

On-Line BOD-COD Pollution Monitoring System(OPMS)

ระบบตรวจสอบมลพิษระยะไกล



ประกาศ/ ระเบียบที่เกี่ยวข้อง

- เรืองกำหนดให้โรงงานที่ต้องมีระบบบำบัดน้ำเสียต้องติดตั้งเครื่องมือหรือเครื่องอุปกรณ์พิเศษและเครื่องมือหรือเครื่องอุปกรณ์เพิ่มเติม พ.ศ. 2547 ลงวันที่ 2 ก.ค. 2547
- เรืองกำหนดให้โรงงานที่ต้องมีระบบบำบัดน้ำเสียต้องติดตั้งเครื่องมือหรือเครื่องอุปกรณ์พิเศษและเครื่องมือหรือเครื่องอุปกรณ์เพิ่มเติม (ฉบับที่ 2) พ.ศ. 2548 ลงวันที่ 7 ม.ค. 2548
- เรืองกำหนดให้โรงงานที่ต้องมีระบบบำบัดน้ำเสียต้องติดตั้งเครื่องมือหรือเครื่องอุปกรณ์พิเศษและเครื่องมือหรือเครื่องอุปกรณ์เพิ่มเติม (ฉบับที่ 3) พ.ศ. 2549 ลงวันที่ 11 ก.ย. 2549
- เรืองกำหนดให้โรงงานที่ต้องมีระบบบำบัดน้ำเสียต้องติดตั้งเครื่องมือหรือเครื่องอุปกรณ์พิเศษและเครื่องมือหรือเครื่องอุปกรณ์เพิ่มเติม (ฉบับที่ 4) พ.ศ. 2552 ลงวันที่ 30 ต.ค. 2552
- ล่าสุดโรงงานที่มีน้ำทิ้งตั้งแต่ 500 Q/วัน ต้องติดตั้งระบบ OPMS

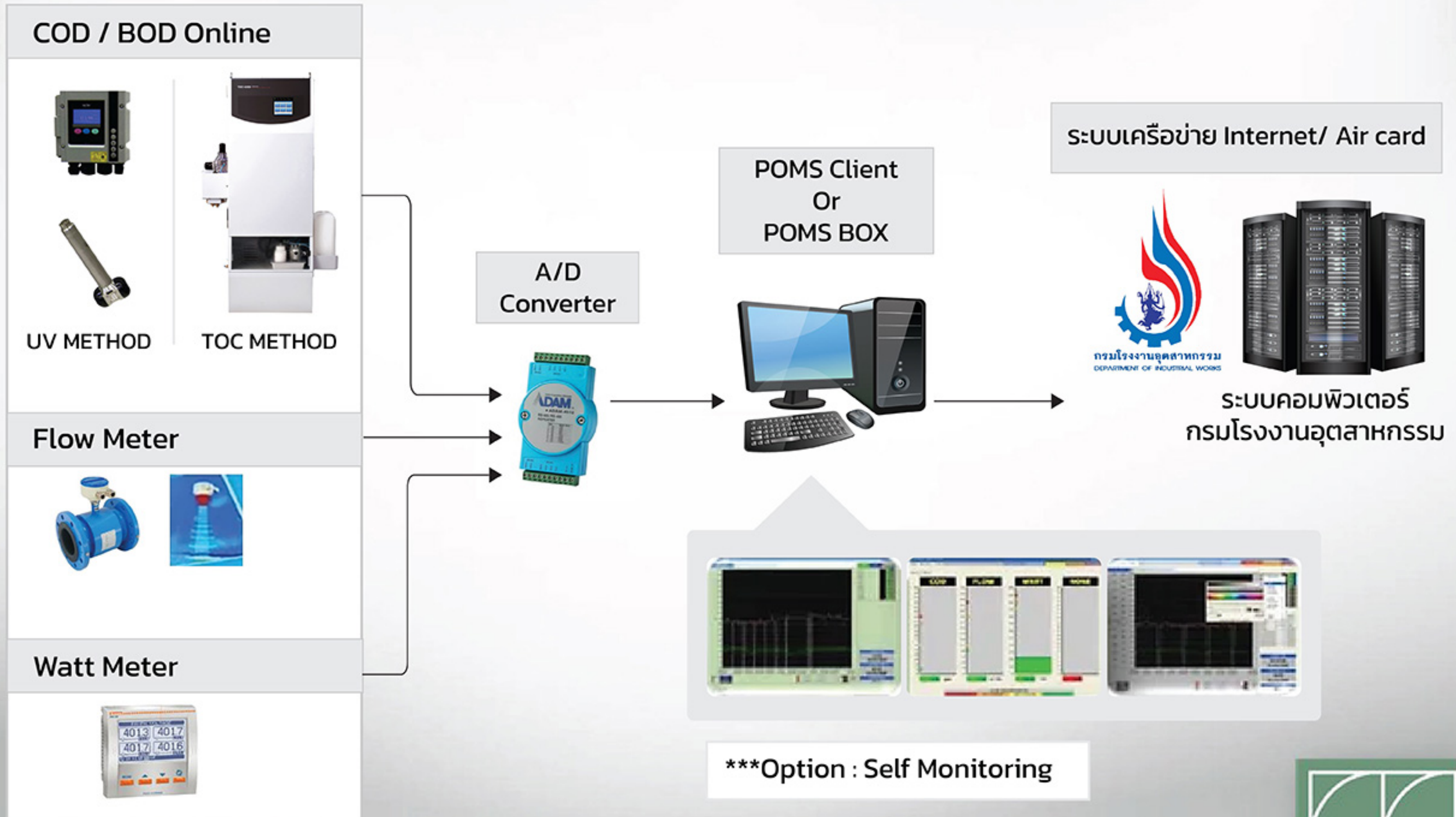


เครื่องมือและอุปกรณ์ ที่โรงงานต้องจัดเตรียม

- 1) เครื่องวัดซีโอดี/ บีโอดี
- 2) เครื่องวัดปริมาณการไหลของน้ำทิ้ง
- 3) เครื่องวัดปริมาณการใช้ไฟฟ้า
- 4) อุปกรณ์แปลงสัญญาณ
- 5) โปรแกรมลูกข่าย/โปรแกรมเชื่อมต่อ(VPN)
- 6) เครื่องคอมพิวเตอร์
- 7) ระบบเครือข่าย (Internet/Air card)



