OIL CONTENT ANALYZER
OCMA−310

■Introduction

- ●This manual is intended for operators of the OCMA-310 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 replacement of the followig parts or consumables

        B−heavy oil after opening

- ● 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.

■Reprinting or reproducing this manual is prohibited

- ●Inquirers regarding duplication of this manual should be made to the following address:
  Miyanohigashi, Kisshoin, Minami-ku, Kyoto, Japan 601−8510
  Horiba, Ltd
  TEL: (075)−313−8121

Safety Notice

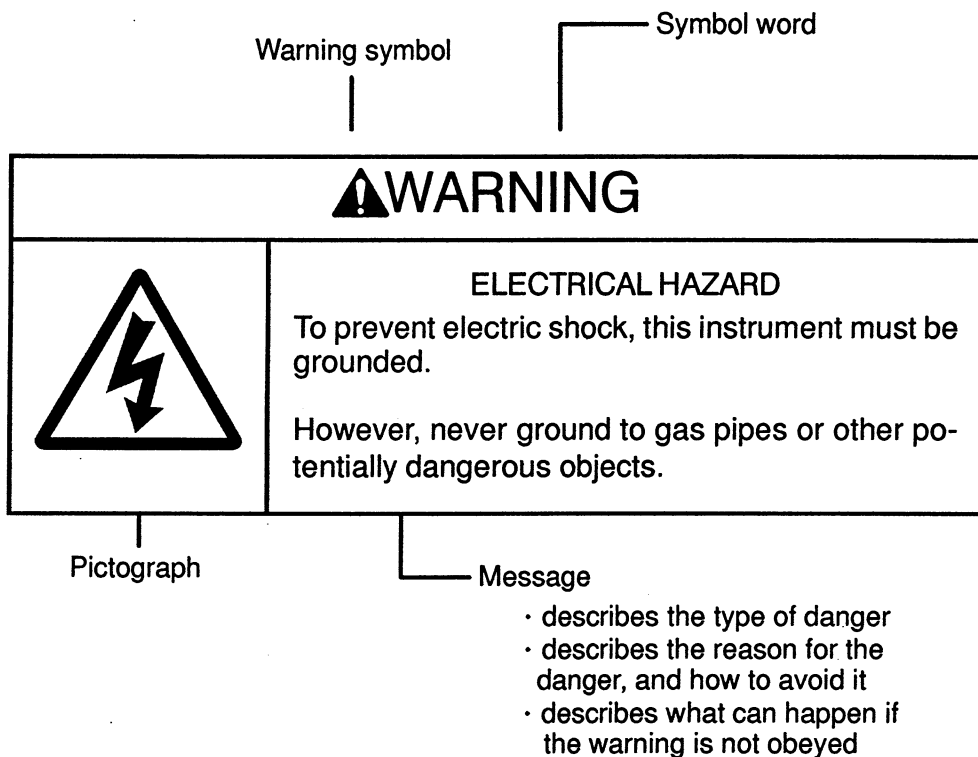## ■CE Marking

● This equipment is in conformity with the following directive(s) and standard(s);

Directive(s) the EMC directive 89/336/EEC as amended by 93/68/EEC, in accordance with the Article 10(1) of the Directive.
the Low Voltage Directive 73/23/EEC as amended by 93/68/EEC.

Standard(s) EN61326:1997/A1:1998 ClassB, Minimun Immuity test requirements.
EN61010-1: 2001

$C \in$

■The Safety Messages Used in Manual and their Meanings

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

Warning symbol

Symbol word

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

Pictograph

Message
· describes the type of danger
· describes the reason for the danger, and how to avoid it
· describes what can happen if the warning is not obeyed

● 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 behaviour.

● Sticking position of warning label on the OCMA-310

ELECTRICAL HAZARD
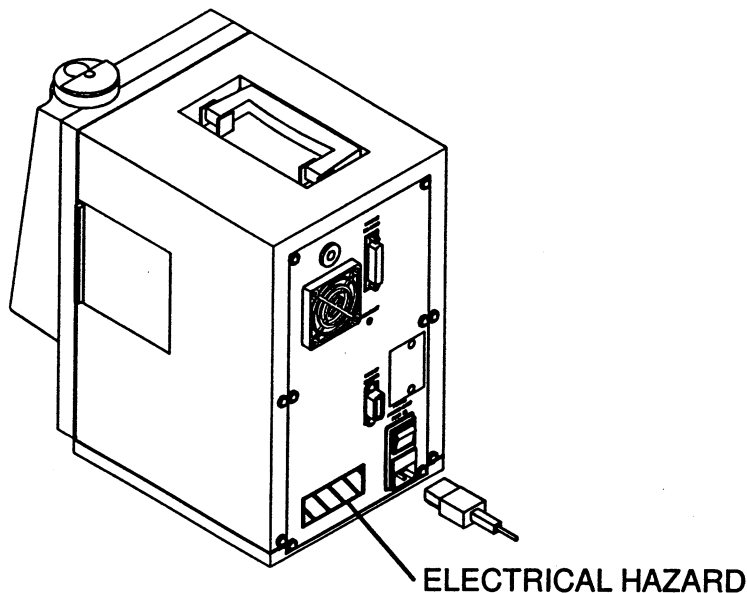
■ General Points to Note Regarding the OCMA-310

● The OCMA-310 is designed for use with S-316 extraction solvents.
Never use any other solvent.

● The OCMA-310 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-310 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-310 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.

■STRUCTURE OF THIS MANUAL

● This manual is composed of 10 chapters listed below.

Chapter 1. Parts Description

Gives an outline of the OCMA-310, and explains its simple functions.

Chapter 2. Measurement Preparations

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. Functions

Explains the functions and settings of the OCMA-310.

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-310.

Chapter 9. Troubleshooting

Describes the troubleshooting procedures for the OCMA-310.

Chapter 10. Technical Reference

NOTE

Contents

Introduction
Handling Cautions
Checking Contents

Introduction

Thank you for purchasing the OCMA-310 Oil Content Analyzer.
This instruction manual describes the operation of the OCMA-310 in order from preparation before operation to actual measurement. In addition, each function is described independently to facilitate reference.

Handling Cautions

● Take care not to spill samples onto the OCMA-310.
  This can result in equipment failure.

● Avoid operating or storing the OCMA-310 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.
  Where it finds any vibration.
  Where its ventilation is poor.
  Where it is close proximity to large electric motors or voltage transformers.
  Where any corrosive gases are presented.
  Where it has sudden temperature 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 during long periods of idleness.

● Use a protective mask and polyethylene gloves when handling solvents.

● Background readings may differ slightly depending on the solvents manufacturing lot. When using solvents from different manufacturing lots or reprocessed solvent, match the backgrounds by mixing the amount of solvent that you plan to use in a glass container before using it.

● Use solvents with the same backgrounds for span and zero calibration, and measurement.

● Samples containing emulsifying agents (surface active agents) cannot be measured.

● Avoid installing the OCMA-310 where the power switch operation can be difficult.

● Environmental condition: Maximum altitude: 2000 m
                          Main power regulation should be ±10% of rating
                          Pollution degree: 2

Checking Contents

The package includes the following main unit and accessories. Check that none of the items listed below is missing or damaged.

Main unit – 1 set
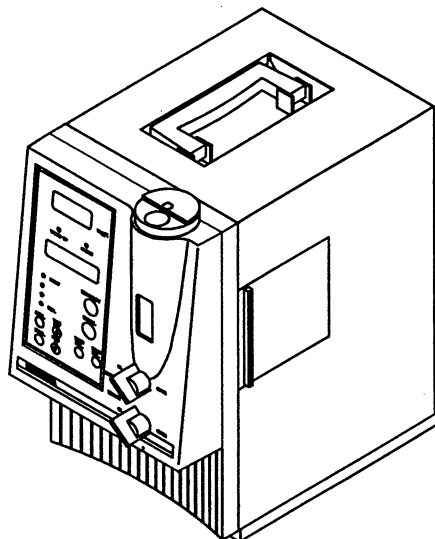
Measurement syringe (for the extraction solvent, 10 ml) – 1 pc
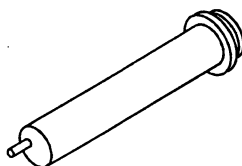
Measurement syringe (for the test sample, 20 ml) – 1 pc
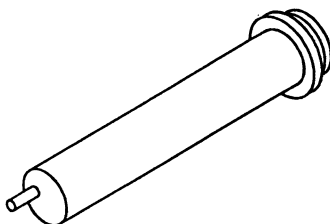
Microsyringe (25 μl) – 1 pc
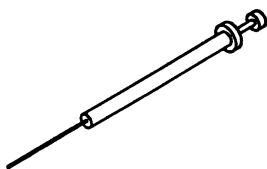
Syringe (made of polyethylene, 2.5 ml) – 1 pc
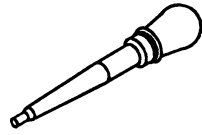
B–heavy oil (contains 10 ml) – 1 bottle

Filters – 5 sheets
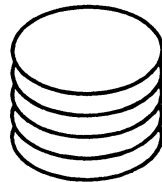
Fuse (3.15A–T) – 1 pc

Power supply cable – 1 pc
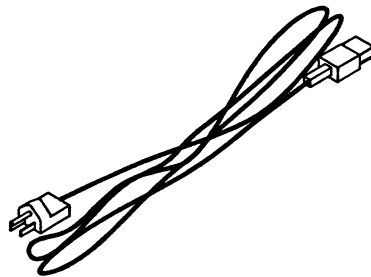
Instruction manual – 1 copy

NOTE

Chapter1 Parts Description

Operation display panel

Inlet(solvent,sample)

