

**NETWORK INTERFACE MODULE
(EtherCAT)**

MODEL **R3-NECT1**

BEFORE USE

Thank you for choosing M-System. Before use, please check contents of the package you received as outlined below. If you have any problems or questions with the product, please contact M-System's Sales Office or representatives.

■ PACKAGE INCLUDES:

Network interface module(1)

■ MODEL NO.

Confirm Model No. marking on the product to be exactly what you ordered.

■ INSTRUCTION MANUAL

This manual describes necessary points of caution when you use this product, including installation, connection and basic maintenance procedures.

POINTS OF CAUTION

■ CONFORMITY WITH EU DIRECTIVES

- The equipment must be mounted inside the instrument panel of a metal enclosure.
- The actual installation environments such as panel configurations, connected devices, connected wires, may affect the protection level of this unit when it is integrated in a panel system. The user may have to review the CE requirements in regard to the whole system and employ additional protective measures to ensure the CE conformity.

■ HOT SWAPPABLE MODULES

- The module can be replaced while the power is ON. Be sure to replace it when the module is not communicating with a host, as it may affect the system. Replacing multiple modules at once may greatly change line voltage levels. We highly recommend to replace them one by one.

■ GENERAL PRECAUTIONS

- DO NOT set the switches while the power is supplied. The switches are used only for maintenance without the power.

■ ENVIRONMENT

- Indoor use.
- When heavy dust or metal particles are present in the air, install the unit inside proper housing with sufficient ventilation.
- Do not install the unit where it is subjected to continuous vibration. Do not subject the unit to physical impact.
- Environmental temperature must be within -10 to +55°C (14 to 131°F) with relative humidity within 30 to 90% RH in order to ensure adequate life span and operation.

■ WIRING

- Do not install cables close to noise sources (relay drive cable, high frequency line, etc.).
- Do not bind these cables together with those in which noises are present. Do not install them in the same duct.
- Be sure to attach the terminal cover for safety.

INSTALLATION

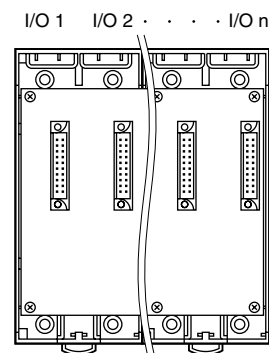
Use the Installation Base Model R3-BS, or Model R3-BSW for free I/O address capability.

Before mounting the Network Interface Module onto the Base, be sure to configure the module as explained below.

■ FIXED ADDRESS AND OTHER SETTINGS

Read the "COMPONENT IDENTIFICATION" surely before mounting the module onto the Base.

■ NETWORK SLOTS ON THE BASE



With Model R3-BS base, mount the I/O Modules from the left end (I/O 1) to the right in order that the Network Module assigns data areas from I/O 1.

Network Module(s) and Power Module are mounted basically at the right end though technically they could be mounted in any position.

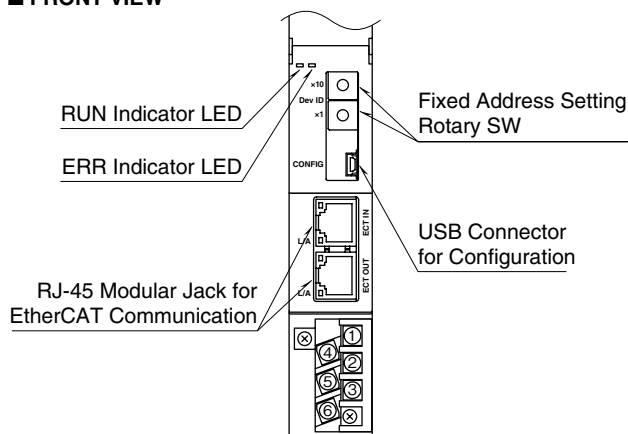
With Model R3-BSW base, there is no limitation in mounting positions as I/O address can be assigned freely to each module using rotary switches equipped on the base.



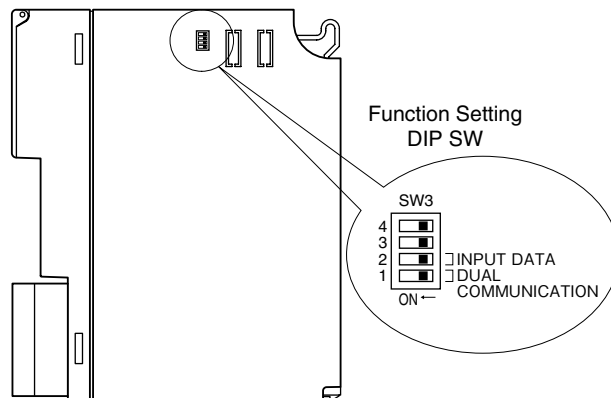
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COMPONENT IDENTIFICATION

