TRELLIS™ QUICK START THERMAL MANAGEMENT

Guide Specifications

VERTIV

1.0 General

1.1 Overview

This document includes the specifications and features of the *Trellis*™ Quick Start Thermal Management package. These include:

1. Capabilities for *Trellis* Quick Start Thermal Management Solution

2. Requirements for network and server hardware

3. Specifications and features for the Avocent® Universal Management Gateway 4000

4. Specification for the temperature sensors

2.0 Software Overview

2.1 *Trellis* Quick Start Thermal Management Solution:

The *Trellis* Data Center Monitoring Solution provides software, hardware, and services for monitoring in a complete package. This solution may also be integrated with other *Trellis* modules to create a full-featured data center infrastructure management (DCIM) solution.

- Support unlimited simultaneous users

- View hot spots in 3D thermal views

- Identify stranded capacity for future planning

- Support simultaneous international languages

- Eliminate hot spots and reduce cold spots

- Monitor critical thermal infrastructure

- Balance cooling capacity with IT load

- Eliminate manual temperature collection

- Lower energy costs by balancing cooling supply with IT demand

- Reduce bypass airflow by monitoring the rack delta T

- Increase equipment life through improved temperature balancing

- Reduce downtime due to excessive heat

- Achieve quicker response time to issues that threaten business operations

- Improve ASHRAE compliance

- Increase efficiency through elimination of manual data entry

- Save time via the use of historical data for future planning

- Reduce time spent generating reports

Trellis Quick Start Thermal Management Solution (30 FMDs)

Trellis Bundle SKU	TR-OF-TDMS
Trellis License Bundle • *Trellis* Site Manager • *Trellis* Thermal System Manager	YES
Licensed Racks/FMDs	30
Wireless Sensors with 3 temp points each	25
Avocent Universal Management Gateway	UMG4000
Maintenance	1-Year Silver
Trellis Host Server	Customer provided based on meeting Avocent requirement specifications
Professional Services	Fixed Cost, T&E included, 4 days onsite, 6 days offsite
Training	Virtual – Instructor Led

2.2 Monitoring Software

The *Trellis* Quick Start Thermal Management Solution provides the following capabilities:

- Monitor critical power and thermal infrastructure

- Improve Alarm /Notification management

- Manage capacity, efficiency, and performance with real-time data

- Manage cooling and power chain

- Monitor environmental sensors

- See colorization from sensors and power conditions

- Provide support in generating reports important to their business

2.2.1 Monitor and Respond To Critical Devices Intelligently

- See device status (Normal, In Alarm, Maintenance Mode, Not Responding) on a graphical floor plan and in real time

- Configure data points for collection and assign data collection intervals

- Categorize and visualize data via Configure, Control, Support and Specification tabs

- Use Accelerated Polling to monitor trends during power outage and when running on battery power for maintenance; compare load with run time to provide additional measurement of load percentage versus available battery run time

- Control and command other devices to perform actions using an alarm as a trigger, minimizing need for personnel intervention (i.e., high temperature); gather data from any device in the system once alarm is triggered

- Have real-time tracking of aisle temperature during extended power outage via Cold Aisle Temperature Sensors and track aisle temperature or evaluate high room temperature events

- Get notifications via SNMP, SMS or email and based on working hours of facilities personnel so alarms are addressed by the right person promptly; determine delivery based on notification states (Success, Failed or Pending)

- Provide alarm attributes, filters, transitions, views (active and audit/calendar) as well as actions (acknowledgment, escalation, accelerations, etc.,); assign alarms and notification rules according to user role

- Use logical operators (AND, OR, NOT) to create logic between alarms so notifications are sent only after conditions of related alarm are met; no notification sent if action is no longer needed

- Suppress alarms so users won't need to spend time receiving and checking notifications from devices that send erroneous, intermittent alarms

- Use Summary View to see what alarm merits immediate attention and Timeline View to see alarms side-by-side to understand their context, cause and relationship, if any

