Celltac α

Automated Hematology Analyzer

MEK-6400/MEK-6410/MEK-6420

MEK-6400C MEK-6410C MEK-6420C
MEK-6400J MEK-6410J MEK-6420J
MEK-6400K MEK-6410K MEK-6420K

If you have any comments or suggestions
on this manual, please contact us at:
www.nihonkohden.com

0634-900086B

Contents

GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel.
Use only Nihon Kohden approved products with this device. Use of non-approved products or in a non-approved manner may affect the performance specifications of the device. This includes, but is not limited to, batteries, recording paper, pens, extension cables, electrode leads, input boxes and AC power.

Please read these precautions thoroughly before attempting to operate the instrument.

1. **To safely and effectively use the instrument, its operation must be fully understood.**

2. **When installing or storing the instrument, take the following precautions:**
   (1) Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and dust, saline or sulphuric air.
   (2) Place the instrument on an even, level floor. Avoid vibration and mechanical shock, even during transport.
   (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
   (4) The power line source to be applied to the instrument must correspond in frequency and voltage to product specifications, and have sufficient current capacity.
   (5) Choose a room where a proper grounding facility is available.

3. **Before Operation**
   (1) Check that the instrument is in perfect operating order.
   (2) Check that the instrument is grounded properly.
   (3) Check that all cords are connected properly.
   (4) Pay extra attention when the instrument is in combination with other instruments to avoid misdiagnosis or other problems.
   (5) All circuitry used for direct patient connection must be doubly checked.
   (6) Check that battery level is acceptable and battery condition is good when using battery-operated models.

4. **During Operation**
   (1) Both the instrument and the patient must receive continual, careful attention.
   (2) Turn power off or remove electrodes and/or transducers when necessary to assure the patient's safety.
   (3) Avoid direct contact between the instrument housing and the patient.

5. **To Shutdown After Use**
   (1) Turn power off with all controls returned to their original positions.
   (2) Remove the cords gently; do not use force to remove them.
   (3) Clean the instrument together with all accessories for their next use.

6. **The instrument must receive expert, professional attention for maintenance and repairs. When the instrument is not functioning properly, it should be clearly marked to avoid operation while it is out of order.**

7. **The instrument must not be altered or modified in any way.**

8. **Maintenance and Inspection**
   (1) The instrument and parts must undergo regular maintenance inspection at least every 6 months.
   (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.

9. **When the instrument is used with an electrosurgical instrument, pay careful attention to the application and/or location of electrodes and/or transducers to avoid possible burn to the patient.**

10. **When the instrument is used with a defibrillator, make sure that the instrument is protected against defibrillator discharge. If not, remove patient cables and/or transducers from the instrument to avoid possible damage.**

WARRANTY POLICY

Nihon Kohden Corporation (NKC) shall warrant its products against all defects in materials and workmanship for one year from the date of delivery. However, consumable materials such as recording paper, ink, stylus and battery are excluded from the warranty.

NKC or its authorized agents will repair or replace any products which prove to be defective during the warranty period, provided these products are used as prescribed by the operating instructions given in the operator's and service manuals.

No other party is authorized to make any warranty or assume liability for NKC's products. NKC will not recognize any other warranty, either implied or in writing. In addition, service, technical modification or any other product change performed by someone other than NKC or its authorized agents without prior consent of NKC may be cause for voiding this warranty.

Defective products or parts must be returned to NKC or its authorized agents, along with an explanation of the failure. Shipping costs must be pre-paid.

This warranty does not apply to products that have been modified, disassembled, reinstalled or repaired without Nihon Kohden approval or which have been subjected to neglect or accident, damage due to accident, fire, lightning, vandalism, water or other casualty, improper installation or application, or on which the original identification marks have been removed.

In the USA and Canada other warranty policies may apply.

RESPONSIBILITIES – PROFESSIONAL USERS

This instrument must be used by a professional user with a full knowledge of operating this instrument, only for his/her intended use and according to the instructions for use. Instructions in the operator's manual must be followed, especially the following points.

- Storage and stability of reagents
- Handling of reagents
- Instrument installation
- Connection of all tubes to inlets and outlets
- Connection of all tubes to reagents and waste container
- Checking the amount of reagents and waste fluid
- Calibration
- Quality control
- Maintaining and servicing

If deviating from the instructions, the professional user does it at the risk and liability of the laboratory and only after validation by the laboratory. Nihon Kohden has no responsibility over such deviations.

EMC RELATED CAUTION

This equipment and/or system complies with the International Standard EN61326-1 for electromagnetic compatibility for electrical equipment and/or system for measurement, control and laboratory use. However, an electromagnetic environment that exceeds the limits or levels stipulated in the EN61326-1, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.

The following describes some common interference sources and remedial actions:

1. **Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:**
   Install the equipment and/or system at another location if it is interfered with by an emitter source such as an authorized radio station. Keep the emitter source such as cellular phone away from the equipment and/or system.

2. **Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:**
   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

3. **Effect of direct or indirect electrostatic discharge:**
   Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.

4. **Electromagnetic interference with any radio wave receiver such as radio or television:**
   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

If the above suggested remedial actions do not solve the problem, consult your Nihon Kohden Corporation subsidiary or distributor for additional suggestions.

This equipment complies with International Standard EN55011 (1999) Group 1, Class B. Class B EQUIPMENT is equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

The CE mark is a protected conformity mark of the European Community. The products herewith comply with the requirements of the IVD Directive 98/79/EEC.

NOTE about Waste Electrical and Electronic Equipment (WEEE) directive 2002/96/EEC
For the member states of the European Union only:
The purpose of WEEE directive 2002/96/EEC is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste.
Contact your Nihon Kohden representative for disposal at the end of its working life.

Conventions Used in this Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

WARNING

A warning alerts the user to the possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.

NOTE

A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

This page is intentionally left blank.

Section 1 General

Introduction

CAUTION

To maintain the instrument in normal condition, the user must perform the periodic maintenance. Refer to "Maintenance" of the operator's manual.

This service manual provides useful information to qualified service personnel to understand, troubleshoot, service, maintain and repair the MEK-6400/6410/6420 Automated Hematology Analyzer (referred to as "the instrument" in this service manual).

The maintenance must be periodically performed because the instrument has fluid paths and precision parts. Accordingly, the user is responsible for performing the periodic maintenance. The "Maintenance" section in this service manual describes the maintenance that should be performed by qualified service personnel. The "Maintenance" section in the operator's manual describes the maintenance that can be performed by the user.

NOTE

If the instrument has a problem and there has been no periodic maintenance, the instrument will usually be normal again by cleaning the fluid paths or replacing a consumable with a new one.

The information in the operator's manual is primarily for the user. However, it is important for service personnel to thoroughly read the operator's manual and service manual before starting to troubleshoot, service, maintain or repair this instrument. This is because service personnel needs to understand the operation of the instrument in order to effectively use the information in the service manual.

For simplicity, the suffix C/J/K will be omitted in this manual. There is no difference in operation and servicing among models with different suffixes unless otherwise specified.

Service Policy

CAUTION

- **Be careful not to directly touch any place where blood is or may spread to.**
- **Wear rubber gloves to protect yourself from infection before doing maintenance.**

Nihon Kohden Corporation's basic policy for technical service is to replace faulty units, printed circuit boards or parts. We do not support component-level repair of boards and units outside the factory.

NOTE

- **When ordering parts or accessories from your nearest Nihon Kohden Corporation's representative, please quote the NK code number and part name which is listed in this service manual, and the name or model of the unit in which the required part is located. This will help us to promptly attend to your needs.**
- **Always use parts and accessories recommended or supplied by Nihon Kohden Corporation to assure maximum performance from your instrument.**

Specifications

Measured Parameters, Ranges and Reproducibility to Specimen from Venous Blood

Specifications except WBC population were determined using hematology control blood (MEK-3DN), counted 10 times consecutively.

Measured Parameters	Measuring Range	Reproducibility to Specimen from Venous Blood (CV: Coefficient of Variation)
WBC: White blood cell count	MEK-6400/6410: 0 to 59 × 10^3/μL* MEK-6420: 0 to 99 × 10^3/μL	within 2.0%CV (4.0 to 9.0 × 10^3/μL)
LY%: Lymphocyte percent	0 to 99.9%	within 5.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, LY%: 20 to 45%)
MO%: Monocyte percent	0 to 99.9%	within 12.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, MO%: 2 to 10%)
GR%: Granulocyte percent	0 to 99.9%	within 5.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, GR%: 40 to 70%)
LY: Lymphocyte count	MEK-6400/6410: 0 to 59 × 10^3/μL* MEK-6420: 0 to 99 × 10^3/μL	
MO: Monocyte count	MEK-6400/6410: 0 to 59 × 10^3/μL* MEK-6420: 0 to 99 × 10^3/μL	
GR: Granulocyte count	MEK-6400/6410: 0 to 59 × 10^3/μL* MEK-6420: 0 to 99 × 10^3/μL	
RBC: Red blood cell count	0 to 14.9 × 10^6/μL	within 1.5%CV (5.0 × 10^6/μL)
HGB: Hemoglobin concentration	0 to 29.9 g/dL	within 1.5%CV (16 g/dL)
HCT: Hematocrit	0 to 99.9%	
MCV: Mean cell volume	20 to 199 fL	within 1.0%CV (70 to 120 fL)
MCH: Mean cell hemoglobin	10 to 50 pg	
MCHC: Mean cell hemoglobin concentration	10 to 50 g/dL	
RDW: Red blood cell distribution width	0 to 50%	
PLT: Platelet count	0 to 1490 × 10^3/μL	within 4.0%CV (3.0 × 10^3/μL)
PCT: Platelet crit	0 to 2.9%	
MPV: Mean platelet volume	0 to 20.0 fL	
PDW: Platelet distribution width	0 to 50%	

* In panic value recount: 0 to 599 × 10^3/μL (MEK-6400, MEK-6410 only)

Standardization Analysis Method

WBC: ICSH1988 — ICSH: The assignment of values to fresh blood used for calibrating automated blood cell counters. Clin Lab Haematol, 10:203-212, 1988

RBC: ICSH1988 — ICSH: The assignment of values to fresh blood used for calibrating automated blood cell counters. Clin Lab Haematol, 10:203-212, 1988

HGB: NCCLS H15-A2 — H15-A2: Reference and Selected Procedures for the Quantitative Determination of Hemoglobin in Blood Second Edition; Approved Standard (1994)

HCT: NCCLS H7-A2 — H7-A2: Procedure for Determining Packed Cell Volume by the Microhematocrit Method Second Edition; Approved Standard (1993)

PLT: Brecher & Cronkite Method: Morphology and enumeration of human blood platelets, J Appl Physiol 3 365 (Dec) 1950; Brecher G, Cronkite EP

Detection Method

Blood cell count:	Electrical resistance detection
Hemoglobin:	Surfactant method (colorimetric method)
Hematocrit:	Histogram calculation
WBC population:	Histogram calculation
Platelet crit:	Histogram calculation
RBC distribution width:	Histogram calculation
Platelet distribution width:	Histogram calculation

Dilution Ratio

- Venous blood

Sample volume:	30 µL in normal dilution mode, about 50 µL in low dilution mode, 10 µL in high dilution mode, 5 µL in higher dilution mode (low and higher dilution modes are not available on the MEK-6420 analyzer)
WBC/HGB:	200:1 (in normal dilution mode)
RBC/PLT:	40,000:1 (in normal dilution mode)

- Pre-dilution blood

Sample volume:	10 µL	20 µL
WBC/HGB:	1200:1	600:1
RBC/PLT:	240,000:1	120,000:1

Counting Time

Closed mode:	about 90 s/sample (from measurement start to data display, MEK-6400 only)
Open mode:	about 60 s/sample (from measurement start to data display)

Display

Display:	5.7 inch, color LCD with backlight and touch screen keys
Resolution:	240 × 320 dots
Screen size:	approx. 86 × 115 mm
Display contents:	Numerical data, histograms, measuring conditions, alarm message and other messages, touch screen keys

Data Storage

Numerical data for all counted parameters for up to 400 samples and histograms for up to 50 samples

Environmental Conditions

Storage temperature:	–20 to 60°C
Operating temperature:	15 to 30°C
Storage humidity:	10 to 95%
Operating humidity:	30 to 85% (Non-condensing)
Storage atmospheric pressure:	70 to 106 kPa
Operating atmospheric pressure:	70 to 106 kPa
Operating altitude:	less than 3000 m

Power Requirements

Power requirements:	MEK-6400J, 6410J, 6420J:	110 to 127 V ±10% AC, 50/60 Hz
	MEK-6400C/K, 6410C/K, 6420C/K:	220 to 240 V ±10% AC, 50/60 Hz
Power consumption:	less than120 VA	

Dimensions and Weight

Dimensions: 230 W × 450 D × 383 H (mm)
Net weight: approx. 18 kg

Electromagnetic Compatibility

IEC 61326-1 Edition 1.0: 2002 (Annex A)
EN 61326: 1997/ Amendment 3: 2003

CISPR11 Edition 4.1: 2004, Group 1, Class B
EN 55011: 1998 Amendment 1: 1999, Group 1, Class B

The power supply short interruption test is performed through the transformer which has at least three times the power capacity as the instrument.

Safety

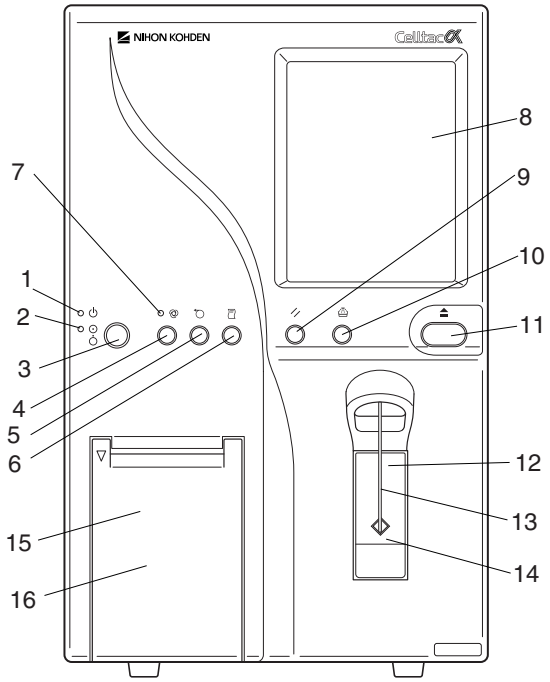
Safety standards: IEC 61010-1 Edition 2.0: 2001
EN 61010-1: 2001
IEC 61010-2-101: 2002
EN 61010-2-101: 2002
IEC 61010-2-081: 2002
EN 61010-2-081: 2002

According to the type of protection against electrical shock: CLASS I EQUIPMENT
According to the degree of protection against harmful ingress of water: IPX0 (Ordinary EQUIPMENT)
According to the degree of safety of application in the presence of a FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE: EQUIPMENT not suitable for use in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE
According to the mode of operation: CONTINUOUS OPERATION
EQUIPMENT types (classification): Indoor stationary EQUIPMENT
Pollution Degree: 2 EQUIPMENT

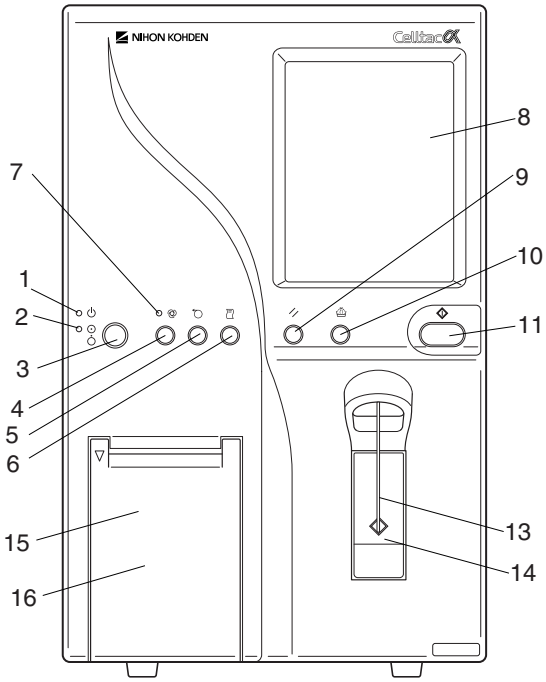
Requirements for marking of IN VITRO DIAGNOSTIC instruments: EN1658: 1996

Panel Description

Front Panel



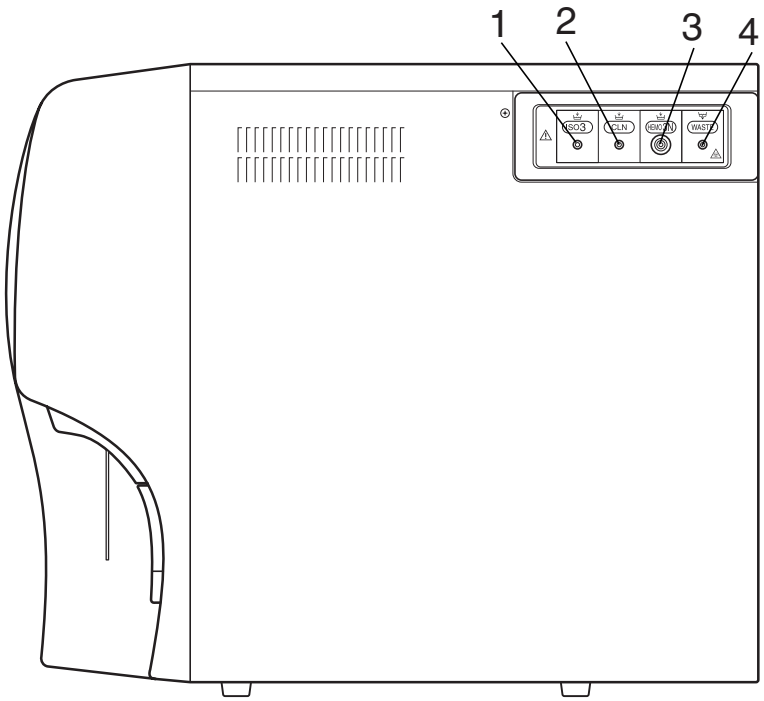
MEK-6400



MEK-6410/6420

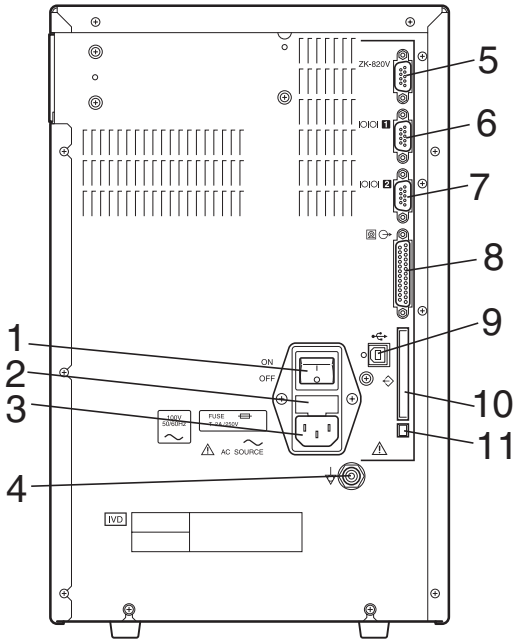
No.	Name	Description
1	Main power lamp	Lights when the [Main power] switch on the rear panel is tuned on.
2	Power lamp	Lights when the [Main power] switch on the rear panel and [Power] key on the front panel are turned on.
3	Power key	Turns the analyzer power on or off when the [Main power] switch on the rear panel is turned on. When the power is turned on, priming and self-check are automatically performed, and the READY screen appears.
4	Auto print key	Switches the printing mode between automatic and manual for the printer.
5	Feed key	Feeds paper of the printer while held down.
6	Print key	Prints displayed data on the printer.
7	Auto print mode lamp	Lights when automatic printing mode is selected.
8	LCD display	Displays various messages, measured data and touch screen keys.
9	Reset key	Stops operation when pressed during operation. Returns to the READY screen when pressed while changing settings. Use this key only when an error occurs.
10	Clean key	Cleans the fluid path, aperture and manometer with detergent. Automatically primes after cleaning the fluid path. Press this key when clogging occurs, the manometer becomes dirty or bubbles occur in the manometer.
11	Eject key	For closed mode only. Opens the tube holder to set the sample tube. (MEK-6400)
	Count key	Aspirates the sample and starts counting when <[Eject] key operation> is set to “Count” on the OPERATION screen of the SETTINGS screen. (MEK-6410, MEK-6420)
	Dispense key	Dispenses the diluent in pre-dilution blood mode when <[Eject] key operation > is set to “Dispense” on the OPERATION screen of the SETTINGS screen. (MEK-6410, MEK-6420)
12	Tube holder	For closed mode only. Holds a sealed vacuum blood collecting tube. Press the [Eject] key to open. After measurement, the holder automatically opens. (MEK-6400)
13	Sampling nozzle	Aspirates the sample. Dispenses the diluent when in the pre-dilution blood mode. (On MEK-6400, for open mode only)
14	Count switch	Aspirates the sample and starts counting.
15	Printer unit (WA-640VK)	Thermal array printer. Prints out measured data and sample ID no. (optional)
16	Printer door	For the recording paper of the WA-640VK printer unit. To open, pull the upper left corner (optional).

Right Side Panel



No.	Name	Description
1	ISO3 Diluent inlet	Inlet for the ISOTONAC•3 diluent.
2	CLN Detergent inlet	Inlet for the CLEANAC detergent.
3	HEMO3N Hemolysing reagent inlet	Inlet for the Hemolynac•3N hemolysing reagent.
4	WASTE Waste outlet	Outlet for waste such as used lyse, detergent and aspirated samples.

Rear Panel

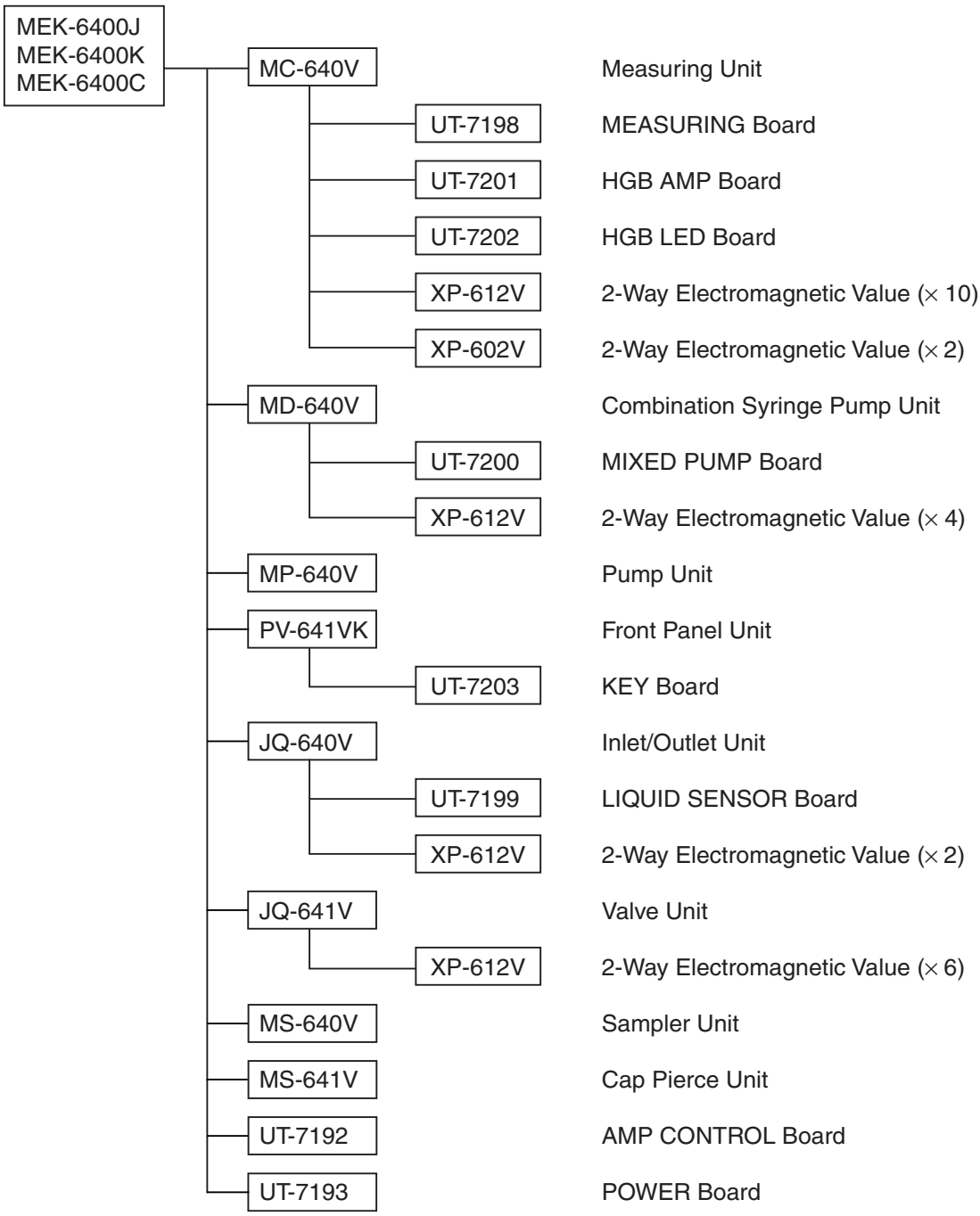


No.	Name	Description
1	Main power switch	Supplies the power to the analyzer when it is turned on. Under normal conditions keep this switch turned on.
2	Fuse holder	Contains the time lag fuse. To replace the fuse, contact your Nihon Kohden representative.
3	AC SOURCE AC source socket	Connects the AC power cord to supply AC power to the analyzer.
4	Equipotential ground terminal	Connects the ground lead to the equipotential ground terminal on the wall for earth grounding.
5	ZK-820V Bar code reader socket	Connects to the optional hand-held bar code reader. Supplies the power to the bar code reader when connected. Power supply voltage: 5 V DC (pin 9: 5 V, pin 5: GND) Rated current: 200 mA
6	Serial port 1	Connects to the optional WA-460V/461V card printer or PC.
7	Serial port 2	Connects to the optional WA-460V/461V card printer or PC.
8	Printer socket	Connects to an external printer (WA-710V/712V or other).
9	USB socket	Connects to a PC. The optional Data Management Software needs to be installed on the PC to receive data from the analyzer.
10	Memory card socket	Insert a memory card when you upgrade the software.
11	Memory card eject button	Press this button when you eject a memory card.

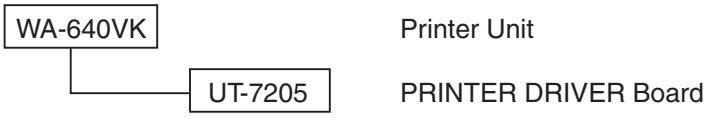
Composition

MEK-6400

Standard

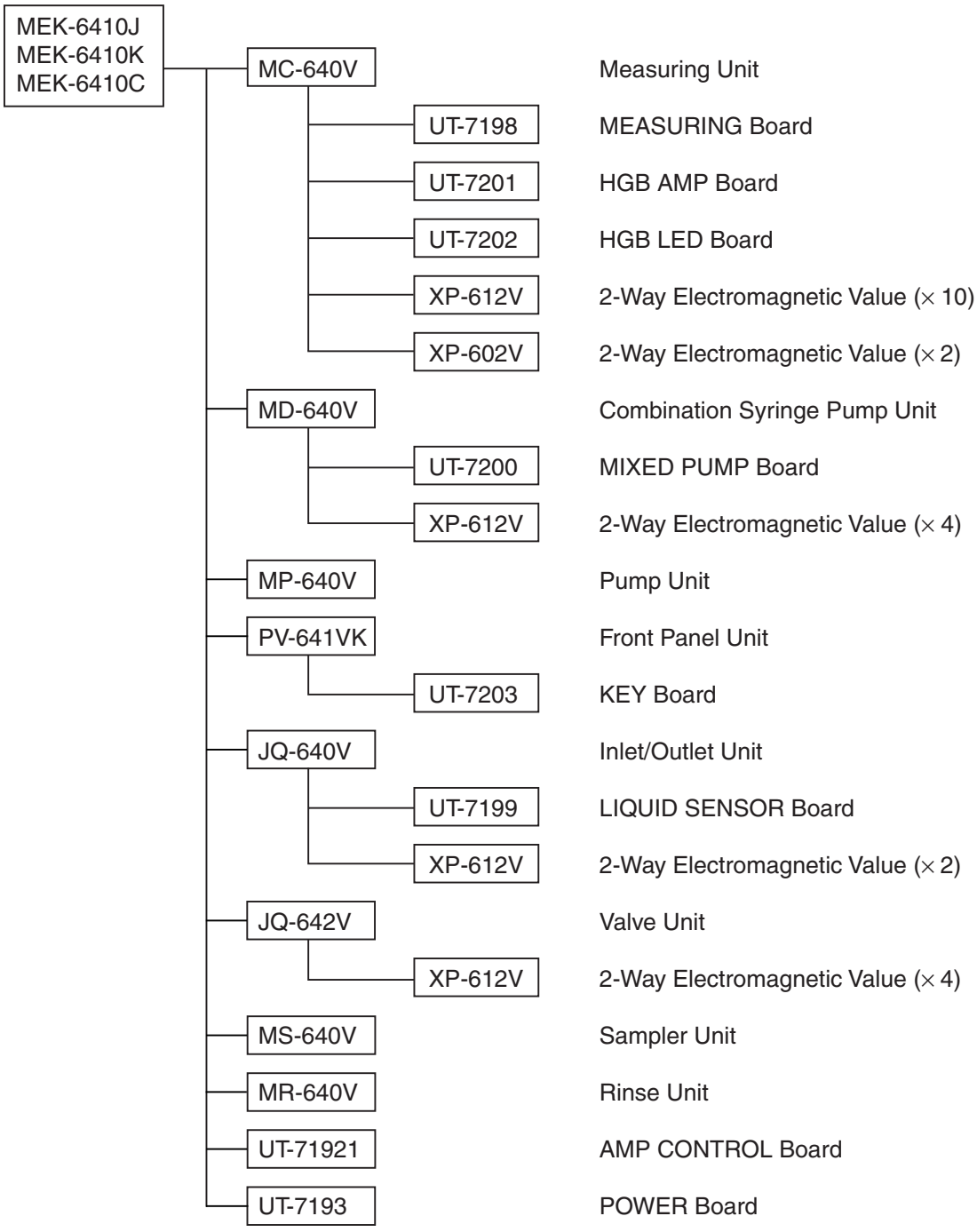


Option

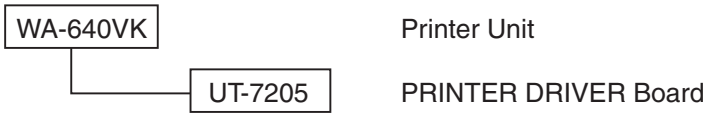


MEK-6410

Standard

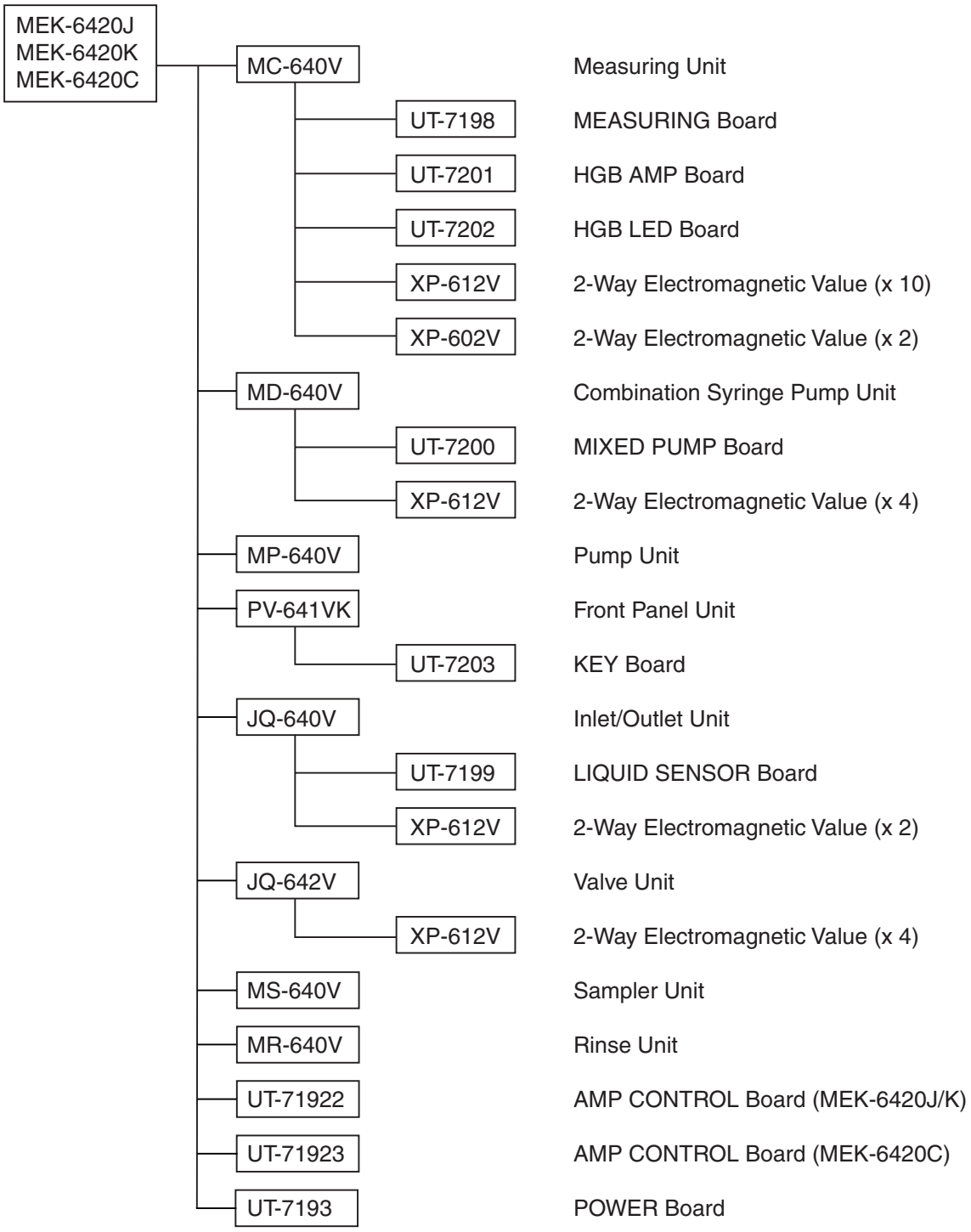


Option

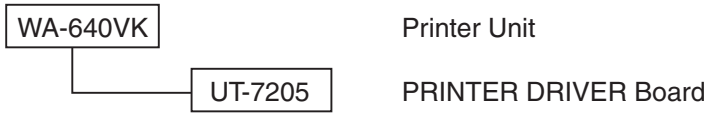


MEK-6420

Standard



Option



Interference Substances

WBC: **High WBC**

When WBC count is outside the measurable range, measure the sample in high dilution mode. If the WBC count is still outside the range, dilute the sample further.

Nucleated erythrocyte

Nucleated erythrocyte is detected as WBC and causes increase in WBC count.

Unlysed red cells

In some rare occasions, the RBC in the blood sample may not completely lyse and these non-lysed RBC may be detected as WBC and cause increase in WBC count.

Multiple myeloma

The precipitation of proteins in multiple myeloma patients may increase the WBC count.

Leukemia

WBC is fragile in leukemia patients and WBC may be destroyed during measurement. These WBC fragments may also interfere with WBC differential measurement.

Chemotherapy

Cytotoxic and immunosuppressive drugs cause low WBC count.

Cryoglobulins

Cryoglobulin may be increased in patients who are pregnant or have myeloma, cancer, leukemia, macroglobulinemia, lymphoproliferative disorders, metastatic tumors, autoimmune disorders, infections, aneurysm, thromboembolic phenomena, diabetes, etc, which cause increase in WBC, RBC or PLT counts and HGB concentration. In such cases, warm the blood sample to 37°C in a water bath for 30 minutes and measure the sample immediately.

RBC: **Leukemia**

An increase in WBC in leukemia patient causes increase in RBC.

Agglutinated RBC

Agglutinated RBC may decrease RBC count. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Cold agglutinins

IgM immunoglobulins which are elevated in clod agglutinin disease may decrease RBC and PLT counts and increase MCV.

Hemolysis

When RBC is hemolyzed, RBC is decreased.

HGB: **Turbidity of the blood sample**

Any physiologic and/or therapeutic factors may increase HGB. In such a case, determine the cause of turbidity and follow the appropriate method below.

1. Increased WBC
   An extreme increase in WBC causes excessive light scatter. In these cases, measure manually. Centrifuge the diluted sample and measure the supernatant fluid with a spectrophotometer.
2. Increased lipids
   The blood sample may be milky when there is excessive lipids. This may occur with hyperlipidemia, hyperproteinemia and hyperbilirubinemia. Accurate HGB measurement can be achieved by manual methods and a plasma blank.
3. Increased turbidity
   When RBC are resistant to lysing, turbidity may increase causing increase in HGB. Observe if MCH and MCHC values are abnormal. HGB result affects MCH and MCHC result.
4. Fetal bloods
   The mixing of fetal and maternal blood may increase HGB value.

5. High WBC levels
   Turbidity of blood increases and the hemoglobin concentration becomes high if WBC level of the blood sample is high. MCH and MCHC levels also become high.

HCT: **Agglutinated RBC**
RBC agglutination may cause erroneous HCT and MCV values. Observe if MCH and MCHC values are abnormal. In such a case, measure manually.

MCV: **Agglutinated RBC**
RBC agglutination may cause erroneous HCT and MCV values. Observe if MCH and MCHC values are abnormal. In such a case, measure manually.

Excessive number of large PLT
Excessive number of large PLT and/or excessively high WBC may affect the MCV value. Check by careful examination of the stained blood film.

MCH: MCH is determined from HGB and RBC values. Therefore, the limitations for HGB and RBC also affect MCH value.

MCHC: MCHC is determined from HGB and HCT values. Therefore, the limitations for HGB and HCT also affect MCHC value.

RDW: RDW is determined from RBC value. Therefore, the limitations for RBC also affect RDW value.

Agglutinated RBC
Agglutinated RBC may decrease RBC count and erroneous RDW. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Nutritional deficiency or blood transfusion
Iron and/or cobalamin and/or folate deficiency may increase RDW.

PLT: **Very small fragments**
Very small RBC, RBC fragments and WBC fragments may be the cause in increased PLT count.

Agglutinated RBC
PLT may be trapped in the agglutinated RBC resulting in decrease in PLT. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Very large PLT
Large PLT may exceed the PLT threshold and might not be counted which results in low PLT count.

Chemotherapy
Cytotoxic and immunosuppressive drugs may increase the fragility of cells which may cause low PLT count. In such a case, measure manually.

Hemolysis
Hemolyzed specimens contain red cell stroma which may increase PLT count.

Anticoagulated blood
Blood anticoagulated with acid-citrate-dextrose may have clumped PLT which may cause decrease in PLT count.

Agglutinated PLT
Clumped PLT may decrease PLT count and/or increase WBC count. For such sample, collect the sample in sodium citrate anticoagulant and measure only PLT. The PLT result must be corrected for the sodium citrate dilution effect.

MPV: **Very large PLT**
Large PLT may exceed the PLT threshold and not be counted which results in low MPV.

Very small fragments
Very small RBC, RBC fragments and WBC fragments may interfere with MPV measurement.

Agglutinated RBC
PLT may be trapped in the agglutinated RBC resulting in erroneous MPV. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Chemotherapy

Cytotoxic and immunosuppressive drugs may affect MPV. In such a case, measure manually.

NOTE

Blood samples collected in EDTA do not maintain stable MPV because platelets swell depending on the interval after collection and storage temperature.

WBC differential parameters are derived from the WBC count, therefore, the limitations for WBC also affect these parameters.

LY and LY%: Erythroblasts, certain parasites and RBC that are resistant to lysis may interfere with an accurate LY count.

MO and MO%: Large lymphocytes, atypical lymphocytes, blasts and excessive number of basophils may interfere with an accurate MO count.

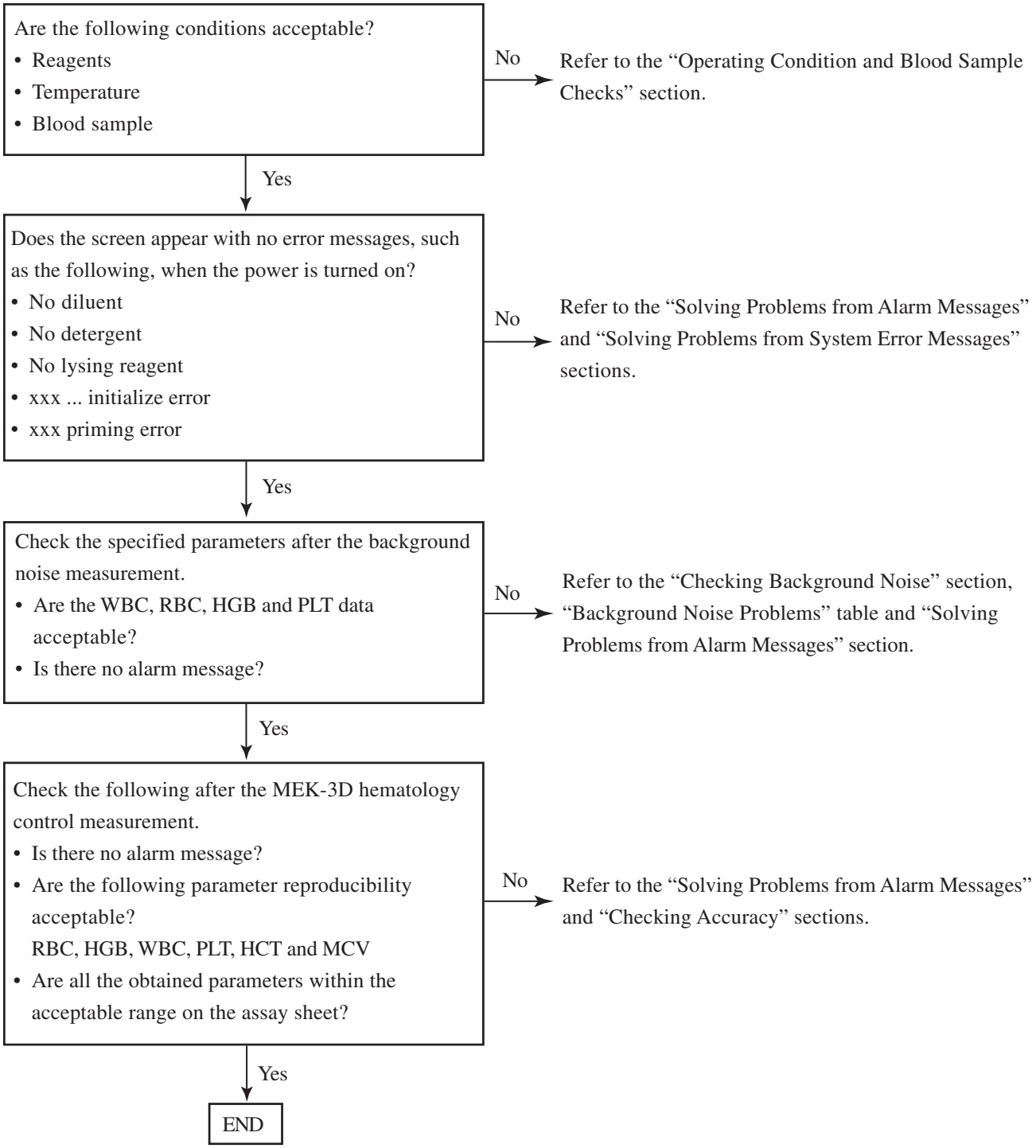
GR and GR%: Excessive eosinophils, metamyelocytes, myelocytes, promyelocytes, blasts and plasma cells may interfere with an accurate GR count and GR%.

EO: Abnormal granules may interfere with an accurate EO count.

Section 2 Troubleshooting

Check Procedure Flowchart

Check the hematology analyzer according to the following check procedure flowchart.



Operating Condition and Blood Sample Checks

Operating Condition Check

Measurement requires the following operating conditions.

- Operating temperature: 15 to 30°C (59 to 86°F)
- Operating humidity: 30 to 85%
- Operating atmospheric pressure: 70 to 106 kPa

If the diluent or hemolysing reagent temperature is lower than 15°C, it will affect the measurement data of HGB, WBC and WBC differential parameters or cause a hemolysing error or sample error alarm.

Blood Sample Handling Check

- Check that the blood sample is counted immediately after collection or stored in a cool place (at temperatures between 2 and 8°C, 36 and 46°F) such as a refrigerator. If the blood sample is stored in a refrigerator at temperatures lower than 2°C for a long time or left more than 12 hours at room temperature after collection, the WBC differential parameters may be affected.

NOTE

If the blood sample causes hemolysing error when it is counted within 30 minutes after collection, wait at least 30 minutes after collection before counting it.

- Measurement data might not be accurate for special blood sample, such as from a neonate or patient with hepatic disease or special treatment. In most cases, these blood samples are difficult to hemolyze because RBC have strong membrane resistance and the analyzer counts high WBC. Bilirubin or WBC in blood affects MCHC. These special blood samples need a different measurement method.

Pre-dilution Sample Preparation Check

Most measurement data errors in pre-dilution mode are caused by blood clotting and dilution of the blood sample. Therefore, check the following points. When pre-dilution blood is measured, data accuracy depends on careful clotting and diluting.

- Before using a sahli pipette for pre-dilution blood collection, check that the sahli pipette is completely cleaned and dried. An optional microcap (20 µL) is recommended for pre-dilution blood collection. (Supply code no. T812).
- When putting the pre-dilution blood into a sample cup, make sure there are no bubbles in the cup. If you cannot avoid making bubbles with the sahli pipette, we recommend the optional microcap which prevents bubbling.

- In pre-dilution mode, about 1 mL of sample is aspirated. Make sure that the sampling nozzle is near the bottom of the sample cup so that the correct volume of the sample can be aspirated.

Checking the Hematology Analyzer

There are two hematology analyzer checks: background noise and reproducibility.

Checking Background Noise

Measure the diluent to check the background noise.

Measurement

Count the diluent in closed mode and open mode. Closed mode is only for MEK-6400.

1. Select “Closed” or “Open” for <Sampling mode> and press the MENU key on the READY screen.
2. Press the OTHER key on the MENU screen.
3. Press the BACKGROUND key on the OTHER screen. The “Measure background noise?” message appears on the screen.
4. Press the YES key to measure background noise. The result is displayed after the measurement is complete.

Parameter Data Check with Diluent

Check that the background check values are less than or equal to the following values. Disregard the other parameter values because noise does not affect the other parameters.

Especially check the data for the PLT parameter because PLT is more affected by dust particles than the other parameters. When there are dust particles smaller than the WBC and RBC parameters in the diluent, the WBC and RBC are not affected by dust but the PLT value increases because the platelets are about the same size as the dust particles. If PLT is over $10 \times 10^3/\mu L$, do the action described below to reduce the background noise.

	Best values	Acceptable values	Values in the operator’s manual
WBC ($\times 10^3/\mu L$):	0.0	0.1	0.2
RBC ($\times 10^6/\mu L$):	0.00	0.01	0.05
HGB (g/dL):	0.0	0.1	0.1
PLT ($\times 10^3/\mu L$):	3	9	10

Reducing Background Noise

To reduce the background noise when the background check value is outside the optimal range shown in the previous tables, do the following.

1. Press the [Clean] key on the front panel to perform cleaning. If this does not reduce the background noise, do the following steps.

2. Thoroughly clean the diluent container with detergent.

3. Wash away any remaining detergent in the hydraulic system with clean diluent.

4. Perform the background check to make sure that the background noise is reduced.

If the data of the background check is still not optimum, replace the diluent with diluent from a new, sealed container.

NOTE

- **Once the background noise is reduced and when the instrument is used every day, the instrument is not severely contaminated. However, contamination builds up in the instrument and cannot be easily removed if the instrument is not cleaned periodically. Periodic maintenance is important for keeping the instrument in optimum condition.**
- **When not using the instrument for a long time, clean the fluid path with diluent. Refer to "Storing and Transporting the Analyzer" in Section 9 of the Operator's Manual.**

Background Noise Problems

Problem	Possible Cause/Criteria	Countermeasure
High background noise for all parameters.	The diluent or diluent container is dirty.	Clean the diluent container or replace the diluent with new one.
	The fluid path inside the hematology analyzer is dirty.	Press the [Clean] key on the front panel to perform cleaning. Perform strong cleaning.
	Noise interference through AC source or other instruments nearby.	Connect the hematology analyzer power cord to another AC outlet. If possible, use an independent AC outlet only for the hematology analyzer. Perform equipotential grounding and remove the other instruments if they are the cause of noise.
	The reagents are not used in the appropriate temperature range and they are deteriorated.	Use the reagents in the appropriate temperature range.
High background noise of WBC, RBC and PLT.	The filters are clogged or dirty.	Clean or replace the filters with new ones.
	The measurement baths and sub baths are dirty.	Clean or replace the measurement baths and sub baths with new ones.
	The apertures are dirty.	Clean or replace the apertures with new ones.
	The rinse unit is dirty.	Clean the rinse unit.
	The apertures are damaged.	Replace the apertures with new one.
	The MC-640V measuring unit is damaged.	Replace the unit with a new one.
	The sampling nozzle is clogged.	Replace the sampling nozzle with a new one.
	The MD-640V combination syringe pump unit failure.	Replace the unit with a new one.
	The UT-7192 AMP CONTROL board failure.	Replace the board with a new one.
	The UT-7193 POWER board failure.	Replace the board with a new one.
	The reagent is dirty.	Replace the reagent with a new one.
High background noise of HGB.	The measurement baths and sub baths are dirty.	Clean or replace the measurement baths and sub baths with new ones.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
	The UT-7201 HGB AMP board failure.	Replace the board with a new one.
	The UT-7202 HGB LED board failure.	Replace the board with a new one.
	The UT-7192 AMP CONTROL board failure.	Replace the board with a new one.
	The UT-7193 POWER board failure.	Replace the board with a new one.
	The reagent is dirty.	Replace the reagent with a new one.

Checking the Reproducibility

This check is used to check reproducibility of the instrument, using printout of the CV values of 10 data of a diluted sample of the same MEK-3DN hematology control. When the CV values are out of the specification range, the reproducibility of the instrument is poor. If the reproducibility is found to be poor, this printed result is used to troubleshoot the instrument.

Checking Procedure

1. Reduce the background noise.

2. Warm the sample (MEK-3DN) to room temperature (15 to 30°C, 59 to 86°F) and stir it sufficiently.

3. Measure the sample 10 times.

4. Press the MENU → OTHER → SERVICE → X10-CV key to display the result and check the CV data. (The type of user must be “Service” to enter the SERVICE screen.)

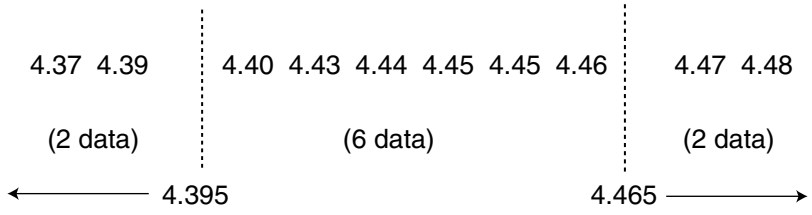
CV Values

The reproducibility is checked using the CV values. The CV value is acquired by dividing the standard deviation by the average value. When the CV value is large, it indicates that the measurement data variability is large (i.e. reproducibility is poor).

Example

Parameters	Measured Value (average)	Acquired CV (%)	Standard CV (%)
WBC	6.8 ($\times 10^3/\mu L$)	1.3	2.0
LY%			5.0
MO%			12.0
GR%			5.0
RBC	4.43 ($\times 10^6/\mu L$)	0.8	1.5
HGB	13.0 (g/dL)	0.7	1.5
MCV	91 (fL)	0.4	1.0
PLT	242 ($\times 10^3/\mu L$)	3.2	4.0
MPV			1.0

In the above example, the RBC measured value is 4.43 and the acquired CV is 0.8%. 0.8% of 4.43 is 0.035, 4.43 ± 0.035 is 4.465 and 4.395. Therefore, the CV of 0.8% indicates that in 6 of 10 measurements, the acquired value is between 4.395 and 4.465.



Reference

The reproducibility depends on the number of counted cells. When this number increases, the reproducibility is improved. Therefore, if the number of counted cells is small (a sample with low concentration is measured), the variation increases. For example, the CV is within 4% when counting 300,000 PLT, but the CV increases to over 4% when counting 100,000 PLT. This is a common feature for any hematology analyzer.