Extraction tank

Extract cock

Drain cock

Drainage outlet

Front view

Exhaust air outlet

Fan with air filter

RS-232C connector

LCD brightness adjustment hole

Printer connector

Power switch

Fuse cover

Power cable socket
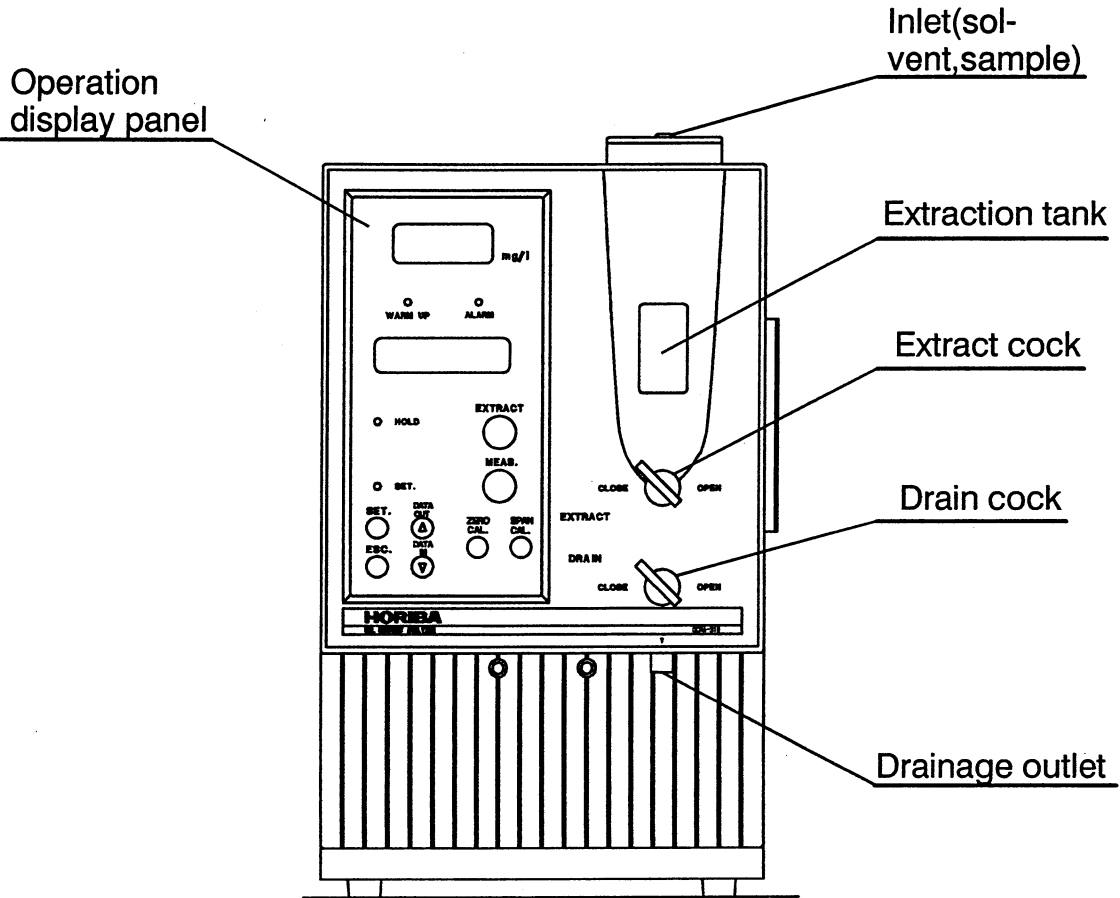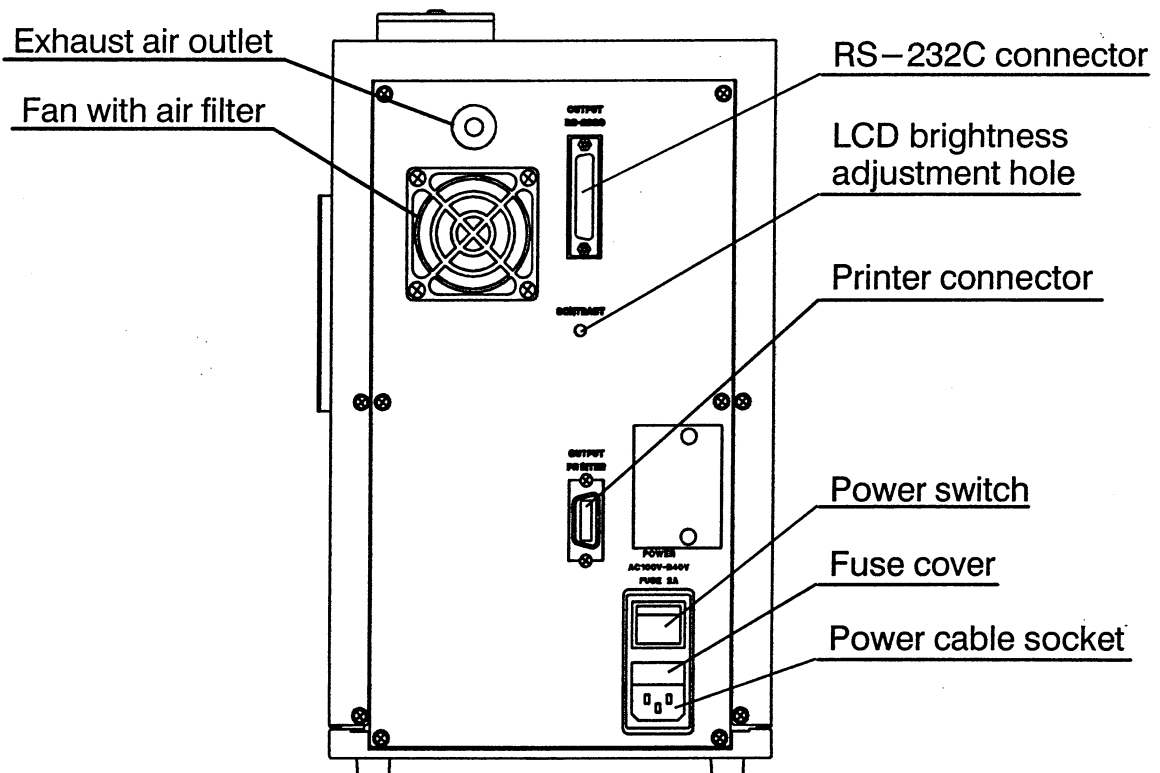
Rear view

1. Parts Description

1
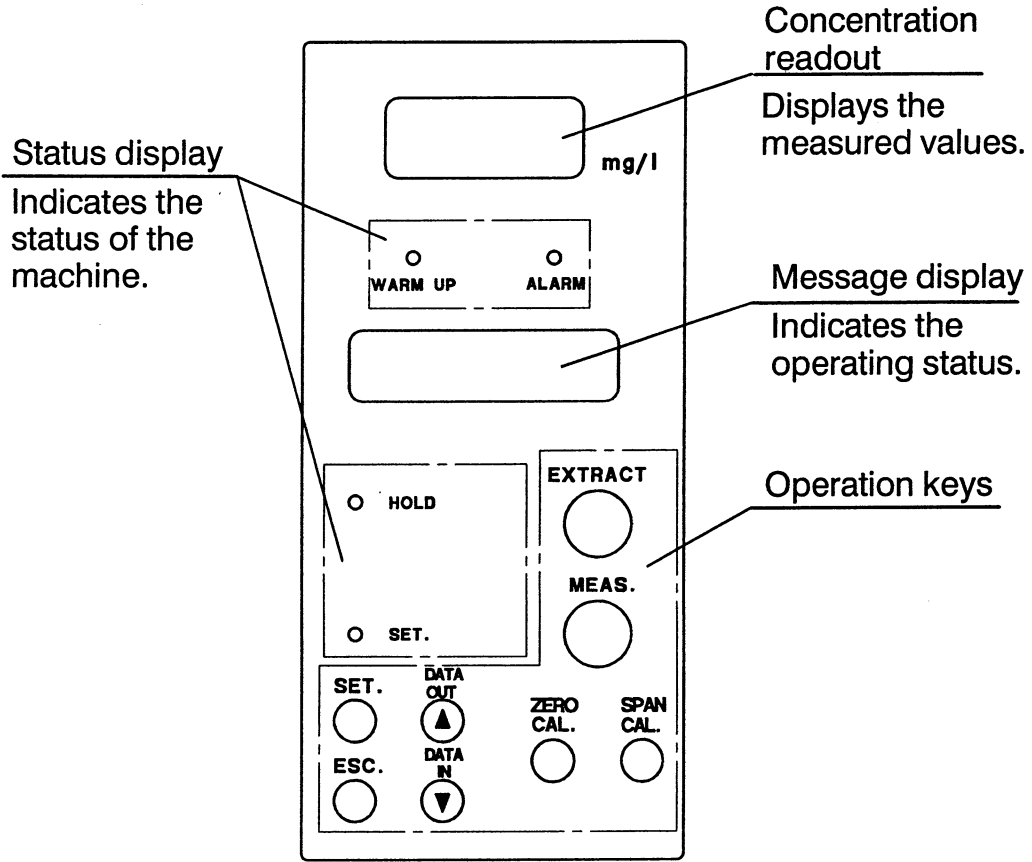
Status display
Indicates the
status of the
machine.

Concentration
readout
Displays the
measured values.

mg/l

WARM UP   ALARM

Message display
Indicates the
operating status.

EXTRACT

Operation keys

HOLD

MEAS.

SET.

SET.   DATA OUT   ZERO CAL.   SPAN CAL.

ESC.   DATA IN

Operation display panel

● Description of the operation keys

EXTRACT

① Press this key to start the extraction.

MEAS.

② Press this key to start the stability judgement of the measured value.

SET.

③ Press this key at the measuring mode to start the setting mode.
After entering the set value, press this key to set the value.

ESC.

④ Press this key to abort the stability judgement and to clear alarms.

DATA
IN

⑤ Press this key to save the data.
Also used to change the value on the settings screen.
Press this key to change the data number on the memory data screen.

DATA
OUT

⑥ Press this key to retrieve the saved data.
Also used to change the value on the settings screen.
Press this key to change the data number on the memory data screen.

ZERO
CAL.

⑦ Press this key to start zero calibration.

SPAN
CAL.

⑧ Press this key to start span calibration.

1-3

1. Parts Description

● FLOW DIAGRAM
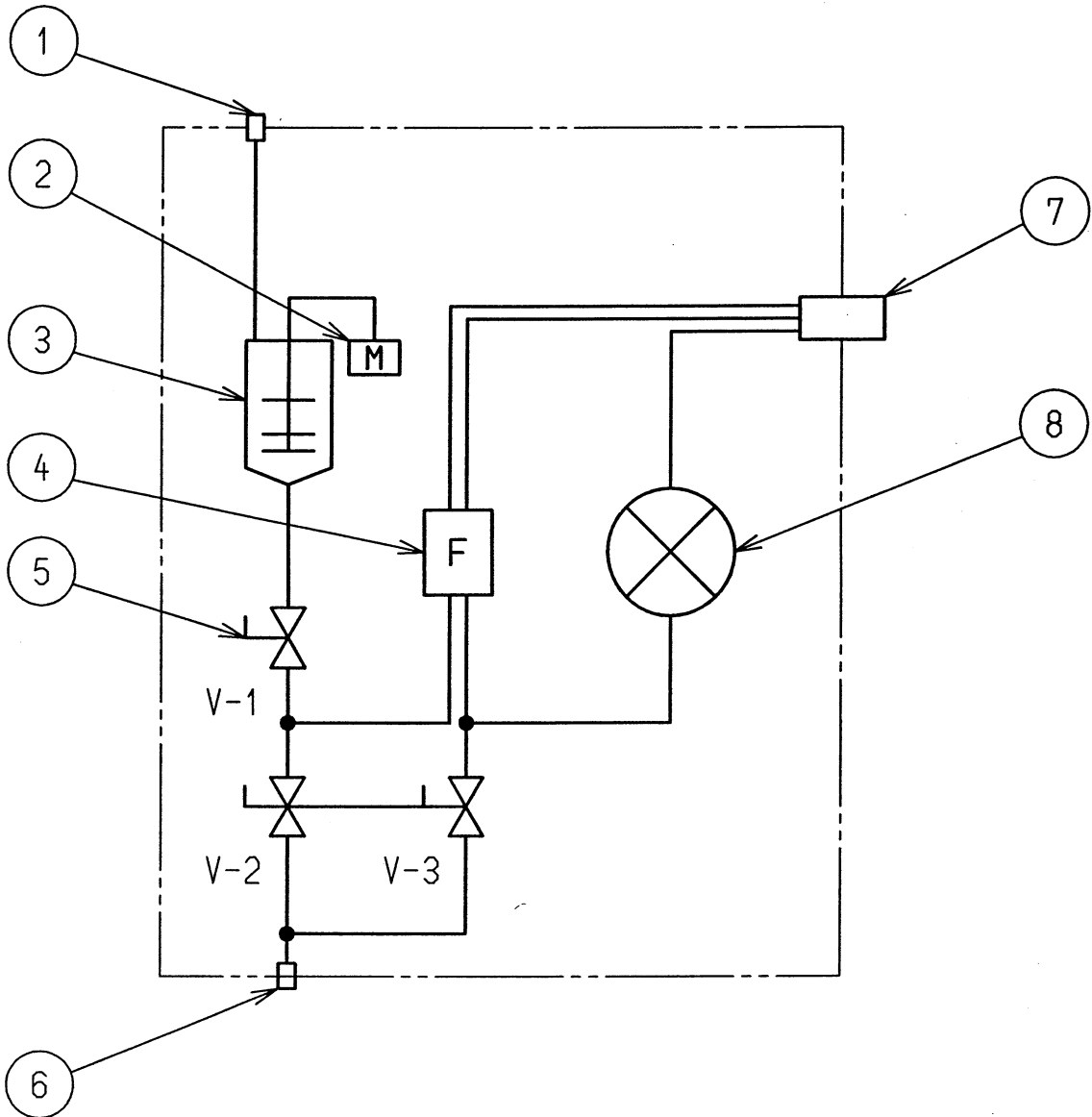
No.	Parts name
1	Sample inlet
2	Stirrer
3	Extracting chamber
4	Filter
5	Ball valve
6	Drain
7	Air Vent
8	Analyzer unit

Chapter2   Measurement Preparations

2.1 Preparations

2.1.1   Connect the power cable

2

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

⚠ 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.

