EMP-2848M Series Hardware Manual

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ICP DAS

WARRANTY

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SUPPORT

EMP-2848M

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1. Introduction

The EMP-2848M series is a SoftPLC based EtherCAT master with an integrated multi-axis motion control kernel. The programmable automation controller combines compact size, economy, flexibility, and excellent performance and is the ideal partner for small and medium-sized motion control applications where cost and space-constrains is an deciding factor.

The high-performance quad-core Cortex-A53 processor together with the Real-Time Linux (RT-Preempt) operating system and built in SoftPLC ensure fast, deterministic and real-time behavior in the motion control applications. The integrated, configurable high-speed EtherCAT master can be connected to any standard, 3rd party EtherCAT slave, such as I/Os, servo motor, stepper motor, encoder, etc.. The EtherCAT master can synchronously update up to 128 slaves including 16 servo/stepper drives within a cycle time of 500 microseconds.

The integrated web server assists the user in configuring and diagnosing the EtherCAT networks, and testing of motion control functions. Win-GRAF workbench is a programming software that ICPDAS developed according to the international standard IEC 61131 and aimed at achieving compatibility and reusability.

List of Common Drivers and Motors That Have Been Market Tested

Company	Drivers	Types of Motors
Delta	ASDA A2-E series	AC Servo Motor
Hiwin	D2 series	AC Servo Motor
Moons'	STF/RS series	Two-phase Stepper Motor
Mitsubishi	MR-JET	AC Servo Motor
Oriental Motor	AZ series multi-axis	Closed loop Stepper Motor
Panasonic	A5B/A6B series	AC Servo Motor
Shihlin	SDP series	AC Servo Motor
Sanyo Denki	R series	AC Servo Motor
Teco	JSDG2/JSDG2S	AC Servo Motor
Yaskawa	Sigma 7 series	AC Servo Motor
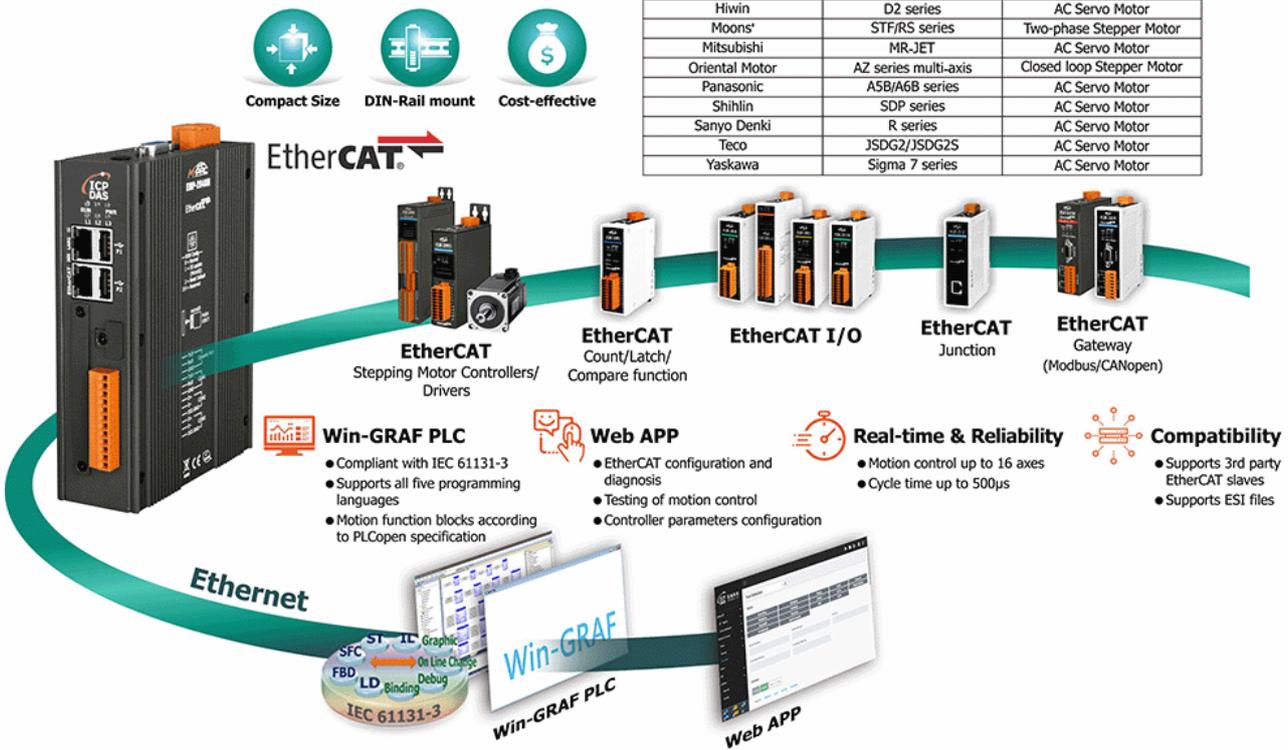
1.1. Specification

