DELCO®

Operating Instruction of Digital Straight Stroke Electric Actuator

(Applicable for DLB and DLC Series)

Version: V5.1.3

DELCO VALVE CO.,LTD

LIST

Introduction

Actuator adopts servo drive technology, equipped with V4.2 control system and A8.2 operating system independently developed , which can provide users with greater space to satisfy individual needs. The debugging operation process of the actuator is fully consistent with the valve debugging requirements, and the operation is simple and convenient. Because of the incremental encoder installed, the actuator is stable for its performance and high precision. Please reset to zero position after power-on for each time.

Salient features:

1.incremental encoder with stable performance and high precision.

2.the adjusting stroke can be set arbitrarily within the full mechanical stroke range of the valve, including the opening and closing direction of the valve.

3.input signal and feedback signal can be combined arbitrarily, for example: input 4-20mA feedback M-BUS or 0-10V. M-BUS needs to be customized.

4.3-gear thrust is available.

5.heat tracing setting is provided. This function can be turned on when the temperature is lower than -20 ℃ to maintain a certain temperature of the motor and circuit board.

I. Technical Specifications

- **Protection Class:** IP65
- **Operating Ambient Temperature:** -20~70℃ (Optional for Other Temperature)
- **Either of the following power supplies are available:**
  - 380 VAC Fluctuation Range: ±10%. Frequency: 50HZ. Harmonic Content ≤5%
  - 220 VAC Fluctuation Range: ±10%. Frequency: 50HZ. Harmonic Content ≤5%
  - 24 VAC Fluctuation Range: ±10%. Frequency: 50HZ. Harmonic Content ≤5%
  - 24 VAC Fluctuation Range: 22VDC~40VDC
- **Max. Power:** 100W
- **Return Difference:** ≤1%
- **Dead Zone:** 0.3%
- **Intrinsic Error:** ≤0.2%
- **Max. Operating Speed**: Actuators of different models have different Max. operating speeds. the operating speed of the actuator fixes at slowest speed when the valve opening percentage is less than the zero buffer distance.the default of zero buffer distance is 3mm and modifiable.Please see *Zero Buffer*.
- **maximum stroke:**Standard maximum strokes of 30mm, 60mm and 100mm are optional, and other maximum stroke can be customized.
- **Thrust:** Standard Torques of 1000N, 2000N, 3000N, 5000N, 6500N, 10000N, 16000N, 20000N and 26000N are optional, and other thrust can be customized.
- **Control Signal:** The control signals supported are MODBUS RTU control, 4-20MA control,20-4MA control, 0-10V control, 10-0V control, switching quantity control, IR remote control and local control, and IR remote control and MODBUS RTU control is not included in standard configuration.
- **Feedback Signal:** The supported feedback includes 4-20mA feedback,20-4mA feedback, 0-10V feedback,10-0V feedback, MODBUS RTU feedback, switching quantity feedback (including on-position feedback, off-position feedback and fault alarm feedback). Within which, switching quantity feedback and MODBUS RTU feedback is not included in standard configuration.
- **Control Precision:**
  - MODBUS RTU Control: default:±0.1%.
  - 4-20mA Control:default:±0.5%.Adjustable range:±0.1%-20%.

➢20-4mA Control:default:±0.5%.Adjustable range:±0.1%-20%.
➢0-10V Control:default:±1%.Adjustable range:±1%-20%.
➢10-0V Control:default:±1%.Adjustable range:±1%-20%.

- **Adjusting Characteristic:** Linear (Optional for Equal Proportion).
- **Adjusting Position:** Mechanical Indication of Valve Position and Monitor Display.
- **Fault Alarm:** Integrated fault alarm signal, indicator light gives alarm and signal.
- **Thrust Protection:** Thrust protection is achieved by controlling the output power of the motor without using switches to reduce the failure rate.

II. Safety Instructions

Read the safety instructions carefully before installation and operation.

Electrical shock and mechanical injury hazards would occur if not handled properly.

Improper operation may result in minor injury or product damage.

Improper operation may damage related products.

1. AC 380V Electric Wiring

The wiring of AC 380V power supply is shown in Fig. 1.

Fig.1 AC 380V Electric Wiring

2. AC 220V Electric Wiring

The wiring of AC 220V power supply is shown in Fig. 2.

Fig.2 AC 220V Electric Wiring

3. AC 24V Electric Wiring

The wiring of AC 24V power supply is shown in Fig. 3.

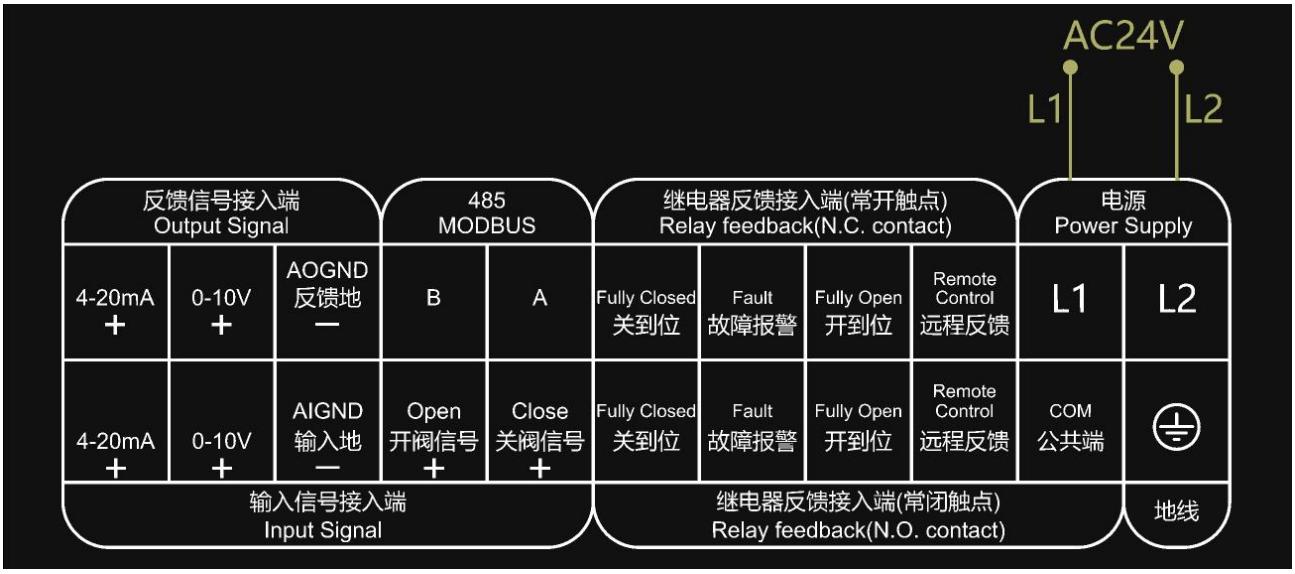


Fig.3 AC 24V Electric Wiring

4. DC 24V Electric Wiring

The wiring of DC 24V power supply is shown in Fig. 4.

Fig.4 DC 24V Electric Wiring

5. 4-20mA ,20-4mA Control Wiring

The 4-20mA control or 20-4mA control wiring is shown in Fig. 5.

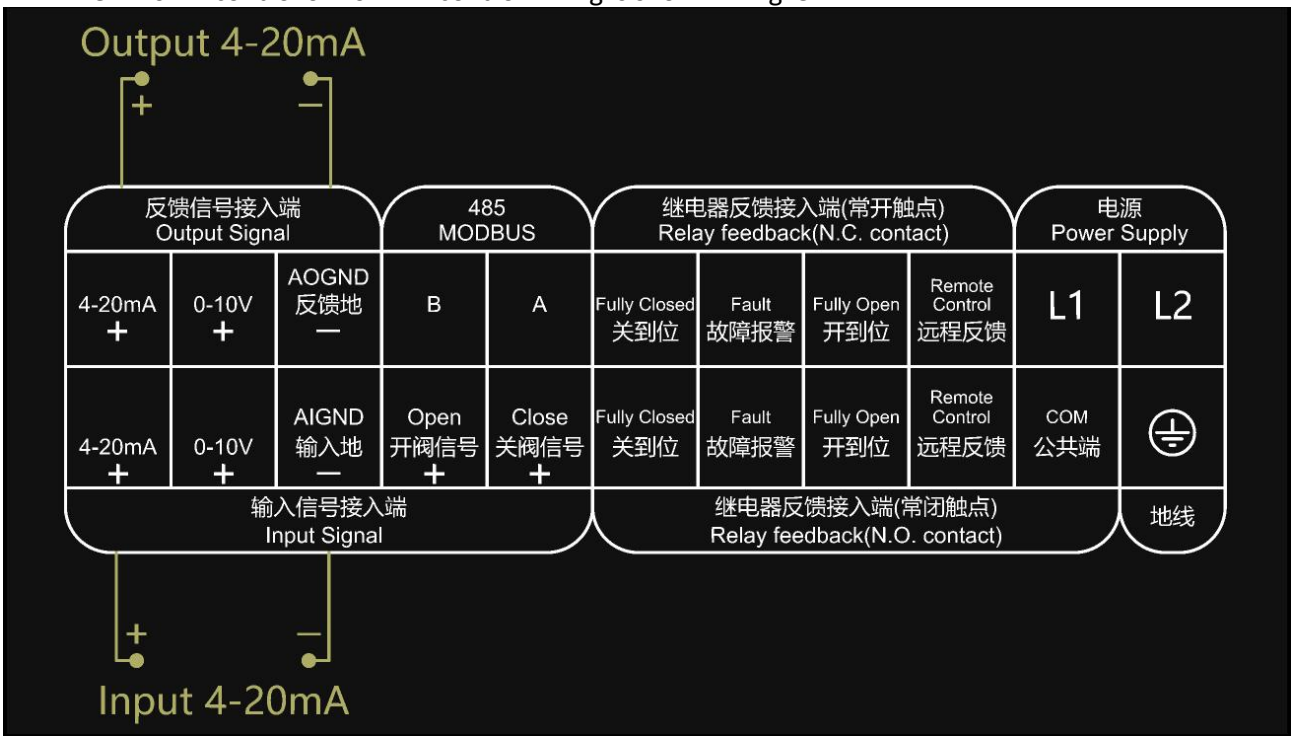


Fig. 5 4-20mA ,20-4mA Wiring

6. 0-10V,10-0V Control Wiring

0-10V or 10-0V control wiring is shown in Fig.6.

