# Digital Stepper Drive 3R110Plus V3.0 User Manual

# Contents

# 1. Product Overview

3R110-PLUS is a high-voltage digital two-phase stepper motor drive with integrated intelligent motion controller functions and built-in S-shaped acceleration and deceleration commands. Through the TTL port, it is convenient to configure the drive and expand the application of the drive.

## 1.1. Characteristic

◆ Working voltage: 110~220VAC

◆ Communication: TTL

◆ Maximum phase current output: 7.2A/Phase (Sinusoidal Peak)

◆ PUL+DIR/CW+CCW pulse mode optional

◆ Phase loss alarm function

◆ Semi-current function

◆ Digital IO port:

3 photoelectric isolation digital signal input, high level can directly receive 24V DC level;

1 photoelectric isolation digital signal output, maximum withstand voltage 30V, maximum input or pull-out current 50mA.

◆ 8 gears can be customized by users

◆ 16 gears can be subdivided by user-defined subdivision, supporting arbitrary resolution in the range of 200~65535

◆ IO control mode, support 16 speed customization

◆ Programmable input port and output port

# 2. Application Environment and Installation

## 2.1. Environmental Requirement

| Item | 3R110Plus V3.0 |
|---|---|
| Installation environment | Avoid dust, oil and corrosive environment |
| Vibration | 0.5G (4.9m/s2) Max |
| Operating temperature/humidity | 0℃ ~ 45℃ / 90% RH or less (no condensation) |
| Storage and transportation temperature: | -10℃ ~ 70℃ |
| Cooling | Natural cooling / away from the heat source |
| Waterproof class | IP54 |

