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User Manual – EtherCAT Network Adapter

EH-RIO2 Series
RIO2-ECA
Version 1.03

User Manual – EtherCAT Network Adapter

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1. Important Notes

Solid state equipment has operational characteristics differing from those of electromechanical equipment.
Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls describes some important differences between solid state equipment and hard-wired electromechanical devices.
Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Hitachi be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.
The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Hitachi cannot assume responsibility or liability for actual use based on the examples and diagrams.

Warning!

✓ **If you don't follow the directions, it could cause a personal injury, damage to the equipment or explosion**

● Do not assemble the products and wire with power applied to the system. Else it may cause an electric arc, which can result into unexpected and potentially dangerous action by field devices. Arching is explosion risk in hazardous locations. Be sure that the area is non-hazardous or remove system power appropriately before assembling or wiring the modules.

● Do not touch any terminal blocks or IO modules when system is running. Else it may cause the unit to an electric shock or malfunction.

● Keep away from the strange metallic materials not related to the unit and wiring works should be controlled by the electric expert engineer. Else it may cause the unit to a fire, electric shock or malfunction.

Caution!

✓ **If you disobey the instructions, there may be possibility of personal injury, damage to equipment or explosion. Please follow below Instructions.**

● Check the rated voltage and terminal array before wiring. Avoid the circumstances over 55℃ of temperature. Avoid placing it directly in the sunlight.

● Avoid the place under circumstances over 85% of humidity.

● Do not place Modules near by the inflammable material. Else it may cause a fire.

● Do not permit any vibration approaching it directly.

● Go through module specification carefully, ensure inputs, output connections are made with the specifications. Use standard cables for wiring.

● Use Product under pollution degree 2 environment.

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1.1 Safety Instruction

1.1.1 Symbols

DANGER ⚠	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death property damage or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION ⚠	Identifies information about practices or circumstances that can lead to personal injury, property damage, or economic loss. Attentions help you to identity a hazard, avoid a hazard, and recognize the consequences.

1.1.2 Safety Notes

DANGER ⚠	The modules are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the modules, ensure that the environment (persons, workplace and packing) is well grounded. Avoid touching conductive components, e.g. FnBUS Pin.

1.1.3 Certification (TBD)

c-UL-us UL Listed Industrial Control Equipment, certified for U.S. and Canada
See UL File E235505

CE Certificate
EN 61000-6-2:2005
EN 61000-6-4/A11:2011

FCC
RoHS (EU, China)

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2. Specification

2.1 The Interface

2.1.1 RIO2-ECA (EtherCAT)

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2.2 Specification
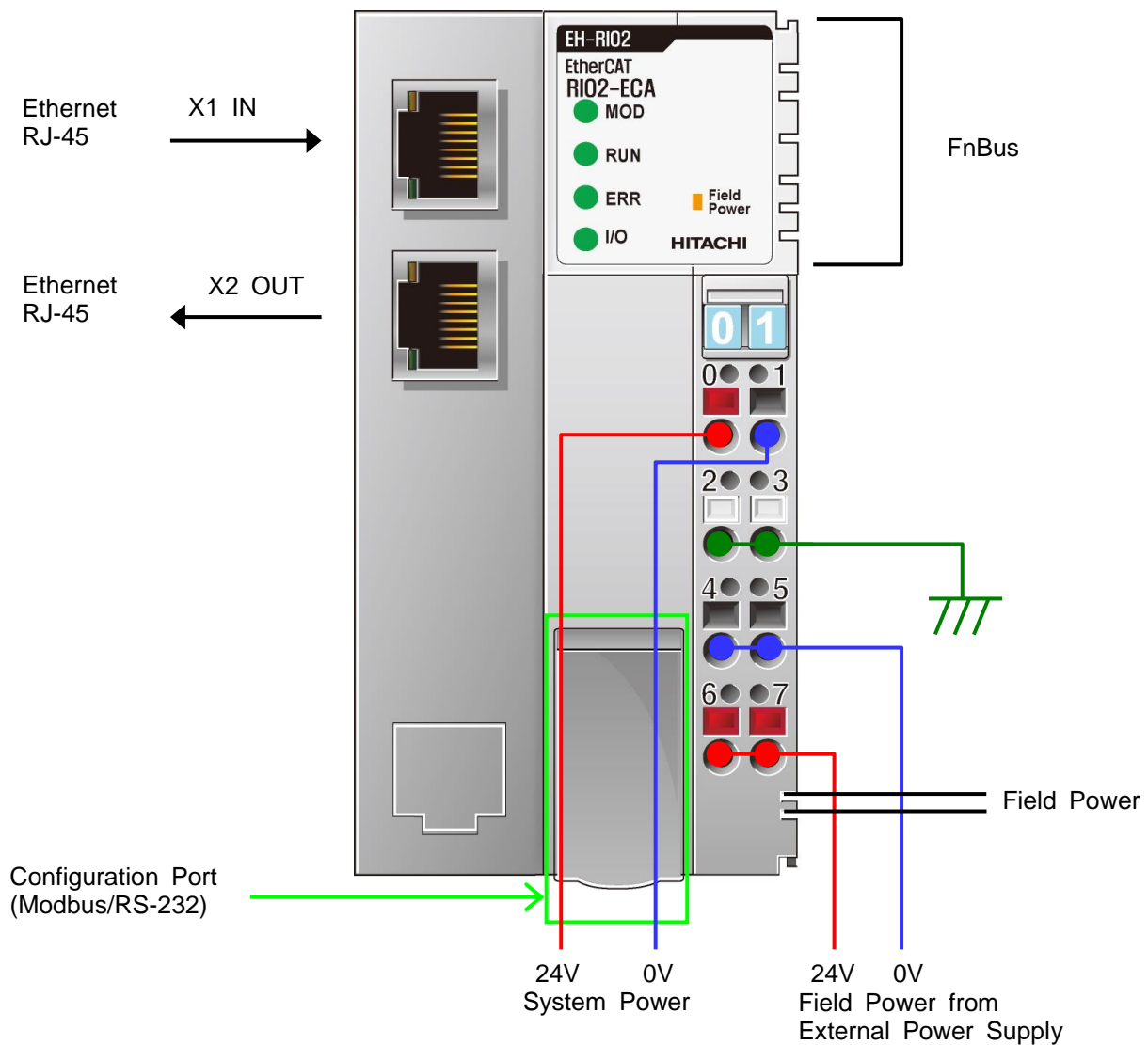
2.2.1 General Specification

