

INSTRUCTION MANUAL  
FOR  
SOUND FLOW SENSOR

MODEL : AF10

Revision△ Sep.20, 1999

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NOHKEN INC.



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# 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.

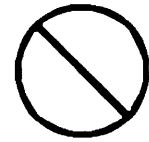
Signal words in this manual means as follows:

 CAUTION	Indicates an potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
 NOTE	Indicates exceptional cases and attention for handling of sensors.

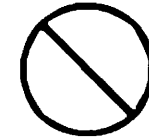
	Indicates prohibition. The explanation with this manual should always be followed.
	Indicates directions. The explanation with this manual should always be followed.

—  **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.



## ⚠ NOTES

• Earth terminal shall be grounded JIS Class D ground (earth resistance maximum 100  $\Omega$ ).  
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.

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MUST BE READ BEFORE USING  
INTRODUCTION  
WARRANTY & DISCLAIMER

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## 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 : turing 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 adjjusting trimmer (approx. 0.1 to 7 sec.)  
                                  OFF DELAY adjjusting trimmer (approx. 0.1 to 7 sec.)
- (e) Ambient temperature : -10 to 70 °C(14 F-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 100M $\Omega$  (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.  $\phi$ 10 and  $\phi$ 8)

### 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

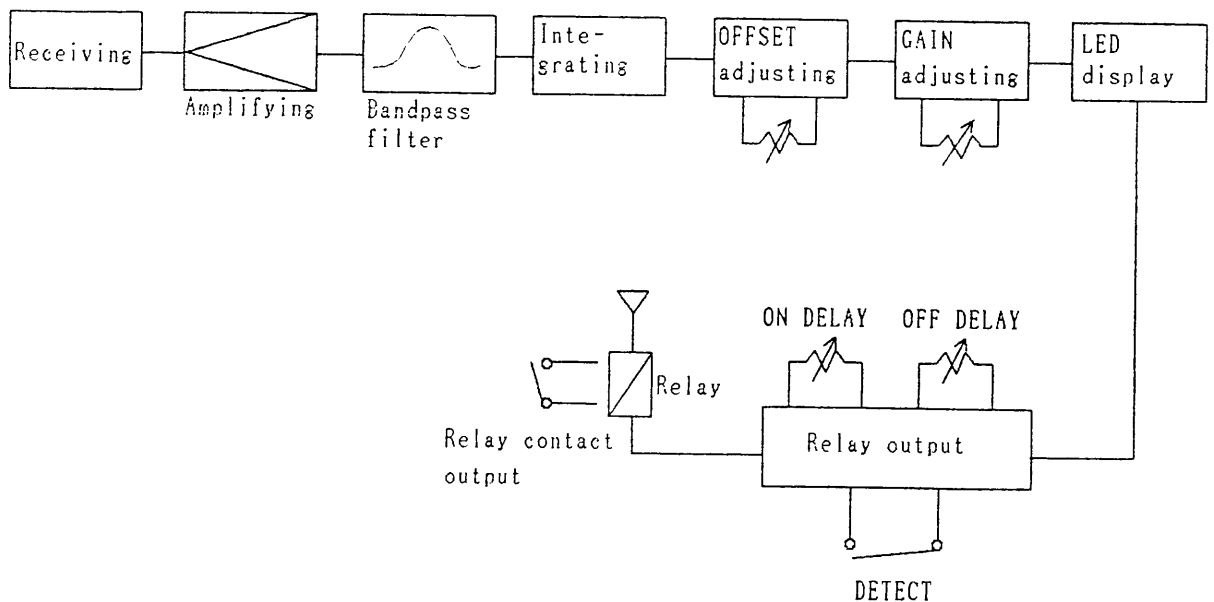


Fig.1

#### 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 flow, 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.

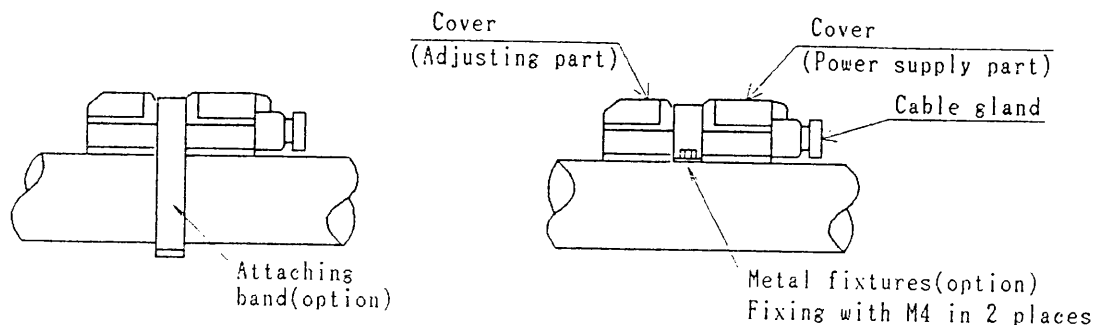


Fig.2

##### 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 atc., to increase the contact efficiency. Unless the receiving part should contact firmly with the wall, it would not operate.

