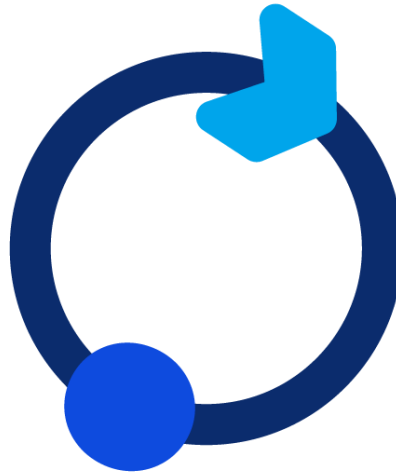




UHPC Hardware Manual

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UHPC System Introduction

Avrion's Ultra High Precision Coulometry (UHPC) battery testing systems offer industry leading accuracy and precision for battery test electronics.

Each testing channel can operate in constant current or constant voltage charge or discharge mode across the full 0–5V load window.

Systems typically come with integrated Thermal Chambers to ensure the temperature stability of the cell. In UHPC experiments, this is critical for minimizing noise and ensuring consistency in data collected. Each channel has integrated local and remote (i.e., cell-level) temperature sensing to monitor room and cell temperature.

When used under appropriate environmental conditions and with quality cells, each channel can measure Coulombic Efficiency to better than 20 ppm precision and better than 50 ppm accuracy.

The Avrion software suite allows users to build and run test protocols with live monitoring of each channel. Output data is stored as text and can be examined using the powerful UHPC plotting software provided or exported in various formats for data analysis and understanding of cell performance.

Read and understand all Safety Precautions prior to first use. The system supplied is designed to be used for testing of electrochemical cells within the known limits between 0-5 Volts in different operation modes (constant current charge/discharge, constant voltage charge/discharge or open circuit storage). This includes, but is not limited to, such devices as rechargeable batteries (Lithium-ion or other) and supercapacitors.

1. System Modules

1.1 Control Module (EMB-HXX-99-56)

The Control Module houses the communication board for connections between control software running on a lab PC, and up to 8 UHPC Channel Modules.



Figure 1: Front and rear panels of Control Module

Note that the USB-B port and the Serial interface are used only by Avrion for setup and debugging and are not intended to be connected to by users. The serial number of the Control module can be found on the rear of the unit near the C14 power socket.



The USB-B port and the Serial interface are used only by Avrion for setup and debug and are not intended to be connected to by users

The connections on the rear of the Control module are highlighted in Figure 2, below.

PC Communications. Use a standard straight-through Cat6 shielded Ethernet cable to connect the Control Module's "Computer" port to the Ethernet connection of your lab PC.

Channel Module Communications Use a standard straight-through Cat6 shielded cable to connect to each Channel Module. A Channel Module connected to Port 1 will appear on the PC's UHPC-Control software as Channels 1-8 (or Channels 1-4 in the case of a 20A Channel Module), and so on.



The Control Module ports will function **only** with standard, straight-through Ethernet cables. Crossover style cables, which are less common, will not work

AC Power. The Control Module accepts 90 – 240VAC power (50/60Hz, 12VA) via a C14 socket. Each module ensures that the switch or breaker is in the OFF position. Use the Avrion -supplied C13/C14 cable to connect the module to AC power.

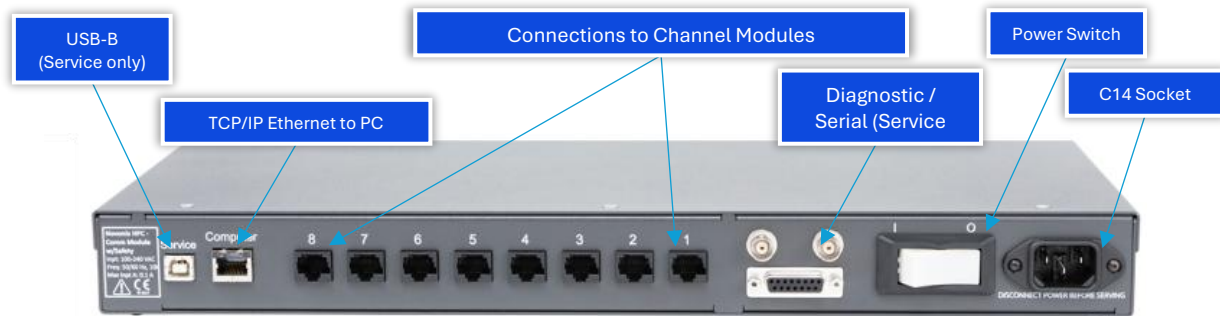


Figure 2: Control module rear panel connection scheme

To power on the Control module for the first time, verify that the switch is OFF.

Connect the provided power cable to your UPS and the C14 socket on the rear of the Control module. Turn the switch ON.

Once powered, the RESET switch on the front panel illuminates. The RESET functions to reboot the module. Use this if there is a loss of communication or during troubleshooting.



Do not reset the Control Module while tests are running on any channels! Always stop any running tests via the software before performing a reset of the Control Module



Control Modules use a single breaker switch, but some legacy units may use a 6.3A Time Delay fuse. See Appendix B: for more information.

Communication between the software and all channels will need to be re-established after performing a reset or otherwise cycling power to the unit. The Control Module can take up to 30s to initialize. Please wait this time before starting Channel Modules and/or starting the control software.

1.2 Power Module (PMA-XXX-99-56)

The UHPC Power Module (PMA-XXX-99-56) is the DC power supply to all Avrion 10A or 20A Channel Modules. 2A Channel Modules do not require a Power Module.

A single Power Module can provide power to any of a single 10A Channel Module, a single 20A



Channel Module, two 20A Channel Modules, two 10A Channel Modules OR a 10A and 20A Module combination.

Figure 3: Power Module, front

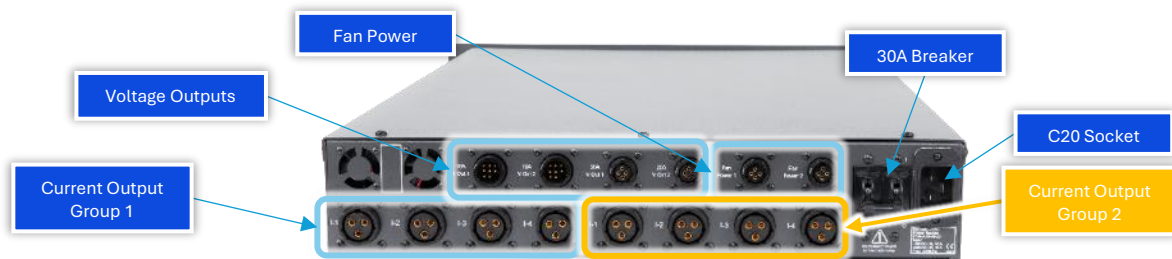


Figure 4: Power Module, rear

AC Input

The Power Module accepts 120 – 240 VAC input (50/60Hz, 3000VA Max). All AC power is delivered via a C20 socket, and all cables are supplied by Avrion. The power input socket is protected by a 30A breaker.



Use only the correctly rated, Avrion -supplied cable to connect the Power Module to mains power. Reset the breaker by flipping the switch if tripped. Do not power on until all DC Outputs are connected.

DC Output

All DC output is located on the rear of the Power Module.

Connect current outputs. Use Group 1 I-1 to I-4 to connect the corresponding connectors on your first 10A or 20A module (Figure 6, above). Only use Group 2 if connecting a second module.

Connected Channel Modules do not have to be identical, i.e. if a 10A Channel Module is connected to Group 1, a 20A may be subsequently connected to Group 2.



If connecting a single module, use **only** the Group 1 I-1 – I-4 current outputs. Mixing current output groups can cause serious damage.

Connect voltage outputs. Only one voltage output is required per Channel Module. Use the appropriately labelled output for your Channel Module.

Connect fan power. Only one fan power connection is required per Channel Module.



Connect all I/O **before** powering on the power module.

1.3 Channel Modules (CMA-XXX-99-56)

2A Channel Module (CMA-HDX-99-56)

The 2A Channel Module provides 8 numbered channels, each with a maximum current of 2A and 5 ranges for measurement: 2A, 200mA, 20mA, 2mA and 200μA.

Based on the current requested by the control software, the 2A Channel Module selects the best range available automatically.



