0x602n0101	PDO Mapping entry (object 0x602n entry 0x01 : Status_Underrange)
	2	Mapping entry 2	U32_T	RO	No	0x602n0201	PDO Mapping entry (object 0x602n entry 0x02 : Status_Overrange)
	3	Mapping entry 3	U32_T	RO	No	0x00000004	PDO Mapping entry (4 bits align)
	4	Mapping entry 4	U32_T	RO	No	0x602n0701	PDO Mapping entry (object 0x602n entry 0x07 : Status_Error)
	5	Mapping entry 5	U32_T	RO	No	0x00000001	PDO Mapping entry (1 bits align)
	6	Mapping entry 6	U32_T	RO	No	0x00000007	PDO Mapping entry (7 bits align)
	7	Mapping entry 7	U32_T	RO	No	0x602n1001	PDO Mapping entry (object 0x602n entry 0x10 : Status_TxPDO Toggle)
	8	Mapping entry 8	U32_T	RO	No	0x602n1120	PDO Mapping entry (object 0x602n entry 0x11 : AI Value)

Index 0x1C00 Sync Manager Type

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1C00	0	Number of SyncManager channels	U8_T	RO	No	4	Sync manager type
	1	Type of SyncManager 0	U8_T	RO	No	1	Sync manager type Channel 1: Mailbox write
	2	Type of SyncManager 1	U8_T	RO	No	2	Sync manager type Channel 2: Mailbox read
	3	Type of SyncManager 2	U8_T	RO	No	3	Sync manager type Channel 3: Process data write
	4	Type of SyncManager 3	U8_T	RO	No	4	Sync manager type Channel 4: Process data read

Index 0x1C12 RxPDO Assign

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1C12	0	Number of RxPDO assignment	U8_T	RW	No	3	SyncManager 2 PDO assignment, Fixed
	1	RxPDO mapping index 1	U16_T	RW	No	0x1600	DO Value
	2	RxPDO mapping index 2	U16_T	RW	No	0x1601	AO Ch1
	3	RxPDO mapping index 3	U16_T	RW	No	0x1602	AO Ch2

Index 0x1C13 TxPDO assign

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x1C13	0	Number of TxPDO assignment	U8_T	RW	No	7	SyncManager 3 PDO assignment
	1	TxPDO mapping index 1	U16_T	RW	No	0x1A00	DI Value
	2	TxPDO mapping index 2	U16_T	RW	No	0x1A01	AO Ch1
	3	TxPDO mapping index 3	U16_T	RW	No	0x1A02	AO Ch2
	4	TxPDO mapping index 4	U16_T	RW	No	0x1A10	AI Ch1
	5	TxPDO mapping index 5	U16_T	RW	No	0x1A11	AI Ch2
	6	TxPDO mapping index 6	U16_T	RW	No	0x1A12	AI Ch3
	7	TxPDO mapping index 7	U16_T	RW	No	0x1A13	AI Ch4

Index 0x6000 Digital Inputs (8 Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x6000	0	Number of entries	U8_T	RO	No	1	
0x6000	1	DI Value	U8_T	RO	Yes	0	bit0–7 => DI0–7

Index 0x6001 Digital Output Status (8 Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x6001	0	Number of entries	U8_T	RO	No	1	
0x6001	1	DI Value	U8_T	RO	Yes	0	1: DO fault signal activated

Index 0x601n Analog Outputs, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x601n	0	Number of entries	U8_T	RO	No	18	
0x601n	1	Status_Underrange	BIT	RO	Yes	0	Underrange -> The AO value written by user is below the selected lower output range
0x601n	2	Status_Overrange	BIT	RO	Yes	0	Overrange -> The AO value written by user exceeds the selected upper range
0x601n	7	Status_ERROR	BIT	RO	Yes	0	ERROR -> General error bit is set with overrange or under range
0x601n	8	Status AO alarm	BIT	RO	Yes	0	AO alarm -> DAC alarm signal asserted
0x601n	17	AO value	I32_T	RO	Yes	0	Analog output value after calibration
0x601n	18	DAC raw value	U16_T	RO	Yes	0	DAC raw value

