OPERATING MANUAL

POWER/NETWORK MODULE
(EtherCAT)

MODEL **R8-NECT1**

CONTENTS

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BEFORE USE ....

Thank you for choosing us. 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 our sales office or representatives.

■ PACKAGE INCLUDES:

Power/network card .....(1)
Protective cover.....(1)

■ MODEL NO.

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

■ OPERATING MANUAL

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

POINTS OF CAUTION

■ CONFORMITY WITH EU DIRECTIVES

- The equipment must be mounted inside a panel.
- 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.
  * For example, installation of noise filters and clamp filters for the power source, input and output connected to the unit, etc.

■ GENERAL PRECAUTIONS

- Before you remove or mount the unit, turn off the power supply for safety.
- DO NOT set the switches on the module while the power is supplied. The switches are used only for maintenance without the power.

■ POWER INPUT RATING & OPERATIONAL RANGE

- Locate the power input rating marked on the product and confirm its operational range as indicated below:
  DC Power supply: 24V DC rating
  24V DC ± 10%, approx. 12W
  (@ internal power max. current 1.6A)
  Excitation supply (excitation for I/O module):
  24V DC ± 10%, operational current 10A
  (From power supply (excitation supply) connector, via connector for internal bus, supplied to each I/O module. Power output current consumption must be under operational current.)

■ 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.

■ AND ....

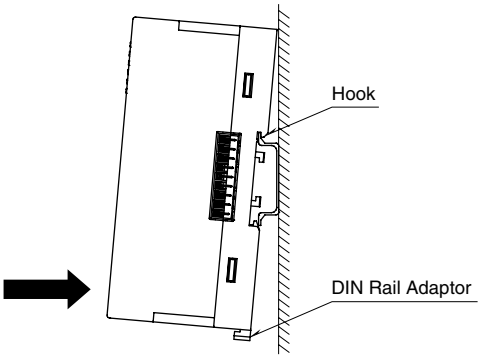
- The unit is designed to function as soon as power is supplied, however, a warm up for 10 minutes is required for satisfying complete performance described in the data sheet.

INSTALLATION

Internal power supply/communication is connected via each module's connector, therefore no backplane base is required, however, hot-swapping of modules is not possible.

■ HOW TO MOUNT THE MODULE ON DIN RAIL

• Power/Network Module



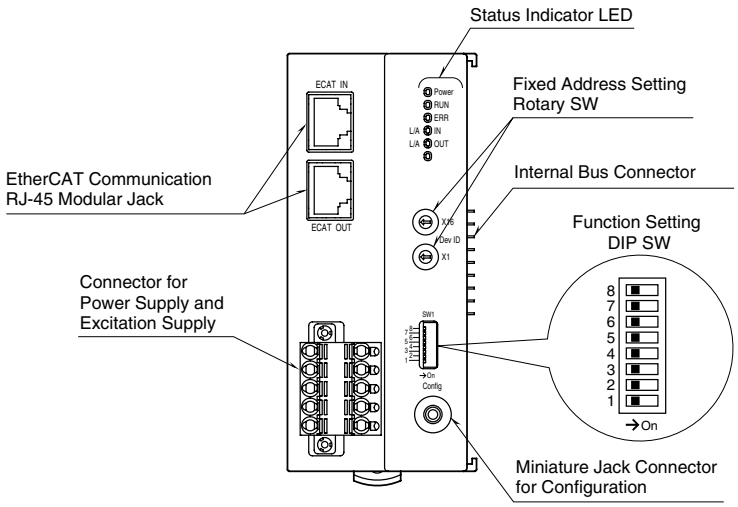
Hang the upper hook at the rear on the DIN rail and push in the lower. When removing the module, push down the DIN rail adaptor utilizing a minus screwdriver and pull.

EtherCAT®

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

COMPONENT IDENTIFICATION

■ FRONT VIEW



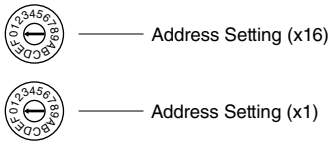
■ STATUS INDICATOR LED

ID	FUNCTION	COLOR	STATUS	
Power	Main unit internal power	Green	Off	Error
			On	Normal
RUN	Device state	Green	Off	INIT
			Blinking	PRE-OPERATIONAL
			Single Flash	SAFE-OPERATIONAL
			On	OPERATIONAL
ERR	Error	Red	Off	No error
			Blinking	Invalid Configuration
			Single Flash	Local error
			On	Application Controller failure
L/A IN	IN port status	Green	Off	No Link
			Flickering	Link and activity
			On	Link without activity
L/A OUT	OUT port status	Green	Off	No Link
			Flickering	Link and activity
			On	Link without activity

Blinking	200ms-On, 200ms-Off
Single Flash	200ms-On, 1000ms-Off
Flickering	50ms-On, 50ms-Off

■ FIXED ADDRESS

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.
Settable range: 0 to 255
Factory default: 0

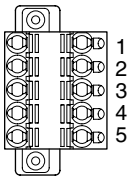


■ MAINTENANCE MODE DIP SW

SW1-1 to 7 Unused
SW1-8 OFF Normal operating
ON Maintenance mode
I/O module RUN indicator turning on order is from the lowest address. This operation is repeated every time it is turned off until recovering.

■ POWER SUPPLY, EXCITATION SUPPLY CONNECTOR ASSIGNMENT

Printed-circuit board connector (Phoenix Contact)
Unit side connector: MSTBV2,5/5-GF-5,08AU
Cable side connector: TFKC2,5/5-STF-5,08AU