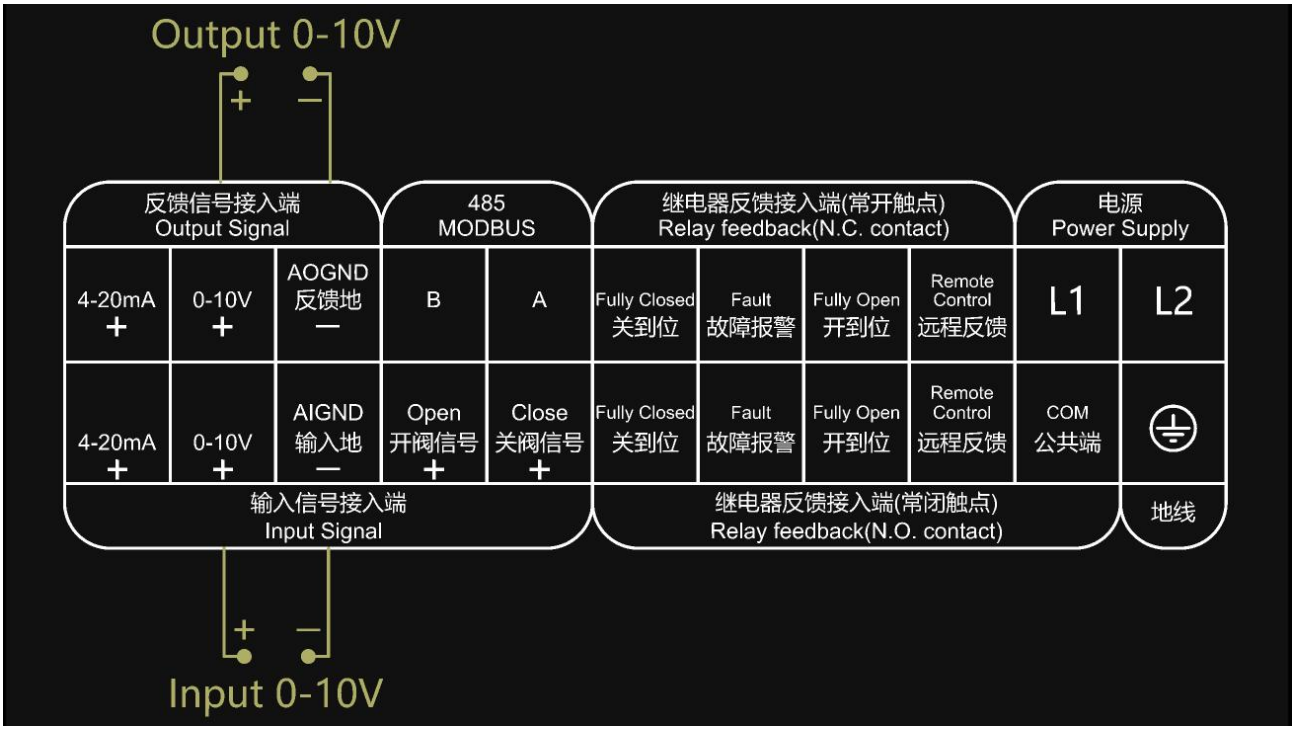


Fig. 6 0-10V ,10-0V Wiring

7. MODBUS RTU Control Wiring

MODBUS RTU control wiring is shown in Fig.7.

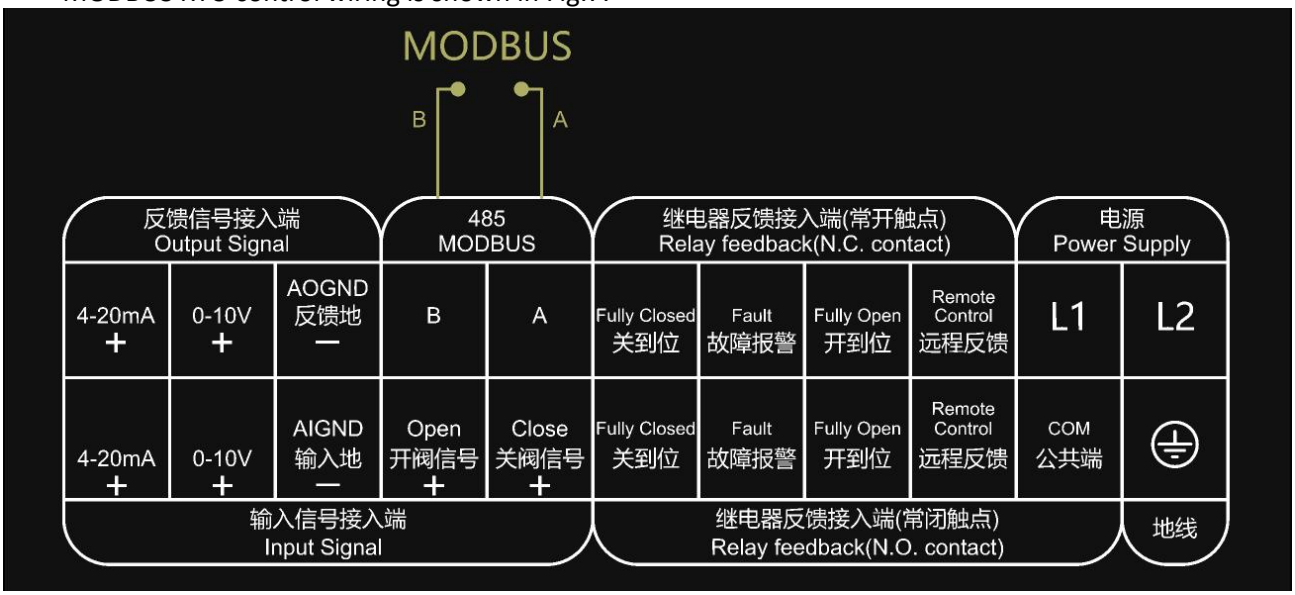


Fig. 7 MODBUS Wiring

8. The Wiring of On-Off Input for Passive Contact

The wiring of on-off input for passive contact is shown in Fig.8.

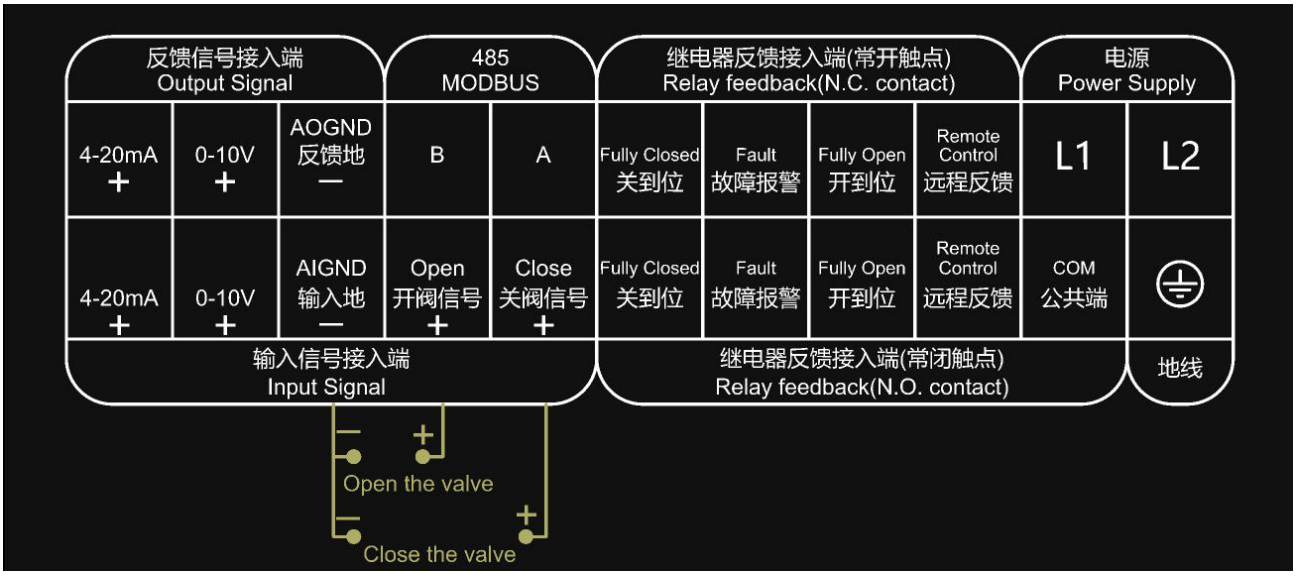


Fig. 8 The Wiring of On-Off Input for Passive Contact

9. Switching Quantity Feedback Wiring

Switching quantity feedback wiring is shown in Fig.9.