FRONT VIEW



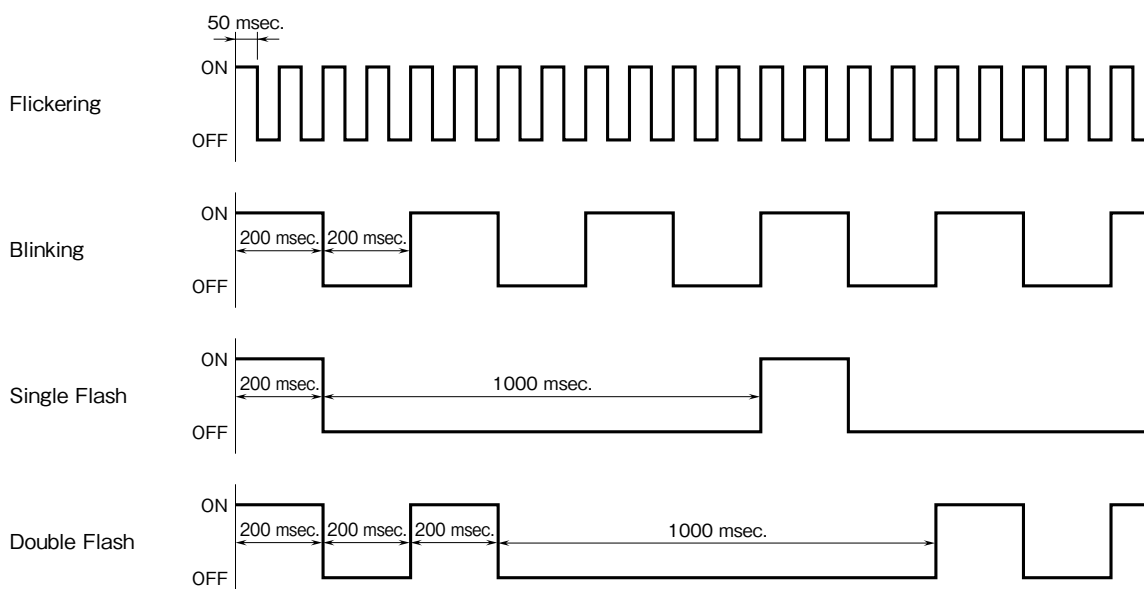
SIDE VIEW



STATUS INDICATOR LED

ID	COLOR	FUNCTION	STATUS	DESCRIPTION
RUN	Green	Device State	OFF	Initialization
			Blinking	PRE-OPERATIONAL
			Single Flash	SAFE-OPERATIONAL
			ON	OPERATIONAL
ERR	Red	Error	OFF	No error
			Blinking	Invalid Configuration
			Single Flash	Unrequested Configuration
			Double Flash	Application Watchdog Timeout
			ON	PDO Watchdog Timeout
L/A	Green	Port status	OFF	LINK of Physical Layer is unestablished
			Flickering	Operating after LINK is established
			ON	LINK of Physical Layer is established

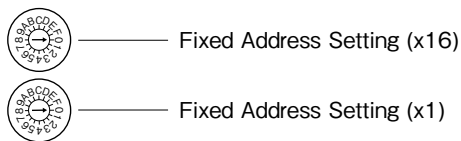
Flickering	50 msec.-ON, 50 msec.-OFF
Blinking	200 msec.-ON, 200 msec.-OFF
Single Flash	200 msec.-ON, 1000 msec.-OFF
Double Flash	200 msec.-ON, 200 msec.-OFF, 200 msec.-ON, 1000 msec.-OFF



■ FIXED ADDRESS SETTING ROTARY SW

Fixed address 1 to 255 can be set using the two rotary switches each marked 0 to F in combination.

When fixed address is not used, set the switches to 0.



■ DIP SW

(*) factory default setting

• Dual Communication: SW3-1

When two network modules are mounted, one must be 'Main' (OFF) network and the other must be 'Sub' (ON) network. For single communication, the network module must always be set to 'Main' (OFF).

SW	DUAL COMMUNICATION	
	MAIN (*)	SUB
SW3-1	OFF	ON

• Input Error Data: SW3-2

Hold: When the communication from an input module is lost due to the input module error, the network module holds the signal and stands by until the communication recovers.

Set to '0': When the communication from an input module is lost due to the input module error, the network module outputs '0.'

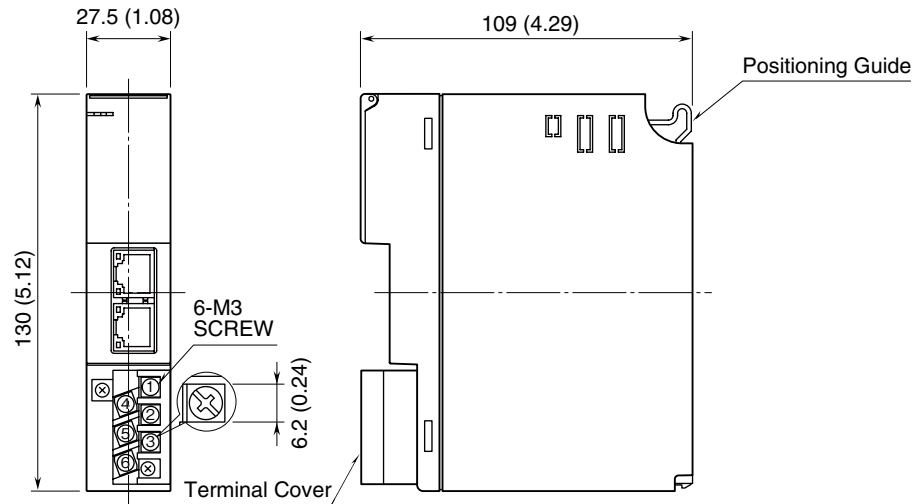
SW	INPUT ERROR DATA	
	HOLD (*)	SET '0'
SW3-2	OFF	ON

Note: Be sure to set unused SW3-3 and 3-4 to OFF.

