

Q SERIES HCQ0-1□00 CPU UNIT

Q0

Manual No.	HPPP1270000EN
Version	3.1
Date	Apr, 2022

Thanks for purchasing HCFA Q series PLC main unit HCQ0-1200-D

Q series controllers include the functions of traditional PLCs and support the extension of multiple remote I/O modules. Users can realize various functions of motion control through SoftMotion provided by the controller. It is a device that integrates high-speed EtherCAT communication, vision, motion control, I/O functions and supports multiple bus communication (including Modbus TCP, CANOpen, serial port communication, etc.)

For the users of HCFA Q series CPU units, refer to this manual to perform the wiring, installation, diagnosis and maintenance and requires the users to have the certain knowledge of electrical and automation. This manual describes the necessary information for using Q series CPU units. Please read this manual carefully before using it and operate it correctly based on a better understanding of safety precautions.

1. Safety precautions

1.1 Safety icons

When using this product, please follow the following safety guidelines and strictly follow the instructions. Users can see more detailed and specific safety guidelines in sections such as DIN rail mounting, wiring, communication, etc.

In this manual, the following safety instructions must be observed.

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.

NOTE: explanations to help better operate and use of the product

1.2 Safety rules

Startup And Maintenance Precautions

DANGER

- Do not touch any terminal while the PLC's power is on. Doing so may cause electric shock or malfunctions.
- Before cleaning or retightening 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 manual and the associated manuals and ensure the safety of the operation. An operation error may damage the machinery or cause accidents.

Startup And Maintenance Precautions

CAUTION

- Do not disassemble or modify the PLC. Doing so may cause fire, equipment failures, or malfunctions. For module repair, contact our 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 blocks and special adapters
 - Battery, terminal block and memory cassette

Disposal Precautions

CAUTION

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

Transport And Storage Precautions

CAUTION

- 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.

2. Product overview

2.1 Model name description

Series name		Additional function software module	
Q0	Basic bus-type motion controller	0	Standard software
Q1	Standard bus-type motion controller	2	Edge computing
Q3	Advanced bus-type motion controller	1	Machine vision
Q5	Basic intelligent mechanical controller	Power type	
Q7	Standard intelligent mechanical controller	D	DC power
Q9	Advanced intelligent mechanical controller	A	AC power
Product name		Control software	
HC HCFA Controller		0	CODESYS
Series model		1	HCPACS
N/A	Standard -type	3	CNC
S	Basic type	4	MC
J	Modular type	2	ROBOT
Number of motion control axis		9	N/A
N(0-8)		Operating system	
2 nd		1	Linux
		3	Windows7
		2	Windows10
		4	QNX

NOTE: number of motion control axis: Recommended number of axes for the controller.

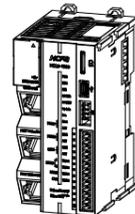


Figure 1 Model name and nameplate description

- ① Model name
- ② Voltage input and current required for normal operation
- ③ Output voltage and power
- ④ Bar code, S/N are the internal serial number, the first four bits of the PN code is the machine version number, example: Figure 1 is V2.000 version
- ⑤ QR code (model name, serial number)

Models	Type	Description	Applicable module
HCQ0-1□00-D	CPU units	16MB user storage space; 2-ch RS485; 1-ch RS232; 1-ch CAN2.0; Supporting Modbus TCP, Modbus RTU, EtherCAT, CANOpen, built-in 3-ch local inputs and 2-ch local outputs.	Q series CPU units and all extension modules

2.2 Part names

2.2.1 Parts on the front side

HCQ0-1200-D/1100-D CPU unit viewed from the front side

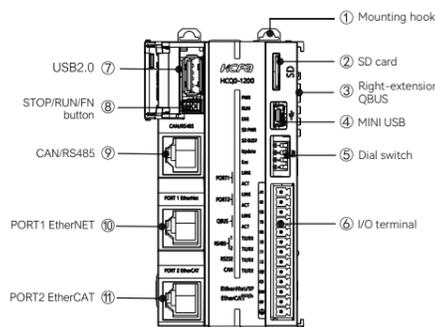
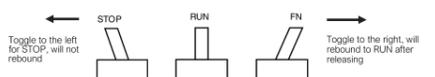


