

Maintenance schedule

Manufacturer recommendations

These safety tests and checkout procedures provide service personnel with a method to verify operational and functional performance of the patient monitor. Safety and functional checkout tests should be documented in the checklist provided in “Maintenance Checklist” on page B-2. Failure to attain any of the listed results indicates a potential malfunction of the Tram-rac 4A housing. The safety tests and checkout procedures are based on the assumption that the tested Tram-rac 4A housing has known test equipment. They also require that the user be familiar with the operation of all test equipment required for the procedures. For more information concerning the operation of these components, refer to the respective operator manual(s).

WARNING

Failure on the part of all responsible individuals, hospitals or institutions, employing the use of this device, to implement the recommended maintenance schedule may cause equipment failure and possible health hazards. The manufacturer does not, in any manner, assume responsibility for performing the recommended maintenance schedule, unless an Equipment Maintenance Agreement exists. The sole responsibility rests with the individuals, hospitals, or institutions utilizing the device.

Manufacturer recommendations

To make sure the Tram-rac 4A housing remains in proper operational and functional order, a proper maintenance schedule must be observed. The manufacturer’s recommendations are as follows:

- **Visual Inspection:** Qualified service personnel should perform visual inspections at installation, every 12 months after installation, and each time the device is serviced. Refer to “Visual inspection” on page 3-3 for more information.
- **General Cleaning:** Qualified service personnel should perform general cleaning after servicing the device. Refer to “Cleaning” on page 3-4 for complete instructions for proper cleaning methods.
- **Electrical Safety Tests:** Qualified service personnel should perform electrical safety tests every 12 months after installation, and each time planned or corrective maintenance is performed. Refer to “Electrical safety tests” on page 3-5 for more information.

Visual inspection

Recommendations

The Tram-rac 4A housing and its components should be carefully inspected upon receipt of the equipment, every 12 months thereafter, and every time the unit is serviced.

1. Carefully inspect the Tram-rac 4A housing for obvious physical damage to the outer case. Refer damaged equipment to qualified service personnel for repair before using it again on a patient.
2. Inspect all external connectors, front and rear, for degraded pins, prongs and connector housings. Refer damaged equipment to qualified service personnel for repair before using it again on a patient.
3. Inspect all cable insulation, cable strain-reliefs and cable connectors for damage, cracks or degradation. Refer damaged equipment to qualified service personnel for repair before using it again on a patient.
4. Confirm safety labels and inscriptions on the device are legible.
5. Record the date and results in “[Appendix B – Checklist](#)” on page B-1.

Calibration

The Tram-rac 4A housing does not require calibration.

Cleaning

Exterior Cleaning

Clean the Tram-rac housing on a regular basis.

Clean the exterior surfaces of the device with a dampened lint-free cloth. Use one of the following approved solutions:

- ammonia (diluted),
- Cidex,
- sodium hypochlorite bleach (diluted), or
- mild soap (diluted).

To avoid damage to the equipment, follow these rules.

CAUTION

Failure to follow these rules may melt, distort, or dull the finish of the case, blur lettering on the labels, or cause equipment failures.

Always dilute the solutions according to the manufacturer's suggestions.

Always wipe off all the cleaning solutions with a dry cloth after cleaning.

Never use wax containing a cleaning substance.

Never pour water or any cleaning solution on the equipment or permit fluids to run behind switches, into the connectors, or into any ventilation openings in the equipment.

Never use these cleaning agents:

- abrasive cleaners or solvents of any kind,
- acetone,
- alcohol based cleaning agents (except for cleaning the thermal print head), or
- Betadine.

Disposal instructions

At the end of their service life, the device described in this manual and its accessories must be disposed of in compliance with the applicable local waste control regulations. If you have questions regarding the disposal of the product or the accessories, please contact GE or its representatives.

Electrical safety tests

General

Electrical safety tests provide a method of determining if potential electrical health hazards to the patient or operator of the device exist.

NOTE

These tests are applicable to Tram-rac 4A units with a power supply. If your Tram-rac 4A housing does *not* have a power supply, follow the test procedure in the appropriate host monitor service manual.

Recommendations

Qualified personnel must perform all safety tests presented in this document:

- Upon receipt of the device.
- Every 12 months thereafter (Planned/Preventive Maintenance). Refer to the “Maintenance schedule” on page 3-2 for more information.
- Each time the main enclosure is disassembled or a circuit board is removed, tested, repaired, or replaced (Corrective Maintenance).