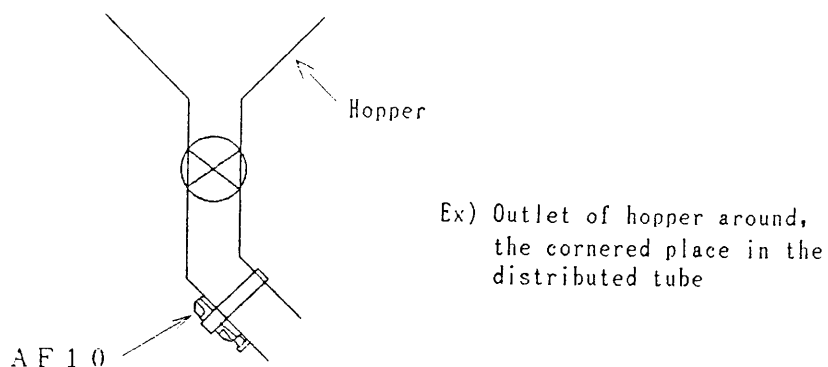


Fig.3



## 5. Wiring

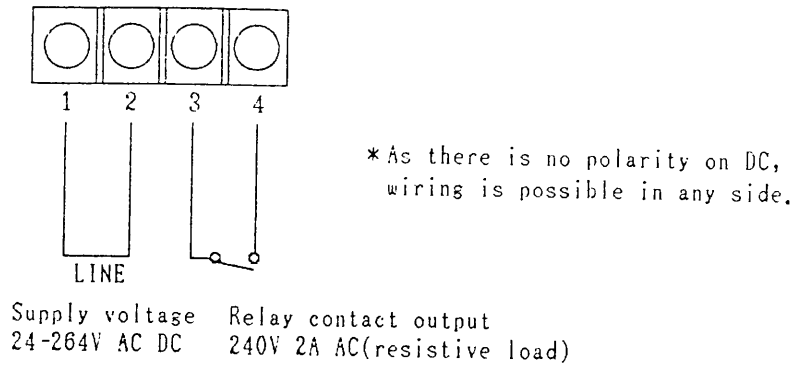


Fig.4

## 6. Adjustment

### 6.1 Explanation of each adjustment place

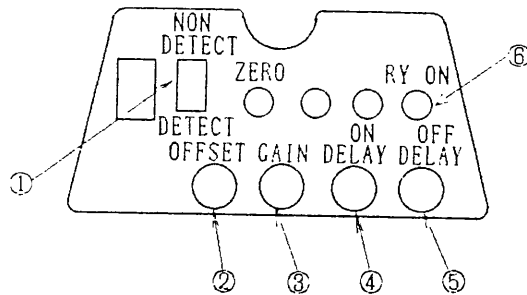


Fig.5

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

	At Non-detection	At detection
DETECT ON	OFF	ON
NON DETECT	ON	OFF

- 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.

	Operation	Indication
1	☆ Stop the flow grains. (the magnitude of noise component is indicated)	ZERO      RY ON ○      ○      ○      ○
2	Rotate the OFFSET trimmer to illuminate the LED of ZERO.	ZERO      RY ON ○      ○      ○      ○
3	☆ Start flowing grains. Rotate the GAIN trimmer to adjust to illuminate LED of RY ON	ZERO      RY ON ○      ○      ○      ○

#### (2) Detecting the stop of grains flowing (detecting "stuck")

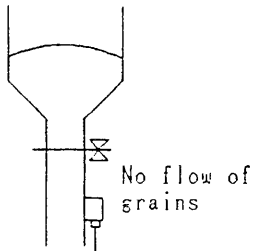
Set the OFFSET trimmer in the center, the GAIN trimmer in extreme left(min.), and the DETECT switch at DETECT side before operating the following procedures.

	Operation	Indication
1	☆ Grains flowing. (Rotate the GAIN trimmer 3-4 readings in the right) 	ZERO      RY ON ○      ○      ○      ○
2	Rotate the OFFSET trimmer to a position where the LED of RY ON es put out.	ZERO      RY ON ○      ○      ○      ○
3	Rotate the GAIN trimmer to adjust to illuminate LED of RY ON.	ZERO      RY ON ○      ○      ○      ○
4	☆ Stop the flow of grains.	ZERO      RY ON ○      ○      ○      ○

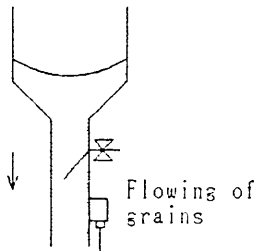
## 6.4 Other functions

### (1) Setting of DETECT switch

① According to the direction of DETECT switch, the relay will operate as follows.