Figure 2 HCQ0-1200-D/1100-D CPU unit viewed from the front side

Table 1 Part names and function description -1

Items	Name	Functions
1	Mounting hook	Install controller onto the DIN rail mounting hook
2	SD card	User data storage, program import, please refer to the description of the Q0 program import and export
3	Right-extension QBUS	Transmit QBUS signal and control circuit current
4	MINI USB	USB 2.0 interface, will support the connection with PLC to monitor and download user program
5	Dial switch	4 digits. For the details please refer to the description of the dial switch
6	I/O terminal	Communication port/I/O port and power supply port
7	USB 2.0	USB 2.0 interface, supporting program import, please refer to the description of the Q0 program import and export
8	STOP/RUN/FN button	Start or stop the CPU unit, long press FN for 2s or more to trigger the dial switch
9	CAN/RS485 (COM2)	Support CANopen and MODBUS RTU master station communication
10	PORT1 EtherNET	Gigabit Ethernet support Modbus TCP; IPV4: 192.168.88.100 Subnet mask: 255.255.255.0
11	PORT2 EtherCAT	Gigabit Ethernet support EtherCAT

- The STOP/RUN/FN button is a three-stage switch: the middle position is RUN. Toggle to the left for STOP which will not rebound, and is used to switch the RUN/STOP state; Toggle to the right is the FN button, which is a rebound switch, and it bounces back to RUN after releasing it. Long-press FN means to turn the switch to FN and keep it above 2s. The diagram shows the following (elevation view)



- Description of Q0 program import and export: Importing program from U disk/SD card by dialing code trigger: According to PLC command in IDE, exporting PLC program to U-disk/SD card. The command is "plcprogram-export", which is used to export internal PLC program to SD card/ U-disk, and the export file is App.hcf; when both of storage device are using at the same time, the program will be exported to the device which inserted first, and the old file which has the same name will be overwritten. Command execution result is given in PLC command interface.



- In order to ensure the security of the program, Q0 only supports the above exported files (suffix hcf) to do program import. Program import through the dip switch to achieve, please refer to the description of the dip switch for details.

- Refer to Q series hardware manual or Q0 brief debugging tutorial for detailed IDE interface operation instruction

I/O terminal description for HCQ0-1200-D/1100-D

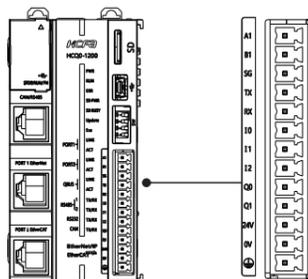


Figure 3 Terminal description for HCQ0-1200-D/1100-D

Table 2 I/O terminal description

Items	Name	Description
1	A1	RS485-A (COM1)
2	B1	RS485-B (COM1)
3	GND	GND for RS485 & RS232
4	TX	RS232 to send
5	RX	RS232 to receive
6	I0	Input point 0, only support PNP input
7	I1	Input point 1, only support PNP input
8	I2	Input point 2, only support PNP input
9	Q0	Output point 0, only support NPN output
10	Q1	Output point 1, only support NPN output
11	24V	24V DC power input
12	0V	0V power supply, COM port for I/O terminal
13	FG	Grounding

