

**Architectural/Engineering Specification for an
Industrial, Managed, Cyber Protected
Ethernet Switch
TUNGSTEN**

This document is intended to provide performance specifications and operational requirements for the TUNGSTEN switch. It is written in a generic format. These specifications may be copied verbatim to form a generic procurement specification.

Senstar and the Senstar logo are registered trademarks of Senstar Corporation. The information in this document is subject to change without notice. Senstar reserves the right to make changes to product design or manufacturing methods, as engineering progresses, or as other circumstances warrant.

Copyright © 2014. Senstar Corporation. All rights reserved.

Part 1	General – 1Gbps, industrial, Managed, Cyber Protected, Ethernet Switch	4
1.1	System Summary	4
1.2	Submittals	4
1.3	Manufacture	4
1.4	Qualifications	4
1.5	Spares.....	5
1.6	Product Support.....	5
1.7	References	5
Part 2	ProduCt Description	6
2.1	General.....	6
2.2	Power Over Ethernet (PoE).....	6
2.3	Quality of Service (QoS)	7
2.4	Virtual LANs (VLANs).....	7
2.5	Security	7
2.6	Multicast	7
2.7	Redundancy	8
2.8	Loop Protection.....	8
2.9	Management.....	8
2.10	SNMP.....	10
2.11	Alarms	10
2.12	Security	10
2.13	License.....	12
2.14	Indicators	12
2.15	Voltage input.....	12
2.16	Enclosure.....	13
2.17	Environmental.....	13
2.18	Regulatory Requirements	13
2.19	Standards	13
2.20	System Manufacturing Quality Requirements.....	14
Part 3	Execution	15
3.1	Site Assessment	15
3.2	System Installation.....	15
3.3	Training	15

PART 1 GENERAL – 1GBPS, INDUSTRIAL, MANAGED, CYBER PROTECTED, ETHERNET SWITCH

1.1 System Summary

The supplier shall provide a 1Gbps wireline speed managed Ethernet switch, suited for industrial environments. The switch will provide 8 copper ports (6 of them with PoE) and 4 SFP ports. It will support converged security protection integration of physical and cyber security layers of the both the switch itself and the traffic passing through it.

1.2 Submittals

- A. The supplier submittals to the facility owner shall include the following as a minimum:
1. Manufacturer’s printed or electronic brochure
 2. Manufacturer’s printed or electronic data sheets
 3. Manufacturer’s user’s manuals including:
 - a. Unboxing training
 - b. Training presentation
 - c. Compliance to standards list
 - d. Warranty Documentation

1.3 Manufacture

- A. The TUNGSTEN system from Senstar meets the requirements stated herein for a switch and shall be the basis of design.
- B. Acceptable Manufacturer:
Senstar Corporation
119 John Cavanaugh Dr.
Ottawa, ON K0A 1L0

Web: www.senstar.com
- C. All fiber optic Ethernet managed switches and SFP modules shall be supplied from a single manufacturer.

1.4 Qualifications

- A. Manufacturer of system shall have a minimum of three years’ experience of successful installation of systems equivalent in function to the system proposed herein.
- B. Installation contractor shall be authorized to install service and maintain the system by the system manufacturer.

1.5 Spares

- A. The supplier shall deliver system components consisting of:
 - 1. For each system component a minimum quantity of one or 10% of the number that comprise the system, whichever is greater.

1.6 Product Support

- A. The product shall carry a minimum three-year warranty from the date of purchase.
- B. The supplier shall warrant that the product shall be supported by repair services and spare parts and assemblies for a minimum of 10 years from date of purchase.

