08-24-21

ITEM#4J
RTC# 21-762

Melissa Meslo

From: Nora Pimentel
Sent: Tuesday, August 24, 2021 1:00 PM
To: Nora Pimentel
Cc: Deanna Santana; Melissa Meslo
Subject: Consent Calendar Item # 4.J
Attachments: 18-HSQ Agreement (fully executed).pdf; Amendment #1 with HSQ Technology (fully executed).pdf

Good afternoon Mayor and Councilmembers,

In response to a Councilmembers request under Consent Calendar Item 4.J "Action on Amendment No. 2 to the Agreement with HSQ Technology for the MISER Supervisory Control and Data Acquisition (SCADA) System

Attached you will find the original contract and amendment #1. This will be posted as post meeting material.

Thank you

Nora

POST MEETING MATERIAL

Ebix Insurance No. S200000123

AMENDMENT NO. 1
TO THE AGREEMENT FOR SERVICES
BETWEEN THE
CITY OF SANTA CLARA, CALIFORNIA,
AND
HSQ TECHNOLOGY

PREAMBLE

This agreement ("Amendment No. 1") is entered into between the City of Santa Clara, California, a chartered California municipal corporation (City) and HSQ Technology, a California corporation (Contractor). City and Contractor may be referred to individually as a "Party" or collectively as the "Parties" or the "Parties to this Agreement."

RECITALS

A. The Parties previously entered into an agreement entitled "Agreement for Services between the City of Santa Clara and HSQ Technology", dated March 10, 2020 (Agreement); and

B. The Parties entered into the Agreement for the purpose of having Contractor provide a turnkey upgrade of the City's existing Miser Supervisory Control and Data Acquisition Human Machine Interface software and hardware, and the Parties now wish to amend the Agreement to increase compensation by Forty-Five Thousand Two Hundred Thirty-Five Dollars and Thirty Cents ($45,235.30) for a revised not-to-exceed maximum compensation of Four Hundred Ninety-Seven Thousand Five Hundred Eighty-Eight Dollars and Thirty Cents ($497,588.30).

NOW, THEREFORE, the Parties agree as follows:

AMENDMENT TERMS AND CONDITIONS

1. Section 6 of the Agreement, entitled "Compensation and Payment" is amended to read as follows:

> In consideration for Contractor's complete performance of Services, City shall pay Contractor for all materials provided and Services rendered by Contractor in accordance with First Revised Exhibit B, entitled "COMPENSATION." The maximum compensation under this Agreement is Four Hundred Ninety-Seven Thousand Five Hundred Eighty-Eight Dollars and Thirty Cents ($497,588.30), subject to budget appropriations, which includes all payments that may be authorized for Services and for expenses, supplies, materials and equipment required to perform the Services. All work performed or materials provided in

excess of the maximum compensation shall be at Contractor's expense. Contractor shall not be entitled to any payment above the maximum compensation under any circumstance.

2. Exhibit B of the Agreement, entitled "Compensation", is hereby amended to read as shown in First Revised Exhibit B.

3. Except as set forth herein, all other terms and conditions of the Agreement shall remain in full force and effect. In case of a conflict in the terms of the Agreement and this Amendment No. 1, the provisions of this Amendment No. 1 shall control.

The Parties acknowledge and accept the terms and conditions of this Amendment No. 1 as evidenced by the following signatures of their duly authorized representatives.

CITY OF SANTA CLARA, CALIFORNIA
a chartered California municipal corporation

Approved as to Form:

Digitally signed by Caio Arellano
Date: 2021.02.23 12:03:07 -08'00'

BRIAN DOYLE
City Attorney

Dated: 2/24/2021

DEANNA J. SANTANA
City Manager
1500 Warburton Avenue
Santa Clara, CA 95050
Telephone: (408) 615-2210
Fax: (408) 241-6771

"CITY"

HSQ TECHNOLOGY
a California corporation

Dated: 02/11/21
By (Signature):
Name: Gustavo Jimenez
Title: Director of Projects and Operations
Principal Place of Business Address: 26227 Research Road, Hayward, CA 94545
Email Address: jimenez@hsq.com
Telephone: (510) 259-1334
Fax: (510) 259-1392

"CONTRACTOR"

FIRST REVISED EXHIBIT B
COMPENSATION

1. MAXIMUM COMPENSATION

The maximum amount payable for all materials and services provided under this Agreement shall not exceed Four Hundred Ninety-Seven Thousand Five Hundred Eighty-Eight Dollars and Thirty Cents ($497,588.30) during the term of the Agreement. Any additional services or materials requested by the City that would exceed the preceding maximum amount will be addressed in an Amendment to the Agreement. No additional services will be performed unless both Parties execute an Amendment outlining the services requested and the compensation agreed for such services.

2. PROGRESS PAYMENT SCHEDULE

2.1. Contractor shall provide all equipment, materials, and labor as specified in Exhibit A on a firm fixed cost basis.

2.2. Progress payments shall be made to Contractor by City following acceptance of designated milestones as shown in Table B-1.

Table B-1: Payment Schedule

Milestone/Deliverable	% of Total	Amount
Project Plan	15%	$67,852
Project Procurement	30%	$135,706
Estimated Sales Tax (to be paid in accordance with applicable milestone for which sales tax is due)	5%	$22,482
Documentation	1%	$5,021
Factory Acceptance Test	14%	$63,000
Shipment to Site	14%	$63,000
System Commissioning	5%	$23,276
Training	1%	$6,333
Final System Acceptance*	15%	$65,683
TOTAL	**100%**	**$452,353**

*The signed Final Acceptance Certificate (Appendix A-2) triggers final payment and start of warranty period.

2.3. All payments are based upon City's acceptance of Contractor's performance as evidenced by successful completion of all of the deliverables as set forth for each milestone. City shall have no obligation to pay unless Contractor has successfully completed, and City has approved, the milestone for which payment is due.