Dial switch description for HCQ0-1200-D/1100-D

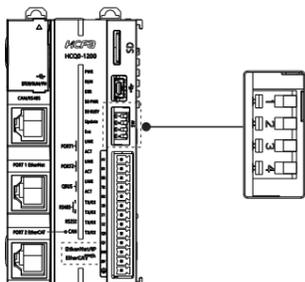


Figure 4 Dial switch description for HCQ0-1200-D/1100-D

Table 3 Dial switch description

Dial switch	Functions
SW2 SW1	
0 0	Long-press FN to install U disk/SD card
0 1	Long-press FN to reset IP address, and restart after completion
1 0	Long-press FN to import the PLC program, and restart after completion
1 1	Reserved
SW3	Reserved
SW4	Rs485 terminal resistance switch in IO terminal

- Dial switch to the left to 1/ON, and to the right to 0/OFF

Table 4 CAN/RS485 interface description

Items	Description
1	CAN-H
2	CAN-L
3	Common grounding for RS485 master and CAN
4	RS485 master-A
5	RS485 master-B
6	N/C
7	N/C
8	N/C

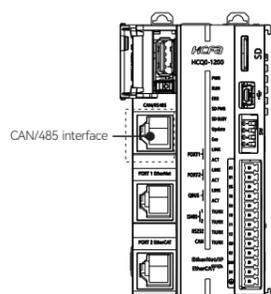


Figure 5 HCQ0-1200-D/1100-D CAN/RS485 interface description

- Rs485 corresponds to COM2 in the program. The port has a built-in 120Ω terminal resistance and does not support MODBUS RTU slave station. The CAN interface also has a built-in 120Ω terminal resistance, which supports the CANopen master station.

2.2.2 Top view description

Top view for HCQ0-1200-D/1100-D CPU unit

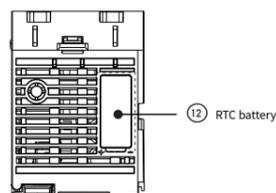


Figure 6 HCQ0-1200-D/1100-D Top view description

Items	Name	Functions
(12)	RTC battery	Save system time

NOTE: Coin cell battery is the standard configuration, maintain part of the system parameters, please do not plug and unplug, the design life of 5 years in normal state use, the model is HCQ0-BAT

2.2.3 Indicator description

Indicator description

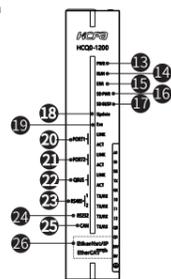


Figure 7 HCQ0-1200-D/1100-D Indicator description

- Four LED status: ON: Lit; OFF: Unlit; blink: Always blinking at a frequency of 5Hz; wink: blinking 10 times and then extinguished

Table 4 Part names and function description-4

Items	Port	Color	Function
(13)	PWR	Green	Shows the current power supply of the module
(14)	RUN	Red	Running status, blink at operation; ON at stop; OFF at no program
(15)	ERR	Red	Fault indicator, ON when error occurs; OFF when reset or program is normal
(16)	SD_PWR	Green	SD card loading
(17)	SD_BUSY	Red	SD card is busy, ON after successfully loading U disk or SD card; OFF after safe unloading
(18)	Update	Red	Status update display ON after successfully importing the program; Click [Flash], the device wink when software is scanned; The device wink after successful resetting IP address; OFF when reset

2.3 Error code description

When the system sends a fault, the system indicator ERR is always on, and the indicator ERR goes off after the reset or the program is normal, please check the system log for specific reasons.