Index 0x602n Analog Inputs, n = 0–3 (AI Ch1–AI Ch4)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x602n	0	Number of entries	U8_T	RO	No	18	
0x602n	1	Status_Underrange	BIT	RO	Yes	0	Underrange -> Analog input signal lies under the lower permissible threshold for this terminal
0x602n	2	Status_Overrange	BIT	RO	Yes	0	Overrange -> Analog input signal lies above the upper permissible threshold for this terminal
0x602n	7	Status_ERROR	BIT	RO	Yes	0	ERROR -> General error bit is set with overrange or under range
0x602n	16	Status_TxPDO Toggle	BIT	RO	Yes	0	TxPDO Toggle -> Toggles with each new analog process value
0x602n	17	AI value	I32_T	RO	Yes	0	Analog input data
0x602n	18	ADC raw value	U16_T	RO	Yes	0	ADC raw value

Index 0x7000 Digital Outputs (8 Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x7000	0	Number of entries	U8_T	RO	No	1	
0x7000	1	DO value	U8_T	RO	No	0	bit0–7 => DO0–7

Index 0x701n Analog Outputs, n=0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x7010	0	Number of entries	U8_T	RO	No	1	
0x7010	1	AO value	I32_T	RO	Yes	0	Unipolar output mode: 0–65535 Bipolar output mode: -32768–32767
0x7011	0	Number of entries	U8_T	RO	No	1	
0x7011	1	AO value	I32_T	RO	Yes	0	Unipolar output mode: 0–65535 Bipolar output mode : -32768–32767

Index 0x8000 DO Settings (8 Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x8000	0	Number of entries	U8_T	RO	No	1	
0x8000	1	Enable Watchdog	BIT	RW	No	1	0: Disabling of the watchdog 1: Enabling of the watchdog (Default Value)

Index 0x8001 Watchdog Settings (8 Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x8001	0	Number of entries	U8_T	RO	No	1	
0x8001	1	Watchdog timeout value	U16_T	RW	No	100	Unit: ms Default value is 100ms

Index 0x801n AO Settings, n = 0–1 (AO Ch1–AO Ch2)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x801n	0	Number of entries	U8_T	RO	No	21	
0x801n	1	Enable data calibration	BIT	RW	No	1	0: Disabling of the data calibration 1: Enabling of the data calibration
0x801n	2	Enable Watchdog	BIT	RW	No	0	0: Disabling of the Watchdog 1: Enabling of the Watchdog (In an event of a communication failure, the analog output value could be reset to a default value.)
0x801n	3	Watchdog setting	BIT2	RW	No	0	0: Default Watchdog value 1: Watchdog ramp 2: Last output value 3: Zero value
0x801n	17	Data calibration offset	I16_T	RW	No	0	Data calibration offset
0x801n	18	Data calibration gain	I32_T	RW	No	32768	Data calibration gain (2^15)
0x801n	19	Output type	U16_T	RW	No	0	0: 0–5 V 1: 0–10 V 2: ±5 V 3: ±10 V 4: 4–20 mA 5: 0–20 mA
0x801n	20	Default output value	U32_T	RW	No	0	For Watchdog (-32768–65535)
0x801n	21	Default output ramp	U32_T	RW	No	65535	For Watchdog (unit: digits/ms) (1–65535) Ramp for ramping down to the default value in digits/ms.

