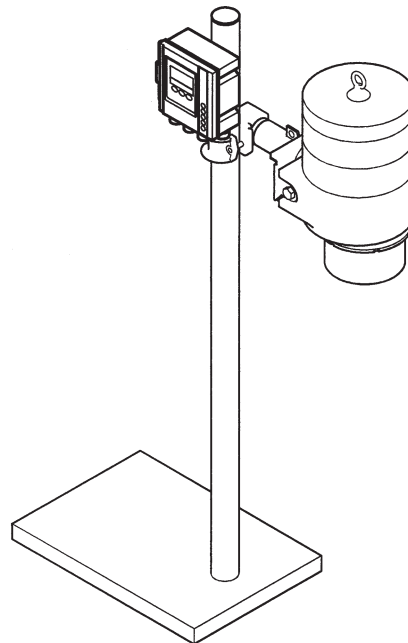


OIL FILM DETECTOR

(High sensitive model)

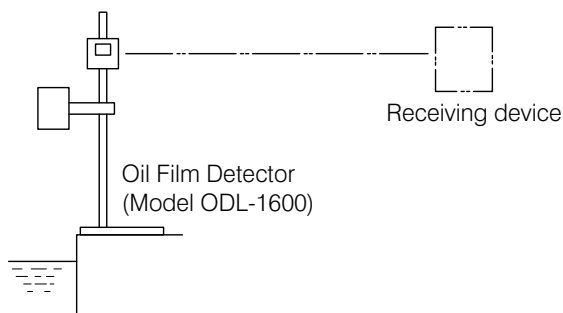
MODEL ODL-1610A



- Please keep this instruction manual close at hand of the persons who are in charge of the operation of this product.
- Before operating this product, please read this instruction manual carefully for its correct handling.

Introduction

- (a) Thank you for your purchase of our product. The Model ODL-1610A Oil Film Detector (High sensitive model) (hereafter called “instrument” or “product”) is a sensing/alarm device that continuously monitors the presence of oil films on a water or floor surface. This product is based on the principle that the reflectance of an oil film is greater than that of water.



Monitoring Example

- (b) This product consists of a detector and a transmitter. The detector consists of a light source, light source scanning unit, reflecting mirror, light receiving section and a signal processor. The detector monitors the presence of oil films from above with no contact and sends oil film detected signals, self-diagnostic information and received light intensity level, etc. to the transmitter via digital communication. The transmitter displays/outputs an oil alarm signal, self-diagnostic information and light received signal intensity, etc., according to communication signals from the detector. It also performs setting of alarm and self-diagnostic conditions, etc.
- (c) Since this product outputs an oil film-detected alarm signal and an error alarm signal, it is possible to build an alarm system in combination with an alarm buzzer, etc.
- (d) The product may indicate or output an incorrect measured value due to the following reasons. We recommend preparing a system such that the related facilities will not be damaged even in cases like these.
- Any problem of the product, such as deterioration or damage of the sensing section or inadequate cable insulation.
 - Inadequate operating condition setting or calibration operation.
 - Electrical interference such as noise in the vicinity or inadequate grounding.
 - Other unpredictable phenomena
- (e) Since important items are described in “Safety Information,” read the contents carefully.
- (f) The product should be handled by persons who have received proper training. In addition, for technical services such as repairs, ask a specialist to do who is qualified for the technical certification system in our company or a person who has technical skills equivalent to that certification system.

Safety Information

(1) Meaning of markings

The signal terminology and symbols related to warnings in the instruction manual are defined below. The alert symbol mark (⚠: General caution mark) indicates the possibility of hazard or damage and also means “Refer to the instruction manual.”

WARNING:



Indicates the degree of hazard which can lead to death or serious injury if you fail to operate the product properly.

Serious injury means an injury such as loss of sight, burns (high temperature or low temperature), electric shock, bone fracture and poisoning, and the aftereffects of the injury remains or the injury requires hospitalization or long periods of outpatient treatment.

CAUTION:

Indicates the degree of hazard/loss which can result in injury or property damage if you fail to operate the product properly.

Injury means an injury not requiring hospitalization or long periods of outpatient treatment and refers to burns or electric shock. Property damage refers to widespread damage to the home, household goods and livestock, pets, equipment, materials, etc. (damage to other than the product itself).

【IMPORTANT】 Indicates important matters other than  **WARNING** and  **CAUTION**. They are the matters such as preventing damage to the product main body, preventing data destruction, preventing wasting time, maintaining performance, and observing regulations.

[NOTE] Indicates comments, reasons, background information, a case example and other items to help the reader understand the meaning.

>> Indicates reference items.

①, ②, ③ Indicates item numbers such as the ones used in operations.

(2) Safety compliance items

WARNING

Hazardous Gasses

- Do not use the product in an area where explosive gas, flammable gas exists. Using the product in any of these areas can cause explosion or fire.

Electric Shock

- Do not touch the terminals inside the controller while power is applied. Touching the terminals may cause electric shock.
- The ground terminal must be grounded. If the terminal is not grounded and a problem occurs in the power supply system, electric shock may result.

Laser beam

- This product uses Class 2 (1mW or less, 400 to 700nm wavelength) laser defined in JIS C6802-2005 "Laser Product Safety Standard". Do not look directly into the laser beam with your eyes and do not make an observation using an optical means (such as lens). If you look directly into laser beam for a long time, you could damage your sight.



Disassembly and Modification

- Do not disassemble or modify the sections of the product that are not described in the instruction manual. The product can be damaged.

Warning Label Lost

- If any warning label affixed to this product becomes too difficult to read or lost, please order a new one through your local sales agent or our sales office and affix it to its original position.

Disposal

- In case you dispose of this product or any part of this product, handle it as industrial waste as specified by law.
-

(3) Notes on use of the instruction manual

Important items such as "Safety compliance items" are described in this manual. Handle the manual as follows:

- (a) The instruction manual is required not only at the start of operation but also required when maintenance is performed or in case a failure occurs. Please keep the manual at hand all the time so that the operator who actually operates the product can read the manual at any time.
- (b) If the manual is lost or too smeared to read, please order a new copy through your local sales agent or directly from our sales office.
- (c) Some of the diagrams used in the manual or on product labels may be modified with part of their shapes or displays omitted or they may be described in abstract form. In addition, numbers etc. shown on the screen example are just examples for such cases.
- (d) The contents of the manual may be changed without prior notice for reasons such as to improve performance.
- (e) Intellectual property right of the manual belongs to DKK-TOA. All or part of the manual must not be reproduced without permission.

Warranty

(1) Warranty Coverage

DKK-TOA Corporation (DKK-TOA) warrants its products against defective material or workmanship for the warranty period.

- (a) The warranty period is one year from the date of delivery to the original user. If the date of delivery cannot be specified, the warranty period is 24 months from the month following the date of manufacture shown on the product nameplate.
- (b) Specific written agreements with DKK-TOA, if any, shall take precedence over this warranty.
- (c) The limitation of warranty described herein may not apply where applicable laws do not allow such limitation.

(2) Limited Warranty

This warranty does not cover the cases listed below.

- (a) Direct or indirect failure or damage caused by the use of the product for a purpose or in a manner not prescribed by the specifications or the instruction manual for the product.
- (b) Direct or indirect failure or damage caused by force majeure, including but not limited to an act of God, natural disaster such as earthquake, storm and flood damage, and lightning, fire, accident, abnormal voltage, salt damage, gas damage, labor unrest, acts of war (declared or undeclared), terrorism, .civil strife, or acts of any governmental jurisdiction.
- (c) Failure or damage caused by any repair or modification not authorized by DKK-TOA.
- (d) Failure or damage caused by the transport, moving, or dropping of the product after the purchase that is not attributable to DKK-TOA.
- (e) Electrodes and consumables (The warranty period for each part has priority when the period is shorter than that for the main unit of the product. If the customer requires any part after more than six months from the date of manufacture, consult DKK-TOA or its distributor.)
- (f) Failure or damage caused by the use of consumables, parts, or software not supplied by DKK-TOA.
- (g) Malfunctions or damage caused by the use of connecting equipment not supplied by DKK-TOA
- (h) Loss of data, settings, programs, or software stored on the product not attributable to DKK-TOA.
- (i) Any product other than DKK-TOA's, if specified by the purchaser or user, that incorporates, or is incorporated into or combined with DKK-TOA's products (*1). In such cases, this warranty covers DKK-TOA's products only.
- (j) Any product not under proper maintenance in accordance with the instruction manual furnished by DKK-TOA.
- (k) Products without a nameplate (excluding products proved to have been delivered by DKK-TOA).

EXCEPT AS EXPRESSLY SET FORTH IN THE PRECEDING SENTENCES, DKK-TOA MAKES NO WARRANTY OF ANY KIND WHATSOEVER WITH RESPECT TO ANY PRODUCT. DKK-TOA EXPRESSLY DISCLAIMS ANY WARRANTY IMPLIED BY LAW, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF REMEDIES: In the event that a defect is discovered within the warranty period, DKK-TOA or its authorized distributor will, at its option, repair or replace the defective product or its part, or will refund the purchase price of the product. **THIS IS THE EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.**

LIMITATION OF DAMAGES: IN NO EVENT SHALL DKK-TOA BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND FOR BREACH OF ANY WARRANTY, NEGLIGENCE, ON THE BASIS OF STRICT LIABILITY, OR OTHERWISE.

(3) Others

- (a) Maintenance parts (*2) for product will normally be supplied for five years (*3) from the date manufacturing and sales are discontinued.
- (b) The cause of any malfunction or damage shall be determined by a DKK-TOA technician.
- (c) For repairs, contact a local distributor in your country or state.

*1: Warranties for products from other companies must be maintained by the user.

*2: Maintenance parts refers to parts that are required to maintain operation of the product.

*3: This five-year period is subject to availability of parts or their replacement.

Reading Guide

Refer to the necessary sections of this instruction manual depending on your purposes such as understanding the outline of this product or starting the product as shown below. The numbers in circles indicate sections to be referred to in sequential order.

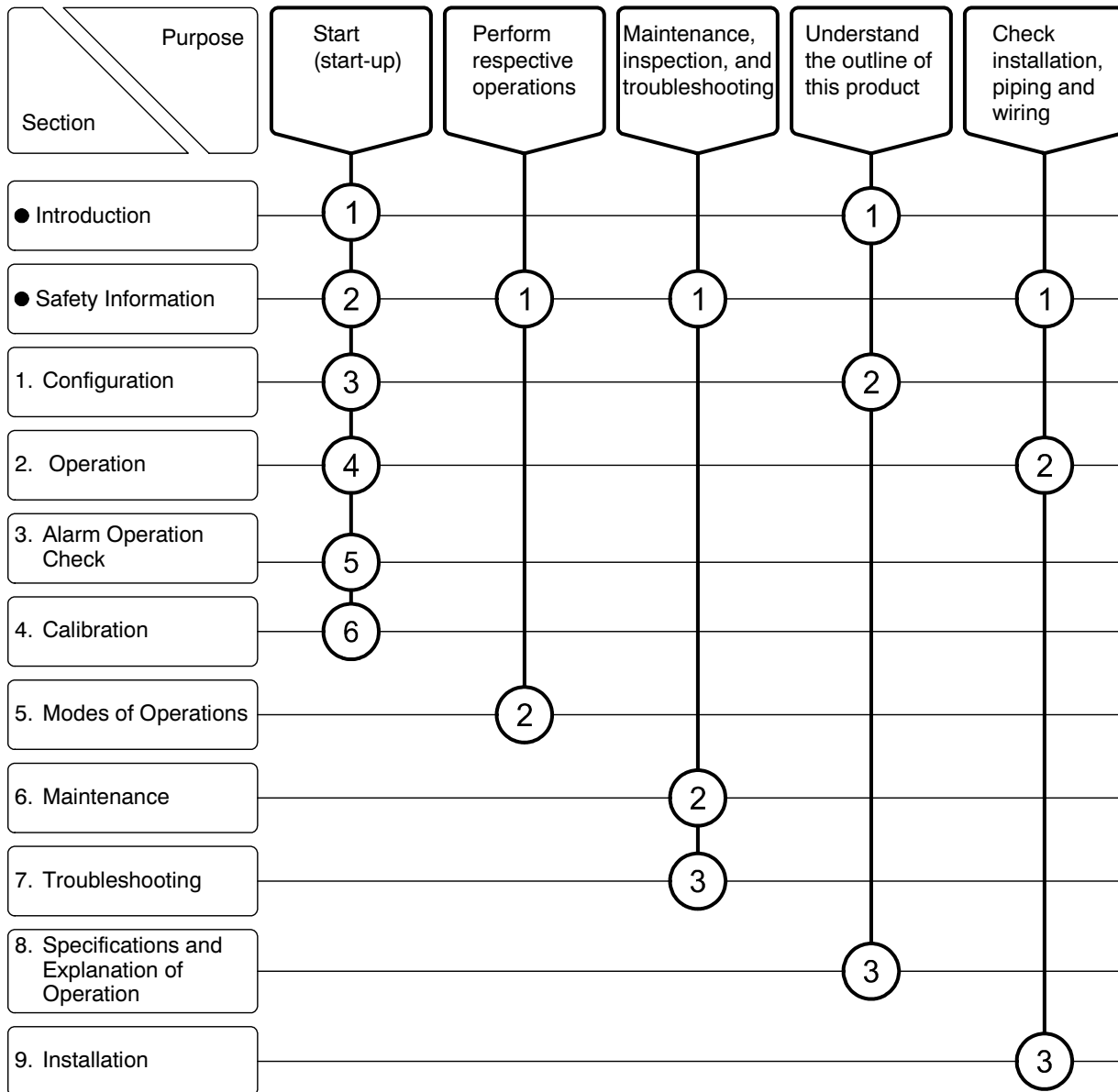


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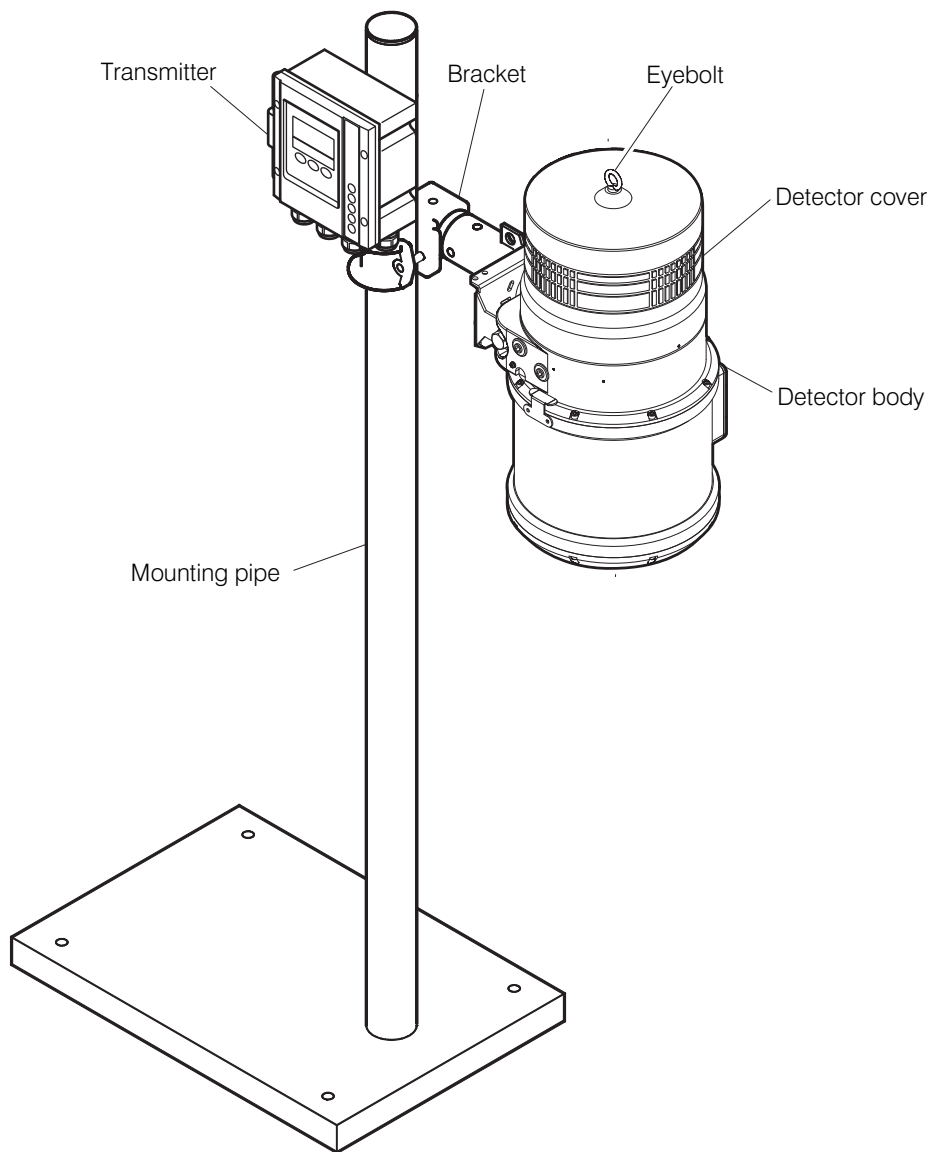
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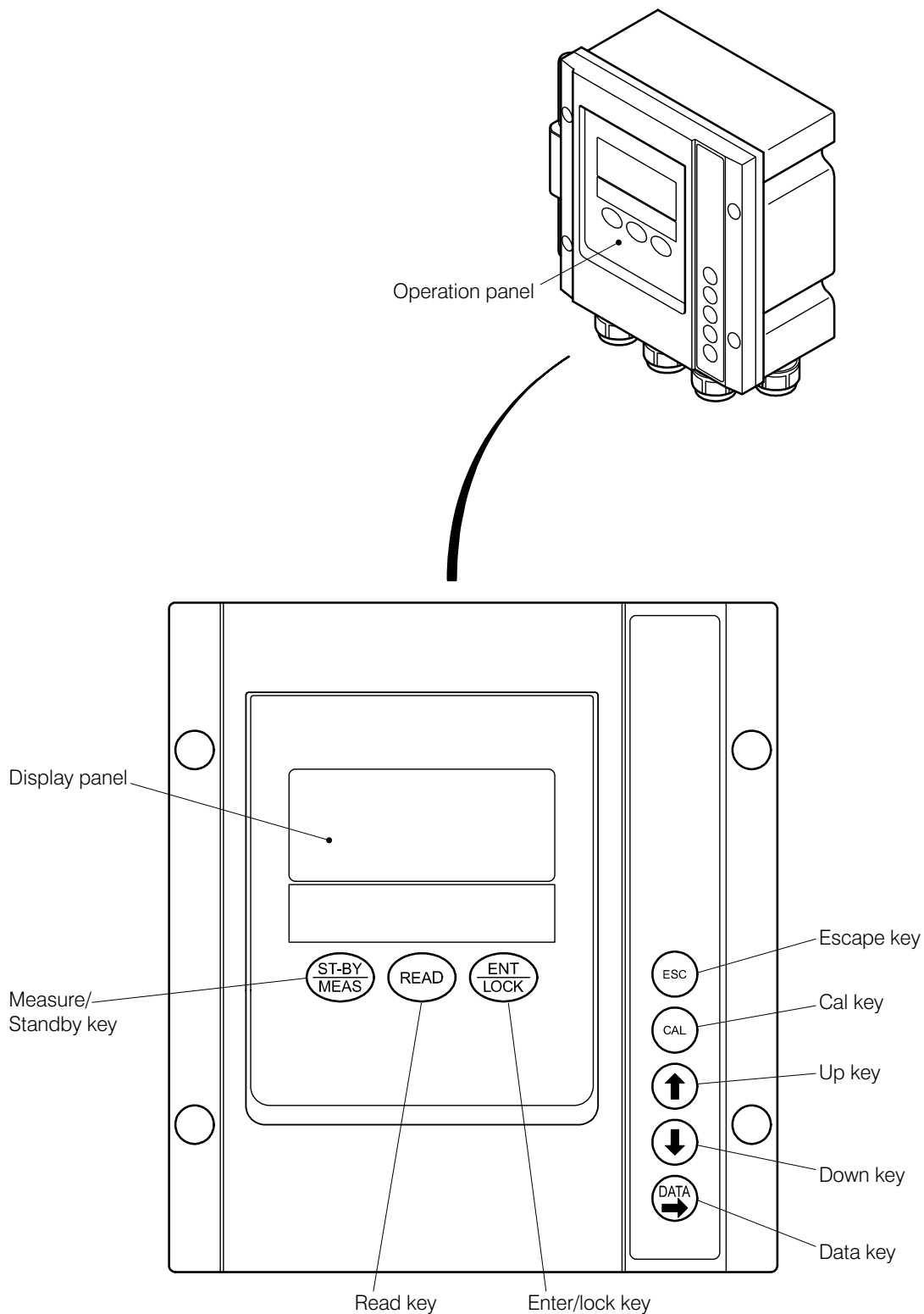
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1. Configuration

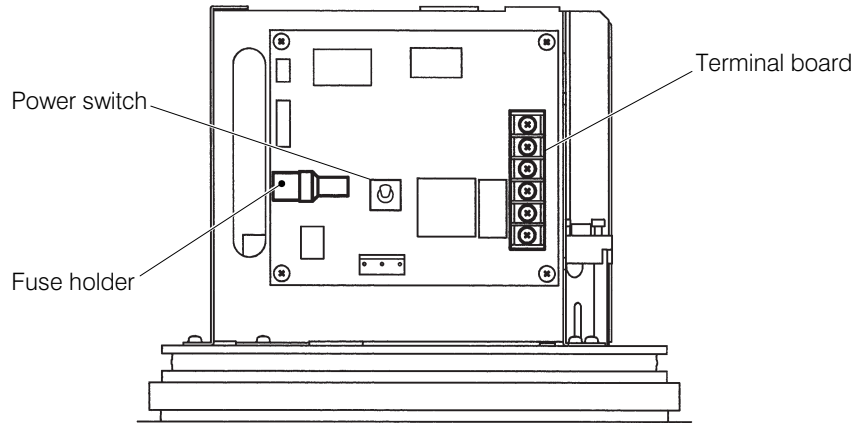
(1) Names of main components



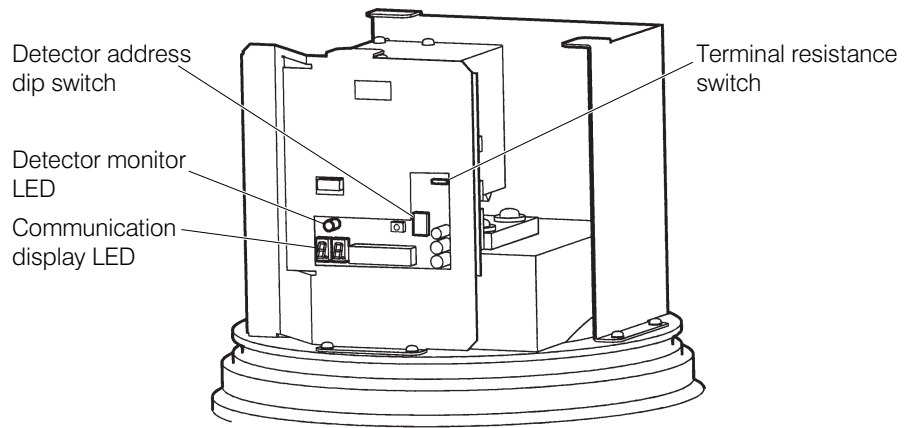
Example of Instrument Construction



Transmitter




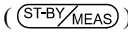




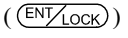

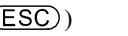

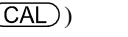














Electric Section 1 of Detector



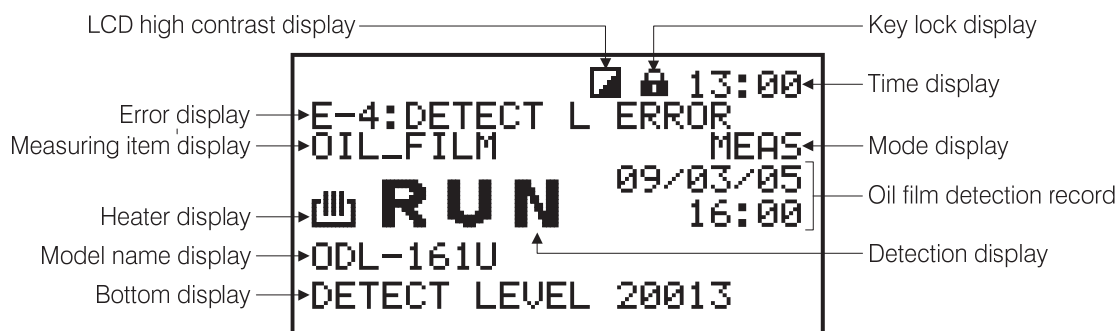
Electric Section 2 of Detector

(2) Operation Keys and Screen Display

Functions of Operation Keys

Operation key (symbol in the text)	Function
Measure/Standby key  ()	<ul style="list-style-type: none"> Pressing this key for 4 seconds or more switches the instrument to the maintenance mode. Pressing this key for 4 seconds or more returns the instrument to the measurement mode.
Read key  ()	<ul style="list-style-type: none"> Displays a parameter in the bottom of the screen. (bottom display) When you press  after a parameter is displayed, the parameter disappears.
Enter/Lock key  ()	<ul style="list-style-type: none"> The number or symbol you entered is confirmed and at the same time the display switches to the next screen. Pressing this key for 4 seconds or more in the measurement mode locks the other operation keys. Pressing this key for 4 seconds or more when the other operation keys are locked, they are unlocked.
Escape key  ()	<ul style="list-style-type: none"> Restores the state before operation. This key cancels the input. By pressing this key for 4 seconds or more during calibration, you can cancel the calibration in the middle.
CAL key  ()	<ul style="list-style-type: none"> Pressing this key in the maintenance mode switches the instrument to the calibration mode. Pressing  returns the instrument to the maintenance mode.
Up key  ()	<ul style="list-style-type: none"> Every time you press this key after displaying a parameter in the bottom of the screen by pressing  in the measurement mode, each parameter is displayed one after another. Every time you press this key after switching to the setting mode by pressing  in the maintenance mode, each parameter is displayed one after another. Every time you press this key after switching the instrument to the calibration mode by pressing  in the maintenance mode, each calibration operation is displayed one after another. When you press this key when you are setting a numeric value in the setting mode or calibration mode, the number you intend to set increases or the choice is switched.
Down key  ()	<ul style="list-style-type: none"> Every time you press this key after displaying a parameter in the bottom of the screen by pressing  in the measurement mode, each parameter is displayed one after another (in the reverse manner to the Up key). Every time you press this key after switching to the setting mode by pressing  in the maintenance mode, each parameter is displayed one after another (in the reverse manner to the Up key). Every time you press this key after switching the instrument to the calibration mode by pressing  in the maintenance mode, each calibration operation is displayed one after another (in the reverse manner to the Up key). When you press this key while setting a numeric value in the setting mode or calibration mode, the numeric value you intend to set decreases or the choice is switched.
Data key  ()	<ul style="list-style-type: none"> Pressing this key in the maintenance mode switches the instrument to the setting mode and displays "PARAM" on the screen. Pressing  causes the instrument to return to the maintenance mode. When you press this key while setting a numeric value in the setting mode, the highlighted decimal place changes, one place to the right.