2.4. Payment for any part or parts of the System provided hereunder, or inspection or testing thereof by City, shall not constitute acceptance or relieve Contractor of its obligations under this Agreement. City may inspect the components of the System when delivered and reject upon notification to Contractor any and all components of the System, which do not conform to the specifications or other requirements of this Agreement. Components of the System that are rejected shall be promptly corrected, repaired, or replaced by Contractor. If City receives components of the System with

defects or nonconformities not reasonably apparent on inspection, then City reserves the right to require prompt correction, repair, or replacement by Contractor in accordance with Contractor's warranty obligations.

3. ADDITIONAL WORK

3.1. In the event that any work is identified during the course of the Project that the Parties agree is necessary to complete the Scope of Services but nevertheless is outside the scope of this agreement, City and Contractor shall negotiate a price for such work. Additional work may be negotiated on a lump sum basis in accordance with the rates set forth in Table B-3 below. City and Contractor will execute an Amendment to the Agreement outlining the additional work and/or services.

Table B-3: Additional Work

Description	Rate
Project Management	$300 per hour
Senior Engineer	$250 per hour
Engineer	$200 per hour

3.2. Pursuant to Amendment No. 1, the City has set aside the maximum amount of Forty-Five Thousand Two Hundred Thirty-Five Dollars and Thirty Cents ($45,235.30) for the payment of the following additional materials and services:

Table B-4: Additional Products and Services

Upgrade remaining screens to current graphic symbols and layout [pursuant to Contractor's Quotation No. COR-007A/Letter No. 018, attached hereto as Appendix B-1)	$41,231.30
Historian system Backup (300GB HD) at Server B [pursuant to Contractor's Quotation No. COR-008/Letter No. 016, attached hereto as Appendix B-2)	$4,004.00

4. INVOICING

4.1. City will pay Contractor within thirty (30) days of City's receipt of an approved invoice.

HSQ TECHNOLOGY
A RailWorks Company

26227 Research Road
Hayward, California 94545-3725
Phone: (510) 259-1334
Fax: (510) 259-1392
www.hsq.com

January 22, 2021

Santa Clara Water Dept.
1500 Warburton Avenue
Santa Clara, CA 95050

Attention: Franz Mortensen
Grant Koepplin

Reference: City of Santa Clara – SCADA System
HSQ Quotation No. COR-007A
HSQ Letter No.: 018: 29993 :007A
UPS Monitoring on SCADA

Gentlemen:

HSQ Technology is pleased to offer you a quotation for the re-development of thirty (30) SCADA screens. HSQ will update the existing screens similar to the thirteen (13) screen upgrades previously done on the SCADA Upgrade project.

- MISER SCADA graphic screen upgrades (thirty [30] screens]
  - HSQ will utilize the thirteen (13) screens already updated on SCADA Upgrade project
- SCADA graphics screen upgrades (drafting)
- SCADA graphics screen upgrades submittal and approval
- SCADA graphics installation, testing and removal of exiting screens
- Deployment, integration and testing on-site.

The total lump sum price for all the items listed above is **$41,231.00** and is valid for a period of sixty (60) days. Delivery will be within one hundred and twenty (120) days of receipt of an order.

Please call the undersigned at 800-486-6684 or email est@hsq.com if you have any questions.

Respectfully,

HSQ TECHNOLOGY, A CORPORATION

Gus Jimenez
Director of Projects and Operations

GJ/PP/MP:ks

By Email

cc: Peter Polissky (By Email)

HSQ TECHNOLOGY
A RailWorks Company

26227 Research Road
Hayward, California 94545-3725
Phone: (510) 259-1334
Fax: (510) 259-1392
www.hsq.com

January 5, 2021

Santa Clara Water Dept.
1500 Warburton Avenue
Santa Clara, CA 95050

Attention: Franz Mortensen
Grant Koepplin

Reference: **City of Santa Clara – SCADA System**
HSQ Quotation No. COR-008
HSQ Letter No.: 016: 29993 :008
SCADA Historian Backup

Gentlemen:

HSQ Technology is pleased to offer you a quotation for implementing a SCADA Historian Back-Up. The Back-Up of the SCADA Historian shall be done via a new 300GB Hard Drive that shall be located at the City Hall SCADA Server.

- MISER SCADA Historian Back-Up
  - New 300GB Hard Drive (QTY 2)
- Development, Configuration, Programming at HSQ
- Deployment, Integration and testing on-site.

The total lump sum price for all the items listed above is **$4,004.00** (including sales tax at 9%) and is valid for a period of sixty (60) days. Delivery will be within sixty (60) days of receipt of an order. Please contact the undersigned if you have any questions.

Respectfully,

HSQ TECHNOLOGY, A CORPORATION

Gus Jimenez
Director of Projects and Operations

GJ/ks

By Email

cc: Peter Polissky (By Email)

EBIX Insurance No. S200000123

AGREEMENT FOR SERVICES BETWEEN THE CITY OF SANTA CLARA, CALIFORNIA, AND HSQ TECHNOLOGY

PREAMBLE

This Agreement is entered into between the City of Santa Clara, California, a chartered California municipal corporation (City) and HSQ Technology, a California corporation (Contractor). City and Contractor may be referred to individually as a "Party" or collectively as the "Parties" or the "Parties to this Agreement."

RECITALS

A. City desires to secure the services more fully described in this Agreement, at Exhibit A, entitled "Scope of Services";

B. Contractor represents that it, and its subcontractors, if any, have the professional qualifications, expertise, necessary licenses and desire to provide certain goods and/or required services of the quality and type which meet objectives and requirements of City; and,

C. The Parties have specified herein the terms and conditions under which such services will be provided and paid for.

The Parties agree as follows:

AGREEMENT TERMS AND CONDITIONS

1. AGREEMENT DOCUMENTS

The documents forming the entire Agreement between City and Contractor shall consist of these Terms and Conditions and the following Exhibits, which are hereby incorporated into this Agreement by this reference:

Exhibit A – Scope of Services
Appendix A-1: Preliminary Project Schedule
Appendix A-2: Final System Acceptance Certificate
Appendix A-3: End User License Agreement
Appendix A-4: Contractor's Proposal Quotation No. 1912-0006-MP dated December 10, 2019
Exhibit B – Compensation
Exhibit C – Insurance Requirements

This Agreement, including the Exhibits and Appendices set forth above, contains all the agreements, representations and understandings of the Parties, and supersedes and replaces any previous agreements, representations and understandings, whether oral or written. In the event of any inconsistency between the provisions of any of the Exhibits and the Terms and Conditions, the Terms and Conditions shall govern and control.