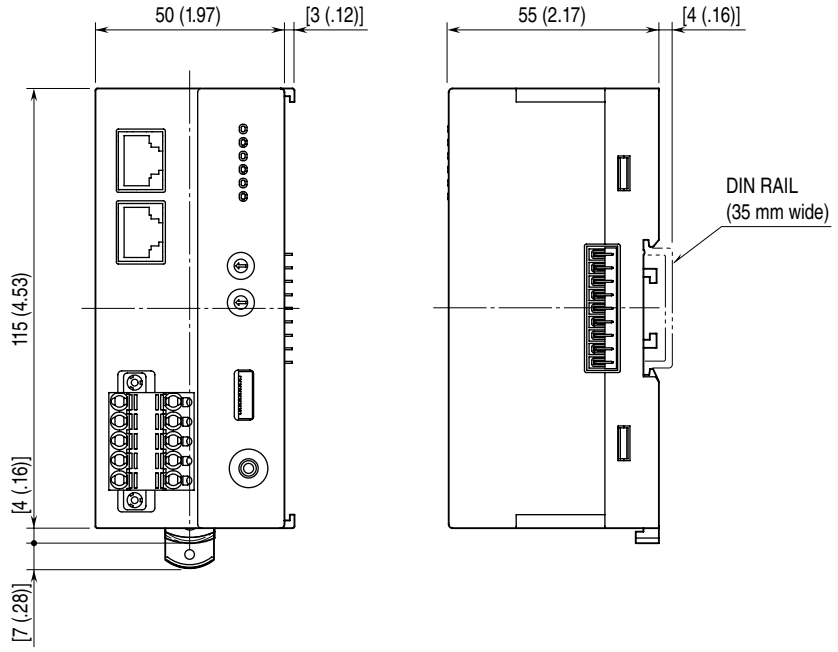
PIN No.	ID	FUNCTION
1	24V	Power supply 24V DC
2	0V	Power supply 0V DC
3	+	Excitation supply 24V DC
4	–	Excitation supply 0V DC
5	FE1	Grounding

TERMINAL CONNECTIONS

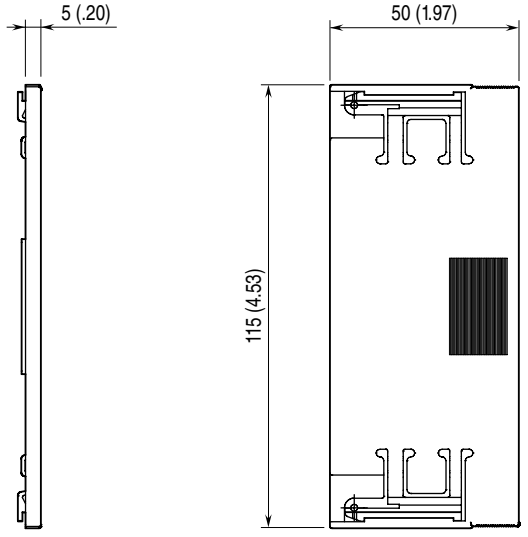
Connect the unit as in the diagram below.

■ **EXTERNAL DIMENSIONS unit: mm (inch)**

• **UNIT**

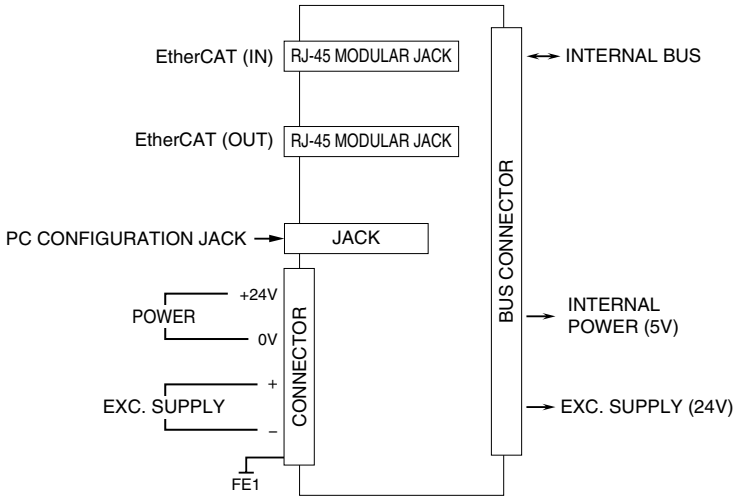


• **PROTECTIVE COVER**



■ CONNECTION DIAGRAM

Note: In order to improve EMC performance, bond the FE1 terminal to ground.
Caution: FE1 terminal is NOT a protective conductor terminal.



WIRING INSTRUCTIONS

■ TENSION CLAMP TERMINAL BLOCK

• Power Input, excitation supply

Applicable wire size: 0.2 – 2.5 mm^2
Stripped length: 10 mm

COMBINATION OF I/O MODULES

■ COMBINATION WITH R8-NECT1 (EtherCAT)

I/O modules that can be combined are limitted by the R8-NECT1 version.
Comfirm the following table when adding new I/O modules.
To confirm the versions of R8-NECT1, use monitoring function of PC Configurator Software (model: R8CFG).

I/O MODULE	R8-NECT1 Ver.
R8Y-DAZH32A	2.00 or higher
R8Y-DCZH32A	
R8-DAT8A2	1.60 or higher
R8-DAT8B2	
R8-DCT8A2	
R8-DCT8B2	
R8-PA4F, R8-PAT4F	1.50 or higher
R8-DCT16A2	1.40 or higher
R8-DCT16B2	
R8-DCM32B2	1.30 or higher
R8-TC2	
Others	1.20 or higher

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EtherCAT SPECIFICATIONS

■ Modular Device Profile

R8-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

R8-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 R8-NECT1 starts up.

■ Initialization

When the R8-NECT1 boots up, the process data is configured according to the configuration of connected I/O card. Then the object of process data mapping (RxPDO, TxPDO) corresponding to the I/O data of devices and the object of various information for R8 are created in the object dictionary. The configuration of process data is fixed at the time only when the R8-NECT1 boots up.

It takes about 3 seconds to initialize the R8-NECT1. After initialization, master can make a demand to slave (R8-NECT1) to switch from INIT state to PREOP state. If initialization is failed with some abnormality of R8, it is denied by using AL status code when transition from INIT to PREOP.

■ Process Data Configuration

After boot up, the R8-NECT1 identifies all connected I/O cards. Set the address for each I/O cards in advance. For analog 4 points input card and analog 4 points output card, two addresses are allocated to one module (selected address and next address). Also there are modules which allocate four addresses, eight addresses.

R8 configures process data by module, as '1 address = 1 module'. One R8-NECT1 can manage max. 32 modules. However, max. number of connectable I/O module is 16.