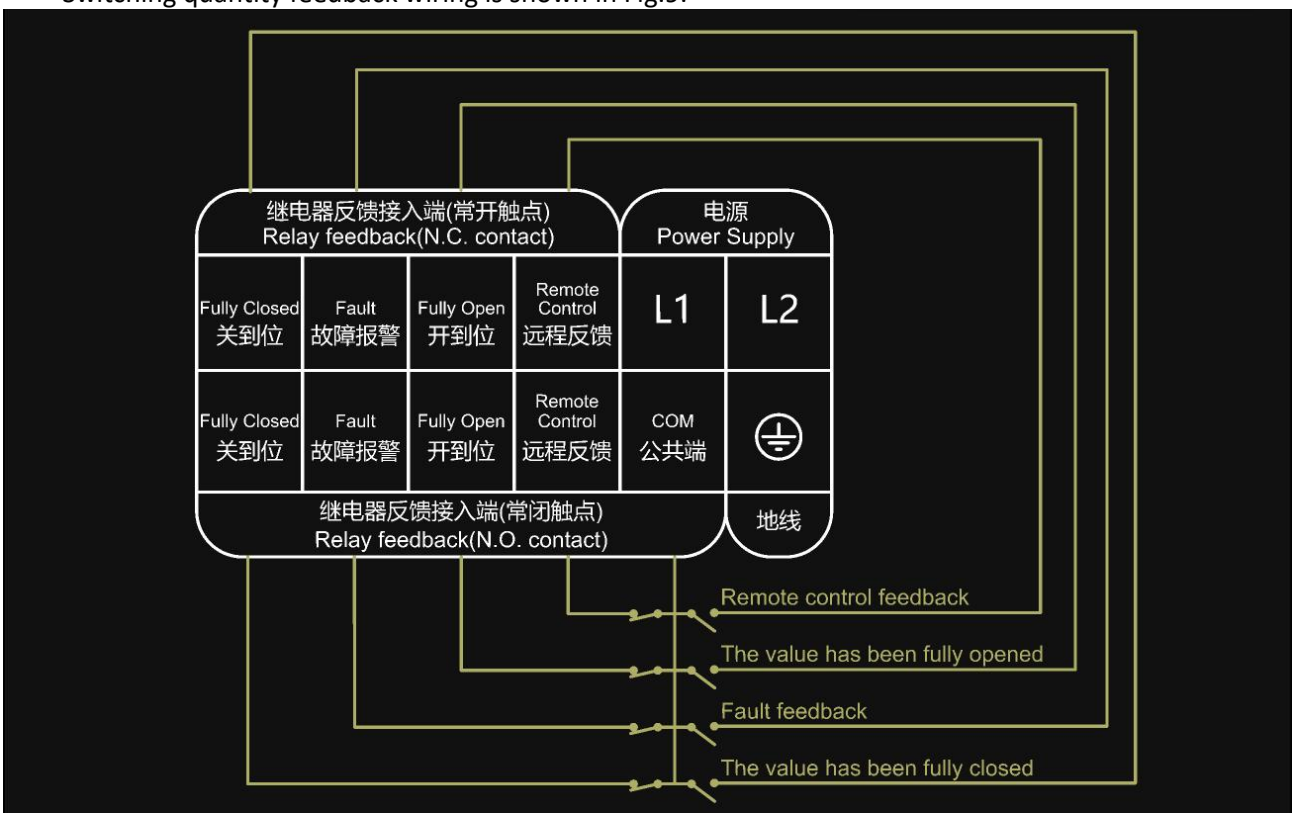


Fig. 9 Switching Quantity Feedback Wiring

III. Installation and Commissioning Steps

1.Fix the actuator to the valve.

2.Connect power cord, please see *Wiring Diagram* for the details.

3.Connect signal line in accordance to the Electric Wiring Diagram on wiring board. select a signal line port based on site conditions, and the wiring for power supply and control signal should be routed separately to avoid interfering with the signal. Please see *Wiring Diagram* for details.

4.To select valve, please see *Valve Type* for details.

5.Stroke Calibration: After power-on, scan valve stroke by “Manual Calibration” or “Automatic Calibration”, please see *Automatic Calibration* for details.

6.Enter menu and select the corresponding control signal and feedback signal, please see *Signal Setting* of the Manual for details.

IV. Work Interface

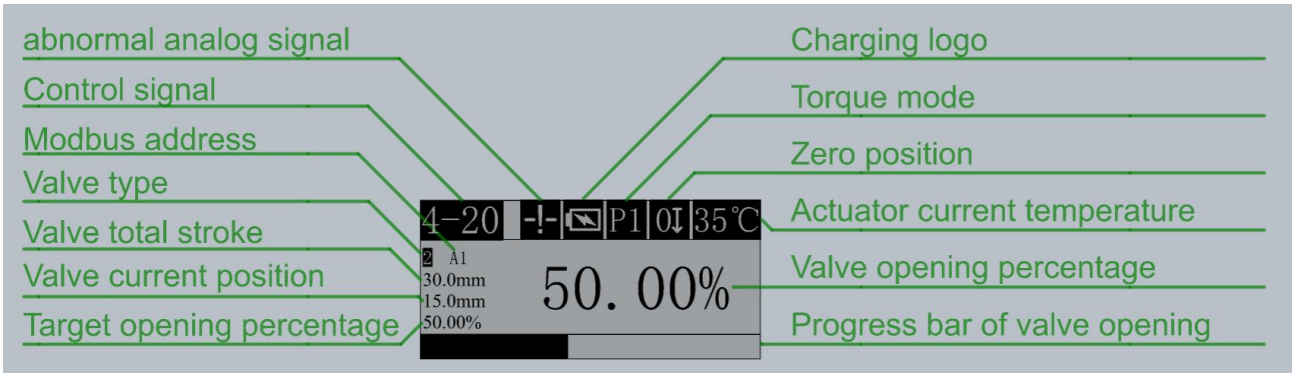


Fig. 10

The work interface of actuator is shown in Fig. 10.

1. Abnormal Analog Signal

-!-:Overflowing: Indicates that the current control signal(4-20mA or 20-4mA)exceeding 24mA is detected

-~-:Break Signal: Indicates that the analog control signal(4-20mA,20-4mA,0-10V or 10-0V) is not detected.

2. Control Signal Display

4-20:Indicates 4-20mA control signal.

20-4:Indicates 20-4mA control signal.

0-10:Indicates 0-10V Control Signal.

10-0:Indicates 10-0V Control Signal.

SW:Indicates Switching Quantity Control.

MBUS:Indicates MODBUS control.

IR:Indicates IR Remote Control.

Local:Indicates Local Control.

3. MODBUS Address Display

A1:The MODBUS address of actuator is 1.

A2:The MODBUS address of actuator is 2.

...

A255: The MODBUS address of actuator is 255.

4. **Valve Type**

 : Indicates that actuator match with two-way valve.

 : Indicates that actuator match with three-way valve.

5. **Valve Total Stroke**

 :Indicates that valve stroke is 30mm.

6. **Valve Current Position**

 :Indicates that valve stroke is 15mm.

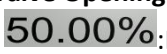
7. **Target opening percentage**

 :Indicates that the target opening percentage that valve received.and 50% indicates that the target opening of the received valve is 50%.

8. **Progress Bar of Valve Opening**

 :Represents the current valve opening.

9. **Valve Opening Percentage**

 :Indicates that valve is 50% open.

10. **Actuator current temperature**

 :Indicates that the internal temperature of the actuator.

11. **Zero Position Display**

 :Indicates Lower Zero Position: The valve is opened when the valve stem moves upward and closed when it runs downward.

 :Indicates Upper Zero Position: The valve is opened when the valve stem moves downward and closed when it runs upward.

12. **Thrust Mode Display**

 : Thrust mode 1.

 : Thrust mode 2.

 : Thrust mode 3.

13. **Charging logo**

 **:** Indicates that the lithium battery inside the actuator is charging.the logo disappear after the fully charged battery.

V. LED Indicator

The actuator is equipped with LED indicator lights with six colors, from left to right: orange red, blue, white, red, green and yellow.

Orange Red Light is the actuating alarm indicator, flashes once indicating overcurrent, continuously for 3 times is alarming for undervoltage, 4 times or 5 times for phrase loss of motor.

Blue Light is the indicator of motor power.

White Light is the indicator of power supply of actuator controller.

Red Light is the off-position indicator, and the indicator is on when the valve is fully closed or is being closed.

Green Light is the on-position indicator, and the indicator is on when the valve is fully opened or is being opened.

Yellow Light alarms for position fault, the indicator is on when the valve fails to run to the target position, and the display screen shows a fault prompt interface.