General Specification	
System Power	Supply voltage : 24Vdc nominal Supply voltage range : 16 ~28.8Vdc Protection : Output current limit(Min. 1.5A) 　　　　　　　 Reverse polarity protection
Power Dissipation	100mA typical @24Vdc
Current for I/O Module	1.5A @5Vdc
Isolation	System power to internal logic : Non-isolation System power I/O driver : Isolation System to Physical (RJ-45) : Trans, Isolation
Field Power	Supply voltage : 24Vdc nominal Supply voltage range : 11~28.8Vdc
Max. Current Field Power Contact	DC 10A Max.
Weight	167g
Module Size	54mm x 99mm x 70mm
Environment Condition	
Environmental Specifications	
Operating Temperature Storage Temperature Relative Humidity Mounting	-20℃~60℃ -40℃~85℃ 5% ~ 90% non-condensing DIN rail
General Specifications	
Shock Operating	IEC 60068-2-27
Vibration/shock resistance	Sine Vibration (Based on IEC 60068-2-6) 　 5 ~ 25Hz : ±1.6mm 　 25 ~ 300Hz : 4g 　 Sweep Rate : 1 Oct/min, 20 Sweeps Random Vibration (Based on IEC 60068-2-64) 　 10 ~ 40Hz : 0.0125g²/Hz 　 40 ~ 100Hz : 0.0125 → 0.002g²/Hz 　 100 ~ 500Hz : 0.002g²/Hz 　 500 ~ 2000Hz : 0.002 → 1.3×10^{-4} g²/Hz Test time : 1hrs for each test
EMC resistance burst/ESD	EN 61000-6-2 : 2005, EN 61000-6-4/A11 : 2011
Installation Pos. / Protect. Class	Variable/IP20
Product Certifications	UL, cUL, CE, FCC, KCC, RoHS(EU,China)

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2.2.2 Interface Specification

Interface Specification, RIO2-ECA (EtherCAT)	
Adapter Type	EtherCAT Slave Node
Max. Expansion Module	63 slots
Max. Input Size	252 bytes (2016 points)
Max. Output Size	252 bytes (2016 points)
Max. Nodes	65,535
Data Baud Rate	100Mbps
Mac Address / IP Address	No need
Interface Connector	RJ-45 socket * 2pcs
Configuration Tool	IO Guide Pro
Serial Configuration (RS232)	Node : 1(Fixed) Baud Rate : 115200(Fixed) Data bit : 8(Fixed) Parity bit : No parity(Fixed) Stop bit : 1(Fixed)
Indicator	5 LEDs (Front Window) - 1 Green/Red, Module Status (MOD) - 1 Green, Current Running Status (RUN) - 1 Green/Red, Error Status (ERR) - 1 Green/Red, Expansion I/O Module Status (I/O) - 1 Green, Field Power Status 2 LEDs (each RJ-45 Connector) - 1 Yellow Link, Active - 1 Green Not used
Module Location	Starter module – left side of FnIO system
Field Power Detection	About 11Vdc

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2.3 LED Indicator

2.3.1 Module Status LED (MOD)

State	LED is :	To indicate :
No Power	Off	No power is supplied to the unit.
Device Operational	Green	The unit is operating in normal condition.
Device in Standby	Flashing Green	The EEPROM parameter is not initialized yet. Serial Number is zero value (0x00000000)
Minor Fault	Flashing Red	The unit has occurred recoverable fault in self-testing. - EEPROM checksum fault
Unrecoverable Fault	Red	The unit has occurred unrecoverable fault in self-testing. - Firmware fault

2.3.2 Current Running Status LED (RUN)

State	LED is :	To indicate :
Init	Off	State of the EtherCAT State Machine: INIT = Initialization
Pre-Operational	Blinking	State of the EtherCAT State Machine: PREOP = Pre-Operational
Safe-Operational	Single Flash	State of the EtherCAT State Machine: SAFEOP = Safe-Operational
Initialization or Bootstrap	Flashes	State of the EtherCAT State Machine: BOOT = Bootstrap (Update of the coupler firmware)
Operational	On	State of the EtherCAT State Machine: OP = Operational

2.3.3 Error Status LED (ERR)

State	LED is :	To indicate :
No Error	Off	No Error
Invalid Configuration	Blinking	Invalid Configuration
Unsolicited State Change	Single Flash	Local Error
Application Watchdog Timeout	Double Flash	Process Data Watchdog Timeout / EtherCAT Watchdog Timeout
Booting Error	Flashes	Booting Error
PDI Watchdog Timeout	On	Application Controller Failure

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2.3.4 Expansion Module Status LED (I/O)

State	LED is :	To indicate :
Not Powered No Expansion Module	Off	Device has no expansion module or may not be powered
FnBus On-line, Do not Exchanging I/O	Flashing Green	FnBus is normal but does not exchanging I/O data (Passed the expansion module configuration).
FnBus Connection, Run Exchanging IO	Green	Exchanging I/O data
FnBus connection fault during exchanging IO	Red	One or more expansion module occurred in fault state. - Changed expansion module configuration. - FnBus communication failure.
Expansion Configuration Failed	Flashing Red	Failed to initialize expansion module - Detected invalid expansion module ID. - Overflowed Input / Output Size - Too many expansion module - Initial protocol failure - Mismatch vendor code between adapter and expansion module.

2.3.5 Field Power Status LED

State	LED is :	To indicate :
Not Supplied Field Power	Off	Not supplied 24V dc field power
Supplied Field Power	Green	Supplied 24V dc field power

