

**HCFA** series

**HCQX Remote Extension Modules**

**Hardware Instruction**

Manual Number	HPPT12000EN
Manual Version	V3.1
Date	2021.8

**1 Introduction**

Thank you for purchasing and using the Q series remote extension modules independently developed and produced by HCFA Corporation.

Name	Module	Version	Power	Description
New Coupler module	HCQX-EC01-D	V1.00	16W	Connect EtherCAT and EtherCAT terminal (digital, analog modules etc.)
Coupler module	HCQX-EC-D	V1.30	8W	Connect EtherCAT and EtherCAT terminal (digital, analog modules etc.)
Digital input module	HCQX-ID16-D	V1.10	0.28W	Connected to the local extension of main unit or the back of coupler, cannot be used alone. NPN and PNP loads are supported.
Digital output module	HCQX-OD16-D	V1.10	1.32W	Connected to the local extension of main unit or the back of coupler, cannot be used alone. NPN output is supported.
Digital I/O module	HCQX-ID16-D	V1.10	1.032W	Connected to the local extension of main unit or the back of coupler, cannot be used alone. NPN and PNP inputs are supported, NPN output is supported.
Analog input module	HCQX-AD04-D	V1.10	1.104W	Analog input. Connected to the local extension of main unit or the back of coupler, cannot be used alone. Support single-ended and differential input with wide range of current/voltage input signal 16bit resolution.
Analog output module	HCQX-DA04-D	V1.40	1.056W	Analog output. Connected to the local extension of main unit or the back of coupler, cannot be used alone. Supporting various current/voltage output, 16bit resolution.
Temperature measurement module	HCQX-TS04-D	V1.00	1W	Connected to the local extension of main unit or the back of coupler, cannot be used alone. Supports multiple sensor signal types.
DC power module	HCQX-PW01-A	To be launched	To be launched	DC power supply module
AC power module	HCQX-PW01-A	To be launched	To be launched	AC power supply module

**1.1.1 Safety symbols**

- ⚠ DANGER** Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury or significant property damage.
- ⚠ WARNING** Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.
- ⚠ CAUTION** Indicates that incorrect handling may cause slight injury or property damage.
- Note** Indicates that incorrect handling may cause damage to the environment / equipment or data loss.

**1.1.2 Safety symbols**

- STARTUP/MAINTENANCE PRECAUTIONS**
  - Do not touch any terminal while the PLC's power is on. Doing so may cause electric shock or malfunctions.
  - Before clearing or reinitializing terminals externally cut off all phases of the power supply. Failure to do so may cause electric shock.
  - Before modifying or disrupting the program in operation or Forced output, RUN, STOP etc., carefully read through this instruction and the associated instructions and ensure the safety of the operation. An operation error may damage the machinery or cause accidents.

**1.1.3 Safety symbols**

- STARTUP/MAINTENANCE PRECAUTIONS**
  - Do not disassemble or modify the PLC. Doing so may cause fire, equipment failures, or malfunctions.
  - For module repair, contact your HCFA distributor.
  - Turn off the power to the PLC before connecting or disconnecting any extension cable. Failure to do so may cause equipment failures or malfunctions.
  - Turn off the power to the PLC before attaching or detaching the following devices. Failure to do so may cause equipment failures or malfunctions.
    - Display module, peripheral devices, expansion boards
    - Extension modules and special adapters
    - Detaching terminal block and memory cassette

**1.1.4 Safety symbols**

- DISPOSAL PRECAUTIONS**
  - Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device.

**1.1.5 Safety symbols**

- TRANSPORT AND STORAGE PRECAUTIONS**
  - The PLC is a precision instrument. During transportation, avoid impacts larger than those specified in Section 3.1. Failure to do so may cause failures in the PLC. After transportation, verify the operations of the PLC.

**1.1.6 Safety symbols**

- CAUTION** When the user selects modules according to the power, part of the power is reserved to avoid the loss during the signal transmission.

**1.1.7 Safety symbols**

- Applicable readers** For the users of HCFA Q series extension modules, refer to the instruction to perform the wiring, installation, diagnosis and maintenance and requires the use of the certain knowledge of electrical and automation.

