Mindman

CONTROLLER



CM20 series

User Manual

Closed-loop step motor controller

Ver. 2605

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1. Safety Precautions

Before installing, operating, or maintaining this product, carefully read this manual and all related documentation to fully understand the product characteristics, safety information, and precautions to ensure correct usage.

Safety notices are classified as:

Warning	Improper operation may result in death or serious injury.
Caution	Improper operation may result in injury or property damage.
Important	No risk of injury, but information necessary for proper use.

- Even items classified as “Caution” or “Important” may result in serious consequences depending on the circumstances.

Warning

General

- This product is not explosion-proof. Do not use it in environments containing explosive, flammable, or corrosive gases; in areas where oil, water, chemicals, or other liquids may adhere to the product; or near combustible materials, as this may result in fire or personal injury.
- Do not use this product in environments exposed to direct sunlight (ultraviolet rays), near magnetic or radioactive objects, or in areas with heavy dust, salt, iron powder, high humidity, or organic solvents and phosphate-ester oils, as this may result in fire or personal injury.
- Do not use this product in medical devices related to life support or human health, or in critical components for transporting personnel.
- Installation, wiring, operation, and troubleshooting must be performed by qualified personnel; otherwise, accidents such as fire, injury, or equipment damage may occur.
- Before performing installation, wiring, operation, or troubleshooting, make sure the power has been turned off and that all LED indicators on the controller are completely extinguished to avoid the risk of electric shock.
- Once power is removed or excitation is released, the motor will lose its holding force. Be sure to secure or restrain all movable parts to prevent movement or falling that could result in personal injury or equipment damage.
- Depending on the type of alarm, the motor may stop and lose its holding force when an alarm occurs. Appropriate safety circuits, devices, or countermeasures must be designed to prevent personal injury or equipment damage caused by sudden stops, power failures, or system alarms.
- When an alarm occurs, always identify and eliminate the cause before resetting it. Continuing operation without correcting the cause may result in abnormal behavior of the motor or controller, leading to personal injury or equipment damage.

Wiring

- The product must be properly grounded to prevent electric shock, static electricity buildup, improve noise immunity, and avoid abnormal operation of the motor and controller.
- Before supplying power or starting the product, be sure to verify that the power source is within the rated operating range. Improper power supply may result in personal injury or equipment damage.
- Wiring must be performed in accordance with this user manual to avoid incorrect connections. Ensure that cables and connectors are securely fastened; otherwise, abnormal operation or fire may occur.

Warning

- Do not excessively bend, pull, clamp, or place heavy objects on cables. Doing so may damage the cables, cause leakage current or poor conduction, and result in fire, electric shock, or abnormal operation of the motor and controller.

Operation

- During a power outage, be sure to turn off the controller power. Otherwise, when power is restored, the motor may start suddenly and cause personal injury or equipment damage.
- Do not set the motor to Servo OFF during operation. The motor will stop and lose its holding force, which may result in personal injury or equipment damage.

Repair, Disassembly, and Modification

- Do not disassemble or modify the motor or controller, as this may result in personal injury or equipment damage. If internal inspection or repair is required, please contact our sales office or authorized service center.

Caution

General

- Do not operate the motor or controller beyond their specified ratings. Doing so may cause malfunction, loss of function, damage, significantly reduced service life, and may result in personal injury or equipment damage.
- Do not insert fingers or objects into the openings of the motor or controller, as this may cause fire, personal injury, or equipment damage.
- Do not touch the motor or controller during operation or for a period after stopping, as they may be hot and could cause burns.
- Do not install the product in locations subject to strong vibration or impact, as such conditions may cause abnormal operation.
- Install an emergency stop device at an appropriate location so that the system can be stopped immediately if a hazardous situation arises during operation. Failure to do so may result in personal injury.

Installation and Setup

- When installing the product, ensure that sufficient space is provided for maintenance work. Insufficient space may make routine inspection and maintenance difficult, possibly leading to equipment stoppage or damage.
- When installing multiple units, ensure adequate spacing between them and use cooling fans as necessary to keep the ambient temperature at 50°C or lower. Do not place objects around the units that obstruct ventilation.
- Before performing maintenance inspections, repairs, or replacements, be sure to completely shut off the power supply and all input/output signals.

Operation

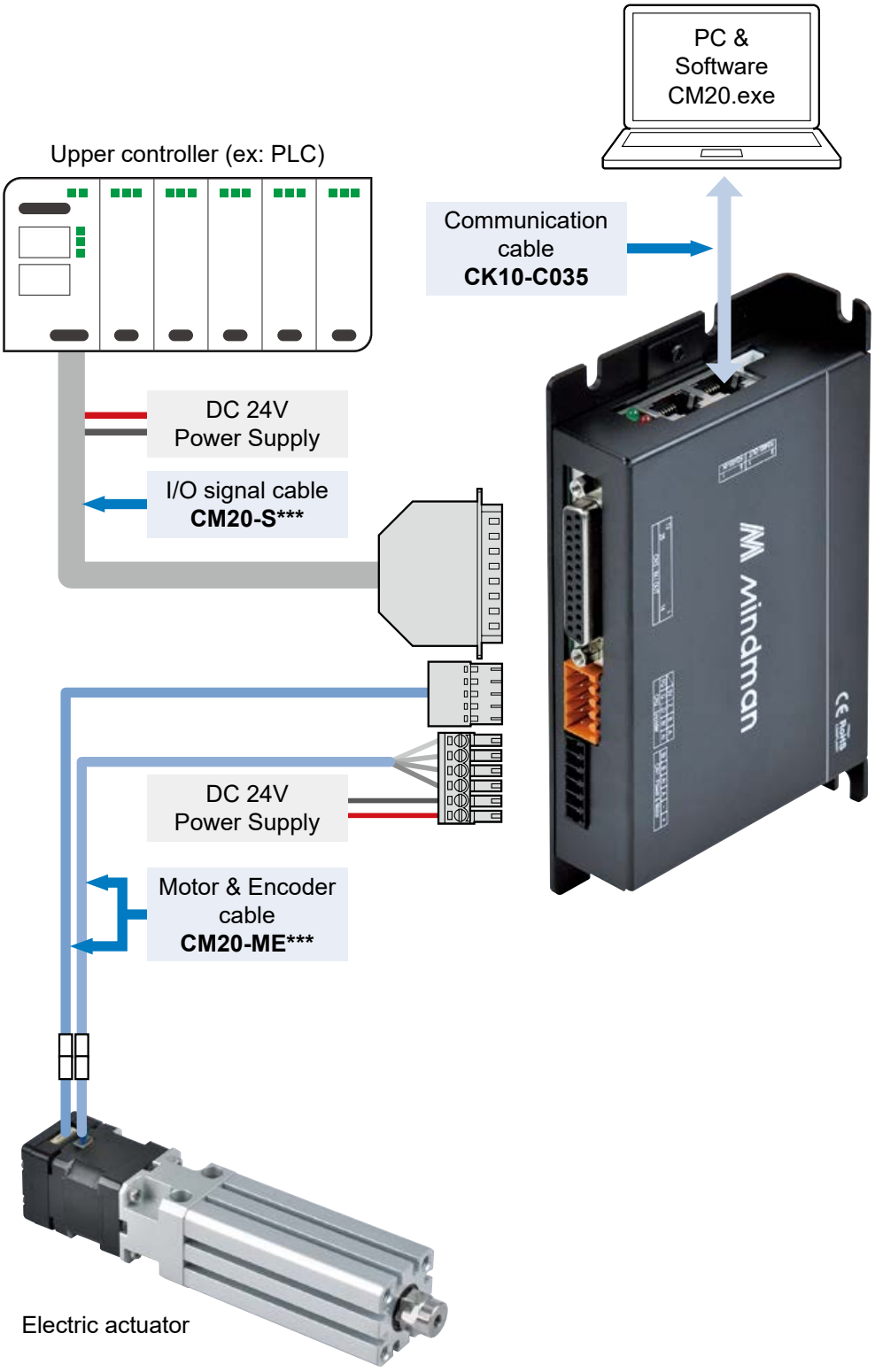
- Do not touch terminals or switches while the power is on, as this may cause electric shock or abnormal operation.
- Before manually moving any movable parts, make sure the product is in the Servo OFF state. Failure to do so may result in personal injury.
- If abnormal heat, smoke, or odor is detected, immediately turn off the power supply.

Maintenance

- Before carrying out any maintenance, inspection, repair, or replacement work on the product, always completely turn off the power supply.

2. Product Description

2.1 System Structure

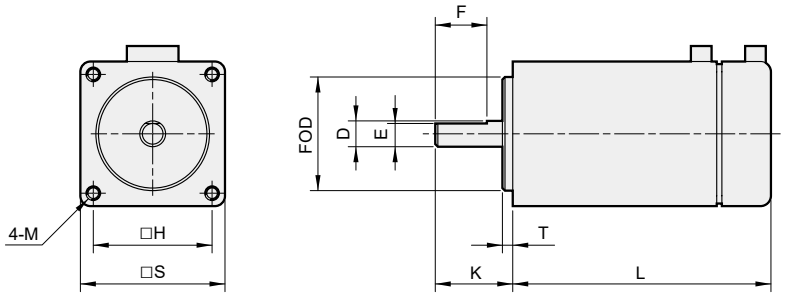


2.2 Controller Specifications

Model	**CM20**
Input power voltage	24VDC~48VDC
Max. output current	4.5A (Peak)
Current consumption	500 mA Max. (without motor)
Suitable motor type	2-phase 4 wires bipolar stepper motor (with encoder)
Drive method	PWM constant current driving
I/O interface	Input: ● 5 Digital inputs ● Pulse, direction input (Configurable as digital input) Output: ● 4 Digital outputs ● Encoder input (Differential A, B, Z) (Fixed)
Functions of digital inputs	Servo ON/OFF Clear Alarm Emergency Stop JOG +/- ORG (Homing)
Functions of digital outputs	General Output No Alarm In Position Performed (Moving) TRQ_LMT
Led indicators	Status, Alarm
Communication interface	RS-485, up to 32 nodes MODBUS RTU protocol, Baud rate: 19200bps(default), up to 115200bps
Control mode	Position Control (Positioning with pulse or RS-485)
Weight	About 350 g (Connectors excluded)
Operating temperature / humidity	0-45°C, less than 85%RH (No condensation)
Storage temperature / humidity	0-85°C, less than 85%RH (No condensation)
Atmosphere	Avoid the corrosive gases

