

A00 19010851

Thank you for buying the AM600-4PME EtherCAT slave station positioning module. This product was developed and produced by Inovance Technology.

This module is an extended module based on the EtherCAT bus. It features 4 pulse output channels, each of which is capable of outputting a pulse in the format of phase A/B 1X frequency, pulse + direction or CW/CCW. It supports up to 200 kHz. Each channel includes 4 digital input terminals and 1 digital output terminal. The digital input terminals function as positive & negative limits, home switches, emergency stop inputs or common inputs, while the digital output terminal functions as a common output or servo enabling signal. The module can be used for the positioning control of a pulse-type servo and a step motor drive.

This User Guide mainly describes the specifications, features and uses of the AM600-4PME EtherCAT slave station positioning module. Users should carefully read these instructions before using this product to ensure the safe and proper use of this product. Please refer to the AM600 Series PLC Hardware Manual and the AM600 Series PLC Programming Manual (Motion Control) to understand how to use the user program development environment and the design method of the product's user program. You can download the latest materials from our website http://www.inovance.cn.

Safety Instructions

There are two levels of safety information and precautions: Warning and Caution. Please take appropriate safety measures when using this product.

- DANGER: Indicates improper operation which, if not avoided, may cause death or serious injury;
CAUTION: Indicates improper operation which, if not avoided, may cause moderate or minor injury, or damage the equipment.

In some cases, failure to follow "Cautions" may also lead to serious consequences. Please make sure to follow both warnings and precautions, otherwise, death, serious injury, or damage to the product or system may result.

Please keep this guide so that it can be read when necessary and forward this guide to the end user.

Control System Design

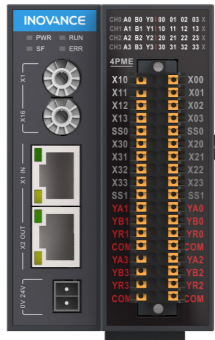
- DANGER: Provide a safety circuit outside the PLC so that the control system can still work safely once external power failure or PLC fault occurs.
CAUTION: An emergency stop circuit, a protection circuit, a forward/reverse operation interlocked circuit, and an upper position limit and lower position limit interlocked circuit must be set in the external circuits of PLC to prevent damage to the machine.

Installation

- DANGER: Installation must be carried out by specialists who have received the necessary electrical training and who have a thorough understanding of electrical knowledge.
CAUTION: Prevent metal filings and wire ends from dropping into the PLC's ventilation holes during installation. Failure to comply may result in fire, equipment breakdown, and malfunction.

Wiring

- DANGER: Wiring must be carried out by specialists who have received the necessary electrical training and who have a thorough understanding of electrical knowledge.
Disconnect all of the system's external power supplies before wiring. Failure to comply may result in electric shock, module breakdown or malfunction.



- CAUTION: Prevent metal filings and wire ends from dropping into the ventilation holes of the PLC during wiring. Failure to comply may result in fire, equipment breakdown, and malfunction.
The external wiring specification and installation method must comply with local regulations. For details, see the wiring section in this guide.

- DANGER: Maintenance & inspection must be carried out by personnel who have the necessary electrical training and experience. Do not touch the terminals while the power is on. Failure to comply may result in electric shock or malfunction.
Disconnect all of the system's external power supplies before cleaning the module or re-tightening screws on the terminal block or screws of the connector. Failure to comply may result in electric shock.

- CAUTION: Thoroughly read these instructions and ensure safety before conducting online modification, and RUN/STOP operations. Disconnect the power supply before installing/removing the extension card.

- CAUTION: Treat scrapped modules as industrial waste. Dispose of the battery in accordance with local laws and regulations.

Product Information

Model and Nameplate section containing a diagram of the AM600-4PME module and its nameplate details.

Table with 4 columns: Model, Classification, Description, Applicable to. Row 1: AM600-4PME, EtherCAT slave station positioning module, EtherCAT slave station 4-channel positioning module, AM600.