- [NOTE] • For mode and screen group >> 5.1(1) “Mode switching”
 • For screen configuration and switching >> 5.1(3) “Operation map”



Screen Display

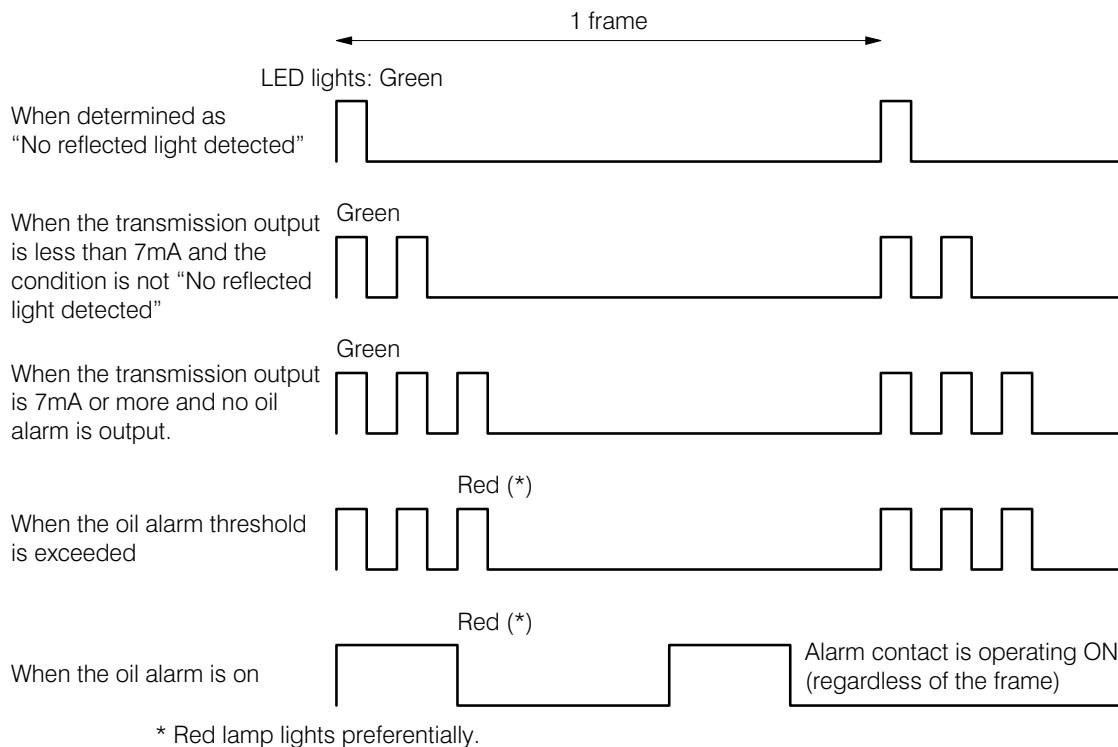
Display Type

Display		Function
Detection display		<ul style="list-style-type: none"> In the measurement mode and maintenance mode, “RUN” is displayed in normal conditions. When an alarm occurs, “ALM” is displayed.
Bottom display		<ul style="list-style-type: none"> In the measurement mode and setting mode, a parameter is displayed in the bottom of the screen.
Mode display	MEAS	<ul style="list-style-type: none"> Indicates that the instrument is in the measurement mode.
	ST-BY	<ul style="list-style-type: none"> Indicates that the instrument is in the maintenance mode.
	PARAM	<ul style="list-style-type: none"> Indicates that the instrument is in the setting mode.
	CAL	<ul style="list-style-type: none"> Indicates that the instrument is in the calibration mode.
Model name display		<ul style="list-style-type: none"> Indicates the model name of the connected detector.
Heater indication		<ul style="list-style-type: none"> Indicates that the heater option is on.
Error display		<ul style="list-style-type: none"> Indicates that an error is occurring in the instrument. >> 7. “Troubleshooting”
Time display		<ul style="list-style-type: none"> Indicates the current time.
Key lock indication		<ul style="list-style-type: none"> When displayed, it indicates that the keys are locked.
Oil film detection record		<ul style="list-style-type: none"> Displays the date (YY/MM/DD) and time (hh: mm) when an oil film was detected in the past. >> 5. “Modes of Operations”

(3) Detector monitor LED

You can grasp light receiving status by the detector alone, based on the blinking interval and coloring of the detector monitor LED.

- (a) Green lamp lights (once) at short lighting time: When reflected light is detected.
- (b) Green lamp lights (twice) at short lighting time: When normal oil film detection is difficult because the reflected light level is too small.
- (c) Green lamp lights (3 times) at short lighting time: Water surface detection is almost normal.
- (d) Red lamp lights (3 times) at short lighting time: When an oil film has been detected
- (e) Red lamp lights (once) at long lighting time: When the detector is in the hold state after detecting an oil film.



Lighting Time of Detector Monitor LED

(4) Communication display LED

The following two display functions are provided.

- (a) Display of a channel number of the detector.
- (b) Display of an error number when an error occurs in the detector.

2. Operation

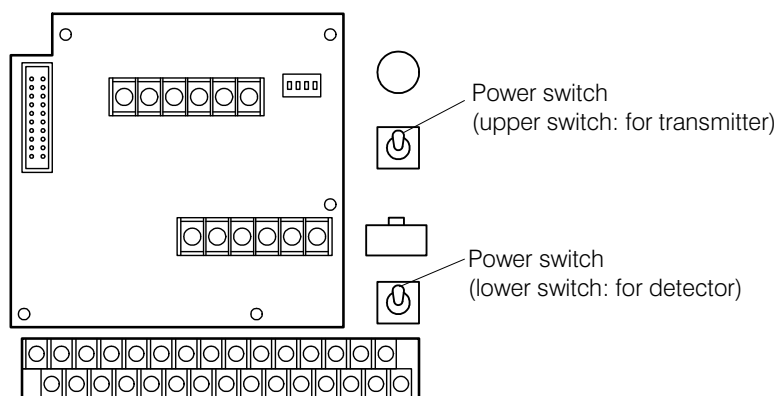
2.1 Operation Start

- ① **Check.** Make sure the installation is completed. >>8.1 “Specifications and Explanation of Operation”, 9. “Installation”
- ② **Turn on the power switch.** Turn on the power switch of the transmitter in the following order:
 - Lower switch → Upper switch
 - After the screen display is switched one after another, the instrument enters the measurement mode.

⚠ **WARNING**

Electric Shock

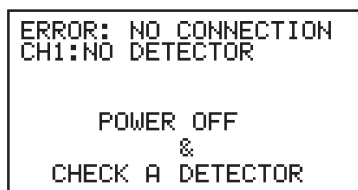
- Do not touch the terminals inside the controller while power is applied. Touching the terminals may cause electric shock.



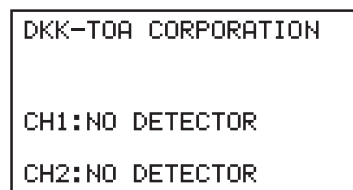
Power Switch Positions



When normal



Detector connection error (when 1 channel)



Detector connection error (when 2 channels)

Examples of Measurement Mode Screens

- [NOTE] • If the power supply of the detector is off, if the cable is not connected or if the address setting differs between the detector and transmitter, an error occurs. Check the address setting and cable connection.

-
- 【IMPORTANT】** • When you restart operation after the instrument was stopped for a long time, perform alarm operation check. >> 3. “Alarm Operation Check”
-

- ③ Perform warm-up operation. Standard warm-up time: Approx. 10 minutes.
- ④ Perform calibration. >> 4. “Calibration”
- ⑤ Check the operation conditions. >> 5.2 “Operations in Measurement Mode and Maintenance Mode”

The instrument is now ready for normal operation.

2.2 Operation Stop and Restart

(1) Operation stop

Turn off the power switch. Turn off the power switches of the transmitter in the following order:

- Upper switch → Lower switch

- [NOTE] • The settings of operation conditions, etc. are held even after the power supply is turned off. No restriction applies to power-off timing.
- When properly done, lastly turn off the power switch on the distribution board.

(2) Operation restart

- ① Inspect the detector. Check the condition of the connected detector.
- ② Turn on the power switch. >> ② in 2.1 “Operation Start”
- ③ Set the date and time. >> 5.3(10) “Date and time”

- [NOTE] • When a long time period has passed since the power supply was turned off, the date and time setting is reset. When restarting operation, check the date and time.

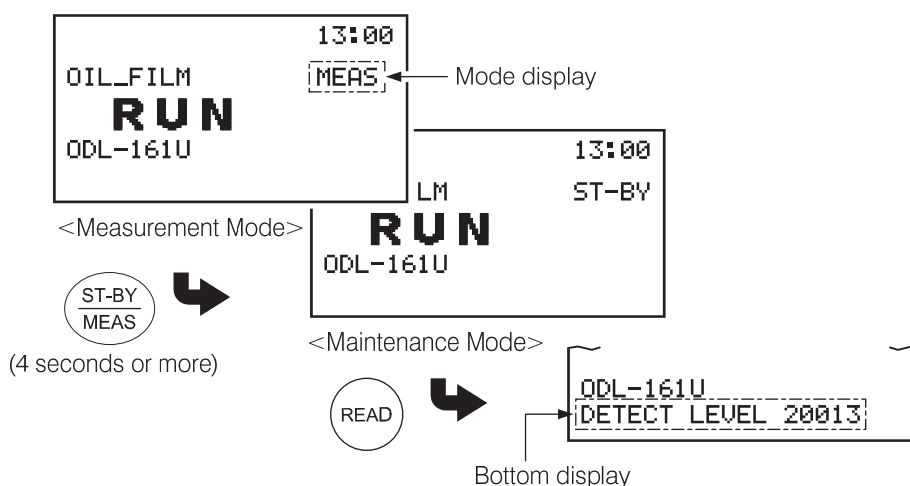
- ④ Perform warm-up operation. Standard warm-up time: Approx. 10 minutes.
- ⑤ Perform calibration, etc. >> 3. “Alarm Operation Check”, 4. “Calibration”

3. Alarm Operation Check

Perform alarm operation check by the following procedure:

① **Make the detection level to appear.** Press **ST-BY/MEAS** for 4 seconds or more then press **READ** (when “MEAS” is displayed).

- After operation, the mode display and bottom display change as follows:
- Mode display: “MEAS” → “ST-BY”
- Bottom display: (Hidden) → “DETECT LEVEL”



② **Check the detection level.** Make sure that the numeric value on the bottom display is within the following range.

- When the detector is installed on a water surface 17000 to 23000

[NOTE] • If a value of 10000 or less is often displayed, check whether the wave condition on the water and the detector installation angle are normal.

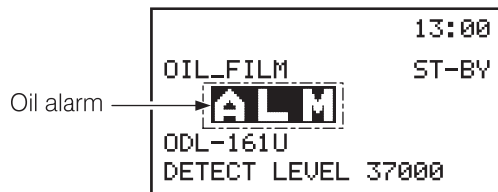
③ **Place the calibration vessel.** Fill the calibration vessel with oil such as light oil or kerosene and place it on the laser beam scanning surface of the detector.

【IMPORTANT】 • For calibration vessel, use the standard accessory vessel (Code No. 136C035).

[NOTE] • If the calibration vessel cannot be placed directly on the laser beam scanning surface, place the calibration vessel above the laser beam scanning surface, with no contact.

④ **Check that an oil alarm is generated.**

[NOTE] • Depending on the set conditions, it may take some time until an alarm is generated.
>> 5.3(2) “Oil alarm”



⑤ Check that error “E-4” is generated. Use the following procedure:

- ① Prepare a black fiber or a lusterless rubber sheet that absorbs or diffuses light.
- ② Place ① on the laser beam scanning surface.
- ③ As in ④, wait until an error is generated.

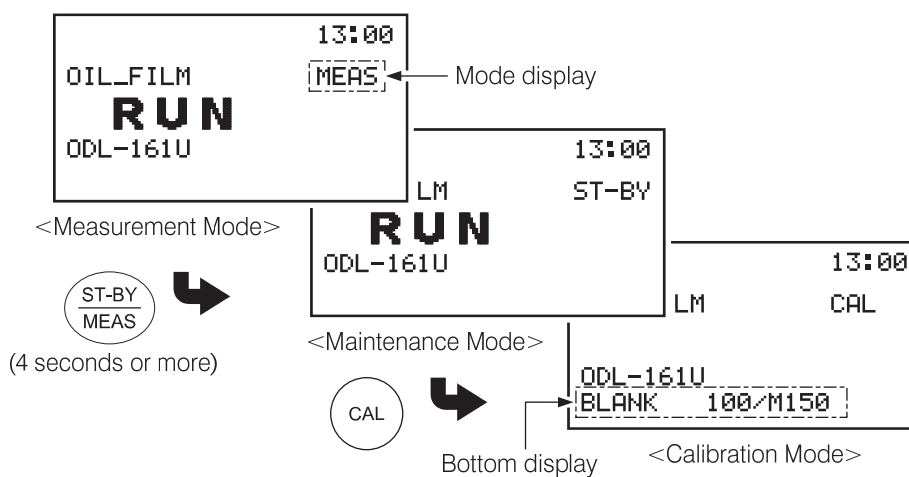
[NOTE] • If it is set to detect a liquid or oil leakage on a floor surface, instead of on a water surface, “E-4” is not generated. >> 5.3(12) “Detection method”
• When an error is detected in ③ to ⑤ >> 7. “Troubleshooting”

4. Calibration

In addition to 3. “Alarm Operation Check”, perform calibration of detection sensitivity once every 6 months by the following procedure:

① **Switch to the calibration mode.** Press **(ST-BY/MEAS)** for 4 seconds or more then press **(CAL)** (when “MEAS” is displayed).

- After operation, the mode display and bottom display change as follows:
- Mode display: “MEAS” → “ST-BY” → “CAL”
- Bottom display: (Hidden) → “BLANK ****/M****”



- [NOTE]
- When “HOLD” is set for the output type (OUT TYPE), the transmission value immediately prior to switching to the maintenance mode is output as a transmission fixed value. When “DUMMY” is set, the preset value is output. >> 5.3(6) “Analog output”
 - In the maintenance mode, the instrument error signal contact and oil alarm signal contact are not output. If you want to check these two signals, do not switch to the maintenance mode.

② **Place a rubber sheet, etc.** Place a lusterless rubber sheet or hubby paper, etc. directly below the detector.

③ **Check the detection level.** Compare two numeric values on the bottom display and check the difference between them. If the difference is large, proceed with ④. If small, proceed with ⑤.

- Bottom display: “BLANK ****/M****”
- “M****” Indicates the maximum value of the received-light detection level. The value is reset every 10 seconds and the maximum value is updated and displayed.
- “****” Indicates the reflected-light detection level stored during the previous calibration operation.
- BLANK calibration standard value 0 to 3000
- WATER calibration standard value 17000 to 23000
- OIL calibration standard value 30000 to 40000

④ **When the difference of the numeric values is large.** Check the following points and correct appropriately and perform ③ again.

- Ⓐ Check whether the calibration item matches the calibration object.
- Ⓑ Check whether the calibration object is placed within the beam scanning range.
- Ⓒ Check whether oil is floating during water surface calibration.

⑤ Confirm. Press **DATA** (→) .

- Bottom display: “BLANK OK? *****/M*****”

⑥ Store. Press **ENT/LOCK** in the next screen.

[NOTE] • This operation stores the zero level (condition in which no laser beam enters).

	13:00
OIL_FILM	CAL
ODL-161U	
BLANK OK? 100/M150	

⑦ Make “WATER” to appear. Place a vessel containing water directly below the detector and press **↓** .

- Bottom display: “WATER *****/M*****”

	13:00
OIL_FILM	CAL
ODL-161U	
WATER 22000/M23118	

⑧ Check the detection level and store it. Operate in the same manner as in ③ to ⑥ and press the **ENT/LOCK** in the next screen.

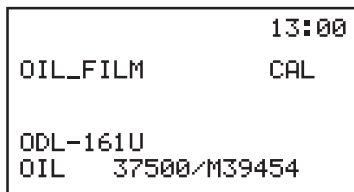
[NOTE] • The water surface reflected-light level is now stored.

- Bottom display: “WATER OK? *****/M*****”

	13:00
OIL_FILM	CAL
ODL-161U	
WATER OK?22678/M23316	

⑨ Make ”OIL” to appear. Place a vessel containing oil directly below the detector and press **↓** .

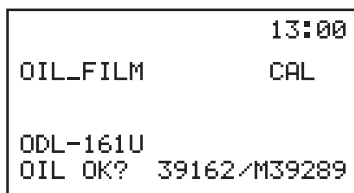
- Bottom display: “OIL *****/M*****”



⑩ Check the detection level and store it. Operate in the same manner as in ③ to ⑥ and press **ENT/LOCK** in the next screen.

[NOTE] • This operation stores the oil surface reflected light.

- Bottom display: "OIL OK? *****/M*****"



⑪ Switch to the maintenance mode. Press **ESC** .

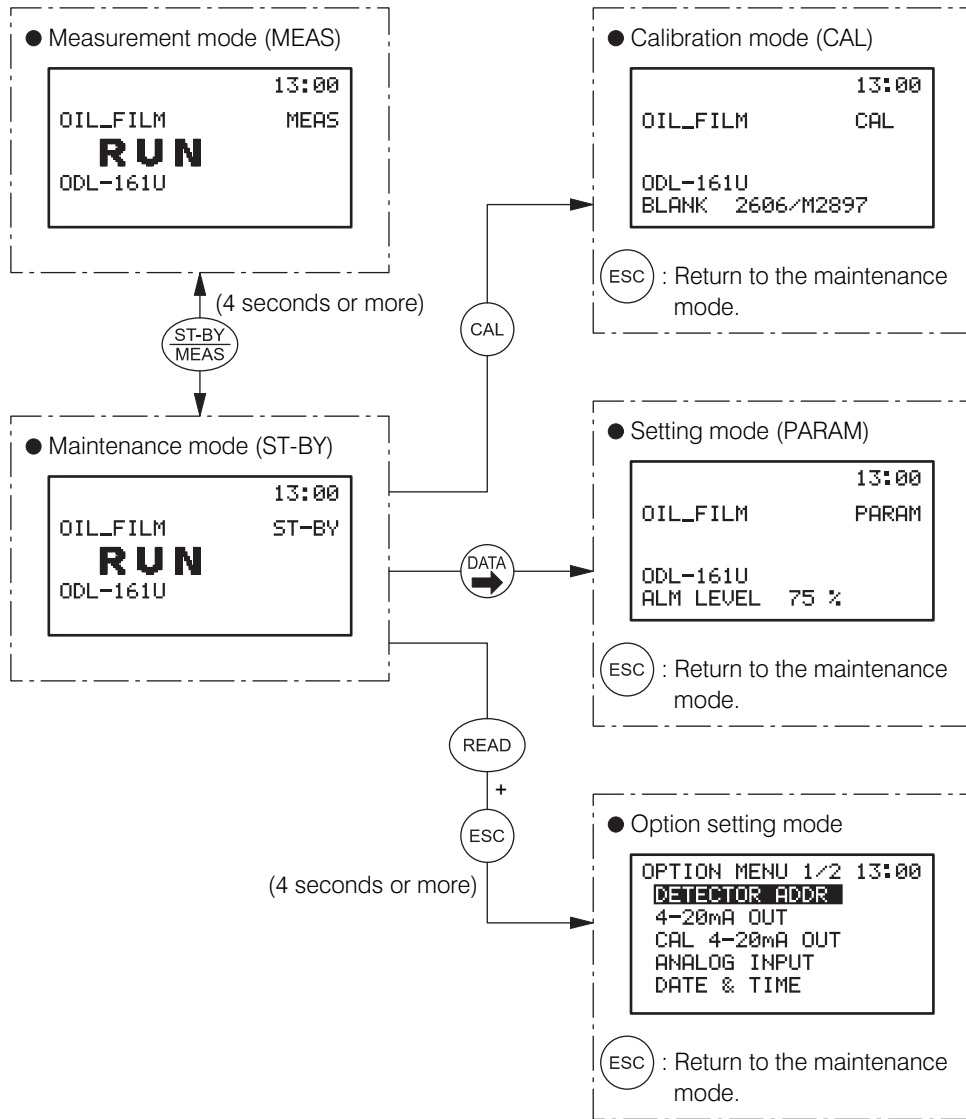
⑫ Return to the measurement mode. When the reading becomes stable, press **ST-BY/MEAS** for 4 seconds or more.

