

ECAT-201x EtherCAT Slave I/O Modules User Manual

English Ver. 1.2, Dec. 2019



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SUPPORT

ECAT-2011H

ECAT-2012H

ECAT-2016N

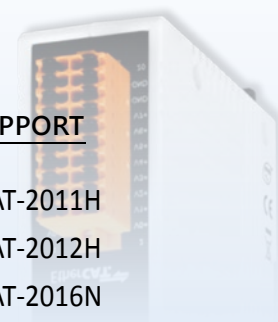


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1. Introduction

The ECAT-2000 is equipped with the EtherCAT protocol and installed by daisy chain connection which permits the flexibility in devices installation and reduces infrastructure and operation costs. All the modules can be deployed in the network topologies such as star, line or ring.

The ECAT-2011H/2012H is built in 8-ch differential inputs or 16-ch single-ended analog inputs by software selectable, ECAT-2016N is built in 1-ch strain gauge. It has passed and verified by the conformance test tool, therefore eligible EtherCAT Master or configurator can manipulate it simply and implement your various applications easily.

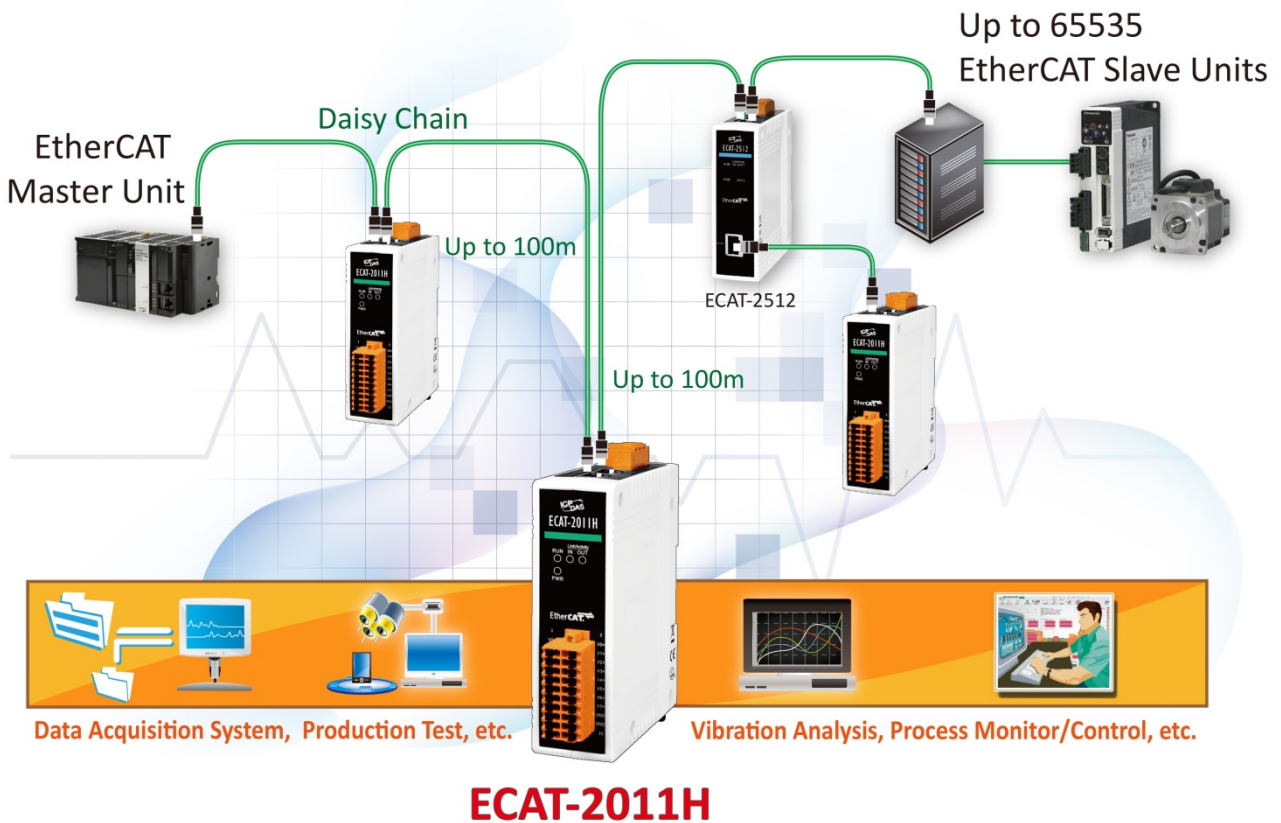


Figure 1.1 Typical Application of ECAT-2011H

1.1 Package List

The shipping package includes the following items:



ECAT-2011H/
ECAT-2012H/
ECAT-2016N



Quick Start



NOTE

If any of these items is missing or damaged, please contact your local distributor for more information. Keep the shipping materials and overall package in case you want to ship the module back in the future.

More Information

- Manual/QuickStart/Datasheet:

http://ftp.icpdas.com/pub/cd/fieldbus_cd/ethercat/slave/ecat-2000/manual/

- XML Device Description(ESI):

http://ftp.icpdas.com/pub/cd/fieldbus_cd/ethercat/slave/ecat-2000/software/

- FAQ:

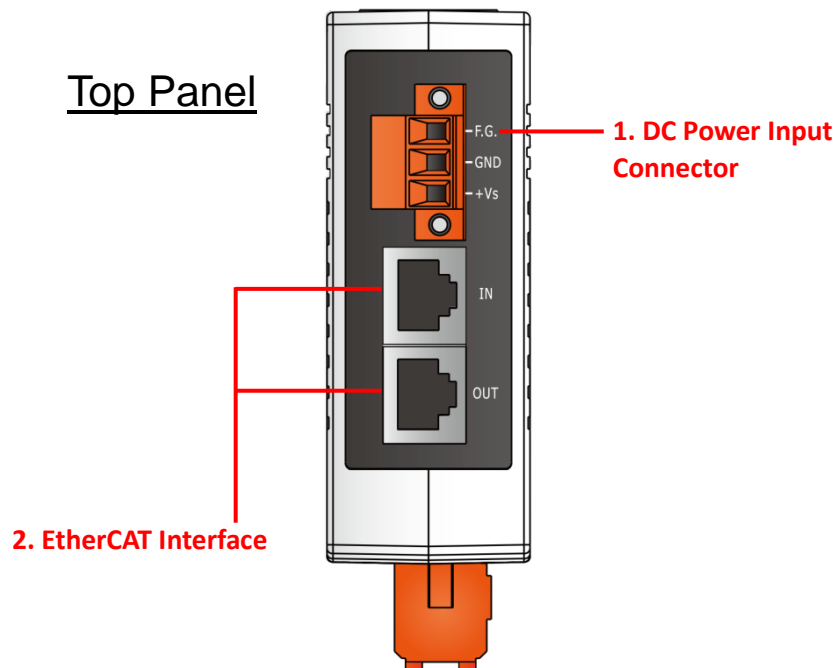
<http://www.icpdas.com/root/support/faq/faq.html>



2. Hardware Information

2.1 Appearance

The front panel and top panel of the ECAT module contain the I/O connector, LEDs, Ethernet Port and power connector.



1. DC Power Input Connector

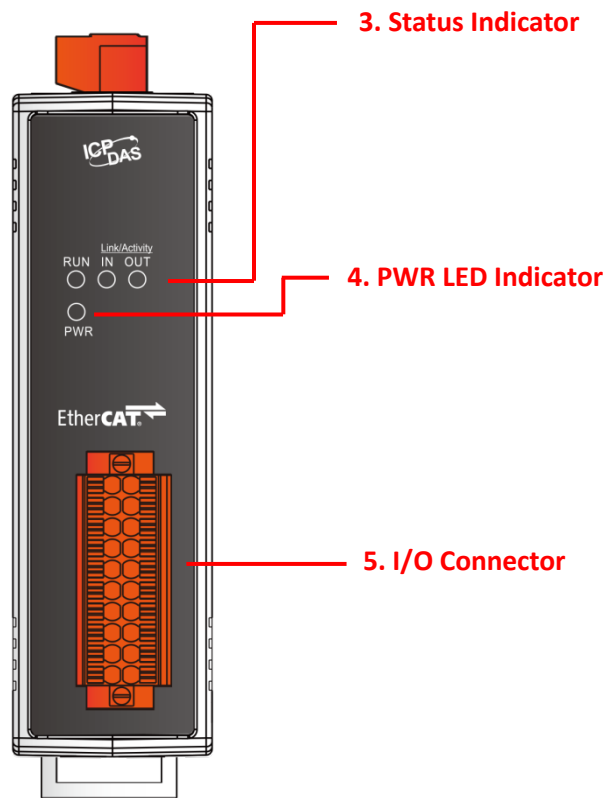
The “+Vs” and “GND” pins are used for the power supply applies to all types of ECAT module. The valid power voltage range is from **+10 to +30 V_{DC}**.

The definition of “**F.G.**” (**Frame Ground**): Electronic circuits are constantly vulnerable to Electrostatic Discharge (ESD), which becomes worse in a continental climate area. ECAT module feature a new design for the frame ground, which provides a path that bypasses ESD, resulting in an enhanced ESD protection capability and ensuring that the module is more reliable.

2. EtherCAT Interface

ECAT modules are equipped with two RJ-45 EtherCAT Interface ports. **IN** is EtherCAT signal input port that connect EtherCAT Master or EtherCAT signal output of previous EtherCAT slave module · **OUT** is EtherCAT signal output that connect the next EtherCAT signal input of EtherCAT slave module.

Front Panel



3. Status Indicator

Notation	Color	States	Description
RUN	Green	Off	The device is in state INIT
		Blinking	The device is in state PRE-OPERARIONAL
		Single Flash	The device is in state SAFE-OPERARIONAL
		On	The device is in state OPERARIONAL
Link Activity IN/OUT	Green	Off	No link
		Blinking	Link and activity
		On	Link without activity

4. PWR LED Indicator

Once power is supplied to the ECAT module, the system LED indicator will illuminate.

5. I/O Connector

For more detailed information regarding the pin assignments for the I/O connector, refer to [Section 2.3 "Pin Assignments"](#).