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3. Dimension

3.1 RIO2-ECA

(mm)
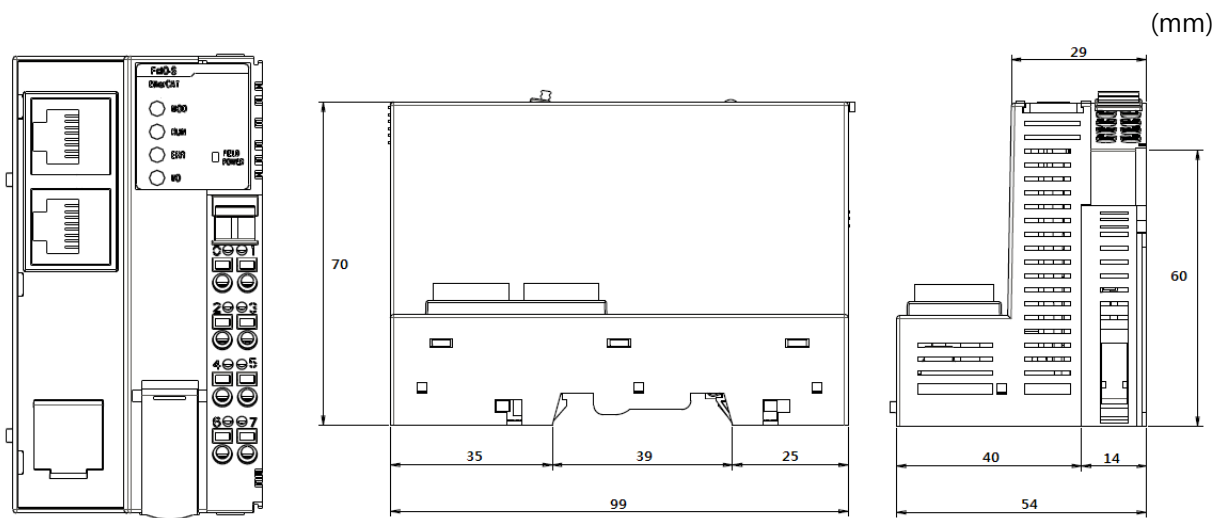
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4. Mechanical Setup

4.1 Total Expansion

The number of the module assembly that can be connected is 63. So the maximum length is 426mm Exception. RIO2-YR8 is excepted to calculate maximum length because that is double width module.

4.2 Plugging and Removal of the Components.
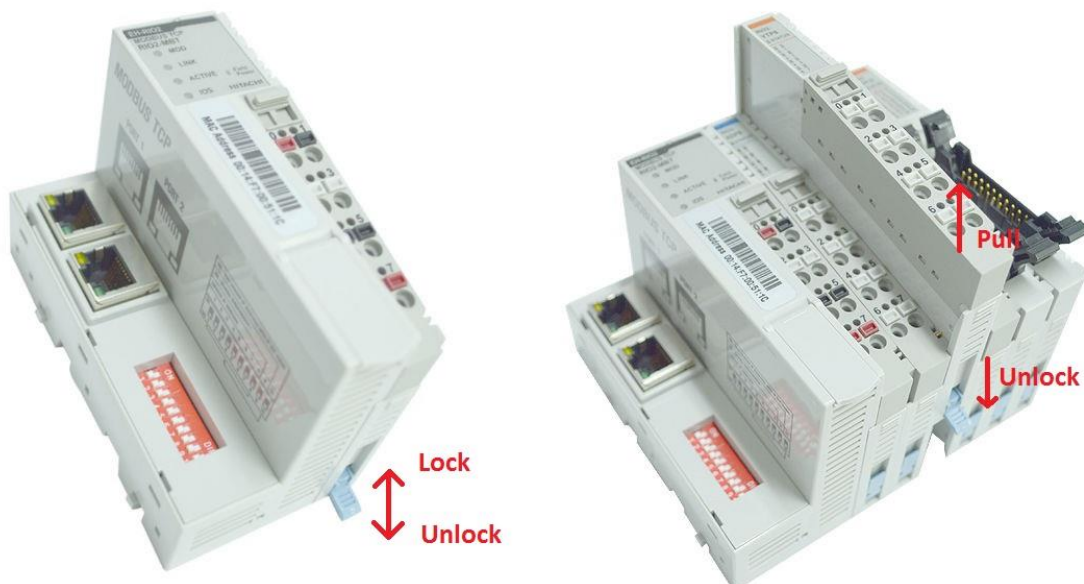
As above figure in order to safeguard the FnIO module from jamming, it should be fixed onto the DIN rail with locking level. To do so, fold on the upper of the locking lever.

To pull out the FnIO module, unfold the locking lever as below figure.

DANGER ⚠	Before work is done on the components, the voltage supply must be turned off.

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5. Electrical Interface

5.1 FnBus System
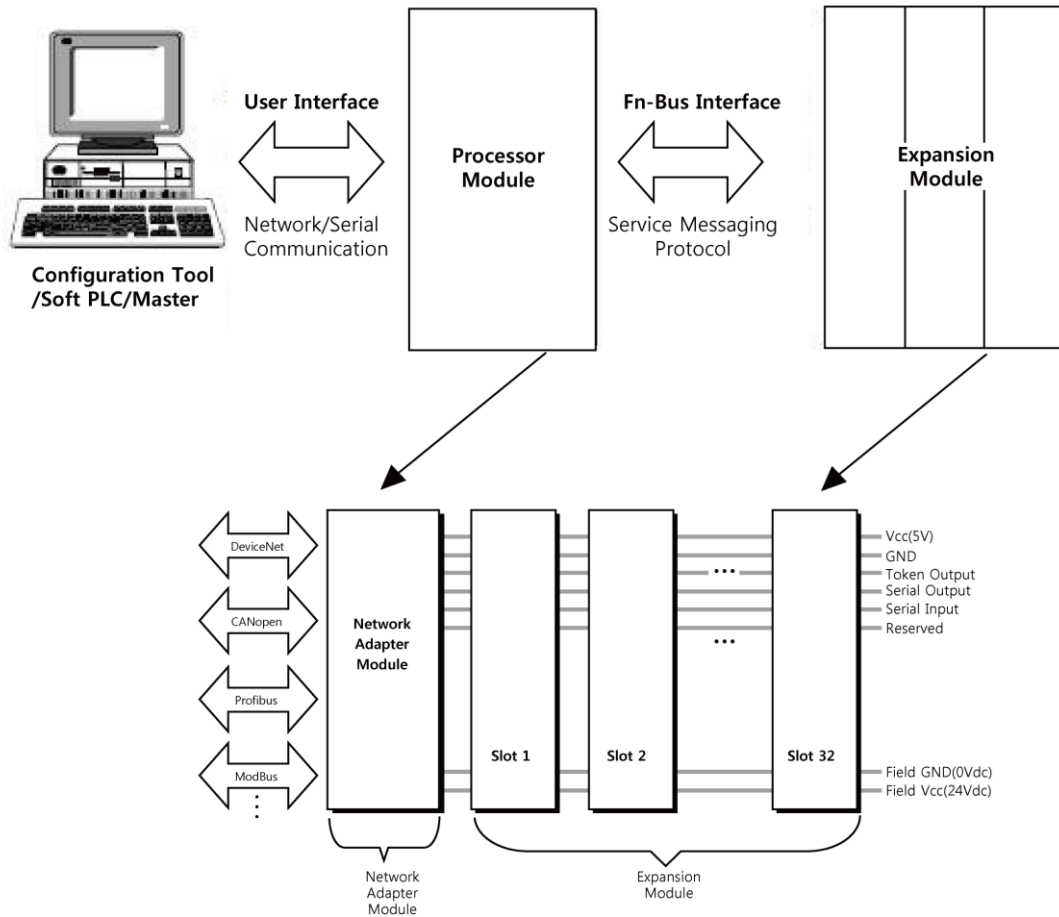
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• Network Adapter Module

The Network Adapter Module forms the link between the field bus and the field devices with the Expansion Modules.

