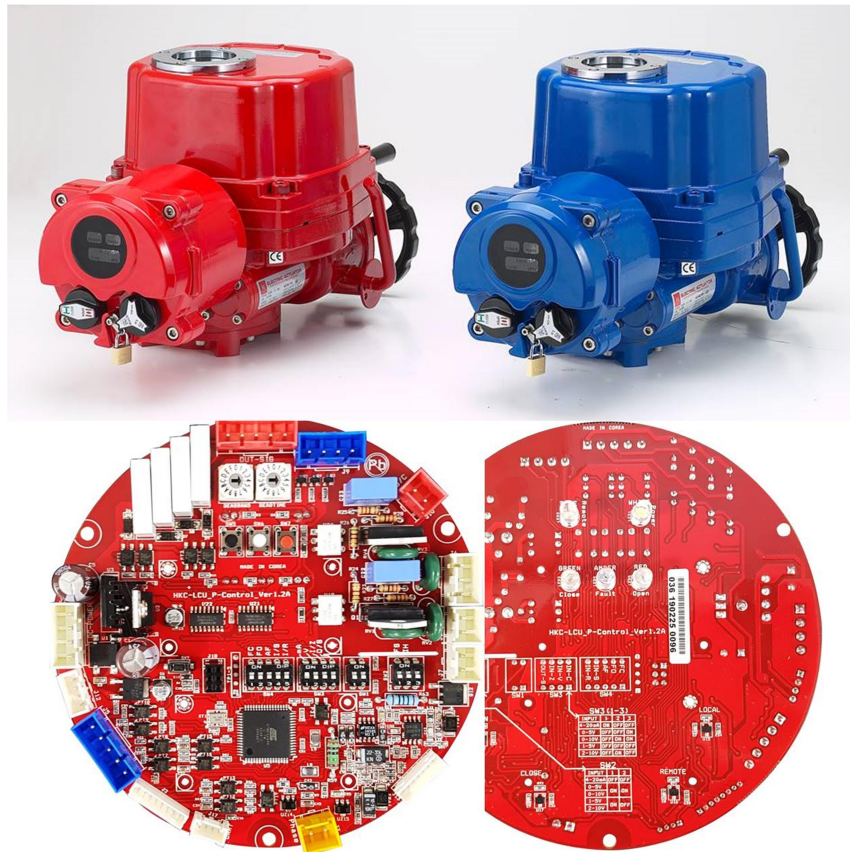


# Local Control Unit - P (LCU-P with PCU function integrated)

## Installation, Operation & Maintenance Manual



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## 1. Introduction

### 1.1 Purpose

The LCU-P unit was developed to add a PCU function to the LCU-B unit for the HQ and HL series electric actuators, and it is possible to add a communication module such as ProfiBus and ModBus for customer convenience. This manual is intended for safe use, installation and maintenance of the LCU-P.

1.2 The LCU-P board has Local mode which can be operated directly from local control and Remote mode which can be remotely operated in distance. It is also possible to integral control of on/off operation and remote modulation operation which input a command signal of 4~20 mA range.

1.3 This product is equipped with 8 BIT RISC CPU to guarantee various functions and high reliability, including self-diagnosis function. The user can conveniently diagnose the error from WINDOW LED status

### 1.4 Safety Notices

Safety notices in this manual outline precaution the user must take to reduce the risk of personal injury and damage to the equipment. The user(s) must read these instructions before the installation, operation or maintenance of HQ-series electric actuators.



**DANGER:** Refers to personal safety and alerts the user to danger or harm.  
*The hazard or unsafe practice will result in severe injury or death.*



**WARNING:** Refers to personal safety. Alerts the user to potential danger.  
*Failure to follow warning notices could result in personal injury or death.*



**CAUTION:** Directs the user's attention to general precautions that, if not followed, could result in personal injury and/or equipment damage.

**Notes:** *Highlighted information is critical to the user's understanding of the actuator's installation and operation.*

## 2. Check point before using the actuator

2.1 Make sure that the actuator specification (model number, main power, control power, optional items, and etc.) is in conformity with the order specification.

2.2 Check that the size, pressure rating, etc. of the valve is in accordance with the order specification.

2.3 Check that the actuator and the valve are assembled securely.

2.4 Check the status of the limit switches, stopper bolts, and indicator setting of the actuator.

2.5 Make sure to check the electrical specifications (power, input/output signal, wiring status according to the wiring diagram, and etc.)

2.6 Do not arbitrarily modify, alter or repair the wirings of the actuator.

2.7 Before shipped from the factory, the settings of Dead band and Dead time are pre-adjusted basically. If the user has arbitrarily adjusted the position of the limit switches or the potentiometer, please make re-setting the present status through press the Auto setting function on the LCU-P board.

