

## OIL ON WATER ALARM

OF-1600

This instrument is suitable for the continuous monitoring of water surfaces, such as those in a sump pit, for the presence of oil. Upon detecting an oil film floating on the surface, the system generates an alarm contact output signal.

The reflectance of an oil film is greater than that of water. From this property, this model detects the presence of oil by projecting light from a high-intensity LED (light-emitting diode) source onto water surface and then measuring the intensity of the reflected light. The instrument is installed about 0.5m above the water level, enabling the non-contact monitoring of the sample.



### Features

Due to its reflectance-based measurement principle, this analyzer is capable of detecting virtually all types of film-forming oil, including heavy oil, light oil, kerosene, gasoline, and solvents.

No consumables are necessary, and the instrument incorporates a compact and lightweight design for ease of maintenance.

A pulsed LED light source has no effect on external light such as sunlight (measurement is possible even under direct sunlight).

The peak hold circuit eliminates the interference effects of non-oil solids floating on the water surface as they pass across the monitored surface.

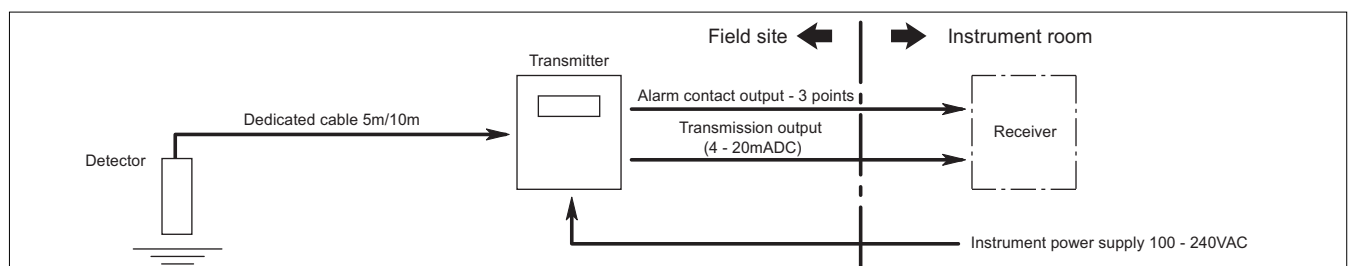
A self-diagnostic function enables the instrument to generate an "Undetectable" alarm signal when the reflected light is so weak that oil film cannot be detected.

The instrument incorporates a comprehensive self-diagnostics capability for the quick detection of errors in the instrument and measurement.

Historical data on oil film detection and undetectable conditions are stored in the internal memory together with the date and time of detection. This data can be read out.

In addition to the oil film detection signal, 4 - 20mADC transmission output is available as standard, for connection to a recorder to record the detection of oil leakage.

### Configuration



## Standard Specifications

Product name	: Oil on water alarm	Repeatability	: Within $\pm 2\%$ FS (still water)
Model	: OF-1600	Response time	: Approx. 20seconds (factory setting)
Measurement object	: Floating oil film on water surface	Sample water conditions	: No freezing No color/turbidity requirements; no vapor (steam) generation; if vapor (steam) is unavoidable, an air curtain is needed to supply instrument air to the transmitter.
Measurement method	: Reflectance measurement of near-infrared rays	Ambient conditions	: -10 - 50°C, 5 - 95%RH (No condensation)
Sensor distance	: 0.5 $\pm$ 0.2m (distance from the water surface to the bottom of the detector)	Configuration	: Detector and transmitter housed in separate enclosures
Light source	: Near-infrared LED	Construction	: Transmitter ; External installation, dustproof, jet water resistant, IP65 Detector ; External installation, dustproof, jet water resistant, IP65 (* IP54 when using an air curtain) (optional)
Alarm contact output signals	: Total of three alarm contacts available (3 x form C contacts) Contact capacity ... 125VAC, 0.2A or 30VDC, 1A (resistance load) Any 3 contacts from the following can be assigned (Duplicated selection is possible; however, duplication using the power cut-off signal is not available.): 1) Power cut-off, 2) Oil on water alarm, 3) Detection error, 4) Instrument malfunction, or 5) Under maintenance.	Power requirements	: 100 - 240VAC $\pm$ 10%, 50/60Hz
Transmission output signals	: 4 - 20mADC (max. load resistance 600 $\Omega$ ), isolated It is possible to set analog output to any mode from the following 1 - 3) using the transmitter: 1) Standard output mode Normal conditions; Approx. 8.8mA (still water) Oil film present; Approx. 11.2mA or more Undetectable conditions; Approx. 4mA (no reflectance) 2) ODL-1600 compatibility mode Normal conditions; Approx. 10.4mA (still water) Oil film present; Approx. 13.6mA or more Undetectable conditions; Approx. 4mA (no reflectance) 3) ODL-20 compatibility mode Normal conditions; 18mA (fixed value) Oil film present; 20mA (fixed value) Undetectable alarm; 16mA (fixed value) Burnout alarm function selectable in mode 1) or 2) Oil on water alarm is ON; 21mA (fixed value) Undetectable alarm is ON; 3mA (fixed value) (Undetectable alarm conditions include both detection error and instrument malfunction.) 1 - 5VDC (250 $\Omega$ resistance to be added) (optional)	Power consumption	: Approx. 8VA (normal), 10VA (max); for 240V, approx. 13VA (normal), 15VA (max)
		Weight	: Transmitter ; Approx. 2.2kg Detector ; Approx. 2kg
		Dimensions	: Transmitter ; Approx. 181(W)x180(H)x95(D)mm Detector ; Approx. $\phi$ 112(diameter)x264(L)mm
		Installation	: 50A pole stanchion
		Materials of construction	: Transmitter ; Die-cast aluminum Detector ; Corrosion-resistant aluminum (A1050P)
		Paint color	: Metallic silver
		Cable entries	: Transmitter ; 6 positions with cable glands for $\phi$ 6 - 12mm (OD) cable (G1/2x6) Detector ; 1 for $\phi$ 6.5mm (OD) dedicated cable (G1/4) Air inlet ; Rc1/8 (optional)
		Cable length	: 5m (standard)/10m (optional) from transmitter to detector