All I/O modules and its module type are shown in the table below. (Refer to the Table 1)

Table 1: All I/O Module And Module Type

I/O CARD	I/O MODULE	MODULE TYPE
R8-SV2	R8-SV2	Analog input
R8-SS2	R8-SS2	Analog input
R8-SV4N	R8-SV4N (ch1, ch2)	Analog input
	R8-SV4N (ch3, ch4)	Analog input
R8-SVT8	R8-SVT8 (ch1, ch2)	Analog input
	R8-SVT8 (ch3, ch4)	Analog input
	R8-SVT8 (ch5, ch6)	Analog input
	R8-SVT8 (ch7, ch8)	Analog input
R8-SS4N	R8-SS4N (ch1, ch2)	Analog input
	R8-SS4N (ch3, ch4)	Analog input
R8-SS4NJ	R8-SS4NJ (ch1, ch2)	Analog input
	R8-SS4NJ (ch3, ch4)	Analog input
R8-SST8	R8-SST8 (ch1, ch2)	Analog input
	R8-SST8 (ch3, ch4)	Analog input
	R8-SST8 (ch5, ch6)	Analog input
	R8-SST8 (ch7, ch8)	Analog input
R8-RS4N R8-RST4N	R8-RSx4N (ch1, ch2)	Analog input
	R8-RSx4N (ch3, ch4)	Analog input
R8-TS2 R8-TST2	R8-TSx2	Analog input
R8-FST4N	R8-FST4N (ch1, ch2)	Analog input
	R8-FST4N (ch3, ch4)	Analog input
R8-FS16N	R8-FS16N (ch1, ch2)	Analog input
	R8-FS16N (ch3, ch4)	Analog input
	:	:
	R8-FS16N (ch15, ch16)	Analog input
R8-PFT1	R8-PFT1	Analog input
R8-YVT2	R8-YVx2	Analog input
R8-YV4N	R8-YV4N (ch1, ch2)	Analog output
	R8-YV4N (ch3, ch4)	Analog output
R8-YVM4N R8-YVT4N	R8-YVx4N (ch1, ch2)	Analog output
	R8-YVx4N (ch3, ch4)	Analog output
R8-YS2 R8-YST2	R8-YSx2	Analog output
R8-YS2NJ	R8-YS2NJ	Analog output
R8-YST4N	R8-YST4N (ch1, ch2)	Analog output
	R8-YST4N (ch3, ch4)	Analog output
R8-CT4E	R8-CT4E (ch1, ch2)	CT input
	R8-CT4E (ch3, ch4)	CT input

I/O CARD	I/O MODULE	MODULE TYPE
R8-PA4	R8-PA4 (ch1)	Pulse input
	R8-PA4 (ch2)	Pulse input
	R8-PA4 (ch3)	Pulse input
	R8-PA4 (ch4)	Pulse input
R8-PA4F R8-PAT4F	R8-PAx4F (ch1)	Pulse input
	R8-PAx4F (ch2)	Pulse input
	R8-PAx4F (ch3)	Pulse input
	R8-PAx4F (ch4)	Pulse input
R8-PC4A R8-PCT4A	R8-PCx4A (ch1, ch2)	Pulse output
	R8-PCx4A (ch3, ch4)	Pulse output
R8-WTUD	R8-WTUD(data1,2)	Data input
	R8-WTUD(data3,4)	Data input
	:	:
	R8-WTUD(data15,16)	Data input
R8-WTU	R8-WTU(data1,2)	Data I/O
	R8-WTU(data3,4)	Data I/O
	:	:
	R8-WTU(data15,16)	Data I/O
R8-TC2	R8-TC2 (data1, 2)	Data I/O
	R8-TC2 (data3, 4)	Data I/O
	:	:
	R8-TC2 (data15, 16)	Data I/O
R8-DA4A	R8-DA4A	Discrete input, 4 points
R8-DC4A	R8-DC4A	Discrete output, 4 points
R8-DC4A2	R8-DC4A2	Discrete output, 4 points
R8-DC4C	R8-DC4C	Discrete output, 4 points
R8-DCT4D	R8-DCT4D	Discrete output, 4 points
R8-DAT8A2	R8-DAT8A2	Discrete input, 8 points
R8-DAT8B2	R8-DAT8B2	Discrete input, 8 points
R8-DCT8A2	R8-DCT8A2	Discrete output, 8 points
R8-DCT8B2	R8-DCT8B2	Discrete output, 8 points
R8-DAM16A	R8-DAM16A	Discrete input, 16 points
R8-DAT16A2 R8-DAT16B2	R8-DAT16x	Discrete input, 16 points
R8Y-DAZH32A	R8Y-DAZH32 (ch1 – 16)	Discrete input, 16 points
	R8Y-DAZH32 (ch17 – 32)	Discrete input, 16 points
R8-DCM16A	R8-DCM16A	Discrete output, 16 points
R8-DCT16A2 R8-DCT16B2	R8-DCT16x	Discrete output, 16 points
R8-DCM32B2	R8-DCM32B2 (ch1 – 16)	Discrete output, 16 points
	R8-DCM32B2 (ch17 – 32)	Discrete output, 16 points
R8Y-DCZH32A	R8Y-DCZH32 (ch1 – 16)	Discrete output, 16 points
	R8Y-DCZH32 (ch17 – 32)	Discrete output, 16 points
R8-DCM16ALZ	R8-DCM16ALZ	Discrete output, 16 points, with 1 interlock
R8-DCM16ALK	R8-DCM16ALK	Discrete output, 16 points, with 3 interlocks
R8-DCM16ALH	R8-DCM16ALH	Discrete output, 16 points, with 3 interlocks