2.2.1 Track Consumption in Real Time For Better Efficiency

- Use the unified dashboard to see real-time data, energy usage and operating efficiency together; key information helps determine system peak performance, maximize energy usage and minimize energy waste

- Customize dashboards so users can enter data manually if the data center is not properly instrumented for measuring total facility or IT load

- Gauge efficiency and comply with current and historical industry- approved efficiency metrics (Compute real-time power consumption (kW/hour) for a device or a group of devices and determine ways to balance capacity and demand within the data center

- Eliminate readings from one or more devices when making PUE and DCIE calculations in a mixed-use (office space + data center) data center facility

- Configure source and currency details that facilitate utility cost calculations at the system and unit levels so you can determine actual costs and not just consumption

- Understand capacity usage to ensure business-critical services are always running while lowering operating costs; roll out measures to improve peak performance

2.2.3 Thermal Visualization to identify hot and cold spots

- Generate 3D thermal heat maps with a customized temperature scale to display areas that are normal, hot or cold.

- Temperature scale may be defined to include up to six colors to indicate the temperature based on sensor input.

- The cover map view displays the heat map at the surface plane of the target device, which may include racks or other critical equipment.

- The layer map shows one, two , or three horizontal planes across the floor plane.

- Horizontal planes are located at 26", 52" and 78"

- The cover map and the layer may be viewed separately or at the same time.

- Real-time visualization allows the user to pinpoint hot spots instantly – saving time, eliminating headaches, and enabling the user to monitor real time conditions

- Eliminate hot spots for preventing downtime and damage to IT equipment

- Monitor and reduce cold spots to utilize cooling resource more effectly to reduce waste and decrease cost.

- Save and print thermal maps to easily communicate the condition and status

2.2.4 Manager Thermal Capacity at the Rack and Room level

- Find the capacity you never knew you had by using Net Sensible Cooling Capacity over name plate value

- Improve your accuracy by up to 100% to know where to place IT equipment at that rack and room level

- Unlock stranded capacity by calculating your true capacity in a dynamic environment

- Use the Thermal View to display all your racks at one location and compare the thermal load and well as the heat load for each rack.

- View and compare all your cooling units in one location

- Drill down to the Service Processor temperatures inside your equipment and find out if you are violating the manufacturing warranties.

- Avoid surprises and prevent running out of cooling

- Improve planning and inventory planning

- Analyze and compare differing cooling units anywhere in the system

2.2.5 Reduce Wasted Cooling and Airflow

- Use the thermal capacity drill down reports to analyze utilization over time to determine if you are overcooling the data center

- The Cooling Capacity Factor report compares cooling utilization with the heat load generated. A ratio is assigned to each room for easy comparison and to determine if they are balanced. Eliminate waste by balancing your utilization with the actual heat load.

- Monitor unused airflow that is blowing right through empty racks or wrapping the rows to eliminate wasted power.

2.3 Maintenance

- One year Silver Support maintenance included

Technical Contacts*	3
Response Time[2]	Based on Severity level: 1, 2 = 4 hours 3, 4 = 12 hours
Follow Up Time[2]	Based on Severity level: 1 = Every 8 hours 2 = Every 2 days 3, 4 = Every 5 days
Phone Support	8 hours, 5 days a week (Monday- Friday)[3] Support available in English, French, Japanese, German and Mandarin

[1] Start date is date of purchase

[2] Communication is via email or phone. Response times are based on initial phone contact.

[3] Local operations center time (Local support centers: Philippines and China in APAC, Romania in EMEA and Florida in North America).

2.4 Installation and Service

Avocent® Professional Services uses a building block approach to build and quote Statements of Work. The following information provides detailed descriptions of the service components outlined in the "Services Scope" the SOW.

2.4.1 *Trellis™* Platform Installation

Avocent Professional Services uses a building block approach to build and quote Statements of Work. The following information provides detailed descriptions of the service components outlined in the "Services Scope" the SOW.

2.4.1.1   01.50.02 *Trellis* Platform Base Installation – Thermal Management Solution

A. Project Kickoff

Avocent will conduct a Project Kickoff, which is a meeting to review the Statement of Work scope, the team involved and the overall objectives of the customer.

