APL-4 Series Valve Position Monitor

Installation, Operation & Maintenance Manual

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Contents

1. General

1.1. HKC APL-4 series limit switch boxes are designed to provide accurate and reliable valve position signalling and indicating of most valves or actuators manufactured.

1.2. APL-4 limit switch boxes consist of a visual position indicator, quick-set cam ass'y, terminal strip, switch ass'y and easy mounting bracket. Quick-set cam allows for a quick and simple hand operation in the setting of switches.

2. Ordering Information

APL - 4 1 0 N
① ② ③

① **Enclosure type of explosion proof is based on IECEx :**
Ex d IIB T6 Gb
Enclosure type of explosion proof is based on ATEX :
II 2 G Ex d IIB T6 Gb
Enclosure type of explosion proof is based on KCs :
Ex d IIB T6 Gb
Enclosure type of explosion proof is based on CSA :
Cl I, Div 1, Gr C & D T6
Cl I, Zone 1, AEx d IIB T6
Ex d IIB T6

② **Switch type**
Mechanical switch
10 : 2-SPDT (Wonwoo : SZM-V16-5FA-61)
11 : 3-SPDT (Wonwoo : SZM-V16-5FA-61)
12 : 4-SPDT (Wonwoo : SZM-V16-5FA-61)
13 : 2-SPST (Wonwoo : SZM-V16-5FA)
14 : 2-DPDT (Omron : DZ-10GW-1B)
15 : 2-SPDT + Potentiometer (Wonwoo : SZM-V16-5FA-61)
16 : 2-SPDT + Signal Unit(4~20mA) (Wonwoo : SZM-V16-5FA-61)
Proximity switch
20 : Proximity sensor (P&F : NJ2-V3-N)
21 : Proximity sensor (Autonics : PS17-5DNU) (Except CSA)
22 : Proximity sensor (P&F : NJ4-12GM-N)
23 : Proximity sensor (P&F : NBB2-V3)
25 : Proximity sensor + Potentiometer (P&F : NJ2-V3-N)
26 : Proximity sensor + Signal Unit(4~20mA) (P&F : NJ2-V3-N)
30 : Reed type Proximity sensor (MS-B 301)

③ **Enclosure material**
N : Aluminium

3. Standard specification

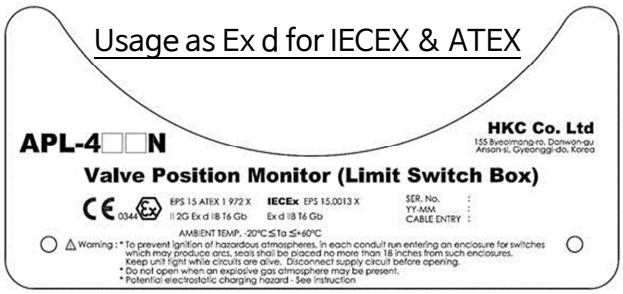
Model	APL-4**N
Enclosure Rating	Please refer to "2. Ordering Information, ① Enclosure type"
Enclosure	High grade aluminium alloy
Ambient Temperature	-20˚C ≤ Ta ≤ +60 ˚C
Cable Entries	Standard : Two NPT 3/4", or M25 for Ex type (Option for Non-Ex : NPT1/2", PT3/4", PT1./2", PF3/4", PF1/2", M20)
Travel Angle	90 degree +/- 10%
Position Indicator	Open : Yellow, Close : Red Language : English (option : French, German)
Mechanical Switch	SZM-V16-5FA-61 (Wonwoo Starion) 16A 1/2HP 125/250Vac, 0.6A 125Vdc, 0.3A 250Vdc, 5A 125Vac

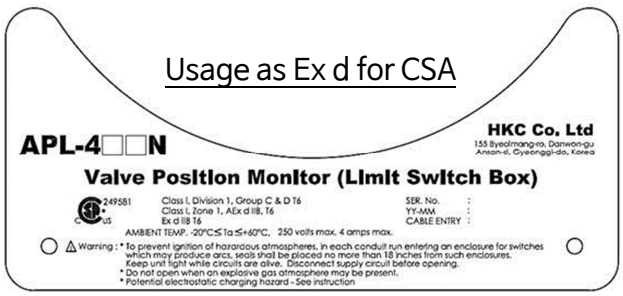
Proximity sensor	NJ2-V3-N (PEPPERL+FUCHS) : 5~25Vdc , 15mA max. PS17-5DNU(Autonics) : 12~24Vdc, 0.2mA max. MS-B 301 : 250Vdc 3.0A max.
Potentiometer	1kΩ (option : 0~5kΩ , 0~10kΩ)
Current Output Signal Unit	4~20mA, 20~4mA
Terminal Strip	8 point (option : 9~14P)
External Coating	Dry powder polyester coating

