Discontinue

SM-7636-A/1

INSTRUCTION MANUAL

FOR

SWITCH FOR CYLINDER VALVE

NAB – C2

NAB – C3

Prior to using the Product, it is essential to read this INSTRUCTION MANUAL, especially the description of safety-use issue.

For quick reference whenever necessary, keep this INSTRUCTION MANUAL in a good manner.

CKD Corporation

FOR SAFETY USE

The Product is to be used by those who has a basic knowledge about material, fluid, piping electricity regarding Control Valves (solenoid valves, motor valves, air operated valves and so on.)

Never use this Product by those who have no knowledge or are not well trained about Control Valves.

Should be any trouble or accident caused by a wrong selection and/or wrong use of the Product even by a person of basic knowledge about Control Valves, we are not responsible therefore.

Since any customer of the Product have a variety of its application, we are not in a position to get all the information on how and where the Product is used. There may be the cases where that the Product may not meet customers' requirement or may cause any trouble or accident, by fluid, piping or other condition that are not within the specifications of the Product.
Under such a circumstance, select with their responsibility the most suitable application and use of the Product according to the customers' requirements.

The Product incorporates a various safety arrangement, however miss-handling of the product may lead to any trouble or accident on customers side. **To avoid any possible trouble, read this INSTRUCTION MANUAL carefully and understand it fully.**

Pay your attention to the items described in this Text, as well as the items indicated below.

⚠ CAUTIONS

- **When energized, heat is generated at coil portion of solenoid valves and motor valves particularly "Class H" coil where may have a high temperature.**

- **There my have electric shock when wire connecting portion of solenoid valves or motor valves are touched. In case of disassembly or inspection, turn off power supply beforehand. Don't touch live portion by wet hands.**

- **Make piping so as not to have leakage and check for no leakage before use, because in case of control valves for high temperature fluid like steam, leakage may cause heat injury.**

1. SWITCH SPECIFICATION AND METHOD OF SPECIFY THE MODEL

Type and model No. / Item	Contactless switch	
	NAB-C2	NAB-C3
Application	For programmable controller	For programmable controller, relay, IC circuit and small-size solenoid valve
Power voltage	——	DC10~28V
Load voltage/current	DC10~30V,5~30mA	Below DC30V Below 150mA
Current consumption	——	Below 15mA at DC24V (at ON)
Internal drop-away voltage	Below 4V	Below 0.5V at 150mA
Leakage current	Below 1mA	Below 10μA
Lamp	Lit up at luminous diode ON	
Lead wire (Note :1)	Oil-proof vinyl round cord 2core,0.2mm^2	Oil-proof vinyl round cord 3core,0.15mm^2
Insulation resistance	Aboue 100MΩchecked by DC500V	
Insulation withstand voltage	AC1000V in a minute	
Maximum impact	30G	
Ambient temperature	-10~60°C	
Protection structure	IEC standerd IP67/and JIS C 0920 (splash-proof),oil-proof	

Note : The max. load current of 30mA is at 25°C ambient temperature, with the current value decreasing as the ambient temperature exceeds 25°C.

THE MODEL OF SWITCH SIMPLEX

NAB - ⓐ - ⓑ

ⓑ — THE LENGTH OF LEAD WIRE - ②

ⓐ — MODEL - ①

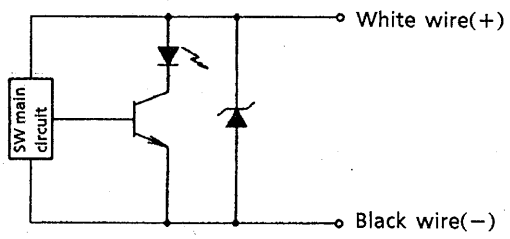
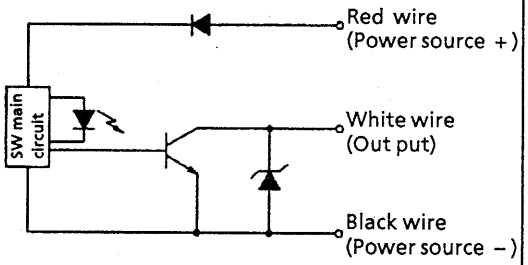
① MODEL