External Interfaces

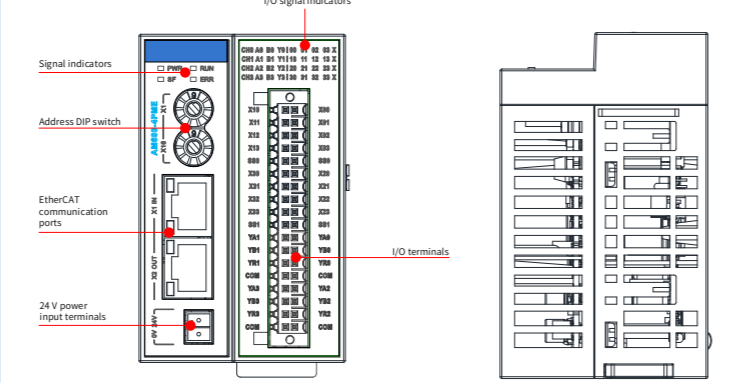


Table with 2 columns: Interface Name, Function. Lists EtherCAT communication interfaces, Signal indicators, I/O signal indicators, 24V power input terminal, Address DIP switch, and I/O terminals.

General Specifications

Table with 2 columns: Item, Specifications. Lists power supply voltage, protocol, baud rate, network interface, and station number range.

Table with 2 columns: Item, Specifications. Lists communication protocol, service supported, synchronization period, mode, physical layer, baud rate, duplex mode, topological structure, transmission medium, distance, frame length, process data, jitter, and refresh time.

Input Specifications

Table with 2 columns: Item, Specifications. Lists signal name, rated input voltage, current, ON/OFF current, input resistance, and common terminal mode.

Output Specifications

Table with 2 columns: Item, Specifications. Lists signal name, control circuit voltage, rated load current, response times, output frequency, and common terminal mode.

Mechanical Design Reference

Mounting Dimensions

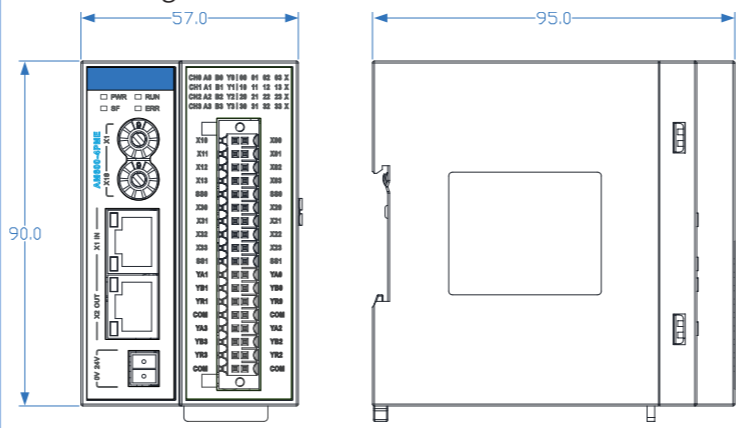
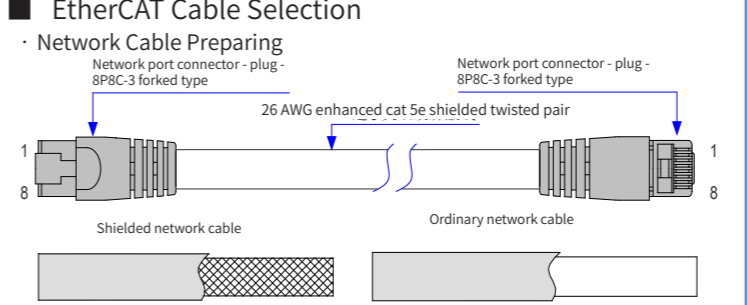


Figure 3 Mounting dimensions (in mm)

Electrical Design Reference

EtherCAT Cable Selection



Please use enhanced cat 5e shielded twisted pair with iron case molding line.