4. Preparing for Installation

4.1. Marking

- HKC logo / Trade mark
- Model
- Switches type
- Cert No.
- Applicable temp.
- Serial No.
- Manufactured YY-MM
- Cable entry size
- Warning letter
- Maker address





4.2. Pre-Installation for use in potentially explosive atmosphere

Installation, commissioning, maintenance, repairs and modification work must only be performed by qualified personnel with extensive knowledge on how to work on explosion-proof electrical equipment.

Warning : Read this installation and maintenance manual carefully and completely before attempting to install, operate, or troubleshoot the HKC product

4.2.1. Cable Connection

① Sealing devices must be used and shall be fitted directly at enclosure wall when using conduit.

② Cable glands shall be suitable for the environment and shall be certified as flameproof if used in Zone 1 application of IECEx scheme in order to connect outside electric wire.

③ Cable glands and conduit to be installed minimum 8 full threads and the length of thread is minimum 8mm.

④ **"Warning"** : Please be sure that user should select the appropriate cable glands and minimum 2SQ of wire for fear that the proper using temperature of cable entry and wire way exceed 70 ℃ or the blanching point is over 80 ℃.

⑤ When cable entries or conduit entries are not used, user or installer shall close by certified blanking elements(stopping plugs) so that the flameproof properties of the enclosure are maintained.

4.2.2. Groundings

① Always ground the enclosure in accordance with local electric codes. The most effective enclosure grounding method is a direct connection to earth ground with minimal impedance. Methods for grounding the enclosure include:
Internal ground connection : The internal ground is located inside the body .
External ground connection : The ground bracket is located on the side of body.
(Min 2SQ wire required)

4.2.3. Special Condition for safe use ("X" marking)

① Electrostatic discharge from window(over 1GΩ) may cause the ignition on the explosive gas atmosphere. By adapting the conducting window bolts make reduce the risk from electrostatic discharge.

② Before installation or maintenance products, shut off incoming power and grounding should be connected.

③ The window must only be cleaned with a damp cloth in order to avoid ignition hazard caused by static electricity.

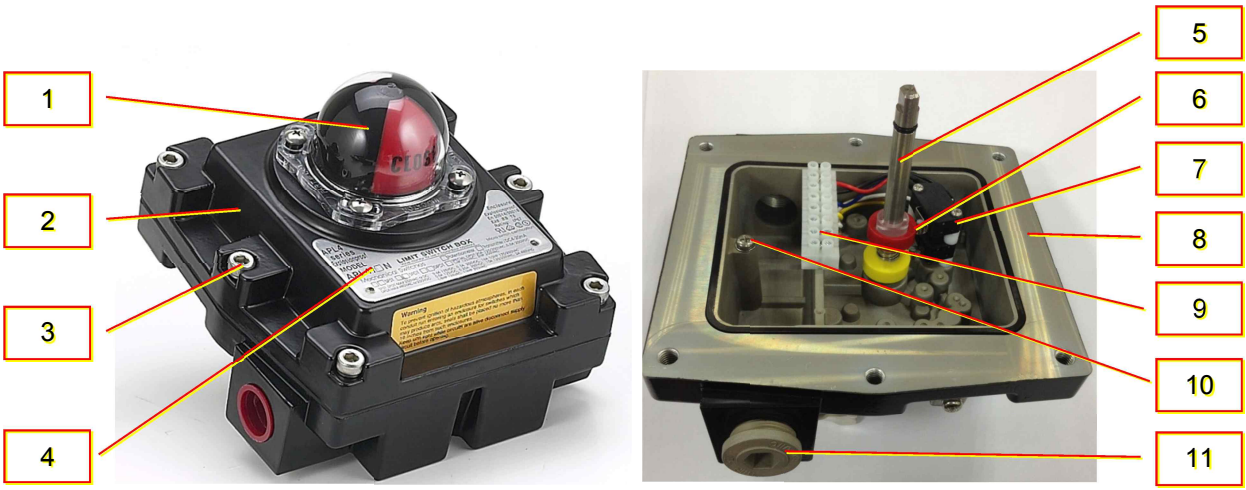
4.3. Initial inspection

When the user receipts the product, inspect the condition of the product and ensure the name plate comparing with order sheet.