ⓐ	MODEL
C2	Contactless switch, 2-wire
C3	Contactless switch, 3-wire

② THE LENGTH OF LEAD WIRE

Symbol	The length of lead wire
3	3m
5	5m

2. INTERNAL CIRCUIT DIAGRAM

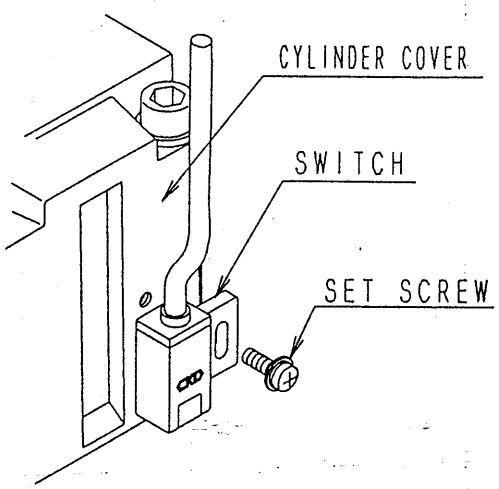
NAB－C2	NAB－C3
•C2 	•C3 

3. LIST OF SWITCH APPLICATIONS

Type / Load and Applications	NAB－C2	NAB－C3
DC small－size relay	——	○
DC medium－size relay	——	○
DC small－size solenoid valve	——	○
Digital IC	——	○
Programmable controller (Sink load input)	○	○
Programmable controller (Source load input)	○	——

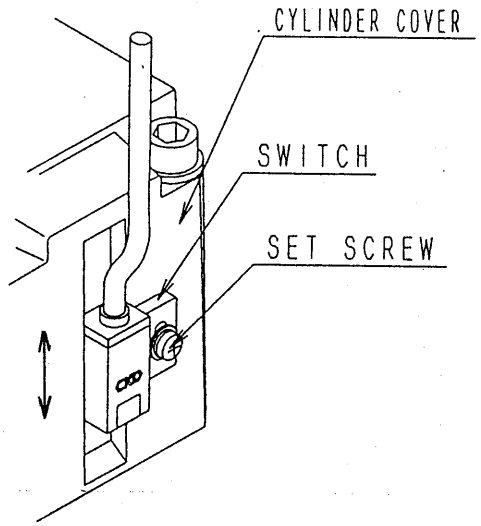
4. INSTALLATION OF SWITCH AND TRANSFER OF INSTALLATION POSITION

(1)Installation of Switch



Insert the switch in the groove of cylinder cover,
and fix to the mount with the set screw.
The tightening torque shall be 0.5~0.7 N·m.

(2)Transfer of Installation Position



Loosen the set screw, then move the switch along the groove of cylinder cover, and tighten the screw at the specified position.
The tightening torque shall be 0.5~0.7 N·m.

5. PRECAUTIONS

5-1. Lead Wire Connection

(1) In the case of C2 :

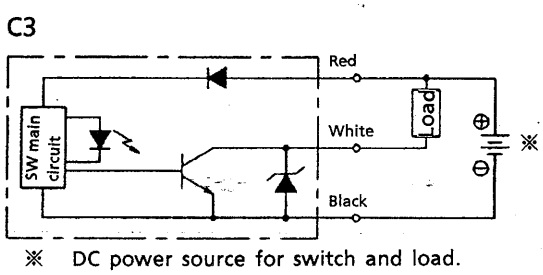
Connect the white wire to ⊕ side and the black wire to ⊖ side.
Do not connect the switch lead wires directly to the power source, be sure to connect loads in series.

(2) In the case of C3 :

Connect the red wire to ⊕ side and the black wire to ⊖ side.
Do not connect the white wire directly to the power source, be sure to connect loads in series.
And be sure to turn off the power source of the device in the connecting side circuit before connection.

