

UNIMOTION

Manual

Closed Loop Stepping System Manual

STDF PD - Pulse-direction



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1 BEFORE OPERATION

Thank you for your purchasing the STDF PD drive.

STDF PD is an all-in-one unit. For the high-speed and high-precision drive of a stepping motor, STDF PD is a unique drive that adopts a new control scheme owing to an onboard high-performance 32-bit MCU.

This manual describes handling, maintenance, repair, diagnosis and troubleshooting of the STDF PD.

Before operating with STDF PD, thoroughly read this manual.

After reading the manual, keep the manual near the STDF PD so that any user can read it whenever required.

1.1 Precautions

1.1.1 Put the Safety First

Before installation, operation and repairing the STDF PD, thoroughly read the manual and fully understand the contents. Before operating the STDF PD please, understand the mechanical characteristics of the STDF PD and related safety information and precautions.

This manual divides safety precautions into Attention and Warning.

Attention

If the user does not properly handle the product, the user may seriously or slightly be injured and damages may occur in the machine.

Warning

If the user does not properly handle the product, a dangerous situation (such as an electric shock) may occur resulting in deaths or serious injuries.

Although precaution is only an Attention, a serious result could be caused depending on the situation.

Follow safety precautions.

1.1.2 Operation

Attention

If a protection function (alarm) occurs, firstly remove its cause and then release (alarm reset) the protection function. If you operate continuously without removing its cause, the machine may get damaged or the user may get injured.

Do not make Motor Free and make input signal to ON during operation. The motor will stop and the stop current will become zero. The machine may get damaged or the user may get injured.

Make all input signals OFF before supply input voltage to STDF PD. The machine may get damaged or the user may get injured by motor operation.

All parameter values are set by default factory setting value. Change this value after reading this manual thoroughly. Otherwise, the machine may get damaged or other kinds of accidents may occur.

1.1.3 Check and Repair

Attention

Stop to supply power to the main circuit and wait for a while before checking or repairing the STDF PD. Electricity remaining in the capacitor may cause danger.

Do not change cabling while power is being supplied. Otherwise, the user may get injured or the product may get damaged.

Do not reconstruct the STDF PD. Otherwise, an electric shock may occur or the reconstructed product can not get After-Service.

2 DRIVE SPECIFICATION AND DIMENSION

2.1 Specifications of Drive

Table 2-1: Drive specifications.

Input Voltage	24 V DC +/- 10%	
Control Method	Closed loop control with 32-bit MCU	
Current Consumption	Max 500 mA (Except the motor current)	
Operating Condition	Ambient temperature	In Use: 0 ~ 50 °C In Storage: -20 ~ 70 °C
	Humidity	In Use: 35 – 85 % RH (Non-condensing) In Storage: 10 – 90 % RH (Non-condensing)
	Vib. Resist.	0.5 G
Function	Rotation Speed	0 ~ 3000
	Resolution [ppr]	500, 1000, 1600, 2000, 3600, 5000, 6400, 7200, 10000 (Selectable with the rotary switch) ¹
	Max. Input Pulse Frequency	500 kHz (Duty 50 %)
	Protection Functions	Over Current Error, Over Speed Error, Position Tracking Error, Encoder Connect Error, In-Position Error, System Error, ROM Error, Position Overflow Error
	LED Display	Power status, In-Position status, Servo On status, Alarm status
	In-Position Selection	0 – F (Selectable with Rotary switch)
	Position Gain Selection	0 – F (Selectable with Rotary switch)
	Pulse Input Method	1 – Pulse/2 – Pulse (Selectable with DIP switch)
	Rotational Direction	CW/CCW (Selectable with DIP switch)
	Speed/Position Control Command	Pulse-Train Input
I/O Signal	Input Signals	Position Command Pulse, Servo On/Off, Alarm Reset (Photocoupler Input)
	Output Signals	In-Position, Alarm (Photocoupler Input) Encoder Signal (A+, A-, B+, B-, Z+, Z-, 26C31 of Equivalent) (Line Driver Output), Brake

¹ When selected resolution is more than encoders resolution, motor shall operate by microstep between pulses.