4.3.1. Remove packing wrap or wooden box carefully. Inspect the product for any physical damage that may have occurred during shipment.

4.3.2. Check the product specification with product ordered. If a wrong product has been shipped, immediately notify our coordinator.

5. Standard Features



No.	Part Name	Q'ty	Description
1	Window / Indicator	1	PC / ABS
2	Cover	1	Aluminium Die casting (ADC12)
3	Captive cover bolt	4	Stainless steel
4	Name plate	1	Stainless steel (A240 T304)
5	Shaft	1	Stainless steel (G4303 SUS303)
6	Cam	2	PC
7	Switch	2	Refer to the clause "2. Ordering Information-② Switch type"
8	Body	1	Aluminium Die casting (ADC12)
9	Terminal strip	1	8P (9~14P available)
10	Earth lug	2	Stainless steel
11	Blanking element	2	PC

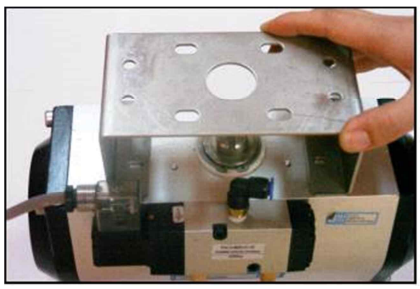
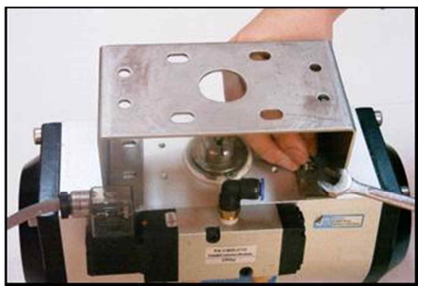
6. Installation

6.1. Mounting bracket

Caution : Where limit switch box or one of parts are to be moved, installed, disassembled, reassembled by a hand, care must not be taken to cause injury by the harmful sharp edges of corners or rough surfaces or residual electricity.

6.1.1. HKC shall supply a NAMUR VDI/VDE standards' bracket and a fixing stuff for mounting on actuator. Brackets are able to applied any type of valves; manual valve, linear valve, pneumatic rotary valve.

① Insure valve actuator alignment (fully open or closed).
② Place the mounting bracket on a horizontal plane of actuator
③ Tighten the bolts enclosed in a box using a proper tool.

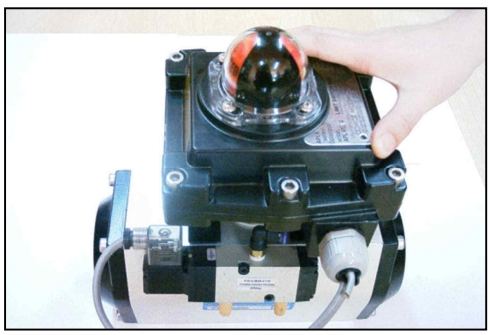
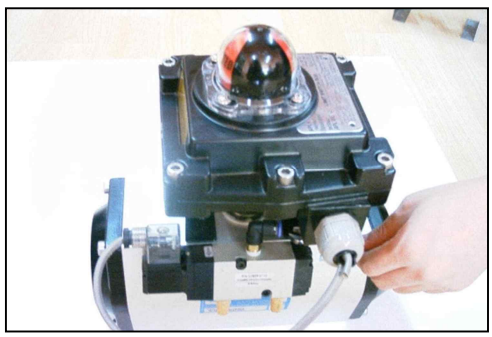



6.2. Mounting limit switch box

Caution ;
Do not attempt to work on limit switch box without first shutting off incoming power

6.2.1. Prior to mounting the limit switch box must be checked for any damage.
6.2.2. Damaged parts must be replaced by original spare parts.
6.2.3. Limit switch boxes are available with a NAMUR shaft that enables direct attachment to actuator pinion without a coupler. These shafts feature a 4mm wide tang that engages the 4mm slot in NAMUR actuators.