5. Modes of Operations

5.1 Modes and Operation Map

(1) Mode switching

(a)By the key operations shown in the following figure, you can switch the operation mode from the “measurement mode” to the “maintenance mode”, “setting mode” “calibration mode” and “option setting mode.”



Mode Switching

(b)You can check the mode to which the current screen belongs with the following table.

- Example: “PARAM” display Setting mode

Display and Mode

Display	Mode
MEAS	Measurement mode
ST-BY	Maintenance mode
PARAM	Setting mode
CAL	Calibration mode

(c) In the “maintenance mode”, “setting mode” and “calibration mode”, measured value output is automatically set to the “fixed value hold” type that is set by the hold method.
 >> 5.3(6) “Analog output”

(d) In the “maintenance mode”, “setting mode” and “calibration mode”, alarm output is deactivated.

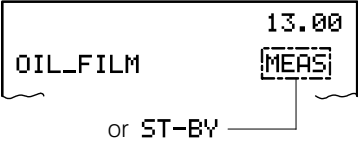
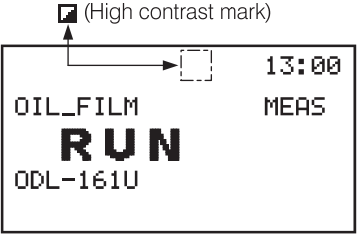


(2) LCD high contrast

(a) This function is used when the LCD is difficult to see in bright locations, such as the outdoors in fine weather.

(b) When **READ** is pressed for 4 seconds or more in the “measurement mode” or “maintenance mode”, the contrast of the LCD can be temporarily maximized.

Setting the function ... >> 5.3(15) “LCD high contrast”

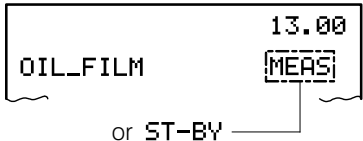
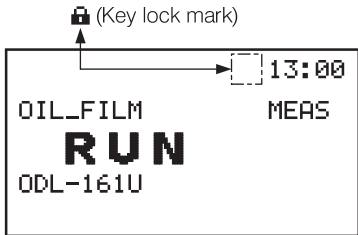


Operation Procedure

Procedure	Operation	Remarks
<p>① Check the mode.</p> 		<ul style="list-style-type: none"> • Check that you are in the “measurement mode” or “maintenance mode” • “MEAS” Measurement mode • “ST-BY” Maintenance mode <p>>> 5.1(1) “Mode switching”</p>
<p>② Set the LCD high contrast.</p>  <p>Example of Measurement Mode</p>	<p>READ (4 seconds or more)</p>	<ul style="list-style-type: none"> • After operation, “” appears. • The same applies to the maintenance mode.
<p>③ Reset the LCD high contrast.</p>	<p>READ (4 seconds or more)</p>	<ul style="list-style-type: none"> • After operation, “” disappears

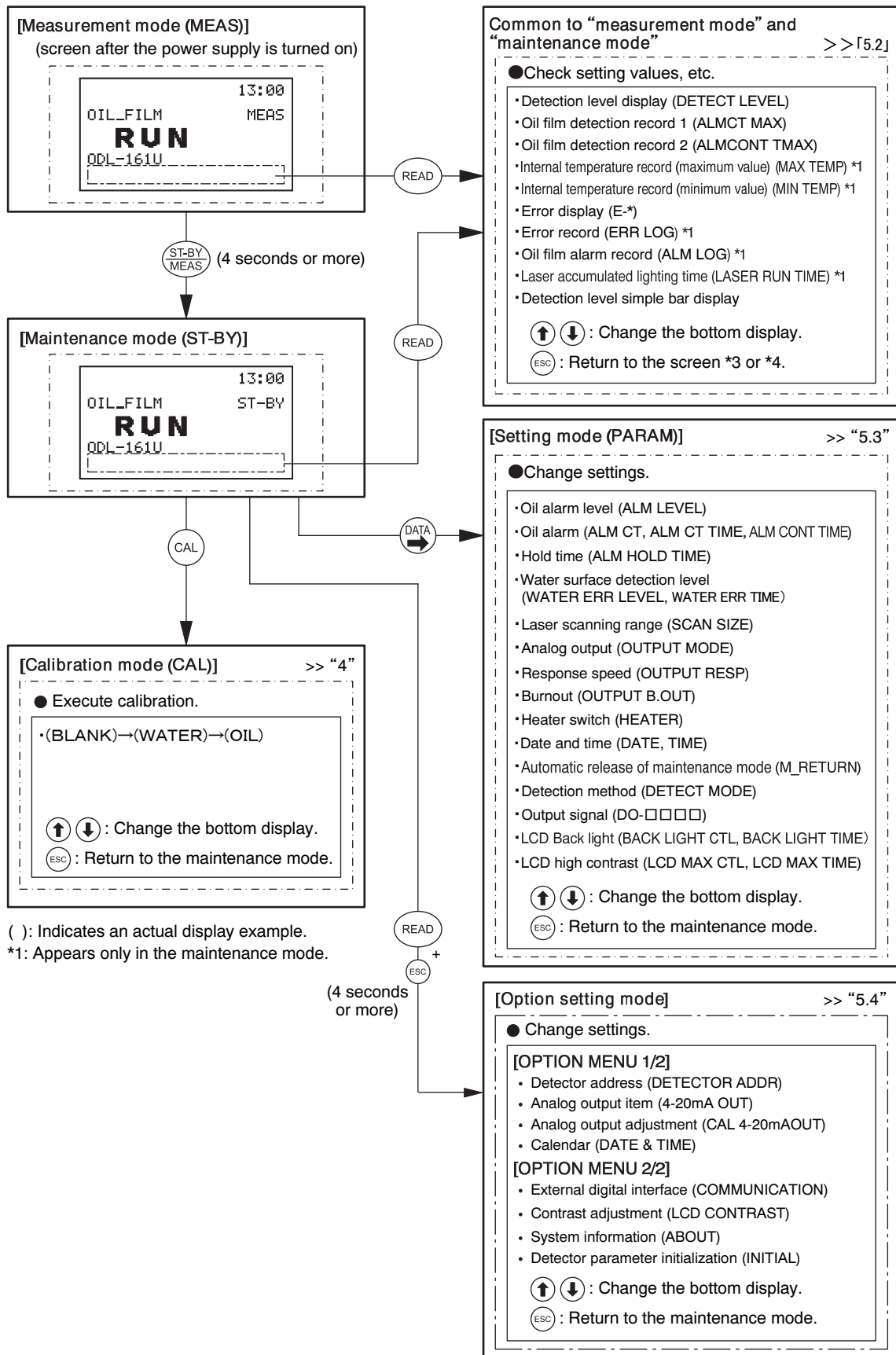
(3) Key lock

When you press **ENT/LOCK** or 4 seconds or more in the “detection mode” or “maintenance mode”, the key lock state is set.

Operation Procedure

Procedure	Operation	Remark
<p>① Check the mode.</p> 		<ul style="list-style-type: none"> • Check that you are in the “measurement mode” or “maintenance mode”. • “MEAS” ... Measurement mode • “ST-BY” ... Maintenance mode • >> 5.1 (1) “Mode switching”
<p>② Set the key lock state.</p>  <p>Example of Measurement Mode</p>	<p>ENT/LOCK (4 seconds or more)</p>	<ul style="list-style-type: none"> • After operation, “” appears and the functions of the other keys stop. • The same applies to the maintenance mode.
<p>③ Release the key lock state.</p>	<p>ENT/LOCK (4 seconds or more)</p>	<ul style="list-style-type: none"> • After operation, “” disappears and the functions of all keys are activated.

(4) Operation map



Operation Map





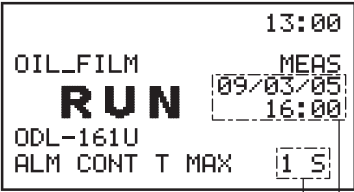

5.2 Operations in Measurement Mode and Maintenance Mode

(MEAS and ST-BY)

In the “measurement mode” and “maintenance mode”, you can check the detection level as well as the oil film detection status record in the past.

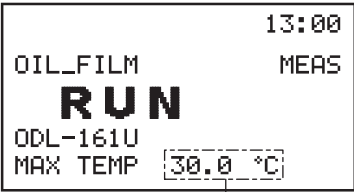
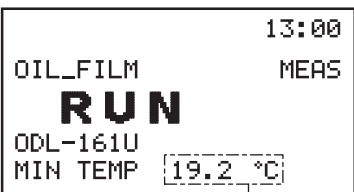


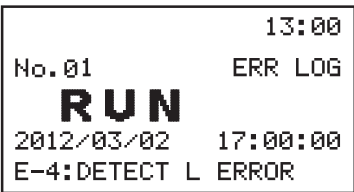
[NOTE] • Tables ⑤ and ⑥ below show operations in the maintenance mode only.

Operation Procedure

Procedure	Operation	Remark
① Detection status  <p>Bottom display</p>	(ST-BY/MEAS) (Press this key for 4 seconds or more when you want to switch to the maintenance mode.)	<ul style="list-style-type: none"> • Main display: Detection status • Bottom display: None • Initial screen of the measurement mode (in the maintenance mode, “MEAS” → “ST-BY”)
② Detection level display  <p>Detection level</p>	(READ) (When screen ① is displayed)	<ul style="list-style-type: none"> • Bottom display: “DETECT LEVEL”
③ Oil film detection record 1 (Maximum)*1  <p>Maximum oil film peak count Occurrence time</p>		<ul style="list-style-type: none"> • Bottom display: “ALM CT MAX” • Displays the maximum oil film peak count in the past per set time and the occurrence time. • (CAL) : Reset the record (*2).
④ Oil film detection record 2 (Maximum)*1  <p>Maximum oil film level continuation time Occurrence time</p>		<ul style="list-style-type: none"> • Bottom display: “ALM CONT T MAX” • Displays the maximum duration in which oil film-detected state continued (unit: second) and the date and time of occurrence. • (CAL) : Reset the record. (*2)




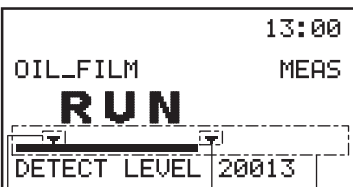
(To be continued)

(Continued)

Procedure	Operation	Remark
<p>⑤ Internal temperature record (maximum value) *2</p>  <p>Maximum temperature record</p>	<p>⬇</p>	<ul style="list-style-type: none"> • Bottom display: “MAX TEMP” • Displays the maximum detector internal temperature record. • CAL : Reset the record. (*2)
<p>⑥ Internal temperature record (minimum value) *2</p>  <p>Minimum temperature record</p>	<p>⬇</p>	<ul style="list-style-type: none"> • Bottom display: “MIN TEMP” • Displays the minimum detector internal temperature record. • CAL : Reset the record. (*2, 3)
<p>⑦ Error display</p>  <p>Error display</p>	<p>⬇</p>	<ul style="list-style-type: none"> • Bottom display: “E- *” • Displays the current occurring error.
<p>⑧ Error record *2</p> 	<p>⬇</p> <p>ENT/LOCK</p>	<ul style="list-style-type: none"> • Bottom display: “ERR LOG PUSH [ENT]” • Displays the last 10 error records.
<p>⑨ Error record display</p> 	<p>⬇ ⬆</p>	<ul style="list-style-type: none"> • Bottom display: “E- * : DETECT L ERROR” • Displays the last 10 error contents and the date and time of occurrence. • CAL : Reset the record. (*2) • ESC : Return to the previous screen.

(To be continued)

(Continued)

Procedure	Operation	Remark
<p>⑩ Oil alarm record *2</p> 	<p>↓ ENT/LOCK</p>	<ul style="list-style-type: none"> • Bottom display: “ALM LOG PUSH [ENT]” • Displays the previous oil alarm record.
<p>⑪ Oil alarm record display</p> 	<p>↓ ↑</p>	<ul style="list-style-type: none"> • Bottom display: “CONTINUE/ **S” (*5, *6) or “COUNT/ **S” (*5, *6) • Displays the last 10 oil alarm occurrence time and date and time of occurrence. No.1 to No.10 • [CAL] : Reset the record. (*4) • [ESC] : Return to the previous screen.
<p>⑫ Laser accumulated lighting time</p>  <p>Accumulated lighting time</p>	<p>↓</p>	<ul style="list-style-type: none"> • Bottom display: “LASER RUN TIME” • Displays the laser accumulated lighting time (unit: time).
<p>⑬ Detection level simple bar display</p>  <p>Oil film alarm threshold Bar display Water surface detection error threshold</p>	<p>↓</p>	<ul style="list-style-type: none"> • Bottom display: Upper Bar display Lower “DETECT LEVEL” • Detection level is displayed by simple bar. • Bar is displayed at the range of 0 to 50000 according to the “DETECT LEVEL” value. • “▼” at the left Water surface detection error threshold • “▼” at the right Oil film alarm threshold • When the bar is displayed among the two “▼”, it indicates that the detection level stabilizes.

↑ : Switch the bottom display differently. **[ESC]** : The bottom display disappears (return to screen ①).

*1 : An oil film detection record also stores the oil film detection status that does not satisfy the condition for the detector to generate an alarm. Refer to the oil film detection record if you want to check the detection status when no alarm is output or if you need a reference for setting an oil alarm generation condition.

*2 : Only in the maintenance mode.

*3 : When “MAX TEMP” is reset, the “MIN TEMP” record is also reset simultaneously.

- *4 : When a record is reset, all the records are reset.
- *5 : The oil film alarm records are grouped into “COUNT” and “CONTINUE”. When an oil film alarm generates by the number of oil film peak per set time, “COUNT” is displayed at the bottom display. When an oil film alarm generates by the oil film level continuous time, “CONTINUE” is displayed at the bottom display.
- *6 : The display time is indicated by the time (seconds) an oil film alarm was generated and does not include the hold time.

5.3 Operations in the Setting Mode

(a) In the setting mode, you can check and change various setting values related to oil film detection.

[NOTE] • All changes you made can be confirmed by pressing **ENT/LOCK** (the cursor goes off).

(b) If you set a value out of the range or an incorrect value, “*ERR*” is displayed, requiring you to reenter.

(c) If you set the object (water, oil or blank) wrongly for calibration, error “E-7” is displayed.

(d) Pressing **ESC** restores the value before change.

(1) Oil alarm level (ALM LEVEL)

(a) You can change the threshold for generating an oil alarm.

(b) This threshold is a ratio at which an alarm is generated, assuming the received light intensity level when oil is present to be 100 at calibration.

(c) Normally, the standard threshold is an intermediate value between the received light intensity level stored with oil and that stored with water. Refer to the table below for the oil types and standard intermediate values.

-
- 【IMPORTANT】**
- If you set a threshold lower than the value stored with water at calibration, “ERROR” is displayed.
 - When "oil on floor detection" is set for the detection method, this function does not operate. >> 5.3(12) "Detection method"
-

Substance name	Refractive index	Reflectance	Intermediate ratio (%)
Air	1.00	0.000	—
Water	1.33	0.020	—
Gasoline	1.40 or more	0.028 or more	86
Kerosene	1.45 or more	0.034 or more	to 79
Heavy oil	1.45 or more	0.034 or more	to 79
Light oil	1.45 to 1.50	0.034 to 0.040	75 to 79
Benzene	1.50	0.040	75
Toluene	1.50	0.040	75
P-paraxylene	1.50	0.040	75
Parafine oil	1.48	0.037	77
Linseed oil	1.48	0.037	77
Olive oil	1.47	0.036	78
Palm oil	1.45	0.034	80
Soy bean oil	1.47	0.036	78
Rapeseed oil	1.47	0.036	78
Whale oil	1.47	0.036	78
Oleum morrhuae	1.48	0.037	77

(d)Intermediate ratio calculation method is as follows.

Oil alarm level (%)

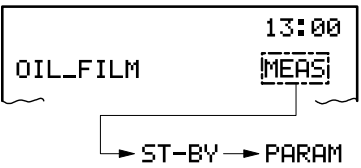
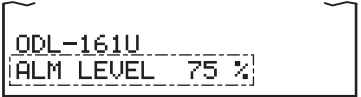
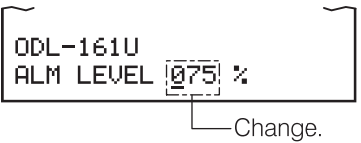
$$= \frac{\{(\text{Water surface calibration value} - \text{non-reflective calibration value}) + (\text{Oil surface calibration value} - \text{non-reflective calibration value})\} \times 0.5}{\text{Oil surface calibration value} - \text{non-reflective calibration value}} \times 100$$

(Example)

When non-reflective calibration value is 0, Water surface calibration value is 20000, and Oil surface calibration value is 36000

$$\text{Oil alarm level (\%)} = \frac{(20000+36000) \times 0.5}{36000} \times 100 = 77.78 \approx 78$$

Operation Procedure

Procedure	Operation	Remark
① Switch to the setting mode "PARAM". 	(ST-BY/MEAS) (4 seconds or more) ↓ (DATA)	>> 5.1(1) "Mode switching"
② Select "ALM LEVEL **%". 	(DATA)	<ul style="list-style-type: none"> At the change position, the cursor blinks.
③ Change the threshold. 	(↑) or (↓) + (DATA) (digit shift) ↓ (ENT/LOCK)	<ul style="list-style-type: none"> Setting range: 0-100 (Factory setting: 75) After confirmation, the cursor disappears. (ESC) : Return without updating the setting.
④ Return to the measurement mode "MEAS".	(ESC) ↓ (ST-BY/MEAS) (4 seconds or more)	<ul style="list-style-type: none"> Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

(2) Oil alarm (ALM CT, ALM CT TIME, ALM CONT TIME)

(a) An oil alarm is output in the following cases:

- When the peak count of light-received signals over the oil film detection level has exceeded the upper limit peak count within the predetermined time period.
- When this light-received signal has continued for the specified time.

(b) In oil alarm output adjustment, the following items can be changed:

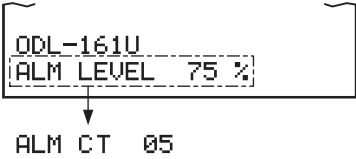
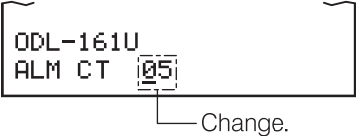
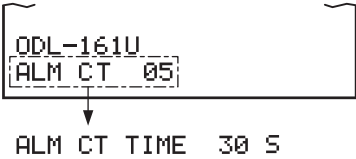
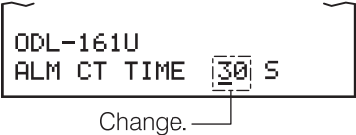
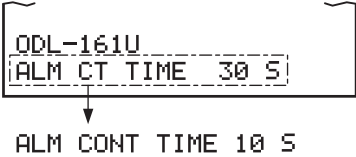
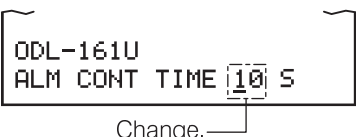
- Oil film peak count (ALM CT)
- Oil film peak time (ALM CT TIME)
- Oil film level continuation time (ALM CONT TIME)

Operation Procedure

Procedure	Operation	Remark
① Switch to the setting mode "PARAM".	(ST-BY/MEAS) (4 seconds or more) ↓ (DATA)	>> 5.1(1) "Mode switching"

(To be continued)

(Continued)

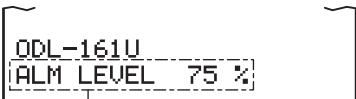
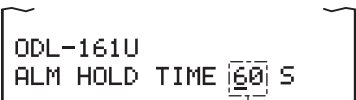
Procedure	Operation	Remark
② Select "ALM CT ***". 	↑ or ↓ ↓ DATA →	<ul style="list-style-type: none"> The cursor blinks at the change position.
③ Change the oil film peak count. 	↑ or ↓ + DATA → (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> Setting range: 0-500 (*1) (Factory setting: 5) After confirmation, the cursor disappears and screen ④ appears. (ESC): Return without updating the setting.
④ Select "ALM CT TIME ** S". 	↑ or ↓ ↓ DATA →	<ul style="list-style-type: none"> The cursor blinks at the change position.
⑤ Change the oil film peak time. 	↑ or ↓ + DATA → (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> Setting range: 0-999 (Factory setting: 30) After confirmation, the cursor disappears. (ESC): Return without updating the setting.
⑥ Select "ALM CONT TIME ** S". 	↑ or ↓ ↓ DATA →	<ul style="list-style-type: none"> The cursor blinks at the change position.
⑦ Change the oil film level continuation time. 	↑ or ↓ + DATA → (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> Setting range: 0-999 (Factory setting: 10) After confirmation, the cursor disappears. (ESC): Return without updating the setting.
⑧ Return to the measurement mode "MEAS".	(ESC) ↓ ST-BY/MEAS (4 seconds or more)	<ul style="list-style-type: none"> Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

*1: When (a value within the setting range) > (the value of "ALM CT TIME")/2, the upper limit count cannot be changed.

*2: By setting the oil film peak count to "0", you can deactivate the oil film peak count (ALM CT) and oil film peak time (ALM CT TIME) functions. This allows you to perform oil film detection based on the oil film level continuation time (ALM CONT TIME) only.

(3) Hold time (ALM HOLD TIME)

You can change the time period in which display, contact and burnout signals are to be held in the state as when the alarm occurred, even after the oil alarm is released,

Operation Procedure		
Procedure	Operation	Remark
① Switch to the setting mode "PARAM".	<p>(ST-BY/MEAS) (4 seconds or more)</p> <p>↓</p> <p>(DATA/↔)</p>	>> 5.1(1) "Mode switching"
<p>② Select "ALM HOLD TIME ** S".</p>  <p>↓</p> <p>ALM HOLD TIME 60 S</p>	<p>↑ or ↓</p> <p>↓</p> <p>(DATA/↔)</p>	<ul style="list-style-type: none"> The cursor blinks at the change position.
<p>③ Change the hold time.</p> 	<p>↑ or ↓</p> <p>+</p> <p>(DATA/↔) (digit shift)</p> <p>↓</p> <p>(ENT/LOCK)</p>	<ul style="list-style-type: none"> Setting range: 0-999 (Factory setting: 60) After confirmation, the cursor disappears. (ESC) : Return without updating the setting.
④ Return to the measurement mode "MEAS".	<p>(ESC)</p> <p>↓</p> <p>(ST-BY/MEAS) (4 seconds or more)</p>	<ul style="list-style-type: none"> Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

(4) Water surface detection level (WATER ERR LEVEL)

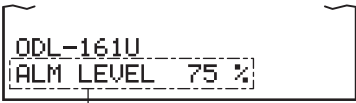
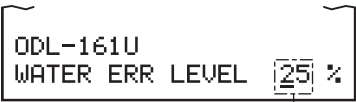

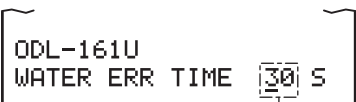
You can change the threshold and the error continuation time at which a water surface detection level error is generated.

- [NOTE]
- This threshold is a ratio at which an alarm is generated, assuming the received light intensity level when water surface detection level is calibrated to be 100.
 - A water surface detection level error is output when the detected light intensity has dropped due to the effects of waves on the water surface, fog, and/or rain.