2.2 Model naming

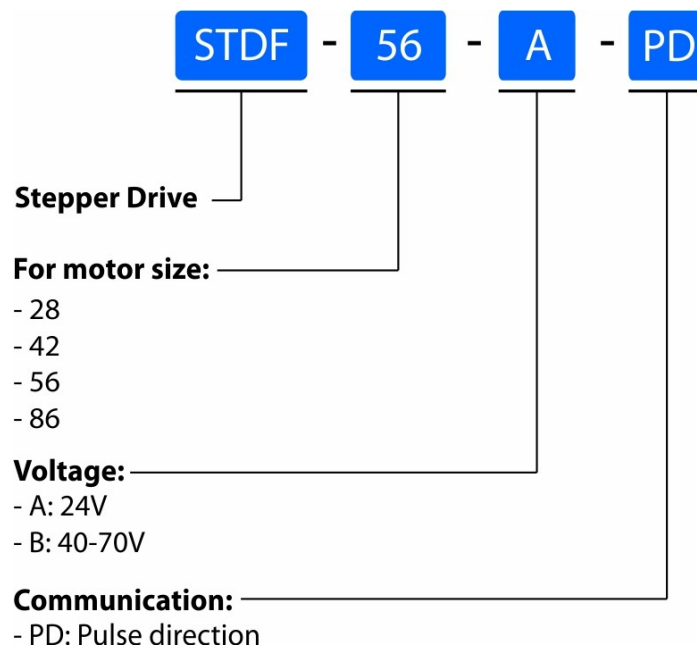


Figure 2-1: Model naming.

2.3 Product dimensions

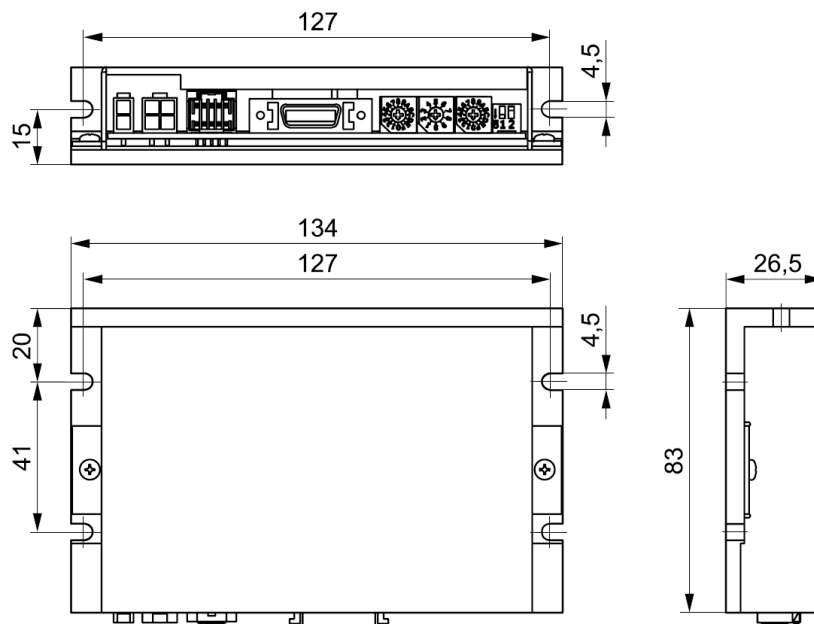


Figure 2-2: Dimensions of the STDF PD drive.

3 INSTALLATION

3.1 Precautions of installation

1. STDF PD is designed for indoor use only.
2. The ambient temperature of the room should be 0 °C ~ 50 °C.
3. If the temperature of the product case is higher than 50 °C, radiate heat of the outside to cool down.
4. Do not install STDF PD under direct rays, near magnetic or radioactive objects.
5. If you set more than 2 drives, you must set over 20 mm vertically and over 50 mm horizontally as shown below.

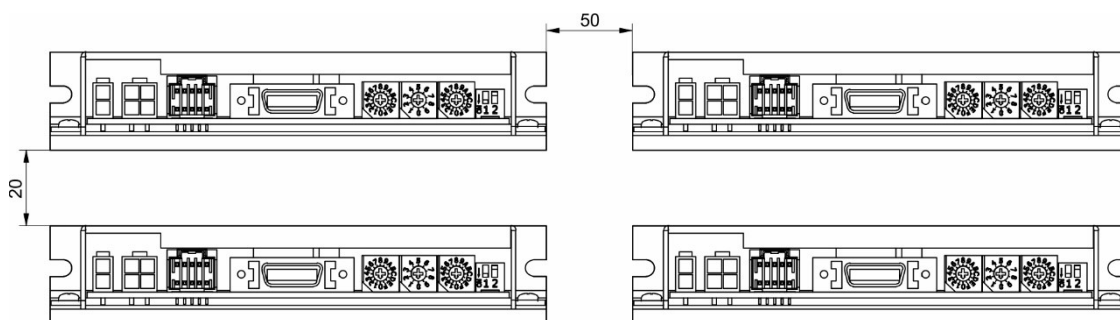


Figure 3-1: Installation dimensions for 2 or more drives.