2.2 Specification

2.2.1 System Specification

Item	Specification
Communication	
Ethernet Port	2 x RJ-45, 100 BASE-TX
Protocol	EtherCAT
Distance between Station	Max. 100 m (100 BASE-TX)
Data Transfer Medium	Ethernet/EtherCAT Cable (Min. CAT 5), Shielded
LED Indicators	
PWR	1
L/A IN (Link/Activity IN)	1
L/A OUT (Link/Activity OUT)	1
RUN	1
EMS Protection	
ESD (IEC 61000-4-2)	4 KV Contact for Each Channel
EFT (IEC 61000-4-4)	Power: 1 KV Class A; Signal: 1 KV Class A
Surge (IEC 61000-4-5)	1 KV Class A
Hi-Pot	1KV Class A
Power	
Powered from Terminal Block	+10 ~ +30 V _{DC}
Power Consumption	4 W (Max.)
Mechanical	
Installation	DIN-Rail Mounting
Dimensions (L x W x H)	110 mm x 90 mm x 33 mm
Environment	
Operating Temperature	-25 ~ +75°C
Storage Temperature	-30 ~ +80°C
Relative Humidity	10 ~ 90% RH, Non-condensing



2.2.2 I/O Specification

Model	ECT-2011H	ECAT-2012H
Analog Input		
Channels	8/16	
Wire Connection	8 Differential or 16 Single-ended (Software Selectable)	
Type	Voltage, Current	
Range	0~10 V, ±10 V, ±5 V, ±2.5 V, 0~ 20 mA, ±20 mA, 4~20mA, ±4~20mA (Software selectable)	
Resolution	12-bit	16-bit
Accuracy	0.2% of FSR	0.05% FSR
Sampling Rate	1 kHz per channel	1 kHz per channel (Max. for 6 channel enable)
Distributed clocks	-	
Individual Channel Configuration	Yes	
Over Voltage Protection	±35 V _{DC}	
Open Wire Detection for +4 ~ +20mA	Yes	

Model	ECT-2016N
Strain Gauge Input	
Channels	1
Sensor	Full-Bridge
Type	Voltage, Current
Range	±1.25 V, ±600 mV, ±300 mV, ±125 mV, ±80 mV, ±60 mV, ±40 mV, ±30 mV, ±20 mV, ±10 mV (Software selectable)
Resolution	16-bit
Accuracy	±0.1% FSR
Sampling Rate	1k Hz per channel
Distributed clocks	-
Input Impedance	20 MΩ
Excitation Voltage	
Channel	1
Output Voltage	10 V _{DC}
Max. Load Current	40 mA


2.3 Pin Assignments

EtherCAT Interface

Terminal No.	Pin Assignment
PWR	F.G.
	GND
	+ Vs
IN	
OUT	


Differential Input(ECAT-2011H/ECAT-2012H)

Terminal No.	Pin Assignment	Pin Assignment	Terminal No.
1	V0-	V0+	2
3	V1-	V1+	4
5	V2-	V2+	6
7	V3-	V3+	8
9	V4-	V4+	10
11	V5-	V5+	12
13	V6-	V6+	14
15	V7-	V7+	16
17	AGND	AGND	18
19	AGND	AGND	20




Single-ended Input(ECAT-2011H/ECAT-2012H)

Terminal No.	Pin Assignment	Pin Assignment	Terminal No.
1	V8	V0	2
3	V9	V1	4
5	V10	V2	6
7	V11	V3	8
9	V12	V4	10
11	V13	V5	12
13	V14	V6	14
15	V15	V7	16
17	AGND	AGND	18
19	AGND	AGND	20



Strain Gauge Input (ECAT-2016N)

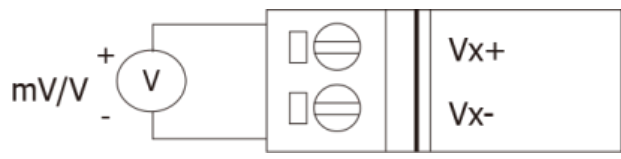
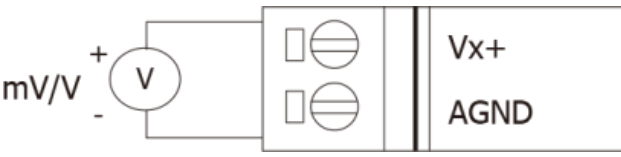
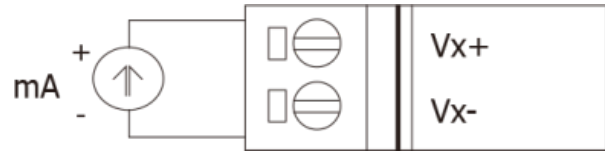
Terminal No.	Pin Assignment	Pin Assignment	Terminal No.
1	EXT.PWR	EXT.PWR	2
3	EXT.PWR	EXT.PWR	4
5	EXT.GND	EXT.GND	6
7	EXT.GND	EXT.GND	8
9	Exc+	Exc+	10
11	Vin+	Vin+	12
13	Vin-	Vin-	14
15	GND	GND	16
17	N/A	N/A	18
19	N/A	N/A	20



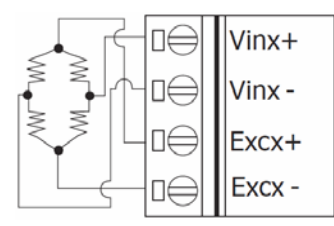
2.4 Wiring Connections

The factory default settings of ECAT-2011H/2012H is differentail input. You can refer to [Section "AD Input Type Selection"](#) to change the input type. For more details regarding the voltage and current wirings, refer to the table below.

NOTE: x = channel unumber

Voltage Input (Differential)	
	(Default Settings)
Voltage Input (Single-ended)	
	
Currnet Input	
	

ECAT-2016N is Strain Guage Input

Strain Guage Input	
	(Default Settings)

2.5 Wiring to the Connector

A tip for connection the wire to the connector

1 Use the blade of a flat-head screwdriver to push the wire clamp, then hold until step 2 complete.

2 Insert the wire

Insulated Terminals Dimensions

Dimensions (Unit: mm)				
Item NO.	F	L	C	W
CE007512	12.0	18.0	1.2	2.8

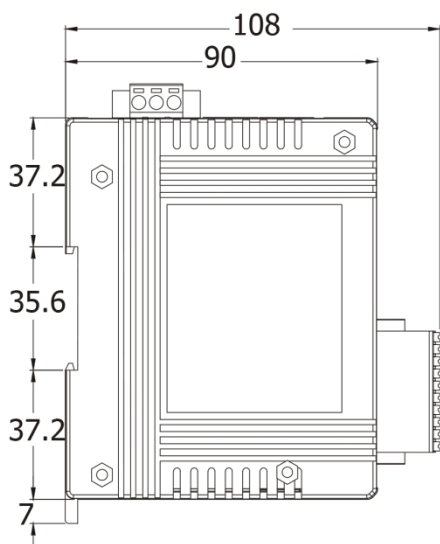
A tip for removing the wire from the connector

1 Use the blade of a flat-head screwdriver to push the wire clamp, then hold until step 2 complete.

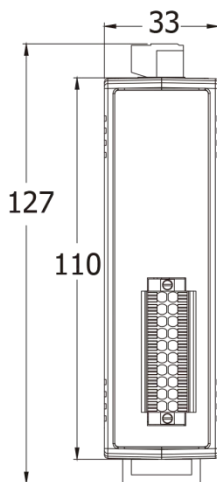
2 Remove the wire

2.6 Dimensions

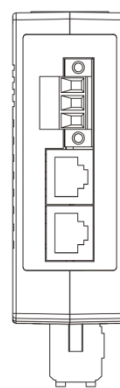
The following diagrams provide the dimensions of the ECAT module and can be used as a reference when defining the specifications for any custom enclosures. All dimensions are in millimeters.



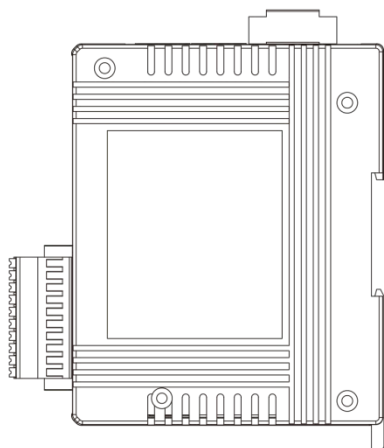
Left Side



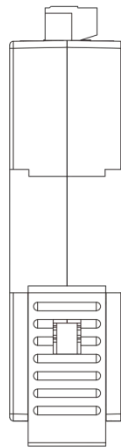
Front



Top



Right Side



Rear



Bottom

3. Getting Started

This chapter provides a basic overview of how to configure and operate your ECAT-2011H module.

3.1 Connecting the Power and the Host PC

Step 1 Connect the IN port on the ECAT-2011H module to the RJ-45 Ethernet port on the Host PC.

Ensure that the network settings on the Host PC have been correctly configured and the connection is functioning normally. Ensure that the Windows or 3rd-party firewall or any Anti-virus software is properly configured to allow incoming connections, or temporarily disable these functions.

NOTE

Attaching an ESC (EtherCAT Slave Controller) directly to an office network will result in network flooding, since the ESC will reflect any frame – especially broadcast frames – back into the network (broadcast storm).

- ❶ Connect the Host device to the **IN Port** on the ECAT module.
- ❷ Connect the **+Vs** pin on the ECAT module to the positive terminal on a **+10 ~ +30 V_{DC}** power supply, and connect the **GND** pin on the ECAT module to the **negative terminal**.

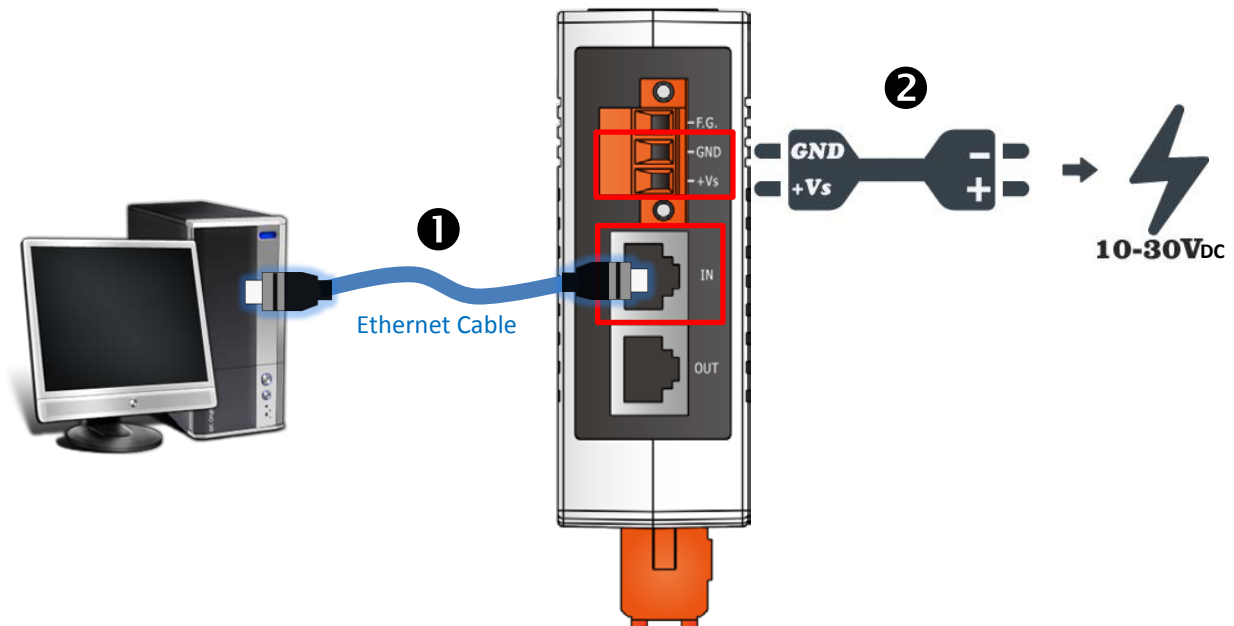


Figure 3-1.1

Step 2 Verify that the LEDs indicators on the ECAT module are illuminated as illustrated below:

- ❶ Once the power is connected, the “PWR” LED should be illuminated in red.
- ❷ Once the Ethernet link is detected, the “IN” LED should flash in green.
- ❸ Once the ECAT module connected to EtherCAT Master, the “RUN” LED should be illuminated in red.