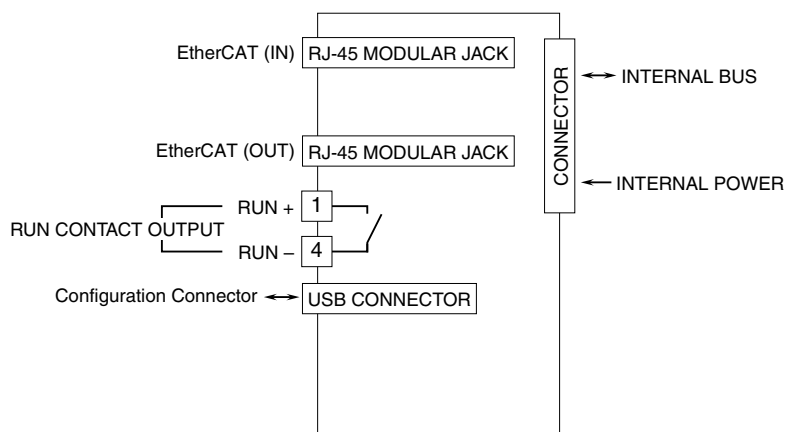
TERMINAL CONNECTIONS

Connect the unit as in the diagram below.

EXTERNAL DIMENSIONS unit: mm (inch)



CONNECTION DIAGRAM



WIRING INSTRUCTIONS

M3 SCREW TERMINAL (RUN contact output)

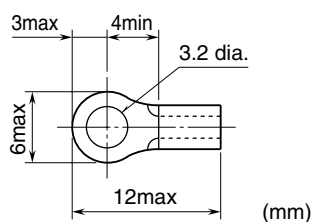
Torque: 0.5 N·m

SOLDERLESS TERMINAL

Refer to the drawing below for recommended ring tongue terminal size. Spade tongue type is also applicable. Solderless terminals with insulation sleeve do not fit.

Recommended manufacturer: Japan Solderless Terminal MFG.Co.Ltd, Nichifu Co.,ltd

Applicable wire size: 0.75 to 1.25 mm²



EtherCAT SPECIFICATIONS

■ Modular Device Profile

R3-NECT1 complies with the Modular Device Profile (MDP) standard, ETG.5001.1 of the EtherCAT standard.
Be sure that the master supports the MDP standard.

■ Fixed address

R3-NECT1 supports Explicit Device Identification by allowing setting of fixed address using the fixed address setting rotary switches (ID selector).

The fixed address can be set to be 1 to 255.

When fixed address is not used, set the ID selector to 0

When the power is turned on with the ID selector set to other than 0, the designated address is written in the resistor 0x0012 of ESC (EtherCAT Slave Controller) when R3-NECT1 starts up.

■ Process Data Configuration

I/O modules and their respective module types are as follows.

For the module types of I/O cards, refer to the specifications of the respective I/O cards.

Table 1: I/O Modules and Module Types

I/O MODULE	MODULE TYPE	MODEL
DI16	Discrete input, 16 points	R3-DA16
DI32	Discrete input, 32 points	R3-DA32
DI64	Discrete input, 64 points	R3-DA64
DO16	Discrete output, 16 points	R3-DC16
DO32	Discrete output, 32 points	R3-DC32
DO64	Discrete output, 64 points	R3-DC64
DIO16	Discrete input, 16 points, Discrete output, 16 points	R3-DAC16
AI2	Analog input, 2 points	R3-LC2
AI4	Analog input, 4 points	R3-SV4
AI8	Analog input, 8 points	R3-SV8
AI16	Analog input, 16 points	R3-SV16N
AO2	Analog output, 2 points	–
AO4	Analog output, 4 points	R3-YV4
AO8	Analog output, 8 points	R3-YV8
AO16	Analog output, 16 points	–
AIO4	Analog input, 4 points, Analog output, 4 points	–
AIO8	Analog input, 8 points, Analog output, 8 points	–
AIO16	Analog input, 16 points, Analog output, 16 points	R3-PA8

■ Data Configuration

Data are configured in accordance with the EtherCAT Modular Device Profile (MDP) specifications as shown below.