2-1

2.2 Initial state at power on

2.2.1 Display

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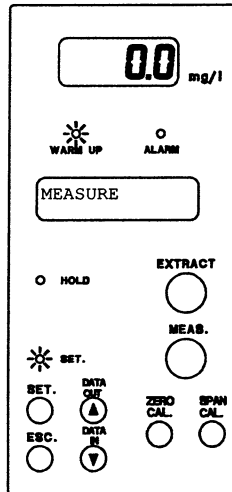
2.2.2 Warmup period

The WARM UP lamp will remain lit for 30 minutes after the power is turned on. This is the time required for the main unit of the oil content analyzer to become stabilized.

It is possible to take measurements while the WARM UP lamp is lit, however the ALARM lamp will light after the measurement is completed and an error will be displayed.

For correct measurements, be sure to wait until the WARM UP lamp goes out before performing any calibrations or measurements.
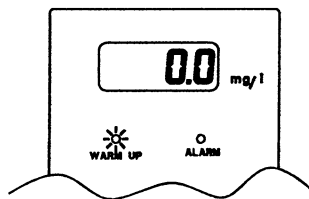
2.2.3 Initial settings

The OCMA-310 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
Extraction time		40 seconds
Span calibration value		200mg/l
RS-232C	Baud rate	2400
	No. of data bits	8
	Parity check	None
	Stop bit	1
Zero shift		0.0mg/l

Reference • To change the settings → Refer to Chapter 5.2 Settings

2.3 Calendar settings

The OCMA-310 contains the calender settings function. When first installing or the power is off for more than a week, set the calender again. Internal memory might be cleared.

Reference • 5.2.4 Calender settings

2.4 Preparations before measurement

2.4.1 Items required

- 1 or 2 (200 ml) beakers for the discharged liquid.
- Measurement syringes (for the solvent and the test sample): accessories
- A polyethylene syringe (for the hydrochloric acid): accessory
- Extraction solvent (S-316)
- Span liquid for calibrations
- Hydrochloric acid → Refer to 10.3 Hydrochloric acid preparation.

2.4.2 Set the drainage beakers

Prepare one or two 200 ml beakers for the drainage liquids. Refer to the following diagrams for the positioning of the beakers.
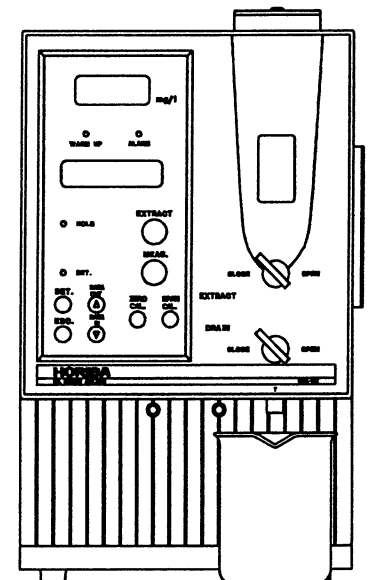
2.4.3 Wash the measurement syringes

Wash the measurement syringes (for the solvent and test sample) with pure S-316 before usage.

2.5 Preparation of zero liquid for the calibrations

Prepare pure solvent (S-316) for the OCMA-310.

2.6 Preparation of span liquid for the calibrations

Prepare some OCMA-310 calibration span liquid.

2.6.1   Using B-heavy oil (accessory)

Use B-heavy oil (specific gravity 0.895 at 20 ℃) as span adjustment solution for the OCMA-310. When the type of oil (and its specific gravity) is known, that type of oil may be used as the calibration oil.

● Items required
  ● Extraction solvent (S-316)
  ● B-heavy oil (accessory)
  ● Microsyringe (accessory)
  ● Flask (250 ml)

> Note   Clean the glass utensils with pure S-316 and let them air dry. If they are not completely dry, purge them 3 to 4 times with the S-316.

● Preparation method

① Draw out 28 μl of the B-heavy oil using the microsyringe.
② Transfer the B-heavy oil to the flask.
③ Fill the flask to the 250 ml line with S-316.

⚠ CAUTION

CHEMICAL HAZARD (S-316)

S-316 can be absorbed through the skin, and a large amount can cause poisoning. Wear gloves when handling it, and take precautions to ensure that you never ingest it accidentally.

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④ Seal the flask with the stopper and mix the contents well.

Span calibration value	B-heavy oil quantity	Span liquid concentration	Span set value
50mg/l	28 μl	100mg/l	50mg/l
20mg/l	11 μl	40mg/l	20mg/l

> Note   · Read the instruction manual for the microsyringe before handling it. Use S-316 for the cleaning solvent in the explanations. Allow the microsyringe to dry completely so there is no S-316 remaining before reuse.
>   · The units for the OCMA-310 are mg/l. Be sure to use the correct quantities when preparing the span liquid.
>   Density (ul/l) = Display density (mg/l) Specific gravity

NOTE

Chapter3 Measurement

Before beginning measurements, you must calibrate the OCMA-310 with the standard solution prepared using the extraction solvent.
Be sure to recalibrate the machine when taking measurements for the first time, or when using a different lot of extraction solvent.

3.1 Measurements

Things to check
- Have you done a zero calibration? If not, perform the zero calibration. → 3.2 Calibration
- Is the WARM UP lamp lit? If so, wait until the WARM UP lamp goes out.
- Is the ALARM lamp lit? If so, check the contents of the error.
- Is the drainage beaker set? If not, set it.

3.1.1 General application

Procedure

ESC.

① Press [ESC.] to lead the screen into the measuring mode.

Check1: Is the test sample water appropriate for use in the OCMA-310 extraction device?

Check 2:Is the extraction time correct?

screen
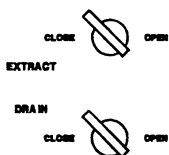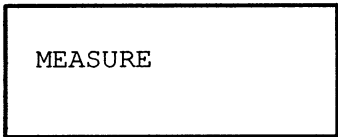
MEASURE

② Confirm that the cock is closed.

③ Using the measurement syringe
(for the solvent), insert 10 ml of
pure solvent into the inlet.
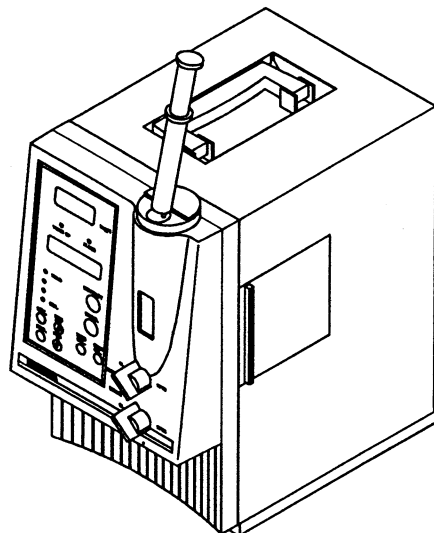
3

⚠ CAUTION

CHEMICAL HAZARD (S-316)

S-316 can be absorbed through the skin, and a large amount can cause poisoning. Wear gloves when handling it, and take precautions to ensure that you never ingest it accidentally.

Check1 : The extraction cannot be performed by the OCMA-310 for the following types of test samples. The test sample must be extracted externally before being inserted into the OCMA-310.

① Test sample water that has an oil membrane or oil drops floating on the surface.
(The special syringe cannot be used to take a sampling. The entire sample must be used for the extraction.)

③ Test sample water containing large amounts of sediment (such as sand or organic materials)
(May damage the syringe or clog the internal filter.)

Check2 : Measuring test samples with unknown extraction time:
With most water samples, the extraction should be attained within 40 seconds. However, there may be some variation in the extraction time depending on the characteristics and state of the water sample. Perform an external extraction without using the OCMA-310 and take comparison measurements. Use manual mode to repetitively take measurements while changing the extraction time, to find an appropriate time interval. When you have determined the time required, use set mode to set the automatic measurement extraction time.
References:External extraction →
3.3 Taking measurements without measurements using the extraction unit

④ Add one drop of hydrochloric acid.

⚠ 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.

3. Measurement

3

⑤ Using the measurement syringe
(for the test sample), insert 20 ml of
the test sample water into the inlet.
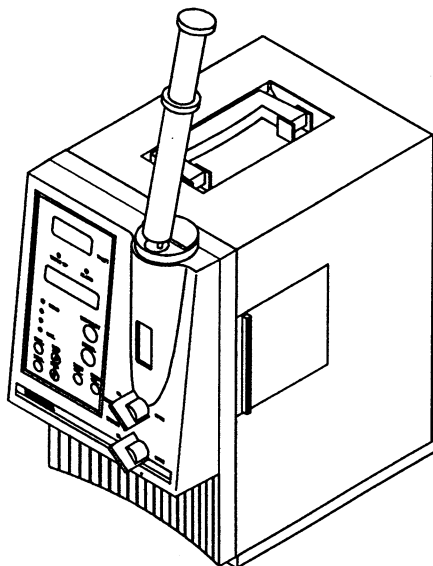
Note   The liquid overflowed from the inlet shows that the liquid covers the
air bleed of the inlet. When this happens, remove the inlet and dischar-
ge the liquide the air bleed.

EXTRACT

⑥ Check that all the liquid has been
entered, then press [EXTRACT] to
begin the extraction.
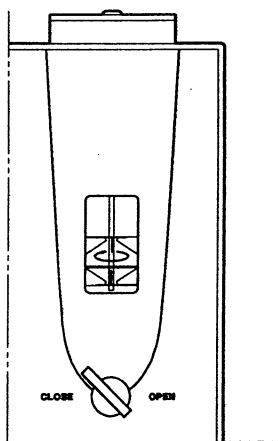
Reference · Changing the extraction time and the number of purges
→ 5.2.1 Extract time setting.

3-4

⑦Layer scparation.
Are the solvent and test sample
water adequately separated?
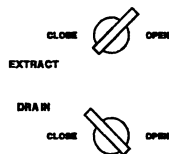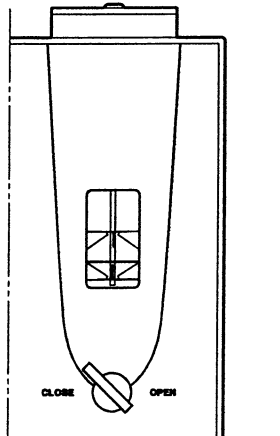
⑧Open the [EXTRACT COCK] to
send a solvent to the cock.

⑨The measuring value is displayed
at the concentration readout
(see 1-2).

⑩Press the [MEAS.] to start the
stability judgement.

Note · "MEASURE" blinks during the stability judgement. When the stability judgement is completed, "HOLD" is lit.
 · In pressing [MEAS.], [EXTRACT COCK] should be open.
Give an enough time to open [EXTRACTCOCK] before pressing [MEAS.].

● To cancel the stability judgement

Press [ESC.] during the stability
judgement to stop the judgement
and display the measuring value.

Reference · 10.4 The stability judgement function.

3-5
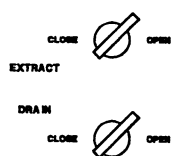
3. Measurement

⑪Open the [DRAIN COCK] to discharge the drains.

Note You cannot obtain correct measurements if the parts that come into contact with the liquid are contaminated with liquid remaining from a previous operation.
Make your measurements after performing three purge cycles.

