

## **EtherCAT**

## **EC7 Series Integrated I/O**

## **User Manual**



Nanjing Solidot Electronic Technology Co., Ltd.

#### Copyright © 2023 Nanjing Solidot Electronic Technology Co., Ltd. All rights reserved.

Without written permission of our company, no organization or individual may extract, copy or transmit part or all of this document.

#### **Trademark notice**

and other Solidot trademarks are all trademarks of Nanjing Solidot Electronic Technology Co., Ltd.

All other trademarks or registeREDtrademarks referREDto in this document belong to their respective owners.

#### Note

The products, services or features you purchase shall be subject to the commercial contracts and terms of Solidot. All or part of the products, services or features given in this document may not be within the scope of your purchase or use. Unless otherwise agreed in the contracts, Solidot does not make any express or implied statement or warranty for the content of this document.

Due to product version upgrading or other reasons, the content of this document is subject to changes from time to time. Unless otherwise agreed, this document shall be only used as reference. None of the statements, information and suggestions in this document shall constitute any express or implied warranty.

Nanjing Solidot Electronic Technology Co., Ltd.

Address: 11F, Ang Ying Building, No.91 Shengli Road, Jiangning District, Nanjing, Jiangsu Province, China Postal code: 211106

Telephone: 4007788929

Website: http://www.solidotech.com/en

## CONTENTS

1	Produ	ct Overview	1			
	1.1	Products	1			
	1.2	Product Characteristics	1			
2	Destin	nation Rules				
	2.1	Destination rules	2			
	2.2	Model List	3			
3	Produ	ct Parameters	4			
	3.1	Common parameter	4			
	3.2	Digital parameter	5			
4	Panel.		6			
	4.1	Product mix	6			
	4.2	Indicator light function	7			
	4.3	Bus Interface Definitions	7			
	4.4	Power Interface Definition	9			
	4.5	I/O Interface Definitions	9			
5	Installi	ng And Connecting	10			
	5.1	External Dimensions	10			
	5.2	Installation Environmental Requirements	11			
	5.3	Module Installation	11			
	5.4	Wiring instructions	12			
	5.4.1	Power connector wiring diagram	12			
	5.4.2	I/O interface wiring diagram	12			
6	Power	Supply Rule	14			
	6.1	Direct power supply rules	14			
	6.2	Tandem power supply rules	16			
7	Use		19			
	7.1	Configuration Module Applications	19			
	7.1.1	Application in TwinCAT3 software environment	19			
	7.1.2	Application in CODESYS V3.5 software environment	24			

	7.1.3	Application in Sysmac Studio software environment	30
8	FAQ		38
	8.1	Failure to find a device in the software	38
	8.2	Failure to start operation of a device	38

## 1 Product Overview

#### 1.1 Products

EC7 series Integrated I/O modules, with EtherCAT industrial Ethernet bus interface, are EtherCAT slave devices with standard IO architecture, which can be compatible with EtherCAT networks of multiple vendors, providing users with multiple options for high-speed data acquisition, optimizing system configuration, simplifying field wiring, and improving system reliability.

### 1.2 Product Characteristics

- IP67 protection rating
   Suitable for harsh industrial environments
- Compactness
   For applications where space is at a premium
- Quick Based on high-performance EtherCAT ASIC communication chip for direct control and faster speeds
- Easy diagnosis
   Innovative channel indicator design, close to the channel, channel status at a glance, easy to detect and maintain
- Easy configuration
   Simple configuration and support for all major EtherCAT masters
- Easy and fast wiring
   Simple wiring with standard cables

## 2 Destination Rules

## 2.1 Destination rules

# $\frac{\text{EC}}{(1)} \frac{7}{(2)} - \frac{1}{(3)} \frac{08}{(4)} \frac{08}{(5)} \frac{\text{A}}{(6)}$

Serial number	Meaning	Description			
(1)	Bus protocol	EC: EtherCAT			
(2)	Protection	IP67			
	class				
(3)	I/О Туре	D: Digital			
(4)	Input Signal	16: 16 channel 08: 8-channel input		00: 0 channel input	
	Points	input			
(5)	Number of	16: 16-channel	08: 8-ch	annel	00: 0 channel output
	output signal	output	output		
	points				
(6)	Signal type	A: NPN		B: PNP	

## 2.2 Model List

Model number	Product description
EC7-1600A	16-channel digital input module, NPN type
EC7-0016A	16-channel digital output module, NPN type
EC7-0808A	8-channel digital input/output module, NPN type
EC7-1600B	16-channel digital input module, PNP type
EC7-0016B	16-channel digital output module, PNP type
EC7-0808B	8-channel digital input/output module, PNP type

## **3** Product Parameters

## 3.1 Common parameter

Interface parameter					
Bus protocol	EtherCAT				
Bus interface	2 x M12, 4Pin, D-code, Blue				
Electrical isolation	500 V				
Number of I/O stations	According to the master				
Data transmission	Category 5+ UTP or STP (STP recommended)				
medium					
Transmission distance	≤100 m (station to station)				
Transmission rate	100 Mbps				
Technical parameters					
Configuration	Through the master				
Power connector	2×M12, 5Pin, L-code, Red				
Electric power source	18~36VDC				
	Reverse polarity protection				
Us Total current	Max: 16A				
Us Current consumption	≤35mA				
$U_L$ Total current	Max: 16A				
U <sub>L</sub> Current consumption	25mA				
	+ Sensor supply current				
	+ Load Output Current				
Electrical isolation	Yes				
Between GND <sub>s</sub> and GND					
L					
Weight	480g				
Dimension	225×62×35.1mm				
Operating temperature	-25~+70°C				
Storage temperature	-40~+85°C				

All rights reserved © Nanjing Solidot Electronic Technology Co., Ltd.