## Principle of Operation

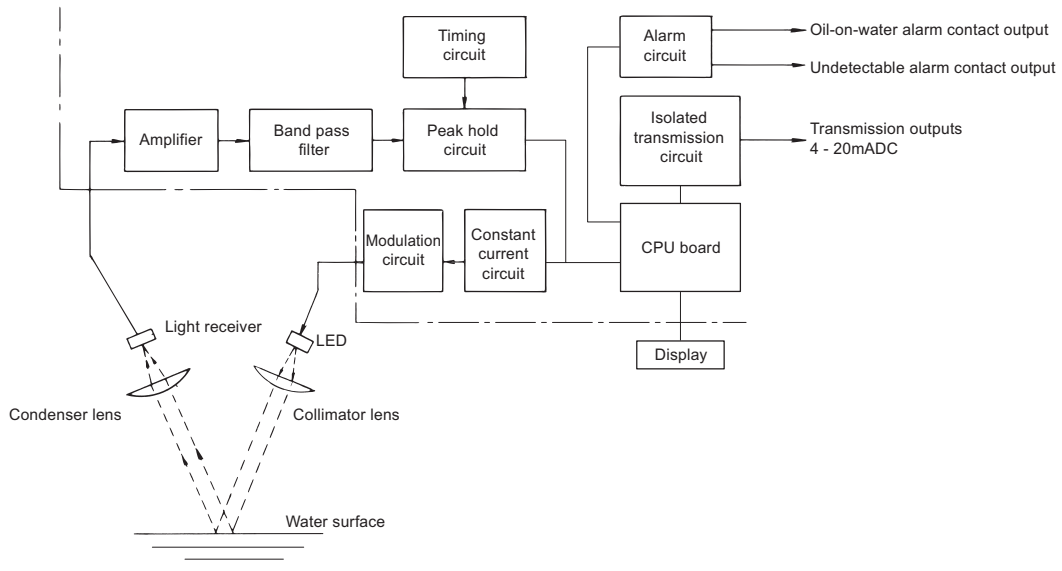
When an oil film is present on water, it has a “glistening” effect, as the reflectance to the visible light of an oil film is greater than that of water. From this property, the presence of oil can be detected by applying a light beam of constant intensity to the water surface and then measuring the intensity of the reflected light.

As shown in the diagram at right, pulse-modulated light from an LED is passed through a collimator lens, and the parallel rays fall onto the water surface to be monitored. The reflected light from the water surface is collected by the light receiver via a condenser lens. The light receiver converts the light into an electric signal that is amplified before passing through a narrow band pass filter, which removes the effects of external light interferences. Only