Model	EMP-2848M
Software	
OS	Real-Time Linux (RT-Preempt, Kernel 4.14.98)
Programming languages per IEC 61131-3	Instruction List (IL)
	Ladder Diagram (LD)
	Function Block Diagram (FBD)
	Structured Text (ST)
	Sequential Function Chart (SFC)
Development Software	Win-GRAF
Protocols	Modbus TCP, Master/Slave
	Modbus RTU/ASCII, Master/Slave
	EtherCAT
Motion Control	PLCopen Function Blocks
Main Unit	
CPU	Cortex-A53, Quad-core, 1.6GHz
SDRAM	LPDDR4 - 1GB
Storage	eMMC Flash – 8GB
	MicroSD slot
LED Indicators	1 x Run, 1 x Power, 3 x EtherCAT Runtime
Communication Ports	
Ethernet	1 x RJ-45, 10/100/1000 Base-TX
EtherCAT	1 x RJ-45
USB	2 x USB 2.0
Console	RS-232 (RxD, TxD, GND); Non-isolated
COM1	RS-232 (RxD, TxD, GND); Non-isolated
COM2	RS-485 (Data+, Data-); 2500 VDC isolated
COM3	RS-485 (Data+, Data-); 2500 VDC isolated
EtherCAT	
Cycle Time	500µs (min.)
Number of Slaves	128
Number of Axes	16
Power	
Input Range	+12 ~ 48 VDC
Consumption	7.2 W (0.3 A @ 24 VDC)
Mechanical	
Casing	Metal
Dimensions (W x L x H)	42 mm x 164 mm x 129mm
Installation	DIN-Rail Mounting
Environmental	
Operating Temperature	-25 ~ +75 ℃
Storage Temperature	-40 ~ +80 ℃
Ambient Relative Humidity	10 ~ 90% RH (non-condensing)

2. Hardware Information
2.1. Appearance

Item	Description
LED Indicator	The details are shownas below. | LED Indicator	Color	Meaning
---	---	---
RUN	Green	OS is running
PWR	Red	Power is on
L1	Green	**EtherCAT Runtime Running** | State	Meaning
ON	Operation task is running
OFF	Runtime is stopped
Blinking	Operation task is stopped	
L2	Orange	**Motion Control Error Status** | State	Meaning
ON	An error occurred
OFF	No error occurred	
L3	Red	**EtherCAT Runtime Error Status** | State	Meaning
ON	An error occurred
OFF	No error occurred		
Ethernet (LAN1)	The details are shownas below. | LED Indicator	State (Color)	Meaning
---	---	---
1G	ON (Orange)	Network Speed: 1 G
	OFF	Network Speed: 10/100 M
Link/Act	ON (Green)	The Link is active
	OFF	The Link is inactive
	Blinking(Green)	Network activity	
EtherCAT	The EtherCAT master output port is used to manage the network, monitor the status of the slaves and exchange I/O data with slaves. Do not use a standard Ethernet switch for wiring between master and slave. For daisy chaining and branch connection, please use EtherCAT Junction module.
USB	Two USB 2.0 port that allows support for the USB devices such as mouse, keyboard or an external USB hard drive.
MicroSD slot	Supports up to 32 GB