2. TERM OF AGREEMENT

Unless otherwise set forth in this Agreement or unless this paragraph is subsequently modified by a written amendment to this Agreement, the term of this Agreement shall begin on March 1, 2020 and terminate on June 30, 2022.

3. SCOPE OF SERVICES & PERFORMANCE SCHEDULE

Contractor shall perform those Services specified in Exhibit A within the time stated in Exhibit A. Time is of the essence.

4. WARRANTY

Contractor expressly warrants that all materials and services covered by this Agreement, shall be free from defect and shall conform to the specifications, requirements and instructions set forth in this Agreement. For the term of this Agreement and one (1) year thereafter, Contractor agrees to promptly replace or correct any incomplete, inaccurate or defective Services at no further cost to City when defects are due to the negligence, errors or omissions of Contractor. If Contractor fails to promptly correct or replace materials or services, City may make corrections or replace materials or services and charge Contractor for the cost incurred by City.

5. QUALIFICATIONS OF CONTRACTOR - STANDARD OF CARE

Contractor represents and maintains that it has the expertise necessary to perform the Services, and City expressly relies upon Contractor's representations regarding its skills and knowledge. Contractor shall perform such Services and duties in conformance to and consistent with the professional standards of a specialist in the same discipline in the State of California.

6. COMPENSATION AND PAYMENT

In consideration for Contractor's complete performance of Services, City shall pay Contractor for all materials provided and Services rendered by Contractor in accordance with Exhibit B, entitled "COMPENSATION." The maximum compensation under this Agreement is Four Hundred Fifty-Two Thousand Three Hundred Fifty-Three Dollars ($452,353), subject to budget appropriations, which includes all payments that may be authorized for Services and for expenses, supplies, materials and equipment required to perform the Services. All work

performed or materials provided in excess of the maximum compensation shall be at Contractor's expense. Contractor shall not be entitled to any payment above the maximum compensation under any circumstance.

7. TERMINATION

A. Termination for Convenience. City shall have the right to terminate this Agreement, without cause or penalty, by giving not less than Thirty (30) days' prior written notice to Contractor.

B. Termination for Default. If Contractor fails to perform any of its material obligations under this Agreement, in addition to all other remedies provided by law, City may terminate this Agreement immediately upon written notice to Contractor.

C. Upon termination, each Party shall assist the other in arranging an orderly transfer and close-out of services. As soon as possible following the notice of termination, but no later than ten (10) days after the notice of termination, Contractor will deliver to City copies of all City information or material that Contractor has in its possession.

8. ASSIGNMENT AND SUBCONTRACTING

City and Contractor bind themselves, their successors and assigns to all covenants of this Agreement. This Agreement shall not be assigned or transferred without the prior written approval of City. Contractor shall not hire subcontractors without express written permission from City.

Contractor shall be as fully responsible to City for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, as Contractor is for the acts and omissions of persons directly employed by it.

9. NO THIRD PARTY BENEFICIARY

This Agreement shall not be construed to be an agreement for the benefit of any third party or parties and no third party or parties shall have any claim or right of action under this Agreement for any cause whatsoever.

10. INDEPENDENT CONTRACTOR

Contractor and all person(s) employed by or contracted with Contractor to furnish labor and/or materials under this Agreement are independent contractors and do not act as agent(s) or employee(s) of City. Contractor has full rights to manage its employees in their performance of Services under this Agreement.

11. CONFIDENTIALITY OF MATERIAL

All ideas, memoranda, specifications, plans, manufacturing procedures, data, drawings, descriptions, documents, discussions or other information developed or received by or for Contractor and all other written information submitted to Contractor in connection with the performance of this Agreement shall be held confidential by Contractor and shall not, without the prior written consent of City, be used for any purposes other than the performance of the Services nor be disclosed to an entity not connected with performance of the Services. Nothing furnished to Contractor which is otherwise known to Contractor or becomes generally known to the related industry shall be deemed confidential.

12. OWNERSHIP OF MATERIAL

All material, which shall include, but not be limited to, data, sketches, tracings, drawings, plans, diagrams, quantities, estimates, specifications, proposals, tests, maps, calculations, photographs, reports, designs, technology, programming, works of authorship and other material developed, collected, prepared or caused to be prepared under this Agreement shall be the property of City but Contractor may retain and use copies thereof. City shall not be limited in any way or at any time in its use of said material. However, Contractor shall not be responsible for damages resulting from the use of said material for work other than Project, including, but not limited to, the release of this material to third parties.

13. RIGHT OF CITY TO INSPECT RECORDS OF CONTRACTOR

City, through its authorized employees, representatives or agents shall have the right during the term of this Agreement and for four (4) years from the date of final payment for goods or services provided under this Agreement, to audit the books and records of Contractor for the purpose of verifying any and all charges made by Contractor in connection with Contractor compensation under this Agreement, including termination of Contractor, excluding information subject to applicable legal privileges and/or proprietary information. Contractor agrees to maintain sufficient books and records in accordance with generally accepted accounting principles to establish the correctness of all charges submitted to City. Any expenses not so recorded shall be disallowed by City. Contractor shall bear the cost of the audit if the audit determines that there has been a substantial billing deviation in excess of five (5) percent adverse to the City.

Contractor shall submit to City any and all reports concerning its performance under this Agreement that may be requested by City in writing. Contractor agrees to assist City in meeting City's reporting requirements to the State and other agencies with respect to Contractor's Services hereunder.