2.8 Please do not disassemble, assemble, or modify the actuator without any technical support or explanation from HKC. If any abnormality or problem occurs, please contact us immediately.

Caution:



In order to use the product correctly and safely, please make sure to fully understand the contents of this manual before using the product.

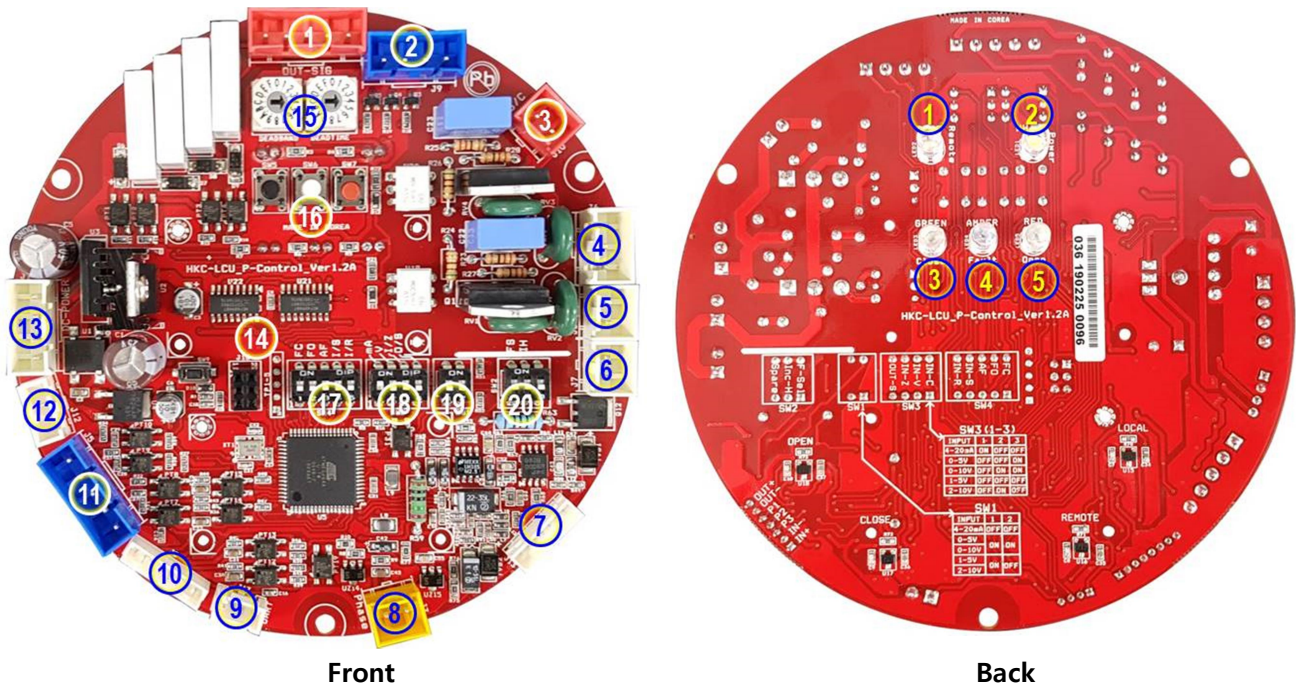
Some contents of this manual may be subject to change without prior notice for the purpose of improving the quality, etc.

### 3. Standard Specification

3.1 Table 1: Standard specification of the Proportional Control Unit

Model	LCU-P
Input signal (setpoint)	4~20mA dc, 1~5V dc, 2~10V dc 0~20mA dc, 0~5V dc, 0~10V dc
Input signal resistance	250Ω, position resistance: 100~10kΩ
Output signal (feedback)	4~20mA dc, 1~5V dc, 2~10V dc 0~20mA dc, 0~5V dc, 0~10V dc
Load resistance	500Ω max
Dead time	0.2~7.5 sec (It can be set in 16 step) <ul style="list-style-type: none"> <li>• Step 0 : 0.2 sec</li> <li>• Step 1 ~ 4 : 0.25 ~ 1sec (0.25sec / step)</li> <li>• Step 5 ~ 15 : 2.5 ~ 7.5sec (0.5sec / step)</li> </ul>
Dead band	0.4~7.5 % (It can be set in 16 step) <ul style="list-style-type: none"> <li>• Step 0 ~ 4 : 0.4 ~ 0.8% (0.1% / step)</li> <li>• Step 5 ~ 9 : 1 ~ 1.8% (0.2% / step)</li> <li>• Step 10 ~ 15 : 5 ~ 7.5% (0.5% / step)</li> </ul>
Fault mode	Fail close, Fail open, Fail stop
Position conversion accuracy	±(0.2 to 5)% (may vary depending on conditions)
Ambient temperature	-20°C to 80°C
Ambient humidity	90% RH max. (non-condensing condition)
Dielectric strength	1500V ac, 1 minute
Insulation resistance	500V dc, 50MΩ or more
Vibration and shock	Z axis 1g/3g, frequency: 100 – 200Hz, time: within 30 minutes