3.2 Appearance and part name

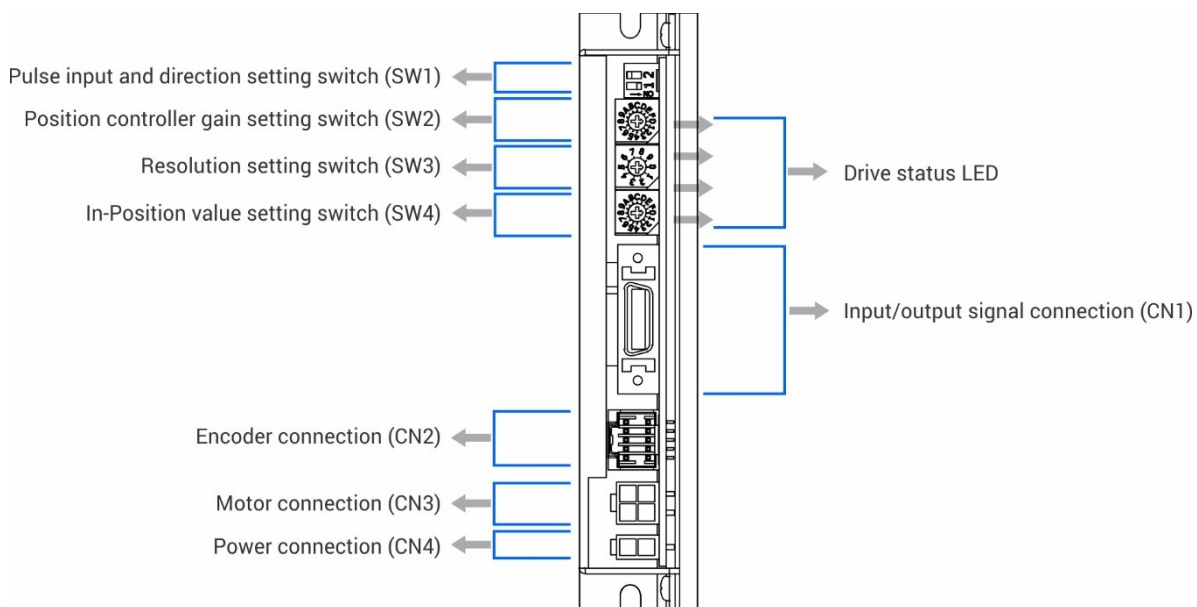


Figure 3-2: Appearance of the STDF PD drive.

4 BRAKE OPERATION TIMING CHART

STDF PD controls Brake by Drive automatically.

Please refer to below Timing Chart when Brake is controlled by the upper controller other than using STDF PD Brake control. Otherwise, Drive malfunctioning and loads can be fall down.

Also, please do not operate Brake while motor operation to prevent damage.

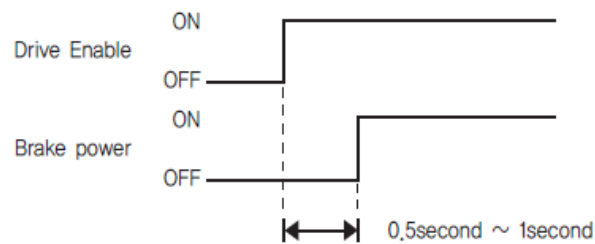


Figure 4-1: Brake operation timing chart.

5 SETTINGS AND OPERATION

5.1 Drive Status LED

Table 5-1: Drive status LED indication.

Indication	Color	Function	ON/OFF Condition
PWR	Green	Power indication	LED is turned On when power is applied
INP	Yellow	Complete Positioning Motion	Lights On when Positioning error reaches within the preset pulse selected by rotary switch
SON	Orange	Servo On/Off Indication	Servo On: Lights On Servo Off: Lights Off
ALM	Red	Alarm Indication	Flash when protection function is activated (Identifiable which protection mode is activated by counting the blinking times)

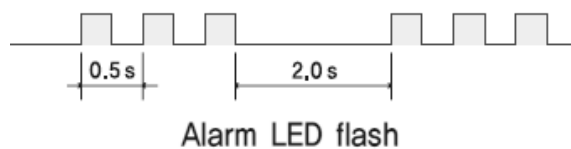


Figure 5-1: Alarm LED flashing cycle

Table 5-2: Protection functions and LED flash times.

Times	Protection	Conditions
1	Over Current Error	The current through power devices if inverter exceeds the limit value of 4.8 A.
2	Over Speed Error	Motor speed exceeds 3000 rpm.
3	Position Tracking Error	Position error value is higher than 180° in motor run state.
4	Over Load Error	The motor is continuously operated more than 5 seconds under a load exceeding the max. Torque.
5	Over Temperature Error	Inside temperature of drive exceeds 85 °C.
6	Over Regenerative Voltage Error	Back-EMF is higher than limit value.
7	Motor Connect Error	The power is ON without connection of the motor cable to drive.
8	Encoder Connect Error	Cable connection error in Encoder connection of drive.
10	In-Position Error	After operation is finished, position error more than 1 pulse is continued for more than 3 seconds.
11	System Error	Error occurs in drive system.
12	ROM Error	Error occurs in parameter storage device (ROM).
15	Position Overflow Error	Position error value is higher than 180° in motor stop state.