The connection to different field bus systems can be established by each of the corresponding Network Adapter Module, e.g. for SyncNet, PROFIBUS, CANopen, DeviceNet, Ethernet/IP, EtherCAT, CC-Link, MODBUS/Serial, MODBUS/TCP etc.

• Expansion Module

The Expansion Modules are supported a variety of input and output field devices.
There are digital and analog input/output modules and special function modules.

• Two types of FnBus Message

- Service Messaging
- I/O Messaging

5.1.1 FnBus Pin Description

Communication between the NA series and the expansion module as well as system / field power supply of the bus modules is carried out via the internal bus. It is comprised of 6 data pin and 2 field power pin.

Field Power Pins

Data Pins
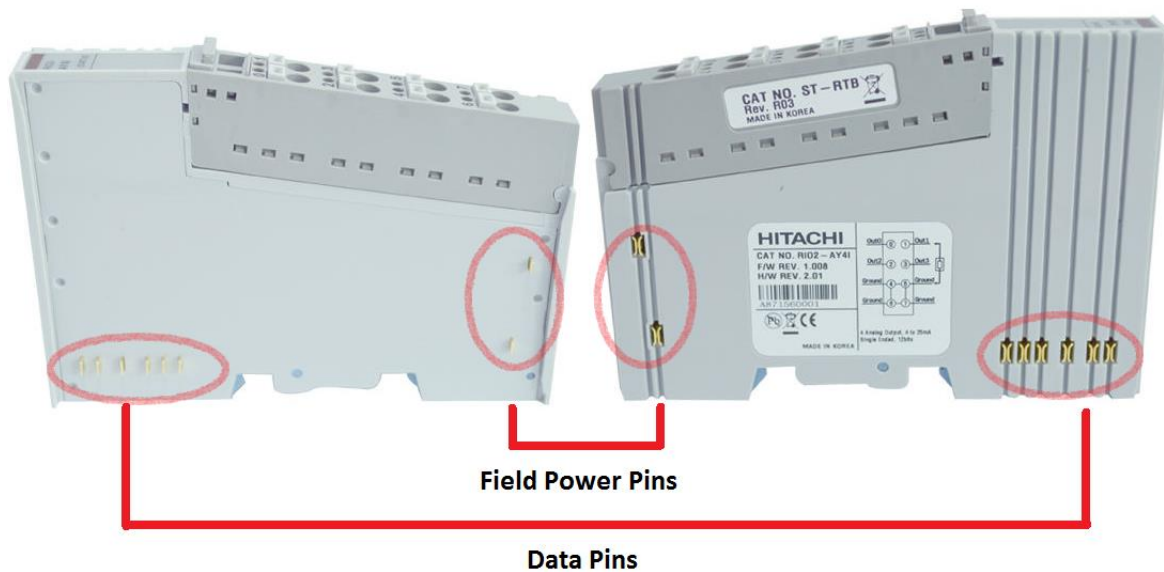
No.	Name	Description
1	Vcc	System supply voltage (5V dc).
2	GND	System Ground.
3	Token Output	Token output port of Processor module.
4	Serial Output	Transmitter output port of Processor module.
5	Serial Input	Receiver input port of Processor module.
6	Reserved	Reserved for bypass Token.
7	Field GND	Field Ground.
8	Field Vcc	Field supply voltage (24Vdc).

DANGER ⚠	Do not touch data and field power pins in order to avoid soiling and damage by ESD noise.

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5.2 EtherCAT Electrical Interface

5.2.1 RIO2-ECA RJ-45 Socket

Ethernet RJ-45 X1 IN →

Ethernet RJ-45 ← X2 OUT

Shielded RJ-45 Socket
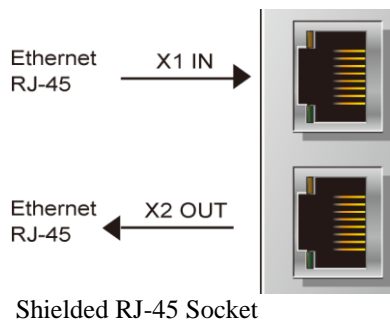
RJ-45	Signal Name	Description
1	TD+	Transmit +
2	TD-	Transmit -
3	RD+	Receive +
4	-	
5	-	
6	RD-	Receive -
7	-	
8	-	
Case	Shield	

ATTENTION ⚠	The use of an incorrect supply voltage or frequency can cause severe damage to the component.

5.2.2 I/O Process Image Map

An expansion module may have 3 types of data as I/O data, configuration parameter and memory register. The data exchange between network adapter and expansion modules is done via an I/O process image data by FnBus protocol. The following figure shows the data flow of process image between network adapter and expansion modules.
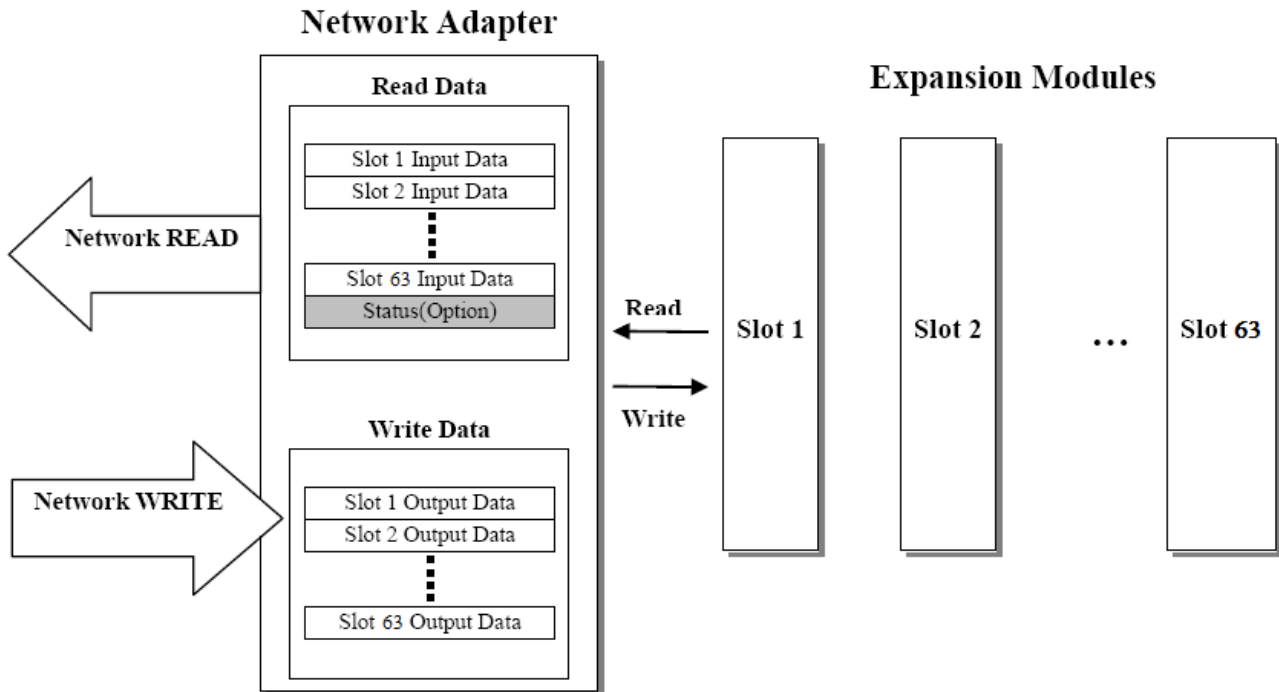
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5.3 Example