Figure 5: 2A Channel Module, front (left) and rear (right)

The front panel is equipped with an LED indicator and a 9-pin output connector (front panel) for each channel, as well as a RESET switch. The serial number of the Channel Module is located on the rear of the unit near the power entry.

The rear panel houses a C14 socket for AC power supply, a power switch and an RJ45 comms connection that accepts a standard, straight through Cat6 shielded Ethernet cable.

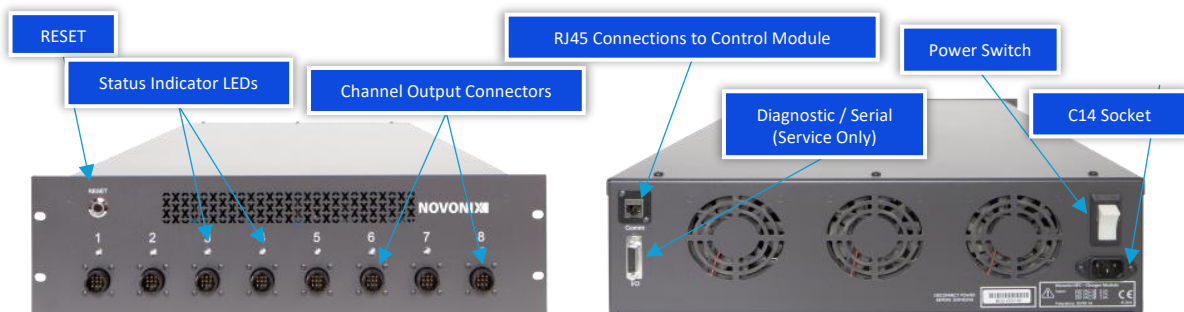


Figure 6: 2A Channel Module front and rear panel I/O scheme

Channel Module Communications Use a standard, straight through **Cat6 shielded** Ethernet cable to connect to a Control Module. Ensure the Channel Module is connected to its Control Module before powering on. A Channel Module connected to Port 1 of a Control Module will appear on the PC's UHPC-Control software as Channels 1-8, Port 2 as 9-16 etc.

AC Power The 2A Channel Module accepts 100 – 230VAC power (50/60Hz, 320VA) via a C14 socket.



2A Channel Modules use a 15A breaker switch, but some legacy units may use a 6.3A Time Delay fuse.

To power on the Channel Module for the first time, verify that the switch is OFF. Connect the green Avrion Communication cable from the Channel Module to a spare port on a Control Module.

Connect the provided power cable to your UPS and the C14 socket on the rear panel of the Channel Module. Turn the switch ON.

Once powered, the RESET switch on the front panel illuminates. The RESET functions to reboot the module. Use this if there is a loss of communication or during troubleshooting.



Do not reset a Channel Module while tests are running on any channels! Always stop any running tests via the software before performing a reset of a Channel Module

Note that the Status Indicator LEDs for each channel will not illuminate until communication is established with the Control Module and the software. The LED code reference is as follows:

Colour	Status
Red	Charging Step (normal operation)
Green	Discharging Step (normal operation)
Yellow	Paused/Suspended Step (normal operation) OR Error, abnormal operation – check log

Each channel on the 2A charger module has the capabilities described in its specification sheet, with current/voltage source across the 0–5V operating window, voltage sense, local (electronics) RTD temperature sensing and RTD temperature sensing from the remote RTD included on Avrion - built cell holders (See 2.2 Cell Holders)

10A Channel Module (CMA-HEX-99-56)

The 10A Channel Module provides 8 independent channels, each with a maximum current of 10A and 6 ranges for measurement: 10A, 1A, 100mA, 10mA, 1mA and 100µA.

Based on the current requested by the control software, the 10A Channel Module selects the best range available automatically.



Figure 7: 10A Channel Module front (left) and rear (right)

The front panel is equipped with an LED indicator and a 9-pin output connector for each channel, as well as a RESET switch. The serial number is located on the rear of the unit.

The rear panel houses a 4 DC Current inputs, a DC Voltage input and a Fan Power input. Each of these inputs is provided by a corresponding output on the Power Module (required). An RJ45 comms connection for standard, straight-through Ethernet cables are located in the left corner of the panel.



This module does not connect to AC power! It accepts **DC Power** from a Avrion Power Module across 6 cables (4 current, 1 voltage, 1 fan power).



Figure 8: 10A Channel Module front and rear panel I/O scheme

Channel Module Communications Use a standard, straight through Ethernet cable to connect to a Control Module. Ensure the Channel Module is connected to its Control Module before powering on. A Channel Module connected to Port 1 of a Control Module will appear on the PC's UHPC-Control software as Channels 1-4, Port 2 as 9-12 etc.

DC Power As noted above, this device accepts DC power supplied by the Power Module (required). Ensure that the communications cable is connected and that the Power Module is OFF prior to connecting cables.

Connect Current Inputs. See 1.2 Power Module in this manual. If this is the first module connected to the Power Module, use Group 1 I-1 to I-4 outputs to connect the corresponding DC Current In connectors on the 20A module. Only use Group 2 if you are connecting your second Channel Module. Connect all four I-1 to I-4 inputs.

Connect Voltage Inputs. Only one input is required per Channel Module. Connect a voltage cable from a 20A output on the Power Module.

Connect Fan Power. Only one fan power connection is required per Channel Module. Connect a fan power cable from a Fan Power output on the Power Module.

Power on your Power Module to begin delivering power to the 10A Channel Module



Only power on the Power Module *after* all current, voltage and fan power connections have been made on both. Verify the Ethernet comms cable is connected before powering on.

Once powered, the RESET switch on the front panel illuminates. The RESET functions to reboot the module. Use this if there is a loss of communication or during troubleshooting.



Do not reset the Channel Module while tests are running on any channels! Always stop any running tests via the software before performing a reset of a Channel Module

Note that the Status Indicator LEDs for each channel will not illuminate until communication is established with the Control Module and the software. The LED code reference is as follows:

Colour	Status
Red	Charging Step (normal operation)
Green	Discharging Step (normal operation)
Yellow	Paused/Suspended Step (normal operation) OR Error, abnormal operation – check log

Each channel on the 10A Channel Module has the capabilities described in its specification sheet, with current/voltage source across the 0–5V operating window, voltage sense, local (electronics) RTD temperature sensing and RTD temperature sensing from an external RTD attached to a cell holder (See 2.2 Cell Holders).

20A Channel Module (CMA-HFX-99-56)

The 20A Channel Module provides 4 numbered channels, each with a maximum current of 20A and 2 ranges for measurement: 20A and 2A.

Based on the current requested by the control software, the 20A Channel Module selects the best range available automatically.



Figure 9: 20A Channel Module front (left) and rear (right)

The front panel is equipped with an LED indicator and a 10-pin output connector for each channel, as well as a RESET switch. The serial number is located on the rear of the unit.

The rear panel houses a 4 DC Current inputs, a DC Voltage input and a Fan Power input. Each of these inputs is provided by a corresponding output on the Power Module (required). An RJ45 comms connection for a custom green Avrion communications cable is in the center of the panel.



This module does not connect to AC power! It accepts **DC Power** from a Avrion Power Module across 6 cables (4 current, 1 voltage, 1 fan power).

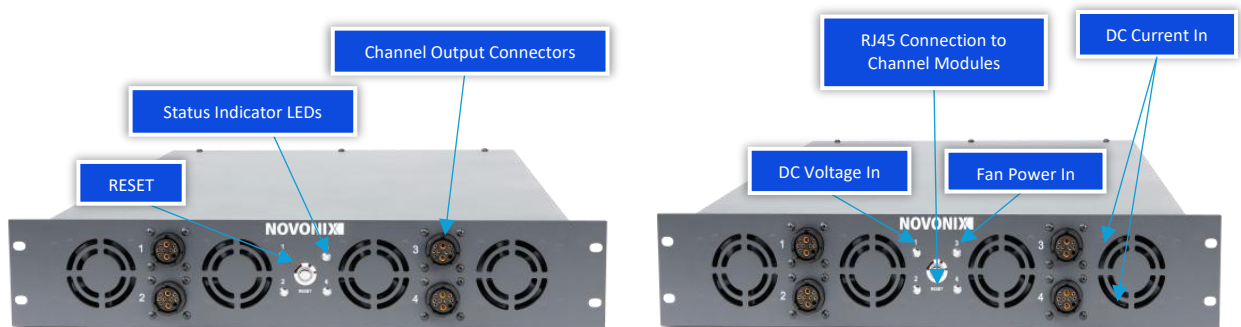


Figure 10: 20A Channel Module front and rear panel I/O scheme

Channel Module Communications Use a standard, straight through Ethernet cable to connect to a Control Module. Ensure the Channel Module is connected to its Control Module before powering on. A Channel Module connected to Port 1 of a Control Module will appear on the PC's UHPC-Control software as Channels 1-4, Port 2 as 9-12 etc.