### 4. Layout of LCU-P board







**Front**



Terminal block				Switch	
No.	Part	No.	Part	No.	Part
1	Relay output signal	8	Phase check connector	15	Deadband & deadtime
2	3-phase motor connector	9	Communication port	16	Close(black), Open(white) & ASCAN(red) button
3	Condenser connector (1ph)	10	Limit & torque s/w Signal connector	17	5-pin dip switch (SW4)
4	1-phase motor connector	11	Remote signal	18	4-pin dip switch (SW3)
5	220V ac input	12	5V dc & 12V dc output	19	2-pin dip switch (SW1)
6	220V ac output	13	28V ac & 10V ac input	20	3-pin dip switch (SW2) 1P: Fault relay NO/NC 2P: Inching/Hold 3P: Close limit bypass (Torque trigger)
7	Set point, potentiometer & feedback	14	Program upload		

**Back**

No.	Position	Color	Signal
1	LED 1	Blue	Remote
2	LED 2	White	Power
3	LED 3	Green	Close
4	LED 4	Amber	Fault
5	LED 5	Red	Open

**5. Main function and it's usage for Local Control**

LED display	Action
	<ol style="list-style-type: none"> <li>1) Power indication (Power LED display: White)</li> <li>2) Select "Local" in mode knob (Remote / Stop / Local)</li> <li>3) When shipped out the actuator from factory, the actuator is fully closed status.</li> </ol>
	<ol style="list-style-type: none"> <li>4) Select "Open" in action knob (Open/Close)</li> <li>5) When action is in opening progress, the open (red) LED is flickering.</li> <li>6) If Opening is completed, the open (red) LED will be maintaining as on.</li> <li>7) After that, the actuator is stopped.</li> </ol>

LED display	Action
	<p>8) Select "Close" in the action knob            9) When action is in closing progress, the close (green) LED is flickering            10) If Closing is completed, the close (green) LED will be maintaining as on            11) After that the actuator is stopped.            * If you want to make stop the actuator under operating, select the stop position of the mode knob</p>
	<p>⊙ Error            - In case of missing a phase or reverse contact in the 3 phase.            - Encountered torque switches due to over torque during operating.            * Please refer to Error display –Page 13.            ⊙ If it is fault condition, the fault LED(amber) will be flickering.</p>

## 6. Main function and usage in Remote Manual Control

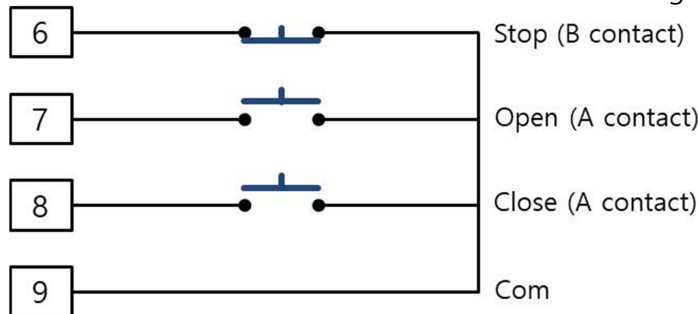
### 6.1 Dry contacts control (command contact)

6.1.1 Command function is activated when is input an action by external dry contact.

6.1.2 Hold / Inching can be selected by changing the 3-pin Dip Switch (SW2) specified in No. 20 of "4. LCU-P board layout".

① Pin No.2 : select as Hold (On) / Inching (Off)

6.1.3 Connect the actuator terminal from outside refer to Fig 1 as below.



< Fig 1 Actuator terminal wiring >

6.1.4 The actuator does not work if the 6 (Stop) and 9 (Com) terminals are not connected.

6.1.5 Check action of the actuator after wiring.

6.1.6 When operating at the site after connect the Common wire;

- ① After make jumper between No.6 (Stop) and No. 9 (Com) terminal, and make jumper between No.7 (Open) and No. 9 (Com) terminal, after that the actuator will be moved to open.
- ② After make jumper between No.6 (Stop) and No. 9 (Com) terminal, and make jumper between No.8 (Close) and No. 9 (Com) terminal, after that the actuator will be moved to close.
- ③ Dip switch (SW2) setting at the clause 6.1.2