2.3 Motor Specifications and Dimensions

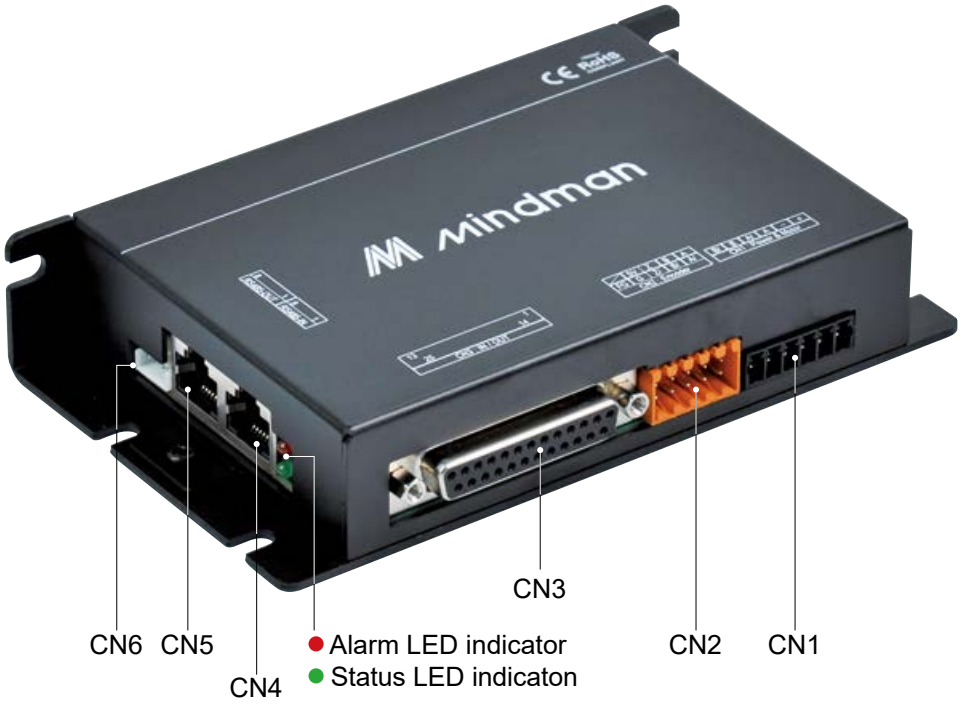
Model		BM					
Size		□20	□25	□28	□35	□42	□56
		NEMA 8	NEMA 10	NEMA 11	NEMA 14	NEMA 17	NEMA 23
Drive type		Bi-Polar					
Phase quantity		2					
Phase current	A	0.6	1	1	1.5	2	3
Holding torque	N·m	0.036	0.085	0.085	0.28	0.51	1.53
Rotor inertia	$g \cdot cm^2$	2.9	8	8	40	75	490
Weights	g	70	120	120	300	400	1150
Insulation resistance	Mohm	100 MIN.(at 500VAC)					
Insulation class		Class B (130°C)					
Operating temp.	°C	0~50					
Encoder resolution (Quadruple)	Incremental optical encoder	6,400 PPR	9,600 PPR	9,600 PPR	12,800 PPR	16,000 PPR	16,000 PPR



Unit: mm

Size	□20	□25	□28	□35	□42	□56
	NEMA 8	NEMA 10	NEMA 11	NEMA 14	NEMA 17	NEMA 23
S	20	25	28	35	42	57
L	56	50.5	50.5	61	58	87
H	16	20	23	29	31	47.14
M	M2×0.4 depth 2.5 min	M2.5×0.45 depth 3.0 min	M2.5×0.45 depth 5.5 min	M3×0.5 depth 4.0 min	M3×0.5 depth 4.0 min	Ø4.5 thru
FOD	Ø15	Ø15	Ø22	Ø22	Ø22	Ø38.1
T	1.5	1.5	1.5	2	2	1.6
D	Ø4	Ø5	Ø5	Ø5	Ø5	Ø8
K	10	15	15.7	20	20	24
E	3.5	4.5	4.5	–	4.5	7.5
F	7	10	10	–	15	20

2.4 Connectors

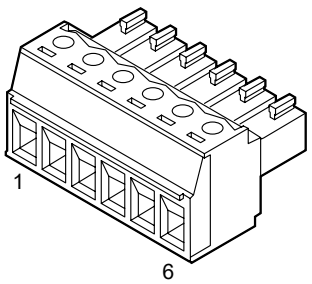


No.	Function	No.	Function
CN1	Power & Motor Connector	CN4	RS485 Connector (IN)
CN2	Encoder Input Connector	CN5	RS485 Connector (OUT)
CN3	I/O Signal Connector	CN6	Reserve

2.4.1 Power & Motor Connect (CN1)

Please use appropriate power sources and cables to supply power and connect the motor, otherwise the controller and motor may be damaged. When wiring, the recommended wire diameter is AWG16~AWG20, and the recommended wire stripping length is 6~7mm.

(Connector: DINKLE / 15EDGRC-3.81-6P)

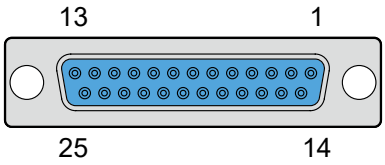
No	Name	Description	Fig
1	B/	motor phase B/	
2	B	motor phase B	
3	A/	motor phase A/	
4	A	motor phase A	
5	GND		
6	V+	Power 24/48 VDC	

Warning

- Please first confirm that the motor parameters in the controller match the currently connected motor. When connecting the motor, the controller must be powered off first.
- If the wrong motor parameter file is imported and written into the controller, it may cause malfunction, alarm, or even damage to the motor and controller.

2.4.2 I/O Signal(CN3)

CM20 supports various I/O functions. See Chapter 3 for detailed descriptions.
(Socket: D-sub 25pin Female)



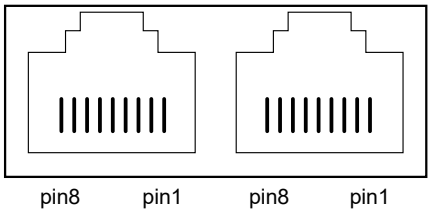
Pin	Name	Function
1	+COM (24V)	Power Input (24VDC)
2	NC	Do not connect
3	NC	Do not connect
4	NC	Do not connect
5	IN1	Single-ended Signal Input, 18~24V available, Maximum Input Frequency 1KHz, Configurable (Default: Clear alarm)
6	IN2	Single-ended Signal Input, 18~24V available, Maximum Input Frequency 1KHz, Configurable (Default: Bit 0(program))
7	IN3	Single-ended Signal Input, 18~24V available, Maximum Input Frequency 1KHz, Configurable (Default: Start program)
8	IN4	Single-ended Signal Input, 18~24V available, Maximum Input Frequency 1KHz, Configurable (Default: Deceleration Stop)
9	IN5	Single-ended Signal Input, 18~24V available, Maximum Input Frequency 1KHz, Configurable (Default: Home switch)
10	OUT1	Single-ended Signal Output, Common Cathode Configuration, Maximum Output Current 50mA, Withstand Voltage 30 VDC, Configurable (Default: In position)
11	OUT2	Single-ended Signal Output, Common Cathode Configuration, Maximum Output Current 50mA, Withstand Voltage 30 VDC, Configurable (Default: No Alarm)
12	OUT3	Single-ended Signal Output, Common Cathode Configuration, Maximum Output Current 50mA, Withstand Voltage 30 VDC, Configurable (Default: Performed)
13	OUT4	Single-ended Signal Output, Common Cathode Configuration, Maximum Output Current 50mA, Withstand Voltage 30 VDC, Configurable (Default: General Output)
14	IN7+	Differential Signal Input, 5~24V available, Maximum Input Frequency 500KHz, Configurable (Default: Servo ON/OFF) *In Pulse Control Mode forced assignment for Pulse / CW
15	IN7-	
16	IN6+	Differential Signal Input, 5~24V available, Maximum Input Frequency 500KHz, Configurable (Default: Inching +) *In Pulse Control Mode forced assignment for DIR / CCW
17	IN6-	
18	Encoder A+	Encoder Output A+
19	Encoder A-	Encoder Output A-
20	Encoder B+	Encoder Output B+
21	Encoder B-	Encoder Output B-
22	Encoder Z+	Encoder Output Z+
23	Encoder Z-	Encoder Output Z-
24	FG	GND
25	-COM (0V)	Output Common Terminal (Common Cathode, 0V)

Warning

- Pin 18~23 signals are differential output, not used Optocouplers.

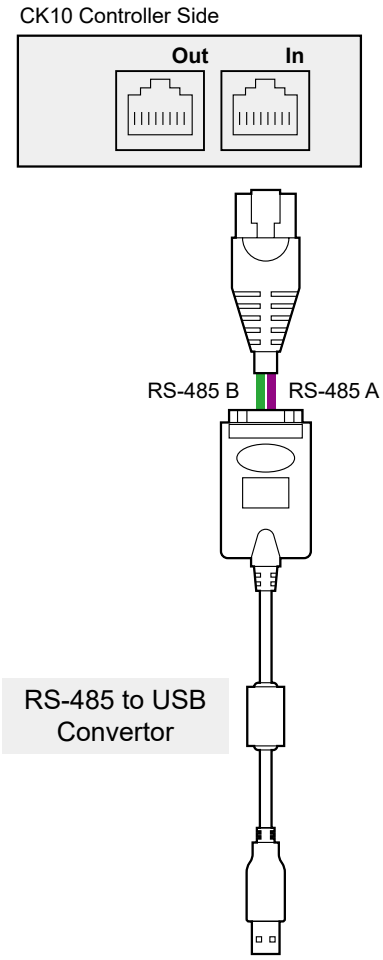
2.4.3 CN4 (RS485-IN) / CN5 (RS485-OUT)

When multiple controllers are connected in series, the last controller must be connected with the terminal resistors. Please short-circuit pins 3 and 8, 6 and 7 of its CN5 (RS485-OUT), that is, the terminal resistor connection is completed.

Pin	Function	Fig
1	NC	
2	GND	
3	A Input (RS485)	
4	NC	
5	NC	
6	B Input (RS485)	
7	NC	
8	NC	
Chassis	Frame GND	

Caution

- This RJ45 interface is not a general Ethernet interface. You must refer to the pin definitions in the table above for wiring, and prepare an RJ45 to RS485 to USB communication cable.
- CN4 (RS485-IN) does not have built-in terminal resistor.