VI. Button Definitions

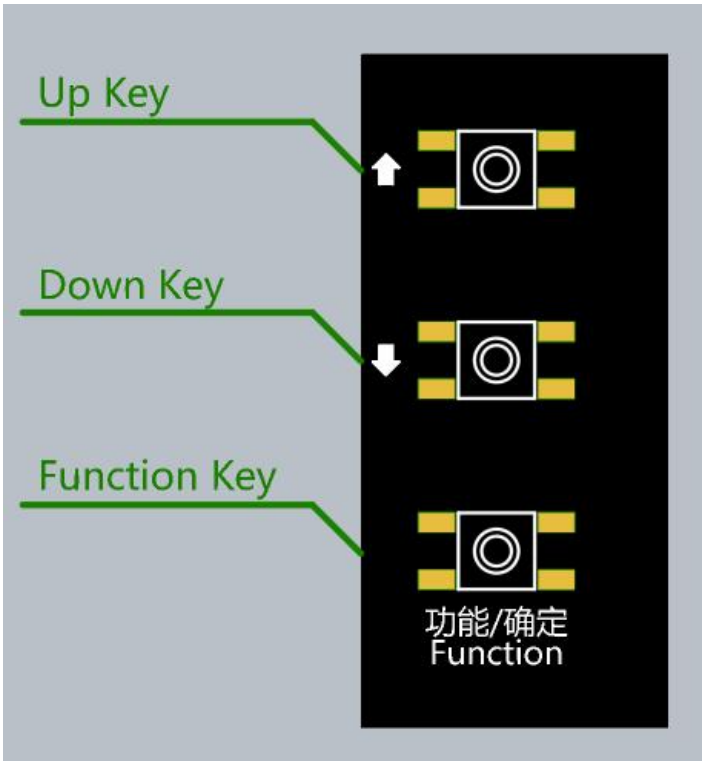


Fig.11

As shown in Fig.11, the actuator has three buttons: Up, Down and Function. Unless otherwise specified, buttons are defined as follows:

Up key:

- Press on the button for local control, and the actuator runs upward and stops when release the button.
- Switch to the previous menu.

Down key:

- Press on the button for local control, and the actuator runs downward and stops when release the button.
- Switch to the next menu.

Function key:

- Tap and hold on the button (> 1 second) to enter Menu.
- Tap and hold on the button (> 1 second) to enter Menu.

VII. Functions

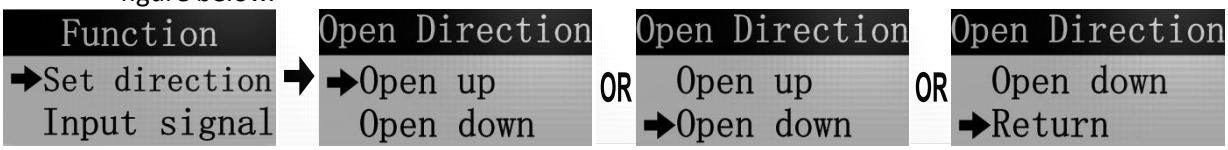
1. Zero Switch

Actuator is applicable for upper zero setting (that is, when the valve stem runs down, the valve is opened) or lower zero setting (that is, when the valve stem runs up, and the valve is open). After the zero setting, the actuator restarts, and the setting steps are as follows:

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Select the "Zero Switch" by shortly pressing the Up or Down button (< 1 second).

(3)Shortly press the Up or Down button (< 1 second) to select the upper or lower zero position, and hold down the Function button (> 1 second) to confirm. The operation steps are shown in the figure below.



2. Input Signal

The actuator seats for Local Control, 4-20MA Control, 20-4mA Control, 0-10V Control, 10-0V Control, MODBUS RTU Control (disable by default), Switching Quantity Control and IR Remote Control (IR remote control is not included in standard configuration). Within which,

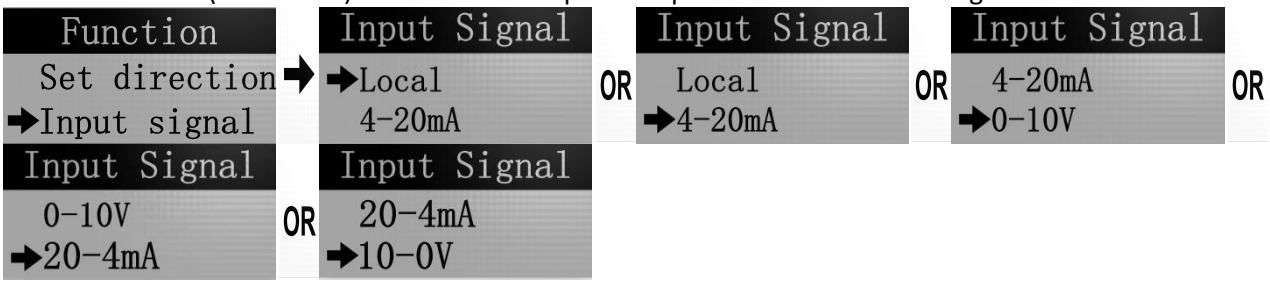
- **Local Control:** Adjust the valve opening through the up and down keys.
- **4-20MA Control:** Adjust valve opening to 0-100% by input 4-20mA signal. when input signal is 4mA, valve opening is 0%, and when input signal is 20mA, valve opening is 100%. Wiring: Please see Wiring Diagram.
- **20-4MA Control:** Adjust valve opening to 0-100% by input 20-4mA signal. when input signal is 20mA, valve opening is 0%, and when input signal is 4mA, valve opening is 100%. Wiring: Please see Wiring Diagram.
- **0-10V Control:** Adjust valve opening to 0-100% by input 0-10V signal. when input signal is 0V, valve opening is 0%, and when input signal is 10V, valve opening is 100%. Wiring: Please see Wiring Diagram.
- **10-0V Control:** Adjust valve opening to 0-100% by input 10-0V signal. when input signal is 10V, valve opening is 0%, and when input signal is 0V, valve opening is 100%. Wiring: Please see Wiring Diagram.
- **MODBUS RTU Control:** The actuator supports MODBUS RTU control. Wiring: Please see MODBUS RTU Communication for details.
- **switching Quantity control:** the actuator supports switching Quantity control, which is a passive contact input. When the control interface is connected to the input ground, the valve is opened, and the on-off control is automatically canceled when the connection is disconnected.Switching Quantity control has higher priority than local control, 4-20mA, 20-4ma, 0-10V, 10-0V and MODBUS-RTU control, and can be used for emergency valve opening and emergency valve closing. It should be noted that the voltage of the control interface cannot exceed 24V, otherwise the main board of the actuator will be damaged. Wiring mode of valve opening control: please refer to the chapter of wiring diagram.
- **IR Remote Control:** The actuator supports IR Remote Control. For details, please see Infrared (IR) Remote Control.

Tap and hold on the the Unlock button of the IR remote controller (> 1 second), switching to IR Remote Control. Control switch quantity automatically when Switch Quantity Interface accesses effective signal, and cancel the control when the signal is invalid. The steps for switching other control signals are as follows:

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Select Input Signal by shortly pressing Up or Down button (< 1 second).

(3)Shortly press Up or Down button (< 1 second) to select the desired control signal, and press Function button (> 1 second) to confirm. The operation process is shown in the figure below.



3. Feedback Signal

The actuator supports MODBUS feedback, Switching Quantity feedback, 4-20mA feedback, 20-4mA feedback, 0-10V feedback, and 10-0V feedback. The default feedback is 4-20mA signal and 0-10V signal. MODBUS feedback and Switching Quantity feedback need to be explained when ordering. After opening, MODBUS feedback and Switching Quantity feedback can be supported simultaneously with 4-20mA feedback and 0-10V feedback.

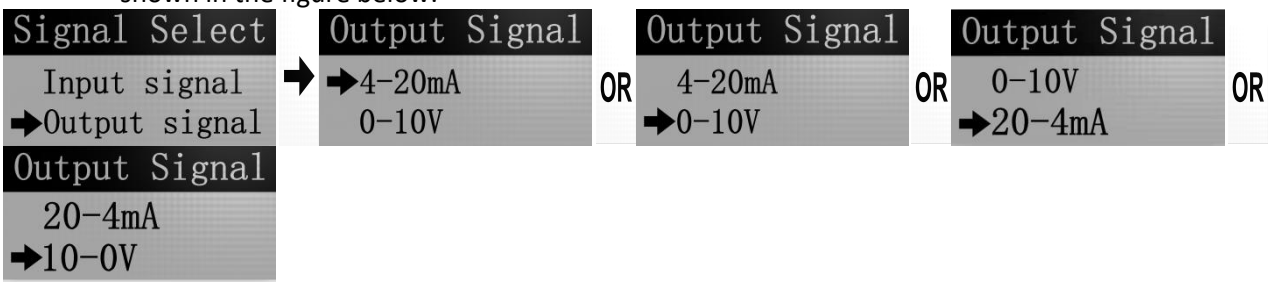
- **MODBUS Feedback:** Read the parameters of the actuator by MODBUS Read Instructions. Please see MODBUS RTU Communication for details.Please see *Wiring Diagram*.
- **Switch Quantity Feedback:** Electromagnetic relay is used to get remote control feedback,on-position feedback, off-position feedback and fault alarm feedback. The contact capacity of relay is DC24V-2A or AC250V-2A, please do not exceed the range of use.When the valve is fully opened, fully closed,using remote control(4-20mA, 20-4mA, 0-10V, 10-0V, MODBUS and Switching Quantity control are all remote control) or fault alarm occurs, the corresponding normally open contact interface is connected with the COM interface , and the normally closed contact interface is connected with the COM interface . Otherwise, the corresponding normally open contact interface is disconnected from the COM interface, and the normally closed contact interface is connected with the COM interface.This function needs to be activated.Please see *Wiring Diagram*.
- **4-20mA Signal Feedback:** indicates 0-100% of valve opening. When feedback signal is 4mA, it indicates that the current opening is 0%, and when it is 20mA, the current valve opening is 100%.Please see *Wiring Diagram*.
- **20-4mA Signal Feedback:** indicates 0-100% of valve opening. When feedback signal is 20mA, it indicates that the current opening is 0%, and when it is 4mA, the current valve opening is 100%.Please see *Wiring Diagram*.
- **0-10V Signal Feedback:**indicates 0-100% of valve opening. When feedback signal is 0V, it indicates that the current opening is 0%, and when it is 10V, the current valve opening is 100%.Please see *Wiring Diagram*.
- **10-0V Signal Feedback:** indicates 0-100% of valve opening. When feedback signal is 10V, it indicates that the current opening is 0%, and when it is 0V, the current valve opening is 100%.Please see *Wiring Diagram*.