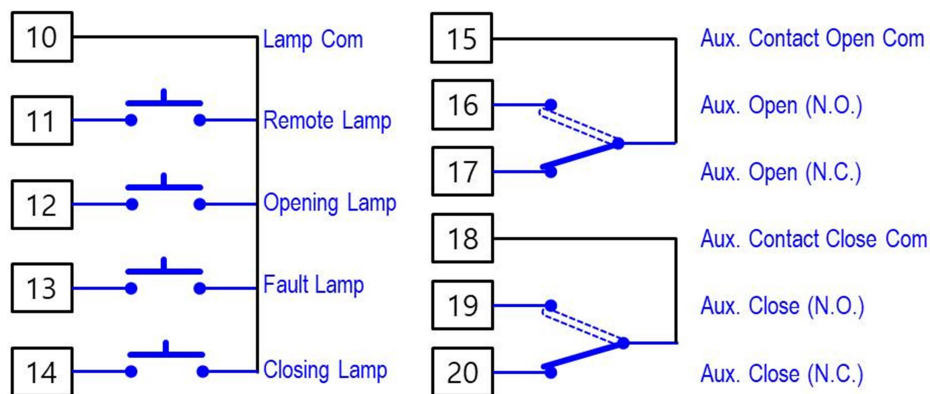
- Hold : At this time, the actuator will be continually move to fully open or fully close position.
- Inching : It is only move in case of connected between No.7(Open) and No.9 (Com), or between No.8(Close) and No.9(Com).  
But if the connection is opened, it doesn't operate.

6.1.7 It can be checked by confirming operation on site whether actuator is contact to command or not.

## 6.2 External output signal contacts

6.2.1 External output signal contacts use when receive about actuator status from external (panel) signal.




6.2.2 Wiring should be as shown below in Fig 2.



<Fig 2 Actuator terminal wiring>

6.2.3 After completed according to Fig 2, operate the actuator for confirming output signal.

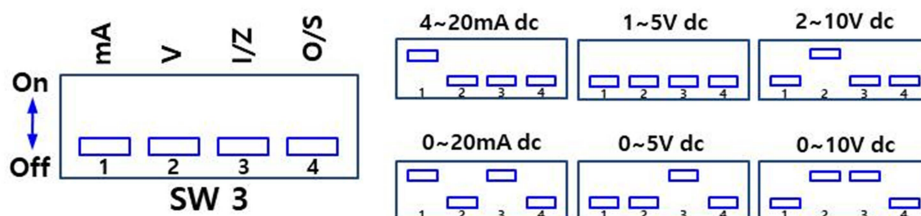
- ① Remote lamp (A-contact: normal open)
  - Checking with No.10 and No.11 terminal.
  - The contact is changed when the Mod knob of the actuator is put to Remote.
- ② Open lamp (A-contact: normal open)
  - Checking with No.10 and No.12 terminal.
  - The contact is changed when the actuator is moving to open.
- ③ Fault lamp (Possible to select A-contact: normal open, B-contact: normal close)
  - Checking with No.10 and No.13 terminal.
  - The contact is changed when the actuator is fault (activated on the torque switch).
  - It is possible to select the contact by 3-pin DIP switch (SW2) of LCU-P layout No20 as No1-On: B-contact, No1-Off: A-contact
- ④ Closing lamp (A-contact: normal open)
  - Checking with No.10 and No.14 terminal.
  - The contact is changed when the actuator is moving to close.
- ⑤ Auxiliary contact for open
  - No.15 and No.16 are consisted A-contact (normal open), No.15 and No.17 are B-contact (normal close).
  - It is used to check in fully open, or used in conjunction with other devices. (B-contact is applied to connect the other devices, A-contact is to check the signal)
- ⑥ Auxiliary contact for close
  - No.18 and No.19 are consisted A-contact (normal open), No.18 and No.20 are B-contact (normal close).
  - It is used to check in fully close, or used in conjunction with other devices. (B-contact is applied to connect the other devices, A-contact is to check the signal)

LED display	Action
	<ol style="list-style-type: none"> <li>1) Power input check (LED display- Power LED : White)</li> <li>2) Select "Remote" of Remote / Stop / Local knob switch</li> <li>3) Confirm the blue on the Remote LED</li> <li>4) The actuator is set as fully close when is shipping to customer.</li> </ol>
	<ol style="list-style-type: none"> <li>5) The open LED (red) is flickering for opening.</li> <li>6) Completed to open : the red LED is On.</li> <li>7) After that the actuator is stopped at open position.</li> </ol>
	<ol style="list-style-type: none"> <li>8) The close LED (green) is flickering for closing.</li> <li>9) Completed to close : the green LED is On</li> <li>10) After that the actuator is stopped at close position.</li> </ol>

## 7. Main function and usage for Remote modulating control (proportional control).

### 7.1 Select input signal switch

Depending on the system environment, the user can select the required command signal type by setting the DIP switch SW3.



