

AUTOMATION

PRODUCTS
GROUP, INC.

Operator's Manual

ACF-10 Series

Acoustical Flow Sensor for Solids

Rev. 1a, 2/03



Automation Products Group, Inc.

APG...Providing tailored solutions for measurement applications

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• Warranty and Warranty Restrictions

APG warrants its products to be free from defects of material and workmanship and will, without charge, replace or repair any equipment found defective upon inspection at its factory, provided the equipment has been returned, transportation prepaid, within 18 months from date of shipment from factory.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESSED OR IMPLIED BY OPERATION OF LAW OR OTHERWISE INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

No representation or warranty, express or implied, made by any sales representative, distributor, or other agent or representative of APG which is not specifically set forth herein shall be binding upon APG. APG shall not be liable for any incidental or consequential damages, losses or expenses directly or indirectly arising from the sale, handling, improper application or use of the goods or from any other cause relating thereto and APG's liability hereunder, in any case, is expressly limited to the repair or replacement (at APG's option) of goods.

Warranty is specifically at the factory. Any on site service will be provided at the sole expense of the Purchaser at standard field service rates.

All associated equipment must be protected by properly rated electronic/ electrical protection devices. APG shall not be liable for any damage due to improper engineering or installation by the purchaser or third parties. Proper installation, operation and maintenance of the product becomes the responsibility of the user upon receipt of the product.

Returns and allowances must be authorized by APG in advance. APG will assign a Return Material Authorization (RMA) number which must appear on all related papers and the outside of the shipping carton. All returns are subject to the final review by APG. Returns are subject to restocking charges as determined by APG's "Credit Return Policy".

• Introduction

The ACF-10 Acoustical Flow Sensor is a compact unit that detects audible noise made by powders and grains which is converted to a relay output.

In addition, since the ACF-10 is attached to the outside of the pipe or chute and does not contact directly with the grains to be detected, the ACF-10 will not have critical problems of flow fluctuations caused by conventional contact-type sensor inside the pipes and chutes, and with abrasion and corrosion problems of the contact-type sensor. The ACF-10 can be easily attached to existing pipes with straps.

The ACF-10 is easily adjusted with the use of four LED.

• Specifications

Operating Characteristics

On Indication	Red LED (4)
Output Capacity:	
Relay Contact	240 V 2 A AC
	30 V 2 A DC (resistive load)
Sensitivity Adjustment	Adjusting by offset and gain trimmers
Output Functions	Detect switch
	On Delay adjusting trimmer (approx. 0.1 to 7 sec.)
	Off Delay adjusting trimmer (approx. 0.1 to 7 sec.)
Ambient Temperature	-10 to 70°C (14 to 158°F) without dewing
Ambient Humidity	Max. 85% RH

Electrical Characteristics

Power Supply Voltage	22~264 VDC AC (50/60 Hz)
Withstand Voltage	1,500 VAC 1 minute (between line terminals and output terminals)
Insulation Resistance	500 VDC 100 MΩ (between line terminals and output terminals)
Power Consumption	Approx. 2.5 VA (at 100 VAC)

Mechanical Characteristics

Vibration Proof	60~2000 Hz 10 G
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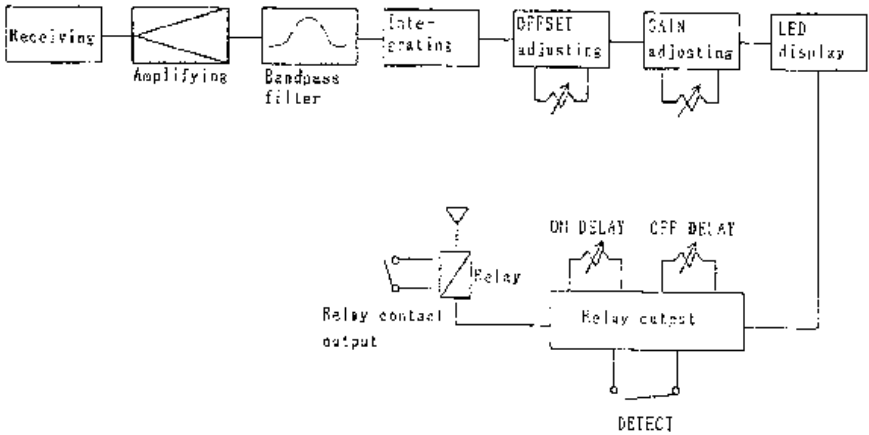
Others

Material	ABS, PC
Construction	Drip-proof (IP54)
Installation	Attaching band or metal fixtures (option)
Wire Inlet	PF1/2 (cable gland method, gasket I.D. ϕ 10 and ϕ 8)

• **Principle of Operation**

When grains flow within a distributed tube such as a pipe or 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 sound pickup of the ACF-10 attached outside the distributed tube receives the generated sounds and vibrations and converts the signal to a relay output.