Pin Assignment	

	Pin	Signal	Description
	1	TxD	Console Port (RS-232)
	2	RxD	
	3	GND	
	4	TxD	COM1 (RS-232)
	5	RxD	
	6	GND	
	7	TxD	COM2 (RS-485)
	8	RxD	
	9	GND	
	10	TxD	COM3 (RS-485)
	11	RxD	
	12	GND	

VGA	Maximum resolution 1920x1080
Rotary Switch	Rotary Switch is an operating mode selector switch which provides seven functions related to the selection of the operating mode.
Power Input and Frame Ground	There are 2 pins for power input and a pin for frame ground as follows:

F.G.
P.GND
PWR → Power Input

2.2. Dimensions (Units: mm)

Left Side View
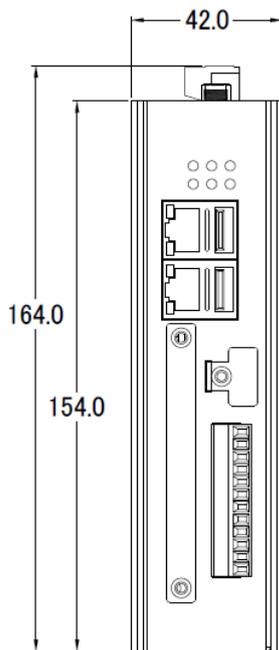
Front View

3. Mounting the Hardware

The hardware has simple rail clips for mounting reliably on a standard 44 mm DIN rail.
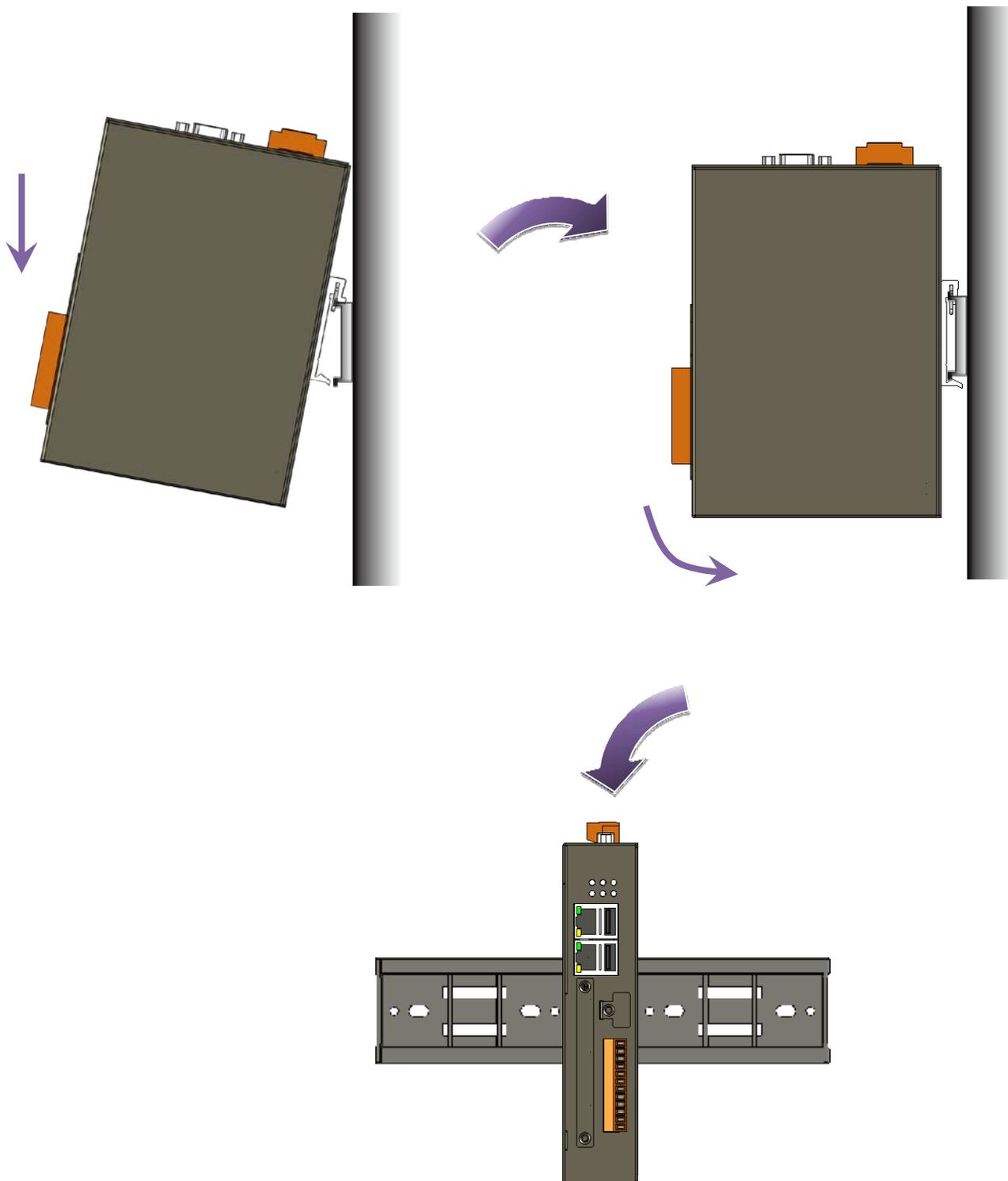
4. System Restore and Reset Default

