Hobart Data Center Consulting
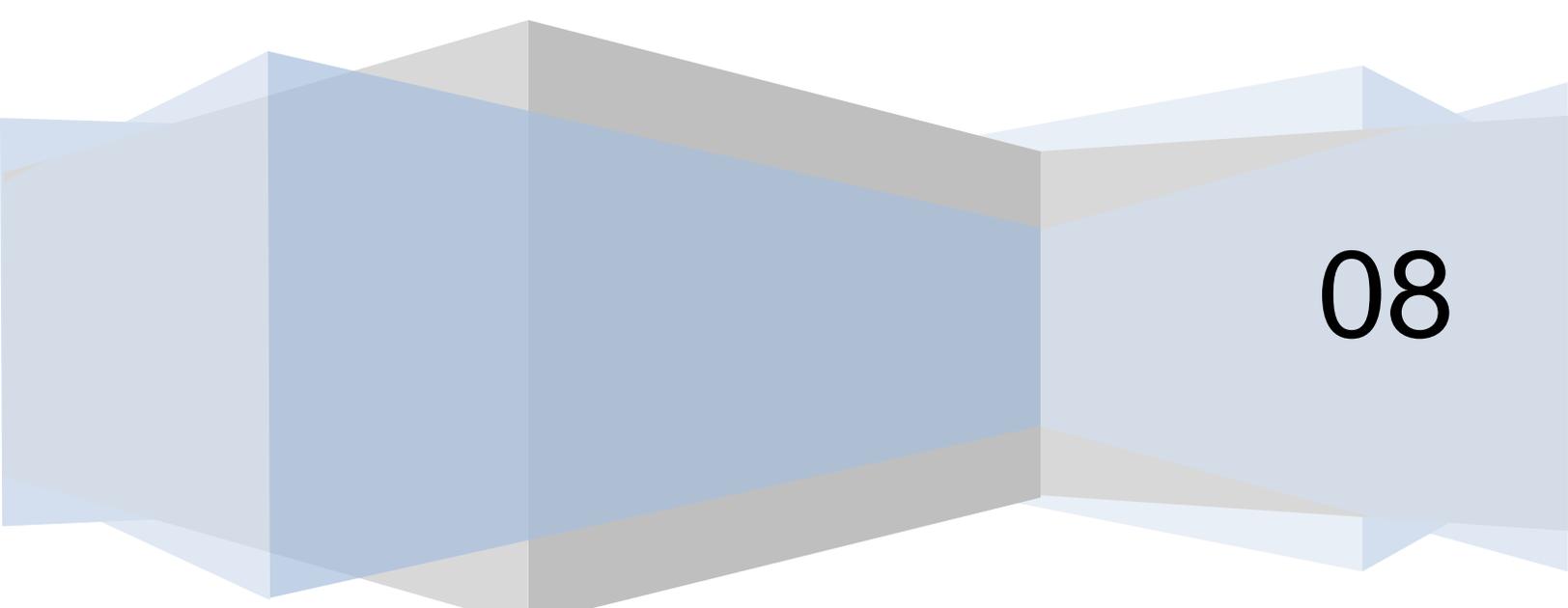
ServerTech PDU

Evaluation of the ServerTech "Smart" PDU for use in Enterprise Data Centers

Chuck Hobart

08

Windows Live
Global Foundation Services

DCOS Power Strip

Technical Analysis Report for ServerTech

Specifications

General Information

Manufacturer	Server Tech
Manufacturer Part Number	Sentry-Prototype
Manufacturer Website Address	www.servertech.com
Brand Name	ServerTech
Product Line	Ethernet Meter (EM)
Product Series	EM Serial # Prototype 006
Product Type	PDU (In Rack Power Distribution System)

Technical Information

Input Receptacles	1 x NEMA L6-30P
Output Receptacles	12 x IEC-60320-C13 4-IEC-60320-C19

Power Description

Input Voltage	208 V AC
Current	30A
Frequency	60 Hz

Management

Management	**Protocols:** • DHCP • HTTP • HTTPS (SSL/SSH) • ICMP • TCP/IP • SMTP/POP3 • SNMP • CSV/Plain Text • Telnet • LDAP • TACACS+ • XML Firmware version