The steps of switching 4-20mA feedback, 20-4mA feedback,10-0V feedback and 0-10V feedback signals are as follows:

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Shortly press Up and Down buttons (< 1 second), select "Signal Setting" and "Feedback Signal" in turn.

(3)Shortly press Up and Down buttons (< 1 second) to select the required 4-20mA feedback signal or 0-10V signal. tap and hold on Function button (> 1 second) to confirm. The operation process is shown in the figure below:



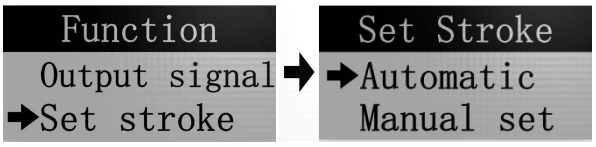
4. Stroke Calibration

4.1.Automatic Calibration

Automatic Calibration refers to the automatic scanning of valve stroke by the actuator. After the stroke been scanned, the actuator automatically returns to zero position, and then surrendering to signal control. The steps to turn on Automatic Calibration are as follows:

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Shortly press Up and Down buttons (< 1 second), select "Stroke Calibration" and "Automatic Calibration" in turn.



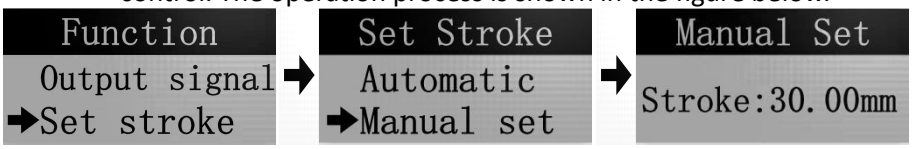
4.2.Manual Setting

Manual Setting refer to input valve stroke directly by pressing Up and Down buttons. After the setting, the actuator automatically returns to zero position, and then surrendering to signal control. The steps to turn on Manual Setting are as follows:

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Select "Stroke Calibration" and "Manual Settings" successively by shortly pressing Up button or Down button (< 1 second).

(3)Input Valve Stroke: Input valve stroke by pressing Up and Down buttons, Shortly press Function button (< 1 second) to switch and modify the decimal and integer number of the valve. Then, long press Function button (＞1 second) after the input for confirmation. The actuator displays "Stroke setting is completed" and automatically returns to zero position, and surrendering to signal control. The operation process is shown in the figure below.



5. Speed Setting

The operating speed of the actuator is the maximum when it leaves the factory, and it supports independent speed setting of valve opening and closing. The operating speed ranges from 30% to 100% of the maximum speed. The thrust of the actuator is inversely proportional to the speed, and the faster the speed, the smaller the thrust. *It should be noted that when the valve opening is less than 2mm, the operating speed of the actuator is fixed at 30% of the maximum, in order to provide the maximum thrust for the valve closing*. The steps for setting the speed are as follows:

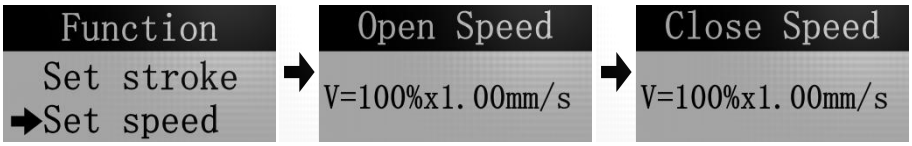
(1)Tap and hold on Function button (>1 second) to enter Menu;

(2)Select “Speed Setting”;

(3)Set Valve Opening Speed: Input Opening Speed of the valve by pressing Up and Down buttons, and then shortly press Function button (<1 second);

(4)Set Valve Closing Speed: Input Closing Speed of the valve by pressing Up and Down buttons, and

then tap and hold on Function button (>1 second) to confirm. The operation process is shown in the following figure.



6. Signal Calibration

The input and feedback signals of the actuator have been calibrated before delivery. In case that the field signal is deviated due to interference or other reasons, the signal could be re-calibrated. Signal calibration steps are as follows:

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Select “Signal Calibration”.

(3)Calibration for the input 4mA signal: Input 4mA signal to actuator. the first line displayed on the screen "Please input 4mA current", and the second line displays the parameters of the 4mA signal. The number on the left white background is the currently input 4mA signal parameter, while the number with the black background on the right is the previously held 4mA signal parameter. After inputting 4mA control signal, shortly press Function button (< 1 second) to confirm. **If there is no need to calibrate the 4-20mA control signal, unplug the 4-20mA signal cable and press Function button (< 1 second) to skip the calibration.**

(4)Calibration for the input 20mA signal: Input 20mA signal to actuator. the first line displayed on the screen "Please input 20mA current", and the second line displays the parameters of the 20mA signal. The number on the left white background is the currently input 20mA signal parameter, while the number with the black background on the right is the previously held 20mA signal parameter. After inputting 20mA control signal, shortly press Function button (< 1 second) to confirm. **If there is no need to calibrate the 4-20mA control signal, unplug the 4-20mA signal cable and press Function button (< 1 second) to skip the calibration.**

(5)Calibration for the input 0V signal: Input 0V signal to actuator. the first line displayed on the screen "Please input 0V current", and the second line displays the parameters of the 0V signal. The number on the left white background is the currently input 0V signal parameter, while the number with the black background on the right is the previously held 0V signal parameter. After inputting 0V control signal, shortly press Function button (< 1 second) to confirm. **If there is no need to calibrate the 0-10V control signal, unplug the 0-10V signal cable and press Function button (< 1 second) to skip the calibration.**

(6)Calibration for the input 0V signal: Input 0V signal to actuator. the first line displayed on the screen "Please input 0V current", and the second line displays the parameters of the 0V signal. The number on the left white background is the currently input 0V signal parameter, while the number with the black background on the right is the previously held 0V signal parameter. After inputting 0V control signal, shortly press Function button (< 1 second) to confirm. **If there is no need to calibrate the 0-10V control signal, unplug the 0-10V signal cable and press Function button (< 1 second) to skip the calibration.**

(7)Calibration for the feedback 4mA signal: Adjust the output 4mA current by Up and Down buttons. when using signal generator and other tools to detect the actuator output current is just 4mA, shortly press Function button (< 1 second) to confirm. **If there is no need to calibrate the 4-20mA feedback signal, shortly press Function button (< 1 second) to skip the calibration.**

(8)Calibration for the feedback 20mA signal: Adjust the output 20mA current by Up and Down buttons. when using signal generator and other tools to detect the actuator output current is just 20mA, shortly press Function button (< 1 second) to confirm. **If there is no need to calibrate the 4-20mA**

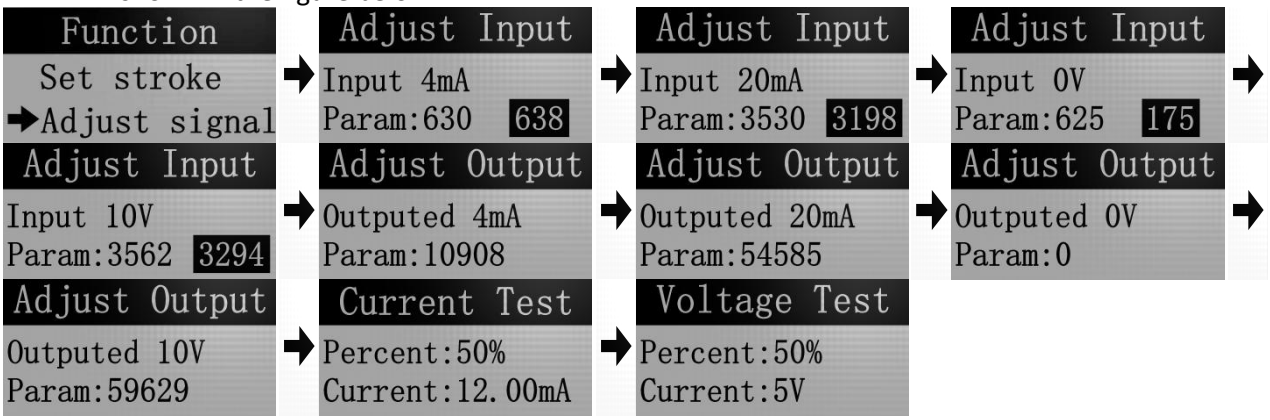
feedback signal, shortly press Function button (< 1 second) to skip the calibration.