## 2.2. Drive Installation Dimensions



**Side**
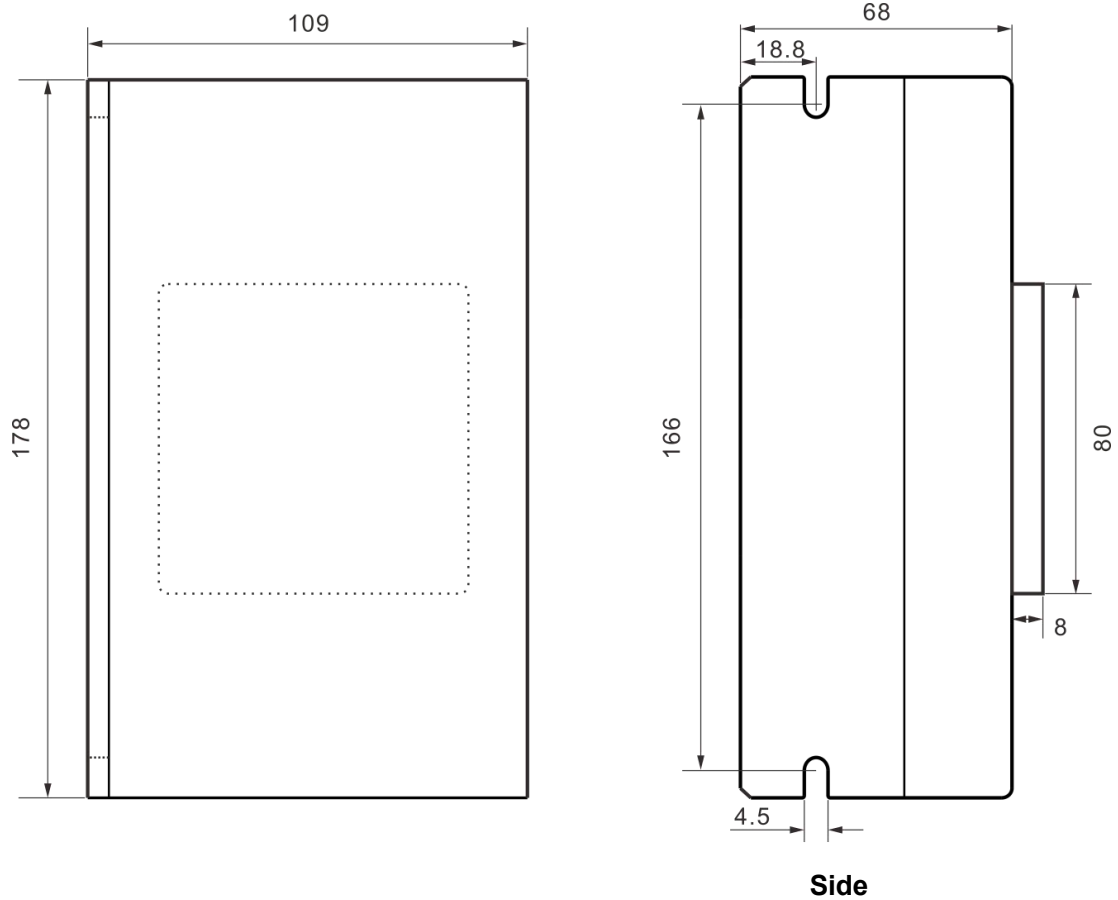
# 3. Drive Port and Connection

## 3.1. Power Supply and Motor Port Function Description
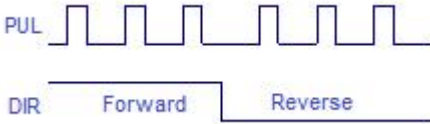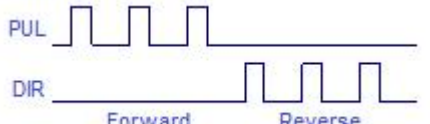
| Function | Grade | Definition | Remarks |
|---|---|---|---|
| Power supply | PE | Single-phase 220VAC power input | |
| | AC | | |
| | AC | | |
| Motor | PE | Motor PE earth wire | Exchanging the U and V, which can make the motor run in the opposite direction |
| | U | Three phase stepper motor | |
| | V | | |
| | W | Dangling | |
| | NC | | |

## 3.2. Control Signal Connection

| Function | Grade | Description |
|---|---|---|
| Pulse /IN1 | PUL+ | The control signal is 5~24V compatible. No additional current limiting resistor is required. |
| Pulse /IN1 | PUL- | The control signal is 5~24V compatible. No additional current limiting resistor is required. |
| Direction /IN2 | DIR+ | The control signal is 5~24V compatible. No additional current limiting resistor is required. |
| Direction /IN2 | DIR- | The control signal is 5~24V compatible. No additional current limiting resistor is required. |
| Enable /IN3 | ENA+ | The control signal is 5~24V compatible. No additional current limiting resistor is required. |
| Enable /IN3 | ENA- | The control signal is 5~24V compatible. No additional current limiting resistor is required. |
| Alarm /OUT1 | ALM+ | Optocoupler isolation, open collector output |
| Alarm /OUT1 | ALM- | Optocoupler isolation, open collector output |

### 3.2.1. PUL, DIR Port (IN1，IN2)

By default, when operating in external pulse command mode, 3R110Plus V3.0 can receive two pulse command signals: PUL+DIR, CW+CCW.

| Pulse and direction (PUL + DIR) |  |
|---|---|
| Double pulse (CW +CCW) |  |

The command form of the external pulse is set by the debugging software.

### 3.2.2. ENA (IN3) Port

The default ENA port is the drive offline (enable) function:

When the internal optocoupler is off, the drive outputs current to the motor. When the internal optocoupler is on, the drive will cut off the current of each phase of the motor to make the motor free, and the step pulse will not be responded.

When the motor is in an error state, it is automatically turned off.

The level logic of the enable signal can be set to the opposite.

At the same time, this port can be reused as other functions like IN1 and IN2.
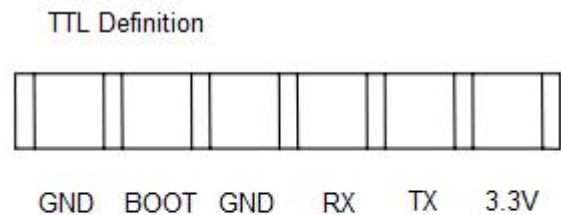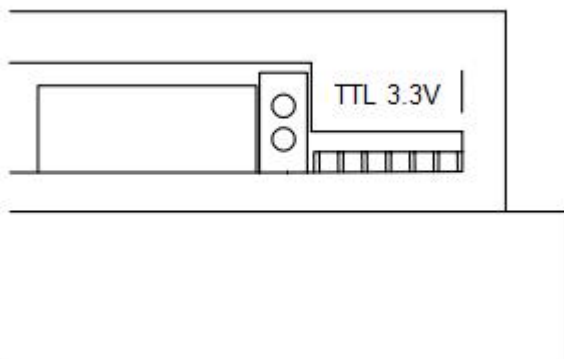
### 3.2.3. ALM (OUT1) Port

