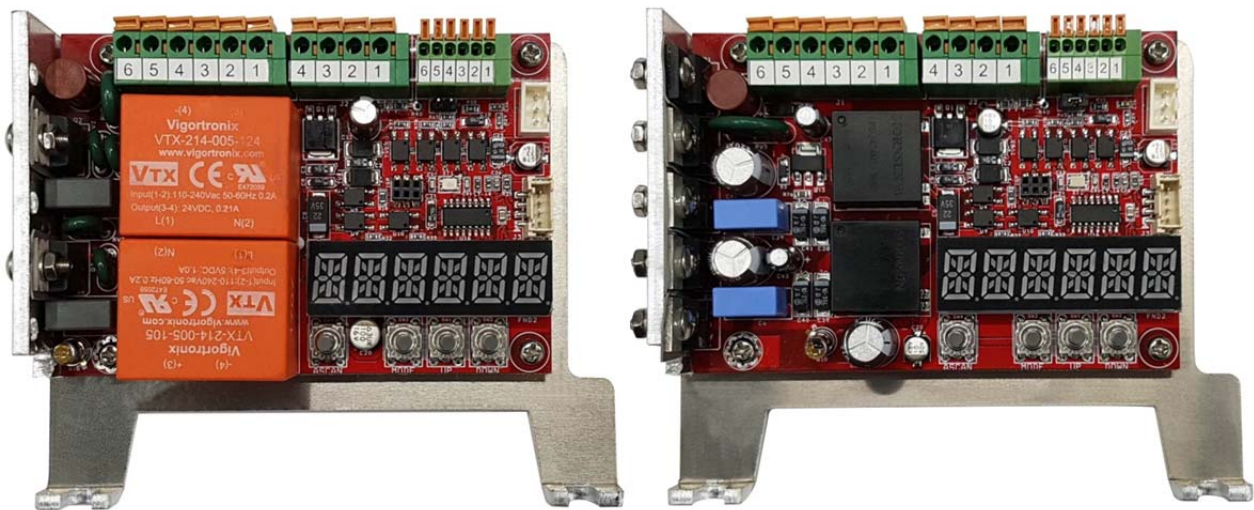


Proportional Control Unit (PCUC -AC, -DC)

Installation, Operation & Maintenance Manual



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1. Check point before using the actuator

- 1.1 Make sure that the actuator specification (model number, main power, control power, options, and etc.) is in conformity with the order specification.
- 1.2 Check that the size, pressure rating, etc. of the valve match the order specification.
- 1.3 Check that the actuator and the valve are assembled securely.
- 1.4 Check the status of the limit switches, stopper bolts, and indicator setting of the actuator.
- 1.5 Make sure to check the electrical specifications (power, input/output signal, wiring status according to the wiring diagram, and etc.)
- 1.6 Do not arbitrarily modify, alter or repair the wirings of the actuator.
- 1.7 Before shipped from the factory, the settings of Dead band and Dead time are pre-adjusted. If the user has arbitrarily adjusted the position of the limit switches or the potentiometer, press the ASCAN button (Auto Scan) of the Proportional Control Unit (PCU) once to set the current status.
- 1.8 Please do not disassemble, assemble, or modify the actuator without any technical support or explanation from our company. 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.

2. Standard Specification

Table 1: Standard specification of the Proportional Control Unit

Model	Ac model: PCUC-AC V1.0, Dc model: PCUC-DC V1.0
Power	Ac model: 110/220V ac, $\pm 10\%$, 50/60Hz, max. 4W Dc model: 12/24V dc, max. 4W
Input signal	4 - 20mA dc, 1 - 5V dc, 2 - 10V dc 0 - 20mA dc, 0 - 5V dc, 0 - 10V dc Input signal resistance: 250 Ω , Position Resistance: 100 - 10k Ω
Output signal	4 - 20mA dc, 1 - 5V dc, 2 - 10V dc 0 - 20mA dc, 0 - 5V dc, 0 - 10V dc
Load Resistance	500 Ω max.
Deadtime	0.2 - 25.0s (can be set in 0.1s increments)
Deadband	0.3 - 10.0% (can be set in 0.1% increments)
Fail safe	Fail stop, fail close, fail open
Position conversion accuracy	$\pm (0.2 \text{ to } 5)\%$ (may vary depending on conditions)
Ambient temperature	-20 $^{\circ}\text{C}$ to 80 $^{\circ}\text{C}$
Ambient humidity	90% RH max. (non-condensing condition)
Dielectric strength	1500V ac, 1 minute
Insulation resistance	500V dc, 50M Ω or more
Vibration and shock	X, Y, Z axis 10g (based on 6g RMF) Frequency: 0.2 - 34Hz, Time: within 30 minutes
Alphanumeric display	6 characters

3. Introduction

The Proportional Control Unit (PCU) is the local actuator controller that operates the open and close functions in accordance with an analogue setpoint from the main controller to control temperature, humidity, pressure, rate of fluid flow, and etc. inside pipelines. The PCU then outputs the current position as an analogue feedback signal to the main controller.