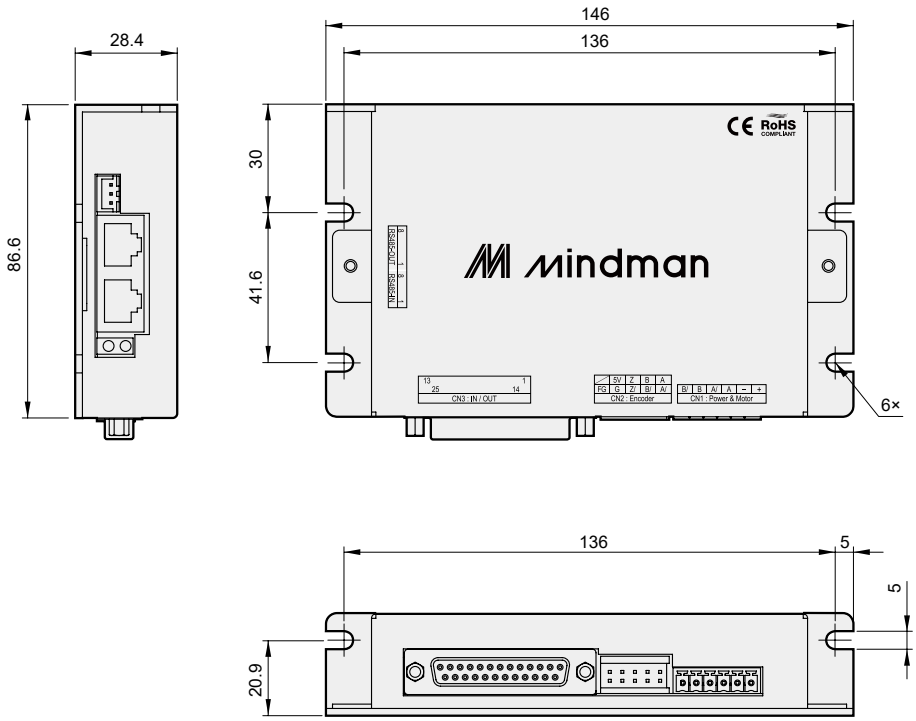
2.4.4 LED Indicators

Name	Color	Function	Description
STAT	Green	Status	Steady light: Running Flickering: Stopping or Servo OFF
ALM	Red	Alarm	Flickering after the protection function is activated (Protection function related to the number of LED flashes)

* For detailed on the number of LED flashes, status and error, please refer to Chapter 5 - Status and Error.

2.5 Controller Dimension

Unit: mm

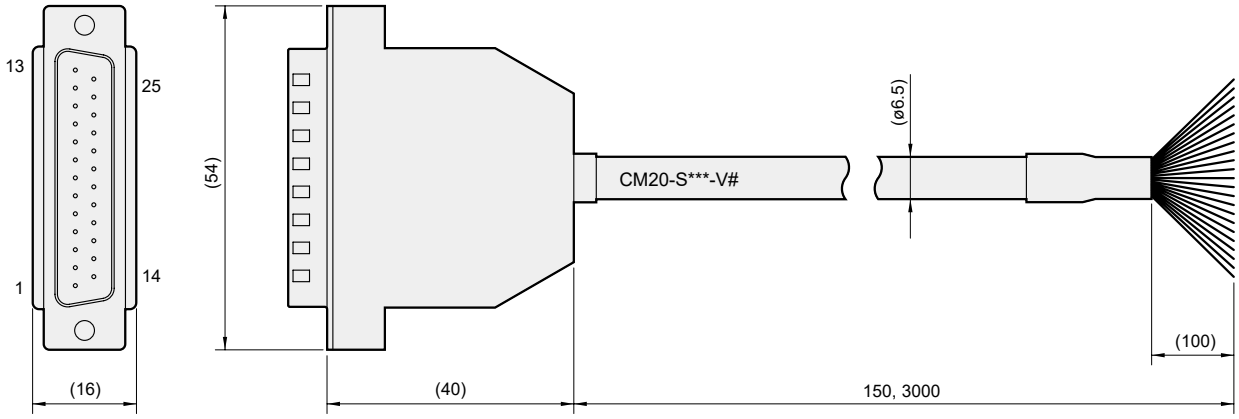


3. I/O Cable and Pin Assignment

Users can set the functions through the I/O setting page of the software.

3.1 I/O Cable

Connector: D-sub 25pin male



- *** means cable length (L), for example: 03 = 3.0 m
- # means cable version.

3.1.1 Signals name and wires color (Cable Version: V2)

The V2 version of the I/O signal cable has a cable model label.

Pin No.	Signal name	Color
1	+COM (24V)	Red
2	NC	Red/Black
3	NC	Yellow
4	NC	Yellow/Black
5	IN1	Green
6	IN2	Green/Black
7	IN3	Gray
8	IN4	Gray/Black
9	IN5	L. Green
10	OUT1	L. Green/Black
11	OUT2	L. Blue/Black
12	OUT3	White/Red
13	OUT4	Pink

Pin No.	Signal name	Color
14	IN7+	Brown
15	IN7-	Brown/Black
16	IN6+	Orange
17	IN6-	Orange/Black
18	A+	Blue
19	A-	Blue/Black
20	B+	Purple
21	B-	Purple/Black
22	Z+	White
23	Z-	White/Black
24	FG	L. Blue
25	-COM (0V)	Black
26		

Caution

- The wire color marking is for reference only. The actual color may be slightly different due to printing or screen display settings. Please refer to the actual product and use with caution.

3.1.2 Signals name and wires color (Cable Version: Old ver.)

The older version of the I/O signal cable did not have a cable model label.

Pin No.	Signal name	Color
1	+COM (24V)	Brown/Black
2	NC	Red/Black
3	NC	Orange/Black
4	NC	Yellow/Black
5	IN1	Green/Black
6	IN2	Blue/Black
7	IN3	Purple/Black
8	IN4	Gray/Black
9	IN5	White/Black
10	OUT1	White/Red
11	OUT2	L. Blue/Black
12	OUT3	L. Green/Black
13	OUT4	Pink

Pin No.	Signal name	Color
14	IN7+	Brown
15	IN7-	Red
16	IN6+	Orange
17	IN6-	Yellow
18	A+	Green
19	A-	Blue
20	B+	Purple
21	B-	Gray
22	Z+	White
23	Z-	Black
24	FG	L. Blue
25	-COM (0V)	L. Green
26		

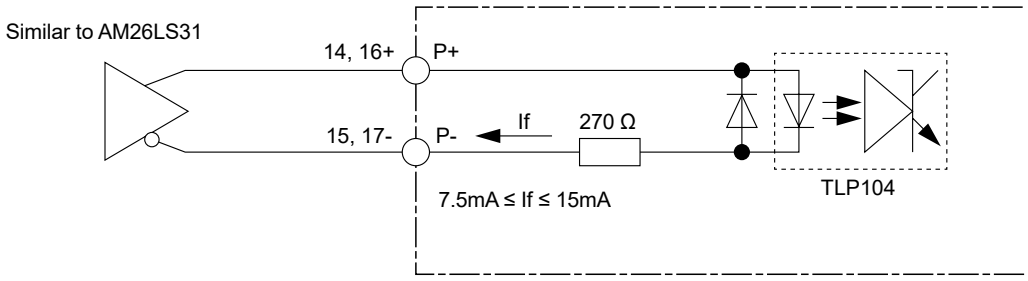
Caution

- The wire color marking is for reference only. The actual color may be slightly different due to printing or screen display settings. Please refer to the actual product and use with caution.

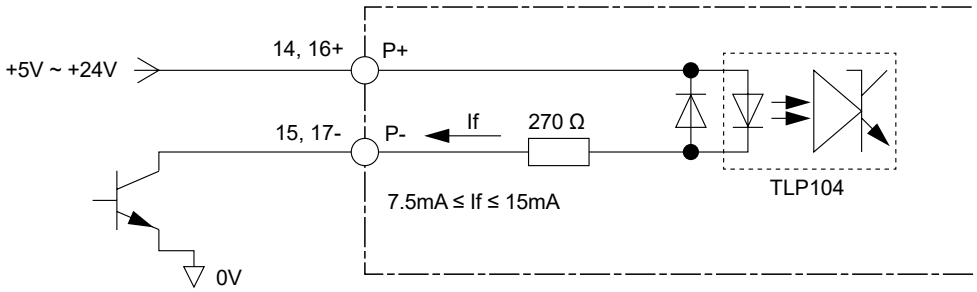
3.2 I/O Circuit Specification

3.2.1 Input Circuit

Command Pulse Input Circuit (Differential Drive)



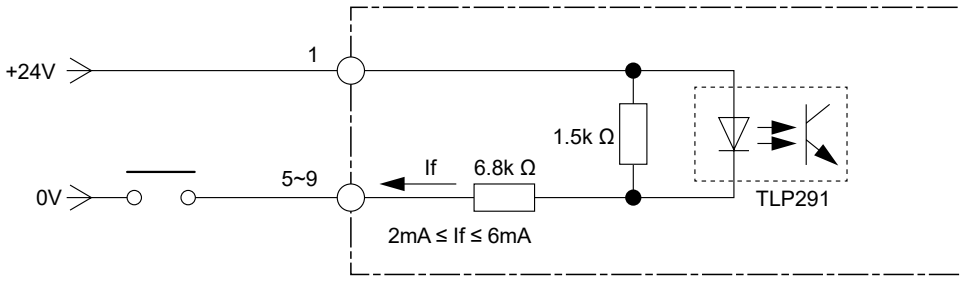
Command Pulse Input Circuit (Open Collector)



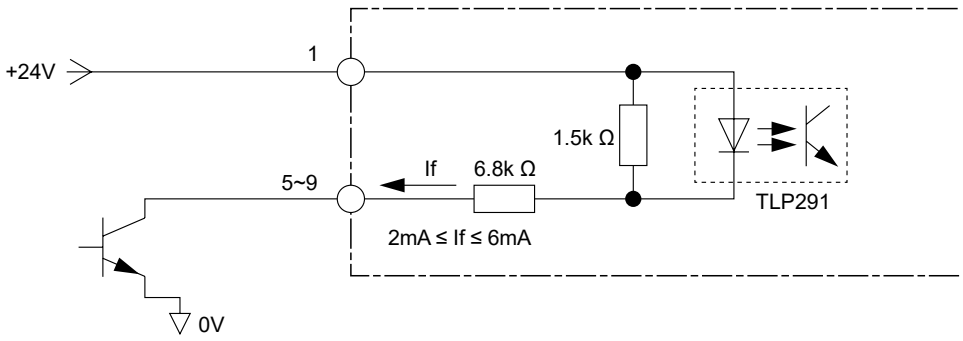
Note

CM20 is compatible both with +5V & +24V signal, so resistor in series is not in need.