(9)Calibration for the feedback 0V signal: Adjust the output 0V current by Up and Down buttons. when using signal generator and other tools to detect the actuator output current is just 0V, shortly press Function button (< 1 second) to confirm. **If there is no need to calibrate the 0-10V feedback signal, shortly press Function button (< 1 second) to skip the calibration.**

(10)Calibration for the feedback 10V signal: Adjust the output 10V current by Up and Down buttons. when using signal generator and other tools to detect the actuator output current is just 10V, shortly press Function button (< 1 second) to confirm. **If there is no need to calibrate the 0-10V feedback signal, shortly press Function button (< 1 second) to skip the calibration.**

(11)Current Test: Input a 4-20mA signal so as to check whether the current displayed on the screen is consistent with the actual value, and use signal generator and other tools to test whether the output current value of the actuator is consistent with the actual value. after the current test is completed, shortly press Function button (< 1 second) to start Voltage Test .

(12)Voltage Test: Input a 0-10V signal so as to check whether the voltage displayed on the screen is consistent with the actual value, and use signal generator and other tools to test whether the output voltage value of the actuator is consistent with the actual value. If they are consistent, tap and hold on Function(press it for more than 1 second to release) to confirm exit. otherwise shortly press Function button (< 1 second) to return to Step 4 for re-calibration. The operation process is shown in the figure below:



7. Power-down Mode(PDM)

After power down the Actuator,the lithium battery that installed inside the actuator begins to supply power until the valve fully closed or opened. The function is known as power down mode,and needs to be activated before it can be used.three optional modes are supply. The default is hold after power down.As follows:

Close: After power down the Actuator, the lithium battery begin to supply until the valve is fully closed.

Hold: After power down the Actuator, the valve remains in original position.

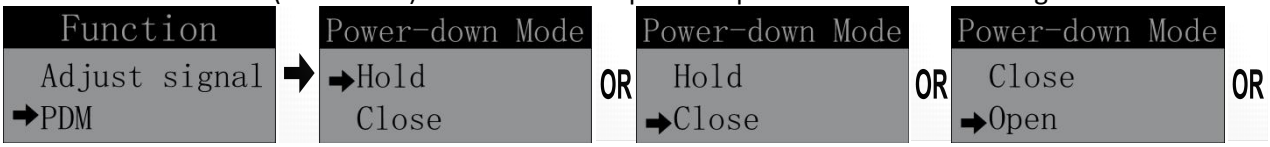
Open: After power down the Actuator, the lithium battery begin to supply until the valve is fully closed.

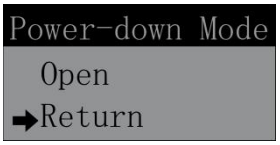
The steps for switching power down modes are as follows:

(1)Tap and hold on the button (> 1 second) to enter Menu.

(2)Shortly press up and down buttons (< 1 second), select "PDM" .

(3)Shortly press up and down buttons (< 1 second) to select the required mode, and tap and hold on Function button (> 1 second) to confirm. The operation process is shown in the figure below:

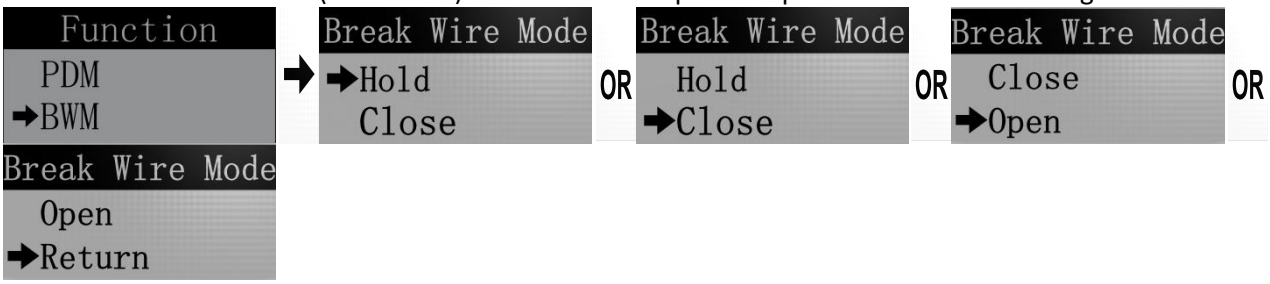




8. Off-signal Mode(BWM)

4-20mA, 20-4ma, 0-10V and 10-0V control signals support the function of signal breaking mode. In case of 0-10V or 10-0V control, the signal disconnection mode will be triggered only after all the signal lines are disconnected. For 4-20mA or 20-4ma control, the signal disconnection mode will be triggered only when all signal lines are disconnected or the input signal is lower than 2.5mA. There are three off signal modes to choose from: off signal valve closing, off signal holding and off signal valve opening. The default is off signal hold.

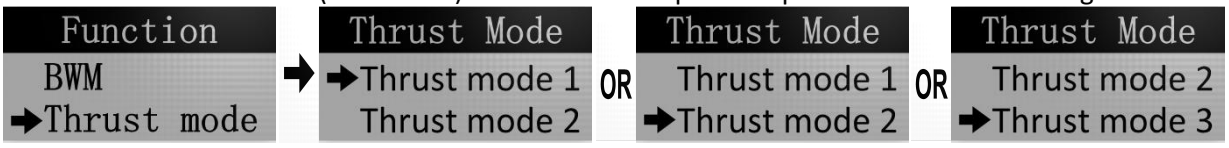
Close: No signal detected in the valid signal detected, and the valve is closed.
Hold: No signal detected in the valid signal detected, and the valve remains in original position.
Open: No signal detected in the valid signal detected, and the valve is opened.
The steps for switching off-signal modes are as follows:
(1)Tap and hold on the button (> 1 second) to enter Menu.
(2)Shortly press up and down buttons (< 1 second), select "BWM" .
(3)Shortly press up and down buttons (< 1 second) to select the required mode, and tap and hold on Function button (> 1 second) to confirm. The operation process is shown in the figure below:



9. Thrust Mode

The actuator supports three thrust modes. The thrust of "thrust mode 2" is about 5% greater than that of "thrust mode 1", and the thrust of "thrust mode 3" is about 5% greater than that of "thrust mode 2". The steps for setting thrust mode are as follows:

(1)Tap and hold on the button (> 1 second) to enter Menu.
(2)Select "Thrust mode".
(3)Select thrust mode: Press Up and Down buttons to select the required thrust , then tap and hold on Function button (> 1 second) to confirm. The operation process is shown in the figure below:



10. Dead Zone Setting

The actuator sets the dead zones (sensitivity) for 4-20mA, 20-4mA,0-10V and 10-0V input signals respectively. Among them, the dead zones of 4-20mA and 20-4mA input signals are ranging from 0.1% to 20%. The dead zone of 0-10V and 10-0V input signal ranges from 1% to 20%. And the operation process is

shown in the figure below.

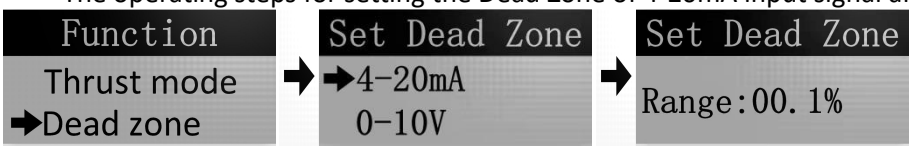
(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Select Dead Zone Setting by shortly pressing Up or Down button (< 1 second).

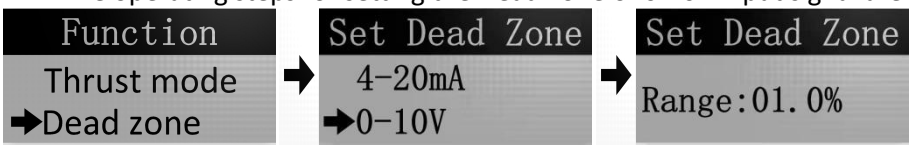
(3)Select the to-be-modified input signal sensitivity by pressing Up or Down button (< 1 second).

(4)Modify the valve of Dead Zone Value: Pressing Up and Down buttons, shortly press Function button (< 1 second) to modify the fractional and integer parts of a numeric value. Long press Function button (>1 second) for confirmation after the input. Then, the actuator shows “Dead Zone setting is completed”, and returns to zero position, then surrendering to signal control.

