QT interval measures the total duration of the depolarization (QRS duration) and repolarization (ST-T) phases of the ventricular action potential. QT interval is measured from the beginning of the QRS to the end of the T-wave. QT interval monitoring can assist in the detection of prolonged QT intervals for adult, pediatric and neonatal patients.

**Indications for QT Interval Monitoring**

Of special concern for QT monitoring is the administration of QT prolonging drugs to patients identified with risk factors for Torsade de Pointes. Females, older patients and patients with bradycardia, impaired left ventricular function (ischemia, left ventricular hypertrophy), hypokalemia and hypomagnesemia are in this increased risk category.

**Limitations for QT Monitoring**

Under the following conditions it may be difficult to achieve reliable QT monitoring and may produce a “Cannot Analyze QT” INOP message.

During QT startup period, this INOP is announced immediately when the QT value is invalid.

1) **T-wave detection limitations**
   - Flat T-wave
   - Atrial Fibrillation or Atrial Flutter
   - Prominent U-waves

In cases where the QT cannot be measured reliably, one should select a single lead with a good T-wave amplitude and no visible fibrillatory or flutter activity, and without a predominant U-wave or P-wave.

2) **QRS Changes**
   - Widened QRS

In this case, if a long QTc is observed you should verify it to ensure that it is not caused by QRS widening.

3) **Rhythm and rate limitations**
   - High heart rate > 150 b/min for adults patients and > 180 b/min for pediatric or neonatal patients.
   - Paced Rhythm
   - Bigeminy Rhythm

In these cases, if rhythm is sustained you may consider turning QT Interval monitoring off.

The CANNOT ANALYZE QT INOP and the ? will be displayed when no QT measurement could be calculated for 10 minutes. Up to this time the previous valid value will be displayed. Additional messages on the cause of the invalid measurements are displayed in the QT View Window. For example:

<table>
<thead>
<tr>
<th>Insufficient Valid Leads</th>
<th>Not enough valid QRS complexes to generate a QT measurement (probably due to artifact - select single-lead)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invalid rhythm for QTc</td>
<td>Not enough valid RR intervals to generate QT-HR, the averaged HR used for QTc calculation (Probably due to paced or ventricular rhythm)</td>
</tr>
</tbody>
</table>

**QTc Formula**

In Unit Settings, the QTc correction formula can be changed to either Bazett or Fredericia. The formula selected is used for QTc measurements calculated by the continuous QT analysis, the 12-lead ECG Analysis QTc and electronic caliper assisted QT/QTc measurements.

**QT Alarms and INOPs**

<table>
<thead>
<tr>
<th>Alarm</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>QTc High</td>
<td>The QTc high limit alarm is generated when the QTc value exceeds the set limit for two consecutive 5-minute values.</td>
</tr>
<tr>
<td>ΔQTc High</td>
<td>The ΔQTc alarm is generated when the difference between the current value and the baseline value exceeds the set limit for two consecutive 5-minute values.</td>
</tr>
<tr>
<td>“Cannot Analyze QT”</td>
<td>The QT algorithm cannot generate a valid QT value for more than 10 minutes, or 1 minute in the Start up phase.</td>
</tr>
</tbody>
</table>
Selecting the QT Leads

For QT Monitoring you can select one of the following three modes:

- **All Leads mode** - All leads available - I, II, III, MCL V and V1-V6. For EASI mode the directly acquired leads - AI, ES, AS.
- **Primary-Lead mode** - Primary arrhythmia lead. If the primary lead is changed, QT measurement will continue with the new primary lead.
- **Single-Lead mode** - Selected from all available leads except the augmented leads. QT monitoring is stopped if the lead becomes unavailable.

To select the mode,

1. Select the QT numeric to enter the **Setup QT Analysis** menu.
2. Select **QT Lead** and select All, Primary Lead or one of the available single leads.

### Using QT View

**To select the QT View,**

1. Select the QT numeric to enter the **Setup QT Analysis** menu.
2. Select the QT View to open the QT View Window.

### QT View popup keys

<table>
<thead>
<tr>
<th>Current</th>
<th>Set Baseline</th>
<th>Print QT</th>
<th>Record QT</th>
<th>Setup QT</th>
</tr>
</thead>
</table>

The current waves are shown in the upper half of the window and the baseline waves in a different color below. The underlined lead labels are the leads used for the QT calculation.

The Q and T points are marked with a vertical line. By selecting one of the lead labels at the top of the window you can highlight the corresponding wave; the other waves are shown in gray.

### Changing the QT View

1. Select **Current View** to see the set of current waves.
2. Select **Baseline View** to see the set of baseline waves.
3. Select **Split View** to return to the combined view with current and baseline waves.

### Setting the QT Baseline

In order to quantify changes in the QTc value, you can set a QTc baseline.

1. Select **QT View**
2. Select **Set Baseline** popup key.

If no baseline has been set for this patient, the first five minute value after the start of monitoring is automatically set as baseline.

If you set a new baseline the previous baseline is discarded. As the ΔQTc alarm is based on the difference between the baseline and the current value, setting an inappropriate new baseline may prevent a ΔQTc alarm from being generated.

Discharging a patient clears the QT baseline.

### Printing or Recording The QT Waves

- Select **Print QT**.

QT printouts can be to a local or central printer.

- Select **Record QT**.

QT recordings can be to a local recorder only.

### Changing the Alarm Limits

Set the high alarm limits based on your assessment of the patient’s clinical condition, unit protocols, physician orders or medication specified limits.

**To select alarm limits,**

1. Select the Setup QT popup key or any QT numeric displayed.
2. Select **QTc High Limit**.
3. Select the appropriate setting.
4. Select **ΔQTc High Limit**.
5. Select the appropriate setting.

### Normal Values for Adults

Men: QTc <450 milliseconds.

Women: QTc <460 milliseconds.