Operation Procedure		
Procedure	Operation	Remark
① Switch to the setting mode "PARAM".	<p>(ST-BY/MEAS) (4 seconds or more)</p> <p>↓</p> <p>(DATA/↔)</p>	>> 5.1(1) "Mode switching"

(To be continued)

(Continued)

Procedure	Operation	Remark
② Select “WATER ERR LEVEL **%”.  ↓ WATER ERR LEVEL 25 %	↑ or ↓ ↓ DATA →	<ul style="list-style-type: none"> The cursor blinks at the change position.
③ Change the water surface detection level.  Change.	↑ or ↓ + DATA → (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> Setting range: 1-100 (Factory setting: 25) After confirmation, the cursor disappears. (ESC) : Return without updating the setting.
④ Select “WATER ERR TIME ** S”.  ↓ WATER ERR TIME 60 S	↑ or ↓ ↓ DATA →	<ul style="list-style-type: none"> The cursor blinks at the change position.
⑤ Change the error continuation time.  Change.	↑ or ↓ + DATA → (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> Setting range: 0-999 (Factory setting: 30) After confirmation, the cursor disappears. (ESC) : Return without updating the setting.
⑥ Return to the measurement mode “MEAS”.	(ESC) ↓ ST-BY/MEAS (4 seconds or more)	<ul style="list-style-type: none"> Return to the maintenance mode “ST-BY” and then measurement mode “MEAS”.

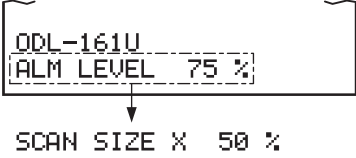
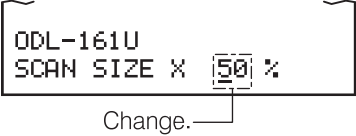
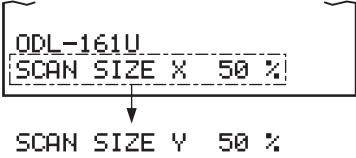
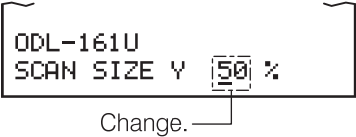
(5) Laser scanning range (SCAN SIZE)

Under normal conditions, you need not change the laser scanning range. In the following cases, change as required:

- When the detection object area on the laser scanning surface is small and the scanning range is out of the detection object.
- When the distance is 3m or more on smooth and still water.

[NOTE] • On a smooth water surface, reflected light does not enter to the detector even if the scan range is extended and the invalid scan range increases. In this case, by reducing the scan range, reliability can be increased.

Operation Procedure

Procedure	Operation	Remark
① Switch to the setting mode "PARAM".	(ST-BY/MEAS) (4 seconds or more) ↓ DATA	>> 5.1(1) "Mode switching"
② Select "SCAN SIZE X ** %". 	↑ or ↓ ↓ DATA	<ul style="list-style-type: none"> The cursor blinks at the change position.
③ Change the scan range (X axis). 	↑ or ↓ + DATA (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> Setting range: 0-100 (Factory setting: 50%) After confirmation, the cursor disappears and screen ④ appears. (ESC) : Return without updating the setting.
④ elect "SCAN SIZE Y ** %". 	↑ or ↓ ↓ DATA	<ul style="list-style-type: none"> The cursor blinks at the change position.
⑤ Change the scan range (Y axis). 	↑ or ↓ + DATA (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> Setting range: 0-100 (Factory setting: 50%) After confirmation, the cursor disappears. (ESC) : Return without updating the setting.
⑥ Return to the measurement mode "MEAS".	(ESC) ↓ (ST-BY/MEAS) (4 seconds or more)	<ul style="list-style-type: none"> Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

(6) Analog output (OUTPUT MODE)

The following analog output functions are provided. You can change analog output as required:

(a) Normal output (NORMAL)

Detected signals are output at 4 to 20mA.

<Example>

- No reflected light is present from the detection surface. Approx. 4mA
- No oil film is present on the detection surface (water only) Approx. 10.4mA
- An oil film is present on the detection surface Approx. 15mA

(b) ODL-20 output (ODL-20)

Analog output that is compatible with DKK-TOA ODL-20 Oil-On Water Monitor. Detected signals are output at 16 to 20mA.

<Example>

- When a detection error occurs..... 16mA (fixed)
- When normal 18mA (fixed)
- When an oil film is detected..... 20mA (fixed)

(c)Output type (OUT TYPE) Only when (a) is selected.

<Output type>

- THROUGH Output the analog signal as is (no hold)
- HOLD Output the previous analog signal (fixed).
- DUMMY Output the arbitrarily set value (fixed).






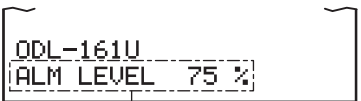








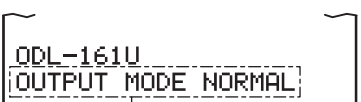
<Modes to which the output type applies >

- When the “maintenance mode”, “setting mode” or “calibration mode” is selected

<Changing the dummy value>



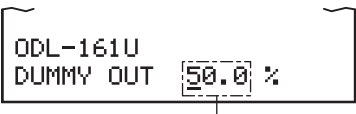
- If you select “DUMMY”, after a screen with the bottom display “OUT TYPE DUMMY” appearing, a screen with the bottom display “DUMMY OUT *.*.* %)” appears, where you can change the dummy value.

Operation Procedure

Procedure	Operation	Remark
① Switch to the setting mode “PARAM”.	 (4 seconds or more) >> 5.1(1) “Mode switching” ↓ 	
② Select “OUTPUT MODE ***”.	 or  ↓ 	• The cursor blinks at the change position.
 ↓ OUTPUT MODE NORMAL	 or  ↓ 	• NORMAL 4-20mA output ODL-20 16-20mA output (Factory setting: NORMAL) • After confirmation, the cursor disappears. (When “ODL-20” is selected, proceeds with ⑧). • (ESC) : Return without updating the setting.
③ Change the output function.	 or  ↓ 	• NORMAL 4-20mA output ODL-20 16-20mA output (Factory setting: NORMAL) • After confirmation, the cursor disappears. (When “ODL-20” is selected, proceeds with ⑧). • (ESC) : Return without updating the setting.
④ Select “OUT TYPE ***”.	 (When ③ is “NORMAL”) ↓ 	• The cursor blinks at the change position.
 ↓ OUT TYPE HOLD		

(To be continued)

(Continued)

Procedure	Operation	Remark
⑤ Change the output type.  <p>Change. →</p>	↑ or ↓ + DATA → (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> • THROUGH No hold • HOLD Output the previous value (fixed). • DUMMY Output the arbitrarily set value (fixed). (Factory setting: HOLD) • After confirmation, the cursor disappears. • (ESC) : Return without updating the setting. • When “HOLD” or “THROUGH” is selected, proceeds with ③.
⑥ Select “DUMMY OUT xxx.x %”.  <p>DUMMY OUT 50.0 %</p>	↑ ↓ DATA →	<ul style="list-style-type: none"> • The cursor blinks at the change position.
⑦ Change the dummy value.  <p>Change. →</p>	↑ or ↓ + DATA → (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> • Setting range: 000.0-100.0%FS (Factory setting: 50.0) • After confirmation, the cursor disappears. • (ESC) : Return without updating the setting.
⑧ Return to the measurement mode “MEAS”.	(ESC) ↓ (ST-BY/MEAS) (4 seconds or more)	<ul style="list-style-type: none"> • Return to the maintenance mode “ST-BY” and then measurement mode “MEAS”.

(7) Response speed (OUT RESP, RESP TIME)

You can change the response speed of analog output if needed.

(a) There are 2 kinds of response format (OUT RESP). Select any one of formats.

- PEAK Process the analog output by peak hold and output it.
- SMOOTH Process the analog output by smoothing and output it.

(b) The response time can be changed within a range of 0-240. The greater value, the slower the response is.

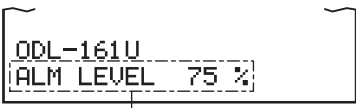


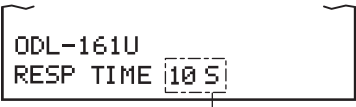
(c) When the response speed is changed to “0”, data per second is converted to analog and output.

Operation Procedure

Procedure	Operation	Remark
① Switch to the setting mode “PARAM”.	(ST-BY/MEAS) (4 seconds or more) ↓ DATA →	>> 5.1(1) “Mode switching”

(To be continued)

(Continued)

Procedure	Operation	Remark
② Select "OUT RESP ***".  OUT RESP PEAK	↑ or ↓ ↓ DATA →	<ul style="list-style-type: none"> The cursor blinks at the change position.
③ Change the response format.  Change.	↑ or ↓ ↓ ENT/LOCK	<ul style="list-style-type: none"> PEAK Peak hold SMOOTH Smoothing (Factory setting: PEAK) After confirmation, the cursor disappears. (ESC) : Return without updating the setting.
④ Select "OUT TYPE ***".  RESP TIME 10 S	↓ ↓ DATA →	<ul style="list-style-type: none"> The cursor blinks at the change position.
⑤ Change the response time.  Change.	↑ or ↓ + DATA → (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> Setting range: 0-240 (Factory setting: 0) After confirmation, the cursor disappears. (ESC) : Return without updating the setting.
⑥ Return to the measurement mode "MEAS".	(ESC) ↓ (ST-BY/MEAS) (4 seconds or more)	<ul style="list-style-type: none"> Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

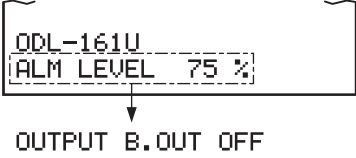
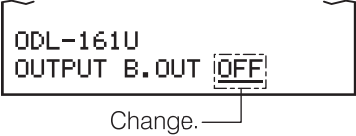
(8) Burnout (OUTPUT B.OUT)

The burnout function outputs a 3 or 21mA analog signal in the following cases. You can change this setting.

- When an oil alarm is generated 21mA (synchronized with contact)
- When a measurement error or instrument error signal is detected 3mA (synchronized with the contact)

[NOTE] • The burnout function allows you to know the detection status, oil alarm and a detector error by one analog output line.
 • Depending on the setting or condition, when an oil alarm and error signal are generated simultaneously, the error signal is output preferably.

Operation Procedure

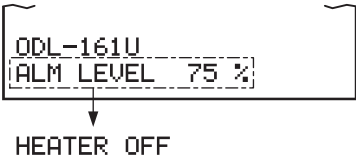
Procedure	Operation	Remark
① Switch to the setting mode "PARAM".	(ST-BY/MEAS) (4 seconds or more) ↓ DATA →	>> 5.1(1) "Mode switching"
② Select "OUTPUT B>OUT ***". 	↑ or ↓ ↓ DATA →	<ul style="list-style-type: none"> The cursor blinks at the change position.
③ Change the setting. 	↑ or ↓ ↓ ENT/LOCK	<ul style="list-style-type: none"> ON Set the burnout function. OFF Do not set the burnout function. (Factory setting: OFF) After confirmation, the cursor disappears. (ESC) : Return without updating the setting.
④ Return to the measurement mode "MEAS".	(ESC) ↓ (ST-BY/MEAS) (4 seconds or more)	<ul style="list-style-type: none"> Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

(9) Heater switch (HEATER)

Power switch of the optional heater

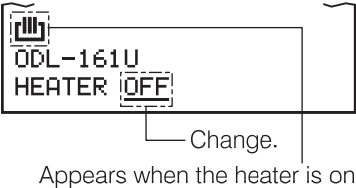
- [NOTE]
- In situation where the window does not mist up, turning off this switch will save power.
 - Even if the heater switch is on, when the internal temperature is over 40°C, the heater is turned off automatically.

Operation Procedure

Procedure	Operation	Remark
① Switch to the setting mode "PARAM".	(ST-BY/MEAS) (4 seconds or more) ↓ DATA →	>> 5.1(1) "Mode switching"
② Select "HEATER ***". 	↑ or ↓ ↓ DATA →	<ul style="list-style-type: none"> The cursor blinks at the change position.

(To be continued)

(Continued)

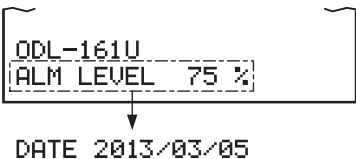
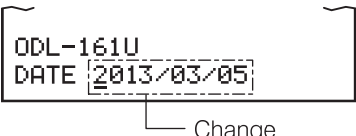
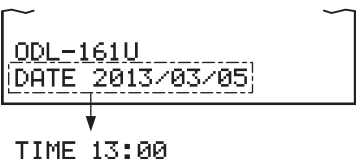
Procedure	Operation	Remark
③ Change the setting. 	(↑) or (↓) ↓ ↓ ↓ (ENT/LOCK)	<ul style="list-style-type: none"> • ON Heater on • OFF Heater off (Factory setting: OFF) • After confirmation, the cursor disappears. • (ESC) : Return without updating the setting.
④ Return to the measurement mode "MEAS".	(ESC) ↓ (ST-BY/MEAS) (4 seconds or more)	<ul style="list-style-type: none"> • Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

(10) Date and Time (DATE, TIME)

You can change the date and time of the instrument internal clock.

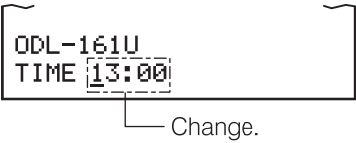
[NOTE] • This date and time is used for oil film detection and error records.

Operation Procedure

Procedure	Operation	Remark
① Switch to the setting mode "PARAM".	(ST-BY/MEAS) (4 seconds or more) >> 5.1(1) "Mode switching" ↓ (DATA/↔)	
② Select "DATE ****/**/**". 	(↑) or (↓) ↓ (DATA/↔)	<ul style="list-style-type: none"> • The cursor blinks at the change position.
③ Change the date. 	(↑) or (↓) + (DATA/↔) (digit shift) ↓ (ENT/LOCK)	<ul style="list-style-type: none"> • After confirmation, the cursor disappears. • (ESC) : Return without updating the setting.
④ Select "TIME **: **: **". 	(↓) ↓ (DATA/↔)	<ul style="list-style-type: none"> • The cursor blinks at the change position.

(To be continued)

(Continued)

Procedure	Operation	Remark
⑤ Change the time. 	↑ or ↓ ↓ ENT/LOCK	<ul style="list-style-type: none"> • After confirmation, the cursor disappears. • (ESC) : Return without updating the setting.
⑥ Return to the measurement mode "MEAS".	(ESC) ↓ ST-BY/MEAS (4 seconds or more)	<ul style="list-style-type: none"> • Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

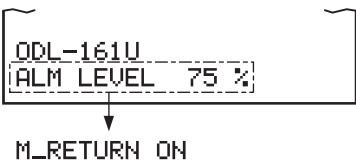
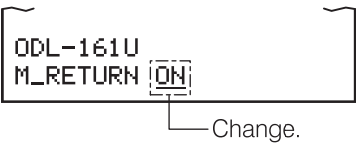
(11) Automatic release of maintenance mode (M_RETURN)

- (a) This function automatically returns the instrument from the maintenance mode to the measurement mode.
- (b) In 2 hours after being switched to the maintenance mode, the mode automatically returns to the measurement mode.

[NOTE] • This function can be used to prevent from forgetting to return the instrument from the maintenance mode to the measurement mode.

[IMPORTANT] • To avoid serious accident, despite the setting in this paragraph, when oil film detection status continues for 10 minutes or more even in the maintenance mode, the instrument returns to the measurement mode automatically and oil filter alarm generates.

Operation Procedure

Procedure	Operation	Remark
① Switch to the setting mode "PARAM".	ST-BY/MEAS (4 seconds or more) >> 5.1(1) "Mode switching" ↓ DATA/→	
② Select "M_RETURN **" 	↑ or ↓ ↓ DATA/→	<ul style="list-style-type: none"> • The cursor blinks at the change position.
③ Change the setting. 	↑ or ↓ ↓ ENT/LOCK	<ul style="list-style-type: none"> • ON Set. • OFF Do not set. (Factory setting: ON) • After confirmation, the cursor disappears. • (ESC) : Return without updating the setting.
④ Return to the measurement mode "MEAS".	(ESC) ↓ ST-BY/MEAS (4 seconds or more)	<ul style="list-style-type: none"> • Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

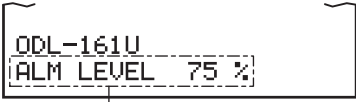

(12) Detection method (DETECT MODE)

You can change the following detection method setting:

- Oil on water detection
- Oil on floor detection

[NOTE] • When oil on floor detection is set, the water surface detection level (WATER ERR LEVEL, WATER ERR TIME) setting is invalidated.

Operation Procedure

Procedure	Operation	Remark
① Switch to the setting mode "PARAM".	(ST-BY/MEAS) (4 seconds or more) ↓ DATA →	>> 5.1(1) "Mode switching"
② Select "DETECT MODE WATER".  DETECT MODE WATER	↑ or ↓ ↓ DATA →	• The cursor blinks at the change position.
③ Change the setting.  Change. →	↑ or ↓ ↓ ENT/LOCK	<ul style="list-style-type: none"> • WATER Oil on water detection • DRY Oil on floor detection (Factory setting: WATER) • After confirmation, the cursor disappears. • (ESC) : Return without updating the setting.
④ Return to the measurement mode "MEAS".	(ESC) ↓ (ST-BY/MEAS) (4 seconds or more)	• Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

(13) Output signal (DO-□□□□)

You can change the terminal assignment for the following various output signals.

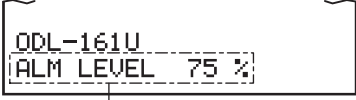

- Measurement error
- Instrument error
- Oil alarm
- Under maintenance

Operation Procedure

Procedure	Operation	Remark
① Switch to the setting mode "PARAM".	(ST-BY/MEAS) (4 seconds or more) ↓ DATA →	>> 5.1(1) "Mode switching"

(To be continued)

(Continued)

Procedure	Operation	Remark
<p>② Select an output signal.</p>  <p>DO MEAS_ERR NONE DO INST_ERR NONE DO ALM NONE DO ST-BY NONE</p>	<p>↑ or ↓ ↓ DATA →</p>	<ul style="list-style-type: none"> • Select the output signal for which you want to set terminal assignment. DO MEAS_ERR Measurement error DO INST_ERR Instrument error DO ALM Oil alarm DO ST-BY Under maintenance • The cursor blinks at the change position.
<p>③. Change the setting.</p>  <p>Example of "Under maintenance"</p>	<p>↑ or ↓ ↓ ENT/LOCK</p>	<ul style="list-style-type: none"> • NONE Do not set. DOUT-1 Terminals "30-31-32" DOUT-2 Terminals "34-35" DOUT-3 Terminals "36-37" DOUT-4 Terminals "38-39" DOUT-5 Terminals "40-41" DOUT-6 Terminals "42-43" (Factory setting) DO MEAS_ERR DOUT-5 DO INST_ERR DOUT-5 DO ALM DOUT-3 DO ST-BY DOUT-2 • Each output terminal can be assigned, duplicated up to 3 points. • After confirmation, the cursor disappears. • (ESC) : Return without updating the setting. • If you want to select another output signal, return to ②.
<p>④ Return to the measurement mode "MEAS".</p>	<p>(ESC) ↓ (ST-BY/MEAS) (4 seconds or more)</p>	<ul style="list-style-type: none"> • Return to the maintenance mode "ST-BY". • Return to the measurement mode "MEAS".

(14) LCD Back light (BACK LIGHT CTL, BACK LIGHT TIME)

- (a) This function automatically turns off the backlighting of the display LCD.
- (b) When the set time has elapsed, the backlighting goes off.

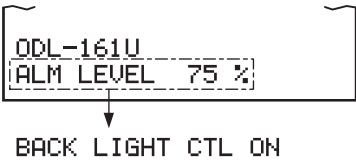
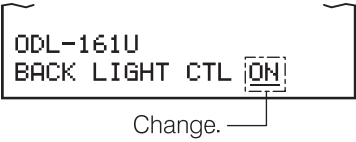
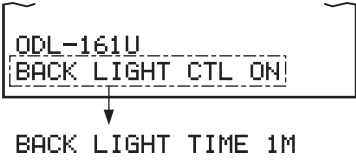

[NOTE] • When any key is pressed after the backlighting goes off, the backlighting comes on again.

Operation Procedure

Procedure	Operation	Remark
<p>① Switch to the setting mode "PARAM".</p>	<p>(ST-BY/MEAS) (4 seconds or more) ↓ DATA →</p>	<p>>> 5.1(1) "Mode switching"</p>

(To be continued)



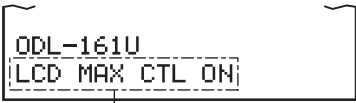
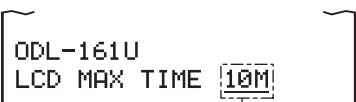
(Continued)

Procedure	Operation	Remark
<p>② Select "BACK LIGHT CTL ***".</p> 	<p>↑ or ↓ ↓ DATA →</p>	<ul style="list-style-type: none"> The cursor blinks at the change position.
<p>③ Change the setting.</p> 	<p>↑ or ↓ ↓ ENT/LOCK</p>	<ul style="list-style-type: none"> ON···Set the LCD back light function. OFF···Don't set the LCD back light function. (Factory setting: ON) After confirmation, the cursor disappears. (ESC) : Return without updating the setting.
<p>④ Select "BACK LIGHT TIME ***".</p> 	<p>↓ (When ③ is "ON")</p>	<ul style="list-style-type: none"> The cursor blinks at the change position.
<p>⑤ Change the back light time(min).</p> 	<p>↑ or ↓ + DATA → (digit shift) ↓ ENT/LOCK</p>	<ul style="list-style-type: none"> Setting range: 1 to 90 (Factory setting: 60M) After confirmation, the cursor disappears. (ESC) : Return without updating the setting.
<p>⑥ Return to the measurement mode "MEAS".</p>	<p>(ESC) ↓ (ST-BY/MEAS) (4 seconds or more)</p>	<ul style="list-style-type: none"> Return to the maintenance mode "ST-BY" and then measurement mode.

(15) LCD high contrast (LCD MAX CTL, LCD MAX TIME)

- (a) The contrast of LCD screen can be temporally maximized by this function.
- (b) Use this function in the measurement mode or maintenance mode when the LCD is difficult to see in locations, such as the outdoors in fine weather. For the method of using >> 5.1(2) "LCD high contrast"
- (c) When the set time (recovery time) passed, the screen returns to the regular contrast display.

Operation Procedure

Procedure	Operation	Remarks
① Select the setting mode "PARAM" screen.	ST-BY /MEAS (4 seconds or more) >> 5.1(1) "Mode switching" ↓ DATA/→	
② Select the "LCD MAX CTL ***" screen.  ↓ LCD MAX CTL ON	↑ or ↓ ↓ DATA/→	<ul style="list-style-type: none"> The cursor blinks at the item to be changed.
③ Change the setting.  Change.	↑ or ↓ ↓ ENT/LOCK	<ul style="list-style-type: none"> ONSet the LCD high contrast function. OFF.....Do not set the LCD high contrast function. (Factory setting: ON) After the change is entered, the cursor goes off. ESC: Return without updating the setting.
④ Select the "LCD MAX TIME ***" screen.  ↓ LCD MAX TIME 10M	↓ (When ③ is "ON")	<ul style="list-style-type: none"> The cursor blinks at the item to be changed.
⑤ Change the contrast recovery time.  Change.	↑ or ↓ + DATA/→ (digit shift) ↓ ENT/LOCK	<ul style="list-style-type: none"> Setting range: 1-90 (Factory setting: 10M) After the change is entered, the cursor goes off. ESC: Return without updating the setting.
⑥ Return to the measurement mode "MEAS" screen.	ESC ↓ ST-BY /MEAS (4 seconds or more)	<ul style="list-style-type: none"> Return to the maintenance mode "ST-BY" and then measurement mode "MEAS".

5.4 Operations in the Option Setting Mode

In the option setting mode, you can check and change various setting values related to the basic oil film detection function of the instrument.

(1) Detector address (DETECTOR ADDR)

(a) Usually, the address of the detector is set to address “1” and that of the transmitter is set to address “1”

(b) When the second detector is connected, the address of channel 2 of the second detector and the transmitter must be changed to “2”.

[NOTE] • If one detector only is connected, set channel 2 to “OFF”.