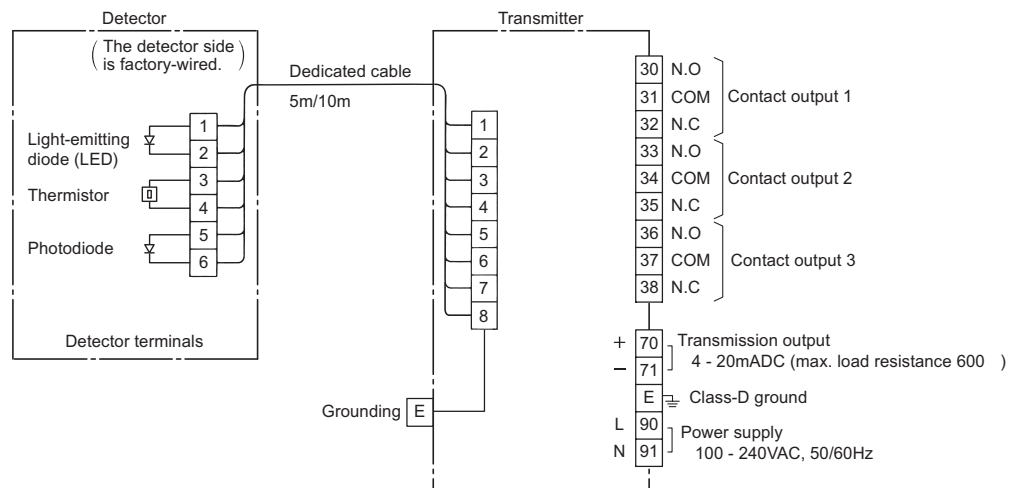
the signal component passes to the peak hold circuit where the peak value of the reflected light is held for a fixed period.

When the peak value exceeds a preset value, the oil on water alarm is activated and an alarm contact output signal is generated.

With a comprehensive self-diagnostic capability, this instrument can generate an “Undetectable” alarm signal as soon as it identifies any detection errors (such as the presence of floating solids on the monitored water surface or rain directly striking the surface) or instrument malfunction (including a damaged light receiver, LED, or electrical circuit failure).



## Terminal connection diagram



## Transmitter Functions

### (1) Display

The transmitter displays calibration operations, oil film detection status, reflected light intensity, self-diagnostics, and error conditions.

### (2) Extensive transmission output modes

A 4-20mA analog output signal is available, representing the intensity of the reflected light from the targeted objects. With the burnout function, an analog output can also be set to indicate the additional alarm status of the instrument (oil detection, undetectable conditions). It does this by changing the analyzer output to an out-of-scale value (21mA, 3mA). Thus, a single analog signal can transmit three detection conditions, normal operation with a raw intensity signal, an oil on water alarm, and undetectable conditions.

To provide compatibility with earlier or similar models, additional transmission output modes are available. With these features, the user is capable of recording transmission management data in a unified manner and making a smooth switch to new systems.

### (3) Alarm contact output signals

A total of 3 alarm contact output signals are available. These can be configured by the operator to represent oil on water alarm, self-diagnostics information, etc. The available signals are as follows:

- Oil on water alarm
- Under maintenance (in ST-BY mode)
- Detection error (water surface detection error, reflected light error, ambient light error)
- Instrument malfunction (LED output trouble, internal temperature error)
- Power cut-off

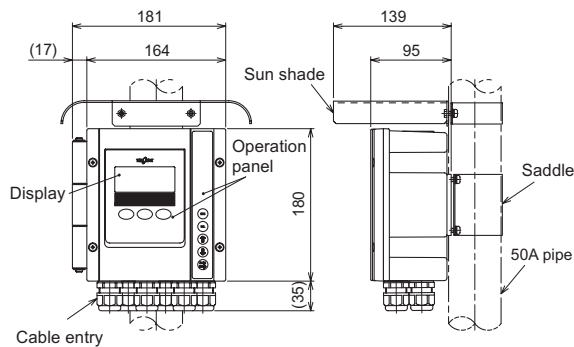
### (4) Detection history stored in memory

Detection parameters and self-diagnostics information are stored in the internal memory with the date and time of detection (up to 10 items). The data can be read out.