■ Process Data Mapping

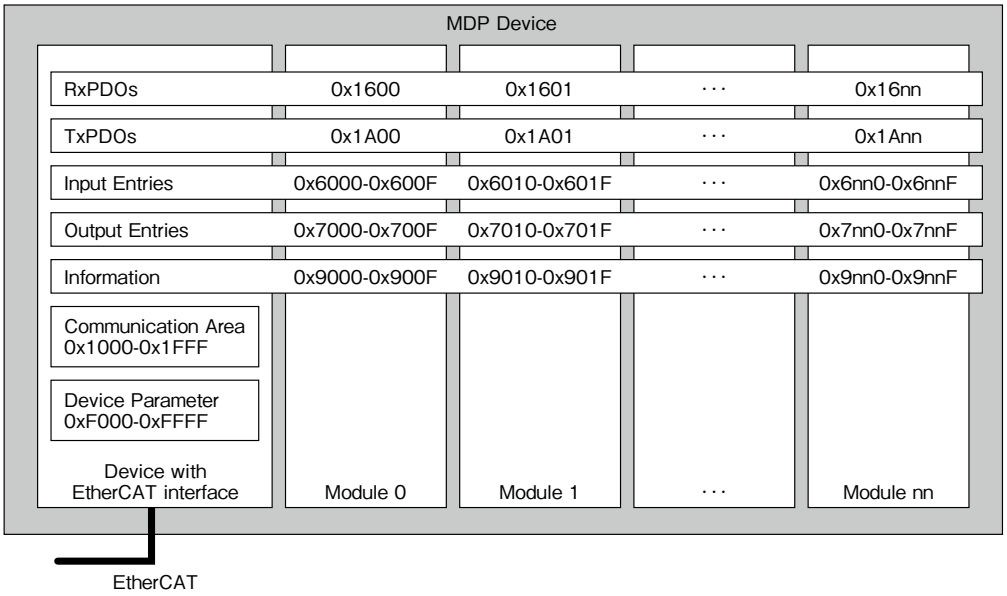
R8 performs mapping of process data according to Modular Device Profile (MDP) of EtherCAT. The configuration of periodically transferred process data is created by using RxPDO and TxPDO.

R8 uses object dictionary 0x6000 to 0x61F0, 0x2000 and 0x2001 as input area, 0x7000 to 0x71F0 as output area. The items in object in the address starting with 0x6000, 0x2000 and 0x7000 are referred in turn by RxPDO and TxPDO by using index and sub-index. Output data is stored in RxPDO (0x1600 to 0x161F and 0x1701), input data is stored in TxPDO (0x1A00 to 0x1A1F, 0x1AFF and 0x1B01). One PDO encapsulates several data to store in one packet.

RxPDO and TxPDO are registered in 0x1C12 (output data) and 0x1C13 (input data) of PDO assign list. The list defines the order of the cyclic transfer of each PDO data.

MDP model is shown in the figure below. (Refer to the Figure 1)

Figure 1: MDP model



■ EtherCAT State

EtherCAT defines four states of slave: INIT, PREOP, SAFEOP, and OP.
TxPDO (input process data) can operate only in the SAFEOP or OP state, and RxPDO (output process data) can operate only in the OP state.

There are 4 types of I/O cards connected; they are analog input, analog output, discrete input, and discrete output. For input card, the RUN LED turns on only in the SAFEOP or OP, for output card, RUN LED turns on only in the OP state OP.

OBJECT DICTIONARY

■ Input Area objects (0x6000 to 0x61F0)

In the object 0x6000 to 0x61F0, input data of I/O module is stored. For one input module, one object exists. Index of the object is fixed by module number (0 to 31 = I/O card address).

Index = 0x6000 + (module number) × 0x0010

The configuration of the object is fixed by data type per one point of input point. (Refer to the Table 1 and 2)

■ Output Area objects (0x7000 to 0x71F0)

In the object 0x7000 to 0x71F0, output data of I/O module is stored. For one output module, one object exists. Index of the object is fixed by module number (0 to 31 = I/O card address).

Index = 0x7000 + (module number) × 0x0010

The configuration of the object is fixed by data type per one point of output point. (Refer to the Table 2 and 3)

Table 2: Object Configuration Example For I/O Module

CARD ADDRESS	MODEL	I/O CARD TYPE	MODULE TYPE	OBJECT INDEX	DATA TYPE
0	R8-SV2	Analog input, 2 points	Analog input	0x6000	16 bits × 2
1(2)	R8-SV4N	Analog input, 4 points	Analog input	0x6010	16 bits × 2
			Analog input	0x6020	16 bits × 2
3(4)	R8-YV4N	Analog output, 4 points	Analog output	0x7030	16 bits × 2
			Analog output	0x7040	16 bits × 2
5	R8-DA4A	Discrete input, 4 points	Discrete input, 4 points	0x6050	1 bit × 4
6	R8-DAM16A	Discrete input, 16 points	Discrete input, 16 points	0x6060	1 bit × 16
7	R8-DC4A	Discrete output, 4 points	Discrete output, 4 points	0x7070	1 bit × 4
8	R8-DCM16ALK	Discrete output, 16 points, with 3 interlocks	Discrete output, 16 points, with 3 interlocks	0x6080	1 bit × 3
				0x7080	1 bit × 16