5.3.1 Example of Input Process Image (Input Register) Map

Input image data depends on slot position and expansion slot data type. Input process image data is only ordered by expansion slot position.

- **For example slot configuration**

Slot Address	Module Description
#0	EtherCAT Adapter
#1	4-discrete input
#2	8-discrete input
#3	2-analog input
#4	16-discrete input
#5	4-discrete input
#6	8-discrete input
#7	4-discrete input
#8	2-analog input
#9	16-discrete input
#10	4-discrete input

- **Input Process Image**

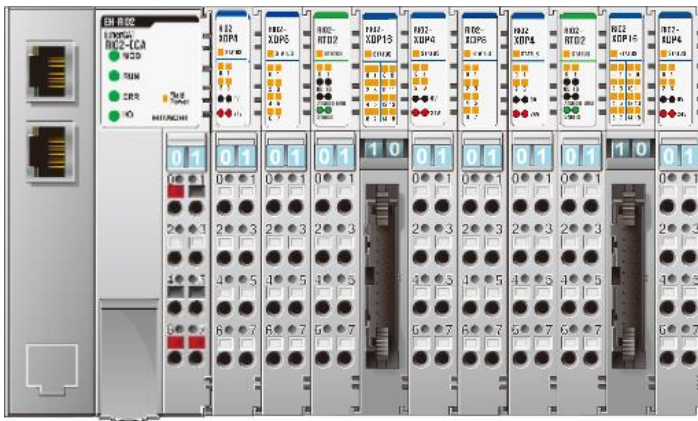| Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte #0	Empty, Always 0				Discrete Input 4 pts (Slot#1)			
Byte #1	Discrete Input 8 pts (Slot#2)							
Byte #2	Analog Input Ch0 low byte (Slot#3)							
Byte #3	Analog Input Ch0 high byte (Slot#3)							
Byte #4	Analog Input Ch1 low byte (Slot#3)							
Byte #5	Analog Input Ch1 high byte (Slot#3)							
Byte #6	Discrete Input low 8 pts (Slot#4)							
Byte #7	Discrete Input high 8 pts (Slot#4)							
Byte #8	Empty, Always 0				Discrete Input 4 pts (Slot#5)			
Byte #9	Discrete Input 8 pts (Slot#6)							
Byte #10	Empty, Always 0				Discrete Input 4 pts (Slot#7)			
Byte #11	Analog Input Ch0 low byte (Slot#8)							
Byte #12	Analog Input Ch0 high byte (Slot#8)							
Byte #13	Analog Input Ch1 low byte (Slot#8)							
Byte #14	Analog Input Ch1 high byte (Slot#8)							
Byte #15	Discrete Input low 8 pts (Slot#9)							
Byte #16	Discrete Input high 8 pts (Slot#9)							
Byte #17	Empty, Always 0				Discrete Input 4 pts (Slot#10)			

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5.3.2 Example of Output Process Image(Output Register) Map

Output image data depends on slot position and expansion slot data type. Output process image data is only ordered by expansion slot.

- **For example slot configuration**

Slot Address	Module Description
#0	EtherCAT Adapter
#1	4-discrete output
#2	8-discrete output
#3	2-analog output
#4	16-discrete output
#5	4-discrete output
#6	8-discrete output
#7	4-relay output
#8	8-relay output
#9	2-analog output
#10	16-discrete output
#11	4-discrete output

- **Output Process Image**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte #0	Empty, Don't care				Discrete Output 4 pts (Slot#1)			
Byte #1	Discrete Output 8 pts (Slot#2)							
Byte #2	Analog Output Ch0 low byte (Slot#3)							
Byte #3	Analog Output Ch0 high byte (Slot#3)							
Byte #4	Analog Output Ch1 low byte (Slot#3)							
Byte #5	Analog Output Ch1 high byte (Slot#3)							
Byte #6	Discrete Output low 8 pts (Slot#4)							
Byte #7	Discrete Output high 8 pts (Slot#4)							
Byte #8	Empty, Don't care				Discrete Output 4 pts (Slot#5)			
Byte #9	Discrete Input 8 pts (Slot#6)							
Byte #10	Empty, Don't care				Discrete Output 4 pts (Slot#7)			
Byte #11	Discrete Output 8 pts (Slot#8)							
Byte #12	Analog Output Ch0 low byte (Slot#9)							
Byte #13	Analog Output Ch0 high byte (Slot#9)							
Byte #14	Analog Output Ch1 low byte (Slot#9)							
Byte #15	Analog Output Ch1 high byte (Slot#9)							
Byte #16	Discrete Output low 8 pts (Slot#10)							
Byte #17	Discrete Output high 8 pts (Slot#10)							
Byte #18	Empty, Don't care				Discrete Output 4 pts (Slot#11)			

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6. ETHERCAT BASICS

6.1 EtherCAT Protocol

The EtherCAT protocol uses an officially assigned EtherType inside the Ethernet Frame. The use of this EtherType allows transport of control data directly within the Ethernet frame without redefining the standard Ethernet frame. The frame may consist of several sub-telegrams, each serving a particular memory area of the logical process images that can be up to 4 gigabytes in size. Addressing of the Ethernet terminals can be in any order because the data sequence is independent of the physical order. Broadcast, Multicast and communication between slaves are possible.