14. HOLD HARMLESS/INDEMNIFICATION

A. To the extent permitted by law, Contractor agrees to protect, defend, hold harmless and indemnify City, its City Council, commissions, officers,

employees, volunteers and agents from and against any claim, injury, liability, loss, cost, and/or expense or damage, including all costs and attorney's fees in providing a defense to any such claim or other action, and whether sounding in law, contract, tort, or equity, in any manner arising from, or alleged to arise in whole or in part from, or in any way connected with the Services performed by Contractor pursuant to this Agreement – including claims of any kind by Contractor's employees or persons contracting with Contractor to perform any portion of the Scope of Services – and shall expressly include passive or active negligence by City connected with the Services. However, the obligation to indemnify shall not apply if such liability is ultimately adjudicated to have arisen through the sole active negligence or sole willful misconduct of City; the obligation to defend is not similarly limited.

B. Contractor's obligation to protect, defend, indemnify, and hold harmless in full City and City's employees, shall specifically extend to any and all employment-related claims of any type brought by employees, contractors, subcontractors or other agents of Contractor, against City (either alone, or jointly with Contractor), regardless of venue/jurisdiction in which the claim is brought and the manner of relief sought.

C. To the extent Contractor is obligated to provide health insurance coverage to its employees pursuant to the Affordable Care Act ("Act") and/or any other similar federal or state law, Contractor warrants that it is meeting its obligations under the Act and will fully indemnify and hold harmless City for any penalties, fines, adverse rulings, or tax payments associated with Contractor's responsibilities under the Act.

15. LIMITATION OF LIABILITY

CONTRACTOR'S AGGREGATE LIABILITY UNDER THIS AGREEMENT SHALL NOT EXCEED $2,000,000, WHETHER IN ACTION(S) IN CONTRACT, TORT OR OTHERWISE.

CONTRACTOR SHALL HAVE NO LIABILITY UNDER THIS AGREEMENT FOR INDIRECT, CONSEQUENTIAL, PUNITIVE OR OTHER SPECIAL DAMAGES, WHETHER ARISING IN AN ACTION IN CONTRACT, TORT OR OTHERWISE.

NOTWITHSTANDING THE ABOVE, THERE SHALL BE NO LIMITATION OF LIABILITY FOR INFRINGEMENT OF INTELLECTUAL PROPERTY, PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE COVERED BY THE INDEMNIFICATION PROVISION IN ARTICLE 14.

16. INSURANCE REQUIREMENTS

During the term of this Agreement, and for any time period set forth in Exhibit C, Contractor shall provide and maintain in full force and effect, at no cost to City, insurance policies as set forth in Exhibit C.

17. WAIVER

Contractor agrees that waiver by City of any one or more of the conditions of performance under this Agreement shall not be construed as waiver(s) of any other condition of performance under this Agreement. Neither City's review, acceptance nor payments for any of the Services required under this Agreement shall be constructed to operate as a waiver of any rights under this Agreement or of any cause of action arising out of the performance of this Agreement.

18. NOTICES

All notices to the Parties shall, unless otherwise requested in writing, be sent to City addressed as follows:

City of Santa Clara
Attention: Water and Sewer Utilities
1500 Warburton Avenue
Santa Clara, CA 95050
and by e-mail at fmortensen@santaclaraca.gov,
gdougherty@santaclaraca.gov and manager@santaclaraca.gov

And to Contractor addressed as follows:

HSQ Technology
26227 Research Road
Hayward, CA 94545-3725
and by e-mail at jimenez@hsq.com

The workday the e-mail was sent shall control the date notice was deemed given. An e-mail transmitted after 1:00 p.m. on a Friday shall be deemed to have been transmitted on the following business day.

19. COMPLIANCE WITH LAWS

Contractor shall comply with all applicable laws and regulations of the federal, state and local government, including but not limited to "The Code of the City of Santa Clara, California" ("SCCC"). In particular, Contractor's attention is called to the regulations regarding Campaign Contributions (SCCC Chapter 2.130), Lobbying (SCCC Chapter 2.155), Minimum Wage (SCCC Chapter 3.20), Business Tax Certificate (SCCC section 3.40.060), and Food and Beverage Service Worker Retention (SCCC Chapter 9.60), as such Chapters or Sections may be amended from time to time or renumbered. Additionally Contractor has

read and agrees to comply with City's Ethical Standards (http://santaclaraca.gov/home/showdocument?id=58299).

20. CONFLICTS OF INTEREST

Contractor certifies that to the best of its knowledge, no City officer, employee or authorized representative has any financial interest in the business of Contractor and that no person associated with Contractor has any interest, direct or indirect, which could conflict with the faithful performance of this Agreement. Contractor is familiar with the provisions of California Government Code section 87100 and following, and certifies that it does not know of any facts which would violate these code provisions. Contractor will advise City if it becomes aware of a conflict.

21. FAIR EMPLOYMENT

Contractor shall not discriminate against any employee or applicant for employment because of race, sex, color, religion, religious creed, national origin, ancestry, age, gender, marital status, physical disability, mental disability, medical condition, genetic information, sexual orientation, gender expression, gender identity, military and veteran status, or ethnic background, in violation of federal, state or local law.

22. NO USE OF CITY NAME OR EMBLEM

Contractor shall not use City's name, insignia, or emblem, or distribute any information related to services under this Agreement in any magazine, trade paper, newspaper or other medium without express written consent of City.

23. GOVERNING LAW AND VENUE

This Agreement shall be governed and construed in accordance with the statutes and laws of the State of California. The venue of any suit filed by either Party shall be vested in the state courts of the County of Santa Clara, or if appropriate, in the United States District Court, Northern District of California, San Jose, California.

24. SEVERABILITY CLAUSE

In case any one or more of the provisions in this Agreement shall, for any reason, be held invalid, illegal or unenforceable in any respect, it shall not affect the validity of the other provisions, which shall remain in full force and effect.

25. AMENDMENTS

This Agreement may only be modified by a written amendment duly authorized and executed by the Parties to this Agreement.