Relative humidity	95%, non-condensing		
Protection class	IP67		

## 3.2 Digital parameter

Digital input						
Product Model	EC7-1600A EC7-1600B		EC7-0808A	EC7-0808B	EC7-0016A	EC7-0016B
Rated voltage		24 VDC				
Number of signal	1	6	8	8		
points						
Input interface		8×M12, 5F	Pin, A-code	-		
Signal Type	NPN	PNP	NPN	PNP		
"0" signal voltage	15~30 V	-3~+3 V	15~30 V	-3~+3 V		
"1" signal voltage	-3~+3 V	15~30 V	-3~+3 V	15~30 V		
Input Filtering		Nc	one			_
Input Current		4 r	nA			
Total sensor		Max: 2A (	(from $U_L$ )			
power supply						
Isolation method		Optocoupl	er Isolation			
Isolated Withstand		50	0 V			
Voltage						
Channel Indicator	Green LED light					
Lights						
Digital output						
Rated voltage				24 VDC	(±25%)	
Number of signal			8		1	6
points						
Output interface				8×M12, 5F	Pin, A-code	
Signal Type			NPN	PNP	NPN	PNP
Load Type			R	esistive loads,	inductive load	ls
Single channel				Max: 500 m	A (from $U_L$ )	
rated current		_				
Total output			$Max: 4 A (from U_L) Max: 8 A (from U_L)$		(from $U_L$ )	
current						
Port protection				overcurren	t protection	
Isolation method				Optocoupl	er Isolation	
Isolated Withstand				50	0 V	
Voltage						
Channel Indicator				Green L	ED light	
Lights						

## 4 Panel

## 4.1 Product mix

#### Name and function description



## 4.2 Indicator light function

Name (of a	Markings	Color	State of	State Description
thing)			affairs	
Network	L/A1	Green	ON	Establish a network connection
indicator IN			Flashing	Network connection with data interaction
			OFF	No data interaction or exception
Network	L/A2	Green	ON	Establish a network connection
indicator OUT			Flashing	Network connection with data interaction
			OFF	No data interaction or exception
System power	Us	Green	ON	Power supply is normal
indicator			OFF	The product is not powered up or the power supply
				is abnormal
Load power	UL	Green	ON	Power supply normal
indicator			OFF	The product is not powered up or the power supply
				is abnormal
Operation	R	Green	ON	Normal operation of the system
status indicator			Flashing	2Hz: the device is in Pre-OP state
RUN				1Hz: device is in Safe-OP state
			OFF	Device is in it or unpowered state
warning	E	RED	ON	Abnormal system operation
indicator			Flashing	Device is down or slave is misconfigured
			OFF	System running normally or not powered up
Input Channel	0 to F	Green	ON	Module channels have signal inputs
Indicator			OFF	No signal input or abnormal signal input on module
				channel
Output	0 to F	Green	ON	Module channels have signal outputs
Channel			OFF	No signal output or abnormal signal output from
Indicator				module channels

## 4.3 Bus Interface Definitions

Bus Interface Connection View (M12, D-code, Hole End)



#### **Description of definitions**

Pin	functionality
1	TX+, data for transmission+
2	RX+, data for reception+
3	TX-, data for transmission-
4	RX-, data for reception-

All rights reserved © Nanjing Solidot Electronic Technology Co., Ltd.

### 4.4 Power Interface Definition

Power connector connection view (M12, Lcode, pin end & hole end)



#### **Description of definitions**

Pin	Functionality	Core Color
1	+24V Us	Brown
2	0V GND∟	White
3	0V GNDs	Blue
4	+24V UL	Black
5	PE	Gray

## 4.5 I/O Interface Definitions

I/O Interface Connection View (M12, A-code, Hole End)





DO	DO
----	----

Description of definitions	5
----------------------------	---

Pin	functionality	Core Color
1	+24V U <sub>L</sub> /NC	Brown
2	DI/DO B	White
3	0V GND∟	Blue
4	DI/DO A	Black
5	PE	Gray

## 5 Installing And Connecting

## 5.1 External Dimensions

**Outline specifications (in mm)** 



## 5.2 Installation Environmental Requirements

To fully utilize the performance of the EC7 module and enhance its reliability, avoid installing it in the following locations:

- location under direct sunlight
- · Locations where ambient temperature or relative humidity exceeds module specifications
- Places with corrosive gas, flammable gas
- Places with acid, oil, chemical droplets
- · Places where there are dust, iron chips, sparks splash
- Places where the module body is directly exposed to shocks and vibrations.
- · Places with strong electric and magnetic fields, radiation and static interference
- Places with power lines and AC strong wires nearby

## 5.3 Module Installation

• Please use screws of M4\*22mm or above to fasten and install the module body.



• The mounting hole dimensions for the module are shown below.



#### 🗲 caveat

- The transparent cover on the module is the reserved cover for the rotary switch, which is fastened at the factory, so please do not disassemble it to avoid damaging the IP67 protection level.
- Please fix the module correctly, if it is not fixed securely it may fail due to vibration.

## 5.4 Wiring instructions

#### 5.4.1 Power connector wiring diagram



#### 🗲 caveat

• It is recommended that the system power supply and load power supply are powered by different switching power supplies to ensure the stability of operation.

• Refer to the "<u>Power Supply Rules</u>" section for power supply rules.

#### 5.4.2 I/O interface wiring diagram



NPN Output





#### 🗲 caveat

• Please install the module's matching waterproof cap on the unused connector interface and tighten it so as not to jeopardize the IP67 protection rating.

• Pin 1 of the PNP output connector is NC and pin 1 of the other types of connector is +24V U<sub>L</sub>.

## 6 Power Supply Rule

### 6.1 Direct power supply rules

The power supply for each module is connected directly from the switching power supply without using the OUT connector. The total current consumption of each module's load power supply should be  $\leq 8A$ .