B. Pre-installation software workshops

Avocent will conduct a pre-installation software workshop with the appropriate Customer personnel to ensure that the Customer has all the necessary hardware and non-*Trellis* platform software installed and configured in advance of Avocent installing the *Trellis* platform software application.

C. Software installation and standard setup

Avocent® will install the *Trellis*™ platform into the Customer's environment and perform standard setup tasks for both the *Trellis* platform application and each of the associated modules. Avocent will perform the following:

D. Software installation

Avocent will perform the following software installation tasks:

- Execute a Pre-Installation Checklist to ensure that Customer has properly prepared the servers for *Trellis* platform installation prior to installing the *Trellis* platform

- Install the *Trellis* platform in Customer's environment

- Execute a Post-Installation Checklist to ensure that the *Trellis* platform was properly installed

2.4.1.2 *Trellis* platform application setup

Avocent will perform the following *Trellis* platform application setup tasks:

- Configure email or SMS, up to three (3) users.

- Setup user accounts, up to three (3) users.

- Create User Groups, and Roles, up to three (3) groups and three (3) roles.

- Spend up to one hour providing knowledge transfer covering:

  - Adding users and assigning roles.

  - Requesting and downloading symbols/element libraries.

A. Project Close Out

Avocent will perform a set of activities to bring closure to the project. It includes introducing the Customer to Avocent's Support department for post-implementation support, and gaining concurrence with the Customer that all the tasks defined within the Statement of Work have been performed.

B. Support Handoff

Avocent will perform the following Support Handoff tasks:

- Facilitate a call between Avocent Support and Customer

- Request that Support review with Customer the Support organizational structure, methods of contacting support, report logging system, and SLAs

- Request that Avocent Support create a Support Login for Customer (if one does not currently exist)

- Review with Customer the process for requesting Element Libraries

C. Project Close Out

Avocent will perform the following Project Close Out tasks:

- Review with Customer each of the tasks defined within the Statement of Work and the work that was completed by Avocent

- Discuss any further work that Customer may wish to consider

2.4.1.3   01.51.02
Floor Plan Import – Thermal Management Solution

Avocent will import and set up an existing data center floor plan drawing in the *Trellis* platform for all Customer environments within the scope of this Statement of Work. A floor plan is defined as a single level within a single building location. A single floor plan can contain multiple rooms as long as they are all on the same level. A data center containing multiple levels will require a floor plan component for each level. The standard file types (.VSD, .DWG, or.DXF) are supported, as are up to two revisions of the floor plan. Avocent assumes all drawings and data provided by the Customer are accurate and complete. This includes Data Center floor plan drawings, which Avocent assumes to be to scale and architecturally (walls, columns, grid, etc…) correct. Customer is responsible for the accuracy and relational integrity of all data provided to Avocent.

2.4.2 *Trellis* Site Manager Installation

2.4.2.1   03.50.01
Trellis Site Manager Base Configuration – Thermal Management Solution

A. Trellis *Site Manager workshop*

Avocent will conduct the *Trellis* Site Manager and *Trellis* Thermal System Manager workshop, which is a meeting (or series of meetings) covering the following:

- *Trellis* Site Manager Scope

- Review Site Scope Document to validate that all devices that are to be monitored are ready for monitoring.

- Review devices to be monitored and protocols to be used

- Determine protocol settings for each monitored device

- Determine monitoring intervals and thresholds

- Determine notifications

- Determine roles and access rights

NOTE: This assumes monitored devices are set up as part of *Trellis*™ Site Manager.

B. Pre-installation hardware workshop

Avocent will conduct a pre-installation hardware workshop with the appropriate Customer personnel to ensure that the Customer has performed the necessary tasks to ensure that the Customer's network and target devices are configured in advance of Avocent installing Avocent hardware.

C. Trellis *Site Manager configuration*

Avocent will complete initial configuration of the *Trellis* Site Manager module with a single Avocent Universal Management Gateway appliance (if applicable).