Sensor, Digital Input Circuit (Contact)

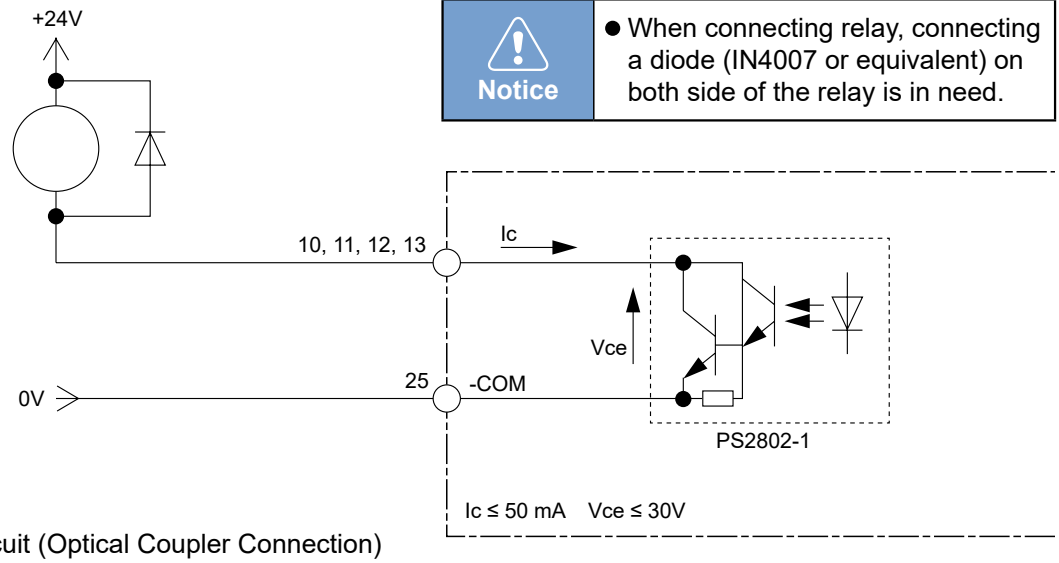


Sensor, Digital Input Circuit (Open Collector)



3.2.2 Output Circuit

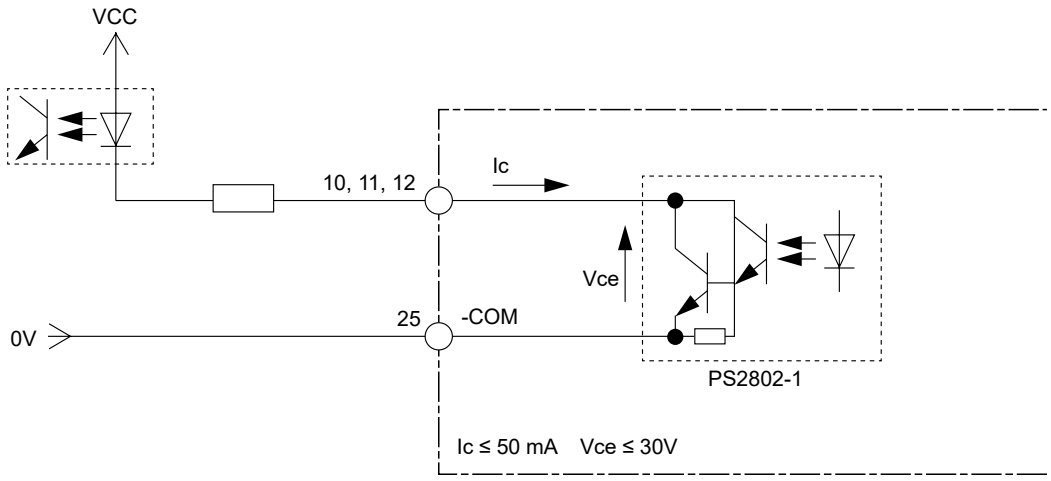
Digital Output Circuit (Relay Connection)



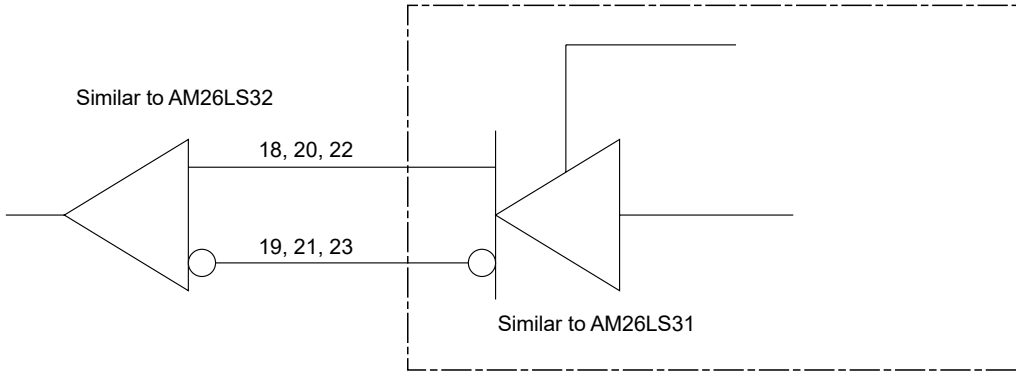
Notice

- When connecting relay, connecting a diode (IN4007 or equivalent) on both side of the relay is in need.

Digital Output Circuit (Optical Coupler Connection)



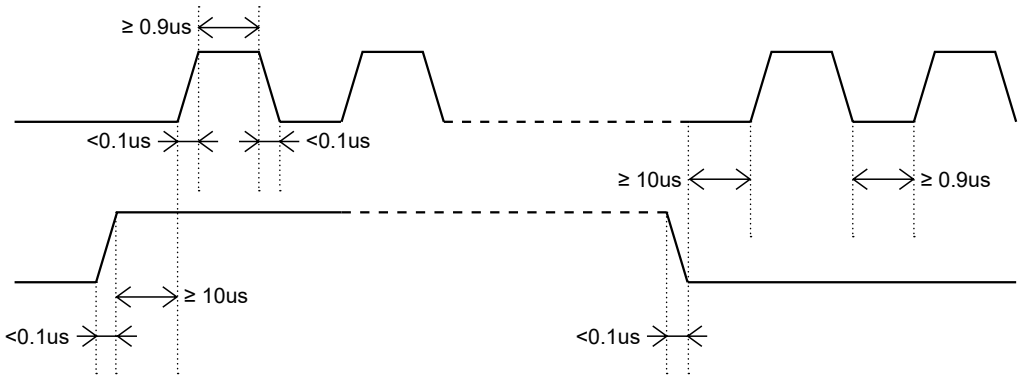
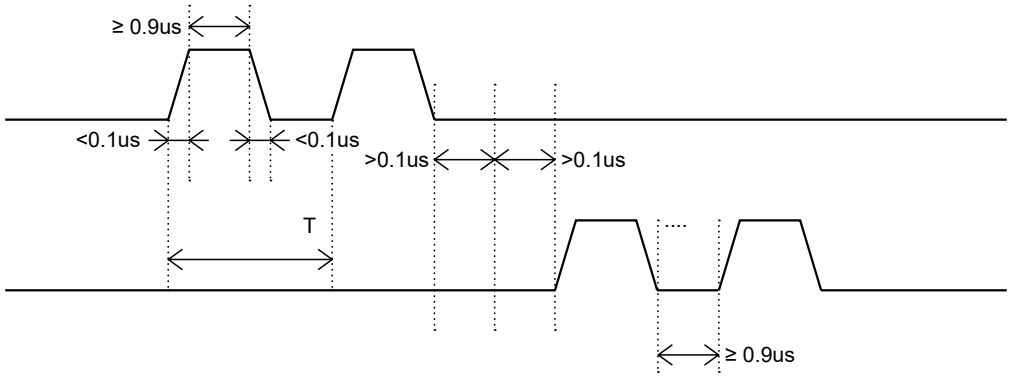
Differential Output Circuit (Encoder Output)



Caution

- There is no opto-coupler isolation for encoder output. Before power on, please check whether the wiring is correct and there is short circuit. So as to avoid any damaging the upper computer and driver by introducing the 24V power supply on the CN3 port.

4. Single/Double Pulse Waveform and Timing

	Waveform and Timing (single pulse mode, PULSE+DIR)
Input 7 Input 6 (Low level forward, high level reverse)	
	Waveform and Timing (double pulse mode, CW+CCW)
Input 7 (Pulse input forward) Input 6 (Pulse input reverse)	

5. Status and Alarm

5.1 Status

The LED may flick (Low level for 0.5 second, High level for 0.5 second).

Status	Green LED	Code	Description
Stopping	Flickering	2	The motor is enabled but not rotating.
Running	Steady light	3	The driver is working.
Disable	Flickering	1	The motor is disabled and in a free status.

5.2 Alarm

The LED may flick (Low level for 0.5 second, High level for 0.5 second).

Alarm	Red LED	Code	Description
Overcurrent	Flashing once	10	Over current or driver failure
Phase loss	Flashing twice	11	Motor wiring is abnormal
Overvoltage	Flashing 3 times	14	Power input is greater than 60V
Undervoltage	Flashing 4 times	13	Power input is less than 18V
Position error	Flashing 5 times	25 or 26	25: Position deviation is larger than set value. 26: Overload, 150% motor current had been output continuously more than 2s.
Other	Other	Other	

5.3 Troubleshooting

Alarm	Red LED	Code	Troubleshooting
Overcurrent	Flashing once	10	Check the controller parameters and whether there are short circuits in the motor.
Phase loss	Flashing twice	11	Check the connection cable between the controller and the motor, and check whether there are short circuits in the motor.
Overvoltage	Flashing 3 times	14	Check the power supply.
Undervoltage	Flashing 4 times	13	Check the power supply.
Position error	Flashing 5 times	25 or 26	Check whether the motor and its driven components are stuck or the load and acceleration and deceleration inertia are too large.
Other	Other	Other	Please contact the sales office where you purchased it.

6. Parameter

Caution	● EEPROM has a writing limit of about 1 million times. Please pay attention when modifying and writing parameters and multi-segment programs. ● If there are functions or parameters not listed in the table in this chapter, do not change them to avoid causing abnormalities or damaging the device.

6.1 Basic Status of Controller

The parameters listed in this section are used for software displaying and can only be read, not written.

Addr. (HEX)	Addr. (DEC)	word	Parameter	Description	Range/Unit
00 64	0100	1	Current	Real-time motor current	0.001 A
00 65	0101	1	Input Voltage	Current input voltage	0.01 V
00 68	0104	2	Resolution	Micro-step resolution set value	ppr
00 6A	0106	1	Pulse Mode	1 : Pulse/Dir mode 2 : CW/CCW mode	1~2
00 6C	0108	1	Alarm	Code of alarm, display "0" for no fault	
00 6D	0109	1	Status	Drive running status.	
00 6E	0110	1	Hardware Ver	Drive hardware version	
00 6F	0111	1	Software Ver	Drive firmware version	
00 75	0117	2	Cmd Pos	Command target position	pulse
00 77	0119	1	Velocity		0.01 rps
00 7E	0126	2	Actual Pos	Real-time position	pulse
00 87	0135	1	Input Status	data: Bit6 ..... Bit1 Bit0 port: IN7 ..... IN2 IN1	
00 88	0136	1	Output Status	data: Bit3 Bit2 Bit1 Bit0 port: OUT4 OUT3 OUT2 OUT1	
00 AE	0174	1	I/O Segment No.		
00 B0	0176	1	Program error No.		
00 B2	0178	1	Run No.		