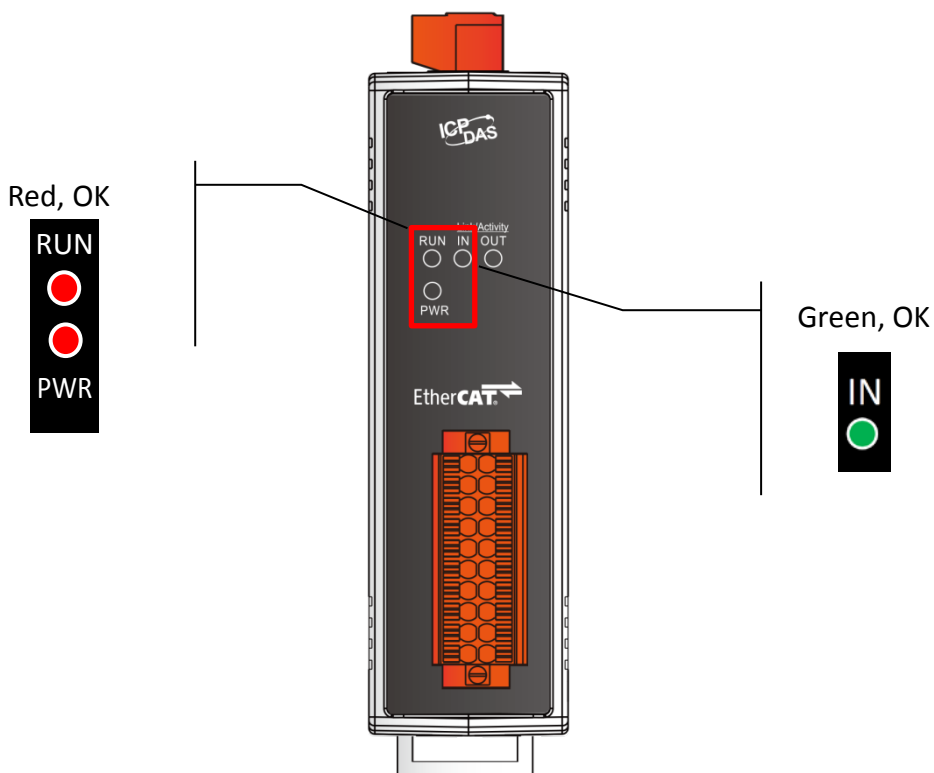


Figure 3-1.2

3.2 Configuration and Operation

Before following the steps below, you must first install the EtherCAT Master software (e.g., Beckhoff TwinCAT, refer to <http://infosys.beckhoff.com>). In this example, we will use **Beckhoff TwinCAT 2.x** to configuring and operating the ECAT module, and **Beckhoff TwinCAT 2.X** is the most commonly used EtherCAT Master Software.

Inserting into the EtherCAT network



NOTE

Installation the latest XML device description(ESI)

Ensure that the latest XML device description has been installed in the appropriate TwinCAT folder. The ESI file can be downloaded from the ICP DAS web site (http://ftp.icpdas.com/pub/cd/fieldbus_cd/ethercat/slave/ecat-2000/software/), and should be installed according to the installation instructions.

Step 1 Install the ESI file

ESI Filename, as indicated in the table below.

Module	Filename
ECAT-2011H	ICPDAS_ECAT-2011.xml
ECAT-2012H	ICPDAS_ECAT-2012.xml
ECAT-2016N	ICPDAS_ECAT-2016.xml

Copy the **ESI** file to the **appropriate Master Tools installation folder**, as indicated in the table below.

Software	Default Path
Beckhoff EtherCAT Configuration	C:\EtherCAT_Configurator\EtherCAT
Beckhoff TwinCAT 3.X	C:\TwinCAT\3.x\Config\Io\EtherCAT
Beckhoff TwinCAT 2.X	C:\TwinCAT\Io\EtherCAT

Step 2 Automatic Scanning

The EtherCAT system must be in a safe, de-energized state before the EtherCAT slave I/O module is connected to the EtherCAT network!

- 1 Switch on the operating power supply, launch the TwinCAT System Manager (Config mode), and scan in the devices, as illustrated in the Figure 3-2.1 below.

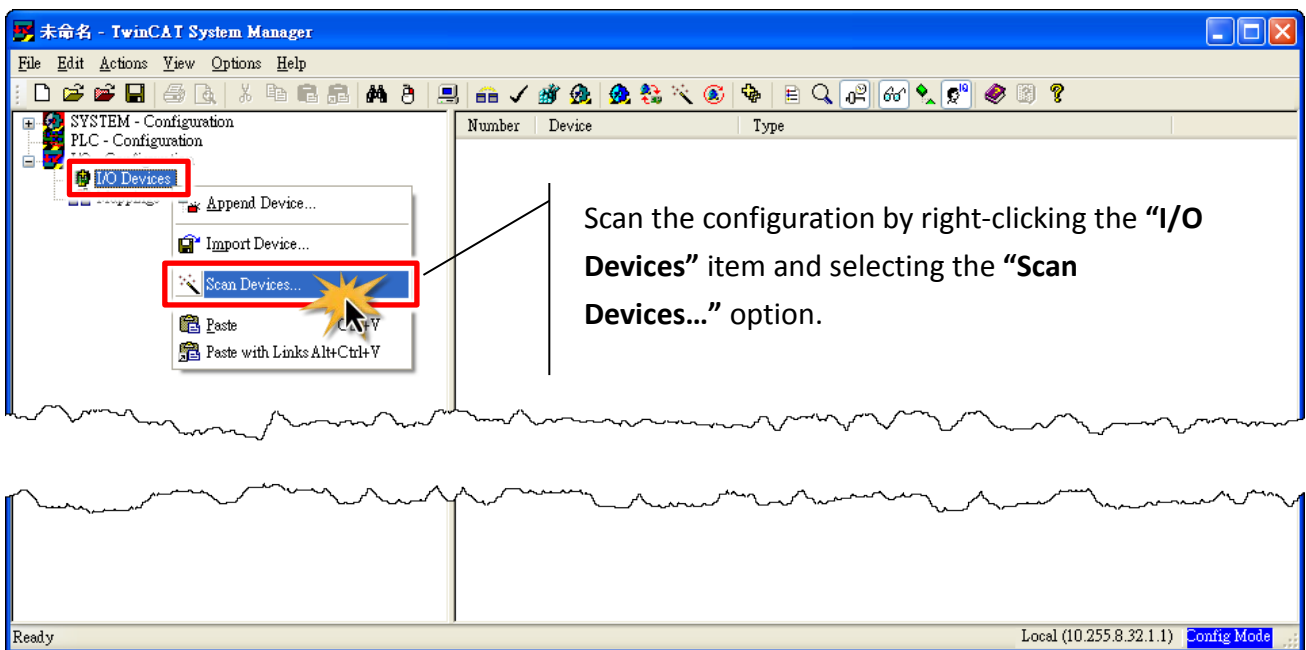


Figure 3-2.1

- 2 Click the “OK” button for all dialogs when requested, ensuring that the configuration is set to “FreeRun” mode.

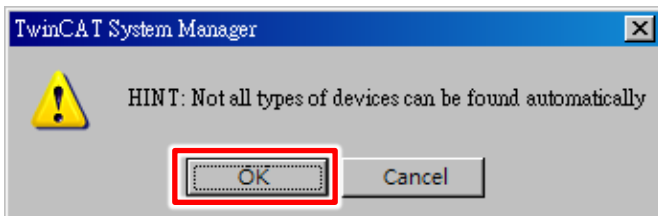
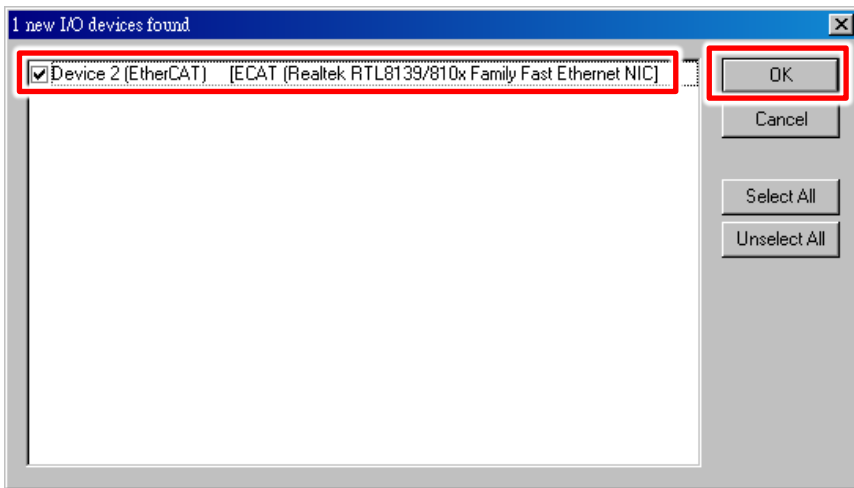
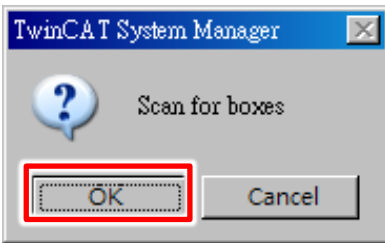


Figure 3-2.2



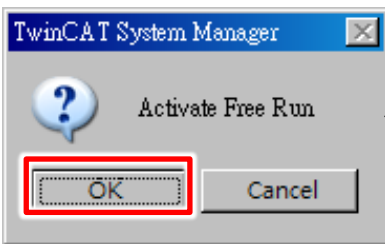
Choose the correct network device which is connected to module and click "OK" button

Figure 3-2.3



Click "OK" to start scanning

Figure 3-2.4



Click "OK" to activate the free run mode

Figure 3-2.5

In the left-hand window, **ECAT** module is now shown in the TwinCAT System Manager.

In the right-hand window, the ECAT module is parameterized via "**Process Data**" and "**CoE-Online**" tabs in the TwinCAT System Manager.

- **Process Data:** The process data-specific settings.
- **CoE-Online:** Settings parameter, refer to [Chapter 4 "Object Description and Parameterization"](#) for details.