3.1.2 Partial drain

Procedure

①Insert the solvent and the sample into the inlet, perform the extraction, and wait till the layer separation is completed.
(See 3.1.1,①~⑦)
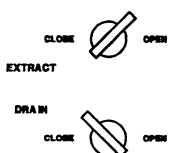
②Open the [EXTRACT COCK] to send the solvent to the cell.
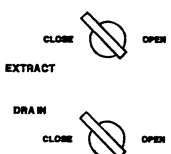
③Fill the cell with the solvent (this takes approx. 30 sec.) and close the [EXTRACT COCK].
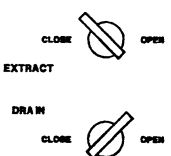
④Open the [DRAIN COCK] to discharge the drains.
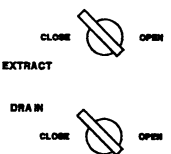
⑤Close the [DRAIN COCK].

⑥Repeat the procedure of ② to ⑤.

⑦Open the [EXTRACT COCK] to send the solvent to the cell.

3-6

⑧ The measuring value is displayed at the concentration readout (see 1-2).

MEAS.

⑨ Press the [MEAS.] to start the stability judgement.

Note · "MEASURE"blinks during the stability judgement. When the stability judgement is completed, "HOLD" is lit.
· In pressing [MEAS.], [EXTRACT COCK] should be open.
Give an enough time to open [EXTRACTCOCK] before pressing [MEAS.].

3
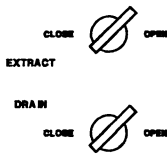
⑩ Open the [DRAIN COCK] to discharge the drains.

Note · You cannot obtain correct measurements if the parts that come into contact with the liquid are contaminated with liquid remaining from a previous operation.
Make your measurements after performing three purge cycles.

3.2 Calibration

3.2.1 Zero calibration

Things to check
- Is the WARM UP lamp lit? If so, wait until the WARM UP lamp goes out.
- Is the ALARM lamp lit? If so, check the contents of the error.
- Is the drainage beaker set? If not, set it.

Procedure

① Preform measurement by zero solvent.
(See 3.1.1, ①~⑩)

ZERO CAL.
○

② Press [ZERO CAL.]. The calibration data will be displayed and the zero calibration will start.

screen

```
1995. 2/10 15:30
ZERO    0.0 mg/L
```

EXTRACT
DRAIN
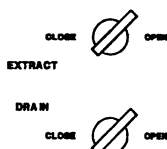
③ Open the [DRAIN COCK] to discharge the drains.

Note You cannot obtain a correct calibration if the parts that come into contact with the liquid are contaminated with liquid remaining from a previous operation. Set the number of purges to 3 or 4 for calibrations.

Note The message of "CALIB WARNING" will be flashing when the zero solvent value differs from the actually calibrated value more than 10mg/l.

screen

```
CALIB WARNING
```

ESC.
○

① Press [ESC.]. The calibration data will be displayed and the zero calibration will start.

screen

```
1995. 2/10 15:30
ZERO    0.0 mg/L
```

3.2.2 Span calibration

Things to
check

· Have you done a zero calibration? If not, perform the zero calibration.
· Is the WARM UP lamp lit? If so, wait until the WARM UP lamp goes out.
· Is the ALARM lamp lit? If so, check the contents of the error.
· Is the drainage beaker set? If not, set it.

● Items required : Span liquid prepared with the extraction solvent to be used.

3

Procedure

①Preform measurement by span solvent.
(See 3.1.1, ①～⑩)

SPAN
CAL.
○

②Press [SPAN CAL.]. The calibration data will be displayed and the span calibration will start.

screen

```
1995. 2/10 15:35
SPAN     200 mg/L
```

EXTRACT
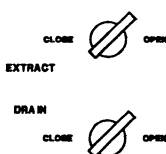
DRAIN

③Open the [DRAIN COCK] to discharge the drains.

Reference · Changing the span calibration value and number of purges
→ 5.2.2 Span calibration value setting.

Note You cannot obtain a correct calibration if the parts that come into contact with the liquid are contaminated with liquid remaining from a previous operation. Set the number of purges to 3 or 4 for calibrations. You will not obtain correct measurements if you perform the span calibration before the zero calibration. When performing the span calibration, be sure to perform a zero calibration first.

Note The message of "CALIB WARNING" will be flashing when the span solvent value differs from the actually calibrated value more than 10%.

screen

```
CALIB WARNING
```

ESC.
○

①Press [ESC.]. The calibration data will be displayed and the span calibration will start.

screen

```
1995. 2/10 15:35
SPAN     200 mg/L
```

3.3 Measuring the oil content in solvent (reference example)

To evaluate the effectiveness of the cleaning of the parts, we will explain here how to perform measurements when there is already oil dissolved in the solvent. The solvent contains slight moisture at normal temperature. From this, the measuring value may be
affected by this moisture.In the measurement and the calibration here, add water to the solvent so that the valnes are free from those effects.

3

Procedure

① Insert 10 ml of solvent into the inlet.
② Add 1ml of pure water.(Use the attached syringe.)
③ Perform measurement.

Note The actuae concentration is twice of displayed concentration.The amount of the solvent and water should not be changed in calibration.

Reference · The measurement is possible by the normal amount;(the solvent:10ml, the pure water:20ml)
Once you make the measurement by these amount, follow the same amount for the calibration.
④ Discharge.

Note You cannot obtain correct measurements if the parts that come into contact with the liquid are contaminated with liquid remaining from a previous operation.
Make your measurements after performing three purge cycles.

3.4 Taking measurements without using the extraction unit (reference example)

● Items required
  ● Separating funnel (for 500 ml and 300 ml)
  ● Cylinder (200 ml, 100 ml)
  ● Hydrochloric acid → Refer to 10.3 Hydrochloric acid preparation.
  ● Extraction solvent (S–316)
  ● pH meter
  ● Others (tissue paper, non–aqueous sodium sulfate or equivalent as required)

● Procedure

```
┌──────────────────────────────┐
│ Put 160 to 200 ml of the test │
│ sample in the cylinder.       │
└──────────────────────────────┘
              │
┌──────────────────────────────┐
│ Pour the test sample into the │
│ separating funnel.            │
└──────────────────────────────┘
              │
┌──────────────────────────────┐
│ Measure the solvent separately.│
│ (Amount: 1/2 the amount of test│
│ sample used).                 │
└──────────────────────────────┘
              │
┌──────────────────────────────┐
│ Put the measured solvent into │
│ the same cylinder that was used│
│ for the test sample. Wash the │
│ inside of the cylinder with the│
│ solvent.                      │
└──────────────────────────────┘
              │
┌──────────────────────────────┐        ┌──────────────────────────────┐
│ Pour the solvent into the     │        │ To verify the zero point, place│
│ separating funnel.            │        │ 200 ml of pure water and 100 ml│
└──────────────────────────────┘        │ of solvent into a second       │
                                         │ separating funnel.             │
                                         └──────────────────────────────┘
              │
┌──────────────────────────────┐
│ Add 0.2 to 0.5 ml (5 to 10 drops)│
│ of the prepared hydrochloric   │
│ acid into the separating funnels.│
└──────────────────────────────┘
              │
┌──────────────────────────────┐
│ Verify that the pH level is    │
│ between 2 and 3.               │
└──────────────────────────────┘
              │
┌──────────────────────────────┐
│ Stopper the separating funnel  │
│ and shake for approximately    │
│ 5 minutes.                     │
└──────────────────────────────┘
              │
┌──────────────────────────────┐
│ After shaking, wait for a few  │
│ minutes until the water and    │
│ solvent separate.              │
└──────────────────────────────┘
```

If the water and solvent separate without any sediment.

If the water and the solvent separate, but there is a lot of sediment.

If the water and solvent contain white turbidity.

3. Measurement

3

Prepare some gauze and a glass container. Clean the gauze with solvent and dissolve any organic substances it may contain using the solvent. Clean the glass container with the solvent. (Air dry both the gauze and the glass container).	Prepare a glass container that has been cleaned with non-aqueous sodium sulfate (Na2 SO4) and solvent. (Air dry).
Strain the solvent layer through the gauze into the glass container.	Pour the solvent layer into the glass container and add the non-aqueous sodium sulfate until the solvent layer becomes transparent (occasionally shaking the container to mix the contents.)
	When the solvent layer becomes isolated, measure the upper, clear liquid. (If there is a large amount of nonaqueous sodium sulfate crystals, first strain them through some gauze.)

Insert the solvent (10ml) separated out using the various procedures above into the inlet.

Transfer the liquid to the cell. (Refer to 3.3 Measurements).

Take the measurement (Refer to 3.3 Measurements).

Discharge the liquid (Refer to 3.3 Measurements).

Repeat more than 3 times (purge).

Note You cannot obtain a correct calibration if the parts that come into contact with the liquid are contaminated with liquid remaining from a previous operation. Repeat the liquid transfer → drainage (purge) cycle at least 3 times, before executing the liquid transfer → measurement → drainage (measurement).

Chapter4   After Measurement

After measurements have been completed, use the following procedures to store the equipment depending on the length of storage time.

4.1 Short term storage (less than 1 week)

If you will not be taking any measurements for a short period (less than a week):

①Clean the cell by the solvent used.   →   Refer to 3.1 Measurements.
②Fill the cell with a clean zero liquid.→   Refer to 3.1 Measurements.
③Turn off the power switch.
④Close the inlet cover.
⑤Dispose of the discharged liquid → Refer to 10.2.2 Reclamation methods.

Note   For the next measurement, first discharge the drains.

4

4.2 Long term storage (longer than 1 week)

If you will not be taking any measurements for a long period (more than a week):

① Purge several times using pure solvent (S–316) →
                              Refer to 3.1 Measurements.
② Turn off the power switch.
③ Close the inlet cover.
④ Disconnect the power cable.
⑤ Dispose of the discharged liquid → Refer to 10.2.2 Reclamation methods.

Note   For the next measurement, confirm the water filter is not dirty (if dirty, replace it to a new one) and clean it well by the solvent used.

4. After Measurement

NOTE

Chapter5   Functions

5.1   Data memory function

This function allows you to save the data for later retrieval.

5.1.1   Saving the data

DATA IN ⑤▼

① After the measurements are completed, press [DATA IN] to save the output data. The verification screen will be displayed for 5 seconds.

screen

Year Month Day Hour | Minute

```
1995. 1/ 1  1:00
No. 1      5.0mg/L
```

If there are already 50 items of data stored and there is no more room to save the data, the message will be displayed on the screen.

screen

```
DATA MEMORY OVER
```

5

Note   [DATA IN] is valid from the following screens:
· Measure mode   : After the stability judgement
· Calibration   : After the calibration
[DATA IN] is not valid in the following states:
· When there is no data.(Hold data)
· If the data has already been saved once.
· When there are already 50 items of data saved and there is no more memory for the new data.
                    (→ Refer to 5.2.3 Memory data clear.)
· Setting mode ("SET." is displayed).

If you continue with the next measurement without pressing [DATA IN], once the results are output, you can no longer save the previous data.

Saving the data after a memory overflow error:
① Clear all the saved data. (→ Refer to 5.2.3 Memory data clear.)
② Go back to a screen where [DATA IN] is valid and press [DATA IN].

5.1.2 Retrieving the data

DATA
OUT
(▲)

① Press [DATA OUT] in one of the screens where it is valid. the data memory area will be displayed.

screen

```
1993. 1/ 1  1:00
No. 1     5.0mg/L
```

(▲)
(▼)

① Press [▲] or [▼] to call up successive data.

ESC.
○

② Press [ESC.] to return to the original screen.

Note [DATA OUT] is valid in the following screens:
- Measure mode   : After the stability judgement
- Calibration   : After the calibration
- In the setting mode (where "SET." is displayed), [DATA OUT] is invalid.

