Version 1.2
Doppler Flow
MS 0821

Microwave Doppler Flow Switch (DC)

CE & UKCA Compliant

Installation & Operation Manual

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PRINCIPLE OF OPERATION

General

The Microwave Doppler Flow Switch is a microwave-based, low cost, non-contact & non-invasive solids flow sensor. It utilizes the Doppler Effect to detect the movement of solid materials such as powders, granules and ores in pneumatic pipelines and feeder chutes etc.

The sensor has wide application across all areas of industry where highly reliable, non-contact flow detection is required.

Some of the industries where this sensor is used include:

- Cement manufacture
- Aluminum manufacture
- Mining
- Iron manufacture (blast furnaces)
- Stockfeed & fertilizer mills
- Agriculture
- Food processing

The sensor is generally used for process control by monitoring bulk solids' flow/no-flow conditions in vacuum pipelines, ducts, air slides, gravity chutes, feeders, and at transfer points in vibrating chutes, conveyor belts and bucket elevators.

Penetrability of Buildup

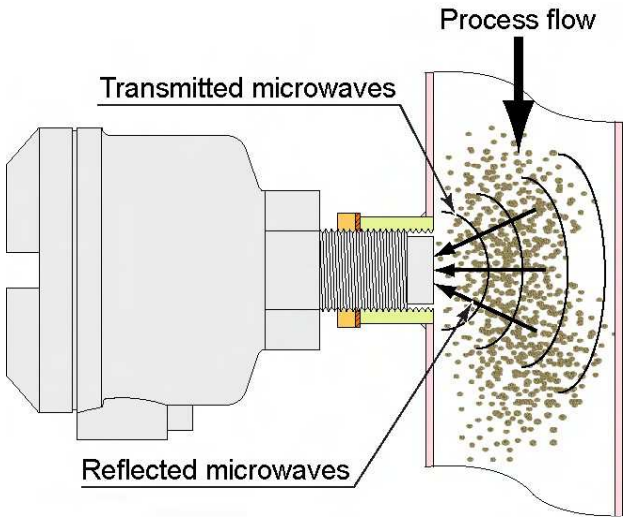
Microwaves can penetrate non-metallic material; thus, nominal material buildup on the sensor head does not affect flow detection.

Penetrability of Walls

Microwaves can penetrate walls and pipes made from non-conductive materials such as refractory/firebrick, ceramic, plastic, glass, wood etc. However, microwaves cannot penetrate metallic or conductive wall linings: a hole must be made, and a suitable process connection welded to the vessel.

The Doppler Effect

The sensor emits a low power microwave signal towards the target material. A portion of these microwaves are then reflected to the sensing head. These are analyzed as to whether they are from a moving or stationary target.



If the return signal has a Doppler frequency shift, then motion is detected, and an output relay is actuated, but only after any RELAY ON/ RELAY OFF delay period (user-set) has passed.

Non-contact flow detection
No direct contact with flow avoids wear on the sensor.

Non-invasive, non-intrusive
No disruption or damage to material flow.

No moving parts
Results in increased reliability, eliminates mechanical failures and keeps the sensor maintenance and trouble-free.

FEATURES

High penetration
Easily penetrates process build-up on the sensor head. The sensor can be installed on the exterior of a plastic or ceramic pipe and detect the material flow inside.

Non-intrusive installation
Mounted flush, no intrusion or damage to material flow.

Equipped with a filter for screening unnecessary incoming Doppler signals
This function eliminates unnecessary incoming Doppler signals (such as signals from a vibrating pipe or conveyer) and improves the signal-to-noise ratio. This improvement enables the sensor to be used in places where previously non-contact flow detection was hardly possible.

Equipped with a sensitivity margin indicator
The sensor indicates the received power level and the sensitivity setpoint, allowing for easy visual adjustment and maintenance.

Equipped with an alarm output
Microwave circuit failure and rising temperature can be detected and output.