The voltage drop in the power supply cable varies depending on the total current consumption of the load power supply of the module and the cable material, the following table shows the voltage drop when using our standard cables.

Total current	Voltage drop at different cable lengths (V)						
consumption of the	1m 3m 5m 1						
power supply (A)							
8	0.64	1.12	1.60	2.72			
7	0.56	0.98	1.40	2.38			
6	0.48	0.84	1.20	2.04			
5	0.40	0.70	1.00	1.70			

4	0.32	0.56	0.80	1.36
3	0.24	0.42	0.60	1.02
2	0.16	0.28	0.40	0.68
1	0.08	0.14	0.20	0.34

#### **Example of calculation of total module current consumption with direct power supply**

For example, Module 1 is EC7-1600A, Module 2 is EC7-0808A, and Module 3 is EC7-0016A, and each module is used as shown in the following table:

I/O Ports		Externally connected devices							
name	port name	Pin Name	I/O Mode	brand name	norm				
		Din/	DI (input current		Current consumption:				
Modulo 1	Dort 19	Г II I <del>4</del>	4mA)	2 Miro Soncorc	30mA				
wodule i	PUIL I~0	Din2	DI (input current	5 WIRE SENSORS	Current consumption:				
		PINZ	4mA)		30mA				
	Port 1~4		Dim 4	DI (input current		Current consumption:			
		71114	4mA)	2 Miro Soncora	30mA				
		Din 2	DI (input current	5 WIRE SENSORS	Current consumption:				
wodule 2							PINZ	4mA)	
	D 1 4 0	Pin4	DO	colonoida	Load current: 500mA				
	Port 4~8	Pin2	DO	solenoids	Load current: 500mA				
Madula 2	Dout 1 0	Pin4	DO	colonoida	Load current: 500mA				
iviodule 3	Port 1~8	Pin2	DO	solenoids	Load current: 500mA				

Calculate the total consumption current and the individual module calculation current as shown in the

table below:

Module	Power	Total Consumption Current	calculation result
name	supply type	Calculation Items	
	System		Module system side power consumption
	power	System consumption current	35mA
	supply Us		
Modulo 1			For all ports
Module 1	Lood power	Modulo input current and	(Sensor consumption current) + (Channel
		module input current and	input current * Number of input points)
	supply of	sensor consumption current	= (30mA * 16) + (4mA * 16)
			= 544 mA
	System		Module system side power consumption
	power	System consumption current	35mA
Module 2	supply $U_{\text{S}}$		
	Lood power	Modulo input current and	For ports 1~4
			(Sensor consumption current) + (Channel
	supply U <sub>L</sub>	sensor consumption current	input current * Number of input points)

			= (30mA * 8) + (4mA * 8)
			= 272 mA
			For ports 5~8
			Channel Output Current * Number of
		Load Output Current	Output Points
			= 500mA * 8
			= 4A
	System		Module system side power consumption
	power	System consumption current	35mA
	supply U <sub>s</sub>		
Module 3			For ports 1~8
Would 5	Load power supply U <sub>L</sub>		Channel Output Current * Number of
		Load Output Current	Output Points
			= 500mA * 16
			= 8A

In summary, the current consumption of each module is as follows:

- For the system power supply U<sub>s</sub>, each module consumes a current of 35mA.
- For the load power supply  $U_L$ :

The load power supply  $U_L$  for module 1 (EC7-1600A) consumes 544 mA, which is less than the module load power supply  $U_L$  maximum current of 8A.

The load supply U<sub>L</sub> for module 2 (EC7-0808A) consumes 272 mA + 4A = 4.272A, which is less than the module load supply U<sub>L</sub> maximum current of 8A.

The load power supply  $U_L$  of module 3 (EC7-0016A) consumes 8A, which is equal to the module load power supply  $U_L$  maximum current of 8A.

In this example, the requirement is satisfied because the total consumption current total of each module

satisfies the sum of the module load power supply consumption current  $\leq$  8A.

### 6.2 Tandem power supply rules

Modules are powered in series through the OUT interface, the sum of the consumption current of the load power supply of each module should be  $\leq$ 8A, and the sum of the consumption current of the system power supply and load power supply of all modules should be  $\leq$ 16A.



When power is supplied in series, the module will have the consumption current of the seriesconnected module flowing inside the module, thus generating a voltage drop in the internal circuit of the module. The voltage drop in the power cable varies according to the total consumption current of the load power supply of the module and the cable material, the following table shows the voltage drop when using our standard cable.

Total current	Voltage drop in the	Voltage drop at different cable lengths (V)			
consumption of the	internal circuit of the	1m	3m	5m	10m
power supply (A)	module (V)				
16	0.64	1.28	2.24	3.20	5.44
15	0.60	1.20	2.10	3.00	5.10
14	0.56	1.12	1.96	2.80	4.76
13	0.52	1.04	1.82	2.60	4.42
12	0.48	0.96	1.68	2.40	4.08
11	0.44	0.88	1.54	2.20	3.74
10	0.40	0.80	1.40	2.00	3.40
9	0.36	0.72	1.26	1.80	3.06
8	0.32	0.64	1.12	1.60	2.72
7	0.28	0.56	0.98	1.40	2.38
6	0.24	0.48	0.84	1.20	2.04
5	0.20	0.40	0.70	1.00	1.70
4	0.16	0.32	0.56	0.80	1.36
3	0.12	0.24	0.42	0.60	1.02
2	0.08	0.16	0.28	0.40	0.68
1	0.04	0.08	0.14	0.20	0.34



• The sum of the current consumption of the load power supply of each module for each module shall be  $\leq 8A$ .

• As shown in the above figure, the total consumption current of the system power supply and load power supply of all modules in series should meet the rule of "1+2+3"  $\leq$  16A.