GE recommends that the qualified personnel performing the tests should record the values of each required electrical safety test in the “Maintenance Checklist” on page B-2. These instructions are intended for any component/device in the system requiring electrical safety testing.

Test equipment

The recommended test equipment required to perform electrical safety tests is listed below.

Item	Specification
Leakage Current Tester	Equivalent to the circuits shown
Digital Multimeter (DMM) (optional, based upon leakage tester and location)	AC volts, ohms
Ground Bond Tester	0 – 1 ohm

Perform electrical safety tests using an electrical safety analyzer per IEC 60601-1, UL 60601-1, EN 60601-1 or CSA C22.2 No. 601. The schematics in the section provide a general understanding of the test equipment. Actual configuration of test equipment may vary.

The device being tested should be placed on an insulating surface.

Power outlet test

Verify that the power outlet is wired correctly per the country's electrical code standard before starting the following electrical safety tests. The results of the following tests will be inaccurate unless a properly wired power outlet is used. Use only non-isolated power outlets when performing safety tests.

Power cord and plug

Verify the power cord being used with the device is good. The following are several areas to check for in this regard:

- Failure of the power cord strain relief is very common. Often times users of the equipment pull on the power cord itself, rather than the power cord plug, to unplug the device from a wall receptacle. Inspect the power cord for wear or damage regularly. If damage is suspected, test for continuity through each conductor of the power cord connector.
- Verify line, neutral, and earth conductors are properly connected to the power cord plug and are not short-circuited. Replace the power cord, as necessary, with a regulatory-approved cord for the country of use.

WARNING

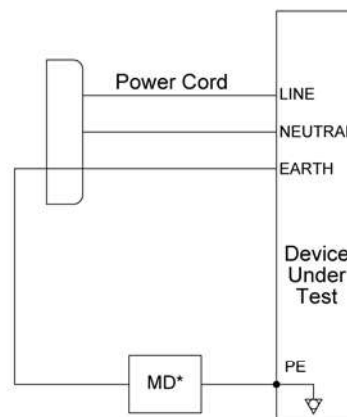
Use only AC power cords recommended or manufactured by GE.

Ground (earth) integrity

Listed below are two methods for checking the ground (earth) integrity, “**Ground continuity test**” and “**Impedance of protective earth connection**”. These tests determine whether the device's exposed metal and power inlet's earth (ground) connection has a power ground fault condition. Perform the test in accordance with your local regulations.

Ground continuity test

Refer to the instructions contained with the safety analyzer to perform each test. The measuring device (MD) in the diagram below may be part of the safety analyzer.



NOTE

*The measuring device (MD) represents the network and voltage measuring instrument and its frequency characteristics per IEC 60601-1.

Impedance of protective earth connection

This test, unlike a ground continuity test, will also stress the ground system by using special ground bond testers. This test normally is only required as a manufacturing production test to receive safety agency compliance. Some country agencies do require this test after field equipment repairs (e.g., Germany's DIN VDE 0751 standards). Consult your country/local safety agency if in question.

Compliance is checked by the following steps:

1. A current of 25A from a current source with a frequency of 50 or 60 Hz with a no-load voltage not exceeding 6VAC is passed for at least 5 seconds, but no more than 10 seconds, through the protective earth terminal or the protective earth terminal or the protective earth pin in the mains plug and each accessible metal part which could become live in case of failure in basic insulation.
2. The voltage drop between the parts described is measured and the impedance determined from the current and voltage drop. It must not exceed the values indicated. When taking this measurement, move the unit's power cord around. There should be no fluctuations in resistance.

Acceptance criteria

For equipment *without* a power supply cord, the impedance between the earth terminal of the (IEC 60320-1) AC inlet receptacle and the protective earth (PE) terminal (or any accessible metal part which is protectively earthed) must not exceed 0.1 ohms.