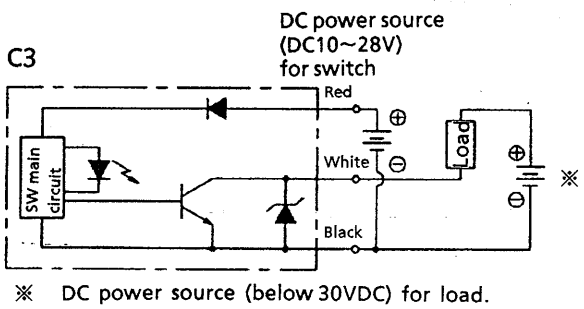
Note : Take utmost care so as not to make misconnection of C3 switch or shortcircuit of load, otherwise not only the switch but also the load side circuit may get broken. Furthermore, making connection, with the power ON, may cause damage to the switch as well as the load side circuit depending on the sequence of connection, even if there is no misconnection.

<Ex. of C3 connection>



※ DC power source for switch and load.

Basic circuit Example 1
(with power sources being the same for switch and load.)



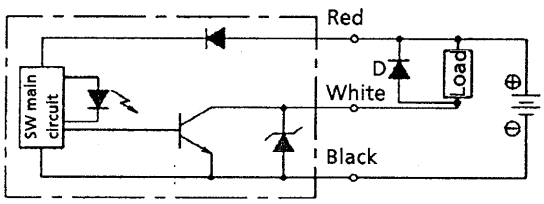
※ DC power source (below 30VDC) for load.

Basic circuit Example 2
(with power sources being different for switch and load.)

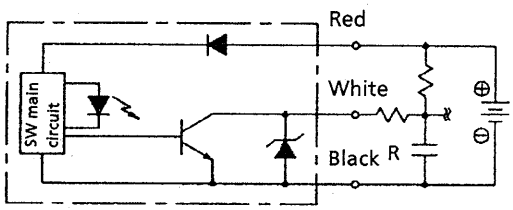
5-2. Connected Load

C2 switch is specially used for progrmmable controller, and because of double-wire type, it can be connected either the sink load input or to the source load input.

C3 switch, on the other hand, can have digital IC, microcomputer, programmable controller, relay, solenoid, solenoid valve, etc. ad loads. At the time of design and selection of load, take due account of the transitional electric characteristics (rush current at switch ON, surge voltage at switch OFF, etc.) of the load as well as the steady and static electric characteristics, so that the load may not exceed the switch ratings. In case the load is likely to exceed the said ratings, be sure to take some protective measures(connection of surge absorbing element, current limiting resistance, etc.).



Example of surge absorbing element (diode) connected to the inductive load.
Use HITACHI VO60 diode or the equivalent.

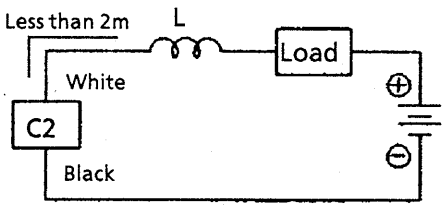


Example of current limiting resistance R connected to capacitive load.
Use resistance here

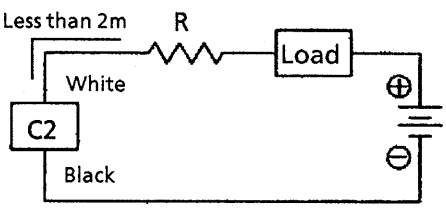
with $R\,(\Omega) = \frac{V}{0.15}\ (\Omega)$.

5-3. Lead Wire Length

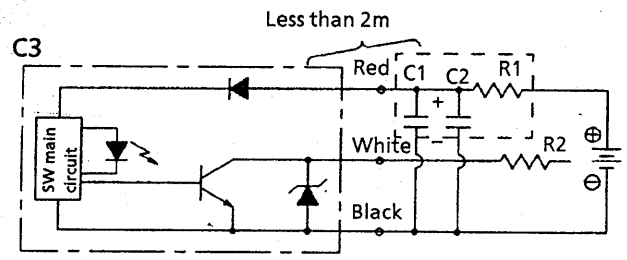
The excessively long wiring length causes rush current to flow at the time of switch ON due to floating capacity, or the external noise to intrude into the system. Hence, take the following preventive measures when the wiring length is to exceed 10 m.



- Choke coil
  Connect choke coil with excellent high – frequency characteristic. L = several hundred μH~several mH.
- Connect the choke coil adjacent to the switch (at a distance less than 2 m away).



- Connect the rush current limiting resistance with R = as large as is permitted by the load circuit.
- Connect the resistance adjacent to the switch (at a distance less than 2 m away).