5.2 Pulse Input Setting Switch (SW1.1)

Indication	Switch Name	Functions
2P/1P	Selecting Pulse Input Mode	Selectable 1-Pulse input mode or 2-Pulse input mode as Pulse input signal ON: 1-Pulse mode OFF: 2-Pulse mode (Default: 2-Pulse mode)

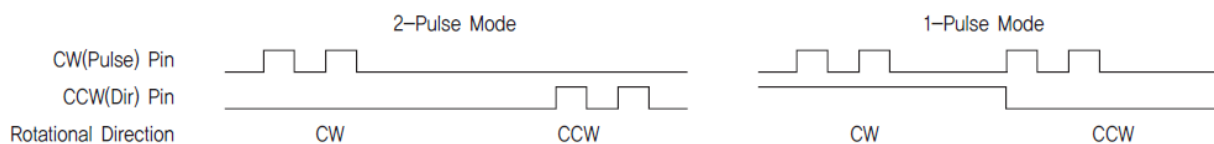


Figure 5-2: Pulse input setting switch.

5.3 Rotational Direction Setting Switch (SW1.2)

Table 5-3: Rotational direction setting switch function.

Indication	Switch Name	Function
DIR	Switching Rotational Direction	Based on CW (+DIR signal) input to driver.

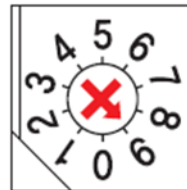


Figure 5-3: Rotation direction setting.

5.4 Resolution Setting Switch (SW3)

Table 5-4: Number of pulses per revolution.

Position	Pulse/Revolution
0	500 ¹
1	500
2	1000
3	1600
4	2000
5	3600
6	5000
7	6400
8	7200
9	10000



¹Resolution of position "0" will be different according to the resolution of encoder adopted to the product. But in case of the encoder with 10,000 ppr resolution, it will be set as 500.

When selected resolution is more than encoder resolution, motor shall be operated by microstep between pulses.

5.5 Position Controller Gain Setting Switch (SW2)

The Position Controller Gain Switch allows for the correction of the motor position deviation after stopping caused by load and friction. Depending on the motor load, the user may have to select a different gain position to stabilize and to correct positional error quickly.

To tune the controller:

1. Set the switch to "0" position.
2. Start to rotate the switch until system becomes stable.
3. Rotate the switch 1~2 position to reach better performance.

Table 5-5: Position controller time constant and gain values.

Position	Time Constant of the integral par	Proportional Gain ¹
0	1	1
1	1	2
2	1	3
3 ²	1	4
4	1	5
5	2	1
6	2	2
7	2	3
8	2	4
9	2	5
A	3	1
B	3	2
C	3	3
D	3	4
E	3	5
F	3	6



¹ Value in the columns are in relative units. They only show the parameter changes depending on the switch's position.

² Default = 3

5.6 In-Position Value Setting Switch (SW4)

To select the output condition of In-Position signal, In-Position output signal is generated when the pulse number of positional error is lower than selected In-Position value set by this switch after positioning command is executed.

Table 5-6: In-Position values.

Position	In-Position Value [Pulse] Fast Response
0 ¹	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	0
9	1
A	2
B	3
C	4
D	5
E	6
F	7



