HORIBA

参　　考
Reference Only

OIL CONTENT ANALYZER

OCMA-350

INSTRUCTION MANUAL

CODE : I042118100

HORIBA, LTD.

■Introduction

- This manual is intended for operators of the OCMA-350 Oil Content Analyzer.
- Be certain to read it carefully before operation, and to store it carefully for future reference.
- The specifications and design of this equipment are subject to change for improvement without prior notice. The contents of this manual are subject to change for improvement without prior notice.

■Scope of warranty and responsibility

- Horiba warrants this product with regard to materials and workmanship for a period of one year from the date of purchase. Should the product fail during this period, Horiba will repair the product free of charge.
  This warranty is void in the following situations:
  - Failure due to incorrect operation
  - Failure due to unauthorized modification or repair
  - Failure due to operation in an inappropriate environment
  - Failure due to events outside the responsibility of Horiba Inc
  - Failure due to fire or natural disaster
  - This warranty does not cover reprints dne to neglect of normalmaintainence,such as cell cleaning and calibration.
  - This warranty does not cover replacement of the Instruments, parts or consumables

    B−heavy oil after opening
    Cell
- In no event will Horiba be liable for any direct, indirect, consequential or incidental damages arising out of the use, results of use or inability to use this product or its software.

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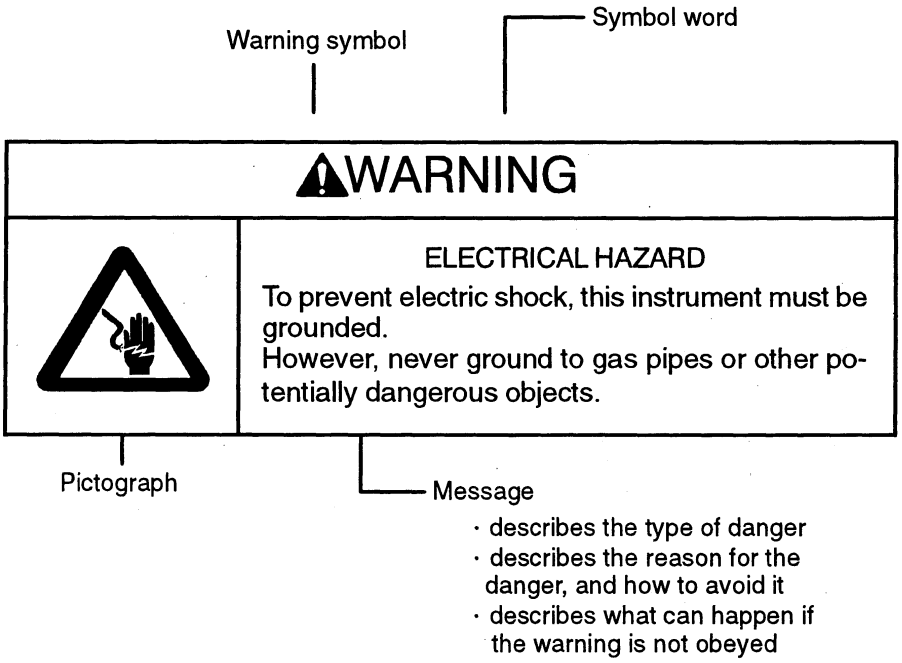
- Inquiries regarding duplication of this manual should be made to the following address:

Miyanohigashi, Kisshoin, Minami-ku, Kyoto, Japan 601
Horiba, Ltd.

■The Safety Messages Used in Manual and their Meanings

● The safety alerts used in this manual consist of a warning symbol, symbol word,and a pictograph. You must obey these safety alerts.



● Signal words and their meanings.

WARNING Indicates latent danger. If the danger is not avoided,death or serious injury may result.

CAUTION Indicates latent danger. If the danger is not avoided,personal injury may result. This alert is also used to indicate unsafe behavior.

■General Points to Note Regarding the OCMA–350

- The OCMA–350 allows only the following solvents in its specification. Measurement should be done by using only the following IR spectroscopy grade solvents.
  - S–316
  - CFC–113
- The OCMA–350 must be grounded to minimize the danger of electrical shock, but the ground wire must not be connected to gas pipes.
- Check that the power supply voltage is correct for the OCMA–350 before switching the power on.
- Test samples may be dangerous. Fully understand the nature of the samples that you plan to measure, and handle them appropriately.
- Carefully read the check and maintenance section in this manual before attempting maintenance work.
- To avoid risk of electric shock, never remove any covers from the OCMA–350 unless specified in this manual.
- Horiba, Ltd. accepts no responsibility for damage or injury resulting from non–compliance with the alert messages in this manual.

■If you do not follow the procedures and cautions

- HORIBA assumes no responsibility for matters which occur due to a failure to follow the instructions and WARNINGS described in this manual.

HOW TO USE THIS MANUAL

■STRUCTURE OF THIS MANUAL

● This manual is comprised of 10 chapters listed below.

Chapter 1. Parts Description

Gives an outline of the OCMA–350, and explains its simple functions.

Chapter 2. Preparations before Measurement

Explains the preparations required before measurement and how to prepare calibration solution.

Chapter 3. Measurement

Explains the calibration and measurement procedures.

Chapter 4. After Measurement

Explains post–operation procedures.

Chapter 5. Settings

Describes the settings of the OCMA–350.

Chapter 6. Connecting the Printer

Explains how to connect the printer and gives printout examples.

Chapter 7. RS–232C Communication Specifications

Describes the RS–232C communication protocol and commands.

Chapter 8. Regular Maintenance

Describes the daily maintenance procedures for the OCMA–350.

Chapter 9. Troubleshooting

Describes the troubleshooting procedures for the OCMA–350.

Chapter 10. Technical Reference

Contents

NOTE 

Introduction

Thank you for purchasing the OCMA-350 Oil Content Analyzer.
This instruction manual describes the operation of the OCMA-350,from preparation before operation to actual measurement. In addition, each function is described independently for easy reference.

Handling Cautions

- Avoid spilling samples onto the OCMA-350.
  This can result in equipment failure.

- Avoid operating or storing the OCMA-350 in the following locations or situations:
  Where the humidity is above 80%.
  Where the temperature is below 0℃ or above 40℃.
  Where it will be exposed to direct sunlight.
  Dusty locations.
  Close proximix to vibration.
  Areas with poor ventilation.
  Close proximity to large electric motors or voltage transformers.
  Presence of corrosive gases.
  Sudden temperature and humidity changes.

- Never strike or drop the instrument.

- Never attempt to operate the keys using sharply pointed objects.

- Ensure that the instrument is grounded.

- Unplug the instrument from the power outlet for long term storage.

- Wear safety glasses when operating the instrument.

- Use a protective mask and polyethylene gloves when handling C_2H_2 or CCL_4 solvents.

- Background readings may differ slightly depending on the lot number of the solvent. When using solvents from different manufacturing lots or reclaim solvent, match the backgrounds by mixing an amount of solvent that you plan to use in a glass container before using it.Then use the mixed lot for zero span and measurement.

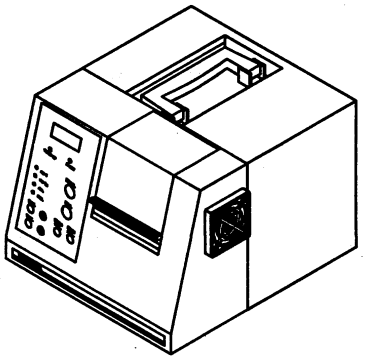
- Always use solvents with the same background readings for span and zero calibration, and
  measurement.

- Never use any extraction solvents oter than infrared.
  Spectroscopy grade(or equivalent)of S-316,CFC-113,C_2H_2 or CCL_4.

Checking Contents

The package includes the model OCMA-350 instrument and accessories. Check that none of the items listed below is missing or damaged.