DC Power As noted above, this device accepts DC power supplied by the Power Module (required). Ensure that the communications cable has been connected and that the Power Module is OFF prior to connecting cables.

Connect Current Inputs. See 1.2 Power Module in this manual. If this is the first module connected to the Power Module, use Group 1 I-1 to I-4 outputs to connect the corresponding DC Current In connectors on the 20A module. Only use Group 2 if you are connecting your second Channel Module. Connect all four I-1 to I-4 inputs.

Connect Voltage Inputs. Only one input is required per Channel Module. Connect a voltage cable from a 20A output on the Power Module.

Connect Fan Power. Only one fan power connection is required per Channel Module. Connect a fan power cable from a Fan Power output on the Power Module.

Power on your Power Module to begin delivering power to the 20A Channel Module



Only power on the Power Module *after* all current, voltage and fan power connections have been made on both. Verify the Avrion comms cable is connected before powering on.

Once powered, the RESET switch on the front panel illuminates. The RESET functions to reboot the module. Use this if there is a loss of communication or during troubleshooting.



Do not reset the Channel Module while tests are running on any channels! Always stop any running tests via the software before performing a reset of a Channel Module

Note that the Status Indicator LEDs for each channel will not illuminate until communication is established with the Control Module and the software. The LED code reference is as follows:

Colour	Status
Red	Charging Step (normal operation)
Green	Discharging Step (normal operation)
Yellow	Paused/Suspended Step (normal operation) OR Error, abnormal operation – check log

Each channel on the 20A Channel Module has the capabilities described in its specification sheet, with current/voltage source across the 0–5V operating window, voltage sense, local (electronics) RTD temperature sensing and RTD temperature sensing from an external RTD attached to a cell holder (See 2.2 Cell Holders).

1.4 Thermal Chambers (TCB-XXX-XX-XX)

Avrion Thermal Chambers are broadly divided into two categories, distinguished by the cooling technology employed.

Peltier Thermal Chambers use a Peltier-effect thermoelectric cooler, alongside resistive heat, to hold a specified temperature. Peltier-cooled chambers can maintain a temperature typically only about 10°C below the ambient room temperature but are much better at maintaining fixed temperatures close to ordinary room temperatures.

Wide Range Thermal Chambers (WRC) use a compressor-evaporator cooling loop alongside resistive heat to meet the setpoint temperature. This design allows for much colder temperatures to be reached and maintained. Due to the mechanical nature of the cooling system, WRCs are larger and heavier than their Peltier counterparts. Additionally, they are not as efficient as Peltier chambers when operating at temperatures at or around the ambient environment temperature.

Both styles of Thermal Chambers may be designed to accommodate between 4 and 16 cell holders (depending on the model) on individual channels.

The serial number for the Thermal Chamber is located on the rear of the unit, near the power socket.



If your application calls for consistently low temperatures (more than 10°C below ambient), use a WRC. In other cases, Peltier Chambers are more reliable and efficient devices, due to their solid-state cooling.



Peltier Thermal Chamber

Temperature Range	10°C to 60°C*
Input Power	100-120VAC 50/60Hz 5A <u>or</u> 220VAC 50/60Hz, 3A
Circuit Breaker	15A, 250VAC
Thermal Auto-Off	85°C

*Cooling capability is approx. 10°C below ambient room temperature

Wide Range Chamber (WRC)

Temperature Range	-20°C to 60°C*
Input Power	100-120VAC 50/60Hz 5A <u>or</u> 220VAC 50/60Hz, 5.5A
Circuit Breaker	20A, 250VAC
Thermal Auto-Off	85°C



The power configuration is specified on the rear of the Thermal Chamber adjacent to the power socket. Ensure only the appropriate input voltage is used to power the chamber.



Figure 11: Front Panel I/O Scheme, Thermal Chamber

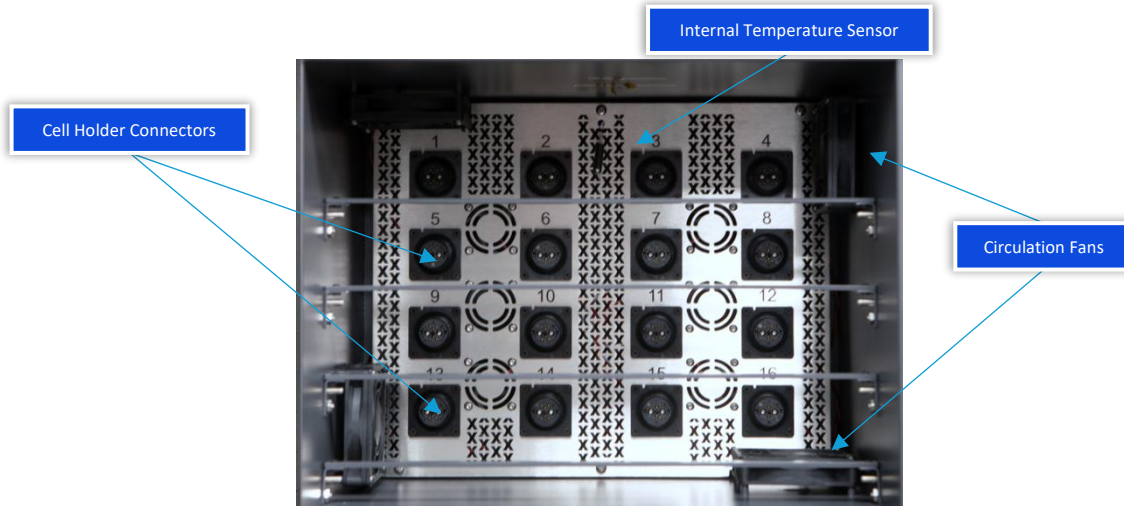


Figure 12: Internal I/O Scheme, Thermal Chamber

Channel Module Communications Each Thermal Chamber connects directly to a Channel Module via a proprietary Avrion Interconnect Cable (See ‘2.1 Interconnect Cables’).

In the example shown above, in Figure 11, the front panel Thermal Chamber connections should be directly connected to the front panel connections on a Channel Module.



Each channel on the Thermal Chamber is individually mapped and isolated, so connections can be made with any correctly rated channels from any combination of UHPC Channel Modules.

Front Panel connections are labelled and mapped 1:1 to their respective internal Cell Holder Connectors.



Always use caution when working inside thermal chambers. Inner walls may be hot during operation. Human skin can sustain first-degree burns at temperatures as low as 50°C.

The Thermal Chamber contains internal fans for air circulation as well as a 4-wire RTD, which provides closed-loop feedback to the temperature controlled.

For safety, thermal auto-shutoff is integrated inline with the resistive heaters; if the temperature inside the chamber exceeds the thermal cut-off temperature of 85°C, power is cut to the heater until the temperature before resuming operation.



The auto-shutoff should never be triggered in normal operation; if this occurs, power off the Thermal Chamber immediately and contact Avrion customer support.

AC Power. Avrion Thermal Chambers accept 100–230VAC power (50/60Hz) via a C14 socket. To power on the Channel Module for the first time, verify that the switch is OFF. Connect the provided power cable to your UPS and the C14 socket on the rear panel of the Channel Module. Turn the switch ON. Once powered, the RESET switch on the front panel illuminates. The RESET functions to reboot the temperature controller and temperature relays. Use this as required during troubleshooting.

Temperature Controller. The Thermal Chamber temperature is controlled by a Watlow EZ-Zone integrated temperature controller, accessed on the front panel. Both models provide similar levels of accuracy and response.

Temperature setpoints can be entered directly on the device. Software-controlled programming of the setpoint is also supported in UHPC Protocol Software.

[Set Temperature Setpoint - Watlow](#)

Selecting your temperature setpoint is straightforward:

1. Power on Thermal Chamber.
2. Enter desired setpoint using ▲ and ▼

Troubleshooting - Watlow

If the Thermal Chamber does not reach the desired set-point after more than 1 hour or the auto-shutoff is triggered, please [contact us](#) for advice.

