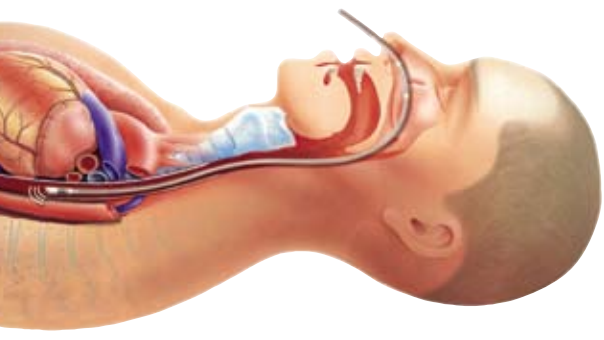
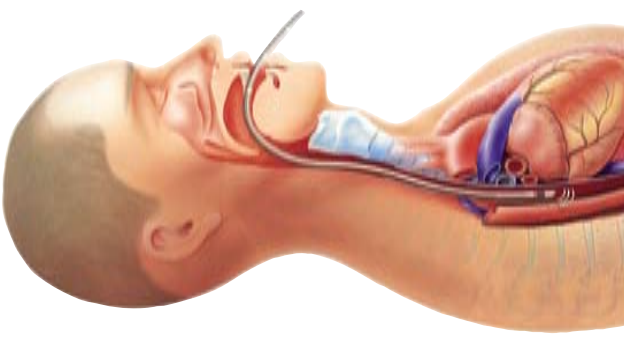
Getting Started

1. Switch power on (rear of CardioQ).
2. Connect probe to Patient Interface Cable (PIC).
3. Use large control knob to dial in patient age. Press to enter. Repeat process for weight and height.
4. Refer to operating handbook if patient data is outside of nomogram limits. Check and press **Accept Data**.
5. Apply water-based lubricant liberally to probe tip and lower part of probe and insert into oesophagus.
6. For oral placement advance probe until incisors are at the second depth marker. When using nasal placement advance probe gently until nasal septum is at the third depth marker (nearest connector).

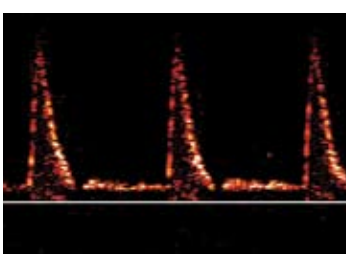
Never use excessive force to insert the probe as this may harm the patient.



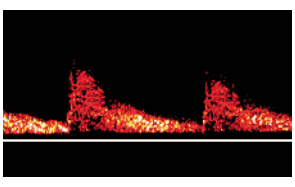


Locating the Descending Aortic Waveform

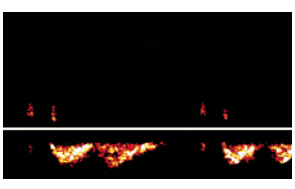
7. When locating the CardioQ signal adjust the volume knob as required.
8. Adjust probe depth to locate the descending aortic signal and then rotate to optimise the signal.



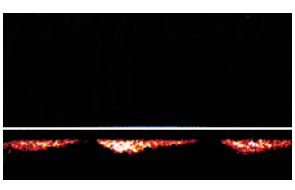
Descending Aorta
Correct placement.



Coeliac Axis
Probe too low.

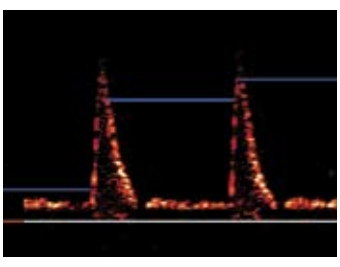


Intracardiac
Rotate probe. Adjust depth as necessary.



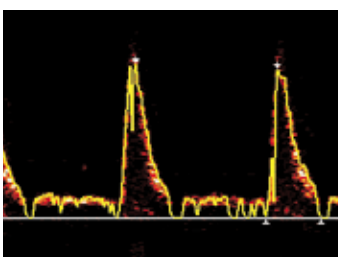
Azygos Vein
Correct depth or slightly low. Rotate and/or withdraw probe slightly.