Error code	Error name	Description
0000	RTSEXCPT_APP_EMPTY	No program
0010	RTSEXCPT_WATCHDOG	IEC-task watchdog overtime
0011	RTSEXCPT_HARDWARE_WATCHDOG	System hardware watchdog overtime
0012	RTSEXCPT_IO_CONFIG_ERROR	IO configuration error
0013	RTSEXCPT_PROGRAM_CHECKSUM	IEC program download checksum error
0014	RTSEXCPT_FIELDBUS_ERROR	Field bus error
0015	RTSEXCPT_IOPUPDATE_ERROR	IO update error
0016	RTSEXCPT_CYCLE_TIME_EXCEED	Periodicity overtime
0017	RTSEXCPT_ONLINECHANGE_PROGRAM_EXCEEDED	Program online change excessive
0018	RTSEXCPT_UNRESOLVED_EXTREMS	Exist Unimplemented function blocks or functions in IEC program
0019	RTSEXCPT_DOWNLOAD_REJECTED	Current download operation rejected
001A	RTSEXCPT_BOOTPROJECT_REJECTED_DUE_RETAIN_ERROR	The boot project was not loaded due to the Retain variable could not be loaded
001B	RTSEXCPT_LOADBOOTPROJECT_FAILED	Start boot project failed, without loading or deleted
001C	RTSEXCPT_OUT_OF_MEMORY	Memory overflow
001D	RTSEXCPT_RETAIN_MEMORY_ERROR	Retain memory corrupted and cannot be mapped
001E	RTSEXCPT_BOOTPROJECT_CRASH	Failed to load, resulting in a crash
0021	RTSEXCPT_BOOTPROJECT_TARGETMISMATCH	Boot project mismatch current device
0022	RTSEXCPT_SCHEDULE_ERROR	Task scheduling error
0023	RTSEXCPT_FILE_CHECKSUM_ERROR	Download file check code does not match
0024	RTSEXCPT_RETAIN_IDENTITY_MISMATCH	Retain Variables mismatch boot project
0025	RTSEXCPT_IEC_TASK_CONFIG_ERROR	IEC tasks configure error
0026	RTSEXCPT_APP_TARGET_MISMATCH	Application cannot operate on the current device
0050	RTSEXCPT_ILLEGAL_INSTRUCTION	Illegal command
0051	RTSEXCPT_ACCESS_VIOLATION	Illegal address access
0052	RTSEXCPT_PRIVILEGE_INSTRUCTION	Privileged command, insufficient authority

0053	RTSEXCPT_IN_PAGE_ERROR	Page error
0054	RTSEXCPT_STACK_OVERFLOW	Stack overflow
0055	RTSEXCPT_INVALID_DISPOSITION	Invalid processing
0056	RTSEXCPT_INVALID_HANDLE	Invalid handle
0057	RTSEXCPT_GUARD_PAGE	Page protect
0058	RTSEXCPT_DOUBLE_FAULT	Double fault
0059	RTSEXCPT_INVALID_OPCODE	Invalid opcode
0100	RTSEXCPT_MISALIGNMENT	Data type misalignment
0101	RTSEXCPT_ARRAY_BOUNDS	Array out bounds
0102	RTSEXCPT_DIVIDE_BY_ZERO	The application has a divide by 0
0103	RTSEXCPT_OVERFLOW	Overflow
0104	RTSEXCPT_NONCONTINUABLE	Noncontinuable
0105	RTSEXCPT_PROCESSOR_LOAD_WATCHDOG	The processor is loaded with the watchdog for all IEC tasks
0150	RTSEXCPT_FPU_ERROR	Floating point error
0152	RTSEXCPT_FPU_U_DIVIDE_BY_ZERO	FPU has a divide by 0
0153	RTSEXCPT_FPU_INEXACT_RESULT	Inaccurate floating-point operation in FPU
0154	RTSEXCPT_FPU_INVALID_OPERATION	Invalid operation in FPU
0155	RTSEXCPT_FPU_OVERFLOW	FPU overflow
0156	RTSEXCPT_FPU_STACK_CHECK	FPU stack check
0157	RTSEXCPT_FPU_UNDERFLOW	FPU underflow
0200	RTSEXCPT_BREAKPOINT	Hardware breakpoint
0FFF	RTSEXCPT_MASK	Block all error codes so far
1000	RTSEXCPT_WATCHDOG_OMITTED_CYCLE	Watchdog period timeout with omitted period
2000	RTSEXCPT_VENDOR_EXCEPTION_BASE	Specific vendor error code base