5
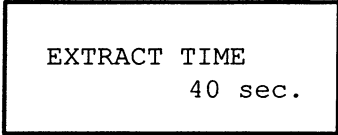
5.2 Settings

SET.
○ ①Press [SET.] to lit "SET." and the setting menu appears on the screen.

screen
```
EXTRACT TIME
        40 sec.
```

②Make a setting for each item.

ESC.
○ ③Press [ESC.] to return to the measuring mode.
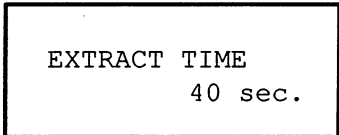
5.2.1 Extract time setting

SET.
○ ①Press [SET.] to go to the extract time setting menu. The setting value will be flashing.

screen
```
EXTRACT TIME
        40 sec.
```

5

▲
▼
②Press [▲] or [▼] to change the extraction time.

SET.
○ ③Press [SET.] to set the value.

Item	Range	Increments
Extraction time	0~600sec.	1sec.

5-3

5.2.2 Span calibration value setting

DATA OUT ▲

①Press [▲] until the span calibration value menu screen appears.

screen

```
SPAN VALUE
        200 mg/L
```

SET. ○
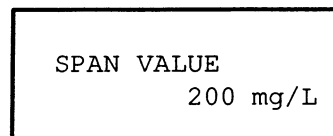
②Press [SET.] to go to the span calibration setting screen. The setting value will be flashing.

▲ ▼

③Press [▲] or [▼] to change the span calibration value.

SET. ○

④Press [SET.] to set the value.

Item	Range	Increments
Span value	0.0~200mg/l	0.1, continue pressing to change to 1 mg/l or 10 mg/l

5.2.3 Memory data clear

DATA OUT ▲

①Press [▲] or [▼] until the data clear menu screen appears.

screen

```
MEMORY DATA
          CLEAR
```

ENT. ○
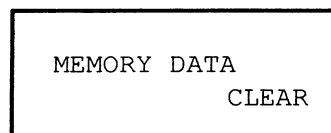
②Press [ENT.] to enter the data clear selection screen.
Press [SET.] to clear the data. Press [ESC.] to cancel the operation.

screen

```
DATA CLEAR OK?
OK: SET NG: ESC.
```
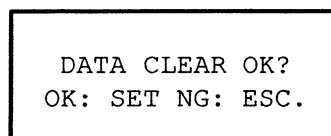
Note · If you clear the data, all the data that has been saved will be erased.
· The calibration data is not erased by the function of "Memory data clear".

5.2.4 Calendar settings

DATA OUT (▲)

① Press [▲] until the calendar setting menu screen appears.

screen

```
CALENDAR
1995. 1/ 3  2:53
```

Year Month Day Hour
                    Minute

SET. ○
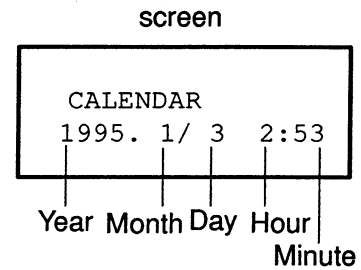
② Press [SET.] to go to the calendar setting screen. The value for the year will be flashing.

(▲) (▼)

③ Press [▲] or [▼] to change the year.

SET. ○

④ Press [SET.] to set the year. The value for the month will begin flashing.

(▲) (▼)

⑤ Press [▲] or [▼] to change the month.

SET. ○

⑥ Press [SET.] to set the month. The value for the day will begin flashing.

(▲) (▼)

⑦ Press [▲] or [▼] to change the day.

SET. ○

⑧ Press [SET.] to set the day. The value for the hour will begin flashing.

(▲) (▼)

⑨ Press [▲] or [▼] to change the hour.

SET. ○

⑩ Press [SET.] to set the hour. The value for the minutes will begin flashing.

(▲) (▼)

⑪ Press [▲] or [▼] to change the minutes.

SET. ○

⑫ Press [SET.] to set the value.

5

● Settings range

Item	Range
Year	1993~2092
Month	1~12
Day	1~31
Hour	0~23
Minute	00~59

5.2.5 RS-232C settings

DATA OUT ▲

① Press [▲] until the RS-232C setting menu screen appears.

screen

```
RS-232C
2400, NONE, 8, 1
```

SET. ○

② Press [SET.] to go to the RS-232C setting screen. The value for the year will be flashing.

screen

```
BAUD RATE
             2400
```

▲ ▼

③ Press [▲] or [▼] to change the baud rate.

SET. ○

④ Press [SET.] to set the baud rate. The value for the parity check will begin flashing.

screen

```
PARITY CHECK
              NONE
```

▲ ▼

⑤ Press [▲] or [▼] to change the parity check.

SET. ○

⑥ Press [SET.] to set the parity check. The value for the data bit will begin flashing.

screen

```
DATA BIT
                8
```

▲ ▼

⑦ Press [▲] or [▼] to change the data bit.

SET. ○

⑧ Press [SET.] to set the data bit. The value for the stop bit will begin flashing.

screen

```
STOP BIT
                1
```

⑨Press [▲] or [▼] to change the stop bit.

⑩Press [SET.] to set the value.

●Settings range

Item	Range
Baud rate	300,600,1200,2400,4800,9600
No. of data bits	7,8
Parity	Odd, even, none
Stop bit	1,2

5

5.2.6 Zero shift setting

DATA OUT
(▲)

①Press [▲] until the span zero shift menu screen appears.

screen

```
ZERO SHIFT
         0.0 mg/L
```

SET.
○
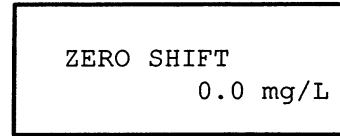
②Press [SET.] to go to the zero shift setting menu. The setting value will be flashing.

(▲)
(▼)

③Press [▲] or [▼] to change the zero shift.

SET.
○

④Press [SET.] to set the value.

● Range

Range	Increments
-100~100mg/l	0.1mg/l

Note   The values set by the procedure here doesn't affect calibration value.

5.3 Language setting for the displayed message

The language displayed as the message can be switched between English and German.

SET.
○

①Turn on the power with pressing [SET.].

Note   To return to the former displayed language, repeat the procedure of ①.

Chapter6 Connecting the Printer

6.1 Connecting the printer

There is a connector for a printer on the OCMA-310 which you can use to connect a printer and print out the measurement data. The recommended printer is the Seiko Electronics DPU-201G.

The connection method is as follows:
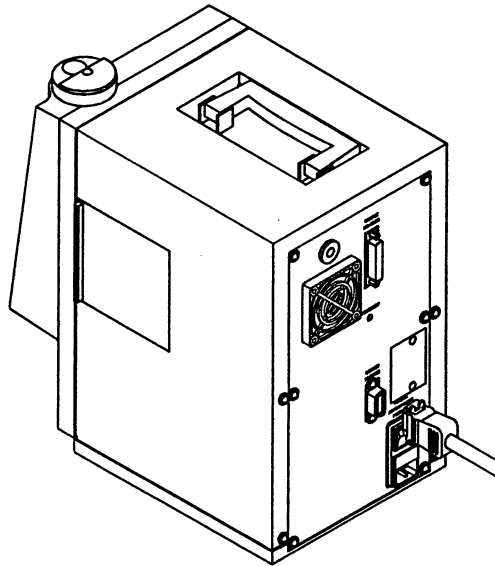
Connecting a printer to the main unit

6

Note Use a simplified centronics specification printer and printer cable.

6.2 Printer output timing and sample printout

6.2.1 Power on printout

When the equipment is recovered from the power shut down, the specification and the recovery time will be printed in the following format.

```
***** HORIBA  OCMA-310 *****
Power on    1995 1/15   10:08
```

6.2.2 Measurement value output

The measurement value printer output will be printed after the stability judgement is completed.
The format of the printout is as follows:

	DATE	TIME	CONC
Z	1/1	9:00	0.0mg/L
S	1/1	9:30	200 mg/L
*	1/1	13:00	0.0mg/L
	1/2	15:05	19.0mg/L
	1/10	2:50	180 mg/L

Month | Hour | Concentration
Day   Minute

← 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

6.2.3 Data memory printout

All the measurement data that was saved to memory is printed from the data out display. The format of the printout is as follows:

```
**** MEMORY DATA PRINT ****
NO   DATE   TIME      CONC
Z    1/1    9:00      0.0mg/L
S    1/1    9:30    200  mg/L
1    1/2    13:00     0.0mg/L
2    1/2    15:00    19.0mg/L
3    1/10   2:50    180  mg/L
**********************************
```

Reference · 5.1 Data memory function

6.3 Pin connections for the output connector

The pin connections for the output connector are as follows:

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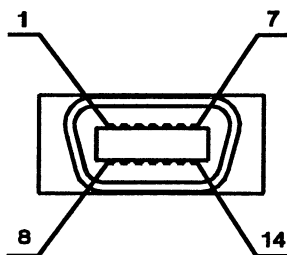
Pin No.	Name
1	STB
2	DB0
3	DB1
4	DB2
5	DB3
6	DB4
7	DB5
8	DB6
9	DB7
10	Not connected
11	BUSY
12	Not connected
13	Not connected
14	GND

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

6

NOTE

6

Chapter7 RS-232C Communication Specifications

RS-232C is standard equipment on the OCMA-310. It can be used for communications between the OCMA-310 and a personal computer or equivalent. The RS-232C connection is mainly used to start OCMA -310 execution or to request and change data from the personal computer. It should also be used to automate measurement and to organize the measurement data.

7.1 Before usage

Take note of the following when using RS-232C.

● Be sure to match the transmission format between the OCMA-310 and the computer.
If the transmission formats do not match, communication errors may occur, or communications will not be established, and you will not be able to perform normal RS-232C communications. If you change the transmission format, turn off the power to both the OCMA-310 and the computer, and restart them.

● Use a commercially available crossed cable for connecting the OCMA-310 to your computer.

● Program your computer so that it waits and then resends a data request when it does not receive data after a data request. This will make your communications more robust.

● Communications are stopped during OCMA-310 condition settings.

● Although the operation switches will work during communications, do not touch them except in emergency situations. It may cause a communications error.

7

7.2 Settings method

Refer to 5.2.5 RS-232C settings for details on how to perform the settings.

7.3 Transmission data format

RS-232C communications basically consist of data transmission from the host such as a personal computer. The OCMA-310 receives the data and returns its own data.

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

SOH	Header command	Transmission start code (1Byte)	Char(01H)
COM	Command code	Indicates the type of transmission processing (1Byte)	Char(40H)~(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)

7.4 List of processing commands

There are basically 6 types of command codes. The following table shows the commands, and the conditions required for processing that command.

Command	Item Name	ASCII Code	Command Code
Operation commands	Start extraction	"A"	Char(41H)
	Start measurement	"C"	Char(43H)
	Start zero calibration	"E"	Char(45H)
	Start span calibration	"F"	Char(46H)
Operation stop command	Stop operation	"G"	Char(47H)
Set command	Extraction time settings	"Q"	Char(51H)
	Calibration values settings	"R"	Char(52H)
	Calendar settings	"S"	Char(53H)
	Zero sift values settings	"T"	Char(54H)
Request status command	Request status	" ` "	Char(60H)
	Error statas	"d"	Char(64H)
Data request commands	Request latest measurement values	"a"	Char(61H)
	Request memory data	"b"	Char(62H)
	Request settings values	"c"	Char(63H)

7.5 Operation commands

● Description

Starts execution of the various types of measurement and calibration processing.

● Execution conditions

During operation wait state (except during settings).
When the command is executed, the OCMA-310 mode and operations will be changed.