**1.1.8 Safety symbols**

- This instruction gives the necessary information for the use of HCFA Q series extension modules, please read this instruction carefully before use and make the correct operation full safety to safety.

**1.1.9 Safety symbols**

- When using this product, please follow the following safety precautions and instructions strictly. Users can check more specific safety guidelines in sections such as mounting, wiring, communication, etc. In this instruction, the following safety guidelines must be followed.

**1.1.10 Safety symbols**

- When the user selects modules according to the power, part of the power is reserved to avoid the loss during the signal transmission.

**1.1.11 Safety symbols**

- When using this product, please follow the following safety precautions and instructions strictly. Users can check more specific safety guidelines in sections such as mounting, wiring, communication, etc. In this instruction, the following safety guidelines must be followed.

**1.1.12 Safety symbols**

- When the user selects modules according to the power, part of the power is reserved to avoid the loss during the signal transmission.

**1.1.13 Safety symbols**

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**1.1.14 Safety symbols**

- When the user selects modules according to the power, part of the power is reserved to avoid the loss during the signal transmission.

**1.1.15 Safety symbols**

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**1.1.16 Safety symbols**

- When the user selects modules according to the power, part of the power is reserved to avoid the loss during the signal transmission.

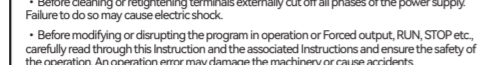
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**⚠ WARNING** Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

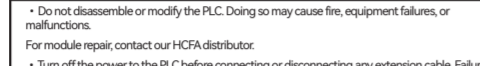
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**Note** Indicates that incorrect handling may cause damage to the environment / equipment or data loss.

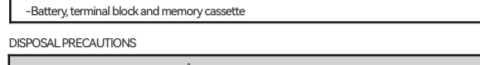
**2.1 Model name description for function modules**



**2.2 Model name description for digital output module**



**2.3 Model name description for digital I/O module**



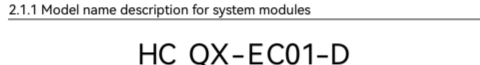
**2.4 Model name description for analog output module**



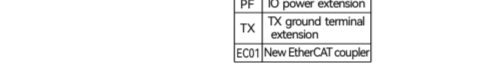
**2.5 Model name description for temperature measurement module**



**2.6 Model name description for coupler module**



**2.7 Model name description for digital input module**



**2.8 Model name description for digital output module**



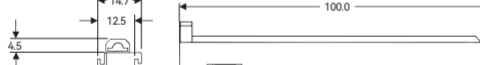
**2.9 Model name description for digital I/O module**



**2.10 Model name description for analog output module**



**2.11 Model name description for temperature measurement module**



**2.12 Model name description for coupler module**



**2.13 Model name description for digital input module**



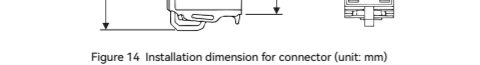
**2.14 Model name description for digital output module**



**2.15 Model name description for digital I/O module**



**2.16 Model name description for analog output module**



**2.17 Model name description for temperature measurement module**



**2.18 Model name description for coupler module**



**MODEL-HCQX-EC01-D**

POWER INPUT: DC24V (15%~20%) 70mA (Typ.)

POWER OUTPUT: 12V 16W

HCFA

**MODEL-HCQX-ID16-D**

INPUT: DC24V 5mA (Typ.)

OUTPUT: 0.8W

HCFA

**MODEL-HCQX-OD16-D**

INPUT: DC24V 5mA (Typ.)

OUTPUT: 0.8W

HCFA

**MODEL-HCQX-DA04-D**

INPUT: DC24V 5mA (Typ.)

OUTPUT: 0.8W

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**MODEL-HCQX-TS04-D**

INPUT: DC24V 5mA (Typ.)