On the PCU there are 5 modes: Proportional Control mode, Setup mode, Manual mode, A-Scan mode, and Error mode. Each mode will be explained in details on following sections.

4. Proportional Control Mode

Proportional Control mode is the default mode that operates the actuator in accordance with a setpoint which satisfies the deadband and deadtime set in Setup mode. The table below shows different types of message showed on the fourteen segment alphanumeric display when the PCU is in Proportional Control mode.

Table 2: Display messages in Proportional Control mode

Display	Description
OPEN	Actuator is in operation to the open limit
CLOSE	Actuator is in operation to the close limit
STOP	Actuator is in the desired position and stopped
OPNL _m T	The open limit switch is ON
CLSL _m T	The close limit switch is ON
OPNT _o Q	The open torque switch is ON
CLST _o Q	The close torque switch is ON

If an error occurs during operation, Proportional Control mode is automatically switched to Error mode and the display will show an error message. The table below shows how the user can enter different types of mode using the buttons on the PCU.

Table 3: How to enter different types of mode

Mode	Display	Description
Setup mode	SET-UP	Press and hold MODE button for 3 or more seconds
Manual mode	MANUAL	Press and hold UP and DOWN buttons for 1 or more second
A-Scan mode	A-SCAN	Press ASCAN button once
Error mode	See section 8. Error Mode	Automatically executed when an error occurs

5. Setup Mode **SET-UP**

Setup mode helps the user to create initial configurations of the PCU. It is recommended to stop the actuator before starting Setup mode. However, Setup mode can be initiated while the actuator is in operation; the actuator will stop ongoing operation until Setup mode is terminated.

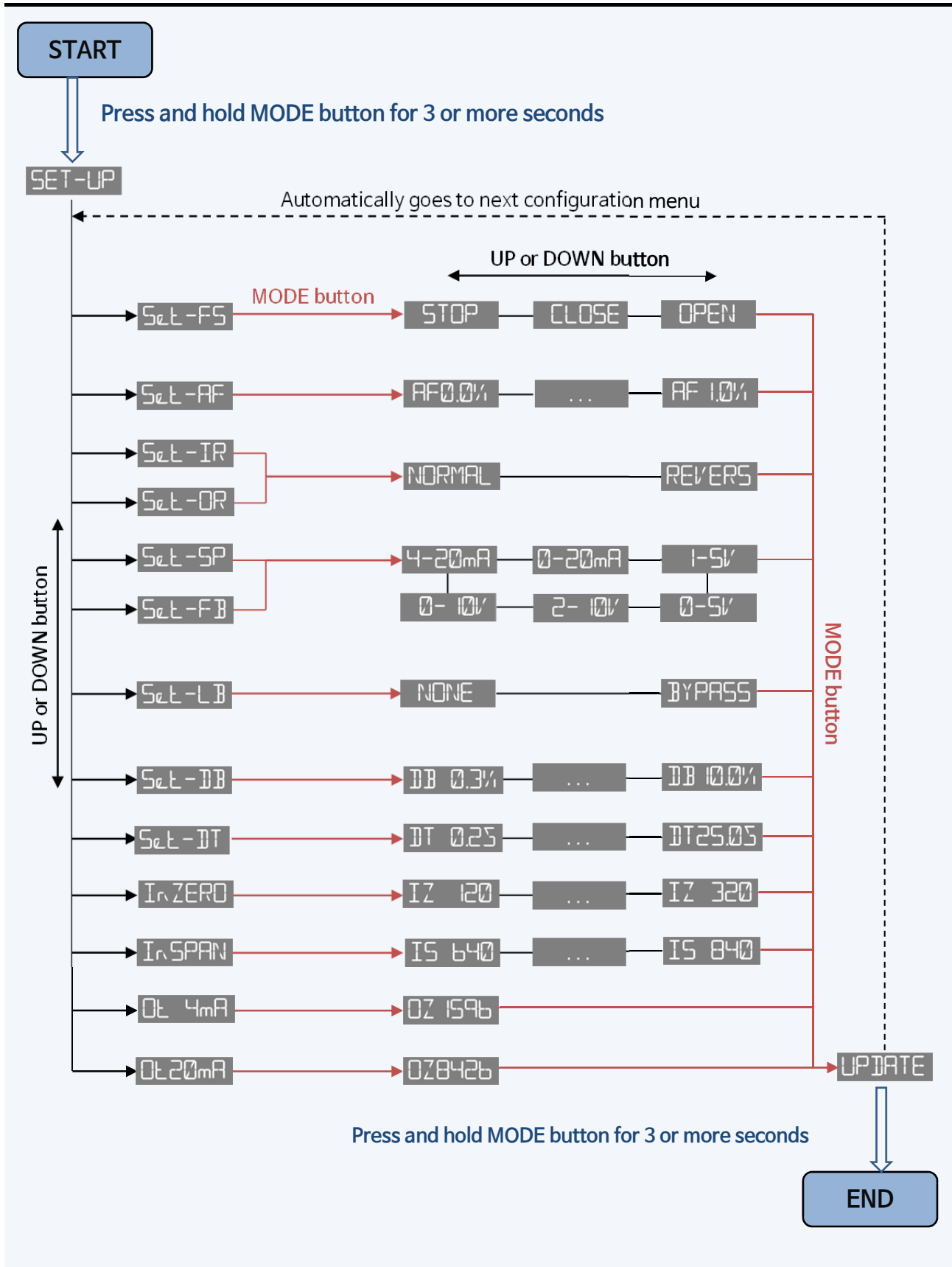
- ① To initiate Setup mode press and hold MODE button for 3 or more seconds. Then the alphanumeric display will show **SET-UP** for a short time and will show **Set-FS**.
- ② Press UP or DOWN buttons to navigate through the configuration setting menus in Setup mode.
- ③ Press MODE button once to enter configuration. The display will show the current setting value. Press UP or DOWN buttons to select a desired setting value.
- ④ Press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑤ To terminate Setup mode press and hold MODE button for 3 or more seconds.