6.2 EtherCAT State Machine

The state of the EtherCAT slave is controlled via the EtherCAT State Machine (ESM). Depending upon the state, different functions are accessible or executable in the EtherCAT slave. Specific commands must be sent by the EtherCAT master to the device in each state, particularly during the bootup of the slave.

A distinction is made between the following states:

- ✓ **Init**
- ✓ **Pre-Operational**
- ✓ **Safe-Operational and**
- ✓ **Operational**
- ✓ **Boot**

The regular state of each EtherCAT slave after bootup is the OP state.
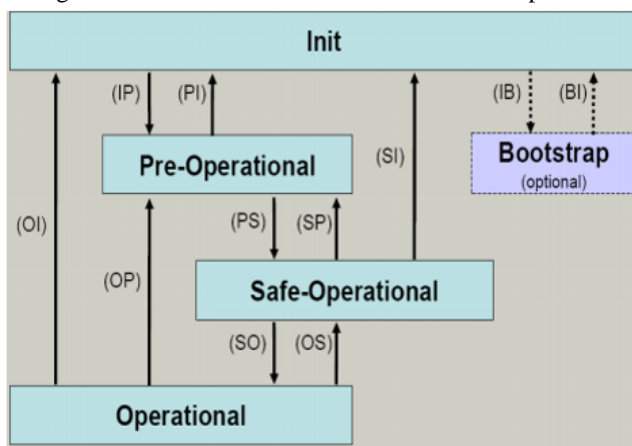
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✓ **Init**
After switch-on the EtherCAT slave in the Init state. No mailbox or process data communication is possible. The EtherCAT master initializes sync manager channels 0 and 1 for mailbox communication.

✓ **Pre-Operational (Pre-Op)**
During the transition between Init and Pre-Op the EtherCAT slave checks whether the mailbox was initialized correctly.

In Pre-Op state mailbox communication is possible, but not process data communication. The EtherCAT master initializes the sync manager channels for process data (from sync manager channel 2), the FMMU channels and, if the slave supports configurable mapping, PDO mapping or the sync manager PDO assignment. In this state the settings for the process data transfer and perhaps terminal-specific parameters that may differ from the default settings are also transferred.

✓ **Safe-Operational (Safe-Op)**
During transition between Pre-Op and Safe-Op the EtherCAT slave checks whether the sync manager channels for process data communication and, if required, the distributed clocks settings are correct. Before it acknowledges the change of state, the EtherCAT slave copies current input data into the associated DP-RAM areas of the EtherCAT slave controller (ECSC).
In Safe-Op state mailbox and process data communication is possible, although the slave keeps its outputs in a safe state, while the input data are updated cyclically.

✓ **Operational (Op)**
Before the EtherCAT master switches the EtherCAT slave from Safe-Op to Op it must transfer valid output data. In the Op state the slave copies the output data of the masters to its outputs. Process data and mailbox communication is possible.

✓ **Boot**
In the Boot state the slave firmware can be updated. The Boot state can only be reached via the Init state.
In the Boot state mailbox communication via the file access over EtherCAT (FoE) protocol is possible, but no other mailbox communication and no process data communication.

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6.3 EtherCAT Mailbox

The device profiles describe the application parameters and the functional behavior of the devices including the device class-specific state machines. For many device classes, fieldbus technology already offers reliable device profiles, for example for I/O devices, drives or valves. Users are familiar with these profiles and the associated parameters and tools. No EtherCAT-specific device profiles have therefore been developed for these device classes. Instead, simple interfaces for existing device profiles are being offered (see Fig. 1).

This greatly assists users and device manufacturers alike during the migration from the existing fieldbus to EtherCAT. At the same time the EtherCAT specification keeps it simple because all the protocols are optional.

The device manufacturer only has to implement the protocol that the device application needs.
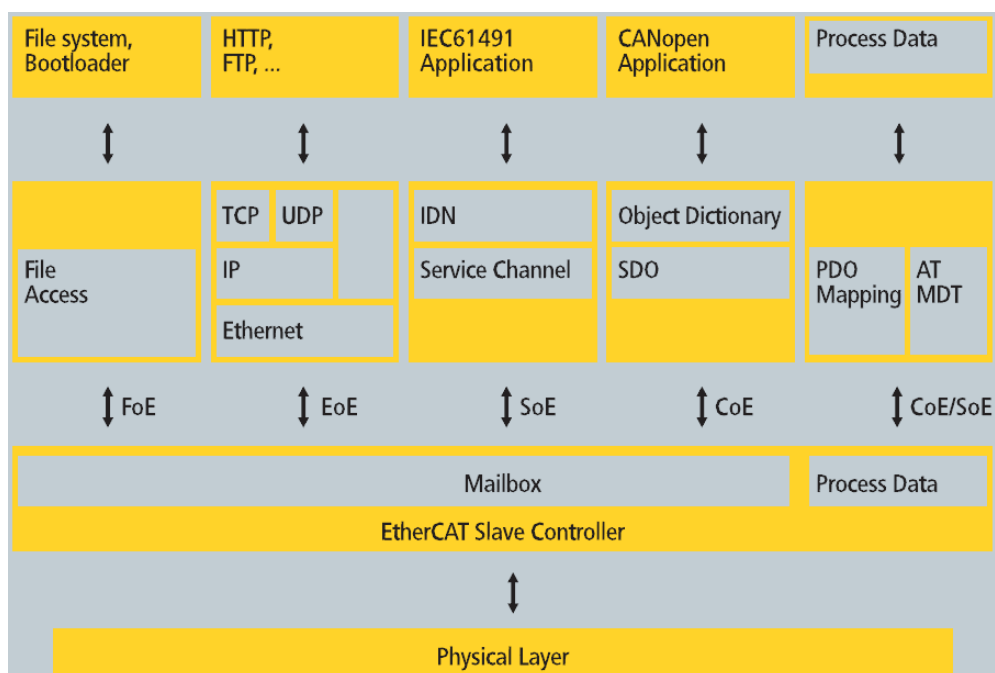
<Fig. 1> Several Device Profiles and Protocols can co-exist side by side

● **CAN application layer over EtherCAT (CoE)**

CANopen® device and application profiles are available for a wide range of device classes and applications, ranging from I/O components, drives, encoders, proportional valves and hydraulic controllers to application profiles for plastic or textile machinery, for example. EtherCAT can provide the same communication mechanisms as the familiar CANopen [1] mechanisms: object dictionary, PDO (process data objects) and SDO (service data objects) – even the network management is comparable. EtherCAT can thus be implemented with minimum effort on devices equipped with CANopen. Large parts of the CANopen firmware can be reused. Objects can optionally be expanded in order to account for the larger bandwidth offered by EtherCAT.