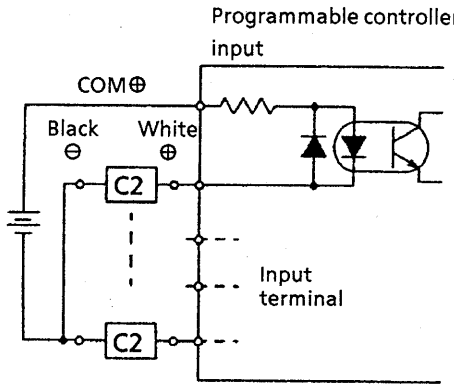


- Power source noise absorbing circuit:
  C1 = 20~50μF ; electrolytic capacitor (withstand voltage:over 50V)
  C2 = 0.01~0.1μF ; ceramic capacitor
  R1 = 20~30Ω
- Rush current limiting resistance:
  R2 = As large as is permitted by the load circuit.
- Make the connections at the proximity of the switch (at a distance less than 2 m away).

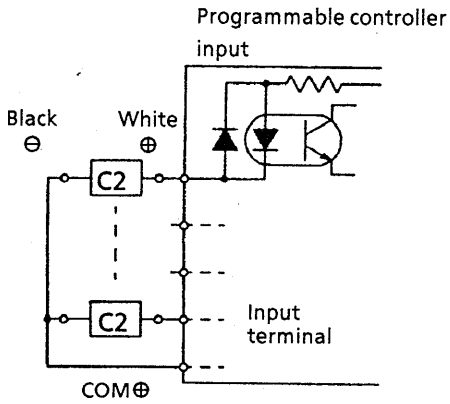
5-4. Connection to Programmable Controller

The connection method differs according to the type of the programmable controller. See figures below for connection.

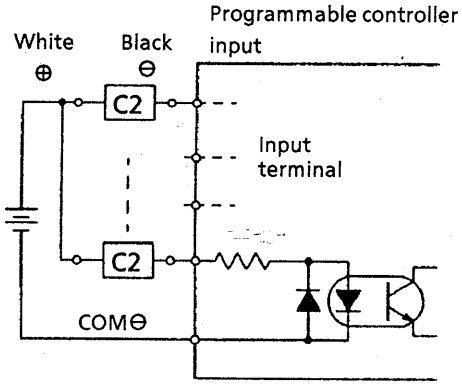
(1) For C2



- This is a common type of programmable controller input;often used for card type and unit type, it is called the sink load input. The COM terminal is connected to the ⊕ side of the power source (the same ⊕ COM connection being made for non – polar input card as well).

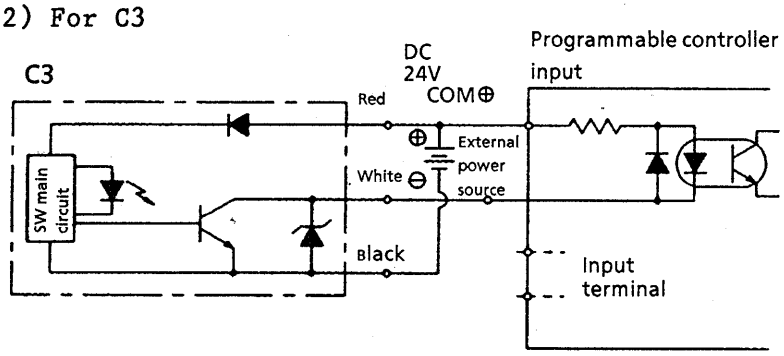


- Often used for small – size programmable controller with built – in power source, this is called the sink load input.
- The COM terminal is connected to the ⊖ side of the power source.

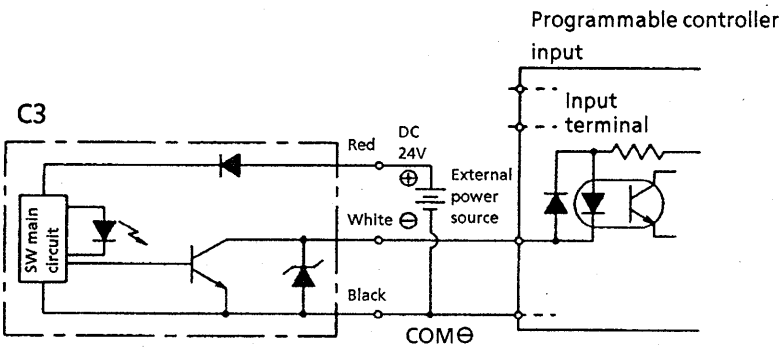


- Often used for card type and unit type, this is called the source load input.