Table 3: Sub-Index Configuration By Type

MODULE TYPE	INDEX	SUB-INDEX	DATA TYPE	BIT	AC-CESS	VALUE	CONTENT
Analog input	0x6nn0(input)	0	UINT8	8	RO	2	Number of items
		1	INT16	16	RO	-32768 to 32767	First point input data
		2	INT16	16	RO	-32768 to 32767	Second point input data
Analog output	0x7nn0(output)	0	UINT8	8	RO	2	Number of items
		1	INT16	16	RW	-32768 to 32767	First point output data
		2	INT16	16	RW	-32768 to 32767	Second point output data
CT input	0x6nn0(input)	0	UINT8	8	RO	2	Number of items
		1	UINT16	16	RO	0 to 65535	First point input data
		2	UINT16	16	RO	0 to 65535	Second point input data
Pulse input	0x6nn0(input)	0	UINT8	8	RO	2	Number of items
		1	UINT32	32	RO	0 to 4294967295	First point input data
Pulse output	0x7nn0(output)	0	UINT8	8	RO	2	Number of items
		1	UINT16	16	RW	0 to 65535	First point output data
		2	UINT16	16	RW	0 to 65535	Second point output data
Data input	0x6nn0(input)	0	UINT8	8	RO	2	Number of items
		1	INT16	16	RO	-32768 to 32767	First point input data
		2	INT16	16	RO	-32768 to 32767	Second point input data
Data I/O	0x6nn0(input)	0	UINT8	8	RO	2	Number of items
		1	INT16	16	RO	-32768 to 32767	First point input data
		2	INT16	16	RO	-32768 to 32767	Second point input data
	0x7nn0(output)	0	UINT8	8	RO	2	Number of items
		1	INT16	16	RW	-32768 to 32767	First point output data
		2	INT16	16	RW	-32768 to 32767	Second point output data
Discrete input, 4 points	0x6nn0(input)	0	UINT8	8	RO	4	Number of items
		1	BOOL	1	RO	TRUE/FALSE	First point input data
		2	BOOL	1	RO	TRUE/FALSE	Second point input data
		3	BOOL	1	RO	TRUE/FALSE	3rd point input data
		4	BOOL	1	RO	TRUE/FALSE	4th point input data
Discrete input, 8 points	0x6nn0(input)	0	UINT8	8	RO	8	Number of items
		1	BOOL	1	RO	TRUE/FALSE	First point input data
		2	BOOL	1	RO	TRUE/FALSE	Second point input data
		:	:	:	:	:	:
		8	BOOL	1	RO	TRUE/FALSE	8th point input data
Discrete input, 16 points	0x6nn0(input)	0	UINT8	8	RO	16	Number of items
		1	BOOL	1	RO	TRUE/FALSE	First point input data
		2	BOOL	1	RO	TRUE/FALSE	Second point input data
		:	:	:	:	:	:
		16	BOOL	1	RO	TRUE/FALSE	16th point input data
Discrete output, 4 points	0x7nn0(output)	0	UINT8	8	RO	4	Number of items
		1	BOOL	1	RW	TRUE/FALSE	First point output data
		2	BOOL	1	RW	TRUE/FALSE	Second point output data
		3	BOOL	1	RW	TRUE/FALSE	3rd point output data
		4	BOOL	1	RW	TRUE/FALSE	4th point output data
Discrete output, 8 points	0x7nn0(output)	0	UINT8	8	RO	8	Number of items
		1	BOOL	1	RW	TRUE/FALSE	First point output data
		2	BOOL	1	RW	TRUE/FALSE	Second point output data
		:	:	:	:	:	:
		8	BOOL	1	RW	TRUE/FALSE	8th point output data
Discrete output, 16 points	0x7nn0(output)	0	UINT8	8	RO	16	Number of items
		1	BOOL	1	RW	TRUE/FALSE	First point output data
		2	BOOL	1	RW	TRUE/FALSE	Second point output data
		:	:	:	:	:	:
		16	BOOL	1	RW	TRUE/FALSE	16th point output data
Discrete output, 16 points, with 1 interlock	0x6nn0(input)	0	UINT8	8	RO	1	Number of items
		1	BOOL	1	RO	TRUE/FALSE	Status for global interlock
	0x7nn0(output)	0	UINT8	8	RO	16	Number of items
		1	BOOL	1	RW	TRUE/FALSE	First point output data
		2	BOOL	1	RW	TRUE/FALSE	Second point output data
		:	:	:	:	:	:
		16	BOOL	1	RW	TRUE/FALSE	16th point output data

MODULE TYPE	INDEX	SUB-INDEX	DATA TYPE	BIT	AC-CESS	VALUE	CONTENT
Discrete output, 16 points, with 3 interlocks	0x6nn0(input)	0	UINT8	8	RO	3	Number of items
		1	BOOL	1	RO	TRUE/FALSE	Status for global interlock
		2	BOOL	1	RO	TRUE/FALSE	Status for interlock 1
		3	BOOL	1	RO	TRUE/FALSE	Status for interlock 2
	0x7nn0(output)	0	UINT8	8	RO	16	Number of items
		1	BOOL	1	RW	TRUE/FALSE	First point output data
		2	BOOL	1	RW	TRUE/FALSE	Second point output data
		:	:	:	:	:	:
		16	BOOL	1	RW	TRUE/FALSE	16th point output data

■ Manufacturer Specific objects (0x2000, 0x2001)

Status data of I/O module is stored in the object 0x2000 and 0x2001. This object is created regardless of configuration of I/O modules.

Input abnormal data of module 0 to 31 (I/O card address 0 to 31) is stored in 0x2000 as 2 bits. When corresponding module is analog input module and first point or second point input is out of -5 to +105% range or burnout state, bit [second point: first point] of corresponding input is set to 1. When corresponding module is other than analog input module, [0 : 0] is set.

Status data of module 0 to 31 is stored in 0x2001 as 32 bits. LSB corresponds module 0, MSB corresponds module 31. A bit for normally existing module is set to 1, a bit for not existing module or module having hardware error (including communication error) set to 0. (Refer to the Table 4)

Table 4: Object For I/O Module Status

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x2000	0	UINT8	8	RO	32	Number of items
	1	BIT2	2	RO	0 to 3	Module 0 input abnormal [2nd point : 1st point]
	2	BIT2	2	RO	0 to 3	Module 1 input abnormal [2nd point : 1st point]
	:	:	:	:	:	:
	32	BIT2	2	RO	0 to 3	Module 31 input abnormal [2nd point : 1st point]
0x2001	0	UINT8	8	RO	1	Number of items (1)
	1	UINT32	32	RO	0xnnnnnnnn	Status for all module (For valid module, corresponding bit is 1)

■ PDO Mapping objects (0x1600 to 0x1701, 0x1A00 to 0x1B01)

• Object 0x1600 to 0x161F, 0x1A00 to 0x1A1F

RxPDO (from 0x1600) is used for the output module, and TxPDO (from 0x1A00) is used for the input module.

Object index of RxPDO is allocated number of output module according to MDP specification.
Index = 0x1600 + (module number of output module)

Object index of TxPDO is allocated number of input module according to MDP specification.
Index = 0x1A00 + (module number of input module)

In the data of RxPDO and TxPDO, index, sub-index, and the number of bit of each object which is referred to, are stored.
For data of the input module, each object with the address starting with 0x6000 is referred to.
For data of the output module, each object with the address starting with 0x7000 is referred to.
(Refer to the Table 5)

Table 5: Object Configuration For RxPDO And TxPDO

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x16nn(RxPDO) (For output)	0	UINT8	8	RO	1 to 16	Number of items
	1	UINT32	32	RO	0xaaaabbcc	aaaa: Index for referenced object bb: Sub-Index for referenced object cc: Number of bits for referenced object
	2	UINT32	32	RO		
	:	:	:	:		
	m	UINT32	32	RO		

0x1Ann(TxPDO) (For input)	0	UINT8	8	RO	1 to 16	Number of items
	1	UINT32	32	RO	0xaaaabbcc	aaaa: Index for referenced object bb: Sub-Index for referenced object cc: Number of bits for referenced object
	2	UINT32	32	RO		
	:	:	:	:		
	m	UINT32	32	RO		

• Object 0x1AFF

0x1AFF of TxPDO refers the object of 0x2001. (Refer to the Table 6)

Table 6: Object Configuration For TxPDO (0x1AFF)

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1AFF(TxPDO)	0	UINT8	8	RO	33	Number of items
	1	UINT32	32	RO	0x20000102	Referred object
	2	UINT32	32	RO	0x20000202	
	:	:	:	:	:	
	32	UINT32	32	RO	0x20002002	
	33	UINT32	32	RO	0x20010120	

• Object 0x1701, 0x1B01

0x1701 of RxPDO and 0x1B01 of TxPDO are used to add empty bit in the end of periodically updated process data. Because some discrete module has 1 bit, 3 bits or 4 bits data on the other hand analog modules have 16 bit data, bit length is fixed at the time PDO is configured so that the end of consecutively configured process data terminate just on the border of 16 bits.