1.7 References

- A. Abbreviations and acronyms: The following acronyms and abbreviations are used in this document:
 - 1. CLI - Command Line Interface
 - 2. COS - Class of Service
 - 3. DiffServ - Differentiated Services
 - 4. DSCP - Differentiated Services Code Points
 - 5. GARP - Generic Registration Protocol
 - 6. GMRP - GARP Multicast Registration Protocol
 - 7. GUI - Graphical User Interface
 - 8. GVRP - VLAN Registration Protocol
 - 9. IGMP - Internet Group Management Protocol
 - 10. MIB - Management Information Base
 - 11. MTBF - Mean Time Between Failures
 - 12. PD - Powered Device
 - 13. PoE - Power over Ethernet
 - 14. PSE - Power Sourcing Equipment
 - 15. QoS - Quality of Service
 - 16. RSTP - Rapid Spanning Tree Protocol
 - 17. SMTP - Simple Mail Transfer Protocol
 - 18. SNMP - Simple Network Management Protocol
 - 19. SSH - Secure Shell
 - 20. VLAN - Virtual Local Area Network
 - 21. VID - VLAN Identifier
 - 22. VoIP - Voice over Internet Protocol

PART 2 PRODUCT DESCRIPTION

2.1 General

- A. The Ethernet Switch (“Switch”) shall be a 12-Port managed device, eight of which are 10/100/1000BASE-TX RJ45 ports, six of them capable of PoE injection; and four 1Gbps SFP ports.
- B. All ports shall support auto-negotiation.
- C. The Switch performance shall provide non-blocking 1Gbps wire speed with store & forward technology on all ports with standard packets sizes of 64 bytes to 1522 (with VLAN tag) and up to 9600 jumbo frames.
- D. The Switch shall support at least 8000 MAC addresses in its internal memory.
- E. The switch shall support 9600 bytes long jumbo frames.
- F. The copper ports will provide built in diagnostics for cable conditions.
- G. The SFP modules shall be equipment with micro-OTDRs providing fiber diagnostics integrated with the Switch.
- H. The Switch shall require no in-field electrical or optical adjustments or in-line attenuators to ease installation. The module shall provide power, link speed, and fiber port status indicating LED’s for monitoring proper system operation.
- I. The Switch shall provide automatic re-settable solid-state current limiters on each module to reduce the chance of a single point failure of the system.
- J. The Switch shall provide a user controllable relay contact output with minimum rating of 1A at 220VDC or 250VAC.
- K. The Switch shall provide an input relay with maximum resistance of 100 Ohm generating system events upon state change.
- L. The Switch shall support an MTBF of greater than 37 years.

2.2 Power Over Ethernet (PoE)

- A. Four ports support PoE+ per IEEE802.3af (15.4W @ 44 - 57 VDC) or IEEE802.3at (30W @ 50 - 57 VDC) for connection to standard PoE PD (Power Devices).
- B. Two ports support ultra-PoE at (60W @ 50 - 57 VDC) for connection to standard PoE PD (Power Devices).
- C. The Switch shall allow the user to selectively enable or disable PoE on each of the six ports.
- D. The Switch shall support a total PoE power consumption of 240 Watts, under all input voltage ranges specified by the manufacturer. No need to manage the power allocation per port.
- E. The Switch shall have an ongoing dynamic re-negotiation function of the IEEE 802.3at LLDP, dynamically reallocating power to the Powered Devices (PDs).

- F. The Switch shall implement the 1 event and Link Layer Discovery Protocol (LLDP) PoE into the system for efficient power budget negotiation between Power Sourcing Equipment (PSE) and PDs.

2.3 Quality of Service (QoS)

- A. The Switch shall fully support QoS in accordance with IEEE 802.1p for optimization of video and voice over the network.
- B. Each port shall support up to eight priority queues.
- C. The Switch shall be capable of processing IEEE 802.1p Class of Service (COS) tags.
- D. The Switch shall provide the ability to map queue settings to DSCP values to be used in IP packets processed by other Layer 3 switches and IP routers.

2.4 Virtual LANs (VLANs)

- A. The Switch shall be fully compliant with IEEE 802.1Q.
- B. VLAN information shall be propagated to switches via GVRP VLAN registration protocol.
- C. The Switch shall allow for up to 4096 VLANs.
- D. Switch ports shall be configurable to allow either all packets or only VLAN tagged packets.
- E. Switch ports shall be configurable for ingress filtering to allow only packets tagged with the VLAN identifier (VID) for which the port has been configured.
- F. Support VLAN stacking IEEE 802.QinQ.