(2) For C3

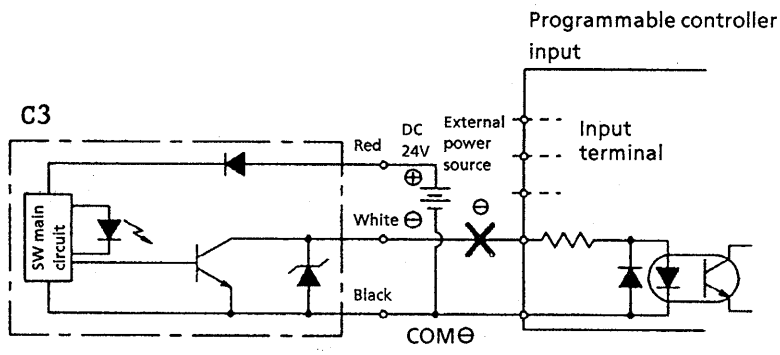


- This is a common type of programmable controller input; often used for card type and unit type, it is called the sink load input. The COM terminal is connected to the ⊕ side of the power source (the same ⊕ COM connection being made for nonpolar input as well).



- Often used for small – size programmable controller with built in power source, this is called the sink load input.
- The COM terminal is connected to the ⊖ side of the power source.

Note : Use C2 switch for source load input type, since C3 can not be used in this case.



5-5. Series Connection

When connecting several C2 switch in series, to 2 pieces of C2 switches, the switch voltage drop is the sum of the voltage drop in 2 pieces of C2 switches.

For example, the switch voltage drop when 2 pieces of C2 switches are connected in series is equivalent to 4V×2=8V.

Please check the specifications of the load, because the charged voltage at the load shall be what is left for taking the voltage drop at the switch from the power voltage. Also, please use the switches with each load voltage within 10V DC~30V DC. (Please avoid using the switches in series, when either lamp of switches turning on dimly becomes problems).

Note: Consult our engineer when connecting several C3 switches in series.

5-6. Parallel Connection

The leakage current increases in proportion to the numbers of C2 switch connected in parallel.

For example, the leakage current when 3 pieces of C2 switches are connected in parallel is equivalent to 1mA×3=3mA.

Decide the number of switches to be connected after confirming the input specification of the programmable controller, the connected load. The number of C3 switch for parallel connection is limited, since the output leakage current increases in proportion to the number of switches. However, there is no problem in normal use, since the leakage current is extremely low (10μA).

The lamp in this case does not get dim or fails to light up.

5-7. Magnetic Environment

Refrain from using the switch at a place with strong magnetic field or/and high current (large magnet, spot welder, etc.) nearby. When the switch mounted cylinder valves are installed in parallel at the proximity of each other, and when a magnetic object moves near the cylinder valve, the mutual when a magnetic object moves near the cylinder valve, the mutual interference thereof may affect the detecting accuracy.

5-8. Lead Wire Wiring

Take care at the time of wiring so as not to apply the binding stress and the tensile force repeatedly to the lead wire, and connect the moving unit with the bend resisting wire such as wire for robot, etc.