Table 2: Data Configuration

OBJECT	ADDRESS	CONTENT
Input Area Objects	0x6000 to 0x60F0	Input data
Output Area Objects	0x7000 to 0x70F0	Output data
PDO Mapping Objects (TxPDO)	0x1A00 to 0x1AF0	Input data list
PDO Mapping Objects (TxPDO)	0x1AFF	Status data list
PDO Mapping Objects (RxPDO)	0x1600 to 0x160F	Output data list
Manufacturer Specific Object	0x2000 to 0x2001	Card status
PDO Assign (IN)	0x1C13	Input data transmission order
PDO Assign (OUT)	0x1C12	Output data transmission order
Sync Manager Type	0x1C00	Sync manager type
Sync Manager Parameter Objects	0x1C32 to 0x1C33	Sync mode
Information Data Object	0x9000 to 0x90F0	Card information
Modular Device Profile Objects	0xF000	MDP information
Detect Module Ident List	0xF050	Card information list
Configured Module Ident List	0xF030	Card information collation by muster module
Detected Address List	0xF040	I/O card address
Device Type	0x1000	Device type
Manufacturer Device Name	0x1008	Device name
Manufacturer Hardware Version	0x1009	Hardware version
Manufacturer Software Version	0x100A	Software version
Identity Objects	0x1018	Vendor information

■ EtherCAT State

EtherCAT defines four states of slave: INIT, PREOP, SAFEOP, and OP.

TxPDO (input configuration data) is updated only in the SAFEOP or OP state, and RxPDO (output configuration data) is updated only in the OP state.

The RUN LED turns on only in the OP state and input and output data are updated, while only input data is updated in the PREOP state.

■ EtherCAT Diagnostics

• AL Status Code

When the slave (R3-NECT1) fails to receive a request from the master or when there is a problem with the slave during normal communication, an error code is set to registers 0x0134 and 0x0135 (AL Status Code) of ESC.

The error codes that R3-NECT1 uses are as shown below.

Table 3: Error Codes of AL Status Code

CODE	ERROR
0x0000	No error
0x0011	Invalid requested state change
0x0012	Unknown requested state
0x0013	BOOT satate not supported
0x0016	Invali Mailbox configuration (PREOP)
0x0017	Invalid SyncManager configuration
0x001B	SyncManager Watchdog Timeout
0x001D	Invalid Output congiguration
0x001E	Invalid Input configuration
0x001F	Invalid Watchdog Configuration
0x0029	FreeRun needs 3 Buffer mode
0x8000	Internal bus error at power on (vendor option)
0x8001	Internal bus error during communication (vendor option)

• **SDO Abort Code**

When the master attempts to access the object dictionary via SDO, if the slave (R3-NECT1) fails to receive SDO messages for any reason, R3-NECT1 sends an error code (SDO Abort Code) to the master and denies its access.

The following error codes are used

Table 4: Error Codes of SDO Abort Code

CODE	ERROR
0x05030000	Toggle bit not changed
0x05040001	Client/Server command specifier not valid or unknown
0x05040005	Out of memory
0x06010000	Unsupported access to an object
0x06010002	Attempt to a read-only object
0x06020000	The object does not exist in the object directory
0x06070010	Data type does not match, length of service parameter does not match
0x06090011	Sub-index does not exist
0x08000020	Data cannot be transferred or stored to the application
0x08000022	Data cannot be transferred or stored to the application because of the present device state

OBJECT DICTIONARY (DATA DESCRIPTION)

■ Input Area Objects (Input Data Area: 0x6000 to 0x60F0)

Input data of R3 I/O modules is allocated to 0x6000 to 0x60F0. One card uses one object.
Index of the object (address) is fixed by mounting slot.

$$\text{Object index} = 0x6000 + (\text{I/O slot number} - 1) \times 0x0010 \text{ (R3 I/O module)}$$

The configuration of the object is fixed by the number of input points and the data type per input point. Sub-Indexes correspond to channel numbers. (Refer to Tables 5 and 6.)

■ Output Area Objects (Output Data Area: 0x7000)

Output data of I/O modules is allocated to 0x7000 to 0x70F0. One card uses one object.
Index of the object (address) is fixed by the mounting slot.

$$\text{Object index} = 0x7000 + (\text{I/O slot number} - 1) \times 0x0010 \text{ (R3 I/O module)}$$

The configuration of the object is fixed by the number of output points and the data type per output point. Sub-Indexes correspond to channel numbers. (Refer to Tables 5 and 6.)

Table 5: Object Configuration Example for R3-NECT1

I/O SLOT NUMBER	MODEL	I/O MODULE	MODULE TYPE	OBJECT INDEX	DATA TYPE
1	R3-DA16A	DI16	Discrete input, 16 points	0x6000	1 bit × 16
2	R3-DC16A	DO16	Discrete output, 16 points	0x7010	1 bit × 16
3	R3-SV4	AI4	Analog input, 4 points	0x6020	16 bits × 4
4	R3-YV4	AO4	Analog output, 4 points	0x7030	16 bits × 4
5	R3-RS8	AI8	Analog input, 8 points	0x6040	16 bits × 8
6	R3-YV8	AO8	Analog output, 8 points	0x7050	16 bits × 8
7	R3-PA16	AI16	Analog input, 16 points	0x6060	16 bits × 16
8	R3-PC16A	AO16	Analog output, 16 points	0x7070	16 bits × 16
9	R3-GCIE1	AIO16	Analog input, 16 points, Analog output, 16 points	0x6080 0x7080	Input 16 bits × 16 Output 16 bits × 16
10	R3-NECT1	(this module)			
11	R3-PS1	(power module)			