The drive includes an optically isolated output port ALM. By default, the ALM port is an alarm output port. When the drive is in an error state and normal operation, the ALM port outputs different optocoupler levels. It can also be reused for other functions, as shown below:
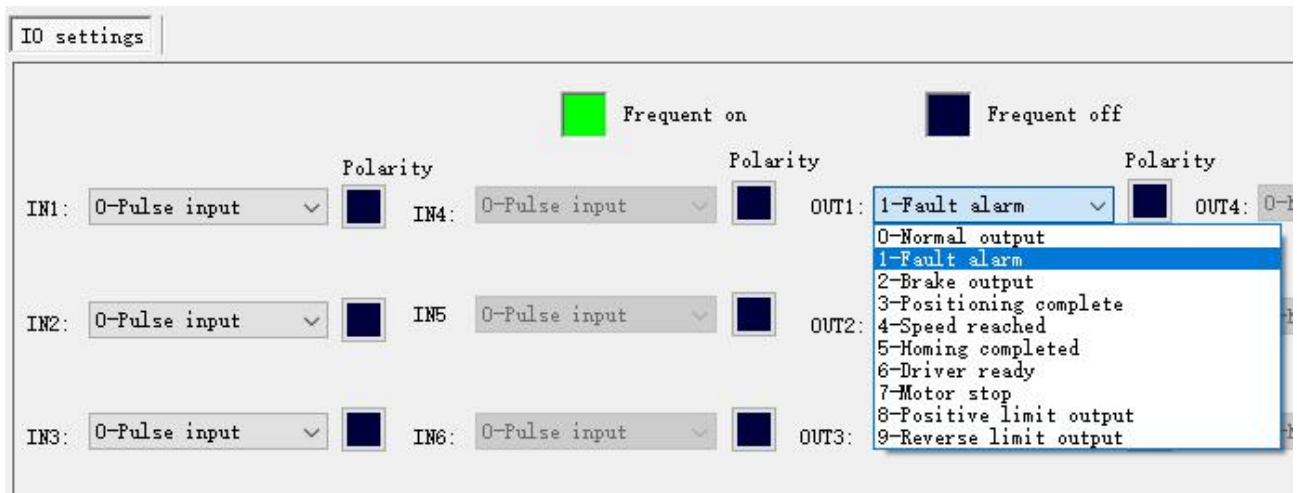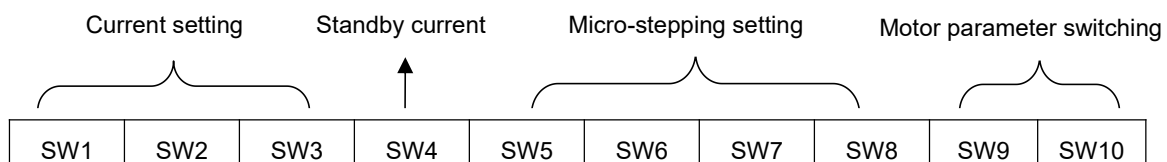


## 3.3. TTL Port

This port is used to debug and connect to the computer.



# 4. The Setting of DIP Switches and Operating Parameters

## 4.1. Current Setting

| Sine peak A | SW1 | SW2 | SW3 | Remarks |
|:---:|:---:|:---:|:---:|:---|
| 2.3 | on | on | on | |
| 3.0 | off | on | on | |
| 3.7 | on | off | on | |
| 4.4 | off | off | on | User can set 8 levels of current through |
| 5.1 | on | on | off | debugging software |
| 5.8 | off | on | off | |
| 6.5 | on | off | off | |
| 7.2 | off | off | off | |

## 4.2. Standby Current

SW4 is used to set the current percentage of the drive when it is in standby.