This chapter describes how to use Rotary Switch to restore the system and reset the default.

Rotary Switch	Mode
	0	Normal mode
	1	Restore system using SD card
	2	Reset default
	3	Delete configuration file

4.1. Restore System Using microSD (Rotary Switch: 1)

[Restore the image to the microSD card]
1. Download the latest version of the SD card system restore image from Download Center. https://www.icpdas.com/tw/download/index.php?model=EMP-2848M
2. The file emp-2848m-system-restore-sd-xxxx-xx-xx.zip contains the emp-2848m-system-restore-sd-xxxx-xx-xx.img image file.
3. Prepare a microSD card with at least 4GB of space. Use HDDRawCopy or Win32DiskImager tool to restore the image file to the SD card.

[Automatic system restore process]
1. Insert the microSD card into the microSD slot and connect the keyboard and monitor to the USB and VGA ports, turn the Rotary Switch to 1, then turn on the power.
2. Wait for the following message to appear on the screen, please enter y to start the automatic system restore process. This message will stay for 5 seconds waiting for user input, if the user does not enter y, you can use the manual system restore process to restore.

```
Welcome To ICPDAS System Restore
Do you want to continue? [y/n] █
```

3. When the restore is successful, one long beeps from buzzer and "system restore successful" will be displayed, press any key to end. If the restore fails, three short beeps from buzzer and "xxx restore failed" will be displayed.

```
mkfs.fat 4.1 (2017-01-24)
22.1MiB 0:00:01 [19.9MiB/s] [================================>] 100%
Image restore successful
22.1MiB 0:00:01 [20.3MiB/s] [================================>] 100%
Image_rt restore successful
37.9KiB 0:00:00 [11.5MiB/s] [================================>] 100%
fsl-umx8mm-iwg34m.dtb restore successful
umount: /dev/mmcblk0p2: not mounted.
mke2fs 1.45.5 (07-Jan-2020)
/dev/mmcblk0p2 contains a ext4 file system
        last mounted on /mnt on Wed Feb 16 11:30:32 2022
Discarding device blocks: done
Creating filesystem with 1755600 4k blocks and 438912 inodes
Filesystem UUID: 1b788641-5160-47fb-89c6-0ad62d6b63dd
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632

Allocating group tables: done
Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done

 447MiB 0:00:50 [8.85MiB/s] [================================>] 100%
rootfs restore successful
system restore successful
```