Interfaces/Ports

Interfaces/Ports	1 x RJ-45 1-RS-232 10/100Base-T Ethernet 2- sensor ports

Physical Characteristics

Form Factor	0U Rack-mountable
Weight Dimensions	18 lb 55.5" x 1.75" x 3.5" (L x W x D)

Miscellaneous

Package Contents	• One 24 outlet strip • Instruction set • Rack Mount Brackets • Controller
Certificate/Authority	• FCC Part 15 Class A Conformance

	•	RoHS Compliant
UL Certification	•	Not available until 6 to 8 weeks past acceptance of prototype
Warranty		
Standard Warranty	•	2 Year Limited

Model Under Test:

> ServerTech- Sentry Prototype
> Dimensions: 55.5" x 1.75" x 3.5"
> List Price $ - Up for negotiation

Rating: (from the comparative requirements spreadsheet) **92.29**
Out of 100

Overview:

The ServerTech (in rack) power distribution unit is a zero U vertical power strip. The device is expecting approval by the Underwriters Laboratory in early February of 09. (Based on MS's acceptance of a prototype). It comes in a variety of configurations; the test configuration is a prototype model. ServerTech has the ability to manufacture for diverse electrical environments present in Europe, Asia, Australia and the Americas. The strip is a zero "U" meaning it mounts vertically in the back of the rack and doesn't utilize any of the in-rack u-space. There are a number of brackets that ship with the strip that allow for mounting on a number of standard racks. The predominate mount, is the slide button. The strip, while narrow, does project out about 3 inches into the rack when mounted.

The strip has an 6 foot main power input cable. The length can be ordered in different sizes. The cable uses 10 gauge stranded copper wire which is more than adequate for the maximum load. The cable is also available as a plenum rated cable where it is required per local code. There is a separate order number for plenum rated devices. The power plug on the unit is a NEMA L6-30. The strip is also available in an NEMA L5-30, L5-20 and L6-20. There is a 3 phase unit with a NEMA L21-30. This model could supply 72 Amps of 208 volt power to a rack if the upstream PDU could provide that much power. That is almost 15,000 watts.

There are 12 ports of IEC-60320-C13 receptacles. There are also 4 ports of IEC 60320-C19 receptacles. Each port is monitored as well as having external power on/off capability. The production unit will have 24 ports of IEC-c13 ports. The ports also have a "memory" that is, the ability to recall their state at power up and to stagger the power up of the ports to limit surge and not stress the breakers. The startup order can be modified. There are 2 sets of breakers at the middle and bottom (near the input cord) the breakers are magnetic and will only reset. They cannot be accidentally tripped. The metal housings are solid and take concentrated effort to open. To reset they are rocked back into position.

Configuration:

The strips are configured through a simple start up procedure starting with a telnet app like Hyper Terminal and then the default access info allows the setup to include either a static IP or a DHCP connection. There was some difficulty in the original setup as the DHCP was not acquired on the first try. This analyst recommended they increase the time to acquire to greater than 30 seconds and more than one attempt. This firmware was updated and the DHCP-IP was acquired. There are two ports to use in the setup. The first port is for the network connection and there is a second port for a RJ45 to serial. This connection to a portable PC will only work if the connection is done with a silver satin type cable. Once the set up is complete (This tester connected using a serial port on his laptop to the RJ 45 on the strip) then the strip can be connected to the network using standard RJ45 patch cable. Once on the network the strip can be accessed by a Telnet application like Hyper Terminal and the URL is the IP address. If the config is ineffective or changes have to be made it is possible to reset to factory standard by rebooting from the URL. The strip has one display. This shows total amps of the strip.

These outlets have a series of power LED's that cycle through green (on) or black (off) .

The unit uses the type C Trip circuit breaker. It also has a beeper in the strip that will alert if the main circuit board reaches a temp of 176 degrees F. The alert will cease when the circuit breaker has been reset or and the temp of the controller board is less than 158 degrees F.

The Browser is opened and the IP address entered as the URL. The screen shows a sign up and authorization. Once in there is a security username and password to access the strip.