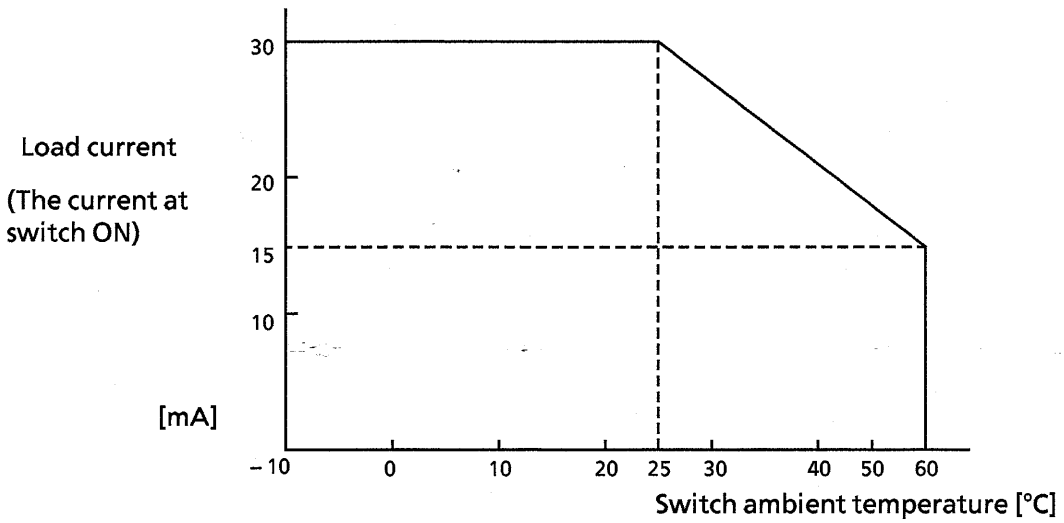
<Example of Wire for Robot>
- TOKAI DENSEN Co.,Ltd. TS-VCT etc.

Noisy environment requires the wiring such as being apart from the power line such as for motor, or with shield cable and like.

5-9. Anbient Temperature

(1) Cannot be used in higher temperature (above 60°C).

(2) Reduce the load current of C2 switch according to the ambient temperature.

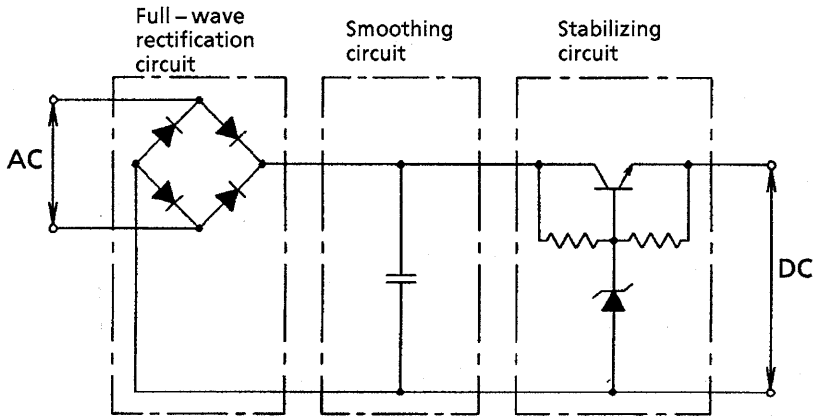


5-10. Power Source

The power voltage range is 10~30V for C2 switch, and 4.5~28V for C3 switch. The switch may fail to function when the power voltage is below the said range, and when the power voltage is below the said range, and when the power voltage exceeds the said range, the internal circuit of the switch may get broken. Hence, make sure that the power voltage is within the said range before using the switch.

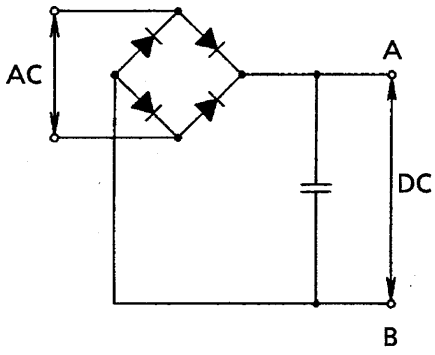
Also, take care of (1)~(3) below.

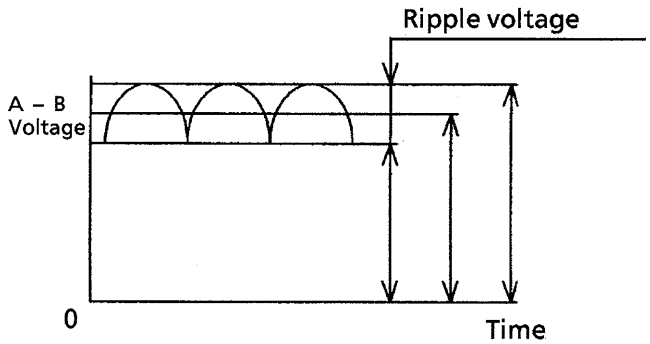
(1) Use stabilized power source as the DC power source.