The table and figure below shows the overview of Setup mode.

Table 4: Setup mode overview

Configuration menu	Display	Setting value	Default setting value
Fail Safe	Set-FS	<ul style="list-style-type: none"> ● Fail stop (stay put) – default ● Fail close (fully close) ● Fail open (fully open) 	Fail stop
Auto Full Action	Set-AF	<ul style="list-style-type: none"> ● 0 - 10% (1% increments) 	2%
Reverse Input	Set-IR	<ul style="list-style-type: none"> ● Normal ● Reverse 	Normal
Reverse Output	Set-OR	<ul style="list-style-type: none"> ● Normal ● Reverse 	Normal
Setpoint Type	Set-SP	<ul style="list-style-type: none"> <li style="width: 50%;">● 4 - 20mA <li style="width: 50%;">● 0 - 20mA <li style="width: 50%;">● 1 - 5V <li style="width: 50%;">● 0 - 5V <li style="width: 50%;">● 2 - 10V <li style="width: 50%;">● 0 - 10V 	4 - 20mA
Feedback Signal Type	Set-FB	<ul style="list-style-type: none"> <li style="width: 50%;">● 4 - 20mA <li style="width: 50%;">● 0 - 20mA <li style="width: 50%;">● 1 - 5V <li style="width: 50%;">● 0 - 5V <li style="width: 50%;">● 2 - 10V <li style="width: 50%;">● 0 - 10V 	4 - 20mA
Close Limit Switch Bypass	Set-LB	<ul style="list-style-type: none"> ● None ● Bypass 	None
Deadband	Set-DB	<ul style="list-style-type: none"> ● 0.3 - 10.0% (0.1% increments) 	1.0%
Deadtime	Set-DT	<ul style="list-style-type: none"> ● 0.2 - 25.0s (0.1s increments) 	1.0s
Input Zero Signal	IrZERO	<ul style="list-style-type: none"> ● 3 - 8mA (0.1% increments) 	4mA
Input Span Signal	IrSPAN	<ul style="list-style-type: none"> ● 16 - 21mA (0.1% increments) 	20mA
Zero Feedback Calibration	0L 4mA		
Span Feedback Calibration	0L 20mA		




Figure 1: Setup mode flowchart





5.1 Fail Safe

If there is no setpoint or an incorrect signal has input, the PCU detects an error and automatically performs either fail stop, fail open, or fail close operation according to the setting value.

Table 5: Fail Safe configuration

Setting Value	Display	Description
Fail stop		Actuator remains in its current position
Fail close		Actuator operates to the position set as the close limit
Fail open		Actuator operates to the position set as the open limit












- ① Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ② The display will show . Press MODE button once to enter Fail Safe configuration setting. The display will show the current setting value.
- ③ Press UP or DOWN buttons to select desired setting value and press MODE button once to save. The display will show  for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ④ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ Default: Fail stop

5.2 A_Full (Auto Full Action)

Because setpoint is an analogue value and analogue signals are affected by unwanted noise, the PCU may not receive the exact value sent by the main controller, causing the valves to not close tightly. Using Auto Full Action can prevent this problem by increasing zero and decreasing span. The setting value of this configuration is in the percentage of setpoint range. For example, when zero is set to 4mA and span to 20mA, the setting value of 2% will increase zero to 4.32mA and decrease span to 19.68mA.