#### Example of calculating the total current consumption of a module when powered in

#### series

For example, if module 1 is EC7-1600A, module 2 is EC7-0808A, and module 3 is EC7-0016A, the usage of each module is the same as in the "<u>Example of Calculating the Total Consumption Current of a</u> <u>Module When Directly Supplied with Power</u>".

Calculate the total consumption current:

 $U_{s} = 35mA + 35mA + 35mA = 105mA$ 

 $U_L = 544mA + 4.272A + 8A = 12.816A$ 

In this example, since the total current consumption of system power supply  $U_s$  and load power supply  $U_L$  of all modules satisfies the rule of "1+2+3"  $\leq$  16A, the requirement is met.

#### 🗲 caveat

• For series power supply mode, if the sum of system power supply  $U_S$  consumption current or load power supply  $U_L$  consumption current exceeds 16A, please change some modules to direct power supply mode to ensure that the sum of system power supply  $U_S$  consumption current or load power supply  $U_L$  consumption current  $\leq$  16A.

7 Use

## 7.1 Configuration Module Applications

#### 7.1.1 Application in TwinCAT3 software environment

#### 1. Preliminary

- hardware environment
  - Module Model EC7-0808A
  - > A computer with pre-installed TwinCAT3 software
  - > Shielded cables for EtherCAT
  - > One switching power supply
  - Device Configuration Files
     Configuration file access: https://www.solidotech.com/documents/configfile
- Hardware configuration and wiring Please follow "5. Installation and Wiring".

#### 2、 Preset Profiles

Place the ESI configuration file (Solidotech EC7\_V2.0.3.xml) in the TwinCAT installation directory under "C:\TwinCAT\3.1\Config\lo\EtherCAT" as shown below.

Windows (C:) > TwinCAT > 3.1 > Configuration	~	U	Q	
名称	修改日期	类型	1	
	2017, 40 1110			
Beckhoff EPP7xxx.xml	2016/12/22 10:57	XM	L文档	
Beckhoff EQ1xxx.xml	2015/11/12 14:24	XM	L文档	
Beckhoff EQ2xxx.xml	2016/11/23 10:42	XM	L 文档	
Beckhoff EQ3xxx.xml	2016/11/22 11:22	XM	L文档	
Beckhoff ER1xxx.XML	2016/11/21 15:46	XM	L文档	
Beckhoff ER2xxx.XML	2016/11/21 14:32	XM	L 文档	
Beckhoff ER3xxx.XML	2017/6/9 13:35	XM	L文档	
Beckhoff ER4xxx.xml	2016/11/22 12:58	XM	L 文档	
Beckhoff ER5xxx.xml	2016/3/14 11:52	XM	L文档	
Beckhoff ER6xxx.xml	2016/3/14 11:52	XM	L 文档	
Beckhoff ER7xxx.xml	2016/11/22 12:14	XM	L文档	
Beckhoff ER8xxx.xml	2016/3/14 11:52	XM	L文档	
Beckhoff EtherCAT EvaBoard.xml	2015/2/4 12:57	XM	L 文档	
Beckhoff EtherCAT Terminals.xml	2015/2/4 12:57	XM	L文档	
Beckhoff FB1XXX.xml	2017/5/24 12:26	XM	L 文档	
Beckhoff FCxxxx.xml	2015/2/4 12:57	XM	L 文档	
Beckhoff ILxxxx-B110.xml	2015/2/4 12:57	XM	L 文档	
Solidotech EC7_V2.0.3.xml	2022/12/30 16:59	XM	L 文档	

#### 3、 Scanning device

#### a. Run the TwinCAT3 software

Click on the TwinCAT icon in the lower right corner of the desktop and select "TwinCAT XAE (VS xxxx)" to open the TwinCAT software as shown below.



#### b. Create Project

Select "New TwinCAT Project", in the pop-up window, "Name" and "Solution name" correspond to the project name and solution name respectively. In the pop-up window, "Name" and "Solution name" correspond to the project name and solution name respectively, and "Location" corresponds to the project path, these three items can be selected by default, and then click "OK", the project is created successfully, as shown in the following figure.



#### c. Scanning device

After creating the project, right-click on the "Scan" option under "I/O -> Devices" to perform a slave device scan, as shown in the following figure.

Solution Explorer	*	Ψ×
© ⊖ ☆   `o - i =   ≠ <u>-</u>		
Search Solution Explorer (Ctrl+;)		ρ- q.
<ul> <li>Solution 'TwinCAT Project1' (1 project)</li> <li>TwinCAT Project1</li> <li>SYSTEM</li> <li>MOTION</li> <li>PLC</li> <li>SAFETY</li> <li>C++</li> <li>I/O</li> </ul>		
Mappings	10 10 10 10	Add New Item     Ins       Add Existing Item     Shift+Alt+A       Export EAP Config File       Scan       Paste     Ctrl+V
		Paste with Links

Check the "Local Connection" box, as shown in the following figure.

1 new I/O devices found	×
Device 2 (EtherCAT) [U,★M [Realtek PCIe GbE Family Controller]]	OK Cancel Select All Unselect All

Select "Yes" for "Scan for boxes" and "Yes" for "Activate Free Run". ", as shown in the figure below.

Microsoft Visual Studio $ imes$	Microsoft Visual Studio $ imes$
Scan for boxes	? Activate Free Run
是(Y) 否(N)	是(Y) 否(N)

7 Use

After scanning the device, you can see TwinCAT in "Online" in the "OP" state, and you can observe that the RUN lamp of the slave device is always on, as shown in the figure below.