Table 7: Object Configuration For RxPDO (0x1701) And TxPDO (0x1B01)

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1701(RxPDO)	0	UINT8	8	RO	1	Number of items
	1	UINT32	32	RO	0x0000000n n: number of empty bits	Referred object (Refer to non-existing object)
0x1B01(TxPDO)	0	UINT8	8	RO	1	Number of items
	1	UINT32	32	RO	0x0000000n n: number of empty bits	Referred object (Refer to non-existing object)

■ PDO Assign objects (0x1C12, 0x1C13)

Allocation list for PDO is created in 0x1C12 and 0x1C13. The entire list for RxPDO is stored in 0x1C12, the entire list for TxPDO is stored in 0x1C13. The index stored in 0x1C12 and 0x1C13 is placed in order that is transferred by PDO.

• PDO group

In R8, PDO group defined by Modular Device Profile (MDP) is sorted by I/O module type. The sorting is defined by object 0x9000.

- PDO group 0: PDO for R8 status
- PDO group 1: PDO for analog input module and analog output module
- PDO group 2: PDO for discrete input module and discrete output module

• Allocation of PDO list

The order in the list for RxPDO and TxPDO is as follows.

Group 0 => Group 1 => Group 2 => empty bit PDO

The order in the same group is in ascending order of object index (I/O card address).
(Refer to the Table 8 and 9)

Table 8: Example Of I/O Card Configuration

CARD ADDR.	MODEL	MODULE TYPE	OBJECT INDEX	PDO GROUP	REFERRED OBJECT
0	R8-DA4A	Discrete input, 4 points	0x6000	2	0x1A00
1	R8-DAM16A	Discrete input, 16 points	0x6010	2	0x1A01
2	R8-DC4A	Discrete output, 4 points	0x7020	2	0x1602

3	R8-DCM16ALK	Discrete output, 16 points, with 3 interlocks	0x6030	2	0x1A03
			0x7030	2	0x1603
4(5)	R8-SV4N	Analog input	0x6040	1	0x1A04
		Analog input	0x6050	1	0x1A05
6(7)	R8-YV4N	Analog output	0x7060	1	0x1606
		Analog output	0x7070	1	0x1607

Table 9: PDO List For Table 8 Example Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1C12(RxPDO)	0	UINT8	8	RO	5	Number of items
	1	UINT16	16	RO	0x1606	RxPDO 1st data
	2	UINT16	16	RO	0x1607	RxPDO 2nd data
	3	UINT16	16	RO	0x1602	RxPDO 3rd data
	4	UINT16	16	RO	0x1603	RxPDO 4th data
	5	UINT16	16	RO	0x1701	RxPDO 5th data
0x1C13(TxPDO)	0	UINT8	8	RO	7	Number of items
	1	UINT16	16	RO	0x1AFF	TxPDO 1st data
	2	UINT16	16	RO	0x1A04	TxPDO 2nd data
	3	UINT16	16	RO	0x1A05	TxPDO 3rd data
	4	UINT16	16	RO	0x1A00	TxPDO 4th data
	5	UINT16	16	RO	0x1A01	TxPDO 5th data
	6	UINT16	16	RO	0x1A03	TxPDO 6th data
	7	UINT16	16	RO	0x1B01	TxPDO 7th data

■ Sync Manager Type (0x1C00)

Sync Manager Type is allocated to object 0x1C00 based on EtherCAT specification. (Refer to the Table 10)

Table 10: Object Configuration Of 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)

In R8, objects 0x1C32 and 0x1C33 do not exist, as the value of Sync Manager Parameter is fixed.
R8 supports Free Run mode only as the Sync mode.
Note that Distributed Clock (DC) mode is not supported.

■ Information Data objects (0x9000 to 0x91F0)

All I/O modules' PDO groups and Module Idents are in Sub-Index of objects 0x9000 to 0x91F0. The number of 0x9nnn is same as objects of 0x6nnn or 0x7nnn.
Index = 0x9000 + module number × 0x0010
Sub-index is 9 or 10. (Refer to the Table 11 and 12)

Table 11: Object 0x9nn0 Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x9nn0	0	UINT8	8	RO	10	Number of items
	9	UINT16	16	RO	1/2	PDO Group
	10	UINT32	32	RO	1 to n	Module Ident

