INSTRUCTION MANUAL
FOR
SOUND FLOW SENSOR
MODEL: AF10

Revision ▲ Sep. 20, 1999
Issued Jan. 14, 1998

NOHKEN INC.
MUST BE READ BEFORE USING

- This manual is for standard specifications.
- This manual describes the handling, inspection and adjustment of the sensor. Read and understand this manual before installation.
- Any documents and/or directions from Nohken and the agents aside from this manual shall be preceded.
- Save this manual to refer when you need.
- If you have any questions or comments about this manual and/or the sensor, ask Nohken's sales office.

Signal words in this manual means as follows:

<table>
<thead>
<tr>
<th>CAUTION</th>
<th>Indicates an potentially hazardous situation which, if not avoided, may result in minor or moderate injury.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTE</td>
<td>Indicates exceptional cases and attention for handling of sensors.</td>
</tr>
</tbody>
</table>

- Indicates prohibition. The explanation with this manual should always be followed.

- Indicates directions. The explanation with this manual should always be followed.
## CAUTIONS

- Since this sensor is not an explosion-proof construction, do not use where flammable gas, explosive gas or the vapor exists. Otherwise, explosion the gases and/or the vapor may cause serious disasters.

- Do not modify or disassemble the sensor. Otherwise, the sensor may be damaged.

- Operating test shall be conducted before practical use. If malfunction occurs and the accident is predicted, the remedy shall be administrated by using another sensor with different operating principle in parallel.

- To prevent from electric shocks such as lightning and the static electricity, provide conductor or the surge absorber. Otherwise, the sensor may cause malfunction, damage, ignition, electric shock and injury.

- When connecting inductive load or the lamp load to the relay output contact.
  
  To prevent overvoltage and overcurrent, provide a protective circuit to the load. Otherwise, the contact may be damaged.

## NOTES

- Do not give strong shocks to the sensor. Dropping, throwing, striking and dragging the sensor, for example, are to cause strong shocks and damage the sensor.

- The specifications such as ambient temperature, maximum voltage and the power rating shall meet the conditions. Otherwise, the sensor may cause malfunction, damage, ignition, electric shock and injury. Read and check the clause of specification in the manual or specification sheets.

- Operating test shall be conducted before practical use. If malfunction occurs and the accident is predicted, the remedy shall be administrated by using another sensor with different operating principle in parallel.
<table>
<thead>
<tr>
<th>NOTES</th>
</tr>
</thead>
</table>
| • Earth terminal shall be grounded JIS Class D ground (earth resistance maximum 100Ω).
  Otherwise, the electric shock may occur. |
| • To prevent from electric shocks such as lightning and the static electricity, provide conductor or the surge absorber. Otherwise, the sensor may cause malfunction, damage, ignition, electric shock and injury. |
| • When connecting inductive load or the lamp load to the relay output contact.
  To prevent overvoltage and overcurrent, provide a protective circuit to the load. Otherwise, the contact may be damaged. |

INTRODUCTION
A. This manual specifies standard specifications of this product. Some specifications may be different from your product if you order the custom-made product.
B. A variety of specifications are available to meet your process conditions, such as installation conditions, chemical compatibility, and so on. We are glad to offer suggestions to assist your decision.
C. If you have any questions or comments for the contents of this manual, ask Nohken's sales office written on the front cover.
D. Nohken Inc. pursues a policy of continuing improvement in design and performance of this product. We will supply the alternative parts or complete new products required to repair or replacement.
E. Specifications are subject to change without any obligation on the part of the manufacturer.
MUST BE READ BEFORE USING

INTRODUCTION

WARRANTY & DISCLAIMER

TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PURPOSE OF USE</td>
<td>1</td>
</tr>
<tr>
<td>2. SPECIFICATIONS</td>
<td>1</td>
</tr>
<tr>
<td>3. EXPLANATION OF OPERATION</td>
<td>2</td>
</tr>
<tr>
<td>3.1 Principle of operation</td>
<td>2</td>
</tr>
<tr>
<td>3.2 Block diagram</td>
<td>2</td>
</tr>
<tr>
<td>4. INSTALLATION METHOD AND CAUTIONS</td>
<td>3</td>
</tr>
<tr>
<td>4.1 Installation method</td>
<td>3</td>
</tr>
<tr>
<td>4.2 Cautions in selecting a place to be attached</td>
<td>3</td>
</tr>
<tr>
<td>5. WIRING</td>
<td>4</td>
</tr>
<tr>
<td>6. ADJUSTMENT</td>
<td>4</td>
</tr>
<tr>
<td>6.1 Explanation of each adjustment place</td>
<td>4</td>
</tr>
<tr>
<td>6.2 Flow detection</td>
<td>5</td>
</tr>
<tr>
<td>6.3 Adjusting</td>
<td>6</td>
</tr>
<tr>
<td>6.4 Other functions</td>
<td>7</td>
</tr>
<tr>
<td>7. CAUTIONS ON HANDLING</td>
<td>8</td>
</tr>
<tr>
<td>7.1 Wiring</td>
<td>8</td>
</tr>
<tr>
<td>7.2 Other cautions</td>
<td>9</td>
</tr>
<tr>
<td>8. CHECK-UP</td>
<td>9</td>
</tr>
</tbody>
</table>
1. Purpose of use