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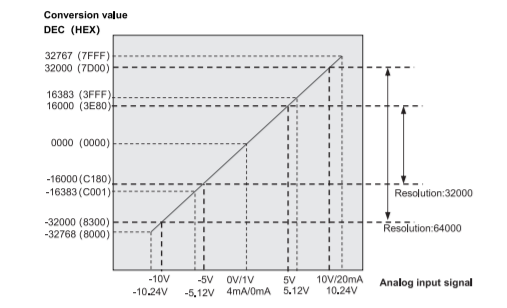
HCFA

**MODEL-HCQX-DA04-D**

The user display configuration is determined by index 0x80n01, where the user can modify the working mode of the channel to display values in different measurement ranges. The analog module has a 16-bit resolution and the maximum display range is -32768... to +32767... The measured and displayed values in different modes are as follows:

Table with columns: Input/output signal, Value. Rows show conversion for 10V, 5V, 0V, -5V, -10V signals.

The graph shown as below:

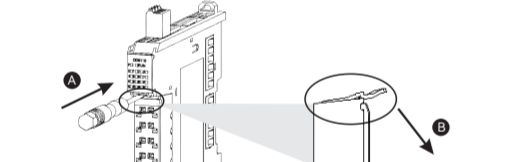


3.1.9 Analog output module specifications

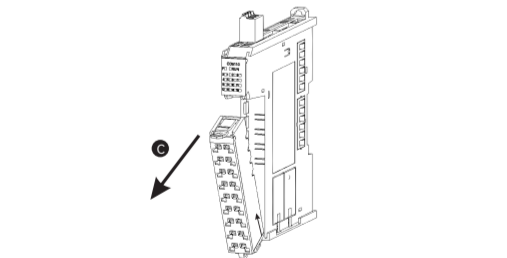
Table with columns: Items, Description. Lists specifications for output channels, signal voltage, accuracy, resolution, channel data refresh time, voltage load, current load, USB over consumption, electrical isolation, process image bit width, weight, working temperature, storage temperature, relative humidity, dimensions, installation, vibration/shock resistance, EMC resistance burst/static resistance, protection level, and certificate.

Remove the connector

1. Insert the screwdriver into the upper side of the connector in the "A" direction, and gently push it downward in the "B" direction to unlock the buckle.

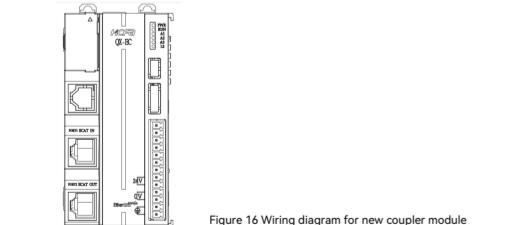


2. After unlocking the connector, remove the connector from the module in the "C" direction.



3.2.2 EC01 coupler module wiring description

External wiring description. As a remote extension coupler of Q series PLC, EC module provides 24V power supply for other extension modules through its side metal sheet. Unlike other remote extension I/O modules, it's not necessary for EC module to use all the ports. The wiring diagram is shown as below:



3.2.3 EC coupler module wiring description

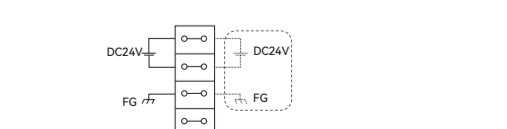
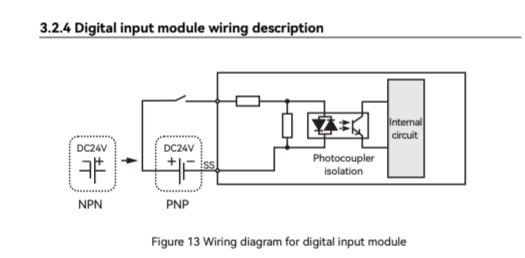


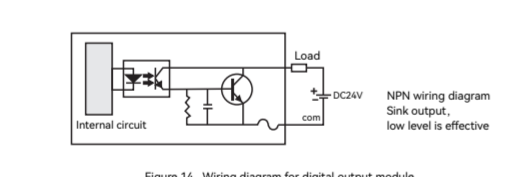
Figure 17 Wiring diagram for old coupler module

Table with columns: Index (HEX), Sub-index (HEX), Description, R/W, Type, Default (HEX), Notes. Contains PDO mapping and parameter settings for various channels and modes.