Symptom	Cause	Solution
Controller displays Limit Error, Low or High Li.E1, Li.L1, Li.h1	Chamber temperature sensor damaged, or wiring damaged	Do not attempt to repair a damaged temperature sensor or wire. Contact us.
No Display	Controller is not receiving power	Check that device is plugged in and that UPS is able to supply sufficient power. Check that breakers are not tripped, or fuses are not blown (where applicable)
Chamber does not reach setpoint or is unstable	Tuning incorrect or setpoint not entered	Verify that setpoint is correct. Follow the programming steps in 8 Appendix A: Programming Watlow Controllers or contact us
Condensation forming on inside of chamber walls when operating at colder temperatures	Significant humidity in ambient air while operating chamber below ambient	This is normal; Avrion Thermal Chambers are not sealed environments, and air is passively exchanged with the ambient air during operation. Dry with a lint-free cloth or open doors and allow to dry naturally. Operate the chamber in a low, stable humidity (<60%RH) environment where possible.

1.5 Uninterruptible Power Supply (UPS)



UHPC systems use an uninterruptible power supply (UPS) to power and protect equipment. The UPS provides a brief battery backup in the event of a power loss. This backup is not meant to provide extended power through a prolonged power outage, but rather to allow a user to stop all tests and shutdown the system safely.



In the event of a power loss, where possible, stop any running tests via the software safely, save data and snapshots, and shut down each module in your system at its switch. The UPS is not intended or designed to run the system through a prolonged loss of mains power.



Using a UPS is critical for protecting the sensitive electronics found in Avrion equipment. If you are a user who has purchased a partial system or individual components, ensure that you have discussed a UPS implementation strategy with your Avrion Sales rep.

The UPS Avrion provides come from APC Canada, and the precise model depends on the configuration of original system provided. All UPS units will input/output either 100, 120 or 220 VAC at 50/60 Hz, configured for input based on country. Replacement battery styles and OEM documentation for your UPS will be provided



In the event of a UPS failure or error, contact the APC Canada customer care team at **1-800-800-4272**. APC will complete diagnostics and replace the unit if required.

1.6 Rack Enclosure

All modules are housed in a standard 19" equipment rack. This rack is equipped with secondary uprights to support the charger modules and Thermal Chambers as well as a smaller set of rear rails to provide rear support for the UPS.

The rack and chassis of all components within the rack must be connected to earth ground via the UPS.

Ensure that when the rack is positioned for final use, all panels are accessible, and doors swing freely.



The rack is equipped with an additional ground wire from the rear earth point that must be connected to earth ground. See the 'Getting started with UHPC: Uncrating and power on' guide for more information.

2. System Peripherals

2.1 Interconnect Cables (ICA-XXX-00-00)



Figure 13: Channel Module to Thermal Chamber interconnect cable

Interconnect cables connect each channel on the front panel of a Channel Module to each channel of a Thermal Chamber.

Cables will be labeled on both ends to indicate which channel they are connected to and are all varying length. In general, these cables never need to be disconnected from their Channel Module host but may be relocated on a Thermal Chamber(s) depending on experimental needs.

Interconnect cables are 9-pin configuration for the current source (+/-), cell voltage sense (+/-), RTD current drive (+/-), RTD voltage sense (+/-) and cable shield.

20A and 10A Interconnect cables are interchangeable, while 2A cables use a different pin configuration and will not physically mate with a 10A or 20A chamber or Channel Module.

2.2 Cell Holders (CHA-XXX-00-00)

Avrion offers different cell holders, broadly split between Standard Format and Large Format configurations. Avrion sales will help you select cell holders appropriate for your application. In some cases, customers with specific needs will opt not to use Avrion-built Environmental Chambers. In these cases, Avrion supports customers by providing custom connections on a case-by-case basis.

Standard Format Cell Holders.

16-position Thermal Chambers can take advantage of Avrion's Standard Format cell holders. These cell holders carry a circuit board hosting an on-board RTD temperature sensor as well as an interface to connect an external RTD (optional). External RTDs are often used if a temperature even closer to the testing cell is desired.

Avrion offers two styles of Standard Format Cell Holder.

2A/10A Capable Holders: These connectors use a magnetic latching mechanism and use a poka-yoke design to ensure only one orientation is possible. Cell holders with these connectors are rated for up to 10A of current at 5V and can safely be used with Avrion 2A and 10A Channel Modules. To disconnect these cell holders once attached, pull gently backwards to overcome the magnetic mating force.

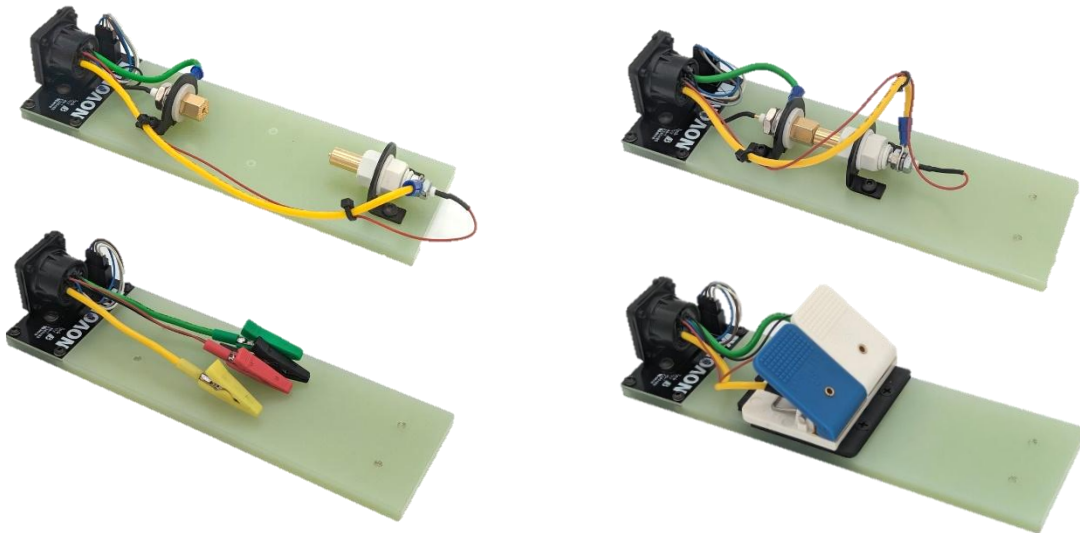


Figure 14: Standard Format Cell Holders with magnetic coupler

To use an external RTD with these connectors, disconnect the 4-pin RTD header (brown, white, grey and blue wires) from the circuit board, and connect your RTD. Otherwise, the onboard RTD will be used for temperature measurements.



Large Format Cell Holders.

Avrion Large Format Cell Holders are typically made to order and feature custom lead lengths and terminations to accommodate various pouch cell sizes. These connectors may be connected directly to a 10A or 20A Channel Module or to a compatible Thermal Chamber.



Figure 15: Large format cell holders, designed for higher current loads, can be configured in a number of ways, with pouch clips, stripped wire, ring terminals, alligator clips etc.

These Cell Holders come wired to accept a separate, external 4-wire RTD, as no on-board RTD is provided.

Avrion often provides custom cell holders of all styles. Instructions regarding their use is not covered in this manual.

2.3 Communication Cables

Communications cables are used to connect a Control Module to Channel Modules, and to a lab PC running Avrion software.



Figure 16: Avrion provides custom length cables for new systems to simplify cable management

Each Control Module can connect up to any 8 Channel Modules simultaneously, provided that they are of the same type (2A, 10A or 20A). Channel Modules do not support connecting to mixed Channel Modules at this time.



One Control Module per type of Channel Module! Control Modules do **not** currently support connecting to multiple types of Channel Modules (2A, 10A or 20A) at this time.

All communications cables use an RJ45 connector, with a straight-through Ethernet configuration. Standard, off the shelf Cat6 shielded cables will work. Crossover style Ethernet cables, which are less common, will not work. Ensure the cables you are using are straight-through Ethernet, available from most computer or office supply stores.

Avrion supplies all necessary cables with new systems cut to a custom length and labeled. Channel Module cables are coloured **green**, while the PC cable is **black**.

3. Safety Limits

Avrion UHPC channels have several safety limits in place to minimize the risk of over-charge or over-discharge of cells.