Notes : DIP switch SW3 is commonly set with 4~20mA dc before shipping.

Please make sure whether the input signal and DIP switches are correct as intended use.

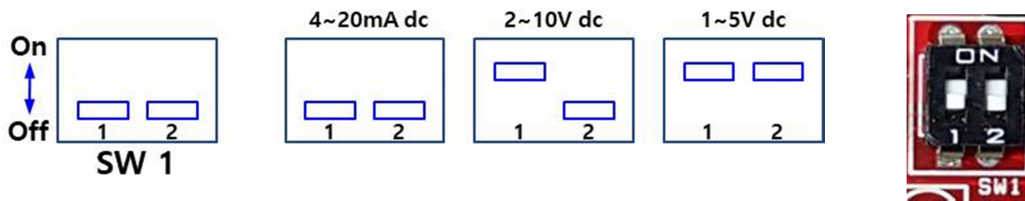


Caution : Zero switch SW3-3 is applied to input and output signals equally.



## 7.2 Set feedback type

Depending on the system environment, the user can select the required output feedback signal by setting the DIP switch SW1.



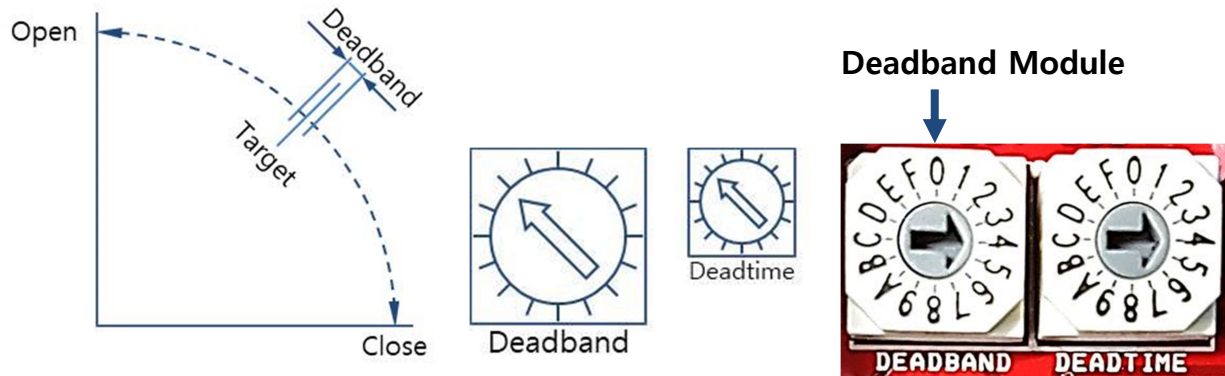
Notes : DIP switch SW1 is commonly set with 4~20mA dc before shipping.

Caution : Please refer to Zero switch SW3-3 of the clause "7.1 Select input signal switch".

## 7.3 Deadband setting

7.3.1 Deadband means maximum allowable tolerance of the actuator stop position from command signal.

7.3.2 It is also minimum difference value for starting to move of the actuator.



7.3.3 Adjustable setting range : 0.4 ~ 7.5% (16 steps available)

- ① Step 0~4 : increase 0.1% increment per step (0.4~0.8%)
- ② Step 5~9 : increase 0.2% increment per step (1.0% ~ 1.8%)
- ③ Step A~F : increase 0.5% increment per step (5.0% ~ 7.5%)
- ④ Initial setting is "4"

7.3.4 If the setting value is too lower, the actuator may not be found the target point and it may be repeatedly operated in forward or reverse direction. This is called "Hunting" and the user must appropriately adjust the deadband to avoid from the hunting.

7.3.5 Continuous hunting causes a failure of the actuator parts such as motor, LCU-P board, potentiometer and etc.

## 7.4 Deadtime setting



7.4.1 This is necessary to apply the command signal.

7.4.2 It is the minimum time for maintaining the state of the input signal satisfying the deadband.

7.4.3 Actuator only accepts input signal satisfying the setting value of the deadtime as normal and operates. It is for preventing from abnormal operation of the actuator by external disturbance something like noise.