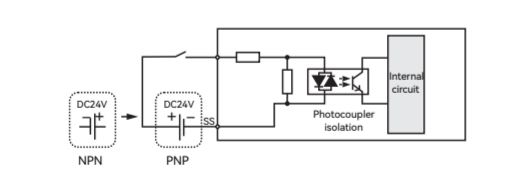
3.2.4 Digital input module wiring description



3.2.5 Digital output module wiring description



3.2.6 Digital I/O module wiring description



3.2.7 Analog input module wiring description

The analog input module, as the remote extension module of the Q series CPU unit, cannot work alone and needs to be connected to the EC coupler or the right side of the CPU unit. It supports both current and voltage input. HCFA offers varieties of input ranges and the working range can be modified online through SDO or COE, where the output signal can be directly used as the control signal of the motor or drive.

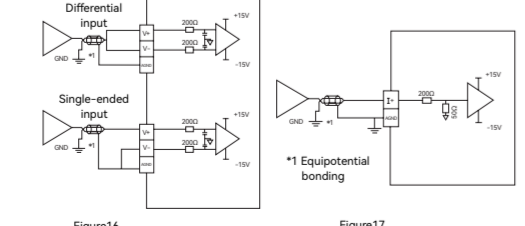


Figure 16 Internal circuit diagram for voltage differential and single-ended input

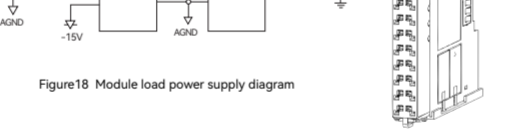
Figure 17 Internal circuit diagram for current input

At the top of analog I/O module, 24VDC needed to be connected. The wiring diagram shown as below:

Table with columns: D, Offset short counting, RO, UDINT, 0. Contains parameter settings for channels 1 through 4 and output value settings.

3.2.8 Analog output module wiring description

The analog output module, as the remote extension module of the Q series CPU unit, cannot work alone and needs to be connected to the EC coupler or the right side of the CPU unit. It supports both current and voltage output. HCFA offers varieties of output ranges and the working range can be modified online through SDO or COE, where the output signal can be directly used as the control signal of the motor or drive.



Tip 2: The analog signal cable adopts twisted-pair shielded wire. Equipotential is needed for the signal to be measured and "AGND".

3.2.8 Analog output module wiring description

The analog output module, as the remote extension module of the Q series CPU unit, cannot work alone and needs to be connected to the EC coupler or the right side of the CPU unit. It supports both current and voltage output. HCFA offers varieties of output ranges and the working range can be modified online through SDO or COE, where the output signal can be directly used as the control signal of the motor or drive.

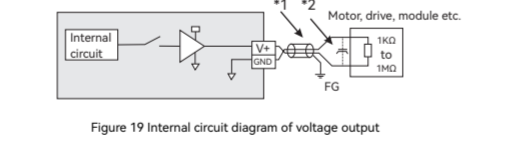
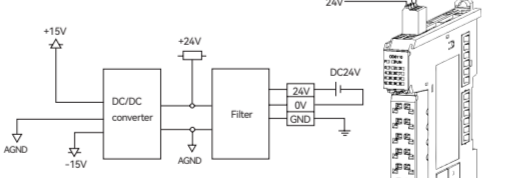


Figure 19 Internal circuit diagram of voltage output

At the top of analog I/O module, 24VDC needed to be connected. The wiring diagram shown as below:



3.2.8 Analog output module wiring description

The analog signal cable adopts twisted-pair shielded wire. Equipotential is needed for the signal to be measured and "AGND".

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4 Module programming examples

4.1 Programming example for digital module

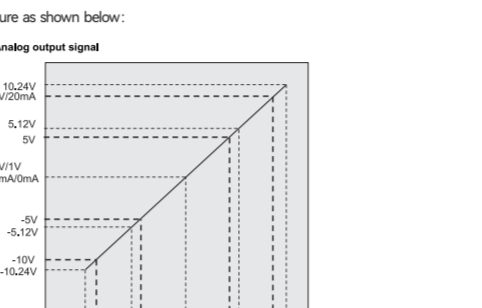
This example uses the CPU unit HCQ1-1300-D + coupler module HCQX-EC + digital module HCQX-ID16-D as an example to illustrate: (Q1 connection has been described briefly. For more details, refer to Q1 Software Manual.)