4.   Finally, turn the Rotary Switch to 0 normal mode and reapply power.

[Manual system restore process]
1.   If the user does not want to connect to the keyboard and monitor, the Console Port can be used for manual system restore.
2.   Connect the CA-0910 female connector to the PC and the other side to the Console Port on the hardware pin.
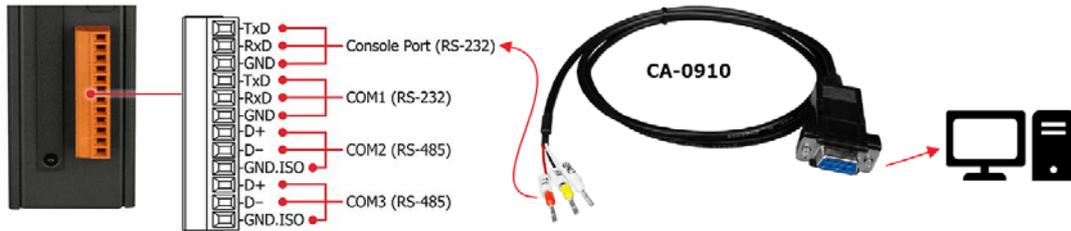
3.   Insert the microSD card into the microSD slot and turn the Rotary Switch to 1, then turn on the power.
4.   Use an SSH/Telnet software, e.g. PuTTY, to connect to UA via the Serial connection. Input your Serial line (default: COM1) and Speed (115200 for UA). And then click "Open" button.
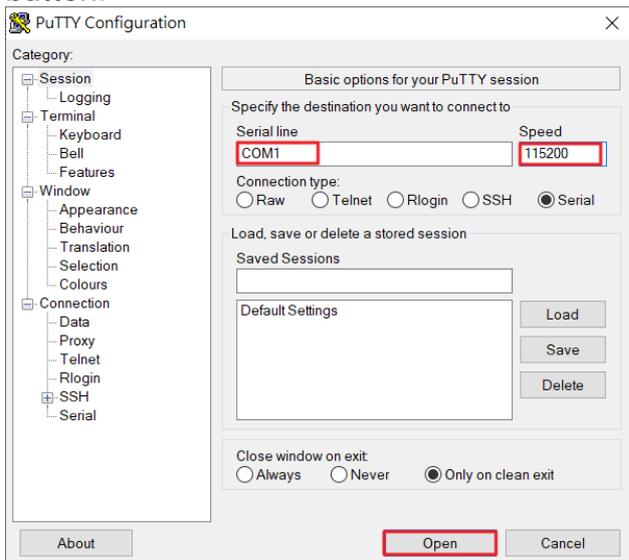
5. After the login message, enter the default username (root) and password (icpdas).

```
            Starting Update UTMP about System Runlevel Changes...
[  OK  ] Finished Update UTMP about System Runlevel Changes.

Ubuntu 20.04.1 LTS icpdas.lp2841 ttymxc3

icpdas login: █
```

6. Enter "cd recovery" to change the directory.

```
root@icpdas:~# cd recovery
root@icpdas:~/recovery# █
```

7. Enter "./sys_recovery.sh" to run the system restore program, wait for the following message to appear, please enter "y" to start the system restore process.

```
root@icpdas:~/recovery# ./sys_recovery.sh
Welcom To ICPDAS System Restore
Do you want to continue? [y/n] █
```

8. When the restore is successful, one long beeps from buzzer and "system restore successful" will be displayed, press any key to end. If the restore fails, three short beeps from buzzer and "xxx restore failed" will be displayed.

```
mkfs.fat 4.1 (2017-01-24)
22.1MiB 0:00:01 [19.9MiB/s] [===============================>] 100%
Image restore successful
22.1MiB 0:00:01 [20.3MiB/s] [===============================>] 100%
Image_rt restore successful
37.9KiB 0:00:00 [11.5MiB/s] [===============================>] 100%
fsl-imx8mm-iwg34m.dtb restore successful
umount: /dev/mmcblk0p2: not mounted.
mke2fs 1.45.5 (07-Jan-2020)
/dev/mmcblk0p2 contains a ext4 file system
        last mounted on /mnt on Wed Feb 16 11:30:32 2022
Discarding device blocks: done
Creating filesystem with 1755600 4k blocks and 438912 inodes
Filesystem UUID: 1b788641-5160-47fb-89c6-0ad62d6b63dd
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632

Allocating group tables: done
Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done

 447MiB 0:00:50 [8.85MiB/s] [===============================>] 100%
rootfs restore successful
system restore successful
```

9. Finally, turn the Rotary Switch to 0 normal mode and reapply power.

4.2. Restore System Using UUU Tool

If you cannot restore the system from the SD card, you can use this method to restore the system.