Checking Accuracy

Before checking accuracy, measure a MEK-3DN hematology control with the procedure described in the "Checking the Reproducibility" section. Confirm that the obtained sample data is within the acceptable range on the assay sheet attached to the hematology control. If the data is outside this range or on the borderline, calibrate the hematology analyzer with the following procedure.

Checking Procedure

1. Measure the MEK-3DN hematology control 10 times on the CALIBRATION screen.

2. Calibrate the instrument. Refer to Section 7 "Calibration" in the Operator's Manual.

3. Remeasure the hematology control. Confirm that the obtained sample data is within the acceptable range on the assay sheet attached to the hematology control.

Poor WBC Reproducibility

The following may be the main reasons for poor WBC reproducibility.

- Measuring unit and fluid path are dirty
- Reagent is deteriorated.
- Samples are not stirred enough.
- Hematology analyzer failure.

Measurement baths, rinse unit or fluid path is dirty

Possible Cause/Criteria	Countermeasure
WBC measurement bath is dirty.	Press the [Clean] key on the front panel to perform cleaning.
	Perform strong cleaning.
	Clean the WBC measurement bath.
	Replace the WBC sub bath with a new one.
	Replace the WBC measurement bath with a new one.
Drain path of WBC measurement bath is dirty.	Replace the hemoglobin filter below air trap with a new one.
	Clean the air trap with a cotton swab.
Rinse unit is dirty.	Clean the rinse unit.
WBC aperture is dirty.	Clean or replace the WBC aperture with a new one.

Deterioration of reagents

Possible Cause/Criteria	Countermeasure
The specified reagents are not used.	Use only the specified reagents.
Deterioration of reagents.	Replace the reagents with new one.
	Use the reagents in appropriate conditions.
The reagents are used outside the specified temperature range.	Use the reagents in the appropriate temperature.

Samples are not stirred enough

Possible Cause/Criteria	Countermeasure
The sample was not stirred thoroughly before measurement.	Stir the sample thoroughly before measurement.

Hematology analyzer failure

Possible Cause/Criteria	Countermeasure
The appropriate amount of hemolyzing reagent is not dispensed.	Put the HEMOLYNAC3 tube assay into the middle of the bottle.
	Replace the HEMOLYNAC3 tube assay with a new one.
	Replace the MD-640V combination syringe pump unit with a new one.
Circuit malfunction (WBC is outside 8.0 ±5% when circuit check is performed by pressing MENU key → OTHER key → CIRCUIT CHECK key)	Replace the MC-640V measuring unit with a new one.
	Replace the UT-7198 MEASURING board with a new one.
	Replace the UT-7192 AMP CONTROL board with a new one.
WBC sample error	Replace the MD-640V combination syringe pump unit with a new one.
	In closed mode, replace the MS-641V cap pierce unit with a new one.
	In open mode, replace the MS-640V sampler unit with a new one.

Poor HGB Reproducibility

The following may be the main reasons for poor HGB reproducibility.

- Measuring unit and fluid path are dirty.
- Reagent is deteriorated.
- Samples are not stirred enough.
- Hematology analyzer failure.

Measurement bath, rinse unit or fluid path is dirty

Possible Cause/Criteria	Countermeasure
WBC measurement bath is dirty.	Press the [Clean] key on the front panel to perform cleaning.
	Perform strong cleaning.
	Clean the WBC measurement bath.
	Replace the WBC sub bath with a new one.
	Replace the WBC measurement bath with a new one.
Drain path of the WBC measurement bath is dirty.	Replace the hemoglobin filter below air trap with a new one.
	Clean the air trap with a cotton swab.
Rinse unit is dirty.	Clean the rinse unit.

Deterioration of reagents

Possible Cause/Criteria	Countermeasure
The specified reagents are not used.	Use only the specified reagents.
Deterioration of reagents.	Replace the reagents with new one.
	Use the reagents in appropriate conditions.
The reagents are used outside the specified temperature range.	Use the reagents in the appropriate temperature.

Samples are not stirred enough

Possible Cause/Criteria	Countermeasure
The sample was not stirred thoroughly before measurement.	Stir the sample thoroughly before measurement.

Hematology analyzer failure

Possible Cause/Criteria	Countermeasure
The appropriate amount of hemolyzing reagent is not dispensed.	Put the HEMOLYNAC3 tube assay into the middle of the bottle.
	Replace the HEMOLYNAC3 tube assay with a new one.
	Replace the MD-640V combination syringe pump unit with a new one.
HGB sample error	Replace the MD-640V combination syringe pump unit with a new one.
	In closed mode, replace the MS-641V cap pierce unit with a new one.
	In open mode, replace the MS-640V sampler unit with a new one.
HGB sensor output failure (HGB ON item is outside 1.5 to 4.5 V range when sensor check is performed by pressing MENU key → OTHER key → SENSOR MONITOR key)	Adjust the HGB variable resistance volume so that HGB ON item is 3.0 V ±1 V. Refer to "Adjusting the HGB Sensor Output Voltage" in Section 5.
	Replace the MC-640V measuring unit with a new one.
	Replace the UT-7201 HGB AMP board with a new one.
	Replace the UT-7202 HGB LED board with a new one.
	Replace the UT-7192 AMP CONTROL board with a new one.

Poor RBC Reproducibility

The following may be the main reasons for poor RBC reproducibility.

- Measuring unit and fluid path are dirty.
- Samples are not stirred enough.
- Hematology analyzer failure.

Measurement bath, rinse unit or fluid path is dirty

Possible Cause/Criteria	Countermeasure
RBC measurement bath is dirty.	Press the [Clean] key on the front panel to perform cleaning.
	Perform strong cleaning.
	Clean the RBC measurement bath.
	Replace the RBC sub bath with a new one.
	Replace the RBC measurement bath with a new one.
Drain path of the RBC measurement bath is dirty.	Clean or replace the filter below RBC measurement bath with a new one.
Rinse unit is dirty.	Clean the rinse unit.
RBC aperture is dirty.	Clean or replace the RBC aperture with a new one.

Samples are not stirred enough

Possible Cause/Criteria	Countermeasure
The sample was not stirred thoroughly before measurement.	Stir the sample thoroughly before measurement.

Hematology analyzer failure

Possible Cause/Criteria	Countermeasure
Circuit malfunction (RBC is outside 1.60 ±5% when circuit check is performed by pressing MENU key → OTHER key → CIRCUIT CHECK key)	Replace the MC-640V measuring unit with a new one.
	Replace the UT-7198 MEASURING board with a new one.
	Replace the UT-7192 AMP CONTROL board with a new one.
RBC sample error	Replace the MD-640V combination syringe pump unit with a new one.
	In closed mode, replace the MS-641V cap pierce unit with a new one.
	In open mode, replace the MS-640V sampler unit with a new one.

Poor PLT Reproducibility

The following may be the main reasons for poor PLT reproducibility.

- Background noise is high. PLT measurement is highly sensitive. Therefore, the background noise must be within the acceptable range (PLT < 10×10^3/μL). Before checking the PLT reproducibility, check the background noise.
- Samples are not stirred enough.
- Measurement settings are inappropriate.
- Dilution error.
- Hematology analyzer failure.

Background noise is high

Possible Cause/Criteria	Countermeasure
The diluent is dirty.	Replace the diluent with a new one.
The diluent bottle is dirty.	Clean the diluent bottle.
The fluid path is dirty.	Press the [Clean] key on the front panel to perform cleaning.
	Perform strong cleaning.
	Clean the sub baths and measurement baths.
	Clean or replace the filter below the RBC measurement bath with a new one.
	Clean the apertures.
	Replace the measurement baths and sub baths with new ones.
	Replace the aperture with a new one.
Rinse unit is dirty.	Clean the rinse unit.
The sampling nozzle is clogged.	Replace the sampling nozzle with a new one.
Noise through AC source	Connect the power cord to another AC outlet.
	Put a noise cut filter on the power cord.
Noise interference	Perform equipotential grounding.
	Move the instrument which is producing the noise away from the hematology analyzer.
The aperture is damaged.	Replace the aperture with a new one.
The MC-640V measuring unit failure	Replace the unit with a new one.
Circuit malfunction (PLT is outside 160 ±5% when circuit check is performed by pressing MENU key → OTHER key → CIRCUIT CHECK key)	Replace the UT-7198 MEASURING board with a new one.
	Replace the MC-640V measuring unit with a new one.
	Replace the UT-7192 AMP CONTROL board with a new one.

Samples are not stirred enough

Possible Cause/Criteria	Countermeasure
The sample was not stirred thoroughly before measurement.	Stir the sample thoroughly before measurement.

Inappropriate measurement settings

Possible Cause/Criteria	Countermeasure
The sensitivity and threshold settings are not appropriate.	Check that the sensitivity and threshold settings are set as below. RBC SENSITIVITY: 5 RBC THRESHOLD: AUTO PLT THRESHOLD: 5

Dilution error

Possible Cause/Criteria	Countermeasure
The MS-640V sampler unit failure.	Replace the sampling nozzle with a new one.
	Replace the unit with a new one.
The MD-640V combination syringe pump unit failure.	Replace the unit with a new one.

Hematology analyzer failure

Possible Cause/Criteria	Countermeasure
The aperture is dirty.	Clean the aperture.
The aperture is damaged.	Replace the aperture with a new one.
Circuit malfunction (PLT is outside 160 ±5% when circuit check is performed by pressing MENU key → OTHER key → CIRCUIT CHECK key)	Replace the UT-7198 MEASURING board with a new one.
	Replace the MC-640V measuring unit with a new one.
	Replace the UT-7192 AMP CONTROL board with a new one.
The MC-640V measuring unit is not attached properly.	Reattach the unit. Make sure to tighten the screws attaching the unit to the chassis. Refer to "Removing the Measuring Unit" in Section 4.
The MC-640V measuring unit failure.	Replace the unit with a new one.

Poor HCT or MCV Reproducibility

The following may be the main reasons for poor HCT or MCV reproducibility.

- Measuring unit is dirty
- Measurement settings are inappropriate.
- Hematology analyzer failure.

Measuring unit is dirty

Possible Cause/Criteria	Countermeasure
Measurement baths and sub baths are dirty.	Clean the measurement baths and sub baths.
Aperture is dirty.	Clean the aperture.

Inappropriate measurement settings

Possible Cause/Criteria	Countermeasure
The sensitivity and threshold settings are not appropriate.	Check that the sensitivity and threshold settings are set as below. RBC SENSITIVITY: 5 RBC THRESHOLD: AUTO

Hematology analyzer failure

Possible Cause/Criteria	Countermeasure
The aperture is damaged.	Replace the aperture with a new one.
Circuit malfunction (RBC is outside 1.60 ±5% when circuit check is performed by pressing MENU key → OTHER key → CIRCUIT CHECK key)	Replace the MC-640V measuring unit with a new one.
	Replace the UT-7198 MEASURING board with a new one.
	Replace the UT-7192 AMP CONTROL board with a new one.
RBC sample error	Replace the MD-640V combination syringe pump unit with a new one.
	In closed mode, replace the MS-641V cap pierce unit with a new one.
	In open mode, replace the MS-640V sampler unit with a new one.

Solving Problems from Alarm Messages

A001: No diluent

This message appears when the sensor in the tank does not detect the diluent during measurement, priming or cleaning.

Reason	Possible Cause/Criteria	Countermeasure
No diluent in the tank	Out of diluent.	Replace diluent.
	The tube between the hematology analyzer and diluent is squeezed, bent, clogged or there is leakage.	Check the tube connection and if necessary, replace the tube with a new one.
	Leakage in the fluid path.	Check the fluid path. If necessary, replace tubes.
	Pump tube is damaged.	Replace the pump tube with a new one.
	The MP-640V pump unit failure.	Replace the unit with a new one.
	The MD-640V combination syringe pump unit failure.	Replace the unit with a new one.
	The UT-7192 AMP CONTROL board failure.	Replace the board with a new one.
	The UT-7193 POWER board failure.	Replace the board with a new one.
Air bubbles	When the hematology analyzer is left unused, the diluent inside the tank may evaporate and enter the fluid path as air bubbles.	Press the [Clean] key to perform cleaning, press the [Reset] and [Power] keys together to turn the power off, then press the [Power] key to turn on.
	Leakage in the fluid path.	Check the fluid path. If necessary, replace tubes.
Failure of the sensor in the tank	Air bubbles on the liquid sensor.	Perform priming.
	Voltage adjustment error of the liquid sensor.	Adjust the voltage. Refer to “Adjusting the Liquid Sensor Output Voltages” in Section 5.
	Liquid sensor failure.	Replace the UT-7199 LIQUID SENSOR board with a new one.
Wrong tube	The cleanac tube 8 (tube for CLEANAC3) is used for diluent.	Use the diluent tube.

A005: No detergent

This message appears when the liquid sensors on the JQ-640V inlet/outlet unit do not detect the detergent during priming or cleaning.

Reason	Possible Cause/Criteria	Countermeasure
No detergent flow	The tube between the hematology analyzer and CLEANAC detergent is squeezed, bent, clogged or there is leakage.	Check the tube connection and if necessary, replace the tube with a new one.
	Pump tube is damaged.	Replace the pump tube with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
	The MP-640V pump unit failure.	Replace the unit with a new one.
Failure of the sensor in the tank	Air bubbles on the liquid sensor.	Perform priming.
	Voltage adjustment error of the liquid sensor.	Adjust the voltage. Refer to “Adjusting the Liquid Sensor Output Voltages” in Section 5.
	Liquid sensor failure.	Replace the UT-7199 LIQUID SENSOR board with a new one.

A007: No lysing reagent

This message appears when the sensors on the JQ-640V inlet/outlet unit do not detect the hemolysing reagent during measurement, priming or cleaning.

Reason	Possible Cause/Criteria	Countermeasure
No hemolyzing reagent flow	The tube between the hematology analyzer and HEMOLYNAC3 hemolysing reagent is squeezed, bent, clogged or there is leakage.	Check the tube connection and if necessary, replace the tube with a new one.
	The MD-640V combination syringe pump unit failure.	Replace the unit with a new one.
Failure of the sensor	Air bubbles on the liquid sensor.	Perform priming.
	Voltage adjustment error of the liquid sensor.	Adjust the voltage. Refer to "Adjusting the Liquid Sensor Output Voltages" in Section 5.
	Liquid sensor failure.	Replace the UT-7199 LIQUID SENSOR Board with a new one.

A009: WBC priming error

This message appears when diluent cannot be primed during priming the WBC manometer (manometer upper or lower sensor does not detect the diluent).

Reason	Possible Cause/Criteria	Countermeasure
Liquid cannot be detected even when there is enough liquid (LED does not light)	WBC manometer upper sensor adjustment error.	Adjust the sensor. Refer to "Adjusting the Upper and Lower Sensor Output Voltages of the Manometers" in Section 5.
	WBC manometer lower sensor adjustment error.	
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Air bubbles in the manometer	WBC aperture is not attached properly.	Reattach the WBC aperture.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A010: RBC PRIMING ERROR

This message appears when diluent cannot be primed during priming the RBC manometer (manometer upper or lower sensor does not detect the diluent).

Reason	Possible Cause/Criteria	Countermeasure
Liquid cannot be detected even when there is enough liquid (LED does not light)	RBC manometer upper sensor adjustment error.	Adjust the sensor. Refer to "Adjusting the Upper and Lower Sensor Output Voltages of the Manometers" in Section 5.
	RBC manometer lower sensor adjustment error.	
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Air bubbles in the manometer	RBC aperture is not attached properly.	Reattach the RBC aperture.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A021: WBC level 1

This message appears when the manometer upper sensor does not detect no liquid at the start of WBC measurement or draining liquid from the manometer.

Reason	Possible Cause/Criteria	Countermeasure
Liquid is drained but liquid cannot be detected (LED does not turn off)	WBC manometer is dirty.	Perform strong cleaning.
	WBC manometer upper sensor adjustment error.	Adjust the sensor. Refer to "Adjusting the Upper and Lower Sensor Output Voltages of the Manometers" in Section 5.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Liquid cannot be drained	Pump tube is damaged.	Replace the pump tube with a new one.
	The MP-640V pump unit failure.	Replace the unit with a new one.
	The UT-7193 POWER board failure.	Replace the board with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
	Electromagnetic valve failure.	Replace the UT-7192 AMP CONTROL board with a new one.
		Replace the UT-7193 POWER board with a new one.

A022: WBC level 2

This message appears when the manometer upper sensor detects no liquid but the lower sensor does not detect no liquid at the start of WBC measurement or draining liquid from the manometer.

Reason	Possible Cause/Criteria	Countermeasure
Liquid is drained but liquid cannot be detected (LED does not turn off)	WBC manometer is dirty.	Perform strong cleaning.
	WBC manometer lower sensor adjustment error.	Adjust the sensor. Refer to "Adjusting the Upper and Lower Sensor Output Voltages of the Manometers" in Section 5.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Liquid cannot be drained	Pump tube is damaged.	Replace the pump tube with a new one.
	The MP-640V pump unit failure.	Replace the unit with a new one.
	The UT-7193 POWER board failure.	Replace the board with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
	Electromagnetic valve failure.	Replace the UT-7192 AMP CONTROL board with a new one.
		Replace the UT-7193 POWER board with a new one.

A023: WBC level 3

This message appears when the manometer lower sensor does not detect the liquid during WBC measurement or aspirating sample.

Reason	Possible Cause/Criteria	Countermeasure
Cannot produce measuring pressure	The pump tube is damaged.	Replace the pump tube with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Measuring pressure can be produced but there is leakage	WBC aperture is not attached properly.	Reattach the WBC aperture properly.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Measuring pressure can be produced but there is clog	WBC aperture is clogged.	Clean or replace the aperture with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A024: WBC bubble 1

This message appears when the manometer upper or lower sensor detects no liquid during WBC measurement or at the start of draining manometer.

Reason	Possible Cause/Criteria	Countermeasure
Diluent cannot be detected even when there is enough diluent (LED does not light)	WBC manometer is dirty.	Perform Strong Cleaning.
	WBC manometer upper sensor adjustment error.	Adjust the sensor. Refer to "Adjusting the Upper and Lower Sensor Output Voltages of the Manometers" in Section 5.
	WBC manometer lower sensor adjustment error.	
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Air bubbles in the manometer	WBC manometer is dirty.	Perform strong cleaning.
	WBC aperture is not attached properly.	Reattach the WBC aperture with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A025: WBC bubble 2

This message appears when the manometer upper sensor detects the liquid during WBC measurement or draining manometer (from upper sensor OFF to lower sensor OFF).

Reason	Possible Cause/Criteria	Countermeasure
Air bubbles in the manometer	WBC manometer is dirty.	Perform strong cleaning.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A026: WBC bubble 3

This message appears when the manometer lower sensor detects no liquid during WBC measurement or aspirating sample (from lower sensor ON to upper sensor ON).

Reason	Possible Cause/Criteria	Countermeasure
Air bubbles in the manometer	WBC manometer is dirty.	Perform strong cleaning.
	WBC aperture is not attached properly.	Reattach the WBC aperture.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A027: WBC bubble 4

This message appears when the WBC measurement or aspirating sample time is too short (from lower sensor ON to upper sensor ON).

Reason	Possible Cause/Criteria	Countermeasure
The aperture is too large.	WBC aperture is damaged.	Replace the WBC aperture with a new one.
	Incorrect aperture (100 µm).	Use an appropriate aperture (80 µm).
Air bubbles in the manometer	No liquid.	Perform priming.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A029: WBC clog

This message appears when the manometer lower sensor detects the liquid but the upper sensor does not detect the liquid during WBC measurement or aspirating sample.

Reason	Possible Cause/Criteria	Countermeasure
Measuring pressure can be produced but there is clog	WBC aperture is clogged.	Clean or replace the WBC aperture with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Cannot produce measuring pressure	The pump tube is damaged.	Replace the pump tube with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Measuring pressure can be produced but there is leakage	WBC aperture is not attached properly.	Reattach the WBC aperture properly.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Measuring at high altitude (higher than 1,000 m above sea level)	High altitude mode needs to be set to On.	Set “High altitude” on ADVANCED SET/SETTINGS MENU of the SERVICE screen must be set to On.

A030: WBC sample error

This message appears when the voltage between the electrodes is out of acceptable range.

Reason	Possible Cause/Criteria	Countermeasure
Diluted sample error for WBC count	The diluent temperature is too low.	The environment temperature must be from 15 to 30°C.
	Specified reagents are not used.	Only use the specified reagents.

A031: WBC noise 2

This message appears when there is baseline wandering during measurement.

A032: WBC noise 1

This message appears when the time sequence of counted pulse is not stable.

Reason	Possible Cause/Criteria	Countermeasure
Power line	2 pin power cord is used.	Use 3 pin power cord.
	Ground lead is not connected.	Perform equipotential grounding.
	Decrease in the power voltage.	Do not share the power source with any other instrument.
Influence from other malfunction	Measurement baths and apertures are dirty.	Clean or replace the measurement baths and apertures with new ones. Perform strong cleaning.
	High background noise.	Refer to “Background Noise Problems” earlier in this section.
	Poor hemolyzation of the sample.	Refer to “! Appears on the right on WBC measured value” later in this section.
	Sample aspiration is not stable (clog alarm).	Refer to “A029: WBC clog”.
Measuring unit failure	WBC aperture is dirty.	Perform strong cleaning. Clean the WBC aperture.
	WBC aperture is damaged.	Replace the WBC aperture with a new one.
	The screw securing the measurement bath is loose.	Tighten the screw.
	The MC-640V measuring unit and chassis are not insulated (there may be leakage).	Remove the cause.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A036: WBC upper manometer dirty

The voltage of the upper liquid sensor on the manometer is 2.25 to 2.75V.

Reason	Possible Cause/Criteria	Countermeasure
Manometer is dirty	The WBC manometer is dirty.	Perform strong cleaning.
Sensor voltage adjustment error	WBC manometer upper sensor adjustment error.	Adjust the WBC manometer upper sensor. Refer to “Adjusting the Upper and Lower Sensor Output Voltages of the Manometers” in Section 5.

A037: WBC lower manometer dirty

The voltage of the lower liquid sensor on the manometer is 2.25 to 2.75V.

Reason	Possible Cause/Criteria	Countermeasure
Manometer is dirty	The WBC manometer is dirty.	Perform strong cleaning.
Sensor voltage adjustment error	WBC manometer lower sensor adjustment error.	Adjust the WBC manometer lower sensor. Refer to “Adjusting the Upper and Lower Sensor Output Voltages of the Manometers” in Section 5.

A041: RBC level 1

This message appears when the manometer upper sensor does not detect no liquid at the start of RBC measurement or draining liquid from the manometer.

Reason	Possible Cause/Criteria	Countermeasure
Liquid is drained but liquid cannot be detected (LED does not turn off)	RBC manometer is dirty.	Perform strong cleaning.
	RBC manometer upper sensor adjustment error.	Adjust the sensor. Refer to "Adjusting the Upper and Lower Sensor Output Voltages of the Manometers" in Section 5.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Liquid cannot be drained	Pump tube is damaged.	Replace the pump tube with a new one.
	The MP-640V pump unit failure.	Replace the unit with a new one.
	The UT-7193 POWER board failure.	Replace the board with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
	Electromagnetic valve failure.	Replace the UT-7192 AMP CONTROL board with a new one.
		Replace the UT-7193 POWER board with a new one.

A042: RBC level 2

This message appears when the manometer upper sensor detects no liquid but the lower sensor does not detect no liquid at the start of RBC measurement or draining liquid from the manometer.

Reason	Possible Cause/Criteria	Countermeasure
Liquid is drained but liquid cannot be detected (LED does not turn off)	RBC manometer is dirty.	Perform strong cleaning.
	RBC manometer lower sensor adjustment error.	Adjust the sensor. Refer to "Adjusting the Upper and Lower Sensor Output Voltages of the Manometers" in Section 5.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Liquid cannot be drained	Pump tube is damaged.	Replace the pump tube with a new one.
	The MP-640V pump unit failure.	Replace the unit with a new one.
	The UT-7193 POWER board failure.	Replace the board with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
	Electromagnetic valve failure.	Replace the UT-7192 AMP CONTROL board with a new one.
		Replace the UT-7193 POWER board with a new one.

A043: RBC level 3

This message appears when the manometer lower sensor does not detect the liquid during RBC measurement or aspirating sample.

Reason	Possible Cause/Criteria	Countermeasure
Cannot produce measuring pressure	The pump tube is damaged.	Replace the pump tube with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Measuring pressure can be produced but there is leakage	RBC aperture is not attached properly.	Reattach the RBC aperture properly.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Measuring pressure can be produced but there is clog	RBC aperture is clogged.	Clean or replace the aperture with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A044: RBC bubble 1

This message appears when the manometer upper or lower sensor detects no liquid during RBC measurement or at the start of draining manometer.

Reason	Possible Cause/Criteria	Countermeasure
Diluent cannot be detected even when there is enough diluent (LED does not light)	RBC manometer is dirty.	Perform strong cleaning.
	RBC manometer upper sensor adjustment error.	Adjust the sensor. Refer to "Adjusting the Upper and Lower Sensor Output Voltages of the Manometers" in Section 5.
	RBC manometer lower sensor adjustment error.	
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Air bubbles in the manometer	RBC manometer is dirty.	Perform strong cleaning.
	RBC aperture is not attached properly.	Reattach the RBC aperture with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A045: RBC bubble 2

This message appears when the manometer upper sensor detects the liquid during RBC measurement or when draining manometer (from upper sensor OFF to lower sensor OFF).

Reason	Possible Cause/Criteria	Countermeasure
Air bubbles in the manometer	RBC manometer is dirty.	Perform strong cleaning.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A046: RBC bubble 3

This message appears when the manometer lower sensor detects no liquid during RBC measurement or aspirating sample (from lower sensor ON to upper sensor ON).

Reason	Possible Cause/Criteria	Countermeasure
Air bubbles in the manometer	RBC manometer is dirty.	Perform strong cleaning.
	RBC aperture is not attached properly.	Reattach the RBC aperture.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A047: RBC bubble 4

This message appears when the RBC measurement or aspirating sample time is too short (from lower sensor ON to upper sensor ON).

Reason	Possible Cause/Criteria	Countermeasure
The aperture is too large.	RBC aperture is damaged.	Replace the RBC aperture with a new one.
	Incorrect aperture (100 μm).	Use an appropriate aperture (80 μm).
Air bubbles in the manometer	No liquid.	Perform priming.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A049: RBC clog

This message appears when the manometer lower sensor detects the liquid but the upper sensor does not detect the liquid during RBC measurement or aspirating sample.

Reason	Possible Cause/Criteria	Countermeasure
Measuring pressure can be produced but there is clog	RBC aperture is clogged.	Clean or replace the RBC aperture with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Cannot produce measuring pressure	The pump tube is damaged.	Replace the pump tube with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Measuring pressure can be produced but there is leakage.	RBC aperture is not attached properly.	Reattach the RBC aperture properly.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
Measuring at high altitude (higher than 1,000 m above sea level)	High altitude mode needs to be set to On.	Set "High altitude" on ADVANCED SET/SETTINGS MENU of the SERVICE screen must be set to On.

A050: RBC sample error

This message appears when the voltage between the electrodes is out of acceptable range.

Reason	Possible Cause/Criteria	Countermeasure
Diluted sample error for RBC count	The diluent temperature is too low.	The environment temperature must be from 15 to 30°C.
	Specified reagents are not used.	Only use the specified reagents.

A051: RBC noise 2

This message appears when time sequence of the counted pulses is not stable.

A052: PLT noise 1

This message appears when there is baseline wandering during measurement.

A053: PLT noise 3

This message appears when the pulses are smaller than the threshold of counted pulses.

Reason	Possible Cause/Criteria	Countermeasure
Power line	2 pin power cord is used.	Use 3 pin power cord.
	Ground lead is not connected.	Perform equipotential grounding.
	Decrease in the power voltage.	Do not share the power source with any other instrument.
Influence from other malfunction	Measurement baths and apertures are dirty.	Clean or replace the measurement baths and apertures with new ones. Perform strong cleaning.
	High background noise.	Refer to “Background Noise Problems” earlier in this section.
	Filter below the RBC measurement bath is clogged.	Clean or replace the filter with a new one.
	Sample aspiration is not stable (clog alarm).	Refer to “A049: RBC clog”.
Measuring unit failure	RBC aperture is dirty.	Perform strong cleaning. Clean the RBC aperture.
	RBC aperture is damaged.	Replace the RBC aperture with a new one.
	The screw securing the measurement bath is loose.	Tighten the screw.
	The MC-640V measuring unit and chassis are not insulated (there may be leakage).	Remove the cause.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A057: RBC upper manometer dirty

The voltage of the upper liquid sensor on the manometer is 2.25 to 2.75V.

Reason	Possible Cause/Criteria	Countermeasure
Manometer is dirty	The RBC manometer is dirty.	Perform strong cleaning.
Sensor voltage adjustment error	RBC manometer upper sensor adjustment error.	Adjust the RBC manometer upper sensor. Refer to “Adjusting the Upper and Lower Sensor Output Voltages of the Manometers” in Section 5.

A058: RBC lower manometer dirty

The voltage of the lower liquid sensor on the manometer is 2.25 to 2.75V.

Reason	Possible Cause/Criteria	Countermeasure
Manometer is dirty	The RBC manometer is dirty.	Perform strong cleaning.
Sensor voltage adjustment error	RBC manometer lower sensor adjustment error.	Adjust the RBC manometer lower sensor. Refer to “Adjusting the Upper and Lower Sensor Output Voltages of the Manometers” in Section 5.

A061: HGB voltage low

This message appears when the HGB BLANK (diluent) voltage is less than 1.5 V.

Reason	Possible Cause/Criteria	Countermeasure
Deterioration from age	WBC measurement bath is dirty.	Clean or replace the WBC measurement bath with a new one.
	HGB voltage adjustment error.	Adjust the HGB voltage. Refer to "Adjusting the HGB Sensor Output Voltage" in Section 5.
Erroneous operation	HGB measurement started when there was blood sample in the WBC measurement bath or the hematology analyzer was drained.	After cleaning, perform priming and measure again.
Photodiode does not receive the light from the LED	There are crystals or other dust on the photodiode.	Remove the cause.
Circuit error	The UT-7201 HGB AMP board failure.	Replace the board with a new one.
	The UT-7202 HGB LED board failure.	Replace the board with a new one.
	The UT-7198 MEASURING board failure.	Replace the board with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A062: HGB voltage high

This message appears when the HGB BLANK (diluent) voltage is more than 4.5 V.

Reason	Possible Cause/Criteria	Countermeasure
Deterioration from age	HGB voltage adjustment error.	Adjust the HGB voltage. Refer to "Adjusting the HGB Sensor Output Voltage" in Section 5.
Erroneous operation	HGB voltage is adjusted when there was blood sample in the WBC measurement bath or the hematology analyzer was drained.	After cleaning, adjust the HGB voltage.
Circuit error	The UT-7201 HGB AMP board failure.	Replace the board with a new one.
	The UT-7202 HGB LED board failure.	Replace the board with a new one.
	The UT-7198 MEASURING board failure.	Replace the board with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A063: HGB circuit error

This message appears when the voltage is more than 0.5 V at HGB LED off.

Reason	Possible Cause/Criteria	Countermeasure
Light interference	The HGB cover is not attached properly.	Reattach the HGB cover.
Circuit error	The UT-7201 HGB AMP board failure.	Replace the board with a new one.
	The UT-7202 HGB LED board failure.	Replace the board with a new one.
	The UT-7198 MEASURING board failure.	Replace the board with a new one.
	The MC-640V measuring unit failure.	Replace the unit with a new one.

A072: Tube holder open

The analyzer cannot operate because the tube holder is open. This message appears only on the MEK-6400 analyzer only.

Reason	Possible Cause/Criteria	Countermeasure
Tube holder cannot be closed.	Tube holder is open.	Close the tube holder
	Holder hook does not move.	Replace the MS-641V cap pierce unit with a new one. Replace the UT-7193 POWER board with a new one.
The analyzer cannot detect if the holder is open or closed.	The holder sensor on the MS-641V cap pierce unit failure.	Replace the holder sensor with a new one. Replace the UT-7193 POWER board with a new one.

A073: Tube in the holder

Open mode cannot be selected because the sample tube is set in the tube holder. This message appears only on the MEK-6400 analyzer only.

Reason	Possible Cause/Criteria	Countermeasure
Tube in the holder	The sample tube is set in the tube holder.	Remove the sample tube and close the tube holder.
The analyzer cannot detect the tube	The tube sensor on the MS-641V cap pierce unit failure.	Replace the tube sensor with a new one. Replace the UT-7193 POWER board with a new one.

A091: Room temperature high

This message appears when measurement is performed at temperatures over 30°C.

A092: Room temperature low

This message appears when measurement is performed at temperatures below 15°C.

Reason	Possible Cause/Criteria	Countermeasure
Room temperature high	Measurement is performed at temperatures above 30°C.	Perform measurement at temperatures between 15 to 30°C.
Room temperature low	Measurement is performed at temperatures below 15°C.	
The analyzer cannot measure the temperature	Sensor failure.	Replace the UT-7202 HGB LED board with a new one.
	The UT-7192 AMP CONTROL board failure.	Replace the board with a new one.

A093: Internal temperature high

A094: Internal temperature low

A095: Power supply temp high

This message appears when the internal temperature is abnormal.

Reason	Possible Cause/Criteria	Countermeasure
Internal temperature is abnormal	Actuator moves inappropriately. Circuit error. Temperature sensor failure.	Replace the electromagnetic valve, motor, unit or board which is causing the abnormal temperature.

! APPEARS ON THE RIGHT OF WBC MEASURED VALUE

! may be displayed on the right of WBC value when the RBC ghosts affect the WBC measurement. During counting, the hematology analyzer detects the RBC pulses which are under the threshold for WBC.

Reason	Possible Cause/Criteria	Countermeasure
Specific characteristics of the sample	High RBC membrane resistance and many RBC ghosts.	Dilute the sample in the pre-dilution mode and measure it in pre-dilution mode or measure the stained sample with a microscope.
	PLT aggregation.	Measure the stained sample with a microscope.
Environmental condition is not appropriate	Diluent temperature is low.	Environment temperature must be from 15 to 30°C.
	Specified reagents are not used.	Only use the specified reagents.
Influence from other malfunctions	High background noise.	Refer to the "Background Noise Problems" earlier in this section.
Measuring unit failure.	WBC sensitivity and threshold settings are inappropriate.	WBC sensitivity must be 5 and threshold 4.
	WBC aperture is not attached correctly.	Reattach the WBC aperture.
	WBC aperture is dirty.	Clean the WBC aperture.
	WBC aperture is damaged.	Replace the WBC aperture with a new one.
	The screws securing the measurement baths are loose.	Tighten the screws.
	The MC-640V measuring unit and chassis are not insulated (there may be leakage).	Remove the cause.
	The MC-640V measuring unit failure.	Replace the unit with a new one.
	The UT-7198 MEASURING board failure.	Replace the board with a new one.
The hemolyzing reagent (HEMOLYNAC3) is not dispensed properly.	Tube is in the upper part of the tank.	Put the tube in the bottom of the tank.
	Tube joints are loose.	Tighten the tube joint.
	Electromagnetic valve of the MD-640V combination syringe pump unit failure.	Replace the unit with a new one.
	The MD-640V combination syringe pump unit failure.	Replace the unit with a new one.
	The UT-7200 MIXED PUMP board failure.	Replace the board with a new one.
	The UT-7193 POWER board failure.	Replace the board with a new one.

! APPEARS ON THE RIGHT OF MCHC MEASURED VALUE

! may be displayed on the right of MCHC value when the MCHC value is out of the normal range (lower than 28.0 or higher than 38.0 g/dL). MCHC is known to be a stable factor, and its physiological variation is approximately 3% independent of the patients.

Reason	Possible Cause/Criteria	Countermeasure
Specific characteristics of the sample	RBC aggregation.	Measure with a microscope.
	Sample is hemolyzing.	Measure with a microscope.
Environmental condition is not appropriate.	Specified reagents are not used.	Only use the specified reagents.
	The reagents are past the expiration date.	Replace the reagents with the new ones.
Calibration of the hematology analyzer is not correct.	Calibration of HGB or HCT is not correct.	Calibrate the hematology analyzer.
HGB measurement error	No hemolysing reagent.	Put the tube into the bottom of the tank.
	HGB sensor voltage adjustment error	Adjust the HGB sensor voltage. Refer to "Adjusting the HGB Sensor Output Voltage" in Section 5.
HCT measurement error	High background noise.	Refer to the "Background Noise Problems" earlier in this section.
Dilution ratio error	The MD-640V combination syringe pump unit failure.	Replace the unit with a new one.
	Liquid cannot be drained from the measurement bath.	Replace the filter below the RBC measurement bath with a new one.
	Blood sampling error (sampling nozzle is clogged, bent or air bubbles in the sampling nozzle).	Replace the sampling nozzle with a new one.

C APPEARS ON THE RIGHT OF WBC OR PLT MEASURED VALUE or PLT Clumps appears

Platelet aggregation is a phenomenon where some platelets stick together to create a large aggregated platelet cell. This is because some platelets in the sample excessively react against anticoagulant. When platelet aggregation occurs, the PLT value is low and the insufficient hemolysing alarm also occurs because the aggregated PLT cell is counted as a WBC or RBC ghost. There is a high possibility that platelet aggregation occurs when heparin is used as an anticoagulant. Platelet aggregation rarely occurs when EDTA (ethylenediaminetetraacetic acid) salt is used. This alarm is displayed when there is poor hemolyzation and PLT value is low.

Reason	Possible Cause/Criteria	Countermeasure
Specific characteristics of the sample.	PLT aggregation.	Measure with a microscope.
Error due to anticoagulant.	Heparin is used as an anticoagulant.	Collect the sample again and use EDTA as an anticoagulant.
	EDTA dependent pseudothrombocytopenia.	Collect the sample again and use heparin as an anticoagulant.

OTHER FLAGS

This message appears when the CBC parameters are outside the range.

Reason	Possible Cause/Criteria	Countermeasure
Adjustment and calibration are not appropriate	Calibration for CBC parameters is not appropriate.	Perform calibration.
Environmental condition is not appropriate	Specified reagents are not used.	Only use the specified reagents.
	The environment temperature is out of 15 to 30°C.	The environment temperature must be within 15 to 30°C.

Solving Problems from System Error Messages

E001: DILUTER INITIALIZE ERROR

The MD-640V combination syringe pump unit cannot be initialized.

Reason	Possible Cause/Criteria	Countermeasure
Diluter piston failure	Cable(s) on the MD-640V combination syringe pump unit is damaged.	Replace the cable with a new one.
	Motor driver on the UT-7193 POWER board failure.	Replace the board with a new one.
	Motor on the MD-640V combination syringe pump unit failure.	Replace the unit with a new one.
Sensor cannot detect the movement of the diluter piston	The UT-7200 MIXED PUMP board sensor failure.	Replace the board with a new one.
	Cable(s) on the MD-640V combination syringe pump unit damaged.	Replace the cable with a new one.

E021: SAMPLER INITIALIZE ERROR

The MS-640V sampler unit cannot be initialized.

Reason	Possible Cause/Criteria	Countermeasure
The sampler unit does not perform the initialization	Sampling nozzles do not move.	Replace the sampling nozzle with a new one.
	The cap on the rinse unit or cap pierce unit for cap piercing catches the nozzle.	Replace the cap with a new one.
	Connector(s) on the sampler unit is disconnected.	Reconnect the connector.
	Cable(s) on the sampler unit is damaged.	Replace the cable with a new one.
	Sampler initialize position sensor failure.	Replace the sampler initialize position sensor with a new one.
	Sampler separating sensor failure.	Replace the sensor with a new one.
	Motor driver to the UT-7193 POWER board failure.	Replace the board with a new one.
	Sampler motor failure.	Replace the MS-640V sampler unit with a new one.

E041: SUB BATH INITIALIZE ERROR

The sub baths of the MC-640V measuring unit cannot be initialized.

Reason	Possible Cause/Criteria	Countermeasure
Sub baths do not rotate	The connector of the sub bath sensor is disconnected.	Reconnect the connector of the sub bath sensor.
	Sub bath is not attached properly.	Reattach the sub bath.
	Cap is not attached properly.	Reattach the cap.
	Cable(s) on the measuring unit is damaged.	Replace the MC-640V measuring unit with a new one.
	Sub bath motor failure.	Replace the MC-640V measuring unit with a new one.
	Motor driver on the UT-7193 POWER board failure.	Replace the board with a new one.
	Sub bath metal plate spring which holds the sub bath spacer has rust or crystallization.	Remove rust or crystallization with a sandpaper. Replace the sub bath spacer with a new one if the problem still occurs.
The sensor cannot detect the rotary movement of the sensor plate	Sub bath sensor on the measuring unit failure.	Replace the sub bath sensor with a new one.
	Cable(s) on the measuring unit is damaged.	Replace the cable with a new one.

E101: BATH DRAIN ERROR

The MP-640V pump unit does not drain the measurement baths.

Reason	Possible Cause/Criteria	Countermeasure
The pump rotor does not move	The MP-640V pump unit is disconnected from the UT-7193 POWER board.	Reconnect or replace the cable with a new one.
	Stepping motor failure.	Replace the MP-640V pump unit with a new one.
	Motor driver on the UT-7193 POWER board failure.	Replace the board with a new one.
The sensor cannot detect the rotary movement	Pump sensor on the pump unit failure.	Replace the pump sensor with a new one.
	Cable(s) on the pump unit is damaged.	Replace the cable with a new one.

E122: CHECK SETTINGS
E123: MEMORY ERROR

Re-enter the calibration coefficient and all other settings. Then sample counting can be performed. If the error still occurs, replace the battery.

Reason	Possible Cause/Criteria	Countermeasure
The data cannot be saved.	The backup data is inappropriately changed.	Replace the CR2450 battery with a new one.
		Replace the UT-7192 AMP CONTROL board with a new one.

E124: CIRCUIT ERROR

Reason	Possible Cause/Criteria	Countermeasure
The analyzer cannot count preliminary pulse.	The MC-640V measuring unit failure.	Replace the unit with a new one.
	The UT-7192 AMP CONTROL board failure.	Replace the board with a new one.

E126: TOUCH PANEL ERROR

Reason	Possible Cause/Criteria	Countermeasure
Touch panel does not react properly.	Cable(s) on the PV-640V front panel unit is damaged.	Replace the unit with a new one.
	Connector(s) on the front panel unit is disconnected.	Reconnect the connector.
	Touch panel failure.	Replace the PV-640V front panel unit with a new one.
	The UT-7192 AMP CONTROL board failure.	Replace the board with a new one.

E141: CAP PIERCE INITIALIZE ERROR

The MS-641V cap pierce unit cannot be initialized.

Reason	Possible Cause/Criteria	Countermeasure
Cap pierce does not move.	Connector(s) on the MS-641V cap pierce unit is disconnected.	Reconnect the connector.
	Cable(s) on the cap pierce unit is damaged.	Replace the cable with a new one.
	Cap pierce motor failure.	Replace the MS-641V cap pierce unit with a new one.
	Motor driver on the UT-7193 POWER board failure.	Replace the board with a new one.
The sensor cannot detect the starting position of the sample needle.	Sensor on the cap pierce unit failure.	Replace the sensor with a new one.
	Cable(s) on the cap pierce unit is damaged.	Replace the cable with a new one.

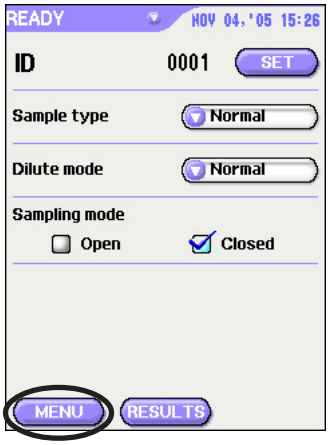
Service Maintenance Screens

The various service maintenance screens are provided for checking the operation of a component or block such as pump, motor, sensor and unit individually, and for setting some functions which are usually not changed. So, these screens are not described on the operator's manual. There may be additional function or change of the function which depends on the software version. If you found a function which is not shown in this section, please contact Nihon Kohden representative before using the function.

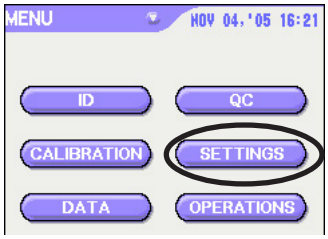
CAUTION

Using a key on one of the service maintenance screens without reading can damage the instrument. Completely read the corresponding part before using a screen key.

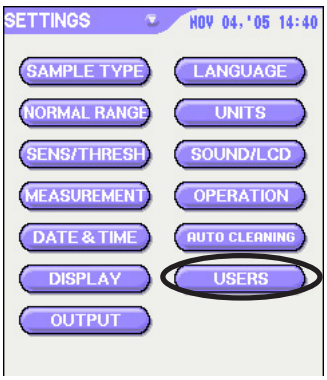
Displaying the SERVICE Screen



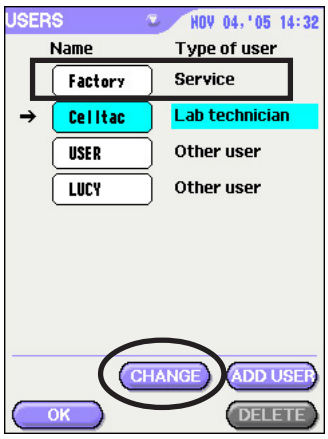
1. Press the MENU key on the READY screen. The MENU screen appears.



2. Press the SETTINGS key on the MENU screen. The SETTINGS screen appears.



3. Press the USERS key on the SETTINGS screen. The USERS screen appears.

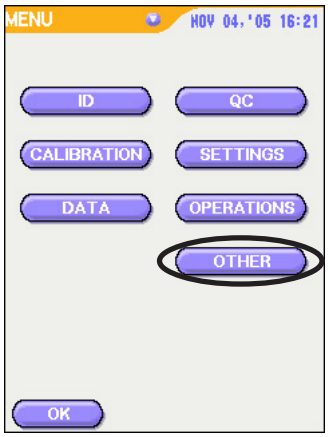


4. Select FACTORY and press the CHANGE key. A promt for the password appears.

5. Type “4321” and press the ENTER key.

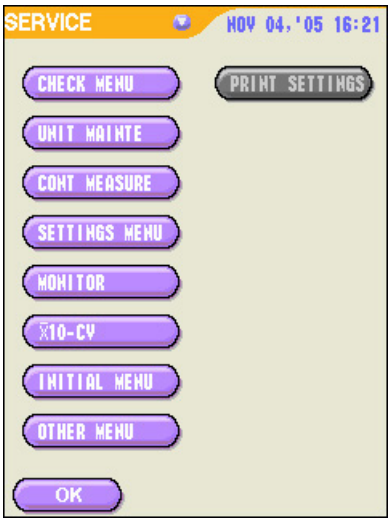
6. Press the OK key on the screen. The SETTINGS screen appears.

7. Press the OK key on the screen. The MENU screen appears.



8. Press the OTHER key on the screen. The OTHER screen appears.

9. Press the SERVICE key on the screen. The SERVICE screen appears.

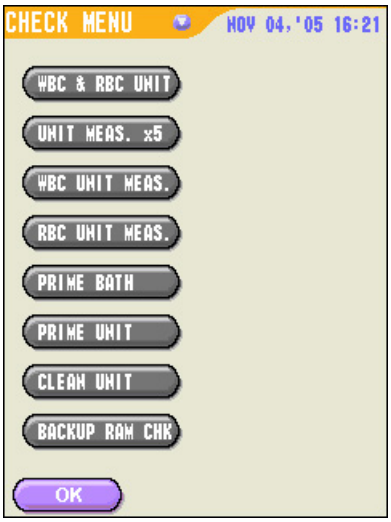


The SERVICE screen has the following menu items.

- CHECK MENU
- UNIT MAINTE
- CONT MEASURE
- SETTINGS MENU
- MONITOR
- X10-CV
- INITIAL MENU
- OTHER MENU
- PRINT SETTINGS

CHECK MENU Screen

This screen allows you to check the measurement operation of the following blocks.



WBC & RBC UNIT: Simultaneously measures each sample in the WBC and RBC measurement baths separately from dilution operation done by MS-640V sampler unit. So, you can check the fluid level movement and any bubble in the two manometers without any noise and vibration from the other units in the instrument.

UNIT MEAS. X5: Automatically measures each sample in the WBC and RBC measurement baths 5 times separately from dilution operation done by MS-640V sampler unit. So, you can check the data reproducibility without any noise and vibration from the other units in the instrument.

WBC UNIT MEAS.: Measures the sample in WBC measurement bath separately from dilution operation done by MS-640V sampler unit.

RBC UNIT MEAS.: Measures the sample in RBC measurement bath separately from dilution operation done by MS-640V sampler unit.

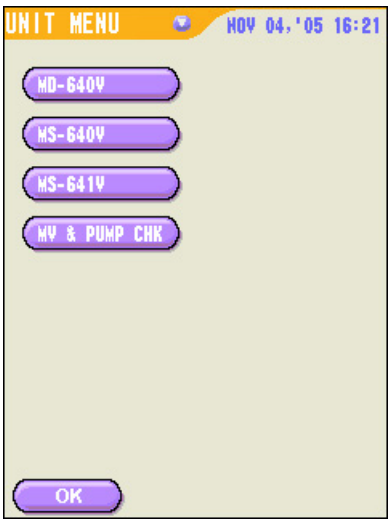
PRIME BATH: Fills the two measurement baths with diluent.

PRIME UNIT: Fills the two manometers with diluent.

CLEAN UNIT: Cleans the two manometers with detergent.

BACKUP RAM CHK: No function

UNIT MAINTE Screen



This screen allows you to check the operation of the following units and valves.

- MD-640V Combination syringe pump unit
- MS-640V Sampler unit
- MS-641V Cap pierce unit
- MP-640V Pump unit
- Solenoid valves

MD-640V

This screen allows you to check the operation of the MD-640V.

CAUTION

- **When pressing the DISPENSE key, place a container under the sampling nozzle because diluent dispenses from the sampling nozzle.**
- **When using the DISPENSE key or 5 TIMES AUTO key, be careful not to let the hemolysing reagent overflow from the WBC measurement bath.**

Always perform INITIALIZE before pressing any other key.

INITIALIZE: Moves the pistons to the initial positions.
ASPIRATE: Moves the pistons to the position for aspiration.
DISPENSE: Moves the pistons to the position for dispense.
5 TIMES AUTO: Repeats the aspiration and dispense operations 5 times.
PRIME: No function.

MS-640V

This screen allows you to check the operation of the MS-640V.

CAUTION

- **Before checking the operation, check that the sampling nozzle is not bent.**
- **Check the sub bath positions which should be upside down because it prevents the sampling nozzle from bending.**

Always perform INITIALIZE before pressing any other key.

INITIALIZE: Moves the sampling nozzle to the initial position.
ASPIRATE POS: Moves the sampling nozzle to the position for aspirating a blood sample
PIERCE POS: Moves the sampling nozzle to the position for the cap pierce lowering motion.
WBC DSP POS: Moves the sampling nozzle to the position for dispensing the diluted sample for WBC measurement.
RBC ASP POS: Moves the sampling nozzle to the position for aspirating the diluted sample for WBC measurement.
RBC DSP POS: Moves the sampling nozzle to the position for dispensing the diluted sample for RBC measurement.
1 CYCLE: Moves the sampling nozzle to the positions according to each operation of MS-640V.
CONT. INITIAL: Repeats moving the sampling nozzle to the initial position until you press the Reset key on the front panel.

MS-641V (MEK-6400 only)

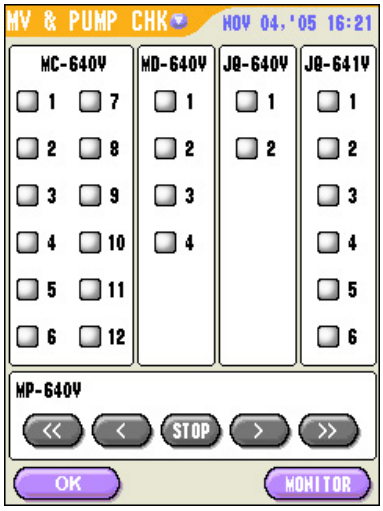
This screen allows you to check the operation of the MS-641V.

CAUTION

If you check the operation while the tube holder is open, the cap pierce needle comes out.

Always perform INITIALIZE before pressing any other key.

INITIALIZE: Moves the cap pierce needle to the initial position.
HIGH POS: Moves the cap pierce needle to the upper position.
LOW POS: Moves the cap pierce needle to the lower position.



MV & PUMP CHK

This screen allows you to check the operation of the valves and MP-640V pump unit.

CAUTION

Before starting the pump, carefully check what happens by opening a specified valve and working the pump. Otherwise, the reagent such as diluent may overflow somewhere in the instrument.