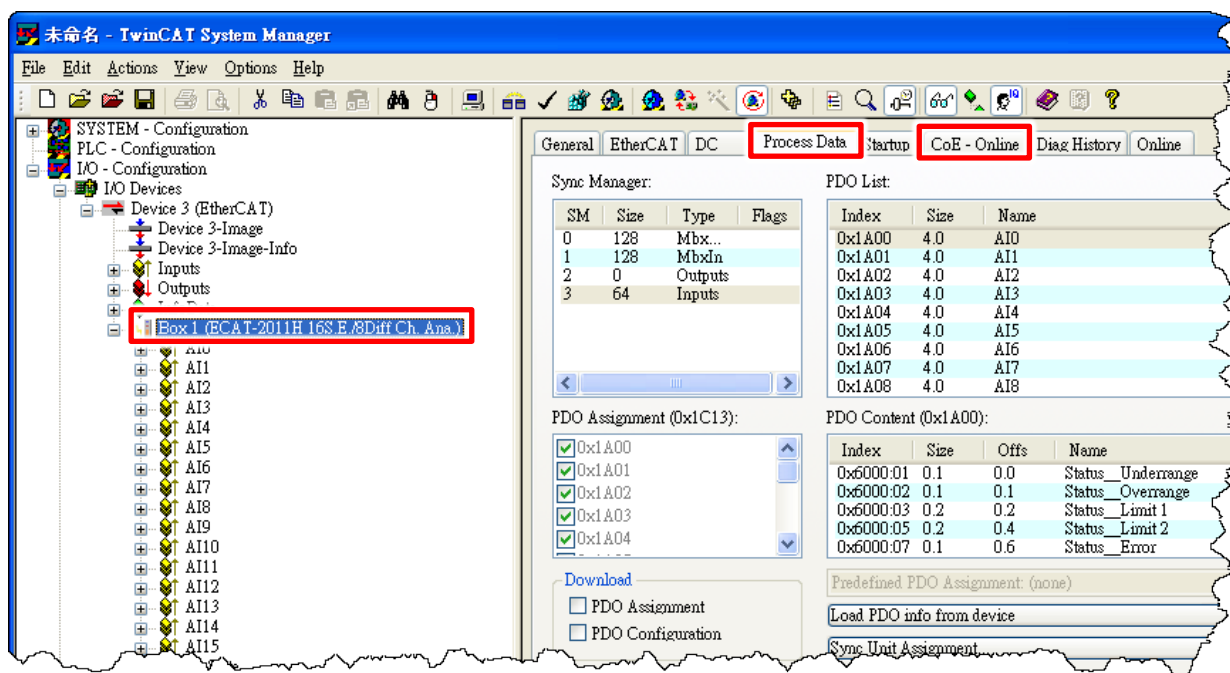
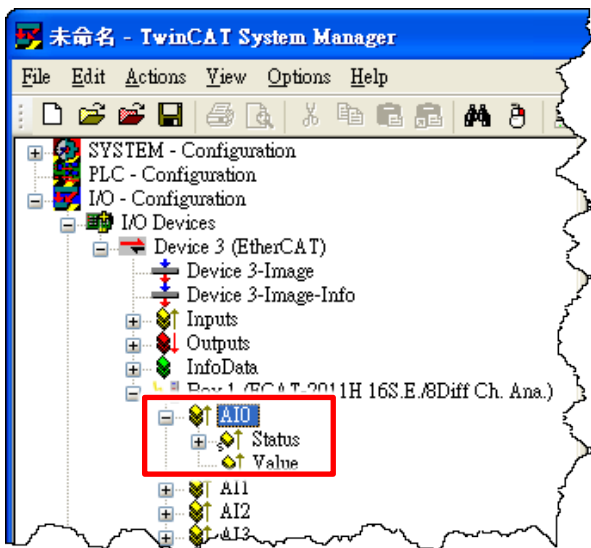


Figure 3-2.6



The modul offer two different process data per analog channel for transmission: the analog value **Value (16-bit)** and status information **Status (16-bit)**

Figure 3-2.7

In the left-hand window, clicking on the “**Status**” variable in the configuration tree (A), the structure can be opened for linking (B). In order to be able to read the bit meanings in plain text in the online display (C), click the Analog Input channel (e.g, AI0) and then click the “**Show Sub Variables**” button to display all subvariables and the structure contents of the status word, refer to table 3-2-1 below for more details.

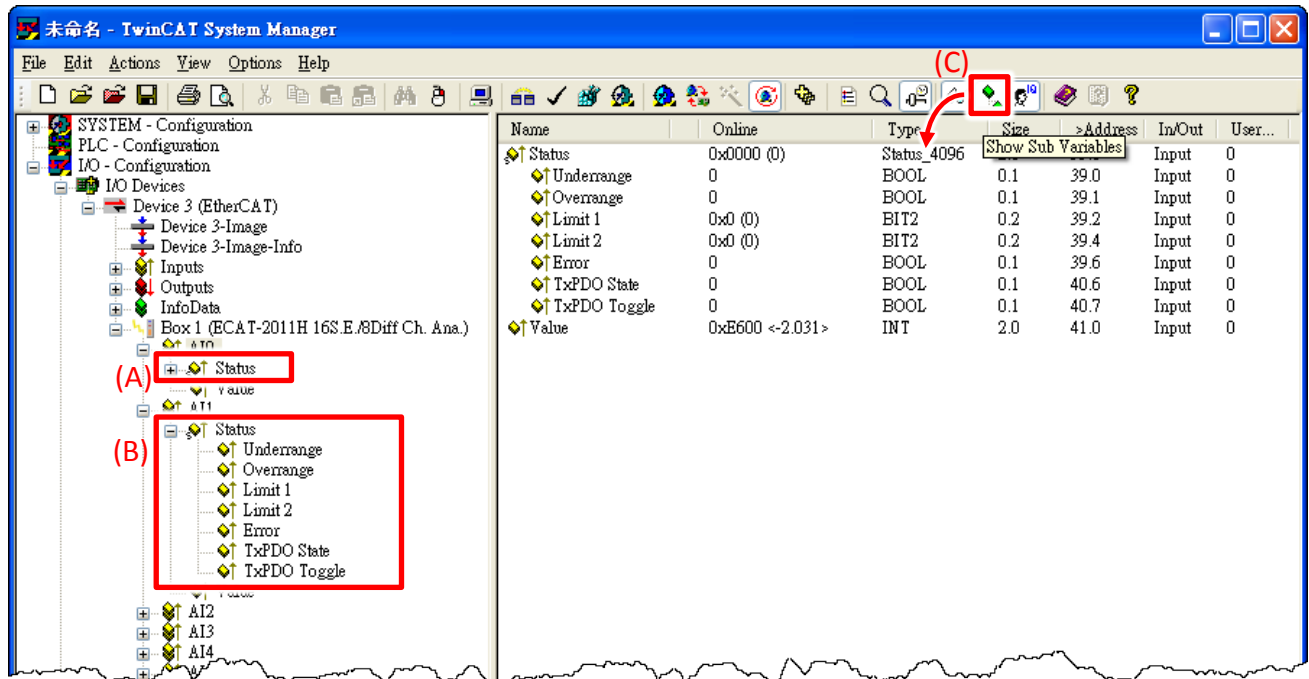


Figure 3-2.8

Table 3-2-1: Status Word (SW) are defined as:

Bit	Name	Description
SW.15	TxPDO Toggle	Toggles with each new analog process value, refer Index 0x60n0:10 for details.
SW.14	TxPDO State	TRUE in the case of an internal error, refer Index 0x60n0:0F for details.
SW.13	-	-
SW.12	-	-
SW.11	-	-
SW.10	-	-
SW.9	-	-
SW.8	-	-
SW.7	-	-
SW.6	EEROR	General error bit, is set together with overrange and underrange, refer Index 0x60n0:07 for details.
SW.5	Limit 2	<p>If the value exceeds or falls below these values, which can be entered in the Index 0x80n0:14, then the bits in the Index 0x60n0:05 is set accordingly. The Index 08n0:08 respectively serve to activate the limit value monitoring.</p> <p>Output Limit 2 (2-bit):</p> <p>0: not active 1: Value is smaller than Limit Value2 2: Value is larger than Limit Value2 3: Value is equal to Limit Value2</p>
SW.4		
SW.3	Limit 1	<p>If the value exceeds or falls below these values, which can be entered in the Index 0x80n0:13, then the bits in the Index 0x60n0:03 is set accordingly. The Index 08n0:07 respectively serve to activate the limit value monitoring.</p> <p>Output Limit 1 (2-bit):</p> <p>0: not active 1: Value is smaller than Limit Value1 2: Value is larger than Limit Value1 3: Value is equal to Limit Value1</p>
SW.2		
SW.1	Overrange	Analog input signal lies above the upper permissible threshold for this terminal, refer Index 0x60n0:02 for details.
SW.0	Underrange	Analog Input signal lies under the lower permissible threshold for this terminal, refer Index 0x60n0:01 for details.

3.3 Self-Test

This chapter can give you the detail steps about self-test. In this way, user can confirm that ECAT-2011H/2012H well or not. Before the self-test, you must prepare a stable signal source (e.g., dry battery) is available, and than follow the steps described below:

- ❶ Wire the **stable signal source (e.g., dry battery)** to **AI channel 0**.
- ❷ ECAT-2011H/2012H connect the **V0- (Pin01)** to **signal positive(-)**, ECAT-2016N connect the **VIn- (Pin14)** to **signal positive(-)**.
- ❸ ECAT-2011H/2012H connect the **V0+ (Pin02)** to **signal positive(+)**, ECAT-2016N connect the **VIn+ (Pin11)** to **signal positive(+)**.

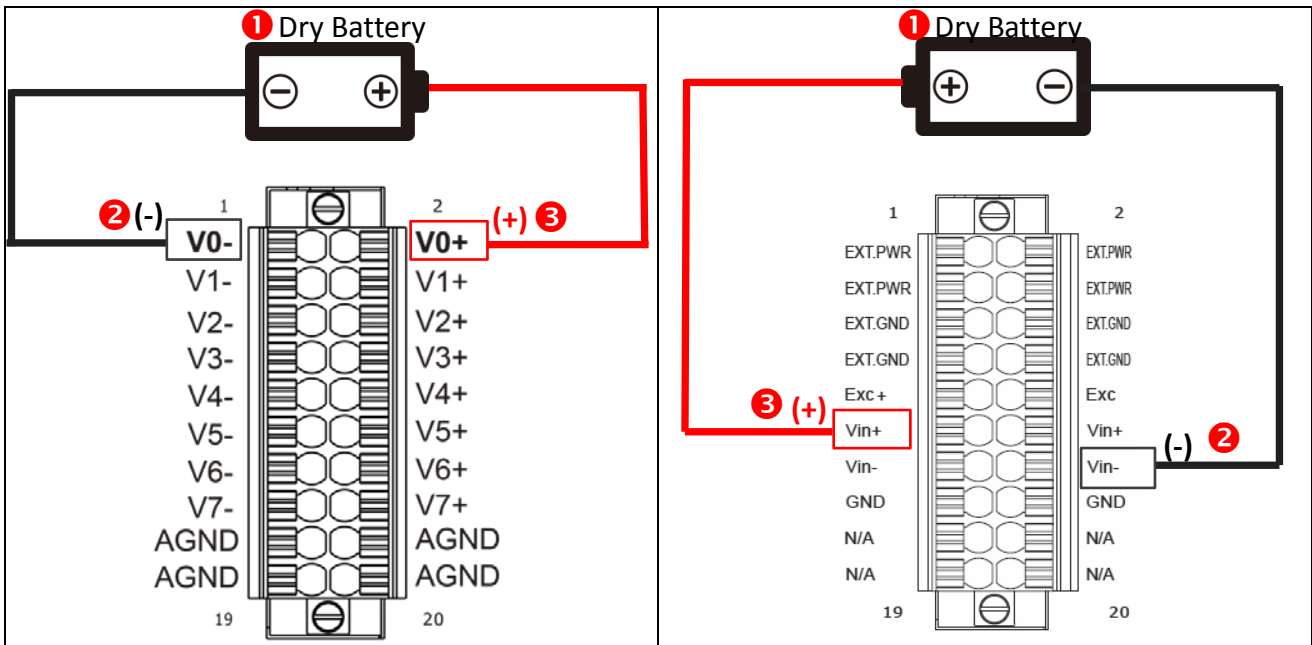


Figure 3-3.1

- ④ In the left-hand window, click “A10” to get and configure state.
- ⑤ In the right-hand window, check the voltage vaule in the “Value” item.