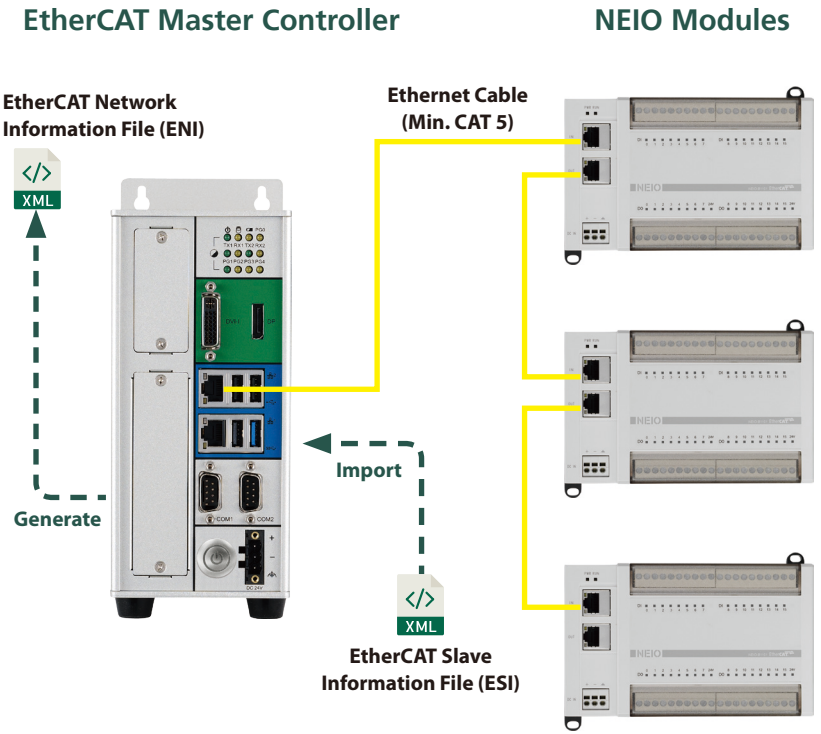
Index 0x802n AI Settings, n = 0–3 (AI Ch1–AI Ch4)

Index	Sub	Name	Data Type	Access	PDO Mapping	Default Value	Description
0x802n	0	Number of entries	U8_T	RO	No	21	
0x802n	1	Enable data calibration	BIT	RW	No	1	0: Disabling of the data calibration 1: Enabling of the data calibration
0x802n	17	Data calibration offset	I32_T	RW	No	0	Data calibration offset (-4194304–4194304)
0x802n	18	Data calibration gain	I32_T	RW	No	0x400000	Data calibration gain (0–0x4CCCCC : 5033164)
0x802n	19	Input type	U16_T	RW	No	0	0: ±10 V 1: 0–20 mA

Chapter 8: EtherCAT Communication

EtherCAT is an open technology of Fieldbus system. It has features of high performance communication, low infrastructure cost, and it only takes simple configuration for operation. You may follow the steps below to complete the communication configuration of NEIO modules.

1. Connect Ethernet cables between master controller and NEIO modules (the maximum distance between nodes is 100 m).
2. Import ESI file of NEIO modules to the master controller.
3. Generate ENI file of the EtherCAT network to start EtherCAT operation.



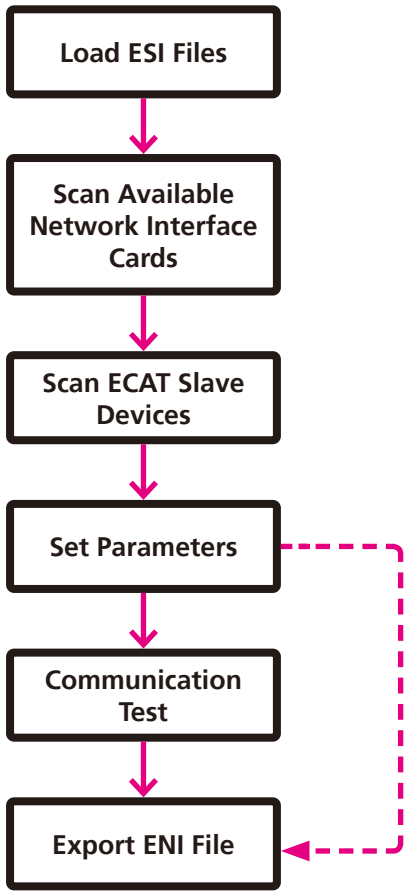
EtherCAT Network Topology

8.1 ESI and ENI File

The ESI file (EtherCAT Slave Information) is the EtherCAT device description in XML format. It contains all configuration information for setting slave modules. The ENI file (EtherCAT Network Information) describes the structure for the EtherCAT system, and it also comes in XML format.