Selectable detection mode
Either flow or non-flow detection mode may be selected.

Equipped with a test button
LED indicators indicate microwave circuit status and internal temperature when the test button is pushed.

Equipped with a Doppler signal incoming indicator
An LED indicator turns on when the Doppler signal is received.
Flow and non-flow conditions are clearly displayed.

SPECIFICATION

Type
HYCMWSDP3-24C

Detection method
The Doppler effect

Power supply
DC24V ±10%

Power consumption
2W

Operating distance
Up to 1.5m (dependent on material)

Frequency & transmission power
Approximately 24 GHz, less than 10 mW

Sensitivity margin indicator
Displayed by 7 LEDs

Control output
1a non-contact output
AC/DC50V, 150mA

Alarm output
1b non-contact output
AC/DC50V, 150mA
Note: Microwave circuit failure and rising temperature.

Delay functions
ON/OFF Delay (Selectable),
0~10sec/ 0~2sec (Selectable)

Delay time from power on to function
Approx. 8 seconds

Doppler signal incoming indicator
Blue LED

Mode selection
NO.1: Flow/Non-flow detection
NO.2: On/Off delay
NO.3: Delay time, 10SEC. /2SEC.
NO.4: Filter, On/Off

Test function
Microwave circuit status and sensor temperature are indicated by LED when the test button is pushed.

Noise tolerance
Pulse noise from simulator +/-1kV (normal and common mode)

Vibration resistance
10 ~ 55Hz, 0.75mm single amplitude in X, Y and Z directions, for 2 hours each.

Operating ambient temperature
-20ºC ~ +55ºC

Storage ambient temperature
-30ºC ~ +70ºC

Continuous maximum pressure
0.5MPa (75psi)

Enclosure rating
IP65

Enclosure construction
Die-cast aluminium

Colour
Orange RAL2009

Weight
1.2kg

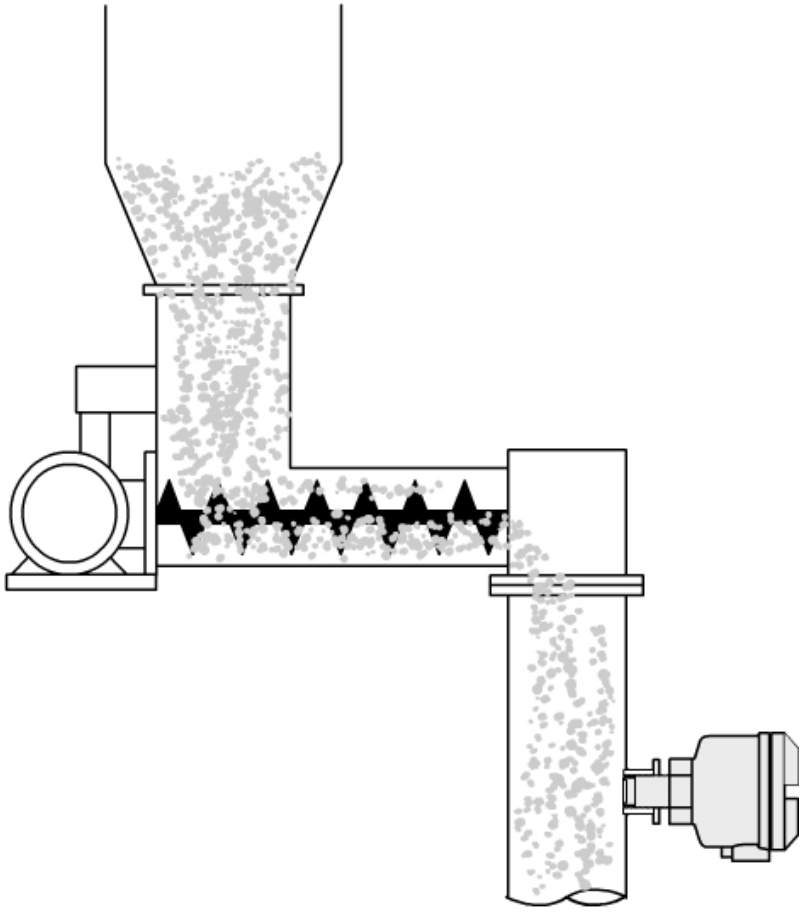
Certification Standards
CE & UKCA compliant

APPLICATIONS

Volumetric Dosing

Monitoring the flow of dosing products allows real-time detection of blockages or empty hoppers.