Table 6: Auto Full Action configuration

Setting Value	Display	Description
0%		Zero: 4.00mA Span: 20.00mA
1%		Zero: 4.16mA Span: 19.84mA
2%		Zero: 4.32mA Span: 19.68mA
3%		Zero: 4.48mA Span: 19.52mA
4%		Zero: 4.64mA Span: 19.36mA
5%		Zero: 4.80mA Span: 19.20mA
6%		Zero: 4.96mA Span: 19.04mA
7%		Zero: 5.12mA Span: 18.88mA
8%		Zero: 5.28mA Span: 18.72mA
9%		Zero: 5.44mA Span: 18.56mA
10%		Zero: 5.60mA Span: 18.40mA

- ① Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ② Press UP or DOWN buttons until the display shows **Set-FF**.
- ③ Press MODE button once to enter Auto Full Action configuration setting. The display will show the current setting value.
- ④ Press UP or DOWN buttons to select desired setting value and press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑤ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ Default: 2.0%

5.3 Input Reverse **Set-IR**

By default, the actuator operates to the close limit at zero and to the open limit at span. Input Reverse configuration inverts setpoint so that the actuator operates to the close limit at span and to the open limit at zero.

Table 7: Input Reverse configuration

Setting Value	Alphanumeric display	Description
Normal	NORMAL	Fully closed at zero and fully open at span
Reverse	REVERS	Fully open at zero and fully closed at zero

- ① Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ② Press UP or DOWN buttons until the display shows **Set-IR**.
- ③ Press MODE button once to enter Input Reverse configuration setting. The display will show the current setting value.
- ④ Press UP or DOWN buttons to select desired setting value and press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑤ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ Default: Normal

5.4 Output Reverse **Set-OR**

By default, the actuator transmits zero (4mA) feedback signal when fully closed and span (20mA) feedback signal when fully open. Output Reverse configuration inverts the feedback signal so that the actuator outputs span (20mA) when fully closed and outputs zero (4mA) when fully open.

Table 8: Output Reverse configuration

Setting Value	Display	Description
Normal	NORMAL	Outputs zero (4mA) at close limit and span (20mA) at open limit
Reverse	REVERS	Outputs span (20mA) at open limit and zero (4mA) at close limit

- ① Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ② Press UP or DOWN buttons until the display shows **Set-OR**.
- ③ Press MODE button once to enter Output Reverse configuration setting. The display will show the current setting value.

- ④ Press UP or DOWN buttons to select desired setting value and press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑤ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ Default: Normal

5.5 Setpoint Type **Set-SP**

Depending on the electrical instrumentation environment, different types of setpoint can be configured.

Table 9: Setpoint Type configuration

Setting Value	Display
4 - 20mA	4-20mA
0 - 20mA	0-20mA
1 - 5V	1-5V
0 - 5V	0-5V
2 - 10V	2-10V
0 - 10V	0-10V

- ① Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ② Press UP or DOWN buttons until the display shows **Set-SP**.
- ③ Press MODE button once to enter Setpoint Type configuration setting. The display will show the current setting value.
- ④ Press UP or DOWN buttons to select desired setting value and press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑤ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ Default: 4 - 20mA

5.6 Feedback Signal Type **Set-FB**

Depending on the electrical instrumentation environment, different types of feedback signal can be configured.

Table 10: Feedback Signal Type configuration

Setting Value	Display
4 - 20mA	4-20mA
0 - 20mA	0-20mA
1 - 5V	1-5V
0 - 5V	0-5V
2 - 10V	2-10V
0 - 10V	0-10V

- ① Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ② Press UP or DOWN buttons until the display shows **Set-FB**.

- ③ Press MODE button once to enter Feedback Signal Type configuration setting. The display will show the current setting value.
- ④ Press UP or DOWN buttons to select desired setting value and press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑤ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ **Default: 4 - 20mA**

5.7 Close Limit Switch Bypass **Set-LB**

Depending on the application of actuator, the close limit switch can be disregarded and the state of fully closed can be determined solely by the close torque/force switch.

Table 11: Close Limit Switch Bypass configuration

Setting Value	Display	Description
NONE	NONE	Actuator stops when close limit switch is ON (fully closed)
BYPASS	BYPASS	Actuator disregards close limit switch and stops when close torque limit switch is ON

- ① Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ② Press UP or DOWN buttons until the display shows **Set-LB**.
- ③ Press MODE button once to enter Close Limit Switch Bypass configuration setting. The display will show the current setting value.
- ④ Press UP or DOWN buttons to select desired setting value and press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑤ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ **Default: NONE**

※ Note: For linear operating valve applications, it is recommended to bypass close limit switch.

※ Note: For safety purposes, the PCU is programmed so that if torque switches are not connected then the setting value of Close Limit Switch Bypass is set to None regardless of the user's input setting.

5.8 Deadband **Set-DB**

Deadband configuration sets a range or band which a setpoint can vary without initiating the response of actuator to prevent actuator from hunting. The setting value of Deadband configuration is the percentage of the setpoint range. For example, if the main controller sends 12mA setpoint value (setpoint type: 4 - 20mA) and Deadband configuration is set to 1.0% then the range of allowable setpoint values are from 11.84 to 12.16mA. Therefore the user needs to choose a compromise between stable operation and position resolution; higher the deadband, less chance of actuator hunting but loses the position resolution.