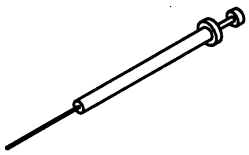
OCMA-350 - 1 set



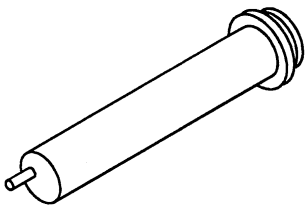
Cell - 1 pc

Cell cap - 1 pc

Microsyringe (25 μl) - 1 pc



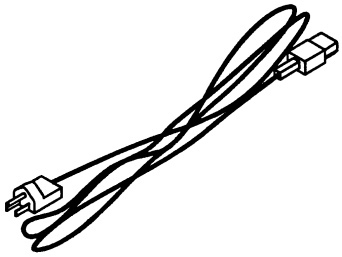
Syringe(10ml) - 1pc



B–heavy oil (contents 10 ml) – 1 bottle

Fuse (3.15A–T) – 1 pc

Power supply cable – 1 pc

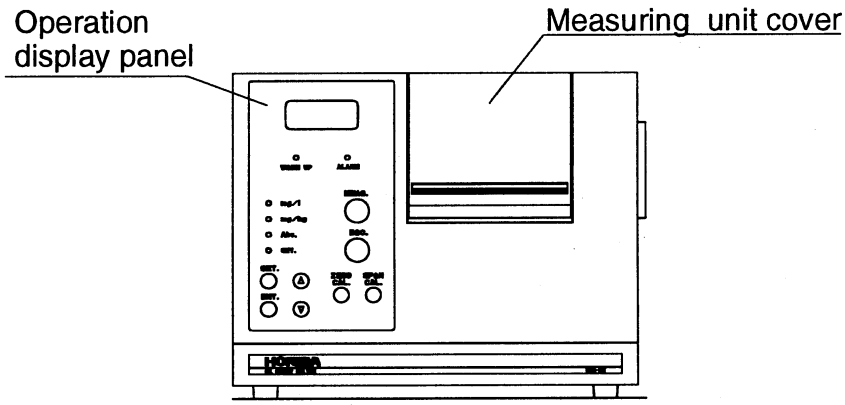


Indication label 1 sheet; Installed under measuring unit cover

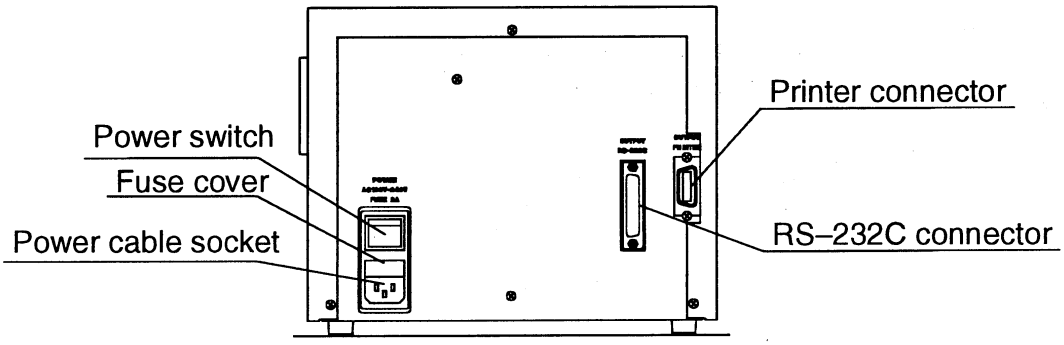
Instruction manual – 1 copy

NOTE 

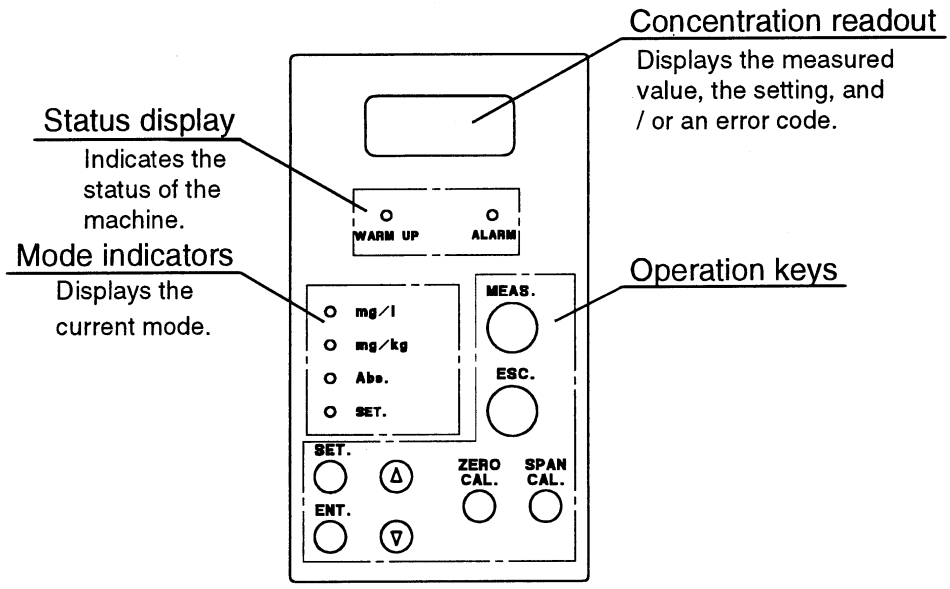
Chapter 1 Parts Description



Front view



Rear view



Operation display panel

● Description of the operation keys

MEAS.

① Press this key to start the measurement stability check.

ESC.

② Press this key to cancel the measurement stability check, and to exit from the error / mode display.

SET.

③ Press this key to switch into the setup mode.

ENT.

④ Press this key to enter a value in the setup mode.

⑤ Press this key to change the unit, the setup items, and the set value.

SPAN CAL.

⑥ Press this key to perform the span calibration.

ZERO CAL.

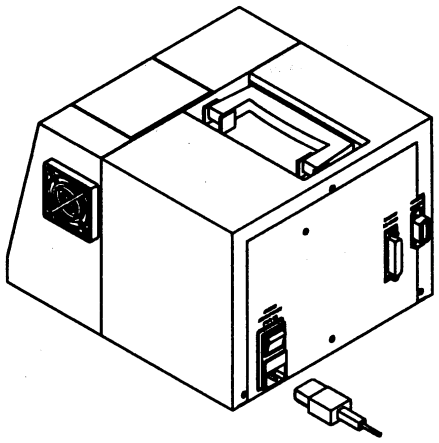
⑦ Press this key to perform the zero calibration.

Chapter 2 Preparations before Measurement

2.1 Preparations

2.1.1 Connect the power cable

Insert the power cable included in the package into the socket in the rear of the instrument.



⚠ WARNING

ELECTRICAL HAZARD

To prevent electric shock, this instrument must be grounded.
However, never ground to gas pipes or other potentially dangerous objects.

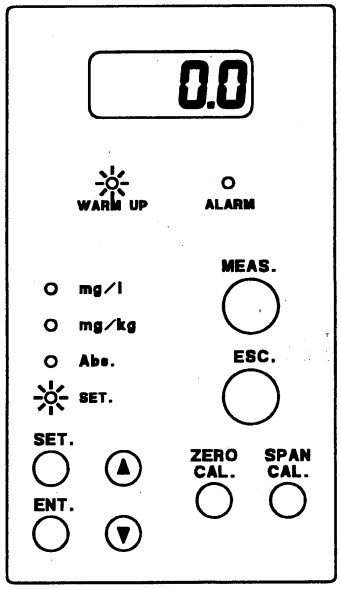
2.1.2 Turn on the power

Turn on the power switch. The operation display panel will light.

2.2 Initial state at power on

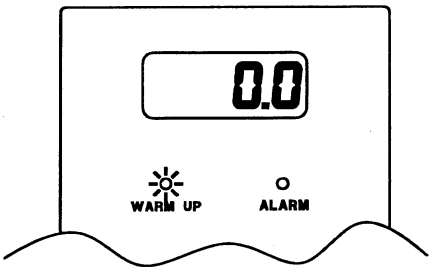
2.2.1 Display

When the power is first turned on, the display will be as follows:



2.2.2 Warmup period

The "WARM UP" lamp will remain lit for 30 minutes after the power is turned on. This is the time required for the OCMA–350 oil content analyzer to stabilize. For accurate measuring results, calibration and measurement should be started after the "WARM UP" lamp is off.



2.2.3 Initial settings

The OCMA–350 is preset for standard measurement conditions, so you can begin taking measurements as soon as the "WARM UP" lamp goes out. The following table shows the default settings.

Setting	Value
Span calibration value	200mg/l
Zero shift value	0.0mg/l
Solvent volume	0.001L
Sample mass	0.001kg

Reference · To change the settings → Refer to Chapter 5. Settings.

2.3 Calendar setting

The OCMA–350 contains a calendar setting function. Upon new analyzer start up or when the power is off for more than a week, set the calendar again. Internal memory might be cleared.

Reference · Calendar settings → 5.6 Setting year, month, day
5.7 Setting (internal) clock

2.4 Preparation of zero liquid for the calibrations

Obtain pure solvent for the OCMA–350 by purchasing in frared spectroscopy grade solvent or reclaiming and purifying extraction solvent used previously for hhese tests. Keep a known reference standard,zero solvent,on hand to test new lot numbers of solvent. Use the same lot number of solventfor zero,span,and measurement. Alternatively,mix enough solvent from different lots to perform zero and span calibration and measurement of samples.

2.5 Preparation of span liquid for calibration

2.5.1 Using B–heavy oil (accessory)

Use B–heavy oil (specific gravity 0.895 at 20 ℃) as span adjustment solution for the OCMA–350. When the type of oil (and its specific gravity) is known, that type of oil may be used as the calibration oil.

● Items required

- solvent
- B–heavy oil (accessory)
- Microsyringe (accessory)
- Volumetric flask (250 ml)

Note Clean the glass utensils with pure solvent and let them air dry.

