

## Quantum Perfusion Systems



# Quantum Perfusion Systems

Spectrum Medical proudly presents a modular range of Quantum Perfusion Modules and Patient Safety Systems in combination with flexible space frame solutions for all ECLs procedures used in Cardiopulmonary Bypass.

- The robust and compact Stainless Steel Space Frame construction improves usability by significantly reducing both footprint and weight. The independent placement of system modules allows fine-tuning of overall ergonomics, which leads to improved patient focus and safety.
- The compact modular design and customization opportunities offer an unprecedented degree of flexibility in the optimization of perfusion circuits focused on lowering hemodilution for improved patient outcomes.
- Integrated into the Stainless Steel Space Frame is the Quantum Power Management Module which contains a four-hour battery pack and can integrate up to thirteen Quantum modules to support changing clinical practice.
- This system can also drive two centrifugal pumps with no change in overall footprint. The Quantum Perfusion System can be upgraded at any time, with the addition of an external drive motor, to support the integration of centrifugal pumps into your clinical practice.
- All power management cabling is contained within the stainless steel frame to improve both ergonomics and system durability.



The New York HLM Frame

# Quantum Workstation

## The 15" Quantum Workstation

The 15" Quantum Workstation is the gateway into the management of the World's most advanced Perfusion Management System.

Integrated software applications (Apps) supported by a unique range of advanced Quantum System Modules extend both perfusion management and perfusion functionality well beyond today's conventional technologies.

With a commitment to both patient and physician safety, the Quantum Workstation with its high resolution 15" LCD screen has been designed to allow the centralization of critical patient data and perfusion management functions into a single user interface.

The Quantum software system is totally configurable to the needs of individual customers. Apps can be selected from the Quantum App Store and integrated into the practice work flow to provide the following functionalities:

- Blood Flow Management, the Delivery of Cardioplegia and Patient Weaning
- Patient Ventilation, Gas Blending and Vacuum Management
- Vitals Management and Diagnostic Alarm Settings
- Quantum EMR and Quantum System Settings



15" Quantum Workstation with optional Pump Control Module

# Quantum Ventilation System

Finally, a fully integrated “single solution” Ventilator technology designed to provide the safe delivery of patient ventilation and the management of vacuum during Cardiopulmonary Bypass.



## Quantum Ventilation System

The second-generation Quantum Ventilation System is a world first solution designed to manage extracorporeal patient ventilation, including the blending of gases, the management of vacuum, integrated patient safety systems, perfusion diagnostics and delivered anaesthesia gas concentration and a calculated MAC value.

The ultra-compact Quantum Ventilation System employs the very latest gas blending technologies to provide the user with an Atmospheric or Hypobaric patient ventilation capability.

In Atmospheric mode the Quantum Ventilation System delivers precision regulated  $\text{FiO}_2$ ,  $\text{CO}_2$  with a sweep flow range from 0.025 to 10 L/m when flowing a single gas e.g.  $\text{O}_2$  and up to a maximum flow rate of 20 L/m when modulating the delivery of two gases. e.g. 60%  $\text{FiO}_2$ .

In Hypobaric mode the Quantum Ventilation System regulates the delivery of two channels of  $\text{O}_2$  to Spectrum Medical's new Ventilator technology with a sweep flow range of 0.025 to 10L/m per channel.

To ensure system performance and safety the ventilation system has a fully integrated secondary monitoring system that continuously compares actual measured values with user defined set-points and activates an alarm when the discrepancy between the two systems is greater than 10%.

In 'Patient Ventilation Mode' the Quantum Ventilation System, combined with its patented  $\text{PaO}_2$  and  $\text{PaCO}_2$  measurement technologies, provides

a decision support capability and an auto regulation function for the modulation of gas flows and gas concentrations when setting  $\text{PaO}_2$  and  $\text{PaCO}_2$  target values. The Quantum Ventilation System provides precision modulation and monitoring of W.A.G and V.A.V.D.

To further improve patient safety the Quantum Ventilation System provides real-time monitoring of the following gas-ventilation parameters:

- Incoming Supply Pressures of Air,  $\text{O}_2$ ,  $\text{CO}_2$ , & Vacuum Channels
- $\text{O}_2$  and  $\text{CO}_2$  Gas Concentrations & Pressures to the Oxygenator
- Overall Gas Flow to the oxygenator (SWEEP)
- $\text{CO}_2$  concentrations measured from the W.A.G. line

Integrated within the Quantum Ventilation System is Spectrum Medical's full range of Non-Invasive Diagnostic and Calculated Physiologic Measurements. To further improve usability the system includes the measurement of Flow (including bubble detection), Pressure, Temperature and Reservoir Level Management.

The second-generation Ventilation System has been further modified to allow the hospital to connect to two independent vacuum sources for both WAG and VAVD. Furthermore, and to reduce routine servicing requirements, the System now includes a new “long-life”  $\text{O}_2$  measuring technology.