- 1) Open CODESYS V3.5 SP14, select New project. The user can select the project type they want, enter the name and save path, and then click "OK".

User display. The user display configuration is determined by index 0x80n01, where the user can modify the working mode of the channel to display values in different measurement ranges. The analog module has a 16-bit resolution and the maximum display range is -32768... to +32767... The measured and displayed values in different modes are as follows:

Table with columns: Input/output signal, Values. Rows show conversion for 10V, 5V, 0V, -5V, -10V signals.

Figure as shown below:



3.1.12 Temperature measurement module specifications

Table with columns: Items, HCQX-TS04-D specifications. Lists specifications for input channel, power input, signal voltage, setting, input filter limit frequency, resolution, warm-up time, absolute maximum rating, conversion time, and temperature range.

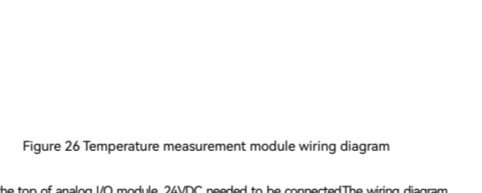
3.2.9 Temperature measurement module wiring description

The temperature measurement module, as the remote extension module of the Q series CPU unit, cannot work alone and needs to be connected to the EC coupler or the right side of the CPU unit. The module provides two wiring methods of two-wire system and three-wire system to match different types of sensors. Wiring diagrams are as follows:



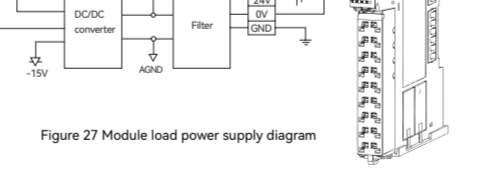
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3.2.9 Temperature measurement module wiring description

At the top of analog I/O module, 24VDC needed to be connected. The wiring diagram shown as below:



4.2 Programming example for analog module

This example uses the CPU unit HCQ1-1300-D + coupler module HCQX-EC + analog module HCQX-AD04-D as an example to illustrate: (Q1 connection has been described briefly. For more details, refer to Q1 Software Manual.)

- 1) Open CODESYS V3.5 SP14, select New project. The user can select the project type they want, enter the name and save path, and then click "OK".

Table with columns: Index (HEX), Sub-index (HEX), Description, R/W, Type, Default (HEX), Notes. Contains parameter settings for channels 1 through 4.

3.1.13 Temperature measurement module configuration and parameter mapping

Table with columns: Index (HEX), Sub-index (HEX), Description, R/W, Type, Default (HEX), Notes. Contains PDO mapping and parameter settings for various channels and modes.

3.1.4 Measuring range and performance

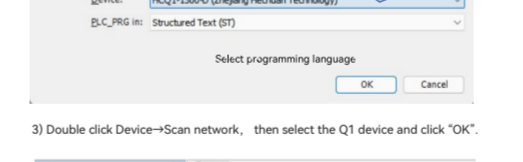
Temperature range for thermocouple

Table with columns: Type, Range. Lists temperature ranges for thermocouples PT100, PT1000, NI100, and NI1000.

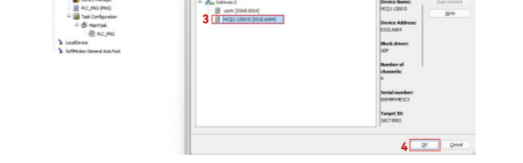
Temperature range for Thermal resistance

Table with columns: Type, Range. Lists temperature ranges for thermal resistors PT100, PT1000, NI100, and NI1000.

3) Double click Device->Scan network, then select the Q1 device and click "OK".



4) After communicating with Q1 device, click Device->Add device->EtherCAT Master SoftMotion



9) After no error for compiling, log in and run the program, and observe whether the value change of the input variable corresponds to the input signal to the corresponding input channel in the program.

4.2 Programming example for analog module

This example uses the CPU unit HCQ1-1300-D + coupler module HCQX-EC + analog module HCQX-AD04-D as an example to illustrate: (Q1 connection has been described briefly. For more details, refer to Q1 Software Manual.)