● Preparation method

①Put about 100 μl of solvent in the 250 ml volumetric flask.
②Draw out 56 μl of the B–heavy oil using the microsyringe.
③Transfer the B–heavy oil to the flask.swirl hte solvent just enough to dissolve the oil.
④Fill the volumetric flask to the 250 ml line with solvent.

> **⚠ CAUTION**
>
> CHEMICAL HAZARD (C_2H_2 & CCL_4 SOLVENT)
> These solvent can be absorbed through the skin, and a large amount can be foxic. Wear gloves when handling it, and take precautions to not to inhale vapoes or ingest liquid.

⑤Seal the flask with the stopper and mix the contents well.

Span concentration value	B–heavy oil quantity	Span liquid concentration	Span set value
200mg/l	56 μl	200mg/l	200mg/l
20mg/l	5.6 μl	20mg/l	20mg/l

Note
- After using a microsyringe, clean it and dry it thoroughly.
- The units for the OCMA–350 are mg/l. Be sure to use the correct quantities when preparing the span liquid.

Density (ul/l) = Display density (mg/l) ÷ Specific gravity

$$mg/L = \frac{(\mu l \text{ oil}) \times (\text{specific gravity of oil})}{\text{Volume of solvent in liters}}$$

2.5.2 Preparing OCB standard

● Obtain the following

- Solvent
- 2,2,4–Trimethylpentane(isooctane) (Guaranteed reagent or equivalent) About 100ml
- Hexadecane (Cetane) (Guaranteed reagent or equivalent) About 100ml
- Chlorobenzene (Mono) (Guaranteed reagent or equivalent) About 100ml
- Measuring flask (100ml, 250ml)
- A bottle with cock (50ml), or airtight bottle
- Pipet with 10ml volumetric (1 pc)
- Pipet with 15ml volumetric (2 pc)

Note Clean the glass utensils with pure solvent and let them air dry.

● Conditioning the mixed standard solution

①Conditioning the mixed standard liquid

Collect 15ml of isooctane, 15ml of cetane, and 10ml of chlorobenzene using by the volumetric pipets. caution use a pipet bulb. Never a spirate by mouth. Put them to the airtight bottle and mix well.

Note Store the conditioned liquid in a dark place. High temperature or, high humidity may cause errors in the measurement.

②Measuring the specific gravity of the mixed standard liquid

Put 1ml of mixed standard liquid measured by a volumetric pipet in the tared measuring flask (100ml). Put a lid on the flask immediately and measure the weight. Obtain specific gravity by the following expression.

Specific gravity (g/ml) = Weight (g) ÷ Volume (ml)

Note The measured specific gravity can fluctuate depending on the ambieut temperature.

⚠ CAUTION	
	NOXIOUS GAS AND LIQUID Inhalation of the vapor of OCB mixed standard solution may cause toxic symptoms. Provide ventilation in the working place and use a respire for if necessary.

③Collectiong the mixed standard liquid

Collect the mixed standard liquid using a microsyringe. Wipe off the extra residue of liquid on the needle of the microsyringe before dispensing into a flask. Also after dispensing the solution into the flask, shake off any residual liquid from the needle of the syringe into the flask.

Note After using the microsyringe, clean it and dry it thoroughly to remove any residual solvents.

To obtain the amount of the mixed standard liquid (per 1000ml) to be collected, use the following expression.

The amount of M.S.L.(μl)=

Span calibration value(mg/l) ÷ Specific gravity(g/ml)

④Fill the flask to the 250ml line with solvent.

⚠ CAUTION

CHEMICAL HAZARD (C_2H_2 & CCL_4 SOLVENT)

These solvent can be absorbed through the skin, and a large amount can be foxic. Wear gloves when handling it, and take precautions to not to inhale vapoes or ingest liquid.

⑤Seal the flask with a stopper and mix the contents well.

Chapter 3 Measurement

3.1 For the accurate measurements

The OCMA-350 has very high sensitivity using the NDIR system.
A slight amount of dirt on the cell or gap in positioning, due to a loose fitting cell, will greatly affect the accuracy during measurement. Follow these when making measurements.

3.1.1 1.Cell

- Use HORIBA's exclnsine cell only.
- Do not touch both ends of the cell. When you find any damage on the cell, do not use that cell.
- Clean the cell by the solvent to use completely.
- Use the same cell as the one used in the zero / span calibration.
- In filling the cell with the solvent, avoid any bubbles from coming into the cell. The surfau of the cell should be dry, and free from the solvent.
- The cell has the front side and the rear side. The front side is the one that has the v-shaped edge.
- Unappropriate setting will cause the errors in the measurement.

3.1.2 2.Calibration

● The zero and span calibration before the measurement is necessary when the measuring background has any changes as below.

- Replacing the measuring cell.
- Changing the lot No. of the solvent.
- When the power is off for more than 1 week.
- Changing the calibration liquid.

● The zero calibration before the measurement is necessary when the measuring background has any changes as below.

- When the power is off for a week.
- When the resistance welding time is over 4 hours.
- Moving the equipment to another place.
- When the temperature and the humidity has a drastic change(over 5℃ for the temperature, over 10% for the humidity).

  examples : by air conditioner
  by weather
  by winds

3.2 Measuring procedure

Span and zero calibration values are stored and referenced during measurement. Therefore, a recent zero and span calibration is imperative.

- Wait until the "WARM UP" light goes out.
- When an "ALARM" sign is lit, an error code is displayed. The alarm light must be off before measurement can be performed.

① Select a mode for measurement using [▲][▼].

Reference
- The mode for the measurement is as follows.
- mg/l :The value of the oil content of the liquid.
- mg/kg:The value of the oil content of a solid.
- Abs. :The value of absorbance. (For reference)

Note When "SET" is lit to show the setting mode, press [ESC.] to switch to the measuring mode.

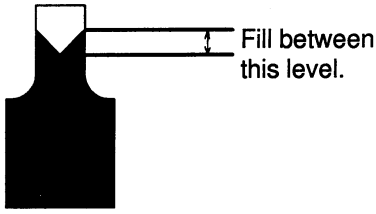
② Open the cover of the measuring unit.

③ Wash the cell with a clean solvent.

⚠ CAUTION

CHEMICAL HAZARD (HYDROCHLORIC ACID)
Hydrochloric acid can irritate the skin. If it gets onto your skin, wash the area with water immediately.
If it gets into your eyes, wash them out immediately with large amounts of water, and then consult a physician.

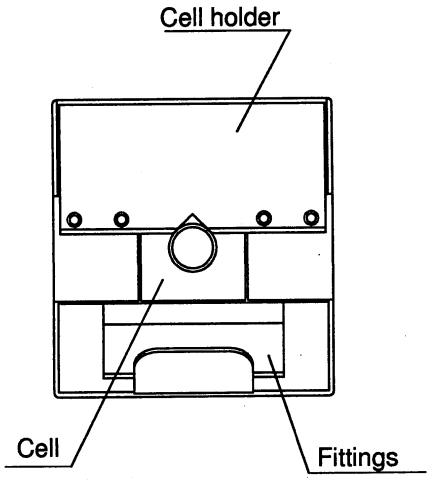
④ Fill the cell with the solvent to the level shown (about 6.5ml).



Note When filling the cell, make sure three are no bubbles in the cell. If bubbles are visible in the cell, shake the cell slowly to remove them. Be careful not to wet the outside of the cell with solvent.

If the cell should get wet, wipe it dry before the inserting it into the analyzer.

⑤Insert the cell carefully. The "V" mark on the cell faces the front of the analyzer .



Top view of cell and analyzer

Note
- The cell has a front side and a rear side. The front side is the one that has the v-shaped edge.
- Do not touch the ends of the cell.
- Misalignment of cell may cause measurement errors.
- Do not spill solvent on the measuring unit when inserting the cell. This may cause breakage.

⑥Close the cover before measurement.

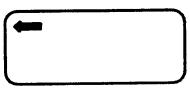
⑦The analyzer is now ready. The measured value is displayed on the LCD.

Note When the cell is inserted, the temperature of the solvent increases due to the light source. Therefore, after inserting the cell, take each measurement after the same waiting period; ie, 1 minute.

MEAS.

⑧Press the [MEAS.] to start the stability judgement.

Note During the stability judgment the LCD continues to display the measured value. The "←" mark blinks at the upper left part in the LCD, until the stability judgment is completed. (When the stability



judgment is over, "←" mark stops blinking but is visible.)

● To cancel the stability judgement

①Press [ESC.] during the stability judgment to stop the judgment and display the measured value.

Reference · 10.3 The stability judgment function

3

● When the sample is out of the measurable range

· If the measured value is under the following values, the LCD will display "U.F."

Unit	Value
mg/l	-20.0
mg/kg	-20.0
Abs.	-0.200

· If the measured value is over the following values, the LCD will display "O.F."

Unit	Value
mg/l	220
mg/kg	1000
Abs.	1.000

3.3 Calibration

Perform zero calibration first, then span calibration.

3.3.1 Zero calibration

● Preparation:Clean solvent, which is from the same lotnumber as the extraction solvent.