The following section shows examples of configuring EtherCAT system with Beckhoff's TwinCAT and NexCOBOT nexECM EtherCAT configuration tool.

You can scan the QR code, which is on the right side of the module to find the ESI file more quickly. Alternatively, you can download the ESI files from the NexCOBOT website. (http://www.nexcobot.com.tw)

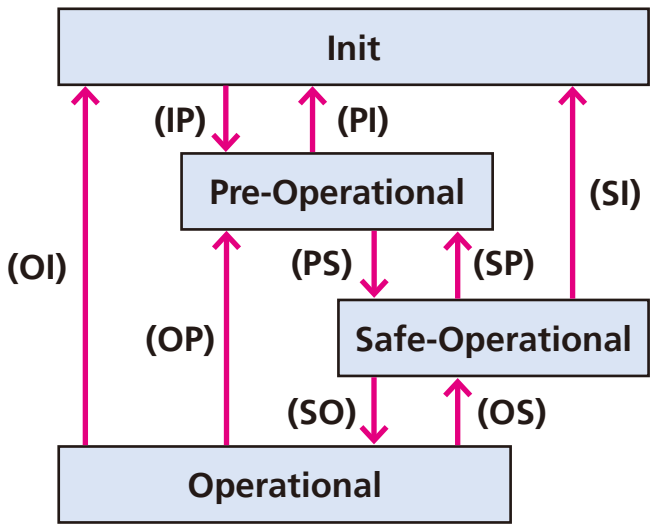


8.2 EtherCAT State Machine

The EtherCAT State Machine (ESM) defines the communication status of master and slave device during startup and operation.

The figure below describes the EtherCAT State Machine.

- Init
- Pre-Operational
- Safe-Operational
- Operational



EtherCAT State Machine

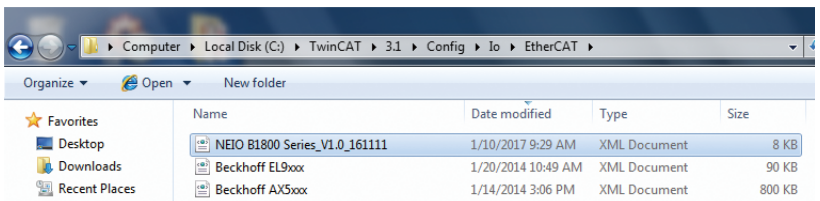
State	EC-Master Service	EC-Slave Service
Init	▪ Cyclic callback function start ▪ No Process Data communication (To slaves) ▪ No Mailbox communication (To slaves)	▪ EC-Master not ready
Pre-Operational	▪ Cyclic callback function start ▪ Mailbox communication start (To slaves) ▪ No Process Data communication (To slaves)	▪ Mailbox communication start
Safe-Operational	▪ Cyclic callback function start ▪ Mailbox communication start (To slaves) ▪ Process Data Input communication start ▪ No Process Data Output communication	▪ Mailbox communication start ▪ Update the Input Data to Process Data Input
Operational	▪ Cyclic callback function start ▪ Mailbox communication start (To slaves) ▪ Process Data Input communication start ▪ Process Data Output communication start	▪ Mailbox communication start ▪ Update the Input Data to Process Data Input ▪ Get Process Data Output, Output data and transfer

8.3 NEIO Configuration

This section describes how to use Beckhoff's TwinCAT and NexCOBOT's NexECM EtherCAT Configuration Tool for configuring the EtherCAT master controller and slave modules.

