

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:

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.

■ ESI FILE

ESI files are downloadable at M-System's web site (<http://www.m-system.co.jp>).

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

- It is possible to replace a module with the power supplied provided that the module is replaced with one with the same model number and installed in the same base slot.
- Turn off signals before replacing the module for safety. Note that replacing multiple modules at once may greatly change line voltage levels. We highly recommend to replace them one by one.

■ 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 10 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

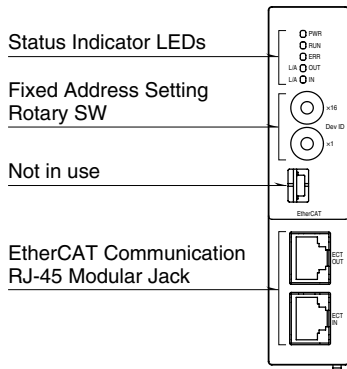
- The unit is designed to function as soon as power is supplied, however, a warm up for 10 minutes is required for satisfying complete performance described in the data sheet.
- Please use this unit with an interface module (model: R30NECT1) of firmware version V1.04.10 or higher, and an interface module (model: R30NCIE1) of firmware version V1.01.13 or higher.



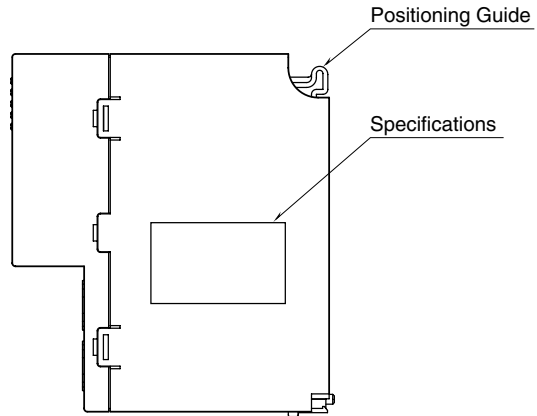
EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

COMPONENT IDENTIFICATION

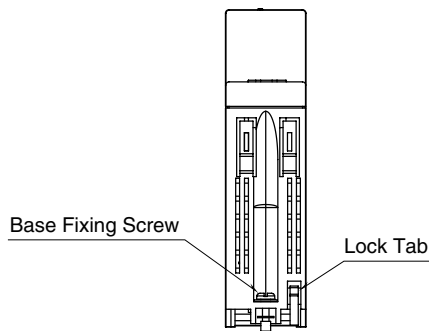
FRONT VIEW



SIDE VIEW



BOTTOM VIEW



STATUS INDICATOR LED

ID	FUNCTION	COLOR	STATUS	
			Indicator State	Meaning
PWR	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
			Double Flash	Process data watchdog timeout/EtherCAT watchdog timeout
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
Double Flash	200ms-On, 200ms-Off, 200ms-On, 1000ms-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 ID selector to 0. Settable range: 0 to 255
Factory default: 0



Fixed Address Setting (x16)



Fixed Address Setting (x1)

INSTALLATION

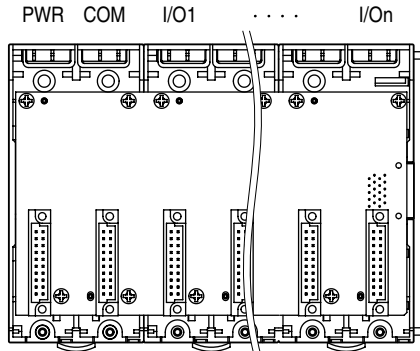
■ INSTALLATION TO THE BASE

Use the Installation Base (model: R30BS).

The I/O slots are numbered in the ascending order starting from the one on the immediate right of the interface module (slot 1, slot 2...).

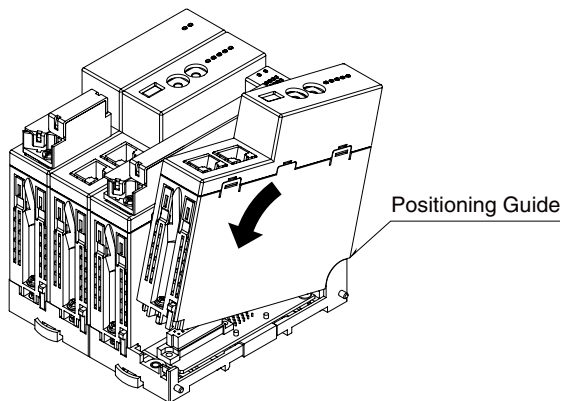
A code indicating the I/O slot number is assigned to each I/O slot and I/O data is allocated in the order of the codes.