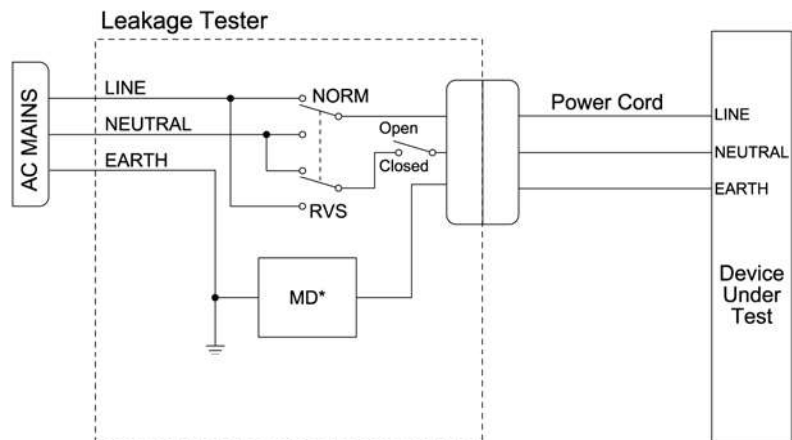
For equipment *with* a power supply cord, the impedance between the protective earth pin in the mains plug and any accessible metal part which is protectively earthed must not exceed 0.2 ohms.

Ground (earth) wire leakage current tests

Perform this test to measure current leakage through the ground (earth) wire of the equipment.

Perform tests in both Normal Condition (NC) and in Single Fault Condition (SFC), where one of the supply conductors is open at a time. Perform the test with normal and reverse polarity.

1. Refer to the instructions contained with the safety analyzer to perform this test.
2. Configure leakage tester as follows:
 - ◆ Polarity – NORMAL
 - ◆ Neutral – CLOSED



NOTE

* The measuring device (MD) represents the network and voltage measuring instrument and its frequency characteristics per IEC 60601-1.

3. Apply the AC mains voltage to the device under test.
4. Read the current leakage indicated on the tester and record the results in the “Maintenance Checklist” on page B-2.
5. Change leakage tester switches to:
 - ◆ Polarity – NORMAL
 - ◆ Neutral – OPEN
6. Read the current leakage indicated on the tester and record the results in the “Maintenance Checklist” on page B-2.
7. Change leakage tester switches to:
 - ◆ Polarity – REVERSE

- ◆ Neutral – OPEN
- 8. Read the current leakage indicated on the tester and record the results in the “Maintenance Checklist” on page B-2.
- 9. Change leakage tester switches to:
 - ◆ Polarity – REVERSE
 - ◆ Neutral – CLOSED
- 10. Read the current leakage indicated on the tester and record the results in the “Maintenance Checklist” on page B-2.
- 11. Remove the AC mains voltage from the device under test.

If measured reading is greater than the Acceptance criteria below, the device under test fails. Contact GE Technical Support.

Acceptance criteria Normal Condition (NC)

- All readings must be less than or equal to 300 μ A for installations that require compliance to UL 60601-1 requirements.
- All readings must be less than or equal to 500 μ A for installations that require compliance to EN 60601-1/IEC 60601-1 requirements.

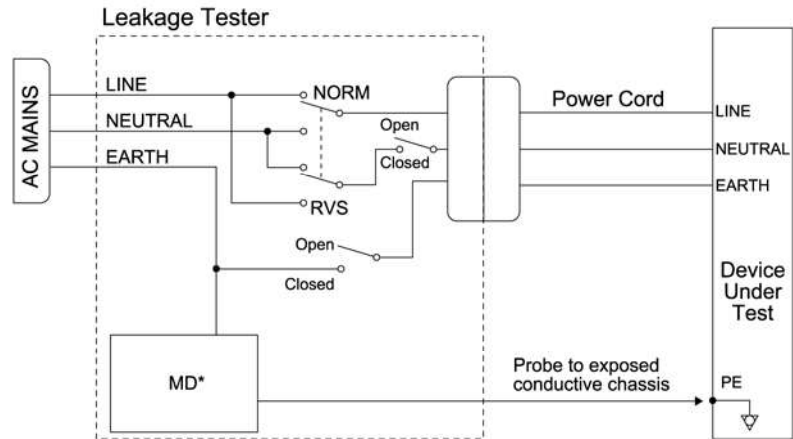
Acceptance criteria Single Fault Condition (SFC) – ground (earth), line or neutral open

- All readings must be less than or equal to 300 μ A for installations that require compliance to UL 60601-1 requirements.
- All readings must be less than or equal to 1000 μ A for installations that require compliance to EN 60601-1/IEC 60601-1 requirements.

Enclosure (touch) leakage current test

Perform this test to measure current leakage through exposed conductive surfaces on the device under test. Refer to the instructions contained with the safety analyzer to perform enclosure leakage current test.