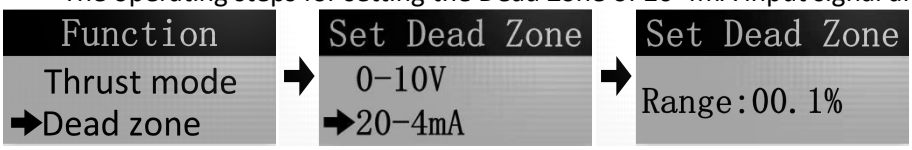
The operating steps for setting the Dead Zone of 4-20mA input signal are as follows:



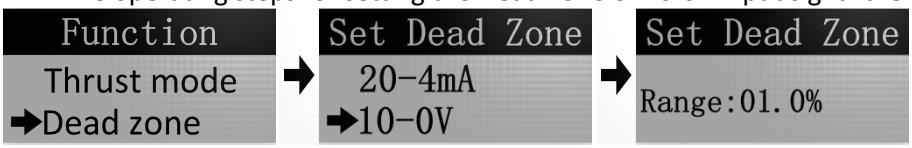
The operating steps for setting the Dead Zone of 0-10V input signal are as follows:



The operating steps for setting the Dead Zone of 20-4mA input signal are as follows:



The operating steps for setting the Dead Zone of 10-0V input signal are as follows:



11. Valve Type(TWV)

The actuator is available for two-way and three-way valves, while two-way is the defaulted. The differences of the two valve types are shown below:

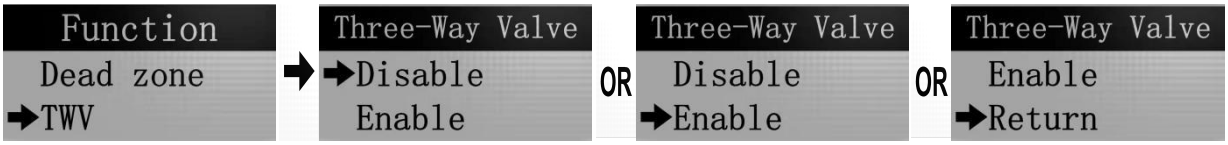
Two-Way Valve	Three-Way Valve
stroke after automatic calibration = actual stroke of valve -1mm	stroke after automatic calibration = actual stroke of valve
When the valve opening reaches 100%, the actuator stops immediately.	When the valve opening reaches 100%, the actuator continues to open the valve until it is fully open before stopping.
The actuator does not slow down when the valve is still 2mm short of 100% opening.	The actuator begins to slow down when the valve is about to reach 100% opening.The deceleration distance is equal to the Zero buffer distance.For the setting method, see the section of *Zero Buffer.*

The configuring steps for valve types:

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Shortly press Up or Down button (< 1 second) to select “TWV”.

(3)Shortly press Up or Down button (< 1 second) to select Three-Way Valve, then long press Function button (>1 second) for confirmation. Please see the below for the steps:



12. Zero Buffer

When the actuator closes the valve, it starts to decelerate when the actuator is less than or equal to the set distance from the fully closed valve to increase the thrust. This distance is the zero buffer. The default distance is 3mm, and the value range of distance is 0~20mm. When the valve is set to the three-way valve type, it will also slow down when the valve is less than or equal to the set distance from the full open position. The steps to modify the distance are as follows:

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Shortly press Up or Down button (< 1 second) to select “Zero buffer”.

(3)Pressing Up and Down buttons, shortly press Function button (< 1 second) to modify the fractional and integer parts of a numeric value. Long press Function button (>1 second) for confirmation after the input. Please see the below for the steps:

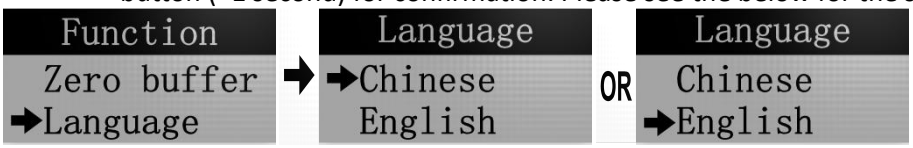
13. Language

The actuator supports switching between Chinese and English. The steps are as follows:

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Shortly press Up or Down button (< 1 second) to select “Language”.

(3)Shortly press Up or Down button (< 1 second) to select the Language, then long press Function button (>1 second) for confirmation. Please see the below for the steps:



14. Infrared (IR) Remote Control

The actuator supports IR remote control and the priority of remote control is the highest.and is equipped with unlock and lock function so as to avoid being triggered mistakenly. There are six buttons on the remote control: "Unlock", "Function", "Zero Switch", "Remote/Local Switch", "On" and "Off".

- Unlock: Tap and hold on (> 1 second) 3 seconds for unlocking. After unlocking, the actuator can be operated, and IR is displayed on the screen. in the unlocked state, shortly press Unlock button(< 1 second), or the actuator is locked if it does not receive the infrared remote control signal within 60 seconds.
- Function: Is the same usage as the Function key on the actuator: tap and hold on the button (> 1 second) to enter Menu. tap and hold on (> 1 second) to confirm.
- Zero Switch: Reserved, the actuator does not operate after being pressed.
- Remote/Local Switch: Reserved, the actuator does not operate after being pressed.
- Open: Consistent with the use of Up on the actuator: For local control, press the button to open the

valve, it stops when release the button. and switch to the previous menu.

- Off: Consistent with the use of Up on the actuator: For local control, press the button to close the valve, it stops when release the button. and switch to the previous menu.

VIII. MODBUS RTU Communication (Optional)

1. Modbus Communication Requirements

(1)Use RS485 standard communication wire harness.
(2)Default communication port settings: Baud rate 9600, 8 data bits, 1 stop bit, even parity.
(3)Secondary address: 1 to 255.
(4)For the wiring, please see the chapter "***Input Signal***".

2. Address List of Actuator

As shown in Table 1, the bus master station has the following instructions for the actuator. The PLC start address is 40001:

Address	Function	Description	R/W	Range	Default	Remarks
40021 40022	Read actuator stroke	Scan out the full stroke, straight stroke unit "mm", floating point number and high byte are transmitted first.	R	0~150	0	Power-off reset, and can be read in any control state.
40023	Read ID address	The upper eight bits are fixed to 0x76, and the lower eight bits can be changed in the menu bar.	R	0x7601 ~0x76FF	0x7601	Power-off reset, and can be read in any control state.
40024	Read valve position adjustment state	0: indicates that the actuator is in the hold state. 1: indicates that the actuator is running.	R	0~1	0	Power-off reset, and can be read in any control state.
40025	Read the working state of the actuator	0: signal following state (the actuator runs with the input signal). 1: the actuator is in signal calibration state. 2: the actuator is in stroke scanning state. 3: the actuator is in the stroke setting state.	R	0~3	0	Power-off reset, and can be read in any control state.

40026	Read the current position of the actuator	0: the actuator is between zero position and maximum position. 1: the actuator is in the zero position, the valve is closed. 2: the actuator is in the maximum position and the valve is fully open.	R	0~2	0	Power-off reset, and can be read in any control state.
40027	Read fault alarm	0: the actuator has no fault. 1: actuator fault alarm.	R	0~1	0	Power-off reset, and can be read in any control state.
40028	Read current position	The integer from 0 to 1000 indicates that the valve opening ranges from 0 to 100%. For example, 777 indicates 77.7%.	R	0~1000	0	Power-off reset, and can be read in any control state.
40029	Set target position	The integer from 0 to 1000 indicates that the valve opening ranges from 0 to 100%. For example, 777 indicates 77.7%.	R/W	0~1000	0	Power-off reset, and can be read in any control state. it is valid only when the target value is written under MODBUS control.
40030	Switch control state	0: local control. 1:0-10V control. 2:4-20MA control. 3: MODBUS control. 4: HART control (writing this value is invalid). 5: IR remote control (writing this value is invalid). 6: switching quantity control. 7:20-4MA control. 8:10-0V control.	R/W	0~8	0	Power-off reset, and can be read in any control state.
40031	Baud rate setting	Set the baud rate of MODBUS. Baud rate of MODBUS = Set value *100. For example, writing 12 indicates that the baud rate is changed to 1200.	R/W	12,24,48,96,144,192,384,430,576,768,1152,1280	96	Power-off protection, and can be read in any control state. it is valid only when the target value is written under MODBUS control.
40032	Odd and even parity	0: No check. 1: Odd parity. 2: Even parity.	R/W	0~3	2	Power-off protection, and can be read in any control state. it is valid only when the target value is written under MODBUS control.
40033	On/off valve command	1:Turn on the valve. 2:Turn off the valve. 4:Stop at current position.	R/W	1、2、4	0	Power-off reset, and can be read in any control state. it is valid only when the target value is

						written under MODBUS control.

Table 1

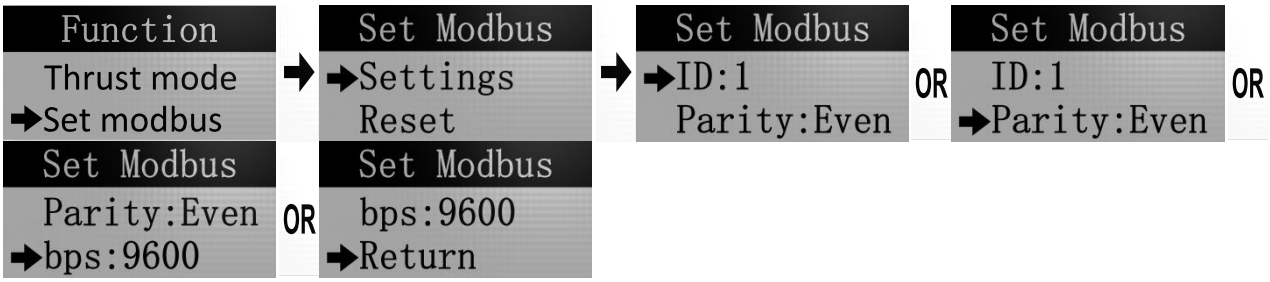
3. Baud Rate Value Allowed

Baud rate allowed: 1200, 2400, 4800, 9600, 14400, 19200, 38400, 43000, 57600, 76800, 115200 and 128000.

4. How to Manually Change the ID Address, Baud Rate, and Parity Bits of the MODBUS

(1)Tap and hold on Function button (> 1 second) to enter Menu.