7.5.1 Start extraction

Command transmission format:

SOH + A + STX + ETX

 OCMA-310 reply (when the command is accepted)

  SOH + A + STX + ETX

   (when the command is rejected)

  SOH + ? + STX + ETX

7.5.2 Start measurement

Command transmission format:

SOH + C + STX + ETX

 OCMA-310 reply (when the command is accepted)

  SOH + C + STX + ETX

   (when the command is rejected)

  SOH + ? + STX + ETX

7.5.3 Start zero calibration

Command transmission format:

SOH + E + STX + ETX

 OCMA-310 reply (when the command is accepted)

  SOH + E + STX + ETX

   (when the command is rejected)

  SOH + ? + STX + ETX

7.5.4 Start span calibration

Command transmission format:

SOH + F + STX + ETX

 OCMA-310 reply (when the command is accepted)

  SOH + F + STX + ETX

   (when the command is rejected)

  SOH + ? + STX + ETX

7

7.6 Operation stop command

● Description:

Stops the various types of measurements and calibrations.

● Execution conditions:

During operation, or when an error is displayed.

7.6.1 Stop operation

Command transmission format:

SOH + G + STX + ETX

    OCMA-310 reply (when the command is accepted)

      SOH + G + STX + ETX

          (when the command is rejected)

    SOH + ? + STX + ETX

7

7.7 Set command

● Description:

Sets the various settings values.

● Execution conditions:

During operation wait state (except during settings).

7.7.1 Extraction time settings

Command transmission format:

SOH + Q + STX + DATA1 + ETX

OCMA-310 reply   (when the command is accepted)

SOH + Q + STX + ETX

(when the command is rejected)

SOH + ? + STX + ETX

Settings data format (Total data length = 4 bytes)

Data No.	Description	Length	Delimiter	Data Input Range	Comments
DATA1	Extraction time	4		0000~0600 (seconds)	Set in increments of 10 seconds.

7.7.2 Calibration vaiues settings

Command transmission format:

SOH + R + STX + DATA1 + ETX

OCMA-310 reply   (when the command is accepted)

SOH + R + STX + ETX

(when the command is rejected)

SOH + ? + STX + ETX

Settings data format (Total data length = 5 bytes)

Data No.	Description	Length	Delimiter	Data Input Range	Comments
DATA1	Span calibration value	5		000.0~00200	0.0 to 99.9, data can contain one decimal value

7

7.7.3 Calendar settings

Command transmission format:

SOH + S + STX + DATA1 +, + DATA2 + ETX

OCMA-310 reply   (when the command is accepted)

SOH + S + STX + ETX

(when the command is rejected)

SOH + ? + STX + ETX

Settings data format (Total data length = 14 bytes)

Data No.	Description	Length	Delimiter	Data Input Range	Comments
DATA1	Calendar	8	,	00/01/01~ 99/12/31	Input year, month and date
DATA2	Time	5		00:00~23:59	Input hours and minutes

7.7.4 Zero sift vaiues settings

Command transmission format:

SOH + T + STX + DATA1 +, + DATA2 + ETX

OCMA-310 reply   (when the command is accepted)

SOH + T + STX + ETX

(when the command is rejected)

SOH + ? + STX + ETX

Settings data format (Total data length = 5 bytes)

Data No.	Description	Length	Delimiter	Data Input Range	Comments
DATA1	Zero sift vaiues	5	,		

7

7.8 Request status command

● Description:

Request the operating status of the OCMA-310.

● Execution conditions:

Anytime.

● Status number table

Mode	Status Number	Status	Status Number	Status
Settings mode	0300	Extraction time setting menu	0301	Extraction time setting
	0310	Span calibration values setting menu	0311	Span calibration value setting
	0320	Data clear	0321	Data clear verification
	0330	Clock settings menu	0331 0332 0333 0334 0335	Year setting Month setting Day setting Hour setting Minute setting
	0340	RS-232C settings menu	0341 0342 0343 0344	Baud rate setting No. of bits setting Parity bit Stop bit
	0350	Zero shift values setting menu	0351	Zero shift values setting
Measurement mode	0100	Momentary measurement	0110	Error display
			0120	Waiting for data transmission
			0140	Data reading
			0150	Extracting
			0160	Zero calibration value display
			0170	Span calibration value display
Stability judgement mode	0200	Stability judgement	0210	Extracting
			0220	Waiting for data transmission
			0230	Data saving
			0240	Data reading
			0250	Extracting
			0260	Zero calibration value display
			0270	Span calibration value display
Data in	0230	Memory data display		
Data out	0240	Memory data displayed		

7

7-7

7.8.1 Request status

Command transmission format:

SOH + ~ + STX + ETX

OCMA-310 reply (when the command is accepted)

SOH + ~ + STX + DATA1 +, + DATA2 + ETX

(when the command is rejected)

SOH + ? + STX + ETX

Settings data format (Total data length = 5 bytes)

Data No.	Description	Length	Delimiter	Data Output Range	Comments
DATA1	Upper word of status number	2	,	01~07	Mode number
DATA2	Lower word of status number	2		00~99	Each status number

7.8.2 Request status

Command transmission format:

SOH + d + STX + ETX

OCMA-310 reply (when the command is accepted)

SOH + d + STX + DATA1 +, + DATA2 + ETX

(when the command is rejected)

SOH + ? + STX + ETX

Settings data format (Total data length = 2 bytes)

Data No.	Description	Length	Delimiter	Data Output Range	Comments
DATA1	Error number	2		00~14	Error number

Note • When "Data output range" is "00", no error is found.
• For "Error number", refer to 9.1 errors.

7.9 Data request commands

● Description:

Request measurement, setting, or memory data.

● Execution condition:

Operation wait state (except during settings).

7.9.1 Request latest measurement values

Command transmission format:

SOH + a + STX + ETX

OCMA-310 reply (when the command is accepted)

SOH + a + STX + DATA1 +, + DATA2 + , +
DATA3 +, + DATA4 +, + DATA5 + ETX

(when the command is rejected)

SOH + ? + STX + ETX

Settings data format (Total data length = 25 bytes)

Data No.	Description	Length	Delimiter	Data Output Range	Comments
DATA1	Data No.	2	,	Z,S,0~50	
DATA2	Calendar	8	,	00/01/01~ 99/12/31	Output measurement date
DATA3	Time	5	,	00:00~23:59	Output measurement time
DATA4	Output measurement value	5	,	−20.0~220.	Output in left adjusted format
DATA5	Enable flag	1		0:Enable, 1:Disable	Output alarm

7

7.9.2   Request memory data

Command transmission format:

SOH +   b   + STX + ETX

OCMA-310 reply   (when the command is accepted)

SOH + b   + STX + DATA1 +, + DATA2 + , +
DATA3 +, + DATA4 +, + DATA5 + ETX

(The data returned above is the zero calibration value, the span calibration value, and the continuous data stored starting from Data No. 1.)

(when the command is rejected)

SOH + ?   + STX + ETX

Settings data format (Total data length = 25 bytes)

Data No.	Description	Length	Delimiter	Data Output Range	Comments
DATA1	Data No.	2	,	Z,S,0~50	
DATA2	Calendar	8	,	00/01/01~ 99/12/31	Output measurement date
DATA3	Time	5	,	00:00~23:59	Output measurement time
DATA4	Output measurement values	5	,	−20.0~220.	Output in left-adjusted format
DATA5	Enable flag	1		0:Enable, 1:Disable	Output alarm

7

7.9.3 Request settings values

Command transmission format:

SOH + c + STX + ETX

OCMA-310 reply (when the command is accepted)

SOH + c + STX + DATA1 +, + DATA2 + , +
DATA3 +, + DATA4 +, + DATA5 + ETX

(when the command is rejected)

SOH + ? + STX + ETX

Settings data format (Total data length = 27 bytes)

Data No.	Description	Length	Delimiter	Data Output Range	Comments
DATA1	Extraction time	4	,	0~600 (seconds)	For automatic mode
DATA2	Span calibration value	5	,	0.0~200	For calibrations
DATA3	Calendar	8	,	00/01/01~ 99/12/31	Output current date
DATA4	Time	5	,	00:00~23:59	Output current time
DATA5	Zero sift values	5			

7

7.10 Realtime output command

● Description:

Output the measurement data after measurement is completed.

● Execution condition:

Always output after a measurement.

7.10.1 Realtime output

Command transmission format: None (automatically output)

OCMA-310 output (for normal measurement)

SOH + ⊔ + STX + DATA1 +, + DATA2 +, +
DATA3 +, + DATA4 +, + DATA5 + ETX

Settings data format (Total data length = 25 bytes)

Data No.	Description	Length	Delimiter	Data Output Range	Comments
DATA1	Data No.	2	,	Z,S,0~50	
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	Enable flag	1		0:Enable, 1:Disable	Output alarm

OCMA-310 output (when measurement is interrupted)

SOH + ⊔ + STX + DATA1 +, + DATA2 +, +
DATA3 + 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		ERROR STOP	
DATA3	Dummy	3			Output 3 spaces

⊔ : Space

7.11 RS-232C specifications

● Conforms to JIS-C6361

● Transmission format:

Baud rate	: 300,600,1200,2400,4800,9600(BPS)
Character length	: 7 bits or 8 bits
Parity	: Odd, even, none
Stop bit	: 1 bit, 2 bits
Communication method	: Full duplex

● Cable specification:

FG	1		1	FG
TXD	2		2	TXD
RXD	3		3	RXD
RTS	4		4	RTS
CTS	5		5	CTS
DSR	6		6	DSR
SG	7		7	SG
	8		8	
	9		9	
	10		10	
	11		11	
	12		12	
	13		13	
	14		14	
	15		15	
	16		16	
	17		17	
	18		18	
	19		19	
DTR	20		20	DTR
	21		21	
	22		22	
	23		23	
	24		24	
	25		25	