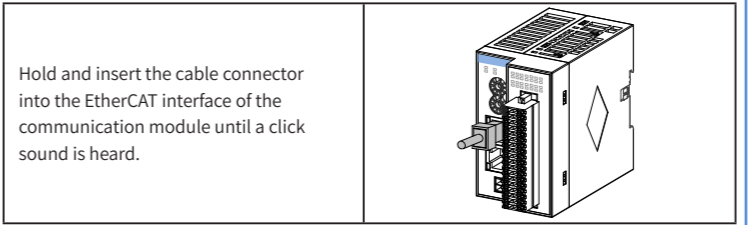
Signal Pin Assignment

Table with 4 columns: Pin, Signal, Signal Direction, Signal Description. Lists pin assignments for data transfer and disabled signals.

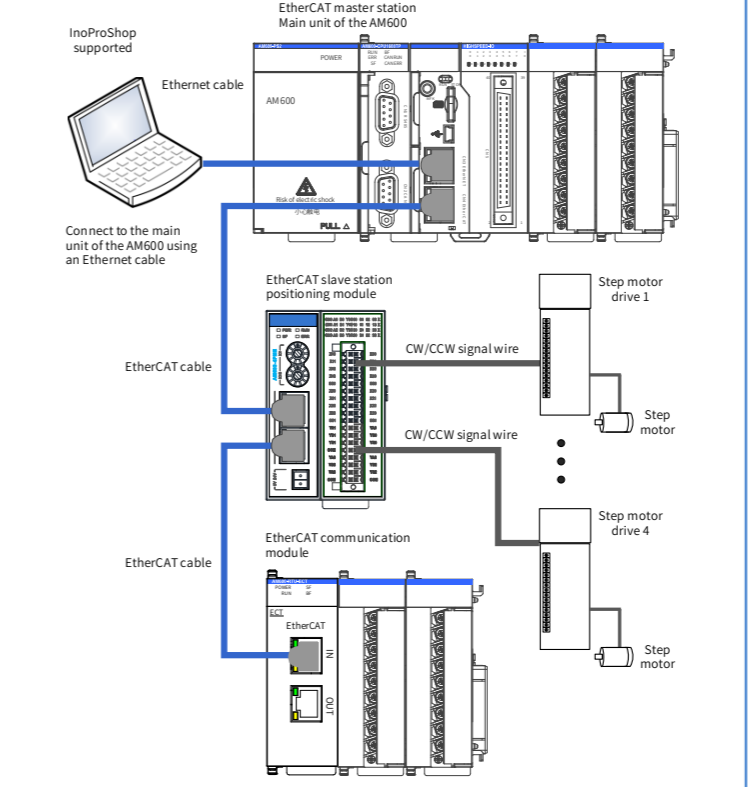
- Length requirements: FastEthernet technology demonstrates the cable length between devices can not exceed 100 m when the EtherCAT bus is used.
Technical requirements: Short circuit, open circuit, displacement and poor contact during the 100% continuity test.

Table with 2 columns: Item, Specifications. Lists cable type, standards compliance, conductor type, and line pair.