Important	● The basic status parameters of the controller can only be read, not written.

6.2 Common

<table>
<tr><th>Addr. (HEX)</th><th>Addr. (DEC)</th><th>word</th><th>Parameter</th><th>Description</th><th>Range/Unit</th></tr>
<tr><td>00 C9</td><td>0201</td><td>1</td><td>Motor direction</td><td>Determine motor rotating direction and encoder direction:
<table>
<tr><th>Value</th><th>bit0</th><th>bit1</th><th>Rotating direction</th><th>Encoder direction</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>the same</td><td>the same</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>change</td><td>the same</td></tr>
<tr><td>2</td><td>0</td><td>1</td><td>the same</td><td>change</td></tr>
<tr><td>3</td><td>1</td><td>1</td><td>change</td><td>change</td></tr>
</table>
* Reboot controller after changing</td><td>0~3</td></tr>
<tr><td>00 CA</td><td>0202</td><td>1</td><td>Pulse rising edge</td><td>0: Falling edge; 1: Rising edge
* Reboot controller after changing</td><td>0~1</td></tr>
<tr><td>00 F1</td><td>0241</td><td>1</td><td>Motor current (mA)</td><td>Set the motor current.</td><td>100~4500
0.1A~4.5A</td></tr>
<tr><td>00 F2</td><td>0242</td><td>2</td><td>Micro-step resolution</td><td>The pulses per motor revolution, pulse/rev</td><td>200~102400 ppr</td></tr>
<tr><td>00 F4</td><td>0244</td><td>1</td><td>Pulse mode</td><td>1: Pulse / Dir; 2: CW / CCW</td><td>1~2</td></tr>
<tr><td>00 F5</td><td>0245</td><td>1</td><td>Current reduction time</td><td>Set the delay time after the motor stopped and then the current reduction starts
* Available in Open-loop mode</td><td>1~30000 ms</td></tr>
<tr><td>00 D5</td><td>0213</td><td>1</td><td>Current reduction ratio</td><td>The current ratio applied when motor stopped
* Available in Open-loop mode</td><td>10%~100%</td></tr>
<tr><td>00 E0</td><td>0224</td><td>1</td><td>Micro-step emulation</td><td>Smaller the value, the smoother the motor motion, but the higher the delay</td><td>0~700</td></tr>
<tr><td>00 EA</td><td>0234</td><td>1</td><td>Digital filter</td><td>Filter coefficient of input pulse.
The larger the value, the lower the frequency response
* Reboot controller after changing</td><td>1~15</td></tr>
<tr><td>01 28</td><td>0296</td><td>1</td><td>Control mode</td><td>0 : External pulse
1 : Internal pulse
5 : Torque Mode
Others : Not available
* Reboot controller after changing
* Default: 1</td><td>0~6</td></tr>
<tr><td>01 2A</td><td>0298</td><td>1</td><td>Device ID</td><td>* Reconnect controller after changing
* Default: 1</td><td>1~250</td></tr>
<tr><td>01 2B</td><td>0299</td><td>2</td><td>Baud</td><td>* Reboot controller after changing
* Default: 19200</td><td>4800~115200</td></tr>
<tr><td>01 51</td><td>0337</td><td>1</td><td>Parity</td><td>0: None; 1: Odd; 2: Even
* Reboot controller after changing
* Default: 0</td><td>0~2</td></tr>
</table>

6.3 Closed Loop

Addr. (HEX)	Addr. (DEC)	word	Parameter	Description	Range/Unit
00 D9	0217	1	Motor control	0: Open-loop control 1: Closed-loop control 2: Position compensation * Reboot controller after changing	0~2
00 F6	0246	1	Encoder Resolution	Resolution = Encoder counts x 4 * Reboot controller after changing	200~65535
00 F7	0247	2	Inposition range	Close-loop reached inposition range, the value is encoder's resolution	1~1000
00 F8	0248	1	Weak magnetic limit	Weak magnetic limit	0~1000
00 F9	0249	1	Weak magnetic coefficient 1	Weak magnetic coefficient 1	0~1000
00 FA	0250	1	Weak magnetic coefficient 2	Weak magnetic coefficient 2	0~1000
00 FB	0251	1	Velocity loop Kp	Velocity loop Kp	0~30000
00 FC	0252	1	Velocity loop Ki	Velocity loop Ki	0~30000
00 FD	0253	1	Velocity loop Kd	Velocity loop Kd	0~30000
00 FF	0255	1	Position loop Kp	Position loop Kp	0~30000
01 00	0256	1	Position loop Ki	Position loop Ki	0~30000
01 01	0257	1	Position loop Kd	Position loop Kd	0~30000
01 02	0258	1	Position error	The value is encoder's count	1~30000
01 08	0264	1	KD filter factor	KD filter factor	0~1000
01 09	0265	1	KD Gain	KD Gain	0~1000
01 0A	0266	1	Current coefficient	Coefficient of the current	0~1000
01 1B	0283	1	TrqRate	Torque value, set current percentage * (+) value means CCW, (-) value means CW	-120~120%
01 1D	0285	1	OrgTrqLmt	Torque limit of homing, set current percentage	10~120%
01 1E	0286	1	TrqLmtTime	Time of torque limit, unit is ms	1~10000 ms
01 1F	0287	1	LmtMaxSpd	Speed of torque mode. Unit: 0.01 rps * Recommended speed in torque mode does not exceed 3.5 rps	1~5000 0.01~50 rps

6.4 Control

<table>
<tr><th>Addr. (HEX)</th><th>Addr. (DEC)</th><th>word</th><th>Parameter</th><th>Description</th><th>Range/Unit</th></tr>
<tr><td>012D</td><td>0301</td><td>1</td><td>Start speed</td><td>Unit: 0.01 rps
* Only valid in internal pulse mode</td><td>1~1000
0.01~10 rps</td></tr>
<tr><td>012E</td><td>0302</td><td>1</td><td>Stop speed</td><td>Unit: 0.01 rps
* Only valid in internal pulse mode</td><td>1~1000
0.01~10 rps</td></tr>
<tr><td>012F</td><td>0303</td><td>1</td><td>Acceleration</td><td>* Only valid in internal pulse mode</td><td>5~10000 rps^2</td></tr>
<tr><td>0130</td><td>0304</td><td>1</td><td>Deceleration</td><td>* Only valid in internal pulse mode</td><td>5~10000 rps^2</td></tr>
<tr><td>01 31</td><td>0305</td><td>1</td><td>ORG mode</td><td>Homing method:
<table>
<tr><td>0</td><td>CW</td><td>10</td><td>+Torque, Z</td></tr>
<tr><td>1</td><td>CCW</td><td>11</td><td>-Torque, Z</td></tr>
<tr><td>2</td><td>+Limit</td><td>12</td><td>(+) ORG, (+)Z</td></tr>
<tr><td>3</td><td>-Limit</td><td>13</td><td>(+) ORG, (-)Z</td></tr>
<tr><td>6</td><td>+Torque</td><td>14</td><td>(-) ORG, (+)Z</td></tr>
<tr><td>7</td><td>-Torque</td><td>15</td><td>(-) ORG, (-)Z</td></tr>
<tr><td>8</td><td>+Z phase</td><td>16</td><td>(+) LM, Z</td></tr>
<tr><td>9</td><td>-Z phase</td><td>17</td><td>(-) LM, Z</td></tr>
<tr><td>Others</td><td colspan="3">Not available</td></tr>
</table>
* Only valid in internal pulse mode</td><td>0~17</td></tr>
<tr><td>01 32</td><td>0306</td><td>1</td><td>Position mode speed</td><td>Unit: 0.01 rps
* Only valid in internal pulse mode</td><td>1~5000
0.01~50 rps</td></tr>
<tr><td>01 33</td><td>0307</td><td>1</td><td>Speed mode speed</td><td>Unit: 0.01 rps
* Only valid in internal pulse mode</td><td>-5000~5000
-50~50 rps</td></tr>
<tr><td>01 34</td><td>0308</td><td>1</td><td>JOG speed</td><td>Unit: 0.01 rps
* Only valid in internal pulse mode</td><td>1~5000
0.01~50 rps</td></tr>
<tr><td>01 35</td><td>0309</td><td>1</td><td>ORG speed</td><td>Homing speed, Unit: 0.01 rps
* Only valid in internal pulse mode</td><td>1~5000
0.01~50 rps</td></tr>
<tr><td>01 36</td><td>0310</td><td>1</td><td>ORG slow speed</td><td>Speed after reached Home, Unit: 0.01 rps
* Only valid in internal pulse mode</td><td>1~5000
0.01~50 rps</td></tr>
<tr><td>01 37</td><td>0311</td><td>2</td><td>ORG offset pulse</td><td>ORG offset as a new ORG
* Only valid in internal pulse mode</td><td>-2000000000~
2000000000 pulse</td></tr>
<tr><td>01 3D</td><td>0317</td><td>2</td><td>Software +limit</td><td>* Only valid in internal pulse mode
* Temporarily invalid during ORG</td><td>-2000000000~
2000000000 pulse</td></tr>
<tr><td>01 3F</td><td>0319</td><td>2</td><td>Software -limit</td><td>* Only valid in internal pulse mode
* Temporarily invalid during ORG</td><td>-2000000000~
2000000000 pulse</td></tr>
<tr><td>01 44</td><td>0324</td><td>1</td><td>Parameter control</td><td>
<table>
<tr><th>Bit4</th><th>Bit3</th><th>Bit1</th><th>Bit0</th></tr>
<tr><td>0</td><td>0</td><td rowspan="2">Soft-ware - limit</td><td rowspan="2">Soft-ware + limit</td></tr>
<tr><td colspan="2">The communication command selects the segment No., and its execution is triggered by the "Start Program" I/O signal.</td></tr>
<tr><td>0</td><td>1</td><td rowspan="4">0: Disable
1: Enable</td><td rowspan="4"></td></tr>
<tr><td colspan="2">The "Bit *(program)" I/O signal selects the corresponding segment No. based on the binary combination and then executes the corresponding action.</td></tr>
<tr><td>1</td><td>0</td></tr>
<tr><td colspan="2">The corresponding segment No. is selected based on the binary combination of the "Bit *(program)" I/O signal, and then the execution is triggered by the "Start Program" I/O signal.</td></tr>
</table>
* Reboot controller after changing</td><td>0~19</td></tr>
<tr><td>01 45</td><td>0325</td><td>1</td><td>ENG stop dec.</td><td>* Only valid in internal pulse mode</td><td>5~10000 rps^2</td></tr>
</table>