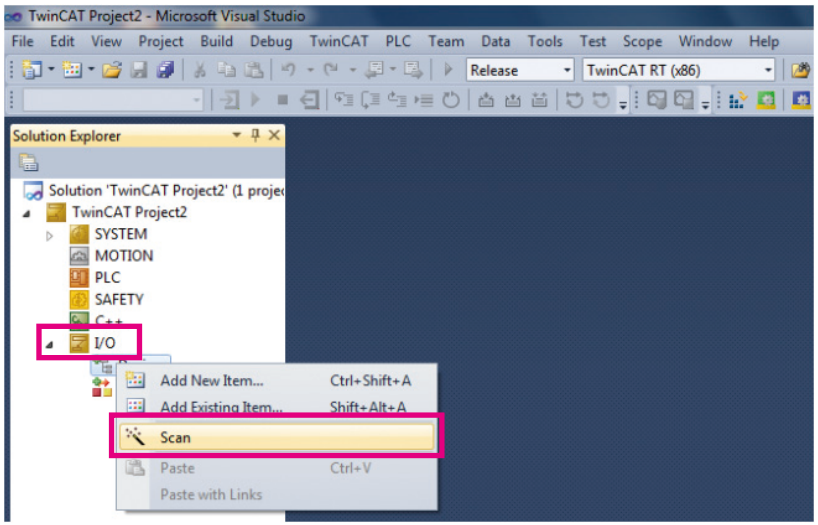
8.3.1 Operation with TwinCAT

Before starting the slave module setup, you should put the ESI file for the NEIO modules in the correct path of the EtherCAT master controller. In TwinCAT 2.x these files are located in `\TwinCAT\IO\EtherCAT`. In TwinCAT 3.x they are located in `\TwinCAT\3.x\Config\Io\EtherCAT`.

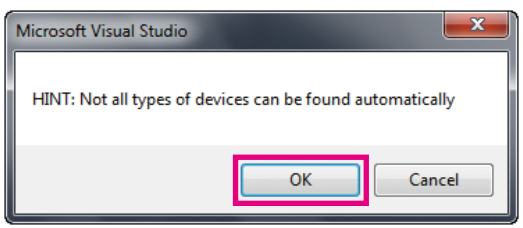


Scan Devices

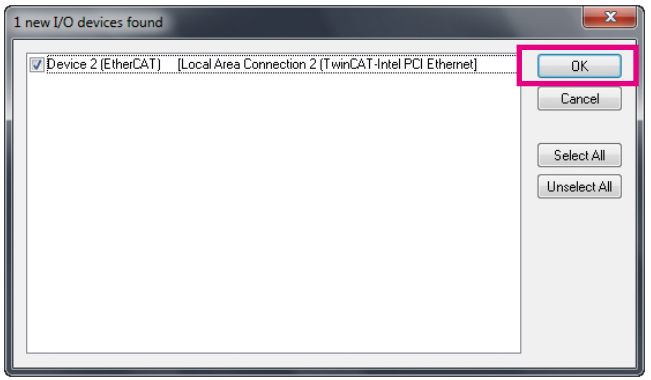
1. Create a new TwinCAT project, and then right-click the **I/O Devices** and select **Scan**.



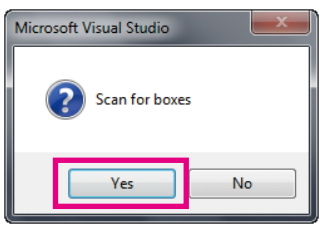
2. Click **OK** to continue the setup.