① Select the unit of "mg/l" using [▲] and [▼].

② Make a measurement using zero liquid, pure solvent, referring to measuring procedure 3.1.

Note Start both calibration and measurement, After the same time intervals, ie, 1 minute after inserting cell.

③ The stability judgment is available if necessary.

④ Press [ZERO CAL.] to make a zero calibration.

3

3.3.2 Span calibration

● Preparation:Span solution must be prepared from the same lotnumber as the solvent used for zero and measurement.

① Select the unit of "mg/l" using [▲] and [▼].

② Perform the span calibration similar to measurement, reference 3.1.

Note Start both calibration and measurement, After the same time intervals, ie, 1 minute after inserting cell.

③ The stability judgment is available if necessary.

④ Press [SPAN CAL.] to make a span calibration.

Reference · Changing the span calibration value. → 5.2 Setting the span calibration value

3.4 SOIL ANALYSIS USING THE OCMA-350

3.4.1 EPA test method 418.1, Total Recoverable Petroleum Hydrocarbons (TPH)

T.P.H. has been the method most specified for oil in soil analysis. This test method utilizes solvent extraction and infrared spectroscopic analysis as does the OCMA-350. The EPA approves test methods but not specific analyzers.
Therefore, although the OCMA-350 is an infrared spectrometer which meets this EPA test protocol it is not an "approved instrument" and neither are any other instrument manufacturers spectrometers. EPA-418.1 actually specifies analysis of TPH in water. However, may States have modified this procedure to include analysis of soil samples.
There are various procedures which will accurately measure TPH in soil. The following method is provided as a simple procedure for use with the Horiba Model OCMA-350 Oil Concentration Monitoring Analyzer.

3.4.2 Procedure

① Perform calibration, zero, span, and measure of zero, with the OCMA-350 in terms of milligrams per liter. Reference 3.2 Calibration.
② Set constants for soil sample amount and solvent volume; reference chapter 5. Setting Constants.
③ Select mg/Kg on the OCMA-350 for soil analysis.
④ From a representative sample of soil, perhaps 1 liter, weigh out to the nearest 0.1 gram the amount set in item 2 above. Example 5.0 grams in a clean 40 ml vial.
⑤ Add anhydrous sodium sulfate, NA2SO4, to dry the soil sample. (Example: 1 gram.) Mix the Na2SO4 with a stainless steel spatula to dry the soil. Add additional Na2SO4 if necessary.
⑥ Add to the vial the amount of solvent set in item 2 above. Example 30 ml solvent.
⑦ Perform an extraction of oil in soil to oil in solvent. Many States prescribe a horn type ultrasonic disruptor such as Horiba Models GE-50 and GE-300. Oil in sandy/ loose soil may be extracted by simply shaking the vial vigorously for one or more minutes. An inline reciprocal shaker can facilitate extraction of in excess of 40 samples simultaneously.
Soxlet extraction devices, supercritical fluid extraction devices (SFE) and microwave extraction systems may also be used.
⑧ Place the vial in its upright position and wait at least 1 minute to allow setting of soil particles.

⑨ Put a 11 cm No. 40 Whatman filter paper in a glass funnel. Add up to 2 grams of conditioned silica gel (60 to200 mesh conditioned to between 1-2% moisture; reference: EPA-418.1).
⑩ Filter the solvent/extract through the filter into a clean beaker.
⑪ Pipette about 6 ml of extract into the OCMA-350 cell.
⑫ Place the cell into the OCMA-350.
⑬ Read the concentration or press measure to start the stability check.
⑭ Remove the cell from the OCMA-350 and empty it in preparation for the next measurement.

Note A second reading of the same extract may be taken to confirm the accuracy or the operator may choose to rinse the cell with a small amount of extract prior to making a measurement. It is not necessary to rezero after every sample. EPA recommends calibration after every 10 samples.

3.5 Cleanliness Verification Using the OCMA-350

The elimination of CFC's as cleaning solvents, has brought about the development of alternative methods for cleaning and the need to verify and quantify the cleanliness actually achieved. Several methods have been developed to verify cleanliness of cleaned items. Solvent extraction of hydrocarbons, "residual soil", and infrared analysis using the OCMA-350 is one of the best in terms of accuracy, resolution, simplicity, and reliability. Horiba Oil Concentration Monitoring Analyzers, OCMA's, are being used to measure residual oil on plumbing cleaned for oxygen service, stainless steel electrical wire, textiles, automotive transmission parts, refrigeration compressor parts, etc. The following three procedures make use of the OCMA-350 to simplify the cleanliness verification check:

① The final rinse of an aqueous cleaning procedure can be measured quickly and accurately. In this case, the sampling and analytical procedure is the same as described in the next section 3.5, Measuring Oil in Water. However, the analyst needs to measure a blank from the final rinse bath before items have been introduced. The OCMA-350 also can be used to determine when to change the intermediate wash baths.

② The OCMA-350 can be used to quickly give relative cleanliness readings by solvent extraction and infrared analysis. The analyst uses the same amount of solvent to extract residual hydrocarbons from precleaned items, of the same size and shape, and uses the OCMA-350 to make sure that the readings are below a pre-determined absorbance, Abs, value.

The OCMA-350 is calibrated in terms of mg of oil / liter per section 3.1 and 3.2. After adjusting the span calibration value, switch to Abs and record the reading with the span calibration liquid in the cell. Next, use an adequate amount of solvent to extract hydrocarbons from the cleaned item and give an absorbance, Abs, reading greater than zero preferably greater than 10% of full scale. Once the optimum amount of extraction solvent and typical Abs reading has been determined , the analyst may choose to use a span value closer to the typical measurement value.

The extraction of "oil" may be modified to best accommodate the item being measured. Examples:Put the item in a closed container, add solvent, and shake for 1 minute. Put the item in a container, add solvent, and put the container in a ultrasonic bath for several minutes. Put the item in a open container, add solvent, and perform the extraction with an ultrasonic horn type disruptor as described in section 3.3, Soil Analysis. Brush and rinse the item with solvent in an open container and catch the solvent for measurement. Soxlet extraction devices, supercritical fluid extraction devices (SFE) and microwave extraction systems may also be used. The container should be clean glass , metal, or glazed ceramic with a non-contaminating closure. Paper inner lids for jars are not acceptable, because they are glued in place, and the glue contains extractable hydrocarbons. Pipette about 6 ml of extract to fill the

OCMA-350 cell. Place the cell into the analyzer for measurement using the Abs mode. Make a statistically significant number of measurements to find an optimum "predetermined" Abs reading.

③ The OCMA-350 may be used to give a rigorous measurement of residual hydrocarbons from precleaned material in terms of mg of oil per square cm of surface area, provided the surface area can be measured and the item does not appreciably absorb or retain the solvent. This procedure is similar to section 3.4.2 above, except the span solution is made by doping a known clean item with a weighed amount of "oil". If the typical oil is known, it may be used, or use the Horiba "B" heavy crude oil. The oil should be applied as evenly as possible. Next, extract the oil using a known amount of solvent, and set the volume of solvent in the OCMA-350, reference chapter 5 Setting Constants. Example: 6 mg of oil and 0.030 liters of solvent equal 200 mg/ L. Use the mg/ L mode and simply divide the span value by the the surface area in square centimeters, or the analyst may prefer to use the mg/ Kg mode and scale the Kg's in terms of square centimeters or square meters to yield a direct readout. The readings obtained are in terms of Total Recoverable Oil and Grease. If a Total Petroleum Hydrocarbons, TPH, measurement is required the extract can be treated with silica gel filtered and measured; reference 3.3 Soil Analysis. The difference, Oil & Grease minus TPH, is the non-petroleum hydrocarbons per EPA 413.2 and 418.1 test methods.

3.6 MEASURING OIL IN WATER WITH THE OCMA-350

3.6.1 EPA test methods 413.2, Total Recoverable Oil and Grease, and 418.1, Total Recoverable Petroleum Hydrocarbons (TPH).

These test procedures utilize solvent extraction and infrared spectroscopic analysis as does the OCMA-350. EPA approves test methods but not specific manufacturers spectrometers. Therefore, although the OCMA-350 is an infrared spectrometer designed for Oil and Grease as well as TPH analysis, it is not an "approved instrument", and neither are any other manufacturers spectrometers. There are many methods which will accurately measure oil in water. The following is one method applicable for measurement using the OCMA-350.