Image: Search Solution Explorer (Ctrl+:)	General EtherCAT I	DC Process Data	Online	
Solution 'TwinCAT Project1' (1 project)  TwinCAT Project1  MOTION  LC  SAFETY	State Machine Init Pre-Op Op	Bootstrap Safe-Op Clear Error	Current State: Requested State:	OP OP
W C++ ✓ VO ✓ Devices ✓ Image-Info ✓ SyncUnits ✓ Inputs Outputs ✓ Outputs ✓ InfoData	DLL Status Port A: C Port B: N Port C: N Port D: N	arrier / Open lo Carrier / Closed lo Carrier / Closed lo Carrier / Closed		
A Box 1 (EC7-0808A) Mappings	-File Access over E Download	therCAT Upload		

#### 4. Data interaction

#### Digital input operation for each channel:

Take channel Input[4] input as an example, if the slave device input channel Input[4] has a valid voltage input, it can be observed in "Digital Input[0...7]" on Box 1 in TwinCAT, as shown in the figure



below:

Note: Convert 16 (0x10) to binary as 00001000b, 8 bits correspond to 8 channel inputs, when a valid voltage is input, the corresponding bit is set to 1.

#### Digital output operation for each channel:

Take channel Output[0] input as an example, if you want the slave device to output digital output channel Output[0] output, you can in TwinCAT Digital Output[0...7] corresponding to the "Online", left click on "Write", in the corresponding dialog box "Dec" enter the value "1", you can see the corresponding channel light on the slave device, as shown in the figure below. "Write", enter the value "1" at "Dec" in the corresponding dialog box, and you can see the corresponding channel light on the following figure.



#### 7.1.2 Application in CODESYS V3.5 software environment

- 1. Preliminary
  - Hardware environment
    - > Module EC7-0808A
    - > A computer with CODESYS V3.5 pre-installed, CODESYS Control Win V3 x64 SysTray software
    - > Shielded cables for EtherCAT
    - > One switching power supply
    - Device Configuration Files
       Configuration file access: https://www.solidotech.com/documents/configfile
  - Hardware configuration and wiring Please follow "5. Installation and Wiring".

#### 2. Installing a device configuration file

- a. Log in to CODESYS.
- b. Select "Tools -> Device Repository".
- c. Click "Install", select the relevant XML file to install, the file format is Solidotech EC7\_V2.0.3.xml. Successful installation, the display shows "Device xxxx has been installed to the device repository", as shown in the following figure.

ocation	System Repository			~	Edit Locations.
	(C:\ProgramData\CODESYS\Devi				
nstalled d	le <u>v</u> ice descriptions				
String for	a fulltext search	Vendor:	<all vendors=""></all>	$\sim$	<u>I</u> nstall
Name				^	<u>U</u> ninstall
	🚊 🚞 Nanjing Solidot Electronic	Technology	Co., Ltd		Export
	🖻 泣 EC7 IO Modules				
	EC7-0016A (16-0	Dutput,NPN,	0.5A)		
	EC7-0016B (16-0	Output,PNP,	0.5A)		
	EC7-0808A (8-In	Out,NPN,0.	5A)		
	EC7-0808B (8-In	Out,PNP,0.5	5A)		
	EC7-1600A (16-1	input,NPN)			
	EC7-1600B (16-I	nput,PNP)			
	🗈 泣 XB6 Series Fieldbus			~	
<				>	<u>D</u> etails
=- <b>0</b> p	:\Solidotech EC7_V2.0.3.xml				
	Device "EC7-0016A (16-Output,N	PN,0.5A)" in	stalled to device repository.		
	Device "EC7-0016B (16-Output,P	NP,0.5A)" in:	stalled to device repository.		
	Device "EC7-1600A (16-Input,NP	N)" installed	to device repository.		
	Device "EC7-1600B (16-Input,PN	P)" installed t	to device repository.		
	Device "EC7-0808A (8-InOut,NPN	1,0.5A)" insta	alled to device repository.		
(	Device "EC7-0808B (8-InOut,PNP	,0.5A)" insta	lled to device repository.		

#### 3、 New construction

Click "File -> New Project" as shown below.

管 New Pro	oject					×
Categories	raries ojects	Templates	HMI project	Standard project	Standard project w	
A project co	ontaining one device, one ap	plication, and an e	empty implement	tation for PLC_	PRG	
<u>N</u> ame <u>L</u> ocation	Untitled1 C:\Users\29719\Document	's			~	
				ОК	Cancel	]

#### 4. Scanning network

- a. To start the PLC with "CODESYS Control Win V3 x64 SysTray", locate "CODESYS Control Win V3 x64 SysTray" in the lower right hand corner of the computer and Right-click on "CODESYS Control Win V3 x64 SysTray" in the lower right corner of the computer and select "Start PLC".
- b. Double-click "Device (CODESYS Control Win V3 X64)" in the left navigation tree of CODESYS, and click "Scan for Networks".

c. Select the device and choose the correct controller network path as shown below.

Device X					
Communication Settings	Scan Network	Gateway 👻	Device -		
Applications		_			
Backup and Restore				• • • • • • • • • • • • • • • • • • •	
Files					
Log			Gateway-1	Gateway	[0000.B194] (active)
PLC Settings			IP-Address:		DeviceName:
PLC Shell			Port:		Device Address:
Users and Groups			1217		0000.B194 Target ID:
Access Rights					0000 0004
Symbol Rights					Target Type: 4096
IEC Objects					Target Vendor: 3S - Smart Software Solutions GmbH
Task Deployment					Target Version: 3.5.15.10
Status					
Information					

#### 5、 Add EtherCAT Master

Right-click "Device(CODESYS Control Win V3 X64)" in the left navigation tree of CODESYS, click "Add Device", select "EtherCAT -& gt; Master -> EtherCAT Master" and add it. gt; Master -> EtherCAT Master" and add it.



#### 6、 Configuring the EtherCAT Master

Double click on "EtherCAT\_Master(EtherCAT Master)" in the left navigation tree to open the right main menu, click on the "Browse" button and select Ethernet.