การเชื่อมต่อ COD/BOD Online กับระบบของกรมโรงงานอุตสาหกรรม



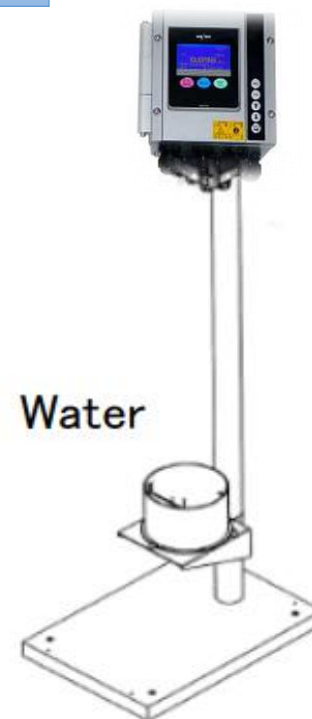
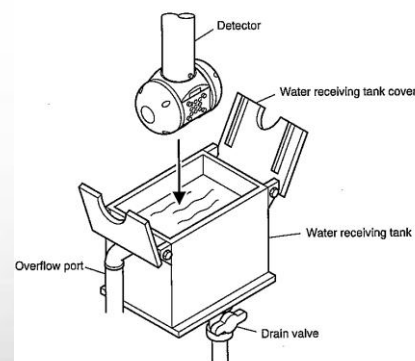
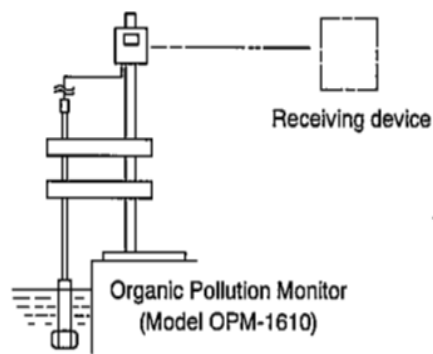
BOD-COD(UV METHOD) MODEL OPM-1610

Immersion type

Sampling type



Low cost
Low maintenance
Low consumable part



BOD-COD(UV METHOD) MODEL OPM-1610

Specification (1)

- Measuring method : 2 Wavelength absorbance measurement
(UV light : 254nm**, Visible light : 660nm)
- Wash method : Automatic wash of cell window by wiper
Operation : 1 wiper cycle at 1 time
Interval : 1 to 9999 minutes
- Calibration method : Zero calibration : Pure water
Span calibration : Potassium Hydrogen Phthalate (KHP)

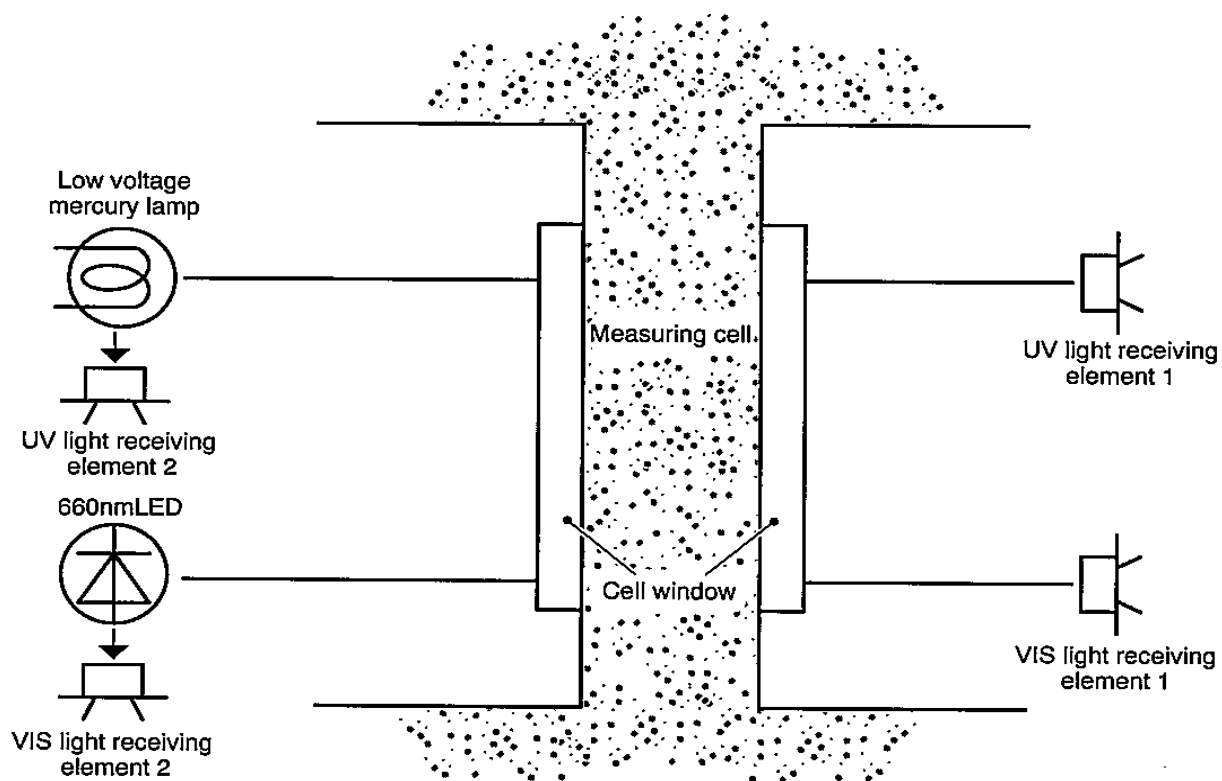
****UV253.7 (254)nm is 5910B Standard method of The Examination of Water and Wastewater which suitable for COD**

BOD-COD(UV METHOD) MODEL OPM-1610

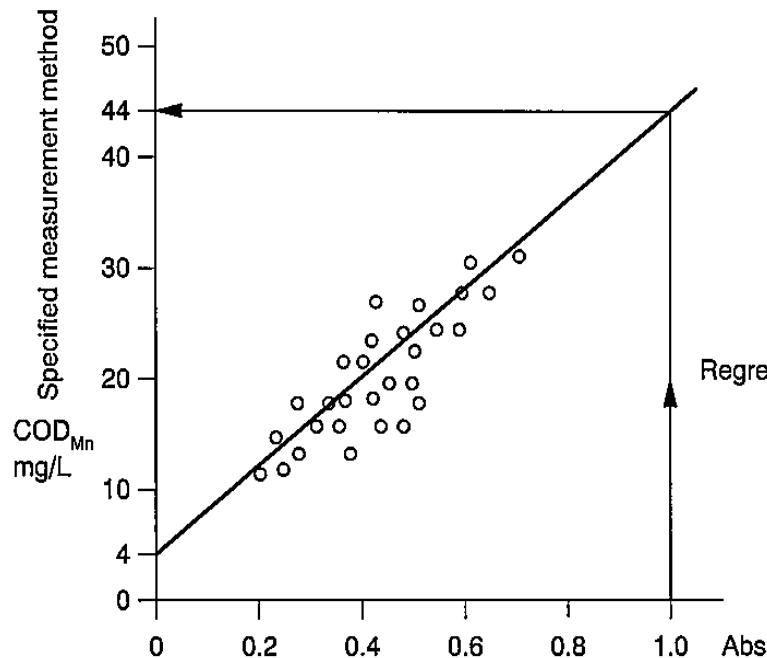
Specification (2)

- Power supply : 100 to 240 VAC
- Power consumption : 10 VA (average), approx. 20 VA (max)
- Measuring range COD : 0-2000 mg/L, BOD : 0-200 mg/L
- COD/BOD value is converted with correlation curve $y = a + bx$
- Display : COD/ BOD/ UV/ VIS
- Output signal : Transmission : 4-20 mA, Contact : 3 contacts
(lamp failure, no sample, leak sensing)