2.5 Security

- A. Port mirroring
 - 1. The Switch shall support Tx and/or Rx mirroring to allow online traffic monitoring on multiple selected ports.
- B. Port security
 - 1. Switch ports shall be configurable for port security, allowing up to 100 MAC addresses and VID, if applicable, to be learned by the switch for permitted access.
- C. IP security
 - 1. The switch shall allow specific IP addresses to be authorized for management access via a web browser or SSH on a specific VLAN.

2.6 Multicast

The Switch shall support IGMP to enable multicasting and specifically supporting the following:

- A. IGMP snooping V1, V2, and V3, which may be enabled on specific VLANs
- B. IGMP query V1 and V2

2.7 Redundancy

The Switch shall support the following redundancy methods:

- A. Spanning Tree Protocol
- B. Rapid Spanning Tree Protocol (RSTP)
 - 1. Allow RSTP parameters to be configured on a per-port basis.
 - 2. Provide a RSTP status to allow viewing of current configuration.

2.8 Loop Protection

The Switch shall support loop protection.

2.9 Management

A. Management utility

The Switch shall be discoverable and configurable by a PC management utility that allows:

- 1. Location of the Switch on the network
- 2. Opening of the Web GUI for the Switch
- 3. Rebooting of the Switch
- 4. Loading factory defaults
- 5. Changing IP address information – static or DHCP client on a designated management VLAN
- 6. Creating and loading backup configuration files
- 7. Upgrade Switch firmware. Two banks will be available for alternate activation of software versions.
- 8. Generation of syslog
- 9. MAC address table display
- 10. Static MAC
- 11. Aging time
- 12. RMON1

B. Interfaces

- 1. The Switch shall provide for out-band management and configuration via an RS-232 serial console port connection.
- 2. The Switch shall provide for in-band management and configuration via web browser or SSH connection.
- 3. Web Interface - The Switch shall provide for a user Graphical User Interface (GUI) allowing straightforward configuration of key system parameters.
 - a. The following web browsers shall be supported: Internet Explorer 7, 8, 9, Firefox 3.6, Chrome 3 or Safari 5.
 - b. No software installation shall be required to operate the web browser.
 - c. The web interface shall be password protected.

- d. The web interface shall have provision for a secure HTTPS log in.
 - e. The web interface shall allow access to a basic group of tasks to include the following:
 - 1) Switch settings
 - 2) Admin password
 - 3) IP configuration
 - 4) Time setting
 - 5) Backup and restore
 - 6) Firmware upgrade
 - 7) Factory defaults
 - 8) Switch reboot
 - 4. The web interface shall allow direct access to port-related settings, including the following:
 - a. Enable/disable port state
 - b. Configure port auto-negotiation
 - c. Port speed
 - d. Duplex communication
 - e. Flow control
 - f. Viewing of port status
- C. Command Line Interface (CLI)

The Switch shall provide a command line interface to the Switch's embedded software and allow configuration in one of the following modes:

- 1. User EXEC mode, allowing basic functionality including ping, SSH, and displaying system commands and running system information.
- 2. Privileged EXEC mode, allowing view of current configuration, reset default, reload switch, show system information, save configuration, and enter the global configuration mode.
- 3. Global configuration mode, allowing configuration of all user settable features, to include the following:
 - a. Administrator account setting
 - b. Set a static ARP entry
 - c. Set a command to its defaults
 - d. IEEE 802.1x standard access security control
 - e. End current mode and change to enable mode
 - f. Exit current mode and down to previous mode
 - g. GMRP protocol
 - h. GARP VLAN Registration Protocol
 - i. Set system's network name

- j. Select an interface to configure and enter an interface configuration mode or VLAN configuration mode
 - k. IP information
 - l. Link Aggregation Control Protocol
 - m. Print command list
 - n. Link Layer Discovery Protocol
 - o. Logging control
 - p. MAC address table
 - q. Negate a command or set its defaults
 - r. Configure Network Time Protocol
 - s. Configure Power over Ethernet
 - t. Quality of Service (QoS)
 - u. Enable a routing process
 - v. SMTP server configuration
 - w. SNMP server
 - x. Spanning tree algorithm
 - y. Trunk group configuration
 - z. Virtual LAN
- 4. Interface configuration mode, allowing configuration of individual port settings
 - 5. VLAN configuration mode, allowing configuration of settings for each VLAN