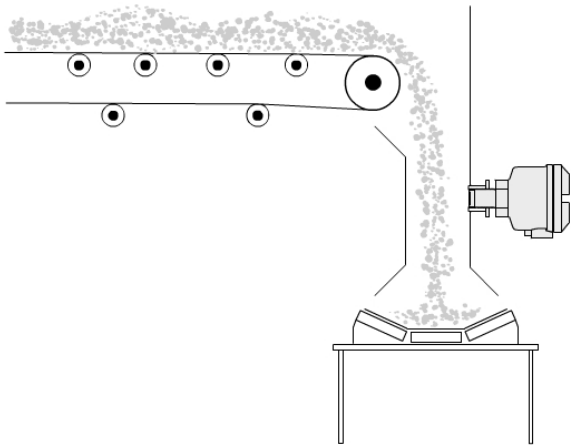
Early detection of abnormal conditions prevents inconsistency of output and damage to the process.



Conveyers and Transfer Points

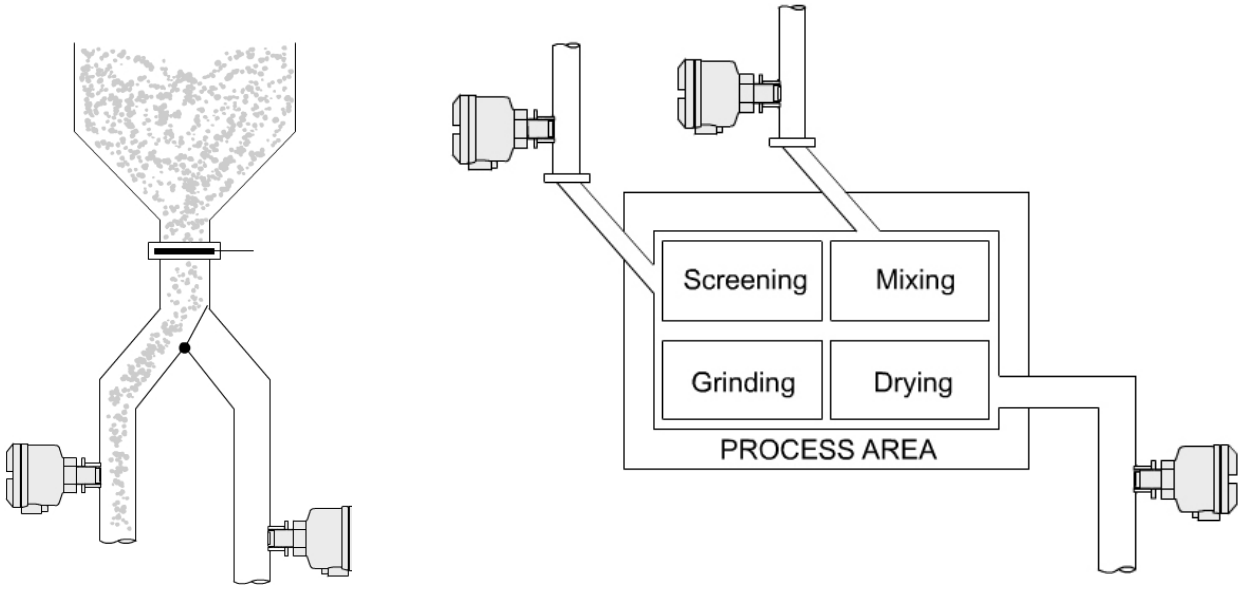
Monitoring product flow on conveyor systems and at transfer points allows early warning of mechanical damage.