Avocent will spend up to five hours covering the following *Trellis* Site Manager tasks:

- Running/Filtering *Trellis* Inventory Manager reports

- Locating Device in Inventory

- View and Edit Device Properties

- Place a Device in Maintenance Mode

- Define /modify monitoring intervals and thresholds

- Define/modify notifications

D. Trellis *Site Manager assumptions*

- Each of the monitored devices will be identified by manufacturer, model and serial number prior to implementation.

- The devices to be monitored must be in a monitorable state and support one of the following protocols: BACnet/IP, Modbus/IP, SNMP, or Velocity. Any devices that are not in a monitorable state will be excluded from the implementation. This solution does not include devices that are monitored through an intermediate system such as a BMS or SiteScan.

- Any hardware, upgrades, or networking required for connectivity to monitored devices must be in-place prior to *Trellis* Site Manager implementation. For any devices requiring monitoring which are not ready in their current state, Avocent/Vertiv can provide products and services to ensure monitoring readiness at an additional cost and require a signed Change Order.

- Any changes made to the monitored devices between the time of the site survey and the implementation need to be communicated to the Avocent implementation team.

- Any changes made to the monitored devices that affect the ability of the *Trellis* platform to receive monitored data either during or after implementation are the responsibility of the Customer.

- Any devices that have not been identified as part of this monitoring implementation will be addressed using a Change Order and may result in additional costs to the Customer.

NOTE: Monitorable state is defined as the device being powered, functional, physically connected to network or monitoring gateway, locally configured (e.g. IP address and unit settings set) and pingable from the network hosting the Universal Management Gateway device.

2.4.2.2   03.51.02
Element Libraries – FMD
– 1 – Thermal Management Solution

Avocent will manage the Element Library request process from initial device parameter gathering, order processing, follow up, deployment and testing for up to five (5) unique floor mounted devices. For example, floor mounted devices include power distribution units, remote power panels, computer room air conditioners and generators. The remaining 25 floor mounted devices must already exist in the *Trellis* Platform Master Element Library.

2.4.2.3   03.52.00
Avocent Universal Management Gateway appliance Physical Installation & Configuration – Thermal Management Solution

Avocent will enroll and configure the *Trellis* platform Avocent Universal Management Gateway appliance into the Customer's environment(s). This service does not include configuring monitored devices.

Avocent will perform the following hardware configuration tasks:

- Connect power cable (cabling outside the rack is to be in place by Customer)

- Connect network cable (cabling outside the rack is to be in place by Customer)

- Power up appliance and configure basic network parameters

- Add appliance to the associated *Trellis* platform modules

- Spend up to two hours providing informal knowledge transfer to both demonstrate as well as allow the Customer to access the Avocent Universal Management Gateway appliance (content will be based on user experience).

A. Avocent® Universal Management Gateway appliance Configuration assumptions

- Customer shall install (rack-mount) the Avocent Universal Management Gateway appliance

- All hardware and wiring from monitored equipment to monitoring devices shall be installed and connected prior to installation of the *Trellis*™ Platform by Avocent Professional Services Consultants.

2.4.2.4   03.53.00
Monitored Devices – 30 – Thermal Management Solution

Avocent will configure up to one hundred (100) monitored devices in the *Trellis* platform, test the EL to ensure they are collecting the proper data, and validate that the collected data matches readings on the device. The 100 devices will include up to 30 floor mounted devices and a combination of up to 70 rack PDUs and rack sensors.

Avocent will configure target devices that are either, physically or logically, connected to the Avocent® Universal Management Gateway appliance. The device types have different configuration considerations and readiness requirements outlined below.