2.4 Product dimensions

◆ Product dimensions

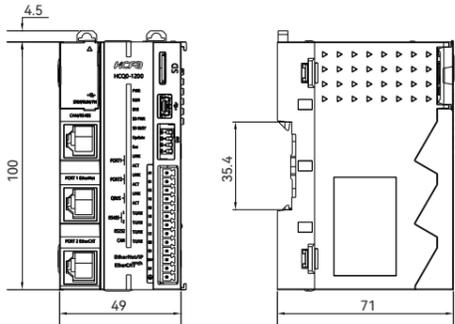


Figure 8 HCQ0-1200-D/1100-D CPU installation dimension (unit: mm)

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3. Installation description

3.1 Electrical specifications

Items	Specifications															
Dielectric withstand voltage	100VAC for one minute, Between power terminals and input/output terminals and between external terminals and housing															
Noise resistance	(IEC61000-4-2/3/4/6) By noise simulator at noise voltage of 1500 Vp-p or more, noise width of 1 μs, rise time of 50ms. Conform to IEC standard (IEC61000-4-2/3/4/6)															
Vibration resistance	<table border="1"> <thead> <tr> <th>Vibration resistance</th> <th>Frequency (Hz)</th> <th>Acceleration (m/s²)</th> <th>Single amplitude (mm)</th> <th>Sweep Count for X, Y, Z: 10 times (80 min in each direction)</th> </tr> </thead> <tbody> <tr> <td>When installed on DIN rail</td> <td>10-57</td> <td>—</td> <td>0.035</td> <td>—</td> </tr> <tr> <td></td> <td>57-150</td> <td>4.9</td> <td>—</td> <td>—</td> </tr> </tbody> </table>	Vibration resistance	Frequency (Hz)	Acceleration (m/s ²)	Single amplitude (mm)	Sweep Count for X, Y, Z: 10 times (80 min in each direction)	When installed on DIN rail	10-57	—	0.035	—		57-150	4.9	—	—
Vibration resistance	Frequency (Hz)	Acceleration (m/s ²)	Single amplitude (mm)	Sweep Count for X, Y, Z: 10 times (80 min in each direction)												
When installed on DIN rail	10-57	—	0.035	—												
	57-150	4.9	—	—												
Insulation resistance	50MΩ or more (by 500V DC megger, Between power terminals and input/output terminals and between external terminals and housing)															
IP protection level	IP20															
Ambient temperature	Max. 50°C, free from dust and corrosive gas															
Working altitude	2000m (80kPa)															
Pollution degree	2, Normally there is only non-conductive pollution, but temporary conductivity caused by condensation should also be expected.															

3.2 Environmental specifications

Classification	Types	Working environment	Transport environment	Storage temperature
Environmental parameters (IEC60721-3)	Protection level	IE33	IE22	IE12
	Temperature	0-50°C (free from freezing)	-40-75°C	-25-75°C
	Humidity	5-95%RH (free from condensation)		
	Impact	Acceleration 150m/s ² , action time 11ms, 2 times in each direction of X, Y, and Z		
Altitude/Pressure	Max.2000m	Max.3000m (>70kPa)		

- IEC60721-3 is the third part of the classification of environmental conditions: the classification of environmental parameter groups and their severity.
- Ambient temperature refers to the surrounding temperature of the module or unit, not the internal temperature of the module.

3.3 Power supply specification

Items	specification
Supply voltage	DC24V
Voltage fluctuation range	-15%~20%
Input power	36W
Undervoltage alignment	19V
Output voltage	12V
Voltage fluctuation	±5%
Output power	16W