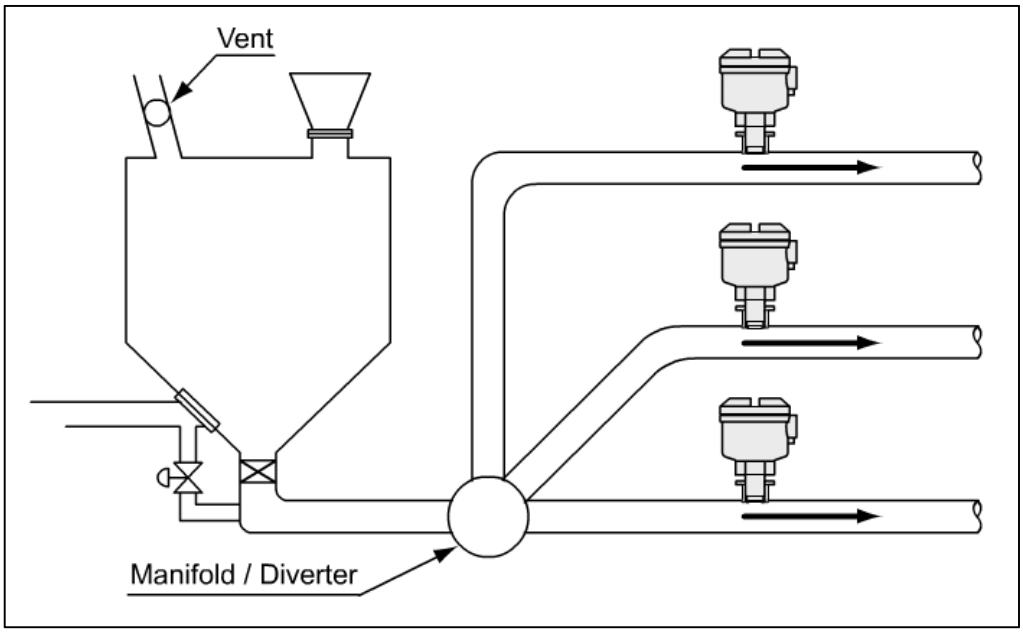
Energy cost savings may also be realized by activating the conveyors only when needed, reducing mechanical wear.



Silo Discharge

Flow/no flow detection at silo discharge points. Monitoring the correct operation of gates and valves serves as an early warning for accidental discharge through incorrect paths.





Typical Industry Applications:

Food Processing

- Animal feeds
- Grains
- Tea & coffee
- Snack foods

Energy Products

- Pulverized coal
- Fly ash

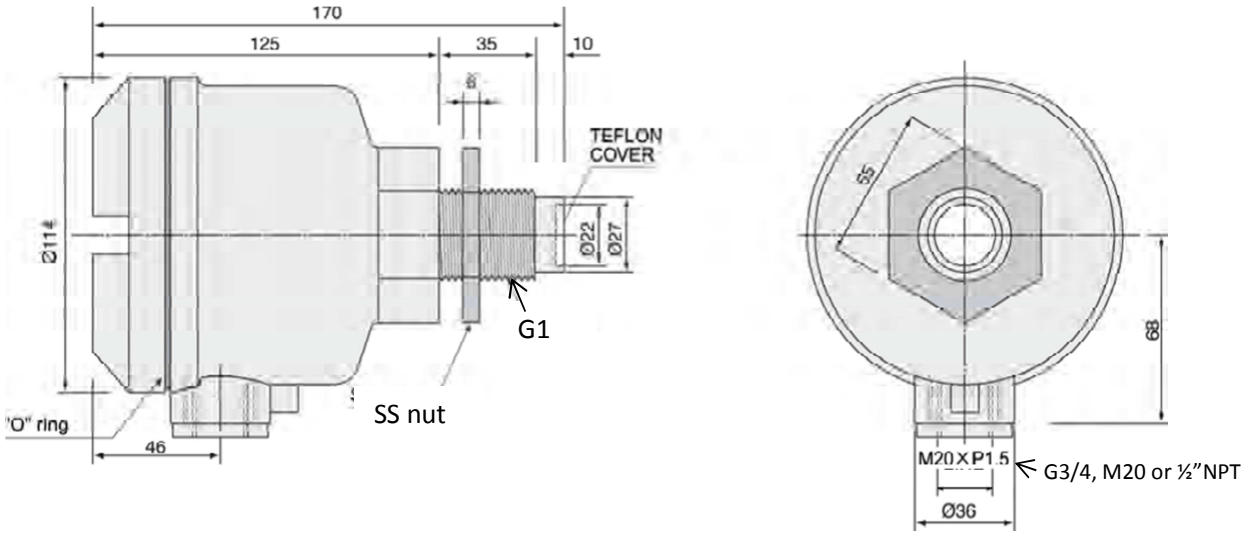
Chemical Plants

- Plastic granules

Construction Materials

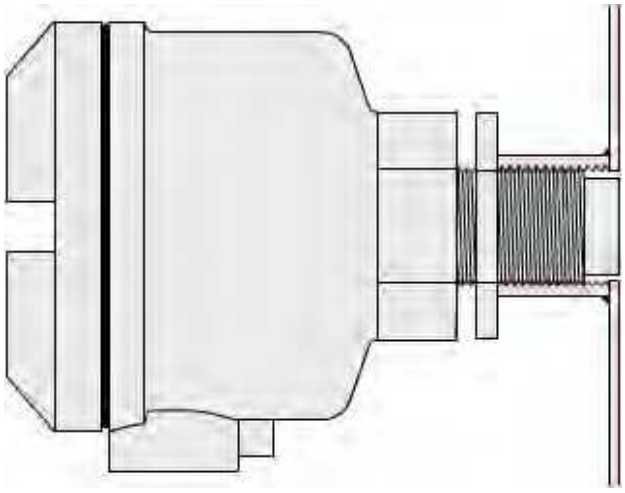
- Cement
- Lime
- Sand
- Aggregate

DIMENSIONS



INSTALLATION & MOUNTING

The sensor is screwed into a connector welded to the wall. The sensor should be mounted flush with the inside of the vessel, and the SS lock nut used to fix the sensor in position. Apply sealant into the screw hole and into any gaps.



WIRING DIAGRAM

Warning ⚠

Do not disconnect the wires connected to the ground, either inside or outside the sensor. If they are disconnected, it may cause electrocution or damage the circuits.

Do not touch live terminals of the sensor as high voltages may be present.

Do not disassemble any part of the sensor's electronics.

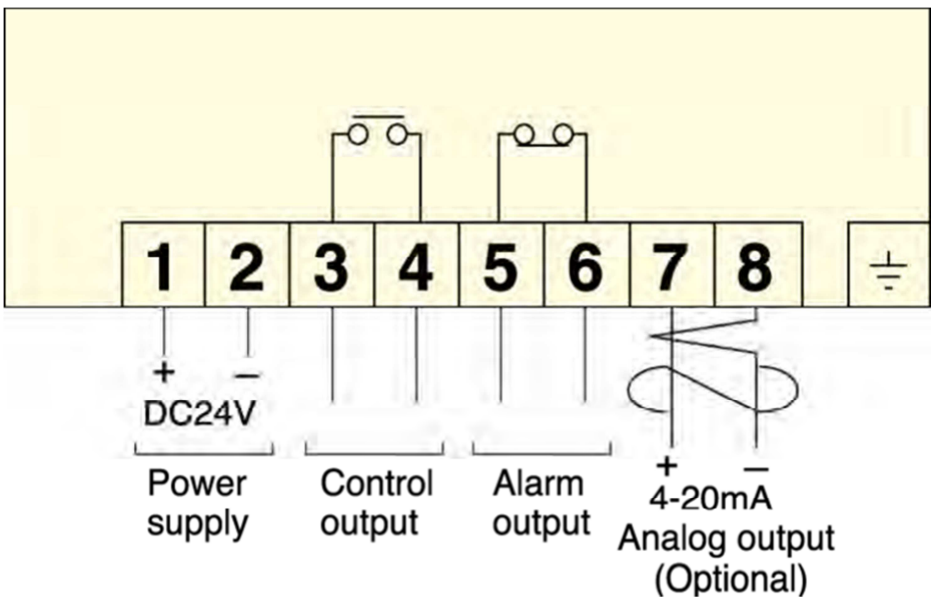
Turn off the power before connecting to terminals. If this is not done, electrocution or damaged circuits may result.