Example of stabilized power source

(2) In case unstable DC power source is used as shown in figure below, the voltage applied to the switch may exceed the power voltage range in spite of 24V indication in the voltmeter. In such case, therefore, make sure that the voltage is within the said range by carrying out voltage test with an oscilloscope.

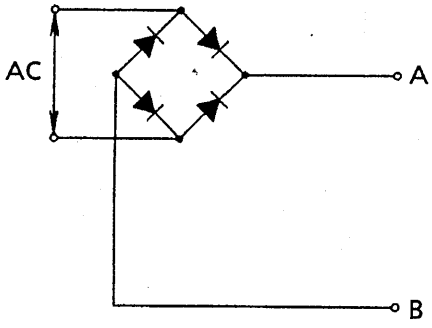


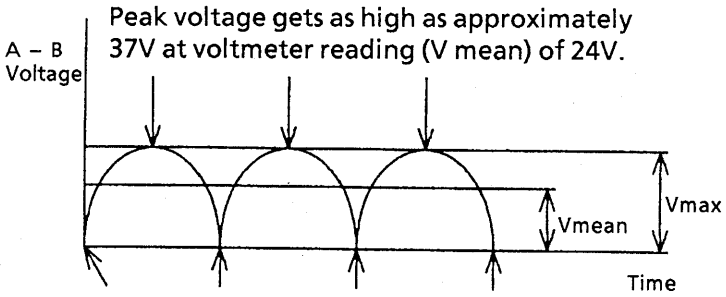


Voltage between A and B

The power source can be used as the PS for switch if the peak voltage = V max is below 30V for C2 and below 28V for C3, and the ripple voltage = V max – V min is below 0.5V.

(3) Switches can not be used for the full-wave rectification circuit as shown in the figure below, since the switches in such case may malfunction or the internal circuits may get broken.

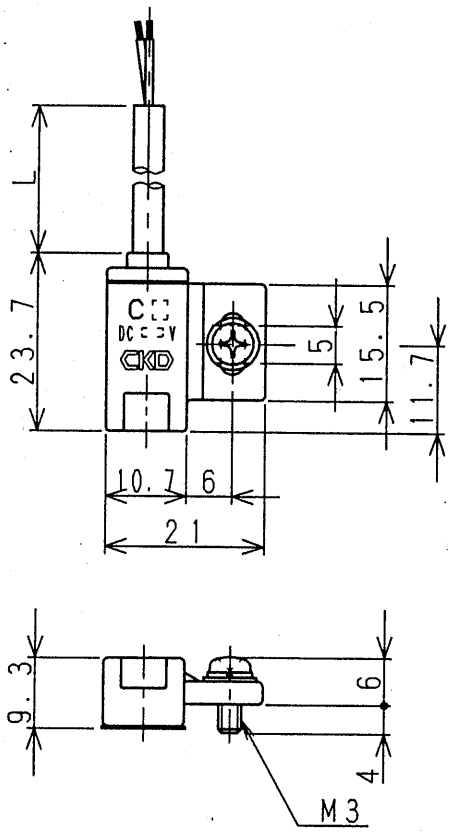




The voltage may become less than the SW power voltage range depending on the time.