1. Download the latest version of UUU system restore file from Download Center (emp-2848m-system-restore-uuu-xxxx-xx-xx.zip).
   https://www.icpdas.com/tw/download/index.php?model=EMP-2848M

2. prepare a Mini USB cable.

3. Disassemble the hardware case and adjust the SW1 dip switch to USB download mode, as shown below.

1,2=10=USB download mode
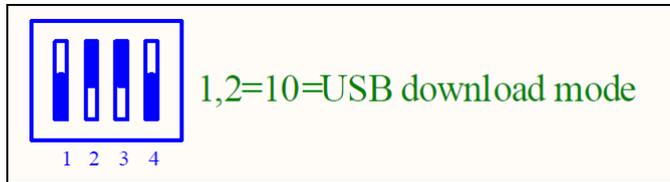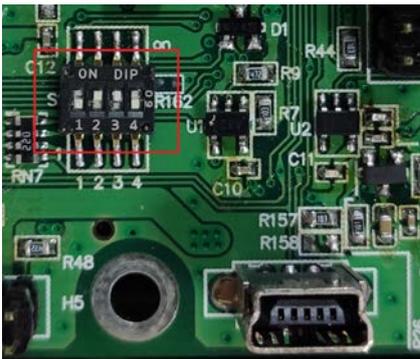
4. Connect the Mini USB cable to the Mini USB connector (J4) of the module and the other end to the PC.
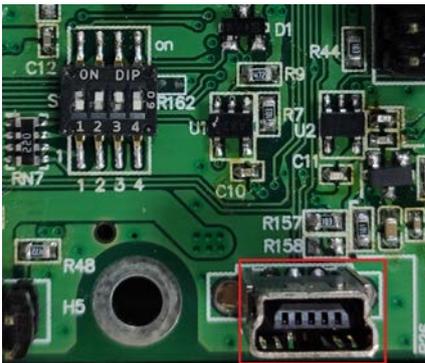
5. Extract emp-2848m-system-restore-uuu-xxxx-xx-xx.zip file, and execute Win-UUU_EMP-2848M_1G.bat.
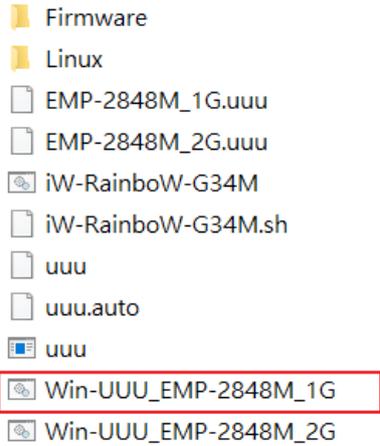
6. Wait for "Wait for Known USB Device Appear" to appear in the command prompt.
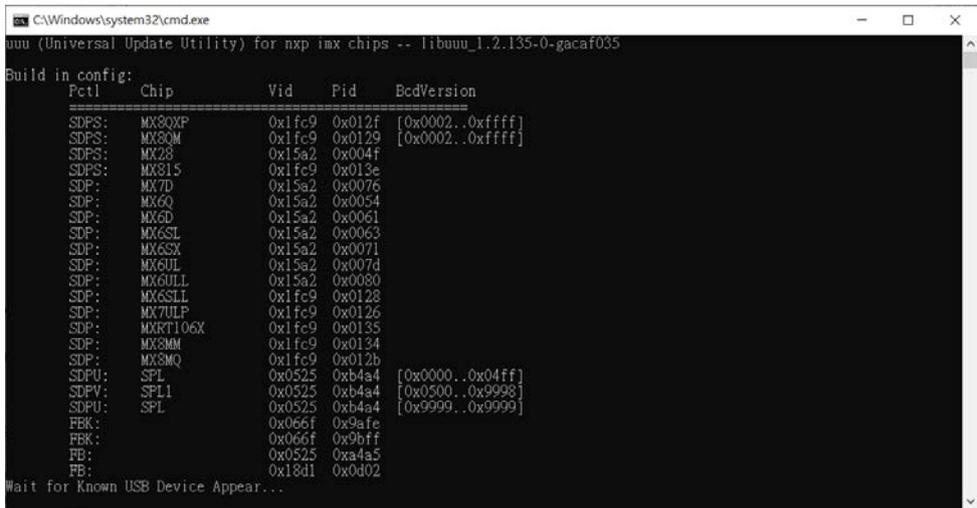
7. Turn on the module power, the system restore process will start, wait for "Start Cmd:FBK Done" to appear and show "Okay", it means the system restore is successful.
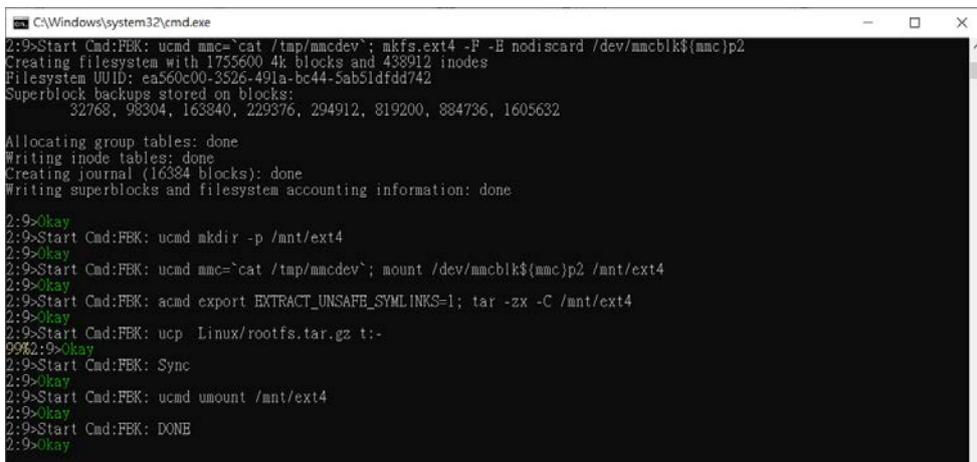
8. As shown in the figure below, adjust the SW1 DIP switch to the internal SPI boot mode and reapply power.