Table 12: Deadband configuration

Setting Value	Display
0.3 - 10.0 % (0.1% increments)	DB 0.3% ... DB 10.0%

- ① Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ② Press UP or DOWN buttons until the display shows **SET-DB**.
- ③ Press MODE button once to enter Deadband configuration setting. The display will show the current setting value.
- ④ Press UP or DOWN buttons to select desired setting value (hold for continuous increments) and press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑤ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ **Default: 1.0%**

※ **Caution:** Continuous hunting can cause faults on actuator components such as motor, potentiometer, the PCU and etc.

5.9 Deadtime **SET-DT**

Deadtime configuration sets the minimum time (delay) for the setpoint, which lies within Deadband configuration, to be maintained and to be recognized before operating the actuator for the purpose of securing the reliability of the setpoint; deadtime prevents malfunctions of actuator from unwanted noise (e.g. a glitch) in the setpoint.

Table 13: Deadtime configuration

Setting Value	Display
0.2 - 25.0s (0.1s increments)	DT 0.25 ... DT25.0S

- ① Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ② Press UP or DOWN buttons until the display shows **SET-DT**.
- ③ Press MODE button once to enter Deadtime configuration setting. The display will show the current setting value.
- ④ Press UP or DOWN buttons to select desired setting value (hold for continuous increments) and press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑤ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ **Default: 1.0s**

5.10 Input Zero Signal **IN ZERO**

Input Zero Signal configuration allows the user to set the zero setpoint value to the PCU to operate the actuator to fully close.

Table 14: Input Zero configuration

Setting Value	Display
3 - 8mA	IZ 120 ... IZ 320

- ① Input the desired zero setpoint to the input terminal: J2 no.3 (-) & no.4 (+); see Section 13. PCU Layout.
- ② Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ③ Press UP or DOWN buttons until the display shows **IZ ZERO**.
- ④ Press MODE button once to enter Input Zero Signal configuration setting. The display will show the previous setting value for 1 second and then show the current A/D converted value: 120 ± 5% (3mA) to 320 ± 5% (8mA) **IZ 120 ... IZ 320**.
- ⑤ To exit Input Zero Signal configuration without saving the current setting value, press either UP or DOWN button once.
- ⑥ Press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑦ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ Default: 4mA

5.11 Input Span Signal **IZ SPAN**

Input Span Signal configuration allows the user to set the span setpoint value to the PCU to operate actuator to fully open.

Table 15: Input Span Signal configuration



Setting Value	Display
16 - 21mA	IS 640 ... IS 840

- ① Input the desired span setpoint signal to the input terminal: J2 no.3 (-) & no.4 (+); see Section 13 PCU Layout.
- ② Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ③ Press UP or DOWN buttons until the display shows **IZ SPAN**.
- ④ Press MODE button once to enter Input Span Signal configuration setting. The display will show the previous setting value for 1 second and then show the current A/D converted value: 640 ± 5% (16mA) to 840 ± 5% (21mA) **IS 640 ... IS 840**.
- ⑤ To exit Input Span Signal configuration without saving the current setting value, press either UP or DOWN button once.
- ⑥ Press MODE button once to save. The display will show **UPDATE** for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑦ Press and hold MODE button for 3 or more seconds to terminate Setup mode.

※ Default: 20mA



5.12 Zero Feedback Calibration

Zero Feedback Calibration setting allows user to calibrate zero of the feedback signal transmitted by the PCU (typically 4mA).

- ① Connect a digital multimeter to the output terminal: J2 no.1 (-) & no.2 (+); see Section 13 PCU Card.
- ② Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ③ Press UP or DOWN buttons until the display shows .
- ④ Press MODE button once to enter Zero Feedback Calibration configuration setting. The display will show the current setting value.
- ⑤ Monitoring the value showed on the digital multimeter, press UP or DOWN buttons to adjust zero of the feedback signal until it reaches the desired value (typically 4mA).
- ⑥ The display will show  for a short time, if there is a change in setting value, and will show the next configuration setting menu.
- ⑦ Press and hold MODE button for 3 or more seconds to terminate Setup mode.


5.13 Span Feedback Calibration

Span Feedback Calibration setting allows user to calibrate span of the feedback signal transmitted by the PCU (typically 20mA)

- ① Connect a digital multimeter to the output terminal: J2 no.1 (-) & no.2 (+); see Section 13 PCU Card.
- ② Press and hold MODE button for 3 or more seconds to enter Setup mode.
- ③ Press UP or DOWN buttons until the display shows .
- ④ Press MODE button once to enter Span Feedback Calibration configuration setting. The display will show the current setting value.
- ⑤ Monitoring the value showed on the digital multimeter, press UP or DOWN buttons to adjust span of the feedback signal until it reaches the desired value (typically 20mA).
- ⑥ The display will show  for a short time, if there is a change in setting value, and will show the next configuration setting menu.

6. Manual Mode

Manual mode allows users to operate the actuator manually on the PCU.