When an I/O slot is vacant, blank data is sent or received to/from the PLC, etc.

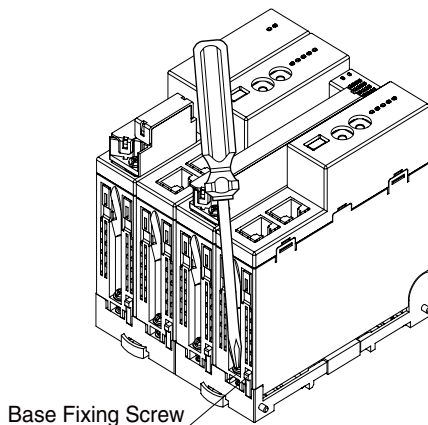


■ HOW TO MOUNT THE MODULE

- 1) Engage the positioning guide of the module with the Installation Base.
- 2) Pivot the module on the positioning guide and press it down until the lock tab clicks into place.

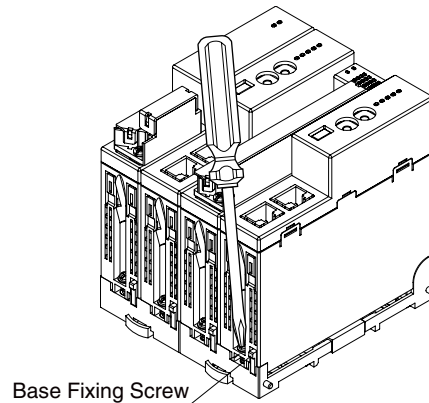


- 3) Tighten the base fixing screw using a screwdriver (stem length: 70 mm/2.76" or more) (torque 0.5 N·m).

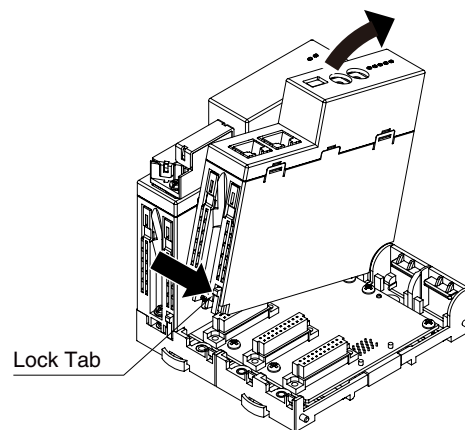


■ HOW TO REMOVE THE MODULE

- 1) Loosen the base fixing screw using a screwdriver (stem length: 70 mm/2.76" or more).



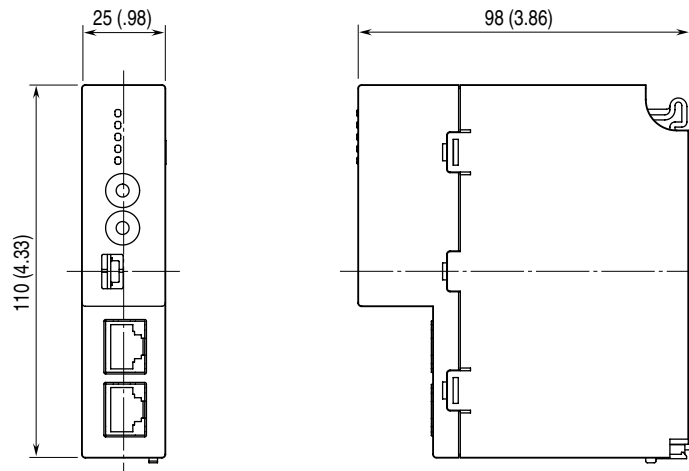
- 2) While pressing the projection on the lock tab, push the module upward.
- 3) Detach the positioning guide of the module from the Installation Base.