A. Serial target configuration:

- Physical connection target device with patch cable and optionally required serial adaptor

- Name serial target device on Avocent Universal Management Gateway appliance

- Test serial device connectivity

B. RPDU target configuration:

- Physically connect the rack mounted PDU to serial port

- Name serial target device on Avocent Universal Management Gateway appliance

- Test serial device connectivity

C. Appliance sensor configuration:

- Physically connect supported sensors terminated at the Avocent Universal Management Gateway appliance

- Configure appliance sensors on Avocent Universal Management Gateway appliance

- Test sensor operation

- Setup and configure Wireless Gateway to include attached wireless sensors

- Map sensor information including ID, location, name to Wireless Gateway.

- Setup wireless sensors for *Trellis* monitoring. Include Wireless Gateway sensor ID name and protocol information.

- Start-up and configuration of wireless sensor and wireless gateway.

D. Customer responsibilities:

- Provide clear unobstructed access to each rack.

- Cabling between target devices and an Avocent Universal Management Gateway appliance is the responsibility of the Customer. Target devices to be physically connected with cables terminated at the Avocent Universal Management Gateway appliance. Avocent will physically connect only cables that are at the Avocent Universal Management Gateway appliance.

- Physically install wireless sensors to the desired racks. Sensors ideally will be installed at the bottom (26"/66cm), middle (52"/132cm), and top (78:/188cm) heights above the floor/raised floor at each rack location.

- The Customer should provide unique device naming for each target device that will be configured.

- Moves, adds, and changes after initial mounting will need to be treated as an exception and agreed upon by Avocent as this may incur additional costs and will require a signed Change Order.

2.4.2.5   03.54.00
Alarm/Alert/Monitoring Rules & Notifications – 25 – Thermal Management Solution

Working with the Customer, Avocent will configure and test up to twenty-five (25) total of any combination of alarms, alerts, notifications and/or rules.

2.4.3   Value Training Services

2.4.3.1   11.50.02
Value Training Services– Thermal Management Solution

Avocent will provide Value Training Services to include eight (8) hours of a senior consulting engineer's time and one (1) hour of project management. During this time standard *Trellis* Platform reports for Site Manager specific to Thermal Management will be overviewed. Customer will be shown how to run and filter specific monitoring reports.

2.5 Floor Mounted Device (FMD) License and Scope

- *Trellis*™ Quick Start Monitoring solution is licensed by the number of Floor Mounted Devices. FMDs include racks or any devices that occupy floor space, like cooling units and UPS units.

- This package includes support for up to 30 FMDs which can be any combination of racks, cooling & power units.

- Devices are components or equipment that fit inside the FMD, like IT servers or rack PDUs. These devices are not included in the FMD count.

- The professional service scope is limited to monitoring 100 devices. The *Trellis* Quick Start Monitoring package license includes an unlimited number of devices but service will only setup and configure up to 100 devices.

- Additional FMD licenses can be added at any time.

3.0 Hardware Specifications

3.1 Server Specifications

Trellis Quick Start Thermal Management solution can be operated on a virtual or physical server platform.

The specifications below are for the current server specifications requirements:

DATA SIZE GUIDELINES	SMALL	MEDIUM	LARGE	ENTERPRISE
Concurrent users	10	20	50	100
Devices	2,000	20,000	100,000	200,000
Power Connections	1,000	10,000	60,000	100,000
Data Connections	2,000	10,000	60,000	100,000
Monitored Datapoints	1,000	10,000	40,000	140,000

FRONT MACHINE	SMALL	MEDIUM	LARGE	ENTERPRISE
CPU manufacturer	Intel®	Intel®	Intel®	Intel®
CPU model	Xeon®	Xeon®	Xeon®	Xeon®
CPU speed (GHz) 8 M L3 cache	2.6	2.6	2.6	2.6
CPU count	1	2	2	2
CPU cores	4	4	4	8
Memory (GB) DDR3 1333 MHz	32	32	40	44
Disk throughput	> 500 MB/s (sequential) [uncached]			
Storage	300 GB Enterprise class			
Ethernet	> 80 MB/s			