6.5 Input

Addr. (HEX)	Addr. (DEC)	word	Parameter	Description		Range /Unit
01 90	400	1	IN1 function selection	0	Null	0~29
				1	ABS mode Start: Move to the specified position. The moving direction is determined by the +/- distance values. The +/- speed values are invalid. Modifying the target position during the running process is valid. * Only valid in internal pulse mode	
				2	INC mode Start: Move with the specified pulses. The moving direction is determined by the +/- distance values. The +/- speed values are invalid Modifying the target position during the running process is invalid. * Only valid in internal pulse mode	
				3	Speed mode start: Move at specified speed until stop command is received * Only valid in internal pulse mode	
				4	JOG+ * Only valid in internal pulse mode	
				5	JOG- * Only valid in internal pulse mode	
				6	Deceleration Stop * Only valid in internal pulse mode	
				7	Emergency Stop	
				8	Set position: Set the current position to a specified value	
				9	Limit+	
				10	Limit-	
				11	Home switch * Only valid in internal pulse mode	
				12	ORG * Only valid in internal pulse mode	
				13	Clear alarm	
				14	Null	
				15	Null	
				16	Start program * Only valid in internal pulse mode	
				17	Pause program * Only valid in internal pulse mode	
				18	End program * Only valid in internal pulse mode	
				19	Null	

(Continue)

Addr. (HEX)	Addr. (DEC)	word	Parameter	Description		Range /Unit
01 90	400	1	IN1 function selection	20	Servo ON/OFF	0~29
				21	Inchig+ * Only valid in internal pulse mode	
				22	Inchig- * Only valid in internal pulse mode	
				23	Null	
				24	Null	
				25	Bit 0 (program) * Only valid in internal pulse mode	
				26	Bit 1 (program) * Only valid in internal pulse mode	
				27	Bit 2 (program) * Only valid in internal pulse mode	
				28	Bit 3 (program) * Only valid in internal pulse mode	
				29	Bit 4 (program) * Only valid in internal pulse mode	
				* Default: 13		
01 91	0401	1	IN2 function selection	The same function list with IN1 * Default: 25		0~29
01 92	0402	1	IN3 function selection	The same function list with IN1 * Default: 16		0~29
01 93	0403	1	IN4 function selection	The same function list with IN1 * Default: 6		0~29
01 94	0404	1	IN5 function selection	The same function list with IN1 * Default: 11		0~29
01 95	0405	1	IN6 function selection	The same function list with IN1 * In external pulse mode, this pin is forced assignment for DIR / CCW * Default: 21		0~29
01 96	0406	1	IN7 function selection	The same function list with IN1 * In external pulse mode, this pin is forced assignment for Pulse / CW * Default: 20		0~29

6.6 Output

Addr. (HEX)	Addr. (DEC)	word	Parameter	Description		Range /Unit
01 A4	0420	1	OUT1 function selection	100	General Output	100~105
				101	No Alarm: ● Output signal when there is no alarm ● No output signal when there is an alarm	
				102	In position	
				103	Servo OFF: ● Output signal when Servo OFF ● No output signal when Servo ON	
				104	Performed, Output signal when the motor is moving	
				105	TRQ_LMT, Output signal when the torque reaches the set value	
				* Default: 102		
01 A5	0421	1	OUT2 function selection	The same function list with OUT1 * Default: 101		100~105
01 A6	0422	1	OUT3 function selection	The same function list with OUT1 * Default: 104		100~105
01 A7	0423	1	OUT4 function selection	The same function list with OUT1 * Default: 100		100~105

6.7 Others

When the following parameters in the table below are set through communication commands, they will not be saved in the EEPROM. They need to be set through the CM20 software and saved in the EEPROM as the initial boot parameters.

Addr. (HEX)	Addr. (DEC)	Parameter
01 2D	301	Start speed
01 2E	302	Stop speed
01 2F	303	Acceleration
01 30	304	Deceleration
01 32	306	Position Speed
01 33	307	Speed Mode Speed
01 34	308	Jog Speed

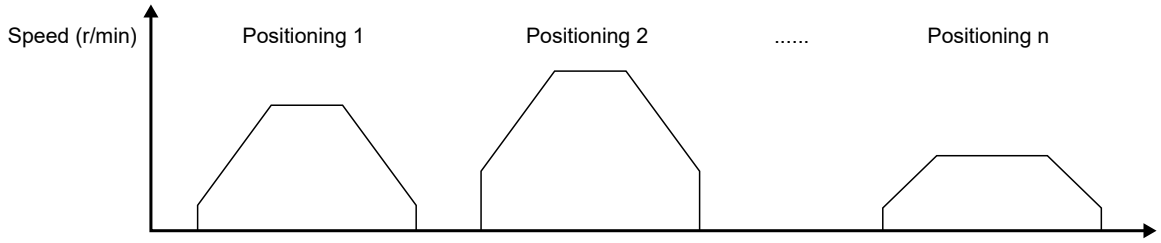
Addr. (HEX)	Addr. (DEC)	Parameter
01 90	400	IN1 Func.
01 91	401	IN2 Func.
01 92	402	IN3 Func.
01 93	403	IN4 Func.
01 94	404	IN5 Func.
01 95	405	IN6 Func.
01 96	406	IN7 Func.

The following 4 address parameters are used for the CM20 software and will not be stored in EEPROM.

Addr. (HEX)	Addr. (DEC)	word	Parameter	Description		Range/Unit
01 39	0313	2	Moving Pulses	Moving Pulses ABS : Move to specified position INC : Move with a relative distance * Only valid in internal pulse mode		-2000000000~ 2000000000 pulse
01 41	0321	2	Position	Set the current position to a specified value		-2000000000~ 2000000000 pulse
01 43	0323	1	Control command	0	Null	0~18
				1	ABS mode Start: Move to the specified position. The moving direction is determined by the +/- distance values. The +/- speed values are invalid. Modifying the target position during the running process is valid.	
				2	INC mode Start: Move with the specified pulses. The moving direction is determined by the +/- distance values. The +/- speed values are invalid. Modifying the target position during the running process is invalid.	
				3	Speed mode start: Move at specified speed until stop command is received	
				4	JOG+	
				5	JOG-	
				6	Deceleration Stop	
				7	Emergency Stop	
				8	Set position: Set the current position to a specified value	
				12	ORG	
				13	Clear alarm	
				16	Start program	
				17	Pause program	
				18	End program	
01 48	0328	1	Assigned Segment No.	Assigned Segment No. to run		0~31

7. Multi-Segment Program

The multi-segment position mode is to combine multiple position segments in order, and trigger the movement through the I/O. The user can save the parameters of several position segment such as acceleration and deceleration, pulse, etc. in EEPROM in advance, and only need to trigger I/O to start the motion.



Programming positioning mode

Caution	● EEPROM has a writing limit of about 1 million times. Please pay attention when modifying and writing parameters and multi-segment programs. ● If there are functions or parameters not listed in the table in this chapter, do not change them to avoid causing abnormalities or damaging the device.

7.1 Motion command

Address for multi-segment program 1024~1536(DEC), 400~600(HEX).

Command	word	Parameter	Description	Range/Unit
1	2	ABS	Parameter 1: Target Position	-2147483647~ 2147483647 Pulse
2	2	INC	Parameter 1: Moving relative distance	-2147483647~ 2147483647 Pulse
3	3	Speed Control	Parameter 1: Moving speed, Unit: 0.01 rps * In torque mode, it is used for mode start and parameter 1 is invalid	-5000~5000 -50~50 rps
6	0	DecStop		
8	2	Position	Parameter 1: The value set for current position	-2000000000~ 2000000000 Pulse
12	1	ORG	Parameter 1: Homing Method * For the details of homing method, please refer to the parameter 305 in section 6.4	0~17
51	1	Start Speed	Parameter 1: Start Speed, Unit: 0.01 rps	1~1000 0.01~10 rps
53	1	Stop Speed	Parameter 1: Stop Speed, Unit: 0.01 rps	1~1000 0.01~10 rps
54	1	Position Speed	Parameter 1: Position Mode Speed, Unit: 0.01 rps	1~5000 0.01~50 rps
61	1	Acc	Parameter 1: Acceleration	5~10000 rps^2
62	1	Dec	Parameter 1: Deceleration	5~10000 rps^2

<table>
<tr><th>Command</th><th>word</th><th>Parameter</th><th>Description</th><th>Range/Unit</th></tr>
<tr><td>65</td><td>2</td><td>Wait Jump</td><td>Data structure:
Parameter 3 (high 8bits)
Parameter 2 (low 8 bits)
Parameter 1 (low 16bits)
Details:
Parameter 1: Wait time for execute the specified line. Set 0 to wait indefinitely for the Input signal.
Parameter 2: The specified line to be executed after the wait time. -1 means executing the next line.
Parameter 3: Waiting input signal, execute the specified line after input signal status matching.
<table>
<tr><th>bit7</th><th>bit6</th><th>bit5</th><th>bit4</th></tr>
<tr><td>Matching status</td><td colspan="3">Specify the input port for matching (1~7)</td></tr>
<tr><th>bit3</th><th>bit2</th><th>bit1</th><th>bit0</th></tr>
<tr><td>Matching status</td><td colspan="3">Specify the input port for matching (1~7)</td></tr>
</table></td><td></td></tr>
<tr><td>66</td><td>2</td><td>Loop</td><td>Data structure:
Parameter 1 (high 16 bits)
Parameter 2 (low 16 bits)
Details:
Parameter 1: Loop times
Parameter 2: Target line to execute</td><td></td></tr>
<tr><td>68</td><td>1</td><td>Output</td><td>Parameter 1: Output status</td><td></td></tr>
<tr><td>73</td><td>1</td><td>Change Mode</td><td>Parameter 1: 1: Internal pulse mode
5: orque mode
Others: Not available</td><td>1~6</td></tr>
<tr><td>74</td><td>1</td><td>TrqRate</td><td>Parameter 1: Torque value
* (+) value means CCW, (-) value means CW</td><td>120~120%</td></tr>
<tr><td>76</td><td>1</td><td>LmtMaxSpd</td><td>Parameter 1: Speed of torque mode
* Recommended speed in torque mode does not exceed 3.5 rps</td><td>1~5000
0.01~50 rps</td></tr>
<tr><td>77</td><td>2</td><td>Condition Wait</td><td>Data structure:
Parameter 3 (high 8bits)
Parameter 2 (low 8 bits)
Parameter 1 (low 16bits)
Details:
Parameter 1: Wait time for execute the specified line. Set 0 to wait indefinitely for the torque condition.
Parameter 2: The specified line to be executed after the wait time or the torque condition to be met. -1 means executing the next line.
Parameter 3: Waiting condition, the "233" means "the torque reaches the set value" status.
* This function is only available in torque mode</td><td></td></tr>
<tr><td>100</td><td>0</td><td>End Section</td><td>The end of each segment requires an "End Section" as the end mark</td><td></td></tr>
</table>

7.2 I/O and Program Segment No. Selection

bit4	bit3	bit2	bit1	bit0	Segment No.
0	0	0	0	0	0
0	0	0	0	1	1
0	0	0	1	0	2
0	0	0	1	1	3
⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	0	1	29
1	1	1	1	0	30
1	1	1	1	1	31

1. Assigning input pin functions to 25~29: Bit0~Bit 4(program), and 16: Start Program.
2. Select the segment to be executed by triggering Bit0~Bit 4(program), and then trigger Start Program to start executing the corresponding motion.