¹ Default = 0

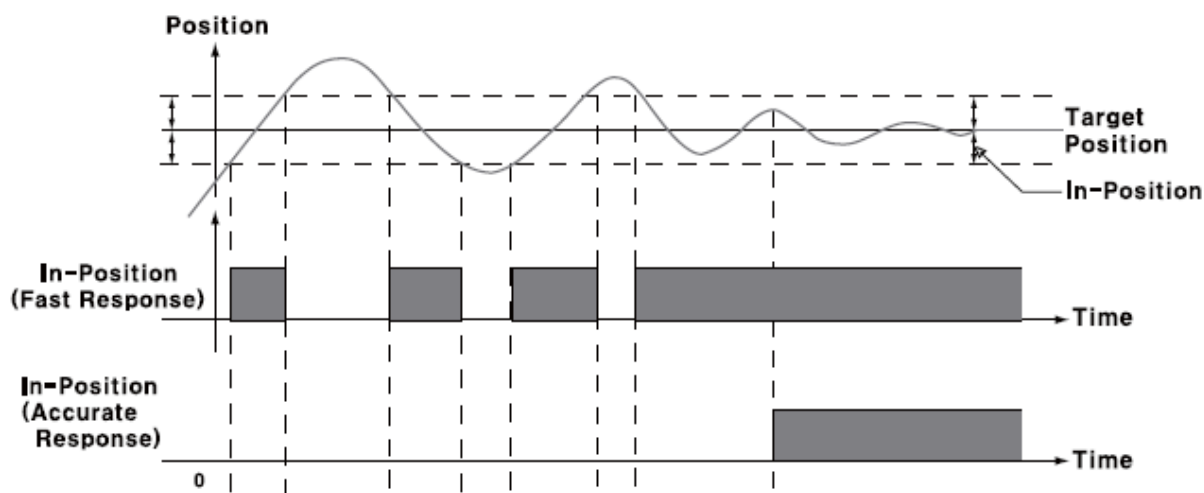


Figure 5-4: Setting method of Fast Response and Accurate Response.

5.7 Encoder Connector (CN2)

Table 5-7: Encoder connector signals.

NO.	Function	I/O
1	A+	Input
2	A-	Input
3	B+	Input
4	B-	Input
5	Z+	Input
6	Z-	Input
7	5 V DC	Output
8	GND	Output
9	F.GND	----
10	F.GND	----

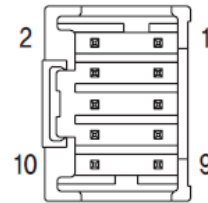


Figure 5-5: Encoder Connector.

5.8 Input/Output Signal Connector (CN1)

Table 5-8: I/O Connector signals.

NO.	Function	I/O
1	CW+ (Pulse+)	Input
2	CW- (Pulse-)	Input
3	CCW+ (Dir+)	Input
4	CCW- (Dir-)	Input
5	A+	Output
6	A-	Output
7	B+	Output
8	B-	Output
9	Z+	Output
10	Z-	Output
11	Alarm	Output
12	In-Position	Output
13	Servo On/Off	Input
14	Alarm Reset	Input
15	Open collector input	Input
16	BRAKE+	Output
17	BRAKE-	Output
18	S-GND	Output
19	EXT_GND	Input
20	EXT_24 V DC	Input

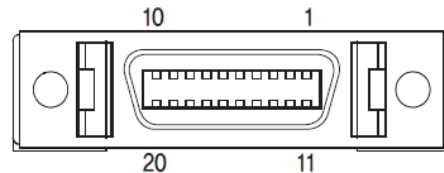


Figure 5-6: I/O Connector.

5.9 Motor Connector (CN3)

Table 5-9: Motor Connector signals.

NO.	Function	I/O
1	A Phase	Output
2	B Phase	Output
3	/A Phase	Output
4	/B Phase	Output



Figure 5-7: Motor Connector.

5.10 Power Connector (CN4)

Table 5-10: Power Connector signals.

NO.	Function	I/O
1	24 V DC	Input
2	GND	Input



Figure 5-8: Power Connector.