Table 6: Sub-index Configuration By Module Type

MODULE TYPE	INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
Discrete input, 16 points	0x6nn0	0	UINT8	8	RO	16	Number of items
		1	BOOL	1	RO	TRUE/FALSE	1st point input data
		2	BOOL	1	RO	TRUE/FALSE	2nd point input data
		:	:	:	:	:	:
		16	BOOL	1	RO	TRUE/FALSE	16th point input data
Discrete input, 32 points	0x6nn0	0	UINT8	8	RO	32	Number of items
		1	BOOL	1	RO	TRUE/FALSE	1st point input data
		2	BOOL	1	RO	TRUE/FALSE	2nd point input data
		:	:	:	:	:	:
		32	BOOL	1	RO	TRUE/FALSE	32nd point input data
Discrete input, 64 points	0x6nn0	0	UINT8	8	RO	64	Number of items
		1	BOOL	1	RO	TRUE/FALSE	1st point input data
		2	BOOL	1	RO	TRUE/FALSE	2nd point input data
		:	:	:	:	:	:
		64	BOOL	1	RO	TRUE/FALSE	64th point input data
Discrete output, 16 points	0x7nn0	0	UINT8	8	RO	16	Number of items
		1	BOOL	1	RO	TRUE/FALSE	1st point output data
		2	BOOL	1	RO	TRUE/FALSE	2nd point output data
		:	:	:	:	:	:
		16	BOOL	1	RO	TRUE/FALSE	16th point output data
Discrete output, 32 points	0x7nn0	0	UINT8	8	RO	32	Number of items
		1	BOOL	1	RO	TRUE/FALSE	1st point output data
		2	BOOL	1	RO	TRUE/FALSE	2nd point output data
		:	:	:	:	:	:
		32	BOOL	1	RO	TRUE/FALSE	32nd point output data
Discrete output, 64 points	0x7nn0	0	UINT8	8	RO	64	Number of items
		1	BOOL	1	RO	TRUE/FALSE	1st point output data
		2	BOOL	1	RO	TRUE/FALSE	2nd point output data
		:	:	:	:	:	:
		64	BOOL	1	RO	TRUE/FALSE	64nd point output data
Discrete input, 16 points Discrete output, 16 points	0x6nn0	0	UINT8	8	RO	16	Number of items
		1	BOOL	1	RO	TRUE/FALSE	1st point input data
		2	BOOL	1	RO	TRUE/FALSE	2nd point input data
		:	:	:	:	:	:
		16	BOOL	1	RO	TRUE/FALSE	16th point input data
	0x7nn0	0	UINT8	8	RO	16	Number of items
		1	BOOL	1	RO	TRUE/FALSE	1st point output data
		2	BOOL	1	RO	TRUE/FALSE	2nd point output data
		:	:	:	:	:	:
		16	BOOL	1	RO	TRUE/FALSE	16th point output data
Analog input, 2 points	0x6nn0	0	UINT8	8	RO	2	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point input data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point input data

MODULE TYPE	INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
Analog input, 4 points	0x6nn0	0	UINT8	8	RO	4	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point input data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point input data
		3	INT16	16	RO	0x0000~0xFFFF	3rd point input data
		4	INT16	16	RO	0x0000~0xFFFF	4th point input data
Analog input, 8 points	0x6nn0	0	UINT8	8	RO	8	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point input data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point input data
		:	:	:	:	:	:
		8	INT16	16	RO	0x0000~0xFFFF	8th point input data
Analog input, 16 points	0x6nn0	0	UINT8	8	RO	16	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point input data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point input data
		:	:	:	:	:	:
		16	INT16	16	RO	0x0000~0xFFFF	16th point input data
Analog output, 2 points	0x7nn0	0	UINT8	8	RO	2	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point output data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point output data
Analog output, 4 points	0x7nn0	0	UINT8	8	RO	4	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point output data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point output data
		3	INT16	16	RO	0x0000~0xFFFF	3rd point output data
		4	INT16	16	RO	0x0000~0xFFFF	4th point output data
Analog output, 8 points	0x7nn0	0	UINT8	8	RO	8	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point output data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point output data
		:	:	:	:	:	:
		8	INT16	16	RO	0x0000~0xFFFF	8th point output data
Analog output, 16 points	0x7nn0	0	UINT8	8	RO	16	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point output data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point output data
		:	:	:	:	:	:
		16	INT16	16	RO	0x0000~0xFFFF	16th point output data
Analog input, 4 points Analog output, 4 points	0x6nn0	0	UINT8	8	RO	4	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point input data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point input data
		3	INT16	16	RO	0x0000~0xFFFF	3rd point input data
	0x7nn0	4	INT16	16	RO	0x0000~0xFFFF	4th point output data
		0	UINT8	8	RO	4	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point output data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point output data
		3	INT16	16	RO	0x0000~0xFFFF	3rd point output data
		4	INT16	16	RO	0x0000~0xFFFF	4th point output data