SW4 = ON, as long as the drive is in the enabled state, the current remains at the set current

SW4 = OFF. After the drive stops receiving pulses for a certain time, it enters the standby state, and the current drops to a certain percentage of the set current.

The default setting is: 1 second after stopping receiving the pulse, the motor winding current will be 50%.

## 4.3. Micro-stepping Setting

Set the pulse per revolution required by the motor. Due to digital control, the number of subdivisions can be set to any number between 200 and 65535.

| Pulse/rev | SW5 | SW6 | SW7 | SW8 | Remarks |
|:---:|:---:|:---:|:---:|:---:|:---|
| 7200 | on | on | on | on | |
| 500 | off | on | on | on | |
| 600 | on | off | on | on | |
| 800 | off | off | on | on | |
| 1000 | on | on | off | on | |
| 1200 | off | on | off | on | |
| 2000 | on | off | off | on | |
| 3000 | off | off | off | on | Users can set up 16 level subdivision |
| 4000 | on | on | on | off | through debugging software. |
| 5000 | off | on | on | off | |
| 6000 | on | off | on | off | |
| 10000 | off | off | on | off | |
| 12000 | on | on | off | off | |
| 20000 | off | on | off | off | |
| 30000 | on | off | off | off | |
| 60000 | off | off | off | off | |

## 4.4. Pulse Command Filtering

The drive has a built-in pulse command smoothing function, which can make the motor start more stable.

The default command filter time is 128*50us=6400us

Command filtering can smooth the motor movement, but also introduces lag. The user needs to choose whether to enable this function according to the actual situation.The filter time can be set by the debugging software:
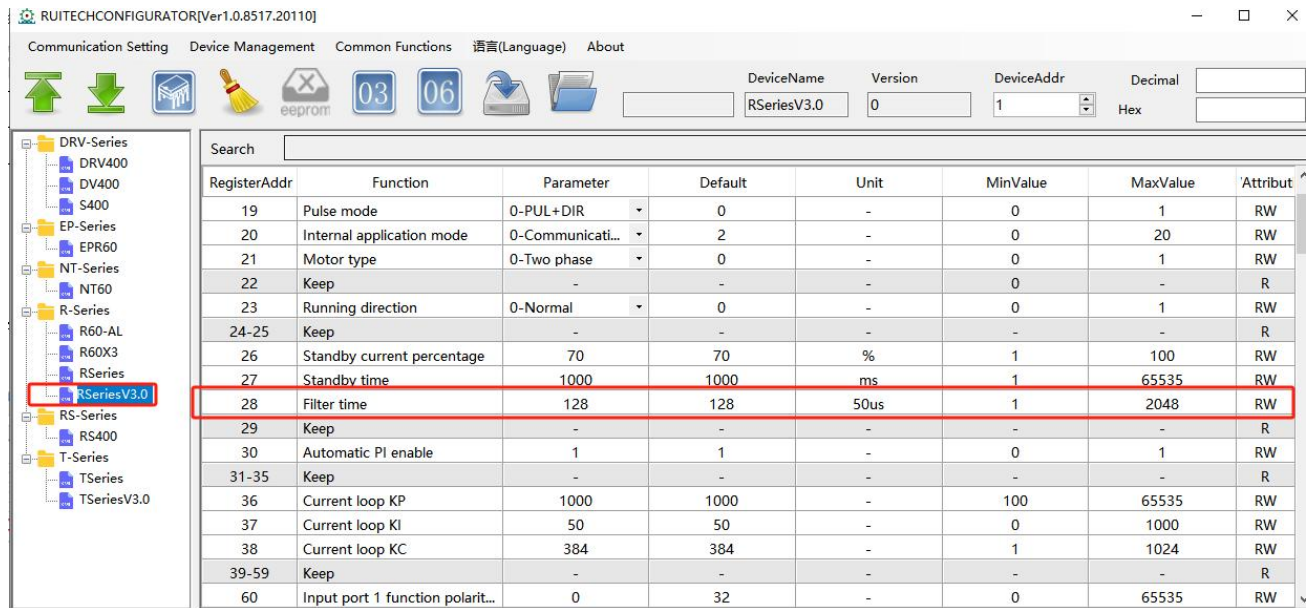