26. COUNTERPARTS

This Agreement may be executed in counterparts, each of which shall be deemed to be an original, but both of which shall constitute one and the same instrument.

The Parties acknowledge and accept the terms and conditions of this Agreement as evidenced by the following signatures of their duly authorized representatives.

CITY OF SANTA CLARA, CALIFORNIA
a chartered California municipal corporation

Approved as to Form:

BRIAN DOYLE
City Attorney

Dated: 3-10-2020

FOR
DEANNA J. SANTANA
City Manager
1500 Warburton Avenue
Santa Clara, CA 95050
Telephone: (408) 615-2210
Fax: (408) 241-6771

"CITY"

HSQ TECHNOLOGY
a California corporation

Dated: 03/06/2020
By (Signature):
Name: Gustavo Jimenez
Title: Director of Projects & Operations
Principal Place of Business Address: 26227 Research Road, Hayward, CA 94545
Email Address: jimenez@hsq.com
Telephone: ( ) 510-259-1334
Fax: ( ) 510-259-1392

"CONTRACTOR"

EXHIBIT A
SCOPE OF SERVICES
HSQ MISER SCADA SYSTEM UPGRADE

1. OVERVIEW

1.1. Under this agreement, Contractor shall provide a turnkey upgrade of the City's existing HSQ Miser Supervisory Control and Data Acquisition (SCADA) System Human Machine Interface (HMI) software and hardware and related network to implement the latest version of Contractor's proprietary HSQ Miser software and hardware (collectively the "System" or "Project").

1.2. This Scope of Services defines the principal activities and responsibilities of Contractor to provide all hardware, software, project management, testing, plans and drawings, system commissioning, configuration, training, and support to upgrade the System.

2. OBJECTIVES

2.1. The City's objectives for this Project are:

2.1.1. Intuitive user interface.

2.1.2. Support for industry standard programming and third-party controller integration.

2.1.3. Support for newer communications protocols including OLE for Process Control (OPC), DNP3, and Modbus.

2.1.4. Support for current software and hardware.

2.1.5. Capability of the HMI system to communicate with newer industry standard controllers.

3. DOCUMENTS

3.1. This Exhibit contains the following Appendices:

3.1.1. Appendix A-1: Preliminary Project Schedule

3.1.2. Appendix A-2: Final System Acceptance Certificate

3.1.3. Appendix A-3: End User License Agreement

3.1.4. Appendix A-4: Contractor's Proposal Quotation No. 1912-0006-MP dated December 10, 2019

3.2. To the extent not inconsistent with this Agreement between the City and

Contractor including this Scope of Services, Contractor's proposal Quotation No. 1912-0006-MP dated December 10, 2019 is hereby incorporated by reference herein, and shall supplement this Scope of Services and be subject to the terms and conditions of the Agreement

4. SOFTWARE

4.1. The terms for the use of HSQ Miser Software delivered pursuant to the Scope of Services, including subsequent software upgrades, updates, customizations or enhancements thereto, shall be as set forth in the End User License Agreement, an unofficial copy attached hereto as Appendix A-3. Upon shipment to City, Contractor shall provide City with an official software certificate, in the exact form set forth in Appendix A-3.

4.2. With respect to any software installed pursuant to this Agreement that is proprietary to a vendor other than Contractor, such software shall be licensed to City pursuant to the terms of the applicable third party license agreements.

5. PROJECT BACKGROUND

5.1. The City's existing SCADA system is based on HSQ MISER software and hardware. The HMI portion of the SCADA system includes graphics, servers, workstations, network equipment and wires as well as wireless communications.

5.2. The City uses the SCADA system to monitor and control the City's water, sewer, and storm drain infrastructure. The SCADA system is utilized by both the Water and Sewer Utilities Department and the Public Works Department's Storm Division. SCADA data is stored in a proprietary Contractor-hosted database and mirrored to a relational database on the City's business network.

5.3. The existing system consists of two (2) legacy servers, two (2) legacy work stations, one (1) master radio, network appliances, and software, all located at the City Corporation Yard. There are approximately 1,700 points being monitored over approximately 60 Remote Telemetry Units (RTUs).

6. GENERAL REQUIREMENTS

6.1. Contractor acknowledges that it has in its possession all applicable specifications, drawings, and information pertaining to the existing system, and such information are adequate to enable Contractor to fairly determine its ability to perform the work called for herein at the price and in accordance with the schedule set forth herein. In the event that there are field conditions not reasonably apparent during Contractor's review of the existing system leading up to this Agreement that will impact project design, schedule or cost, both parties shall work together to resolve and rectify the issue.

6.2. Contractor shall provide City a list of team members who will be working on-site, and update this list within forty-eight (48) hours of any change in personnel.

6.3. Contractor shall ensure that any hardware or materials are insured against "all risks" from the time the they are placed in the possession of the carrier for shipment to/from City until delivery to the City. Contractor will pack and ship all equipment in accordance with good commercial practices.

7. PROJECT COORDINATION

7.1. Contractor Responsibilities

7.1.1. The principal members of the Contractor's project team are shown below. Contractor must obtain City's prior approval before changing the principal team members.

Name	Role
Gus Jimenez	Project Manager
Peter Polissky	Director of Engineering

7.1.2. The Project Manager ("PM") shall be the primary person communicating with the City and keeping City fully apprised on the status and progress of the Project. The PM shall also be responsible for project schedule updates; creation and preparation of progress reports and meeting minutes; adherence to project scheduling; and general project coordination.

7.1.3. Contractor shall develop and maintain a detailed project schedule containing all deliverables, tasks, and milestones.

7.2. City Responsibilities

7.2.1. City shall provide oversight for the entire Project, but Contractor must provide overall project management for all tasks required to upgrade the System.

7.2.2. City shall assign a project manager who shall work closely with Contractor to facilitate the successful completion of the implementation process and who shall be responsible for supervising the staff of the City and their cooperation with and participation in such process. The City's Project Manager shall maintain project communications with Contractor's Project Manager.