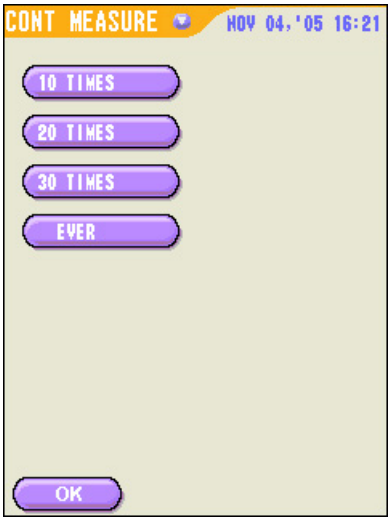
When pressing a check box of MC-640V, MD-640V, JQ-640V and JQ-641V, a check mark is placed in the check box and the valve is open. When pressing the check box with a check mark, the check box is cleared and the valve is closed.

There are five keys for the MP-640V pump unit. The function of each key is shown below.

<<: High-speed clockwise rotation
<: Low-speed clockwise rotation
STOP: Stops the rotation.
>: Low-speed counterclockwise rotation
>>: High-speed counterclockwise rotation

When pressing the MONITOR key at the bottom of the screen, the SENSOR MONITOR screen which shows each sensor status appears.

CONT MEASURE Screen



This screen allows you to check the instrument during continuous measurement.

NOTE

Before starting the continuous measurement, check that each reagent volume and waste container capacity are enough to do the continuous measurement.

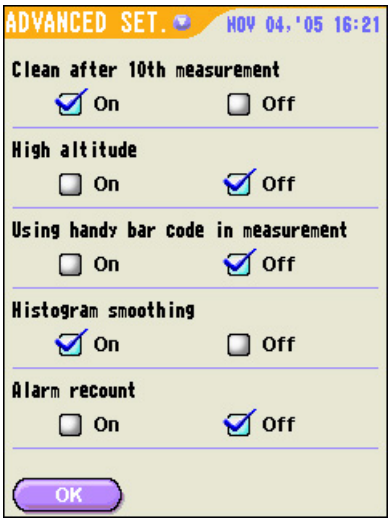
10 TIMES: Continuously measures the sample 10 times.
20 TIMES: Continuously measures the sample 20 times.
30 TIMES: Continuously measures the sample 30 times.
EVER: Measures the sample until you press the Reset key on the front panel.

SETTING MENU Screen

The screen has settings which are not usually changed.

ADV. SETTINGS: Advanced settings
REAGENT FACTOR: Reagent consumption ratio setting
USER MAINTE: Measurement times settings for user maintenance
PANIC VALUE: Threshold settings for panic value
FLAG SETTINGS: Threshold settings for special flag display
BAR CODE PORT: Settings for RS-232C communication
INPUT UNIT CAL: Compensation value settings

ADV. SETTINGS Screen



The following settings are available.

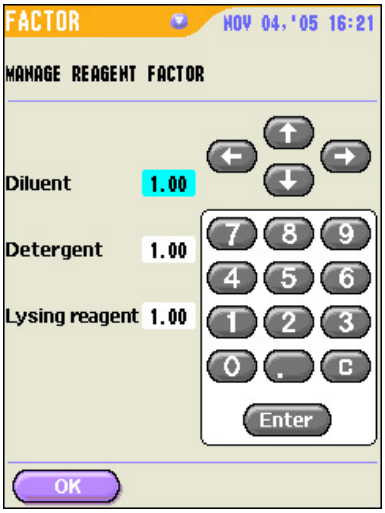
Clean after 10th measurement:
Automatically cleans the fluid path with the detergent after every 10 measurements when this setting is set to on. To cancel this function, set this setting to off. This setting is only for MEK-6400 and MEK-6410.

High altitude:
Makes the measurement time longer when this setting is set to on. When the instrument is installed at a place lower than 1000 m above sea level, check that this setting is set to off.

Using handy bar code in measurement:
Allows input of sample ID number with a handy bar code reader when this setting is set to on.

Histogram smoothing:
Smooths the histogram when this setting is set to on. The default setting is on.

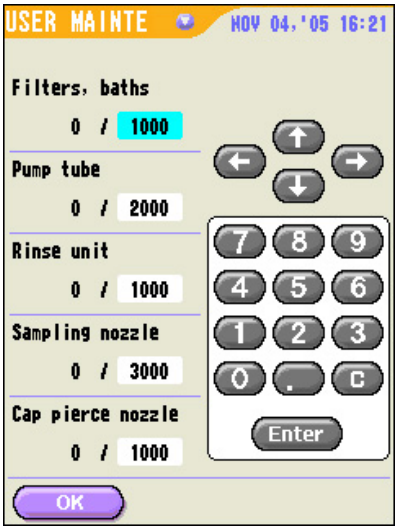
Alarm recount:
When this setting is set on and an alarm message such as bubble or noise occurs, the instrument automatically measures the sample up to 3 times while displaying the alarm message for each measurement. This function is useful to check what alarm occurs during the recount if the recount frequently occurs. The default setting is off.



REAGENT FACTOR Screen

This screen allows you to change the ratio of consumption of each reagent when there is a difference between the actual consumption and calculated consumption on the screen.

Diluent: Changes the consumption rate of the diluent.
Detergent: Changes the consumption rate of the detergent.
Lysing reagent: Changes the consumption rate of the hemolysing reagent

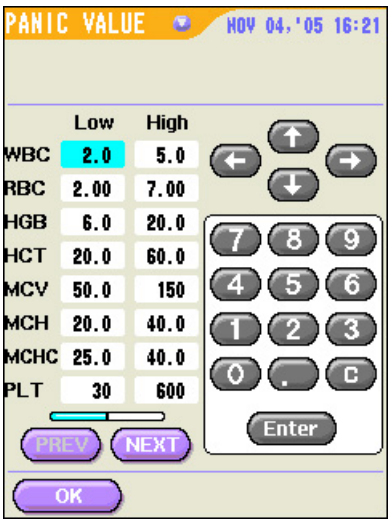


USER MAINTENANCE Screen

This screen allows you to change the measurement times of the following items.

The instrument counts the measurement times. When the actual measurement times exceeds the preset measurement times for check, cleaning or replacement, the corresponding user maintenance message appears.

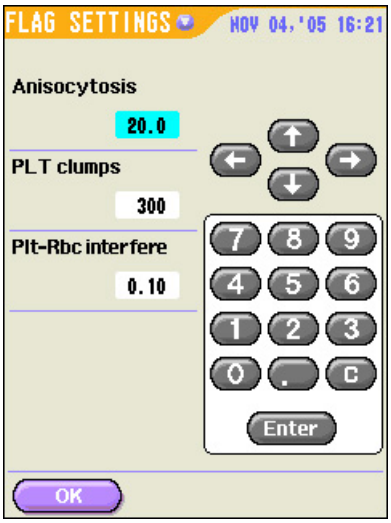
Filters, Baths: Measurement times for checking, cleaning or replacing the filter and measurement and sub baths.
Pump tube: Measurement times for checking, cleaning or replacing the pump tube.
Rinse unit: Measurement times for checking, cleaning or replacing the rinse unit.
Sampling nozzle: Measurement times for checking, cleaning or replacing the sampling nozzle.
Cap pierce nozzle: Measurement times for checking, cleaning or replacing the cap pierce needle.



PANIC VALUE Screen (for MEK-6400 and MEK-6410)

This screen allows you to change the upper and lower thresholds for remeasurement with the dilution ratio changed.

When a blood sample has a parameter which is out of the range between the upper and lower thresholds, the instrument automatically measures the sample with the dilution ratio changed. Changing the upper and lower thresholds depends on the user's needs.

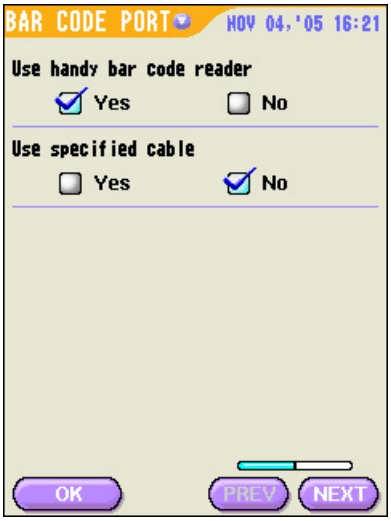


FLAG SETTINGS Screen

This screen allows you to change the thresholds for display of the following specified flags.

If there are a lot of normal blood samples which have one of the following flags frequently displayed, increase the value to prevent displaying the flag.

Anisocytosis: The initial value is 20.0 (RDW)
PLT clumps: The initial value is 300.
Plt-Rbc interface: The initial value is 0.10

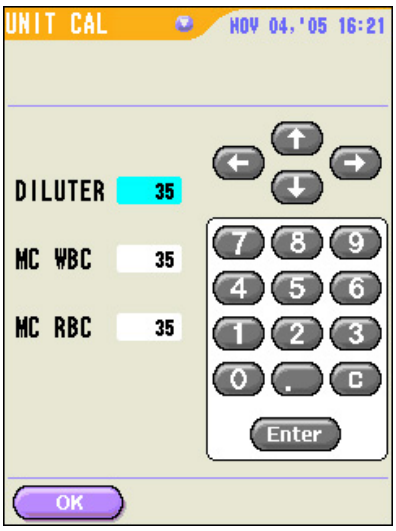


BAR CODE PORT Screen

This screen allows you to set the settings for serial data communication when the bar code port is used as RS-232C port.

Use handy bar code reader: Check that a check mark is place in the check box aside of "Yes" when using a handy bar code reader. The default setting is "Yes".

Use specified cable: Press the check box aside of "Yes" when using this port as RS-232C port with the YZ-0319 cable. The default setting is "No".

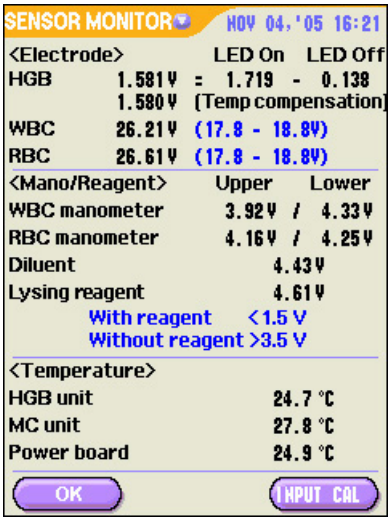


UNIT CAL Screen

This screen allows you to change the compensation values of the cylinder volume of the MD-640V combination syringe pump unit and manometer volumes for RBC and WBC of the MC-640V measuring unit. When replacing the MD-640V or MC-640V unit with a new one, the change of the compensation value is not necessary because the compensation value of the new unit is automatically registered. When you replace the board of the MD-640V or MC-640V unit, i.e. UT-7200 or UT-7198, with a new one, you need to change the compensation value. Before the board replacement, write down the compensation value. Enter it after the board replacement.

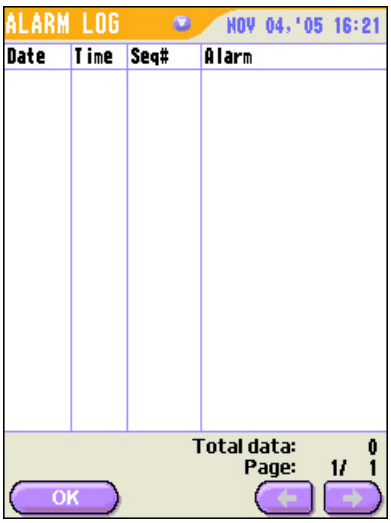
MONITOR Screen

This screen allows you to check the output voltage from each sensor, alarm log and system error log.

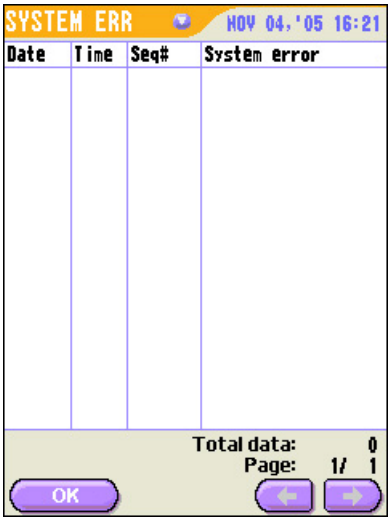


- **SENSOR MONITOR screen:**
  Displays the status of all sensors with voltage or temperature.
  For details on the INPUT CAL key, refer to Section 5 “Adjustment”.

- **POS SENSOR screen:**
  No function

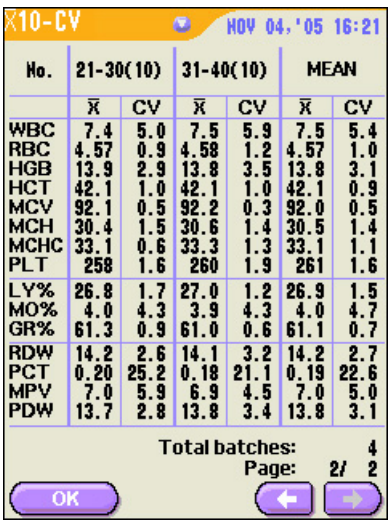


- **ALARM LOG screen:**
  Displays all the alarm data with date and time if they occur. You can get the problem tendency using this log data. For example, if some "manometer dirty" message occurs frequently, you can try to perform the strong cleaning.



- **SYSTEM ERR LOG screen:**
  Displays all the system error data with date and time so you can see any problem trends.

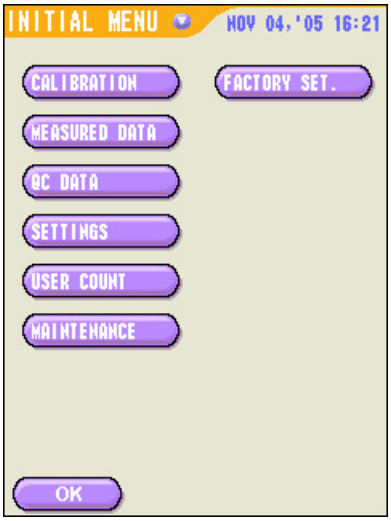
X10-CV screen



This screen allows you to check the data reproducibility of the latest 10 measurement data.

After the instrument is repaired or the measurement results are unstable, use this function. If the latest 10 measurements include unnecessary data, delete the unnecessary data beforehand.

INITIAL MENU Screen



This screen allows you to initialize specified parts or all data in the instrument.

- **CALIBRATION:** Sets all the calibration coefficients to 1000.
- **MEASURED DATA:** Deletes all the measurement data.
- **QC DATA:** Deletes all the measurement data for quality control and initializes all the settings for quality control.
- **SETTINGS:** Initializes all the settings on the SETTINGS screen. This function is same as the “INITIALIZE” key at the bottom of the SETTINGS screen.
- **USER COUNT:** Resets all the counters for regular replacement parts to zero.
- **MAINTENANCE:** Initializes all the settings on the service maintenance screens.
- **FACTORY SET:** Initializes all the above mentioned settings to factory default settings and deletes all the above mentioned data.

OTHER MENU Screen

This screen allows you to download the demonstration data from the PC memory card when inserting the memory card into the slot at the rear panel of the instrument and pressing the “DOWNLOAD DATA” key.

PRINT SETTINGS Screen

No function

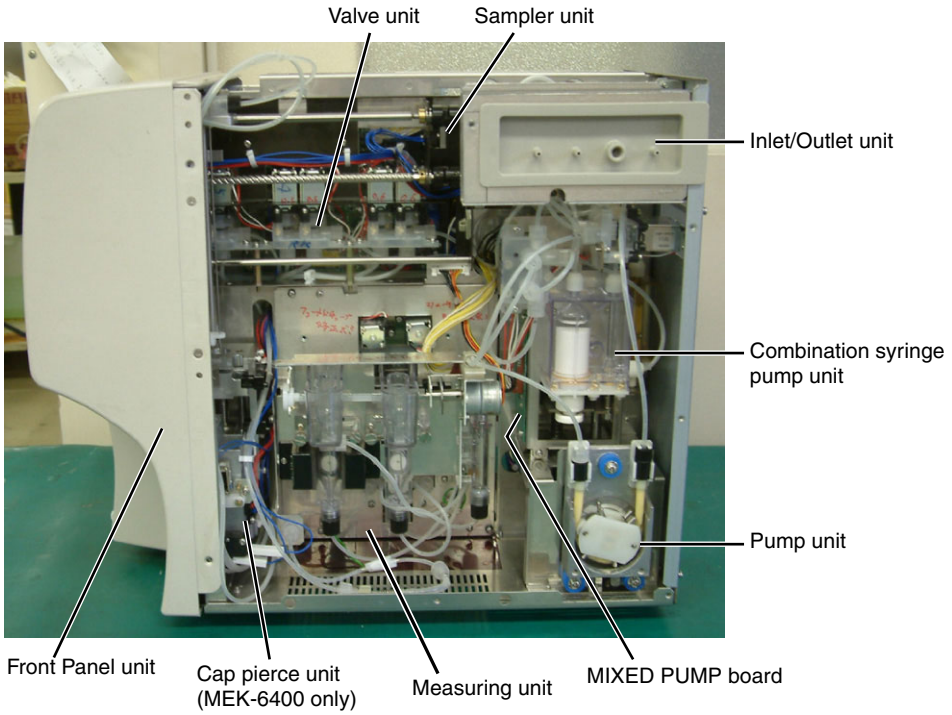
Section 3 Board/Unit Description

This section describes the following units and boards and how they work during operation. This information helps you to fully understand the overall operation of the instrument.

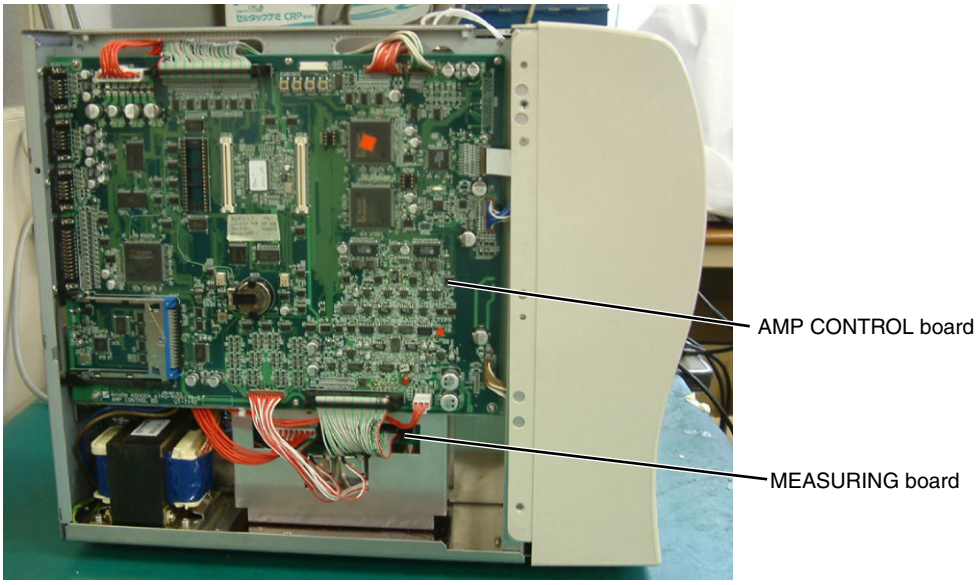
- Measuring unit
- Combination syringe pump unit
- Pump unit
- Front panel unit
- Inlet/Output unit
- Valve unit
- Sampler unit
- Cap pierce unit (MEK-6400 only)
- AMP CONTROL board
- POWER board
- MEASURING board
- HGB AMP board and HGB LED board
- MIXED PUMP board
- PRINTER DRIVER board
- KEY board
- LIQUID SENSOR board
- 2-way electromagentic valve

Board and Unit Location

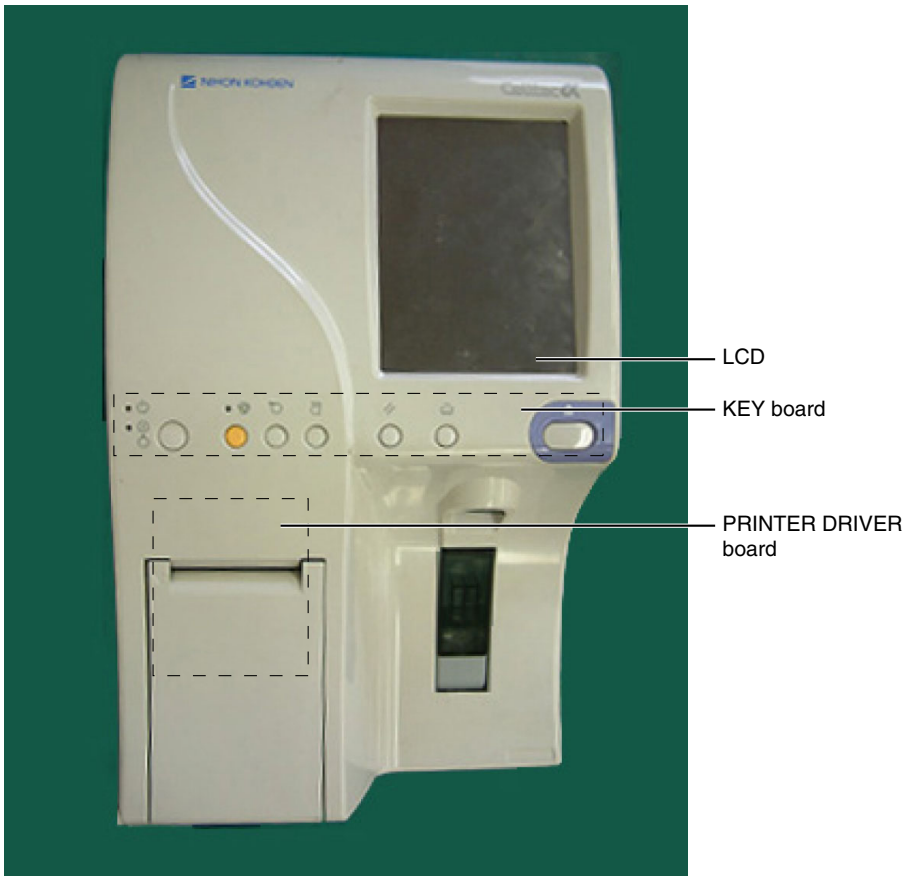
Right Side View



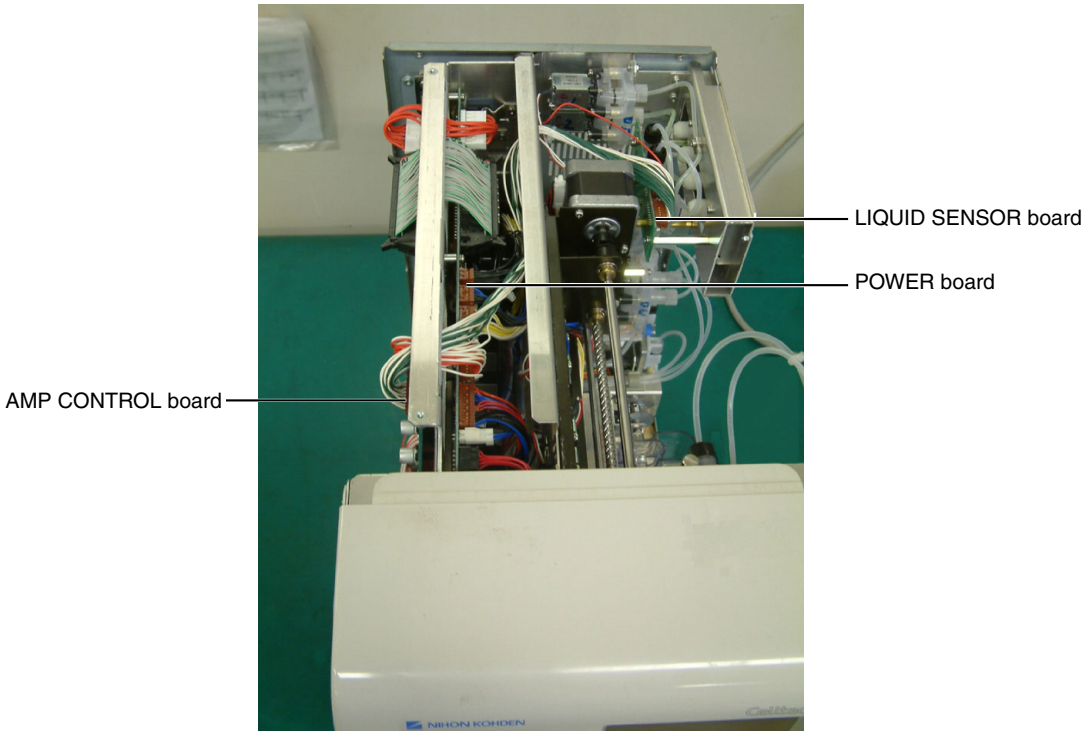
Left Side View



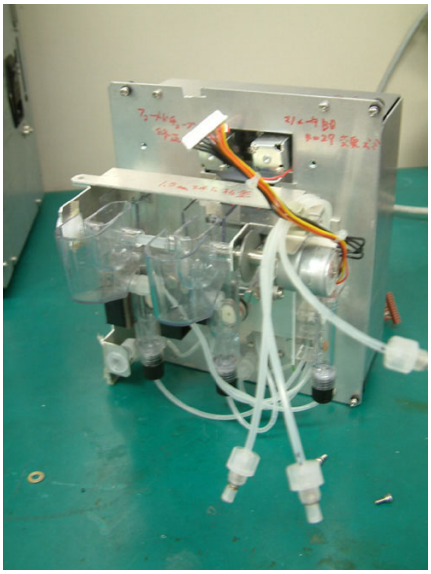
Front View



Top View



MC-640V Measuring Unit

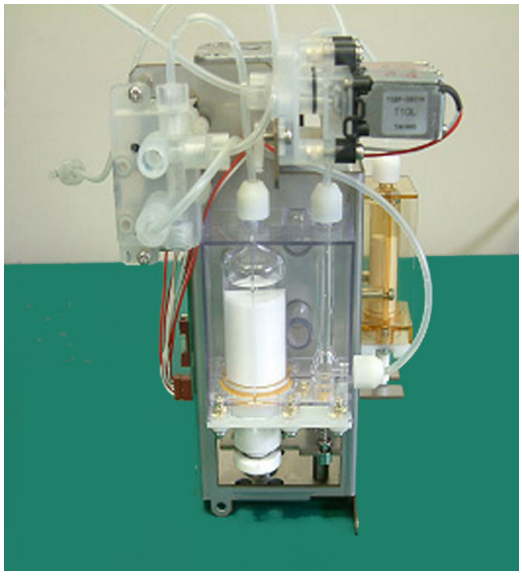


When a blood cell of the diluted blood sample passes through the aperture, the resistance between the external and internal electrodes increases. This change in resistance causes a proportional change in voltage because a constant current flows between the electrodes. This measuring unit counts the blood cells by the voltage changes. Meanwhile, the total diluted blood sample volume which is aspirated through the aperture is kept constant by the manometer of this measuring unit.

At the lower part of the WBC measurement bath, a light of 540 nm wavelength shines through the hemolyzed blood sample. The sample absorbs some of the light. A photodiode detects the unabsorbed light. The HGB can be determined from the light absorption ratio of the sample and diluent.

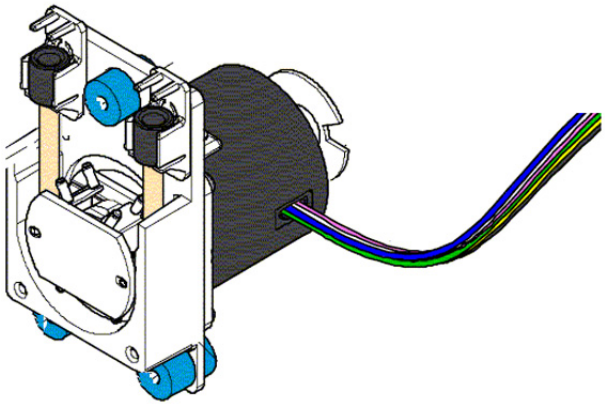
MD-640V Combination Syringe Pump Unit

This unit dilutes the blood sample 200 times and sends the diluent to each part of the fluid path. This unit has another syringe pump for hemolyzing reagent which aspirates the hemolyzing reagent from the reagent bottle and sends it to the WBC measurement bath.



MP-640V Pump Unit

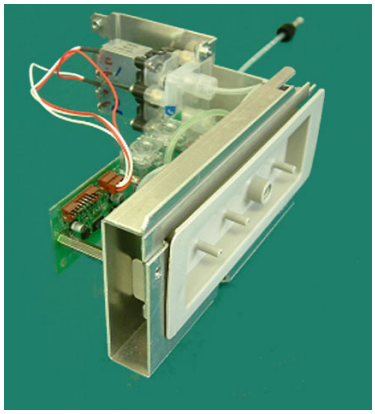
This unit creates a negative pressure to aspirate diluted blood through each aperture, and to drain the waste fluid. This unit creates a positive pressure to completely mix the diluted blood sample and hemolyzing reagent for hemolyzation.



PV-641V Front Panel Unit

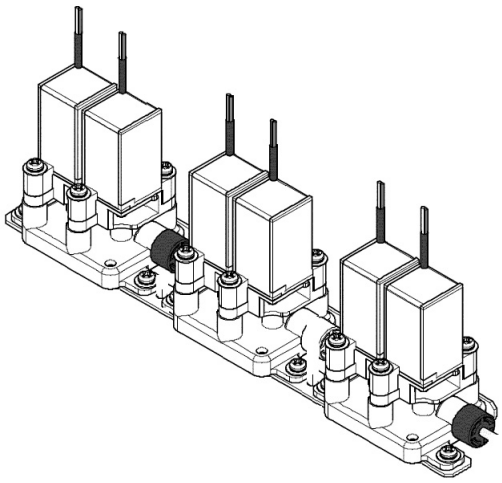
This unit has key switches and LCD with touch screen. It may also have an optional printer unit. The LCD displays the measurement result (numeric data and histogram) and alarm message if something wrong occurs. The measurement result can be printed if an optional printer is installed.

JQ-640V Inlet/Outlet Unit



This unit has inlet ports for diluent, detergent and hemolyzing reagent and an outlet port for waste fluid. The three liquids which are detected with liquid sensors of this unit are supplied to the related units through the fluid path. The waste fluid is drained through the outlet port.

JQ-641V/JQ-642V Valve Unit



JQ-641V Valve Unit

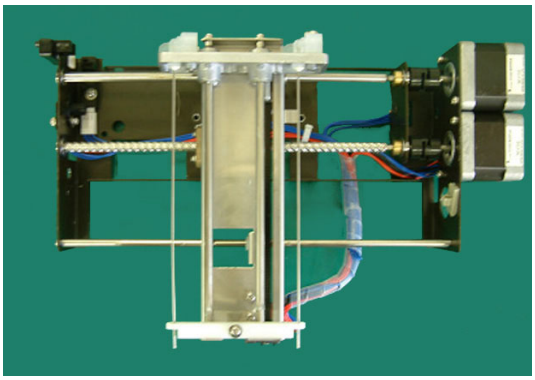
This unit is for the MEK-6400 analyzer. It has six 2-way valves and a fluid path to send the diluent or detergent to the other units.

JQ-642V Valve Unit

This unit is for the MEK-6410/MEK-6420 analyzers. It has four 2-way valves and a fluid path to send the diluent or detergent to the other units.

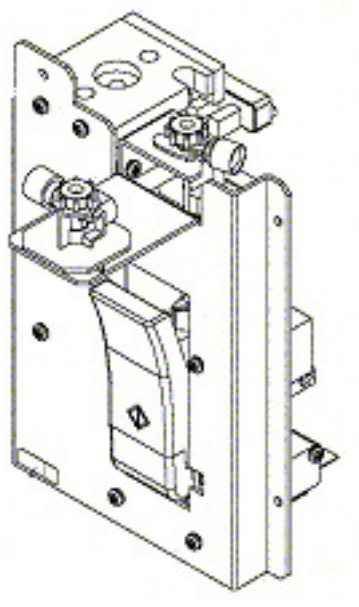
MS-640V Sampler Unit

This unit moves the two sampling nozzles to the positions for aspiration and dispensing. The diluted sample is dispensed into the WBC and RBC measurement baths by coordination between this sampler unit and the syringe pump unit.



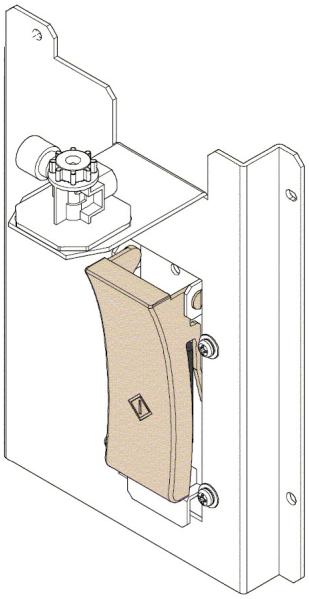
MS-641V Cap Pierce Unit (MEK-6400 only)

This unit pierces the cap of a sample tube with a cap pierce needle to aspirate the blood sample with the sampling nozzle (without opening the cap of the sample tube). This unit also has a cap pierce rinse unit to clean the cap pierce needle.



MR-640V Rinse Unit (MEK-6410/6420 only)

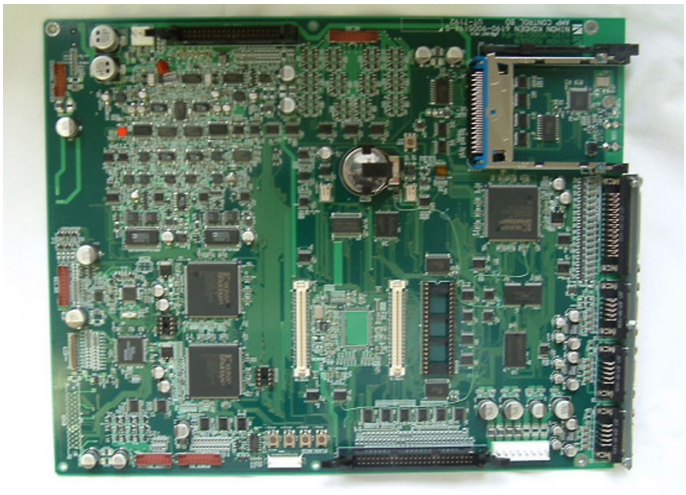
This unit cleans the sampling nozzles.



UT-7192 AMP CONTROL Board

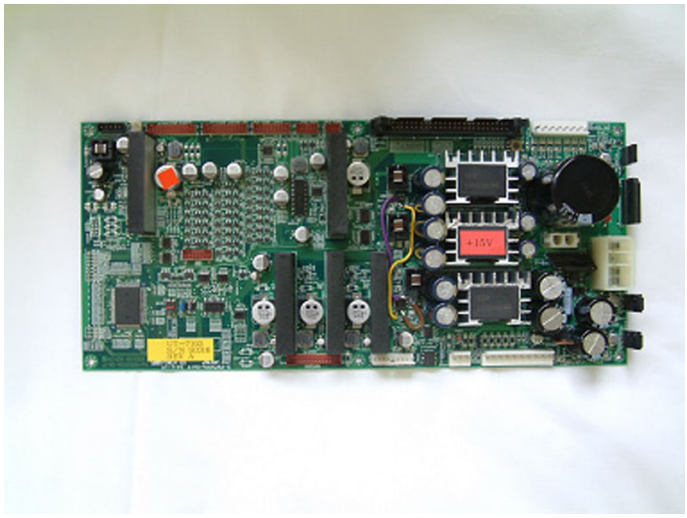
This board consists of two blocks. One block amplifies the analog signals from the measuring unit and converts the amplified analog signals to digital signals. The other block controls the valves and motors while receiving the key switch status and signals from the sensors.

This board controls all the operations such as cleaning and measurement.



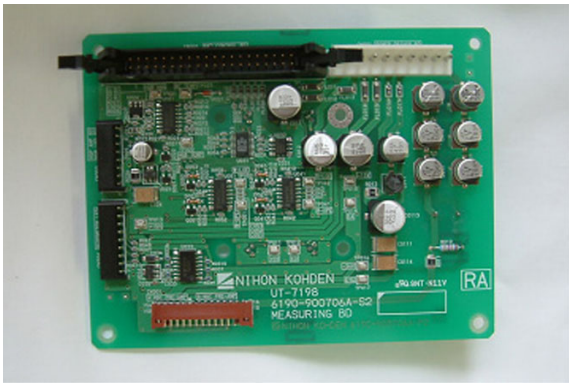
UT-7193 POWER Board

This board converts AC line voltage to the necessary DC voltages through the power transformer. This board also has all the motor driver ICs to control the stepping motor(s) and valve(s) of each unit.



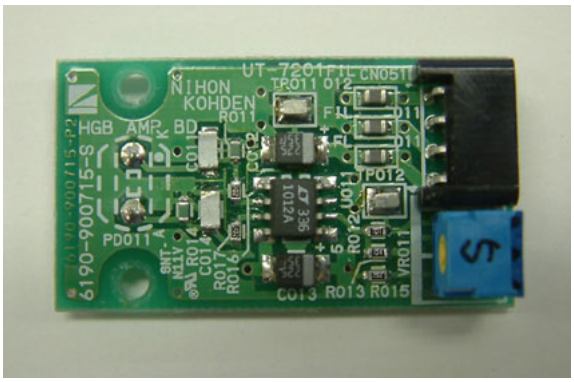
UT-7198 MEASURING Board

This board which is attached to the MC-640V measuring unit sends the voltage between the electrodes, liquid level sensor output voltages and HGB sensor output voltages to the UT-7192 AMP CONTROL board.

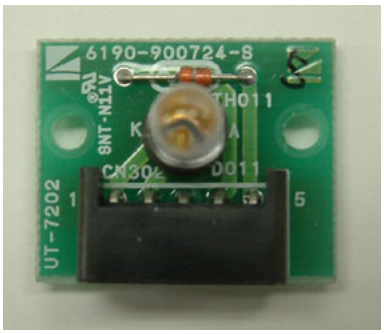


UT-7201 HGB AMP Board and UT-7202 HGB LED Board

These boards which are attached to the MC-640V measuring unit sends the HGB optical density to the UT-7198 MEASURING board.



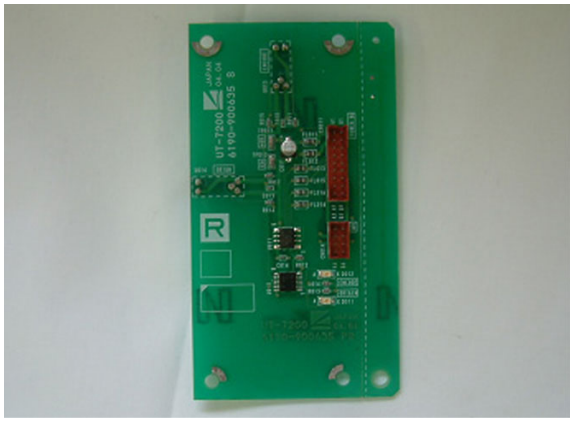
UT-7201



UT-7202

UT-7200 MIXED PUMP Board

This board which is attached to the MD-640V combination syringe pump unit sends the position sensor output signal of the diluter piston to the UT-7193 POWER board.

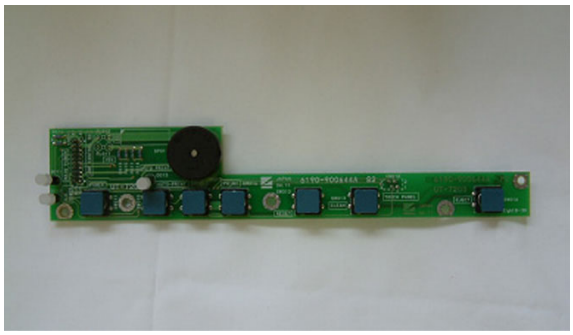


UT-7205 PRINTER DRIVER Board

This board which is attached to the WA-640VK printer unit receives the printer control signals from the UT-7192 AMP CONTROL board to drive the motor and thermal array head of the printer unit.

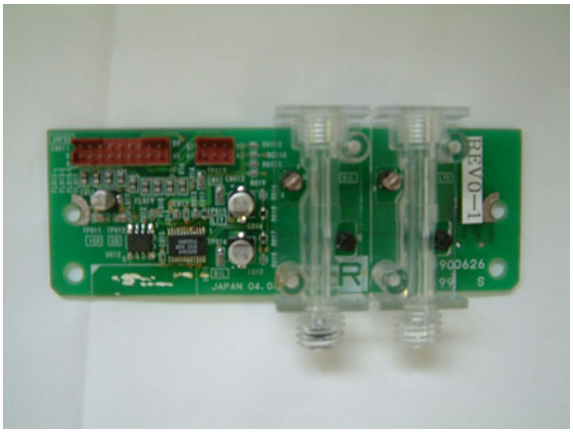
UT-7203 KEY Board

This board which is attached to the PV-640VK front panel unit sends the status signals of the key switches on this board to the UT-7192 AMP CONTROL board.



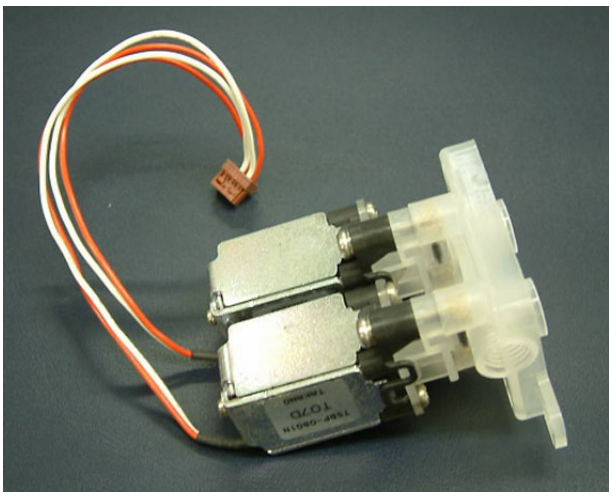
UT-7199 LIQUID SENSOR Board

This board which is attached to the JQ-640V inlet/outlet unit has two liquid sensors for detection of diluent, detergent and hemolyzing reagent.



XP-602V/XP-612V 2-way Electromagentic Valve

These valves open or close the fluid path when receiving the valve drive voltage from the UT-7193 POWER board. XP-602V valve has a silicone rubber diaphragm. XP-612V valve has a fluorocarbon rubber diaphragm.



Section 4 Disassembly and Assembly

The procedures in this section tell how to remove, replace and install major components in the instrument.

Before You Begin

Only qualified service personnel should remove, replace and install major components.

Warnings and Cautions

WARNING

- **To avoid the possibility of injury to yourself or damage to the instrument, do not install or remove any component or change switch settings while the power is on and wait 10 minutes before installing to or removing any component from the instrument after the power is off.**
- **To avoid accidental discharge of static electricity which could damage the instrument components, use a wrist ground strap when installing or removing any component of the instrument.**
- **When replacing any parts or units in the instrument, do not touch any part of the instrument where blood is or may have contacted.**
- **Wear rubber gloves to prevent infection by blood.**

CAUTION

- **Before connecting or disconnecting any cables, turn off the instrument and unplug the AC power cord from the instrument.**
- **Fuses cut off the power when an abnormality occurs in the instrument. Eliminate the malfunction before replacing the fuse. Use the correct fuse only. The fuse rating is shown on the holder.**
- **Removal and replacement of any component in the instrument should be done by qualified service personnel.**
- **Only use parts recommended by Nihon Kohden to assure maximum performance from your instrument.**

Required Tools

- Anti-static bench mat
- Wrist ground strap
- Phillips screwdriver (insulated type)
- Flat-blade screwdriver (insulated type)
- Hex socket driver
- Tweezers

Caution and Notes Related to Valve Joint, Black Screw and Tube Joint in the Instrument

CAUTION

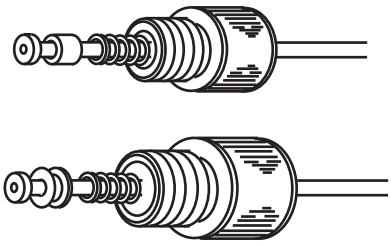
Valve Joint

When connecting the valve joint to the electromagnetic valve, turn the valve joint clockwise, using moderate force until the valve joint comes to a stop. Do not use extreme force to tighten the valve joint further because this will damage the tip of the valve joint. If the valve joint is loosely connected, it will leak.

NOTE

Black screw

Black screws are used to fasten the individual units to the chassis of the instrument to enable the quick removal and replacement of these units. However, to fasten the pump unit to the chassis, normal screws are used.

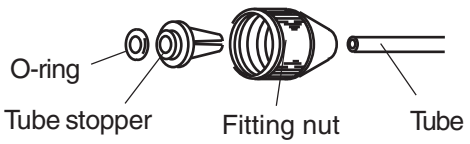


Spring type tube joint

- **Spring type tube joints are used in the instrument to prevent over-tightening of the joints, and to prevent loosening of the joints after the joints are tightened.**
- **There are 2 types of spring tube joints, white (inlet side) and black (outlet side). Each tube joint and its corresponding port in the instrument are marked with the same color or number to ensure matching.**

No spring type tube joint

The no spring type tube joint consists of an O-ring, tube stopper and fitting nut. To disconnect the tube from this joint, turn the fitting nut counterclockwise to loosen the joint and pull the tube toward you. To reconnect the tube to this joint, insert the tube into the fitting nut and turn the fitting nut clockwise to fasten it.



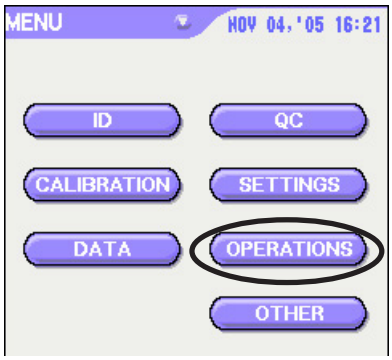
Board and Unit Location

Refer to “Board and Unit Location” in Section 3.

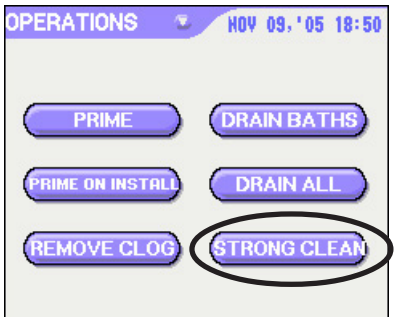
Turning the Power Off

Before turning the analyzer power off, perform strong cleaning and drain the fluid from the instrument.

Cleaning and Draining the Fluid Pathway

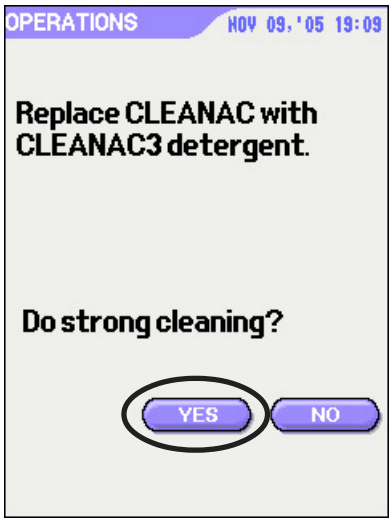


1. Press the OPERATIONS key on the MENU screen to display the OPERATIONS screen.



2. Press the STRONG CLEAN key on the OPERATIONS screen.

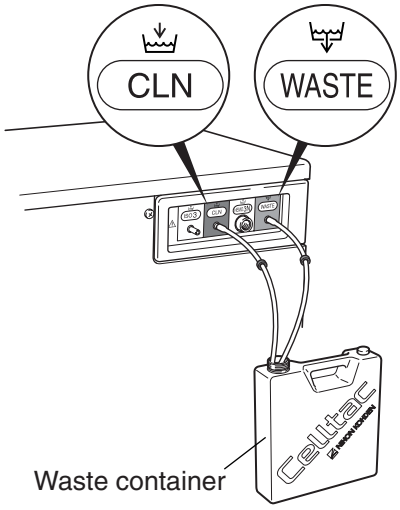
3. Replace the CLEANAC detergent with CLEANAC•3 detergent. Refer to "Connecting Tubes and Installing Reagents" in Section 2 of the Operator's Manual.



4. Press the YES key to perform strong cleaning. The analyzer starts cleaning and the "Strong cleaning" message appears on the screen.

   After cleaning, the instruction to replace the CLEANAC•3 detergent with CLEANAC detergent appears.

5. Ignore the message and press the OK key. The screen returns to the READY screen.



6. Remove the diluent tube from the ISO3 diluent inlet and the hemolysing reagent tube from the HEMO3N inlet on the right side panel. Remove the detergent tube from the detergent container and put it into the waste container.

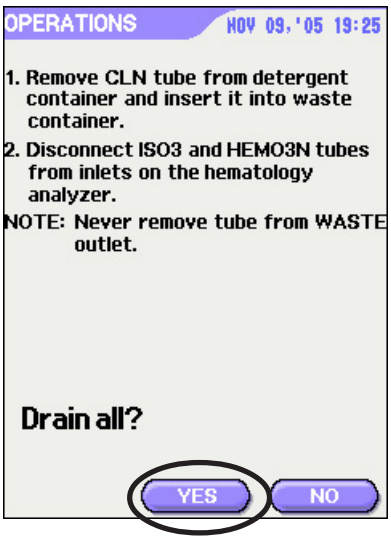
   Do not disconnect the waste tube from the WASTE outlet.

NOTE

- **Make sure that the waste tube is correctly connected.**
- **Waste comes out from the CLN inlet when DRAIN ALL is performed.**
- **To handle the diluent, detergent, hemolysing reagent and waste containers, follow the instructions on each package label.**

7. Press the OPERATIONS key on the MENU screen to display the OPERATIONS screen.

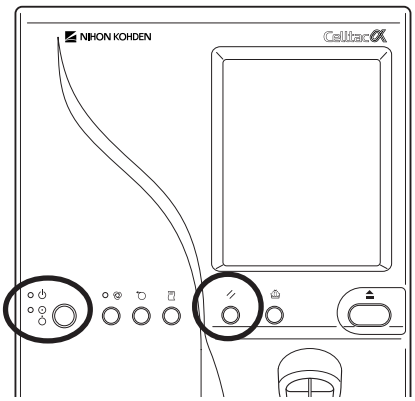
8. Press the DRAIN ALL key on the OPERATIONS screen. A confirmation message appears.



9. Press YES to start draining. During draining, the screen shows the "Draining" message.

   After draining, the screen returns to the READY screen.

Turning the Power Off



CAUTION

Turn off the main power before doing maintenance. Otherwise, the operator may receive electrical shock.

Press the [Power] key while holding down the [Reset] key. The power turns off without cleaning. Check that the power lamp is off.

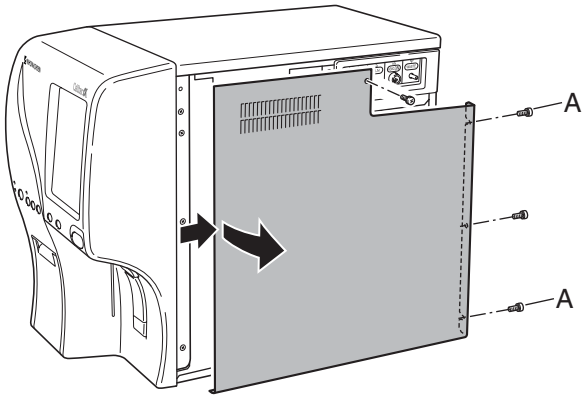
Removing the Right Side Cover, Top Cover and Rear Cover

WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

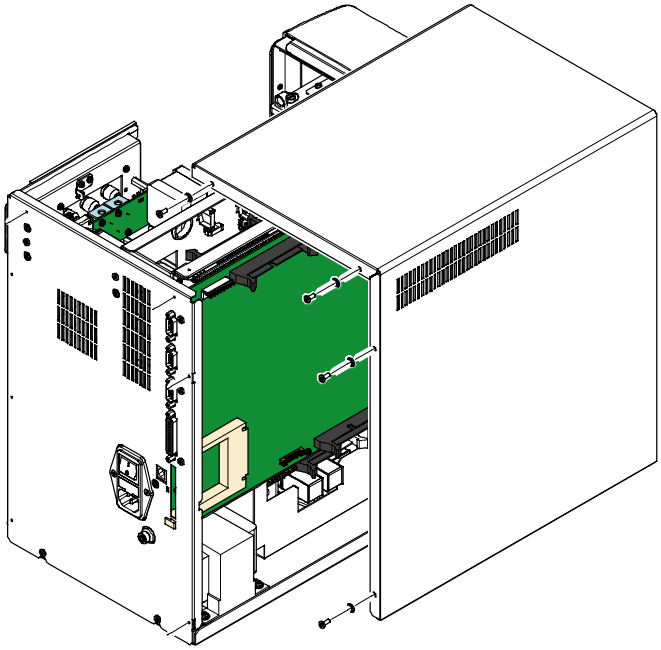
1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the 3 screws on the rear panel and one screw on the right side panel. The two screws marked with A only need to be loosened and not removed.