(c) The address of channel 2 of the transmitter can be changed by the following procedure:

Changing the address of the second detector >> 9.3 (2) “Changing the address (detector)”

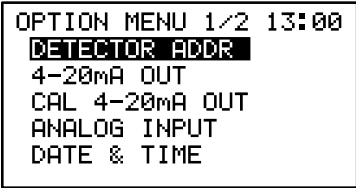
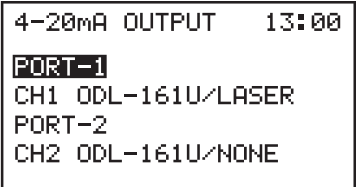
Operation Procedure

Procedure	Operation	Remark
① Switch to the maintenance mode “ST-BY”.	(4 seconds or more)	>> 5.1(1) “Mode switching”
② Display the “OPTION MENU 1/2” screen.	In the maintenance mode ①, + (4 seconds or more)	• “DETECTOR ADDR” is highlighted.
③ Select “DETECTOR ADDR”.		• When you press , screen ④ appears.
④ Change “Chan2”.	or ↓ ↓ or ↓ 	• OFF No second detector 2 Second detector connected (Factory setting: OFF) • After confirmation, the cursor disappears and the display returns to ③.
⑤ Return to the measurement mode “MEAS”.	 ↓ 	• Return to ②. • Return to measurement mode “MEAS”.

(2) Analog output item (4-20mA OUT)

You can change the item to be output to the analog signal (4-20mA) port.

Operation Procedure

Procedure	Operation	Remark
① Switch to the maintenance mode "ST-BY".	(4 seconds or more)	>> 5.1(1) "Mode switching"
② Display the "OPTION MENEU 1/2" screen. 	In the maintenance mode ①, + (4 seconds or more)	• "DETECTOR ADDR" is highlighted.
③ Select "4-20mA OUT".	or ↓ 	• When you press , screen ④ appears.
④ Change "PORT-1" or "PORT-2". 	 ↓ or ↓ 	• LASER Detection signal NONE 4mA fixed signal (Factory setting: LASER) • After confirmation, the cursor disappears and the display returns to ③.
⑤ Return to the measurement mode "MEAS".	 ↓ 	• Return to ②. • Return to the measurement mode "MEAS".

(3) Analog output adjustment (CAL 4-20mAOUT)

You can adjust the analog signal (4-20mA) in accordance with the span of the receiving device.

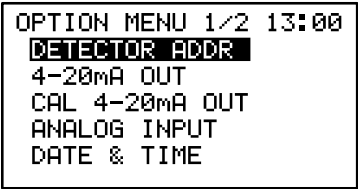
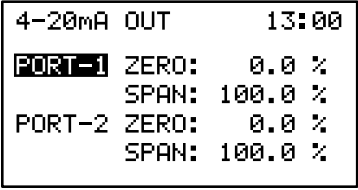
[NOTE] • The factory setting values are adjusted to 4mA and 20mA.

Operation Procedure

Procedure	Operation	Remark
① Switch to the maintenance mode "ST-BY".	(4 seconds or more)	>> 5.1(1) "Mode switching"

(To be continued)

(Continued)

Procedure	Operation	Remark
② Display the "OPTION MENU 1/2" screen. 	In the maintenance mode ①, (ESC) + (READ) (4 seconds or more)	<ul style="list-style-type: none"> • "DETECTOR ADDR" is highlighted.
③ Select "CAL 4-20mA OUT".	(↑) or (↓) ↓ (DATA)	<ul style="list-style-type: none"> • When you press (DATA), screen ④ appears.
④ Change "PORT-1" or "PORT-2". 	(DATA) ↓ (↑) or (↓) ↓ (DATA) ↓ (ENT/LOCK)	<ul style="list-style-type: none"> • ZERO 0.0 ± 5% (Factory setting: 0.0%) • SPAN 100.0 ± 5% (Factory setting: 100.0%) • After confirmation, the cursor disappears and the display returns to ③. • (ESC) : Return without updating the setting.
⑤. Return to the measurement mode "MEAS".	(ESC) ↓ (ESC)	<ul style="list-style-type: none"> • Return to ②. • Return to the measurement mode "MEAS".

(4) Calendar (DATE & TIME)

You can adjust the time that is displayed on the upper right of the screen.

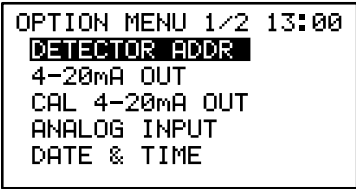
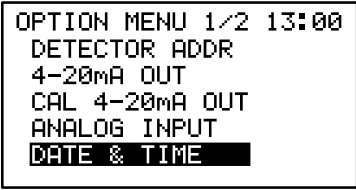
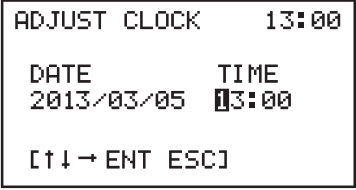
- 【IMPORTANT】**
- This instrument is not equipped with a backup battery but date and time information is retained in memory for 1 to 3 days without power supply.
 - If the power supply of the instrument has been turned off for a long time, set the date and time again when you turn on the power supply.

Operation Procedure

Procedure	Operation	Remark
① Switch to the maintenance mode "ST-BY".	(ST-BY/MEAS) (4 seconds or more)	>> 5.1(1) "Mode switching"

(To be continued)

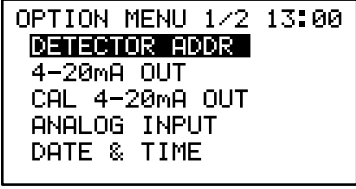
(Continued)

Procedure	Operation	Remark
② Display the “OPTION MENU 1/2” screen. 	In the maintenance mode ①, (ESC) + (READ) (4 seconds or more)	<ul style="list-style-type: none"> • “DETECTOR ADDR” is highlighted.
③ Select “DATE & TIME”. 	(↑) or (↓) ↓ (DATA/→)	<ul style="list-style-type: none"> • When you press (DATA/→), screen ④ appears.
④ Change the date and time. 	(DATA/→) ↓ (↑) or (↓) ↓ (ENT/LOCK) (confirm)	<ul style="list-style-type: none"> • Move the highlight to the place you want to change and change the number. • After confirmation, the cursor disappears and the display returns to ③. • (ESC) : Return without updating the setting.
⑤ Return to the measurement mode “MEAS”.	(ESC) ↓ (ESC)	<ul style="list-style-type: none"> • Return to ②. • Return to the measurement mode “MEAS”.

(5) External digital interface (COMMUNICATION)

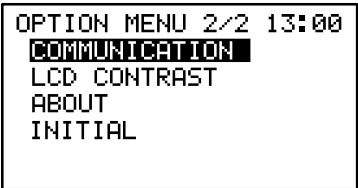
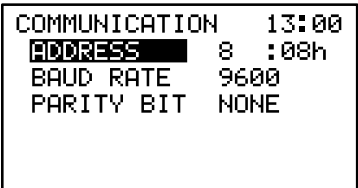


To retrieve data from digital signals that are sent from the external devices, you need to match the conditions with the connected device.

Operation Procedure

Procedure	Operation	Remark
① Switch to the maintenance mode “ST-BY”.	(ST-BY/MEAS) (4 seconds or more)	>> 5.1(1) “Mode switching”
② Display the “OPTION MENU 1/2” screen. 	In the maintenance mode ①, (ESC) + (READ) (4 seconds or more)	<ul style="list-style-type: none"> • “DETECTOR ADDR” is highlighted.

(To be continued)

(Continued)

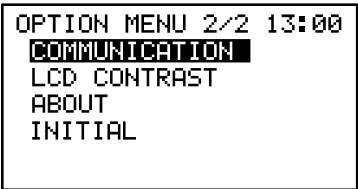
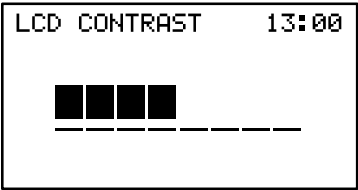
Procedure	Operation	Remark
<p>③ Display the “OPTION MENU 2/2”.</p> 	<p>↓</p>	<ul style="list-style-type: none"> • “COMMUNICATION” is highlighted.
<p>④ Select “COMMUNICATION”.</p>	<p>DATA →</p>	<ul style="list-style-type: none"> • When you press DATA →, screen ⑤ appears.
<p>⑤ Change the address (ADDRESS).</p> 	<p>DATA →</p> <p>↓</p> <p>↑ or ↓</p> <p>↓</p> <p>ENT/LOCK</p>	<ul style="list-style-type: none"> • “ADDRESS” is highlighted. • Setting range: Can be changed in units of 8. (Factory setting: 8) • After confirmation, the cursor disappears and the display returns to screen ④. • (ESC) : Return without updating the setting.
<p>⑥ Change the rate (BAUD RATE).</p> 	<p>↓</p> <p>DATA →</p> <p>↓</p> <p>↑ or ↓</p> <p>↓</p> <p>ENT/LOCK</p>	<ul style="list-style-type: none"> • Highlight “BAUD RATE” with ↓. • Setting range: 2400/4800/9600/19200/38400/57600bps (Factory setting: 9600) • After confirmation, the cursor disappears and the display returns to screen ④. • (ESC) : Return without updating the setting.
<p>⑦ Change the parity bit (PARITY BIT).</p> 	<p>↓</p> <p>DATA →</p> <p>↓</p> <p>↑ or ↓</p> <p>↓</p> <p>DATA →</p> <p>↓</p> <p>ENT/LOCK</p>	<ul style="list-style-type: none"> • Highlight “PARITY BIT” with ↓. • Setting range: NONE, ODD, EVEN (Factory setting: NONE) • After confirmation, the cursor disappears. • (ESC) : Return without updating the setting.
<p>⑧ Return to the measurement mode “MEAS”.</p>	<p>(ESC)</p> <p>↓</p> <p>(ESC)</p>	<ul style="list-style-type: none"> • Return to ②. • Return to the measurement mode “MEAS”.

(6) Contrast adjustment (LCD CONTRAST)

You can adjust the contrast of the screen display. Since an adequate contrast is set at factory, usually you need not re-adjust it.

[NOTE] • Depending on the angle at which you view the screen, the contrast varies. Adjust it, as required.

Operation Procedure

Procedure	Operation	Remark
① Switch to the maintenance mode "ST-BY".	(ST-BY/MEAS) (4 seconds or more)	>> 5.1(1) "Mode switching"
② Display the "OPTION MENU 2/2".	In the maintenance mode ①, (ESC) + (READ) (4 seconds or more)	• "LCD CONTRAST" is highlighted.
		
③ Select "LCD CONTRAST".	(↑) or (↓) ↓ (DATA/→)	• When you press (DATA/→), screen ④ appears.
④ Change the contrast.	(DATA/→) ↓ (↑) or (↓) ↓ (ENT/LOCK)	<ul style="list-style-type: none"> • When the number of ■ increases, the contrast becomes stronger. When the number of ■ decreases, the contrast becomes weaker. • After confirmation, the cursor disappears and the display returns to ③. • (ESC) : Return without updating the setting.
		
⑤ Return to the measurement mode "MEAS".	(ESC) ↓ (ESC)	<ul style="list-style-type: none"> • Return to ②. • Return to the measurement mode "MEAS".

(7) System information (ABOUT)

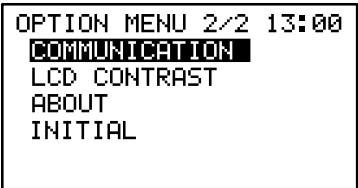
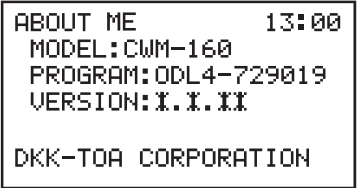
Information such as the combined model and software version is displayed.

Operation Procedure

Procedure	Operation	Remark
① Switch to the maintenance mode "ST-BY".	(ST-BY/MEAS) (4 seconds or more)	>> 5.1(1) "Mode switching"

(To be continued)

(Continued)

Procedure	Operation	Remark
② Display the “OPTION MENU 2/2” screen. 	In the maintenance mode ①, (ESC) + (READ) (4 seconds or more)	<ul style="list-style-type: none"> • “COMMUNICATION” is highlighted.
③ Select “ABOUT”.	(↑) or (↓) ↓ (DATA) (→)	<ul style="list-style-type: none"> • When you press (DATA) (→), screen ④ appears.
④ System information is displayed. 		
⑤ Return to the measurement mode “MEAS”.	(ESC) ↓ (ESC)	<ul style="list-style-type: none"> • Return to ②. • Return to the measurement mode “MEAS”.

(8) Detector parameter initialization

In the following situations, all parameters of the detector can be initialized.

- When the power supply is turned on or when a hardware error (H-E) is displayed during detection operation.
- When any question arises during setting value change, etc.

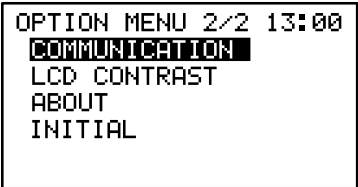
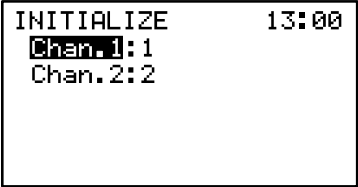
【IMPORTANT】 • Even if parameters are initialized, detection can be carried on. However, you should perform re-calibration and setting change as required and use the instrument, conforming to the detection conditions.

Operation Procedure

Procedure	Operation	Remark
① Switch to the maintenance mode “ST-BY”.	(ST-BY/MEAS) (4 seconds or more)	>> 5.1(1) “Mode switching”

(To be continued)

(Continued)

Procedure	Operation	Remark
<p>② Display the “OPTION MENU 2/2” screen.</p> 	<p>In the maintenance mode ①, (ESC) + (READ) (4 seconds or more)</p>	<ul style="list-style-type: none"> • “COMMUNICATION” is highlighted.
<p>③ Select “INITIAL”.</p>	<p>↑ or ↓ ↓ DATA →</p>	<ul style="list-style-type: none"> • When you press (DATA →), screen ④ appears.
<p>④ Check “Chan.* INITIAL EXEC?”.</p> 	<p>↑ or ↓ ↓ DATA →</p>	<ul style="list-style-type: none"> • Chan.1 ... Detector 1 Chan.2 ... Detector 2 • After confirmation, screen ⑤ appears.
<p>⑤ Check “INITIA_EXE?” and confirm it.</p>	<p>(ENT/LOCK)</p>	<ul style="list-style-type: none"> • After confirmation, the cursor disappears and the display returns to ④. • ESC: Return without updating the setting.
<p>⑥ Return to the measurement mode “MEAS”.</p>	<p>(ESC) ↓ (ESC)</p>	<ul style="list-style-type: none"> • Return to ②. • Return to the measurement mode “MEAS”.

6. Maintenance

6.1 Maintenance List

(a) To be able to operate the product always normally and maintain a desired performance level, you should be well informed of the functionalities of the product and perform maintenance periodically.

【IMPORTANT】 • If maintenance is not performed periodically, it may cause malfunctions.

(b) “Cycle” in Table “Standard Maintenance List” is based on the standard installation conditions (9.1 (1) “Installation Location”). Depending on the condition, the maintenance work cycle may differ from this. Change the cycle adequately, based on the operation status for several months or more.

(c) For technical services such as repairs, ask DKK-TOA or our dealer. Technical services should be performed by a person who has received proper training or a person who has technical skills equivalent to that certification system.

Standard Maintenance List

Object	Contents	Start time	Cycle					Execution method, etc.
			1 month	6 months	1 year	4 years	When required	
Detector	(1) Window cleaning		○					>> 6.3 “Window Cleaning”
	(2) Alarm operation check	○	○					>> 3. “Alarm Operation Check”
	(3) Calibration			○				>> 4. “Calibration”
	(4) Replacement of silica gel				○			>> 6.4 “Replacement of Silica Gel”
	(5) Replacement of light source unit					○		>> 6.5 “Replacement of Light Source Unit”
	(6) Application of lubricant			○				>> 6.6 “Application of lubricant”
	(7) Replacement of varistor unit				○			>> 6.7 “Replacement of varistor unit”
Transmitter	Replacement of varistor unit				○			>> 6.7 “Replacement of varistor unit”

○: Appropriate maintenance cycle

[NOTE] • The period differs depending on the installation condition.







Electric shock

- Do not touch the terminals inside the transmitter while power is supplied. If you touch, there is a risk of getting an electric shock. If there is a possibility that you may touch a terminal during maintenance work or troubleshooting, turn off the power supply source to the product.



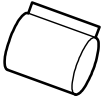



6.2 Accessories and Spare Parts

The following table lists general accessories and spare parts. Accessories and spare parts differ depending on the specification and may be changed without prior notice. The instruction manual may be delivered separately from the product, depending on the order specification.

Accessories

No.	Code No.	Part name	Sketch view	Qty	Remark
1		Instruction Manual		1	
2		Inspection Record		1	
3	104A288	Time lag fuse 218.630		2	Common to transmitter and detector
4	136C035	Calibration vessel		2	

Spare Parts

No.	Code No.	Part name	Sketch view	Qty			Replacement cycle	Remark
				Consumables	Periodic replacement parts	Spare parts		
1	7151200U	Light source unit				1	4 years	
2	104A288	Time lag fuse 218.630				2		Common to transmitter and detector
3	143C089	Silica gel 50g, packed in bag		2	2		1 year	
4	141E030	Rust prevention lubricant 94mL				1		Prevention from adherence of a screw part
5	7041310U	Varistor unit			2		1 year	Common to transmitter and detector
6	7308540U	Varistor unit			6		1 year	

6.3 Window Cleaning

Clean the acrylic window on the bottom of the detector with a soft cloth.

-
- 【IMPORTANT】**
- If dirt is greasy, use neutral detergent.
 - Do not use organic solvent (such as thinner).
-

6.4 Replacement of Silica Gel

If dew condensation occurs internally in the window, it may be impossible to detect oil films. To prevent this from occurring, replace two silica gels in the detector once a year or so.

6.5 Replacement of Light Source Unit

The recommended replacement cycle of the laser diode used in the light source unit is approx. 4 years. When 4 years (35,064 hours) has passed for the accumulated lighting time, error “E-8” generates. >> 7.1 “Error and Handling”, 5.2⑫ “Laser accumulated lighting time”

If the laser diode is deteriorated, it may cause the light intensity to drop, resulting in a false alarm or a detection error. Therefore, the light source should be replaced periodically. Contact the dealer for replacement of the light source unit.

6.6 Application of Lubricant

In order to prevent the screw part of a detector and a detector lid from adhering, we recommend the application of a periodical lubricant.

6.7 Replacement of Varistor Unit

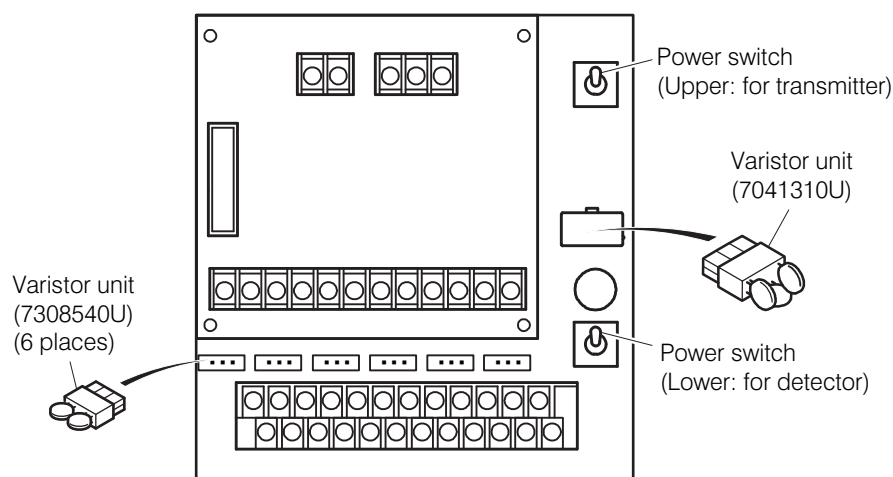


Electric Shock

- Do not touch the terminals inside the controller while power is applied. Touching the terminals may cause electric shock.
-

(1) Transmitter

Replace the varistor units about once a year by the following procedure.

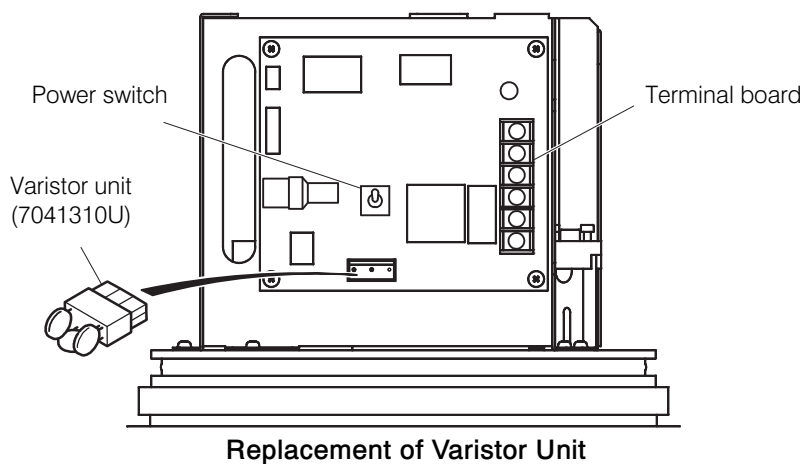


Replacement of Varistor Unit

- ① **Turn off the power switch.** Turn off the power switches of the transmitter in the following order:
 - Upper switch → Lower switch
- ② **Stop supplying power.** Stop the supply of all the power applied to the power supply and contacts.
- ③ **Replace the varistor units.** Remove the old varistor units (2 kinds, total 7 places) by pulling them forward and replace them with new varistor units.
- ④ **Return to the original state.** Return to the original state by the opposite procedure of steps ① and ②.

(2) Detector

Replace the varistor units about once a year by the following procedure.



- ① **Turn off the power switch.** Turn off the power switches of the transmitter in the following order:
 - Upper switch → Lower switch
- ② **Stop supplying power.** Stop the supply of all the power applied to the transmitter power supply and contacts.
- ③ **Replace the varistor units.** Remove the old varistor units by pulling them forward and replace them with new varistor units.
- ④ **Return to the original state.** Return to the original state by the opposite procedure of steps ① and ②.

7. Troubleshooting

7.1 Errors and Handling

- (a) If an error occurs during detection, an error display blinks on the top of the screen.
- (b) If an error listed in the table below occurs in the measurement mode, the contact of the set output terminal is “closed”. This contact does not operate in modes other than the measurement mode (maintenance mode and calibration mode).
- Output terminal setting >> 5.3(13) “Output signal”
- (c) When an error occurs during detection, first check whether an error display appears.
- (d) When an error occurs, even if the error display is released, it lights again unless the cause of the error is removed. When the cause of the error has been removed, the error display goes out automatically. >> 5.3(6) “Analog output”

【IMPORTANT】 • The error display on the top of the screen shows the most recent error content only. However, by pressing (READ) and selecting with (↑) or (↓) in the state of this measurement mode, you can display errors that are currently occurring, each one after another. Note that if an error occurs during detection, check the error content in the measurement mode.