BOD-COD(UV METHOD) MODEL OPM-1610



BOD-COD(UV METHOD) MODEL OPM-1610



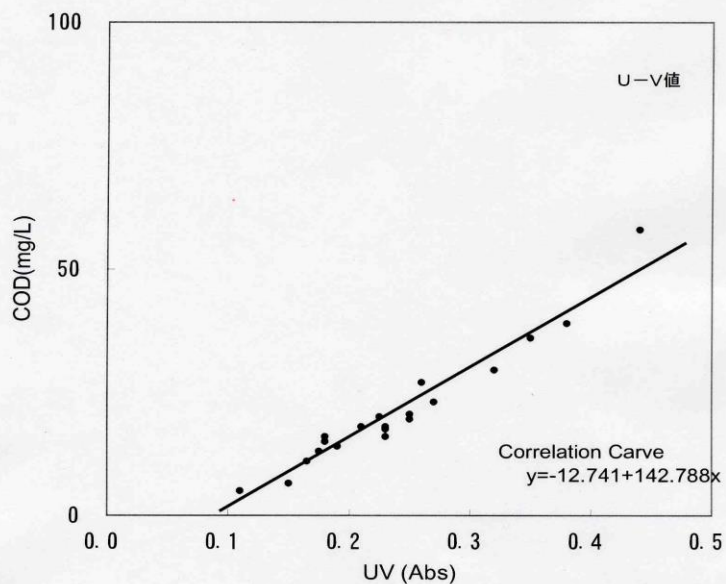
Scatter Chart Example

Regression formula $y = a + bx$
 y: COD(BOD) measured values
 (mg/L) by lab analysis
 x: Measured value (Abs) by this
 product
 a: Intercept
 b: Regression coefficient (slope)

BOD-COD(UV METHOD) MODEL OPM-1610

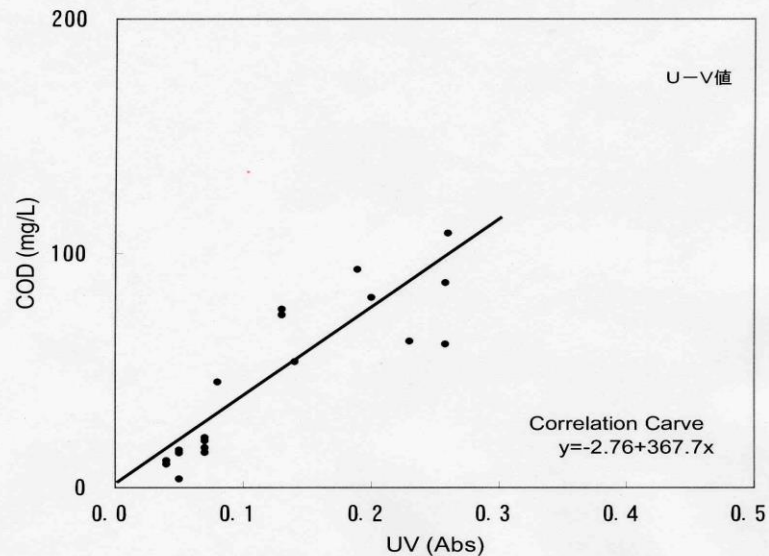
Correlation of COD Automatic Analyzer & UV Analyzer
(UV Monitor)

Paint Factory



Correlation of COD Automatic Analyzer & UV Analyzer
(UV Monitor)

Synthetic Dye • Organic Pigment



BOD-COD(UV METHOD) MODEL OPM-1610

Measurement Mode Operation (MEAS)

(a) In the “measurement mode” the following values can be checked.

Absorbance measured value	Each measured value	Others
U-V	COD	Each set value
UV	SS	
VIS	Turbidity	
---	Temperature	

(b) The main display and bottom display are switched by pressing the following keys:

	Main display	Bottom display
Operation key	↑	↓

BOD-COD(UV METHOD) MODEL OPM-1610

Troubleshooting Error and Corrective actions

Kinds of Errors

Error indication	Error name	Error removing method	
		Mode	Operation
E-1 : HIGH LIMIT HUMIDITY	Detector leak	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-2 : SAMPLE ERROR	No sample water	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-3 : UV LAMP FAIL	UV lamp error	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-4 : VIS LAMP FAIL	VIS lamp error	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-5 : MOTOR DOWN	Motor error	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-6 : SAMPLE TEMP	Temperature error	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-7 : H_U-V	U-V absorbance high	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)

(To be continued)

BOD-COD(UV METHOD) MODEL OPM-1610

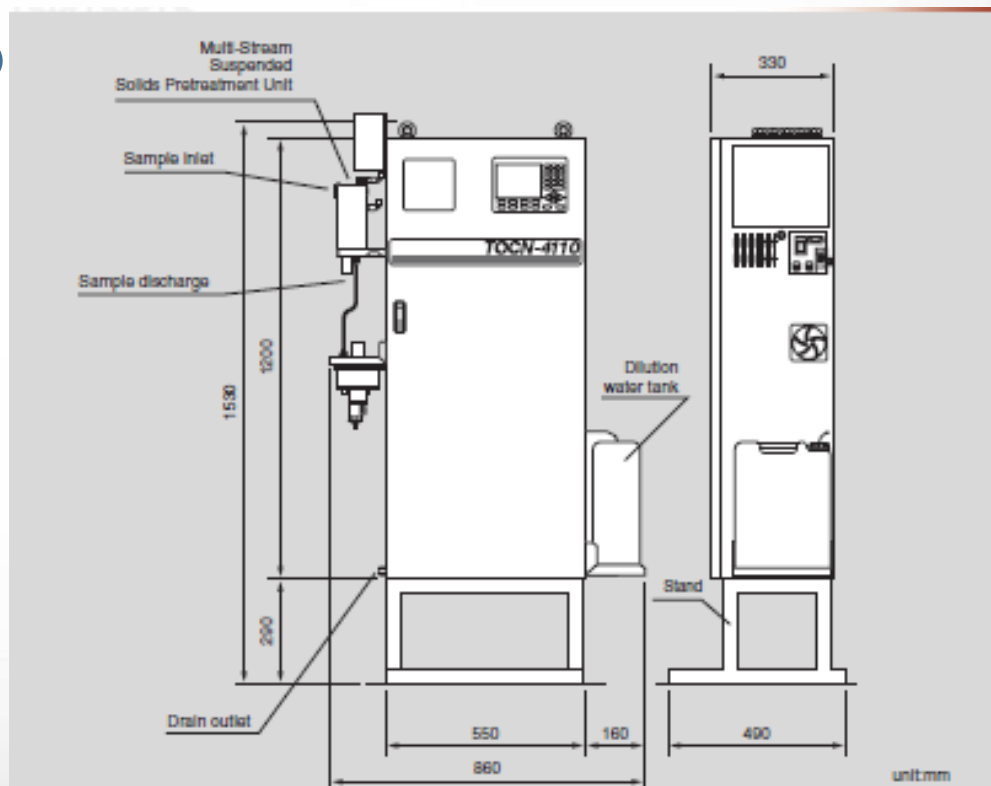
Troubleshooting Error and Corrective actions