# Principles of Quantum Directed Perfusion (QDP)

Quantum Directed Perfusion (QDP) provides the next generation capabilities beyond basic Goal Directed Perfusion (GDP) techniques and the simplistic approach of measuring  $DO_2$ .

This multifaceted approach to QDP provides the clinical team with the methodologies to improve the quality of bypass management that can lead to the reduction of AKI, and the higher costs associated with extended I.C.U. Time. <sup>1,2,3,4</sup>

## Real-Time Diagnostics:

The starting point for QDP is the use of Spectrum Medical's non-invasive diagnostic technology for the measurement of Oxygen Delivery ( $DO_2$ ), Oxygen Consumption ( $VO_2$ ),  $CO_2$  Production ( $VCO_2$ ), and multiple other calculations and indices. The monitoring of real-time total Oxygen Deficit is a completely new and critically important concept to the world of Perfusion. The Quantum technology displays the real-time reporting of total time and percentage of case time when actual  $DO_2$  is below target  $DO_2$ .



## Visualising Real-Time Information:

Spectrum Medical's Critical Care Scoring technology supports a proactive clinical risk assessment using recognized AKI markers such as age, gender, Pre-op Hct /Hb, EF, DM, and existing renal issues, and the subsequent deployment of an individual patient care strategy. Using Quantum Informatics and its LIVE VUE technology patient care is improved with the seamless integration of "multiple information feeds" into a real-time display system.



## Oxygen Deficit:

It is accepted that the potential of AKI is significantly increased with large  $DO_2$  deficits.<sup>4</sup> Calculating the Oxygen Deficit and then equating it to actual patient outcomes is a relatively straight forward process when using Spectrum Medical's Quantum Informatics technology.

The Quantum Directed Perfusion calculation of Oxygen Deficit is expressed as total "Area Under the Curve", and is a product of the accumulation of an actual deficit value (target  $DO_2$  minus actual  $DO_2$ ) multiplied by a unit of time.



## Metabolic Compensation:

To further increase the precision of patient  $DO_2$  requirements Spectrum Medical includes the capability to apply a percentage reduction per degree C to reflect decreasing metabolic activity as patients are cooled during Cardiac Bypass Surgery. The reduction per degree C is fully programmable and dependent on hospital based protocols. For example, if a  $DO_2$  of 270mL/kg/m<sup>2</sup> at 37°C is the standard target and hospital protocols indicate a 7% / degree C as the change in Oxygen demand, the target  $DO_2$  would be 251mL/kg/m<sup>2</sup> when the patient is at 36° C.

### References

1. Alshaiikh, et al. Financial Impact of Acute Kidney Injury After Cardiac Operations in the United States. *Ann Thoracic Surg.* 2018 Feb;105(2):469-475.
2. de Somer, et al.  $O_2$  Delivery and  $CO_2$  Production During Cardiopulmonary Bypass as Determinants of Acute Kidney Injury: Time for a Goal-Directed Perfusion Management? *Critical Care* 2011; 15:R192.

### References

3. Dasta JF, Kane-Gill SL, Durtschi AJ, et al. Costs and Outcomes of Acute Kidney Injury (AKI) Following Cardiac Surgery. *Nephrol Dial Transplant.* 2008;23:1970-1974.
4. Ranucci M, Romitti F, Isgro G, et al. Oxygen Delivery During Cardiopulmonary Bypass and Acute Renal Failure After Coronary Operations. *Ann Thorac Surg.* 2005;80:2213-20.

## Perfusion Roller Pump

A Quantum leap in patient safety and perfusion systems' functionality.



The compact range of Quantum direct drive peristaltic roller pumps are provided with 4", 6" and 8" raceway diameters which maximizes both flexibility and compactness when optimizing HLM design. In particular, the introduction of the mid-range 6" option eliminates the current compromise that compels users to use 8" pumps in medium flow applications.

The Quantum Universal Clamping System supports the mounting of pumps into multiple locations and pump change times of less than 60 seconds. Importantly, Quantum's pump detection software eliminates user intervention when adding or exchanging pumps.

Smart LEDs enable visual identification of pump function and color coordination with both the Quantum Workstation and the Quantum Pump Control Module. Spectrum Medical's universal tube clamping system is designed to eliminate the frustration of using current tube clamping solutions and colour coded plastic inserts. A single 'bobbin' solution allows for the clamping of all tubing diameters associated within the selected size of race-way.

## Intelligent Tube Occlusion



The Quantum Smart Occluder is a revolutionary new approach to the management of perfusion-tube occlusion during bypass surgery. The Quantum Smart Occluder replaces the guesswork associated with conventional technologies with precise user inputs for the setting of flow—a critical requirement during certain phases of care.