① Check to be sure the drive slot on the top of the actuator and the shaft of switch box are the same direction.
② Insert the shaft of switch box carefully into the mounting bracket.
③ Tighten the bolts enclosed in a box using a proper tool.
④ Check the connection of shaft being assembled correctly.

6.3. Cam setting

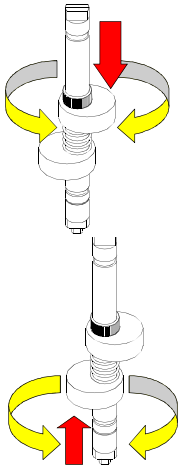
Note :

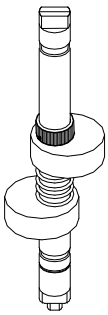
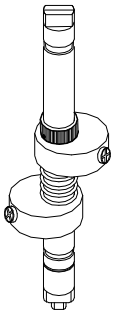
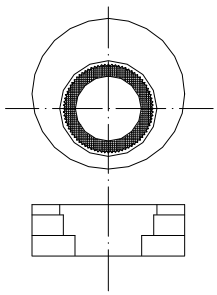
Basically, cams shall be set by manufacturer before shipment.

6.3.1. The colour of cams harmonized with position indicator help us to set the cams easily without wiring diagram. Cams shall be easily set without tool. APL series cams are splined and can be setting lift up or push down the cam from gear by hand in a seconds without setting tools. Self-locking, spring loading make never slip out of adjustment.

6.3.2. Loose the captive cover bolts with an applicable tool. (L-Hex. Wrench recommended)
6.3.3. Turn the cover counter clockwise to open carefully.
6.3.4. Open cam setting
① Electric power or air supply of valve actuator on to operate the actuator fully open
② Lift the bottom yellow cam up and rotate it until the switch is activated.
③ And then release it. Cam shall be back into a stable position by itself.

6.3.5. Close cam setting
① Electric power or air supply of valve actuator off to operate the actuator fully close
② Push the upper cam down and rotate it until the switch is activated.
③ And then release it. Cam shall be back into a stable position by itself.



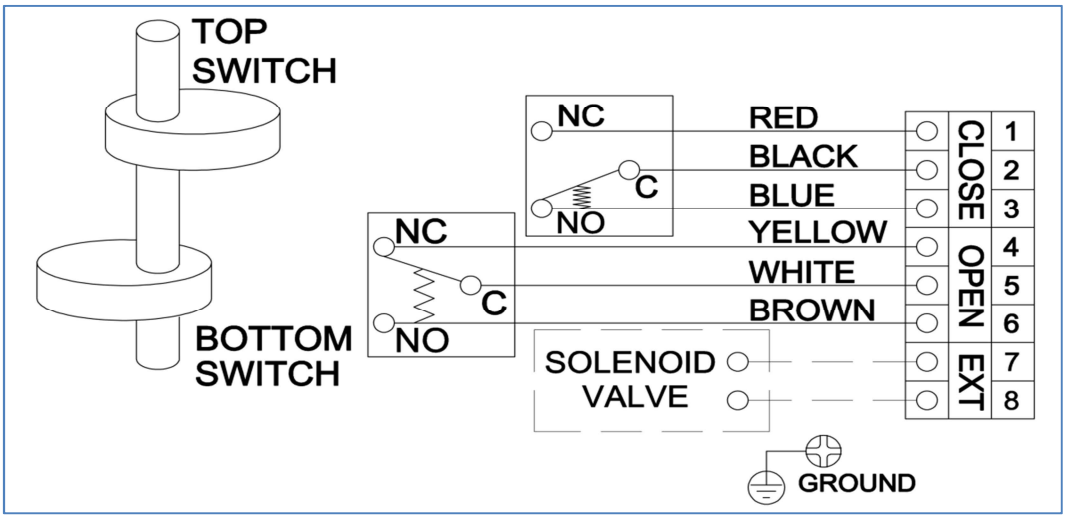
Mechanical switches	Proximity sensors	Splined cam
		