Communication Connection



Connection Diagram of the Communication System



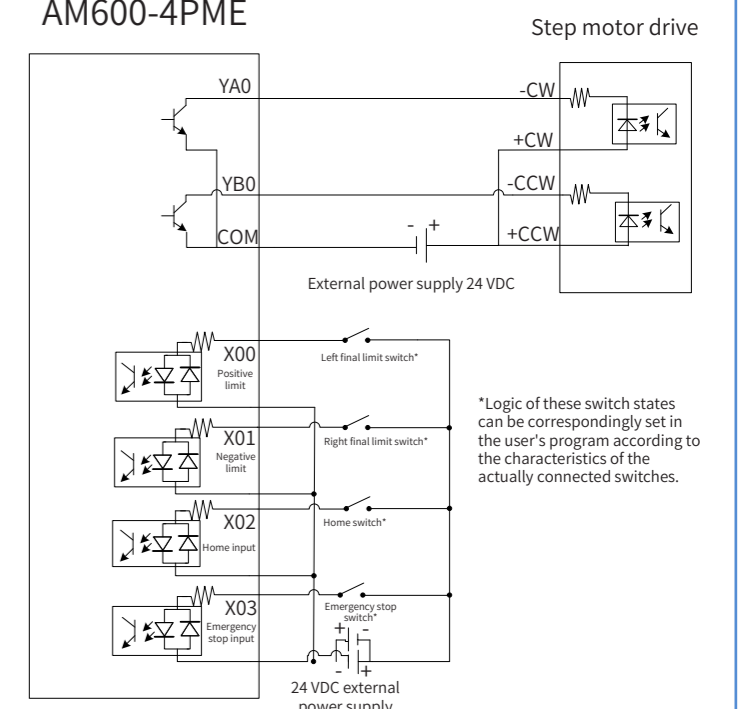
Note: To avoid the influence on the communication cable due to other tension and ensure the stability of communication, secure the cable near the equipment.

Fault Indication and Countermeasures for EtherCAT Communication Slave Module

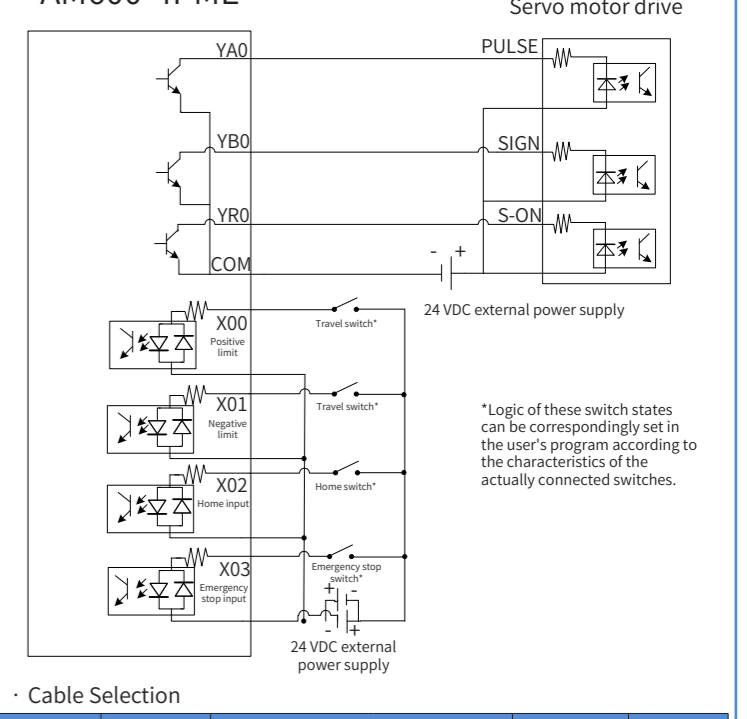
Table with 3 columns: LED Indicators, Description, Solution. Lists fault indicators like RUN, Flashing, ERR, and SF with their descriptions and solutions.

User Output Terminal Connection

Connection Diagram of Signal Terminals



Connection Diagram of the Communication System



Cable Selection

Table with 5 columns: Cable Name, Model, Applicable Cable Diameter (Chinese and American), Manufacturer, Crimping Tool. Lists Tubular lug GTVE07512.

Those cable lugs are applicable to this module, and the cable rated temperature is required must be above 75°C.

Cable Preparing Procedures

- Strip back the wire outer coating by 11 to 14 mm. Pass the cable through the tube of proper wire size.
- Insert the exposed end into the hole of the cable lug, and then crimp the cable with a recommended crimping tool.