The Protocol Designer software package, UHPC-Protocol, includes operating and emergency limits, global settings for a given protocol and the option of individual settings for each step in the protocol. A channel will shut down if these limits are exceeded. These limits can be based on channel current, cell voltage, cell temperature or run time. These safety limits are stored locally with each saved protocol, with default values stored locally on the control PC.

The Control Software, UHPC-Control also uses built-in safety limits. If a user attempts to run a protocol that contains values that exceed UHPC-Control's default limits, it will throw an error and prevent the protocol file from being loaded.

During operation, the software continuously monitors the data returned from each channel and compares this to both the system limits and the limits contained in the protocol file. These limits are integrated in the control software.

The channel boards, located in all UHPC Channel Modules, employ hard current and voltage limits that will prevent these values exceeding the system limits. These limits are inherent to the board and cannot be changed. In the case of constant current testing, channels' voltage limits are slightly above (charge) or below (discharge) the step voltage limit.

Finally, all channel boards employ a hardware timeout; all current is cut if no heartbeat signal is received after a certain period of time. The default value is 60s but can be changed via software settings to a minimum of 10s. See the Software Manual for further information.

4. Software

Three software programs are supplied with each system:

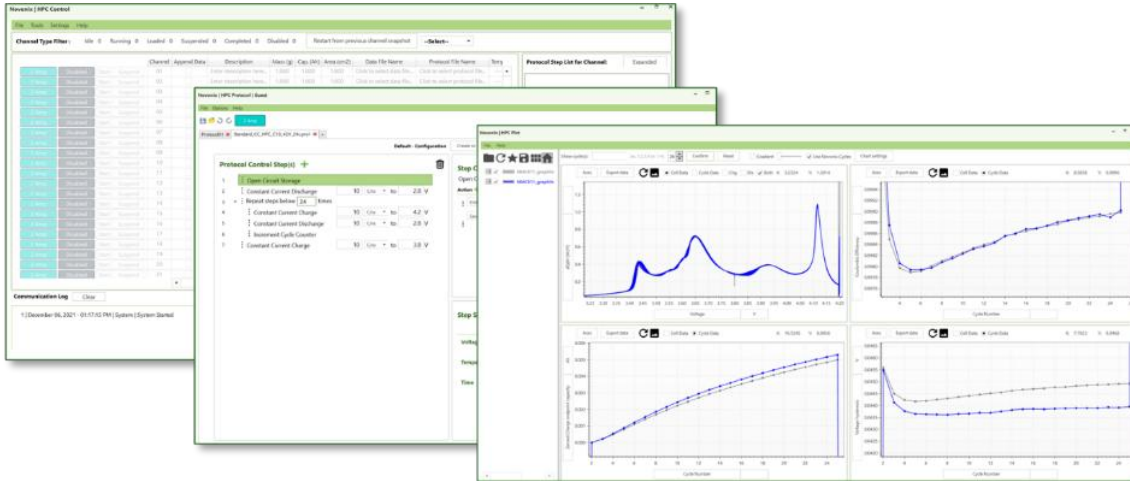
UHPC Control: this program starts and runs tests dictated by protocol files. It controls the Control Module, its communication with connected channels and controlling charge/discharge profiles etc.

UHPC Protocol: this program is used to generate the test sequence protocol files that dictate how a charger channel will operate for a given cell. It allows the user to configure currents, voltage limits, data collection intervals etc.

UHPC Plot: this program allows the user to analyze data files generated by the UHPC Control software. It provides both a graphical interface for viewing of data and a data export section that



The UHPC software (UHPC-Protocol, UHPC-Control, UHPC-Plot) are pre-installed on the included PC. However, it is worth checking the [UHPC Software](#) to verify that your software is operating with the latest version of each software package.



If there is an issue with an existing installation, each piece of software may be removed using the native Windows “Add or remove programs” in System settings.

Remove the problematic installation and reinstall by downloading the latest version from the Avrion Customer Area, extracting the folder and running the Setup application.



A Software Manual that covers detailed use of the UHPC Software suite is available in the [Avrion UHPC Software](#) and is outside the scope of this document.

allows the user to export simple text files for subsequent graphing and further analysis

5. Appendix A: Programming Avrion Chamber Controllers

More detailed instruction on use of the temperature controller is provided in the hardware manual for your specific controller - [Watlow PM PLUS controller](#).

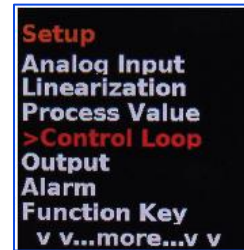
Basic Avrion Chamber controller operation:

Control Mode

1. From Home, tap the forward arrow to go to Operations.
2. Scroll to and select Setup.
3. Scroll to and select Control Loop.
4. Scroll to and select Control Mode.
5. Select Off, Auto, or Manual.

Auto: loop adjusts output, so process matches set point.

Manual: user sets control loop output in percent power. Off: no control loop output



Control Loop Set Point

1. Press the **Home** button to return to the home screen.
2. Use the numeric slider or the +/-keys to choose the set point.

Autotune

1. From Setup, scroll to and select **Control Loop**.
2. Scroll to and select **Autotune**.
3. Select **Yes**.

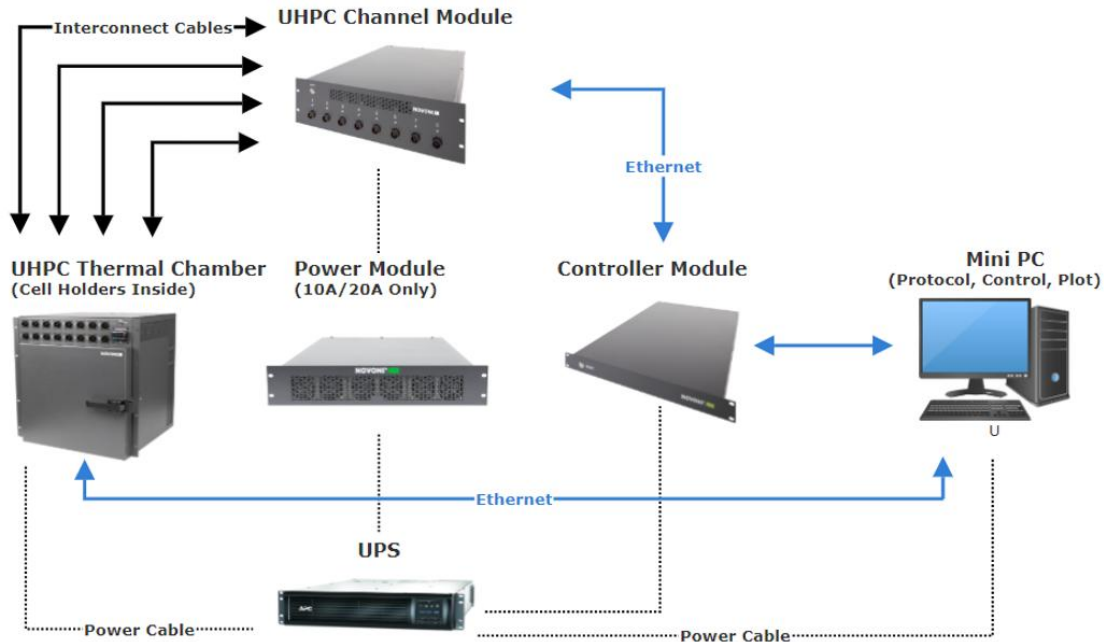


Temperature Control with UHPC Software:

- Temperature can be controlled remotely via Avrion UHPC Software (see software manual, Appendix A).

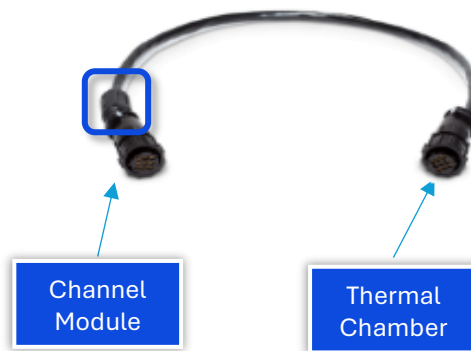
6. Appendix B: Cable connections of a UHPC system

The cable connection of an example 2A UHPC system is shown below.



✓ **To set up or check cable connection**

- Make sure **interconnect cables** are correctly installed between the Channel Module and the Thermal Chamber. Identify the Channel Module end by looking for additional RF shielding on the cable (see image below).