- 1) Open CODESYS V3.5 SP14, select New project. The user can select the project type they want, enter the name and save path, and then click "OK".

Table with columns: Index (HEX), Sub-index (HEX), Description, R/W, Type, Default (HEX), Notes. Contains parameter settings for channels 1 through 4.

3.1.4 Measuring range and performance

Temperature range for thermocouple

Table with columns: Type, Range. Lists temperature ranges for thermocouples PT100, PT1000, NI100, and NI1000.

Temperature range for Thermal resistance

Table with columns: Type, Range. Lists temperature ranges for thermal resistors PT100, PT1000, NI100, and NI1000.

3) Double click Device->Scan network, then select the Q1 device and click "OK".



4) After communicating with Q1 device, click Device->Add device->EtherCAT Master SoftMotion



9) After no error for compiling, log in and run the program, and observe whether the value change of the input variable corresponds to the input signal to the corresponding input channel in the program.

4.2 Programming example for analog module

This example uses the CPU unit HCQ1-1300-D + coupler module HCQX-EC + analog module HCQX-AD04-D as an example to illustrate: (Q1 connection has been described briefly. For more details, refer to Q1 Software Manual.)

- 1) Open CODESYS V3.5 SP14, select New project. The user can select the project type they want, enter the name and save path, and then click "OK".

Sampling speed. Disconnection detection OFF: TC: 100ms\* Number of enabled channel\* Filtering times of this channel PT: 200ms\* Number of enabled channel\* Filtering times of this channel Disconnection detection ON: Test once for 7 sampling cycles and each takes 450ms.

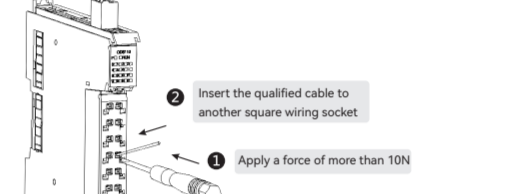
3.2 Wiring Description

3.2.1 Cable selection and connector wiring

Table with columns: Item, Specifications. Lists specifications for cable selection, installation method, push force, cable type, cable length, cross section, and sleeve.

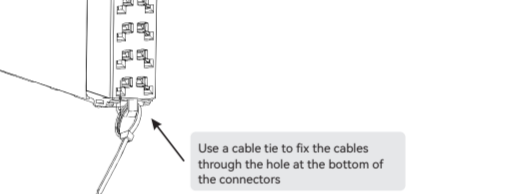
Connector installation

1) Align the connector end with the extension module bottom. After aligning and inserting, press the terminal down in the B direction as shown below.

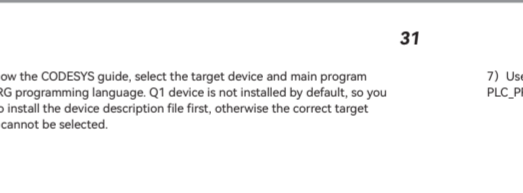


Connector wiring

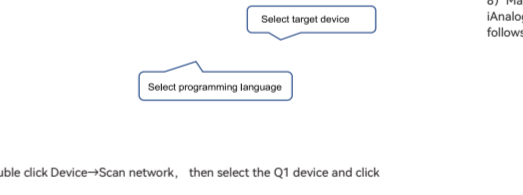
1) Take out the small screwdriver in the package and insert it into the square socket of the connector, applying a force of more than 10N. And then insert the qualified cable from another square wiring socket (located inside the module) to the bottom, loosen the screwdriver, gently pull the cable up and down until the cable is clamped.



2) After completing the wiring of the connector, use a cable tie to fix the cables through the hole at the bottom of the connectors and cut off the excess cable tie. e screwdriver, gently pull the cable up and down until the cable is clamped.



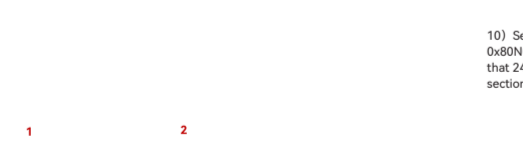
7) Use ST programming language to define two groups of BYTE variables in PLC\_PRG, and map them to the corresponding input variables.