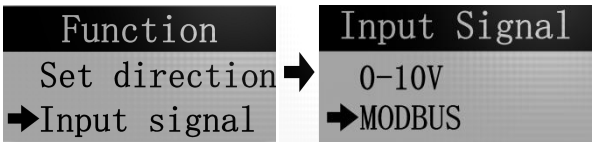
(2)Shortly press Up and Down buttons (< 1 second), select "MOBUS Setting" and "Parameter Setting" in turn, then shortly press (< 1 second) Function button to select "MBUS Address", "Odd-Even Parity" and "Baud Rate". After modifying the ID address, baud rate, and parity bit of the actuator by pressing Up and Down buttons, then tap and hold on Function button (> 1 second) to confirm the modification and exit Menu. The operation process is shown in the figure below:



5. Manually Switch to MODBUS Control

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Shortly press Up and Down buttons (< 1 second), select "Signal Setting", "Input Signal" and "MODBUS" in turn. then tap and hold on Function button (> 1 second) to confirm the modification and exit Menu. The operation process is shown in the figure below:

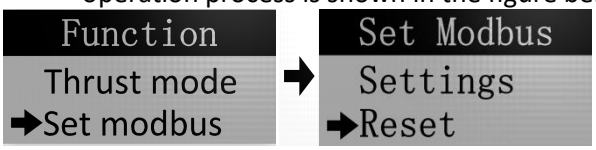


6. Manually Reset MODBUS Parameters

After resetting, baud rate is 9600, 8 data bits, 1 stop bit, even parity, and cancel MODBUS control. To manually reset MODBUS parameters, please perform the following steps:

(1)Tap and hold on Function button (> 1 second) to enter Menu.

(2)Shortly press Up and Down buttons (< 1 second), select "MODBUS" and "Parameter Rest" in turn. then tap and hold on Function button (> 1 second) to confirm the modification and exit Menu. The operation process is shown in the figure below:



IX. Problems and Troubleshooting

1. The control signal had been given, but the actuator did not respond.

When signals of 4-20mA,20-4mA,0-10V or 10-0V were prevailing, the main causes for no responds from the actuator are:

(1)When the interface is incorrectly connected, the screen displays  . Please confirm whether the control signal is correctly connected to the corresponding interface.

(2)When the positive and negative poles of the control signal are connected reversely, the screen displays  . Please check whether the control signal cable is connected inversely.

(3)When the actuator is not switched to the corresponding control signal,  is displayed on the screen. Check whether the displayed icon of the control in the upper left corner is consistent with the actual control signal. If not, switch the control signal. For switching, please refer to *Input Signa*l.

(4)If the input signal is too large, when the input signal of 4-20mA or 20-4mA exceeds 24mA,  is displayed on the screen.

(5)The upper computer does not give the actuator signal, please use multimeter and other tools to measure whether the upper computer really output the correct signal to the actuator.

2. No analog feedback signal

The steps to judge whether the actuator gives the feedback of 4-20mA signal and 20-4mA:

(1)When the control signal is switched to 4-20mA control and the 4-20mA interface is not connected to the signal,  is displayed on the screen.

(2)As shown in Fig. 12, applying the short-circuit for 4-20mA input interface and 4-20mA feedback interface on the actuator with wires. If  on the display disappears, it indicates that the actuator has a feedback signal of 4-20mA or 20-4mA.

Fig. 12

The method to judge whether the actuator feedback 0-10V or 0-10V signal is as follows:

(1)When the control signal is switched to 0-10V or 10-0V control, and the 0-10V interface is not connected to the signal, the screen displays  .

(2)As shown in Fig. 13, applying short-circuit for 0-10V or 10-0V input interface and 0-10V feedback interface on the actuator with wires. If  on the display disappears, it indicates that the actuator has the feedback of 0-10V signal.

Fig. 13

3. The actuator automatically opens and closes the valve without obeying to the command of the control signal.

If the total stroke of the valve on the left screen of the actuator is "0.00mm" or the current position of

the valve shows "------" on the screen, it indicates that the actuator does not maintain valve stroke. Re-calibrate the valve again, and please see *Stroke Calibration* for details.

4. Actuator Fault

As shown in Fig. 14, the actuator reports "Actuator Fault", indicating that the actuator cannot read the signal of the encoder. The main reason is that the connection line of the encoder is loose, so the motherboard needs to be disassembled and the 8PIN white terminal connected to the motherboard shall be firmly inserted.

Fig. 14

5. Thrust Protection

As shown in Fig. 15, thrust protection is caused by the blocked valve, occurring when opening and closing the valve, and the valve is unable to reach to the target valve position. There are many situations resulting in thrust protection alarm, including:

(1)Power is over small.

(2)The valve has not been used for a long time, resulting in dry lubricating oil and increased resistance. It needs to manually turn the actuator.

(3)When the actuator has been installed, no scanning for the stroke displayed by the actuator, so the thrust protection is reported because the stroke displayed by the actuator is inconsistent with the actual stroke of the valve. Please re-calibrate stroke.

(4)Valve inlet and outlet are installed reversely.

(5)The actuator and valve actuator are not concentric for the installation, resulting in excessive resistance and thrust protection failure when the actuator runs to a certain position.

(6)The actuator thrust selected is too small, causing that the actuator fails to drive the valve, and reporting thrust protection.

(7)Undervoltage and overcurrent for the actuator and motor phase loss: When orange red light on the display flashes for one or three times, it indicates an overcurrent/undervoltage alarm, and it needs to replace the power supply with a higher power. when orange red light flashes for 5 times in a succession, it indicates that the motor is losing phase and the motor wires are in poor contact. It is necessary to disassemble the display panel of the actuator and reconnect the motor wires.

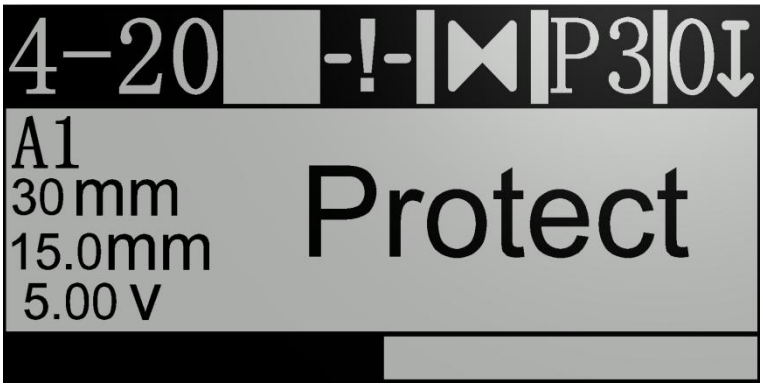


Fig. 15

X. Actuator Parameter Table

1. DLB Series

型号	出轴推力 (N)	输出轴运行速度 (mm/s)	最大行程 (mm)	电压 (V)	电流 (A)	功率 (W)
DLB410	1000	1	40	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLB430	3000	0.7	40	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLB465	6500	0.7	40	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLB4100	10000	0.3	40	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLB4120	12000	0.3	40	24(DC)	6.25	150
				24(AC)	6.25	
				220(AC)	0.68	
				380(AC)	0.39	
				24(DC)	6.25	

DLB4160	16000	0.3	40	24(AC)	6.25	150
				220(AC)	0.68	
				380(AC)	0.39	
DLB4200	20000	0.3	40	24(DC)	6.25	150
				24(AC)	6.25	
				220(AC)	0.68	
				380(AC)	0.39	
DLB4260	26000	0.3	40	24(DC)	6.25	150
				24(AC)	6.25	
				220(AC)	0.68	
				380(AC)	0.39	
DLB10200	20000	0.3	100	24(DC)	6.25	150
				24(AC)	6.25	
				220(AC)	0.68	
				380(AC)	0.39	
DLB12260	26000	0.3	120	24(DC)	6.25	150
				24(AC)	6.25	
				220(AC)	0.68	
				380(AC)	0.39	

Remarks:

1. To enable modbus, add "M" after the corresponding model;
2. If switching Quantity control is required, add "K" after the corresponding model;
3. If a Power-down Function is required, add "F" after the corresponding model;
4. If all three functions are included, add "KMF" after the corresponding model.

2. DLC Series

型号	出轴推力 (N)	输出轴运行速度 (mm/s)	最大行程 (mm)	电压 (V)	电流 (A)	功率 (W)
DLC310	1000	1	30	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLC320	2000	1	30	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLC330	3000	1	30	24(DC)	2.5	60
				24(AC)	2.5	

				220(AC)	0.27	
				380(AC)	0.16	
DLC350	5000	1	30	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLC630	3000	1	60	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLC650	5000	1	60	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLC665	6500	1	100	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLC6100	10000	0.7	100	24(DC)	2.5	60
				24(AC)	2.5	
				220(AC)	0.27	
				380(AC)	0.16	
DLC6160	16000	1	60	24(DC)	6.25	150
				24(AC)	6.25	
				220(AC)	0.68	
				380(AC)	0.39	
DLC6260	26000	1	60	24(DC)	6.25	150
				24(AC)	6.25	
				220(AC)	0.68	
				380(AC)	0.39	
DLC10160	16000	1	100	24(DC)	6.25	150
				24(AC)	6.25	
				220(AC)	0.68	
				380(AC)	0.39	
DLC10260	26000	1	100	24(DC)	6.25	150
				24(AC)	6.25	
				220(AC)	0.68	
				380(AC)	0.39	

Remarks:

1. To enable modbus, add "M" after the corresponding model;
2. If switching Quantity control is required, add "K" after the corresponding model;
3. If a Power-down Function is required, add "F" after the corresponding model;
4. If all three functions are included, add "KMF" after the corresponding model.

Note: customisation is required on > 100 trips, please specify when ordering