6 SYSTEM CONFIGURATION

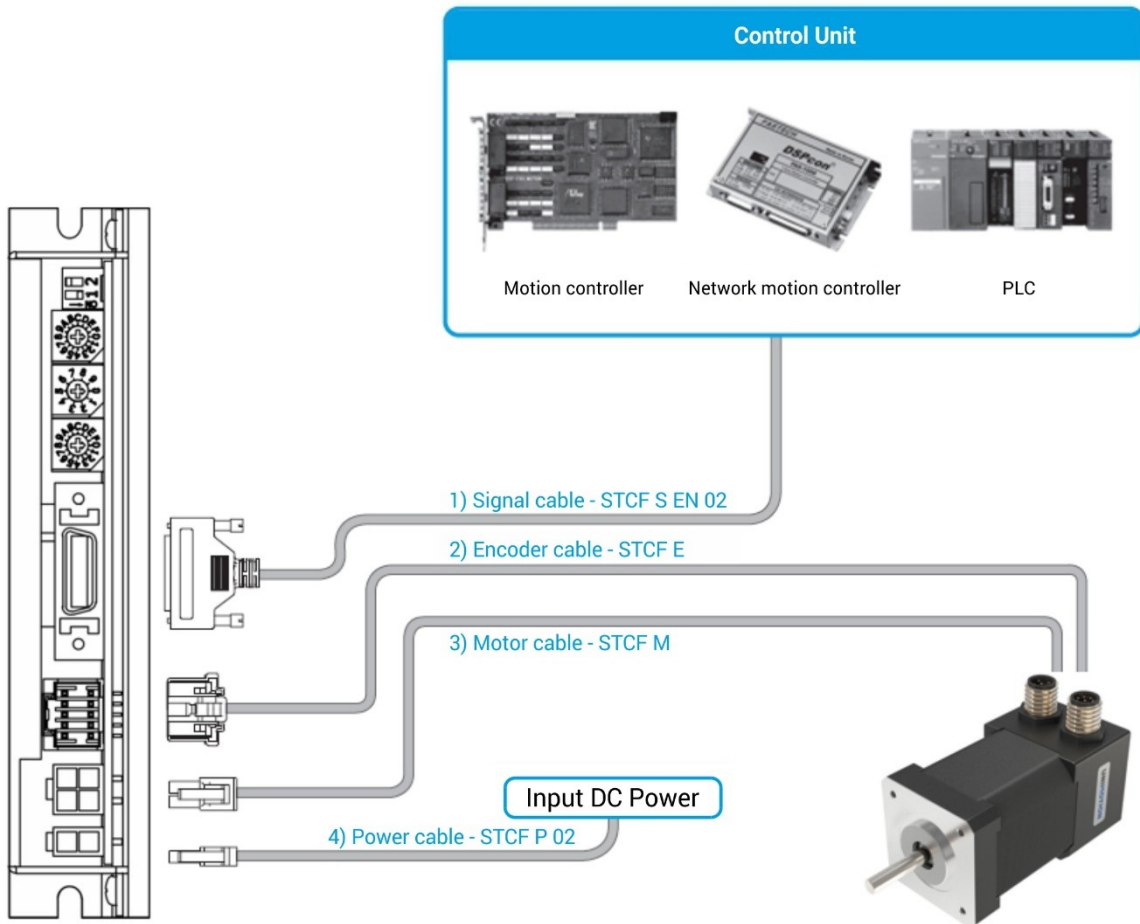
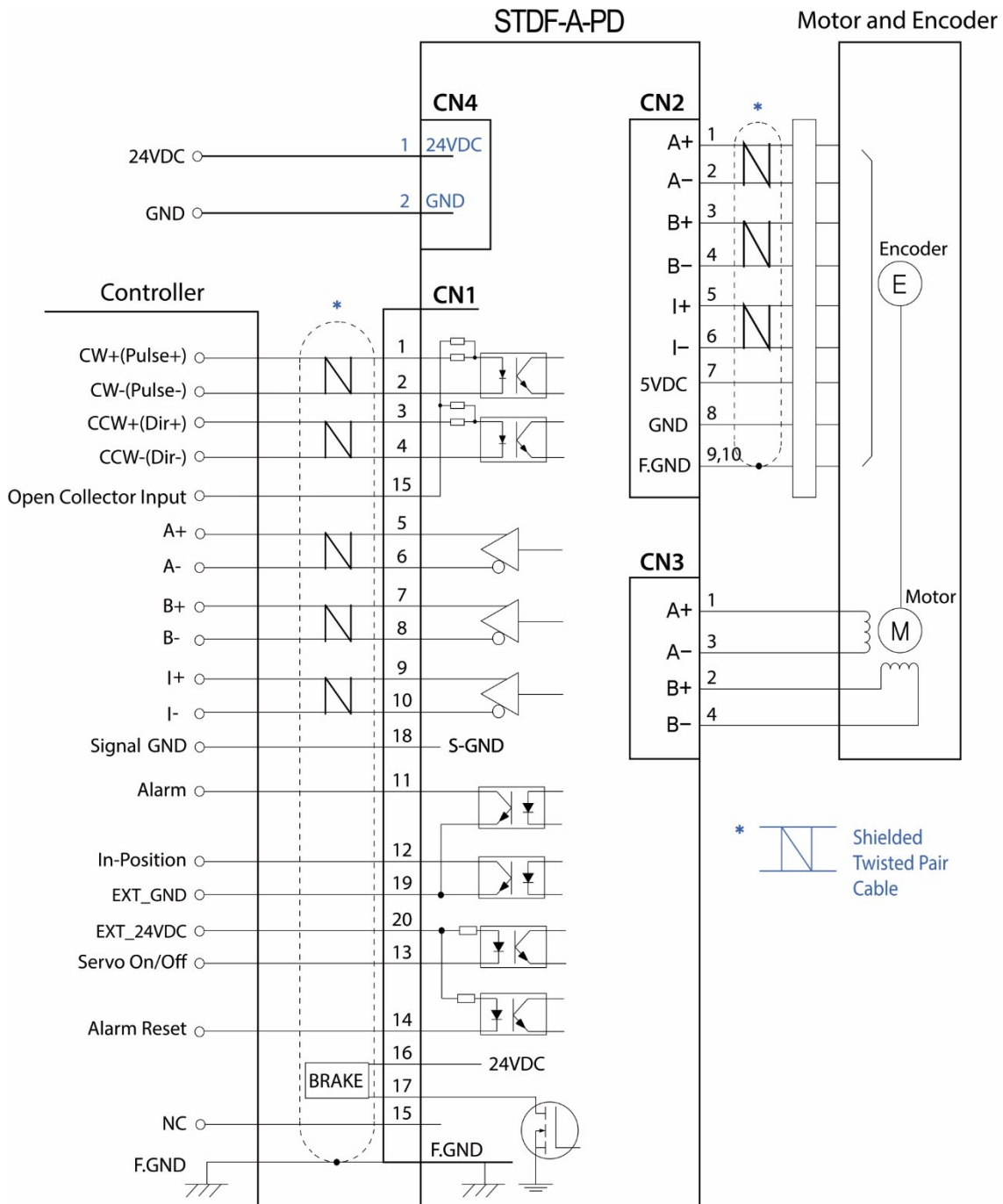


Figure 6-1: System configuration.