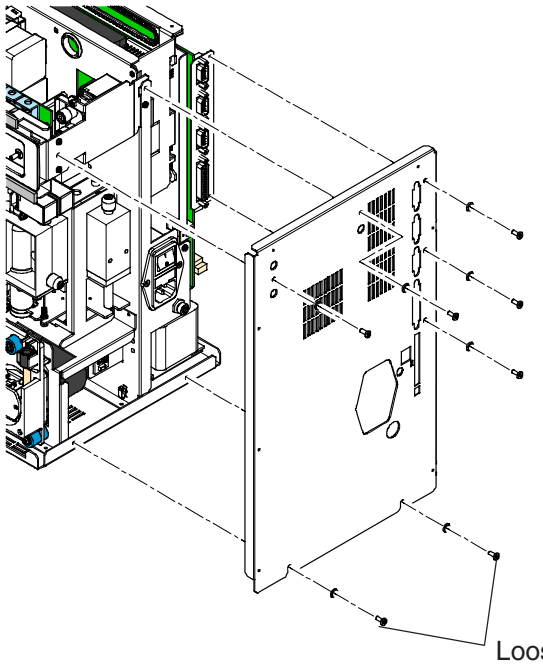
3. Slide the right side cover to the rear direction and then outward to remove the cover from the chassis.

4. Remove the 4 screws which secure the top cover to the chassis.



5. Pull the top cover rearward and remove it.

6. Loosen the two screws at the bottom of the rear cover.



7. Remove the 5 screws from the rear cover.

8. Remove the rear cover by tilting it rearward and then lifting it up.

Reattaching the Right Side Cover, Top Cover and Rear Cover

To reattach the right side cover, top cover and rear cover, reverse the above procedure.

Removing the Front Panel Unit

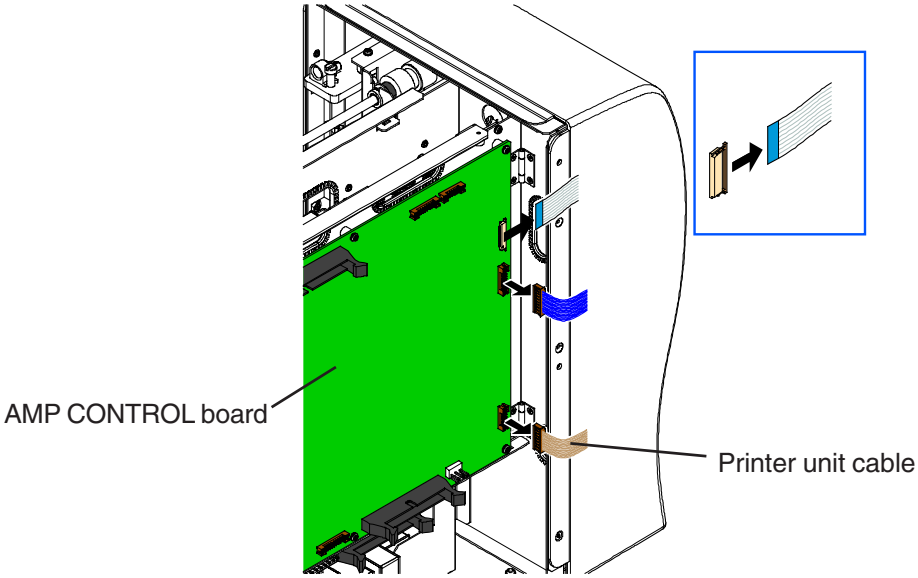
WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

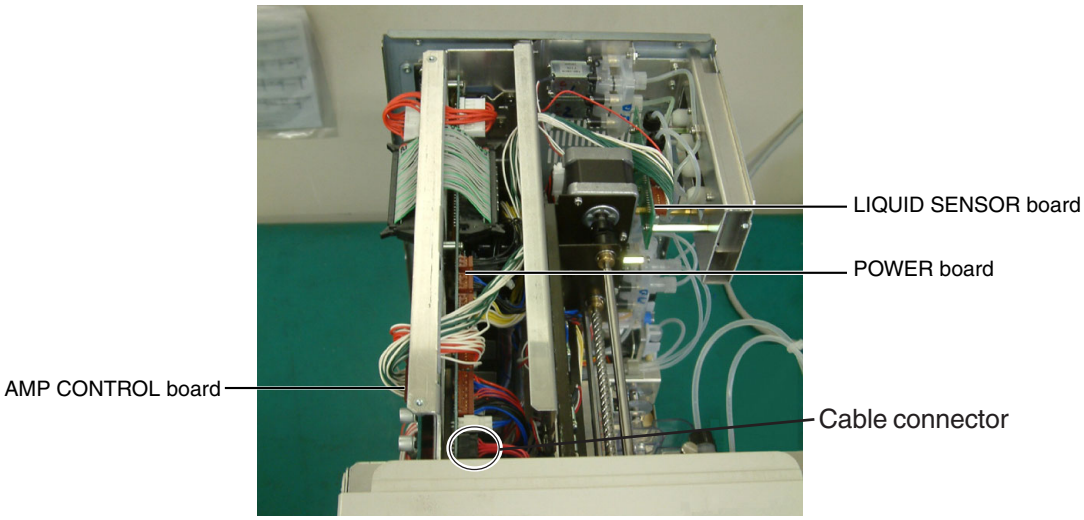
1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the right side cover and top cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

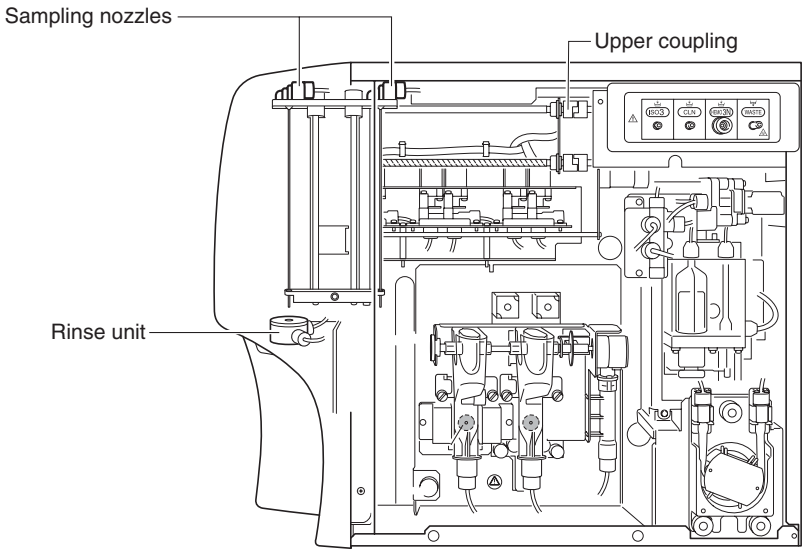
3. Remove the 3 cable connectors from the AMP CONTROL board. The lowest cable is connected between the AMP CONTROL board and printer when the optional WA-640VK printer unit is installed in the instrument.



4. Remove the cable connector (red cable) from the POWER board.



5. Check the sampling nozzle position. Make sure that the sampling nozzle is up and not inserted in the rinse unit. If the sampling nozzle is lowered and in the rinse unit, the sampling nozzle may be broken when the front panel unit is removed. To raise the sampling nozzle to the top position, rotate the upper coupling counterclockwise (when viewed from the front).



6. Remove the 4 screws which secure the front panel unit to the chassis.

There are 2 screws on the same position on the right side of the front panel.

7. Carefully pull the front panel unit frontward while checking that the cables are not caught. Completely separate the front panel unit from the chassis.

Reattaching the Front Panel Unit

To reattach the front panel unit, reverse the above procedure.

Installing the WA-640VK Printer Unit (Option)

WARNING

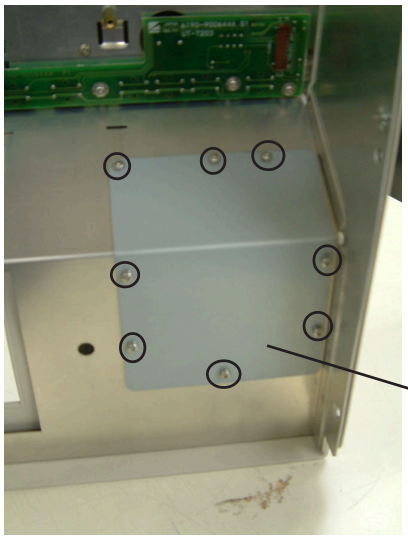
For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

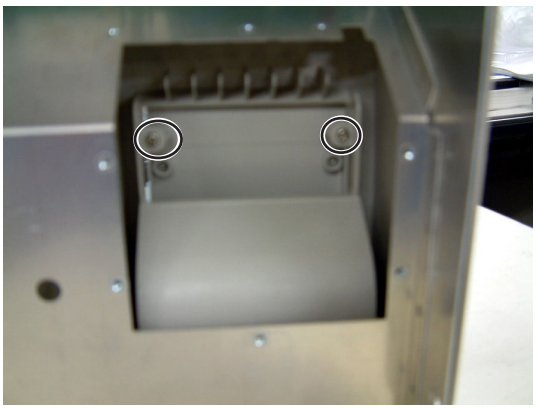
2. Remove the right side cover and top cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

3, Remove the front panel unit. Refer to “Removing the Front Panel Unit” earlier in this section.

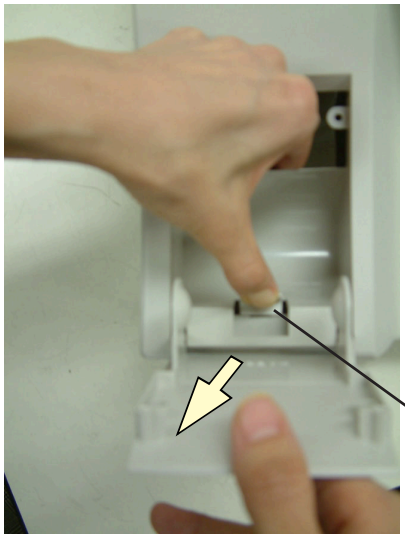
4. Remove the 8 screws which secure the blank panel to the front panel unit and remove the blank panel.

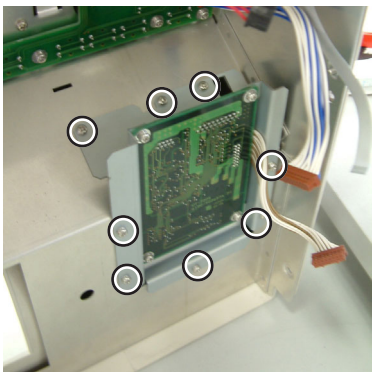


5. Remove the 2 screws which secure the printer blank panel to the backside of the front cover.



6. Remove the printer blank panel from the front side of the front panel unit while depressing the stopper downward and pulling the printer blank panel as shown left.





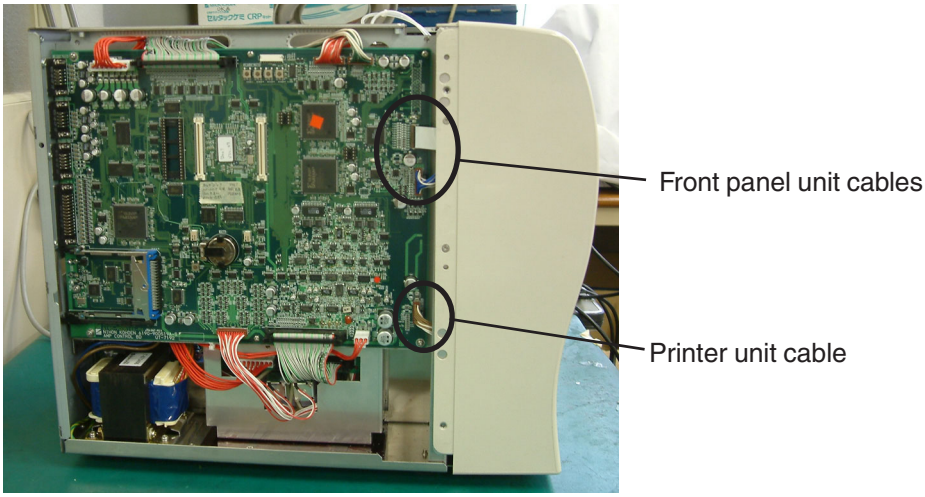
7. Attach the optional WA-640VK printer unit without printer door to the front cover with 8 screws. During this step, check that no cable is pinched.

8. Put the front panel unit back to the original position.

9. Fasten the front panel unit to the chassis with the 4 screws.

10. Connect the 2 cables of the front panel unit to the AMP CONTROL board.

11. Connect the cable of the printer unit to the AMP CONTROL board.



12. Connect the cable of the front panel unit to the POWER board. (Refer to step 4 in the “Removing the Front Panel Unit” section.)

13. Attach the printer door to the printer unit on the front side of the front panel unit while depressing the stopper downward and pushing the printer door into the opening of the printer unit.

Removing the Measuring Unit

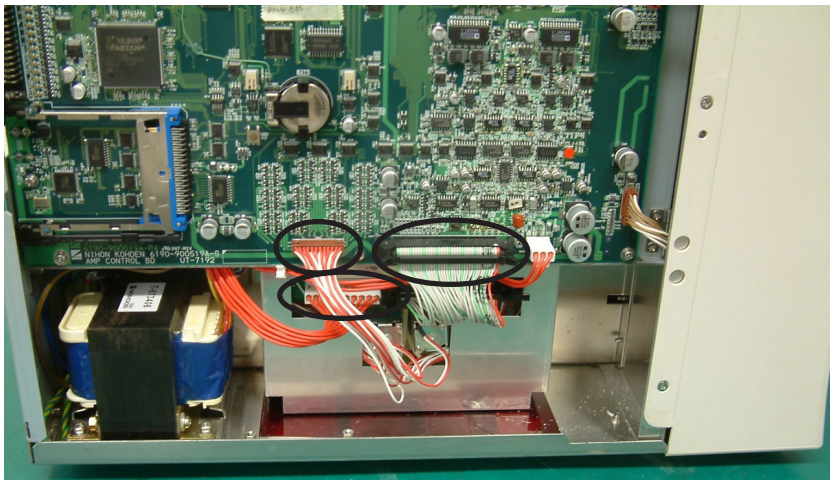
WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

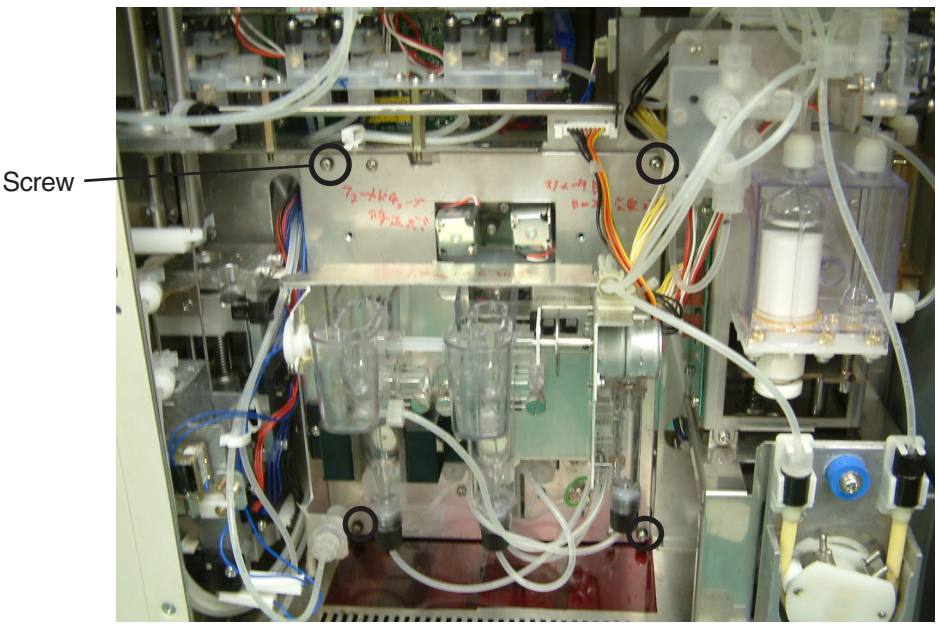
1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the right side cover and top cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

3. Disconnect the 3 cables from the AMP CONTROL board.



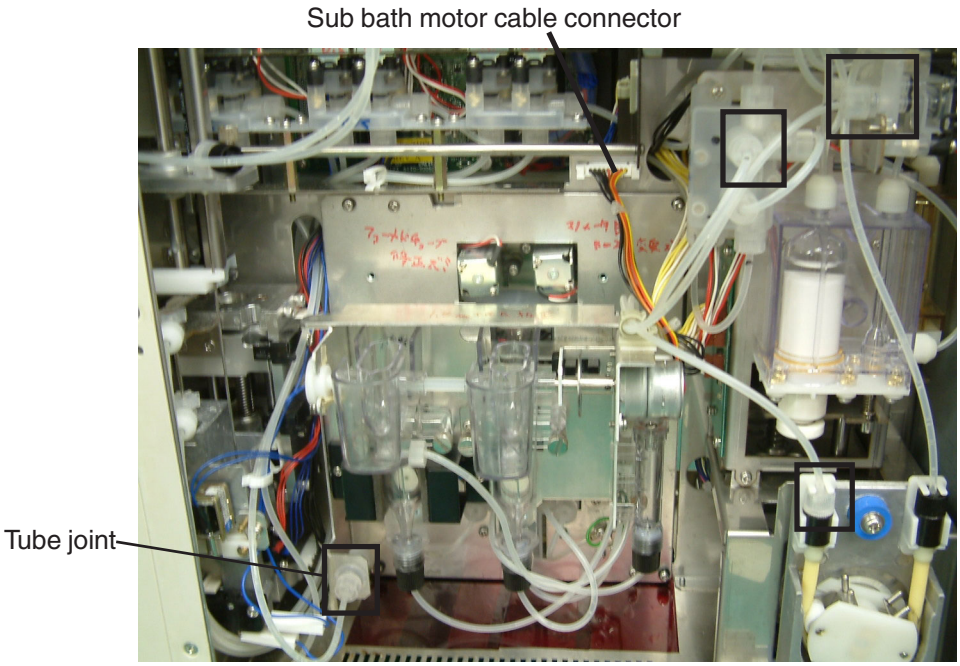
4. Loosen the 4 screws which secure the measuring unit to the chassis.



5. Remove the 4 tube joints and sub bath motor cable connector.

CAUTION

Be careful not to cut your finger with the edges of the chassis.



6. Pull out the measuring unit toward you.

Reattaching the Measuring Unit

To reattach the measuring unit, reverse the above procedure.

NOTE

When reattaching the measuring unit, place the measuring unit to the right as far as possible.

Accessing the Connectors on the POWER Board

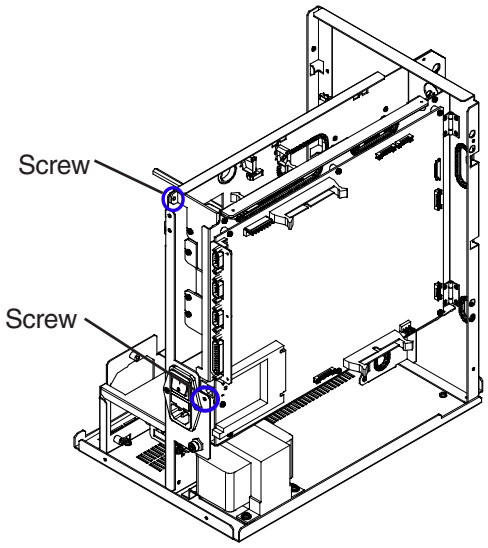
WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

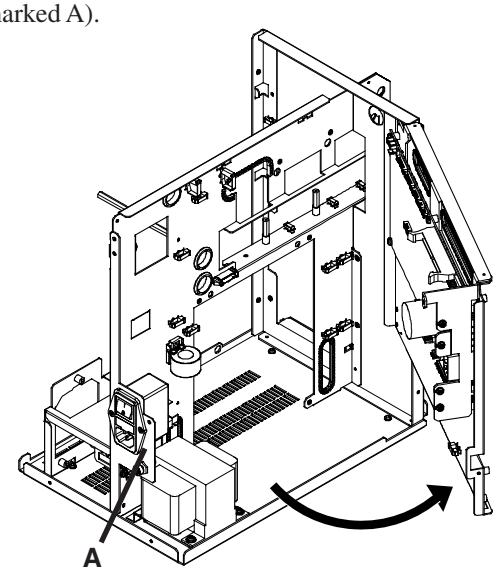
1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the right side cover, top cover and rear cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

3. Remove the 2 screws which secure the POWER board to the chassis.



4. Open the board to the right. If it is difficult to open the board, pull out the chassis (marked A).



Reassembling the Board

To assemble the board, reverse the above procedure.

Removing the Combination Syringe Pump Unit

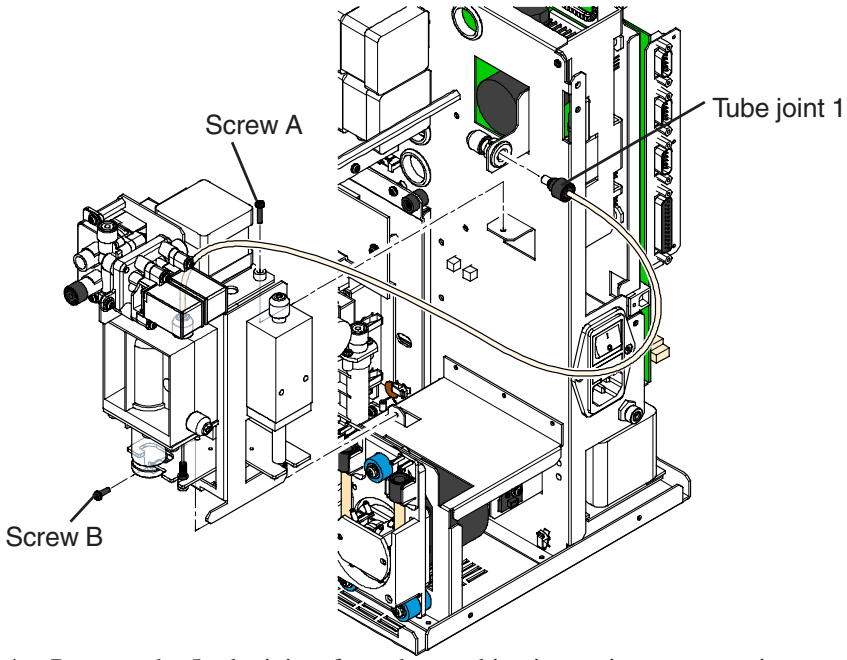
WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

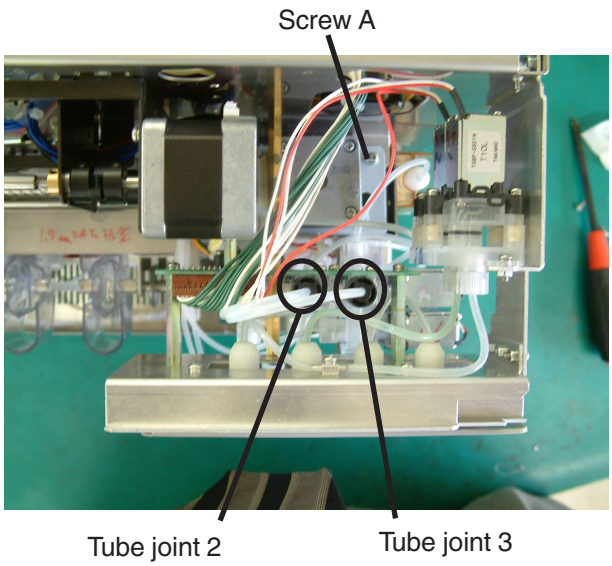
1. Do the procedure in "Turning the Power Off" earlier in this section to turn off the instrument.

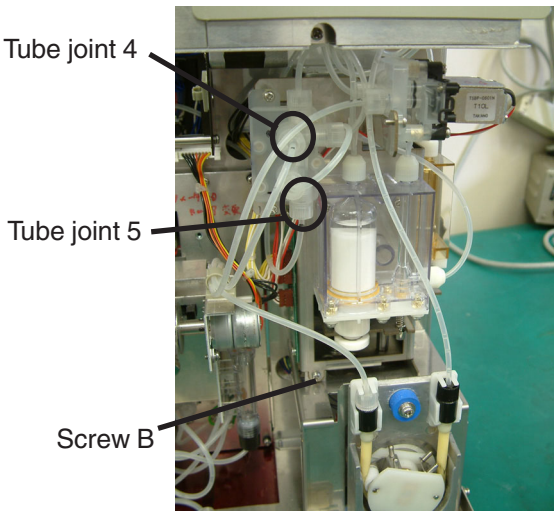
2. Remove the right side cover, top cover and rear cover. Refer to "Removing the Right Side Cover, Top Cover and Rear Cover" earlier in this section.

3. Loosen the 2 screws (A and B) which secure the combination syringe pump unit to the chassis.

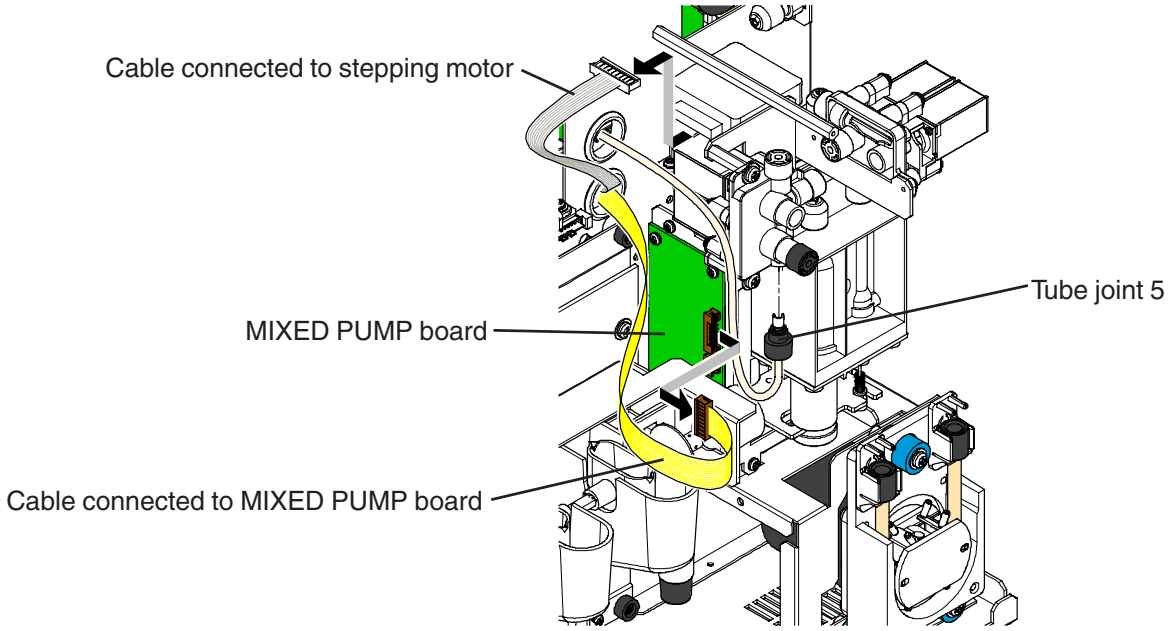


4. Remove the 5 tube joints from the combination syringe pump unit.

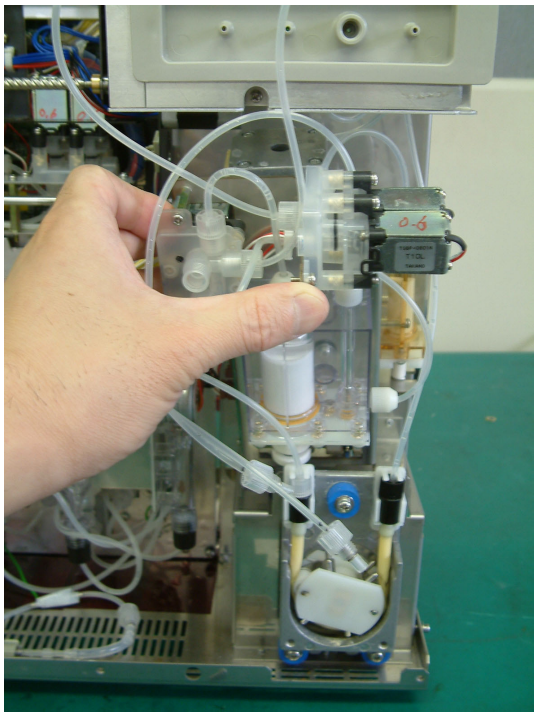




5. Remove the cable connector from the MIXED PUMP board and stepping motor.



6. Pull out the combination syringe pump unit by tilting it toward you. Be careful not to damage any tube.



Reattaching the Combination Syringe Pump Unit

To reattach the combination syringe pump unit, reverse the above procedure.

Removing the Pump Unit

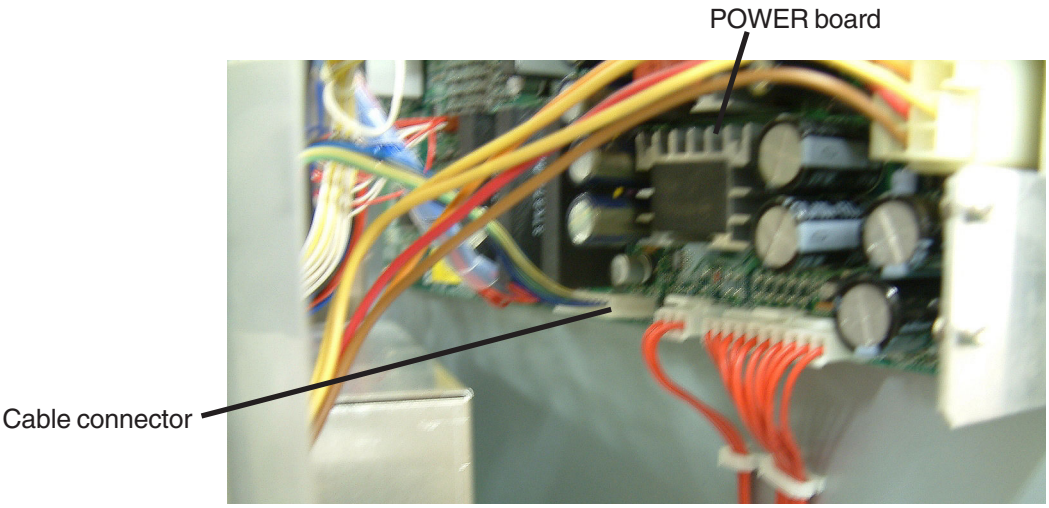
WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

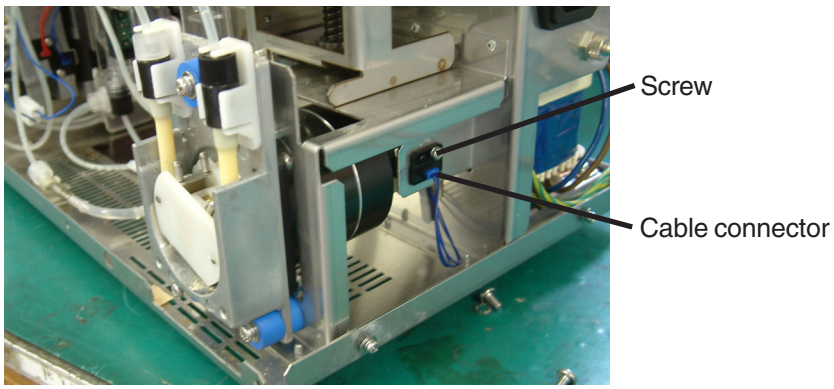
1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the right side cover, top cover and rear cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

3. Remove the cable connector from the POWER board (blue and yellow cables). To access the POWER board, refer to “Accessing the Connectors on the POWER Board” earlier in this section.



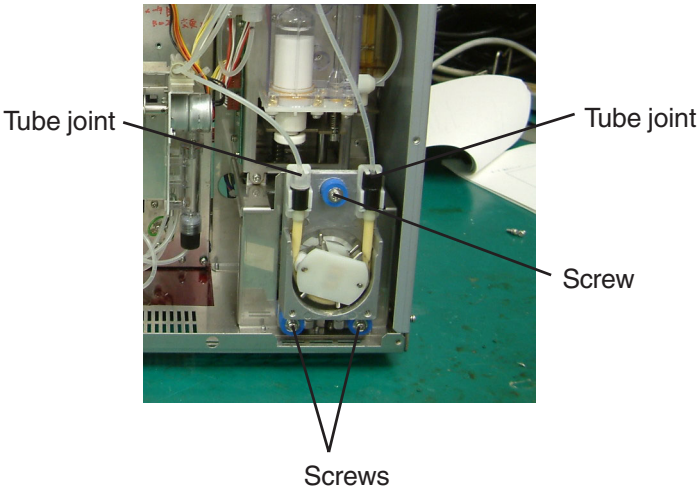
4. Remove the cable connector from the photo sensor. Remove all cable clamps from this cable.



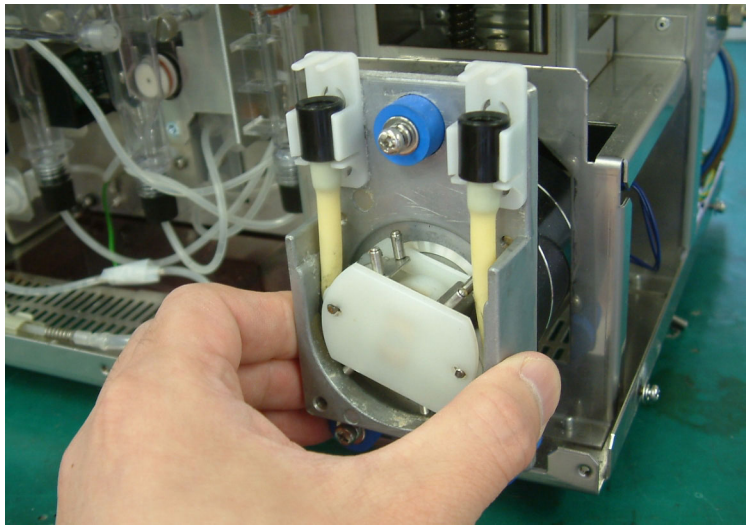
5. Remove the screw and pull out the photo sensor.

6. Remove the 3 screws which secure the pump unit to the chassis. The screws are guarded by blue rubber rings.

7. Remove the 2 tube joints from the pump unit.



8. Pull out the pump unit toward you.



Reattaching the Pump Unit

To reattach the pump unit, reverse the above procedure.

Removing the Sampler Unit

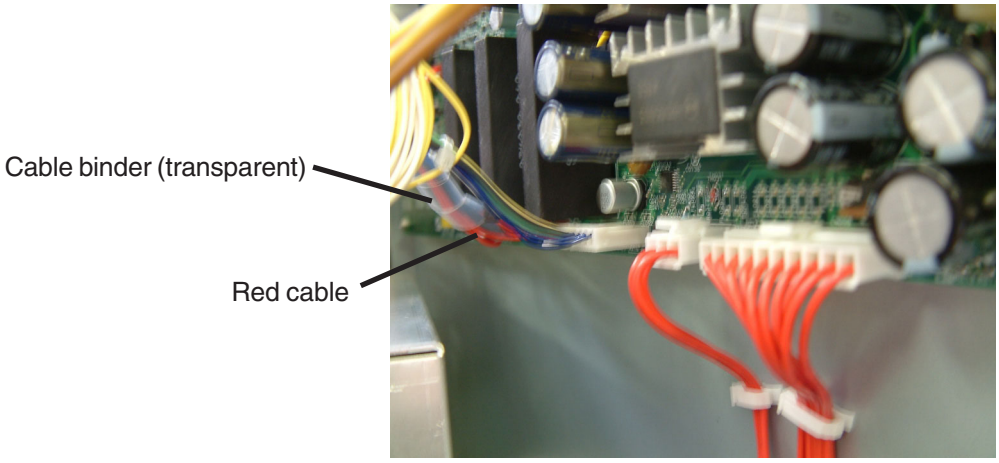
WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

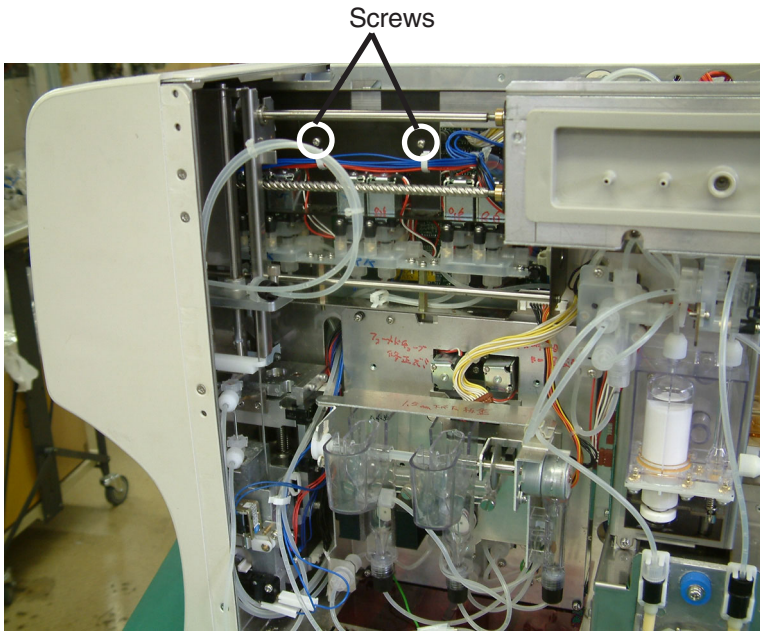
1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the right side cover, top cover and rear cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

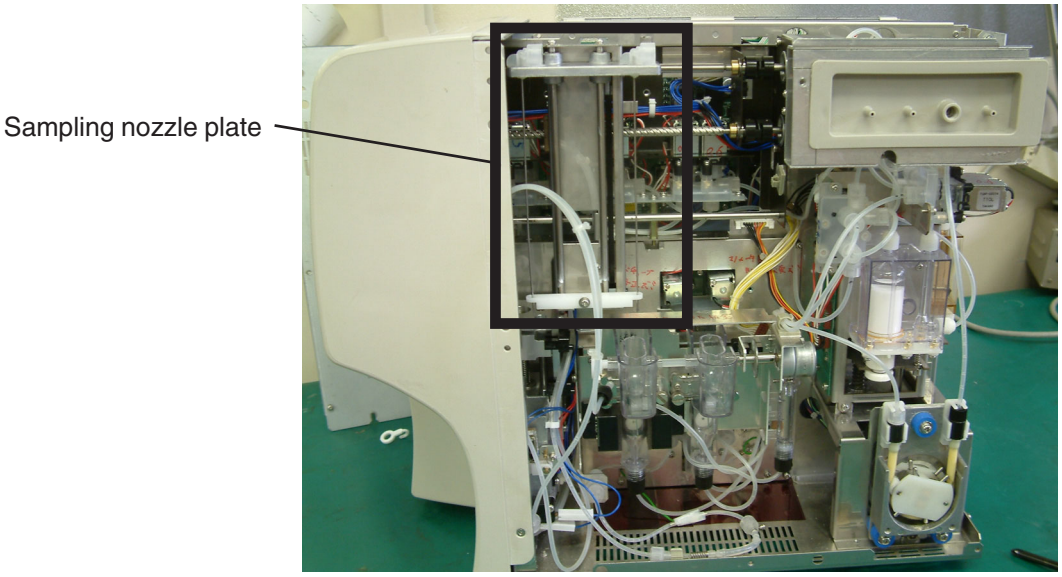
3. Remove the cable connector from the POWER board (red cable). Remove the cable binder from the cable. To access the POWER board, refer to “Accessing the Connectors on the POWER Board” earlier in this section.



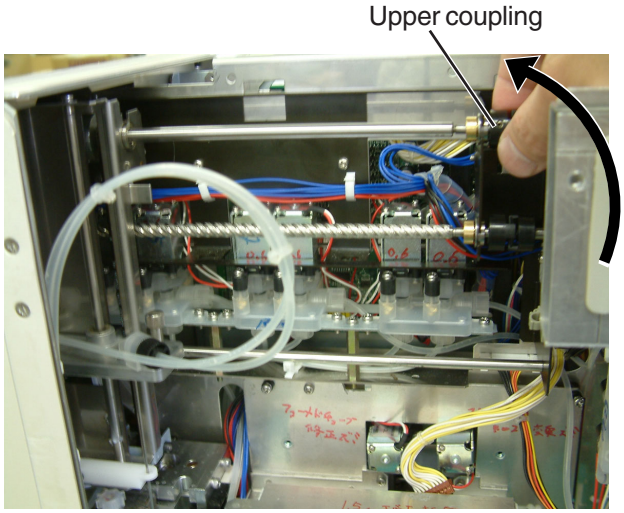
4. Remove the 2 screws which secure the sampler unit to the chassis.



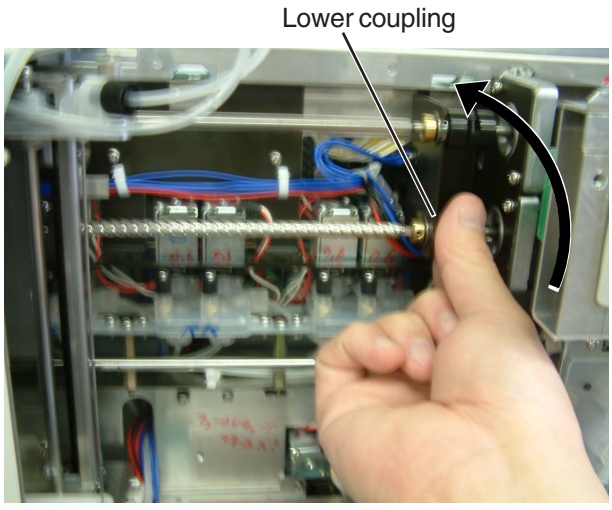
5. Move the sampling nozzle plate to the position shown below.



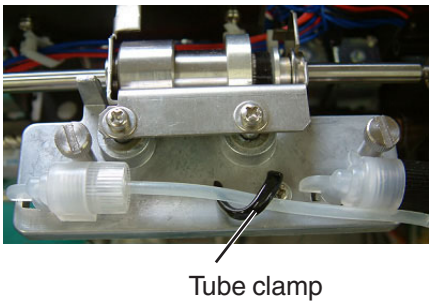
i) Rotate the upper coupling counterclockwise when looked from the front view to raise the sampling nozzle plate up.

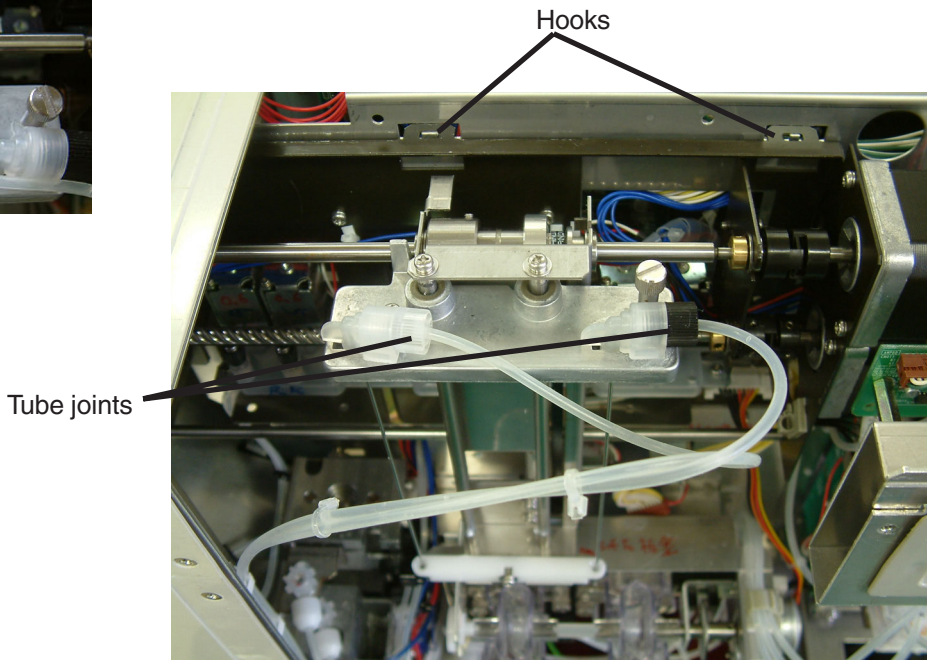


ii) Rotate the lower coupling counterclockwise when viewed from the front to move the sampling nozzle plate to the rearward (to the right when viewed from the right side).



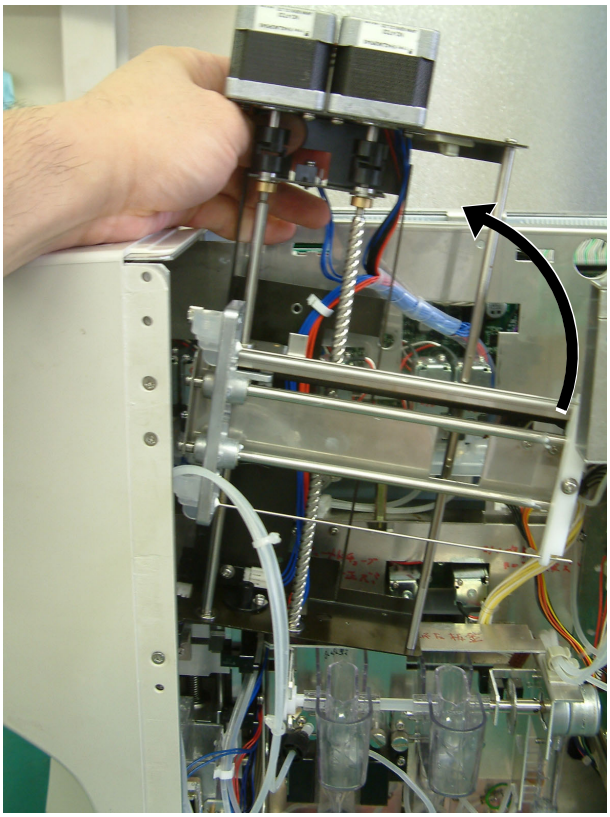
6. Remove the 2 tube joints from the sampling nozzles. Remove the tube of the left sampling nozzle from the tube clamp.





7. Lift up and pull the sampler unit toward you to unhook the hooks on the sampler unit from the tabs on the chassis.

8. Rotate the sampler unit 90° counterclockwise when viewed from the right side and lift the unit up. Be careful not damage sampling nozzles, cables and tubes.

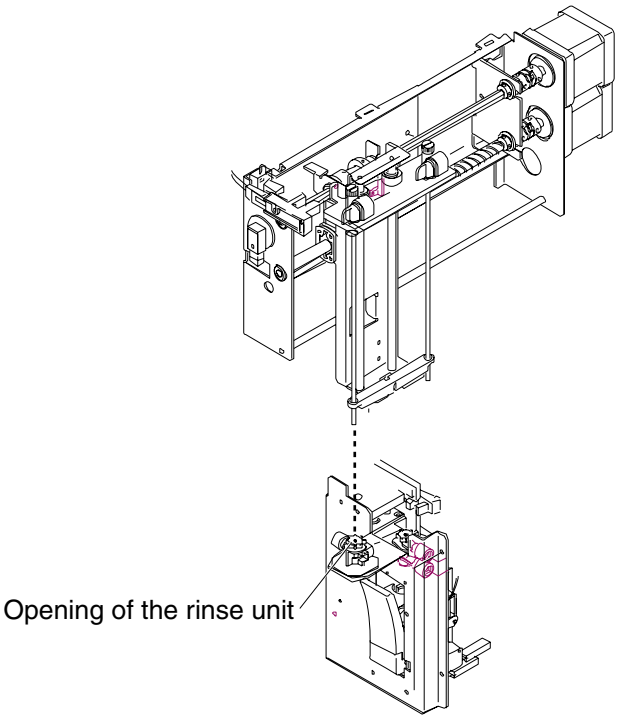


Reattaching the Sampler Unit

To reattach the sampler unit, reverse the above procedure.

NOTE

- **When attaching the sampler unit to the chassis, put the sampler unit to the left (front side) as far as possible.**
- **Be careful not to pinch the cables of the valve unit.**
- **Turn the upper coupling clockwise to bring down the sampling nozzle and check that the sampling nozzle on the left (front side) goes through the opening of the rinse unit. Use the lower coupling to adjust the position of the sampling nozzle sideways (front and back). The cap pierce unit (on the MEK-6400 analyzer) or rinse unit (on the MEK-6410/6420 analyzers) position may need to be adjusted.**



Removing the Cap Pierce Unit or Rinse Unit

WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

The MEK-6400 analyzer has the MS-641V cap pierce unit.
The MEK-6410/6420 analyzers have the MR-640V rinse unit.

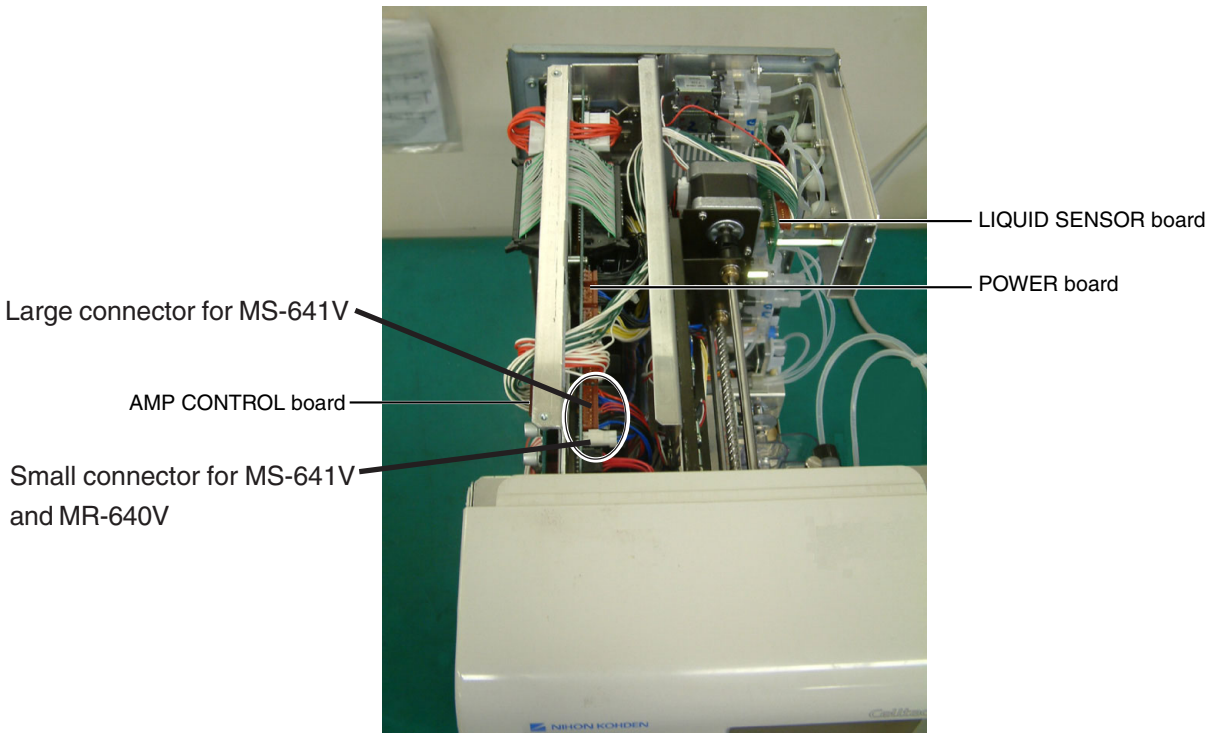
1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the right side cover, top cover and rear cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

3. Remove the cable connectors from the POWER board.

   MEK-6400
   For the MS-641V cap pierce unit, remove red and blue cable connector (large) and blue cable connector (small).

   MEK-6410/6420
   For the MR-640V rinse unit, remove the blue cable connector.