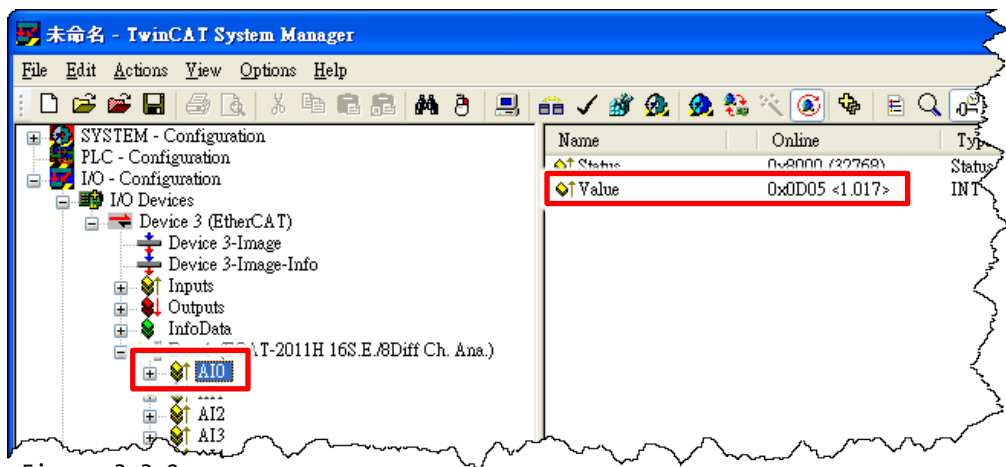


Figure 3-3.2

AD Input Type Selection(ECAT-2011H/2012H)

The ECAT-2011H/2012H provides 8-channel of differential inputs or 16-channel single-ended inputs. **The factory default settings is differential input.** Refer to the following instructions for details of how to change the Analog Input type.

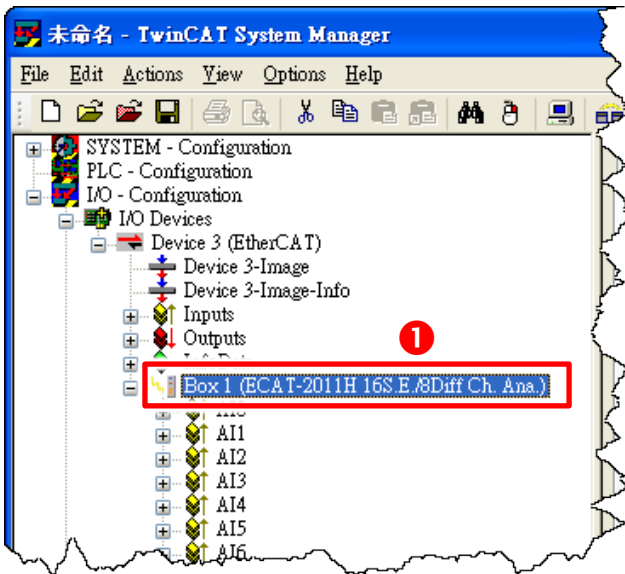


Figure 3-3.3

❶ In the left-hand window, click the “**Box 1 (ECAT-201xH 16S.E./8Diff Ch. Ana.)**” item.

❷ In the right-hand window, click the “**CoE – Online**” tab.

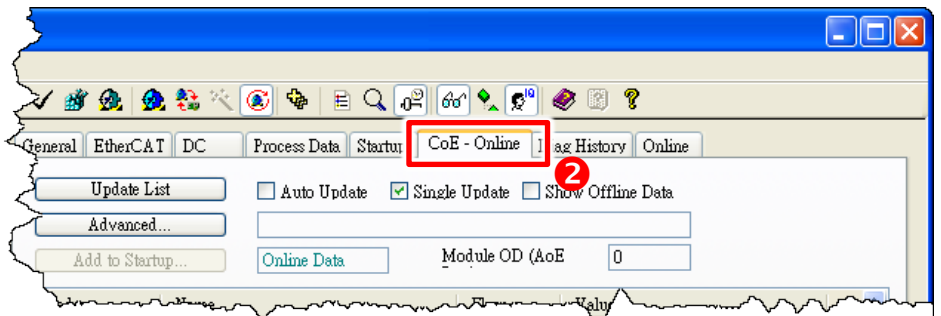


Figure 3-3.4

❸ Double-click the “**Index 8000:09 (Analog input type)**” to open the “**Set Value Dialog**” box.

Index	Name	Flags	Value
60F0:0	AI inputs		> 17 <
8000:0	AI Settings		> 26 <
8000:01	Enable user scale	RW	FALSE
8000:02	Presentation	RW	Signed (0)
8000:05	Enable Chanel	RW	TRUE
8000:06	Enable filter	RW	FALSE
8000:07	Enable limit 1	RW	FALSE
8000:08	Enable limit 2	RW	FALSE
8000:09	Analog input type	RW	Differential (0)
8000:0A	Enable user calibration	RW	FALSE
8000:0B	Enable vendor calibration	RW	TRUE
8000:0E	Swap limit bits	RW	FALSE
8000:0F	User scale offset	RW	

Figure 3-3.5

④ Select the “Single-ended” option from the “Enum” drop down options and then click the “OK” button. **Note that all AI channels will be changed to single-ended input.**

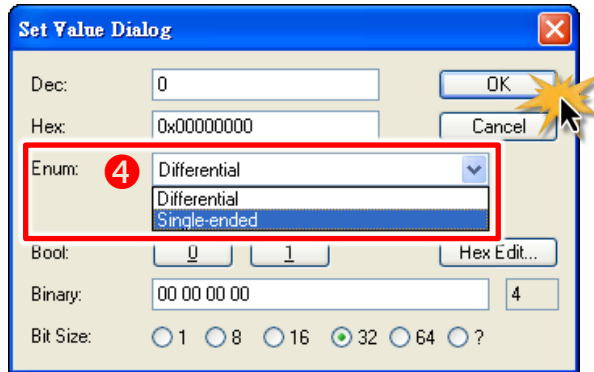


Figure 3-3.6

⑤ Double-click the “Index 80n0:05 (n = 8 to F, Enable Channel)” to enable AI channel. Here, the AI8 (Index 8080:05) is used as an example.

⑥ Type the “1” in the “Dec:” field and then the “OK” button.

Note that AI Channels 8 to 15 (0xF) defaults setting is FALSE (0x00). If the input type is single-ended, you must manually enable AI Channels 8 to 15 (0xF).

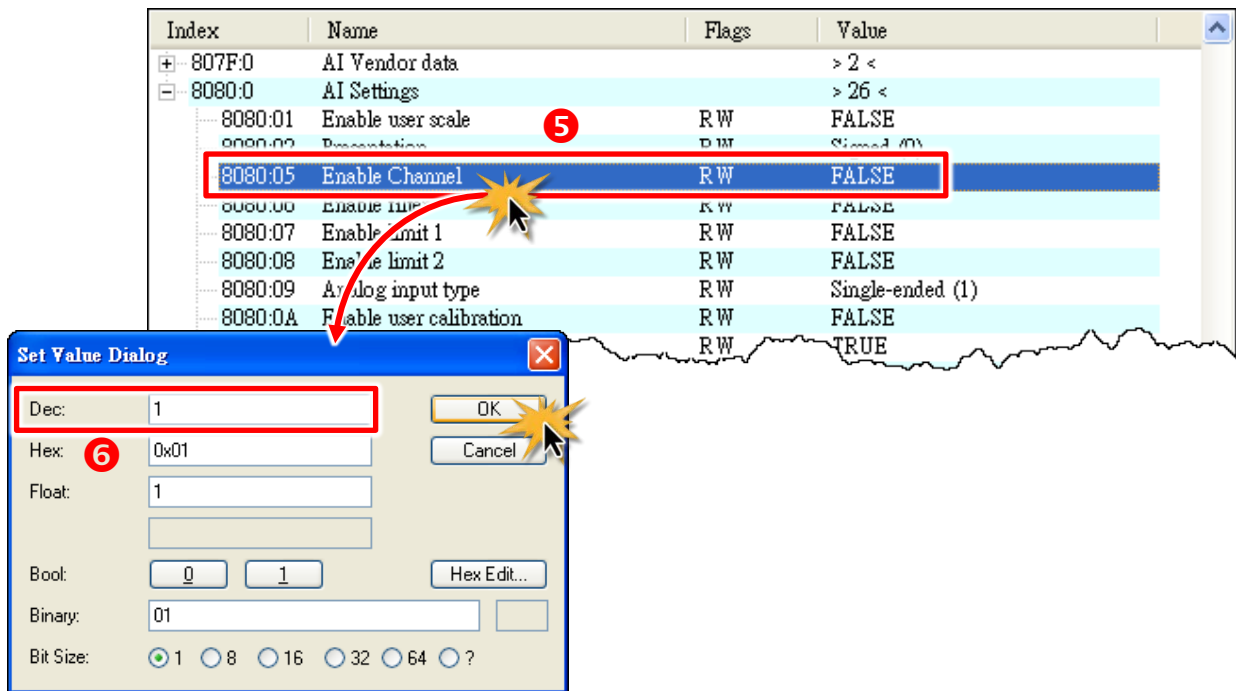


Figure 3-3.7

AD Range Selection

The ECAT-2011H provides Analog Input voltage range of $\pm 10\text{ V}$, $\pm 5\text{ V}$, $\pm 2.5\text{ V}$, $0 \sim +10\text{ V}$ and Analog Input current range of $\pm 20\text{ mA}$, $0 \sim +20\text{ mA}$, $+4 \sim +20\text{ mA}$. **The factory default a setting is $\pm 10\text{ V}$.**

ECAT-2016N provides Strain Guage Input range of $\pm 1.25\text{ V}$ 、 $\pm 600\text{ mV}$ 、 $\pm 300\text{ mV}$ 、 $\pm 125\text{ mV}$ 、 $\pm 80\text{ mV}$ 、 $\pm 60\text{ mV}$ 、 $\pm 40\text{ mV}$ 、 $\pm 30\text{ mV}$ 、 $\pm 20\text{ mV}$ 、 $\pm 15\text{ mV}$ and $\pm 10\text{ mV}$. **The factory default a setting is $\pm 1.25\text{ V}$**

Refer to the following instructions for details of how to change the AD range.