## 4.5. Motor Parameter Switching

In order to simplify the model and increase product adaptability, increase the DIP matching motor parameters.

| Motor model | SW9 | SW10 |
|---|---|---|
| 86 | ON | ON |
| 86H | OFF | ON |
| 110 | ON | OFF |
| 130 | OFF | OFF |

# 5. Drive Working Status LED Indication

| LED status | | Drive status |
|---|---|---|
| 🟢 | Green indicator is on for long time | Drive not enabled |
| 🟢🟢 | Green indicator is flickering | Drive working normally |
| 🟢🔴 | One green indicator and one red indicator | Drive overcurrent |
| 🟢🔴🔴 | One green indicator and two red indicators | Drive input power overvoltage |
| 🟢🔴🔴🔴 | One green indicator and three red indicators | The internal voltage of the drive is wrong |
| 🟢🔴🔴🔴🔴🔴🔴🔴 | One green indicator and seven red indicators | Motor lose phase |

# 6. Phase Loss Alarm

The drive has a motor phase loss alarm function, which can detect the phase loss state of the motor during stationary and movement. During the operation of the stepper motor, due to mechanical reasons, the winding wire of the motor may be loosened and disconnected. At this time, the drive will output an alarm signal to prevent the device from making an erroneous action.

Since this function relies on the current detection of the motor windings, this function has a false alarm when the motor current is too small (less than 300 mA). At this point, the user can turn off this function. In the parameter management and setting interface of the debugging software, set parameter No. 188 (phase loss detection enable) to 0.

# 7. Internal Motion Control Function

When working in the internal pulse command mode, the PUL and DIR ports are used as IO input signals. The IO function needs to be set through the debugging software. As shown below:

# 7.1. Communication control mode

In this mode, the user can make the motor run the specified pulse stroke or jog operation by communicating the given operation command.

In internal pulse mode, the motor is controlled by register 18

**0: Waiting state**

The drive receives any control command and will resume the waiting state after the drive processes it. So reading this register always returns 0.

**1: Fixed length forward rotation**

In the relative position mode, the motor runs in the forward direction according to the 70~74 register parameters.
In the absolute position mode, the operation state is determined according to the current position and the absolute position set by 70~74.

**2: Fixed length reverse rotation**

In the relative position mode, the motor runs in the reverse direction based on the 70~74 register parameters.
In the absolute position mode, the operation state is determined according to the current position and the absolute position set from 70~74.

**3: Speed mode, continuous forward rotation**

According to 75 and 76 registers, the motor runs at forward acceleration.

**4: Speed mode, continuous reverse**

According to 75 and 76 registers, the motor runs at reverse acceleration.

**5: Emergency stop**

According to the 77 register, the motor decelerates and stops

**6: Slow down and stop**

In position mode, the motor decelerates and stops according to the 71 register

In speed mode, the motor decelerates and stops according to the 76 register

Others: no effect.

## 7.1.1. Point Control Mode

The communication controls the function of the motor to run the specified pulse stroke. The specific modes and parameters to be set are as follows (register addresses are not specified or specified as decimal numbers):

(1) Set the value of register address 20 (preset application selection in internal pulse mode) to 0 (Communication control, respond to the command of register address 18).

(2) Set the function of the digital input and output port according to the application requirements and the actual wiring terminals.

(3) Set the motion parameters:

| Address | Unit | Parameter Description |
|---|---|---|
| 70 | R/S^2 | Acceleration of point motion |
| 72 | RPM | Speed of point motion |
| 73 | Command pulse | The number of command pulses for point motion, low 16-bit register |
| 74 | Command pulse | The number of command pulses for point motion, high 16-bit register |
| 78 | R/S^2 | Emergency stop deceleration |
| 84 | - | Set position operation mode:<br>0: Incremental<br>1: Absolute |

(4) Communication given operation command: start the point movement by writing the values "1" (fixed length forward rotation) and "2 "(fixed length reverse rotation) to register 18. (See Register 18 in "Drive Control Mode Settings [17~23]" for a detailed description of this register.)

(5) During operation, if need to stop, please write value "6 "(deceleration to stop, deceleration is the setting value of register 71) and value "5" (emergency stop, deceleration is the setting value of register 78) to register 18.