Optimise the Waveform



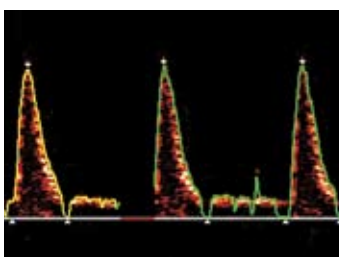
9. Press **Show PVD**.

Adjust the probe to find the highest blue line (peak) and the sharpest audible pitch to obtain the best signal quality.



10. Activate **Auto Gain**.

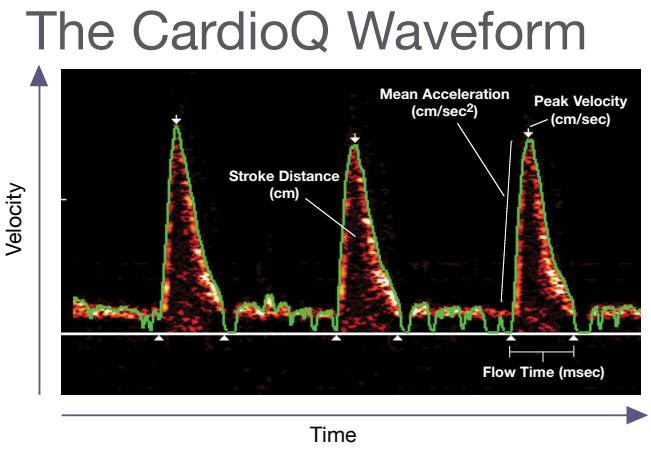
Yellow line confirms auto gain activation.



11. Monitoring begins.

Green line and white arrows confirm start of monitoring.

The CardioQ Waveform



The **green line,** indicates the velocity/time envelope which the monitor uses to make calculations. The **white arrows** indicate time and velocity values used for CardioQ calculations.

The Stroke Distance (SD) is the area under the waveform and is the basic measured parameter upon which calculations of Stroke Volume (SV) and all other Cardiac Output (CO) and indexed measurements are made. Stroke Volume is the parameter of choice for fluid management protocols, however changes in Stroke Distance (SD) or Stroke Volume Index (SVI) can also be utilised.

The waveform base, (flow time) depends on heart rate, left ventricular filling and afterload. The flow time corrected to a heart rate of 60bpm (FTc) is inversely correlated with the systemic vascular resistance (SVR).

FTc is often used as an indicator of hypovolaemia and fluid responsiveness, however during anaesthesia the vasodilatory effects of anaesthetic agents should be considered. Under anaesthesia or other vasodilators there may be a decrease in left ventricular afterload such that the baseline FTc may be elevated above the normal range (330 to 360 ms). A longer FTc may also be seen in conditions associated with a low SVR e.g. sepsis and pregnancy.

If FTc does not increase after an appropriate fluid challenge, other causes of vasoconstriction, (e.g. excess vasopressors, cold temperature, or obstructed circulation such as pulmonary embolus) should be considered.

Haemodynamic Parameters*

SV ◆	Stroke Volume	Blood volume ejected during each systolic phase (ml).
SD ◆	Stroke Distance	Distance a column of blood moves through the descending thoracic aorta during each systolic phase (cm).
SVI ◆	Stroke Volume Index	Stroke Volume normalised for body surface area (l/min/m^2).
FTc	Flow Time Corrected	Systolic flow time corrected for heart rate (ms).
PV	Peak Velocity	Peak velocity of blood flow in systolic phase (cm/s).
CO	Cardiac Output	Litres of blood pumped per minute (l/min).
CI	Cardiac Index	Cardiac output normalised for body surface area (l/min/m^2).
MD	Minute Distance	Distance a column of blood moves through the descending thoracic aorta per minute (cm); MD = SD x HR; linear cardiac output.
HR	Heart Rate	Beats per minute (bpm).
MA	Mean Acceleration	Average acceleration of blood from start of systole to detected peak velocity (cm/s^2).
SVR	Systemic Vascular Resistance	The resistance that the left heart pumps against; measure of left ventricular afterload; note: external blood pressure data required to calculate SVR (dyn.s/cm^5).
SVRI	Systemic Vascular Resistance Index	Systemic vascular resistance normalised for body surface area (dyn.s/cm^5/m^2).