#### 7、 Scanning device

a. Before scanning for the first time, you must log in the program to PLC, right-click
 "EtherCAT\_Master(EtherCAT Master)" in the left navigation tree to select the scanning device,
 after scanning to the corresponding device, select the module, click "Copy to project", as shown
 below. After scanning the corresponding device, select the module and click "Copy to Project", as
 shown in the following figure.

Devices 👻 4 🗙	Device BtherCAT_Ma	ster X	
Untitled1     Device [connected] (CODESYS Control Win V3 x64)	General	Autoconfig Master/Slaves	EtherCAT
🖶 🔛 PLC Logic	Sync Unit Assignment		
🖹 🚫 Application [run]	Scan Devices		– 🗆 X
- Ibrary Manager - IPLC_PRG (PRG)	Scanned Devices		
E-100 Task Configuration	Device name Device type	Alias Address	
· · · · · · · · · · · · · · · · · · ·	ECT_DODDA ETT-DODDA (B	(Indust, MYR, 0, 5A)	
	Assign Address		Droient
	Scan Device		Copy to project Close
< >			
Sevices POUs			

b. After successful copying, it is shown below.

/ces 👻 🕈 🗙	- 7 X Device 🔂 EtherCAT_Ma	ster = EC7_0808A ×		
test         ■ <th>A X      Denice     EtherCAT_Me     Control     Contro     Contro     Contro     Control     Control     Control     Cont</th> <th>Address Ether X address Court 2 address Court</th> <th>Additional    Beable expert settings  Optional</th> <th>Ether CAT.</th>	A X      Denice     EtherCAT_Me     Control     Contro     Contro     Contro     Control     Control     Control     Cont	Address Ether X address Court 2 address Court	Additional    Beable expert settings  Optional	Ether CAT.

8、Test IO Module

a. To configure the IO module bus mode, click "Online -> Exit" in the menu bar to exit the PLC, as shown in the following figure.

] 🛎 🖬 🎯 🗠 α 🔏 🖻 🗟 X	Logout	Alt+F8	Application [D	evice: PLC	Logic] • 🧐 😋 🕴	■ ≪ (ほうまい * 8   ◆   ■		
lices	Create Bo	ot Application	ster X					
Untitled1     Om Device [connected] (CODESYS Cor     Device [	Online Ch Source D	Download Online Change Source Download to Connected Device		Autoconfig Master/Slaves				
B O Application [run]	Multiple (	ownload	EtherCAT NIC S	etting —				
Ibrary Manager     ILbrary Manager     PLC_PRG (PRG)     Start Configuration     G    SetterCAT_Task (1	Reset Wa	rm	Destination add	iress (MAC)	FF-FF-FF-FF-FF-FF	Broadcast Enable redundancy		
	Reset Col	d	Source address (MAC) 7C-8A-E1-95-25 Network Name 以太网	7C-8A-E1-95-25-53	Browse			
	Reset Ori	ain		以太网				
MainTack (IEC.Ta	Simulation	1	Select network	ork by MAC	<ul> <li>Select netwo</li> </ul>	ork by name		
Plantas (EC-Ta     B) PLC_PRG     Dig EtherCAT Master (EtherCAT M	Security	•	( Distributed Cl			Cations		
	Operating	Operating Mode •		ACK .		popuons		
EC7_0808A (EC7-0808A (8-InOu	Out,NPN,0.5A))	Information	Cycle time	4000	ф µs			
			Sync offset	20	÷ %			
			Sync window	monitoring				
			Sync window	1	us			
			Diagnostics mes	sage No :	slaves in configuration: pr	epared for scan for devices		
			Bus load		0 %			
			1					

- b. Check "EtherCAT I/O Mapping" in the menu folder of the module EC7-0808A.
- c. In the "Always update variables" menu at the bottom right corner of the page, select the "Enable 1" mode, as shown in the following figure.

File Edit View Project Build Online Debug Tools Window Help

Eile Edit View Project Build Online Debug Iools Window Help

evices 👻 🗘 🛪	Device EtherC	AT_Master EC7_0808	A X						
Untiled I     Proce (CODESYS Control Win V3 x54)	General	Find		Filter Show all				Add FB for IO Channe	L., → Go to Instance
A CLARK     Activation     Comparison     Comp	Process Data InterCAT 10 Mapping EtherCAT IIC Objects Datas Jafornation	Variable	Mapping	Channel Digital Oxtou(07) Digital Poul(07)	Address %Q80 %280	Type USBNT USBNT	Unit	Description Description Desid Sound(2) - 7 Degid Sound(2) - 7 Degid Sound(2) - 7	
						77 - Y2			

d. Log back in and run the software and test the module as shown below.

◎☞■●○○◇३№◎× ₩%₩%	別別別	Application [Device: PLC L	ogic] • 🤫	<b>≪</b> → ∎ ≪ 10	1 9 <u>1 61</u> 4	1 \$   4	罰 〒 沙				
Devices 👻 🤻 🛪 🗙	Device BtherCAT_Ma	ster EC7_0808A X									
Linoted1	General	Find		Filter Show all			• 🗣 Add FB	<ul> <li>Add FB for IO Channel</li> <li>Go to Instance</li> </ul>			
G II Device (connected) (CODESYS Control Win V3 x64)     GI PLC Logic     G Application [run]	Process Data	Variable 	Mapping	Channel Digital Output[07]	Address %Q80	Type USINT	Current Value	Prepared Value	e Unit	Description Digital Output[07]	
Lbrary Manager	EtherCAT I/O Mapping	18-1 <b>9</b>		Digital Input[07]	%IB0	USINT	16			Digital Input[07]	
- 📄 PLC_PRG (PRG) = í Itask Configuration	EtherCAT IEC Objects										
- 😏 🥩 EtherCAT_Task (IEC-Tasks) =- 😏 🥸 MainTask (IEC-Tasks)	Status										
PLC_PRG	Information										
C = EC7_0808A (EC7-0808A (8-InOut,NPN,0.5A)											
						Ret	set Mapping Alway:	updatevariables	Enabled 1	(use bus cycle task if not used in any task)	
Cervices POUs		🍫 – Create new variable	🍖 – Ma	p to existing variable							