The introduction of closed loop flow control ensures flow control within +/- 2% of the requested set point. System wide communication allows the user to combine the Smart Occluder with other Quantum Modules to deliver levels of functionality new to the

world of Perfusion, such as automated initiation and weaning.

Continuing the Quantum philosophy of seeking to improve system ergonomics, wherever possible, the Smart Occluder module includes two channels of flow measurement and bubble detection, two channels of pressure measurement and a two channel reservoir level detection system.

An interlocking lid, Color-coded LEDs and a mechanical override system maximizes system safety.

# Quantum Diagnostic System

# I.T. Solutions for Perfusion, ECMO and the I.C.U.

Proven non-invasive measurement technologies provide flexible cost-effective management of Cardiopulmonary Bypass.



## Quantum Diagnostic System

The 'entry level' Quantum Diagnostics sensor-module is designed to provide the complete range of perfusion circuit parameters required for the safe management of extracorporeal circulation. The sensor module includes three measurement channels of pressure and flow (including emboli & bubble detection), two temperature channels and a reservoir level detection system.

The Quantum Diagnostics module integrates the entry level sensor module capabilities with

Spectrum Medical's proven System M non-invasive Diagnostic technology as well as its complete range of Calculated Physiologic indices. New to Spectrum Medical is the capability for a single configuration to measure with high accuracy a gas flow range from 0.025 to 10.00 L/m.

Offering complete flexibility, the Quantum Diagnostics module can be connected directly to the Quantum Workstation and to multiple locations on the Quantum Pump Console.



## Quantum Informatics, I.T. Solutions for Perfusion, ECMO and the I.C.U.

Quantum Informatics is a revolutionary new methodology for the provision of specialized health informatics solutions for the critical care space including the I.C.U. and the O.R. The real-time integration of physiologic data facilitates the real-time implementation of Best Practice and Evidence Based Protocols that can support the identification of adverse events before they become adverse outcomes. Quantum Informatics is highly configurable and can easily integrate within existing Hospital Information Systems, clinical workflows and diverse care locations. The overall system consists of the following three modules:

**VIPER EMR** - VIPER EMR is the clinical interfacing software that uses an App based architecture for easy integration into the individual workflow needs of a hospital. VIPER EMR can run on either the 12" or 15" Quantum Workstation or a Quantum Tablet.

**VISION** - Spectrum Medical's VISION server application provides system-wide maintenance of software, system-wide communication, the creation and transfer of patient records (end of case and real-time) and bi-directional HL7 communication to the



H.I.S. using a Mirth Interface Engine. VISION's SQL database is used for the storage of critical patient information and is supported by a comprehensive analytics package to support improved quality outcomes.

**LIVE VUE** - LIVE VUE is Spectrum Medical's web-based near real-time remote monitoring solution. Highly configurable graphical presentation systems and integrated best practice alert systems provide clinicians with instant access to live patient data from a variety of care locations to enhance patient safety and rapid decision support.

# Total Customer Support

With an absolute dedication to customer support and a total solutions approach to a long-term partnership Spectrum Medical is proud to present Sentinel Total Care.

## Sentinel Total Care:

**Extended Warranty:** Full warranty on your Quantum Perfusion System including Associated Accessories (sensors, cable assemblies) for its 10-year life at no cost to the customer. Quantum products beyond economic repair will be replaced with latest 'new build' technologies.

**Annual Servicing:** Includes all required servicing visits performed by dedicated Spectrum Medical's service personnel and the cost of all servicing items.

**Accidental Damage:** Accidental damage including accessories (sensor, cable assemblies) for the 10-year life of your Quantum Product at no cost to the customer. (Available with Vigilance in US Markets).

**Quantum eLearning:** Includes access to Spectrum Medical web-based electronic Learning Management System (or LMS) to streamline product training and to complement your current training practice and recertification.

**Remote On-Line Support:** Integrated within the VISION Server System and with VPN access, the Sentinel maintenance application provides a capability to support the remote monitoring and fault diagnosis of all Quantum systems network connected to the local VISION server.

**Emergency Loan Equipment** For all products that cannot be repaired within 24 hours of being returned to Spectrum Medical Service Center.

**Software Updates:** During the service visit Quantum Software will be maintained to latest standards, including changes to user functionality, updates to enhance maintainability, reliability and protocol changes to 3<sup>rd</sup> party device driver software at no cost to the customer. Software deployment is subject to prior customer approval and training via webinar or in-house at Spectrum Medical is included free of charge.

**Comprehensive 24/7 Support:** Spectrum Medical's innovative 24-hour live messaging support platform enables users to have immediate access to an extensive knowledge-based product library, frequently asked questions and troubleshooting tips. Additionally the 24-hour support platform supports immediate communication with Spectrum Medical's global support team which comprise, service technicians, clinical consultants and system application experts via a dedicated phone number, email address or Spectrum Medical 24-hour live messaging service.



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