3.6.2 Items required

1 liter glass sample collection bottle with teflon inner lid
Hydrochloric Acid
40 ml Vials, with teflon lined closures
Miscellaneous laboratory glassware
Solvent for extraction of oil from water (Infrared spectroscopy grade of Horiba S-316, Freon-113, or Perchloro-ethylene)
Anhydrous sodium sulfate
Silica Gel, 60 to 200 mesh spectroscopy grade

3.6.3 Procedure

① Collect a representative water sample in a 1 liter glass bottle with teflon lined inner lid.
② Add hydrochloric Acid to bring the pH to <= 2.
③ Perform calibration, zero , span , and measurement of zero solvent in terms of milligrams per liter. Reference 3.2 Calibration.
④ Select mg/ L on the OCMA-350 for oil in water analysis.
⑤ Shake the glass sample bottle to assure good mixing of sample. Accurately pipette 10 ml into a 40 ml vial. The sample volume may be varied and a dilution factor applied to the results to measure a broad range from lower or higher concentration samples.
⑥ Accurately pipette 10 ml of solvent into the 40 ml vial. The solvent volume may be varied and a dilution factor applied to the results to measure a broad range from lower or higher concentrations samples.
⑦ Cap the vial and shake it vigorously to extract oil in water to oil in solvent. (Note: An inline reciprocal shaker can facilitate in excess of 40 samples simultaneously.)

⑧ Place the vial in an upright position and allow the air bubbles to come out of the solvent; normally < 30 seconds.

⑨ Carefully view the vial. There should be an abrupt break between the solvent on the bottom and the water on the top. There should not be any emulsion layer. The solvent/extract may be colored from some samples but should not be unduly turbid.

- Treat the extract to break an emulsion. If the sample does not require this treatment proceed to step No. 10.
- Carefully pipette as much solvent/extract as possible without taking the water layer into a clean beaker.
- Add 1 or more grams of anhydrous sodium sulfate, Na2SO4, to break the emulsion by stirring with a glass stirring rod. The extract should appear non-turbid but may be colored from some samples.
- Put a conditioned 11 cm No. 40 Whatman filter paper into a glass funnel and filter the extract to remove Na2SO4. Reference EPA-413.2 & 418.1.
- If less than 6 ml of sample/extract are recovered, add a measured amount of solvent, and account for the dilution in the results.

⑩ Pipette about 6 ml of solvent/extract to fill the OCMA-350 cell.

⑪ Place the cell into the OCMA-350 for measurement.

⑫ Read the concentration or press measure to start the stability check. Be sure to account for any dilution/concentration when using a water solvent ratio other than 1:1 or when solvent is added in step 9E. This readings obtained are in terms of Total Recoverable Oil and Grease.

- If a measurement of Total Petroleum Hydrocarbons, TPH, is needed, the extract may be treated with conditioned silica gel, filtered with a No. 40 Whatman filter paper, and remeasured; reference 3.3, Soil Analysis Using the OCMA-350. The difference, Oil and Grease minus Total Petroleum Hydrocarbon, is the non-petroleum hydrocarbons.

⑬ Remove the cell from the OCMA-350 and empty the cell in preparation for the next measurement.

Note A second reading of the same extract may be taken to confirm the accuracy, or the operator may rinse the cell with a small amount of extract prior to making a measurement. It is not necessary to rezero after every sample. EPA recommends calibration every 10 samples.

Chapter 4 After Measurement

After measurements have been completed, use the following procedures to store the equipment.

4.1 Short term storage (less than 1 week)

① Discharge the solvent in the cell. Clean it and store it carefully.
② Turn off the power switch.
③ Close the cover on the unit.
④ Dispose of the discharged liquid → Refer to 10.3.2 Reclamation.

4.2 Long term storage (longer than 1 week)

① Discharge the solvent in the cell and purge the cell with clean solvent.
→Refer to 8.1, "cleaning the cell."
② Turn off the power switch.
③ Close the cover on the unit.
④ Disconnect the power cable.
⑤ Dispose of the discharged liquid → Refer to chapter 10.3.2, "Reclamation".
⑥ Clean the cell and store it a long with all accessories with the analyzer.

4. After Measurement

Chapter 5 Setting Constants

5.1 Adjustable items

Display	Item	Range	Function
n.01	Span calibration value	1.0～200mg/l	Setting span calibration value
n.02	Zero shift value	−100～100mg/l	Setting zero shift value
n.11	Solvent volume	0.001～19.99L	Setting solvent volume
n.12	Sample amount	0.001～19.99kg	Setting sample amount
n.21	Year and date	Year:0～99 Month:1～12 Day:1～31	Setting year and date
n.22	Time	Hour:←0～11 Min:0～59	Setting time

5.2 Span calibration value

This is the mode to set the span calibration value.

SET.

①Press [SET.] in the measuring mode to change to the setting mode.

▲ ▼

②Select item No.(n.01) using [▲] and [▼].

ENT.

③Press [ENT.] to display the set value on in the LCD.

▲ ▼

④Adjust the value using [▲] and [▼].

ENT.

⑤Press [ENT.] to set the value.
The LCD will display No.(n.01).

ESC.

⑥Press [ESC.] to return to the measuring mode.

● Range for span values

Range	Increments
1.0~200mg/l	0.1mg/l

5.3 Zero shift value

This is the mode to set the zero shift value.

SET.

①Press [SET.] in the measuring mode to change to the setting mode.

▲ ▼

②Select No.(n.02) using [▲] and [▼].

ENT.

③Press [ENT.] to display the set value on in the LCD.

▲ ▼

④Adjust the set value using [▲] and [▼]. Note: Usually 01 on

ENT.

⑤Press [ENT.] to set the value. The LCD will display No.(n.02).

ESC.

⑥Press [ESC.] to return to the measuring mode.

● Range for zero values

Range	Increments
−100~100mg/l	0.1mg/l

Note The value set by this procedure does not affect the span or zero calibration value.

5.4 Solvent volume

This is the mode to set the solvent volume used to measure the oil content of a soil sample.

SET.

①Press [SET.] in the measuring mode to change to the setting mode.

②Select the setting item as No.(n.11) using [▲] and [▼].

ENT.

③Press [ENT.] to dispaly the set value on the LCD.

④Adjust the set value using [▲] and [▼].

ENT.

⑤Press [ENT.] to set the value. The LCD will display No.(n.11).

ESC.

⑥Press [ESC.] to return to the measuring mode.

● Range for solvent volume

Range	Increments
0.001～19.99L	0.001L

Reference · The unit of "mg/kg" is obtained by the following expression.
Oil concentration (mg/kg) = Oil concentration (mg/l) ×
Solvent volume (L) ÷ Sample amount (kg)

5.5 Sample amount

This is the mode to set the solvent amount in kg when measuring the oil content of a soil sample.

SET.

①Press [SET.] in the measuring mode to change to the setting mode.

②Select No.(n.12) using [▲] and [▼].

ENT.

③Press [ENT.] to display the set value on the LCD.

④Adjust the set value using [▲] and [▼].

ENT.

⑤Press [ENT.] to set the value. The LCD will display No.(n.12).

ESC.

⑥Press [ESC.] to return to the measuring mode.

● Range for sample amount

Range	Increments
0.001～19.99kg	0.001kg

Reference · The unit of "mg/kg" is obtained by the following expression.
Oil concentration (mg/kg) = Oil concentration (mg/l) × Solvent volume (L) ÷ Sample amount (kg)

5.6 Year and date

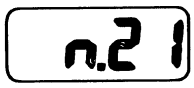
This is the mode to set the year and date.

SET.
○

①Press [SET.] in the measuring mode to change to the setting mode.

▲
▼

②Select the setting item as No.(n.21) using [▲] and [▼].



ENT.
○

③Press [ENT.] to display the year which will be blinking on the LCD.

▲
▼

④Adjust the "year" using [▲] and [▼].

ENT.
○

⑤Press [ENT.] to set the year.
Date is displayed next on the LCD, and "month" blinks.

▲
▼

⑥Adjust the "month" using [▲] and [▼].

ENT.
○

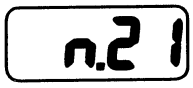
⑦Press [ENT.] to set the month.
"Day" blinks in the LCD.

▲
▼

⑧Adjust the "day" using [▲] and [▼].

ENT.
○

⑨Press [ENT.] to set the day.
The LCD displays the No.(n.21).



ESC.
○

⑩Press [ESC.] to return to the measuring mode.

● Range for date

Item	Range	Increments
Year	0~99	1
Month	1~12	1
Day	1~31	1

5.7 Time

This is the mode to set the time.

SET.

①Press [SET.] in the measuring mode to change to the setting mode.

②Select No.(n.22) using [▲] and [▼].

ENT.

③Press [ENT.] to let the clock display "hour" blink on the LCD.

④Adjust the "hour" using [▲] and [▼].

5

Note "←"Mark in the LCD means it is AM.

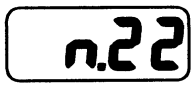
ENT.

⑤Press [ENT.] to set the data of hour. "Minute" will blink.

⑥Adjust the "minute" using [▲] and [▼].

ENT.

⑦Press [ENT.] to set the minute, the LCD displays No.(n.22).



ESC.

⑧Press [ESC.] to return to the measuring mode.