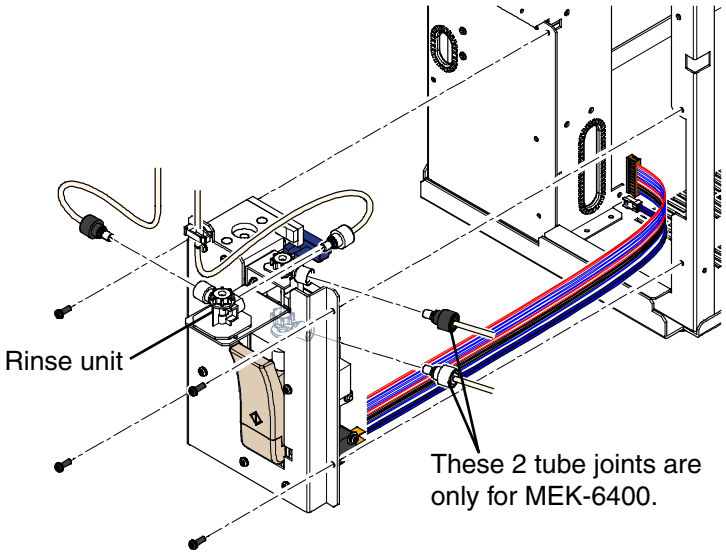
   Also remove cable binder from the cable.

   To access the POWER board, refer to “Accessing the Connectors on the POWER Board” earlier in this section.

4. Remove the front panel unit. Refer to “Removing the Front Panel Unit” earlier in this section.

5. **MEK-6400**
   Remove the 2 tube joints from the cap pierce unit and 2 tube joints from the rinse unit.

   MEK-6410/6420
   Remove the 2 tube joints from the rinse unit.



6. Remove the 4 screws which fasten the cap pierce unit/rinse unit to the chassis.

7. Pull out the cap pierce unit/rinse unit toward you.

Reattaching the Cap Pierce Unit or Rinse Unit

To reattach the cap pierce unit/rinse unit, reverse the above procedure.

NOTE

After reattaching the cap pierce unit/rinse unit, check that the sampling nozzle on the left (front side) goes through the opening of the rinse unit. On the sampler unit, turn the upper coupling clockwise to bring down the sampling nozzle and turn the lower coupling to adjust the position of the sampling nozzle sideways (front and back). If necessary, adjust the cap pierce unit or rinse unit position.

Removing the Inlet/Outlet Unit

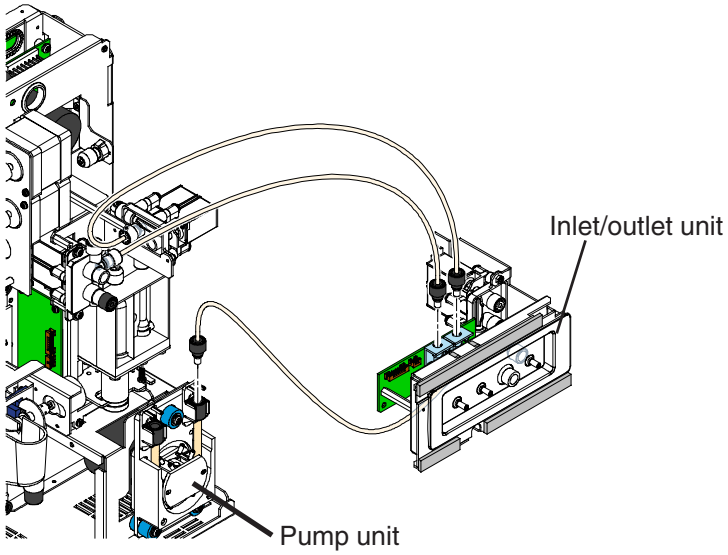
WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

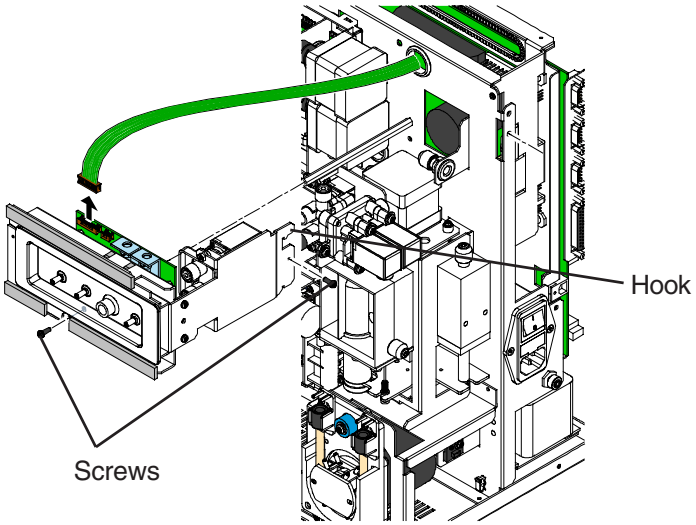
1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the right side cover, top cover and rear cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

3. Remove the 2 tube joints from the inlet/outlet unit and 1 tube joint from the pump unit.



4. Remove the cable connector from the inlet/outlet unit.



5. Remove the 2 screws which secure the inlet/outlet unit to the chassis.

6. Lift the inlet/outlet unit up to unhook the hook from the chassis and pull out the unit toward you.

Reattaching the Inlet/Outlet Unit

To reattach the inlet/outlet unit, reverse the above procedure.

Removing the Valve Unit

WARNING

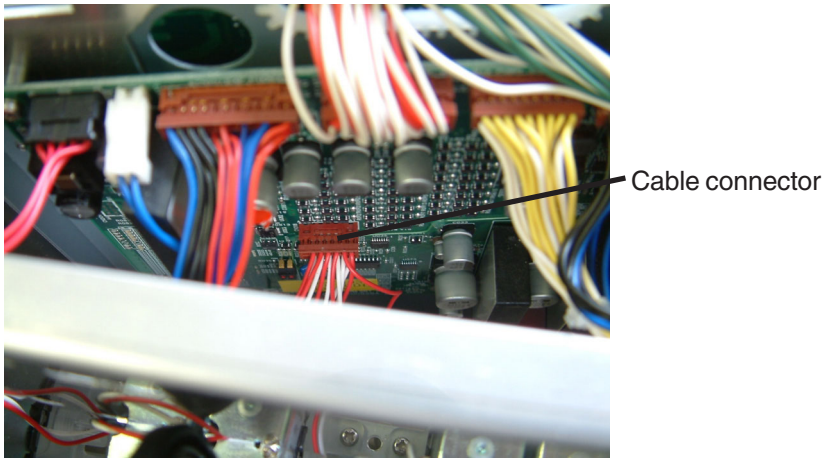
For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

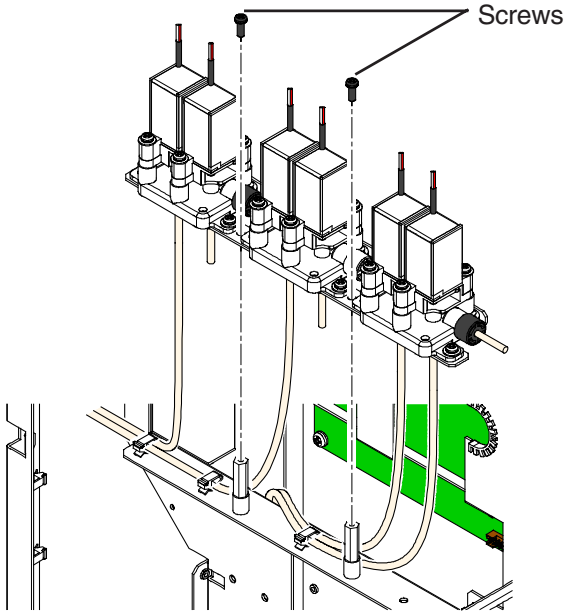
2. Remove the right side cover, top cover and rear cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

3. Remove the sampler unit. Refer to “Removing the Sampler Unit” earlier in this section.

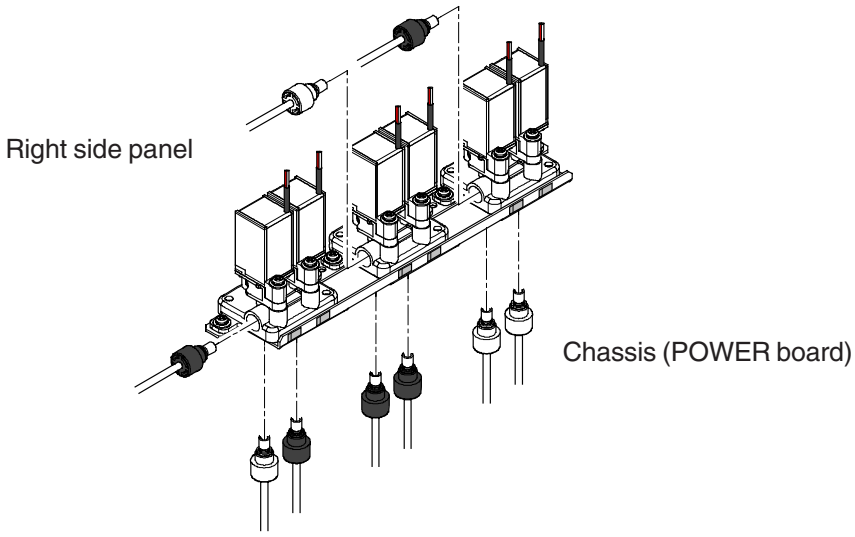
4. Remove the cable connector from the POWER board (red and white cable). Remove the cable binder from the cable. To access the POWER board, refer to “Accessing the Connectors on the POWER Board” earlier in this section.



5. Remove the 2 screws which secure the valve unit to the chassis.



6. Tilt the valve unit toward you and remove the 9 tube joints from the valve unit.



7. Pull out the valve unit toward you.

Reattaching the Valve Unit

To reattach the valve unit, reverse the above procedure.

Removing the AMP CONTROL Board

WARNING

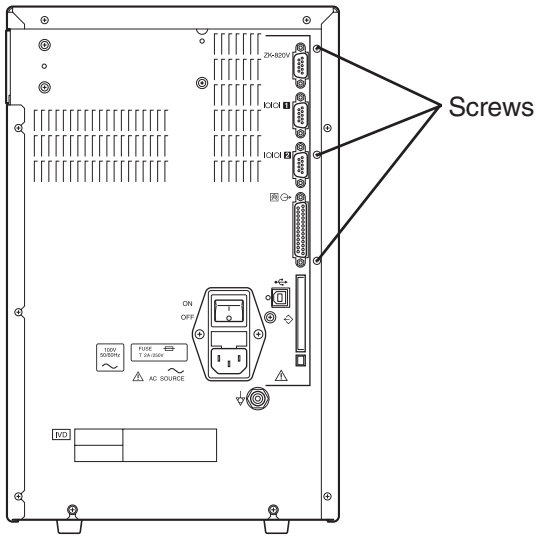
For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

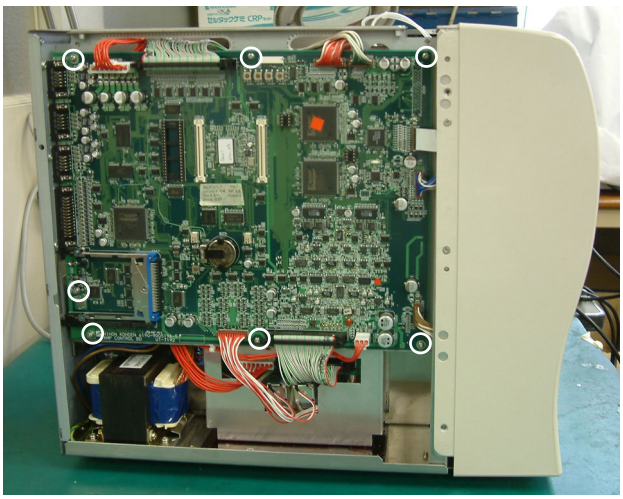
2. Remove the right side cover and top cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

3. Remove all cable connectors from the AMP CONTROL board.

4. Remove the 3 screws which secure the AMP CONTROL board from the rear cover.



5. Remove the 7 screws which secure the AMP CONTROL board to the chassis.



6. Pull the AMP CONTROL board to the right then toward you to remove it from the instrument.

Reattaching the AMP CONTROL Board

To reattach the AMP CONTROL board, reverse the above procedure.

Removing the POWER Board

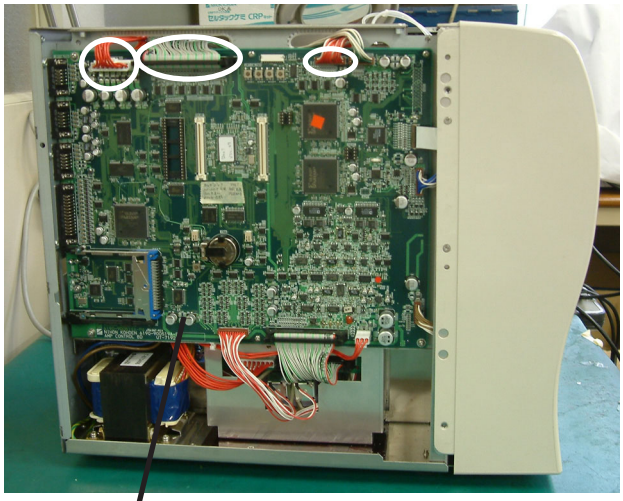
WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

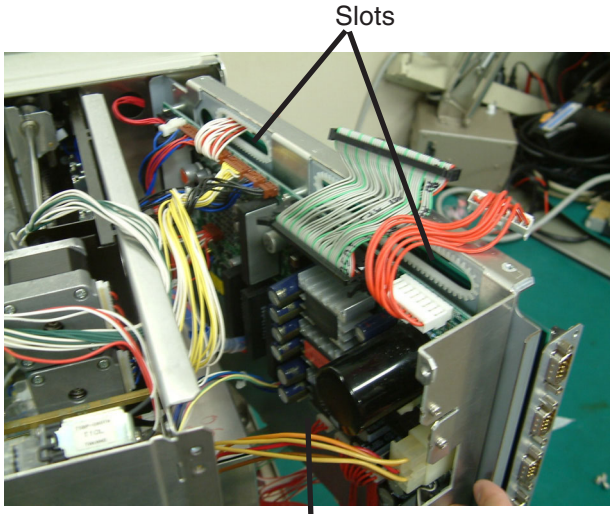
1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Do the procedure in “Accessing the Connectors on the POWER Board” earlier in this section to open the POWER board.

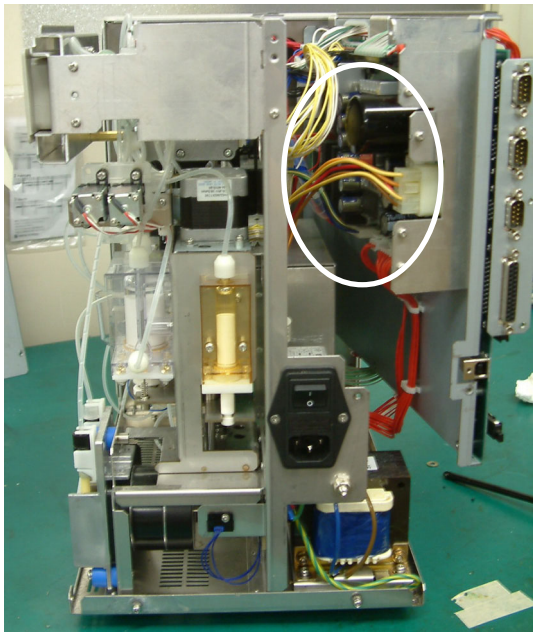
3. Remove the 3 cable connectors from the AMP CONTROL board. Pull the cables to the POWER board side through the slots on the chassis.



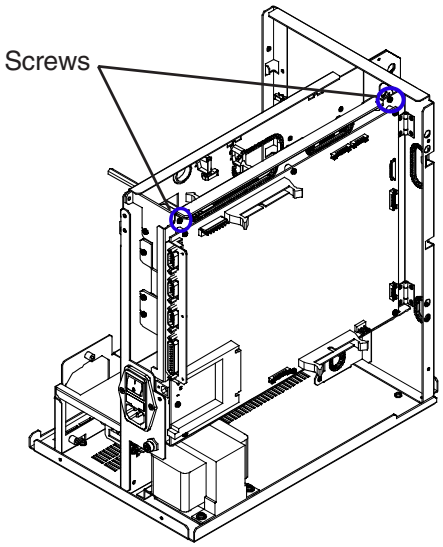
AMP CONTROL board



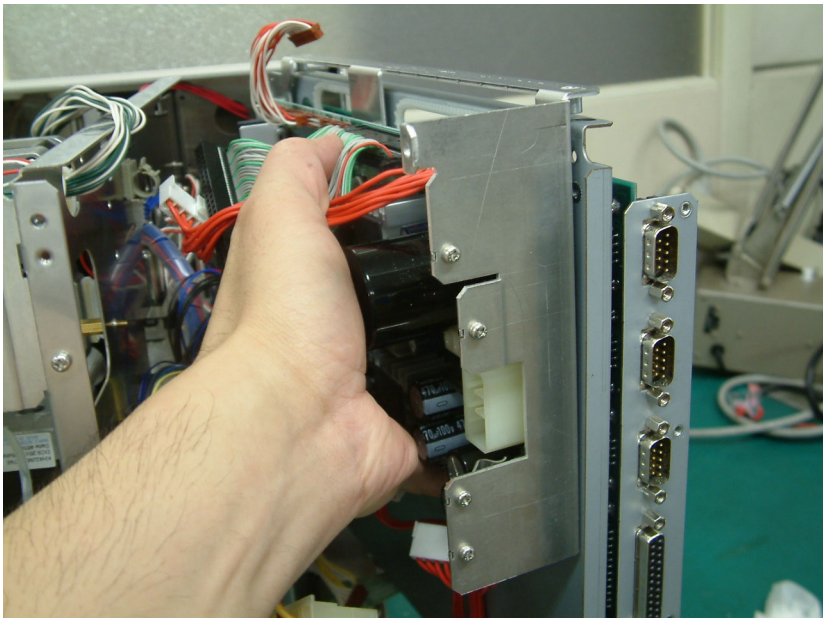
4. Remove all cable connectors from the POWER board.

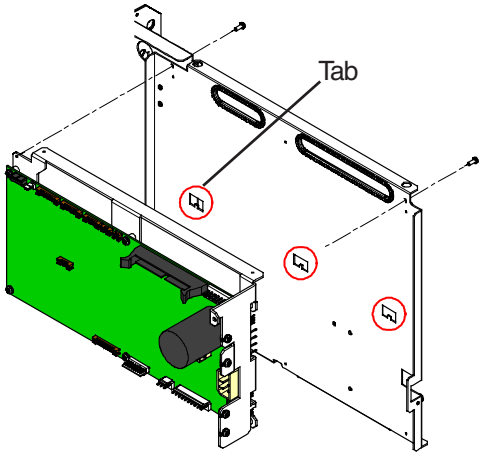


5. Remove the 2 screws which secure the POWER board to the chassis.



6. Lift up the POWER board to unhook the POWER board from the 3 tabs on the chassis and pull out the board toward you.





Reattaching the POWER Board

To reattach the POWER board, reverse the above procedure. Make sure that the hooks on the POWER board is hooked onto the tabs on the chassis (refer to step 6 in the above procedure).

Removing the MEASURING Board

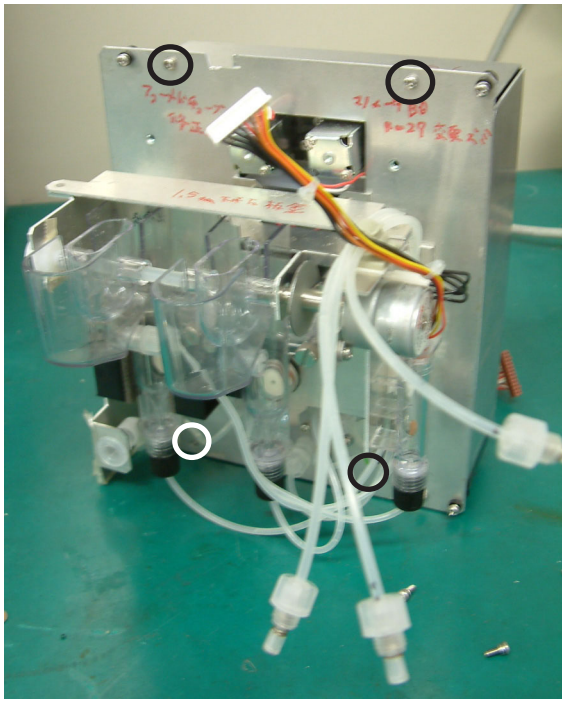
WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

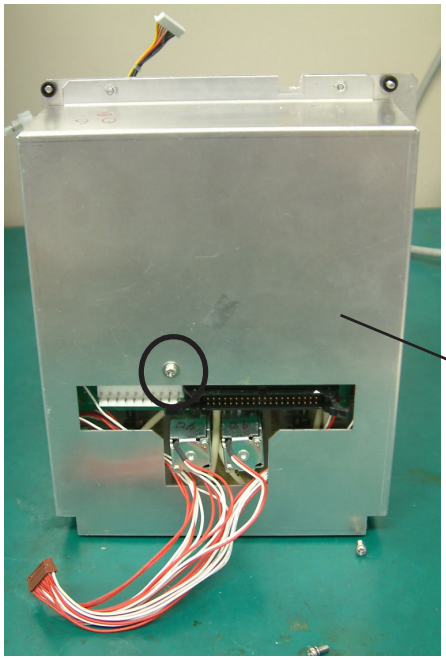
1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Do the procedure in “Removing the Measuring Unit” earlier in this section to remove the measuring unit from the chassis.

3. Remove the 4 screws from the front panel of the measuring unit.

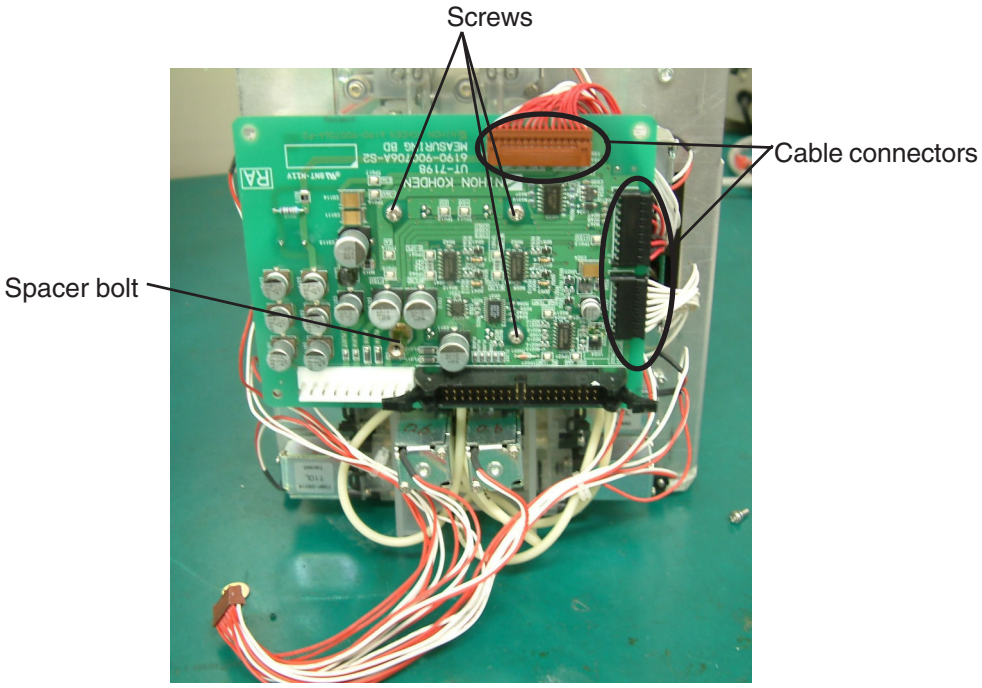


4. Remove the screw from the rear panel of the measuring unit and remove the MC cover.



5. Remove the 3 cable connectors from the MEASURING board.

6. Remove the 3 screws which secure the MEASURING board to the measuring unit.



7. Remove the spacer bolt with a hex socket driver and remove the MEASURING board. Be careful not to drop the black cap of the manometer.

Reattaching the MEASURING Board

To reattach the MEASURING board, reverse the above procedure.

NOTE

Make sure to attach the screw on the MC cover. Otherwise, it may cause noise.

Removing the MIXED PUMP Board

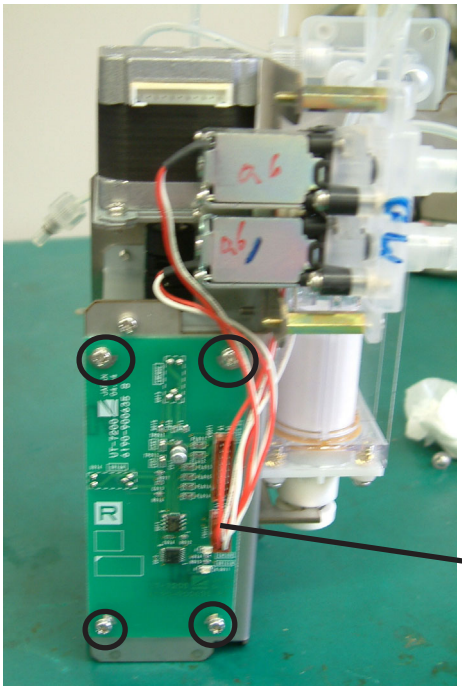
WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Do the procedure in “Removing the Combination Syringe Pump Unit” earlier in this section to remove the combination syringe pump unit from the chassis.

3. Remove the cable connector from the MIXED PUMP board. The MIXED PUMP board is located at the left side of the combination syringe pump unit.



4. Remove the 4 screws which secure the MIXED PUMP board to the combination syringe pump unit and remove the board.

Reattaching the MIXED PUMP Board

To reattach the MIXED PUMP board, reverse the above procedure.

Removing the PRINTER DRIVER Board

WARNING

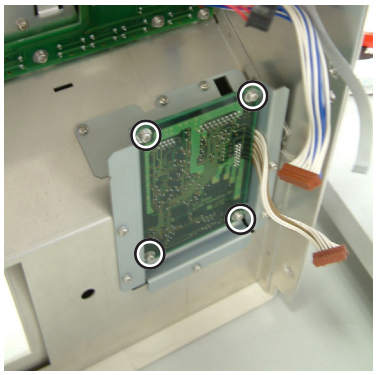
For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the right side cover and top cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

3. Remove the front panel unit. Refer to “Removing the Front Panel Unit” earlier in this section.

4. Remove the 4 screws from the PRINTER DRIVER board.



Reattaching the PRINTER DRIVER Board

To reattach the PRINTER DRIVER board, reverse the above procedure.

Removing the KEY Board

WARNING

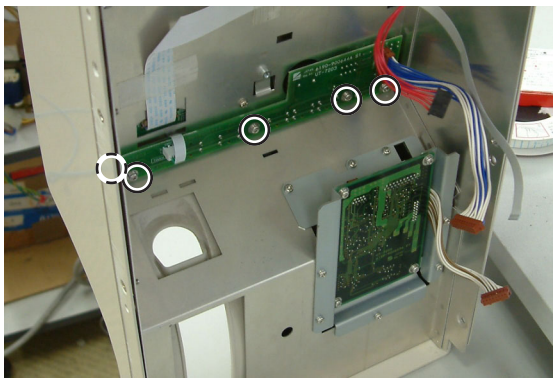
For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the right side cover and top cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

3. Remove the front panel unit. Refer to “Removing the Front Panel Unit” earlier in this section.

4. Remove the 5 screws from the KEY board.



Reattaching the KEY Board

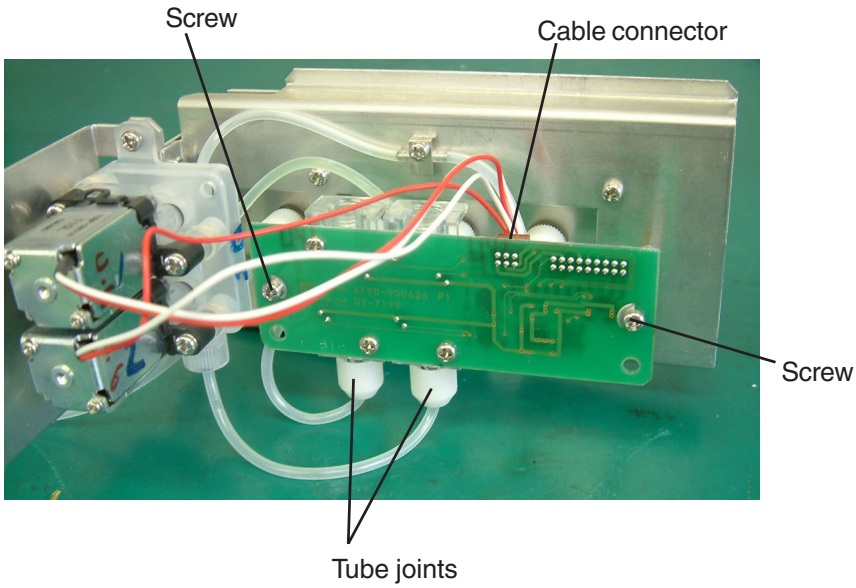
To reattach the KEY board, reverse the above procedure.

Removing the LIQUID SENSOR Board

WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

1. Do the procedure in "Turning the Power Off" earlier in this section to turn off the instrument.
2. Remove the right side cover, top cover and rear cover. Refer to "Removing the Right Side Cover, Top Cover and Rear Cover" earlier in this section.
3. Remove the inlet/outlet unit. Refer to "Removing the Inlet/Outlet Unit" earlier in this section.
4. Remove the cable connector from the LIQUID SENSOR board.
5. Remove the 2 tube joints.
6. Remove the 2 screws which secure the LIQUID SENSOR board to the inlet/outlet unit.



Reattaching the LIQUID SENSOR Board

To reattach the LIQUID SENSOR board, reverse the above procedure.

Removing the LCD

WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.

1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.

2. Remove the right side cover and top cover. Refer to “Removing the Right Side Cover, Top Cover and Rear Cover” earlier in this section.

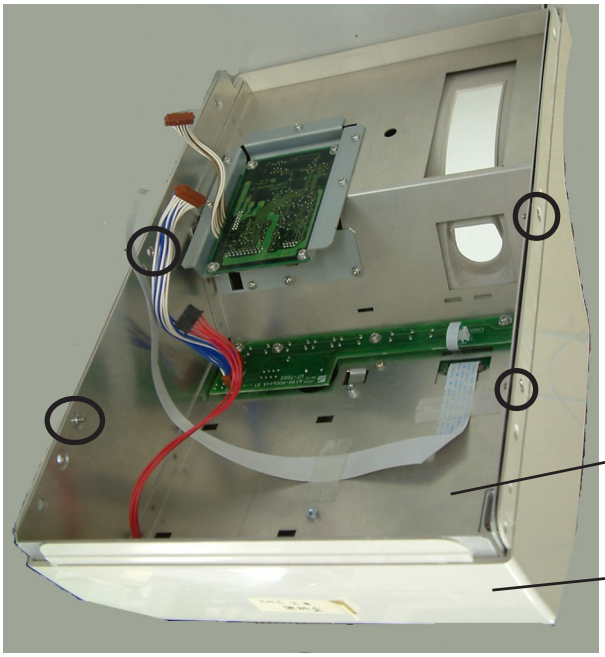
3. Remove the front panel unit. Refer to “Removing the Front Panel Unit” earlier in this section.

4. Place the front panel unit face down on a table covered with a clean, soft and smooth antistatic material.

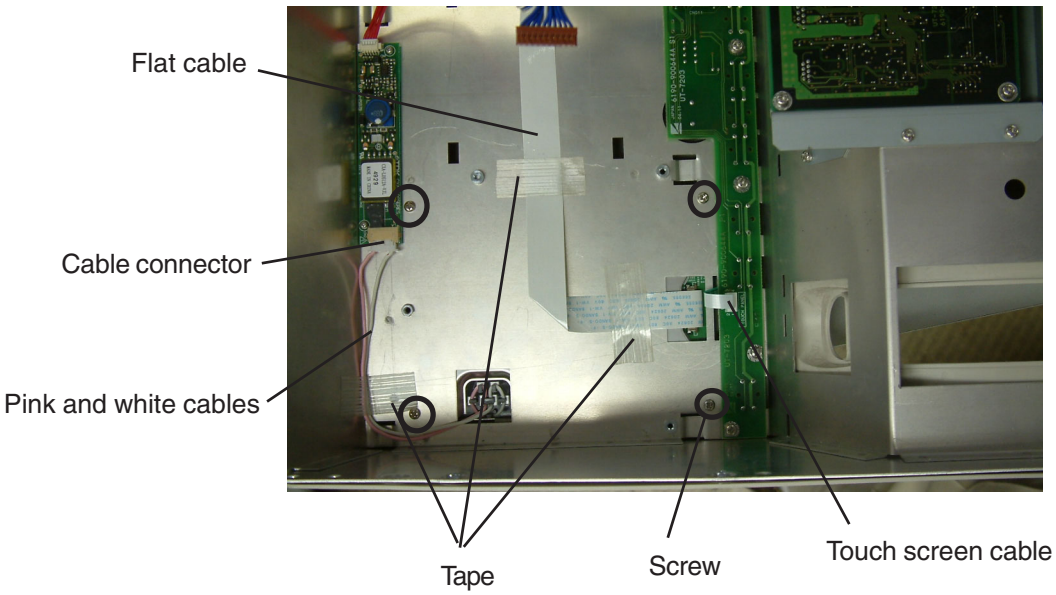
NOTE

If the front panel unit is not faced down, the key top covers will come off and fall from the rear of the front panel cover.

5. Remove the 4 screws and pull out the front panel chassis from the front panel cover.



6. Remove the 4 screws from the front panel chassis.



7. Carefully peel off the 3 pieces of tape which fasten the flat cable and pink and white cables to the front panel unit.

8. Remove the cable connector, flat cable connector and touch screen cable connector and put the front panel unit face up.

9. Carefully pull out the LCD from the front side of the front panel chassis.

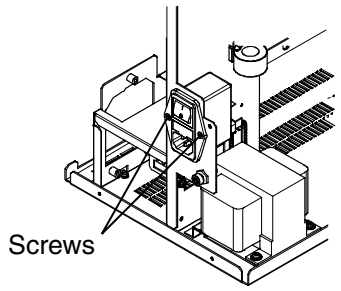
Reattaching the LCD

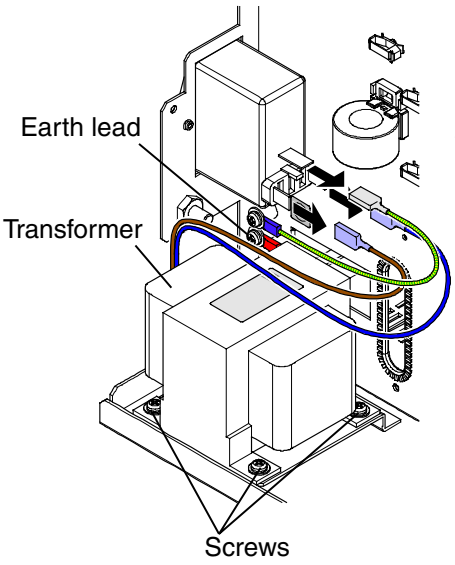
To reattach the LCD, reverse the above procedure.

Removing the Transformer

WARNING

For your safety, before disassembling the hematology analyzer, wait 10 minutes after turning off the main power switch. Remove all cables and cords connected to the instrument.





1. Do the procedure in “Turning the Power Off” earlier in this section to turn off the instrument.
2. Do the procedure in the “Accessing the Connectors on the POWER Board” earlier in this section to open the POWER board.
3. Remove all cable connectors from the POWER board so that the board can be opened fully.
4. Remove the 2 screws which secure the AC inlet to the chassis and pull out the AC inlet rearward so that the screws and connectors of the transformer can be easily accessed.
5. Remove the 3 screws which secure the transformer to the chassis.
6. Remove the screw which secure the earth lead to the terminal.
7. Remove the 3 cable connectors.
8. Remove the transformer from the chassis.

Reattaching the Transformer

To reattach the transformer, reverse the above procedure.

Section 5 Adjustment

General

This section describes how to adjust the following sensors.

- HGB sensor output voltage
- Upper and lower sensor output voltages of the manometer
- Liquid sensor output voltages

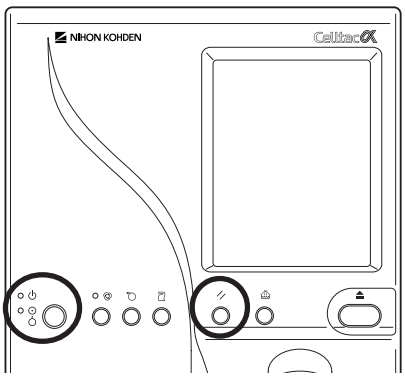
To adjust the HGB sensor, you need to remove the right side cover. For the other sensors, you only need to display the screen for adjustment. You do not need to disassemble the instrument.

Adjusting the HGB Sensor Output Voltage

The HGB sensor is located at the WBC measurement bath on the MC-640V measuring unit. To maintain the measurement accuracy, the HGB sensor voltage must be 3.0 ±0.1 V when the LED for HGB measurement is lit (LED On) and less than 0.5 V when the LED for HGB measurement is not lit (LED Off).

When the HGB sensor output voltage is off the appropriate value, the following alarm may occur for HGB measurement.

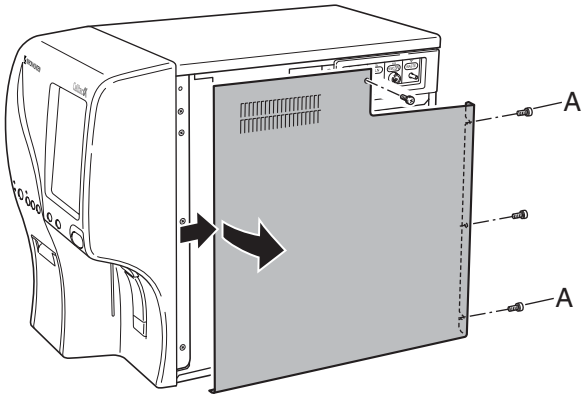
- "?" displayed beside HGB value: HGB sensor voltage is below 1.5 V when LED On
- "!" displayed beside HGB value: HGB sensor voltage is above 4.5 V when LED On
- "*" displayed beside HGB value: HGB sensor voltage is above 0.5 V when LED Off



In the above cases, the HGB measurement is not reliable. The HGB sensor output voltage must be adjusted.

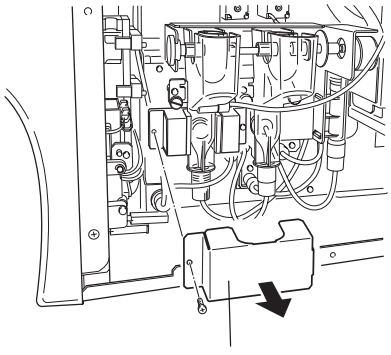
1. Turn off the instrument by pressing the [Power] key while holding down the [Reset] key. The power turns off without cleaning. Check that the power lamp is off.

2. Remove the 3 screws on the rear panel and one screw on the right side panel. The two screws marked with A only need to be loosened and not removed.



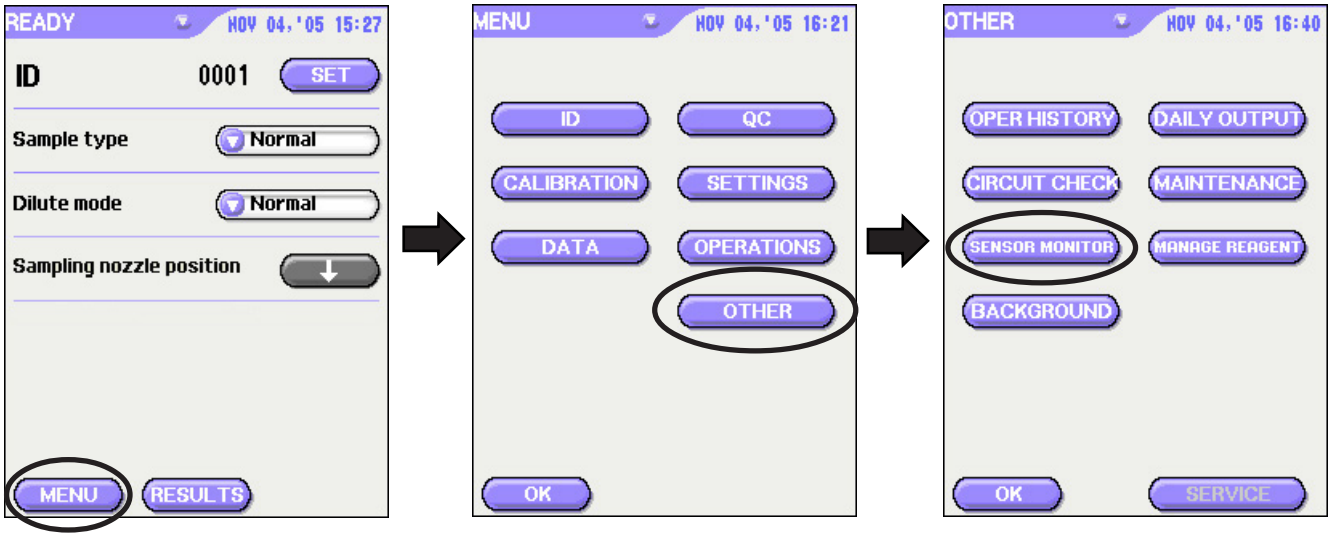
3. Slide the right side cover to the rear direction and then outward to remove the cover from the chassis.

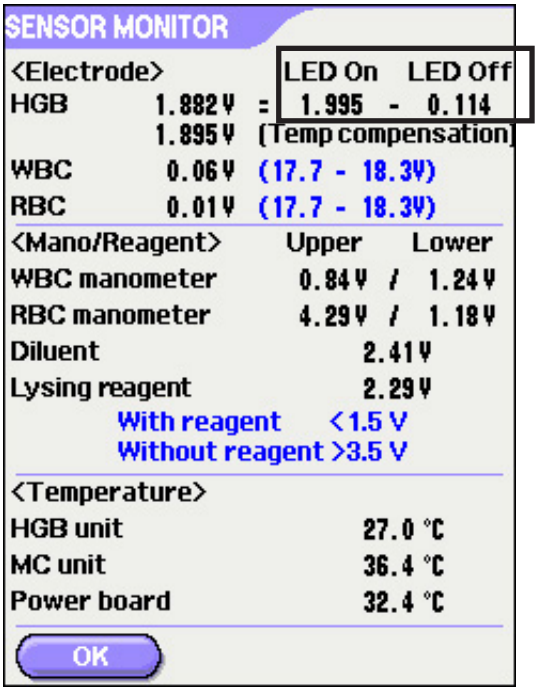
4. Remove the screw on the HGB cover to remove the HGB cover.



5. Turn on the instrument by pressing the [Power] key.

6. On the READY screen, press the MENU key → OTHER key → SENSOR MONITOR key to display the SENSOR MONITOR screen.

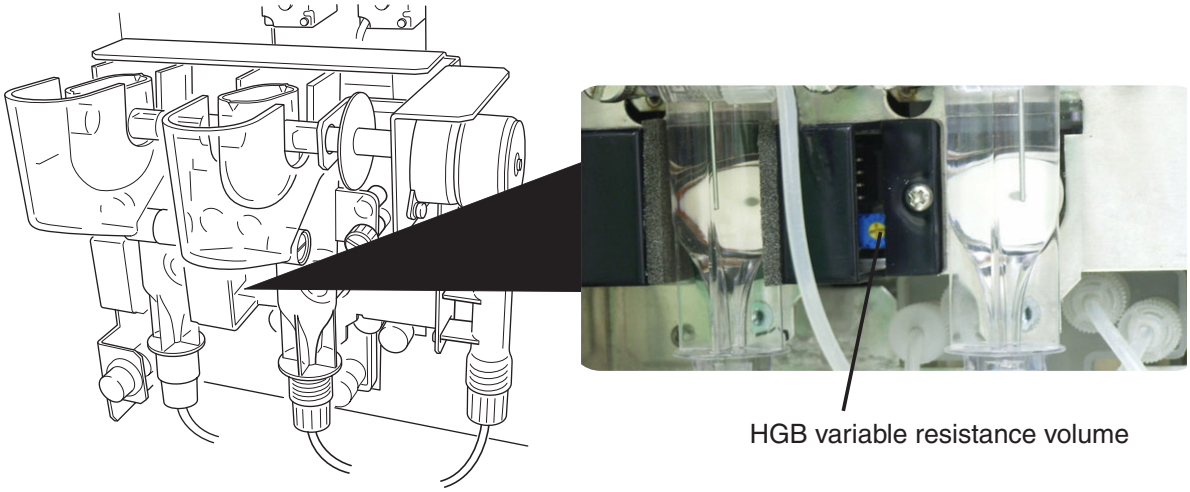




7. Check that the following values are displayed. If not, HGB sensor must be adjusted.

   HGB LED On: 3.0 ±0.1 V
   HGB LED Off: below 0.5 V

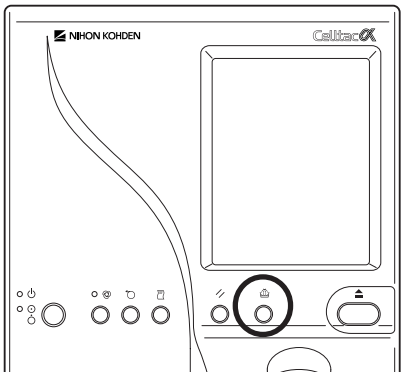
8. Adjust the HGB variable resistance volume on the measuring unit with a phillips screwdriver so that the HGB sensor voltage is within the appropriate range.



9. Turn off the instrument and replace the right side cover.

Adjusting the Upper and Lower Sensor Output Voltages of the Manometers

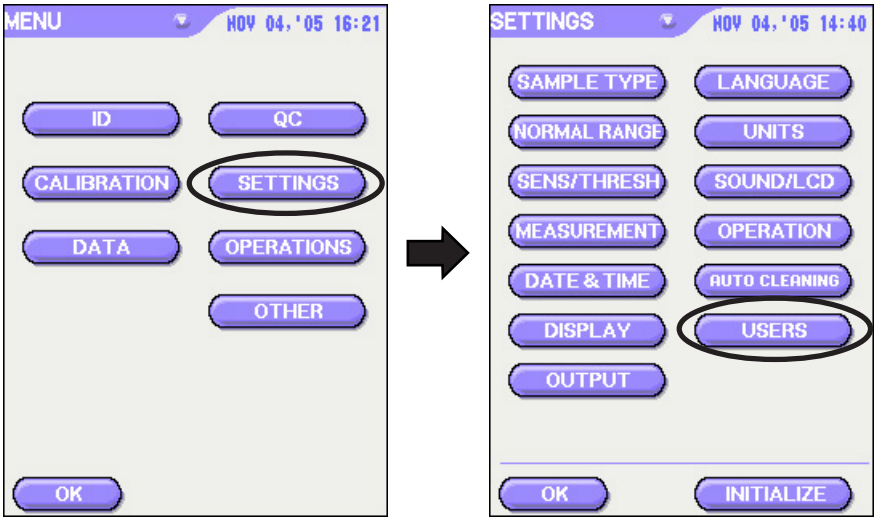
The MC-640V measuring unit has manometer for WBC and RBC for sampling 360 µL of diluted sample accurately. Each manometer has upper and lower sensors for detecting the presence or absence of liquid in the manometer. When there is liquid in the manometer, the sensor voltage should be less than 1.5 V. When the manometer is empty, the sensor voltage should be more than 3.5 V.

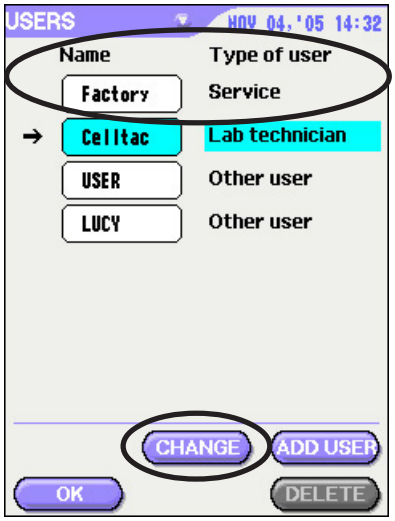


The upper and lower sensors detect the presence or absence of liquid in the manometer based on the borderline sensor voltage of 2.5 V. If the sensor voltage is between 2.25 and 2.75 V, the sensors cannot detect the liquid surface accurately and “manometer dirty” alarm may occur. To correctly detect the presence or absence of liquid in the manometer, the sensor voltage difference of at least 2.0 V is required.

1. With the instrument power on, press the [Clean] key on the front panel to perform cleaning. Clean two or three times.

2. The type of user must be “Service” to enter the SERVICE screen.
   i) On the MENU screen, press the SETTINGS key → USERS key.

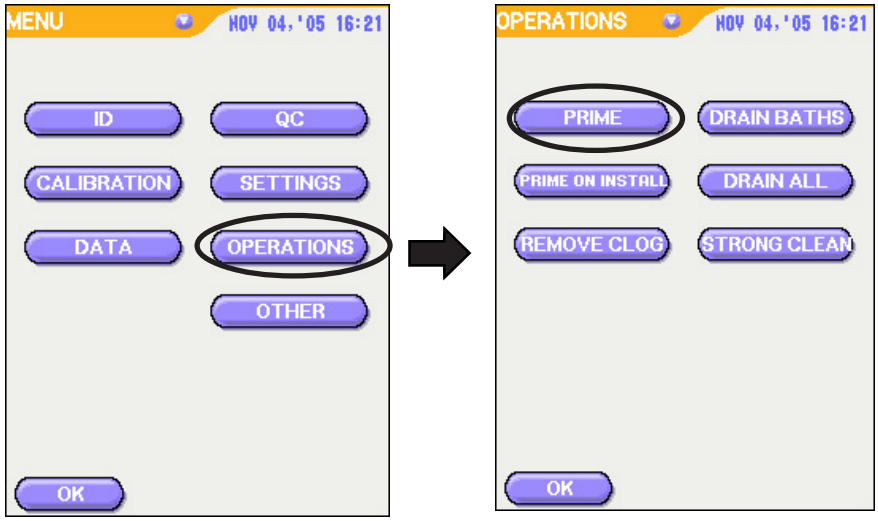




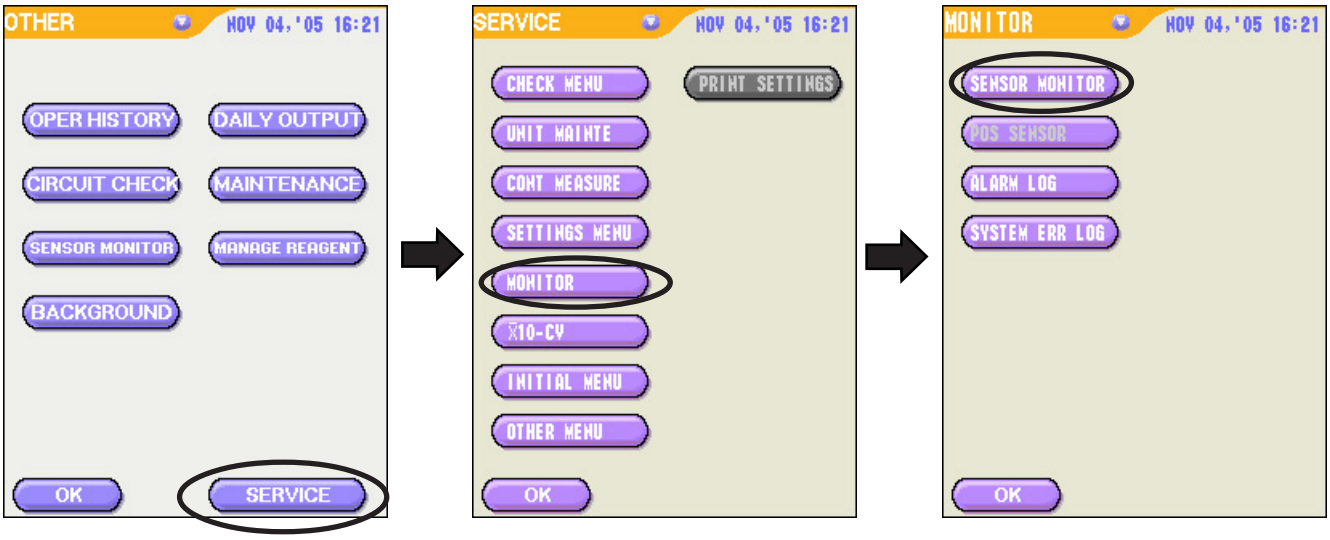
   ii) Select “Factory” user and press the CHANGE key.