1,2=01=Internal SPI boot mode

1 2 3 4
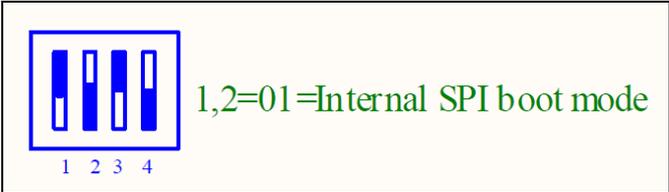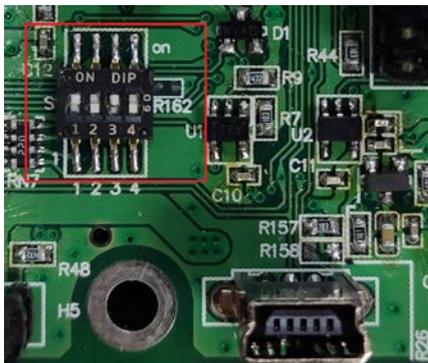
4.3. Reset Default (Rotary Switch: 2)

1. Turn the Rotary Switch to 2 and turn on the power. Wait for the buzzer to beep every three seconds to indicate a successful reset of the default value.

Factory Default Settings		
Network	IP (LAN1)	192.168.255.1
	Netmask	255.255.0.0
	Gateway	192.168.1.1
OS Account	Username	Password
	root	icpdas
	icpdas	icpdas
Web Account	Username	Password
	admin	admin

2. Turn the Rotary Switch to 0 normal mode and reapply power.

4.4. Delete the Configuration File (Rotary Switch: 3)

1. Turn the Rotary Switch to 3 and turn on the power. Wait for the buzzer to beep every three seconds to indicate successful deletion of the configuration file.

Configuration file	
EtherCAT	Delete the default ENI file
Win-GRAF	Delete the PLC program file

2. Turn the Rotary Switch to 0 normal mode and reapply power.

Revision History

Revision	Date	Description
1.0	2022/07	Initial issue