Make sure a **standard, straight-through Ethernet cable** connects Control Module “computer” port to your PC. Additionally, **standard, straight-through Ethernet cables** should connect Control Module to Channel Modules. Verify that crossover style cables are not being used.

- **Power cables** of all modules should be connected via a UPS. Please refer to the specific device’s [specification sheet](#) for power draw information if using a 3rd party UPS or have another power solution.
- Make sure that all cables are connected and seated securely.

UPS Power Configuration and Compatibility

Each UHPC system is shipped **pre-configured** based on the equipment ordered. All internal power requirements are handled prior to delivery, and no additional setup is required by the user for normal operation.



The only information the user needs to verify is that the **UPS plug type is compatible with the available power outlets in your lab**. Plug types vary by region and voltage, so please confirm compatibility before installation.

UPS Plug Type and Regional Compatibility

UPS Power	Plug Type	Voltage / Frequency	Region
3000VA	NEMA L5-30P	120V / 60Hz	North America (Low Voltage)
3000VA	BS 1363A	220–240V / 50–60Hz	UK
	CEE 7/7 (EU1-16P)	220–240V / 50–60Hz	Europe
	IEC 60320 C20	220–240V / 50–60Hz	North America (High Voltage), parts of Asia

For North America – High Voltage (208–240V)

- The UPS plug type will be **IEC 60320 C20**
- This requires the use of a Tripp Lite isolation transformer or line conditioner
- The Tripp Lite device must then connect to a **NEMA L6-30P** wall outlet

Optional Configuration

If your lab has its own power backup or regulation system in place, UHPC systems can also be powered directly from AC, bypassing the UPS entirely with the proper Tripp Lite device.

Thermal Chamber Plug Type and Voltage Compatibility

Voltage	Plug Type
100–120V	NEMA 5-15P
220–240V	IEC 320 C14

[7. Appendix C: Avrion TERMS AND CONDITIONS OF SALE](#)

Avrion Battery Labs Inc.

TERMS AND CONDITIONS OF SALE

NOTWITHSTANDING ANY CONTRARY LANGUAGE PROPOSED BY BUYER IN ANY OTHER DOCUMENT THAT STATES THAT ANY OTHER DOCUMENT, ACT, OR FAILURE TO ACT BY SELLER CONSTITUTES ACCEPTANCE OF ANY DIFFERENT OR ADDITIONAL TERMS OR CONDITIONS, ANY OFFER OR ACCEPTANCE BY SELLER IS MADE SUBJECT TO THESE TERMS AND CONDITIONS, AND THESE TERMS AND CONDITIONS EXPRESSLY LIMIT ACCEPTANCE TO THE TERMS AND CONDITIONS STATED HEREIN. ANY ADDITIONAL OR DIFFERENT TERMS OR CONDITIONS IN ANY BUYER DOCUMENT, WHETHER IN A PURCHASE ORDER, SHIPPING INSTRUCTION, OR OTHERWISE, ARE REJECTED, ARE OF NO FORCE OR EFFECT, AND SHALL NOT APPLY UNLESS SPECIFICALLY AND EXPRESSLY ASSENTED TO IN WRITING BY AN AUTHORIZED REPRESENTATIVE OF SELLER, AND FULFILLMENT OF BUYER'S ORDER DOES NOT CONSTITUTE ACCEPTANCE OF ANY OF BUYER'S TERMS OR CONDITIONS.

1. **COMPLETE AGREEMENT:** If this document has been issued by Seller in conjunction with a quote ("**Quote**") or acknowledgement ("**Acknowledgement**") in response to a written offer made by Buyer, Seller rejects Buyer's offer and Seller makes this offer expressly limited to the terms hereof, and Seller reserves the right to withdraw this offer at any time before its acceptance by Buyer. If these Terms and Conditions are not acceptable, Buyer is to notify Seller in writing at once. Buyer's action in (a) accepting any products delivered by Seller ("**Products**"), or (b) issuing a purchase order against or otherwise accepting a Quote referencing or incorporating these Terms and Conditions, will constitute an unqualified acceptance by Buyer of these Terms and Conditions. Each applicable accepted Quote or Acknowledgement as governed by these Terms and Conditions may be referred to herein as the "**Agreement.**"

The Agreement, together with the specifications, drawings and any other documentation referred to herein and therein, which by this reference are all made a part hereof, constitutes the entire agreement between **Avrion Battery Labs Inc.**, a Canadian corporation, with a principal place of business located at 177 Bluewater Road, Bedford, Nova Scotia B4B 1H1, Canada ("**Seller**"), and the buyer of the Products set forth in the Agreement (the "**Buyer**"). The Agreement between the parties supersedes all prior negotiations, proposals, writings, trade customs and trade usage pertaining to the subject matter of the Agreement.

2. **DELIVERY OF PRODUCTS; RISK OF LOSS:** Unless otherwise provided in the Agreement, (a) delivery of the Products shall be made ExWorks, Seller's designated facility located at 110 Simmonds Drive, Dartmouth, NS (Incoterms® 2020); (b) Buyer shall bear the risk of loss or damage to the Products covered by the Agreement after they are made available for Buyer's disposal at Seller's designated facility; and (c) title to the Products shall pass to Buyer after the Products are made available for Buyer's disposal at Seller's designated facility.
3. **DELAYS; FORCE MAJEURE:** All Delivery Dates are estimates only and are not guaranteed by Seller; provided that Seller will exercise its commercially reasonable efforts to meet the Delivery Dates specified in the Agreement. "**Delivery Date**" means when Products ordered pursuant to the Agreement are delivered to Buyer. Products ordered under an Agreement are usually made available for shipment within the lead time specified in the applicable



Quote, which does not commence until execution of such Agreement. Seller shall notify Buyer of any delay in delivery of Products and take commercially reasonable steps to minimize the length of any such delay.

If prevention of Seller's performance or a delay in delivery is caused by (a) an event of *force majeure*, including but not limited to, acts of God or public enemy; terrorism; war; civil commotion; riot; blockage or embargo; work stoppage; strike or other labor dispute or industrial disturbance, slowdowns or interruption, lockout; fire; flood; earthquake; explosion; drought; the elements; casualty; epidemic; pandemic; default by any common carrier; which are due to any law, order, proclamation, regulation, ordinance, demand, requisition or requirement or any other act of governmental authority, agency or entity, whether foreign, national, state or local, including court orders, judgments, or decrees; or any other similar or dissimilar contingency, delay, failure or cause beyond the Seller's reasonable control, irrespective of whether such contingency is specified herein or is presently occurring or anticipated by Seller; or (b) the inability or refusal of Buyer or its customers to accept or receive shipment when due (whether or not valid), then Seller will be entitled, at its sole option, to

- a. extend the time for performance and delivery for a period, or periods, of time that, in Seller's sole discretion, appears to be reasonable, or (ii) cancel the sale, in either case without liability on the part of Seller. If prevention of Seller's performance or a delay in delivery is due to an event described in clause (b) above, Buyer will reimburse Seller for the reasonable costs and expenses incurred by Seller in connection with such delay, including, without limitation, Seller's cost and expense to store the Products.
4. **SECURITY INTERESTS:** Buyer hereby grants Seller a continuing first priority purchase money security interest in and to the Products sold hereby and all replacements, substitutions and accessions thereto and all proceeds thereof, including insurance proceeds, to secure payment of all obligations and indebtedness of Buyer to Seller hereunder. Buyer agrees that Seller will have the right to take such actions with respect to the Products as Seller may reasonably determine is necessary in order to create a first lien perfected security interest in the Products, including filing UCC-1 financing statements (or the equivalent thereof if the Products are located outside the United States) evidencing the Products as collateral; and Buyer further agrees to take such actions as Seller may reasonably request in order to perfect Seller's first-lien security interest in the Products. Buyer specifically agrees and acknowledges that the security interest herein granted has attached. Upon the occurrence of an Event of Default, Seller will have all the rights and remedies of a secured party under the Uniform Commercial Code, or if the Products are located outside the United States, then the equivalent thereof. The security interests granted to Seller under this Agreement will automatically terminate upon payment in full of the purchase price for the Products, and Buyer will be entitled to file a UCC-3 termination statement (or the equivalent thereof if the Products are located outside the United States) evidencing such termination.
5. **INSPECTION OF PRODUCTS:** Buyer will perform acceptance testing of the Products against Seller's "Customer Acceptance Form," and if the acceptance testing demonstrates that the applicable Products function according to the specifications in Seller's "Customer

Acceptance Form,” those Products will be deemed accepted. Buyer will communicate acceptance or reasons for non-acceptance to Seller in writing without unreasonable delay and no later than 30 days from the Delivery Date. If Seller has not received Buyer’s communication of acceptance or non-acceptance before this deadline, acceptance of the applicable Products will be deemed given. If Seller determines that Buyer’s communication of non- acceptance is valid, Seller will, at its option, as the exclusive remedy of Buyer, within a reasonable period of time, repair or replace the nonconforming Products.