MODULE TYPE	INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
Analog input, 8 points Analog output, 8 points	0x6nn0	0	UINT8	8	RO	8	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point input data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point input data
		:	:	:	:	:	:
		8	INT16	16	RO	0x0000~0xFFFF	8th point input data
	0x7nn0	0	UINT8	8	RO	8	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point output data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point output data
		:	:	:	:	:	:
		8	INT16	16	RO	0x0000~0xFFFF	8th point output data
Analog input, 16 points Analog output, 16 points	0x6nn0	0	UINT8	8	RO	16	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point input data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point input data
		:	:	:	:	:	:
		16	INT16	16	RO	0x0000~0xFFFF	16th point input data
	0x7nn0	0	UINT8	8	RO	16	Number of items
		1	INT16	16	RO	0x0000~0xFFFF	1st point output data
		2	INT16	16	RO	0x0000~0xFFFF	2nd point output data
		:	:	:	:	:	:
		16	INT16	16	RO	0x0000~0xFFFF	16th point output data

■ Manufacture Specific Objects (Card Status: 0x2000, 0x2001)

Status information of each I/O card is allocated to 0x2000 and mounting information of I/O cards is allocated to 0x2001.

Input abnormal data of I/O slot number 0 to 16 (I/O card address 0 to 31) are stored in 0x2000 as 1 bit per channel (for a module with 4 channels, 4 bits). When the corresponding module is an analog input module and first point or second point input is out of

-15 to +105% range, out of temperature table range or burnout state, the bit [second point: first point] of corresponding input is set to 1. When the corresponding module is other than the analog input module, [0:0] is set.

Status data of I/O slot number 0 to 16 are stored in 0x2001 as 16 bits. LSB corresponds to I/O slot number 1, MSB corresponds to I/O slot number 16.

A bit for normally existing I/O slot is set to 1, a bit for not existing I/O slot or I/O slot having a hardware error (including communication error) set to 0. (Refer to Table 7)

Table 7: Card Status Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x2000	0	UINT8	8	RO	16	Number of items
	1	UINT16	16	RO	n	R3 I/O module 1 status information
	2	UINT16	16	RO	n	R3 I/O module 2 status information
	:	:	:	:	:	:
	16	UINT16	16	RO	n	R3 I/O module 16 status information
0x2001	0	UINT8	8	RO	1	Number of items
	1	UINT16	16	RO	0xnxxx	Mounting status of I/O cards

■ PDO Mapping Objects (Data list, TxPDO (input): 0x1A00 to 0x1A0F, RxPDO (output): 0x1600 to 0x160F)

Of the mounted I/O cards, input data list is allocated to TxPDO, output data list is allocated to RxPDO and status data list is allocated to 0x1AFF of TxPDO.

Object index (input data) = 0x1A00 + (I/O slot number - 1) (R3 I/O module)

Object index (output data) = 0x1600 + (module number) (R3 I/O module)

RxPDO data and TxPDO data contain the object index, Sub-Index and number of bits of R3-NECT1.

Table 8: Object configuration for RxPDO and TxPDO

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x16nn (RxPDO)	0	UINT8	8	RO	1 to 16	Number of items
	1	UINT32	32	RO	0xaaaaabcc	aaaa: Index for I/O module bb: Sub-index for I/O module cc: Number of bits for I/O module
	2	UINT32	32	RO		
	:	:	:	:		
	m	UINT32	32	RO		
0x1Ann (TxPDO)	0	UINT8	8	RO		
	1	UINT32	32	RO	0xaaaaabcc	aaaa: Index for I/O module bb: Sub-index for I/O module cc: Number of bits for I/O module
	2	UINT32	32	RO		
	:	:	:	:		
	m	UINT32	32	RO		

Table 9: Object configuration for 0x1AFF

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1AFF	0	UINT8	8	RO	17	Number of items
	1	UINT32	32	RO	0x20000110	Reference object
	2	UINT32	32	RO	0x20000210	
	:	:	:	:	:	
	16	UINT32	32	RO	0x20001010	
	17	UINT32	32	RO	0x20010110	

■ PDO Assign Objects ((Data Transmission Order, Output: 0x1C12, Input: 0x1C13)

An allocation list for RxPDO and an allocation list for TxPDO are created in 0x1C12 and 0x1C13, respectively. The indexes stored in 0x1C12 and 0x1C13 are placed in the order they are actually transmitted via PDO.

• PDO group

Assignment of the PDO groups is based on the I/O card types as defined by Information Data Objects.

- PDO group 0: Status
- PDO group 1: Analog I/O card
- PDO group 2: Discrete I/O card

The PDO group data is transmitted in the following order of priority: Group 0 > Group 1 > Group 2.

Table 10 shows the PDO list for the card configuration example of Table 5

Table 10: PDO List for the Configuration Example of Table 5

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	PDO GROUP	VALUE	CONTENT
0x1C12	0	UINT8	8	RO	–	5	Number of items
	1	UINT16	16	RO	1	0x1603	Analog output data
	2	UINT16	16	RO	1	0x1605	Analog output data
	3	UINT16	16	RO	1	0x1607	Analog output data
	4	UINT16	16	RO	1	0x1608	Analog output data
	5	UINT16	16	RO	2	0x1601	Discrete output data
0x1C13	0	UINT8	8	RO	–	6	Number of items
	1	UINT16	16	RO	0	0x1AFF	Status data
	2	UINT16	16	RO	1	0x1A02	Analog input data
	3	UINT16	16	RO	1	0x1A04	Analog input data
	4	UINT16	16	RO	1	0x1A06	Analog input data
	5	UINT16	16	RO	1	0x1A08	Analog input data
	6	UINT16	16	RO	2	0x1A00	Discrete input data

■ Sync Manager Type (0x1C00)

Sync Manager Type is allocated to object 0x1C00 based on the EtherCAT specification. (Refer to Table 11.)