#### 7.1.3 Application in Sysmac Studio software environment

#### 1. Preliminary

- hardware environment
  - > Module Model EC7-0808A
  - > One computer with Sysmac Studio software pre-installed
  - One Omron PLC
     This description is based on model NJ301-1100 as an example.
  - > Shielded cables for EtherCAT
  - > One switching power supply
  - Device Configuration Files
     Configuration file access: https://www.solidotech.com/documents/configfile
- Hardware configuration and wiring
   Please follow "5. Installation and Wiring".
- Computer IP requirements

Set the IP address of the computer and the IP address of the PLC to make sure they are on the same network segment.

#### 2、 New construction

a. Open the Sysmac Studio software and click the "New Project" button.

Sysmac Studio (64bit)						٥	×
	_		_	_			_
Offline Rev Project Project Project Project	Project P Project name Author Comment	roperties EC7 29719	_				
Online <u>4</u> <u>Connect to Device</u> Version Control	Type	Standard Project					
Ucense	Category Device Version	Controller NJ301	• 1100	*			
Robot System				<u>C</u> reate			

- Project name: Customize.
- Select device: "Device" selects the corresponding PLC model, and "Version" recommends selecting V1.40 and above.
- b. Once the project properties have been entered, click the Create button.

c. Click "Controller -> Communication Settings" in the menu bar, select the method to be used every time you connect to the controller when you are online, and enter "Remote IP Address" as shown in the following figure.



d. Click "Ethernet communication test", the system shows that the test is successful.

#### 3. Installation of XML files

- a. Expand "Configuration and Settings" in the left navigation tree and double-click on "EtherCAT".
- b. Right-click on "Master Device" and select "Show ESI Library" as shown below.



c. In the pop-up "ESI Library" window, click the "Install (file)" button, select the XML file path, click the button "Yes" to complete the installation.



#### 4. Adding devices and setting node addresses

There are two ways to add devices: online scanning and offline adding, this note is introduced with online scanning as an example.

a. Click the online button on the toolbar, right-click on "Master Device", click and select

"Compare and Merge with Physical Network Configuration", as shown in the following figure.



b. In the Compare and Merge with Physical Network Configuration pop-up dialog box, click Show Write Slave Node Address Dialog Box, as shown in the following figure.



c. In the Set Node Address dialog box, click the value under Set Value to enter the node address, and then click the Write button, as shown in the following figure.

Slave Node Address Writing	-		$\times$
Present valuelSet valuelActual network configuration	_	_	
Master			
0 EC7-0808A Rev:0x00000001			
Update With Latest Actual No	etwork C	onfigura	tion
Node addresses are set for slaves. When any value other than 0 is set to a slave whose node address can be set from hardware, the setting has pric addresses set here are applicable.	ority. In c	other case	es, the
	Write	e Cai	ncel

d. After writing, a re-power prompt will pop up, as shown in the following figure, click the "Write" button, and then follow the prompts to reboot the power from the device.

Slave Node Address Writing	Slave Node Address Writing ×
Node addresses are written to the slaves. It make to when the most of the spandard gas base to split the power rapply to the shaw and monable. It must be also be discussional spandard.	Writing node addresses to slaves was successfully completed. Cycle the power supply to the slave to reflect the settings.
Write Cancel	Close

e. Right-click "Master Device", click and select "Compare and Merge with Physical Network Configuration", a dialog box will pop up, click "Apply Physical Network Configuration", as shown in the following figure.

Compare and Merge with Actual Network Configuration											$\times$
Node Address Network confi	guration on S	Node addresslActua	l network configuration	n	I (	Network configuration	Comparison result	Actual network config	Lower (	Configur	ation
	Master Master		Master			Master	Matched	Master			
		1.00	EC7-080	I8A Rev:0x00000001			Added	1 : EC7-0808A Rev:0x			
K	>										
		<ul> <li>Apply actual net</li> </ul>	work configuration								
Some slaves such as Power Su	upply Units are	not included in the	actual network config	uration.	_						
					lose						

f. Click the "Apply" button in the pop-up dialog box, as shown below.



g. After the topology application is complete the dialog box is closed and the module is displayed in the Network Setup screen as shown below.



#### 5. Download configuration to PLC

a. Click the button "Controller -> Transmit in (A) -> Transmit to Controller (T)" in the menu bar, as shown in the following figure.

File Edit View Insert Project	Controller Simulation Tools Windo	ow Help						
v an s a s a a	Communications Setup		AXAA	5 5 0	0 17 0 17			
	Change Device					~ ~		
Multiview Explorer	Online	Ctrl+W						-
	Offline	Ctrl+Shift+W		1		1		
new_controller_0	Supphronize	Ctrl+M						
<ul> <li>Configurations and Setup</li> </ul>	Synchronize	CUITEM				Item name	Value	
EtherCAT	Transfer	•	To Controller	Ctrl+T		Model name	Master	
L C Node1 : EC7:0808A (E001)	Mode	•	From Controller	Ctrl+Shift+T		Product name	Master	
E CPII/Expansion Packs	Monitor				,	Number of Slaves		
CPU/Expansion Racks	Monitor					PDO Communications Cycle 1	2000	us
🖋 I/O Map	Stop Monitoring					PDO Communications Cycle 2		us
Controller Setup	Set/Reset	,				Reference Clock	Exist	
► ⊕ Motion Control Setup	Forced Refraching					Total Cable Length		m
e' Cam Data Settings	rorect nerrearing					Fail-soft Operation Setting	Fail-soft operation	
Event Settings	MC Test Run	,				Wait Time for Slave Startup		\$
F Task Gardings	MC Monitor Table					PDO communications timeout Benision Check Method	Z Sattion on Actual device	times
Task Settings	CNC Coordinate System Monitor Table					Serial Number Check Method	Setting <= Actual device	
Data Trace Settings	cive coordinate system monitor rust	. ,				DC Synchronous Correction	Disable slave monitoring ontion	
Programming	SD Memory Card					be synchronous concetion		
	Controller Clock							
	Release Access Right							
	Hadata COULUSIA Norra							
	Opdate CPO Unit Name							
	Security	•						
	Clear All Memory					C Device name		
	Reset Controller					Set a name for the master.		
			1					