**Note:**

◆ When the motor is in operation, it only responds to the stop command (deceleration stop or emergency stop). If it is necessary to change the running direction of the motor by command, please send the stop command to wait for the motor to stop, and then send the start signal of the other direction.

◆ The acceleration (register 70), deceleration (register 71), and speed (register 72) are changed during motor operation, but the driver will not respond to these set values immediately. It will not run at the set values until the motor is stopped and restarted.

◆ It is important to note that the emergency stop deceleration (Register 78) is responded to during the current sport emergency stop, without waiting for the next stop of the emergency stop.

## 7.1.2. Jog Control Mode

3R110Plus V3.0 has the function of controlling the jog operation of the motor through communication.The specific modes and parameters to be set are as follows (register addresses are not specified or specified as decimal numbers):

(1)  Set the value of register address 20 (preset application selection in internal pulse mode) to 0 (Communication control, respond to the command of register address 18).

(2)  Set the function of the digital input and output port according to the application requirements and the actual wiring terminals.

(3)  Set the motion parameters:

| Address | Unit | Parameter description |
|---------|------|----------------------|
| 75 | R/S^2 | Acceleration of jog motion |
| 76 | R/S^2 | Deceleration of jog motion |
| 77 | RPM | Speed of jog motion |
| 78 | R/S^2 | Emergency stop deceleration |

(4)  Communication given operation command: Start jog movement by writing values 3 (continuous forward rotation) and 4 (continuous reverse rotation) to register 18.(See Register 18 in "Drive Control Mode Settings [17~23]" for a detailed description of this register.)

(5)  During operation, if need to stop, please write value "6 "(deceleration to stop, deceleration is the setting value of register 76) and value "5" (emergency stop, deceleration is the setting value of register 78) to register 18.

**Note:**

◆  When the motor is in operation, it only responds to the stop command (deceleration stop or emergency stop). If it is necessary to change the running direction of the motor by command, please send the stop command to wait for the motor to stop, and then send the start signal of the other direction.

◆  The acceleration (register 75) and deceleration (register 76) are changed during motor operation, but the driver will not respond to these set values immediately. It will not run at the set values until the motor is stopped and restarted.

◆  It is important to note that the emergency stop deceleration (Register 78) is responded to during the current sport emergency stop, without waiting for the next stop of   the emergency stop.

◆  The speed (register 77) can be changed during the operation of the motor, and the drive will respond immediately, that is, the motor will run at the set speed value immediately, without stopping and restarting to respond.

## 7.2. IO Control: Start/Stop + Direction

With this mode, two IN terminals are used to control the operation of the motor. One IN terminals is used to control the start/stop of the motor, and the other IN terminal is used to control the running direction of the motor. The specific settings are as follows:

(1)  Command mode: 0 - internal pulse

(2)  Internal application mode: 2 - IO control: start/stop + direction
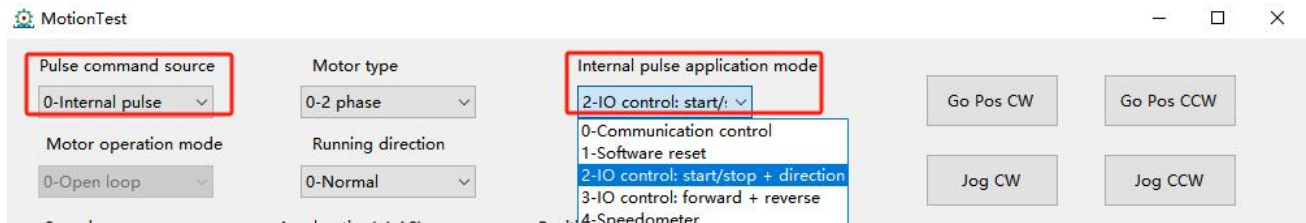