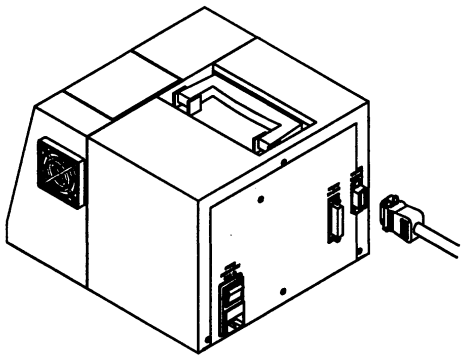
● Range for time

Item	Range	Increments
Hour	←0～11	1 (Indicating "←":AM)
Minute	0～59	1

Chapter 6 Connecting the Printer

6.1 Connecting the printer

There is a printer port on the rear of the OCMA-350 to allow measured data to be printed.



Connecting a printer to the main unit*

* Horiba can supply, as an accessory, a cable to connect to a printer.

6.2 Printer output timing and sample printout

6.2.1 Measurement value output

The printer output will print, zero / span calibration, and measurement values. The format of the printout is as follows:

```
    POWER ON    1/23  8:30
          DATE   TIME      CONC
    Z     1/1    9:00      0.0 mg/L
    S     1/1    9:30       50 mg/L
  *       1/1   13:00       3.4 mg/L
          1/2   15:05      -0.1 mg/kg
          1/10   2:50     0.007 Abs.
```

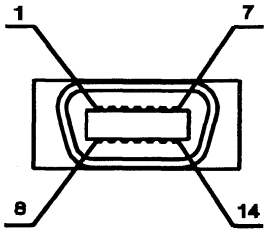
←A line is printed the first time the power is turned on and after each measurement is completed

Z : Zero calibration printout
S : Span calibration printout
* : Alarm printout

6.3 Pin connections for the output connector

The pin connections for the output connector are as follows:

Pin configuration and pin No.



Pin No.	Name
1	STB
2	DB0
3	DB1
4	DB2
5	DB3
6	DB4
7	DB5
8	DB6
9	DB7
10	Not connected
11	BUSY
12	Not connected
13	Not connected
14	GND

Reference
- Connector : 57–20140 (DDK)
- Suitable connectors : 57–10140 (DDK) or equivalent

Chapter 7 RS–232C Communication Specifications

An RS–232C point at the rear of the OCMA–350 may be used to transmit data to a computer, the RS–232C port is especially useful if many measurements need to be stored in computer memory.

7.1 Before using RS–232C port

- Be sure to match the transmission format between the OCMA–350 and the computer.
  If the transmission formats do not match, communication errors may occur, or communications will not be established. If you change the transmission format, turn off the power to both the OCMA–350 and the computer, and restart them.

- Use a commercially available crossed cable for connecting the OCMA–350 to your computer.

7.2 Transmission data format

SOH + COM + STX + DATA + · · · + DATA + ETX

Code	Name	Meaning	Command Code
SOH	Header command	Transmission start code (1Byte)	Char(01H)
COM	Command code	Indicates the type of transmission processing (1Byte)	Char(20H)~(63H)
STX	Text start code	Code indicating the start of the data (1Byte)	Char(02H)
DATA	Text data	Encoded representation of the transmission data	Char(20H)~(7FH)
ETX	Text end code	Code indicating the end of the transmission (1Byte)	Char(03H)

7.3 Realtime output command

● Description:
Output the measurement data after measurement is completed.

● Execution condition:
Always output after a measurement.

7.3.1 Realtime output

Command transmission format: None (automatically output)

OCMA–350 output (for normal measurement)

SOH + ␣ + STX + DATA1 +, + DATA2 +, +
DATA3 +, + DATA4 +, + DATA5 +, + DATA6 + ETX

Settings data format (Total data length = 25 bytes)

Data No.	Description	Length	Delimiter	Data Output Range	Comments
DATA1	Measure-ment / Zero / Span	2	,		␣:Measurement Z:Zero S:Span
DATA2	Calendar	8	,	00/01/01～ 99/12/31	Output measurement date
DATA3	Time	5	,	00:00～23:59	Output measurement time
DATA4	Output mea-surement value	5	,	–20.0～220.	Output in left–adjusted format
DATA5	Unit	1	,	1～3	1:mg/l 2:mg/kg 3:Abs.
DATA6	Error No.	2			Output the error No.

OCMA–350 output (when measurement is interrupted)

SOH + ␣ + STX + DATA1 + DATA2 + DATA3 +
DATA4 + ETX

Settings data format (Total data length = 16 bytes)

Data No.	Description	Length	Delimiter	Data Output Range	Comments
DATA1	Dummy	3			Output 3 spaces
DATA2	Message	10			
DATA3	Dummy	5	,		Output 3 spaces
DATA6	Error No.	2			Output the error No.

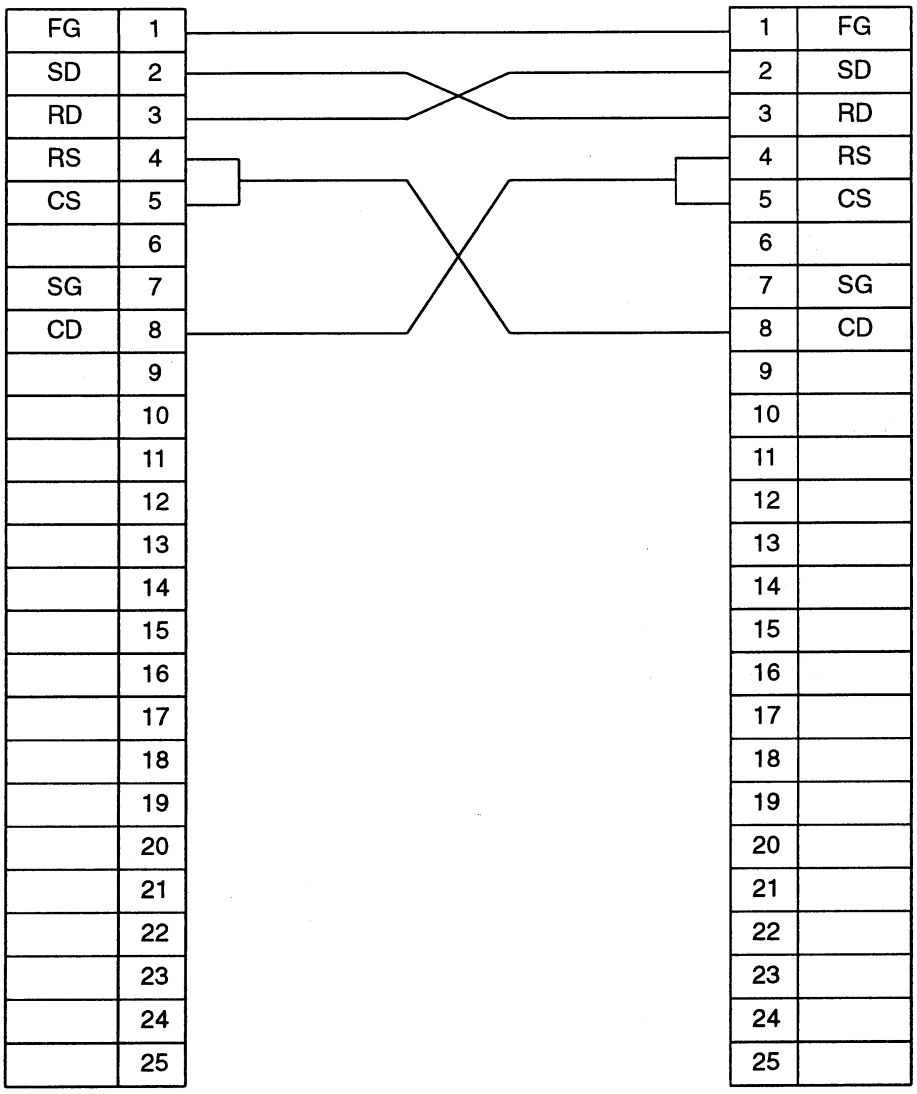
␣ : Space

7.4 RS–232C specifications

- Conforms to JIS–C6361
- Transmission format:

Baud rate	: 2400(BPS)
Character length	: 8 bits
Parity	: None
Stop bit	: 1 bits
Communication method	: Full duplex

- Cable specification:



7.5 Sample program

```
10  'SAVE "A:¥RS_OCM.BAS",A                          ┐
20  '************************************************  │
30  ' OCMA-350 RS-232C SAMPLE PROGRAM(N88BASIC)      │
40  '************************************************  ┘ Comment lines
50  '
100 CLS
110 OPEN "COM:N81NN" AS #1                           ←Open RS-232C
                                                      communications
120  *RSNEXT
130    B$=INPUT$(1,#1)                               ←Data received
                                                      (1 byte)
140    C$=C$+B$
150    IF B$=CHR$(&H3) THEN GOTO *REND ELSE GOTO *RSNEXT  ←Check
                                                           whether
                                                           end of
                                                           data
160  *REND
170  PRINT C$                                        ←Display data
                                                      received
180 CLOSE #1                                         ←Close RS-232C
                                                      communications
190 END
```