- ① To initiate Manual mode, press and hold UP and DOWN buttons simultaneously for more than 1 second.
- ② The display will alternatively show  and the actuator's state (see section 4. Proportional Control Mode).
- ③ Press and hold UP button to operate the actuator to the open limit and DOWN button to operate the actuator to the close limit.
- ④ If the actuator is not operated for more than 10 seconds, the PCU automatically terminates Manual mode and executes Proportional Control mode. Alternatively, press either ASCAN or MODE button once.

7. A-SCAN Mode (Auto Setting Mode) **A-SCAN**

When the valve and actuator are assembled, calibration is needed to determine the stroke positions 0% and 100% of the valve. A-Scan mode automatically operates the actuator to do the calibration.

- ① Check that the actuator is correctly mounted to a valve and input signal, input power and wiring are correct.
- ② Press ASCAN button once to initiate A-Scan mode, regardless of actuator's current position.
- ③ The display will alternatively show **A-SCAN** and the actuator's state (see section 4. Proportional Control Mode).
- ④ The actuator will perform the following operations
 - a. The actuator will operate to the close limit until the close limit switch is ON
 - b. The actuator will operate to the open limit until the open limit switch is ON
 - c. The actuator will operate back to the close limit until the close limit switch is ON
- ⑤ Pressing UP, DOWN, or MODE button once will terminate A-Scan mode and Proportional Control mode will be executed. Also if an error, such as Motor Reverse, Limit Fault, or Torque Trip, occurs the PCU terminates A-Scan mode and enters Proportional Control mode.

8. Error Mode

Error mode is automatically executed when an error occurs and automatically terminates when the error has been resolved. While in error mode it is possible to enter Setup mode, Manual mode, and A-Scan mode (except Motor Reverse, Limit Fault, or Torque Trip). The table below shows the different types of error message and how to resolve them.

Table 16: Types of error messages

Error types	Display	How to resolve
EEPROM malfunction	EEPROM	Perform Auto setting (section 8. A-Scan)
Input signal initialization failure	NotInS	Set zero and span of the input signal by performing Input Zero Signal and Input Span Signal (section 5.10 and 5.11)
Auto setting initialization failure	NotASc	Perform Auto setting (Section 8. A-Scan)
Input signal failure	LoStSP	Check input signal and its wiring
Motor reverse	MoREVI	Check motor and potentiometer wiring
Input signal selection failure	ErrSIG	Check input signal and set its type by performing Input Signal Type (section 5.5)
Potentiometer failure	ErrPOT	Perform Auto setting (Section 8. A-Scan)
Open failure	OPNErr	Check motor and potentiometer wiring
Close failure	CLSErr	Check motor and potentiometer wiring
Limit switch failure	ErrLMT	Check limit switch wiring
Torque trip	TQTRIP	Torque overload: check if valve is jammed and reset torque switch

9. Tools Required

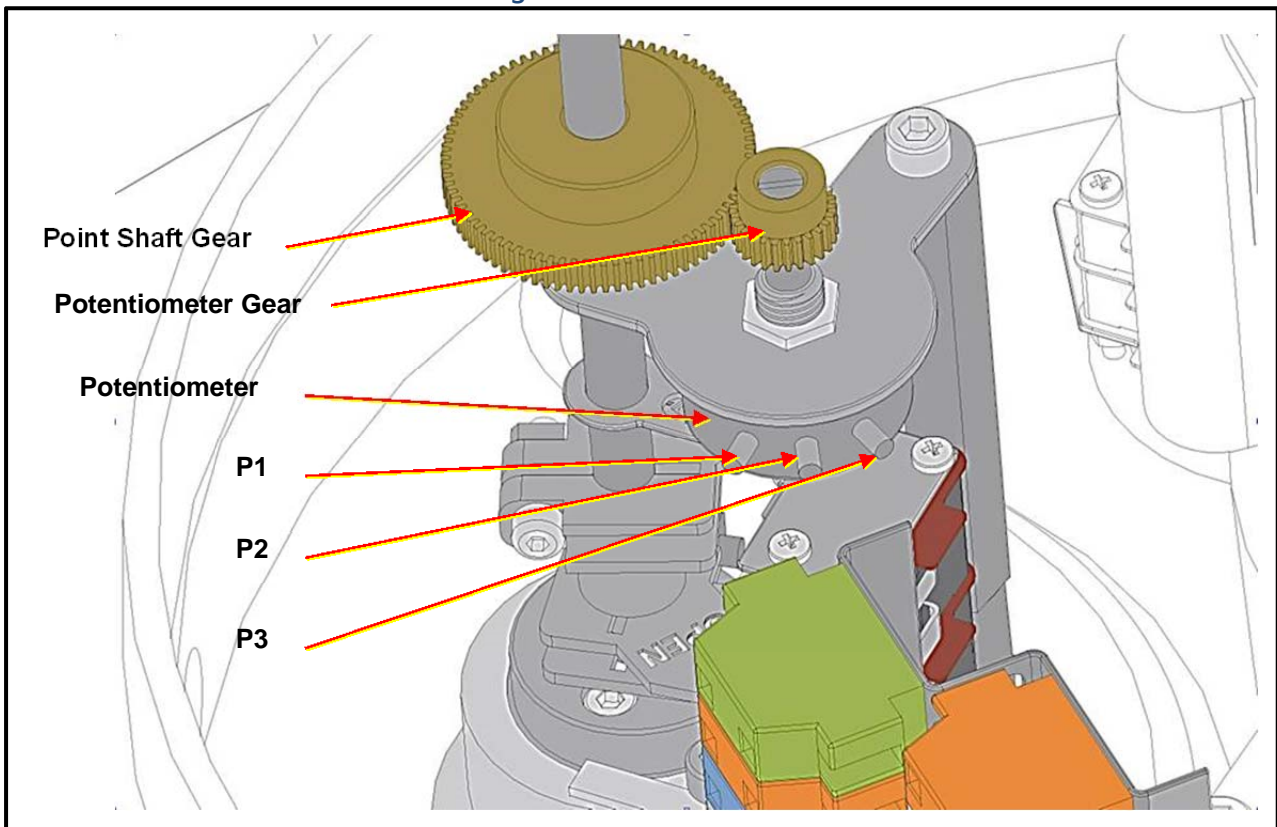
- ① L-Wrench 1 set (metric)
- ② Screw driver (-)
- ③ Monkey wrench 1 set
- ④ DC signal generator (0-24mA DC)
- ⑤ Digital multifunction calibrator
- ⑥ Digital multimeter