7.4.4 Adjustable setting range : 0.2~7.5 sec (16 steps available)

- ① Step 0 : 0.2 sec (minimum value)

- ② Step 1~4 : increase 0.25 sec increment per step (0.25~1 sec)
- ③ Step 5~F : increase 0.5 sec increment per step (2.5~7.5 sec)
- ④ Initial setting is "4"

### 7.5 Auto setting

7.5.1 It shall be proceeded "Stop" status of the mode knob.



7.5.2 Check connection status of the input power, input/output signal after actuator and valve are correctly assembled.

7.5.3 When the wiring is normal without problem, push the auto setting button.

7.5.4 Then the Remote LED (blue light) of the window is flickering, and perform the auto setting function.

7.5.5 Auto setting details

Select "Stop" position of the mode knob, and you can perform according to ① or ② method as below.

- ① Operate SW7 (A-SCAN) of the LCU-P board
  - 1) Need to open the LCU cover of the actuator, and push the Auto setting button.
- ② Operate knob
  - 1) Confirm "Stop" position of the mode knob
  - 2) Hold for 5 seconds at "Close" of the action knob
  - 3) Confirm to Off from On of the blue LED
  - 4) Operate "Open" of the action knob within 3 seconds
  - 5) Confirm to Off from On of the blue LED as holding status for about 5 seconds
  - 6) Change to "Local" of the mode knob, and then turn to "Stop"
  - 7) Not need to open the LCU cover

7.5.6 After pushing the A-SCAN, Auto setting is performed as follows.

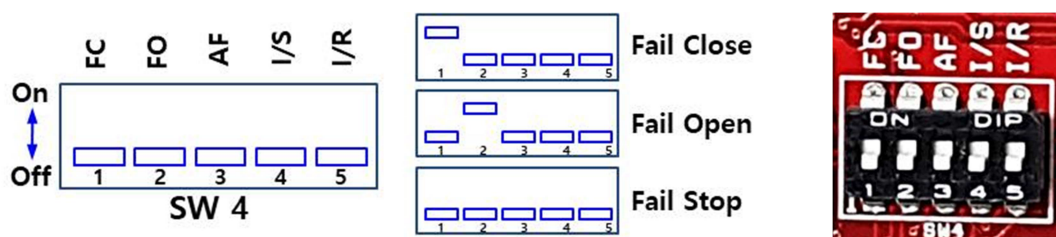
- ① Flickering the blue LED continuously.
- ② Green LED is flickering during closing, the green LED is on after fully closed.  
If the actuator were already closed, the closing operation will be skipped.
- ③ Red LED is flickering during opening, the red LED is on after fully opened.
- ④ Green LED is flickering during closing, the green LED is on after fully closed.
- ⑤ When all of the sequences are automatically and successfully completed, blue LED will be On, and then move to pre-specified position



Notes : During the auto setting processes, if you press any button or operate the knob, the auto setting mode is cancelled.

### 7.6 Fail close (FC), fail open (FO) and fail stop

When an analogue command signal does not come in or a wrong signal is received, the LCU-P will detect Fault and operates automatically open, close and stop according to specified fail position.

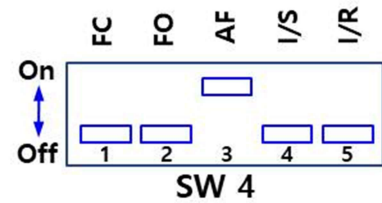


## 7.7 Auto full action (AF)

7.7.1 Turn on the AF (Auto Full) DIP switch No3

7.7.2 Response of the actuator

- ① Move to fully close position at 4.3 mA and lower of the input signal.
- ② Move to fully open position at 19.7 mA and over of the input signal

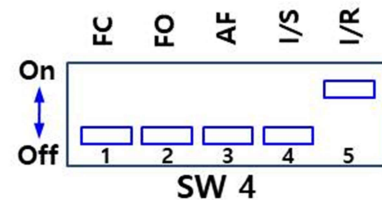


## 7.8 Reverse mode (I/R)

7.8.1 It is used when user want to operate actuator by inverting input signal and output signal.

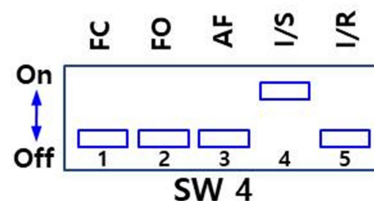
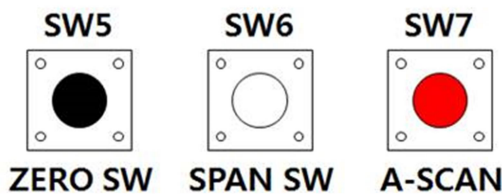
7.8.2 When the command signal is 4 mA, the actuator moves to fully open position, and makes 4 mA dc as an output signal.

7.8.3 When the command signal is 20 mA, the actuator moves to fully close position, and makes 20 mA dc as an output signal.