Important

- "1" in the table means "Activated signal"
- The signal of segment selected should be triggered and completed at least 20 ms before the Start Program signal.

7.3 Writing, Verification and Saving of Multi-segment Program with Modbus

Important	● The data in the example is expressed in hexadecimal

1. Multi-segment Parameters Setting

Command 1. Current line #0: Set constant moving speed 1000, i.e. 10rps

01	10	04 00	00 02	04	00 36	03 E8	21 DF
①	②	③	④	⑤	⑥	⑦	⑧

① Slave address 0x01
② MODBUS function: writing multiple registers 0x10 (16 in decimal)
③ Registers starting address 0x0400 (1024 in decimal)
④ 2 data
⑤ 4 bytes
⑥ Data 1, Constant moving speed command 0x0036 (54 in decimal)
⑦ Data 2, Constant moving speed value 0x03E8 (1000 in decimal)
⑧ CRC

Command 2. Current line #1: Set relative positioning with 10000 pulses

01	10	04 00	00 03	06	00 02	27 10 00 00	20 CB
①	②	③	④	⑤	⑥	⑦	⑧

① Slave address 0x01
② MODBUS function: writing multiple registers 0x10 (16 in decimal)
③ Registers starting address 0x0402 (1026 in decimal
④ 3 data
⑤ 6 bytes
⑥ Data 1, Relative positioning command 0x0002 (2 in decimal)
⑦ Data 2, Moving pulse value 0x2710 (10000 in decimal)
⑧ CRC

Command 3. Current line #2: Waiting for 1000ms

01	10	04 05	00 03	06	00 41	03 E8 00 03	1F DE
①	②	③	④	⑤	⑥	⑦	⑧

① Slave address 0x01
② MODBUS writing multiple registers command 0x10 (16 in decimal)
③ Registers starting address 0x0405 (1029 in decimal)
④ 3 data
⑤ 6 bytes
⑥ Data 1, Relative positioning command 0x0041 (65 in decimal)
⑦ Data 2, Convert data 03 E8 00 03 to 00 (A) 03 (B) 03E8 (C)
⑧ CRC

Note: 4 byte data. The lower 16 bits are in front, and the higher 16 bits are in the back.
Parameter A : Default value is 0, do not change the setting
Parameter B : Waiting for jumping to line #3, current line is #2
Parameter C : Waiting time value 0x03E8(1000 ms in decimal)

Command 4. Current line #3: Relative positioning loop for 10 times

01	10	04 08	00 03	06	00 42	00 01 00 0A	DB 92
①	②	③	④	⑤	⑥	⑦	⑧

① Slave address 0x01
② MODBUS writing multiple registers command 0x10 (16 in decimal)
③ Registers starting address 0x0408 (1032 in decimal
④ 3 data
⑤ 6 bytes
⑥ Data 1, Relative positioning command 0x0042 (66 in decimal)
⑦ Data 2, Convert data 00 01 00 0A to 00 0A (A) 00 01 (B)
⑧ CRC

Note: 4 byte data. The lower 16 bits are in front, and the higher 16 bits are in the back.
Parameter A : Times of jumping 0x0A (10 in decimal)
Parameter B : Jump to line #1 and repeat the relative positioning

Command 5. Current line #4: End of the motion segment

01	06	04 0B	00 64	FB D3
①	②	③	④	⑤

① Slave address 0x01
② writing single register command 0x06 (6 in decimal)
③ Registers starting address 0x040B (1035 in decimal
④ End of the data 0x0064 (100 in decimal)
⑤ CRC

2. Multi-segment Parameters Verification

01	06	01 43	00 0E	F8 26
①	②	③	④	⑤

① Slave address 0x01
② MODBUS writing single register command 0x06 (6 in decimal)
③ Registers starting address 0x0143 (323 in decimal)
④ Data: Check multi-segment data 0x0E (14 in decimal)
⑤ CRC

3. Multi-segment Parameters Saving

Note: Check the data CRC before saving, or the data may not be saved correctly.

01	06	01 43	00 0F	39 E6
①	②	③	④	⑤

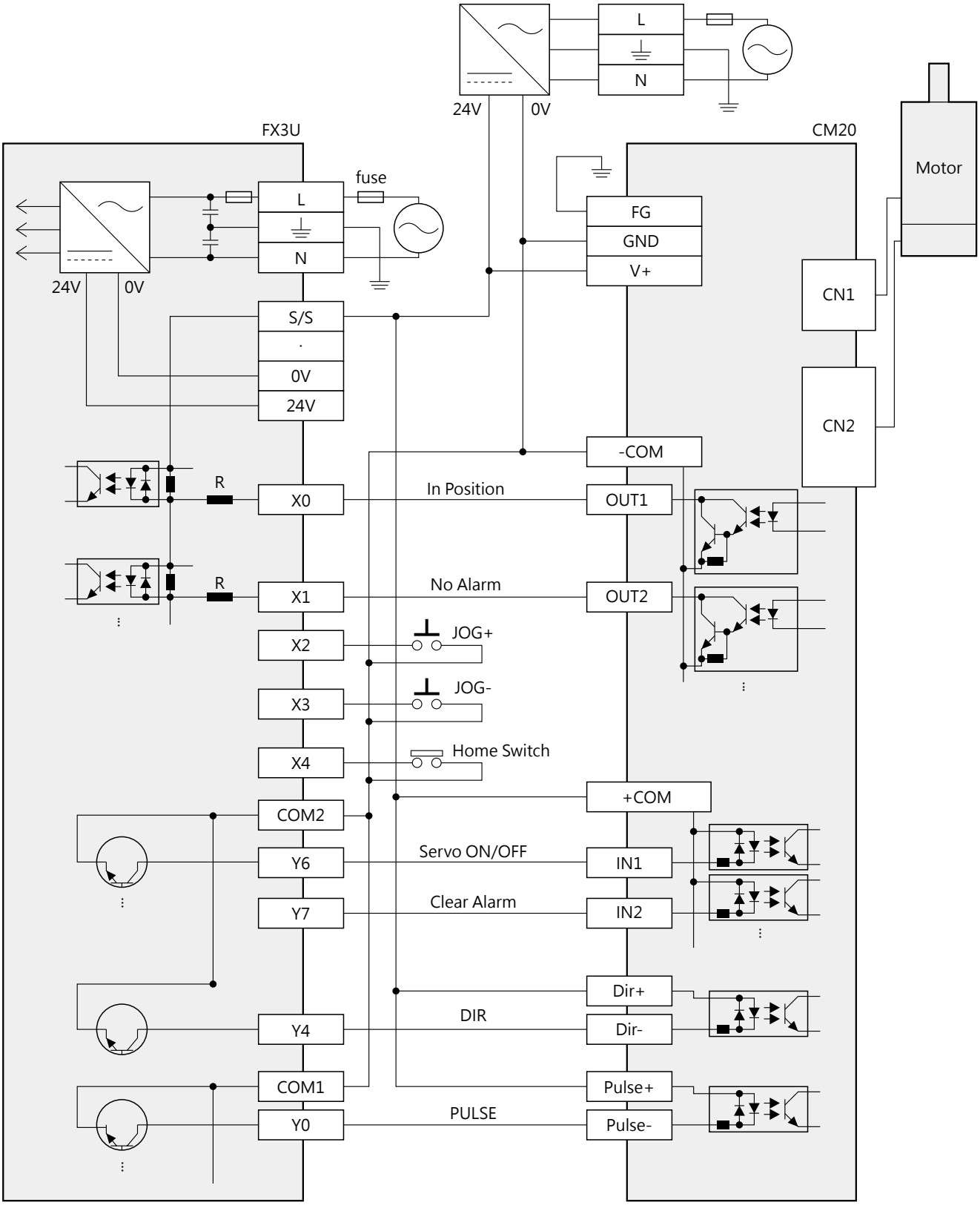
① Slave address 0x01
② MODBUS writing single register command 0x06 (6 in decimal)
③ Registers starting address 0x0143 (323 in decimal)
④ Data: Check multi-segment data 0x0F (15 in decimal)
⑤ CRC