Error Types (with Contact Signal Release Operation in the Measurement Mode)

Error display	Error name	Release method	
		Mode	Operation
NONE	No error	—	—
E-1: LASER_L_ERROR	Laser beam output drop or stop (instrument error)	Measurement, maintenance	Press (ST-BY/MEAS) for 4 seconds or more. (Switch to the maintenance mode once.)
E-2: LASER_H_ERROR	Laser beam output high (instrument error)	Measurement, maintenance	Press (ST-BY/MEAS) for 4 seconds or more. (Switch to the maintenance mode once.)
E-3: TEMP_ERROR	Internal temperature unusual (instrument error)	Measurement, maintenance	Press (ST-BY/MEAS) for 4 seconds or more. (Switch to the maintenance mode once.)
E-4: DETECT_L_ERROR	Water surface detection error (measurement error)	Measurement, maintenance	Press (ST-BY/MEAS) for 4 seconds or more. (Switch to the maintenance mode once.)
E-5: DETECT_H_ERROR	Unusual reflected light detected (measurement error)	Measurement, maintenance	Press (ST-BY/MEAS) for 4 seconds or more. (Switch to the maintenance mode once.)
E-6: INPUT_H_ERROR	Ambient light, light intensity high (measurement error)	Measurement, maintenance	Press (ST-BY/MEAS) for 4 seconds or more. (Switch to the maintenance mode once.)
E-7: ILLEGAL SETTINGS	Input error including a calibration error	Maintenance, calibration	Press (ESC) .

(To be continued)

(Continued)

Error display	Error name	Release method	
		Mode	Operation
E-8: EXCHANGE LASER	Laser exchange alarm (instrument error)	Measurement, maintenance	Press ST-BY/MEAS for 4 seconds or more. (Switch to the maintenance mode once.)
E-9: NO COMMUNICATION	Communication error (instrument error)	—	Turn off the power supply and turn it on again.
H-E: HARDWARE ERROR	Hardware error	—	Turn off the power supply and turn it on again.
ERR	Setting error Input value is out of range	Maintenance	Press ESC .

(a) “E-1” – Laser beam output drop or stop

[Display condition]

- Displayed when laser beam emission stops or light intensity drops (laser beam intensity is controlled thus it is constant under normal conditions).

[Instrument status]

- Detection continues. Data may be incorrect.

[Main cause]

- Deterioration of laser element, etc.

[Action]

- Replace the light source unit. >> Contact the dealer.

(b) “E-2” – Laser beam output high

[Display condition]

- Displayed when some error occurs in the laser control circuit and laser beam output exceeds the specified intensity.

[Instrument status]

- Laser emission stops immediately. Detection does not continue.

[Main reason of error]

- Defective laser element.

[Action]

- Inspect the detector. >> 7.3 “Troubleshooting of Detector”
- If this error persists, contact the dealer.

(c) “E-3” – Internal temperature unusual

[Display condition]

- Displayed when the detector internal temperature exceeds 70°C.

[Instrument status]

- Laser emission stops immediately. Detection does not continue.

[Main reason of error]

- Defective detector
- The instrument case temperature has increased because of external ambient temperature rise and direct sunlight, etc.

[Action]

- Inspect the detector. >> 7.3 “Troubleshooting of Detector”
- If this error persists, contact the dealer.

(d) “E-4” – Water surface detection error

[Display condition]

- Displayed when the detector fails to receive reflected light from the water surface and the error condition continues after the continuation time set by the parameter has passed.

[Instrument status]

- Detection continues.

[Main reason of error]

- Reflected light cannot be received from the water surface due to waves, rain, and fog, etc.
- The detector is not installed properly.

[Action]

- When water surface detection is successful, the error display and error signal stop (when the received light intensity exceeds the error threshold).

(e) “E-5” – Unusual reflected light detected

[Display condition]

- Displayed when reflected light larger than the maximum reflected light (assuming the oil surface) has entered continuously for 10 seconds.

[Instrument status]

- Detection continues.

[Main reason of error]

- Object with high reflectance is present on the laser scanning surface.

[Action]

- When detection is successful, the error display (threshold of the received light intensity at which this error was set) and error signal stop.

(f) “E-6” – Ambient light, light intensity high

[Display condition]

- Displayed when the reflected light intensity level of sunlight, etc, especially of parallel beam is large and exceeds the tolerance.

[Instrument status]

- Detection continues.

[Main reason of error]

- The reflected light intensity level of sunlight, etc., especially of a parallel beam is high and the input voltage to the first-rank amplifier circuit has exceeded the tolerance.

[Action]

- If the incident direction of the reflected light is the same as that of sunlight, install a sun shade cover.
- If this error persists, contact the dealer.

(g) “E-7” – Input value error including a calibration error

[Display condition]

- A calibration error is displayed when the following condition is not satisfied

Input count value
 $BLANK_DATA < WATER_DATA < OIL_DATA$

[Instrument status]

- Restores data prior to setting.

[Main reason of error]

- The input value is not valid.

[Action]

- Enter a valid value.
- If this error persists, contact the dealer.

(h) “E-8” – Laser exchange alarm

[Display condition]

- Displayed when the 4 years (35,064 hours) have passed for the laser accumulated lighting time.

[Instrument status]

- Detection continues.

[Action]

- Maintain the detector or contact the dealer. >> 6.5 “Replacement of Light Source Unit”

(i) “E-9” – Communication error

[Display condition]

- Displayed when communication between the transmitter and detector fails.

[Instrument status]

- Detection continues. Output signals to the external device such as transmissions stop.

[Main reason of error]

- The transmitter or detector is out of order.
- Power supply to the detector is off.
- Invalid wiring

[Action]

- Turn off the power supply once and turn it on again.
- Inspect the wiring connection.

- If this error persists, contact the dealer.

(j) “H-E” – Hardware error

[Display condition]

- Displayed when an error occurs during memory check at power-on.

[Instrument status]

- The instrument operates, and output stops.

[Main reason of error]

- The setting value is out of the specified range.

[Action]

- Turn off the power supply and turn it on again.
- If this error persists, contact the dealer.

(k) “*ERR*” – Setting error

[Display condition]

- Displayed when the input value is out of the setting range.

[Instrument status]

- Returns to the state prior to the input/change.

[Main reason of error]

- Input is out of the setting range.

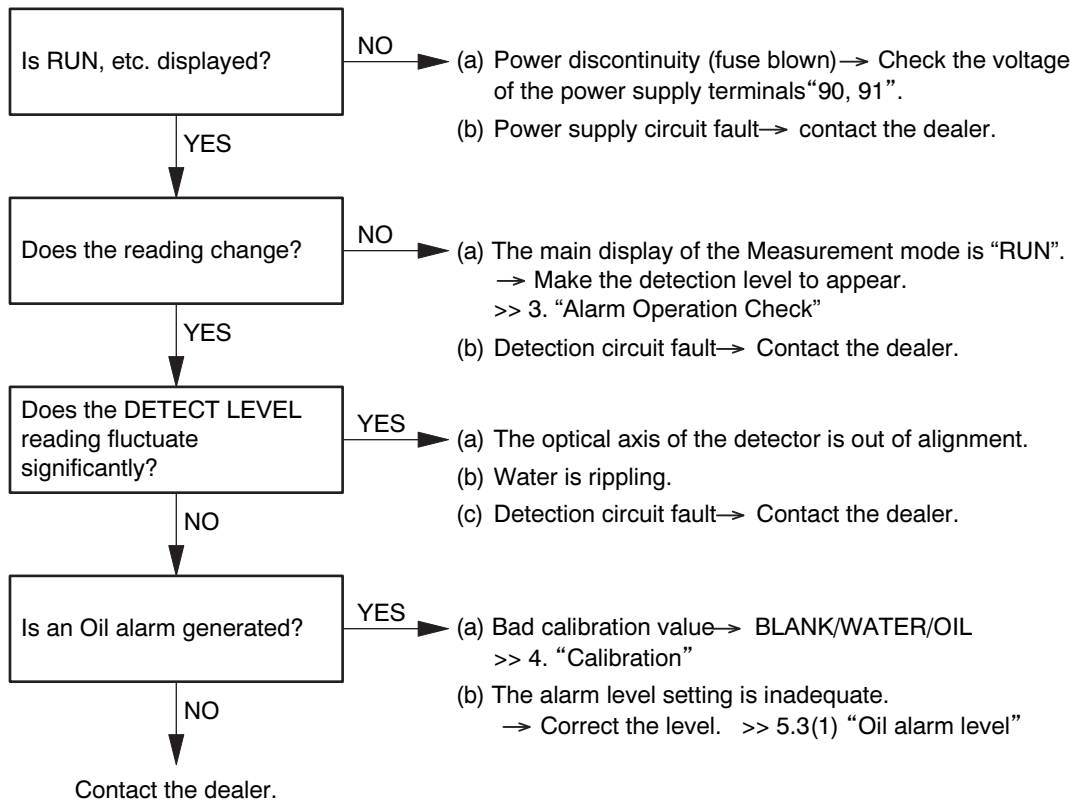
[Action]

- Enter a valid value.
- If this error persists, contact the dealer.

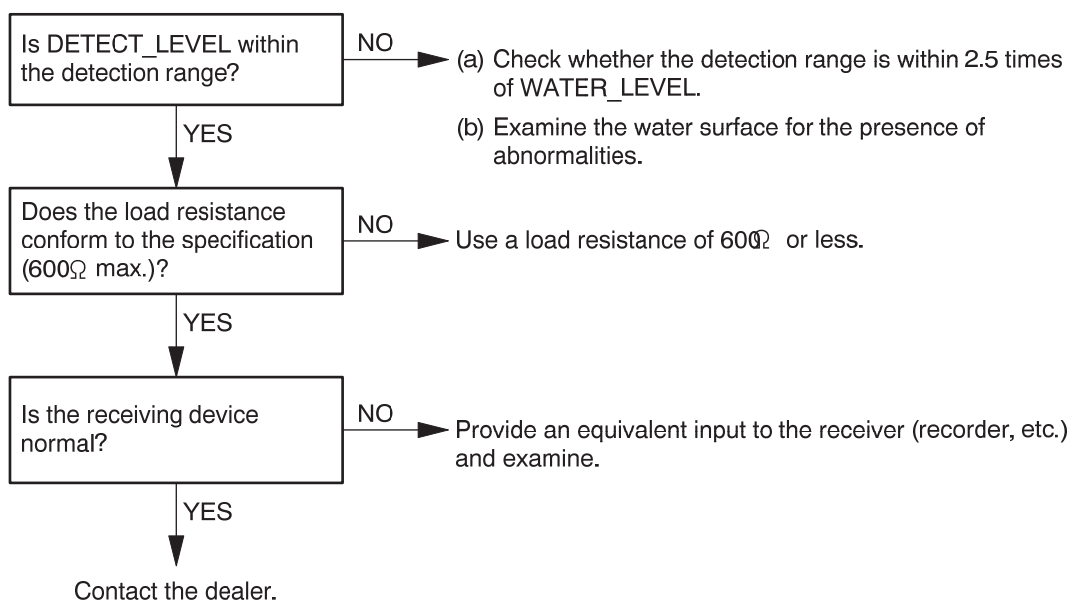
7.2 Troubleshooting of Transmitter

If an error occurs during detection, check the transmitter by the following procedure.

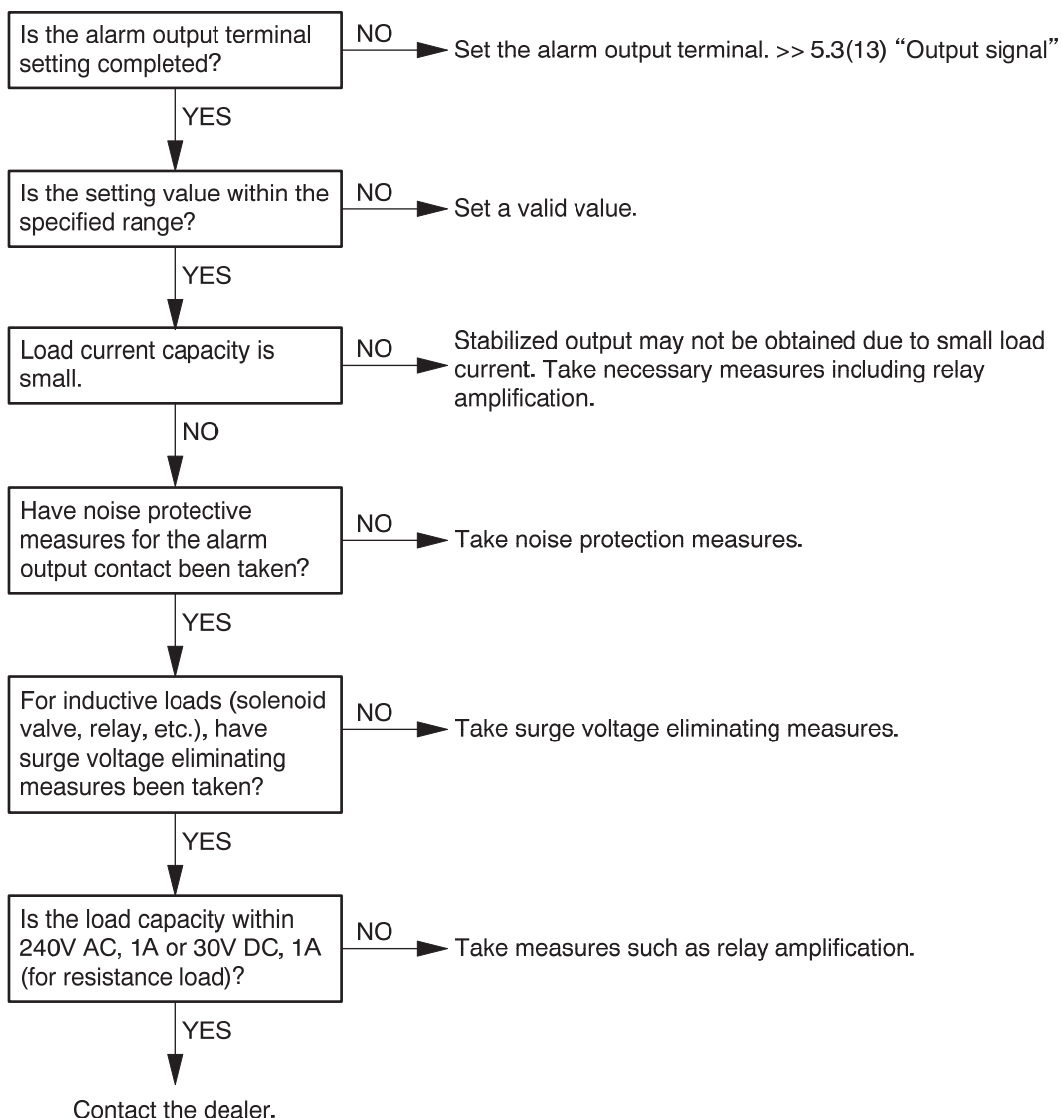
(1) Detection error



(2) Reflected light output (analog) error

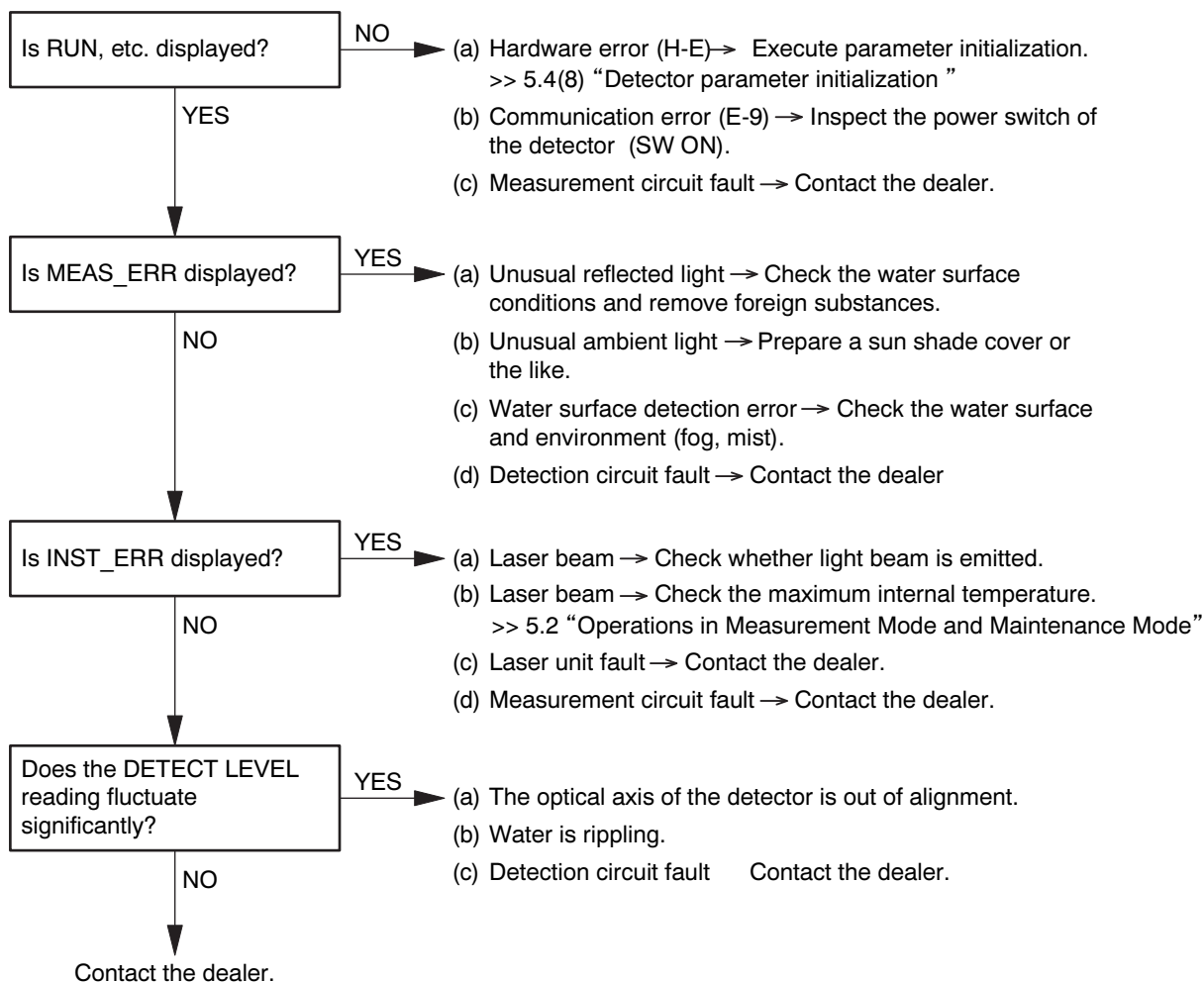


(3) Alarm contact output error



7.3 Troubleshooting of Detector

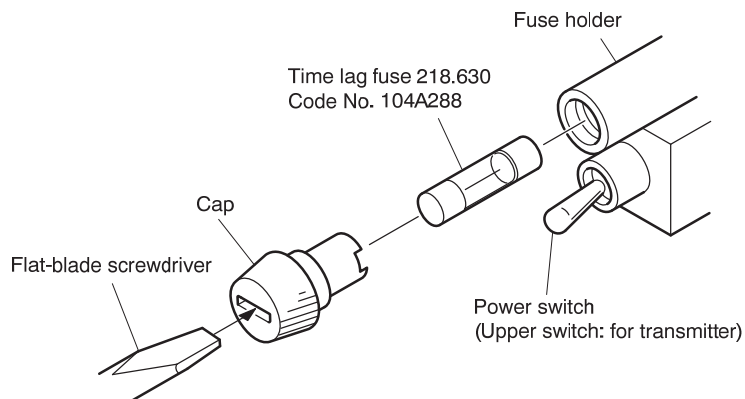
If an error occurs during detection, check the detector by the following procedure.



7.4 Fuse Replacement

If the fuse is blown, replace it by the following procedure.

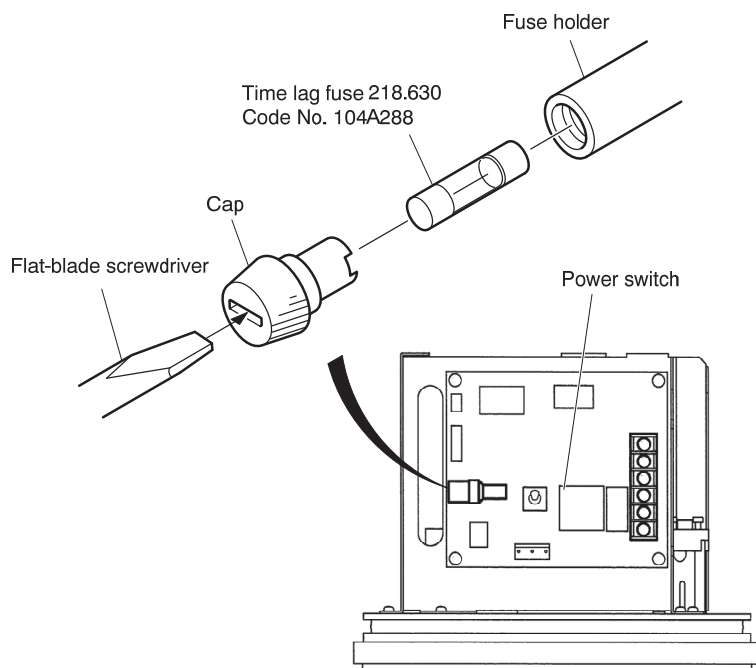
(1) Replacing the fuse in the transmitter



Replacing the Fuse (Transmitter)

- ① Turn off the power switch. Turn off the power switches (2 places) (upper side → lower side).
- ② Stop power supply. Stop power supply to the transmitter.
- ③ Remove the fuse. Turn the cap counterclockwise to remove it together with the blown fuse.
- ④ Replace. Replace the blown fuse with a new one.
- ⑤ Reinstall. Turn the cap with the new fuse clockwise while pushing it in and install it in place. Supply power to the transmitter and turn on the power switch.

(2) Replacing the fuse in the detector



Replacing the Fuse (detector)

- ① **Turn off the power switch.** Turn off the power switch of the detector.
- ② **Stop power supply.** Stop power supply to the detector.
- ③ **Remove the fuse.** Turn the cap counterclockwise to remove it together with the blown fuse.
- ④ **Replace.** Replace the blown fuse with a new one.
- ⑤ **Reinstall.** Turn the cap with the new fuse clockwise while pushing it in and install it in place.
Supply power to the detector and turn on the power switch.

If the fuse is blown again in (1) and (2), contact the dealer.

●Repair contact

If a repair is required, please contact your sales representative, our sales office, or our service department. In this case, let us know the following information:

Model name (MODEL)

Serial number (SER. No.)