Table 12: PDO Group & Module Indent

I/O Module	Module Type	PDO Group	Module Ident
R8-SV2	Analog Input	1	1
R8-SS2	Analog Input	1	2
R8-SV4N (ch1, ch2)	Analog Input	1	10
R8-SV4N (ch3, ch4)	Analog Input	1	11
R8-SVT8 (ch1, ch2)	Analog Input	1	240
R8-SVT8 (ch3, ch4)	Analog Input	1	241
R8-SVT8 (ch5, ch6)	Analog Input	1	242
R8-SVT8 (ch7, ch8)	Analog Input	1	243
R8-SS4N (ch1, ch2)	Analog Input	1	12
R8-SS4N (ch3, ch4)	Analog Input	1	13
R8-SS4NJ (ch1, ch2)	Analog Input	1	36
R8-SS4NJ (ch3, ch4)	Analog Input	1	37
R8-SST8 (ch1, ch2)	Analog Input	1	201
R8-SST8 (ch3, ch4)	Analog Input	1	202
R8-SST8 (ch5, ch6)	Analog Input	1	203
R8-SST8 (ch7, ch8)	Analog Input	1	204
R8-RSx4N (ch1, ch2)	Analog Input	1	38
R8-RSx4N (ch3, ch4)	Analog Input	1	39
R8-TSx2	Analog Input	1	42
R8-FST4N (ch1, ch2)	Analog Input	1	3
R8-FST4N (ch3, ch4)	Analog Input	1	4
R8-FS16N (ch1, ch2)	Analog Input	1	48
R8-FS16N (ch3, ch4)	Analog Input	1	49
:	:	:	:
R8-FS16N (ch15, ch16)	Analog Input	1	55
R8-PFT1	Analog Input	1	217
R8-YVx2	Analog Output	1	224
R8-YV4N (ch1, ch2)	Analog Output	1	14
R8-YV4N (ch3, ch4)	Analog Output	1	15
R8-YVx4N (ch1, ch2)	Analog Output	1	225
R8-YVx4N (ch3, ch4)	Analog Output	1	226
R8-YSx2	Analog Output	1	40
R8-YS2NJ	Analog Output	1	41
R8-YST4N (ch1, ch2)	Analog Output	1	222
R8-YST4N (ch3, ch4)	Analog Output	1	223
R8-CT4E (ch1, ch2)	CT Input	1	56
R8-CT4E (ch3, ch4)	CT Input	1	57
R8-PA4 (ch1)	Pulse Input	1	43
R8-PA4 (ch2)	Pulse Input	1	44
R8-PA4 (ch3)	Pulse Input	1	45
R8-PA4 (ch4)	Pulse Input	1	46
R8-PAx4F (ch1)	Pulse Input	1	205
R8-PAx4F (ch2)	Pulse Input	1	206
R8-PAx4F (ch3)	Pulse Input	1	207
R8-PAx4F (ch4)	Pulse Input	1	208
R8-PCx4A (ch1, ch2)	Pulse Output	1	220
R8-PCx4A (ch3, ch4)	Pulse Output	1	221
R8-WTUD(data1,2)	Data input	1	209
R8-WTUD(data3,4)	Data input	1	210
:	:	:	:
R8-WTUD(data15,16)	Data input	1	216

I/O Module	Module Type	PDO Group	Module Ident
R8-WTU(data1,2)	Data I/O	1	88
R8-WTU(data3,4)	Data I/O	1	89
:	:	:	:
R8-WTU(data15,16)	Data I/O	1	95
R8-TC2 (data1, 2)	Data I/O	1	80
R8-TC2 (data3, 4)	Data I/O	1	81
:	:	:	:
R8-TC2 (data15, 16)	Data I/O	1	87
R8-DA4A	Discrete Input, 4 points	2	5
R8-DC4A	Discrete Output, 4 points	2	6
R8-DC4A2	Discrete Output, 4 points	2	7
R8-DC4C	Discrete Output, 4 points	2	8
R8-DCT4D	Discrete Output, 4 points	2	64
R8-DAT8A2	Discrete Input, 8 points	2	32
R8-DAT8B2	Discrete Input, 8 points	2	33
R8-DCT8A2	Discrete Output, 8 points	2	76
R8-DCT8B2	Discrete Output, 8 points	2	77
R8-DAM16A	Discrete Input, 16 points	2	27
R8-DAT16x	Discrete Input, 16 points	2	28
R8Y-DAZH32 (ch1 – 16)	Discrete Input, 16 points	2	29
R8Y-DAZH32 (ch17 – 32)	Discrete Input, 16 points	2	30
R8-DCM16A	Discrete Output, 16 points	2	17
R8-DCT16x	Discrete Output, 16 points	2	20
R8-DCM32B2 (ch1 – 16)	Discrete Output, 16 points	2	18
R8-DCM32B2 (ch17 – 32)	Discrete Output, 16 points	2	19
R8Y-DCZH32 (ch1 – 16)	Discrete Output, 16 points	2	24
R8Y-DCZH32 (ch17 – 32)	Discrete Output, 16 points	2	25
R8-DCM16ALZ	Discrete Output, 16 points, with 1 Interlock	2	21
R8-DCM16ALK	Discrete Output, 16 points, with 3 Interlocks	2	22
R8-DCM16ALH	Discrete Output, 16 points, with 3 Interlocks	2	23

■ Modular Device Profile objects (0xF000)

Object 0xF000 contains Modular Device Profile (MDP). The Index interval of module is stored in Sub-Index 1. The maximum number of module is in Sub- Index 2. And, the PDO group parameter of the slave device is stored in Sub-Index 5. (Refer to the Table 13.)
In the Sub-Index 4, the data that shoes valid Sub-Index of object 0x9nn0 is stored.
bit 0 = Sub-Index 1 of 0x9nn0
bit 1 = Sub-Index 2 of 0x9nn0

The bit number and Sub-Index number are correlated.

Table 13: Object 0xF000 Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0xF000	0	UINT8	8	RO	5	Number of items
	1	UINT16	16	RO	0x0010	Index Interval
	2	UINT16	16	RO	32	Maximum number of module
	4	UINT32	32	RO	0x00000300	Valid Sub-Index of 0x9nn0
	5	UINT16	16	RO	0	PDO Group

■ Detected Module Ident List (0xF050)

The Idents of all connected I/O modules are stored in object 0xF050.
The Sub-index numbers are same as the module addresses. The address of module not installed, the Sub-index is 0. (Refer to the Table 14.)

■ Configured Module Ident List (0xF030)

The master confirms the module configuration with object 0xF030.
The master writes Module Idents to the addresses that the master confirmed the existence of the modules. The slave confirms if the Module Ident is correct. When it is correct, the writing is done. If it is incorrect, it will be error.
The all of Sub-indexes are correct, the object 0xF030 is same as 0xF050. It is not necessary that the master confirm with 0xF030. (Refer to the Table 14.)

Table 14: Object 0xF030 and 0xF050, Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0xF030	0	UINT8	8	RW	32	Number of items
	1	UINT32	32	RW	0 to n	Module Ident or 0 (Confirmation by Master)
	2	UINT32	32	RW	0 to n	
	:	:	:	:	:	
	32	UINT32	32	RW	0 to n	
0xF050	0	UINT8	8	RO	32	Number of items
	1	UINT32	32	RO	0 to n	Module Ident or 0
	2	UINT32	32	RO	0 to n	
	:	:	:	:	:	
	32	UINT32	32	RO	0 to n	

■ Detected Address List (0xF040)

The address of all connected I/O modules are stored in object 0xF040.
The Sub-index numbers are same as the module addresses.
The address of module not installed, the Sub-index is 0. (Refer to the Table 15.)