URL:

The main screen opens to a side menu and a display of individual outlets. The side menu has 5 entries. They are **Outlet control, Power monitoring, Environmental monitoring, Configuration and Tools.**

The outlet page shows the outlet ID, name, status, load in amps, power in watts, control state and control action.

Menus:

Outlet Control

This menu has 2 functions, the individual function and the group function. The individual function provides a single screen that shows the outlets. The outlets have an outlet ID (useful for future automated activity like power shedding), there is an outlet name (24 characters), Outlet status (on, off), the load in amps and the load in watts, the control state (on, off, idle on) and lastly the Control Action (none, On, Off and reboot). The bottom of the screen has two push buttons that allow for Apply and Cancel.

The screen is well laid out and easy to interpret. There is good spacing and the 24 character naming convention allows for the standard naming convention. This meets the requirements. There is also a refresh option which seems a tad slow but not a real issue. The Details selection in the Power Outlet column is excellent design. When selected it provide in depth overview of the power port. The information provided includes

Outlet ID
Outlet name
Outlet Status
Control State
Capacity in Amps
Load in Amps
Voltage (to one decimal point accuracy)
Active Power in Watts
Apparent Power (VA)
Crest Factor*
Power Factor

This screen is automatically refreshed every 10 seconds. This is a nice feature for testing and analysis. The capacity in amps is also quite valuable to capacity planning as new loads are brought on the capacity drops and a DCM could easily check a location for power capacity prior to assignment of equipment.

The other screen called **Group** has a lot of potential for control. Groups can be defined in the configuration and they can allow members of that group to have access to specific ports based on access and passwords. When a group is defined and accessed the user only sees the ports that he/she has access to. It is also possible to assign a single port to a group and then make that group available to many users. It would be a good design change, to have the group mirror the capabilities in **Individual** for enhanced control of single ports. The controllers allow for grouping with other strips which would be valuable for rebooting dual attached servers.

Power Monitoring

Under power monitoring there are three sub menus. They are **Input feeds**, **System** and **UPS**.

The **Input feeds** menu shows a ten second view of the input to the power strip. It is automatically refreshed and provides:

Input Feed ID

Input Feed Name (definable)

Input Status

Input Load, voltage and power (in watts)

This is basically a snapshot of the input power.

The **system** menu provides:

Total power consumption (in watts)

Total Area (square meter)

Watts per Area Unit

This is a somewhat antiquated screen. Most new DC's are rack based, not square foot based. This screen simply takes the total load and divides it into the total area to provide a - watts per square foot value. This is not used much anymore in DC design. A better algorithm might be to divide the total load by the number of devices in the rack. This would provide average watts per device and could be compared against other racks. This may identify efficiencies in the DC to emulate.

The **UPS** menu provides:

> Index
>
> Type
>
> Status
>
> Voltage
>
> Host/IP

This menu provides upstream info on the UPS system that supplies the on floor PDU. It's a nice feature, but not required. It could be used in a mapping exercise on dual attached server to ensure the power source is truly redundant.

Environmental Monitoring

This is an image that shows the 2 temperature and humidity probes. They have 10 foot cords to be placed within that radius. The test strip didn't have these sensors so no details are included. They are available.

Configuration:

The configuration menu is large and robust; it covers many of the more obscure functions. The various menu items include:

System
Network
Telnet/SSH
HTTP/SSL
Serial port
Towers
Input Feeds
UPS
Outlets
Shutdown
Groups
Users
FTP
SNTP/Syslog
SNMP/Thresholds
LDAP
TACACS+
Email
Features

System

The system menu provides firmware info, network info and MAC address. It is also indicates that the strip has an impressive 2 Meg of storage as well as the uptime in days, hours, minutes and seconds. The location can be defined, as well as the Display Orientation. This is useful if the input power feed is from above. There are other items like strong password and temperature protocols available.

Below the main system config menu is a naming section that allows the user to establish names for the device ports (power, serial, environmental and sensor). These fields support up to 24 characters. (Note: The naming convention only supports printable characters and no spaces.)

Network

The network provides data on the standard network information. This includes link, speed, Duplex and negotiation for connecting to the serial port and the ability to set up DHCP or static IP and the corresponding information.