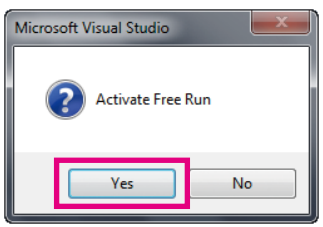


3. Choose the network interface card which you assigned to TwinCAT, and click **OK**.

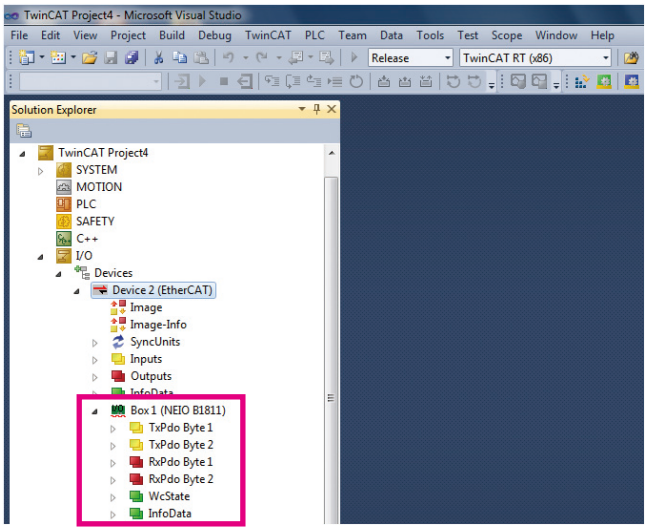


4. Click **Yes** to scan the slave modules, and then click **Yes** to activate the free run mode.



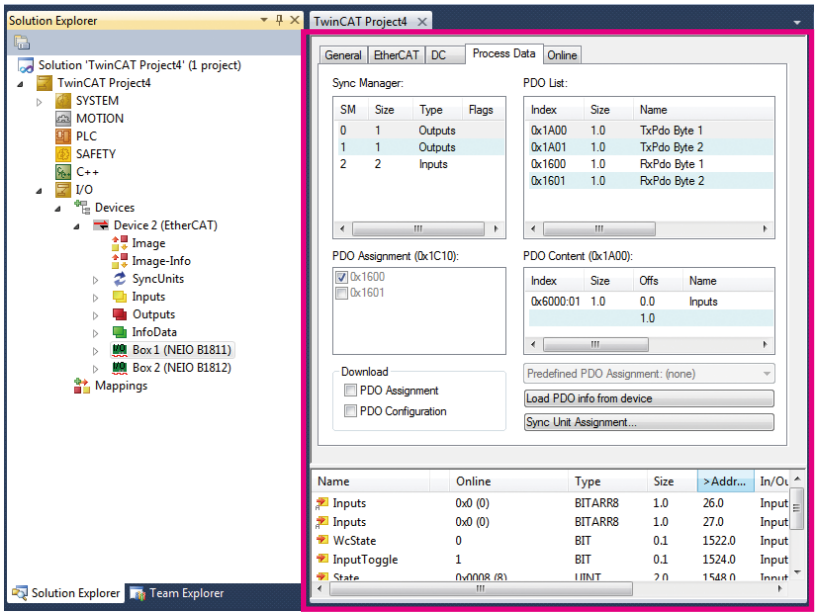


5. After successful scanning, you will see the NEIO device(s) in the TwinCAT project.



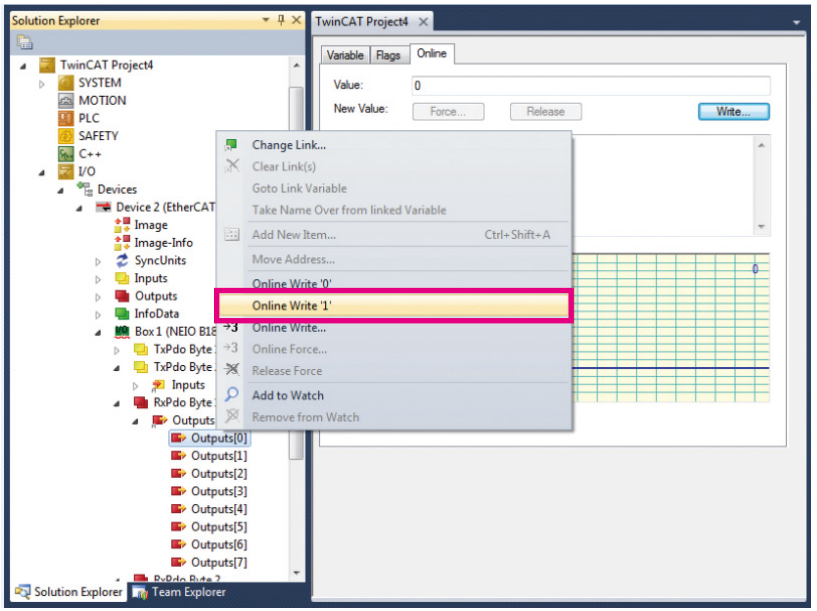
Set Parameters

Double-click the module. You can set the parameters in the window on the right.



Test Communication

Select an output channel, and then right-click **Online Write '1'** to test the device. If the DO LED on the module is turned ON, the communication between the EtherCAT Master Controller and the NEIO module is working.