7.2.3. City shall provide Contractor information required to configure the System.

8. PROJECT SCHEDULE

8.1. It is the City's expectation that Contractor shall meet all the project deliverables and dates in accordance to the Project Implementation schedule as shown on Appendix A-1. Any changes to the Project Implementation Schedule which will impact the completion date of each deliverable must be mutually agreed to and incorporated into a revised Project Implementation Schedule.

9. SYSTEM DESIGN AND DEVELOPMENT

9.1. Following contract award, Contractor shall conduct an on-site project kick-off meeting with the City's project team to ensure all parties have a common understanding of the requirements, expectations, and schedule; define processes for tracking project status; define change control procedures; discuss and define the deliverable review and final system acceptance processes; and review escalation management process, including lines of communication, reporting relationships, etc.

9.2. The initial phase of implementation will consist of the development of the design and installation schedule and system, equipment, and component submittals. Contractor shall conduct field investigations and site visits as required to confirm existing conditions. Within 60 days after contract award, Contractor shall submit to City a Project Plan, which shall include but not limited to:

9.2.1. Fiber termination due date

9.2.2. Site access authorization

9.2.3. Product data submittal

9.2.4. Responsibility matrix

9.2.5. Cost and schedule impacts

9.3. In the event the Project Plan identifies additional costs greater than the 10% contingency reserved for this Project for unanticipated critical system requirements, the City reserves the right to terminate the Agreement and compensate Contractor for reasonable costs incurred. Such costs shall not exceed the initial payment amount for the Project Plan listed in the first line of Table B-1 (Payment Schedule) of Exhibit B (Compensation).

9.4. Prior to starting pre-installation services, Contractor shall submit a System Design Plan to City for review and approval. The System Design Plan shall include but not limited to:

9.4.1. Test acceptance criteria

9.4.2. System design, drawings, diagrams, layouts, cut sheets, etc.

9.5. At all times, Contractor shall ensure that:

9.5.1. All existing reports continue to function after the upgrade to the system is complete.

9.5.2. The existing export of the historian data to an outside server on the City's business network shall continue uninterrupted.

9.5.3. All existing functionalities critical to system operation shall be maintained.

9.5.4. There is a rollback plan in place and that the existing system is able to take control in the event there are major issues with the new upgraded software during initial rollout.

10. PRE-INSTALLATION SERVICES

10.1. Preliminary Testing

10.1.1. Contractor shall conduct preliminary testing of the hardware, software and new graphics at the Contractor's site during the conversion process in accordance with the System Design Plan.

10.1.2. Contractor shall implement all necessary hardware such as the RTUs currently used by the City to accurately emulate the existing configuration and tags at the City.

10.1.3. City staff shall be able to participate in the preliminary testing process. When a graphic is completed, Contractor shall inform the City. City staff shall be allowed to participate in testing the graphic and all its elements.

10.1.4. The test shall at a minimum check for accuracy of implementation, failure modes and functional correctness for a period of time sufficient to demonstrate proper operations.

10.1.5. System malfunctions discovered during the testing shall be documented and corrected prior to the Factory Acceptance Test (FAT).

10.2. Factory Acceptance Test (FAT)

10.2.1. A FAT shall be conducted to verify the functional performance of the System after Contractor has completed the conversion of the entire HMI and the preliminary testing.

10.2.2. Contractor shall submit to City for approval the acceptance test

criteria and plan at least seven (7) days before the start of the FAT. At a minimum, the FAT procedures shall include but not limited to: graphics functionality, display performance, data collection configuration, Excel spreadsheets, trends, pop-up windows, right click options, navigation, log in, permissions, etc.

10.2.3. The FAT shall be observed by up to five (5) City representatives. In addition. The City shall be given full access to the system during the FAT, with at least one (1) Contractor project staff available to provide information and answer questions.

10.2.4. The City shall be responsible for travel, lodging and meals expenses and shall coordinate and arrange the same.

10.2.5. The FAT shall be considered successfully completed when all criteria have passed their respective test procedures and all test documents have been signed by the City and Contractor. Minor deviations shall not be considered grounds for failure of the FAT. Major deviations found during the FAT shall result in the retest of the respective hardware or software before the FAT is considered successfully complete. The determination of whether a deviation qualifies as a "minor" or "major" deviation shall be at the sole discretion of City's Project Manager.

10.2.6. Upon City's written acceptance of the FAT, Contractor shall perform a full back-up of the system prior to dismantling the equipment for shipment to City.

10.3. Miser Scada System and Graphics Screen Development Training

10.3.1. Contractor shall provide three (3) days of training for up to five (5) City staff. Training shall be at Contractor site after the FAT, and include:

10.3.1.1. One (1) day of system training and two (2) days of graphics training.

10.3.1.2. Training course development, preparation time, and lunch.

11. SYSTEM INSTALLATION AND COMMISSIONING

11.1. Contractor shall procure, install, configure, and deploy the following:

11.1.1. Three (3) new server/workstation racks, one (1) in the SCADA Building, one (1) in the Library, and one (1) in the Emergency Operations Center (EOC), and install new Ethernet cable for racks as needed. Each of the racks shall be provided with a rack

mount Universal Power Supply (UPS) to power all rack mounted hardware for fifteen (15) minutes upon power outage. Contractor shall also provide a rack mount UPS in the already existing City Hall Data Center Rack.

11.1.2. Two (2) new redundant HSQ MISER Servers, to replace existing servers, STCVSA and STCVSB. New servers will be installed in the SCADA Building (STCVSA) and City Hall Data Center (STCVSB). Servers will be rack mounted HPE rx2800 i6 servers running the latest version of VSI OpenVMS operating system and HSQ MISER software. The systems will each have 16GB RAM, a 146 GB system drive, and a 300GB history drive. These servers will have redundant power supplies. Servers will include required software licensing.

11.1.3. Miser software which has the latest available capability of supporting RTU/controller communications over all media typically used in the industry including DNP3 and MODBUS.