※ It is recommended to use highly recognized measuring equipment that can measure up to $1/10^6$.

10. Replacing and Setting Potentiometer

- ① Operate the actuator to the fully closed.
- ② Using a digital multimeter, measure the resistance of the potentiometer (P1 and P2). Turn the potentiometer until it reaches a resistance value of $100 \pm 20 \Omega$.
- ③ Engage the potentiometer gear into the point shaft gear and tighten the screw using an L-wrench.

Figure 2: Potentiometer

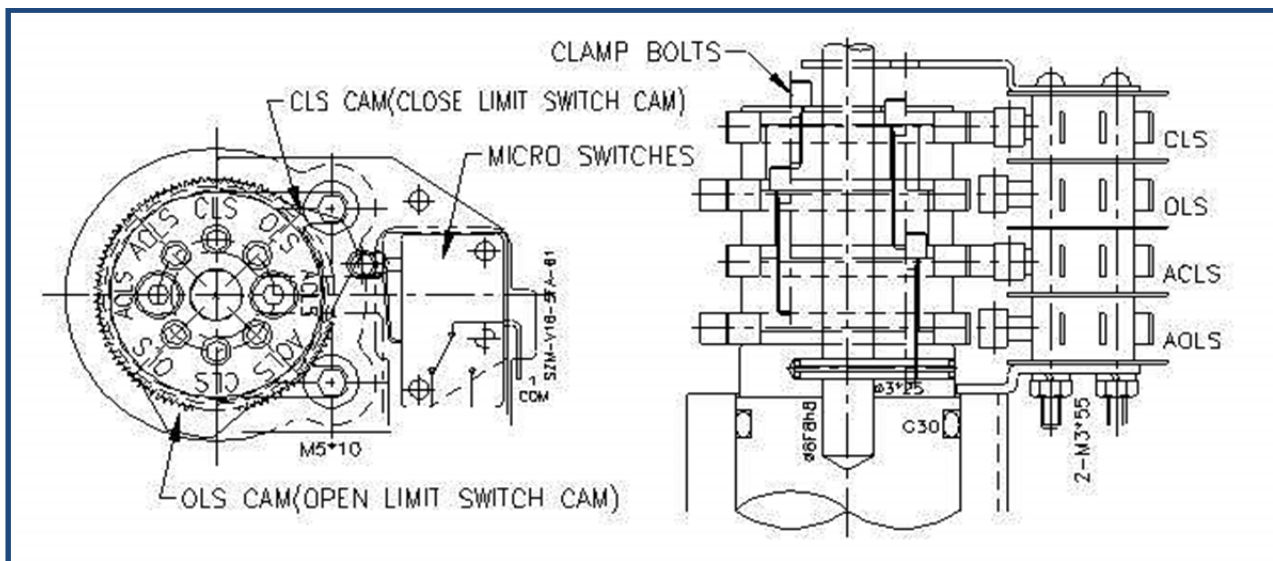


⚠ Danger: HAZARDOUS VOLTAGE. Make sure all power is disconnected before replacing or setting a potentiometer.

11. Limit Switch Setting

- ① Pull the actuator's lever and turn the handle clockwise until the valve is fully closed.
- ② Loosen the bolt tightening the Close Limit Switch (CLS) cam with an L-wrench and turn the CLS cam clockwise towards the lever of CLS until the switch 'clicks'.
- ③ Tighten the bolt.
Pull the actuator's lever and turn the handle counter-clockwise until the valve is fully open.
- ④ Loosen the bolt tightening the Open Limit Switch (OLS) cam with an L-wrench and turn the OLS cam counter-clockwise towards the lever of OLS until the switch 'clicks'.
- ⑤ Tighten the bolt.