6. **PRICE:** In consideration of the provision of the Products, Buyer agrees to pay to Seller the prices specified in the Agreement (“**Prices**”). Prices are listed in the Agreement in United States Dollars. Prices are exclusive of all taxes, fees, tariffs and duties, shipping and handling fees, insurance, and any other similar financial contributions imposed by law on or on account of the purchase and delivery of the Products (collectively, “**Taxes and Shipping Fees**”). Buyer agrees to pay all Taxes and Shipping Fees assessed in connection with each shipment of Products.
7. **PAYMENT TERMS:** Unless otherwise provided in the body of the Agreement, Seller may invoice Buyer on, or at any time after, the date of each Product shipment for the Prices and Taxes and Shipping Fees associated with the Products Shipped. Unless otherwise agreed upon by the parties in writing or stated elsewhere in the Agreement, terms of payment for Products is due net thirty (30) days from the date of the applicable invoice. Failure of Buyer to make any payment when due will constitute an Event of Default (as hereinafter defined) and will entitle the Seller to treat the entire balance owing to Seller under the Agreement as immediately due and owing and to withhold further deliveries without liability until such Event of Default is cured, and/or entitle Seller to cancel the unperformed part of the Agreement. Further, Seller will have the right to interest on all balances not paid when due at a rate of interest equal one and one half percent (1.5%) per month (or such lesser amount as may be the maximum permitted by applicable law). Upon Seller’s request, Buyer will submit to a credit check for Seller to determine Buyer’s creditworthiness. In the event Buyer’s financial condition, payment history, or any other circumstance occurs that results in Seller reasonably deeming itself insecure as to the payment of any and all amounts due to Seller from Buyer under the Agreement, Seller may, do any one or more of the following: (a) change or otherwise modify the payment and/or credit terms set forth in this Agreement, including by way of example, but not of limitation, change the terms of payment to payment in full or in part in advance of shipment of the entire undelivered balance of Products, (b) delay or postpone delivery of the Products and/or suspend any outstanding orders for Products, and/or (c) require financial data from Buyer for verification of Buyer’s creditworthiness. Buyer shall not be entitled to deduct from, or set off against, any sums due and owing to Seller any sums owed by Seller to Buyer.
8. **WARRANTY; DISCLAIMER:** For 12 months following acceptance of the Products as set out in Section 5, for the Product contained in such shipment, Seller warrants that the Products ordered will conform to any applicable specifications and will be free from defects in materials and workmanship. If Buyer makes a warranty breach claim against any Product, and if Seller determines that Buyer’s claim is valid, Seller will, at its option, as the sole and exclusive remedy of Buyer, within a reasonable period of time, repair or replace the non-conforming Products or provide a refund or credit to Buyer for the price of such Products (in which case, Buyer will return the non-conforming Products to Seller as instructed by

Seller). Seller's limited warranty with respect to products is voided if any breach thereof results directly or indirectly from (a) the applicable products being subjected to operating, usage, storage, and/or environmental conditions outside of the conditions set forth in any applicable specifications or documentation; (b) the applicable Products being subjected to abuse, misuse, neglect, negligence, accident, acts of God or other peril, improper installation or hardware or software configuration, improper calibration or failure to routinely calibrate, improper storage, improper handling, improper disposal, or abnormal physical, electrical or environmental stress; (c) normal wear and tear; (d) the applicable Products being used with any other hardware, devices, or other products other than as provided in any applicable specifications or documentation; (e) any non-conformity relating to the design or manufacture of any hardware, devices, or other products in which the applicable products are incorporated; or (f) the applicable products being reconstructed, reconfigured, repaired, tampered with, modified or altered at any time by persons or parties after Seller delivers them, including without limitation by Buyer or any of its representatives or personnel, agents or customers (clauses (a)-(f), collectively, the "Exclusions").

EXCEPT FOR THE LIMITED WARRANTY IN THIS SECITON 10, THE PRODUCTS ARE SOLD "AS-IS", AND SELLER HEREBY DISCLAIMS TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY EXPRESS OR IMPLIED WARRANTIES OR CONDITIONS OF TITLE, DESIGN, NON- INFRINGEMENT, WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SELLER FURTHER DISCLAIMS ANY LIABILITY OR RESPONSIBILITY WHATSOEVER TO BUYER OR TO ANY OTHER PERSON FOR INJURY TO PERSON OR DAMAGE TO OR LOSS OF PROPERTY OR VALUE CAUSED BY ANY PRODUCTS TO THE EXTENT SUCH INJURY, DAMAGE OR LOSS RESULTS FROM ANY OF THE EXCLUSIONS.

9. **CANCELLATION:** If the Seller breaches any material provision of any Agreement, and such breach is not cured by the Seller within 30 days after the Seller's receipt of notice of such breach, Buyer may, by written notice to Seller, cancel further performance by Seller under the Agreement. Otherwise, the Agreement may not be canceled, in whole or in part, by Buyer without both (a) Seller's prior written consent and (b) prior payment to Seller of a sum equal to the total of the out-of- pocket expenses incurred by Seller in connection with the Agreement, including, but not limited to, finished Products, work in process, raw materials that are non-returnable to Seller's suppliers and any supplier cancellation/return fees, plus a reasonable sum for overhead expenses and lost profits, as reasonably determined by Seller.

With respect to Buyer, each of the following constitutes an event of default by Buyer hereunder (each an "**Event of Default**"): (a) failure to pay any sum due Seller under the Agreement, as and when the same is due, (b) breach of any material provision in any Agreement by Buyer that is not cured by Buyer within 30 days after the Buyer's receipt of notice of such breach, or (c) Buyer is unable to pay its debts when due, is adjudged bankrupt, makes a general assignment for the benefit of its creditors, or a receiver is appointed on account of Buyer's insolvency. If any Event of Default should occur, Seller may: (i) terminate this Agreement effective immediately and demand a return of the Products for which payment has not been made to the destination specified by Seller, freight prepaid by Buyer, and/or (ii) take possession of all Products from Buyer, and for that purpose, enter upon any premises owned or leased by Buyer, and/or (iii) file for arbitration

pursuant to Section 15(i) (Dispute Resolution), and/or (iv) take any and all other actions specified herein or otherwise permitted by applicable law.

10. **INTELLECTUAL PROPERTY:** Buyer acknowledges and agrees that Seller (or its licensors) will retain all intellectual property rights in and to the Products, all Product specifications and Product documentation, including, without limitation, all patents, patent applications, and other patent rights and any other governmental authority-issued indicia of invention ownership; all trademarks, service marks, trade dress, trade names, brand names, logos, corporate names and domain names and other similar designations of source, sponsorship, association or origin, together with the goodwill symbolized by any of the foregoing; trade secrets, including all inventions, discoveries, trade secrets, business and technical information and know-how, databases, data collections, patent disclosures and other confidential and proprietary information and all rights therein; and all other industrial and intellectual property rights, and all rights, interests and protections that are associated with, equivalent or similar to, or required for the exercise of, any of the foregoing, however arising, in each case whether registered or unregistered and including all registrations and applications for, and renewals or extensions of, such rights or forms of protection pursuant to the laws of any jurisdiction throughout in any part of the world (collectively, "Seller IPR"). Buyer has a limited, non-exclusive right to use any Product software solely in connection with the use of the Product on which it is installed for Buyer's internal business operations and subject in all cases to use in accordance with any applicable Product specifications or documentation. Except for the foregoing limited right of use, the sale of Products hereunder does not convey any license or other rights under any Seller IPR, and Seller expressly reserves all of its rights in and to the Seller IPR.
11. **CONFIDENTIALITY:** Each party shall protect and safeguard the confidentiality of all confidential and proprietary information disclosed to it by the other party ("**Confidential Information**") with at least the same degree of care as the receiving party would protect its own confidential and proprietary information, but in no event with less than a commercially reasonable degree of care. A receiving party shall not publish, disclose or use Confidential Information for any purpose other than such party's performance of its obligations, and exercise of its rights, pursuant to the Agreement and, then, only to those persons with a need to know for such limited purpose. This obligation of non-disclosure shall not apply to the following: (a) information that is or becomes publicly available through no act or fault of a receiving party or its agents; (b) information that is already in the receiving party's possession and is not subject to any confidentiality obligation; or (c) information that is obtained by the receiving party from a third-party who is rightfully in possession of the information. If the receiving party of Confidential Information is requested or required by any legal process to disclose any Confidential Information of the other party, the receiving party will promptly notify the disclosing party unless prohibited from doing so by applicable law or by a governmental agency so that the disclosing party may seek an appropriate protective order and/or waive the receiving party's obligation to comply with these confidentiality obligations. Upon the earlier of the termination or expiration of the Agreement or the request of the disclosing party, the receiving party will promptly return or destroy the disclosing party's Confidential Information, except that a party may retain electronic files consistent with customary backup and retention procedures, provided that any Confidential Information therein will remain subject to the confidentiality obligations provided herein until the same are destroyed as part of such procedures.