- ❶ In the left-hand window, click the “**Box 1 (ECAT-201xH 16S.E./8Diff Ch. Ana.)**” itme. (See Figure 3-3.3)
- ❷ In the right-hand window, click the “**CoE – Online**” tab. (See Figure 3-3.4)
- ❸ **Double-click** the “**Index 8000:19 (AI Range)**” to open the “**Set Value Dialog**” box.
- ❹ Select the **AI range value (e.g., $\pm 5\text{ V}$)** from the “**Enum**” drop down options and then click the “**OK**” button.

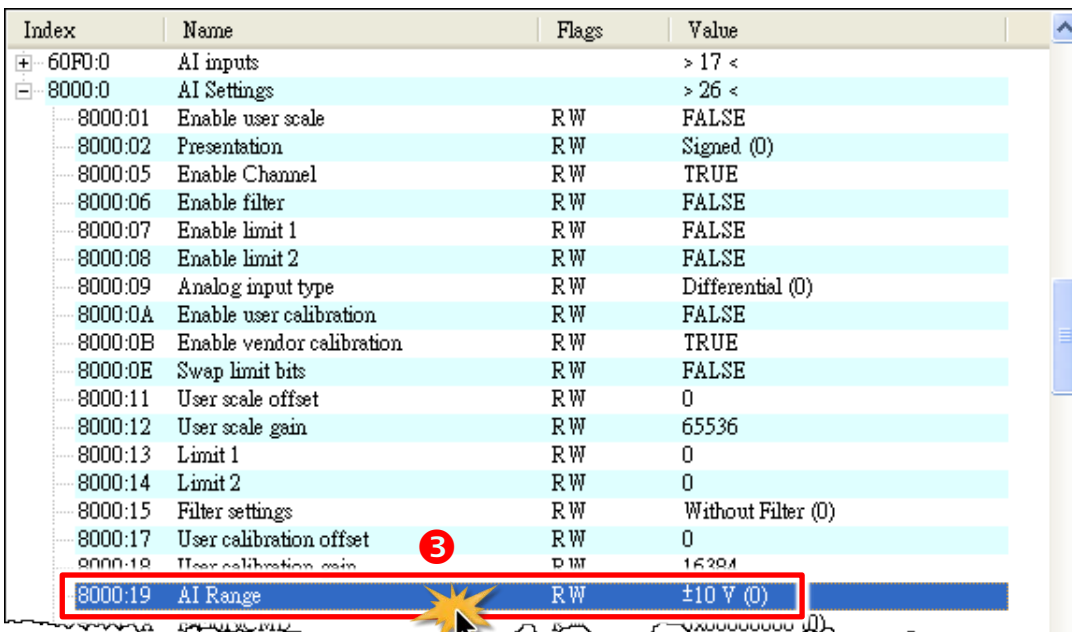
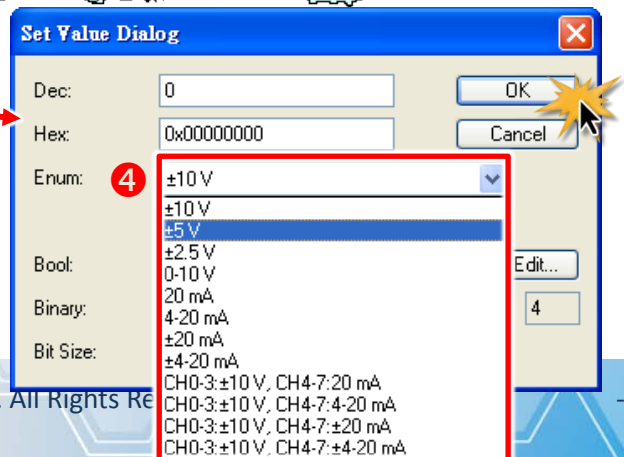


Figure 3-3.8



4. Object Description and Parameterization

The CoE interface is used for parameter management of EtherCAT devices. The display matches that of the CoE objects from the XML device description (ESI file). Once the ECAT connected to EtherCAT Master, you can configure the parameters via “CoE – Online” tab (double-click on the respective object). In general, the changes to the online CoE directory are immediately effective.

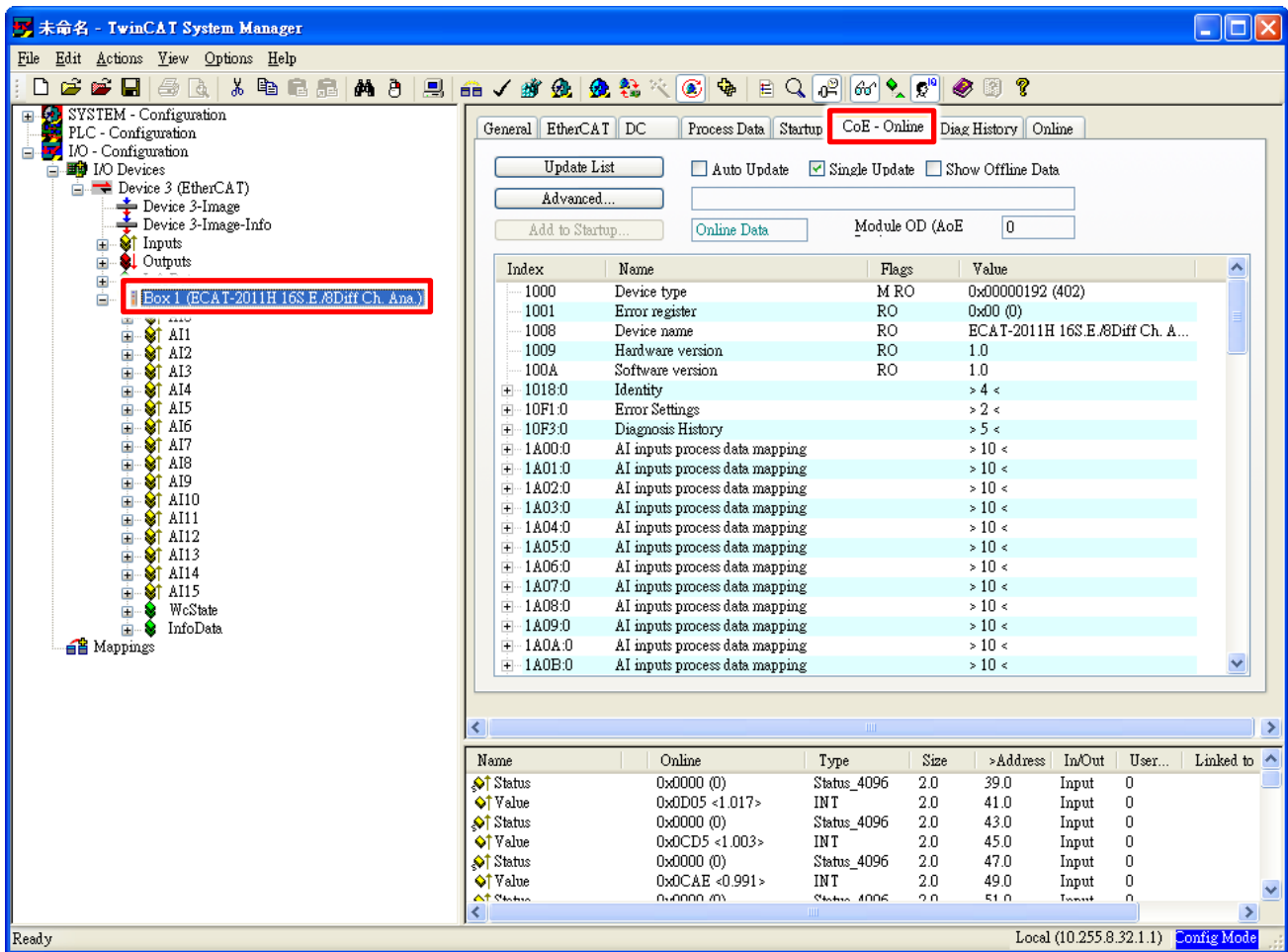


Figure 4-1.1

The following section first describes the standard objects required, followed by a complete overview of profile specific objects.

4.1 Standard Object(0x1000-0x1FFF)

Index 1000 Device Type

Index	Name	Meaning	Data type	Flags	Default
1000:00	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	0x00000192 (402dec)

Index 1001 Device Type

Index	Name	Meaning	Data type	Flags	Default
1001:00	Error Register	Error Register for EtherCAT slave	UINT8	RO	0x00 (0dec)

Index 1008 Device Name(For ECAT-2011H)

Index	Name	Meaning	Data type	Flags	Default
1008:00	Device name	EtherCAT Slave Device Name	String	RO	Depend on device

Index 1009 Hardware Version

Index	Name	Meaning	Data type	Flags	Default
1009:00	Hardware version	Hardware version of the EtherCAT slave	String	RO	1.0

Index 100A Software Version

Index	Name	Meaning	Data type	Flags	Default
100A:00	Software version	Firmware version for EtherCAT slave	String	RO	1.0

Index 1018 Identity

Index	Name	Meaning	Data type	Flags	Default
1018:00	Identity	Information for identifying the slave	INT8	RO	0x04(4dec)
1018:01	Vendor ID	Vendor ID of the EtherCAT slave	UINT32	RO	0x00494350 (4801360dec)
1018:02	Product code	Product code of the EtherCAT slave	UINT32	RO	Depend on device
1018:03	Revision	Revision number of the EtherCAT slave;	UINT32	RO	Depend on device
1018:04	Serial number	Serial number of the EtherCAT slave	UINT32	RO	Depend on device

Index 10F1 Error Settings

Index	Name	Meaning	Data type	Flags	Default
10F1:00	Error Settings	Error Settings	INT8	RW	0x02(2dec)
10F1:01	Local Error Reaction	Local Error Reaction	UINT32	RW	0x00000001(1dec)
10F1:02	Sync Error Counter Limit	Sync Error Counter Limit	UINT16	RW	0x0004(4dec)

Index 10F3 Diagnosis History

Index	Name	Meaning	Data type	Flags	Default
10F3:00	Diagnosis History	Diagnosis History	INT8	RW	0x05(5dec)
10F3:01	Maximum Messages	Maximum Messages	UINT8	M RO	0x14(20dec)
10F3:02	Newset Message	Newset Message	UINT8	M RO	0x00(0dec)
10F3:03	Newest Acknowledged Message	Newest Acknowledged Message	UINT8	M RW	0x00(0dec)
10F3:04	New Message Available	New Message Available	BOOLEAN	M RO P	FALSE(0dec)
10F3:05	Flags	Flags	UIN16	M RW	0x0000(0dec)

Index 1A0n AI Input Process Data Mapping (for $0 \leq n \leq F$)