(Continued from previous page)

Error indication	Error name	Error removing method	
		Mode	Operation
E-8 : H_UV	UV absorbance high	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-9 : H_VIS	VIS absorbance high	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-10 : H_COD	COD concentration high	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-11 : H_SS	SS concentration high	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-12 : H_TURB	Turbidity high	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-13 : REAGENT ENPTY	No reagent	Measurement	Press (ST-BY/MEAS) for 4 seconds or more. (Select the maintenance mode first)
E-14 : ZERO CAL FAIL	Zero calibration error	Maintenance/ Calibration	Press (ESC) for 1 second or more.
E-15 : UV CAL FAIL	UV span calibration error	Maintenance/ Calibration	Press (ESC) for 1 second or more.
E-16 : TURB CAL FAIL	Turbidity span calibration error	Maintenance/ Calibration	Press (ESC) for 1 second or more.
E-17 : OUT OF TEMP	UV span calibration solution temperature error	Maintenance/ Calibration	Press (ESC) for 1 second or more.

BOD-COD(TOC METHOD) MODEL TOC-4200

High accuracy for
All application



BOD-COD(TOC METHOD) MODEL TOC-4200



BOD-COD(TOC METHOD) MODEL TOC-4200

On-Line TOC Analyzer

TOC-4200: Features

Easy to Use

- Simple operation by **color LCD touch screen**.
- Set diverse measurement schedules.
Calendar functions allow precise settings of holidays and operation days.
- **Interrupt measurements** simplify popular offline measurements.
- **Notification when replacement** of consumables is required.

Support for a Wide Range of Samples (1) → Diverse Applications

- Uses Shimadzu's proven 680 °C combustion catalytic oxidation method.
- Select a sampling unit to match the sample characteristics.
- Supports 5 mgC/L to 20,000 mgC/L full-scale.
High sensitivity measurements from 0 to 1mgC/L*
- Supports many types of TOC measurements (NPOC, TC-IC*, NPOC + POC* measurements).
- Automatic dilution function (50× max.) handles acid and alkaline samples.
- **High-salt sample combustion tube kit** handles samples with high levels of inorganic salt, such as seawater samples*.

BOD-COD(TOC METHOD) MODEL TOC-4200

• Final effluent monitoring

- A substitute for the official analytical method (manual BOD/COD measurement) that permits automated, high-frequency measurements of organic pollutants in effluent.
- Measurements at a short measuring cycle (4 minutes minimum) rapidly capture dramatic changes in organic matter or abnormal effluent.
 - ➔ Provides data for voluntary effluent management and report data agreed to by local government.

• Total pollutant load control regulation applications (organic pollution load)

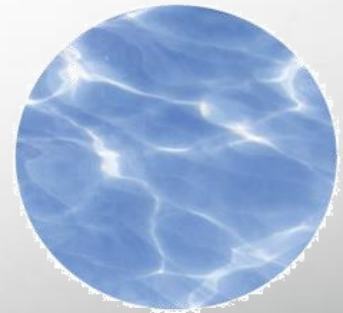
- Converting the measured TOC values into COD values allows applications to COD total volume control.
- TOC $\Rightarrow$ COD conversion functions are installed as standard.

BOD-COD(TOC METHOD) MODEL TOC-4200

- **Wastewater treatment plant influent (upstream monitoring)**
 - Measurements at a short measuring cycle (4 minutes minimum) rapidly capture fluctuations in organic pollutants in influent. Contributes to load control and prevention of abnormal effluent outflow in treatment systems.
 - A TOC analyzer can detect all organic substances. It captures organic pollutants missed by UV detectors.
 - Permits measurement of up to 6 flow lines for precise monitoring of a treatment facility.
- **Plant water (washing water, cooling water, recovered water, boiler water, condensate, etc.)**
 - Permits continuous monitoring of all process water used in a plant.
 - Measurements at a short measuring cycle (4 minutes minimum) rapidly detect malfunctions and accidents.