## 7.9 Random command signal setting

7.9.1 Proceed after select "Stop" of the mode knob for using this function.



7.9.2 It is needed to change the Zero (fully close) and Span (Fully open) signal.

7.9.3 Adjustable setting range of the Zero signal : about 3~8mA dc

7.9.4 Adjustable setting range of the Span signal : about 16~21mA dc

※ Example: Set as the 5 mA dc was apply to Zero, and 19 mA dc was Span signal

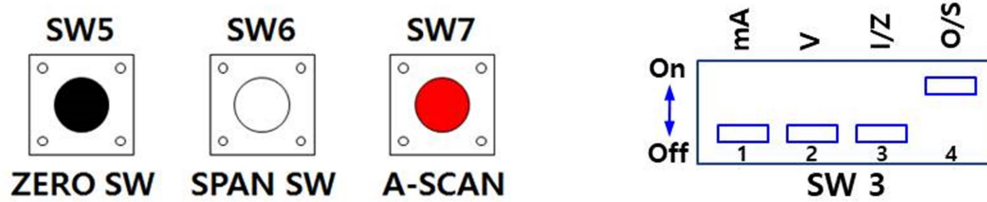
- ① Confirm the mode knob position as "Stop".
- ② Turn on No 4 (I/S input set) of the DIP SW4.
- ③ Quickly flickering both of the red and green LED.
- ④ About 1.5 second later, quickly flickering the green LED only
- ⑤ Input 5mA to command signal at the input terminal, and then push to unlock the Zero button (black)
- ⑥ If it were successfully set, yellow LED is flickered 1 time, green LED is on (completed setting) and red LED is flickering for waiting to input setting.
- ⑦ Input 19mA to command signal at the input terminal, and then push to unlock the Span button (white)
- ⑧ If it were successfully set, yellow LED is flickered 1 time and red LED is on (completed setting).
- ⑨ After 1.5 second, this sequence will be repeated from "③".
- ⑩ When you want to quit from this setting, turn off No.4 of the DIP SW4 (I/S input set)

※ If the No.4 of the DIP SW4 were turned off during processing, the setting is cancelled.

※ If there were not input anything for 2 minutes, the setting process is also cancelled.

## 7.10 Adjust output (feedback) signal

7.10.1 Proceed after select "Stop" of the mode knob for using this function.



7.10.2 Adjust Zero (4mA) and Span (20mA) value of the output signal.

7.10.3 Each time the zero button (black) is pushed, the output signal decreases.

7.10.4 Each time the span button (white) is pushed, the output signal increases.

※ Example : Set as the 4 mA dc was apply to Zero, and 20 mA dc was Span signal

- ① Put the mode knob position as "Stop".
  - ② Turn on No 4 switch of the DIP SW3.
  - ③ Flickering both of the red and green LED and then waiting to flicker the green LED only.
  - ④ Adjust output signal value as 4 mA pushing the Zero or Span button.
  - ⑤ Confirm the 4 mA output, press A-SCAN button (red).
  - ⑥ Confirm the yellow LED is on and off.
  - ⑦ Green LED is on, and confirm that red LED is flickering.
  - ⑧ Adjust output signal value as 20 mA pushing the Zero or Span button.
  - ⑨ Confirm the 20 mA output, press A-SCAN button (red).
  - ⑩ Confirm the yellow LED is on and off.
  - ⑪ Confirm the red LED is on.
  - ⑫ Flickering both of the red and green LED at the same time and then waiting to flicker the green LED only.
  - ⑬ Turn off No.4 of the DIP SW3
- ※ If the No.4 of the DIP SW3 were turned off during the setting process, the setting is cancelled.
- ※ If there were not input anything from the button for 2 minutes, the setting process is also cancelled.

## 8. LED display

### 8.1 Operating display

Signal	Operating	Display	LED	Color
Power	Power on	On	LED 1	White
Remote	Digital	On	LED 2	Blue
	Analog or Auto Scan	Flicker		
Close	Close limit	On	LED 3	Green
	Closing	Flicker		
Fault	Torque trip	On	LED 4	Amber
	Malfunction	Flicker		
Open	Open limit	On	LED 5	Red
	Opening	Flicker		