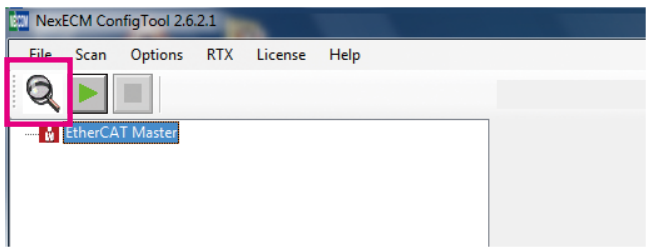


8.3.2 Operation with NexECM EtherCAT Configuration Tool

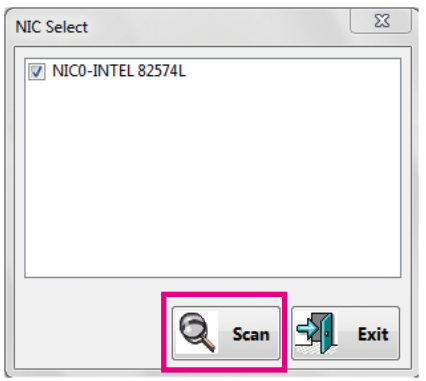
Before starting the slave module setup, you should put the ESI file for the NEIO module in the correct path of the EtherCAT master controller. In the NET series 32-bit systems these files are located in `\Program Files\NEXCOM\NexECMRtx\tools\x32\ESI_File`. In 64-bit systems they are located in `\Program Files\NEXCOM\NexECMRtx\tools\x64\ESI_File`.

Scan Devices

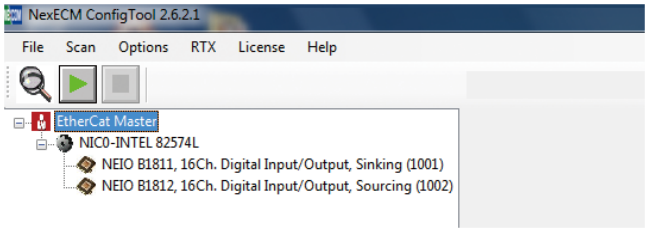
1. Click the icon to search the network port for EtherCAT.



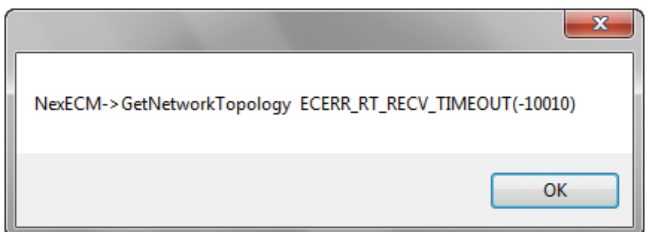
2. Click **Scan** to scan the EtherCAT slave devices connected to the LAN port.