6.1 External Wiring Diagram



CAUTION

Please refer to the Manual when connecting the motor extension cable.

Carefull connection will be required to protect the drive from any damages.

※ When connecting the I/O cables between the controller and drive, please turn off the power of both controller and drive to protect the drive from any damage.

Figure 6-2: External wiring diagram.

7 CONTROL SIGNAL INPUT/OUTPUT DESCRIPTION

7.1 Input Signal

Input signals of the drive are all photocoupler protected. The signal shows the status of internal photocouplers [ON: conduction], [OFF: Non-conduction], not displaying the voltage levels of the signal.

7.2 CW, CCW Input

Table 7-1: CW and CCW input functions..

Pin No.	Function
1	CW+
2	CW-
3	CCW+
4	CCW-

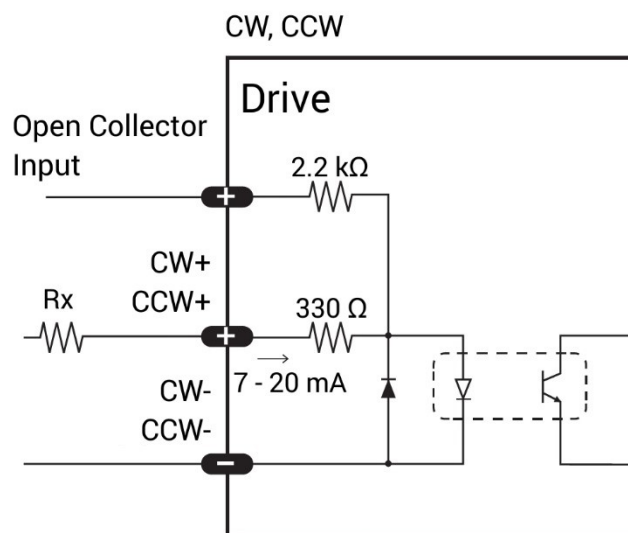


Figure 7-1: CW and CCW wiring diagram.

This signal can be used to receive a positioning pulse command from a user’s host motion controller. The user can select 1-pulse input mode or 2-pulse input mode. The input schematic of CW, CCW is designed for 5 V TTL level. When using 5 V level as an input signal, the resistor Rx is not used and connected to the drive directly.

When the level of input signal is more than 5 V, Rx resistor is required. If the resistor is absent, the drive can be damaged. In the case input signal level is 12 V, Rx value is 680 Ω and 24 V, Rx value is 1.8 kΩ or use an open collector input.

7.3 Servo On/Off Input

Table 7-2: Servo On/Off input functions.

Pin No.	Function
13	Servo On/Off
14	Alarm Reset
20	EXT_24 V DC

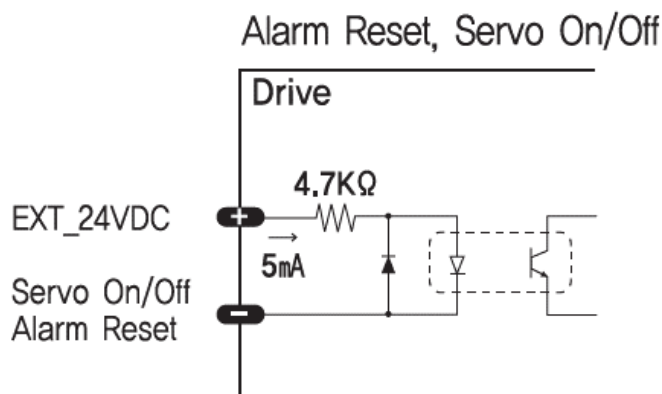


Figure 7-1: Alarm reset and Servo On/Off wiring diagram.

This input can be used only to adjust the position by moving the motor shaft manually from the load-side.

By setting the signal [ON], the drive cuts off the power supplied to the motor. Then, output position can be adjusted manually. When setting the signal back to [OFF], the drive resumes to supply the power to the motor and recovers the holding torque. When driving a motor, the signal shall be set [OFF].