3) Double click Device->Scan network, then select the Q1 device and click "OK".



4) After communicating with Q1 device, click Device->Add device->EtherCAT Master SoftMotion

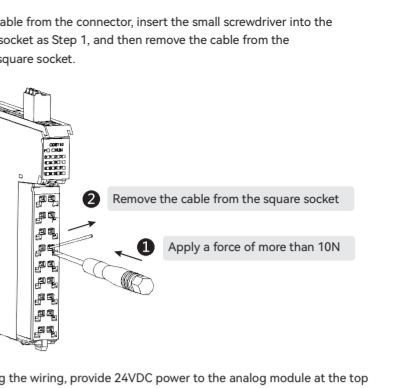


9) After no error for compiling, log in and run the program, and Set the current channel operating mode according to signal type to be measured. First, select the channel to be set, and then tick "Enable Expert Mode" in "General".

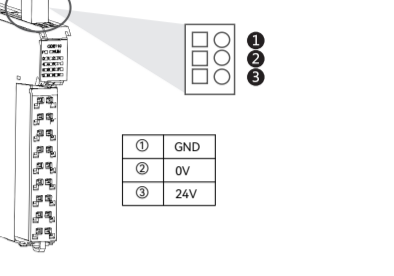
4.2 Programming example for analog module

This example uses the CPU unit HCQ1-1300-D + coupler module HCQX-EC + analog module HCQX-AD04-D as an example to illustrate: (Q1 connection has been described briefly. For more details, refer to Q1 Software Manual.)

- 1) Open CODESYS V3.5 SP14, select New project. The user can select the project type they want, enter the name and save path, and then click "OK".

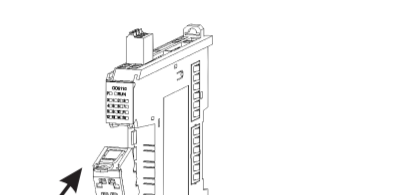


4. After completing the wiring, provide 24VDC power to the analog module at the top



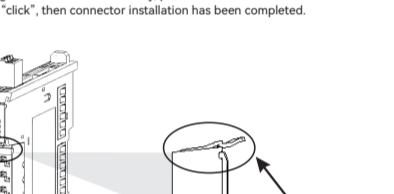
Connector installation

1) Align the connector end with the extension module bottom. After aligning and inserting, press the terminal down in the B direction as shown below.



Connector wiring

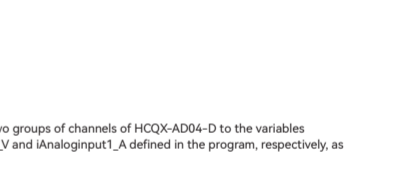
1) Take out the small screwdriver in the package and insert it into the square socket of the connector, applying a force of more than 10N. And then insert the qualified cable from another square wiring socket (located inside the module) to the bottom, loosen the screwdriver, gently pull the cable up and down until the cable is clamped.



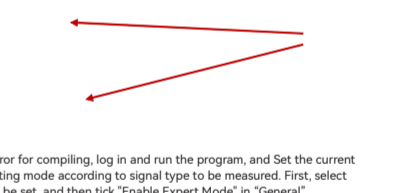
2) After completing the wiring of the connector, use a cable tie to fix the cables through the hole at the bottom of the connectors and cut off the excess cable tie. e screwdriver, gently pull the cable up and down until the cable is clamped.



7) Use ST programming language to define two groups of INT variables in PLC\_PRG, and map them to the corresponding input variables.



3) Double click Device->Scan network, then select the Q1 device and click "OK".



4) After communicating with Q1 device, click Device->Add device->EtherCAT Master SoftMotion



9) After no error for compiling, log in and run the program, and Set the current channel operating mode according to signal type to be measured. First, select the channel to be set, and then tick "Enable Expert Mode" in "General".

4.2 Programming example for analog module

This example uses the CPU unit HCQ1-1300-D + coupler module HCQX-EC + analog module HCQX-AD04-D as an example to illustrate: (Q1 connection has been described briefly. For more details, refer to Q1 Software Manual.)

- 1) Open CODESYS V3.5 SP14, select New project. The user can select the project type they want, enter the name and save path, and then click "OK".