	Relay	Contact
DETECT side	OFF	OPEN
NON DETECT side	ON	CLOSE



	Relay	Contact
DETECT side	ON	CLOSE
NON DETECT side	OFF	OPEN

### (2) Setting of DELAY TIME

ON DELAY	OFF DELAY
0.1-7seconds	0.1-7seconds

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  $\phi 6$ - $\phi 10$ 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.

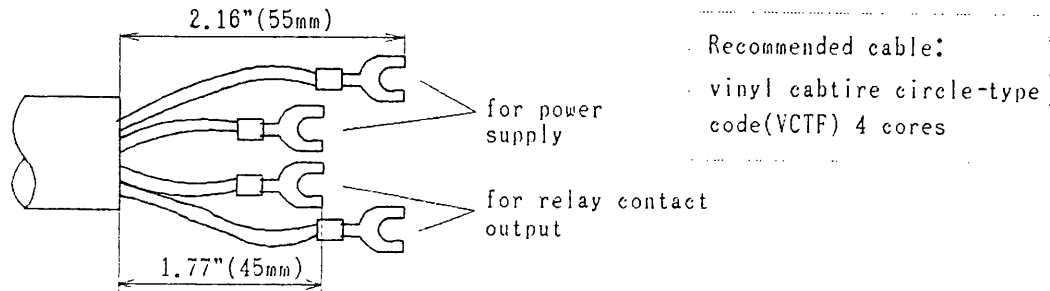


Fig.6

(2) Shape of solderless terminal for cable

Use the solderless terminal with the size as shown in Fig. 7

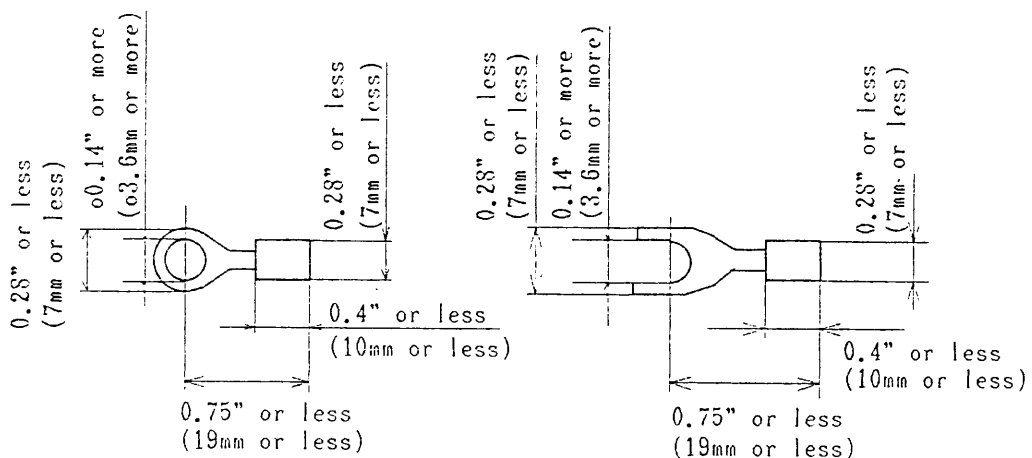


Fig.7

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

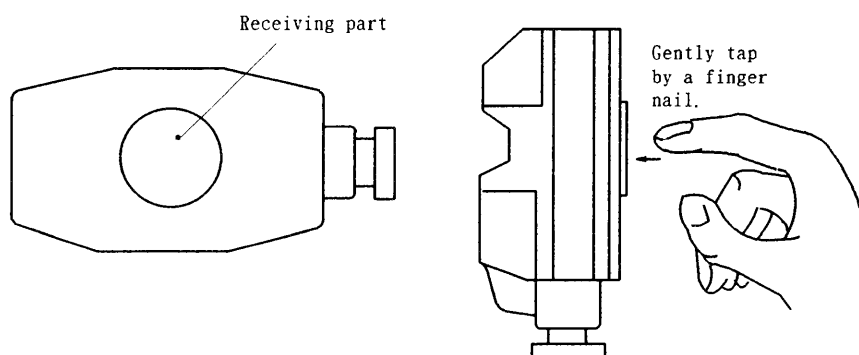


Fig. 8

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.

# NOHKEN INC.

HEAD OFFICE : 15-29,Hiroshiba-cho,Suita-city,Osaka 564-0052,Japan.

TEL:06-6386-8141 FAX:06-6386-8140

TOKYO BRANCH OFFICE : 67,Kandasakumagashi,Chiyoda-ku,Tokyo 101-0026,Japan.

TEL:03-5835-3311 FAX:03-5835-3316

NAGOYA OFFICE : 3-10-17,Uchiyama,Chikusa-ku,Nagoya-city,Aichi 464-0075,Japan.

TEL:052-731-5751 FAX:052-731-5780

KYUSHU OFFICE : 14-1,2-chome,Asano,Kokurakita-ku,Kitakyushu-city,Fukuoka 802-0001,Japan.

TEL:093-521-9830 FAX:093-521-9834