◆ Fluid management algorithm protocol parameters ◆ Alternative fluid management algorithm protocol parameters

* Refer to the operating handbook for additional haemodynamic parameters provided by the CardioQ.

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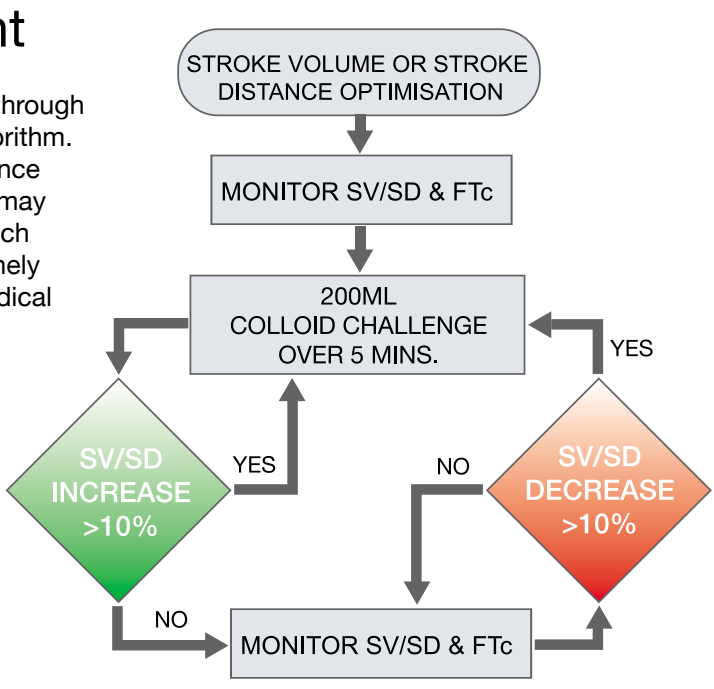
Surgical Application - Interpreting results

Fluid Management

Typically, optimisation is achieved through the use of a fluid management algorithm. Stroke Volume (SV) or Stroke Distance (SD) responses to fluid challenges may help guide further interventions. Such algorithms have been utilised routinely in outcome studies with Deltex Medical Oesophageal Doppler Monitors.



Interpreting Results - **Fluid Management**

Typical Parameter Values*

*These values should not be confused with a physiological target.

Flow Time Corrected (FTc)

330 - 360 milliseconds

Note – Under anaesthesia FTc can be elevated due to vasoactive effects of anaesthetic agents (see Interpreting Results - CardioQ Waveform).

1 Singer, M. Oesophageal Doppler monitoring of aortic blood flow: beat by beat cardiac output monitoring. **International Anesthesiology Clinics**; 1993; Vol. 31, No 3: 99 - 125.

2 Gardin, JM, Davidson, DM, Rohan, MK, et al. Relationship between age, body size, gender and blood pressure and Doppler flow measurements in the aorta and pulmonary artery. **Am Heart J**; 1987; 113: 101-109.