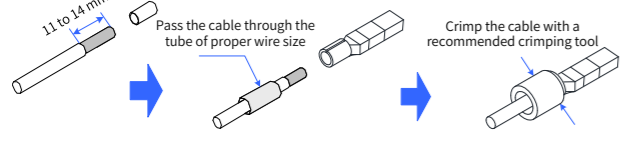


Figure 4 Cable preparing

Terminal Arrangement

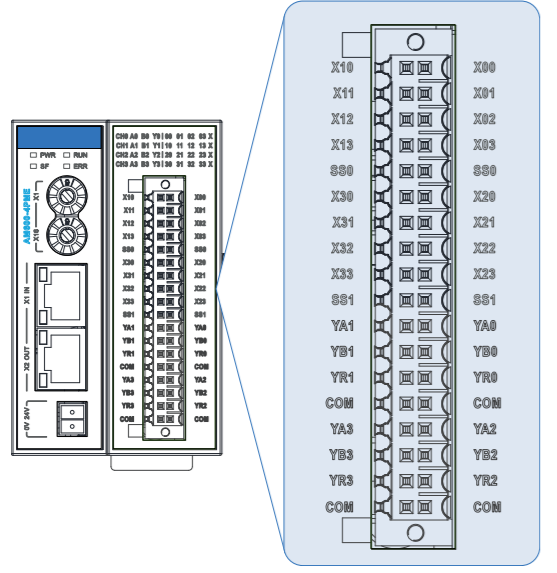
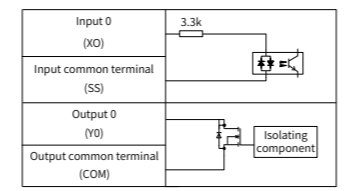


Figure 5 Terminal arrangement

External Wiring

External Wiring	Signal Name	Terminal NO.	Signal Name	External Wiring
	Column B		Column A	
	CH1 input 0 (X10 positive limit)	2	CH0 input 0 (X00 positive limit)	
	CH1 input 1 (X11 negative limit)	4	CH0 input 1 (X01 negative limit)	
	CH1 input 2 (X12 home switch)	6	CH0 input 2 (X02 home switch)	
	CH1 input 3 (X13 input interrupted)	8	CH0 input 3 (X03 input interrupted)	
	CH1 input common terminal (SS0)	10	CH0 input common terminal (SS0)	
	CH3 input 0 (X30 positive limit)	12	CH2 input 0 (X20 positive limit)	
	CH3 input 1 (X31 negative limit)	14	CH2 input 1 (X21 negative limit)	
	CH3 input 2 (X32 home switch)	16	CH2 input 2 (X22 home switch)	
	CH3 input 3 (X33 input interrupted)	18	CH2 input 3 (X23 input interrupted)	
	CH3 input common terminal (SS1)	20	CH2 input common terminal (SS1)	
Load	CH1 output A (YA1)	22	CH0 output A (YA0)	Load
Load	CH1 output B (YB1)	24	CH0 output B (YB0)	Load
Load	CH1 output R (YR1)	26	CH0 output R (YR0)	Load
	CH1 output common terminal (COM)	28	CH0 output common terminal (COM)	
Load	CH3 output A (YA3)	30	CH2 output A (YA2)	Load
Load	CH3 output B (YB3)	32	CH2 output B (YB2)	Load
Load	CH3 output R (YR3)	34	CH2 output R (YR2)	Load
	CH3 output common terminal (COM)	36	CH2 output common terminal (COM)	

Internal Equivalent Circuit



Wiring Precautions

After the I/O terminal block is installed to the CNS, fix it with 0.2 to 0.25 Nm torque, as shown in the figure on the right:

Do not bundle the terminal connection cables together with power cables (high voltage, large current) which produce strong interference signals. Separate it from other cables and avoid cabling in parallel. Select recommended cables and pinboards for connection. It is recommended that shielded cables be used as terminal connection cables to enhance capacity of resisting interference.