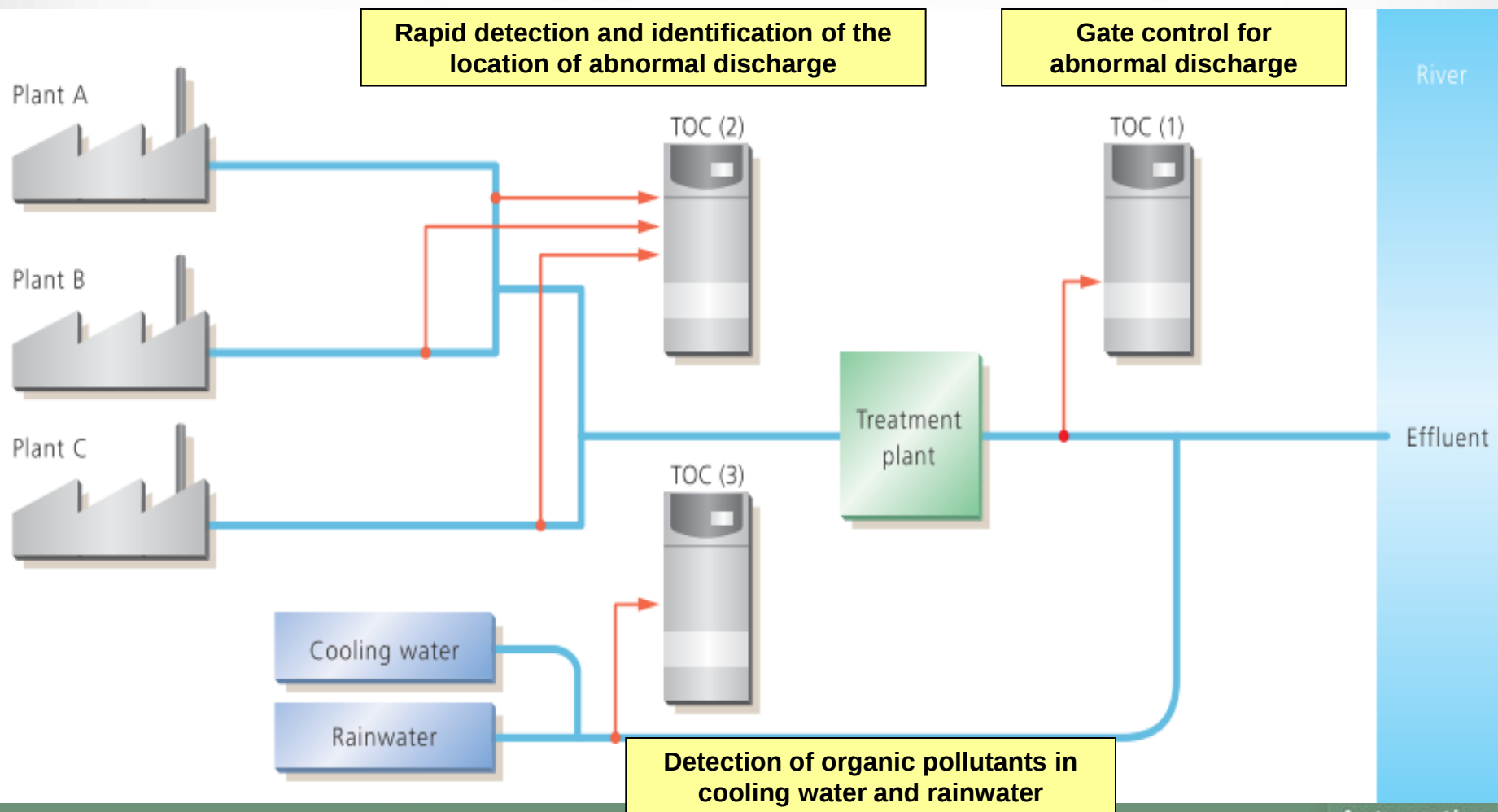
BOD-COD(TOC METHOD) MODEL TOC-4200

- Monitoring of river water sampled at water purification plants and treated water (tap water)
 - Monitoring of fluctuations in sampled water quality due to rain and feedback to treatment processes
 - Monitoring of water quality problems upstream of sample inlet due to effluent discharge accidents
 - Permits simultaneous monitoring of treated tap water.
 - Supports monitoring TOC Removal Rate based on EPA regulations.



Diverse Applications:

Example of Upstream Monitoring



Diverse Applications

Covers a Wide Range from Pure Water to Heavily Polluted Water

- **Uses Shimadzu's proven 680 °C combustion catalytic oxidation method**
 - Detects all organic substances, even in samples with suspended solids.
- **Measuring range from 5 mg C/L to 20,000 mg C/L (50× sample dilution)**
 - An option can be attached to support high sensitivity measurements to 1 mg C/L full-scale.
- **Permits TOC measurements that match a sample's characteristics**
 - TOC measurement by acidify and sparg TOC also know as non-purge able organic carbon (NPOC)
 - TOC determination by difference between total carbon (TC) and inorganic carbon (IC)
 $TOC = TC - IC$ (requires option)
 - TOC determination by addition method of NPOC and purgable organic carbon (POC)
 $TOC = NPOC + POC$ (requires option)
- **Simultaneous TN measurements**
 - The TN measurement option permits TN measurements using the catalytic thermal decomposition-chemiluminescence method (measuring ranges: 0–1 mg N/L to 0–10,000 mg N/L).

Diverse Applications

Sampling Unit

- **From pure water to heavily polluted water**
 - The sampling unit for heavily polluted water incorporates a unique washing function and special operation sequences to control blockages and biological contamination. This reduces the maintenance frequency.
 - The sampling unit for pure water restricts exposure of the sample to the environment and inhibits contamination of the sample from the environment.
- **Models are available to switch between up to 6 sample flow lines**
 - More economical as the need for multiple instruments is eliminated (reduced instrument and piping costs)
 - Thorough internal and external washing reduces cross-contamination between flow lines

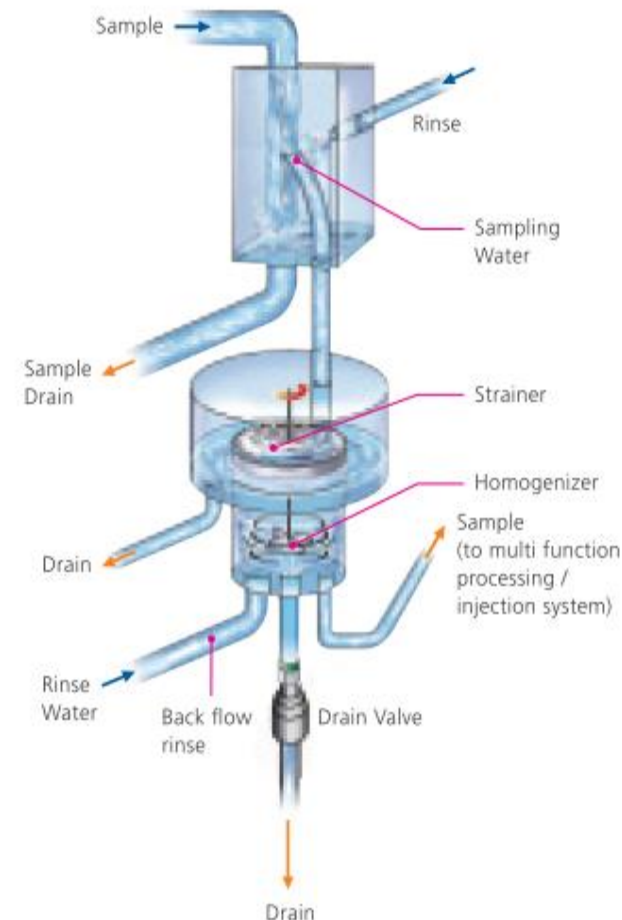


Diverse Applications

Sampling Unit: Multi-Stream Suspended Solids Sampling Unit



- **Support for samples with high suspended solids levels**
 - Incorporates a homogenizer equipped with a strainer.
 - Automatic washing of liquid-contact parts.
⇒ Prevents blockage due to slime or algae build-up.
 - Separate sampling unit and pretreatment unit ⇒ Fewer parts requiring maintenance
- **Handles up to 6 flow lines**
- **Required sample flow rate: 10 L/min**
- **Low-flow model available**
 - Required sample flow rate: 1 to 2 L/min

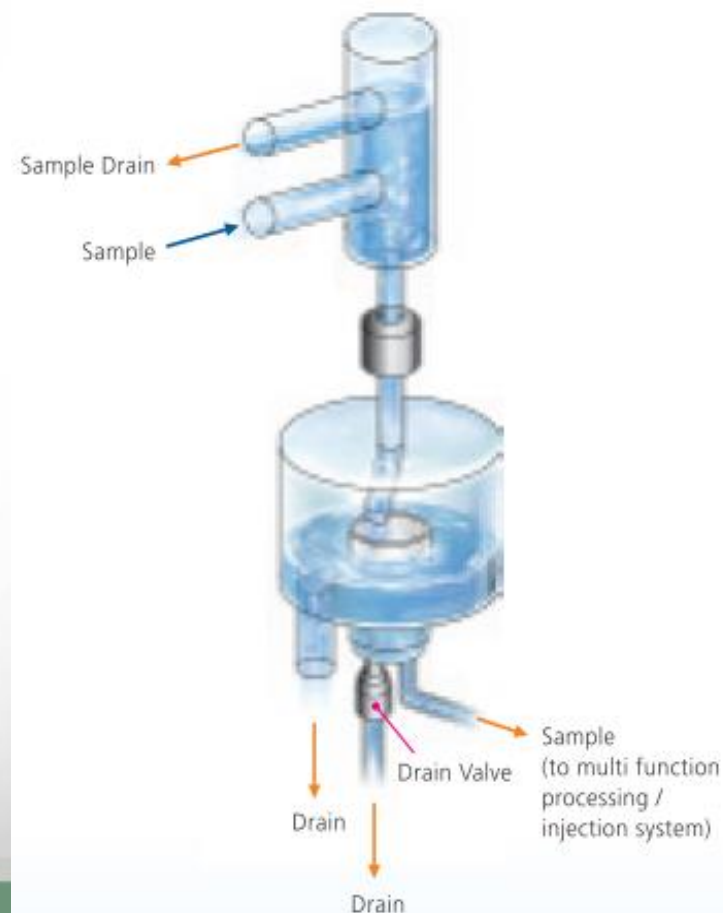


Diverse Applications

Sampling Unit: Multi-Stream Sample Switching Unit



- Support for samples with low suspended solids levels
 - Assuming measurements of purified water, a water sampler is installed to minimize exposure of the sample to air.
- Handles up to 6 flow lines
- Required sample flow rate: 1 to 3 L/min