Explanation of Functions

Offset Adjustment

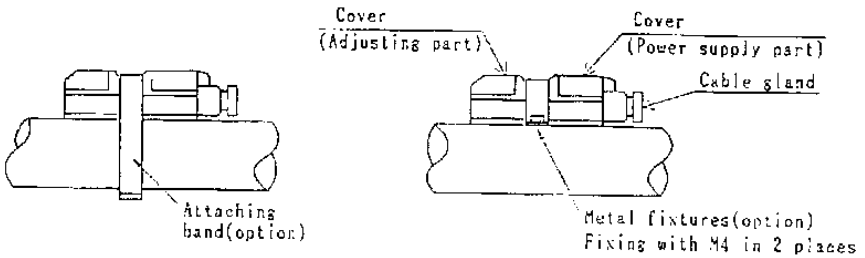
By adjusting the signals (noise: sounds and vibrations generating during the operation of the surrounding equipment) from the sound pickup when the grains are not flowing, the component of noise can be cancelled.

Gain Adjustment

When the grains flows, by adjusting to amplify only the component of signals, the signals can be increased to a desired voltage.

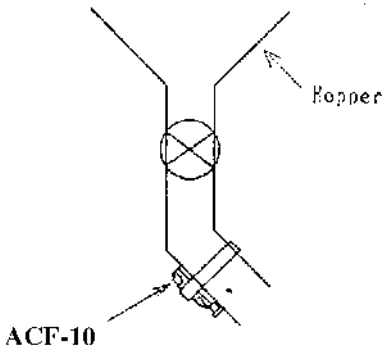
• Installation

The ACF-10 can be attached by fastening the band or the metal fixtures with two bolts.



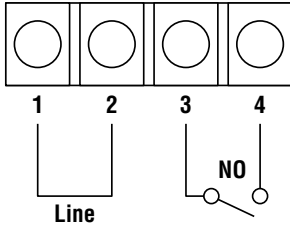
Cautions in Selecting a Place to be Attached

Select a place where a lot of sounds and vibrations are generating to install the ACF-10. 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 is in contact firmly with the wall, the sensor will be insensitive.



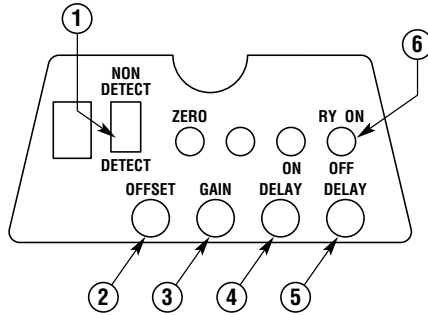
Ex) Outlet of hopper around, the cornered place in the distributed tube

• **Wiring**



Supply Voltage: 24-264V AC/DC
Relay Contact Output: 240V 2A AC
(resistive load)

• Adjustment



1. DETECT 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

2. OFFSET Adjusting Trimmer

An offset adjusting trimmer for noise component
left ... larger right ... smaller

3. GAIN Adjustment Trimmer

An adjusting trimmer for amplifying only input signals
left ... smaller right ... larger

4. ON DELAY Adjusting Trimmer

A time adjusting trimmer for ON DELAY
Max. setting time is approx. 7 seconds

5. OFF DELAY Adjusting Trimmer

A time adjusting trimmer for OFF DELAY
Max. setting time is approx. 7 seconds

6. LED Display




The red LED (4 pieces) indicate the intensity of input signals. When the LED illuminate, the relay will be switched on.

Preparations

Attach the ACF-10 to a distributed tube to check up again the wiring before switching on. After switching on, the ACF-10 starts operating in an initial time of some 2 seconds by the initial time circuit. Within the initial delay time, the relay will not operate.





(1) Flow Detection

Set the OFFSET trimmer to center, the GAIN trimmer to extreme left (min.) and the DETECT switch to DETECT position before starting 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 ZERO LED	ZERO 	○	○	RY ON ○
3	★ Start flowing grains. Rotate the GAIN trimmer to adjust to illuminate RY ON LED	ZERO ○	○	○	RY ON 

(2) Plugged Detection

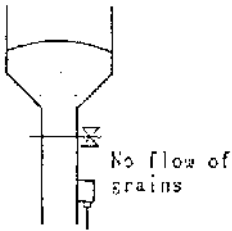
Set the OFFSET trimmer to center, the GAIN trimmer to extreme left (min.) and the DETECT switch to DETECT position before starting the following procedures.

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

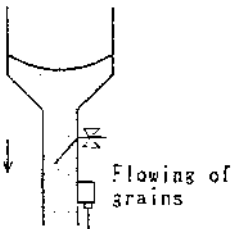
Other Functions

(1) Setting of DETECT switch

- Depending upon position 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 to 7 seconds	0.1 to 7 seconds

ON DELAY: Delay in output for change from non-detection to detection.