Table 15: Object 0xF040 Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0xF040	0	UINT8	8	RO	32	Number of items
	1	UINT16	32	RO	0 to 32	Module address or 0
	2	UINT16	32	RO	0 to 32	
	:	:	:	:	:	
	32	UINT16	32	RO	0 to 32	

■ Device Type (0x1000)

The device type of slave is stored in object 0x1000.
R8 series are compatible with Modular Device Profile (MDP). The device type is 5001. (Refer to the Table 16.)

Table 16: Object 0x1000 Configuration

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

■ Manufacturer Device Name (0x1008)

The device name of slave is stored in object 0x1008 in String form. (Refer to the Table 17.)

Table 17: Object 0x1008 Configuration

INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1008	STRING	-	RO	R8-NECT1	Device name

■ Manufacturer Hardware Version (0x1009)

The hardware device version of slave is stored in object 0x1009 in String form. The format of version is “n.nn.” (Refer to the Table 18.)

Table 18: Object 0x1009 Configuration

INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1009	STRING	32	RO	n.nn	Hardware version

■ Manufacturer Software Version (0x100A)

The software version of slave is stored in object 0x100A in String form. The format of version is "n.nn." (Refer to the Table 19.)

Table 19: Object 0x100A Configuration

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

■ Identity object (0x1018)

The unique information of slave is stored in object 0x1018. The vendor ID and product code are unique, but the revision number is incremented at each major version up of the software.
The serial number is a 32 bit data converted from the R8-NECT1's serial number (8 alpha-numeral characters). The conversion method to the 32 bit data is following. The first and second characters are converted to two 6 bit values. The 3rd to 8th characters are converted to a binary data as a 6 figure value. (Refer to the Table 20.)

6BIT	6BIT	20BIT
1st character	2nd character	3rd to 8th character (0 to 999999)

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

Table 20: Object 0x1018 Configuration

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1018	0	UINT8	8	RO	4	Number of items
	1	UINT32	32	RO	0x0000060C	Vendor ID
	2	UINT32	32	RO	0x52380002	Product code
	3	UINT32	32	RO	n	Revision number
	4	UNIT32	32	RO	0xnnnnnnnn	Serial number

DIAGNOSTIC

■ Internal Bus Error Detection (at power on)

When the power of the unit turns on, if an I/O card has a fault with the internal bus or the card address is duplicated with another card, the R8-NECT1 detects the fault and ERR LED blinks. In such a case, check if the address is duplicated at first. (A 4-point analog I/O card uses 2 successive card addresses. Be careful with duplication of the address.)
When the unit detects an internal bus error, the state transition from INIT to PREOP cannot be done despite state machine from the master.

■ Internal Bus Error Detection (at operation)

If an I/O card has a fault with the internal bus during normal operation, the R8-NECT1 detects the fault and set the error code in AL Status Code, and ERR LED blinks. If the EtherCAT state is OP, the state transits to SAFEOP.
When the internal bus error is recovered, the ERR LED turns off and error code is reset. However, the state remains at SAFEOP. To transit to OP state, send command from the master.

■ Card Address Confirmation

Set SW1-8 on and turn on the power, then the R8-NECT1 starts in Card Address Confirmation mode.
The RUN LED of I/O card flashes from address 0. When the card uses 2 addresses, the LED flashes twice.
Repeating the flashing from address 0 to the last address. (In operation mode, non-continuous address does not affect the operation. However, in this mode, the unit ignores the addresses following the unused one.)
The time of flashing is On for 400 msec., and Off for 100 msec.
In order to change the mode to operation, turn SW1-8 off and turns the power on again.

■ AL Status Code

If State machine cannot be accepted, or a slave makes a fault during communication, the salve sets error code in register 0x0134: 0x0135 (AL Status Code) of ESC.
The error codes of R8 series are shown below. (Refer to the Table 21.)

Table 21: Error Code of AL Status Code

CODE	ERROR
0x0000	No error
0x0011	Invalid requested state change
0x0012	Unknown requested state
0x0013	BOOT strap not supported
0x0016	Invalid MailBox configuration (PREOP)
0x0017	Invalid SyncManager configuration
0x001B	SyncManager Watchdog
0x001D	Invalid Output Configuration
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

If a slave cannot accept during SDO access to object dictionary by the master, the slave sends the error code (SDO Abort Code) and denies access.

The error codes of R8 series are shown below. (Refer to the Table 22.)

Table 22: Error Code 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

LED INDICATOR

■ LEDs of R8-NECT1

R8-NECT1 has 5 LEDs to indicate status of the unit. The lighting patterns of each LED and what they mean are shown below. (Refer to the Table 23.)

Table 23: Lighting Pattern and meaning

LED	FUNCTION	STATUS		Reason of Error
Power	Main unit internal power	Off	Error	Internal power fault
		On	Normal	-
RUN	Device state	Off	INIT	-
		Blinking	PRE-OPERATIONAL	-
		Single Flash	SAFE-OPERATIONAL	-
		On	OPERATIONAL	-
ERR	Error	Off	No error	-
		Blinking	Invalid Configuration	Internal bus error at power on, I/O card address duplication, Error at state change
		Single Flash	Local error	Internal bus error
		On	Application Controller failure	Fault of the interface module (PDI error)
L/A IN	IN port status	Off	No Link	-
		Flickering	Link and activity	-
		On	Link without activity	-
L/A OUT	OUT port status	Off	No Link	-
		Flickering	Link and activity	-
		On	Link without activity	-

Blinking	200ms-On, 200ms-Off
Single Flash	200ms-On, 1000ms-Off
Flickering	50ms-On, 50ms-Off

■ RUN LED of I/O Card

Each I/O card connected to the R8-NECT1 has a RUN LED.
The RUN LED turns on when the card communicates with the master and the system bus runs correctly.
If the card is input card (analog input or discrete input), when state of the R8-NECT1 is OPERATIONAL or SAFE-OPERATIONAL, it turns on. If the card is output card (analog output or discrete output), when state is OPERATIONAL, it turns on.
PDO communications of I/O cards are available only when RUN LED turns on.