Diverse Applications

Automatic Dilution Function, High-Salt Sample Combustion Tube Kit

- **Automatic dilution function**

- TOC-4200 offers automatic dilution functions ($\times 2$ to $\times 50\times$) as standard.
- Dilution functions do more than extend the measurement range...
 - When measuring an acid, strong alkaline, or inorganic salt sample that may damage the instrument or consumables, the effect can be alleviated by diluting the sample.
 - TOC-4200 permits automatic dilution measurements, regardless of the measurement range.

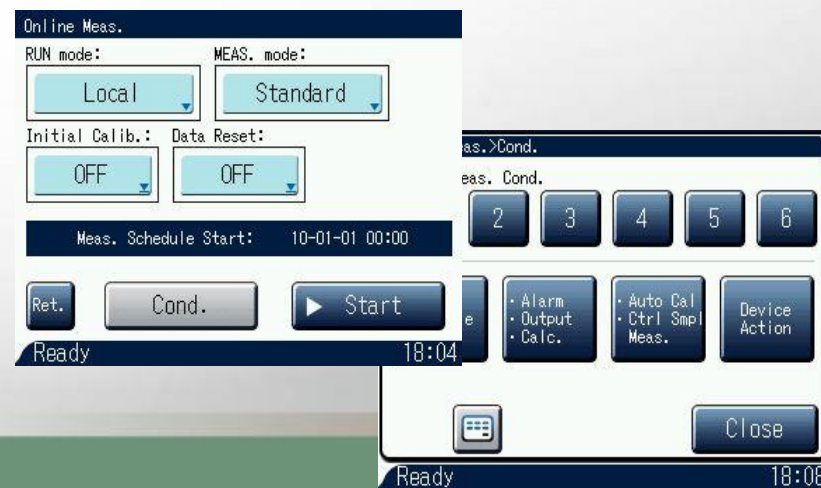
- **Combustion tube kit for salinity samples**

- When measuring samples with high levels of inorganic salt, such as seawater, the inorganic salt can accumulate inside the combustion tube and cause physical blockage or deterioration of the combustion tube. This kit extends the tube-replacement period approximately ten times as compared to a normal combustion tube.

Easy to Use

Color LCD Touch Screen

- Easy operation by color LCD touch screen
 - Intuitive operation
 - Large-button design and pressure-sensitive touch screen permit operation while wearing gloves.
 - The transparent front panel prevents operation when door is closed. Door key and software password offer security.
 - Multi-language support (English, German, Japanese, Chinese)



Easy to Use

Diverse Scheduling Functions

- **Simple schedule setup**

- Simply setting the measured item, range, and measurement period for each flow line makes it easy to enter even complex measurement schedules.

Online Meas.>Cond.>Schedule 2/3

	Stream	Cycle(Min)	Repetition
1	S#1	30	3
2	S#2	15	1
3	S#3	60	2

Cancel Clear Prev Next

Ready 18:11

- **Calendar**

- The calendar simplifies scheduling for automatic calibration, instrument sleep function, control sample measurement, and catalyst regeneration (up to 14 weeks).
- Batch inputs can be made by specifying a day of the week.

Online Meas.>Cond.>Schedule 3/3

Sun	Mon	Tue	Wed	Thu	Fri	Sat	
Fau			Res			Cal	Adv
21	22	23	24 Res	25	26	27 Cal	Aug
28 Fau	29	30	31 Res	1	2 Fau	3 Cal	Sep
4 Fau	5	6	7 Res	8	9	10 Cal	

Cal:Cal. Res:Cat. Reg. Ctrl:Ctrl Smpl Fau:Pause

Cancel Previous Week Next Week Prev OK

Ready 18:16

Easy to Use

Management and Notification of Replacement Periods for Consumables

- **Management of replacement periods for consumables**
 - Management functions for replacement periods of consumables (reagents, etc.)
 - Recommended replacement periods of consumables are evaluated from the operation status.
 - By inputting the actual volumes, reagents can be managed according to the prepared reagent volumes.
- **Notification of replacement periods**
 - When the time to replace a consumable approaches, a pop-up window notifies the operator and gives instructions.
 - Combining the contact outputs and other warning outputs simplifies consumables management.

Maintenance>Counter

	Remaining	Alarm
Dil. Water(mL)	10000	1000
Acid(mL)	2000	200
Std.Sol.1(mL)	500	100

OK

Ready USB 16:31

Inst. Alarm

! Short acid.
Refill the Acid container.