BACK MACHINE	SMALL	MEDIUM	LARGE	ENTERPRISE
CPU manufacturer	Intel®	Intel®	Intel®	Intel®
CPU model	Xeon®	Xeon®	Xeon®	Xeon®
CPU speed (GHz) 8 M L3 cache	2.6	2.6	2.6	2.6
CPU count	1	2	2	2
CPU cores	4	4	4	8
Memory (GB) DDR3 1333 MHz	24	32	32	32
Disk throughput	> 500 MB/s (sequential) [uncached]			
Storage	*300 GB Enterprise class for base installation			
Ethernet	> 80 MB/s			

TOTALS	SMALL	MEDIUM	LARGE	ENTERPRISE
Total CPUs	2	4	4	4
Total cores	8	16	16	32

*Hardware sizing varies depending on usage requirements and is performed by Professional Services.

Operating Systems

The *Trellis*™ platform supports the following operating systems and software. One of the following operating systems must be installed on both the front and back machines:

- Microsoft® Windows® 2008, R2 SP1 Enterprise, 64-bit (full installation)

- Red Hat® Enterprise Linux® version 6.4, 6.5 or 6.6, 64-bit

3.2 Avocent® Universal Management Gateway 4000 Specifications

3.2.1 Features

A. Serial target configuration:

- IPMI 1.5, IPMI 2.0
- HP iLO
- Dell DRAC, iDrac
- Cisco UCS-C
- FSC iRMC
- IBM RSA, IBM Bladecenter
- Sun ALOM, Sun ILOM, Sun eLOM

B. Server Management

- Console access via SoL and vKVM
- Console data logging (local, NFS, Syslog)
- Power on/off/cycle/status support
- Graceful shutdown support (IPMI only)
- System event logs (SEL)
- Hardware environmental sensors
- Alert management
- Platform event traps (PET)

C. User Interface

- Built-in Consoles
  - Secure WebUI
  - CLI/SSH
  - VGA
- SSH
- Local VGA and USB access

3.2.2 Specifications
3.3.3   3.3 Wireless Sensors

A. Mechanical

Size (W x D x H): 1.70 in. (43.1 mm) X 17.1 in. (434 mm) X 20.0 in. (508mm)

Weight: 26 lbs (11.7 kgs)

B. Environmental

Ports/Connections

Device Ports: 40 RJ45

Device Port Type: Auto-sensing (except the 2000, 32 SP)

C. Power Supply

Dual Internal (redundant) AC Input Range: 100 – 240V

D. Power Usage

UMG 4000

120V 1.15amp, 240V 0.68amp

* Please see most recent release notes for exact firmware versions supported

3.4 Wireless Gateway

3.4.1 EMC performance shall comply with EN61326-1:2006

The wireless gateway shall be designed to operate in the following environments:

Ambient Dry Bulb Temperature Range: -40°C to 75°C (-40°F to 167°F)
Relative Humidity Range: 0% to 100% (non-condensing)

3.4.2 Wireless Gateways

The Liebert® iCOM-S™ enclosure shall provide 24VDC screw terminal phoenix connector for remote powering of up to 16 Vertiv approved/supplied wireless gateways

3.4.3 Wireless Gateways

The wireless gateway shall process wireless radio sensor information for the purpose of communication and security to provide enhanced unit control and information that will be used in thermal visualization. The wireless gateway shall be constructed of 0.70 lb Polycarbonate housing may be mounted on Top hat rail EN 50022. The gateway antenna shall be a 2 dBi rubber dipole with SMA male connector and shall support external antenna options. The wireless gateway shall be able to support at maximum 100 wireless radios (300 temperature sensors and 100 battery values)

3.4.2 Wireless Gateway Power

The input voltage shall be 10.5-30 VDC.

The power consumption shall be 3 Watts and be supported via 24VDC transformer power connection on bottom of iCOM-S enclosure.

The radio frequency power output from Antenna is a maximum of 10 mW (10 dBm) EIRP

3.4.2 Wireless Gateway Communication

The wireless gateway shall provide two Ethernet ports for dual communication paths. The iCOM-S shall use one of these ports. The other port can be utilized by monitoring solutions including Liebert SiteLink/SiteScan, Liebert Trellis, or 3rd party BMS system