6.4. Wiring

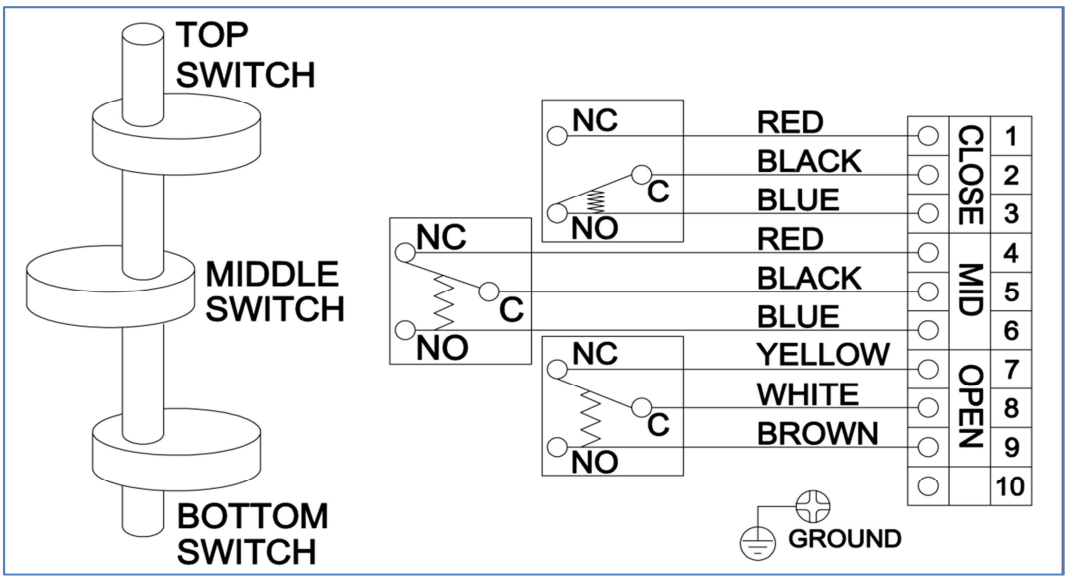
Danger : HAZARDOUS VOLTAGE. No electrical power should be connected until all wiring and limit switch adjustments have been completely.

6.4.1. Open circuit before removing cover, and seal required within 450mm (18 inch) of the enclosure by CSA.
6.4.2. APL limit switch box enclosure feature prewired switches. All user connections are made at a numbered terminal strip. A wiring diagram, located inside the cover, indicates which terminal numbers correspond to switch contacts, such as normally open (NO), normally closed (NC), etc. Follow the wiring diagram and electrical code to connect the switches to your system.
6.4.3. Solenoid valve may also can be wired through the APL enclosure. Two auxiliary terminals are included as standard.
6.4.4. APL limit switch box has two cable entries on the body and supply a blanking plug not a cable gland which meet the type of protection. Cable gland shall be applied by installer or user.

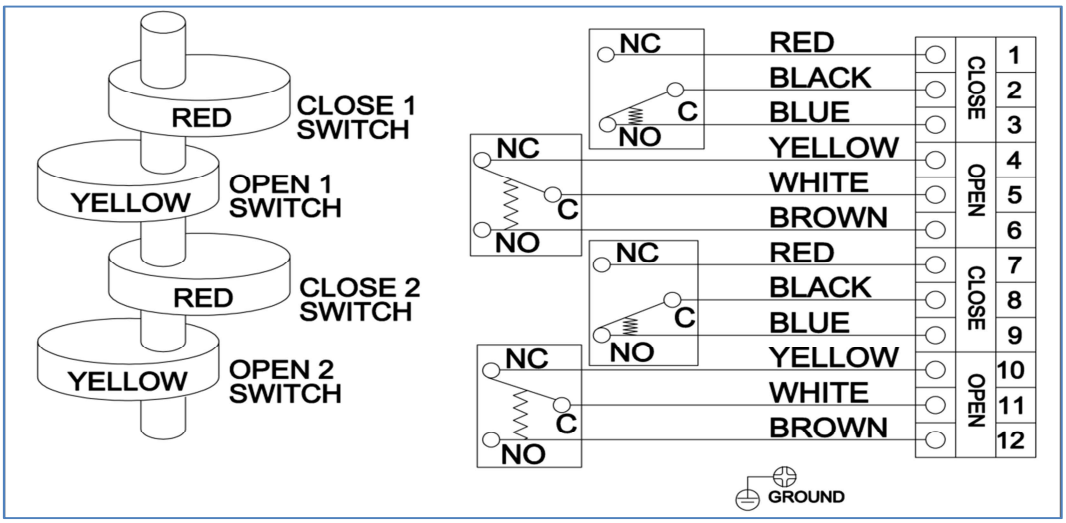
① Mechanical Switch (2 SPDT)