OK

Ready USB 16:50

Low Maintenance, Low Running Costs

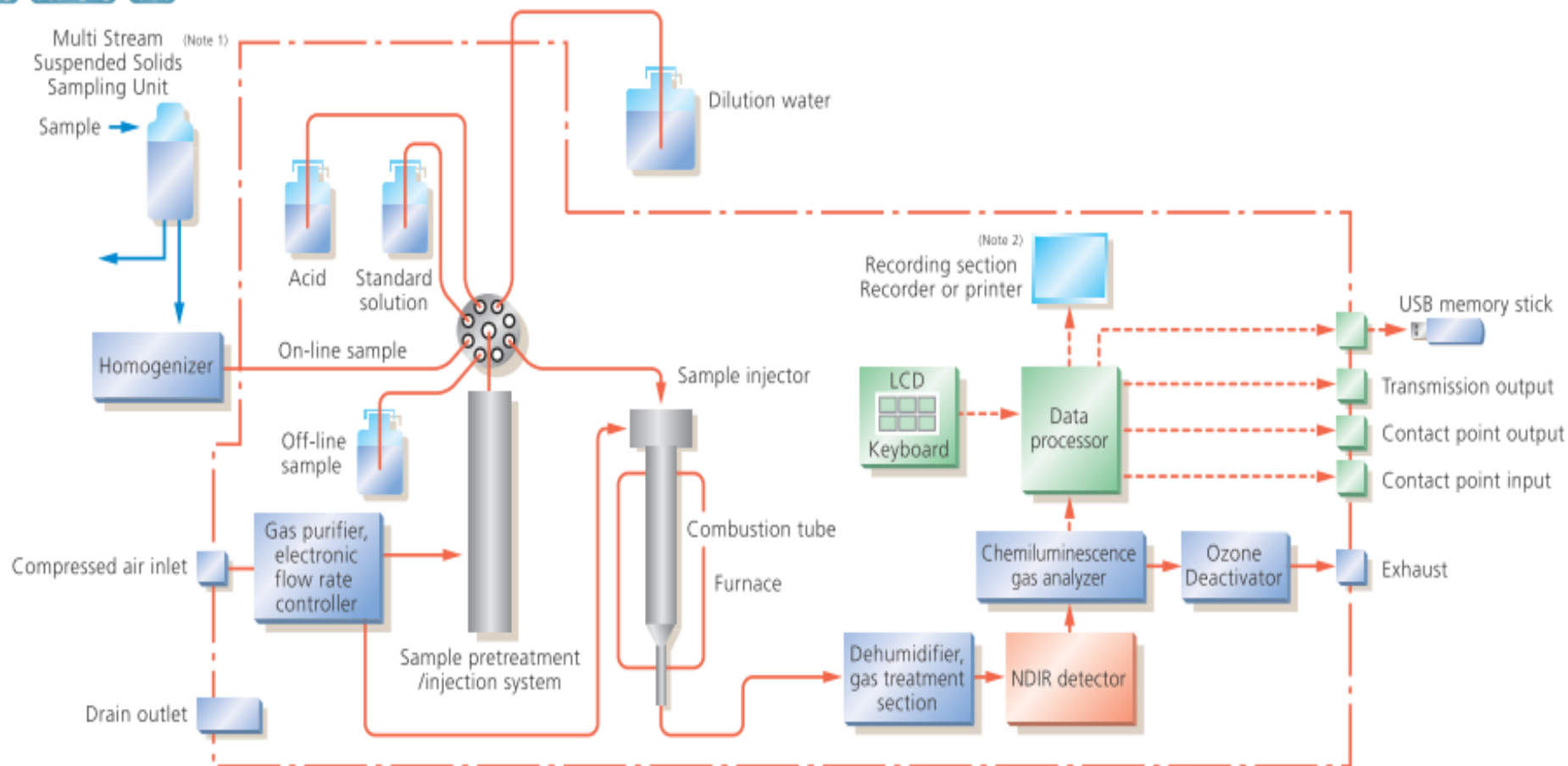
Carrier Gas Purification and Saving Functions

- **Carrier gas purification function as standard**
 - Carrier gas purification function is installed as standard for 24-hour continuous operation by the online TOC analyzer. Purifying instrument or compressor air in a facility to produce carrier gas significantly reduces running costs.
- **N₂ carrier gas kit**
 - Compressed air is normally used as the carrier gas source but high-purity nitrogen gas can also be used as the carrier gas. Convenient when a nitrogen gas centralized pipe is available in a facility (optional).
- **Gas cylinder-adaptation (carrier gas saving function)**
 - A gas cylinder (high-purity air) can be used in facilities where no instrument air pipes or compressor are available.
 - The carrier gas-saving function is provided because using gas from a cylinder increases the running costs. (Carrier gas can be saved more efficiently as the measurement interval increases.)
 - Using the carrier gas-saving function in combination with the normal carrier gas purification function reduces the frequency of compressor maintenance.

Low Maintenance, Low Running Costs

TOC-4200 Flow Diagram

TC NPOC TN



Comprehensive Conventional Communications Functions

Contact I/O, Analog I/O

- **Contact output**

- 10 channels standard. Expand to 36 channels.
- Supported events are programmable.

- **Contact input**

- Supports standard single flow line measurements.
- Expansion 1 supports measurements with contact control up to 3 flow lines.
- Expansion 2 supports measurements with contact control up to 6 flow lines.
- Supported events are fixed.

- **Analog output**

- 2 channels standard. Expandable in 2-channel increments to 12 channels max.
- Select 4–20 mA or 0–16 mA output.

- **Analog input**

- Supports 3 flow lines max. (optional).
- Dedicated flow inputs (for load calculations).