Manufacturing date (DATE)

8. Specifications and Explanation of Operation

8.1 Specifications

Product name	: Oil Film Monitor (High sensitive model)
Model name	: ODL-1610A
Measurement object	: Floating oil film on water or floating oil film on floor surface
Measurement method	: Laser beam scanning reflectance measurement
Detection distance	: 0.3-10m above water or floor surface No wave or fog to interfere with reflected light detection
Light source	: Red semiconductor laser diode (for class 2)
Display	: Liquid crystal digital display, with back lighting
Ambient temperature	: -10 to +50°C
Ambient humidity	: 5 to 95%RH (no condensation)
Sample water temperature	: No freezing
Transmission output signals (analog output)	: Detection signal level 4-20mA DC, load resistance 600Ω max., isolated output It is possible to change the setting to the output of the following ① or ② by the transmitter arbitrarily. ① Standard output mode* ¹ Normal Approx.10.4mA Oil film presentApprox.13.6mA or more Detection error Approx.4mA ② ODL-20-compatible mode Normal 18mA (fixed value) Oil film present20mA (fixed value) Detection error 16mA (fixed value) *1 Burnout function can be selected. Oil film alarm ON 21mA (fixed value) Error alarm ON 3mA (fixed value) (Error alarm applies to all of measurement errors and instrument errors.)
Contact output signals	: Output item ①Under maintenance, ②Oil alarm, ③Instrument error* ¹ , ④Measurement error* ² , ⑤Power off *1 Instrument error contents (Laser beam output error (output drop, output stop, or output large), internal temperature unusual, communication error, hardware error, laser exchange alarm)

		*2 Measurement errors contents (Water surface detection error, reflected light error, ambient light error)
	Number of outputs	6 (Output 1-6) Above 4 items ① to ④ can be allocated to the 5 contacts of output 2 to 6 arbitrarily (Multiple can be selected.) Above ⑤ is fixed to output 1. concentration corresponding to preset scale
	Form and capacity.....	Output 1 CO contact (capacity: 240V AC 1A or 30V DC 1A (resistive load)) Output 2 to 6 (one of the following can be specified) NO or NC contact (capacity: 240V AC 1A or 30V DC 1A (resistive load))
Communication method	: Interface	RS-485 compliant (isolated type)
	Communication speed ..	Select from 2400/4800/9600/19200/ 38400/57600bps.
	Protocol.....	MODBUS/RTU
	Data length	8 bits
	Parity.....	Select from NONE/ODD/EVEN.
	Stop bit	1 bit, 2 pairs (for parallel connection)
	Data order	BIG ENDIAN
Power supply	: 100-240V AC ± 10%	50/60Hz
Power consumption	: 100V AC	Approx. 13VA, (when heater*1 provided, 18VA max.) 240V AC
		Approx. 27VA, (when heater provided, 32VA max.)
		*1 option specifications
Cable port	: Outer diameter 6 to 12mm cable gland (When the cable gland is removed, G1/2 conduit pipe connection screw)	
		The number of cable glands used: transmitter: 6, detector: 1 (other 3 are plugged)
Cable length	: Between transmitter and detector: One of 2m, 10m, 20m, 100m is specified (100m max. and length can be arbitrarily specified in increments of 1m unit.)	
Construction	: Outdoor installation, IP65 (dust-proof and jet-proof type)	

Main material・finish	: Transmitter ···· Aluminum die-casting (Painting color ····· Metallic silver) Detector ····· Aluminum casting (Painting color ····· Metallic silver)
Weight	: Transmitter ···· Approx. 2.2kg Detector ····· Approx. 26kg
Dimensions	: Transmitter ···· Approx. 181(W) × 180(H) × 95(D)mm Detector ····· Approx. φ307 × 577(L)mm

8.2 Explanation of Operation

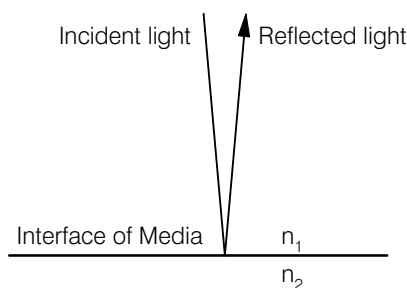
(1) Principle of detection

(a)Based on the principle and installation method, the oil film detection methods are classified as shown in the table below. The principle of detection of this product is “based on the reflectance difference” (one shown in the table), and the installation method is based on “install the instrument at a distance from the water surface”.

Classification of Oil Film Detection Methods

Item	Classification
Principle of detection	Based on the Reflectance difference
	Based on the buoyancy difference
	Based on the permittivity difference
Installation method	Install the instrument at a distance from the water surface
	Float the instrument on the water surface

(b)If an oil film is present on a water surface, it usually appears shinny. This is because “oil reflects more visible light than water”, i.e. the reflectance of oil is larger than that of water. The following formula represents the reflectance of light at the interface of two media (substance that acts as a field through which waves such as light travel) when light enters perpendicular to the interface, as shown in the following figure.



Reflection at the Interface of Media

Reflectance = $(n_2 - n_1 / n_2 + n_1)^2$, where, $n_2 > n_1$

n_1 : Refractive index of air n_2 : Refractive index of water, oil, etc.

Refractive Index of Media (Air, Water, Oil)

Medium name	Refractive index	Medium name	Refractive index
Air	1.00	P-paraxylene	1.50
Water	1.33	Parafine oil	1.48
Gasoline	1.40 or more	Linseed oil	1.48
Kerosene	1.45 or more	Olive oil	1.47
Light oil	1.45 to 1.50	Palm oil	1.45
Heavy oil	1.45 or more	Soy oil	1.47
Benzene	1.50	Whale oil	1.47
Toluene	1.50	Oleum morrhuae	1.48

The refractive indexes of oils listed in the table are approximate values because they are not pure materials and thus the refractive index varies. When the reflectance of water and oil is calculated using the above formula, the results will be as follows:

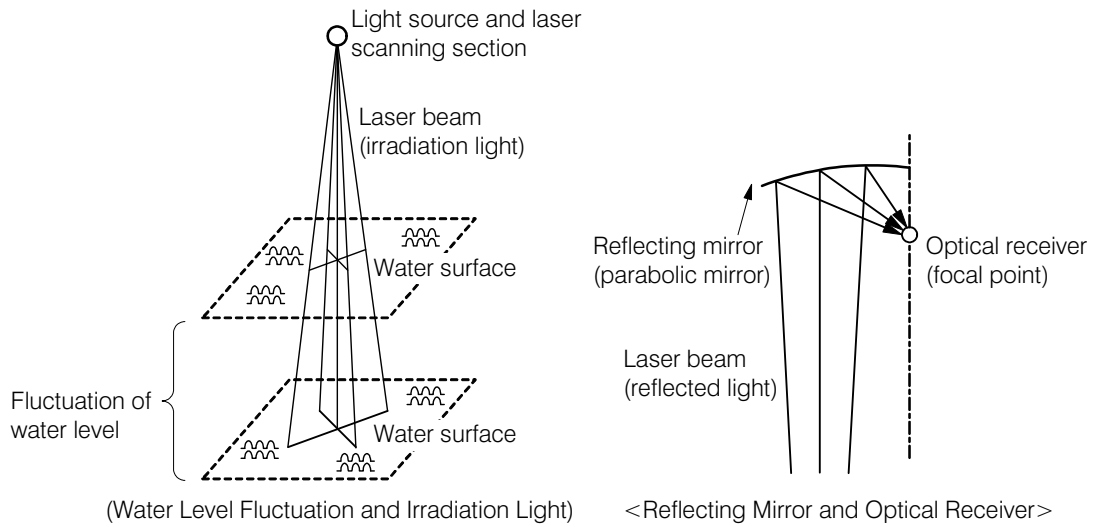
Reflectance of water: 2%

Reflectance of oil: 3 to 4%

The reflectance of oil is 50 to 100% larger than that of water.

- (c) Thus, by irradiating light with a constant intensity (such as a laser beam) on a water surface and measuring the reflected light intensity, an oil film can be detected from the difference of the reflectance. If light is irradiated to a ground or concrete surface, the reflected light will be scattered about because the surface is rough, resulting in the reflected light being very weak. However, when oil flows on this surface and a flat and smooth oil film is formed, light shows the same reflectance as the oil film on the water.
- (d) The oil film detection range is generally a range where an oil film is recognizable with eyes. In terms of oil film thickness, this is a level of $1 \mu\text{m}$ or less. Even if the oil film is thicker than this, the reflected light intensity is unchanged and constant. In addition, since almost all oils have a reflectance of a 1.40 or more as shown in the table “Refractive Index of Media (air, water, oil)”, they can be detected at any place where a flat and smooth oil film is formed.

(2) Explanation of operation



Explanation of Operation

- (a) This product consists of a detector and a transmitter. The detector internally has a detection optical system that consists of a light source (semiconductor laser diode), a laser scanning section, a reflecting mirror (parabolic mirror) and an optical receiver (photo diode) and an electrical circuit.
- (b) Laser beams irradiated from the light source are periodically scanned in the direction of XY by the laser beam scanning section and then irradiated perpendicular to the water surface. Some of the laser beams reflected at the water surface reach the reflecting mirror and are collected by the optical receiver placed on the focal point. To block the effect of sunlight, a cut filter is applied over the window of the optical receiver. This improves the SN ratio (the logarithm of noise intensity to a signal power). In addition, to avoid the effect of noise of sunlight that belongs to the waveband required for detection, the light source is turned on by a constant fraction. Further, by shortening the laser beam lighting interval, the sensing reliability at the wave surface is improved. The detector, which consists of a control circuit for controlling lighting of the light source, an amplifier circuit for amplifying signals from the optical receiver and a control computer for processing signals, etc., performs various processing including the determination of the presence of oil films and self-diagnostics.
- (c) The transmitter receives information in (b) via digital communication and displays it. It also outputs transmissions and contacts, etc. to external devices. In addition, the transmitter allows you to set various measurement modes, alarm parameters and calibration, etc. by communication with the detector.

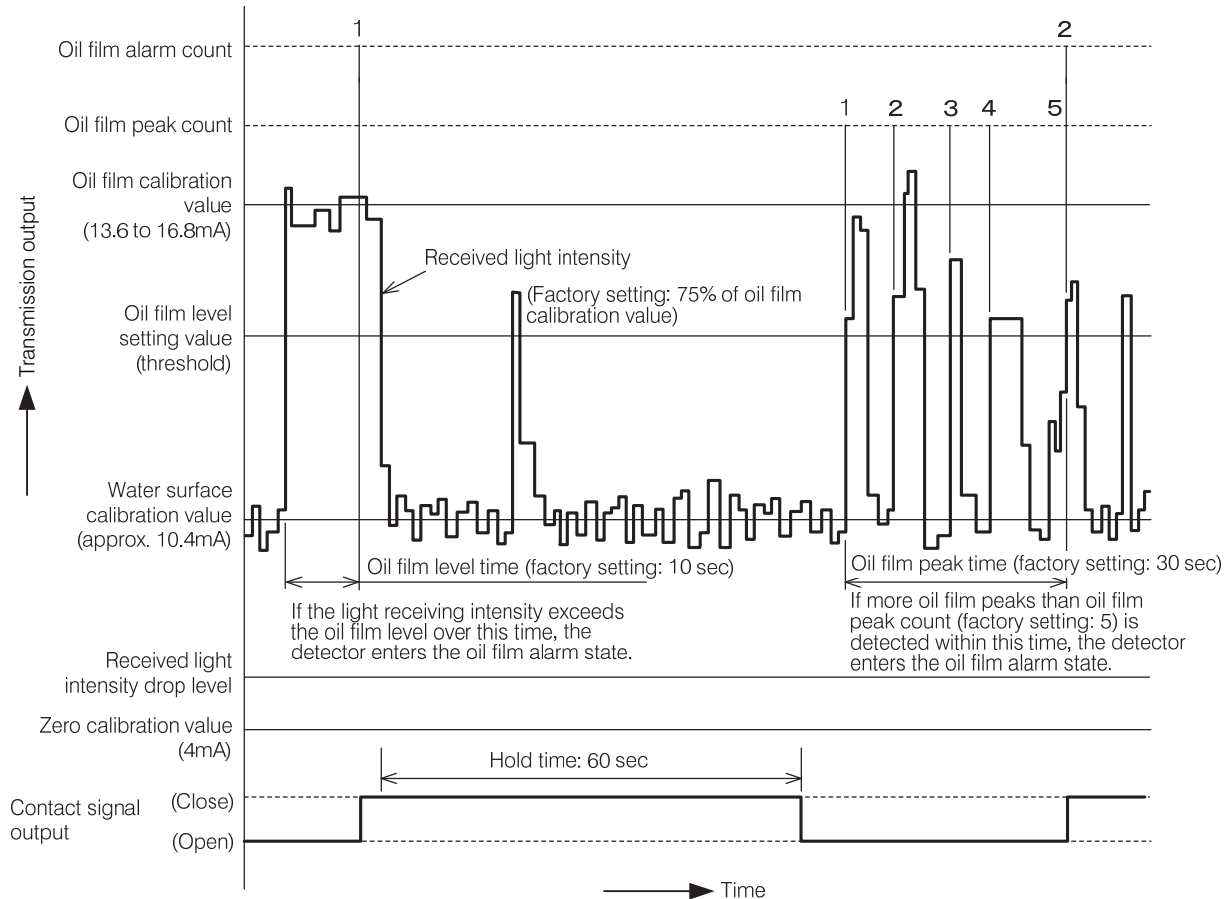
(3) Example of detection

(a) Example of oil alarm

The figure below shows an example of oil alarm mode setting and oil film detection.

Example of Oil Alarm Mode Setting

Setting item	Input value
Oil film alarm level (ALM LEVEL)	75%
Oil film peak count (ALM CT)	5 times
Oil film peak time (ALM CT TIME)	30 seconds
Oil film level continuation time (ALM CONT TIME)	10 seconds
Hold time (ALM HOLD TIME)	60 seconds



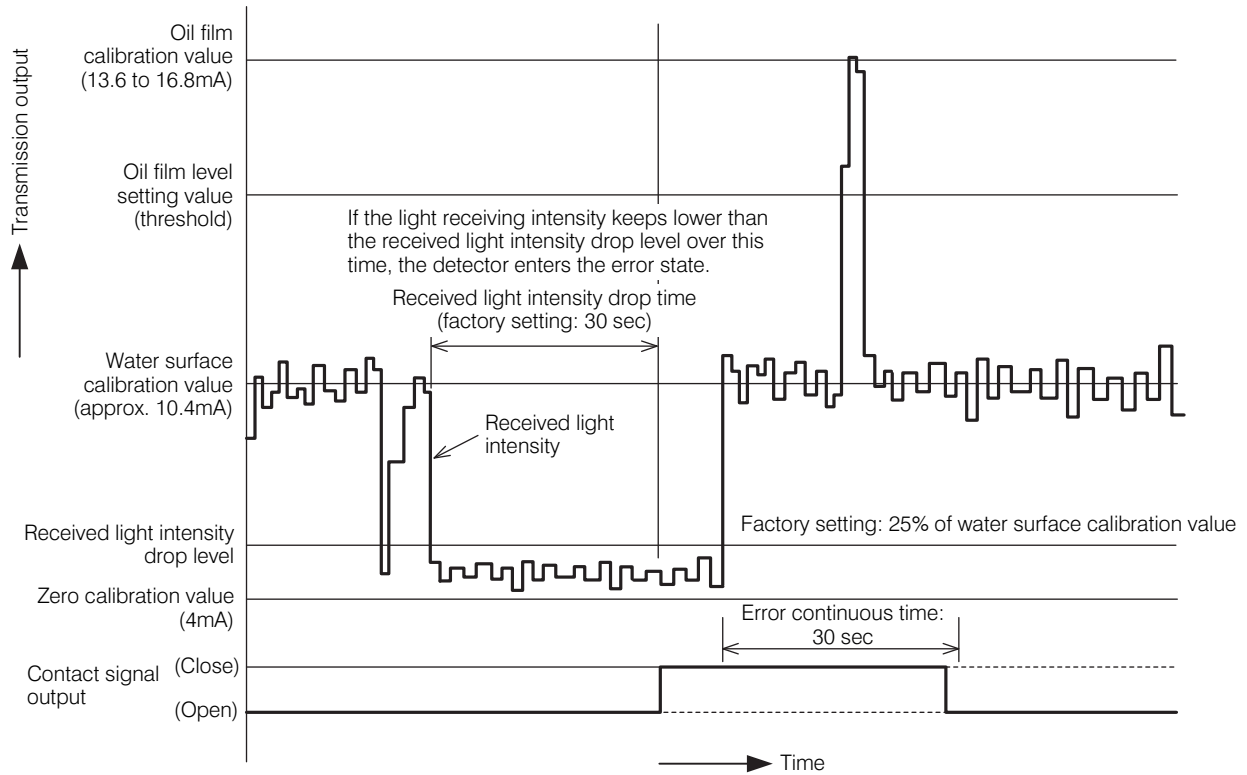
Example of Oil Alarm

(b) Example of water surface detection level error

The figure below shows an example of measurement error (water surface detection error) and error detection.

Example of Measurement Error Mode Setting

Setting item	Input value
Water surface detection error level (WATER ERR LEVEL)	25%
Error continuation time (WATER ERR TIME)	30 seconds



Example of a Measurement Error

[NOTE] • When the received light intensity dropped state is eliminated, the error is automatically released after the contact signal being held for the set received-light intensity drop time.

9. Installation

9.1 Installation

WARNING

Hazardous Gasses

- Do not use the product in an area where explosive gas, flammable gas exists. Using the product in any of these areas can cause explosion or fire.
-

(1) Installation location (Detector)

The detector should be installed in a location that accommodates the specifications and satisfy the following conditions. >> 8.1 “Specifications”

- (a) The closer the distance from the water surface the more ideal as a detection condition, but be careful so that heavy rain does not splash onto the detector window, etc. at the bottom because the detector is too close to the water surface. In addition, install in a location where the distance does not exceed the specification range (0.3-10m) by the water level fluctuation.
- (b) Where water flow is calm
If the flow of the monitoring water is strong (jet flow), oil films may not be detected.
- (c) Where the water surface is not exposed to rain and strong wind
If the water surface is exposed to rain or strong wind, light is scattered about due to small waves rising on the water, causing the detector to fail to detect oil films. If the effect of wind and rain is expected, take preventive actions.
- (d) Where there is no garbage and dead leaves piled up by the effect of water flow
- (e) Where the monitoring water surface is not exposed to direct sunlight
If the monitoring water is exposed to direct sunlight, an abnormal signal may occur. In this case, spread a cover, etc. on the water surface to block sunlight.
- (f) Where there is no vibration and shock
- (g) Where there is no mist rising off the water
If mist is present, light is scattered about, causing the detector to fail to detect oil films. In this case, you may need a piece of equipment for removing mist by spraying air, separately. Consult DKK-TOA.
- (h) Where a horizontal and smooth fluid level can be formed (when monitoring a liquid leak on a dry surface such as a floor surface)
If the monitoring surface is pitched, the reflected light does not reach the detector and thus cannot be detected. Take measures so that a smooth liquid surface will be formed even when a liquid spills. If the monitoring surface is smooth and shiny, too much reflected light may be received, resulting in a detection error. In this case, install a non-reflective black rubber sheet on the monitoring surface.

【IMPORTANT】 • About the state of the water surface

Optically, fine waves scatter laser light and a level near 100% cannot be received. Especially, if the detection distance is long, the effect of waves is easily received. When installing, take ample countermeasures.

(2) Installation location (Transmitter)

The transmitter should be installed in a location that accommodates the specifications and satisfies the following conditions. >> 8.1 “Specifications”

- (a) Where installation and maintenance work is easy to perform
- (b) Where the transmitter is not exposed to direct sunlight and there is no rapid temperature change and no local temperature change

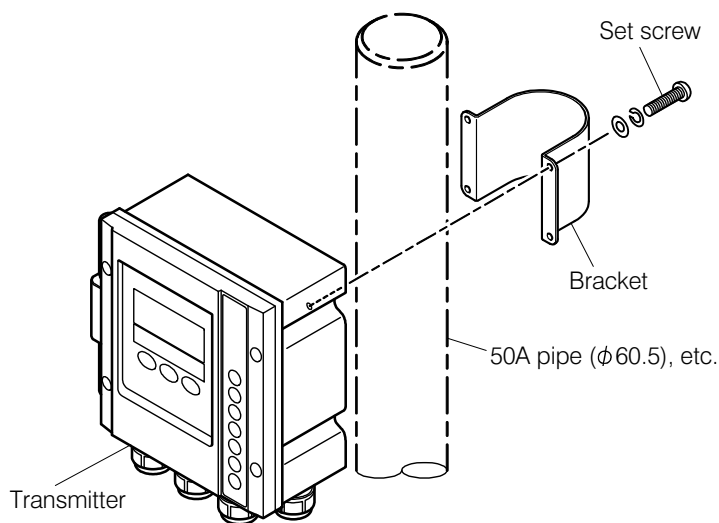
【IMPORTANT】 • In locations where the detector is exposed to direct sunlight, we recommend using an optional sun shade.

- (c) Where there is no electric noise source around
- (d) Where there is no sea water, chemicals, etc. are not splashed.
- (e) Where there is no vibration
- (f) Where there is no corrosive gas.

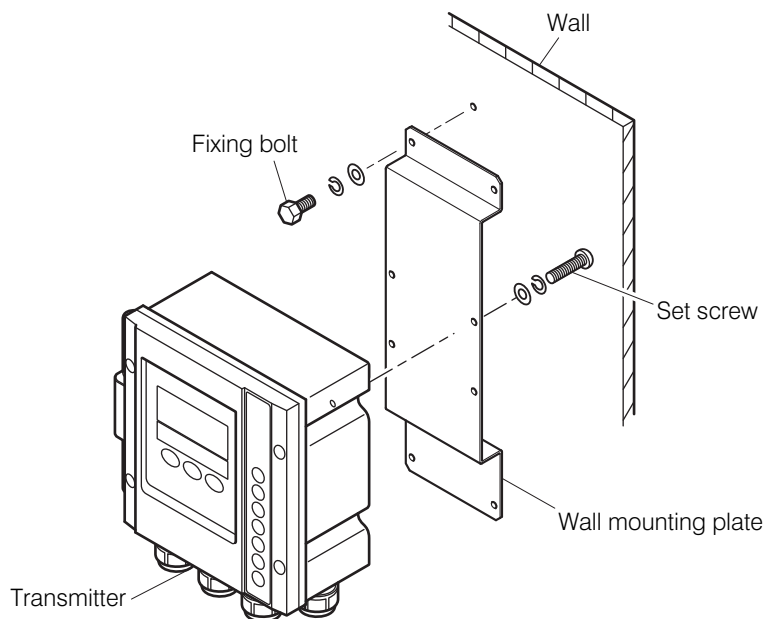
[NOTE] • Unless otherwise restricted, we recommend installing the transmitter near the detector.

(3) Installation example

Install the transmitter and detector, according to the dimensions and installation guidelines presented in the delivery specifications.



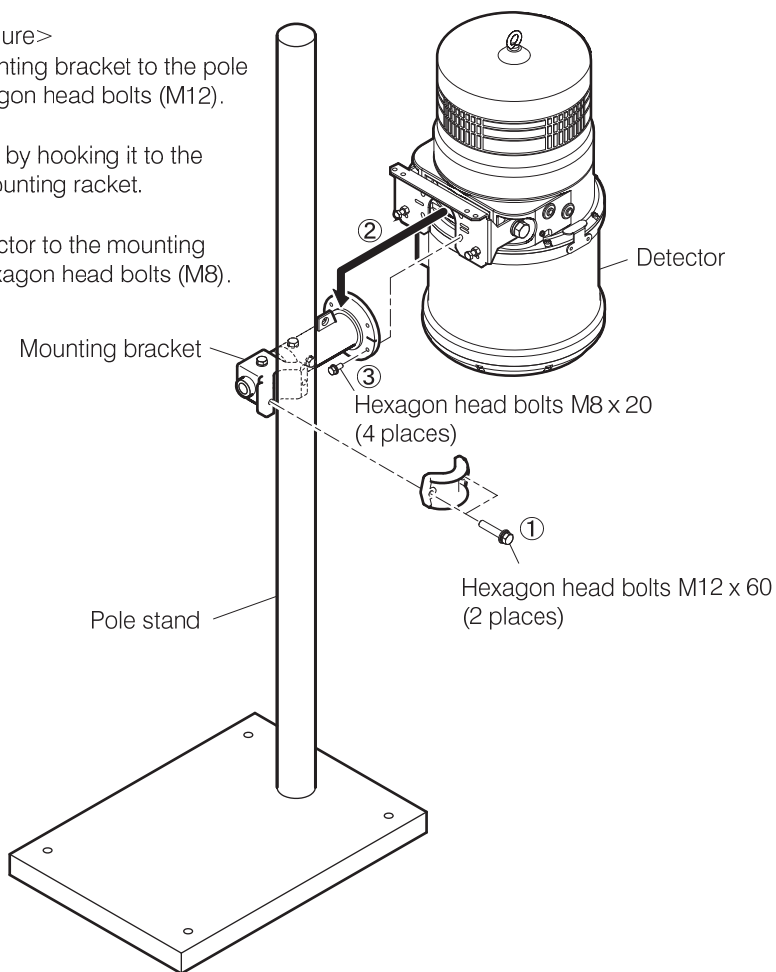
Example of Transmitter Installation to a Pipe



Example of Transmitter Installation on a Wall

<Mounting procedure>

- ① Fasten the mounting bracket to the pole stand with hexagon head bolts (M12).
- ② Set the detector by hooking it to the flange of the mounting racket.
- ③ Fasten the detector to the mounting bracket with hexagon head bolts (M8).