b. Download the configuration to the PLC as shown in the figure below. After the download is complete, power needs to be reapplied.

Transfer to Controller		
The following data will be transferred	ł.	
- Configurations and Setup EtherCAT, CPU Rack, I/O Map, Cc Motion Control Setup, Cam Data Task Settings	ontroller Setup	
- Programming POUs, Data, Library	Downloading 35%	
Options		
Clear the present values of variabl	Cancel	insferred when this option is changed.
<ul> <li>Do not transfer the following. (All         <ul> <li>NX Unit application data on the </li> <li>Unit operation settings and NX L</li> <li>Do not transfer the EtherNet/IP co</li> </ul> </li> </ul>	tems are not transterred.) CPU Rack and EtherCAT slav Jnit application data on Slav nnection settings (i.e., tag c	✓ ve backup parameters. ve Terminals. Jata link settings).
		Execute Close

#### 6、 Test IO Module

After restarting the power, you can see the PLC is running mode in the lower right corner, double click "I/O Mapping" in the left navigation tree, you can monitor the input/output signals and force them to be output, as shown in the following figure.

Ele Edit View Insert Broject Controller Simulation Iools Window Help								
Multiview Explorer 🚽 🦞	🚟 EtherCAT 🚽 🔐 🕼 Map 🗙					- Toolbox	÷ å	
Hubbleve Explorer     9       Inner Construction of All Stap       Inner Construction       Inner Construction       Inner Construction       Inner Status       In	State         Postion         Ford           Noisei         ExerceCAI Protocomponence           Noisei         ExerceCAI Protocomponence           Noisei         ExerceCAI Protocomponence           Outprotocomponence         Schröder Network           Built-Int/G         Built-Int/G           Optionition         Built-Int/G           Optionition         Built-Int/G           Optionition         Patter-Int/Settings           Optionition         NK Built-Int/Settings           Optionition         NK Built-Int/Settings           Optionition         NK Built-Int/Settings           Optionition         NK Built-Int/Settings           Data         Built-Int/Settings           Optionition         NK Built-Int/Settings           Data         Description           Built-Int/Settings         Description	Description   F/W W R     gred decenal	Data hype   V	alue Variable I	Variable Comment Varia	Toolbox     Costroller Status     Costroller Status     Costroller Status	• V V D V V V D V V V D V V V D V V D V V V D V V D V V D V D	
🕄 Filter 🕑	Output Build							

#### Digital input operation for each channel:

Take channel Input[4] input as an example, if the slave device input channel Input[4] has a valid voltage input, it can be observed in "Inputs\_Digital Input[0...7]" in "I/O Mapping" as shown in the figure below. in the "I/O map", as shown in the figure below.

<u>Eile Edit View Insert Project Controller Simulation Tools Window H</u> elp								
X ● ■ ■ つ さ Ø   回 き A 銘 卒 用 忠 A Ø   天 ▲ A A A A A A A A A A A A A A A A A A								
-								
Variable Type								
order								
MSB-LSB 🔵 LSB-MSB								

Note: Convert 16 (0x10) to binary as 00001000b, 8 bits correspond to 8 channel inputs, when a valid voltage is input, the corresponding bit is set to 1.

#### Digital output operation for each channel:

Take channel Output[0] input as an example, if you want the slave device to output digital output channel Output[0] output, you can write "1" at "Value" on Outputs\_Digital Output[0...7], and you can see the corresponding channel light on the slave device as shown in the figure below. You can write "1" at the "value" of Outputs\_Digital Output[0...7], and then you can see the corresponding channel light on the figure below.

Eile Edit View Insert Project Controlle	r <u>S</u> imulatio	on <u>I</u> ools <u>W</u> indow <u>H</u> elp							
X 40 R 6 5 C 60 00 6	~ #	55 R # A 0 R A X	63 🔮 🗣 📬 O	맙	2 I	ଷ୍ଦ୍	10		
Multiview Explorer 🚽 🌵	EtherCAT	🚽 I/O Map 🗙							-
new_Controller.0	Built-in (/ Optionflo NXBusMa	Port     Port     Port     Port     Scherchart Network Configuration     Compares Development     Port     Port     Compares Development     Port     P	Description	R R	Data Type USINT USINT	Value	Variable	Variable Comment	Variable Type
	Monitor type	e 🔴 Binary 🜑 Hex 🜑 Signed decimal 🌑 Unai	gned decimal					Bit ord O M	ler SB-LSB C LSB-MSB

## 8 FAQ

## 8.1 Failure to find a device in the software

- 1. Confirm that the ESI profile is installed correctly.
- 2. Confirm that the ESI profile, version is accurate.
- 3. Whether to restart the Twin CAT software after installing the ESI profile.

#### 8.2 Failure to start operation of a device

- 1. Confirm whether the project is established correctly.
- 2. Confirm the relevant setting of the node station number.
- 3. Make sure if the power supply is normal.
- 4. EtherCAT The communication line is normal.
- 5. Re-power the device after changing from the device node address.