Telnet/SSH

This is very basic and allows the user to select port and the ability to enable or disable Telnet and SSH.

HTTP/SSL

This is similar to the above. It allows the user to enable or disable the HTTP server and establish the comm port number. There is also an authentication level of Basic or MD5. For the SSL, the server can be enabled or disabled and secure access may be set to optional or required.

Serial Ports

The serial port configuration is simply the ability to set the data rate and the connection timeout, very basic. There is also the ability to edit a serial port.

Towers

The Towers configuration is very simple and only allows for naming the strip. However, the serial number model number and some electrical info are presented. Through SNMP, this would allow for a simple inventory process.

Input Feeds

This is another basic menu. It allows for naming the strip and would be useful for defining primary and secondary feeds. There is also a prefilled in location for input voltage and load capacity.

UPS

This allows for the association of a UPS to the strip (a typical data center practice). The manufacture is selected from a drop down and the Hostname/IP is entered. Once this is complete the user may edit the info on the UPS.

Outlets

Outlets show all the physical outlets and their current status and their post on delays. It also allows for the editing of the power port. Each port may be assigned a name, a wake-up state (on, off, last) and a Post-on delay up to 999 seconds. The menu also offers a shutdown configuration.

Groups

The groups menu simply allows for the creation of a group name. It is possible to name a group for each port and then add members to that group name to control access. Once a group is created it is possible to edit that group to provide which ports are included in the group.

Users

The users menu provides a way to set up users and links in to AD. Once a user is created a login and password must be created as well. Again, once a use is created the ability to edit that user exists as well. This menu also allows users to be deleted. This may be minor as LDAP may be the way to handle these types of admin functions.

FTP

The FTP menu has a small number of sub menus for the configuration of FTP. There is a *Configure FTP client* option, a *Configure FTP automatic update* option and a *Configure FTP Server* option. The online pdf goes into detail on the setup of these items.

SNTP/Syslog

This allows the setting up of a time server for syncing with the log. If this isn't set up the log shows events but without a time stamp. This is the menu that allows for a setup of the time server and includes the usual GMT offset. There is also a Syslog primary host, secondary host and port selection. The default port is 514.

SNMP/Thresholds

The SNMP setup includes the usual agent, Get, Set, Trap, Error trap timing, destinations etc. There is also a configuration option for traps on the strip, input, outlet, environmental and sensors.

LDAP

The LDAP is the configuration for the MSAD tie in. There is also a LDAP group the once created can be modified based on rights. The access level options include:

View Only
On Only
Reboot only
User
Power User
Admin

TACACS+

Is a protocol which provides access control for routers, network access servers and other networked computing devices via one or more centralized servers? TACACS+ provides separate authentication, authorization and accounting services. The TACACS+ configuration allows for options, authentication configuration and establishing privilege levels.

Email

This is standard email configuration that will send an outgoing formatted e-mail if a threshold is breached. There is room for a primary and a secondary address and the events, authorizations, power and configuration can be included.

Tools

The tools menu only has four functions; they are ping, change password, view log and restart

Ping

Ping is just the standard tool except rather then get the actual ping references you get a statement that the IP is responding.

Change Password

This is the standard Change Password config with verification.

View Logs

The view log is just a portal into the logs. The logs are quite extensive and show the log number, time (if connected to a time source) and every action a specific user or the unit it performed. An example of the log:

AUTH: User "ADMN" logged in -- connection source 10.88.144.37 using HTTP

This is a nice feature and very robust. It looks like any activity would be accountable and with the AD and clock tied in, it would be possible to know who did what, when. This shows great accountability and security. Impressive.

Restart

The restart function allows for a series of reboots. They include:

None
Restart
Restart and reset to factory defaults
Restart and reset to factory defaults except network
Restart and download firmware vie FTP
Restart and generate a new X.509 certificate
Restart and compute new SSH key

Once selected, these choices have to be applied so there is an extra element of security.

Power Outlets:

The outlet themselves are the standard IEC 320-C13's. The test unit also has some C-19's. The strip can be mounted upside down as well. This is a prototype so there is an expectation that the sockets themselves will be numbered on the strip so that it can correspond with the software, currently there isn't any socket numbering that this user could see. There is a LED embedded in each socket that shows its current state.