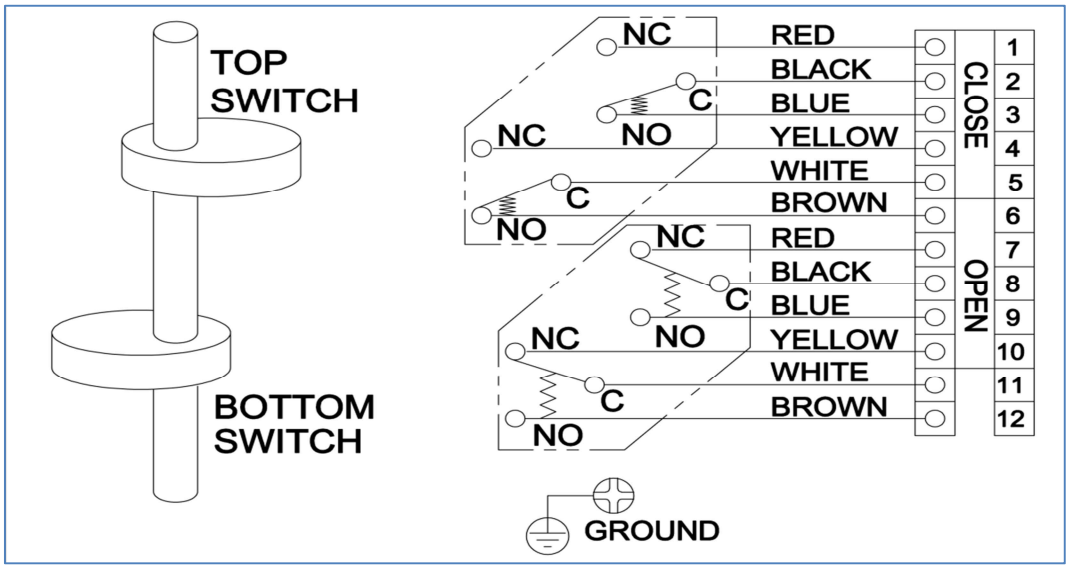
② Mechanical Switch (3 SPDT)



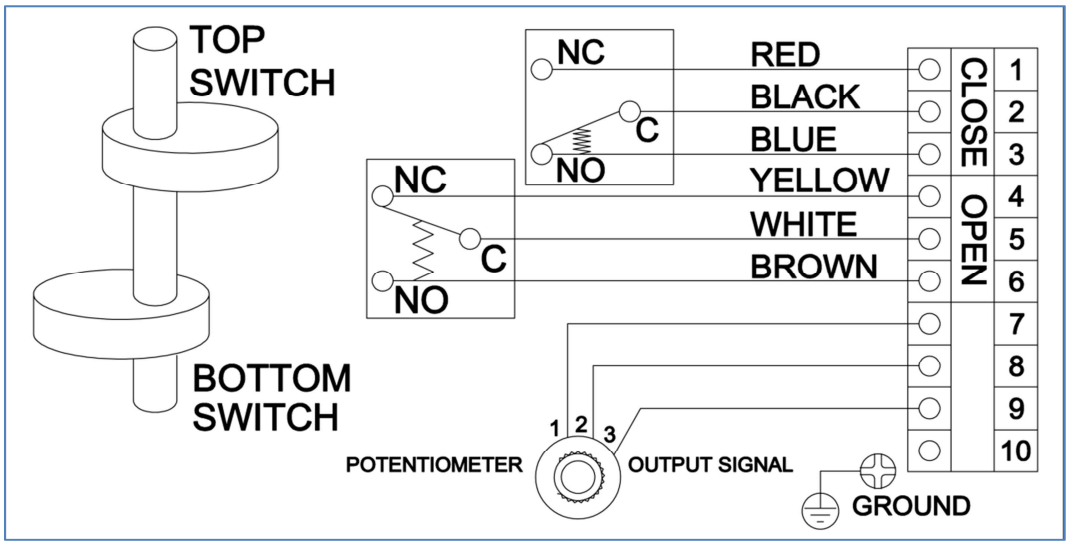
③ Mechanical Switch (4 SPDT)