7

7-13
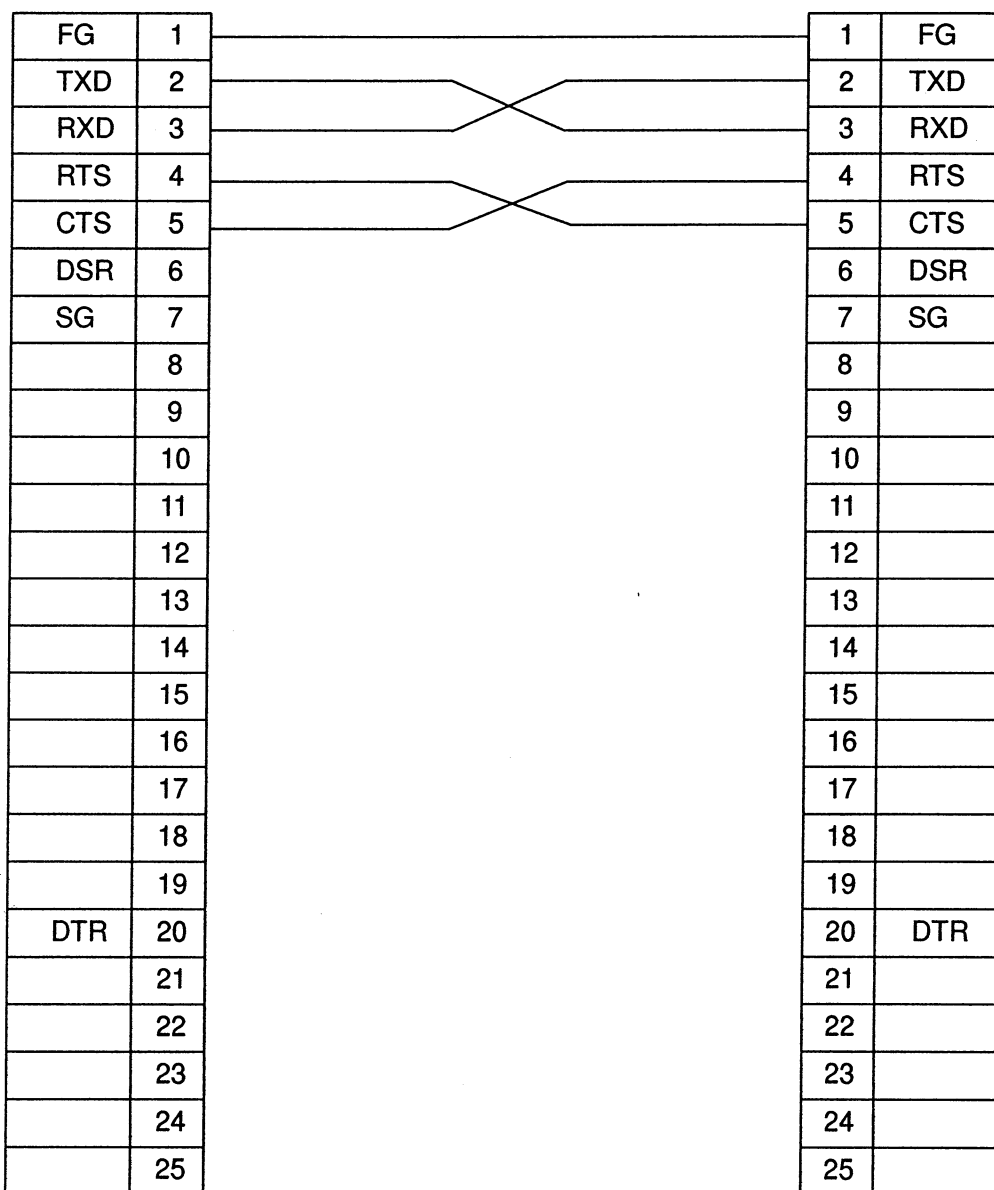
7.12 Sample program

```
10   'SAVE "A:\RS_OCM.BAS",A                                    ⎫
20   '***************************************************       ⎪
30   ' OCMA-310 RS-232C SAMPLE PROGRAM(N88BASIC)                ⎬ Comment lines
40   '***************************************************       ⎪
50   '                                                          ⎭
100  CLS
110  OPEN "COM:N81NN" AS #1                      ←Open RS-232C
                                                  communications
120    A$=CHR$(&H1)+CHR$(&H40)+CHR$(&H2)+CHR$(&H3)←Communications
                                                  data
                                                  (Automatic mode)
130  PRINT #1,A$                                 ←Data sent
140  *RSNEXT
150    B$=INPUT$(1,#1)                           ←Data received
                                                  (1 byte)
160    C$=C$+B$
170    IF B$=CHR$(&H3) THEN GOTO *REND ELSE GOTO *RSNEXT  ←Check
                                                           whether
                                                           end of
                                                           data
180  *REND
190    PRINT C$                                  ←Display data
                                                  received
200  CLOSE #1                                    ←Close RS-232C
                                                  communications
210  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

7

Chapter8   Regular Maintenance

## 8.1   Replacing the water filter

8.1.1   Replacement period

When test samples containing large amounts of sediment are measured repeatedly, the water filter may become clogged. If the filter becomes clogged then during the liquid transfer stage of the measurement operation, when the extracted liquid is transferred to the cell for analysis, the liquid will not flow well and the liquid level in the extraction tank will not go down.

When this happens, you must replace the filter element. (Normally, the liquid level will be reduced to a certain level within 30 seconds. If this takes longer than 60 seconds, it is time to replace the filter element).

> Note   If you enter the next measurement liquid before the previous measurement liquid has been adequately discharged, the liquid will accumulate in the inlet pipe to the analysis section. Although the filter is not clogged, the surface level in the extraction tank will not go down.
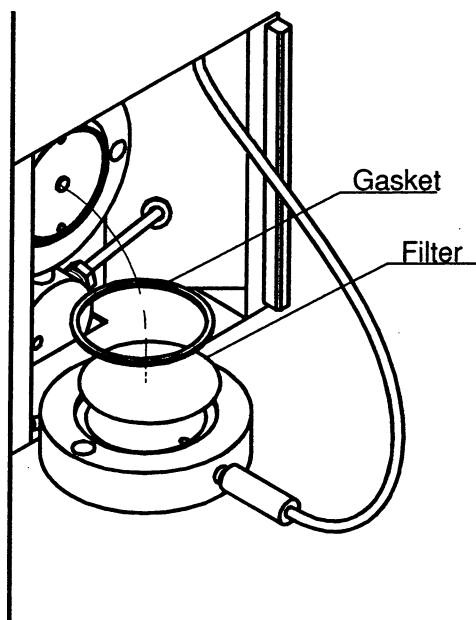
8.1.2   Replacement method

① Open the cover on the right hand side.

8
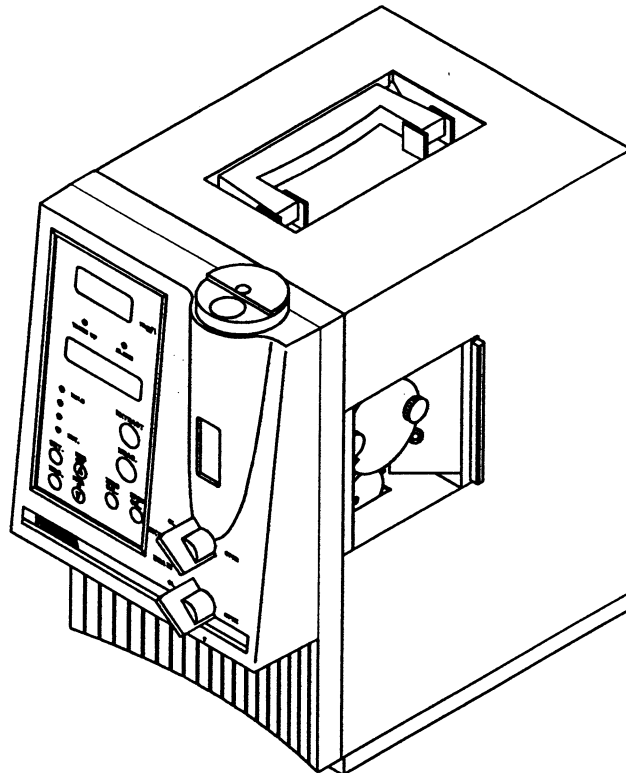
② Loosen the screws for the filter and remove the filter block.

Gasket

Filter

③ Remove the filter gasket attached to the filter block, and replace the filter element. During the replacement, wipe away any liquid on the inner surface of the filter block with tissue paper.

④ After replacement, use the reverse procedure to assemble the filter block.

⑤ Check the following before closing the cover.

Set to measurement mode liquid transfer (3.1), insert 10 ml of S–316 in the inlet, press the start button and wait until the liquid transfer has completed. Check whether any liquid is leaking from any parts of the filter section. If there are any leaks, recheck the filter gasket, etc.

⚠ CAUTION
CHEMICAL HAZARD (S–316)
S–316 can be absorbed through the skin, and a large amount can cause poisoning. Wear gloves when handling it, and take precautions to ensure that you never ingest it accidentally.

⑥ Use the measurement mode discharge operation (3.1) to discharge the liquid.

8

8.2 Cleaning the fan filter

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

① Remove the retainer.
② Clean the filter.
③ Mount as it was originally.

Filter
Retainer
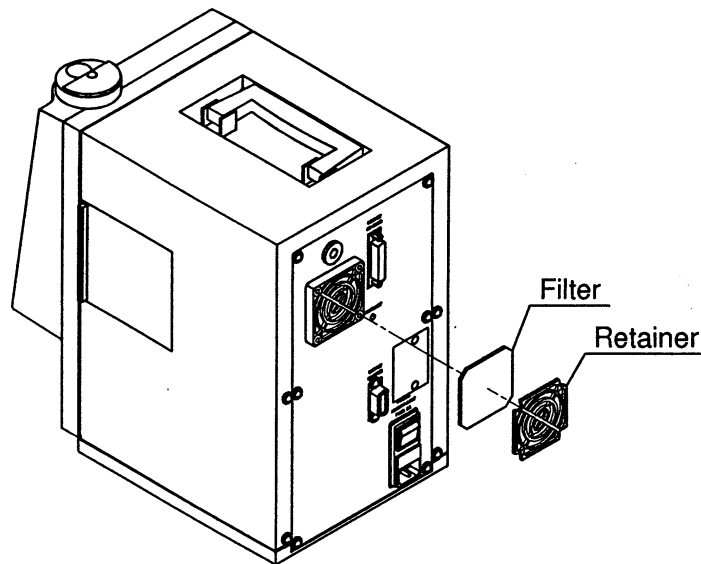
8.3 Replacing the fuse

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

8

Mount a new fuse and push the fuse cover back in.
(Fuse used: AC250V 3.15A-T, 1 pc)
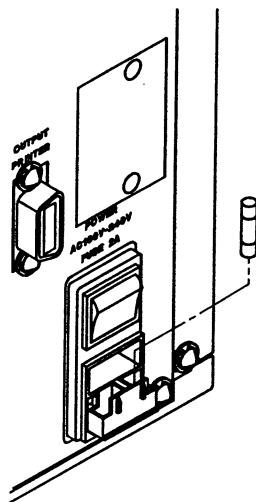
8.4 Supplementary parts list

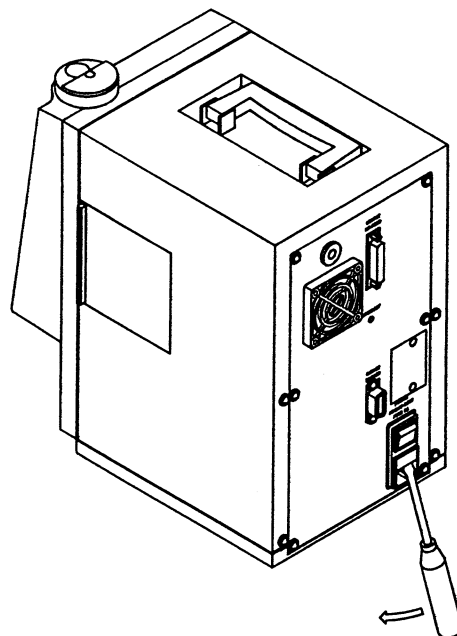| Part Name	Part Number	Specifications
Microsyringe	9039000100	25 μl
Measurement syringe	9039002300	For the extraction solvent, 10 ml
Measurement syringe	9039002400	For the test sample, 20 ml
Filter element	9039000400	ϕ 40, contains 5 filters
Filter gasket	9039001000	For the filter
B–heavy oil	9018000600	10 ml
Solvent	9050000800	S–316 1kg

These supplies may be ordered by part name and part number from your retailer.

8

8.5 Cleaning

When the OCMA-310 becomes dirty, wipe them off with a soft dry cloth or a cloth damped with clear water.

Chapter9 Troubleshooting

9.1 Errors

The OCMA-310 has a function to display a description of the error in the message display area, and to display the ALARM in the status display area. The following types of errors may occur.

Error No.	Display	Description of Error
1	EEPROM ERROR	Malfunction in the internal memory (EEPROM).
2	RAM ERROR	Malfunction in the internal memory (RAM).
4	POWER ERROR	Malfunction in the power supply for the automatic switching valve operation.
5	MOTOR ERROR	Malfunction in the extraction motor.
7	LAMP ERROR	Light source output degradation.
9	DRIFT DATA	Measurement (value) instability.
10	(DATA OVER)	Measurement value falls outside the measurement range.
11	CALIB ERROR	Calibration value falls outside the calibration value range.
12	(WARM UP ERROR)	Measurement or calibration performed during warm up.
14	MEMORY OVER	Memory data excesses the range of maximum memory of the equipment.

Note · When an error occurs, the message is displayed in the message display area, and the ALARM lamp lights.
· When multiple errors occur simultaneously, those errors are repeatedly displayed one error message by one.
· The errors of No.10 and No.12 have no message at the massage display.

9

9.2 Error handling

● Error No. 1: EEPROM ERROR

Definition: Data in the internal EEPROM memory was erased.

Error cancellation method: Turn the power on again.

Causes	Countermeasures
This is a malfunction in the internal EEPROM memory.	

● Error No. 2: RAM ERROR

Definition: Data in the internal RAM memory was erased.

Error cancellation method: Press the [ESC.] key.

Causes	Countermeasures
The backup battery is dead.	The error is cleared by pressing the [ESC] key, however, you must redo the settings and calibrations. When you turn off the power, any data you saved to memory will be erased.
This is a malfunction in the internal RAM memory.	

● Error No. 3: ROM/RAM ERROR

Definition: Data in the internal memory (EEPROM, RAM) was erased.

Error cancellation method: Turn the power on again.

Causes	Countermeasures
This is a malfunction in the internal EEPROM or RAM memory.	

● Error No. 4: POWER ERROR

Definition: The power source (12V) for RS–232C and the motor has troubles.

Error cancellation method: Turn the power on again.

Causes	Countermeasures
The internal power supply is broken.	
The fuse for the internal power supply was tripped.	
The air cooling fan is broken.	

9

● Error No. 5: MOTOR ERROR

Definition: A wire has broken in the extraction motor, or the motor has overloaded.

Error cancellation method: Press the [ESC.] key.

Causes	Countermeasures
A wire is broken in the extraction motor.	
The extraction motor has overloaded.	
A foreign substance has been mixed into the extraction tank.	Clean the extraction tank.

● Error No. 7: LAMP 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 in the measurement cell is dirty.	Purge several times with the zero liquid.
A foreign substance has entered the measurement cell.	Purge several times with the zero liquid.
The light source has degraded.	
A wire is broken in the light source.	

● Error No. 9: DRIFT DATA

Definition: The measurement value does not stabilize during measurement and the results cannot be output after 5 minutes.

Error cancellation method: Press the [ESC.] key.

Causes	Countermeasures
The liquid is not completely in the measurement cell.	Replace the water filter.
The warm up cycle has not completed.	Redo the measurement after the warm up cycle has completed.
The machine is vibrating.	Move the machine to a location where it will not vibrate and redo the measurement.

9

● Error No. 10: DATA OVER

    Definition: The measurement value is less than –20 mg/l or greater than 220 mg/l.

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

$$\boxed{\mathbf{u.F.}}$$

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

$$\boxed{\mathbf{o.F.}}$$

Causes	Countermeasures
There was an error in the amount of sample and solvent used.	Insert 20ml of sample and 10ml of solvent and redo the measurement.
The wrong value was used in the calibration.	Redo the zero and span calibrations.
The concentration of the sample is too high. (Higher than 220 mg/l)	Dilute the sample and redo the measurement.

● Error No. 11: CALIB 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.	Use the automatic calibration setting to set the correct calibration value.