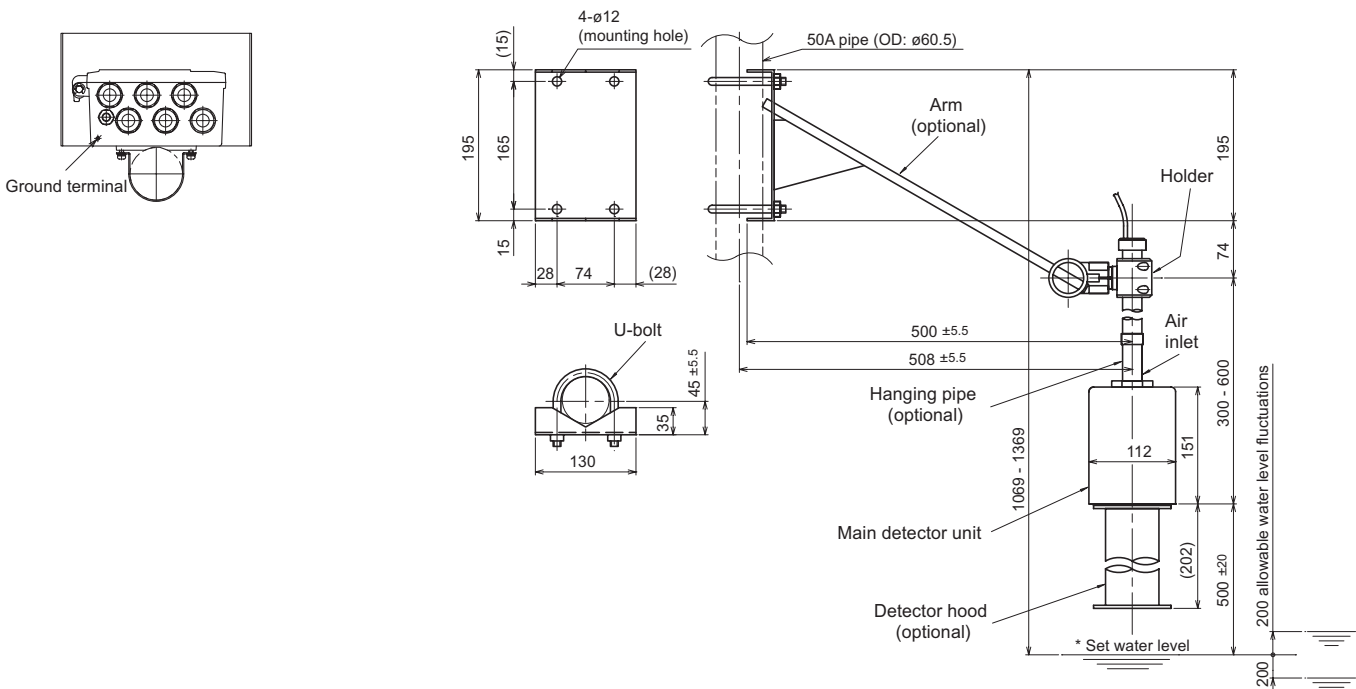
## Dimensions

Unit : mm

### ● Transmitter



### ● Detector (hanging-arm type)



Product code

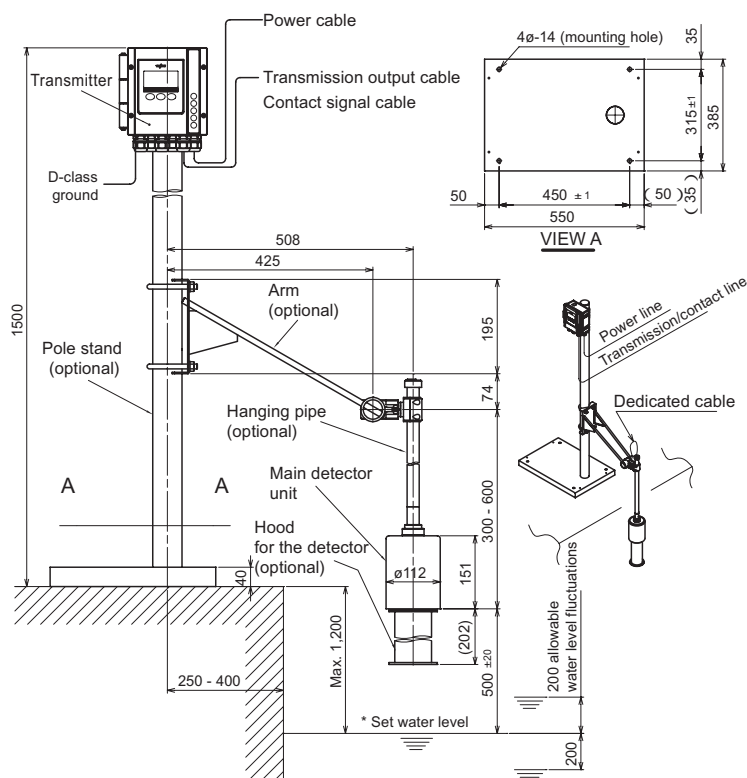
OF1600-0-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	1										Transmission output
	2										4 - 20mADC
		1									1 - 5VDC
		2									Mounting of the transmitter
			1								On a 50A pole
			2								Wall or rack mounting
				A							Surface finish (coating)
				B							Standard coating
											High-performance anticorrosion coating*1
											Arrester*2
			1								None
			2								Included
											Power/transmission/signal cable entries*3
			1								Cable glands for ø6 - 12 cable (standard)
			2								G 1/2 conduit threads for when a cable gland is removed
			3								NPT 1/2 (supplied with 3 adapters)
											Cable length from the transmitter to the detector
				A							5m
				B							10m
											Hanging pipe for the detector*4
			0								None (pipe end connection: Rc1/2)
			1								Equipped 474mm (no hanging arm)
			2								Equipped 974mm (no hanging arm)
			3								Equipped 1,474mm (no hanging arm)
			4								Hanging-arm type (equipped with 474mm hanging pipe)
											Hood for the detector*5
			0								None
			1								Equipped (air tube length: 5m)
			2								Equipped (air tube length: 10m)
			9								Equipped (air tube length: custom spec.)*6
											Sun shade for the transmitter
			0								None (standard)
			1								Equipped (mounting on a 50A pipe; code No. 7049930K)
			2								Equipped (wall mounting; code No. 69304500)
											Markings
				A							Japanese (standard)
				B							English