Index	Name	Meaning	Data type	Flags	Default
1A0n:00	AI Input Process Data Mapping	PDO Mapping TxPDO _n	UINT8	RO	0x0A(10dec)
1A0n:01	SubIndex 001	PDO Mapping entry (object 0x60n0,entry 0x01)	UINT32	RO	0x60n0:01,1
1A0n:02	SubIndex 002	PDO Mapping entry (object 0x60n0,entry 0x02)	UINT32	RO	0x60n0:02,1
1A0n:03	SubIndex 003	PDO Mapping entry (object 0x60n0,entry 0x03)	UINT32	RO	0x60n0:03,2
1A0n:04	SubIndex 004	PDO Mapping entry (object 0x60n0,entry 0x05)	UINT32	RO	0x60n0:05,2
1A0n:05	SubIndex 005	PDO Mapping entry (object 0x60n0,entry 0x07)	UINT32	RO	0x60n0:07,1
1A0n:06	SubIndex 006	PDO Mapping entry (2 bits align)	UINT32	RO	0x0000:00,1
1A0n:07	SubIndex 007	PDO Mapping entry (6 bits align)	UINT32	RO	0x0000:00,6
1A0n:08	SubIndex 008	PDO Mapping entry (object 0x60n0,entry 0x0F)	UINT32	RO	0x60n0:0F,1
1A0n:09	SubIndex 009	PDO Mapping entry (object 0x60n0,entry 0x10)	UINT32	RO	0x60n0:10,1
1A0n:0A	SubIndex 010	PDO Mapping entry (object 0x60n0,entry 0x11)	UINT32	RO	0x60n0:11,16

Index 1C00 Sync Manager Type

Index	Name	Meaning	Data type	Flags	Default
1C00:00	Sync manager type	Using the sync managers	UINT8	RO	0x04(4dec)
1C00:01	SubIndex 001	Sync-Manager Channel 1:Mailbox write	UINT8	RO	0x01(1dec)
1C00:02	SubIndex 002	Sync-Manager Channel 2:Mailbox read	UINT8	RO	0x02(2dec)
1C00:03	SubIndex 003	Sync-Manager Channel 3:Process data write	UINT8	RO	0x03(3dec)
1C00:04	SubIndex 004	Sync-Manager Channel 4:Process data read	UINT8	RO	0x04(4dec)

Index 1C12 RxPDO Assignment

Index	Name	Meaning	Data type	Flags	Default
1C12:00	RxPDO Assignment	PDO Assign Outputs	UINT8	RW	0x00(0dec)

Index 1C13 TxPDO Assignment(For ECAT-2011H/2012H)

Index	Name	Meaning	Data type	Flags	Default
1C13:00	TxPDO Assignment	PDO Assign Inputs	UINT8	RW	0x010(16dec)
1C13:01	SubIndex 001	1st allocated TxPDO	UINT16	RW	0x1A00(6656dec)
1C13:02	SubIndex 002	2nd allocated TxPDO	UINT16	RW	0x1A01(6657dec)
1C13:03	SubIndex 003	3rd allocated TxPDO	UINT16	RW	0x1A02(6658dec)
1C13:04	SubIndex 004	4th allocated TxPDO	UINT16	RW	0x1A03(6659dec)
1C13:05	SubIndex 005	5th allocated TxPDO	UINT16	RW	0x1A04(6660dec)
1C13:06	SubIndex 006	6th allocated TxPDO	UINT16	RW	0x1A05(6661dec)
1C13:07	SubIndex 007	7th allocated TxPDO	UINT16	RW	0x1A06(6662dec)
1C13:08	SubIndex 008	8th allocated TxPDO	UINT16	RW	0x1A07(6663dec)
1C13:09	SubIndex 009	9th allocated TxPDO	UINT16	RW	0x1A08(6664dec)
1C13:0A	SubIndex 010	10th allocated TxPDO	UINT16	RW	0x1A09(6665dec)
1C13:0B	SubIndex 011	11th allocated TxPDO	UINT16	RW	0x1A0A(6666dec)
1C13:0C	SubIndex 012	12th allocated TxPDO	UINT16	RW	0x1A0B(6667dec)
1C13:0D	SubIndex 013	13th allocated TxPDO	UINT16	RW	0x1A0C(6668dec)
1C13:0E	SubIndex 014	14th allocated TxPDO	UINT16	RW	0x1A0D(6669dec)
1C13:0F	SubIndex 015	15th allocated TxPDO	UINT16	RW	0x1A0E(6670dec)
1C13:10	SubIndex 016	16th allocated TxPDO	UINT16	RW	0x1A0F(6671dec)

Index 1C13 TxPDO Assignment(For ECAT-2016N)

Index	Name	Meaning	Data type	Flags	Default
1C13:00	TxPDO Assignment	PDO Assign Inputs	UINT8	RW	0x01(16dec)

Index 1C32 TxPDO Assignment

Index	Name	Meaning	Data type	Flags	Default
1C32:00	SM output parameter	Synchronization parameters for the outputs	UINT8	RO	0x20(32dec)
1C32:01	Synchronization type	Current synchronization type: Bit0 = 0: Free Run Bit1 = 1: Synchron with SM 2 Event Bit15 = 0: Standard Bit15 = 1: FastOp mode (CoE deactivated)	UINT16	RW	0x0000(0dec)
1C32:02	Cycle	Cycle time (in ns): Free Run: Cycle time of the local timer Synchronous with SM 2 event: Master cycle time	UINT32	RO	0x00000000 (0dec)
1C32:04	Synchronization type supported	Supported synchronization modes: Bit0 = free run is supported Bit1 = synchronous with SM 2 event is supported (outputs available) Bit1 = synchronous with SM 3 event is supported (no outputs available) Bit4-5 = 01: input shift with SYNC 1 event (no output available) Bit14 = 1: dynamic times	UINT16	RO	0x401F (16415dec)
1C32:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x000186A0 (100000dec)
1C32:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master	UINT32	RO	0x000061A8 (2500dec)
1C32:08	Get cycle time	With this entry the real required process data provision time can be measured. 0: Measurement of the local cycle time is stopped 1: Measurement of the local cycle time is started	UINT16	RW	0x0001(1dec)
1C32:09	Delay time	Time between SYNC1 event and reading of the inputs	UINT32	RO	0x000009C4 (2500dec)
1C32:0A	Sync0 cycle time	SYNC0 cycle time (in ns)	UINT32	RW	0x00000000 (0dec)
1C32:0B	SM-event missed	Number of missed SM events in OPERATIONAL	UINT16	RO	0x0000(0dec)
1C32: 0C	Sync Error	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000(0dec)

Index 1C33 SM Input Parameter

Index	Name	Meaning	Data type	Flags	Default
1C33:00	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20(32dec)
1C33:01	Synchronization Type	Current synchronization type: Bit0 = 0: Free Run Bit1 = 1: Synchron with SM 2 Event Bit15 = 0: Standard Bit15 = 1: FastOp mode (CoE deactivated)	UINT16	RW	0x0000(0dec) (Only support Free Run Mode)
1C33:02	Cycle time	Cycle time (in ns): Free Run: Cycle time of the local timer Synchronous with SM 2 event: Master cycle time	UINT32	RO	0x00000000 (0dec)
1C33:04	Synchronization Type supported	Supported synchronization modes: Bit0 = free run is supported Bit1 = synchronous with SM 2 event is supported (outputs available) Bit1 = synchronous with SM 3 event is supported (no outputs available) Bit4-5 = 01: input shift with SYNC 1 event (no output available) Bit14 = 1: dynamic times	UINT16	RO	0x401F (16415dec)
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x000186A0 (100000dec)
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master	UINT32	RO	0x000061A8 (2500dec)
1C33:08	Get cycle time	With this entry the real required process data provision time can be measured. 0: Measurement of the local cycle time is stopped 1: Measurement of the local cycle time is started	UINT16	RW	0x0000(0dec)
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs	UINT32	RO	0x000009C4 (2500dec)
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL	UINT16	RO	0x0000(0dec)
1C33:0C	Cycle time to small	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000(0dec)
1C33:20	Sync error	The synchronization was not correct in the last cycle	BOOLEAN	RO	FALSE(0dec)

4.2 Profile Specific Objects(0x6000-0xFFFF)

Index 60n0 AI Inputs (for 0 ≤ n ≤ F)

Index	Name	Meaning	Data type	Flags	Default
60n0:00	AI Inputs	Maximum subindex	UINT16	RO P	0x11(17dec)
60n0:01	Underrange	Value below measuring range	BOOLEAN	RO P	FALSE(0dec)
60n0:02	Overrange	Measuring range exceeded	BOOLEAN	RO P	FALSE(0dec)
		Limit value monitoring Limit 1			
		0: not active			
60n0:03	Limit 1	1: Value is smaller than Limit Value1 2: Value is larger than Limit Value1 3: Value is equal to Limit Value1	Bit2	RO P	
		Limit value monitoring Limit 2			
		0: not active			
60n0:05	Limit 2	1: Value is smaller than Limit Value2 2: Value is larger than Limit Value2 3: Value is equal to Limit Value2	Bit2	RO P	
60n0:07	Error	The error bit is set if the data is invalid (over-rang, un-der-range)	BOOLEAN	RO P	FALSE(0dec)
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0=valid, 1=invalid)	BOOLEAN	RO P	FALSE(0dec)
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO P	TRUE(1dec)
60n0:11	Value	Analgo input data	INT16	RO P	0x000B(11dec)

Index 80n0 AI Settings (for $0 \leq n \leq F$, for ECAT-2011H/2012H)

Index	Name	Meaning	Data type	Flags	Default
80n0:00	AI Settings	Maximum subindex	UINT8	RW	0x1A(26dec)
80n0:01	Enalbe user scale	User scale is active	BOOLEAN	RW	FALSE(0dec)
80n0:02	Presentation	Change the method of representation of the measured value. 0: Signed presentation (Refer to Table 4-2-1 below) 1: Unsigned presentation (Refer to Table 4-2-2 below) 2: Absolute value with MSB as sign Signed amount representation (Refer to Table 4-2-3 below)	Bit3	RW	Signed(0dec)
80n0:05	Enable Channel	Enable Channel	BOOLEAN	RW	TRUE(1dec)
80n0:06	Enalbe filter	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary	BOOLEAN	RW	FALSE(0dec)
80n0:07	Enable limit 1	Limit 1 enable	BOOLEAN	RW	FALSE(0dec)
80n0:08	Enalbe limit 2	Limit 2 enable	BOOLEAN	RW	FALSE(0dec)
80n0:09	Analog input type	0: Differential input 1: Single-ended input	NIT32	RW	Differential (0dec)
80n0:0A	Enalbe user calibration	Enabling of the user calibration	BOOLEAN	RO	FALSE(0dec)
80n0:0B	Enalbe vendor calibration	Enabling of the vendor calibration	BOOLEAN	RW	TRUE(1dec)
80n0:0E	Swap limit bits	Swap limit bits FALSE: 0: not active 1: value < limit value 2: value > limit value 3: value is equal to the limit value TRUE: 0: not active 1: value < limit value 2: value > limit value 3: value is equal to the limit value	BOOLEAN	RW	FALSE(0dec)

