Factors affecting ECG trace quality

Monitor

- CMRR (Common Mode Rejection Ratio) used to separate ECG from other signals
- Filters
- Bandwidth (frequency response)
- Amplifier noise
- Ground loops
- Saturation distortion (e.g. defibrillation recovery)
- Input impedance
- Differential input (required to generate ECG tracing)

Skin

- Impedance
- Diaphoresis
- Dryness
- Oiliness
- EMG, respiration and other biopotentials (physiological electrical signals)
- Skin preparation techniques
- Obesity
- Skin stretch
- Motion artifact

Electrode

- Adhesion
- Conductor
- Gel
- Backing
- Size
- Design
- Motion
- Shelf life
- Application technique
- Electrical/mechanical properties
- Location on the body

Environment

- Electrical field (60 Hz)
- Humidity
- Temperature
- Static electricity
- Magnetic field
- Radiofrequency
- Vicinity of other machines (nebulizers, fans, power cords, etc.)

Cables & lead wires

- Mechanical/electrical properties of materials
- Shielded cable and shielded lead wires
- Open lead wires (avoid loops)
- Triboelectric effect (generated by cable movement)

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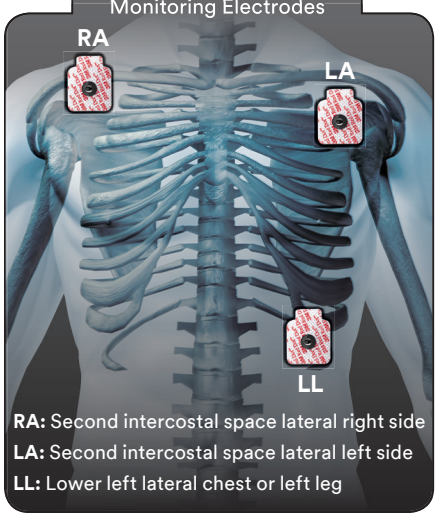
3M | Red Dot™ Electrodes

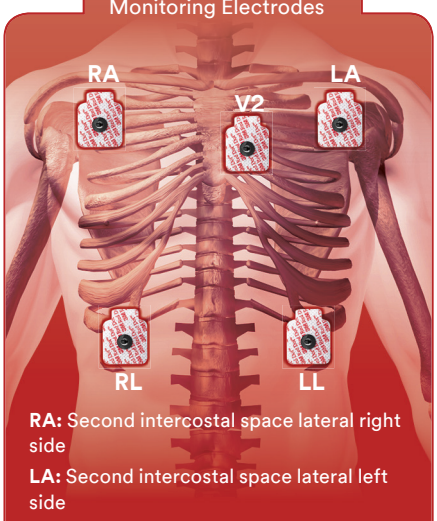
ECG electrode placement

3-Lead Placement
Monitoring Electrodes



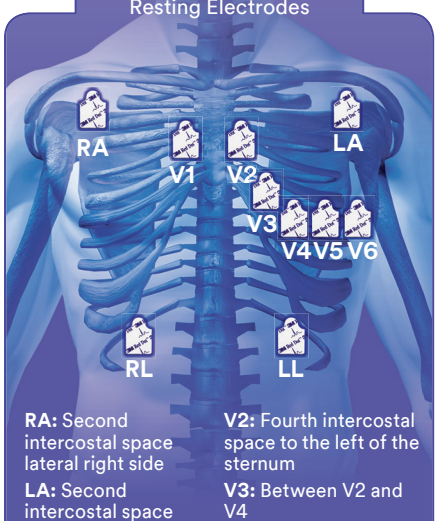
RA: Second intercostal space lateral right side
LA: Second intercostal space lateral left side
LL: Lower left lateral chest or left leg

5-Lead Placement
Monitoring Electrodes



RA: Second intercostal space lateral right side
LA: Second intercostal space lateral left side
LL: Lower left lateral chest or left leg
RL: Lower right lateral chest or right leg
V2: Fourth intercostal space to the left of the sternum

12-Lead Placement
Resting Electrodes



RA: Second intercostal space lateral right side
LA: Second intercostal space lateral left side
LL: Lower left lateral chest or left leg
RL: Lower right lateral chest or right leg
V1: Fourth intercostal space to the right of the sternum
V2: Fourth intercostal space to the left of the sternum
V3: Between V2 and V4
V4: Fifth intercostal space along the mid-clavicular line
V5: Fifth intercostal space between V4 and V6
V6: Fifth intercostal space along the mid-axillary line

Troubleshooting ECG traces

Troubleshoot each artifact in order, starting with ❶

Artifacts	Skin Impedance	Muscle Movement	Electrical Continuity	Electrodes	Cabling	Interference	Equipment
No Base Line			❷ Check all connections/ perform continuity check	❹ Check for dry-out	❸ Check for proper cable		❶ Check lead switch and ECG machine set-up
Base Line Wander	❸ Abrade skin	❶ Stop patient movement	❷ Check ground connections	❹ Use same type of electrode at all sites	❻ Check for proper cable	❺ Check for static build-up	
AC Noise	❸ Abrade skin	❻ May be untreatable involuntary muscle tremor	❶ Check ground connections	❺ Check for dry-out	❼ May need fully shielded cable and lead wires	❷ Keep cable away from AC cord	❹ Turn off fluorescent lights and/or other equipment
Intermittent Signal			❶ Check for loose connections	❷ Check for loose electrode or dry-out	❹ Perform continuity check	❸ Check for static build-up	
Motion Artifact	❷ Abrade skin	❶ Move electrodes off muscle mass	❸ Check for loose connections	❹ Check for loose electrode or dry-out	❼ Perform continuity check	❺ Turn off fluorescent lights and/or other equipment	❻ Check for proper EKG machine set-up
Low Amplitude	❸ Abrade skin		❶ Check all connections	❹ Check for dry-out		❺ Turn off radio, TV and/or other equipment	❷ Check gain settings