Table 11: Object configuration for 0x1C00

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1C00	0	UINT8	8	RO	4	Number of items
	1	UINT8	8	RO	1	Mailbox Write
	2	UINT8	8	RO	2	Mailbox Read
	3	UINT8	8	RO	3	Process Output Data
	4	UINT8	8	RO	4	Process Input Data

■ Sync Manager Parameter Objects (0x1C32, 0x1C33)

Setting object for Sync Mode.

Objects 0x1C32 and 0x1C33 are fixed as R3-NECT1 only supports the Free Run mode.

Distributed Clock (DC) mode is not supported.

■ Information Data Objects (0x9000 to 0x90F0)

Objects 0x9000 to 0x91F0 store the PDO group and Module Ident of I/O cards. (Refer to Table 13.)
The same number of objects as the number of I/O data items are allocated.

$$\text{Index} = 0x9000 + (\text{I/O slot number} - 1) \times 0x0010 \text{ (R3 I/O module)}$$

Sub-Index is 9 or 10. (Refer to Table 12.)

Table 12: Object 0x9nn0 Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x9nn0	0	UINT8	8	RO	10	Number of items
	3	STRING	128	RO	(model name)	Device Type
	9	UINT16	16	RO	1/2	PDO group
	10	UINT32	32	RO	1 to n	Module Ident

Table 13: PDO Group and Module Ident of I/O Cards

I/O MODULE	MODULE TYPE	PDO GROUP	MODULE IDENT
DI16	Discrete input, 16 points	2	401
DI32	Discrete input, 32 points	2	402
DO16	Discrete output, 16 points	2	403
DO32	Discrete output, 32 points	2	404
AI4	Analog input, 4 points	1	405
AI8	Analog input, 8 points	1	406
AI16	Analog input, 16 points	1	407
AO4	Analog output, 4 points	1	408
AO8	Analog output, 8 points	1	409
AO16	Analog output, 16 points	1	410
DIO16	Discrete input, 16 points, Discrete output, 16 points	2	411
AIO16	Analog input, 16 points, Analog output, 16 points	1	412
AIO8	Analog input, 8 points, Analog output, 8 points	1	413
DI64	Discrete input, 64 points	2	414
DO64	Discrete output, 64 points	2	415
AI2	Analog input, 2 points	1	416
AO2	Analog output, 2 points	1	417
AIO4	Analog input, 4 points, Analog output, 4 points	1	420

■ Modular Device Profile Objects (0xF000)

Object 0xF000 contains Modular Device Profile (MDP). The Index interval is allocated to Sub-Index 1. The maximum number of cards is allocated to Sub-Index 2. And, the PDO group parameter of the slave device is allocated to Sub-Index 5. (Refer to Table 14.)

Sub-Index 4 indicates the valid/invalid statuses of object 0x9nn0 Sub-Indexes.

The allocations are as follows:

bit 0 = 0x9nn0 Sub-Index 1

bit 1 = 0x9nn0 Sub-Index 2

:

1: Valid, 2: Invalid

Table 14: Object 0xF000 configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x9nn0	0	UINT8	8	RO	5	Number of items
	1	UINT16	16	RO	0x0010	Index Interval
	2	UINT16	16	RO	1	Maximum number of cards
	4	UINT32	32	RO	0x00000300	Valid Sub-Index of 0x9nn0
	5	UINT16	16	RO	0	PDO group

■ Detected Module Ident List (0xF050)

The list of Module Idents of the mounted I/O cards is allocated to object 0xF050.

The Sub-Index numbers are the same as the I/O slot numbers.

The Sub-Index number of vacant I/O slots is 0. (Refer to Table 15.)

■ Configured Module Ident List (0xF030)

The master confirms the module configuration with object 0xF030.

With the Sub-Index numbers being the same as the I/O slot numbers, the master writes Module Idents to the modules it recognizes.

The slave confirms the Module Ident: if it is correct, the writing has been successful; if there is any error, the writing has failed.

When all is correct, objects 0xF030 and 0xF050 show the same configuration.

Object 0xF030 is solely for the confirmation by the master. The use of this object can be omitted. (Refer to the Table 15.)

Table 15: Object 0xF030 and 0xF050, Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT	
0xF030	0	UINT8	8	RW	16	Number of items	
	1	UINT32	32	RW	0	Set Module Ident or 0.	
	2	UINT32	32	RW	0		
	4	UINT32	32	RW	0		
	5	UINT32	32	RW	0		
	6	UINT32	32	RW	0		
	7	UINT32	32	RW	0		
	8	UINT32	32	RW	0		
	9	UINT32	32	RW			
	10	UINT32	32	RW	0		
	:	:	:	:	:		
	16	UINT32	32	RW	0		
0xF050	0	UINT8	8	RO	16	Number of items	
	1	UINT32	32	RO	401	Display Module Ident or 0 on the master module	
	2	UINT32	32	RO	403		
	3	UINT32	32	RO	405		
	4	UINT32	32	RO	408		
	5	UINT32	32	RO	406		
	6	UINT32	32	RO	409		
	7	UINT32	32	RO	407		
	8	UINT32	32	RO	410		
	9	UINT32	32	RO	412		
	10	UINT32	32	RO	0		
	:	:	:	:	:		
16	UINT32	32	RO	0			

■ Detected Address List (0xF040)

The addresses of mounted I/O cards are allocated in object 0xF040.