7.4 Alarm Reset Input

When a protection mode has been activated, a signal to this alarm reset input cancels the Alarm output.

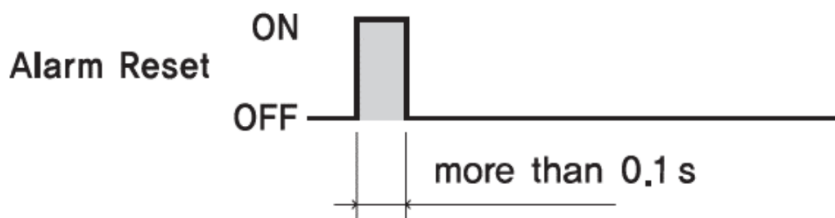


Figure 7-2: Alarm reset time.

By setting the alarm reset input signal [ON], cancel the Alarm output. Before cancel the Alarm output, have to remove the source of alarm.

7.5 Output signal

Output signals from the driver are photocoupler protected: Alarm, In-Position and the Line Driver Outputs (encoder signal). In the case of photocoupler outputs, the signal indicates the status of internal photocouplers [ON : conduction], [OFF : Non-conduction], not displaying the voltage levels of the signal.

7.6 Alarm Output

Table 7-3: Alarm output functions.

Pin No.	Function
11	Alarm
12	In-Position
19	EXT_GND

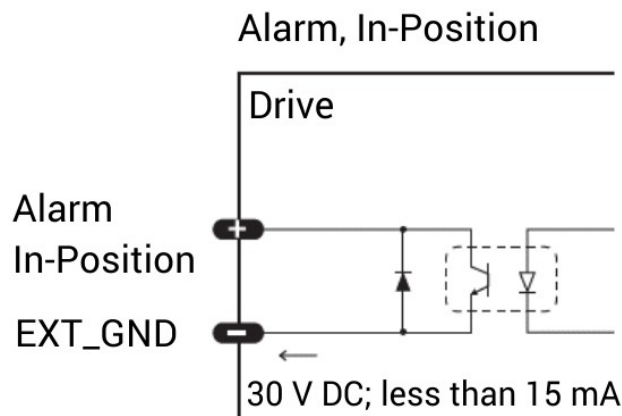


Figure 7-3: Alarm output wiring diagram.

The Alarm output indicates [ON] when the drive is in a normal operation. If a protection mode has been activated, it goes [OFF]. User's host controller needs to detect this signal and stop sending a motor driving command. When the drive detects an abnormal operation such as overload or over current of the motor, it sets the Alarm output to [OFF], flashes the Alarm LED, disconnect the power to a motor and stops the motor simultaneously.

[Caution] Only at the Alarm output port, the photocoupler isolation is in reverse. When the drive is in normal operation the Alarm output is [ON]. On the contrary when the drive is in abnormal operation that start protection mode, the Alarm output is [OFF].

7.7 In-Position Output

In-Position signal is [ON] when positioning is completed. This signal is [ON] when the motor position error is within the value set by the switch SW4.

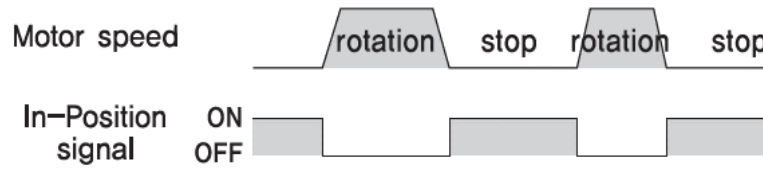


Figure 7-4: In-Position signal graph.

7.8 Encoder Signal Output

Table 7-4: Encoder Signal Output functions.

Pin No.	Function
5	A+
6	A-
7	B+
8	B-
9	I+
10	I-
18	S-GND

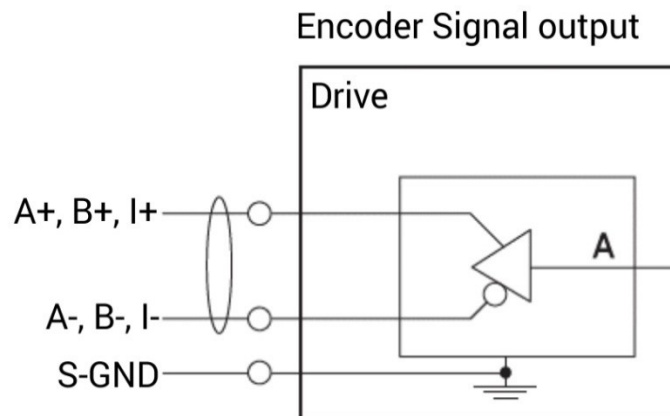


Figure 7-5: Encoder Signal Output wiring diagram.

The encoder signal is a line drive output. This can be used to confirm the stop position.

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