● Error No. 12: 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).

        Note   The calibration during the "WARM UP" is lit is not available. Try the calibration again after the "WARM UP" is off.

● Error No. 14: MEMORY OVER

    Definition: Memory data excesses the range of maximum memory of the equipment.

    Error cancellation method: Press the [ESC.] key.

    Countermeasures:Clear all the saved data. (→ Refer to 5.2.3 Memory data clear.)

9

9.3 Errors that are not displayed

The following describe ways to handle various symptoms that do not cause an error to be displayed.

For problems that are not described here, contact your nearest retailer or HORIBA service station.

● 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 wrong amounts of sample and solvent liquids were used.	Redo the measurement using 20ml of sample liquid and 10ml of solvent.
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.	Redo the zero and span calibrations.
The liquid is not completely in the measurement cell.	Replace the water filter.
The temperature of the surroundings is outside the ambient operating temperature range.	Redo the measurements at a location where the temperature of the surroundings is within the range 0 to 40 °C.
The number of purges is too low.	Purge several times.
The span liquid value is too small.	Use span liquid that is greater than 10 mg/l.

● There is nothing displayed on the message display LCD.

Causes	Countermeasures
The contrast control knob position is off.	Adjust the contrast control knob inside the hole on the rear panel.

● The switches do not work/The display is strange

Causes	Countermeasures
The system is locked.	Turn off the power and turn it back on. If this does not fix the problem, contact your nearest retailer or HORIBA service station to request repairs.

9

9. Troubleshooting

● 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.

● 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-310 are using different communications specifications.	Reset the communications specifications on the personal computer or the OCMA-310 and reset the power.
The OCMA-310 is either in the middle of an operation or settings.	Redo communications after the operation or settings have been completed.

● The indication value goes down to a minus

Causes	Countermeasures
The solvent used for the calibration, and the solvent used for the measurement came from different lots.	Mix each solvents well to make the original concentration the same, and try the calibration and the measurement again.
The measured value is approx. 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.
No liquid is sent to the cell.	Replace the water filter.

Note   When the solvents for the calibration and for the measurement is different in lots or the residual oil concentration, it is available to obtain the original sample concentration by measuring the sample liquid as the zero solvent (Sample concentration (mg/l) = measured value of sample liquid - measured value of zero solvent). Even though the both solvents are the same in lots or the residual oil concentration, sometimes the measured value could be minus, affected by a slight moisture. When this happens, try the procedure for the measurement and the calibration shown in page 3-7. Lastly, the measured value can be also down to minus when the solvent is treated by ultrasonic or filtered especially in the measurement of residual oil concentration. When this happens, the solvent for the calibration needs the same treatment, with the solvent for the measurement.

9

Chapter10 Technical Reference

10.1 Measurement principles

Although there are many methods that are appropriate for measuring the oils contained in natural water or drainage 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 is gaining 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.
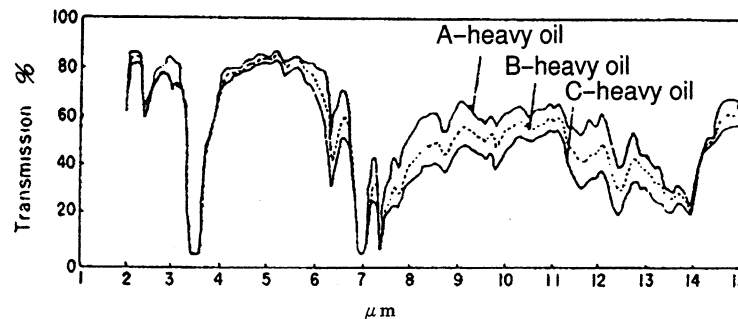
Example absorption
spectrum
Figure 1
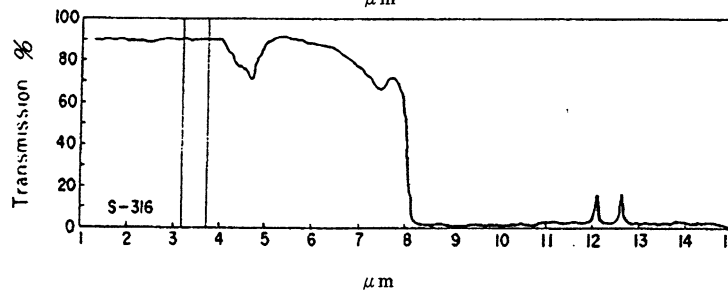
Flon S–316
absorption
spectrum
Figure 2

The HORIBA oil Content Analyzer makes use of the facts described above and the fact that oils are composed of hydrocarbons.

As shown in Figure 1, there is an absorption band that follows the expansion and contraction movements of the radicals in (-CH2-), (-CH3), etc. that are characteristic of hydrocarbons which are composed of C-H unions near the 3.4 to 3.5 μ m (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 dissolved in water, the difference in specific gravity is large, so that oil is easily dissolved. Taking advantage of these features, we can measure the oil concentration in test sample water as follows:

10

after the oil which has been dispersed in water is extracted (dissolved) in S-316, the oil concentration in the sample is measured from the changes in the amount of infrared absorption in the 3.4 to 3.5 μ m wavelength range of the extracted liquid.

Infrared analysis meters can be generally divided into "spectral infrared analysis meters" and "non-dispersive infrared analysis meters". The OCMA-310 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 merits such as the ability to take measurements without losing elements with low boiling points, making it currently one of the best quantitative methods for oils.

10.2 The oil measurement solvent (S−316)

S-316 is a double chlorotrifluoroethylene obtained from a dimerization (doubling) reaction of chlorotrifluoroethylene monomer.

10.2.1 Characteristics

- Almost no infrared absorption in the 3,000 cm^{-1} absorption wavelength of hydrocarbon radicals.
- Because of the high boiling point of +134 ℃, and the low freezing point of -143 ℃, measurements can be taken under a wide temperature range.
- Chemically stable in acid, alkali, oil and water.
- Insoluble in water.
- Non-volatile because of low vapor pressure.
- Non-combustible so there is no danger of explosion.
- Highly safe because of extremely low toxicity to people.

Because of the above characteristics, S-316 is an excellent solvent fulfilling the conditions required for an oil extraction solvent.

10.2.2 Reclamation methods

- To reclaim the solvent, use the optional solvent reclamation device(SR-300).

10

10.2.3 Property table

Property		S–316
Chemical formula		$Cl(CF_2-CFCl)_2Cl$
Molecular weight		304
Boiling point		+134
Freezing point		−143
Specific gravity (g/ml,at25°C)		1.75
Surface tension (dynes/cm,at25°C)		27
Viscosity (cst,at25°C)		0.96
Vapor pressure (mmHg)	at25°C	11.5
	at50°C	38
Bending ratio (n_{25})		1.380
Saturation point in water (ppm)	5°C	45
	25°C	48
	50°C	55
Solubility in water (ppm)	25°C	4.5
	50°C	7.5
Acute oral toxicity (LD_{50})		Greater than 52.5 g/kg

10

10-3

10.3 Hydrochloric acid preparation

For the OCMA-310, hydrochloric acid is added to bring out the effectiveness of chlorine analysis. The method for preparing the hydrochloric acid is described below.

Pour commercially available undiluted hydrochloric acid along a glass rod into a container containing pure water in a 1:1 ratio. Be sure not to pour the hydrochloric acid all at once.

⚠ 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.

10.4 The measurement value stable display function

The OCMA-310 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. The reason for this function is to remove the measurement errors due to individual variations.

The rules for the decision are: Take the average movement in the values for each second of sampling time over 10 seconds. When the movement in the average values becomes less than 0.1 mg/l for the 10 second period, this final average value is displayed. Therefore the minimum time for a measurement is 20 seconds.

10

10.5 Specifications

The following are the specifications for the OCMA-310.

Model name	OCMA-310
Measurement method	Solvent extraction – non-dispersive infrared absorption analysis method
Measured objects	Substances that are extracted by solvents from test sample water and which show infrared absorption in the proximity of 3.4 μm to 3.5 μm wavelengths
Measurement range	0~200mg/l
Resolution	0-99.9mg/l:0.1mg/l 100-200 :1 mg/l
Repeatability	0~9.9mg/l:±0.2mg/l ±1dig. 10.0~99.9mg/l:±2.0mg/l ±1dig. 100~200mg/l:±4mg/l ±1dig.
Display method	Backlit 3 character LCD (measurement value display) Backlit character display LCD (16 x 2) (message display)
Calibration method	Zero, span calibration: Automatic calibration after liquid is poured in.
Amount of test sample required	2:1 (ratio of test sample to solvent)
Extraction solvent	S-316
Amount of extraction solvent required	0~200mg/l: 10ml
Extraction method	By the extraction function of the analyzer.
Ambient operating temperature	0~40°C
Power supply	AC100V~240V±10% 50/60Hz
Maximum power	Approx. 120 VA
External dimensions	342 (H) x 200 (W) x 315 (D) mm
Mass	Approx. 7 kg
External output	RS-232C output Printer output (centronics)
Measurement flow	Manual switch by the cock
Other functions	50 item data memory function Self determination function Measurement stabilized value display function Interactive display method Clock function

10

NOTE