8. Appendix

8.1 PLC Wiring (Using FX3U as an example)

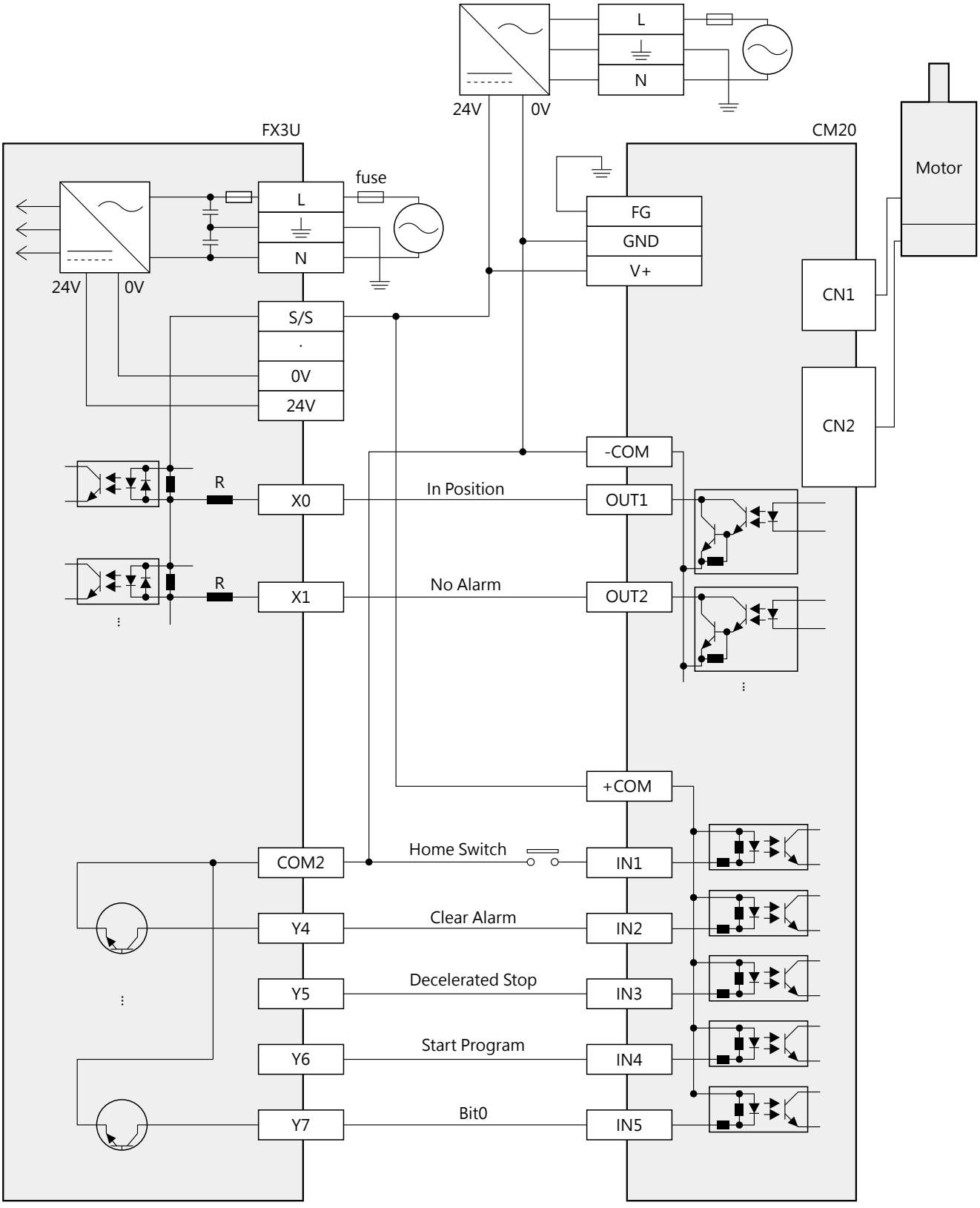
8.1.1 Pulse Control

* The controller must first configure relevant parameters and I/O assignment.

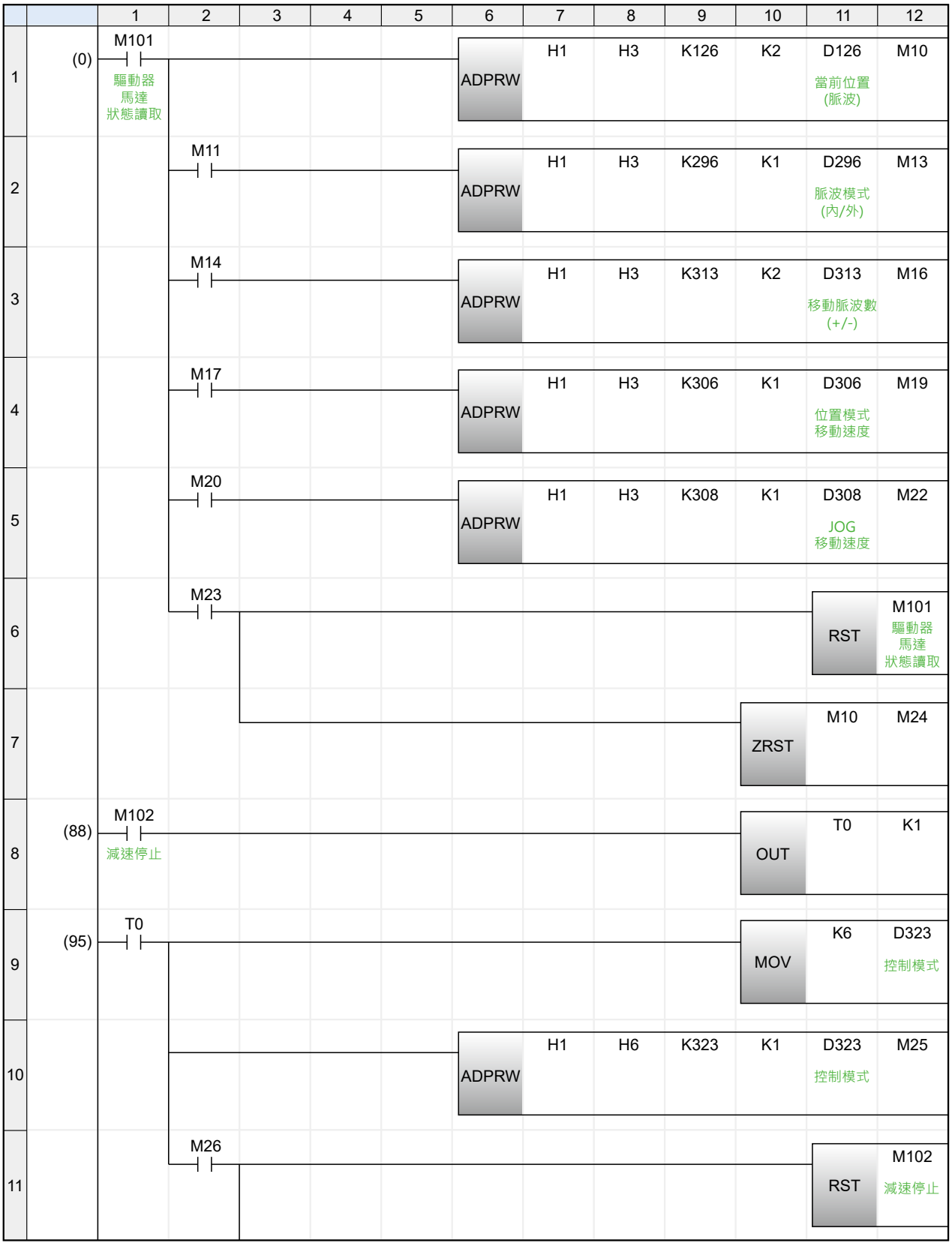


8.1.2 I/O Control

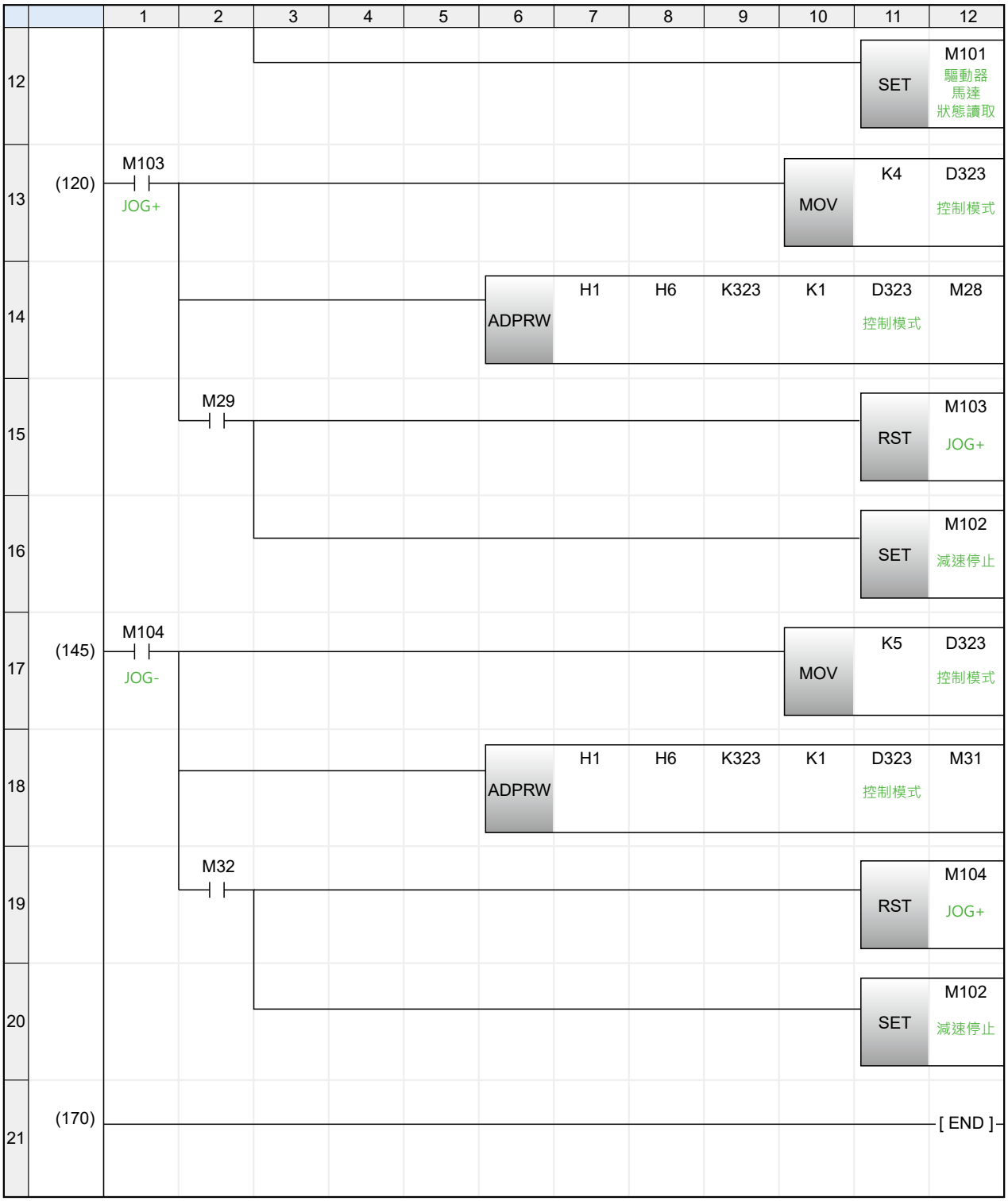
* The controller must first configure relevant parameters and I/O assignment.



8.2 JOG by Modbus RTU (Using FX5U as an example)



(Continue)


1 2 3 4 5 6 7 8 9 10 11 12
12
SET
M101
驅動器
馬達
狀態讀取
13
(120)
M103
JOG+
MOV
K4
D323
控制模式
14
ADPRW
H1
H6
K323
K1
D323
控制模式
M28
15
M29
RST
M103
JOG+
16
SET
M102
減速停止
17
(145)
M104
JOG-
MOV
K5
D323
控制模式
18
ADPRW
H1
H6
K323
K1
D323
控制模式
M31
19
M32
RST
M104
JOG+
20
SET
M102
減速停止
21
(170)
[END]