Index	Name	Meaning	Data type	Flags	Default
80n0:11	User scale offset	User scaling offset	INT16	RW	0x00(0dec)
80n0:12	User scale gain	User scaling gain. The value 1 corresponds to 65535 dec (0x00010000) and is limited to ±0x7FFFF.	INT32	RW	0x0x0001000 (65535dec)
80n0:13	Limit 1	First limit value for setting the status bits	INT16	RW	0x00(0dec)
80n0:14	Limit 2	Second limit value for setting the status bits	INT16	RW	0x00(0dec)
80n0:15	Filter settings	This object determines the digital filter settings, if it is active via Enable filter (Index 0x80n0:06). The possible settings are sequentially numbered. 0: Without Filter 1: N/A 2: IIR 1 (168 Hz) 3: IIR 2 (88 Hz) 4: IIR 3 (43 Hz) 5: IIR4 (21 Hz) 6: IIR5 (10.5 Hz) 7: IIR 6 (5.2 Hz) 8: IIR 7 (2.5 Hz) 9: IIR 8 (1.2 Hz)	UINT16	RW	Without Filter (0dec)
80n0:17	User calibration offset	User offset compensation	INT16	RW	0x0000(0dec)
80n0:18	User calibration gain	User calibration gain	INT16	RW	0x4000(16384dec)
80n0:19	AI Range	0: ±10V 1: ±5V 2: ±2.5V 3: 0~10V 4: 20 mA 5: 4~20 mA 6: ±20 mA 7: ±4~20mA 8: CH0-3: ±10V, CH4-7: 20mA 9: CH0-3: ±10V, CH4-7: 4~20mA 10(A): CH0-3: ±10V, CH4-7: ±20mA 11(B): CH0-3: ±10V, CH4-7: ±4~20mA	UINT32	RW	±10V (0dec)
80n0:1A	FactoryCMD	Factory Command	UINT32	RW	0x00000000(0dec)

Index 80n0 AI Settings (for $0 \leq n \leq F$, for ECAT-2016N)

Index	Name	Meaning	Data type	Flags	Default
80n0:00	AI Settings	Maximum subindex	UINT8	RW	0x1A(26dec)
80n0:01	Enalbe user scale	User scale is active	BOOLEAN	RW	FALSE(0dec)
80n0:02	Presentation	Change the method of representation of the measured value. 0: Signed presentation (Refer to Table 4-2-1 below) 1: Unsigned presentation (Refer to Table 4-2-2 below) 2: Absolute value with MSB as sign Signed amount representation (Refer to Table 4-2-3 below)	Bit3	RW	Signed(0dec)
80n0:05	Enable Channel	Enable Channel	BOOLEAN	RW	TRUE(1dec)
80n0:06	Enalbe filter Type	0:Enable Sinc3 1:Enable Sinc1+Sin5	BOOLEAN	RW	Sinc3(0dec)
80n0:07	Enable limit 1	Limit 1 enable	BOOLEAN	RW	FALSE(0dec)
80n0:08	Enalbe limit 2	Limit 2 enable	BOOLEAN	RW	FALSE(0dec)
80n0:09	Analog input type	0: Differential input	NIT32	RW	Differential (0dec)
80n0:0A	Enalbe user calibration	Enabling of the user calibration	BOOLEAN	RO	FALSE(0dec)
80n0:0B	Enalbe vendor calibration	Enabling of the vendor calibration	BOOLEAN	RW	TRUE(1dec)
80n0:0E	Swap limit bits	Swap limit bits FALSE: 0: not active 1: value < limit value 2: value > limit value 3: value is equal to the limit value TRUE: 0: not active 1: value < limit value 2: value > limit value 3: value is equal to the limit value	BOOLEAN	RW	FALSE(0dec)

Index	Name	Meaning	Data type	Flags	Default
80n0:11	User scale offset	User scaling offset	INT16	RW	0x00(0dec)
80n0:12	User scale gain	User scaling gain. The value 1 corresponds to 65535 dec (0x00010000) and is limited to ±0x7FFFF.	INT32	RW	0x0x0001000 (65535dec)
80n0:13	Limit 1	First limit value for setting the status bits	INT16	RW	0x00(0dec)
80n0:14	Limit 2	Second limit value for setting the status bits	INT16	RW	0x00(0dec)
80n0:15	Filter settings	The possible settings are sequentially numbered. 0: 125 kSPS 1: IIR0 (125 kSPS) 2: IIR 1 (62.5 kSPS) 3: IIR 2 (62.5 kSPS) 4: IIR 3 (31.25 kSPS) 5: IIR4 (25 kSPS) 6: IIR5 (15.625 kSPS) 7: IIR 6 (10.390 kSPS) 8: IIR 7 (5.0 kSPS) 9: IIR 8 (2.5 kSPS) 10: IIR 9 (1 kSPS) 11: IIR 10 (500 SPS) 12: IIR 11 (400 SPS) 13: IIR 12 (200 SPS) 14: IIR 13(100.2 SPS) 15: IIR 14(59.87 SPS) 16: IIR 15(49.92 SPS) 17: IIR 16(20 SPS) 18: IIR 17(16.7 SPS) 19: IIR 18(10 SPS) 20: IIR 19(5 SPS)	UINT16	RW	125 kSPS (0dec)
80n0:17	User calibration offset	User offset compensation	INT16	RW	0x0000(0dec)
80n0:18	User calibration gain	User calibration gain	INT16	RW	0x4000(16384dec)
80n0:19	AI Range	0: ±1.25V 1: ±600mV 2: ±300mV 3: ±125mV 4: ±80mV 5: ±60mV 6: ±40mV 7: ±30mV 8: ±20mV 9: ±15mV 10(A): ±10mA	UINT32	RW	±1.25V (0dec)
80n0:1A	FactoryCMD	Factory Command	UINT32	RW	0x00000000(0dec)

➤ Table 4-2-1: Signed Integer representation as follows:

The negative output value is represented in two's complement (negated + 1).

Maximum representation range for 16 bits = -32768 to +32767dec

Input signal							Value	
±10 (V)	±5 (V)	±2.5 (V)	0-10 (V)	20 (mA)	4-20 (mA)	±4 – 20 (mA)	Decimal	Hexadecimal
10	5	2.5	10	20	20	20	32767	0x7FFF
5	2.5	1.25	5	10	12	12	16383	0x3FFF
								0x0001
0	0	0	0	0	4	±4	0	0x0000
								0xFFFF
-5	-2.5	-1.25				-12	-16383	0xC001
-10	-5	-2.5				-20	-32768	0x8000

Input signal											Value	
±1.25 (V)	±600 (mV)	±300 (mV)	±125 (mV)	±80 (mV)	±60 (mV)	±40 (mV)	±30 (mV)	±20 (mV)	±15 (mV)	±10 (mV)	Decimal	Hexadecimal
1.25	600	300	125	80	60	40	30	20	15	10	32767	0x7FFF
0.75	300	150	72.5	40	30	20	15	10	7.5	5	16383	0x3FFF
												0x0001
0	0	0	0	0	0	0	0	0	0	0	0	0x0000
												0xFFFF
-0.75	-300	-150	-72.5	-40	-30	-20	-15	-10	-7.5	-5	-16383	0xC001
-1.25	-600	-300	125	-80	-60	-40	-30	-20	15	-10	-32768	0x8000

➤ Table 4-2-2: Unsigned Integer representation as follows:

The output value is represented with 15-bit resolution without sign, therefore polarity detection is no longer possible. Maximum representation range for 16 bits = 0 to +32767dec

Input signal							Value	
±10 (V)	±5 (V)	±2.5 (V)	0-10 (V)	20 (mA)	4-20 (mA)	±4 – 20 (mA)	Decimal	Hexadecimal
10	5	2.5	10	20	20	20	32767	0x7FFF
5	2.5	1.25	5	10	12	12	16383	0x3FFF
								0x0001
0	0	0	0	0	4	±4	0	0x0000
								0xFFFF
-5	-2.5	-1.25				-12	-16383	0xC001
-10	-5	-2.5				-20	-32768	0x8000

Input signal											Value	
±1.25 (V)	±600 (mV)	±300 (mV)	±125 (mV)	±80 (mV)	±60 (mV)	±40 (mV)	±30 (mV)	±20 (mV)	±15 (mV)	±10 (mV)	Decimal	Hexadecimal
1.25	600	300	125	80	60	40	30	20	15	10	32767	0x7FFF
0.75	300	150	72.5	40	30	20	15	10	7.5	5	16383	0x3FFF
												0x0001
0	0	0	0	0	0	0	0	0	0	0	0	0x0000
												0xFFFF
-0.75	-300	-150	-72.5	-40	-30	-20	-15	-10	-7.5	-5	-16383	0xC001
-1.25	-600	-300	125	-80	-60	-40	-30	-20	15	-10	-32768	0x8000

➤ Table 4-2-3: Absolute value with MSB as sign - representation as follows:

The output value is displayed in magnitude-sign format: MSB=1 (highest bit) in the case of negative values. Maximum representation range for 16 bits = -32767 to +32767dec

Input signal							Value	
±10 (V)	±5 (V)	±2.5 (V)	0-10 (V)	20 (mA)	4-20 (mA)	±4 - 20 (mA)	Decimal	Hexadecimal
10	5	2.5	10	20	20	20	32767	0x7FFF
5	2.5	1.25	5	10	12	12	16383	0x3FFF
								0x0001
0	0	0	0	0	4	±4	0	0x0000
								0x8001
-5	-2.5	-1.25				-12	[-16383]	0xBFFF
-10	-5	-2.5				-20	[-32768]	0xFFFF

Input signal											Value	
±1.25 (V)	±600 (mV)	±300 (mV)	±125 (mV)	±80 (mV)	±60 (mV)	±40 (mV)	±30 (mV)	±20 (mV)	±15 (mV)	±10 (mV)	Decimal	Hexadecimal
1.25	600	300	125	80	60	40	30	20	15	10	32767	0x7FFF
0.75	300	150	72.5	40	30	20	15	10	7.5	5	16383	0x3FFF
												0x0001
0	0	0	0	0	0	0	0	0	0	0	0	0x0000
												0x8001
-0.75	-300	-150	-72.5	-40	-30	-20	-15	-10	-7.5	-5	[-16383]	0xBFFF
-1.25	-600	-300	125	-80	-60	-40	-30	-20	15	-10	[-32768]	0xFFFF

Index 80nE AI Internal Data (for 0<=n<=F)

Index	Name	Meaning	Data type	Flags	Default
80nE:00	AI Internal data	Maximum subindex	UINT8	RO	0x1(1dec)
80nE:01	ADC raw value	ADC raw value	UINT16	RO	0x0008(8dec)

Index 80nF AI Vendor Data (for 0<=n<=F)

Index	Name	Meaning	Data type	Flags	Default
80nF:00	AI Vendor data	Maximum subindex	UINT8	RW	0x2(2dec)
80nF:01	Calibration offset	Offset (vendor calibration)	UINT16	RW	0xFFED(-19dec)
80nF:02	Calibration gaing	Gain (vendor calibration)	UINT16	RW	0x40AD (16557dec)

Appendix: Revision History

This chapter provides revision history information to this document.

The table below shows the revision history.

Revision	Date	Description
1.0	Oct. 08 2018	Initial issue
1.1	Dec. 2018	Add the unit conversion table about Signed Integer, Unsigned Integer and Most Significant Bit (MSB).
1.2	Dec. 2019	Add ECAT-2012H and ECAT-2016N information