Custom spec. code;  
 Numeric digit: 9  
 Alphabet: Z

- \*1. Both the transmitter and detector shall have high-performance anticorrosion coating.  
 High-performance anticorrosion coating: Epoxy primer and middle coat, polyurethane resin topcoat; average coating thickness: greater than 100µm; glossiness: G80
- \*2. Ceramic surge arresters (simplified) are mounted on the power line and transmission line.
- \*3. There are 6 cable entries with cable glands for ø6 - 12 cable (G 1/2 conduit threads when a cable gland is removed).  
 NPT 1/2 is supplied with three SUS316 adapters. Screw in the required number of adapters to the cable entries after removing the cable glands. Cable entry ports that are not used should be left with the standard cable glands fitted, which will provide a seal function.
- \*4. If you replace our existing model, the OF-10, it is acceptable to use the available hanging arm when mounting the detector. However, incorporating a new arm into the existing unit (replacement) is recommended, as the parts inside the existing arm such as the resin components may have deteriorated.
- \*5. To protect the detector from steam rising from the water surface, using this option is recommended. If a hood for the detector is desired, the unit will come equipped with an air curtain, as well as an air supply tube.
- \*6. Please contact us to specify the tube length you require.

Note: The model operates on adjustable-voltage 100 - 240VAC power supply. Alarm contact output signals (generated when oil film is present and in undetectable conditions) and 4 - 20mA analog output signals are available.

## Installation diagram



\* **Set water level:** The water level used when adjusting the optical axis; it will serve as a reference for determining the correct detector's position and allowable water level fluctuation range.

Installation example using the dedicated hanging arm

Note: A custom float type is available for installation in locations where there are large water level fluctuations. Please contact us for details.

## Installation recommendations

### Installation location:

The instrument can be installed on a conduit wall, aqueduct bridge, manhole, or on the ground. Select a location where vibrations and mechanical shocks are minimized and where the water flows as smoothly as possible.

### Water surface to be monitored:

Install the analyzer at a location where the monitored water surface will not be subjected to direct rainfall or direct wind disturbance, as rippled water surface may reduce the intensity of reflected light and thus interfere with oil film detection. For such locations, protection against direct rainfall will be required.

Avoid installing the detector at locations where vapors (steam) may rise from the water surface. The vapors may cause a scattering of light or condensation on the window of the detector, thus resulting in the failure of detection. If it is unavoidable, take additional measures such as supplying a gentle airflow to clear the vapors (steam) away or installing an air curtain (optional) on the detector.

Condensation is more likely to form on the window during rainy seasons with high humidity. To ease maintenance, using an air curtain is recommended.

### Distance from the water surface:

Install the detector so that the distance from the bottom of the detector to the water surface is 0.5m, and then set the optical axis. This will eliminate the need for realignment even if the water level fluctuates by  $\pm 0.2\text{m}$  (0.3m - 0.7m).

### Installing the detector:

The detector should be installed nearly perpendicular to the water surface. Since a surface with a rapid current is not necessarily horizontal, set the optical axis so that the system itself can correct it to true vertical by  $\pm 2$  degrees in 2 directions and so that it does not require realignment even if the unit shifts after installation. You can adjust the optical axis while checking the display on the transmitter.

### Air:

For the air curtain of the detector (optional)  
 $\varnothing 2.4 \times \varnothing 3.2$  TAC joint, detector Rc1/8, dry air (equivalent to instrument air) 0.01 - 0.05MPa, approx. 5L (N)/min



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**CAUTION**

Do not operate products before consulting instruction manual.