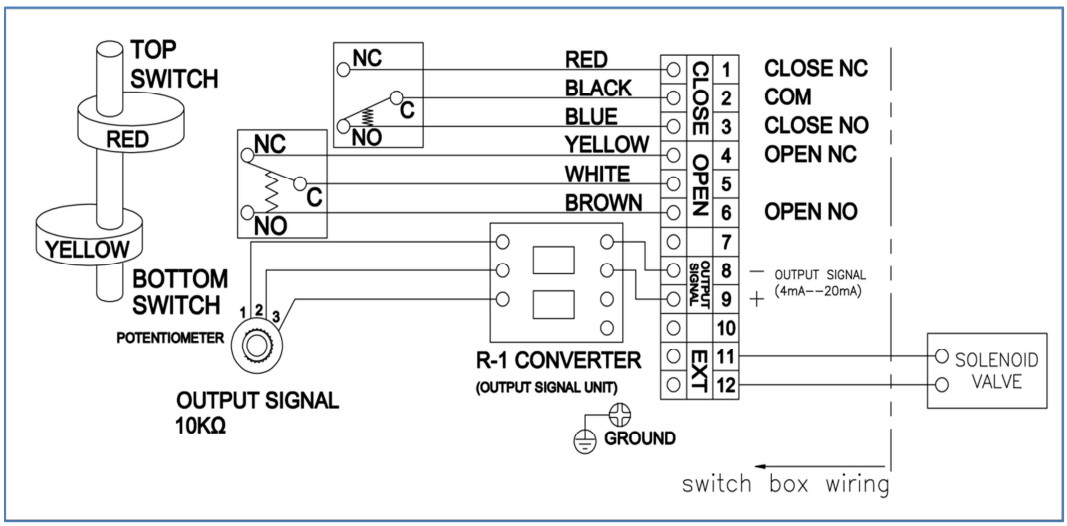
④ Mechanical Switch (2 DPDT)



⑤ Mechanical Switch (2 SPDT) with Potentiometer



⑥ Mechanical Switch (2 SPDT) with Signal Unit



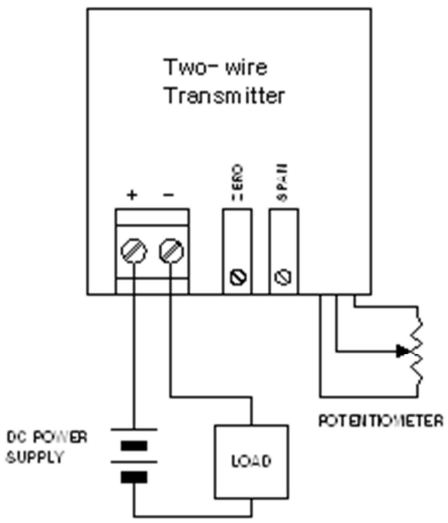
Note ;
Grounding should be connected until all wiring had been completely.
Internal/External grounding wire square shall be min. 2SQ recommended.

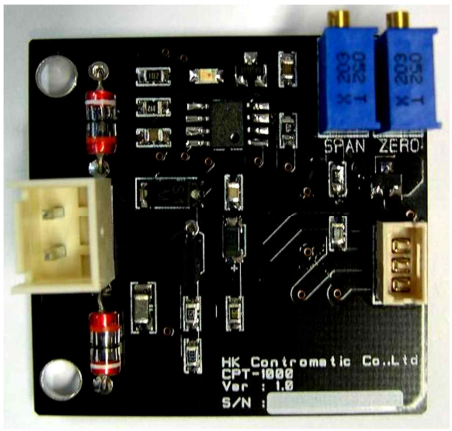
6.5. Setting Position Transmitter Unit (APL- 4*6)

6.5.1. Potentiometer reads the current position of actuator and transfers a resistance value to a current position transmitter card. Transmitter indicates the actuator position throughout the stroke by a 4~20mA output signal.

6.5.2. Technical Features

①	Power Supply Range	12.5 ~ 37VDC (24V typical)
②	Current Signal Output	4~20mA
③	Max. Load Resistance	Max. Resistance (ohm) = (Supply voltage - 12.5) / 0.02
④	Potentiometer	0~500 ohm / 10k ohm
⑤	Operating Temperature	-20 ~ 60 ℃
⑥	Dimension	40 * 60 * 15





6.5.3. Calibration Potentiometer

① Apply power or air to the actuator to operate fully closed position
② Connect an ohm meter to P1 and P3 resistances, the values shall be approximately 1kΩ.
③ Loosen the shaft gear and connect the ohm meter to P1 and P3 and gently rotate until 80 ~ 120 ohm is achieved (100ohm preferred). While maintaining the value, tighten a lock screw with a hex wrench.