<Refer to 6.4>

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- **Servo drive profile according to IEC 61800-7-204(SERCOS) (SoE)**

SERCOS interface™ is acknowledged as a high-performance real-time communication interface, particularly for motion control applications. The SERCOS profile for servo drives and the communication technology are covered by the IEC 61800-7-204 standard. The mapping of this profile to EtherCAT (SoE) is specified in part 304 [2]. The service channel, and therefore access to all parameters and functions residing in the drive, is based on the EtherCAT mailbox.
Here too, the focus is on compatibility with the existing protocol (access to value, attribute, name, units, etc. of the IDNs) and expandability with regard to data length limitation. The process data, with SERCOS in the form of AT and MDT data, are transferred using EtherCAT device protocol mechanisms. The mapping is similar to the SERCOS mapping. The EtherCAT slave state machine can also be mapped easily to the phases of the SERCOS protocol. EtherCAT provides advanced real-time Ethernet technology for this device profile, which is particularly widespread in CNC applications. Optionally, the command position, speed or torque can be transferred. Depending on the implementation, it is even possible to continue using the same configuration tools for the drives.

- **Ethernet over EtherCAT (EoE)**

The EtherCAT technology is not only fully Ethernet-compatible, but also characterized by particular openness "by design": the protocol tolerates other Ethernet-based services and protocols on the same physical network – usually even with minimum loss of performance. There is no restriction on the type of Ethernet device that can be connected within the EtherCAT segment via a switchport.
The Ethernet frames are tunneled via the EtherCAT protocol, which is the standard approach for internet applications(e.g. VPN, PPPoE (DSL), etc.). The EtherCAT network is fully transparent for the Ethernet device, and the real-time characteristics are not impaired (see Fig. 2).
The master acts like a layer 2 switch that redirects the frames to the respective devices according to the address information. All internet technologies can therefore also be used in the EtherCAT environment: integrated web server, e-mail, FTP transfer, etc.
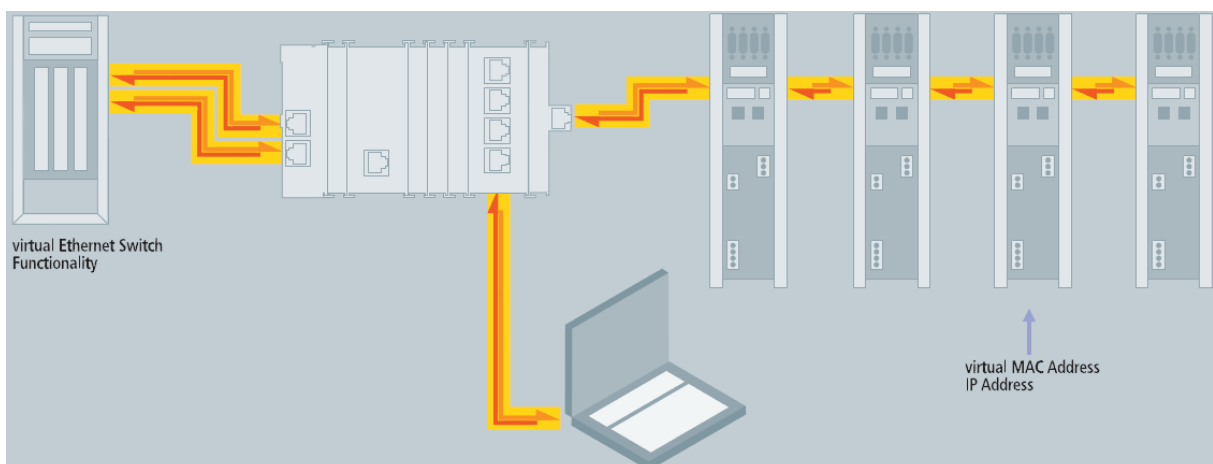
<Fig. 2> Transparent for all Ethernet Protocols

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- **File Access over EtherCAT (FoE)**

  any data structure in the device. Standardized firmware upload to devices is therefore possible, irrespective of whether or not they support TCP/IP.

➢ **Literature**

[1] EN 50325-4: Industrial communications subsystem based on ISO 11898 (CAN) for controller-device interfaces. Part 4: CANopen.

[2] IEC 61800-7-301/304, Adjustable speed electrical power drive systems – Part 7-301: Generic interface and use of profiles for power drive systems – Mapping of profile type 1 to network technologies – Part 7-304: Generic interface and use of profiles for power drive systems – Mapping of profile type 4 to network technologies

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6.4 CoE Interface – parameter management in the EtherCAT system

The CiA organization (CAN in Automation) pursues among other things the goal of creating order and exchangeability between devices of the same type by the standardization of device descriptions. For this purpose so-called profiles are defined, which conclusively describe the changeable and unchangeable parameters of a device. Such a parameter encompasses at least the following characteristics:

- Index number – for the unambiguous identification of all parameters. The index number is divided into a main index and a subindex in order to mark and arrange associated parameters.
  - Main index
  - Subindex, offset by a colon ':'
- Official name – in the form of an understandable, self-descriptive text
- Specification of changeability, e.g. whether it can only be read or can also be written
- A value – depending upon the parameter the value can be a text, a number or another parameter index.