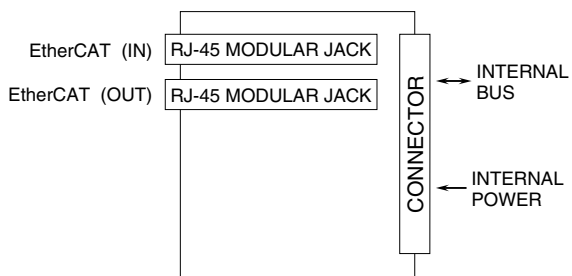
TERMINAL CONNECTIONS

Connect the unit as in the diagram below.

EXTERNAL DIMENSIONS unit : mm (inch)



CONNECTION DIAGRAM



EtherCAT SPECIFICATIONS

■ Modular Device Profile

R30GECT1 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

R30GECT1 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 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 register 0x0012 (Configured Station Alias) of ESC (EtherCAT Slave Controller) when R30GECT1 starts up.

■ Process Data Configuration

The number of data R30GECT1 can transmit: 4 points (4 words) for input; and 4 points (4 words) for output.

■ Data Configuration

The data configuration is in accordance with the EtherCAT Modular Device Profile (MDP) specifications.

Table 1: Data Configuration

OBJECT	ADDRESS	CONTENT
Device Type	0x1000	Device type
Error register	0x1001	Error register
Manufacturer Device Name	0x1008	Device name
Manufacturer Hardware Version	0x1009	Hardware version
Manufacturer Software Version	0x100A	Software version
Identity Objects	0x1018	Vendor information
PDO Mapping Objects (RxPDO)	0x1600	Output data list
RxPDO Gap	0x1701	Output data gap
PDO Mapping Objects (TxPDO)	0x1A00	Input data list
PDO Mapping Objects (TxPDO)	0x1AFF	Status data list
TxPDO Gap	0x1B01	Input data gap
Sync Manager Type	0x1C00	Sync manager type
PDO Assign (OUT)	0x1C12	Output data transmission order
PDO Assign (IN)	0x1C13	Input data transmission order
Sync Manager Parameter Objects	0x1C32, 0x1C33	Sync manager parameter
Manufacturer Specific Objects	0x2000	Module status
Input Area Objects	0x6000	Input data
Output Area Objects	0x7000	Output data
Information Data Objects	0x9000	Module information
Modular Device Profile Objects	0xF000	MDP information
Configured Module Ident List	0xF030	Module information collation by master module
Detected Module Ident List	0xF050	Module information list

■ EtherCAT State

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

TxPDO (input configuration data) is updated 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 data and output data are updated, while only input data is updated in the PREOP state.

■ EtherCAT Diagnostics

• AL Status Code

When the slave (R30GECT1) 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.

See Table 2 below for the error codes used on the R30GECT1.

Table 2: Error Codes of AL Status Code

CODE	ERROR
0x0000	No error
0x0011	Invalid requested state change
0x0012	Unknown requested state change
0x0013	BOOT state 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 specific error)
0x8001	Internal bus error during communication (vendor specific error)

• SDO Abort Code

When the master attempts to access the object dictionary via SDO, if the slave (R30GECT1) fails to receive SDO messages for any reason, the R30GECT1 sends an error code (SDO Abort Code) to the master and denies its access.

See Table 3 below for the error codes that are used.

Table 3: 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 write 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)

Input data of I/O modules is allocated to 0x6000.

Sub-Indexes correspond to channel numbers.

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

Output data of I/O modules is allocated to 0x7000.

Sub-Indexes correspond to channel numbers.

Table 4: Object Configuration For I/O Data By Module Type

MODULE TYPE	INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
Analog input, 4 points	0x6000	0	UINT8	8	RO	4	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
		3	INT16	16	RO	-32768 to 32767	Third point input data
		4	INT16	16	RO	-32768 to 32767	Fourth point input data
Analog output, 4 points	0x7000	0	UINT8	8	RO	4	Number of items
		1	INT16	16	RO	-32768 to 32767	First point output data
		2	INT16	16	RO	-32768 to 32767	Second point output data
		3	INT16	16	RO	-32768 to 32767	Third point output data
		4	INT16	16	RO	-32768 to 32767	Fourth point output data

■ Manufacturer Specific Objects (Module Status: 0x2000)

Status information of the module is allocated to 0x2000.

0x0000 is set when the R30GECT1 communicates with the master normally, while 0x000F is set during non-communication or communication error with the master.