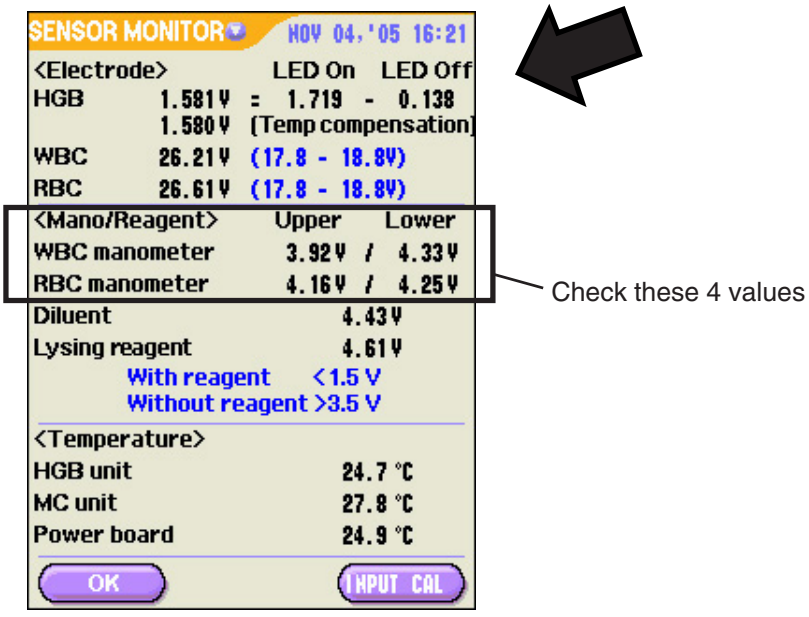
   iii) Enter “4321” for the password using the numeric keys and press the Enter key.

3. On the MENU screen, press the OPERATIONS key → PRIME key to fill the WBC and RBC measurement baths with diluent.



4. On the MENU screen, press the OTHER key → SERVICE key → MONITOR key → SENSOR MONITOR key to display the SENSOR MONITOR screen.

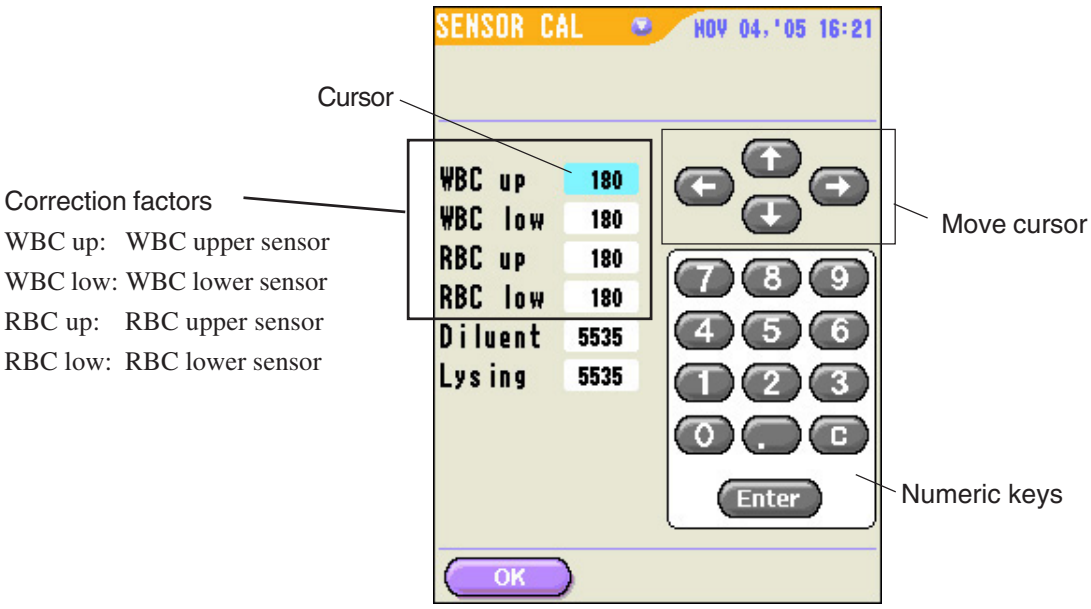




5. Check the values on the screen. With diluent in the measurement baths, all four values should be less than 1.5 V.

   If not, press the INPUT CAL key at lower part of the screen to change the correction factors.

   i) Touch the setting value or use the arrow keys to move the cursor to the setting value you want to change.



   ii) Enter the value using the numeric keys and press the Enter key.
   When the value is increased, the voltage also increases.
   When the value is decreased, the voltage also decreases.

   iii) Press the OK key to return to the SENSOR MONITOR screen and see if the 4 values are less than 1.5 V.

   iv) When the 4 values are less than 1.5 V, go to the next step.
   If not, repeat steps i) to iii) until all 4 values are less than 1.5 V.

6. On the MENU screen, press the OPERATIONS key → DRAIN ALL key to drain the fluid from the manometers. Follow the instructions on the screen. Make sure that the tubes are correctly connected.

7. Repeat steps 4 and 5 so that all values become above 3.5 V.

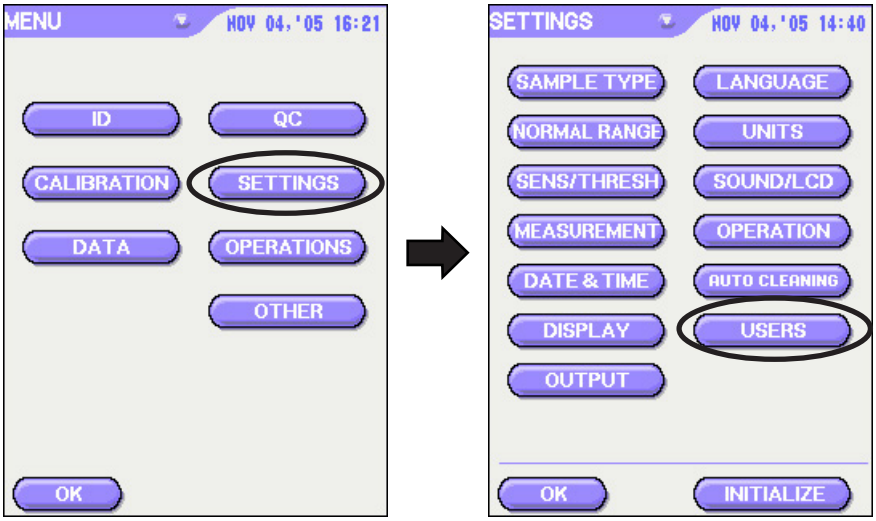
8. When the upper and lower sensor output voltages of the manometers are correctly adjusted, return the type of user to the previous type.

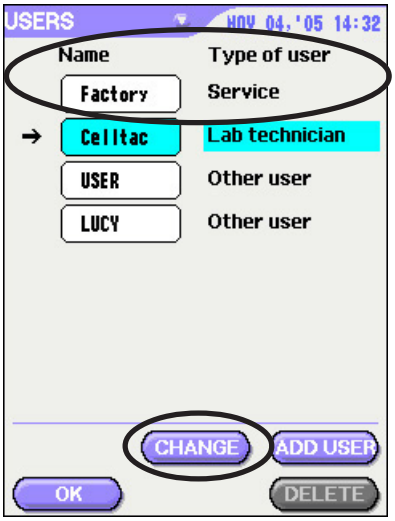
Adjusting the Liquid Sensor Output Voltages

The JQ-640V inlet/outlet unit has liquid sensors for detecting the presence or absence of diluent/detergent and hemolysing reagent. When there is reagent in the instrument, the sensor voltage should be less than 1.5 V. When the instrument is empty, the sensor voltage should be more than 3.5 V.

The liquid sensors detect the presence or absence of reagent in the instrument based on the borderline sensor voltage of 2.5 V. If the sensor voltage is not correct, the sensors cannot detect the reagent in the instrument and “No diluent”, “No detergent” or “No lysing reagent” alarm may occur.

1. The type of user must be “Service” to enter the SERVICE screen.
   i) On the MENU screen, press the SETTINGS key → USERS key.

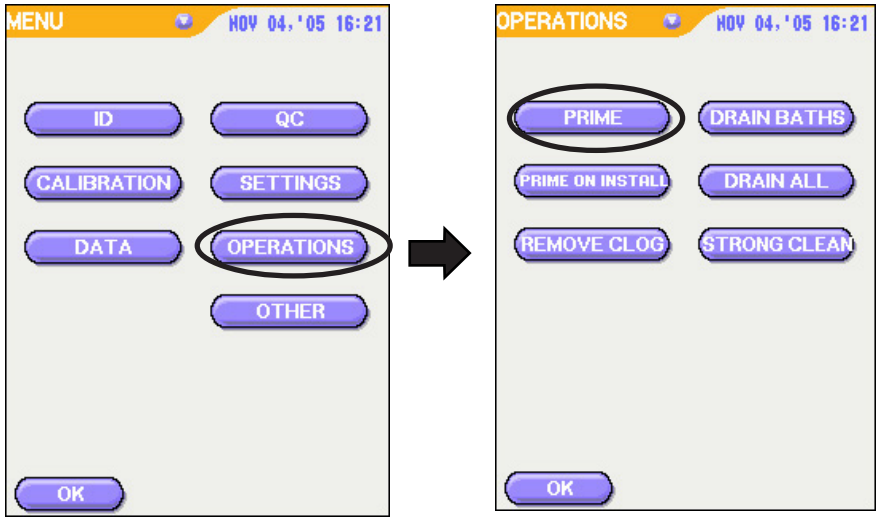




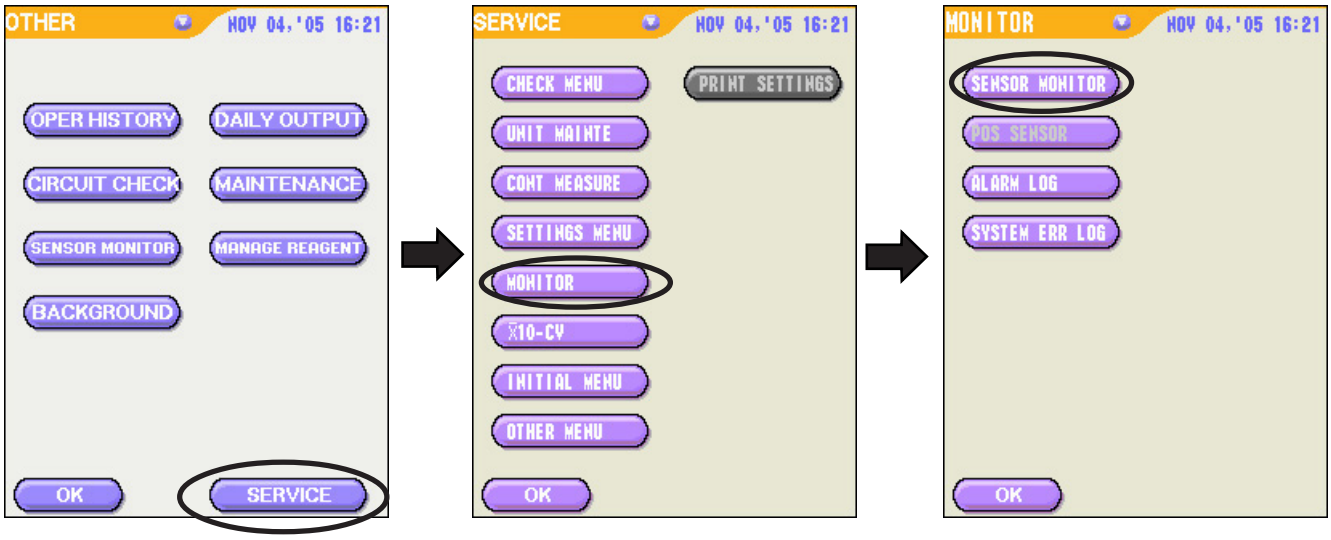
   ii) Select “Factory” user and press the CHANGE key.

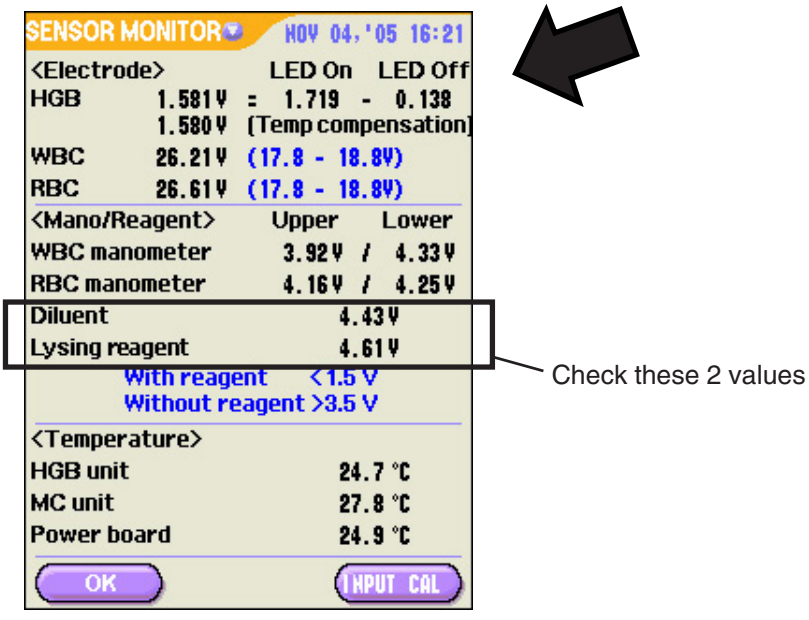
   iii) Enter “4321” for the password using the numeric keys and press the Enter key.

2. On the MENU screen, press the OPERATIONS key → PRIME key to fill the instrument with diluent.



3. On the MENU screen, press the OTHER key → SERVICE key → MONITOR key → SENSOR MONITOR key to display the SENSOR MONITOR screen.

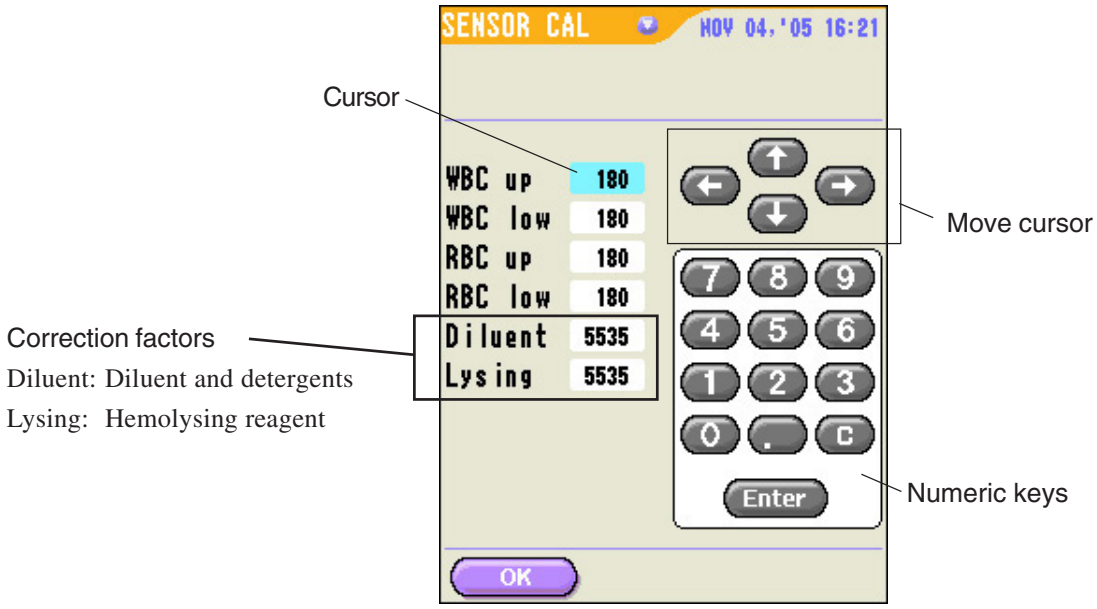




4. Check the values on the screen. With diluent in the instrument, both values should be less than 1.5 V.

   If not, press the INPUT CAL key at lower part of the screen to change the correction factors.

   i) Touch the setting value or use the arrow keys to move the cursor to the setting value you want to change.



   ii) Enter the value using the numeric keys and press the Enter key.
   When the value is increased, the voltage also increases.
   When the value is decreased, the voltage also decreases.

   iii) Press the OK key to return to the SENSOR MONITOR screen and see if both values are less than 1.5 V.

   iv) When both values are less than 1.5 V, go to the next step.
   If not, repeat steps i) to iii) until both values are less than 1.5 V.

5. On the MENU screen, press the OPERATIONS key → DRAIN ALL key to drain the fluid from the instrument. Follow the instructions on the screen. Make sure that the tubes are correctly connected.

6. Repeat steps 3 and 4 so that both values become above 3.5 V.

7. When the liquid sensor output voltages are correctly adjusted, return the type of user to the previous type.

Section 6 Maintenance

General

The scheduled maintenance procedures described in this section must be routinely performed in order to ensure optimum performance. Failure to perform the scheduled maintenance procedures may result in inaccurate or imprecise analysis of whole blood samples.

This section describes the maintenance procedures and provides the maintenance check sheet for documenting the activity.

NOTE

When performing any maintenance procedure, perform strong cleaning and drain baths prior to turning the power off and document the activity. After maintenance and turning the power on, measure background noise (run without a specimen) until results are within specifications, followed by running hematology control. Refer to "Measuring Background Noise" in Section 2 of the Operator's Manual.

The maintenance schedule outlined on the following page will minimize operational problems with the analyzer. The recommended intervals are based on analyzers operating in laboratories that process samples from a general patient population. These intervals are affected by several factors, including the following:

- Number of samples processed
- Work load schedule
- Operating environment
- Patient population being analyzed

Each laboratory must assess its own situation and modify these recommended intervals as necessary.

WARNING

- **Protect yourself from infection before cleaning and doing maintenance.**
- **Be careful not to directly touch any place where blood is or may have contacted.**

CAUTION

Gloves should be worn during the maintenance procedures. They should be powder-free as powder may cause instrument problems.

NOTE

Overdue maintenance is usually indicated by an increase in imprecision of one or more of the directly-measured parameters. This imprecision is due to carryover or dilution/sampling inconsistencies. If this occurs on more than a random basis, perform the appropriate maintenance more frequently than indicated.

Disposing of Waste

Follow your local laws for disposing of medical waste.

WARNING

- **Dispose of the blood sample and replaced parts by following your local laws for disposing of infectious medical waste.**
- **Always wear rubber gloves to protect yourself from infection when handling waste.**

Repair Parts Availability Policy

Nihon Kohden Corporation (NKC) shall stock repair parts (parts necessary to maintain the performance of the instrument) for a period of 7 years after delivery of the instrument. In that period, NKC or its distributors will repair the instrument. This period may be shorter than 7 years if the necessary board or part is not available. For discontinuation announcements, contact your Nihon Kohden distributor or representative.

Parts to be Replaced Periodically

- Filter (code no. T802), 3 pcs for MEK-6400, 2 pcs for MEK-6410/6420
- Pump tube (code no. T462), 1 pc.

Maintenance Schedule

Perform the following procedures at the scheduled intervals. You can use the OPER HISTORY screen to keep track of maintenance.

Daily

- Check reagent volume, reagent expiration date, recording paper and other consumables
- Check sampling nozzle (open mode), switches, keys and outside surface of the analyzer
- Check reagent tube connection
- Check power cord and grounding lead connection
- Check external instrument connection (printer, PC, bar code reader)
- Check screen display and touch screen key function (Calibrate touch screen)
- Check date and time settings
- Check daily accuracy (background noise, measure hematology control)
- Check measurement baths and sub baths
- Check pump tube

Every 300 counts

- Check filters and filter packings

Monthly or every 1,000 counts, whichever comes first

- Replace filters
- Clean measurement baths and sub baths
- Clean rinse unit and check cap pierce nozzle*

* Checking cap pierce nozzle is only necessary on the MEK-6400 analyzer.

Every four months or every 3,000 counts, whichever comes first

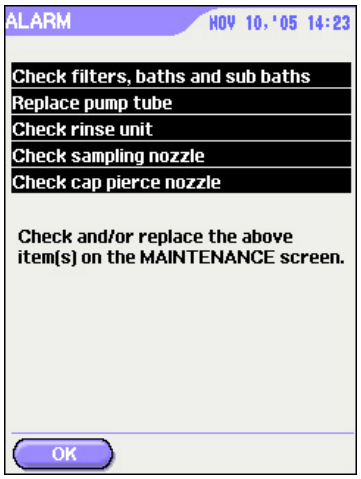
- Check sampling nozzles
- Replace pump tube

Every six months or as required

- Clean aperture caps
- Clean external electrodes on the measurement baths
- Check sensor monitor
- Check circuit
- Check $\bar{X}$-R values
- Check calibration coefficients
- Check priming function
- Check draining function
- Check cleaning function
- Check dispensing function
- Check external instrument function (printer, PC, bar code reader)
- Check that the 3-pin plug type power cord is used and the 3 pins and plug housing are not deformed
- Check that the resistance of the protective ground line of the power cord is 0.1 Ω
- Check that the earth leakage current is 0.5 mA or less under normal condition and 3.5 mA or less under each single fault condition

Displaying Operation History Screen

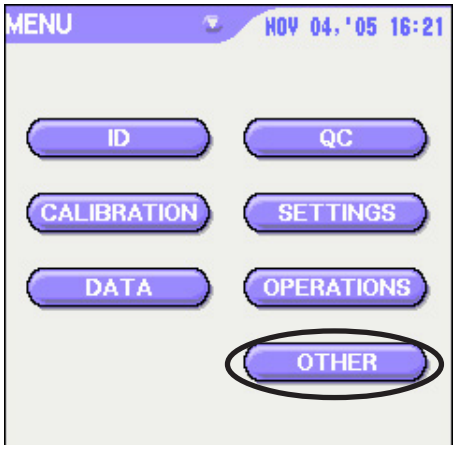
You can display the total operating time (hours), total number of counts, and number of counts used to determine the maintenance schedule for filters, measurement baths, sub baths, pump tube, rinse unit, sampling nozzles and cap pierce nozzle. (Cap pierce nozzle is only necessary for MEK-6400 analyzer.)



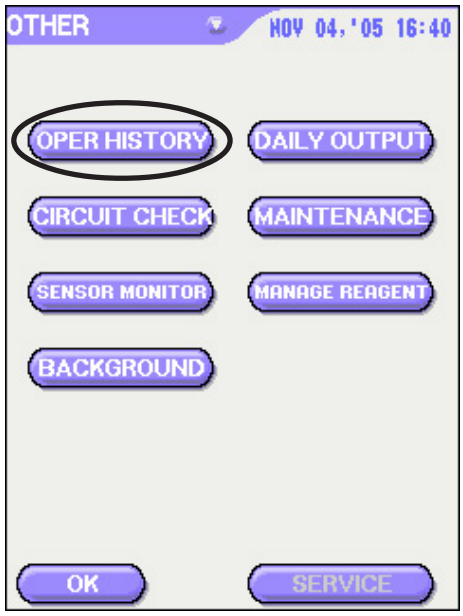
When the filters, measurement baths, sub baths, pump tube, rinse unit, sampling nozzles and cap pierce nozzle are used more than the following number of sample counts, the ALARM screen appears to prompt you to check and/or replace them.

Filters, measurement baths and sub baths:	1,000 counts
Pump tube:	3,000 counts
Rinse unit:	1,000 counts
Sampling nozzles:	3,000 counts
Cap pierce nozzle:	1,000 counts

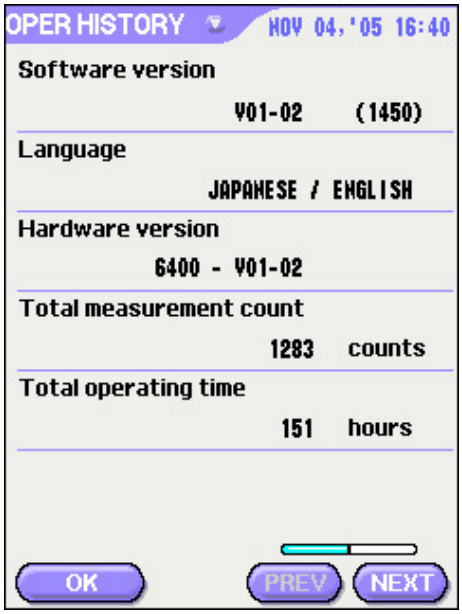
1. Press the OTHER key on the MENU screen to display the OTHER screen.



2. Press the OPER HISTORY key to display the OPER HISTORY screen.



The first page displays the software version, installed language, hardware version, total operating time (hours) and total number of counts.



The second page displays the number of counts for filters, measurement baths, sub baths, pump tube, rinse unit, sampling nozzles and cap pierce nozzle.

After checking and replacing the filters, measurement baths, sub baths, pump tube, rinse unit, sampling nozzles and cap pierce nozzle, reset the counts to zero by pressing the RESET key.

3. Press the OK key to return to the OTHER screen.

Maintenance Check Sheet

Copy, fill out and save this check sheet each time you do maintenance or service.

Checking Date:_____

Customer:_____

Customer Address:_____

Service Personnel:_____ Service Company:_____

Analyzer Model:_____ Analyzer Serial Number:_____

Hardware Revision Number:_____ Software Revision Number:_____

Check Item				OK	No
Daily Check					
There are enough Nihon Kohden specified reagent, recording paper and other consumables.					
The reagents are not expired.	ISOTONAC3 diluent				
	CLEANAC detergent				
	CLEANAC3 detergent				
	HEMOLYNAC3N lysing reagent				
There are no damaged or dirty parts on the outside of the analyzer.					
There is no leakage from the analyzer.					
The sampling nozzle, switches and keys are not damaged.					
The labels are not torn or removed.					
The reagents are properly connected to the analyzer. The tubes are not damaged, bent or clogged.					
The power cord is connected properly. The power cord is not damaged.					
Grounding lead is connected properly.					
The external instruments are properly connected to the analyzer. The connection cables are not damaged.					
No alarms appear when the analyzer is turned on and the READY screen appears.					
The messages are displayed properly.					
The touch screen keys function properly. Calibrate the touch screen when necessary.					
Date and time are correct.					
Measure background noise	Enter the value	Closed	Open		
	WBC: 0.2 ($\times 10^3/\mu L$)				
	RBC: 0.05 ($\times 10^6/\mu L$)				
	HGB: 0.1 (g/dL)				
	PLT: 10 ($\times 10^3/\mu L$)				
Measure hematology control and check that the obtained data is within the acceptable range on the assay sheet of the hematology control.					
Check that the measurement baths and sub baths are not dirty or damaged.					
Check that the pump tube is not collapsed or damaged.					
Every 300 counts					
Check that filters and filter packings are not damaged.					
Monthly or every 1,000 counts, whichever comes first					
Replace filters					
Clean sub baths and measurement baths					
Clean rinse unit and check cap pierce nozzle*					

* Only necessary on the MEK-6400 analyzer.

Check Item				OK	No
Every four months or 3,000 counts, whichever comes first					
Check sampling nozzles					
Replace pump tube					
Every six months or as required					
Clean aperture caps					
Clean external electrodes on the measurement baths					
Check sensor monitor			Enter the value		
	HGB LED On: 1.5 to 4.5 V				
	HGB LED Off: <0.5 V				
	WBC: 17.7 to 18.3 V				
	RBC: 17.7 to 18.3 V				
	Without reagent	WBC manometer Upper: >3.5 V			
		WBC manometer Lower: >3.5 V			
		RBC manometer Upper: >3.5 V			
		RBC manometer Lower: >3.5 V			
		Diluent: >3.5 V			
		Lysing reagent: >3.5 V			
	With reagent	WBC manometer Upper: <1.5 V			
		WBC manometer Lower: <1.5 V			
		RBC manometer Upper: <1.5 V			
		RBC manometer Lower: <1.5 V			
		Diluent: <1.5 V			
		Lysing reagent: <1.5 V			
	HGB unit (°C)				
	MC unit (°C)				
	Power board (°C)				
Check circuit			Enter the value		
	WBC: 7.6 to 8.4 ($\times 10^3/\mu L$)				
	RBC: 1.52 to 1.68 ($\times 10^6/\mu L$)				
	MCV: 85 to 115 (fL)				
	PLT: 152 to 168 ($\times 10^3/\mu L$)				
	HGB ON: 1.5 to 4.5 V				
	HGB OFF: <0.5 V				
	WBC sensitivity				
	WBC threshold				
	RBC sensitivity				
	RBC threshold				
	PLT threshold				

Check Item						OK	No
Check $\overline{X}$-R values MEK-3DN lot no.:_____	Enter the value	$\overline{X}$		R	Acceptable R value		
	WBC ($\times10^3/\mu L$)				<0.7		
	LY%				<5.2		
	MO%				<3.3		
	GR%				<11.4		
	LY ($\times10^3/\mu L$)				—		
	MO ($\times10^3/\mu L$)				—		
	GR ($\times10^3/\mu L$)				—		
	RBC ($\times10^6/\mu L$)				<0.29		
	HGB (g/dL)				<1.0		
	HCT (%)				—		
	MCV (fL)				<3.6		
	MCH (pg)				—		
	MCHC (g/dL)				—		
	PLT ($\times10^3/\mu L$)				<39		

Check current calibration coefficients	Enter the value	Closed*		Open		Predilution			
		Meas data	Cal coef	Meas data	Cal coef	Meas data	Cal coef		
	WBC								
	RBC								
	HGB								
	HCT								
	MCV								
	MCH								
	MCHC								
	PLT								
Check new calibration coefficients MEK-3DN lot no.:_____	Enter the value	Closed*		Open		Predilution			
		Meas data	Cal coef	Meas data	Cal coef	Meas data	Cal coef		
	WBC								
	RBC								
	HGB								
	HCT								
	MCV								
	MCH								
	MCHC								
	PLT								
Check prime function									
Check draining function									
Check cleaning function									
Check dispensing function									
WA-640VK internal printer	Check paper feed operation								
	Check auto printing operation								
	Check printing operation								
	There is no dot missing on the printed paper.								
External printer	Check paper feed operation								
	There is no dot missing on the printed paper.								

* Only necessary on the MEK-6400 analyzer.

Check Item	OK	No
Check the bar code reader operation		
Check communication status when PC is connected.		
Check that the 3-pin plug type power cord is used and the 3 pins and plug housing are not deformed.		
Check that the resistance of the protective ground line of the power cord is 0.1 Ω.		
Check that the earth leakage current is 0.5 mA or less under normal condition and 3.5 mA or less under each single fault condition.		

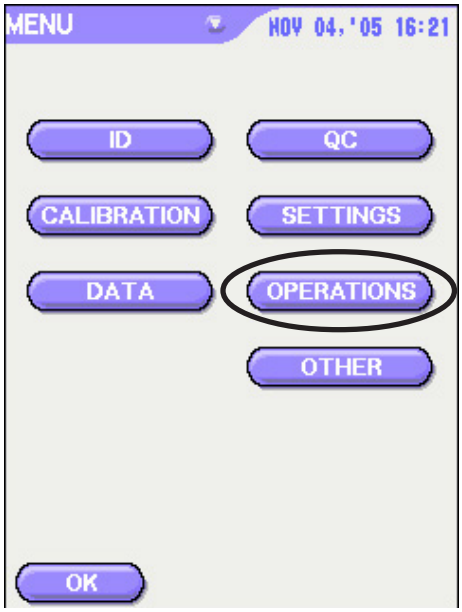
Before Maintenance Procedure

Before turning the analyzer power off for maintenance, perform strong cleaning and drain fluid from the measurement baths and sub baths.

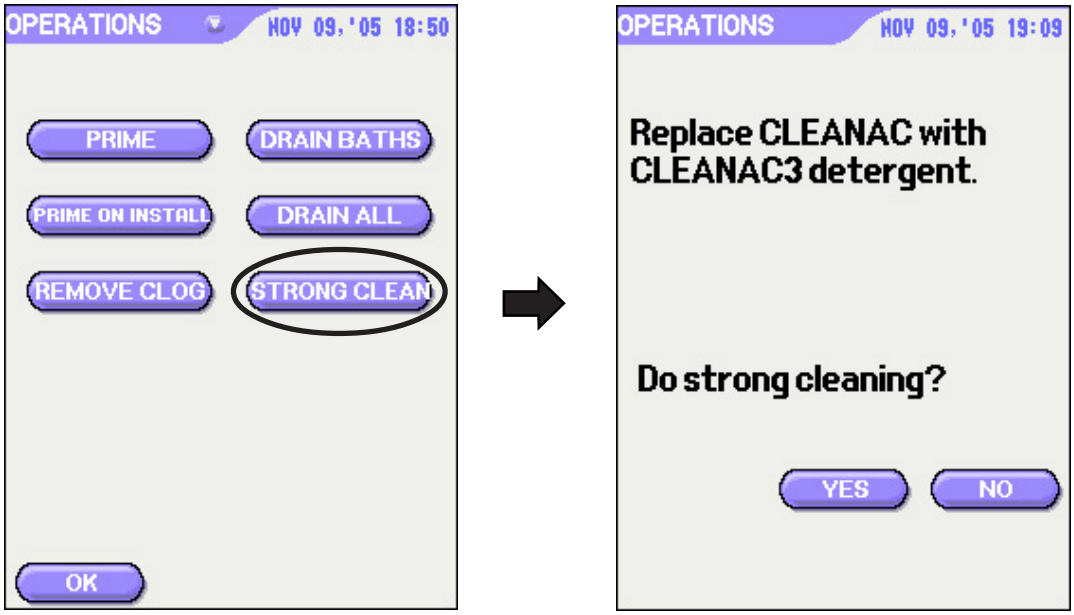
When background counts are out of specification or the clogging message frequently appears, perform strong cleaning to clean the analyzer more thoroughly with CLEANAC•3 detergent containing sodium hypochlorite.

Strong Cleaning

1. Press the OPERATIONS key on the MENU screen to display the OPERATIONS screen.



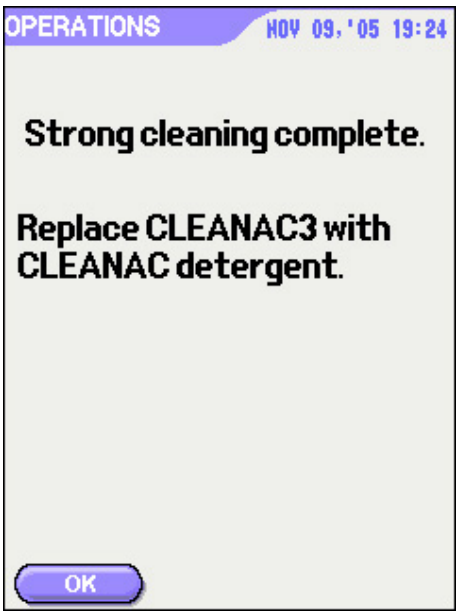
2. Press the STRONG CLEAN key on the OPERATIONS screen.



3. Replace the CLEANAC detergent with CLEANAC•3 detergent. Refer to "Connecting Tubes and Installing Reagents" in Section 2.

4. Press the YES key to perform strong cleaning. The analyzer starts cleaning and the "Strong cleaning" message appears on the screen.
   Press the NO key to cancel the procedure.

   After cleaning, the instruction to replace the CLEANAC•3 detergent with CLEANAC detergent appears.



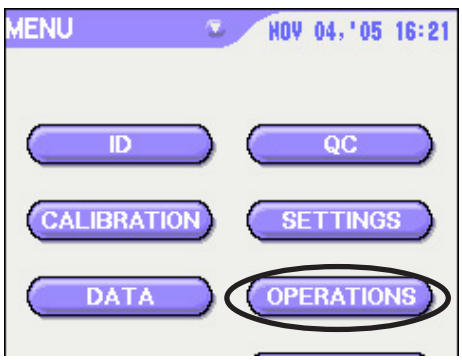
5. Replace the CLEANAC•3 detergent with CLEANAC detergent and press the OK key. The analyzer cleans with the CLEANAC detergent and the screen returns to the READY screen.

6. After maintenance is complete and the analyzer is turned on again, measure background noise at least twice.

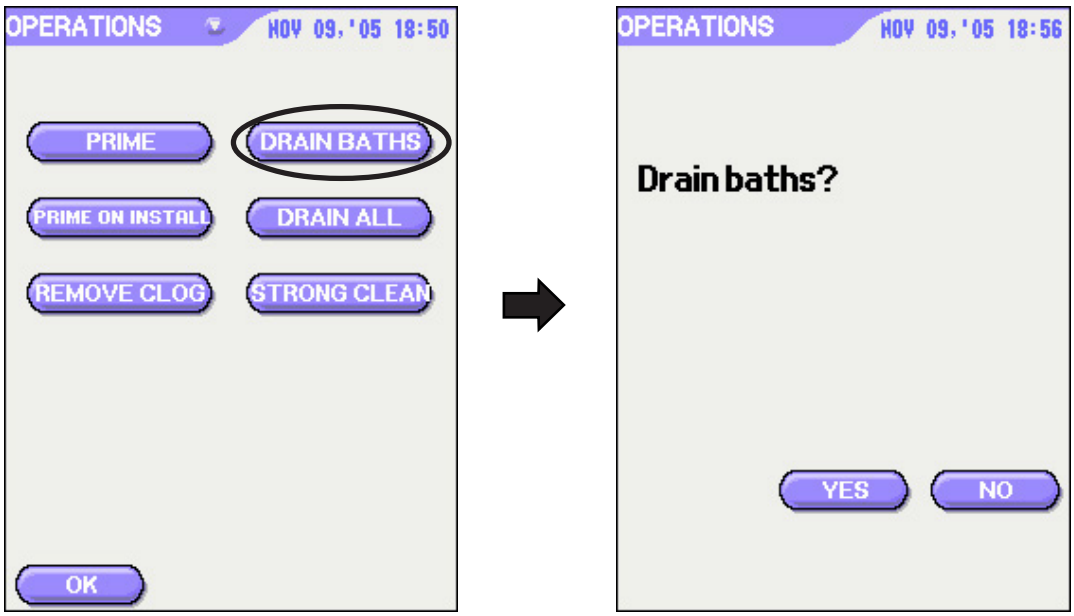
Draining Measurement Baths and Sub Baths

This function drains the measurement and sub baths to avoid spillage of the diluent.

1. Press the OPERATIONS key on the MENU screen to display the OPERATIONS screen.



2. Press the DRAIN BATHS key on the OPERATIONS screen. The “Drain baths?” message appears.



3. Press the YES key to drain fluids from the measurement baths and sub baths. The analyzer starts draining the baths and the “Draining” message appears on the screen.
   Press the NO key to cancel the procedure.

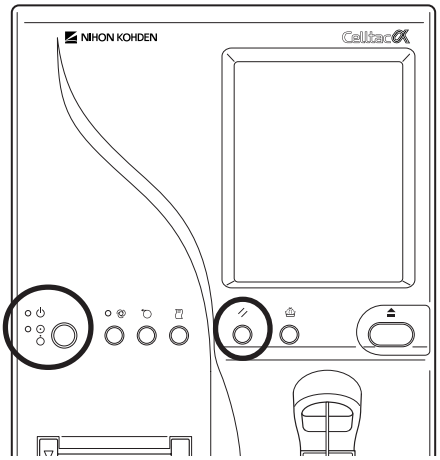
   After draining, the screen returns to the READY screen.

Turning Power Off

CAUTION

Turn off the main power before doing maintenance. Otherwise, the operator may receive electrical shock.

Press the [Power] key while holding down the [Reset] key. The power turns off without cleaning. Check that the power lamp is off.



Daily Maintenance Procedures

Checking Reagents and Other Consumables

CAUTION

Use only Nihon Kohden recommended reagents. Otherwise the measurement result cannot be guaranteed and incorrect reagent concentration can cause equipment damage.

Check that the following Nihon Kohden specified reagents are used.

- ISOTONAC•3 diluent
- CLEANAC detergent
- CLEANAC•3 detergent (For STRONG CLEAN only)
- Hemolynac•3N hemolysing reagent

Check that these reagents are not expired and are not run out.

Check that there are enough consumables, such as hematology control, sample containers, sample tubes and sample cups.

When using a printer, check that there is enough recording paper.

Checking the Appearance of the Analyzer

Check the following points.

- There are no damaged or dirty parts on the outside of the analyzer.
- The sampling nozzle, switches and keys are not damaged.
- There is no leakage from the analyzer
- The labels are not torn or removed

WARNING

- **Be careful not to directly touch any place where blood is or may have contacted.**
- **Protect yourself from infection before cleaning and doing maintenance.**

CAUTION

Turn off the main power before disinfection or cleaning the analyzer. Otherwise, the operator may receive electrical shock.

Disinfecting the Surface of the Analyzer

NOTE

Disinfect the sampling nozzle before every maintenance because infectious blood may be adhered to it.

Wipe the analyzer with a cloth moistened with disinfecting ethanol. Disinfect the sampling nozzle (open mode) thoroughly because it touches blood.

Cleaning the Surface of the Analyzer

CAUTION

Never use organic solvents such as thinner or acetone because they damage the enclosure of the analyzer.

NOTE

When wiping the analyzer with a cloth moistened with water, wring out the cloth to prevent water from entering the analyzer.

1. Dilute a neutral detergent with water.
2. Wipe off the dirt with a soft cloth moistened with the diluted neutral detergent.
3. Wipe the analyzer with a dry soft cloth.

Checking the Reagents Connection Tubes

Check that the reagent tubes are not damaged, bent or clogged. For correct tube connection, refer to “Connecting Tubes and Installing Reagents” in Section 9.

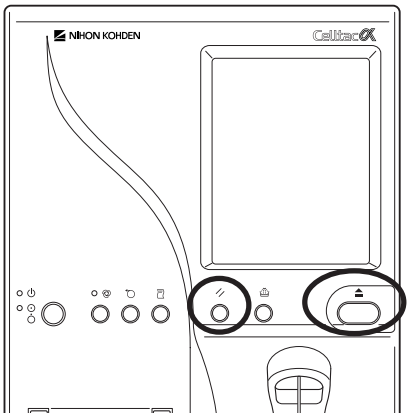
Checking the Power Cord and Grounding Lead

Check that the power cord and grounding lead are properly connected and not damaged.

Checking the External Instrument Connection

When using an optional printer, PC and hand-held bar code reader, check that they are properly connected to the analyzer. Check that the connection cables are not damaged.

Checking the Power On



When the analyzer is turned on, check that the self-check is performed and the READY screen appears. Check that no alarms appear and the touch screen keys function properly. Also check that there is no smell, heat or noise and that there is no leakage from the analyzer.

Calibrating the Touch Screen

Calibrate the touch screen when the pressed position and operating position do not match.

1. Press the [Eject] key (MEK-6400) or [Count] key (MEK-6410/6420) while holding down the [Reset] key. The TOUCH SCREEN CALIBRATION screen appears.

2. Follow the instructions on the screen to calibrate the screen.

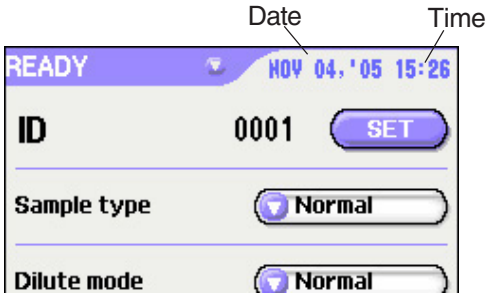
NOTE

Do not use a sharp object to press the mark. Use your finger.

After calibration is completed, the screen returns to the READY screen.

Checking the Date and Time

Check that the date and time on the screen are correct. To change the date and time, refer to “Setting Date and Time” in Section 3 of the Operator’s Manual.



Clock Accuracy

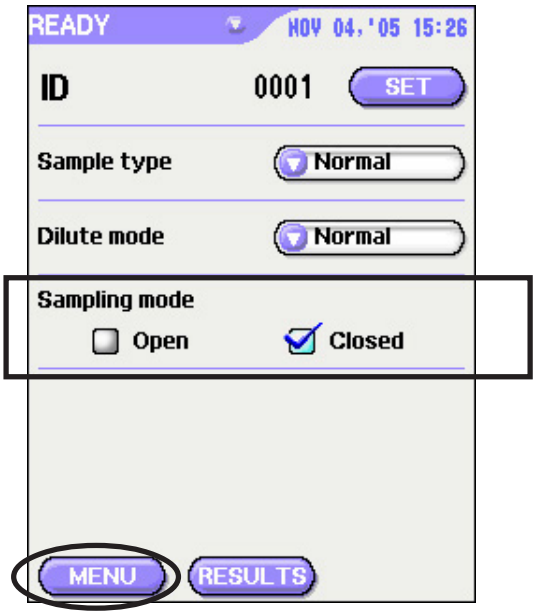
At an operating temperature of 25°C, the accuracy of the clock IC of the analyzer is about ±52 seconds per month.

At storage temperatures between –20 and +60°C, the accuracy of the clock IC of the analyzer is about –7 minutes to +52 seconds per month.

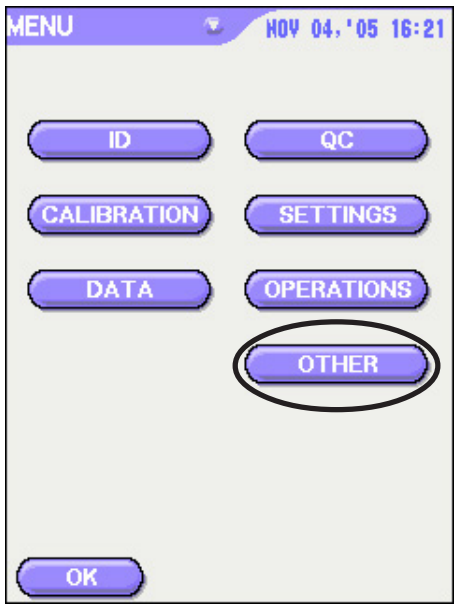
Measuring Background Noise

Measure background noise in closed mode and open mode. (Closed mode is only for MEK-6400.)

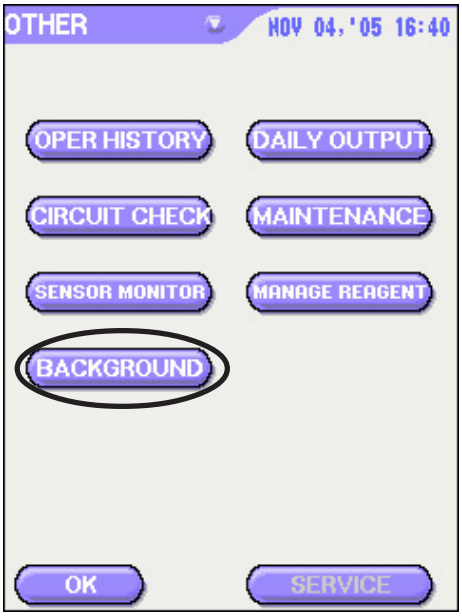
1. Select “Closed” or “Open” for <Sampling mode> and press the MENU key on the READY screen.



2. Press the OTHER key on the MENU screen.

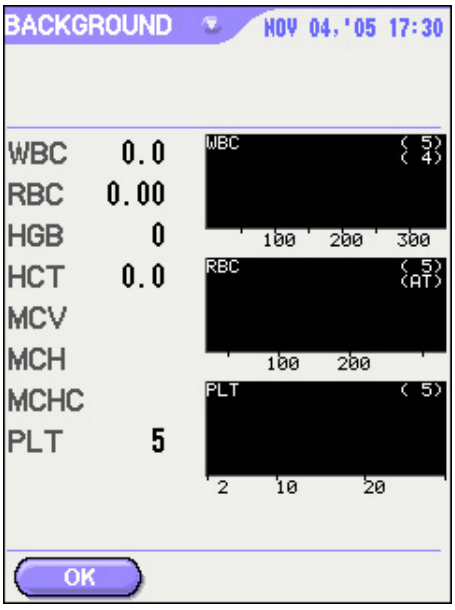


3. Press the BACKGROUND key on the OTHER screen.



The “Measure background noise?” message appears on the screen.

4. Press the YES key to measure background noise. The result is displayed after the measurement is complete.



Make sure that the values are less than or equal to the following values.

WBC: 0.2 ($\times 10^3/\mu L$)
RBC: 0.05 ($\times 10^6/\mu L$)
HGB: 0.1 (g/dL)
PLT: 10 ($\times 10^3/\mu L$)

“Fail” appears beside the parameter which is over the acceptable value.

Disregard the other parameter values because noise does not affect the other parameters.

If the values are greater than the values listed above, check the following items, press the [Clean] key on the front panel to clean the fluid path and recount the diluent. If the values are still not optimum, refer to Section 2 “Troubleshooting”.

- The diluent is clean.
- No bubbles in the diluent.
- The aperture caps are clean.
- The aperture caps are firmly attached.
- The measurement baths and sub baths are clean.

Measuring Hematology Control

Measure a MEK-3D hematology control which has the same conditions as human blood. Confirm that the obtained sample data is within the acceptable range on the assay sheet attached to the hematology control.

CAUTION

- **Use hematology control before the expiration date.**
- **Do not use hematology control when the top layer is slightly red or the whole hematology control is red, because the red blood cells in the control are hemolyzed.**
- **Do not freeze the hematology control because this hemolyses it.**
- **Use and store the hematology control with extreme care according to its instructions.**

1. Gently take out the hematology control from the refrigerator.

2. Bring to room temperature by rolling the hematology control vial between the palms of the hands.

3. Turn the hematology control vial upside down at least 30 times to thoroughly mix the plasma and red blood cells.

4. Select “Open” for <Sampling mode> on the READY screen.

5. Put the sampling nozzle into the bottom of the hematology control vial so that the tip of the sampling nozzle touches the bottom of the vial.

6. Press the [◇ Count] switch on the front panel. The hematology control is aspirated and counting is performed.

   After counting, the result appears on the screen.

7. Check the data with the assay sheet.

NOTE

Calibrate the analyzer when the obtained sample data is different from the values described on the assay sheet after recounting. For details, refer to Section 7 "Calibration" in the Operator's Manual.

Checking Measurement Baths and Sub Baths

Refer to the "Checking and Cleaning Measurement Baths and Sub Baths" in the "Monthly/Every 1,000 Counts Maintenance Procedures" later in this section.

Checking Pump Tube

Refer to the "Replacing Pump Tube" in the "Every Four Months/Every 3,000 Counts Maintenance Procedures" later in this section.

Weekly/Every 300 Counts Maintenance Procedures

Checking/Cleaning Filters

Check and clean the filters once a week or every 300 sample counts. Refer to the "Replacing Filters" in the "Monthly/Every 1,000 Counts Maintenance Procedures" later in this section.

Monthly/Every 1,000 Counts Maintenance Procedures

Replacing Filters

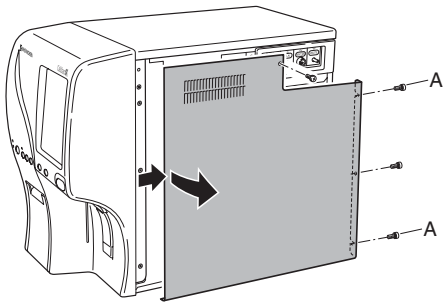
Materials Required

- Powder-free gloves, lab coat, safety glasses
- Phillips screwdriver
- Tweezers

Procedure

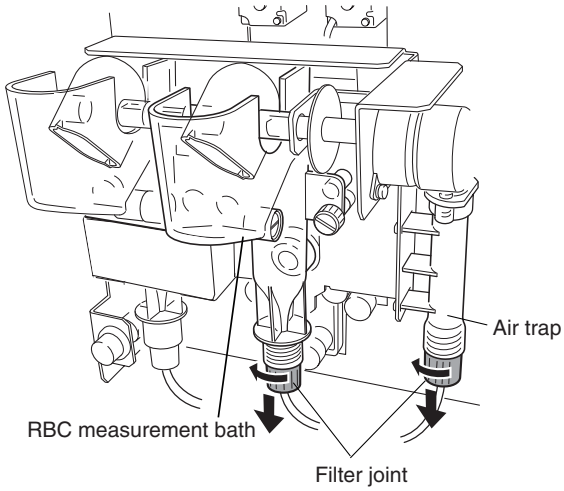
Replace the filters when they are clogged, dirty and/or after every 1,000 sample counts.

1. Do the procedure in the “Before Maintenance Procedure” earlier in this section to turn off the instrument.



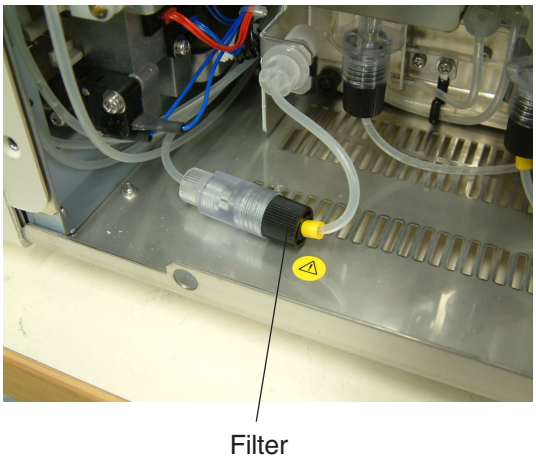
2. Remove the three screws on the rear panel and one screw on the right side panel. The two screws marked with A only need to be loosened and not removed.