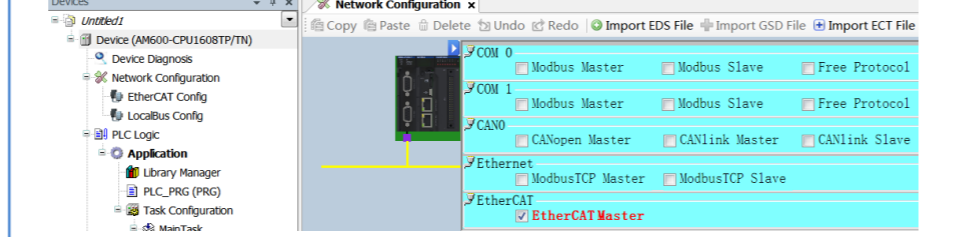
Electric Shock Protection When Using Inductive Load

When the inductive load is applied, large back EMF will be produced between contacts and arc discharge is also caused when the inductive load stops. This may result in contact failure or contact sag, shortening the contact lifetime. Therefore, it is recommended to use the products with a built-in relay protection circuit. The freewheel diode must meet the following conditions: ① reverse voltage is 5 to 10 times of load voltage; ② forward current is larger than load current.

Programming Examples

This example mainly implements the following functions:
Send 50000 pulses in "phase A&B" format through channel Ch0 in the frequency of 10 K. Connect Ch1 to a step motor which will turn each time the step motor receives 5000 pulses in the form of "pulse + direction". The load travels 50 mm for each turn of the motor, and the load is controlled by the PLC program to travel 100 mm in a forward direction at the rate of 10 mm/s. In addition, X10 is connected to the positive limit switch and X11 is connected to the negative limit switch to provide limit protection.

- Start the AM600 programming software to enable the functions of AM600 EtherCAT master station.

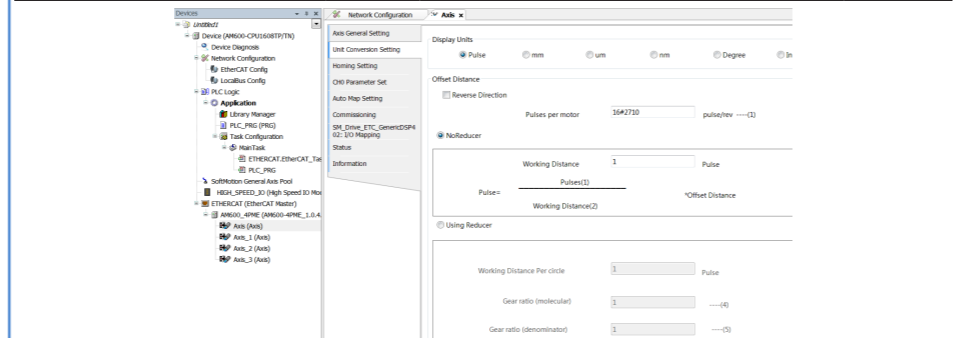


- Double click the AM600-4PME module in the Network Devices List to add it to the configuration.