The Sub-Index numbers are same as the I/O slot numbers.

The Sub-Index number of vacant I/O slots is 0. (Refer to Table 16.)

Table 16: Object 0xF040 Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0xF040	0	UINT8	8	RO	32	Number of items
	1	UINT32	32	RO	0 to n	I/O slot number or 0.
	2	UINT32	32	RO	0 to n	
	:	:	:	:	:	
	32	UINT32	32	RO	0 to n	

■ Device Type (0x1000)

The device type of this network card is allocated to object 0x1000. The device type is 5001. (Refer to Table 17.)

Table 17: Object 0x1000 Configuration

INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1000	UINT32	32	RO	5001	Device Type

■ Manufacturer Device Name (0x1008)

The model number of this network card is allocated to object 0x1008 in String form. (Refer to Table 18.)

Table 18: Object 0x1008 Configuration

INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1008	STRING	32	RO	R3-NECT1	Module number

■ Manufacturer Hardware Version (0x1009)

The hardware device version of this network card is allocated to object 0x1009 in String form. (Refer to Table 19.)

Table 19: Object 0x1009 Configuration

INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x100	STRING	32	RO	n.nn	Hardware version

■ Manufacturer Software Version (0x100A)

The software version of this network card is allocated to object 0x100A in String form. (Refer to Table 20.)

Table 20: Object 0x100A Configuration

INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x100A	STRING	32	RO	n.nn	Software version

■ Identity Object (0x1018)

Information unique to this network card is allocated to object 0x1018. While the vendor ID and product code are fixed, the revision number is incremented by one at each major version up of the software.

A unique serial number is allocated to each product. (Refer to Table 22.)

A serial number consists of 8 digits, starting with two alpha-numeral characters followed by six numeral characters.

The serial number is expressed as 32-bit data divided into 6-bit, 6-bit and 20-bit groups, with the first two characters converted into 6-bit values. (Refer to Table 21.)

6 BITS	6 BITS	20 BITS
1st digit	2nd digit	3rd to 8th digits (000000 to 999999)

Table 21: Serial Number Conversion Table

CHARACTER	VALUE
0	0
1	1
:	:
9	9
A	10
B	11
:	:
Z	35

Table 22: Object 0x1018 Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1018	0	UINT8	8	RO	32	Number of items
	1	UINT32	32	RO	0x0000060C	Vendor ID
	2	UINT32	32	RO	0x52333001	Product code
	3	UINT32	32	RO	n	Revision number
	4	UINT32	32	RO	0 to n	Serial number

I/O DATA DESCRIPTIONS

The data allocations for typical I/O modules are shown below.
Refer to the manual for each module for detailed data allocations.

■ OPERATION IN CASE OF A COMMUNICATION ERROR WITH I/O MODULES

When the communication between the network module and the I/O modules is lost due to an error in an input module, the last process values are held until the communication is re-established.

■ ANALOG DATA (16-bit data, models: R3-SV4, YV4, DS4, YS4, US4, etc.)

16-bit binary data.

Basically, 0 to 100% of the selected I/O range is converted into 0 to 10000 (binary).

-15 to 0 % is a negative range represented in 2's complement.

In case of R3-US4, -10 to 0% is a negative range represented in 2's complement.



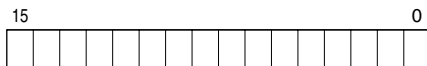
■ TEMPERATURE DATA (16-bit data, models: R3-RS4, TS4, US4, etc.)

16-bit binary data.

With °C temperature unit, raw data is multiplied by 10. For example, 25.5°C is converted into 255.

With °F temperature unit, the integer section of raw data is directly converted into the data. For example, 135.4°F is converted into 135.

Minus temperature is converted into negative values, represented in 2's complements.



■ ANALOG DATA (16-bit data, models: R3-CT4A, CT4B, etc.)

16-bit binary data.

Integer obtained by multiplying unit value (A) by 100.

In case of CLSE-R5, integer obtained by multiplying unit value (A) by 1000.



■ ACCUMULATED COUNT DATA (32-bit data, models: R3-PA2, PA4A, WT1, WT4, etc.)

32-bit binary data is used for accumulated counts and encoder positions.

Lower 16 bits are allocated from the lowest address to higher ones, higher 16 bits in turn.



■ BCD DATA (32-bit data, models: R3-BA32A, BC32A, etc.)

32-bit binary data is used for BCD.

Lower 16 bits are allocated from the lowest address to higher ones, higher 16 bits in turn.



■ DISCRETE DATA (models: R3-DA16, DC16, etc.)