The AF10 Sound Flow Sensor (compact type) is a new small-sized powder-grain sensor which has integrated a receiving part detecting a fricative sound that generates when powder and grains (hereafter called "grains") flow through a distributing tube such as pipes and chutes etc., to convert into electric signals, and an electronic circuit part (signal processing circuit, relay driving circuit, and power supply circuit) into one unit.

In addition, since the AF10 can be attached to the outside of the distributing tube and does not contact directly with the grains to be detected, the AF10 will not have critical problems of flow fluctuations caused by attaching a conventional contact-type sensor inside the pipes and chutes, and of the abrasion and corrosion of the contact-type sensor.

The AF10 can be easily attached to existing distributing tubes by band-fixing.

Since the AF10 sensor can be adjusted while watching the LEDs (4 pieces) which indicate the intensity of a fricative sound, everyone can simply adjust the sensor.

2. Specifications

1) Operating characteristics
   (a) On indication: turning on a red LED.
   (b) Output capacity: relay contact 240V 2A AC
       30V 2A DC (resistive load)
   (c) Sensitivity adjustment: adjusting by OFFSET and GAIN trimmers
   (d) Output functions: DETECT switch
       ON DELAY adjusting trimmer (approx. 0.1 to 7 sec.)
       OFF DELAY adjusting trimmer (approx. 0.1 to 7 sec.)
   (e) Ambient temperature: -10 to 70 °C (14 F to 158 F) without dewing
   (f) Ambient humidity: Max. 85%RH

2) Electrical characteristics
   (a) Power supply voltage: 22~264V DC, AC (50/60Hz)
   (b) Withstand voltage: 1,500V AC 1 minute (between LINE terminals and OUTPUT terminals)
   (c) Insulation resistance: 500V DC 100MΩ (between LINE terminals and OUTPUT terminals)
   (d) Power consumption: Approx. 2.5VA (at 100V AC)

3) Mechanical characteristics
   (a) Vibration proof: 60~2000Hz 10G

4) Others
   (a) Material: ABS, PC
   (b) Construction: drip-proof (IP54)
   (c) Installation: Attaching band or Metal fixtures (option)
   (d) Wire inlet: PF1/2 (Cable gland method, Gasket I.D. φ10 and φ8)
3. Explanation of operation

3.1 Principle of operation
When grains flow within a distributed tube such as a pipe and a chute, by collision and friction between grains themselves or between grains and the wall of the distributed tube, various sounds and vibrations will be generated.
The receiving part in the AF10 attached outside the distributed tube receives the generated sounds and vibrations to convert into electric signals by the piezoelectric devices.
By processing the signals in the electronic circuit part to detect if the grains flow in the distributed tube, the AF10 will output a relay contact output.

3.2 Block diagram

![Block Diagram](image)

Fig.1

Explanation of functions

1) OFFSET Adjustment
By adjusting the signals (noise: sounds and vibrations generating during the operation of the surrounding equipment) from the receiving part when the grains are not flowing, the component of noise can be cancelled.

2) GAIN Adjustment
When the grains flows, by adjusting to amplify only the component of signals, the signals can be increased to a desired voltage.
4. Installation method and cautions

4.1 Installation method
The AF10 can be attached by fastening the band or the metal fixtures with two bolts.

![Diagram showing installation method]

Fig. 2

4.2 Cautions in selecting a place to be attached

Select a place where a lot of sounds and vibrations are generating to install the AF10. Be sure to install the receiving part so that it can contact firmly with the wall of a distributed tube. If the receiving part does not contact firmly due the rugged surface of the wall, paint the surface with silicon grease etc., to increase the contact efficiency. Unless the receiving part should contact firmly with the wall, it would not operate.

![Diagram showing caution on selection of place]

Fig. 3
5. Wiring

*As there is no polarity on DC, wiring is possible in any side.

Supply voltage Relay contact output
24-264V AC DC 240V 2A AC(resistive load)

Fig.4

6. Adjustment

6.1 Explanation of each adjustment place

Fig.5

①DETECT Switch---For shifting the magnetizing state of the output relay. The magnetizing state of the output relay is as follows.

<table>
<thead>
<tr>
<th></th>
<th>At Non-detection</th>
<th>At detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>DETECT ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>NON DETECT</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

②OFFSET Adjusting Trimmer---An offset adjusting trimmer for noise component.
left-->larger right-->smaller

③GAIN adjustment Trimmer---An adjusting trimmer for amplifying only input signals.
left-->smaller right-->larger

④ON DELAY Adjusting Trimmer---A time adjusting trimmer for ON DELAY.
Max. setting time is approx. 7 seconds.