2.10 SNMP

- A. The Switch shall support SNMP v2c and allow for setting community string parameters.
- B. The Switch shall support SNMP v3, providing for security level, authorization level and password, and encryption.
- C. The Switch shall have an enable function for SNMP traps, allowing for configuration of the SNMP trap server IP, Community name, and trap Version V2c or V3.
- D. The Switch shall support standard SNMP MIBS (MIB-II, Bridge MIB, VLAN MIB, SNMP MIB, RMON) and its own private MIBs.

2.11 Alarms

- A. The switch will display on the web interface the current active alarms in a designated window.
- B. The user will be able to navigate directly from this window to the relevant section in the web GUI by clicking on the specific alarm.

2.12 Security

- A. Network elements
 - 1. The user shall configure the security policy per port with regard to the network elements connected to the port (MAC address and IP address).

2. The user shall mark the set of network elements allowed per port.
 3. The system shall monitor the marked ports for forbidden network elements and shall take action in accordance with the configured security policy per port i.e. generate log and isolate port.
 4. The user can change the policy or the marking of network elements at all times.
 5. The application of the security policy shall not affect the traffic switching performance.
- B. Network flows
1. The user shall configure the security policy per port with regard to the network flows (client IP address to server IP address and port #).
 2. The user shall mark the set of network flows allowed.
 3. The system shall monitor the marked ports for forbidden network flows and shall take action in accordance with the configured security policy per port i.e. generate log and isolate port.
 4. The user can change the policy or the marking of network flows at all times.
 5. The application of the security policy shall not affect the traffic switching performance.
- C. Fiber protection
1. The Switch shall support connection of a pair of single mode, DWM fibers between two switches.
 2. The links shall perform in protection mode i.e. one fiber designated as working and the second as protection. In case the working fiber fails, the protection fiber becomes active and takes over the responsibility of carrying the traffic.
 3. The user can control whether reverting to the working fiber is automatic or manual.
 4. The user can force working on one of the fibers.
 5. The Switch shall monitor the fiber for attack attempts such as fiber length change or sudden change in the attenuation.
 6. In case an attack is detected, the Switch will shut down the link until the user manually re-enables it.
 7. The application of the fiber protection shall not affect the traffic switching performance.
- D. Port security
1. The user shall configure the security policy per port with regard to the events and behaviour of the port and the network elements connected to it.
 2. The system shall monitor the marked ports for events (mute ports, change in cable length, change in fiber attenuation, change in PoE PD power consumption, etc.) and shall take action in accordance with the configured security policy per port i.e. generate log and isolate port.
 3. The user can change the policy of the port security at all times.

4. The application of the security policy shall not affect the traffic switching performance.
- E. DHCP snooping
1. The user shall configure the switch DHCP snooping policy, designating trusted ports.
 2. The Switch shall display DHCP snooping and DHCP relay status.
- F. ARP inspection
1. The user shall configure the switch ARP policy per port.
 2. The user shall configure the static ARP table.
 3. The user shall be able to copy dynamic APR entries to the static ARP table.
 4. The switch shall exercise the ARP inspection and apply the necessary policies to prevent cyber-attacks in the ARP domain such as ARP poisoning.

2.13 License

- A. The Switch shall be license protected.
- B. The user will enter a new license key for activation of new features.

2.14 Indicators

- A. The Switch shall provide visual indication of the following:
 1. Input voltage on each of the power inputs
 2. System status
 3. Remote management locking
 4. Discrete input
 5. Discrete output
 6. License state
 7. Port link activity
 8. Delivery of power from a PoE port
- B. The Switch shall indication of the following via the switch web interface:
 1. Device connected to port full-duplex mode
 2. Collision of frames in half-duplex mode
 3. Port speed
 4. PoE state
 5. SFP state

2.15 Voltage input

- A. The Switch shall provide for two redundant DC power inputs via two 2-pin terminal connectors.
- B. Power inputs shall be reverse polarity protected.