➢ **Example) RIO2-ECA (with RIO2-XDP4, RIO2-YTP4) CoE directory**

Index		Name	Flags	Value
1000		Device type	RO	0x00001389(5001)
1001		Error register	RO	0x00 (0)
1008		Device name	RO	RIO2-ECA(Hitachi Europe GmbH)
1009		Hardware version	RO	RIO2-ECA.v1
100A		Software version	RO	1.001
1018:0		Identity	RO	> 5 <
	1018:01	Vendor ID	RO	0x0000029D (669)
	1018:02	Product Code	RO	0x39313836 (959526966)
	1018:03	Revision	RO	0x00010001 (65537)
	1018:04	Serial Number	RO	0x00000001 (1)
	1018:05	Release date	RO	0x20120625 (538052133)
10F1:0		Error Settings	RO	> 2 <
	10F1:01	Local Error Reaction	RO	0x00000000 (0)
	10F1:02	Sync Error Counter Limit	RO	0x00000004 (4)
1601:0		Slot#2, RIO2-YTP4, RxPDO	RO	> 1 <
	1601:01	SubIndex 001	RO	0x7010:01, 8
1A00:0		Slot#1, RIO2-XDP4, TxPDO	RO	> 1 <
	1A00:01	SubIndex 001	RO	0x6000:01, 8
1A01:0		Slot#2, RIO2-YTP4, TxPDO	RO	> 1 <
	1A01:01	SubIndex	RO	0x6010:01, 8
1C00:0		Sync manager type	RO	> 4 <
	1C00:01	SubIndex 001	RO	0x01 (1)
	1C00:02	SubIndex 002	RO	0x02 (2)
	1C00:03	SubIndex 003	RO	0x03 (3)
	1C00:04	SubIndex 004	RO	0x04 (4)
1C12:0		RxPDO assign	RO	> 0 <
	1C12:01	SubIndex 001	RO	0x1601 (5633)
1C13:0		TxPDO assign	RO	> 0 <
	1C13:01	SubIndex 001	RO	0x1A00 (6656)
	1C13:02	SubIndex 002	RO	0x1A01 (6657)

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6000:0		RIO2-XDP4 (Input)	RO	> 1 <
└	6000:01	Byte#0	RO P	0x00 (0)
6010:0		RIO2-YTP4 (Output)	RO	> 1 <
└	6010:01	Byte#0	RO P	0x00 (0)
7010:0		RIO2-YTP4 (Output)	RO	> 1 <
└	7010:01	Byte#0	RO P	0x00 (0)
8010:0		RIO2-YTP4 (Parameter)	RO	> 2 <
├	8010:01	Byte#0	RW	0x00 (0)
└	8010:02	Byte#1	RW	0x00 (0)
F000:0		Modular device profile	RO	> 2 <
├	F000:01	Module index distance	RO	0x0010 (16)
└	F000:02	Maximum number of modules	RO	0x0020 (32)
F010:0		Module list	RO	> 2 <
├	F010:01	SubIndex 001	RO	0x00001224 (4644)
└	F010:02	SubIndex 002	RO	0x00002414 (9236)

● Index Range

The relevant ranges for EtherCAT fieldbus users are:

x1000 : This is where fixed identity information for the device is stored, including name, manufacturer, serial number etc., plus information about the current and available process data configurations.
x8000 : This is where the operational and functional parameters for all channels are stored, such as filter settings or output frequency.

Other important ranges are:

x4000 : In some EtherCAT devices the channel parameters are stored here (as an alternative to the x8000 range).
x6000 : Input PDOs ("input" from the perspective of the EtherCAT master)
x7000 : Output PDOs ("output" from the perspective of the EtherCAT master)

6.5 EtherCAT Reference

EtherCAT Reference Documents
http://www.ethercat.org

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7. APPENDIX A

A.1. Product List

No.	Model name	Description	ID(hex)			Production Status
Digital Input Module						
	RIO2-XDP4	4 Points, Sink(Positive), 12V/24Vdc,	41	00	03	Active
	RIO2-XDP8	8 Points, Sink(Positive), 12V/24Vdc,	41	00	07	Active
	RIO2-XDP16	16 Points, Sink(Positive), 12V/24Vdc,	41	01	13	Active
	RIO2-XAH4	4 Points, 220Vac,	41	00	0A	Active
Digital Output Module						
	RIO2-YTP16	16 Points Source(Positive Logic), 24Vdc/0.5A,	81	01	16	Active
	RIO2-YTP4	4 Points Source(Positive Logic), 24Vdc/0.5A,	81	00	10	Active
	RIO2-YTP8	8 Points Source(Positive Logic), 24Vdc/0.5A,	81	00	12	Active
	RIO2-YTP4C	4 Points Source(Positive Logic), 24Vdc/2A,	81	00	3C	Active
	RIO2-YR8	8 Points, 230Vac/2A, 24Vdc/2A, Relay	81	00	50	Active
Analog Input Module						
	RIO2-AX4I	4 Channels, Current, 4~20mA, 12bit	41	43	1D	Active
	RIO2-AX8I	8 Channels, Current, 4~20mA, 12bit	41	47	83	Active
	RIO2-AX4V	4 Channels, Voltage, 0~10Vdc, 12bit	41	43	20	Active
	RIO2-AX8V	8 Channels, Voltage, 0~10Vdc, 12bit	41	47	22	Active
	RIO2-AX4H	4 Channels, Voltage, -10Vdc~10Vdc, 12bit	41	43	21	Active
	RIO2-RTD2	2 Channels, RTD, Status	41	41	28	Active
	RIO2-RTD4	4 Channels, RTD, Status	41	43	64	Active
	RIO2-RTD8	8 Channels, RTD, Status	41	47	65	Active
	RIO2-TC2	2 Channels, TC	41	41	2A	Active
	RIO2-TC4	4 Channels, TC	41	43	66	Active
Analog Output Module						
	RIO2-AY2I	2 Channels, Current, 4~20mA, 12bit	81	41	2D	Active
	RIO2-AY4I	4 Channels, Current, 4~20mA, 12bit	81	43	6E	Active
	RIO2-AY2V	2 Channels, Voltage, 0~10Vdc, 12bit	81	41	2E	Active
	RIO2-AY4V	4 Channels, Voltage, 0~10Vdc, 12bit	81	43	6A	Active
	RIO2-AY2H	2 Channels, Voltage, -10~10Vdc, 12bit	81	41	2F	Active

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No.	Model name	Description	ID(hex)				Production Status
Special Module							
	RIO2-CU24	1 Channel, High Speed Counter, 24V Input	C1	01	05	39	Active
	RIO2-CU24L	2 Channel, High Speed Counter, 24V Sink Input	C1	01	07	4D	Active
	RIO2-RS232	RS232 Communication, 1Channel, RTS/CTS Flow Control	C1	05	05	42	Active
	RIO2-RS485	RS485 Communication, 1Channel	C1	05	05	45	Active
	RIO2-PWM2	2 CH PWM output, 0.5A/24Vdc, source	C1	05	01	56	Active
	RIO2-PO2	2 CH Pulse output, 0.5A/24Vdc, source	C1	09	07	90	Active

A.2. Glossary

- System Power: The power for starting up CPU.
- Field Power: The power for input and output line.
- Terminator Resistor: Resistor for prevention reflected wave.
- EDS: Electronic Data Sheet.
- sinking: The method of input and output what device does not have power source.
- sourcing: The method of input and output what device have power source.

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