This sample program is written in NEC N88BASIC (V6.0). The baud rate, parity check, and stop bits settings are given below:

Baud rate	: 2400 bit
No. of data bits	: 8 bits
Parity check	: None
Stop bit	: 1 bit

Chapter 8 Regular Maintenance

8.1 Cleaning of the cell

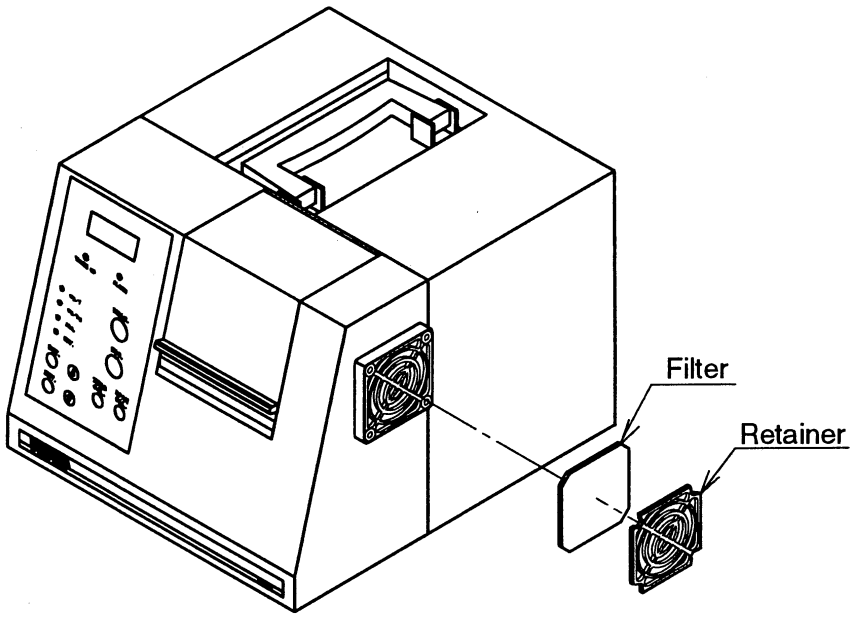
- After use, wash the cell with clean solvent, dry it well with air and store to avoid damage.
- After cleaning, cap the cell for storage, alternatively, fill the cell with clean solvent and cap it print to storage.
- When the cell is extremely dirty, immerse it in water with a small amount of neutral detergent.Clean the cell in an ultrasonic bath first, then clean with water, and dry it well with air.

Note When cleaning the cell, be careful not to damage or scratch it.
Do not use as cratched or damaged cell.

8.2 Cleaning the fan filter

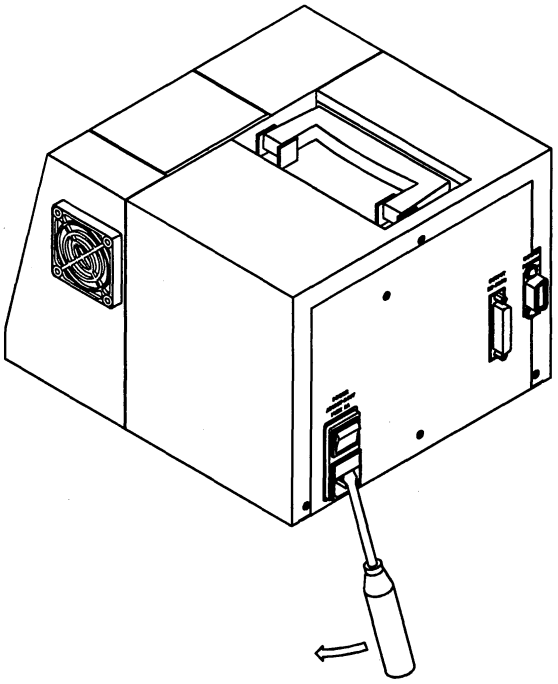
In order to preserve the efficiency of the light source, clean the fan filter about once a month.

①Remove the retainer.
②Clean and dry the filter.
③Re-assemble.

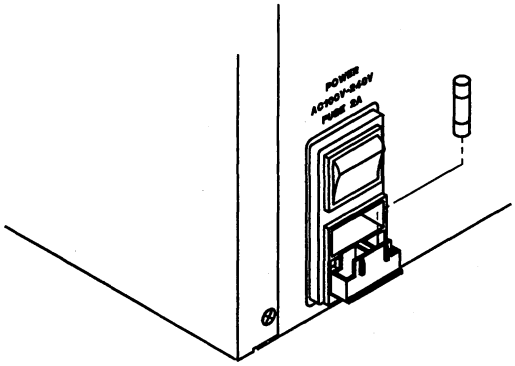


8.3 Replacing the fuse

①Use a screwdriver and carefully pull out the fuse cover located near the power cable socket on the rear panel.



②Install a new fuse and push the fuse cover back in to position.
(Fuse: AC250V 3.15A-T, 1 pc)



8.4 Supplementary parts list

Part Name	Part Number	Specifications
Cell	9039002000	Quartz (20mm)
Cell cap	9039002100	For cell
Syringe	9039002300	10ml
Microsyringe	9039000100	25 μl
B-heavy oil	9018000600	10 ml

These supplies may be ordered by part name and part number.

NOTE 

Chapter 9 Troubleshooting

9.1 Error codes

OCMA–350 has the function of indicating the error No. in the LCD and light the "ALARM" .

Error No.	Error Name	Description of Error
E.01	EEPROM ERROR	Malfunction in the internal memory (EEPROM).
E.02	RAM ERROR	Malfunction in the internal memory (RAM).
E.07	Light source ERROR	Light source output degraded.
E.09	Unstable data	Measurement (value) in unstable.
E.11	Calibration liquid ERROR	Calibration value falls outside the calibration value range.
	WARM UP	Measurement or calibration performed during warmup.

Note
- When any error occurs, the error code is indicated on the LCD and the "ALARM" lamp lights.
- When multiple errors occur simultaneously, those errors are repeatedly displayed, one error message after the other.

9.2 Error handling

● Error No. 1: EEPROM ERROR

Definition: Data in the internal EEPROM memory was erased.

Error cancellation method: Turn the power off, then on again.

Causes	Countermeasures
This is a malfunction in the internal EE-PROM memory.	Contact HORIBA service for repairs.

● Error No. 2: RAM ERROR

Definition: Data in the internal RAM memory was erased.

Error cancellation method: Press the [ESC] key.

Causes	Countermeasures
The back–up battery has run out. (The lifetime is approx. 1week when power is off.)	Error can be cancelled by ESC key. Re–set the calendar again.
This is a malfunction in the internal RAM memory.	Contact HORIBA service for repairs.

● Error No. 7: Light source ERROR

Definition: During measurement, the output from the light source is less than 40% of the output at time of shipment from the factory.

Error cancellation method: Press the [ESC] key.

Causes	Countermeasures
The window of the measurement cell is dirty.	Purge several times with the zero liquid.
Foreign substance has entered the measurement cell.	Purge several times with the zero liquid.
The light source has degraded.	Contact HORIBA service for repairs.
The light source is broken.	

● Error No. 9: Unstable data

Definition: The measurement value does not stabilize during measurement and the results are not displayed after 5 minutes.

Error cancellation method: Press the [ESC] key.

Causes	Countermeasures
The cell is not completely full.	Fill the cell.
The warmup cycle is not completed.	Redo the measurement after the warmup cycle is completed.
The analyzer is vibrating.	Move the analyzer to a location where it will not vibrate and redo the measurement.

● Error No. 11: Caribration liquid ERROR

Definition: Either the zero calibration value, or the span calibration value does not fall within the calibration range.

Error cancellation method: Press the [ESC] key.

Causes	Countermeasures
The calibration liquid was not clean; it contained some impurities.	Redo the calibration with pure solvent.
The wrong value was used for the span calibration.	Remake the span calibration liquid.
The wrong value was set for the span calibration value.	

● WARM UP ERROR

Definition: A measurement or calibration was performed less than 30 minutes after the power was turned on (while the WARM UP lamp was still lit)

Error cancellation method: Press the [ESC] key.

Note Calibration cannot be performed during the "WARM UP" period.

9.3 Errors that are not displayed

The following describes ways to handle various problems that do not cause an error to be displayed.
For problems that are not described here, contact HORIBA service.

● Nothing is displayed when you turn on the power

Causes	Countermeasures
The power cable is not connected.	Connect the power cable to the machine and to the power outlet.
A fuse has blown.	Replace the fuse.
The power switch is not turned on.	Turn on the power switch.

● The measured value is not an expected value

Causes	Countermeasures
The extraction ratio between the sample and the solvent is wrong.	Confirm and correct the extraction ratio.
The wrong value was used in the calibration.	Redo the zero and span calibrations.
The solvent used for the calibration, and the solvent used for the measurement came from different lots.	Try the zero / span calibration again using solvents from the same lots.
The cell is not full.	Fill the cell to the full line.
The ambient temperature outside the operating temperature range.	Redo the measurements at a location where the ambient temperature is within the range 0 to 40 ℃.
The span liquid value is too low.	Use span liquid that is greater than 10 mg/l.