Figure 3: Limit Switches



⚠ Danger: HAZARDOUS VOLTAGE. Make sure all power is disconnected before setting the limit switches

12. Maintenance and Inspections

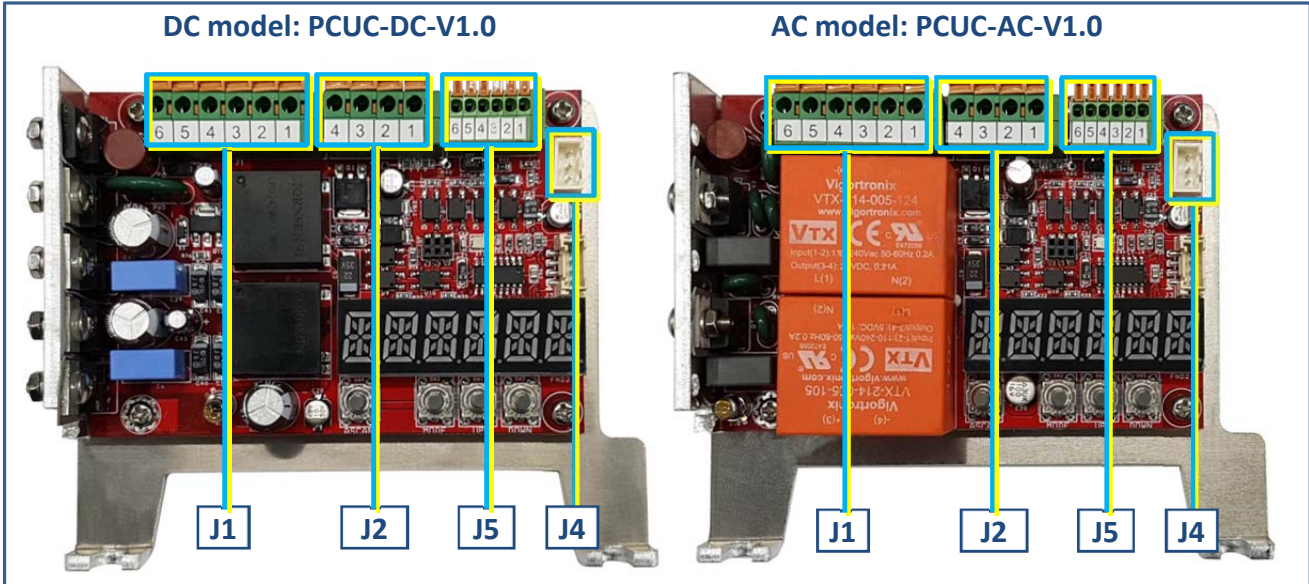
- ① **Lubricant**
Since EP type grease is fully supplied, there is no need to lubricate the lubricant during normal operation. But for those using in an extremely dry place with a humidity of 15% or less, or in a high temperature region with a temperature of 30 °C or more, apply an appropriate amount of EP type grease to the 2 grease nipples once every 2 years.
- ② **Routine test run**
Always supply the power and test run the actuator once a week even if the actuator usage cycle does not operate for a long time.
- ③ **Routine maintenance**
Periodic inspection and maintenance are necessary to use the actuator for a long time without any problem. Once a year, a comprehensive inspection, such as abnormal operating, corrosion, and etc., needs to be performed and the actuator needs to be repaired.
- ④ **Manual**
This manual focuses on the PCU. For descriptions of our actuators, please refer to the relevant actuator instruction and maintenance manual.

⑤ Others

Do not use a two-way radio or mobile phone within 1 meter of the actuator or control line as it may cause damage of malfunction of the unit. HKC is not responsible for any damaged caused by noise from the user.

If you have any problems or have any inquiries about the usage, please contact us.

13. PCU Layout



**Table 17: J1 power and motor
(6 pin, 15-24 AWG)**

Pin No.	Description(ac)	Description(dc)
1	Motor CW	Motor (+)
2	Motor CCW	Motor(-)
3	Motor COM	
4	Neutral L2	DC power 0V in
5	Live L1	DC power 12V or 24V in
6	Earth GND	Earth GND

**Table 18: J2 setpoint and feedback signal
(4 pin, 15-24 AWG)**

Pin No.	Description
1	4 - 20mA out (-)
2	4 - 20mA out (+)
3	4 - 20mA in (-)
4	4 - 20mA in (+)

Table 19: J5 switches (6 pin, 20-26 AWG)

Pin No.	Description
1	Close limit switch
2	Open limit switch
3	Limit switch COM
4	Close torque switch
5	Open torque switch
6	Torque switch COM

Table 20: J4 potentiometer (3 pin)

Pin No.	Description
1	P3
2	P2
3	P1

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