Table 5: Object Configuration for Module Status

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x2000	0	UINT8	8	RO	1	Number of items
	1	UINT16	16	RO	0x000 / 0x000F	Module status information

■ PDO Mapping Objects (Data List: 0x1600, 0x1A00, 0x1AFF)

• Objects 0x1600, 0x1A00

Output data list (RxPDO) and Input data list (TxPDO) are allocated to 0x1600 and 0x1A00, respectively.

RxPDO data and TxPDO data contain Object index, Sub-Index and the number of bits to which they refer to.

For input data, objects 0x6000 to 0x6FFF are referred to.

For output data, objects 0x7000 to 0x7FFF are referred to.

Table 6: Object Configuration For Output Data List and Input Data List

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1600 (RxPDO)	0	UINT8	8	RO	4	Number of items
	1	UINT32	32	RO	0xaaaabccc	aaaa: Index
	2	UINT32	32	RO		bb: Sub-Index
	3	UINT32	32	RO		cc: Number of bits
	4	UINT32	32	RO		
0x1A00 (TxPDO)	0	UINT8	8	RO	4	Number of items
	1	UINT32	32	RO	0xaaaabccc	aaaa: Index
	2	UINT32	32	RO		bb: Sub-Index
	3	UINT32	32	RO		cc: Number of bits
	4	UINT32	32	RO		

• Object 0x1AFF

Module status list (TxPDO) is allocated to 0x1AFF.

Module status list refers to Object 0x2000. See Table 5 below.

Table 7: Configuration For Object 0x1AFF

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1AFF	0	UINT8	8	RO	1	Number of items
	1	UINT32	32	RO	0x20000110	Reference object

■ RxPDO / TxPDO Gap (0x1701, 0x1B01)

Objects 0x1701 and 0x1B01 are not used.

■ PDO Assign Objects (PDO Allocation List for Output: 0x1C12, Input: 0x1C13)

Allocation lists for RxPDO and TxPDO are allocated to 0x1C12 and 0x1C13, respectively.

0x1C12 and 0x1C13 contain all of RxPDO data and TxPDO data, 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 module types as defined by Information Data Objects.

- PDO group 0: Status

- PDO group 1: Analog I/O module

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

Table 8: Object Configuration For PDO Allocation List

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1C12	0	UINT8	8	RO	2	Number of items
	1	UINT16	16	RO	0x1600	Output data
	2	UINT16	16	RO	0x1701	RxPDO Gap
0x1C13	0	UINT8	8	RO	3	Number of items
	1	UINT16	16	RO	0x1AFF	Status data
	2	UINT16	16	RO	0x1A00	Input data
	3	UINT16	16	RO	0x1B01	TxPDO Gap

■ Sync Manager Type (0x1C00)

Sync Manager Type is allocated to 0x1C00 based on the EtherCAT specification.

Table 9: Object Configuration For Sync Manager Type

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)

Objects 0x1C32 and 0x1C33 do not exist as the values of Sync Manager Parameter are fixed on the R30GECT1.

This unit supports only the Free Run mode and does not support Distributed Clock (DC) mode.

■ Information Data Objects (Module Information: 0x9000)

Module Information (PDO group, Module Ident) is allocated to 0x9000.
Sub-index is 9 or 10.

Table 10: Object Configuration For Module Information

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x9000	0	UINT8	8	RO	10	Number of items
	9	UINT16	16	RO	1	PDO Group
	10	UINT32	32	RO	120	Module Ident

Table 11: PDO Group & Module Ident Of Module

I/O TYPE	MODULE TYPE	PDO GROUP	MODULE IDENT	MODULE
AIO4	Analog Input, 4 points; Analog Output, 4 points	1	120	-

■ Modular Device Profile Objects (MDP Information: 0xF000)

Modular Device Profile (MDP) information is allocated to 0xF000.

The Index interval, the maximum number of modules, and the PDO group of the slave device are allocated to Sub-Indexes 1, 2 and 5. See Table 12 below.

Sub-Index 3 and Sub-Index 4 respectively indicate the valid/invalid statuses of 0x8000 and 0x9000.