3. After successful scanning, you will see the NEIO device(s) in the list.

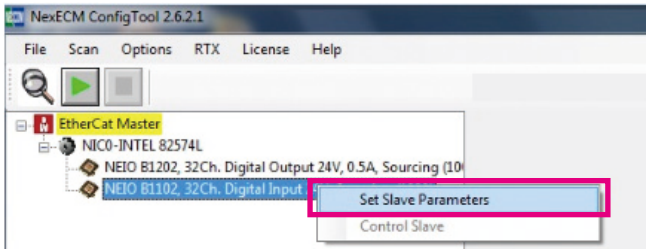


Note: If the "-10010" error occurs, please check the connection of devices.

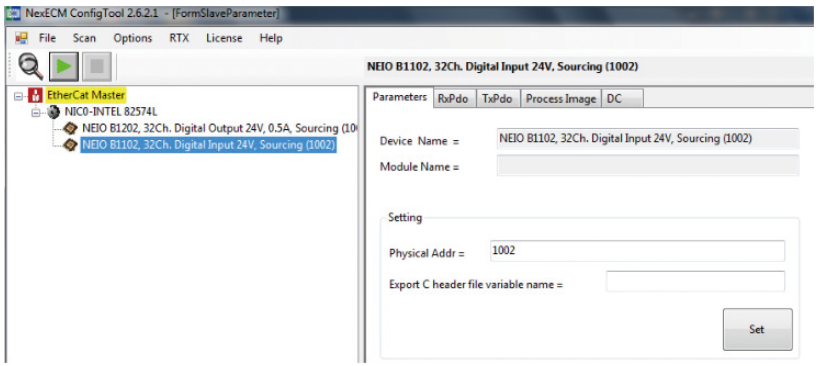


Set Parameters

1. Select the NEIO device and right-click ➔ **Set Slave Parameters**.



2. Then you can set the parameters in the window on the right.

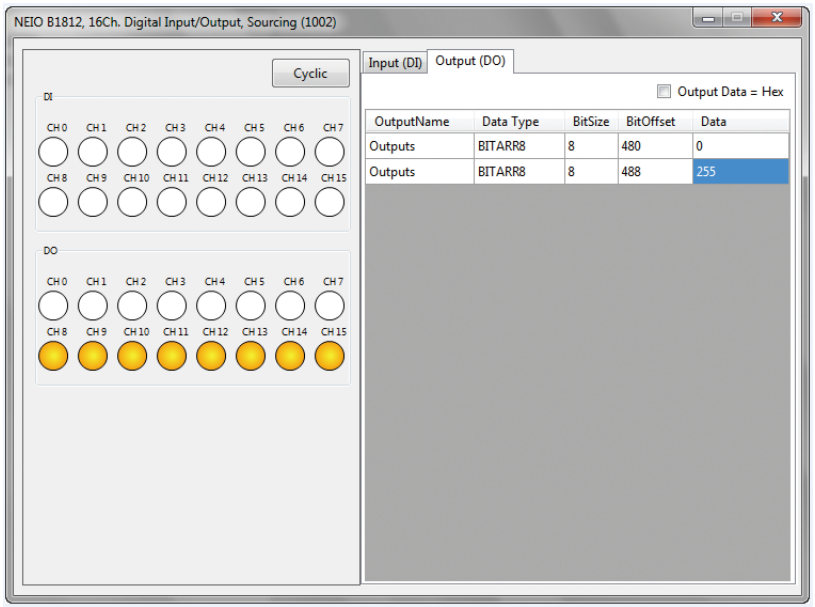


Note: The slave device setting page **must be used before starting the network**, because all the parameters changed are valid only before starting the network. If users changed the setting after the network has been started, a network restart is required.

3. Click the  icon to start the network.

Test Communication

1. Double-click the selected DI/O slave device which you want to test, and the DI/O operation window will appear.
2. You can click the DO button to operate DO, or you can use the **Cyclic function** to change DO status automatically.



3. Otherwise, you can key in the data value directly in the **Data** column.
4. See if the DO LED(s) is working according to your operation in the NexECM Configuration Tool to check the communication between the EtherCAT Master Controller and the NEIO module.