(3)  IO settings:
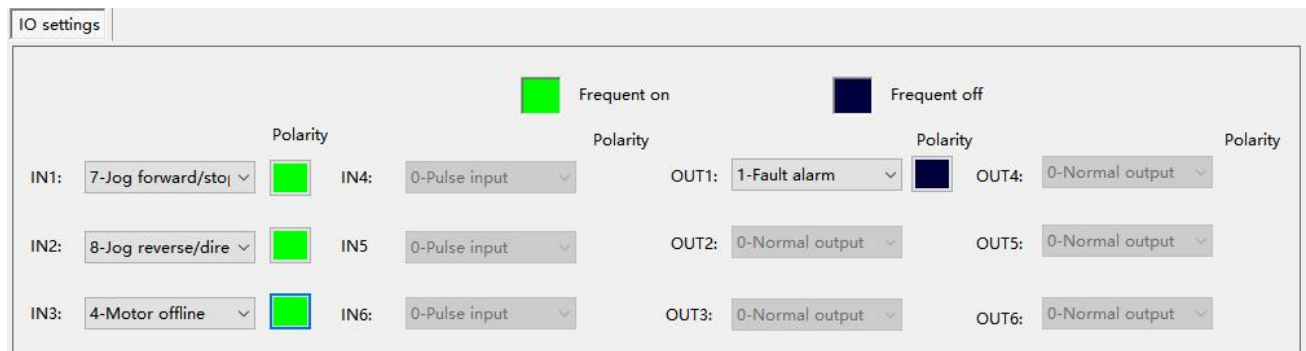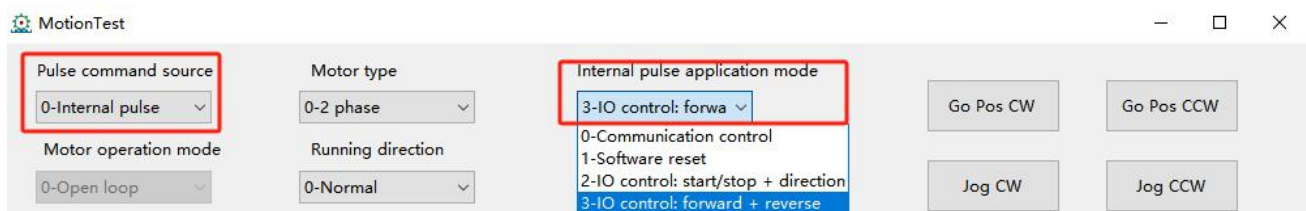


(4)  This mode is for the speed defined by the speed table, selected by SW5, 6, 7, 8.

(5)  Set the motion parameters, you can modify the acceleration, deceleration.

| 75 | JOG Acceleration | 0 | 0 | r/s^2 |
|----|------------------|---|---|-------|
| 76 | JOG Deceleration | 0 | 0 | r/s^2 |
| 77 | JOG Speed | 0 | 0 | RPM |
| 78 | Emergency stop deceleration | 0 | 0 | RPM |

## 7.3. IO Control: Forward + Reverse

Same as 7.2, only need to change (2) to: 3 - IO control: forward + reverse:

# 8. Common Faults and Troubleshootings

| Phenomenon | Possible situations | Solutions |
|---|---|---|
| Motor does not work | Power indicator is off | Check the power supply circuit for normal power supply |
| | The motor rotor is locked but the motor does not work | Pulse signal is weak; increase the signal current to 7-16mA |
| | The speed is too slow | Select the right micro-stepping |
| | Drive is protected | Solve the alarm and re-power |
| | Enable signal problem | Pull up or disconnect the enable signal |
| | Command pulse is incorrect | Check whether the upper computer has pulse output |
| The direction of motor is wrong | The rotary direction of motor is reverse | Adjust the DIP SW5 |
| | The motor cable is disconnected | Check the connection |
| | The motor has only one direction | Pulse mode error or DIR port damaged |
| Alarm indicator is on | The motor connection is wrong | Check the motor connection |
| | The voltage is too high or too low | Check the power supply |
| The position or speed is wrong | The signal is disturbed | Eliminate interference for reliable grounding |
| | The command input is incorrect | Check the upper computer instructions to ensure the output is correct |
| | The setting of pulse per revolution is wrong | Check the DIP switch status and correctly connect the switches |
| | Encoder signal is abnormal | Replace the motor and contact the manufacturer |
| The Drive terminal burned up | Short circuit between terminals | Check power polarity or external short circuit |
| | Internal resistance between terminals is too large | Check whether there is any solder ball due to excessive addition of solder on the wire connections |