OFF DELAY: Delay in output for change from detection to non-detection.

• **Cautions on Handling**

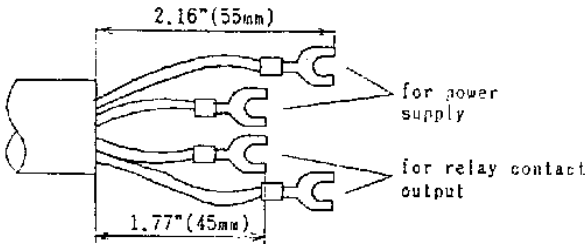
Wiring

Use the connection cables of $\varnothing 5$ to $\varnothing 10$ mm cross section.

If using cables other than specified diameter and strained cables, drip-proof must be maintained.

Treat the cable as shown in the following figure.

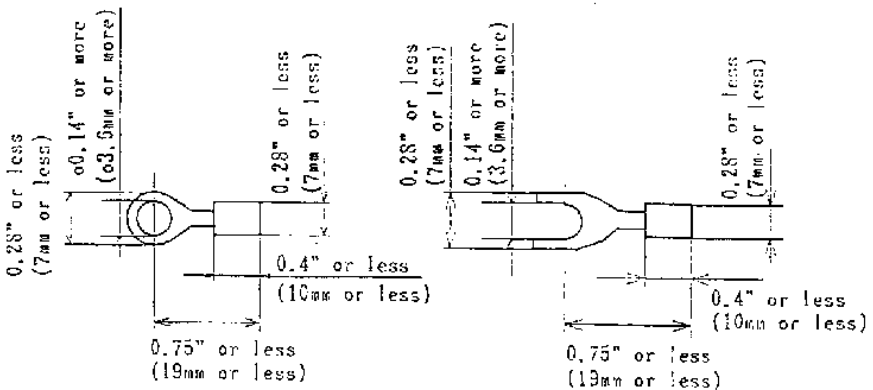
After passing the cable through the cable gland, making press-fit is recommended for easy-to-work.



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

Shape of solderless terminals for cable

Use the solderless terminal with the size as shown in the figure below.



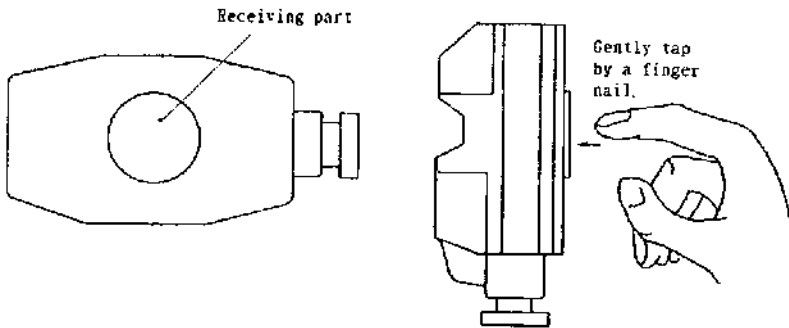
Recommended press-fit terminal: nominal 1.25-3.5

Use the terminal with insulating tube.

Other Cautions

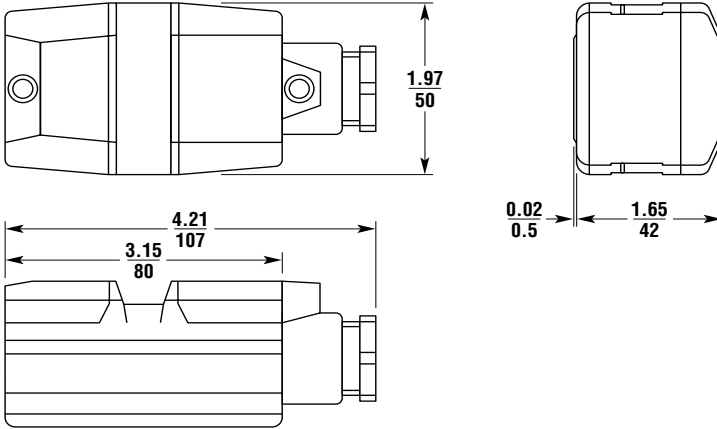
- If the ACF-10 is dropped or receive a strong shock, it may be damaged. Handle with care.
- Do not use the ACF-10 in a vapor and corrosive gases or misty environments.
- Be sure to check up the terminal numbers before wiring. Be sure to fasten the cable gland and the cover. If the fastening is loose, this may damage the drip-proof.
- When using the ACF-10 outside, install to avoid direct sunlight or attach a sunshading cover to avoid the temperature rise and the effect of ultraviolet rays.

• Check Up



Check up the ACF-10's operational functions with the following procedures. Be sure to wire the ACF-10 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.

• Dimensions — in./mm



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