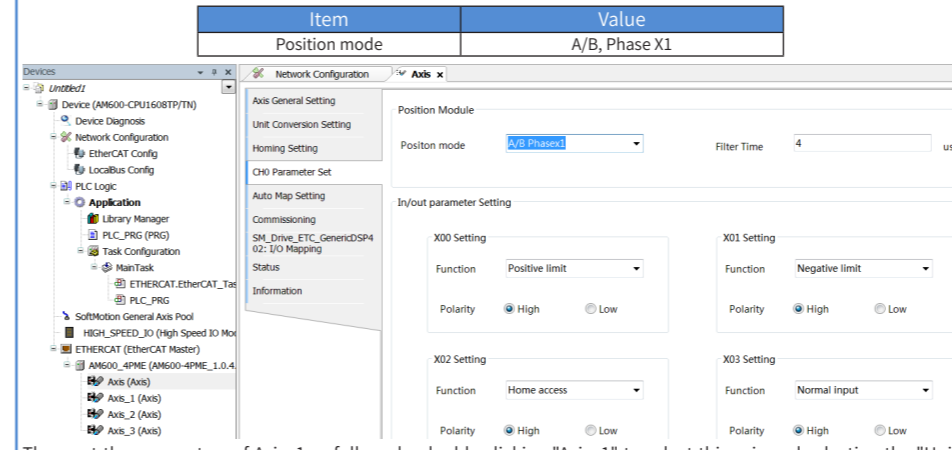


- Set the configuration parameters of Axis and Axis_1 according to the actual application scenario. First, set the parameters of Axis as follows by double clicking "Axis" to select this axis and selecting the "Unit Conversion Setting" page on the right:

Item	Value	Item	Value
Display unit	Pulse	Reducer	Disabled
Number of instruction pulses after the motor performs a turn	1	The operating stroke after a motor performs a turn	1

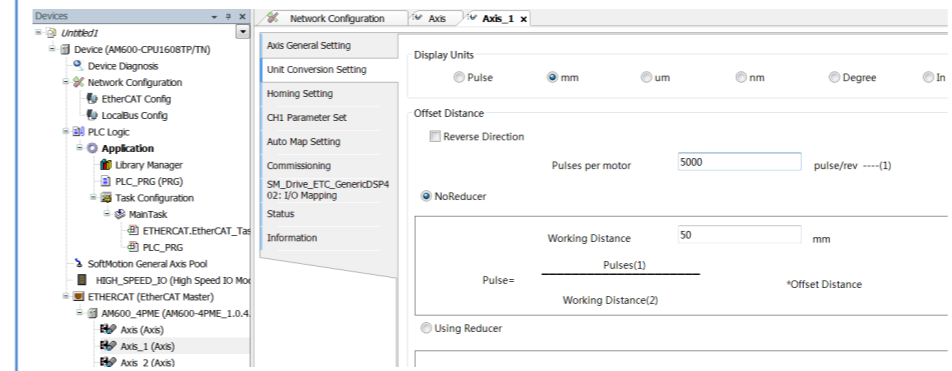


Double click "Axis" to select this axis, select the "CH0 Parameter Set" page on the right and set the parameters as follows:



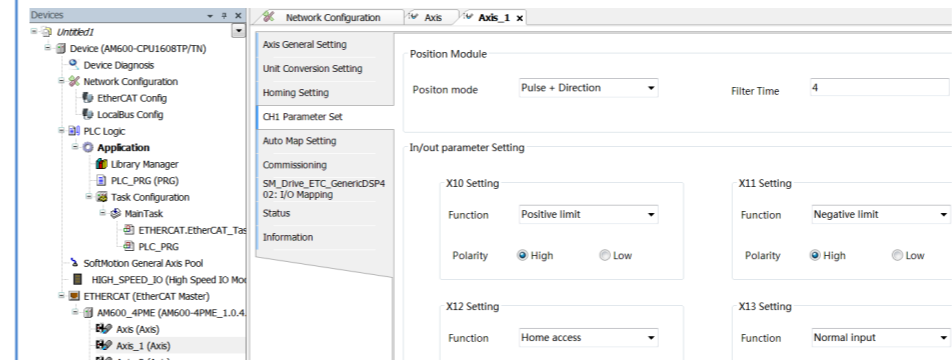
Then, set the parameters of Axis_1 as follows by double clicking "Axis_1" to select this axis and selecting the "Unit Conversion Setting" page on the right:

Item	Value	Item	Value
Display unit	mm	Reducer	Disabled
Number of instruction pulses after the motor performs a turn	5000	Operating stroke after a motor performs a turn	50



Double click "Axis_1" to select this axis, select the "CH1 Parameter Set" page on the right and set the parameters as follows:

Item	Value
Position mode	Pulse + Direction
X10 setting	Positive limit
X11 setting	Negative limit



- PLC programming

This module uses the 402 protocol, allowing all positioning functions to be implemented in CSP mode. Therefore, all operations on channels are implemented according to the servo axis.