To prevent electrocution, ensure that the ground terminal of the sensor is connected before turning on the power.

Before turning on the power supply confirm that it is compatible with the sensor.

Ensure that the ground wire is connected to the earth before connecting any other cables to the sensor.

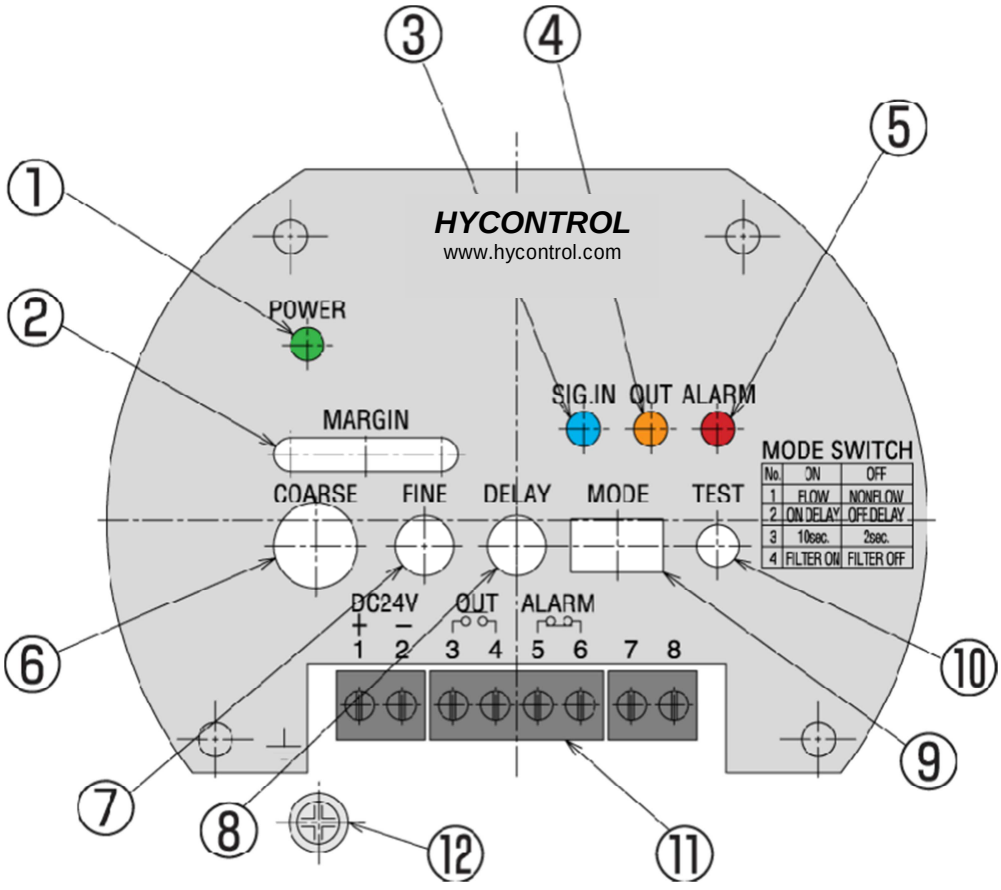
Terminal Connection



Selection of detection mode and relay configuration

Detection mode		Flow	Non-flow	Alarm
Terminal Number		3 - 4		5 - 6
Unpowered state		Open	Open	Close
Powered state	Non-detecting state	Open	Open	Open
	Detecting state	Close	Close	Close