Perform tests in both Normal Condition (NC) and in Single Fault Condition (SFC), where one of the supply conductors is open at a time. Perform the test with normal and reverse polarity.



NOTE

*The MD represents the network and voltage measuring instrument and its frequency characteristics per IEC 60601-1.

1. Configure leakage tester as follows:
 - ◆ Polarity – NORMAL
 - ◆ Neutral – CLOSED
 - ◆ GND (Earth) – CLOSED
2. Apply the AC mains voltage to the device under test.
3. Read the current leakage indicated on the tester and record the results in the “Maintenance Checklist” on page B-2.
4. Change leakage tester switches to:
 - ◆ Polarity – NORMAL
 - ◆ Neutral – OPEN
 - ◆ GND (Earth) – CLOSED
5. Read the current leakage indicated on the tester and record the results in the “Maintenance Checklist” on page B-2.
6. Change leakage tester switches to:
 - ◆ Polarity – NORMAL
 - ◆ Neutral – CLOSED
 - ◆ GND (Earth) – OPEN
7. Read the current leakage indicated on the tester and record the results in the “Maintenance Checklist” on page B-2.

8. Change leakage tester switches to:
 - ◆ Polarity – REVERSED
 - ◆ Neutral – CLOSED
 - ◆ GND (Earth) – OPEN
9. Read the current leakage indicated on the tester and record the results in the “Maintenance Checklist” on page B-2.
10. Change leakage tester switches to:
 - ◆ Polarity – REVERSED
 - ◆ Neutral – OPEN
 - ◆ GND (Earth) – CLOSED
11. Read the current leakage indicated on the tester and record the results in the “Maintenance Checklist” on page B-2.
12. Change leakage tester switches to:
 - ◆ Polarity – REVERSED
 - ◆ Neutral – CLOSED
 - ◆ GND (Earth) – CLOSED
13. Read the current leakage indicated on the tester and record the results in the “Maintenance Checklist” on page B-2.
14. Remove the AC mains voltage from the device under test.

If measured reading is greater than the Acceptance criteria below, the device under test fails. Contact GE Technical Support.

Acceptance criteria NC

All readings must be less than or equal to 100 μ A.

Acceptance criteria SFC - ground (earth), line or neutral open

- All readings must be less than or equal to 300 μ A for installations that require compliance to UL 60601-1 requirements.
- All readings must be less than or equal to 500 μ A for installations that require compliance to EN 60601-1/IEC 60601-1 requirements.

Test completion

1. Disconnect the safety tester from the AC mains voltage outlet.
2. Disconnect all test equipment from the device under test.
3. Disconnect the power cord of the device under test from the safety tester.
4. Confirm that the Checklist is filled in and complete.

Tram-rac 4A Housing Service Kits

The following part lists are given for ordering purposes. These kits are available to aid troubleshooting by swapping a suspect component.

NOTE

When ordering these kits, note that each kit contains only the latest revision of the PCB assemblies. Contact Service—Tech Support to verify if the latest revision is compatible with your system.

PN 2006853-001

This kit can be ordered as an aid to troubleshooting a Tram-rac 4A chassis without a power supply.

Description	Part Number	Qty
Tram-rac 4A Processor Acquisition PCB	2004288-001	1
Tram-rac 4A Interface PCB	800516-001	1

PN 2006854-001

This kit can be ordered as an aid to troubleshooting a Tram-rac 4A chassis with a power supply.

Description	Part Number	Qty
Tram-rac 4A Processor Acquisition PCB	2004288-001	1
Tram-rac 4A Interface PCB	800516-002	1
Tram-rac 4A Power Supply	6123-211	1

PN 2006855-001 (Repair Kit–3-to-2 Board Conversion)

This kit can be ordered to repair an older Tram-rac 4A (with the gold plate below the module slots). Use this kit to repair an older Tram-rac 4A if the 800514 or the 800518 PCBs are damaged. The 2004288 PCB replaces the functions on the two older PCB assemblies. The new light pipe and silver bottom plate allow for the front bezel LED to be visible.

Description	Part Number	Qty
Tram-rac 4A Processor Acquisition PCB	2004288-001	1
Tram-rac 4A Power Light Pipe	2004496-001	1
Tram-rac 4A Bottom Cover	400766-004	1
Grommet, Non-metallic, 3/16 inch ID	2006427-001	1
CD, Service Manual	2002029-025	1