⑤OFF DELAY Adjusting Trimmer---A time adjusting trimmer for OFF DELAY.
Max. setting time is approx. 7 seconds.

⑥LED Display---The red LEDs (4 pieces) indicate the intensity of input signals.
When the LEDs illuminate, the relay will be switched on.
6.2 Preparation

Attach the AF10 to a distributed tube to check up again the wiring before switching on. After switching on, the AF10 starts operating in an initial time of some 2 seconds by the initial time circuit.

Within the initial time, the relay will not operate.
6.3 Adjusting

(1) Detecting the start of grains flowing
Set the OFFSET trimmer in the center, the GAIN trimmer in the extreme left (min.), and the DETECT switch at DETECT side before operating the following procedures.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  ☆ Stop the flow grains. (the magnitude of noise component is indicated)</td>
<td>ZERO ○ ○ ○ ○ RY ON ○ ○ ○ ○</td>
</tr>
<tr>
<td>2  Rotate the OFFSET trimmer to illuminate the LED of ZERO.</td>
<td>ZERO ○ ○ ○ ○ RY ON ○ ○ ○ ○</td>
</tr>
<tr>
<td>3  ☆ Start flowing grains. Rotate the GAIN trimmer to adjust to illuminate LED of RY ON</td>
<td>ZERO ○ ○ ○ ○ RY ON ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

(2) Detecting the stop of grains flowing (detecting "stuck")
Set the OFFSET trimmer in the center, the GAIN trimmer in extreme left (min.), and the DETECT switch at DETECT side before operating the following procedures.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  ☆ Grains flowing. (Rotate the GAIN trimmer 3–4 readings in the right)</td>
<td>ZERO ○ ○ ○ ○ RY ON ○ ○ ○ ○</td>
</tr>
<tr>
<td>2  Rotate the OFFSET trimmer to a position where the LED of RY ON is put out</td>
<td>ZERO ○ ○ ○ ○ RY ON ○ ○ ○ ○</td>
</tr>
<tr>
<td>3  Rotate the GAIN trimmer to adjust to illuminate LED of RY ON.</td>
<td>ZERO ○ ○ ○ ○ RY ON ○ ○ ○ ○</td>
</tr>
<tr>
<td>4  ☆ Stop the flow of grains.</td>
<td>ZERO ○ ○ ○ ○ RY ON ○ ○ ○ ○</td>
</tr>
</tbody>
</table>
6.4 Other functions

(1) Setting of DETECT switch

According to the direction of DETECT switch, the relay will operate as follows.

<table>
<thead>
<tr>
<th></th>
<th>Relay</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>DETECT side</td>
<td>OFF</td>
<td>OPEN</td>
</tr>
<tr>
<td>NON DETECT side</td>
<td>ON</td>
<td>CLOSE</td>
</tr>
</tbody>
</table>

(2) Setting of DELAY TIME

<table>
<thead>
<tr>
<th>ON DELAY</th>
<th>OFF DELAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1-7 seconds</td>
<td>0.1-7 seconds</td>
</tr>
</tbody>
</table>

ON DELAY: Delay in output for change from non-detection to detection.
OFF DELAY: Delay in output for change from detection to non-detection.
7. Cautions on handling

7.1 Wiring

(1) Use the connection cable of $\phi 6-\phi 10\text{mm}$ cross section.
In case of using cables other than specified diameter and strained cables, drip-proof may be maintained.
Treat the cable as shown in the following Figure. (Fig. 6)
After passing the cable through the cable gland, making press-fit is recommended for easy-to-work.

![Fig. 6](image)

Recommended cable:
- vinyl cahtire circle-type code(VCTF) 4 cores

(2) Shape of solderless terminal for cable
Use the solderless terminal with the size as shown in Fig. 7

![Fig. 7](image)

Recommended press-fit terminal: nominal 1.25-3.5
☆ Use the terminal with insulating tube.
7.2 Other cautions

(1) If the AF10 is dropped or receive a strong shock, it may be broken down. therefore, handle it with care.

(2) Do not use the AF10 in a place full of vapor and corrosive gases or in a watery place.

(3) Be sure to check up the terminal numbers before wiring. Be sure to fasten the cable gland and the cover. If the fastening is poor, this may damage the drip-proof.

(4) When using the AF10 in the outdoor, install in a place that the direct sunlight can not reach, or attach a sunshading cover to avoid the temperature rise and the effect of ultraviolet rays.

8. Check-up

Check up the AF10's operational functions with the following procedures. Be sure to wire the AF10 before switching on.
In approximately 2 seconds, set the OFFSET trimmer in the center to tap lightly the receiving part by a finger nail.
When the illumination of the LED moves rightward from the zero point, the operations are regarded as normal.
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