- Invoking the MC_Power functional block will separately enable the two axes.

The variables xenable and ienable are initialized by default. Axis and Axis_1 are enabled after EtherCAT communication is established. The "Status" signal of two functional blocks are effective. At the same time, the Y output terminals of axes Ch0 and Ch1 output effective levels.

```

PROGRAM PMEpower
VAR
  xenable: BOOL := 1;
  ienable: BOOL := 1;
  MC_Power_0: MC_Power;
  MC_Power_1: MC_Power;
END_VAR
  
```

Invoke the relative positioning functional block "MC_MoveRelative" to cause Ch0 corresponding to Axis to send 50000 pulses. Enabling variable axis_enable starts sending pulses, and sending completes when the Done signal is effective.

```

PROGRAM PLC_PRG
VAR
  MC_MoveRelative_0: MC_MoveRelative;
  axis_enable: BOOL;
  axis_distance: LREAL := 50000;
  axis_velocity: LREAL := 10000;
  axis_acc: LREAL := 10000;
  axis_dec: LREAL := 10000;
END_VAR
  
```

Invoke the relative positioning functional block "MC_MoveRelative" to cause Ch1 corresponding to Axis_1 to travel 100 mm in a forward direction. Pulses are sent when the signal is valid and sending completes when the signal is valid.

```

PROGRAM PME_relative
VAR
  MC_MoveRelative_1: MC_MoveRelative;
  axis_1_enable0: BOOL;
  axis_1_distance0: LREAL := 100;
  axis_1_velocity: LREAL := 10;
  axis_1_acc: LREAL := 10;
END_VAR
  
```

Failures and Alarms

The failure type of Ch0 can be found from object dictionary 603Fh. Ch1 failures, Ch2 failures, and Ch3 failures can be obtained from object dictionary 683Fh, 703Fh, and 783Fh, respectively.

Failure Code	Description	Solution
0x0001	Emergency stop failure The DI terminal is configured as emergency stop and input from the DI terminal is valid.	Check whether the DI terminal is configured as emergency stop. Check whether the emergency stop input is valid.
0x0002	Following error The given target position is significantly deviated from the current position	Check whether the target position of the PLC program is suddenly changed. Check whether the following error window is set too small.
0x0003	Frequency too high The target output frequency exceeds 200 K.	Check whether the PLC program's target speed exceeds 200 K.

Alarm codes and Solutions

Alarm Code	Description	Solution
0x0101	Limit valid The DI terminal is configured as limit switch and input is valid.	Check whether the DI terminal is configured as limit switch. Check whether the limit switch is valid.
0x0102	Maximum output frequency reached, i.e. 200 K The target output frequency is 200 K.	Check whether the limit switch is valid. Check whether the PLC program's target speed is 200 K.
0x0104	Error when synchronizing the target position The target position is deviated from the internal target position.	Check whether the limit switch is touched during operation. After the limit switch is invalid, continue to travel in this direction.

INOVANCE Warranty Agreement

- Inovance provides 18-month free warranty to the equipment itself from the date of manufacturing for the failure or damage under normal use conditions.
- Within the warranty period, maintenance will be charged for the damages caused by the following reasons:
 - Improper use or repair/modification without prior permission
 - Fire, flood, abnormal voltage, other disasters and secondary disasters
 - Hardware damage caused by dropping or transportation after procurement
 - Improper operations
 - Damage out of the equipment (for example, external device factors)
- The maintenance fee is charged according to the latest Maintenance Price List of Inovance.
- If there is any problem during the service, contact Inovance's agent or Inovance directly.
- Inovance reserves the rights for explanation of this agreement.

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