Alerts:

Alerts are sent as e-mails, this strip could be used with a small bit of programming to reduce its own load if it approaches a strip level threshold.

Accuracy:

According to the published specs this strip is 98% accurate. Based on the 208V unit, that would be a 203.84 to 212.16 volt range with a variance of 4.16 volts. On the circuit level this turns out to be .17 volts per outlet accuracy. On the amperage the values are recalculated into watts. A test bed was set up and three servers were connected to various ports. A calibrated Fluke Ammeter was connected to 3 of the 3 servers and the stress software "SANDRA" was calibrated to processor activity. SANDRA runs the processor from 0% to 50% of capacity. Readings were locked in on both the ServerTech output and the Ammeter at the same moment. Ideally the readings would be the same. The Ammeter was calibrated about 30 days ago and is believed to be accurate. SANDRA was started on the set of test server and run up to 50 % of capacity and the following tables show the results. The test was repeated on the same server to indicate how well the measurements repeated. This was then performed on a second and third server in the same manner. The table below shows the percent of test completed (read as increasing processor activity) and readings taken at that point. The first column is watts which is the amps times the volts times the PF. Watts measures power use.

The deltas are the differences between the readings of the calibrated Ammeter and the ServerTech PDU. The percent of accuracy is the calibrated meter difference in percent from the ServerTech PDU readings and the Calibrated Fluke Analyzer. ServerTech claims that they are 97% accurate. Based on the just the volt amp readings that is more than true. The testing actually shows a higher accuracy value and also a faster response time then the Fluke digital multimeter. When the percentages are totaled and the average taken, **the overall accuracy of the strip is 99.29% or rounded to 99%**

Test Results:

The test setup consists of 3 servers and 3 drive bays and the ServerTech unit. The primary strip was connected to the three servers. This was the unit under test. The strip was connected to a NEMA L6-30 receptacle. The servers were all loaded with the SANDRA and IOMeter application. The "SANDRA" power management efficiency test and readings were taken from each of the active ports of the active server at different completion levels of the tests. The readings correspond with 10, 20, 30, to 50 % of completion. This test runs the processor up to about 50% percent. This was done in 10% increments. The chart below shows the values by server on the primary in watts.

This indicates that the repeatability is quite good. The largest deviation may have been operator error. If that is dropped the repeatability is great. With a stronger test suite I believe the repeatability would prove excellent.

Server Tech Accuracy Test

DCOS Test 1			STRIP			METER	STRIP	METER	
Percent	Test 1	Test 2	Test3	Test 1	Test 2	Test3	Average	Average	DELTA
Processor	Watts	Watts	Watts	Watts	Watts	Watts	Watts	Watts	Watts
10%	94	95	96	95	96	96	95.00	95.67	0.67
20%	96	98	97	97	97	98	97.00	97.33	0.33
30%	98	99	99	99	99	99	98.67	99.00	0.33
40%	101	102	101	102	102	102	101.33	102.00	0.67
50%	103	103	104	103	103	103	103.33	103.00	0.33
DCOS Test 2							Average Delta		0.47
Percent	Test 1	Test 2	Test3	Test 1	Test 2	Test3			
Processor	Watts	Watts	Watts	Watts	Watts	Watts			
10%	116	115	115	118	117	116	115.33	117.00	1.67
20%	119	119	119	120	120	120	119.00	120.00	1.00
30%	123	123	123	123	124	124	123.00	123.67	0.67
40%	124	124	125	125	125	126	124.33	125.33	1.00
50%	125	126	124	126	126	125	125.00	125.67	0.67
DCOS Test 3							Average Delta		1.00
Percent	Test 1	Test 2	Test3	Test 1	Test 2	Test3			
Processor	Watts	Watts	Watts	Watts	Watts	Watts			
10%	100	100	98	99	100	99	99.33	99.33	0.00
20%	103	104	101	102	102	101	102.67	101.67	1.00
30%	101	102	103	103	103	104	102.00	103.33	1.33
40%	105	106	105	105	106	106	105.33	105.67	0.33
50%	106	109	108	108	110	107	107.67	108.33	0.67
							Average Delta		0.67
							Total Delta		0.71
							Average Accuracy		**99.29**