The allocations are as follows:

bit 0 = 0x8000 (0x9000) Sub-Index 1

bit 1 = 0x8000 (0x9000) Sub-Index 2

:

1: Valid, 0: Invalid

Table 12: Object Configuration For Modular Device Profile (MDP)

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	1	Maximum number of modules
	3	UINT32	32	RO	0x00000000	Valid Sub-Index of 0x8nn0
	4	UINT32	32	RO	0x00000300	Valid Sub-Index of 0x9nn0
	5	UINT16	16	RO	0	PDO group

■ Detected Module Ident List (Module Information List: 0xF050)

Module information list is allocated to 0xF050.

Each Sub-Index number in the list represents the module address.

0 is set as the Sub-Index number for a non-existing module. See Table 13 below.

■ Configured Module Ident List (Module Information Collation by Master Module: 0xF030)

0xF030 is referred to for confirming the configuration of modules registered on the master module.

Module Ident is written for each module that is existing (recognized by the master) with Sub-Index number as the module address.

The slave confirms the Module Ident to determine whether writing is correct (successful) or wrong (failed).

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

0xF030 is solely for the confirmation by the master, and thus can be omitted.

Table 13: Object Configuration For Module Information List

INDEX	SUB-INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0xF030	0	UINT8	8	RW	1	Number of items
	1	UINT32	32	RW	120	Module Ident or 0 (confirmed by master)
0xF050	0	UINT8	8	RO	1	Number of items
	1	UINT32	32	RO	120	Module Ident or 0

■ Device Type (0x1000)

The device type is allocated to 0x1000.

The device type is 5001.

Table 14: Object Configuration For Device Type

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

■ ERROR REGISTER (0x1001)

The object 0x1001 is not used.

■ Manufacturer Device Name (0x1008)

The device name is allocated to 0x1008 in String form.

Table 15: Object 0x1008 Configuration

INDEX	DATA TYPE	BIT	ACCESS	VALUE	CONTENT
0x1008	STRING	32	RO	R30GECT1	Model number

■ Manufacturer Hardware Version (0x1009)

The hardware device version is allocated to 0x1009 in String form.

The version format is 'n.nn'.

Table 16: Object Configuration For Hardware Version

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

■ Manufacturer Software Version (0x100A)

The software version is allocated to 0x100A in String form.

The version format is 'n.nn'.

Table 17: Object Configuration For Software Version

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

■ Identity Object (Vendor Information: 0x1018)

Vendor Information is allocated to 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.

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.

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

Serial Number Conversion Table

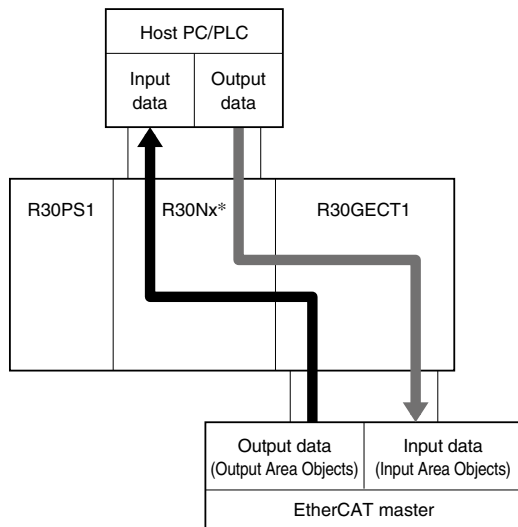
CHARACTER	VALUE
0	0
1	1
:	:
9	9
A	10
B	11
:	:
Z	35

Table 18: Object Configuration For Vendor Information

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	0x52333008	Product code
	3	UINT32	32	RO	n	Revision number
	4	UINT32	32	RO	0 to n	Serial number

TRANSMISSION DATA DESCRIPTION

• DATA FLOW



* R30Nx: R30 Network module

■ FLOW OF OUTPUT DATA

[EtherCAT master]—>[R30GECT1]—>[R30 internal bus]
—>[R30 Network module]—>[Host PC/PLC]

Output data (Output Area Objects) from EtherCAT master is transmitted as Input data to Host PC/PLC.

■ FLOW OF INPUT DATA

[Host PC/PLC]—>[R30 Network module]—>[R30 internal bus]
—>[R30GECT1]—>[EtherCAT master]

Output data from Host PC/PLC is transmitted as Input data (Input Area Objects) to EtherCAT master.