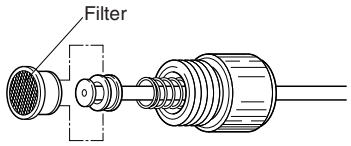
3. Slide the right side cover to the rear direction and then pull it toward you to remove the cover.



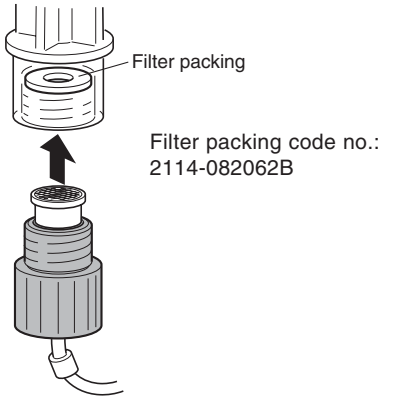
4. Remove the 2 filter joint assemblies by turning the tube connectors.

   For MEK-6400, also replace the filter between the MC-640V Measuring Unit and JQ-641V Valve Unit.





5. Remove the filter from each assembly. Use tweezers to remove any dust from the filter. If it is still dirty, replace it with a new one.



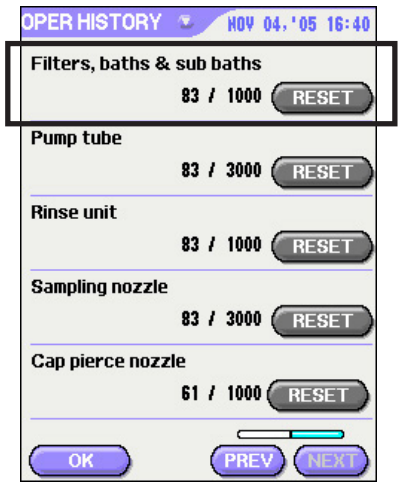
6. Reattach the filter joint assemblies to the bottom of the RBC measurement bath and air trap. Make sure that the tube with the same number as the number label on the attaching part is connected back to the original position. Only finger tighten the filter joint.

NOTE

- **When attaching the filter joint assembly, be careful not to bend or damage the filter packing at the bottom of the measurement bath.**
- **If there is leakage noted after installment of the filter, check that there are no scratches or damage around the filter. Damage may occur if a component is overtightened.**

7. Reattach the right side cover and fasten it with the three screws on the rear panel and one screw on the right side panel.

8. Press the [Power] key to turn on the power. The analyzer starts priming the fluid pathway.



9. If filters were replaced, reset the filter counter. When the filter counter is reset, the measurement baths and sub baths counter is also reset. Before resetting the counter, the measurement baths and sub baths should be cleaned. Refer to the “Checking and Cleaning Measurement Baths and Sub Baths” section.

   To reset the counter, press the RESET key for <Filters, baths & sub baths> on the OPER HISTORY screen to reset the counts to zero.

10. Fill in the Maintenance Check Sheet.

Checking and Cleaning Measurement Baths and Sub Baths

Check the measurement baths and sub baths every day.

Clean the measurement baths and sub baths when there is any blood or dust on them. (Once a month or every 1,000 sample counts)

Materials Required

- Powder-free gloves, lab coat, safety glasses
- Phillips and flat-blade screwdrivers
- CLEANAC•3 detergent
- Dry lint-free cloth

Procedure

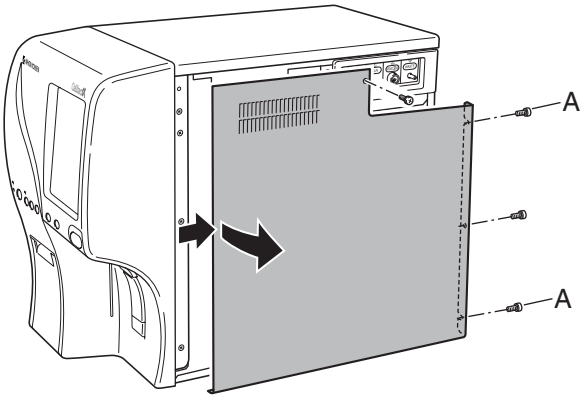
NOTE

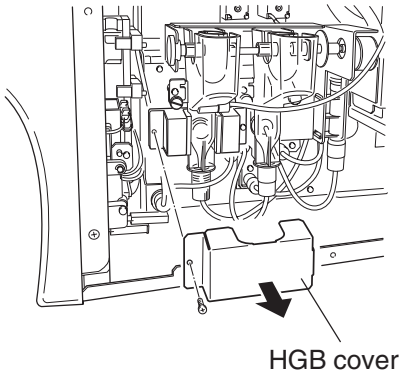
Be careful not to damage the measurement baths and sub baths.

1. Do the procedure in the “Before Maintenance Procedure” earlier in this section to turn off the instrument.

2. Remove the three screws on the rear panel and one screw on the right side panel. The two screws marked with A only need to be loosened and not removed.

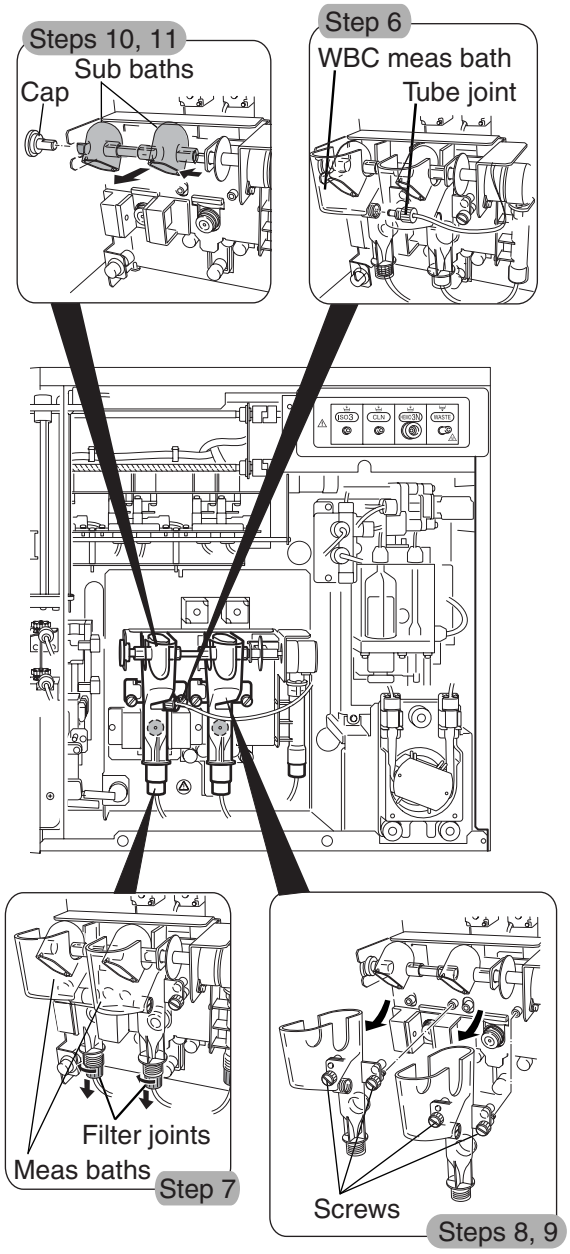
3. Slide the right side cover to the rear direction and then pull it toward you to remove the cover.

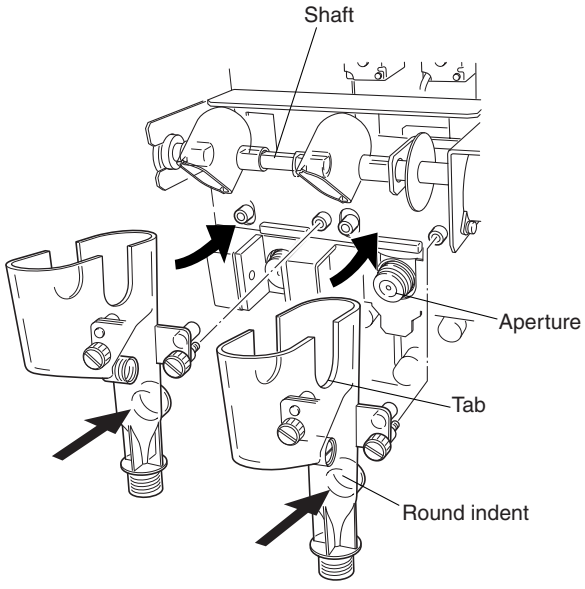




4. Remove the screw on the HGB cover to remove the HGB cover.

5. Check the WBC and RBC measurement baths and sub baths. If there is any blood or dust on them, remove and clean them taking the following steps.





6. Remove the tube joint connected to the WBC measurement bath by turning the knurl joint.

7. Remove filter joints on the RBC and WBC measurement bath assemblies by turning the tube connectors.

8. Loosen the screws fastening the measurement baths. (The screws cannot be removed from the measurement baths.)

9. Remove the measurement baths by pulling them toward you to remove them from the aperture and then pulling them downward.

10. Remove the cap from the left side of the WBC sub bath.

11. Remove the sub baths by pushing them to the left, then pulling them toward you.

12. Soak the measurement baths and sub baths in CLEANAC•3 detergent for about 10 minutes.

13. Rinse the measurement baths and sub baths with water and wipe them with a dry lint-free cloth.

14. Reattach the sub baths to their original positions. Reattach the cap (which was removed in step 10) to the left side of the WBC sub bath to fasten the sub baths.

15. Reattach the measurement baths so that the sub bath is in the measurement bath, the shaft of the sub bath is in the tab of the measurement bath, and the round indent of the measurement bath fits the aperture.

16. Tighten the screws which were loosened in step 8 to fasten the measurement baths.

NOTE

Before tightening the screws, check and remove any dirt or rust on and around the screws. If dirt or rust is present, noise alarm may occur during measurement.

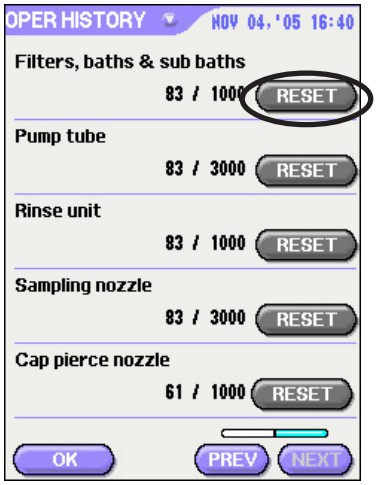
17. Reconnect the filter joints to the RBC and WBC measurement bath assemblies by turning the tube connectors.

18. Reattach the tube joint to the WBC measurement bath by turning the knurl joint.

19. Reattach the HGB cover and fasten it with the screw.

20. Reattach the right side cover and fasten it with the three screws on the rear panel and one screw on the right side panel.

21. Press the [Power] key to turn on the power. The analyzer starts priming the fluid pathway.



22. If the measurement baths and sub baths were cleaned, the bath counter will have to be reset. When the bath counter is reset, the filter counter is also reset. Before resetting the counter, the filters should be replaced. Refer to "Replacing Filters" earlier in this section.

    To reset the counter, press the RESET key for <Filters, baths & sub baths> on the OPE HISTORY screen to reset the counts to zero.

23. Fill in the Maintenance Check Sheet.

Checking and Cleaning/Replacing the Rinse Unit and Cap Pierce Nozzle

Check and clean the rinse unit and cap pierce nozzle once a month or every 1,000 sample counts whichever comes first.

WARNING

The cap pierce nozzle is sharp and potentially contaminated with infectious materials. Be careful when handling the cap pierce nozzle and performing this procedure.

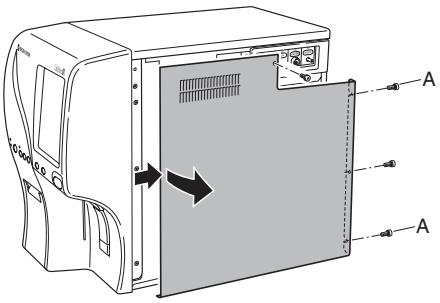
Cap pierce nozzle is only on the MEK-6400 analyzer.

Materials Required

- Powder-free gloves, lab coat, safety glasses
- Phillips and flat-blade screwdrivers
- Cotton swabs
- CLEANAC•3 detergent
- Lint-free pad
- New cap pierce nozzle (when required code no.: YZ-0342)

Procedure

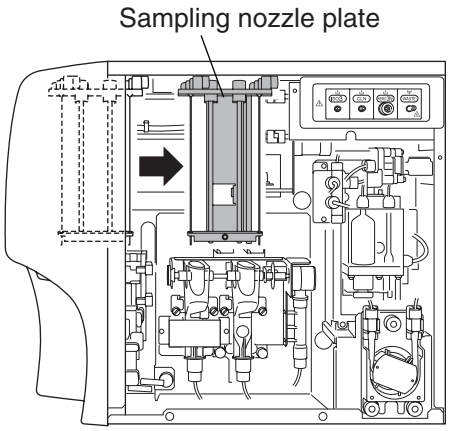
1. Do the procedure in the "Before Maintenance Procedure" earlier in this section to turn off the instrument.

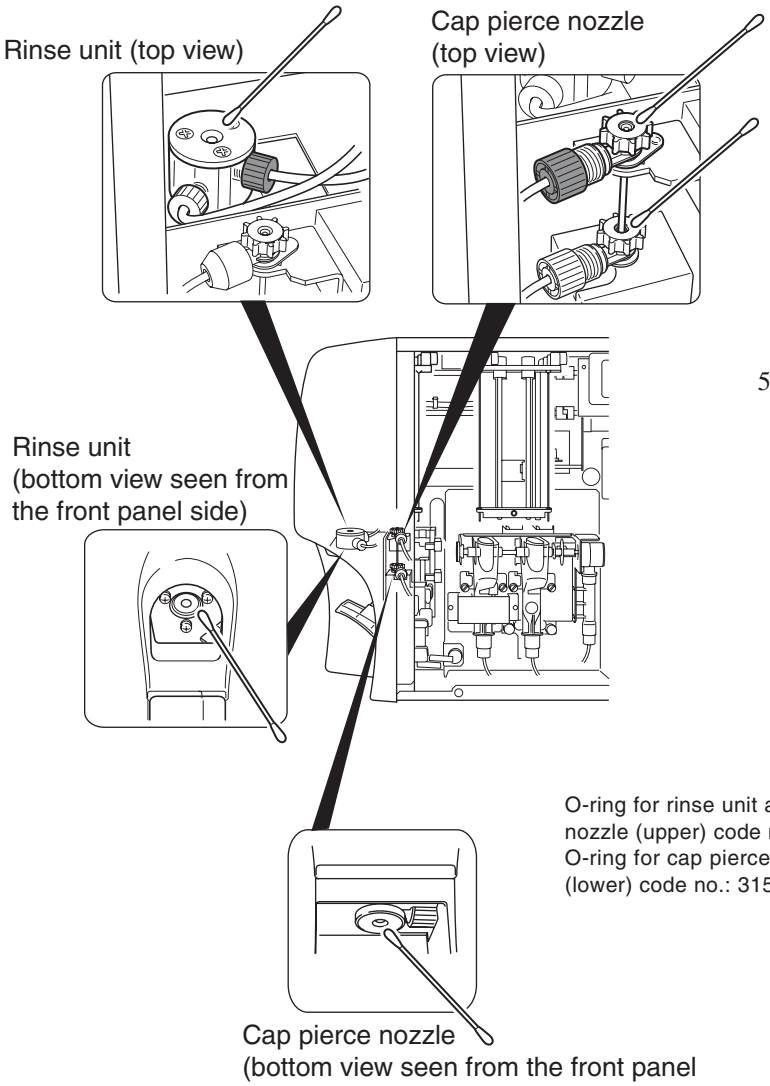


2. Remove the three screws on the rear panel and one screw on the right side panel. The two screws marked with A only need to be loosened and not removed.

3. Slide the right side cover to the rear direction and then toward you to remove the cover.

4. Slide the sampling nozzle plate to the right.

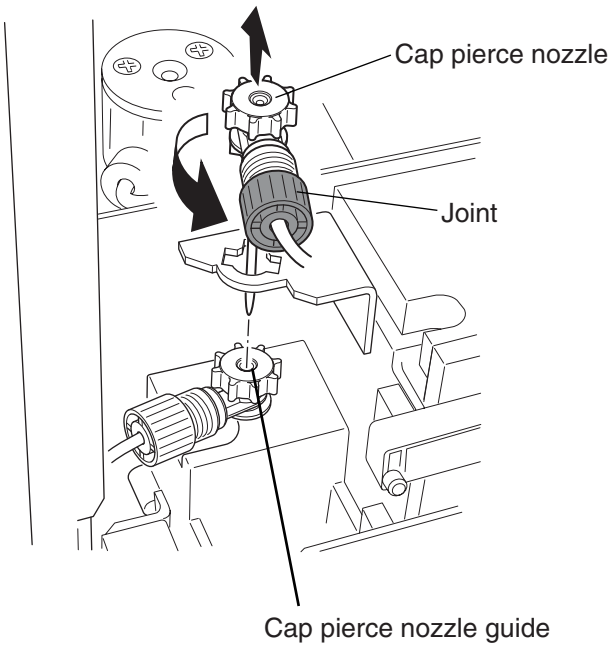




5. Check the parts indicated in the illustration for dirt or blood clot. Remove blood or salt crystals on the rinse unit and the tip of the cap pierce nozzle with a cotton swab or lint-free pad moistened with CLEANAC•3 detergent.

   If the cap pierce nozzle is damaged or dirt/ blood cannot be removed, replace the cap pierce nozzle with a new one.

O-ring for rinse unit and cap pierce nozzle (upper) code no.: 295538
O-ring for cap pierce nozzle guide (lower) code no.: 315366



To replace the cap pierce nozzle:

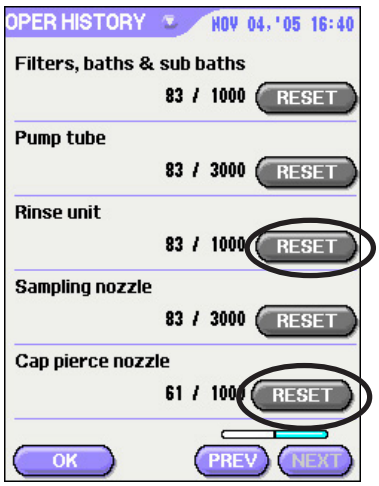
1) Turn the cap pierce nozzle 90° counterclockwise.

2) Remove the joint from the cap pierce nozzle.

3) Pull the cap pierce nozzle up to remove it.

4) Reattach the joint to the new cap pierce nozzle.

5) Insert the cap pierce nozzle into the cap pierce nozzle guide and turn the cap pierce nozzle 90° clockwise.



6. Reattach the right side cover and fasten it with the three screws on the rear panel and one screw on the right side panel.

7. Press the [Power] key to turn on the power. The analyzer starts priming the fluid pathway.

8. If the rinse unit and cap pierce nozzle were checked and cleaned, the rinse unit and cap pierce nozzle counter will have to be reset. To reset the counter, press the RESET key for <Rinse unit> and <Cap pierce nozzle> on the OPER HISTORY screen to reset the counts to zero.

9. Fill in the Maintenance Check Sheet.

Every Four Months/Every 3,000 Counts Maintenance Procedures

Checking and Cleaning/Replacing the Sampling Nozzles

Check and clean the sampling nozzles once every four months or every 3,000 sample counts whichever comes first.

When PLT background count increases or the sampling nozzle is bent, replace the sampling nozzles with a new one.

WARNING

The sampling nozzles are sharp and potentially contaminated with infectious materials. Be careful when handling the sampling nozzles and performing this procedure.

Materials Required

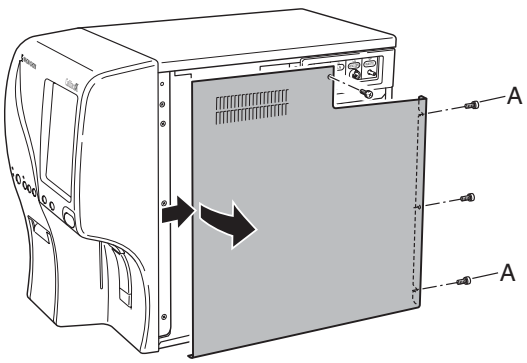
- Powder-free gloves, lab coat, safety glasses
- Phillips and flat-blade screwdrivers
- Cotton swabs
- CLEANAC•3 detergent
- Lint-free pad
- New sampling nozzle(s) (when required code no.: YZ-0341)

Procedure

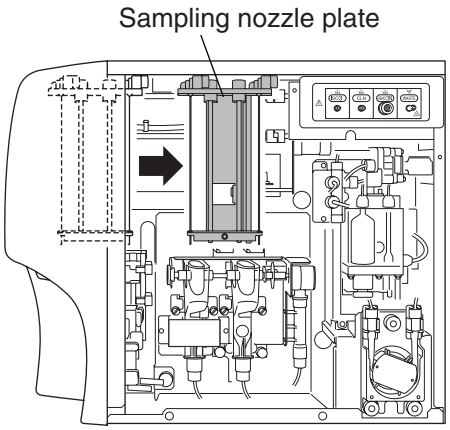
1. Do the procedure in the “Before Maintenance Procedure” earlier in this section to turn off the instrument.

2. Remove the three screws on the rear panel and one screw on the right side panel. The two screws marked with A only need to be loosened and not removed.

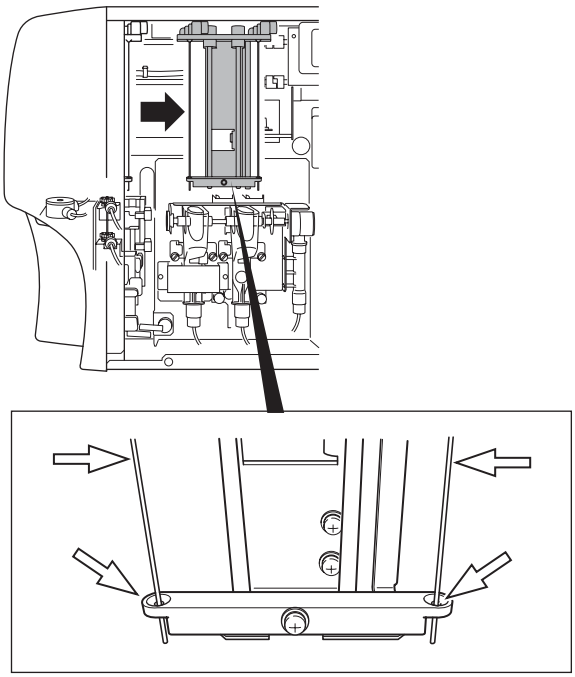
3. Slide the right side cover to the rear direction and then toward you to remove the cover.



4. Slide the sampling nozzle plate to the right.

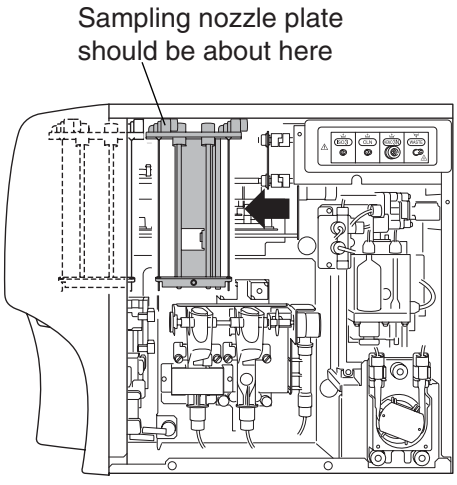


5. Check the following parts for dirt or blood clot. Remove blood or salt crystals on the tip of the sampling nozzles with a cotton swab or lint-free pad moistened with CLEANAC•3 detergent.



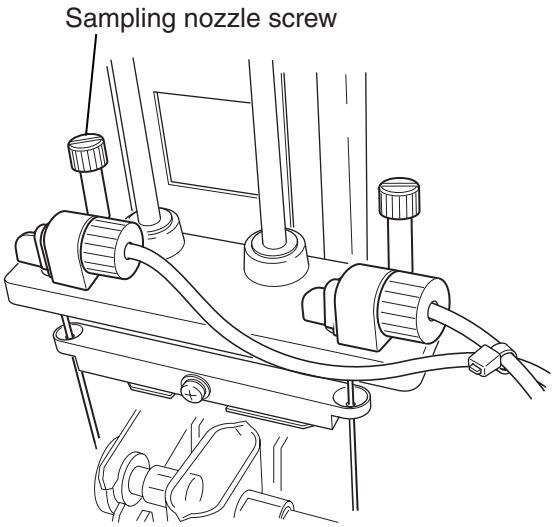
Sampling nozzles

If the sampling nozzle is damaged or dirt/blood cannot be removed, replace the sampling nozzle with a new one.



To replace sampling nozzles:

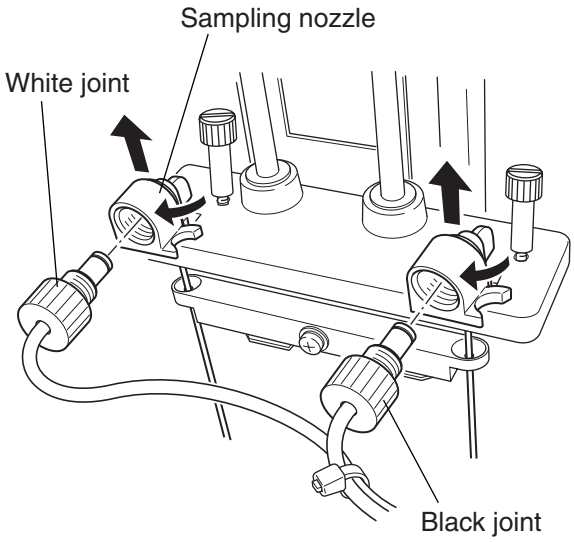
1) Push down the sampling nozzle plate as far as it goes. The sampling nozzle plate must be at the position indicated at left. Otherwise, the measurement baths and sub baths get in the way and the sampling nozzles may be damaged.



2) Loosen the sampling nozzle screw from each of the sampling nozzle.

NOTE

Be careful not to drop the screws into the analyzer.



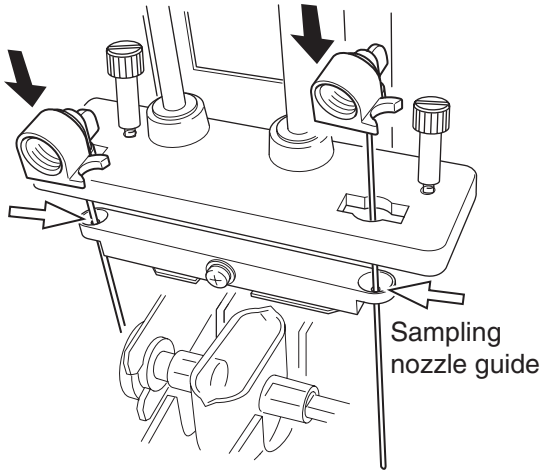
3) Turn the sampling nozzle 90° clockwise.

4) Remove the joint from each sampling nozzle.

NOTE

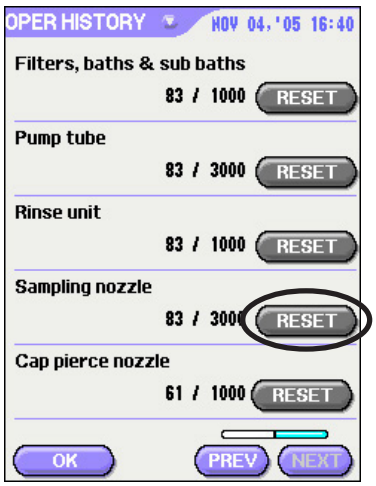
Diluent may flow out from the sampling nozzle when the joint is removed.

5) Pull the sampling nozzle up to remove it.



6) Insert each new sampling nozzle into the sampling nozzle guide, attach the joint and turn the sampling nozzle 90° counterclockwise to lock it into place. Make sure that the white joint is attached to the left sampling nozzle (front panel side) and the black joint to the right sampling nozzle. Fasten the sampling nozzles with the sampling nozzle screws.

7) Raise the sampling nozzle plate to the original position.



6. Reattach the right side cover and fasten it with the three screws on the rear panel and one screw on the right side panel.

7. Press the [Power] key to turn on the power. The analyzer starts priming the fluid pathway.

8. If the sampling nozzles were checked and cleaned, the sampling nozzle counter will have to be reset. To reset the counter, press the RESET key for <Sampling nozzle> on the OPER HISTORY screen to reset the counts to zero.

9. Fill in the Maintenance Check Sheet.

Replacing Pump Tube

Check the pump tube for water droplets and leaks every day.

Replace the pump tube when there are water droplets or leaks. (Once every 4 months or every 3,000 sample counts whichever comes first.)

NOTE

Do not leave the pump tube with water droplets or leaks on it.

Materials Required

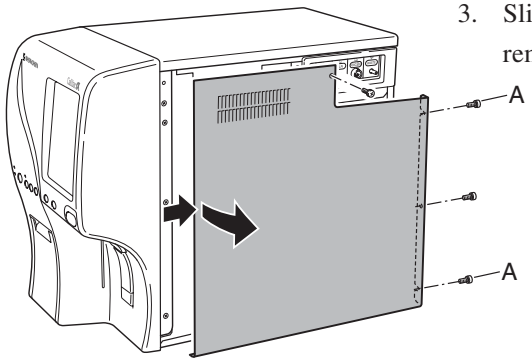
- Powder-free gloves, lab coat, safety glasses
- Phillips screwdriver

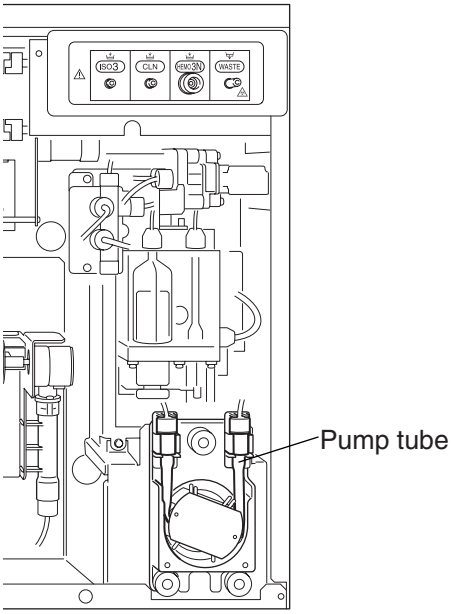
Procedure

1. Do the procedure in the “Before Maintenance Procedure” earlier in this section to turn off the instrument.

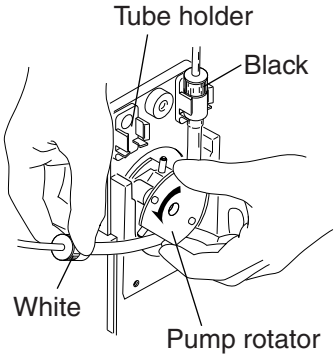
2. Remove the three screws on the rear panel and one screw on the right side panel. The two screws marked with A only need to be loosened and not removed.

3. Slide the right side cover to the rear direction and then toward you to remove the cover.

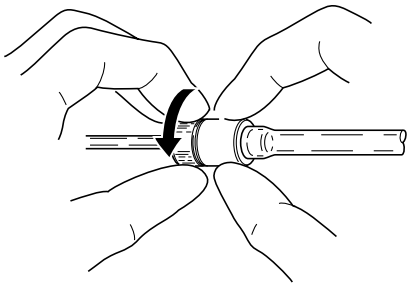




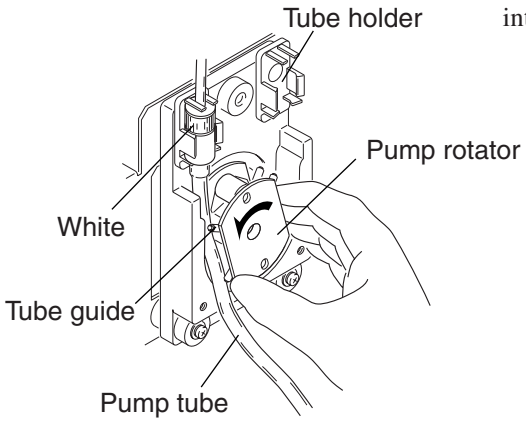
4. Check the pump tube for water droplets and leaks. If any droplet or leak is found, replace the tube with a new one by using the following steps.



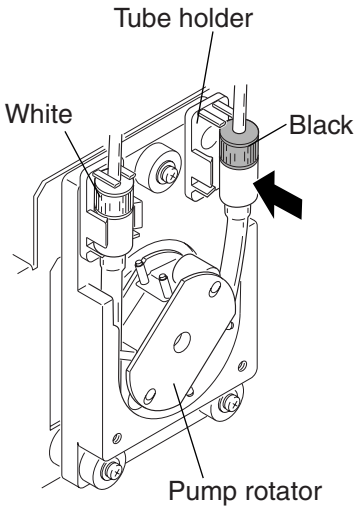
5. Pull out the white tube joint from the tube holder and pull out the pump tube by turning the pump rotator counterclockwise. Then pull the black tube joint out of the tube holder.



6. Remove the white and black tube joints and replace the pump tube.



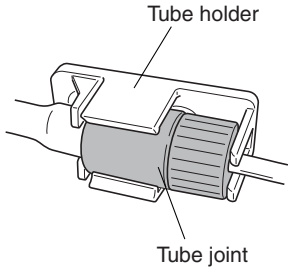
7. Return the white tube joint to the original position and push the pump tube into the tube guide by turning the rotator counterclockwise.



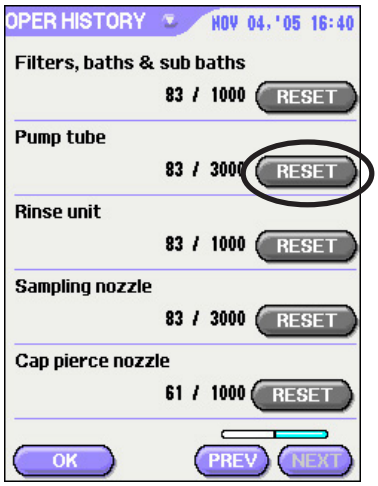
8. Return the black tube joint to the original position.

NOTE

- **Be careful not to pinch the new pump tube between the tube guide and housing. This may damage the pump tube.**
- **Do not attach the black tube joint to the tube holder before the white tube joint because internal compressed air may disconnect the tube.**
- **Put back the pump tube properly. If the pump tube has slack, remove the slack by turning the rotator clockwise. If the pump tube has slack, it will be damaged by the tube guide.**
- **Make sure the joints are held properly by the tube holder as shown below. Otherwise, the pump tube may be damaged or the life of the pump tube will be shortened.**



9. Reattach the right side cover and fasten it with the three screws on the rear panel and one screw on the right side panel.



10. Press the [Power] key to turn on the power. The analyzer starts priming the fluid pathway.

11. If the pump tube was replaced, the pump tube counter will have to be reset. To reset the counter, press the RESET key for <Pump tube> on the OPER HISTORY screen to reset the counts to zero.

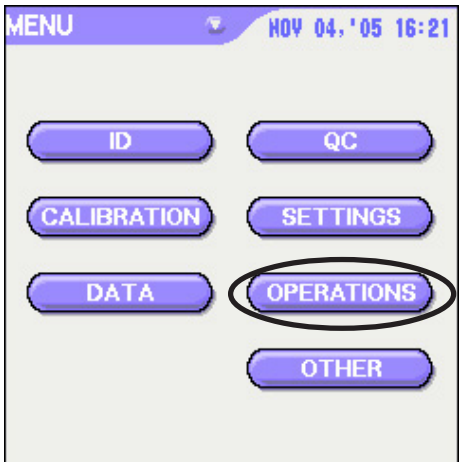
12. Fill in the Maintenance Check Sheet.

Every Six Months/As-Required Maintenance Procedures

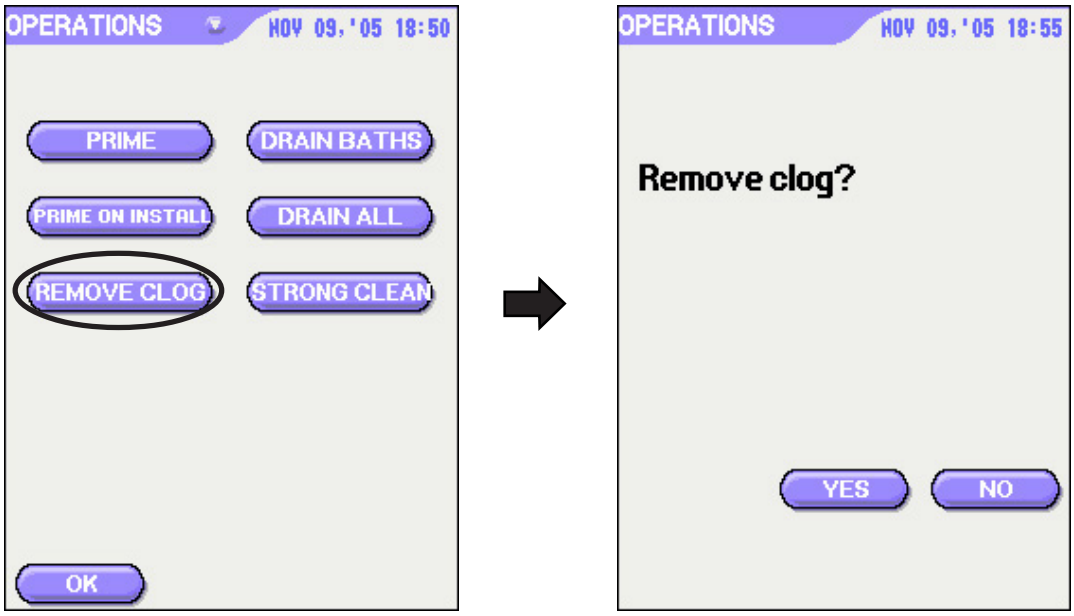
Removing a Clog from the Aperture

When the “CLOG” alarm occurs, remove the clog by the following procedure.

1. Press the OPERATIONS key on the MENU screen to display the OPERATIONS screen.



2. Press the REMOVE CLOG key on the OPERATIONS screen. The confirmation message appears.



3. Press the YES key to remove the clog from the aperture. The analyzer starts removing the clog and the “Removing clog” message appears on the screen.
   Press the NO key to cancel the procedure.

   After removing the clog, the screen returns to the OPERATIONS screen.

Cleaning Aperture Caps

Materials Required

- Powder-free gloves, lab coat, safety glasses
- Phillips and flat-blade screwdrivers
- Dry cloth or tissue paper
- CLEANAC•3 detergent
- Microscope

Procedures

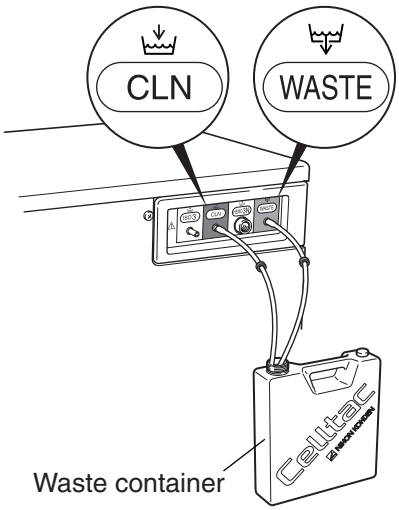
For daily cleaning of the aperture caps, press the [Clean] key on the front panel.

However, if the “CLOG” message frequently appears or the background count is high, clean the aperture caps as directed in the following procedure.

NOTE

The aperture caps are behind the measurement baths.

1. Replace the CLEANAC detergent with CLEANAC•3 detergent.
2. Press the STRONG CLEAN key on the OPERATIONS screen to perform strong cleaning. Refer to “Before Maintenance Procedure” earlier in this section.
3. Replace the CLEANAC•3 detergent with CLEANAC detergent.
4. Remove the diluent tube from the ISO3 diluent inlet and the hemolysing reagent tube from the HEMO3N inlet on the right side panel.
5. Remove the detergent tube from the detergent container and put it into the waste container. Do not disconnect the waste fluid tube from the WASTE outlet.

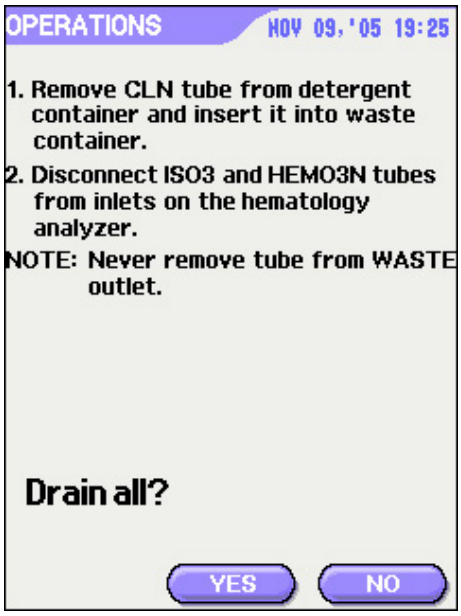


NOTE

Waste comes out from the CLN inlet when DRAIN ALL is performed.

6. Press the DRAIN ALL key on the OPERATIONS screen.

A confirmation message appears on the screen.



7. Press YES to start draining the analyzer.

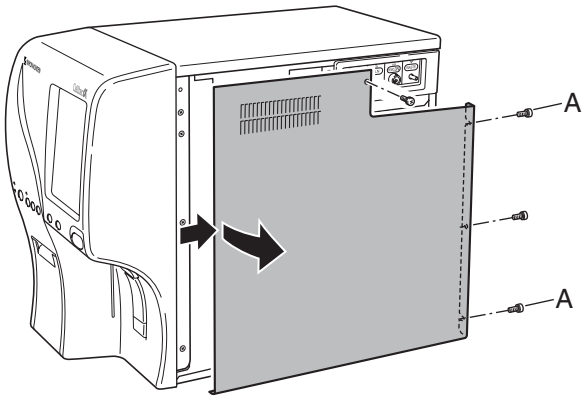
NOTE

Be sure all reagent has drained into the container. Failure to do so may result in a liquid spill.

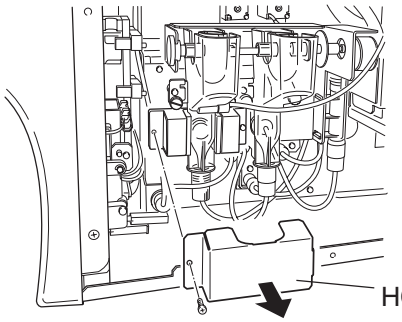
8. After draining, press the [Power] key while holding down the [Reset] key to turn the power off. Check that the power lamp is off.

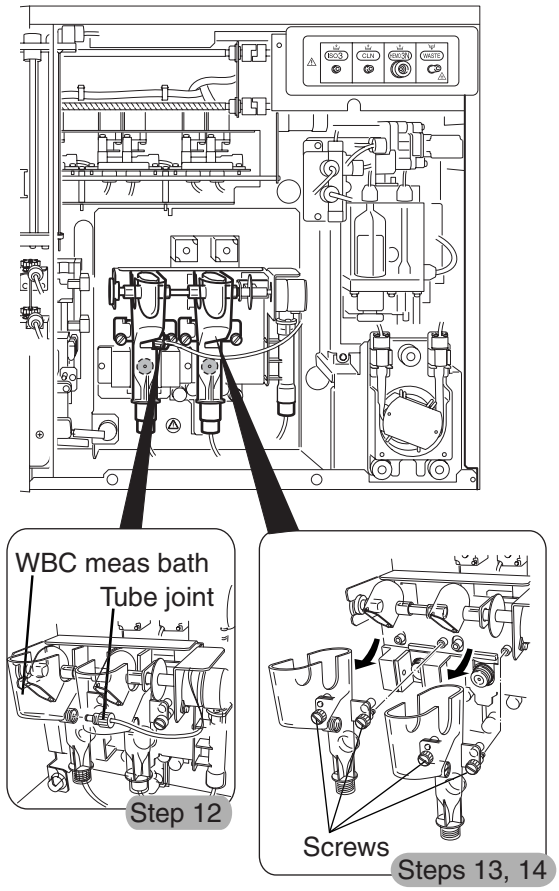
9. Remove the three screws on the rear panel and one screw on the right side panel. The two screws marked with A only need to be loosened and not removed.

10. Slide the right side cover to the rear direction and then toward you to remove the cover.



11. Remove the screw on the HGB cover to remove the HGB cover.

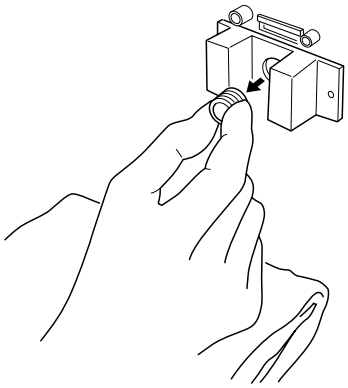




12. Remove the tube joint connected to the WBC measurement bath by turning the knurl joint.

13. Loosen the screws fastening the measurement baths. (The screws cannot be removed from the measurement baths.)

14. Remove the measurement baths by pulling them toward you to remove them from the aperture and then pulling them downward. If necessary, remove filter joints on the RBC and WBC measurement bath assemblies by turning the tube connectors.



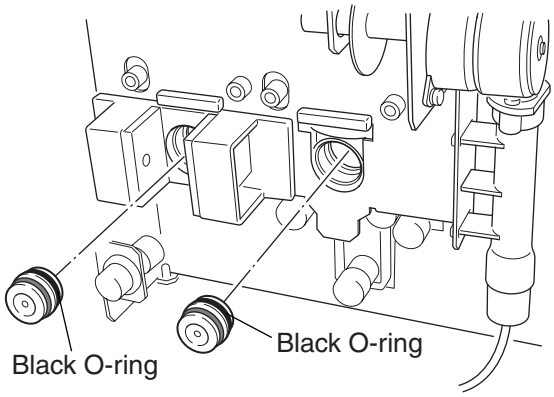
15. Place a cloth or tissue paper under your hand and remove the aperture cap by pulling it toward you. If it is not easy to pull the aperture cap, move it slowly left and right to remove it.

16. Carefully rinse the aperture cap. Remove all protein build-up, especially from the inside. The condition of the aperture cap can be checked with a 100× microscope.

17. If a clog or dust still remains in the aperture caps, soak the aperture caps in CLEANAC•3 detergent for about an hour.

CAUTION

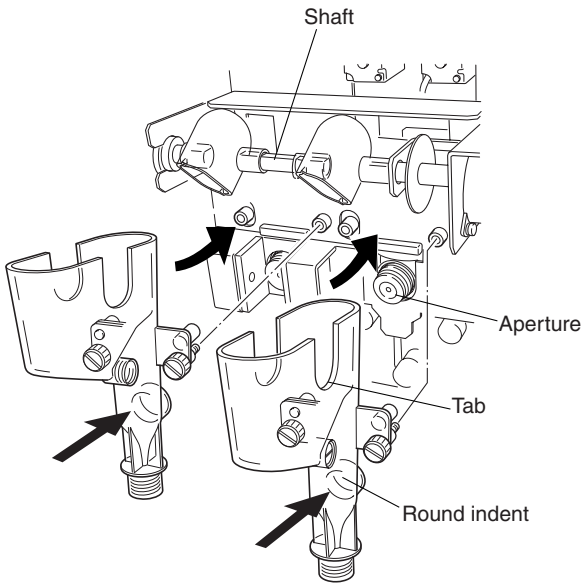
Handle the aperture caps with care. They can be damaged if a sharp object is used to clean them.



18. Rinse the aperture caps with water and replace them in the original positions. Make sure that the black O-ring is facing the hole (analyzer side).

NOTE

When replacing the aperture cap, do not push the aperture cap with your ball of finger. Otherwise, the aperture cap may be broken.



19. Reattach the measurement baths so that the sub bath is in the measurement bath, the shaft of the sub bath is in the tab of the measurement bath, and the round indent of the measurement bath fits the aperture.

20. Tighten the screws which were loosened in step 13 to fasten the measurement baths.

NOTE

Before tightening the screws, check and remove any dirt or rust on and around the screws. If dirt or rust is present, noise alarm may occur during measurement.

Reconnect the filter joints to the RBC and WBC measurement bath assemblies by turning the tube connectors if they were removed in step 14.

21. Reattach the tube joint to the WBC measurement bath by turning the knurl joint.

22. Reattach the HGB cover and fasten it with the screw.

23. Reattach the right side cover and fasten it with the three screws on the rear panel and one screw on the right side panel.

24. Press the [Power] key to turn on the power. The analyzer starts priming the fluid pathway.

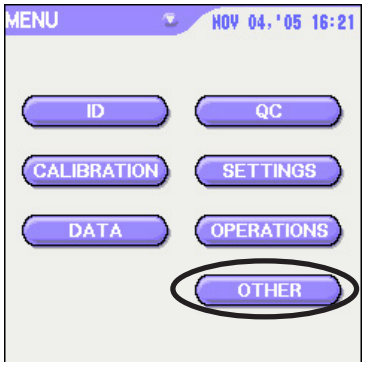
25. Fill in the Maintenance Check Sheet.

Cleaning the External Electrodes on the Measurement Baths

The external electrodes are the screws on the left side of each measurement bath. Check that these screws are not dirty or rusty. If there are dirt or rust on the external electrodes, they may cause NOISE alarm. When the screws are dirty or rusty, remove them by cleaning the measurement bath with the CLEANAC•3 detergent. Refer to the “Checking and Cleaning Measurement Baths and Sub Baths” earlier in this section.

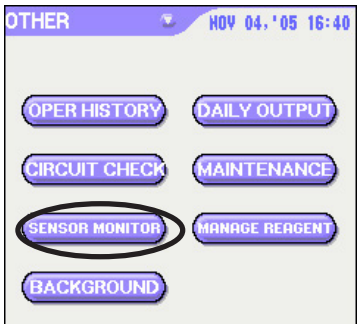
Checking the Sensor Monitor Screen

You can view the power voltage for the sensors in real-time on the SENSOR MONITOR screen. For the upper and lower manometer sensors, the voltage must be checked without reagent and then with reagent in the manometers.



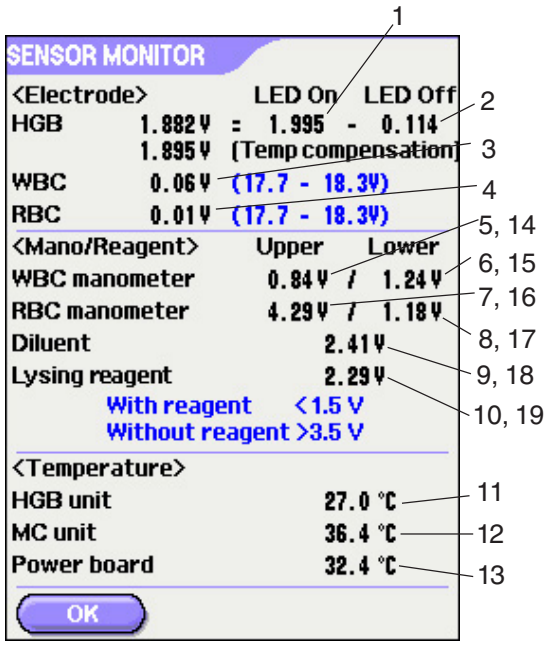
Before displaying the SENSOR MONITOR screen, make sure that the fluid are drained from the instrument.

1. Press the OTHER key on the MENU screen to display the OTHER screen.



2. Press the SENSOR MONITOR key on the OTHER screen.

   The SENSOR MONITOR screen appears listing the output voltage of each sensor.



3. Check that the results are in the following ranges.

   Normal range

   <Electrode>

   1. HGB LED On: 1.5 to 4.5 V
   2. HGB LED Off: <0.5 V
   3. WBC: 17.7 to 18.3 V
   4. RBC: 17.7 to 18.3 V

   <Mano/Reagent>

   Without reagent in the manometers

   5. WBC manometer upper: >3.5 V
   6. WBC manometer lower: >3.5 V
   7. RBC manometer upper: >3.5 V

8. RBC manometer lower: >3.5 V
9. Diluent: >3.5 V
10. Lysing reagent: >3.5 V

<Temperature>

11. HGB unit: (any value is OK as long as no alarm is displayed)
12. MC unit: (any value is OK as long as no alarm is displayed)
13. Power board: (any value is OK as long as no alarm is displayed)

4. Turn on the instrument and fill the manometers with reagent.

5. Display the SENSOR MONITOR screen and check the following values.

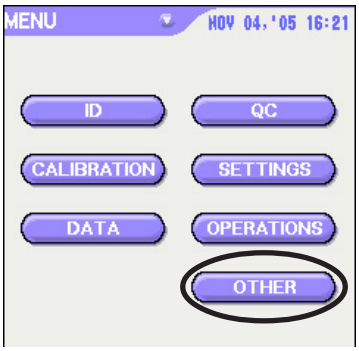
With reagent in the manometers

14. WBC manometer upper: <1.5 V
15. WBC manometer lower: <1.5 V
16. RBC manometer upper: <1.5 V
17. RBC manometer lower: <1.5 V
18. Diluent: <1.5 V
19. Lysing reagent: <1.5 V

If a check result is outside the normal range, sensors must be adjusted. Refer to Section 5 “Adjustment” to adjust the sensors.