Repeatability

ServerTech Repeatability Test

Test Server	Strip	Base	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%		
		watts												
DCOS Test1	P	93	93	96	94	95	94	100	95	97	100	107		
DCOS Test1	P	94	94	95	94	95	94	100	99	99	103	103		
DCOS Test1	P	94	94	94	93	96	97	101	98	98	**104**	106		
	Average	94	94	95	94	95	95	100	97	98	104	105		
	Skew	-1.73	-1.73	0.00	-1.73	1.73	1.73	1.73	-1.29	0.00	0.72	-1.29	-0.17	
	Std Dev	0.58	0.58	1.00	0.58	0.58	1.73	0.58	2.08	1.00	4.04	2.08	1.35	
DCOS Test2	P	113	113	114	115	117	116	121	119	119	122	124		
DCOS Test2	P	113	113	115	114	118	115	119	120	119	122	126		
DCOS Test2	P	112	112	114	114	116	116	118	121	120	124	126		
	Average	113	113	114	114	117	116	119	120	119	123	125		
	Skew	-1.73	-1.73	1.73	1.73	0.00	-1.73	0.94	0.00	1.73	1.73	-1.73	0.09	
	Std Dev	0.58	0.58	0.58	0.58	1.00	0.58	1.53	1.00	0.58	1.15	1.15	0.85	
DCOS Test3	P	97	97	95	96	101	103	101	97	106	111	111		
DCOS Test3	P	96	96	95	99	101	102	98	99	107	111	112		
DCOS Test3	P	97	97	94	97	99	104	99	97	105	110	113		
	Average	97	97	95	97	100	103	99	98	106	111	112		
	Skew	-1.73	-1.73	-1.73	0.94	-1.73	0.00	0.94	1.73	0.00	-1.73	0.00	-0.46	
	Std Dev	0.58	0.58	0.58	1.53	1.15	1.00	1.53	1.15	1.00	0.58	1.00	0.97	

Average Skew	**-0.18**
Average Std. Dev.	**1.05**

Roadmap:
Environmental extensions
This unit will be available as a 24 port IEC320-C13
Possible larger memory
There are additional capabilities with the controller unit. This includes the ability to virtualize the strips such that separate PDU's may be grouped down to the port.

Environmental:
The strip has connections to supply two temperature monitors each and a humidity monitor. The temperature monitors are sensors on a 10 ft cable that allows placement to any part of the rack. The connection is an RJ12. There is also a temperature / humidity sensor that has the same physical characteristics.

Analysis:
The ServerTech meets and exceeds most of the specifications. However, there are a few areas that could be enhanced. It must be kept in mind that this is a prototype and ServerTech would be willing to upgrade the product for the right market. The unit is about **99%** accurate. It is also very good on repeatability. One small notation: The addition of printed port numbers on the strip would assist the DC tech to setup more efficiently. It is also understood that the commercial unit will have 24 ports, all C-13's.

The set up is relatively easy and straightforward. As mentioned above there was a firmware upgrade to allow better acquisition of a DHCP/ IP. The current product does support Active Directory. The logging is excellent and when connected to a time server produces an accurate record of who did what, when and all automated functions. The setup does not allow for a lower critical level for the strip. This could be modified with a software routine to detect the lower readings. When a port is selected the screen automatically refreshes every 10 seconds. Overall the ServerTech is excellent in most areas and very good for a first entry for a "Smart" power strip. The accuracy and repeatability approaches a scientific instrument and the architecture of the strip shows the current trends in data center design of homogenizing the environment. This PDU

could be used to tie into the cooling systems. The general construction of the GUI is professional and looks well designed and thought out. Security is solid and in general this is a solid PDU.

Ranking:

The ServerTech PDU has a ranking of **99.29** the strong points are international plug configurations, active control of all sockets, SNMP support at all levels, AD support, enterprise grouping, limit controls and notifications, authorization by socket, and the GUI.
On the negative side, this is a prototype and the strip should have port numbers printed on the ports.

Report End

Addendum
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$$C = \frac{|x|_{\text{peak}}}{x_{\text{rms}}}$$ **Crest Factor Calculation**