11.1.4. Three (3) new HSQ MISER workstations to replace existing workstations STCVS1 and STCVS4 and new workstation STCVS2. Workstations will be located in Library (STCVS1), SCADA Building (STCVS2), and EOC (STCVS4). One (1) workstation, STCVS1, will be configured as the primary MISER Windows PC Client Server to facilitate adding Xview Windows PC clients. A second workstation (STCVS2), will be configured as a backup MISER Windows PC Client Server. Workstations will be new rack mounted HPE rx2800 i6 workstations running the latest version of VSI OpenVMS operating system and HSQ MISER software. These systems will each have 16GB RAM, a 146 GB system drive. These workstations will also be provided with redundant power supplies. Workstations will include required software licensing.

11.1.5. Five (5) 24" HP Monitors for the two (2) servers and three (3) workstations.

11.1.6. Four (4) new HSQ MISER Xview Windows PC clients, to be STCVS3, STCVS5, STCVS6, and STCVS7. Three (3) Xview Windows PC clients will be located in Library. One (1) Xview Windows PC client will be located at the City Hall Water and Sewer office. The four (4) Xview Windows PC Clients will be configured with Windows 10 Pro x64 and the latest version of XView for Windows, Exceed Edition. Windows PC basic specs will be a Dell Optiplex 5070, Intel Core i5 processor, 8 GB Ram, and a 1 TB Hard Drive. Contractor shall confirm with City exact specifications at the time of order. Windows PC Clients will

include required software licensing.

11.1.7. Four (4) 24" Dell Monitors for the 4 Windows PC Clients.

11.1.8. Eight (8) keyboard, video, mouse (KVM) extender pairs for servers, workstations, and Windows PC clients to provide for connection from desks. KVM will provide connections for monitor, keyboard, mouse, and speakers.

11.1.8.1. Two (2) KVM sets will be deployed in the Library and connected to the Workstation and one Windows PC Client in the Library.

11.1.8.2. Two (2) KVM sets will be deployed to the Electric Control Room and connected to two (2) Windows PC Clients in the Library.

11.1.8.3. Two (2) KVM sets will be deployed to the SCADA Building and connected to the Server and Workstation in the SCADA building.

11.1.8.4. One (1) KVM set will be deployed to the EOC and connected to the Workstation in the EOC.

11.1.8.5. One (1) KVM set will be deployed to the City Data Center and connected to the Server in the City Data Center.

11.1.9. Eight (8) current model rack mounted HP switches to facilitate redundant communication between the Library, Electric Control Room, new SCADA building, EOC, the City Hall Data Center, and City Hall office. The City Hall Office will be connected to the redundant switches in the City Hall Data Center. Contractor shall install and configure network components to bring HSQ SCADA network to the Library, Electric Control Room, new SCADA building, the EOC, City Hall Data Center, and City Hall office. Existing fiber communication installed and commissioned by City will be utilized for the communication. Switches will be HP Aruba 2540 Switches with Fiber ports, to provide network redundancy for the upgraded network that has the additional flexibility of accommodating any Layer 3 transports for future isolation and control of the SCADA network, including the ability to add encrypted tunnels and support DECnet across the network. Switches will have 1 Gbps Copper Ethernet Ports and 1 Gbps Fiber Ethernet Ports.

11.1.10. Four (4) N-Tron Fiber/Ethernet Media Converters, one at each rack, for fiber to ethernet conversion.

11.1.11. Two (2) new master radios, and associated antenna and cable accessories, at the SCADA building and Electrical Shop (Master Radio Only), with installation of the antenna and cabling on existing mast at the SCADA Building. Contractor shall work with City Federal Communications Commission (FCC) vendor for related license and permitting. Radios will be setup for an online/standby configuration. Radios will be new GE MDS Master Radios, with required cabling, antennas, and accessories. The new master radios will be installed within the rack at the new SCADA building and the Electrical Shop.

11.1.12. Upgrade thirteen (13) existing SCADA graphics screens to the currently available MISER graphic offerings. Contractor shall provide City with a submittal package with upgrades to screens for approval. Upon approval, Contractor shall install and test the upgraded graphic screens. When the new SCADA graphic screens are functional, the existing SCADA graphics screens will be removed from the system. Contractor has allotted three (3) days per screen for this work. Contractor shall ensure that no existing functionality critical to the system operation is lost.

11.1.13. A current backup of the System to the newest MISER revision, including modifying the database to accommodate an extended acronym length of thirty-five (35) characters, and install a SNMP driver (SNMPNCC) to allow SCADA to directly monitor network devices. Contractor shall configure SNMP monitoring such that the protocol does not have any adverse impacts on the SCADA network communications.

11.2. Contractor shall install the cabinets and power up the system.

11.3. Contractor shall be responsible for mounting the equipment inside the cabinets.

11.4. Once the equipment is mounted and connected to the network, Contractor shall make sure that this connection does not have any negative impact on the proper functioning of the existing system if it is still in operation during commissioning.

11.5. Once a normalized connection is set up and tested, the commissioning of the new system shall commence.

11.6. Contractor shall be responsible for commissioning and startup of the system onsite at the City.

11.7. The end of commissioning of the system means that the entire SCADA system HMI is successfully transferred over to the new HSQ MISER software, hardware, and both wired and wireless communications, and is

able to control and monitor the entire system.

11.8. For the purpose of measuring and ensuring that the new system will perform at a minimum at the same level or better than the existing system, Contractor shall benchmark the performance of the existing system prior to the start of the commissioning of the new system.

11.9. Based on the benchmark established at the start of the commissioning process, the new system shall at a minimum, match the responsiveness, data acquisition and display, control and graphic refresh rate of the existing system.

11.10. Errors discovered during the commissioning period shall be fixed by the Contractor before final system acceptance can commence.

12. FINAL SYSTEM ACCEPTANCE TEST

12.1. Upon the completion of the commissioning period with all errors corrected, the final system acceptance test period shall begin.

12.2. A successful final acceptance test means that the City's operations shall run on the new system error free for a minimum of seven (7) consecutive days, except as otherwise provided in Section 12.3 below.