- C. Two power connectors shall be included.
- D. The following modes will be supported:
 - 1. 24VDC (20VDC-36VDC PoE Regulated)
 - 2. 48VDC (36VDC-60VDC PoE Regulated)
 - 3. 54VDC (18DVC-60VDC not regulated, 48VDC to support IEEE 802.3af PD's or 53 VDC if the Switch is to support IEEE 802.3at PDs)

2.16 Enclosure

- A. The Switch shall be packaged in industrial-grade aluminum IP40 housing.
- B. The Switch shall provide for DIN rail or wall-mount installation. All mount bracket included.
- C. The switch shall weight less than 2.3 Kg/4.9 lbs.
- D. The Switch dimensions shall be less than 18.8x14.5x10.5cm/7.4x5.7x4.1".
- E. All optical connectors shall be covered with dust caps and remain on the module until installing cable connectors to module.

2.17 Environmental

- A. The Switch operating temperature range shall be -40° to +70°C when operating within the IEEE 802.3af specification.
- B. The Switch operating temperature range shall be -40° to +60°C when operating within the IEEE 802.3at specification.
- C. The Switch shall operate in a humidity range of 0 - 90%.
- D. No fans shall be used for cooling.

2.18 Regulatory Requirements

- A. The system shall be FCC certified.
- B. The system shall comply with CE regulations as a Class 1 device and bear the CE mark.
- C. The system shall comply with UL60950–1. Electrical Substation: IEC 61850-3, IEEE 6013, Rail Traffic EN50121–4, Industrial grade EMS (EN61000–6–3) and EMI (EN61000–6–4).

2.19 Standards

The Switch shall comply with the following standards:

- A. IEEE 802.3 Ethernet Standards
 - 1. IEEE 802.3 10Base-T
 - 2. IEEE 802.3i - 10BASE-T
 - 3. IEEE 802.3u - 100BASE-TX
 - 4. IEEE 802.3ab - 1000BASE-TX
 - 5. IEEE 802.3ad LACP

6. IEEE 802.3af Power over Ethernet
 7. IEEE 802.at LLDP PoE Plus
 8. IEEE 802.3x Flow Control and Back-Pressure
 9. IEEE 802.1ab LLDP
 10. IEEE 802.1D-2004 Rapid Spanning Tree Protocol (RSTP)
 11. IEEE 802.1p Class of Service
 12. IEEE 802.1Q Virtual LAN's
 13. IEEE 802.1x Port Based Network Access Control
- B. Emissions
1. FCC Part 15 Subpart B, Class A limit
 2. Canadian EMC Requirement ICES-003
 3. European Standard EN55022
 4. CISPR 22
- A. Immunity - European Standard EN55024
1. IEC61000-4-2/EN61000-4-2: ESD
 2. IEC61000-4-3/EN61000-4-3: RF
 3. IEC61000-4-4/EN61000-4-4: Fast Transient/Burst
 4. IEC61000-4-5/EN61000-4-5: Surge
 5. IEC61000-4-6/EN61000-4-6: Conducted Disturbance
 6. IEC61000-4-8/EN61000-4-8: Magnetic Field
 7. IEC61000-4-11/EN61000-4-11: DIPS and Voltage Variations
- B. Safety
1. IEC 60950/EN60950
 2. CSA C22.2 No. 60950/UL60950 Third Edition
- C. ROHS - European Standard: 2002/95/EC Directive (RoHS)

2.20 System Manufacturing Quality Requirements

- A. The manufacturer's quality management system shall be certified as conforming to ISO 9001:2008.
- B. All switch units shall be conformal coated and units shall be tested during manufacture over their entire operational temperature range on a sample basis.

PART 3 EXECUTION

3.1 Site Assessment

- A. Before installation begins, the installation contractor shall provide a report documenting any site conditions that may prevent the system from operating satisfactorily.

3.2 System Installation

- A. The system shall be installed in accordance with the manufacturer's recommended procedures as defined in the manufacturer's documentation for the system.

3.3 Training

- A. The installation contractor shall train maintenance personnel in the switch operation and maintenance procedures as given in the manufacturer's User Guide.