● The switches do not work/The display is abnormal.

Causes	Countermeasures
The system is locked.	Turn off the power and turn it back on. If this does not fix the problem, contact your HORIBA service representative for repairs.

● The indicated value is negative

Causes	Countermeasures
The solvent used for the calibration, and the solvent used for the measurement came from different lots.	Mix each solvent well to make the original concentration the same, and try the calibration and the measurement again.
The measured value is approximately 0~–0.4mg/l	This value is within the repeatability of the analyzer and not abnormal. Regard any value up to –0.4mg/l as 0.0mg/l.
The extraction procedure for the calibration, and the extraction procedure for the measurement is different.	The calibration should be made by the same extraction procedure (adding water) with the one for the measurement.

Note When solvent for calibration and for measurement are from different lots, either switch to one lot number or the other or mix the lot nubers together:

● The printer does not print

Causes	Countermeasures
The power supply for the printer is not turned on.	Turn on the power to the printer.
The printer cable is not connected.	Connect the printer cable.
The printer does not conform to the simplified centronics specification.	Use one of the printers recommended by HORIBA.

● The instrument cannot perform RS–232C communications

Causes	Countermeasures
The communications cable is not connected.	Connect the RS–232C (cross) cable.
The personal computer and the OCMA–300 are using different communications specifications.	Reset the communications specifications on the personal computer or the OCMA–350 and reset the power.

NOTE 

Chapter 10 Technical Reference

10.1 Measurement principles

Several methods are appropriate for measuring oils contained in natural or waste water, including: the n–hexane extraction method, Soxhlet's extraction method, the soaking method, the emulsification turbidity method, the fluorescence analysis method, and gas chromatography methods using FID and FPD. Recently, the infrared absorption method has gained widespread use as a quantitative method for oils. The infrared absorption measurement principle reflects the chemical structure of the molecules well, and a characteristic absorption pattern is shown by the chemical structure of the substances. Therefore, the absorption of various wavelengths in the infrared range is measured, and the position and strength of the absorption bands enable us to make a qualitative and quantitative analysis of the substances.

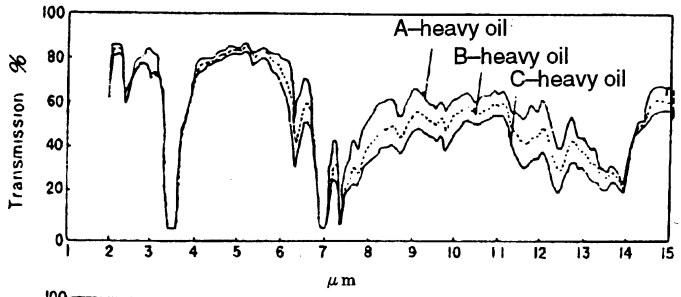


Figure 1:
Example absorption spectrum

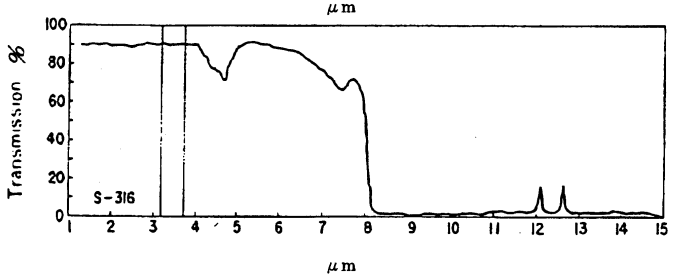


Figure 2:
S–316 solvent absorption spectrum

The HORIBA Oil Content Analyzer uses the principles described above and the fact that oils are hydrocarbons.

As shown in Figure 1, an absorption band follows the expansion and contraction movements of the radicals in (–CH2–), (–CH3), etc. These are characteristic of hydrocarbons composed of C–H bonds which absorbe near the 3.4 to 3.5 μm (2,941 to 2,857 cm^{-1}) wavelengths. The wavelength spectrum for this range can be measured at the same sensitivity with almost no dependency on the type of oil (plant oil, animal oil or mineral oil).

On the other hand, as shown in Figure 2, S–316 has no absorption band within this wavelength range. Further, when oil is dissolved in water, the difference in specific gravity is large, so that oil is easily extracted. Taking advantage of these features, we can measure the oil concentration in test sample water as follows:

After the oil in water, on other material, is extracted, (dissolved) in solvent, the oil concentration in the extract is measured, the amount of infrared absorption at 3.4 to 3.5 μm wavelength.
Infrared analysis meters can be generally divided into "spectral infrared analysis meters" and "non–dispersive infrared analysis meters". The OCMA–350 belongs to the "non–dispersive" family. Because the "non–dispersive" type allows a more sensitive analysis than the "spectral" type, the cell length can be made shorter, so that less test sample is required. It has many other advantages, such as the ability to take measurements without losing compounds with low boiling points. Currently it is one of the best quantitative methods for measureing oils.

10.2 OCB (octane, cetane, chlorobenzene) standard liquid

The OCB standard liquid is defined as a solution mixture of 2,2,4– Iso–octane, cetane and chloro benzen by the volume ratio of 3:3:2.

10.3 Oil measurement solvent (S–316)

S–316 is a polymer of chlorotrifluoroethylene.

10.3.1 Characteristics of S–316 solvent

- Neglible infrared absorption in the 3,000 cm^{-1} absorption wavelength of hydrocarbon radicals.
- Because of the high boiling point, +134 ℃, and the low freezing point,–143℃ , measurements can be made in a wide temperature range.
- Chemically stable in acid, alkali, oil and water.
- Negligible solubility in water.
- Relatively non–volatile because of low vapor pressure.
- Non flammable
- Extremely low toxicity.

Because of the above characteristics, S–316 is an excellent choise for an oil extraction solvent.

10.3.2 Reclamation methods

- To reclaim the solvent, use the optional solvent reclamation device (CR–200 or SR–300).

10.3.3 Property table, S–316 solvent

Property		S–316
Chemical formula		Cl $(CF_2-CFCl)_2$Cl
Molecular weight		304
Boiling point ℃		+134
Freezing point ℃		−143
Specific gravity (g/ml,at 25℃)		1.75
Surface tension (dynes/cm,at 25℃)		27
Viscosity (cst,at25℃)		0.96
Vapor pressure (mmHg)	at 25℃	11.5
	at 50℃	38
Bending ratio (n_{25})		1.380
Saturation point in water (ppm)	5℃	4.5
	25℃	4.8
	50℃	5.5
Solubility in water (ppm)	25℃	4.5
	50℃	7.5
Acute oral toxicity (LD_{50}), rats		Greater than 52.5 g/kg

10.4 CFC–113

In 1987, the "Montreal Protocol on Substances thatDeplete the Ozone Layer" was adopted. The subsequent revisions abolished the use of all fluore chlorocarbons in 1996. However, because of the unsuccessful search for all alternative solvent the revised protocol allows "the essential use" for 2 years from 1996.

10.5 Measurement value stability function

The OCMA–350 automatically judges the stability of the measurement value from the time the liquid is transferred to the measurement cell until the measurement results are displayed. This function eliminates measurement errors due to individual variations.

To judge the stability, the moving average for 10 seconds is used. The final value is displayed when the moving average is less than 0.1 mg/l for 10 sec. The stability function takes approximately 20 seconds total.

10.6 Specifications

The following are the specifications for the OCMA–350.

Model name	OCMA–350
Measurement method	Solvent extraction – non–dispersive infrared absorption analysis method
Measured substance	Substances that are extracted by solvents from test sample and which show infrared absorption at 3.4 μm to 3.5 μm wavelengths
Measurement unit	mg/l,mg/kg,Abs.
Measurement range	0～200mg/l 0～1000mg/kg 0～1.000Abs.
Resolution	0～99.9mg/l :0.1mg/l 100～200mg/l :1 mg/l 0～9.9mg/kg :0.01 mg/kg 10～99.9mg/kg :0.1 mg/kg 100～1000mg/kg:1 mg/kg 0～1.000Abs. :0.001Abs.
Repeatability	0～9.9mg/l :±0.4mg/l ±1dig. 10.0～99.9mg/l:±2.0mg/l ±1dig. 100～200mg/l :±4mg/l ±1dig. 0～1.000Abs. :±1%F.S
Display method	Backlit 3 character LCD
Calibration method	Zero, span calibration: Automatic calibration after liquid is poured in.
Extraction solvent	S–316, CFC–113
Amount of extraction solvent required	Approximately 6.5ml
Extraction method	Depends on the external extracting function
Ambient operating temperature	0～40℃
Power supply	AC100V～240V±10% 50/60Hz
Power consumption	Approx. 60VA
External dimensions	200×250×285(H×W×D)
Weight	Approx. 5 kg
External output	RS–232C output Printer output (centronics)
Other	Self determination function Measurement stabilized value display function Clock function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