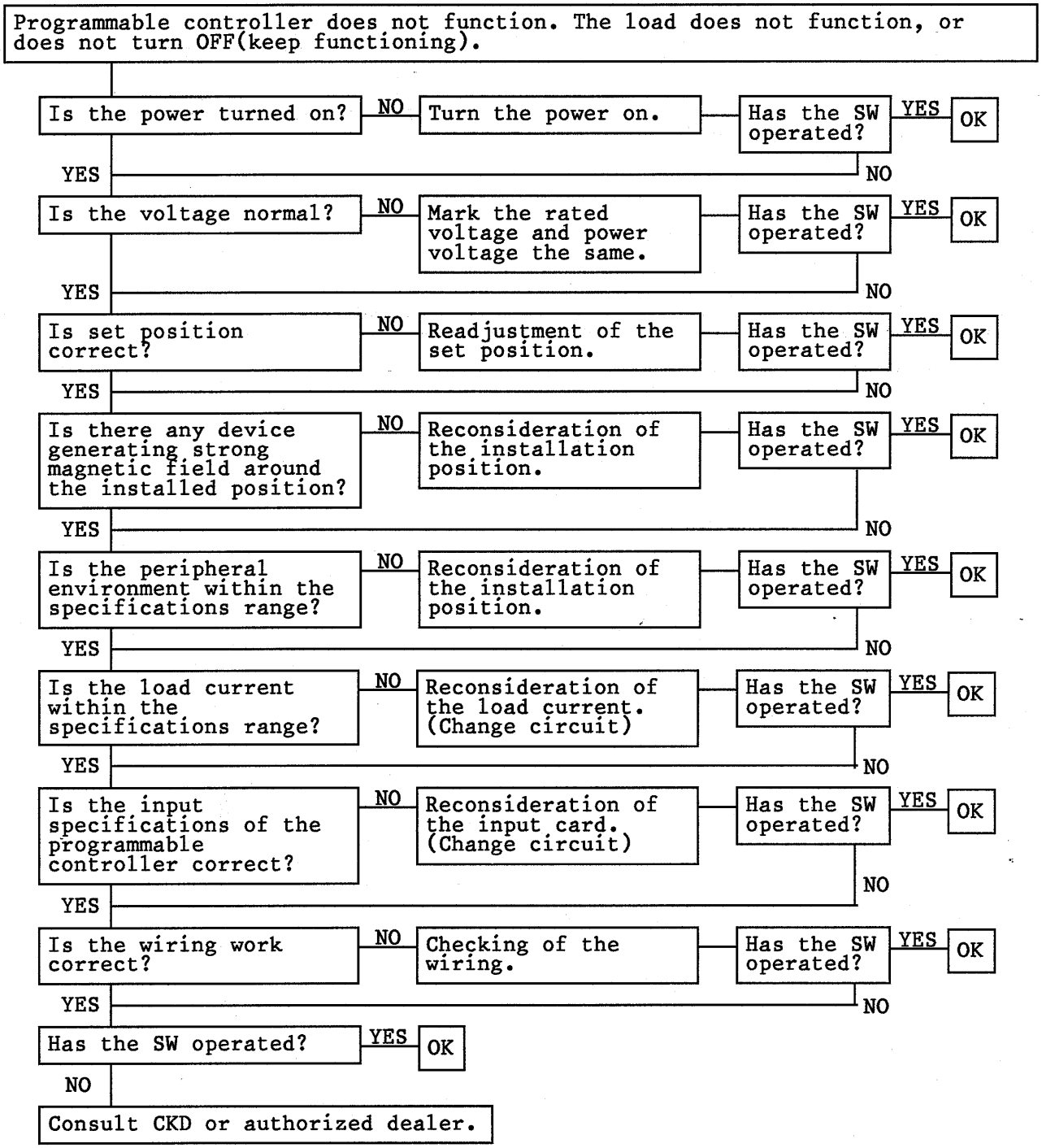
A – B voltage wave – form

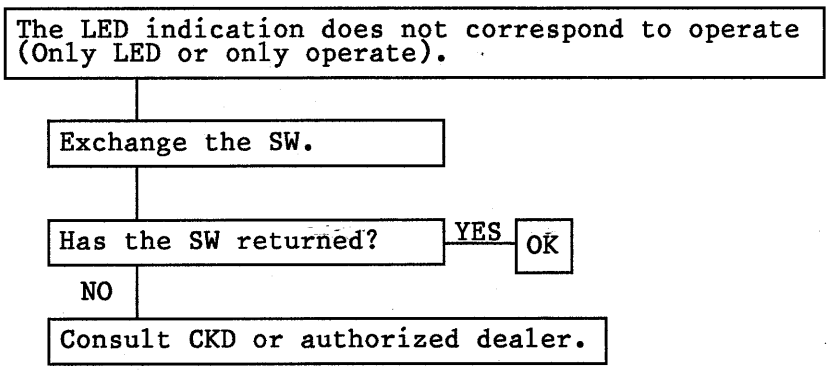
6. EXTERNAL DIMENSION DIAGRAM OF SWITCH SIMPLEX



L : Read Wire Length
3m
5m

7. TROUBLESHOOTING





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