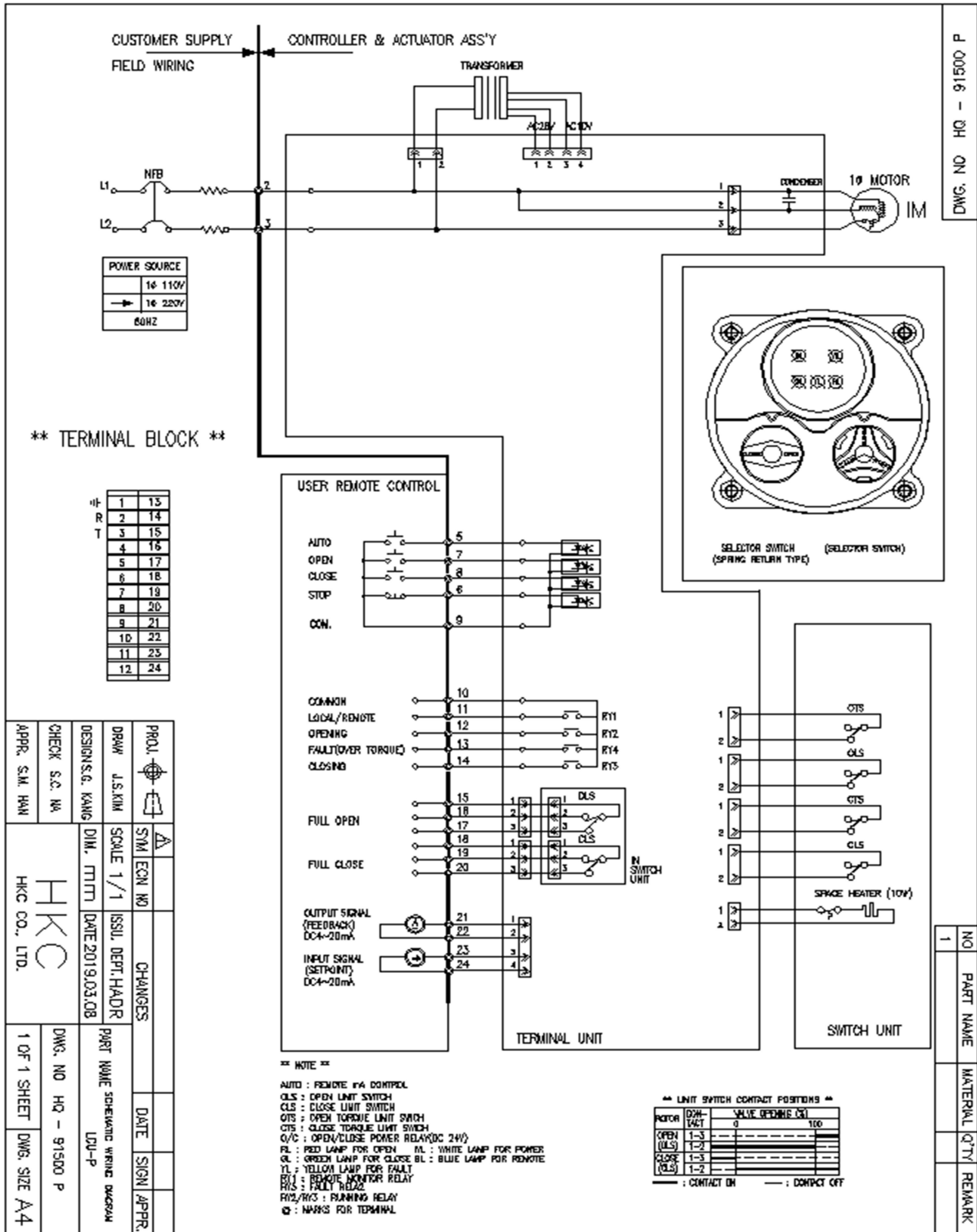
## 8.2 Error display

No	Error type (Malfunction)	LED display			
		White	Green	Amber	Red
1	Mode switch	Off	Off	Off	On
2	Abnormal of local switch	Off	Off	On	Off
3	Remote switch	Off	Off	On	On
4	Abnormal of limit switch	Off	On	Off	Off
5	Torque trip	Off	On	Off	On
6	Missing a phase of power	Off	On	On	Off
7	Abnormal of EEPROM	Off	On	On	On
8	Abnormal of initial set point	On	Off	Off	Off
9	Abnormal of initial auto setting	On	Off	Off	On
10	Lose of set point	On	Off	On	Off
11	Reverse turn the motor	On	Off	On	On
12	Abnormal of set point selection	On	On	Off	Off
13	Abnormal of potentiometer	On	On	Off	On
14	Abnormal of opening	On	On	On	Off
15	Abnormal of closing	On	On	On	On

## 9. LCU-P operating

Actuator position	Fully close	Fully open
Input signal	4mA dc, 0V dc, 1V dc, 2V dc	20mA dc, 5V dc, 10V dc
Output signal	4mA dc, 0V dc, 1V dc, 2V dc	20mA dc, 5V dc, 10V dc
Signal LED	Green LED - On	Red LED - On
Auto setting	Blue LED Flicker	
Fault	Amber LED Flicker	

## 10. LCU-P wiring diagram


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