6.5.4. Calibration Zero Span

Zero span setting has been calibrated by manufacturer. However if re-calibration is required

① Operate an actuator to 50% position and then fully closed position.
② When the actuator is in the fully closed position, adjust the "zero" button on the card until a value of 20mA is achieved.

7. Maintenance

Caution ;
- Shut off incoming power or air supply on the valve actuator before maintenance limit switch box.
- Be sure that the area is clean before disassemble and maintenance limit switch box. Clean all parts and housing before re-assemble.
- Refer to the part list when ordering replacement or spare parts.

7.1. Maintenance, under normal conditions at six month intervals or 10,000 cycle operation. But when conditions are more severe, more frequent inspections may be required.

7.1.1. Insure valve actuator alignment
7.1.2. Insure wiring is insulated, connected and terminated properly
7.1.3. Insure all screws are present and tight
7.1.4. Insure cleanliness of internal electrical devices

7.1.5. Insure conduit connections are installed properly and are dry
7.1.6. Check internal devices for condensation
7.1.7. Check enclosure O rings seals and verify that the O ring is not pinched between housing
7.1.8. Visually inspect during open/close cycle
7.1.9. Inspect identification labels for wear and replace if necessary

Warning :
Flameproof enclosure! Before opening, ensure the absence of gas and voltage.
Treat cover with care. Gap surfaces must not be damaged or dirtied in any way.

8. Inspection

8.1. The limit switch box should be inspected upon receipt to ensure that no damage has been sustained on transit.
8.2. Check the item and quantity of products with packing list or related documents.
8.3. Check the limit switch box o-ring. Where damage on it, it caused the corrosion of internal parts.
8.4. Check the adjustment of cams. Cams shall be released when those have been used for a long period of operating. If do so, they don't work correctly with switches.

9. Storage

The products must be stored in a clean, cool and dry area. The unit shall be stored with the cover installed and the conduit openings sealed. Storage must be off the floor, covered with a sealed dust protector.

10. Trouble shooting

The following instructions are offered for the most common difficulties encounter during installation and start-up.

Signal fails to main control room.

① Check the wiring of limit switch box in accordance with wiring diagram.
② Check where the cams or switches are damaged or broken.
③ Check the main signal wire from the terminal strip.
④ Re-set the limit switch box.
⑤ Verify the current position transmitter resistance value.
⑥ Check potentiometer gear jamming.
⑦ Check the zero and span calibration.
⑧ Check the card damaged or not.

11. Tools

① 1 Set Metric Allen Key (Hex Wrench)
② Set Screw Drivers
③ 1 Set Metric Spanner
④ 1 Wire Stripper long Nose
⑤ 1 Needle nose plier
⑥ 1 Multi Meter (AC, DC, Resistance)
⑦ 1 ohm Meter (0~25mA) : if applicable 16 adapted

12. Installation and Maintenance Tips

For any installation and maintenance work, the following should be observed :

Caution :
- ✓ *A regular inspection and maintenance performed by qualified and trained personnel*
- ✓ *When working in potentially explosive areas, observe the standard EN 60079-14 "Electrical Installations in Hazardous Areas".*
- ✓ *Work at the open actuator under voltage must only be performed if it is assured that for the duration of the work there is no danger of explosion.*
- ✓ *Observe additional national regulations.*

12.1. Check the limit switch box visually. Ensure that no outside damage or changes are visible. The electric connecting cables must be without damage and wired correctly.

12.2. Cable entries, cable glands, plugs etc. have to be checked for correct tightness and sealing.
12.3. Check whether Ex-connections are fastened correctly.
12.4. Take care of possible discolouration of the terminals and wires.
12.5. Check the flame path gaps of flameproof enclosures for dirt and corrosion. Since the dimensions of all Ex gaps are strictly defined and inspected, no mechanical work shall be performed on them.
12.6. Ensure that all housing covers are handled carefully and that the seals are checked.
12.7. All cables have to be checked.
12.8. If defects which affect the safety are detected during maintenance, repair measures have to be taken immediately.
12.9. Any kind of surface coating for the gap surface is not permitted.
12.10. When exchanging parts, seals etc. only original spare parts shall be used.

Warning ;
Flameproof enclosure! Before opening, ensure the absence of gas and voltage.

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