3.4 Performance specifications

Items	Specifications	
Programming	Total program capacity	16MBytes
	Area I (%)	128KBytes
	Area Q (%Q)	128KBytes
	Area M (%M)	512KBytes
Units configuration	Power down protection zone	800KBytes
	Other Variables	limitless
EtherCAT	Communication standard	IEC 61158 Type12
	EtherCAT master specifications	Class B (compatible with function motion control)
	Physical layer	100BASE-TX
	Modulation	Baseband
	Transmission speed	100Mbps (100Base-TX)
	Duplex mode	Duplex all
	Topology	Linear, daisy chain and branch
	Transmission medium	Twisted-pair cable of category 5 or higher (aluminum foil + braided double shielded directconnect cable)
	Maximum transmission distance between nodes	100m
	Maximum process data	Input: 5,736 bytes Output: 5,736 bytes (The maximum number of frames of process data is 4.)
	Longest communication cycle	Mini.1ms
	Link layer	CAN2.0A
	Terminal resistance	Built-in 120Ω, not support disconnection
	Support baud rate	20K, 50K, 100K, 125K, 250K, 500K, 800K and 1M
CANOpen master station	Topology	Linear, daisy chain and branch
	Transmission Media	Twisted-pair cable of category 5 or higher
	Max transmission distance	2500 m (20Kbit/s)
	Max number of slaves	32
	Communication period	Minimum 1ms

6

Items	Specifications	
Serial port	Physical layer	COM1 RS485 COM2 RS485 only support master COM3 RS232
	Terminal resistance	COM1 Built-in 120Ω, Supports toggleswitching COM2 Built-in 120Ω, not support disconnection
	Baud ratebps	4800~115200
	Max communication distance	COM1, COM2 500m COM3 15m
	Topology	COM1, COM2 Linear, daisy chain and branch COM3 P2p
	Max number of slaves	COM1, COM2 32 COM3 1
	Transmission Media	Twisted-pair cable of category 5 or higher

3.5 General I/O Specification

◆ General input specifications

Items	specification
Signal name	Transistorized common input (I0-I2)
Rated input voltage	DC24V (+20%~-15%, Pulsation±10%)
Type of Input	Drain type input
Rated input Current	3.65mA
ON current	>4.14mA
OFF current	<3.88mA
Input resistance	1.5K
Max input frequency	1KHz
Public Method	Shared with power supply 0V, internally shorted

◆ General output specification

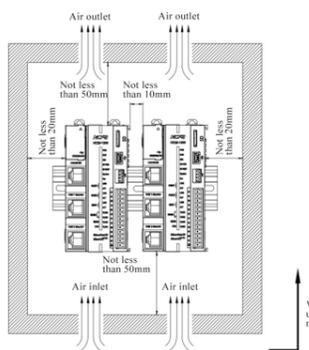
Items	specification
Signal name	Transistorized common input (Q0-Q1)
Output polarity	Drain type input (NPN)
Control circuit voltage	DC5V~24V
Rated load voltage	50mA
ON Maximum voltage drop	0.05V
OFF Leakage current	<0.1mA
Output frequency	Maximum 1KHz
Public method	Shared with power supply 0V, internally shorted

3.6 Installation instructions

3.6.1 Control cabinet installation

Carrying out the installation in the control cabinet of the equipment, please note the following points:

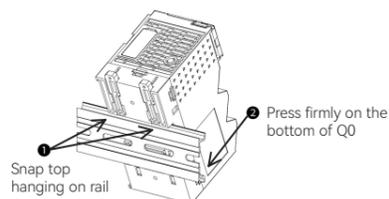
- Please ensure that the installation direction is perpendicular to the wall, use natural convection or a fan to cool the device and mount the controller firmly on the 35MM international rail by means of a two-way linkage clip.
- The top and bottom sides of the equipment or modules must be spaced at least 50 mm apart from the internal walls to allow for ventilation and replacement of the equipment or modules; the left and right sides of the equipment or modules must be spaced at least 20 mm apart from the internal walls.
- For side-by-side installation, a distance of 10mm or more is recommended between devices (if installation space is limited, no spacing is optional).