12. INDEMNIFICATION: Buyer will defend, indemnify, and hold harmless Seller and its affiliates, and its and their respective directors, officers, members, managers, shareholders, employees, agents, representatives, successors, and assigns from and against all third-party claims, suits, demands, actions, and allegations and all resulting damages, losses, liabilities, judgments, settlements, penalties, fines, costs, and expenses (including all reasonable attorneys' fees and costs of dispute resolution) (collectively, "**Claims**") arising from or relating to (a) Buyer's breach of any provision of the Agreement or (b) any Exclusions. Seller will promptly notify Buyer of any Claims; provided, however, that if Seller fails to so promptly notify Buyer, Buyer's indemnity obligations will not be excused, except to the extent Buyer is actually and materially prejudiced thereby. The indemnified parties will cooperate with Buyer in the course of Buyer's indemnification of them, at Buyer's sole cost and expense. Each indemnified party may participate in Buyer's defense of a Claim with counsel of their own choosing, at their sole cost and expense. Buyer will not settle any Claim without the prior written consent of each indemnified party.

LIMITATION OF LIABILITY: IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY LOSS OF USE, REVENUE OR PROFIT OR DIMINUTION IN VALUE, OR FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR PUNITIVE DAMAGES WHETHER ARISING OUT OF BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, REGARDLESS OF WHETHER SUCH DAMAGES WERE FORESEEABLE AND WHETHER OR NOT SELLER WAS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, AND NOTWITHSTANDING THE FAILURE OF ANY AGREED OR OTHER REMEDY OF ITS ESSENTIAL PURPOSE. IN NO EVENT SHALL SELLER'S AGGREGATE LIABILITY ARISING OUT OF OR RELATED TO THE APPLICABLE AGREEMENT, WHETHER ARISING OUT OF OR RELATED TO BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, EXCEED THE AMOUNTS PAID BY BUYER UNDER THE APPLICABLE AGREEMENT FOR THE PRODUCTS SOLD. THE FOREGOING LIMITATIONS APPLY WHETHER OR NOT SUCH DAMAGES WERE FORESEEABLE AND WHETHER OR NOT SELLER WAS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, AND NOTWITHSTANDING THE FAILURE OF ANY AGREED OR OTHER REMEDY OF ITS ESSENTIAL PURPOSE.

13. COMPLIANCE WITH LAWS: Each party shall take all actions reasonably necessary to ensure, that its performance of obligations under the Agreement will be in full compliance with all applicable laws, including without limitation those related to anti-bribery and anti-corruption. Each party shall obtain all permits, certificates and licenses which may be required for the performance of the Agreement and with respect to Buyer, its purchase, import, export and use of the Products.

14. GENERAL PROVISIONS:

A. CUMULATIVE REMEDIES: Except as otherwise provided for herein, all remedies available to a party for breach of the Agreement are cumulative and may be exercised concurrently or separately, and the exercise of any one remedy shall not be deemed an election of such remedy to the exclusion of other remedies. Seller specifically reserves the right, in its sole discretion, to set off any amounts to be paid by Seller to Buyer under this Agreement

against any amounts that Buyer may owe to Seller, whether pursuant to this Agreement or any other agreement between Buyer and Seller.

- B. **INDEPENDENT CONTRACTOR:** The relationship of Buyer and Seller established by the Agreement is that of independent contractors. Nothing in the Agreement shall create between the parties a partnership, joint venture, employer-employee relationship or principal-agent relationship, and neither party has the authority to bind the other to any third person or otherwise to act in any way as the representative of the other.
- C. **ASSIGNMENT:** Neither the Agreement nor any portion thereof may be assigned or subcontracted by the Buyer without Seller's prior written consent, and any such assignment or subcontract without consent will be null and void. Seller reserves the right to freely assign the Agreement. Any permitted assignment shall be binding upon any permitted successors and assigns.
- D. **SEVERABILITY:** If any term or provision of the Agreement shall for any reason be held invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other term or provision hereof and the remainder of the Agreement shall remain valid and enforceable according to its terms and the Agreement shall be interpreted and construed as if such term or provision, to the extent the same shall have been held to be invalid, illegal or unenforceable, had never been contained herein.
- E. **WAIVER:** No term or provision hereof shall be deemed waived and no breach excused unless such waiver or consent shall be in writing and signed by the party claimed to have waived or consented. The failure by a party to insist, in any one or more instances, upon the performance of any of the terms or conditions of the Agreement, or to exercise any right hereunder, shall not be construed as a waiver of the future performance of any such terms or conditions or the future exercise of such right.
- F. **SURVIVAL:** Any provision of the Agreement, which, by its nature or express terms is intended to survive termination or expiration, shall survive termination or expiration of the Agreement regardless of the reason for such termination or expiration.
- G. **NOTICES:** Any notice required to be given hereunder shall be in writing and addressed to the applicable party at the addresses set forth in the body of the Agreement (or to such other address that may be designated by the receiving party from time to time in accordance with this Section). All notices shall be delivered by personal delivery, internationally recognized overnight courier (with all fees pre-paid) or certified or registered mail (in each case, return receipt requested, postage prepaid). A notice will be deemed given upon receipt by the receiving party if delivered by personal delivery or courier or, five (5) days after mailing if mailed in accordance with the terms hereof.
- H. **GOVERNING LAW:** The Agreement shall be governed by and construed in accordance with the laws of the State of New York, USA, without regard to the conflict of laws provisions thereof. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to these Terms and Conditions or any Agreement, and the parties hereby disclaim the application thereof.
- I. **DISPUTE RESOLUTION:** Except as otherwise provided in this Section 15(i), each party agrees that all disputes arising under the Agreement will be submitted to binding arbitration under the applicable rules of the American Arbitration Association then in effect (the "**Rules**"). Either party may commence the arbitration by delivering a request for arbitration

as specified in the Rules. The arbitration will be conducted before a sole neutral arbitrator, selected as provided in the Rules. The arbitration will be conducted in the English language at a site specified by Seller in New York, New York, USA. The arbitrator will apply the law set forth in Section 15(h) (Governing Law) to any such arbitration and shall have the power to award any remedy available at law or in equity; provided, however, that the arbitrator shall have no jurisdiction to amend this Agreement or grant any relief not permitted herein or beyond the relief permitted herein. The award of the arbitrator will be the exclusive remedy of the parties for all claims, counterclaims, issues or accountings presented or plead to the arbitrator. The award of the arbitrator will require the non-prevailing party to pay the prevailing party's costs, fees and expenses (including attorneys' fees). Judgment upon the award may be entered in any court or governmental body having jurisdiction thereof. Any additional costs, fees or expenses incurred in enforcing the award may be charged against the party that resists its enforcement. Each party agrees that if the other party reasonably believes that the former has, in any manner, breached its confidentiality obligations to the other party or has damaged the other party in such a way where monetary relief would not be a sufficient remedy, then the other party may seek emergency, preliminary or other appropriate interim relief in the federal or state courts whose district encompasses New York, New York, USA, and any actions to enforce the arbitration provisions hereof will be brought exclusively in such courts.