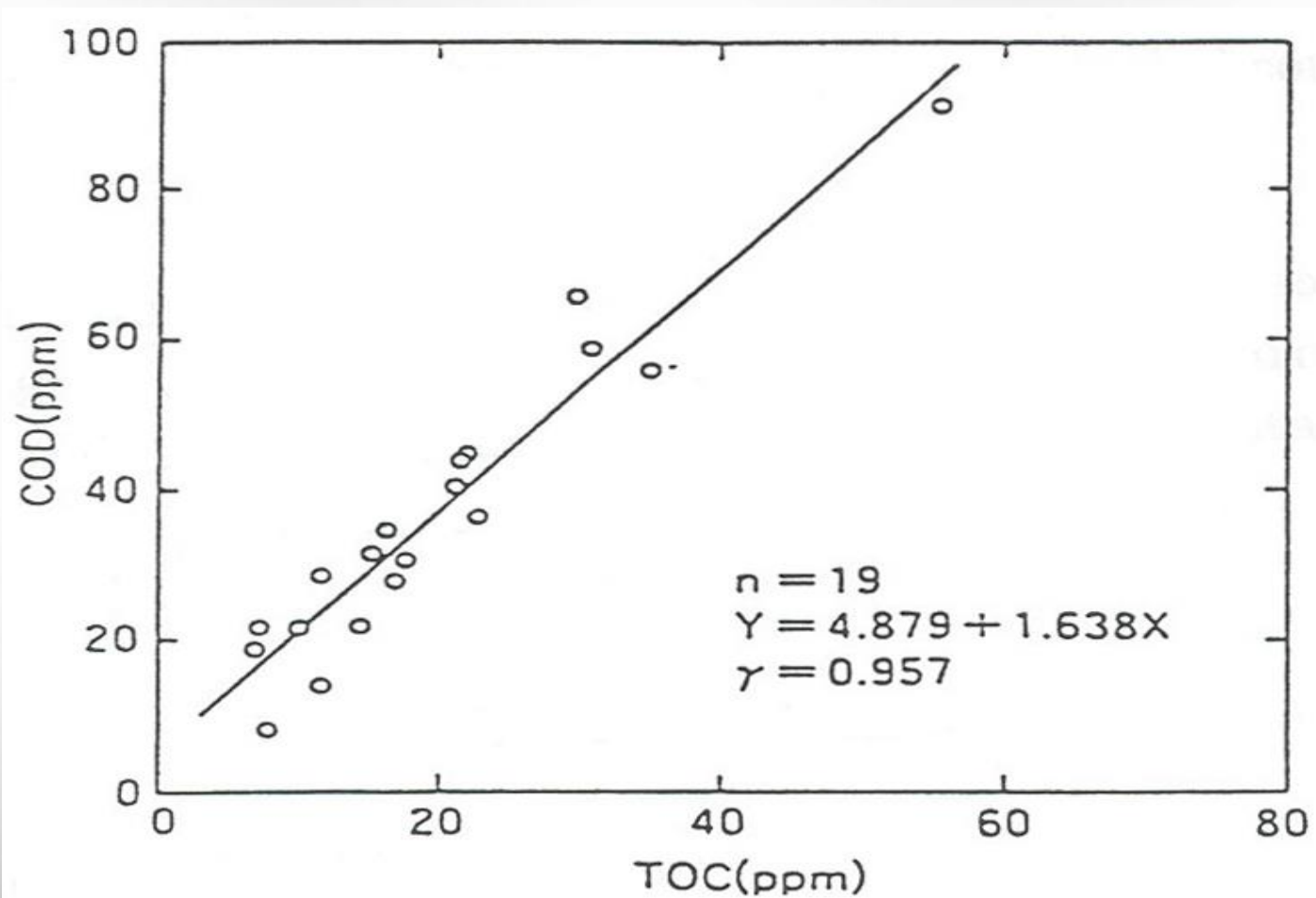


Enhanced Data Handling

Powerful Data Storage and USB Memory

- Internal memory can hold:
 - (1) 20,000 measured values
(approx. one year's data at a 30-minute measuring cycle)
 - (2) History of 100 calibrations (weekly calibration over approx. two years)
 - (3) History of 100 alarms
- Saved data can be output to USB memory
 - Data saved to USB memory in CSV format
 - Use PC spreadsheet software to edit the data or to generate reports.





Site reference (1)

Company	Parameter	Method	Location
AISIN THAI AUTOMOTIVE CASTING CO.,LTD.	COD/BOD	TOC AND UV	PRACHINBURI
BLCF POWER PLANT	COD/BOD	UV	RAYONG
BLCF POWER PLANT	COD/BOD	TOC	RAYONG
TENMA PAPER CO.,LTD	COD/BOD	UV	PATHUMTANI
DOW CHEMICAL	COD (3 SETS)	TOC	RAYONG
THAI POLYCARBONATE CO.,LTD	COD	TOC	RAYONG
TOSTEM THAI CO.,LTD	COD (2 SETS)	UV	PATHUMTANI
บ. ผลิตภัณฑ์พลาสติกไทย จก.	COD	UV	PATHUMTANI
โรงงานอุตสาหกรรมกระดาษบางปะอิน	COD	UV	AYUTTAYA
THAI POLYACETAL CO.,LTD.	COD (2 SETS)	TOC	RAYONG

Site reference (2)

Company	Parameter	Method	Location
YAKULT	BOD	UV	BANGKOK
YAKULT	BOD	UV	AYUTTAYA
PURAC(THAILAND)CO.,LTD	COD	TOC	RAYONG
THAI TINPLATE CO.,LTD	COD	UV	SAMUTPRAKARN
PHOENIX PULP AND PAPER	COD	UV	KHONKHAEN
PANASONIC (THAILAND) CO.,LTD	COD	UV	KHONKHAEN
Cho Heng Rice Vermicelli Factory Co.,Ltd.	COD/BOD	TOC	NAKHONPATHOM
BAYER PREMIER CO.,LTD.	COD (6 SETS)	TOC	RAYONG
DISIN (THAILAND) CO.,LTD	COD	UV	KHONKHAEN
MC TOWA SWEETENER CO.,LTD.	COD (2 SETS)	TOC	RAYONG

Site reference (3)

Company	Parameter	Method	Location
NISSAN AUTOMOBILE	TOC	COD (2 SETS)	SAMUTPRAKARN
NISSAN MOTOR	UV	COD (4 SETS)	SAMUTPRAKARN
THAI NOK CO.,LTD	TOC	COD	CHONBURI
PURAC (THAILAND) CO.,LTD	TOC	COD (2 SETS)	RAYONG
TOYOTA MOTOR (THAILAND) CO.,LTD	TOC	COD	SAMUTPRAKARN
TOYOTA MOTOR (THAILAND) CO.,LTD	UV	COD/ BOD	BANPHO
TOYOTA MOTOR (THAILAND) CO.,LTD	TOC	COD	BANPHO
TOYOTA MOTOR (THAILAND) CO.,LTD	TOC	COD (3 SETS)	GATEWAY
SINGHA BEER	UV	COD	NAKHONPATHOM
SINGHA BEER	TOC (PROCESS)	COD	NAKHONPATHOM

Site reference (4)

Company	Parameter	Method	Location
DENSO (THAILAND) CO.,LTD.	COD	TOC	CHONBURI
THAI TORAY SYNTHETICS CO.,LTD.	COD (2 SETS)	TOC	BANGKOK
POSCO THAINOX STAINLESS CO.,LTD.	COD (2 SETS)	TOC	RAYONG
THAI HONDA (LADKABANG)	COD	UV	BANGKOK
ISUZU MOTORS (THAILAND) CO.,LTD.	COD	TOC	SAMUTPRAKARN
THAI MMA CO.,LTD.	COD	TOC	RAYONG
PROSPER FOODS CO.,LTD.	BOD	UV	PRACHUABKHIRIKHAN
MANDARIN SPINNING CO.,LTD.	COD	UV	NONTABURI
THAI TAFFITA CO.,LTD	COD	UV	RAYONG
TUNTEX TEXTILE CO.,LTD.	COD	TOC	RAYONG
HOYA LENS	COD	UV	LAOS

Site reference (5)

Company	Parameter	Method	Location
SIAM MITSUI PTA CO.,LTD.	COD (2 SETS)	TOC	RAYONG
THAI PAPER MILL CO.,LTD.	COD/ BOD	UV	RAYONG
THAI FOOD CO.,LTD.	COD/ BOD	UV	SUPHANBURI
PTT CHEMICAL CO.,LTD.	COD	TOC	RAYONG
JFE STEEL GAVANITE CO.,LTD.	COD	UV	RAYONG
THAI RAYON PUBLIC CO.,LTD.	COD	UV	ANG THONG
YAN WAL YUN CO.,LTD.	COD	TOC	SAMUTSAKORN
PTT (R&D) - WANGNOI	COD/ BOD	TOC	AYUTTHAYA
ASIA SILICONES MONOMER CO.,LTD.	COD (2 SETS)	TOC	RAYONG
NIPPON STEEL GAVANIZE CO.,LTD.	COD	UV	RAYONG

Site reference (6)

Company	Parameter	Method	Location
SIAM MITSUI PTA CO.,LTD.	COD (2 SETS)	TOC	RAYONG
THAI PAPER MILL CO.,LTD.	COD/ BOD	UV	RAYONG
THAI FOOD CO.,LTD.	COD/ BOD	UV	SUPHANBURI
PTT CHEMICAL CO.,LTD.	COD	TOC	RAYONG
JFE STEEL GAVANITE CO.,LTD.	COD	UV	RAYONG
THAI RAYON PUBLIC CO.,LTD.	COD	UV	ANG THONG
YAN WAL YUN CO.,LTD.	COD	TOC	SAMUTSAKORN
PTT (R&D) - WANGNOI	COD/ BOD	TOC	AYUTTHAYA
ASIA SILICONES MONOMER CO.,LTD.	COD (2 SETS)	TOC	RAYONG
NIPPON STEEL GAVANIZE CO.,LTD.	COD	UV	RAYONG