6. Press the OK key to return to the OTHER screen.

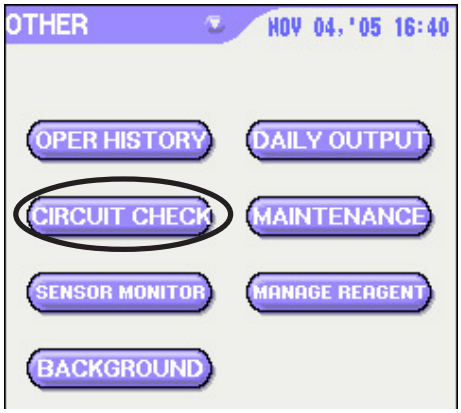
Checking the Circuit



Check the analyzer’s electrical circuit.

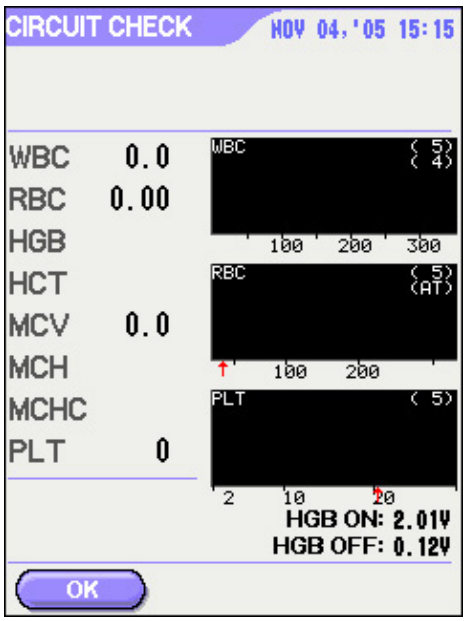
1. Press the OTHER key on the MENU screen.

2. Press the CIRCUIT CHECK key on the OTHER screen.



The analyzer starts checking the circuit and the screen shows the "Checking circuit" message.

When the check is completed, the result appears.



3. Check that the results are in the following ranges.

Normal range

WBC:	7.6 to 8.4 (10^3/µL)
RBC:	1.52 to 1.68 (10^6/µL)
MCV:	85 to 115 (fL)
PLT:	152 to 168 (10^3/µL)
HGB ON:	1.5 V to 4.5 V
HGB OFF:	less than 0.5 V

- If the HGB value is outside the normal range, clean the WBC measurement bath and recheck the circuit.
- If a check result is outside the normal range, check the cable connection between the MC-640V measuring unit and the AMP CONTROL board. Refer to Section 2 "Troubleshooting".
- Also check the sensitivity and threshold setting and write down the settings in the maintenance check sheet.

4. Press the OK key to return to the OTHER screen.

5. Press the OK key to return to the MENU screen.

Checking the $\bar{X}$-R Values

Measure the MEK-3DN hematology control twice on the QUALITY CONTROL screen and check that the $\bar{X}$ values are within the range on the assay sheet provided with the hematology control and that the R values are within the following range. The following range are calculated statistically from the coefficient variation of the instrument.

WBC: $<0.7 \times 10^3/\mu L$
LY%: <5.2%
MO%: <3.3%
GR%: <11.4%
RBC: $<0.29 \times 10^6/\mu L$
HGB: <1.0 g/dL
MCV: <3.6 fL
PLT: $<39 \times 10^3/\mu L$

For details on how to measure the hematology control on the QUALITY CONTROL screen, refer to Section 6 “Quality Control” in the Operator’s Manual.

Checking the Current Calibration Coefficients

When the $\bar{X}$-R values are within the range in the previous check, you only need to write down the current calibration coefficients on the CALIBRATION screen for closed, open and pre-dilution modes.

When the $\bar{X}$-R values are outside the range in the previous check, measure the MEK-3DN hematology control 3 times on the CALIBRATION screen and write down the mean values and calibration coefficients. If the measured data of one measurement is extremely different from the other two measurements, delete that data and only use the mean of the two measurement data which are close to each other.

For details on how to measure the hematology control on the CALIBRATION screen, refer to Section 7 “Calibration” in the Operator’s Manual.

Checking the New Calibration Coefficients

For details on how to measure the hematology control on the CALIBRATION screen, refer to Section 7 “Calibration” in the Operator’s Manual.

1. Measure the MEK-3DN hematology control 3 times on the CALIBRATION screen for closed mode. Write down the lot number of the measured hematology control. If the measured data of one measurement is extremely different from the other two measurements, delete that data and only use the mean of the two measurement data which are close to each other.

2. In the <Data> field, enter the median of the assay value listed in the assay sheet which is attached to the hematology control.

3. Write down the values of the <Data> field and <Cal> field.

4. Repeat the procedure in open mode, then in pre-dilution mode.

NOTE

Other calibration method may be used in some laboratories. Before changing calibration coefficients, check with the laboratories on the calibration method.

Checking the Prime Function

This function fills the fluid path inside the analyzer with diluent.

1. Press the OPERATIONS key on the MENU screen to display the OPERATIONS screen.

2. Press the PRIME key. The “Prime?” confirmation message appears.

3. Press the YES key to prime. The analyzer automatically checks the reagent and starts priming.
   Press the NO key to cancel the procedure. The screen returns to the OPERATIONS screen.

   During priming, the screen shows the “Priming” message. After priming is completed, the screen returns to the READY screen.

Checking the Drain Function

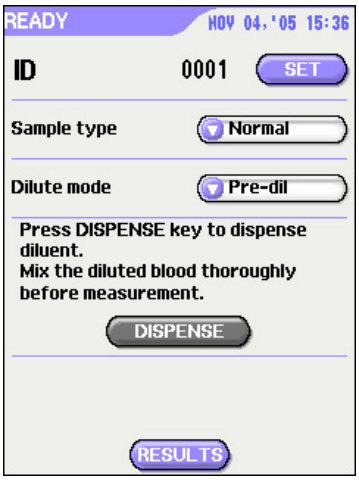
Refer to “Before Maintenance Procedure” earlier in this section.

Checking the Cleaning Function

Press the [Clean] key on the front panel to check the cleaning function. After cleaning, the screen returns to the READY screen.

For checking the strong cleaning function, refer to “Before Maintenance Procedure” earlier in this section.

Checking the Dispensing Function



1. **On MEK-6400**
   On the READY screen, check that "Open" is selected for <Sampling mode> and select "Pre-dil" for <Dilute mode>. The DISPENSE key appears on the screen.

   On MEK-6410/6420
   On the READY screen, select "Pre-dil" for <Dilute mode>. The DISPENSE key appears on the screen.

2. Put the sampling nozzle into an empty cup and press the DISPENSE key on the screen. Check that about 2 mL of diluent is dispensed into the cup.

Checking the External Instruments Function

Printers

Check the printer function. Check that data is printed properly and that the print is not faint and no dots missing. Also check the auto print function.

Hand-held Bar Code Reader

Read a sample ID bar code label with the hand-held bar code reader and check that the correct ID appears on the READY screen.

PC

Send a sample data to PC and check that the data is properly received by the PC.

Checking the Power Cord

- Check that there is no damaged AC plug and exposed wire on the power cord.
- Check that the 3-pin plug type power cord is used and the 3 pins and plug housing are not deformed.

Checking the Resistance of the Protective Ground Line

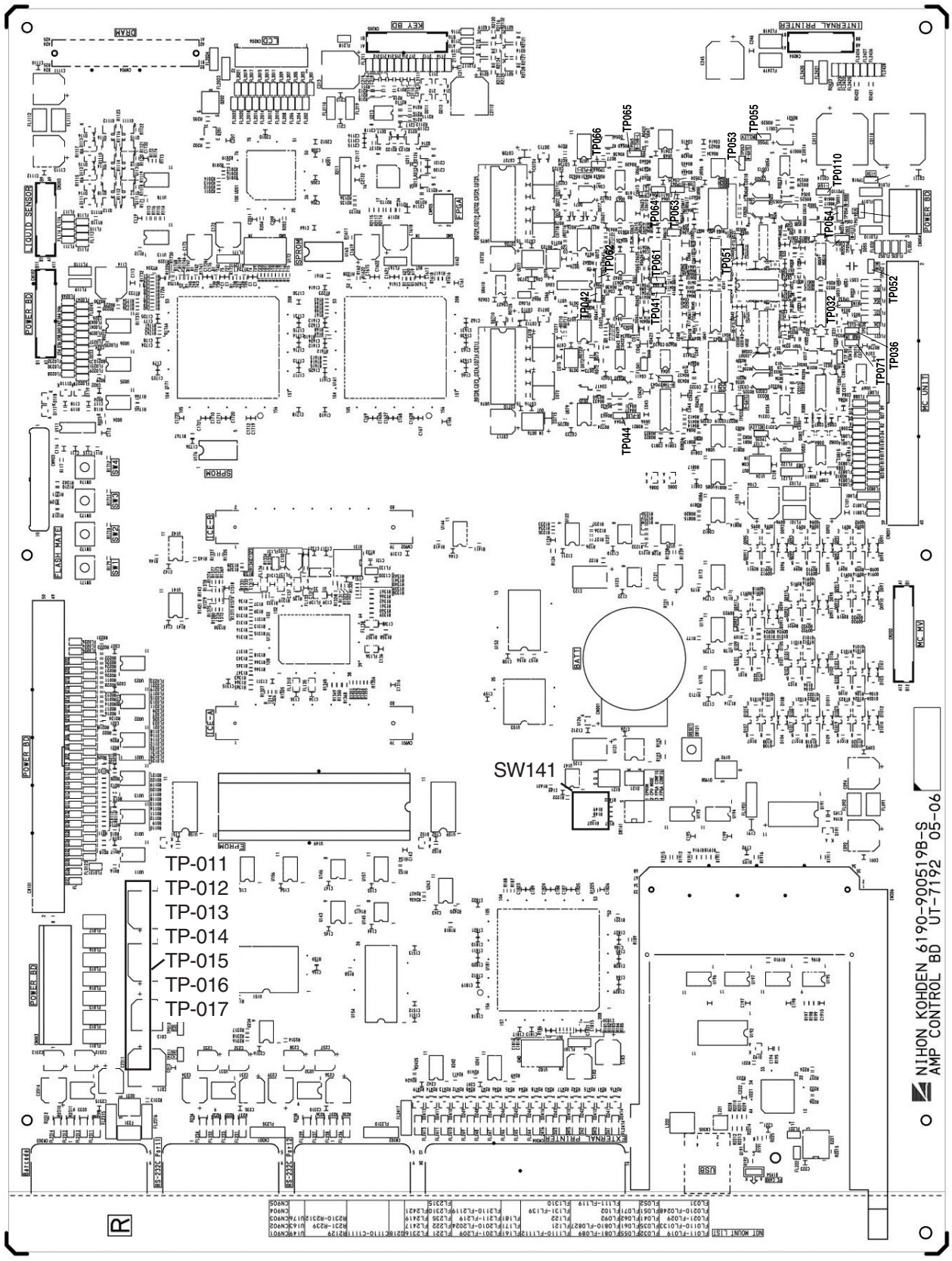
Check that the resistance of the protective ground line of the power cord is 0.1 Ω or less by using an earth tester or check the continuity with a multimeter.

Checking the Earth Leakage Current

Check that the earth leakage current is 0.5 mA or less under normal condition.
Check that the earth leakage current is 3.5 mA or less under each single fault condition.

Section 7 Test Point, Variable Resistor, LED and Switch on Board

AMP CONTROL Board

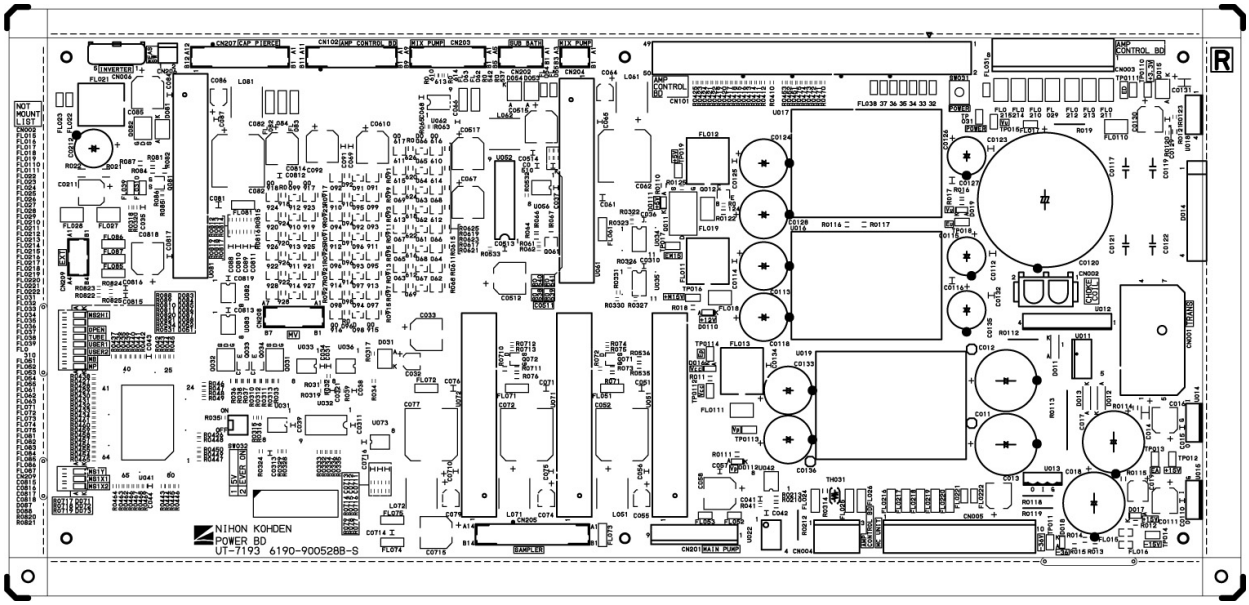


TP011 [+5V]: +5 V DC terminal for digital circuit
TP012 [ED]: Ground terminal for digital circuit
TP013 [+3.3V]: +3.3 V DC terminal for digital circuit
TP014 [+Vp]: Supply voltage (Vp) terminal for optional built-in printer
TP015 [Ep]: Ground terminal for optional built-in printer
TP016 [+M15V]: +15 V DC terminal for valve control
TP017 [EM15V]: Ground terminal for valve control

SW0141: Bit switches for debug (All the bit switches are set to off.)

TP018 [+15V]: +15 V DC terminal for analog circuit
TP019 [EA]: Ground terminal for analog circuit
TP0110 [-15V]: –15 V DC terminal for analog circuit
TP031 [RFIL]: Test point for RBC pulses through the low-pass filter
TP032 [RIN]: Test point for RBC pulse analog waveform from the measuring unit
TP033 [R-GATE]: Test point for RBC gate pulse
TP034 [R-ROB]: Test point for output waveform from Robinson gate circuit for RBC
TP035 [RCLLEV]: Test point for RBC level
TP036 [RELE]: Test point for voltage between the electrodes at RBC side
TP041 [RANA]: Test point for RBC analog output waveform from the gain setting circuit
TP042 [R-PH]: Test point for output waveform from the peak-hold circuit at RBC side
TP043 [R-THR]: Test point for RBC threshold
TP044 [R-PLS]: Test point for RBC digital pulse
TP051 [WFIL]: Test point for WBC pulses through the low-pass filter
TP052 [WIN]: Test point for WBC pulse analog waveform from the measuring unit
TP053 [W-GATE]: Test point for WBC gate pulse
TP054 [W-ROB]: Test point for output waveform from Robinson gate circuit for WBC
TP055 [WCLLEV]: Test point for WBC level
TP056 [WELE]: Test point for voltage between the electrodes at WBC side
TP061 [WANA]: Test point for WBC analog output waveform from the gain setting circuit
TP062 [W-PH]: Test point for output waveform from the peak-hold circuit at WBC side
TP063 [W-THR-H]: Test point for WBC upper threshold
TP064 [W-PLS-H]: Test point for WBC digital pulses which exceed the upper threshold
TP065 [W-THR-L]: Test point for WBC lower threshold
TP066 [W-PLS-L]: Test point for WBC digital pulses which exceed the lower threshold
TP071 [HGB IN]: Test points for HGB voltage from the HGB AMP board

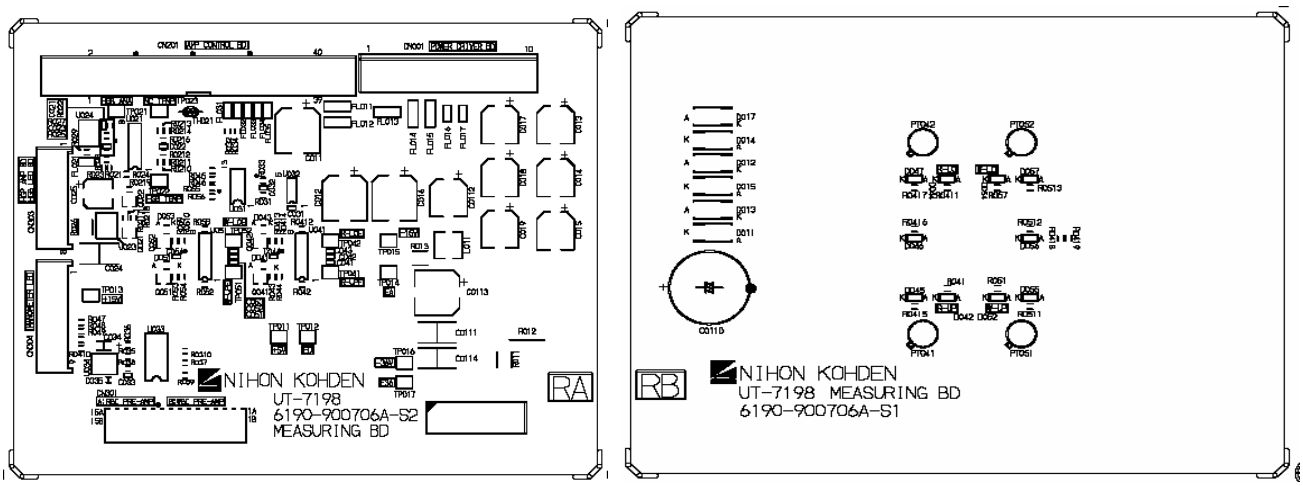
POWER Board



TP011 [-36V]:	–36 V DC terminal for analog circuit
TP012 [+15V]:	+15 V DC terminal for analog circuit
TP013 [EA]:	Ground terminal for analog circuit
TP014 [-15V]:	–15 V DC terminal for analog circuit
TP015 [Vu]:	Supply voltage (Vu) terminal for motor control
TP016 [+M15V]:	Supply voltage (+15 V DC) terminal for valves
TP017 [EM15]:	Ground terminal for valves
TP018 [Eu]:	Ground terminal for motor control
TP019 [+5V]:	+5 V DC terminal for digital circuit
TP0110 [+3.3V]:	+3.3 V DC terminal for digital circuit
TP0111 [ED]:	Ground terminal for digital circuit
TP0112 [VCC]:	Supply voltage (Vcc) terminal for secondary power circuit control
TP0113 [Vp]:	Supply voltage (Vp) terminal for optional printer unit
TP0114 [EP]:	Ground terminal for optional printer unit
TP021 [POWER]:	Test point for power key switch status check
SW031 [POWER]:	Power key switch
SW032:	Bit switches for power supply mode selection
	No. 1: ON +5 V power supply always ON
	No. 2: ON ALL power supply always ON
D016 [Vcc]:	LED for supply voltage check for secondary power circuit control.
	When the voltage is supplied to the circuit, this LED is lit.
D017 [+15V]:	LED for +15 V DC
D018 [-36V]:	LED for -36 V DC
D019 [Vu]:	LED for checking supply voltage for motor control
D0110 [+M12V]:	LED for checking supply voltage for valves
D0111 [+5V]:	LED for +5 V DC
D0112 [+Vp]:	LED for checking supply voltage for optional printer unit
D051 [MPSEN]:	LED for checking position sensor for MP-640V
D052 [MBSEN]:	LED for checking sub bath rotation sensor

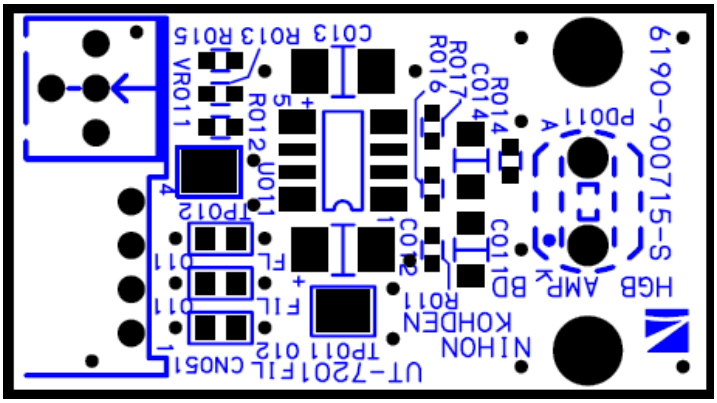
D071 [MS1YSEN]: LED for checking x-axis position sensor for MS-640V
D072 [MS1XSEN1]: LED for checking y-axis position sensor for MS-640V
D073 [MS1XSEN2]: LED for checking position sensor for MS-640V
D083 [MS2HI]: LED for checking upper position sensor for MS-641V
D084 [MS2LOW]: LED for checking lower position sensor for MS-641V
D085 [MS2OPEN]: LED for checking tube holder position sensor for MS-641V
D086 [MS2TUBE]: LED for checking tube sensor for MS-641V

MEASURING Board



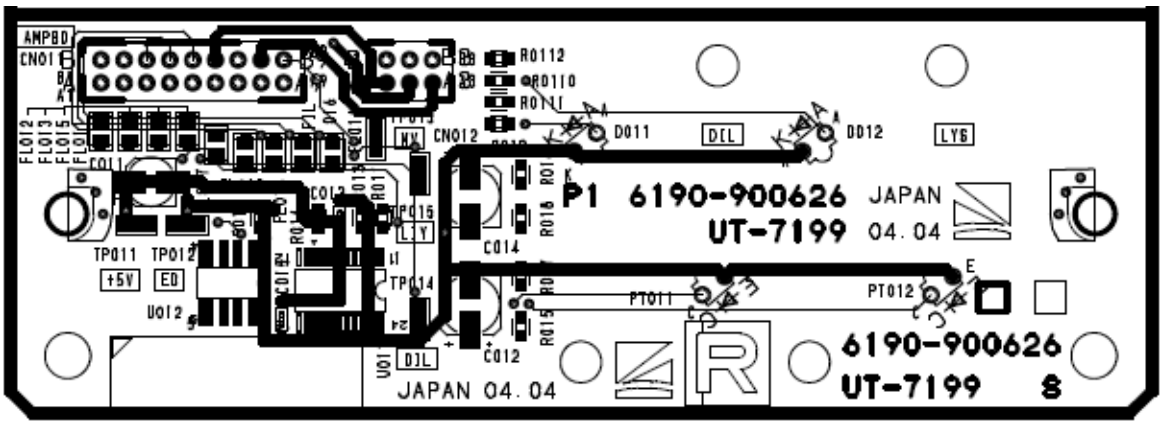
TP011 [+5V]: +5 V DC terminal for digital circuit
TP012 [ED]: Ground terminal for digital circuit
TP013 [+15V]: +15 V DC terminal for analog circuit
TP014 [EA]: Ground terminal for analog circuit
TP015 [-15V]: –15 V DC terminal for analog circuit
TP016 [-36V]: –36 V DC terminal
TP017 [E36]: Ground terminal for –36 V DC
TP021 [HGB ANA]: Test point for HGB sensor output
TP022 [HGB TEMP]: Test point for HGB temperature output
TP023 [MC TEMP]: Test point for MC-640V temperature output
D042 [R-UP]: LED for checking upper liquid sensor for RBC manometer
D044 [R-LO]: LED for checking lower liquid sensor for RBC manometer
D052 [W-UP]: LED for checking upper liquid sensor for WBC manometer
D054 [W-LO]: LED for checking lower liquid sensor for WBC manometer

HGB AMP Board



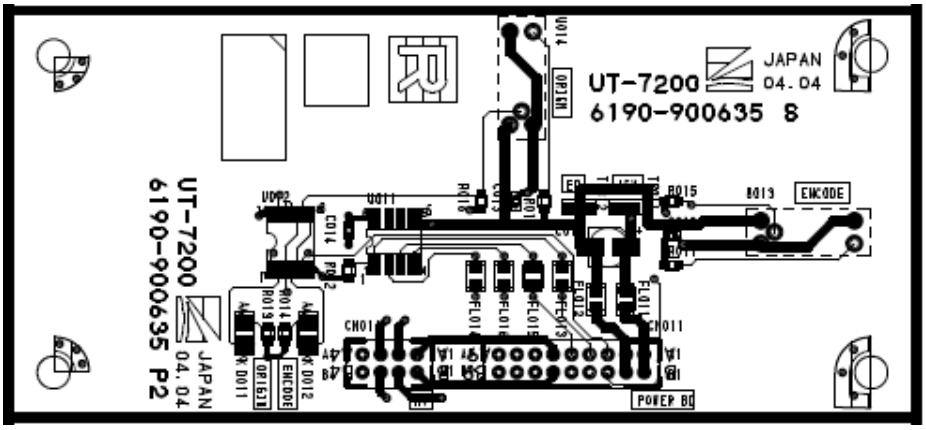
TP011 [EA]: Ground terminal for analog circuit
TP012 [HANA]: Test point for checking HGB sensor output

LIQUID SENSOR Board



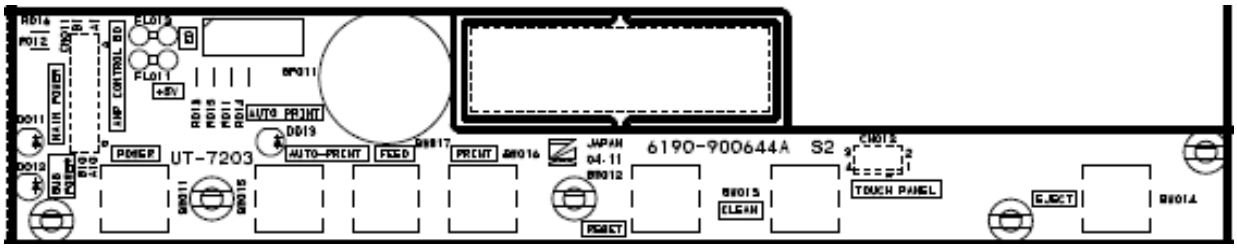
TP011 [+5V]: +5 V DC terminal for digital circuit
TP012 [ED]: Ground terminal for digital circuit
TP014 [DIL]: Test point for liquid sensor output for diluent
TP015 [LIY]: Test point for liquid sensor output for hemolysing reagent

MIXED PUMP Board



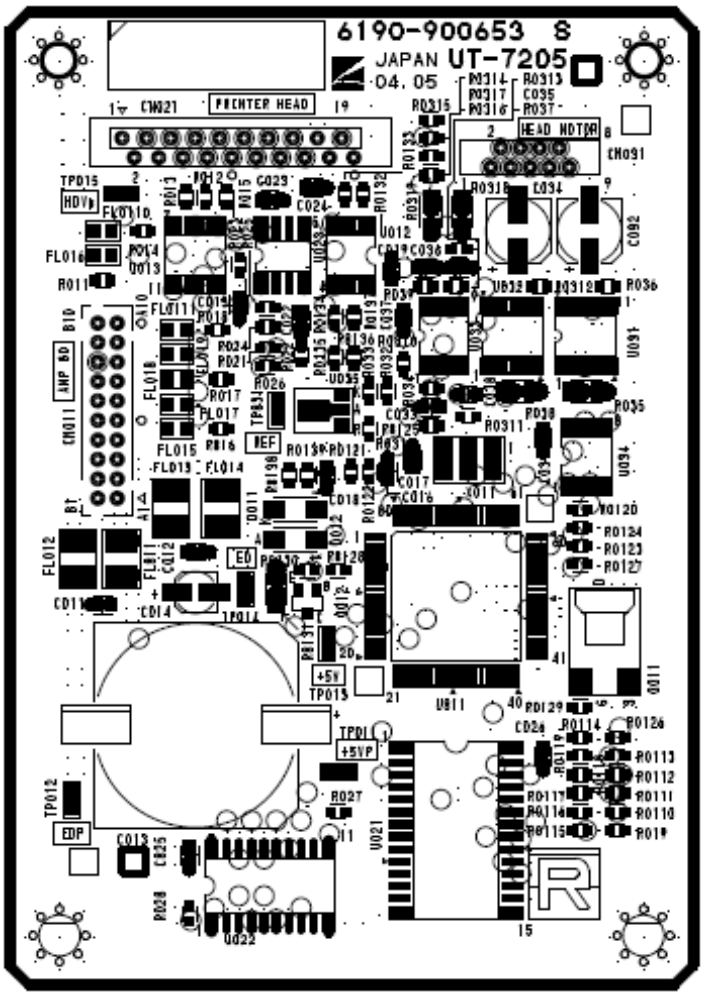
TP011 [+5V]: +5 V DC terminal for digital circuit
TP012 [ED]: Ground terminal for digital circuit
D011 [ORIGIN]: LED for checking bottom position for piston
D012 [ENCODE]: LED for checking encoder output

KEY Board



D011 [MAIN POWER]: Main power LED lamp (Vcc)
D012 [SUB POWER]: Power LED lamp (+5 V DC)
D013 [AUTO PRINT]: LED for automatic printing mode
SW011 [MAIN POWER]: Power key switch
SW012 [AUTO PRINT]: Auto print key switch
SW013 [FEED]: Feed key switch
SW014 [PRINT]: Print key switch
SW015 [RESET]: Reset key switch
SW016 [CLEAN]: Clean key switch
SW017 [EJECT]: Eject key switch

PRINTER DRIVER Board



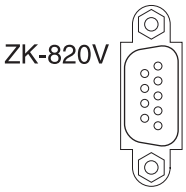
TP011 [+5VP]: +5 V DC terminal for printer
TP012 [EDP]: Ground terminal for printer
TP013 [+5V]: +5 V DC terminal for digital circuit
TP014 [ED]: Ground terminal for digital circuit
TP015 [HDVp]: Supply voltage for thermal array head of printer
TP031 [REF]: Test point for reference voltage

Section 8 Socket Pin Assignment

CAUTION

Connect only the specified instruments to the analyzer and follow the specified procedure. Failure to follow this instruction may result in electrical shock or injury to the operator, and cause fire or instrument malfunction.

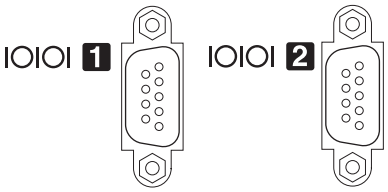
ZK-820V Bar Code Reader Socket



D sub 9 pin

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	FG	4	(To pin 6)	7	CTS0
2	TXD0	5	SG	8	RTS0
3	RXD0	6	(To pin 4)	9	VCC

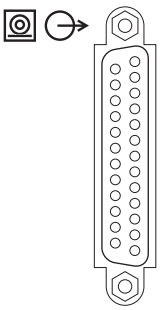
Serial Port 1/Serial Port 2



D sub 9 pin

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	FG	4	(To pin 6)	7	RTS
2	RXD	5	SG	8	CTS
3	TXD	6	(To pin 4)	9	NC

Printer Socket



D sub 25 pin (female)
SDBB-25S-SL-LNK (02)

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	XSTROBE	10	XACK	19	SG
2	D0	11	BUSY	20	SG
3	D1	12	PE	21	SG
4	D2	13	SLCT	22	SG
5	D3	14	NC	23	SG
6	D4	15	XERR	24	SG
7	D5	16	XSLCTIN	25	SG
8	D6	17	SG		
9	D7	18	SG		

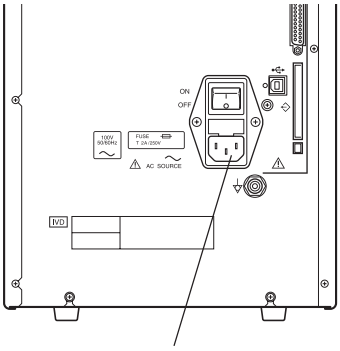
USB Socket

Pin No.	Signal
1	NC
2	USB-D+
3	USB-D–
4	ED

Section 9 Installation

Connecting the Power Cord and Grounding the Analyzer

Connecting the Power Cord



AC source socket

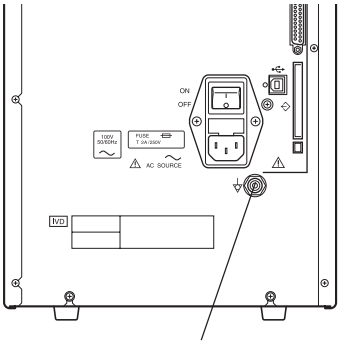
CAUTION

Only use the provided power cord. Using other power cords may result in electrical shock or other injury to the operator.

Connect the provided power cord to the AC SOURCE socket on the rear panel and plug the cord into a 3-prong AC outlet.

If possible, use an independent AC outlet only for this instrument. The instrument must not share an AC outlet with noise generating equipment such as a centrifuge, constant temperature bath (thermostat), refrigerator, air conditioner or ultrasonic cleaner.

Equipotential Grounding



Equipotential ground terminal

WARNING

For operator safety, equipotential grounding of all instruments must be performed. Consult with a qualified biomedical engineer.

When more than one electrical instrument is used, there may be electrical potential difference between the instruments. The potential difference between the instruments may cause current to flow to the patient connected to the instruments, resulting in electrical shock (micro shock).

Always perform equipotential grounding when required. It is often required in the operating room, ICU room, CCU room, cardiac catheterization room and X-ray room. Consult with a biomedical engineer to determine if it is required.

When equipotential grounding is required, connect the equipotential ground terminal on the rear panel of the analyzer to the equipotential ground terminal on the wall (equipotential grounding system) with the equipotential grounding lead (potential equalization conductor).

Connecting Tubes and Installing Reagents

In order for the analyzer to operate correctly, you must install all reagent and waste tubing before the power is turned on.

Materials Required

- Powder-free gloves, lab coat, safety glasses
- ISOTONAC•3 diluent
- CLEANAC detergent
- CLEANAC•3 detergent
- Hemolynac•3N lysing reagent
- Reagent inlet tubings and waste outlet tubing
- Waste container (or appropriate drain)
- 2 L container
- Lint-free cloth

CAUTION

Only use Nihon Kohden recommended reagents. Otherwise the measurement result cannot be guaranteed and incorrect reagent concentration can cause equipment damage.

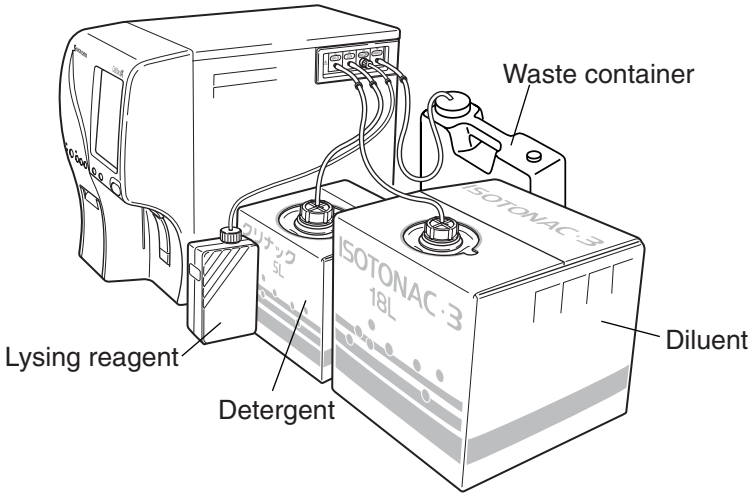
NOTE

- **Only use the CLEANAC•3 detergent for strong cleaning. If used for daily use, HGB measurement may be affected.**
- **The Hemolynac•3 lysing reagent (with cyan) cannot be used. There is no assay sheet for this reagent.**

Connecting Tubes

NOTE

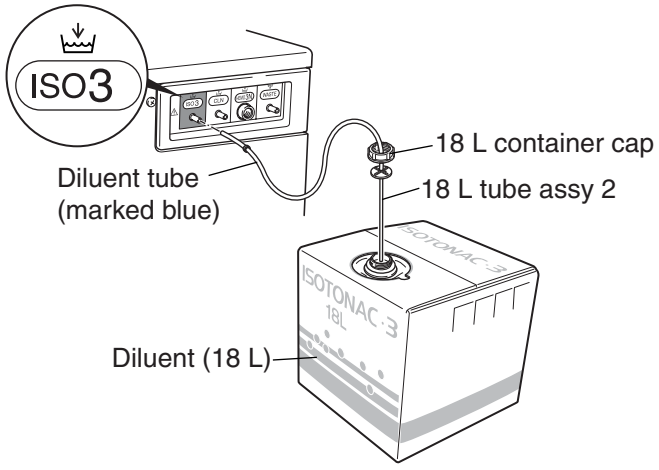
- **Do not squeeze or bend the tubes. Otherwise the analyzer may be damaged.**
- **Follow the instructions on each package for handling the reagent.**
- **Be careful not to let dust enter the lysing reagent, diluent and detergent.**



Diluent Tube

NOTE

Place the diluent container at the same level as the analyzer.



1. Connect the diluent tube (marked blue) to the ISO3 inlet on the right side panel.
2. Pass the diluent tube through the 18 L container cap.
3. Connect the end of the diluent tube to the 18 L tube assy 2.
4. Put the 18 L tube assy 2 into the diluent container and tighten the 18 L container cap.

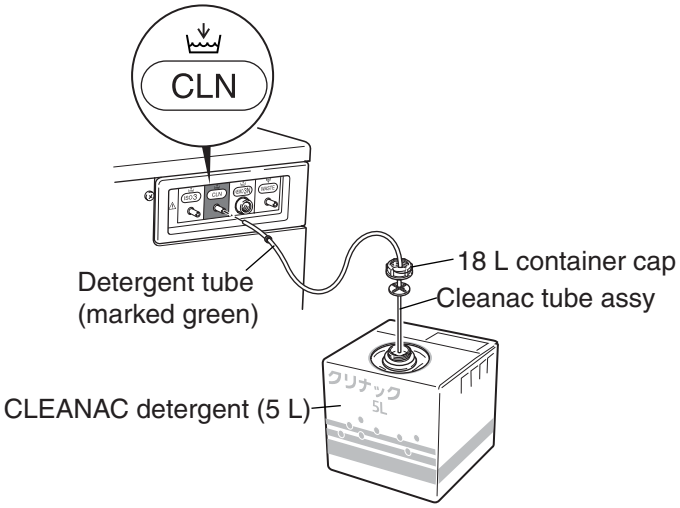
Detergent Tube

NOTE

- **Place the detergent containers at the same level as the analyzer.**
- **Only use the specified detergent tubes for the detergent.**

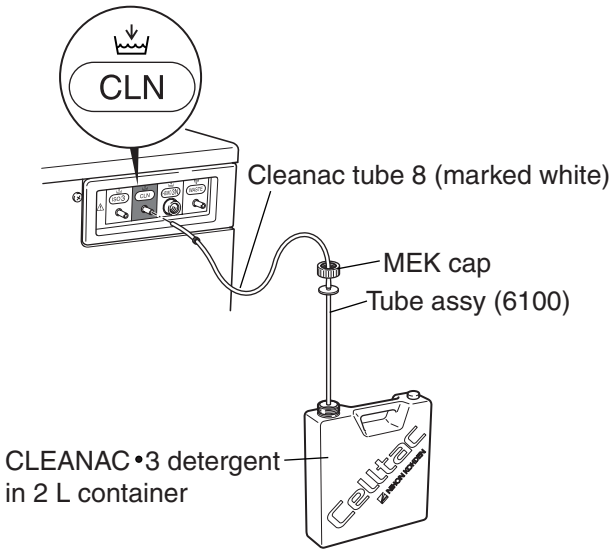
For performing STRONG CLEAN, use CLEANAC•3 detergent. For other purposes, use CLEANAC detergent.

CLEANAC Detergent



1. Connect the detergent tube (marked green) to the CLN inlet on the right side panel.
2. Pass the detergent tube through the 18 L container cap.
3. Connect the end of the detergent tube to the cleanac tube assy.
4. Put the cleanac tube assy into the CLEANAC container and tighten the 18 L container cap.

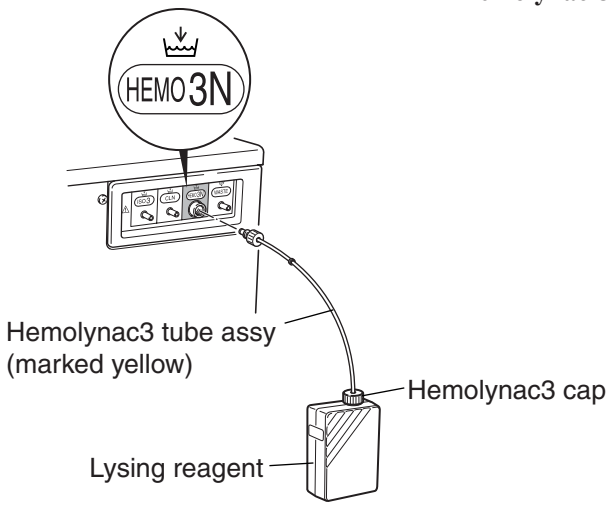
CLEANAC•3 Detergent (For STRONG CLEAN only)



1. Pour the CLEANAC•3 detergent into the 2 L container. Use the 18 L container cock for pouring the diluent.
2. Connect the cleanac tube 8 (marked white) to the CLN inlet on the right side panel.
3. Pass the cleanac tube 8 through the MEK cap.
4. Connect the end of the cleanac tube 8 to the tube assy (6100).
5. Put the tube assy (6100) into the 2 L container of the CLEANAC•3 detergent and tighten the MEK cap.

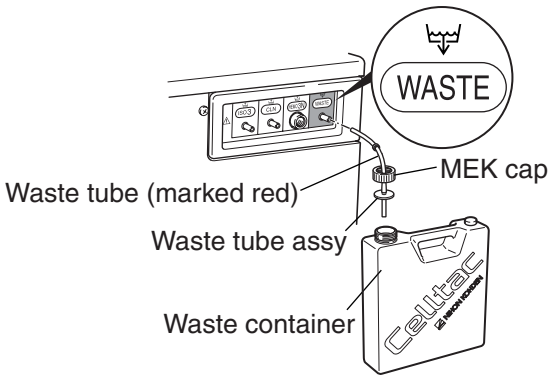
Lysing Reagent Tube

Hemolynac•3N



1. Replace the lysing reagent cap with the Hemolynac3 cap and tighten the cap.
2. Connect the Hemolynac3 tube assy (marked yellow) to the HEMO3N inlet on the right side panel.
3. Put the other end of the tube into the lysing reagent container through the Hemolynac3 cap.
4. When using the reagent tray, place the lysing reagent container on the upper shelf of the reagent tray.

Waste Fluid Tube

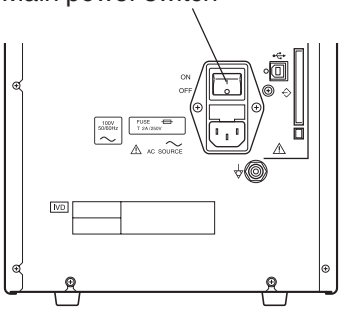


1. Connect the waste tube (marked red) to the waste outlet on the right side panel.
2. Pass the waste tube through the MEK cap.
3. Connect the waste tube to the waste tube assy.
4. Insert the waste tube assy into the 2 L container (waste container) and tighten the MEK cap.

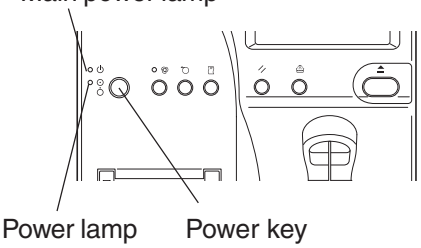
Turning Power On/Off

Turning On the Power

Main power switch



Main power lamp



Power lamp Power key

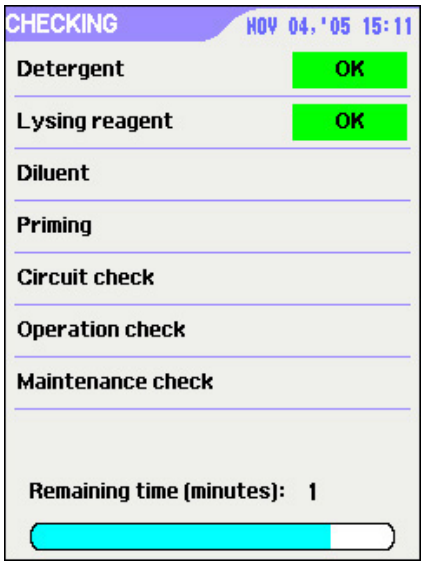
1. Confirm that the analyzer and optional external instrument power cords are connected to grounded power outlets.

2. Set the printer power switch ON.

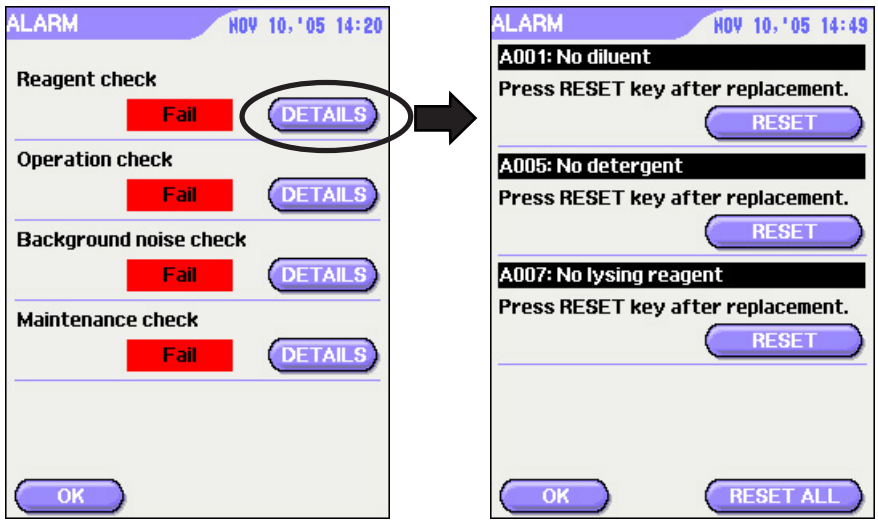
3. Press the [Main power] switch on the rear panel to ON. The [Main power lamp] on the front panel lights.

   Always leave the main power ON except for storage and transportation of the analyzer.

4. Press the [Power] key on the front panel ON. The [Power lamp] lights and the screen illuminates within 15 to 30 seconds. Cleaning of the fluid path, priming and circuit self-check are automatically performed.

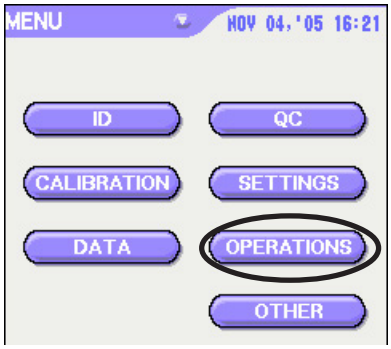


When there is an error, the “Fail” appears on the screen. Press the DETAILS key to display details on the alarm.



Cleaning the Fluid Path After Turning the Power On (PRIME ON INSTALL)

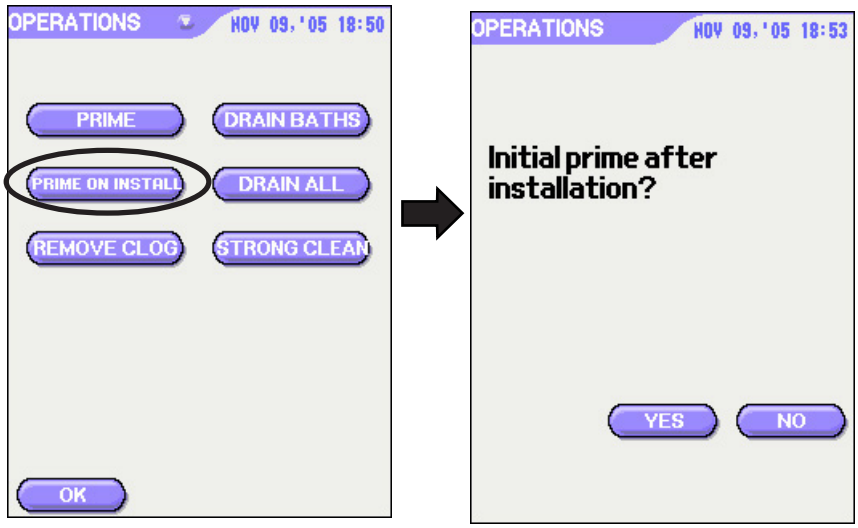
The fluid path inside the analyzer must be cleaned after installation or long-term storage. Perform PRIME ON INSTALL on the OPERATIONS screen. For details, refer to “Using the Analyzer after Storage” in Section 9 of the Operator’s Manual.



1. Press the MENU key on the READY screen.

2. Press the OPERATIONS key on the MENU screen.

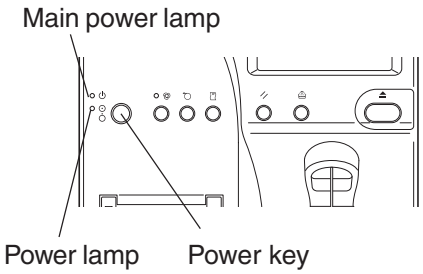
3. Press the PRIME ON INSTALL key on the OPERATIONS screen. A confirmation message appears on the screen.



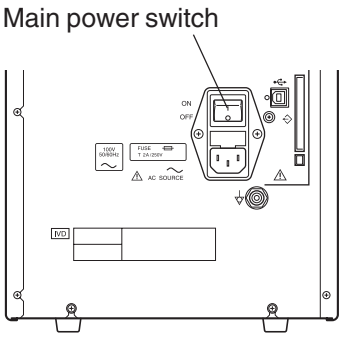
4. Press the YES key to prime the analyzer.
   Press the NO key to cancel the procedure and the screen returns to the OPERATIONS screen.

   After priming, the READY screen appears.

Turning Off the Power



To turn the power off, press the [Power] key on the front panel. The analyzer automatically performs cleaning and the “After cleaning, the power will automatically shut off.” message appears. After the cleaning is completed, the power is automatically turned off.



To turn the main power off, press the [Main power] switch on the rear panel. Check that the [Main power lamp] on the front panel is off.

Always leave the main power on except for storage and transportation of the analyzer.

Checking Accuracy

Check the analyzer before measurement to assure measurement reliability. For details on the measurement reliability, refer to Section 6 “Quality Control” of the Operator’s Manual.

Checking the Circuit

Check the analyzer’s electrical circuit. Refer to “Checking the Circuit” in Section 6.

Measuring Background Noise

Count the diluent to measure background noise. When using the analyzer in closed mode, measure background noise in closed mode. When using the analyzer in open mode, measure background noise in open mode. (Closed mode is only for MEK-6400.) To measure background noise, refer to “Measuring Background Noise” in Section 6.

The result appears on the screen after measurement. Make sure that the values are less than or equal to the following values.

WBC: 0.2 ($\times 10^3/\mu L$)
RBC: 0.05 ($\times 10^6/\mu L$)
HGB: 0.1 (g/dL)
PLT: 10 ($\times 10^3/\mu L$)

When measured on the BACKGROUND screen, “Fail” appears beside the parameter which is over the acceptable value.

Disregard the other parameter values because noise does not affect the other parameters.

If the values are not optimum, check the following items, press the [Clean] key on the front panel to clean the fluid path and recount the diluent. If the values are still not optimum, refer to Section 2 “Troubleshooting”.

- Grounding
- Not sharing the AC outlet on the wall with other instrument.
- The diluent is clean.
- No bubbles in the diluent.
- Remove clog from the aperture.
- Do strong cleaning.
- The external electrodes (the screws) on the measurement baths are securely fastened.
- Filters are clean.

- The aperture caps are clean.
- The aperture caps are firmly attached.
- The measurement baths and sub baths are clean.

Calibrating

For checking accuracy, use a MEK-3D hematology control which has the same conditions as human blood. For details on calibration, refer to Section 7 “Calibration” of the Operator’s Manual. After calibration, measure the hematology control again and check that the measured values are within the range on the assay sheet.