FUNCTION OF SWITCHES INDICATORS & RHEOSTATS



No.	Part Name	Description
1	Power indicator	Green when power is on
2	Sensitivity margin indicator	Indicates sensitivity margin for nonflow and flow conditions
3	Signal incoming indicator	Blue when doppler signal is received
4	Output indicator	Orange when flow or non-flow is detected
5	Alarm indicator	Red when alarm is output
6	Coarse sensitivity rheostat	For sensitivity adjustment
7	Fine sensitivity rheostat	For fine sensitivity adjustment
8	Delay time rheostat	Delay time to detection output
9	Mode switch	Selects detection mode Factory adjustment 1:ON 2:OFF 3:ON 4:OFF
10	Test button	Transmission halt, signal incoming condition and temperature are indicated when the test button is pushed.
11	Terminals	
12	Earth terminal	

SENSITIVITY ADJUSTMENT

After finishing the installation and wiring, check the following and adjust the sensitivity:

1. On turning on the power supply, the power light ① POWER (Green) will turn on.

2. Turn the delay time rheostat ⑧ counter-clockwise to set it at the minimum point.

3. Turn the coarse sensitivity rheostat ⑥ fully clockwise to set it at maximum. Next, turn the fine sensitivity rheostat ⑦ fully counter-clockwise to set it at a minimum.

4. Confirm the output indicator ④ OUT (Orange) is off while operating the pipeline with an empty condition. If the output indicator ④ OUT (Orange) is on, turn the coarse sensitivity rheostat ⑥ counter-clockwise slowly and find the point where the output indicator ④ OUT (Orange) turns off.
   This is the actuating point for the non-flow condition.

5. While operating the pipeline with a continuous flow to be detected, you can see the output indicator ④ OUT (Orange) turns on. Turn the coarse sensitivity rheostat ⑥ further counter-clockwise slowly and find the point where the output indicator ④ OUT (Orange) turns off.
   This is the actuating point for the flow condition.

6. Set the coarse sensitivity rheostat midway between the actuating point for the non-flow condition and the actuating point for the flow condition. This is the sensitivity set point. The margins from the flow and non-flow actuating points to the sensitivity setpoint can easily be seen by viewing the sensitivity margin indicator ②. Vibration and surrounding noise from other machinery such as conveyers etc., will sometimes increase receiving power levels in the non-flow condition and result in unwanted detection. You can use the filter function to increase the margins and avoid unwanted detection by turning on the mode switch No.4 ⑨and repeating adjustment procedures (steps 4 to 6).

7. To detect a sporadic flow, set the continuous detecting limit with the delay time rheostat ⑧.

8. To not detect a sporadic flow, set the non-detecting limit with the delay time rheostat ⑧ after turning on the mode switch No.2 ⑨.

GUARANTEE PERIOD

The guarantee period is for one year from the date of delivery.

Conditions

Any sensor that malfunctions during the guarantee period due to a manufacturing fault will be repaired free of charge on return to Hycontrol; the buyer will bear the cost of freight.
This guarantee does not cover any malfunction resulting from the conditions listed below:

1) When used under conditions or in environments not stated in the manufacturer's specifications or brochures.

2) When the cause of the malfunction is not the result of the unit's operation itself.

3) When repairs or modifications have been done by anyone other than the manufacturer.

4) When used for purposes other than those intended.

5) When the cause of the malfunction is due to a natural disaster.

The guarantee is not transferable to any second party.

Service

Onsite service by Hycontrol is not included in the unit's price. Hycontrol will provide an estimate of the cost for such services on request.