3.6.2 Mounting and dismounting of guide rails

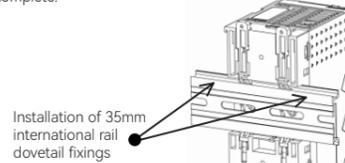
■ Rails installation

- Align the bottom part of Q0 with the 35MM international rail, make the upper part of the two-way linkage snap hang on the rail, then press the bottom of Q0, when you can obviously hear the "click" sound, indicating that the bottom of the two-way linkage snap has been snapped together with the rail, at this time Q0 installation is complete (before installation should ensure that all two-way linkage snap is in a contracted state, otherwise it may lead to installation failure).



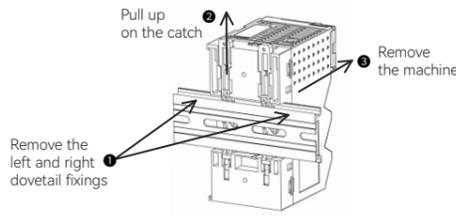
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- After the Q0 installation is complete, 35MM national rail dovetail fixings should be installed on the left and right side of the machine after the installation is complete, please see the packaging accessories bag for materials so that the installation is all complete.



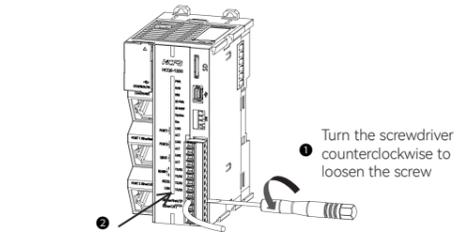
■ Rails dismounting

When disassembly is required, first remove the 35MM international guide dovetail fixings installed on the left and right sides of the machine, then pull the two-way linkage clasp upwards by a distance of about 5.8MM (when pulling upwards, you can clearly feel the "click" sound, representing the completion of the clasp pulling), at this point you can already directly remove the machine, complete the machine Disassembly (you can use auxiliary tools such as screwdrivers when pulling the two-way linkage clasp).

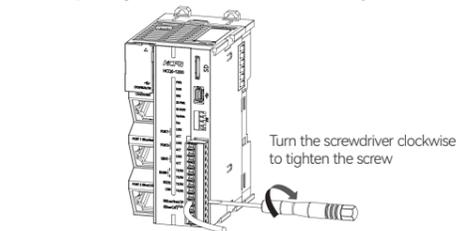


3.6.3 Terminal block wiring

- Insert the small screwdriver sideways at the screw on the right side of the row, turn it counterclockwise until the screw is completely loosened and insert the compliant cable from the front into the corresponding square hole until it cannot be inserted.



- Keeping the cable in place, use a small screwdriver to tighten the corresponding screw clockwise until the cable is fully secured.



3.7 Wiring description

3.7.1 Cables

Items	Specification	
Mounting type	Push-in	
Push-in force (single contact)	10N	
Cable type	Copper wire only (do not use aluminum cable)	
Cable length	7-9 mm ²	
Cross section of cables	Single strand	0.08-1.50 mm ² /28-16 AWG
	Multiple strand	0.25-1.50 mm ² /24-16 AWG
	Wiring sleeve	0.25-0.75 mm ² /24-20 AWG

3.7.2 Wiring

■ Local IO input wiring diagram

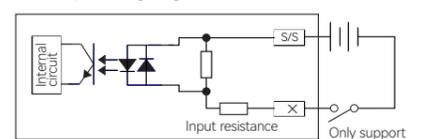


Figure 9 Local IO input wiring for HCQ0-1200-D/1100-D

■ Local IO output wiring diagram

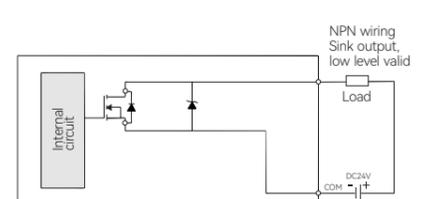


Figure 10 Local IO input wiring for HCQ0-1200-D/1100-D

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