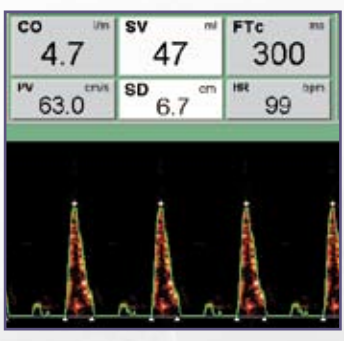
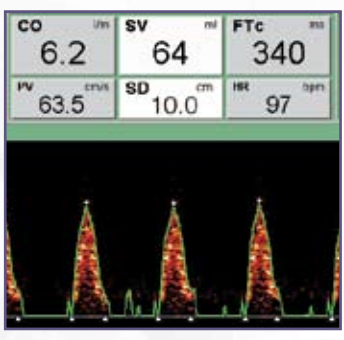
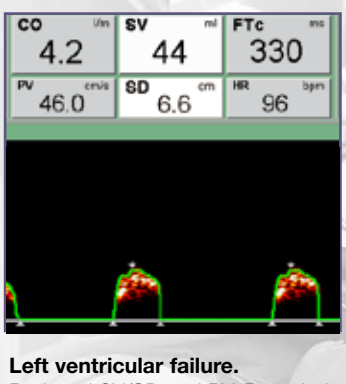
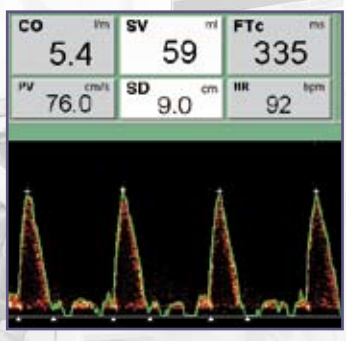
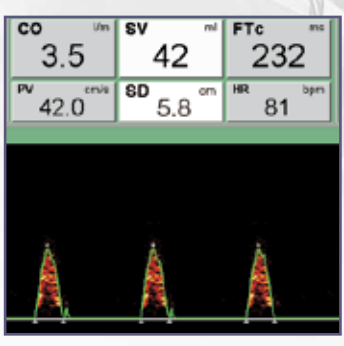
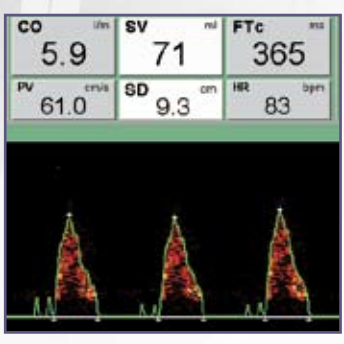
Peak Velocity (PV)[1,2]

20 years	**90 - 120 cm/s**
30 years	85 - 115 cm/s
40 years	80 - 110 cm/s
50 years	**70 -100 cm/s**
60 years	60 - 90 cm/s
70 years	50 - 80 cm/s
80 years	40 - 70 cm/s
90 years	30 - 60 cm/s

Extrapolated values are in plain text.

Interpreting Results - **Typical Parameter Values**

Intervention

Base Line		Favourable Response
	**FLUID**	
Possible hypovolaemia. Reduced SV/SD, decreased FTc.		**Positive fluid response.** SV/SD increases by more than 10%.
	**INOTROPE**	
Left ventricular failure. Reduced SV/SD and PV. Rounded waveform apex.		**After inotrope.** Increased SV/SD and PV.
	**VASODILATE**	
Probable high SVR/afterload. Reduced SV/SD, PV and FTc.		**Reduced SVR/afterload.** Increased SV/SD, PV and FTc.

Interpreting Results - **Intervention**

Additional Features

- **Number of Cycles per Calculation**
  To change cycle setting: While in the Run Mode, press **Setup**, then press **Cycles**. Rotate the large control knob to make cycle selection, and press the control knob to finish. Press again to return to Run Mode. Increasing cycle setting may aid parameter averaging on patients with an irregular rhythm or a respiratory swing, while decreasing cycle setting may be useful for monitoring during diathermy.

- **Storing a Waveform/Snap Function**
  While in a Run screen, press **Freeze**. Rotate the large control knob to place the desired section under the red snap window bar. Press **Take Snap**. The snap is then displayed in the split screen. Record and view up to five recorded waveform images.

- **Setting the Signal Filter**
  Begin probe focusing and monitoring with the filter off. To help reduce artefacts and/or signal interference, initiate filter use by displaying Probe Focus screen. Press **Filter** to turn the filter on. Press again to turn the filter off.

⚠ Refer to the CardioQ operating handbook for additional information.

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Interpreting Results - **Additional Features**

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Surgical Application - Getting Started