Example of Detector Installation

9.2 Wire Connection



Electric Shock

- Do not touch the terminals of the controller and the terminals in the solenoid valve. Electric shock may result.

(1) Applicable cables

Note the following when installing cables.

(a) Use the specified cables listed in the table below or their equivalents.

Wire connection and Material

Wiring location	Cable material	Number of cores	Finished outer diameter	Remark
Power supply line Terminals “90, 91, E1”	CVV 1.25 [□] to 2 [□]	3	φ6 to φ12	Connect to the transmitter.
Measured value output signal line Terminals “70 to 73”	CVV/CVVS 1.25 [□] to 2 [□]	2 to 4	φ6 to φ12	
Contact output signals line Terminals “30 to 43”	CVV/CVVS 1.25 [□] to 2 [□]	2 to 13	φ6 to φ12	
Digital signals (RS-485) Terminals “74 to 76”	CPEV-S	2	φ6 to φ12	Twisted pair cable (shielded)
Connection with the detector Terminals “60 to 62, 92, 93, E2)	Use the detector cable.			

[NOTE] ● Because of the finish outside diameter (maximum φ12), the wiring of seven or less cores should use one cable with 1.25 mm² wire rods. Or the wiring of four or less cores should use one cable with 2 mm² wire rods. When the number of cores increases, add a cable further and connect with a spare wiring mouth.

(b) Ground the ground terminal located on the bottom of the transmitter with the D-type ground (ground resistance 100Ω max.). If it is impossible to ground the ground cable near the transmitter, use a 3-core power cable and connect it to the ground terminal “E” in the transmitter then ground it on the distribution board. Do not share the ground with power equipment.

(c) For cables, use the crimp terminal which suits a wire rod (a 1.25 mm² or 2 mm²). Refer to the following for our recommended standard.

- 2-MS3 ● 1.25-MS3 (These are all J.S.T. Mfg. Co. Ltd. made.)



Electric Shock

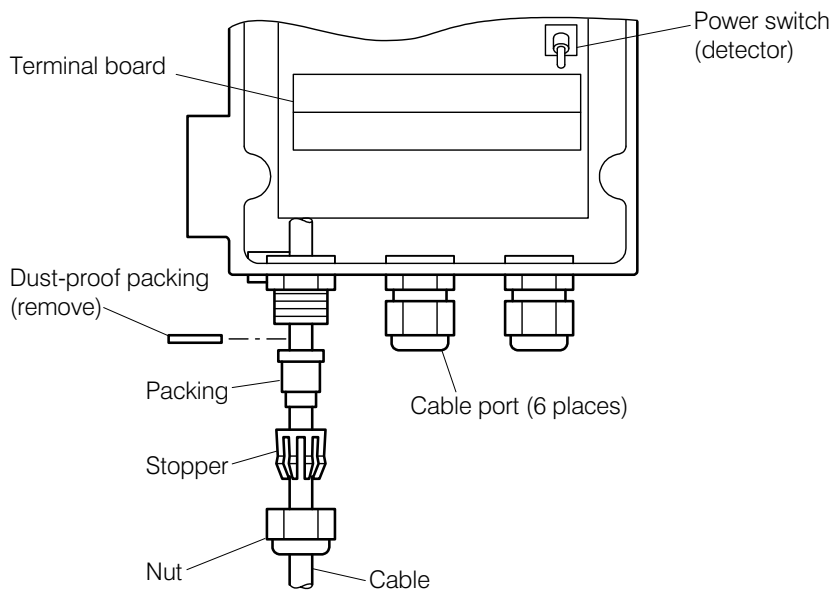
- Make sure to install grounding wire. Otherwise, electric shock can result if a problem occurs in the power supply system.

(d) Keep output signal lines away from the power line and noise sources.

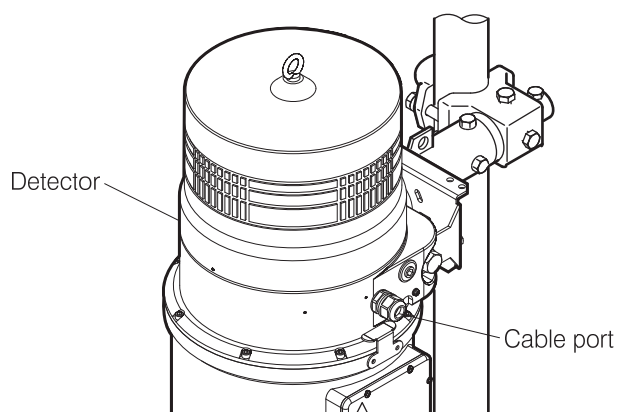
(2) Cable port

Install each cable to the inside through a cable port (for $\phi 6$ to 12 cables) on the bottom of the transmitter or detector.

-
- 【IMPORTANT】**
- Use a cable with an outer diameter fit to the cable gland. If not, an airtight condition in the transmitter cannot be maintained and the humidity in the transmitter will increase, causing an insulation deterioration.
 - To maintain an airtight condition, tighten all nuts after wiring. Do not remove the dust-proof packing from any unused cable port.
-

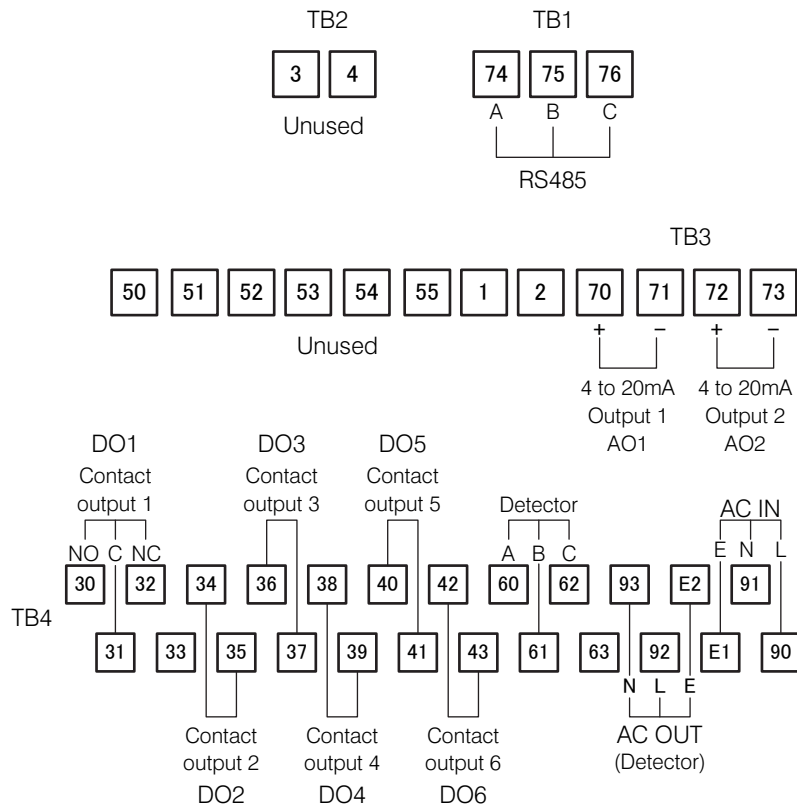


Cable Ports of Transmitter



Cable Ports of Detector

(3) Terminals of transmitter



Terminal Diagram

- 【IMPORTANT】**
- For cables, especially for the power cable, use crimping terminals and connect them securely to ensure they do not fall out or become short-circuited.
 - Be sure not to connect a wrong cable. A wrong cable causes a trouble.
 - When removing the detector cover, tie up eyebolts and brackets with a string or chain to prevent them from falling.

(a) “30 to 43” Contact output signal terminals (DO1 to 6)

Operation: Can be changed as required. >>>5.3(13) “Output signal”

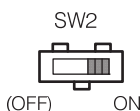
Contact capacity: 240V AC, 0.1A 30V DC, 0.1A (resistance load)

Contact output 1 has a “close” and an “open” contact. “Power-off” is assigned to this contact beforehand. Normally this cannot be changed. The contact “30-31” is switched to “Open”, and “31-32” is switched to “Close” at “Power-off”. For other than contact output 1, when the set function is ON, the contact is switched to “close”. Factory settings are as shown in the figure below:

Factory Settings of Contact Output Terminals

Contact number	DO1	DO2	DO3	DO4	DO5	DO6
When one detector only is connected	Power-off	Under maintenance	Oil alarm	—	Measurement error, Instrument error	—
When two detector are connected	Power-off	CH1, CH2 Under maintenance	CH1 Oil alarm	CH2 Oil alarm	CH1 Measurement error, Instrument error	CH2 Measurement error, Instrument error

- (b)“70 to 73” Transmission output signal terminals
 Specification: 4 to 20mA DC, load resistance 600 Ω max., isolated output (non-isolation between channels).
 You can assign the measured value, etc. to the transmission output of two channels by setting.
- (c)“74 to 76” Digital signal terminals
 Specification: RS-485 (modbus)
 When connecting other instruments, set the terminator to OFF. The terminator setting switch is located in the right side of the terminal.



Terminator Setting

- (d)“60 to 62, 92, 93, E2” Detector connection terminals
 These terminals are used for detector connection using the detector cable. Connect the cable so that the each number indicated on the cable will match the number of the terminal. Terminals “60 to 62” are used for signal line connection. Terminals “92, 93, E2” are used for power supply line connection.
- (e)“90, 91” Power supply input terminals
 Specification: 100 to 240V AC, 50/60Hz

【IMPORTANT】 • For safety, do not turn on the power supply of this product before operating 3.1 “Operation Start Procedure”.
 • Do not connect a power supply other than 100 to 240V AC ± 10%, 50/60Hz. If connected, it may cause a fire.

- (f)“E1” Ground terminal
 If the ground terminal on the bottom of the transmitter is not grounded, ground this “E1” terminal.
 Specification: Grounding shall be D-type ground (ground resistance 100 Ω max.)

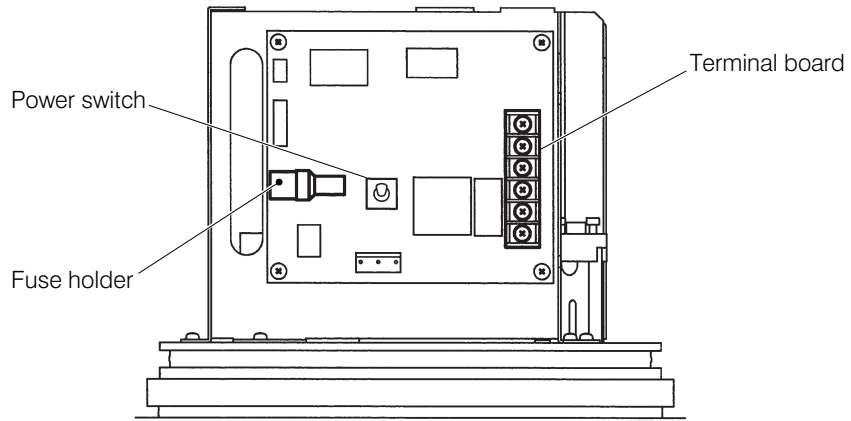
【IMPORTANT】 • Do not share the ground with power equipment.



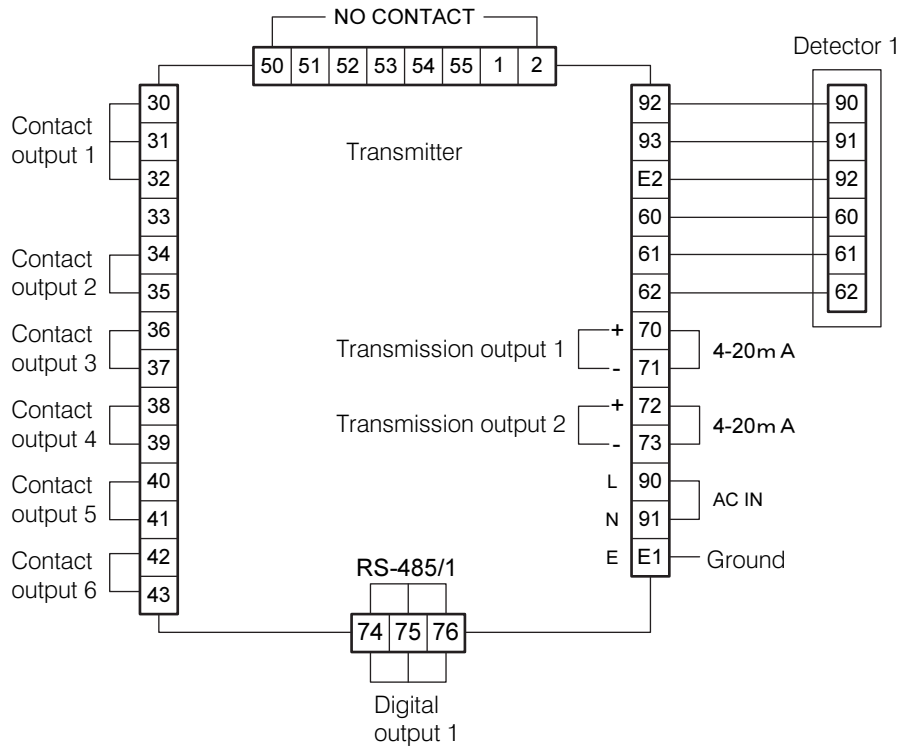
Electric Shock

- Make sure to install grounding wire. Otherwise, electric shock can result if a problem occurs in the power supply system.

(4) Terminals of detector



Position of Terminal Board



Wire Connection Diagram

- “60 to 62, 90, 91, 92” Transmitter connection terminals
 These terminals are used for transmitter connection using the detector cable. Connect so that the number indicated on the cable matches the number of the terminal. Terminals “60 to 62” are used for signal line connection. Terminals “90, 91, 92” are connected with terminals “92, 93, E2” of the transmitter (power supply).
 When two detector are connected >> 9.3 “Addition of Detector”

9.3 Addition of Detector

To connect the second detector, follow the procedure below.

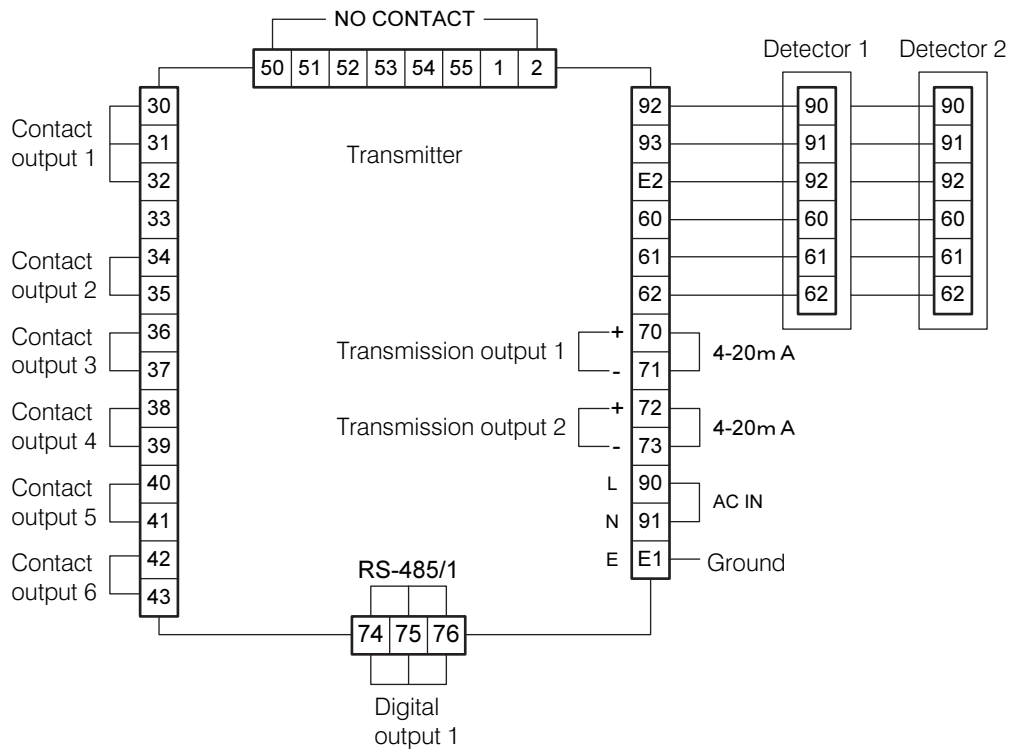


Electric shock

- When connecting the second detector be sure to stop power supply to the main body (transmitter and detector). Even after the power switch of the detector is turned off, power is still supplied from the transmitter and there is a possibility of electric shock.

(1) Connecting the cables

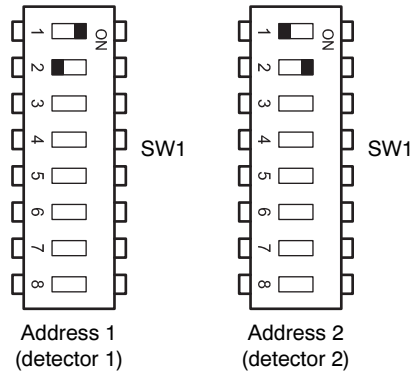
- ① Remove the cover of each detector.
- ② Connect cables. Connect the transmitter, detector 1 and detector 2 by detector cables.



Connecting two Detector

(2) Changing the address (Detector)

- (a) The address of the second detector must be changed to “2”.
- (b) The address of the detector is usually preset to “1” at factory. Check and change the address by the following procedure.



Dip Switch (DIPSW)

Dip Switch Setting

Detector No.	DIPSW1-1	DIPSW1-2	Address
No.1	ON	OFF	1
No.2	OFF	ON	2

- ① Check DIPSW1 of detector 1. Make sure that the setting is identical to that shown in the table above.
- ② Change DIPSW1 of detector 2. Change the setting as shown in the table above.

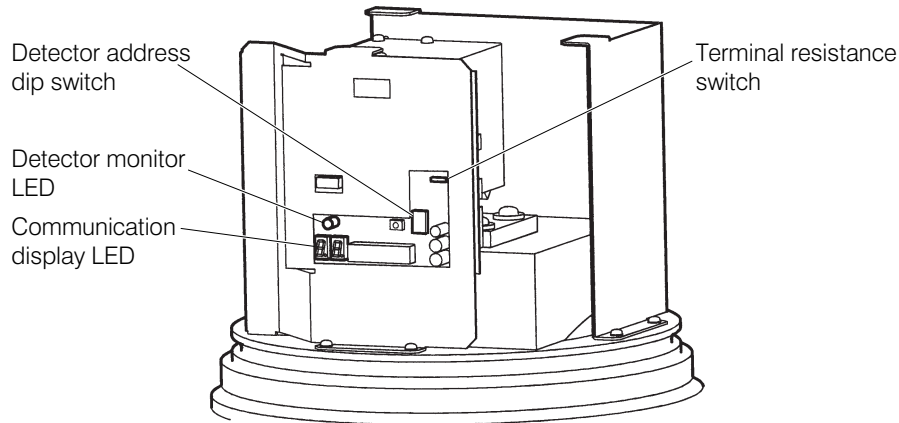
【IMPORTANT】 • Turn on either DIPSW1-1 or DIPSW2. If both are ON or OFF, a detector error occurs.

Incorrect Setting

Detector No.	DIPSW1-1	DIPSW1-2	Address
No.1 or 2	ON	ON	Error
No.1 or 2	OFF	OFF	Error

(3) Changing the terminal resistance switch

Turn OFF the terminal resistance switch on the substrate of electric section 2 of detector 1.



Electric Section 2 of Detector



Changing the Terminal Resistance Switch

(4) Changing the address (Transmitter)

(a) The address of the transmitter must be changed to the same address as that of the detector.

(b) The address can be changed by key operation.


① **Check the wire connection.** Before turning on the power supply, make sure that the wire connection, etc. is correct.

② **Switch to the option setting mode and change the address.** >> 5.4(1) “Detector address”

(5) Screen display (When two detector are connected)

(a) This instrument is capable to monitor the oil film detection status of two detector.

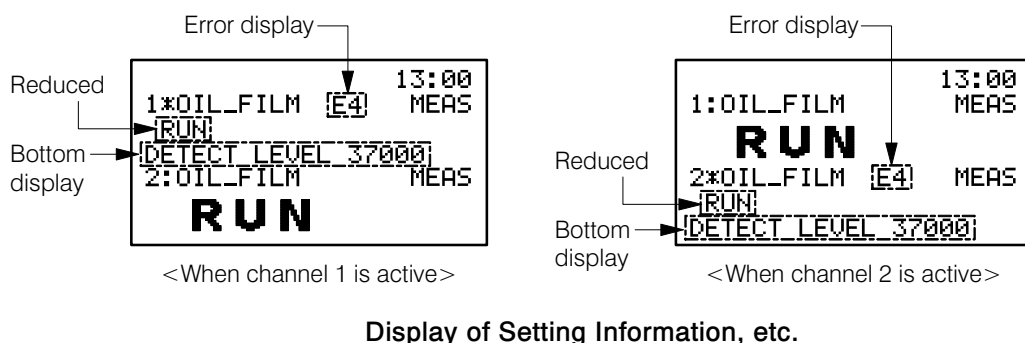
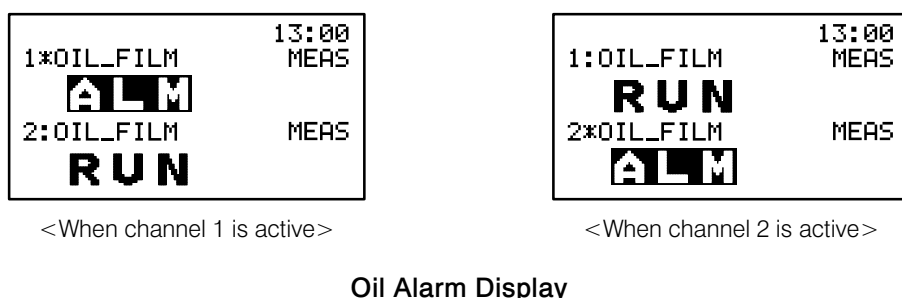
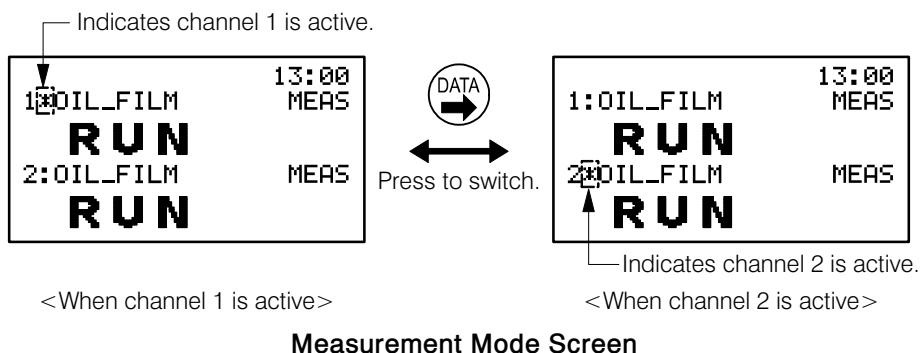
(b) On the screen of the transmitter, the active one of the two channels is indicated with a “*” mark.

(c) A “*” mark can be switched by pressing .

(d) The “RUN” display and error display of the active channel are reduced-displayed, when you check the setting.

(e) Alarm operation check, calibration and modes of operations are the same as when one detector only is connected. >> 3. “Alarm Operation Check”, 4. “Calibration”, 5. “Modes of Operations”

Indicates channel 1 is active.



Revision History

Instruction Manual No. ODL-IB55900E	16/04/2014 (JJ)	New Version in English (RW2 S. Inoue, DEC Kuribayashi)
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DKK-TOA CORPORATION

Head Office Address: 29-10, 1-Chome, Takadanobaba, Shinjuku-Ku, Tokyo, 169-8648 Japan

Telephone: +81-3-3202-0225 Facsimile: +81-3-3202-5685

URL <http://www.toadkk.co.jp/>