12.3. In order to complete a successful final acceptance test, errors or anomalies discovered during the final acceptance test period shall be fixed by Contractor based on the response time outlined in Section 15. If the errors are not fixed within the timeframe outlined in Section 15 under maximum resolution time, the test will be considered a failure and the final acceptance test period shall restart.

12.4. Upon Contractor's completion of all the deliverables set forth herein, Contractor and City will memorialize this event by promptly executing a Final System Acceptance Certificate (Appendix A-2).

13. DOCUMENTATION

13.1. Contractor shall document all standard and customized changes to the new system. All hardware changes and additions, including but not limited to rack mounted equipment, shall be documented in Visio.

13.2. Contractor shall provide documentation in electronic format such as DVD or USB media format.

13.3. Contractor shall provide an up to date copy of the configuration files based on the final accepted system configuration.

13.4. Contractor shall at a minimum provide one set of as-shipped HSQ MISER upgraded system full back-up files. Contractor shall provide three (3) sets of

installation and configuration manuals.

14. WARRANTY

14.1. For a period of one year following Final System Acceptance ("Warranty Period"), Contractor shall warrant that the System will perform and operate in accordance with the functional requirements and specifications set forth in this Agreement. All inclusive costs, (parts, labor, repairs, Contractor travel time, Contractor expenses, etc.) covered by the warranty and incurred during the Warranty Period shall be provided without additional cost to the City.

14.2. In the event a warranty call is investigated as a legitimate cost adder to the project, such a change order shall be submitted for the additional cost incurred for work identified as non-warranty work.

14.3. Contractor shall pass through to City any manufacturers' warranties which Contractor receives on the System and, at City's request, Contractor shall enforce such warranties on City's behalf.

15. SERVICE RESPONSE TIME

15.1. Errors discovered during Final System Acceptance Test and the Warranty Period shall have the following characterization and response timeframe:

Error Level	Description	Definition	Maximum Resolution Time
1	Major error without workaround	• Abnormal termination that cannot be bypassed • Major numerical errors • Data corruption • Unimplemented requirements	24 hours
2	Major error with workaround	• Abnormal termination that can be bypassed • Small numerical errors • Minor failures implementing requirements	72 hours
3	Cosmetic error	• Formatting • Description • Display Message	72 hours

16. ADDITIONAL PRODUCTS AND SERVICES

16.1. Unless otherwise included herein, any additional products or services required to upgrade the System shall be at additional cost.

17. TECHNICAL SUPPORT

17.1. Contractor shall provide maintenance and technical support pursuant to the terms and conditions of the existing "Agreement for Telephone Support Service" between HSQ Technology and the City of Santa Clara dated August 29, 2019 and with a term between September 1, 2019 and August 31, 2021.

APPENDIX A-1
PRELIMINARY PROJECT SCHEDULE

The project schedule will proceed in accordance with this Preliminary Project Schedule, except as may be modified into a Final Project Schedule that is approved by the City. The Final Project Schedule, as mutually agreed upon, will become the governing project schedule incorporated into the Agreement.

City acknowledges that the success and timeliness of the implementation process shall require the active participation and collaboration of the City and its staff, and agrees to act reasonably and cooperate fully with Contractor to achieve the completion of the Project.

Contractor shall make all reasonable efforts to improve upon the preliminary dates set forth below.

Task Name	Start	Finish
Contract Award	3/9/2020	
Project Plan	3/9/2020	5/6/2020
Hardware Procurement	6/15/2020	8/14/2020
System Design Plan	5/11/2020	10/2/2020
Preliminary Testing	8/17/2020	10/2/2020
Factory Acceptance Test	10/5/2020	10/9/2020
Miser SCADA System and Graphics Screen Development Training	10/12/2020	10/16/2020
Shipment to City	10/9/2020	10/23/2020
System Installation/Commissioning	10/26/2020	2/5/2021
Final System Acceptance Test	2/8/21	2/12/21
Documentation	1/15/2021	1/29/2021
City's Final System Acceptance	2/15/21	

APPENDIX A-2

FINAL SYSTEM ACCEPTANCE CERTIFICATE

After the City is satisfied with all test results and resolutions, as specified herein, the City will initiate execution of the Final System Acceptance Certificate.

Customer Name: **City of Santa Clara ("City")**

Project Name: **HSQ MISER SCADA Upgrade**

This Final System Acceptance Certificate memorializes the occurrence of System Acceptance.

Contractor and the City acknowledge that:

1. Contractor has completed all Deliverables promised under this Agreement.
2. The System is accepted, and all punch list items generated during testing have been completed.
3. By acknowledging the Final Acceptance of the System, the City agrees to pay any remaining and approved outstanding invoices to Contractor, including previously withheld retainage.

City of Santa ("City")	**HSQ Technology ("Contractor")**
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____
Date: _____	Date: _____

APPENDIX A-3
END USER LICENSE AGREEMENT

END USER LICENSE AGREEMENT

This copy of MISER ("the Software Product") and accompanying documentation is licensed and not sold. This Software Product is protected by copyright laws and treaties, as well as laws and treaties related to other forms of intellectual property. HSQ Technology or its parent company, affiliates, and suppliers (collectively "HSQ") own intellectual property rights in the Software Product. The Licensee's ("you" or "your") license to use the Software Product is subject to these rights and to all the terms and conditions of this End User License Agreement ("Agreement").

Acceptance

YOU ACCEPT AND AGREE TO BE BOUND BY THE TERMS OF THIS AGREEMENT BY INSTALLING OR USING THE SOFTWARE PRODUCT. IF YOU DO NOT AGREE TO ALL OF THE TERMS OF THIS AGREEMENT, YOU MUST NOT INSTALL OR USE THE SOFTWARE PRODUCT.

License Grant

This Agreement entitles you to install and use one copy of the Software Product. In addition, you may make one archival copy of the Software Product. The archival copy must be on a storage medium other than a hard drive, and may only be used for the reinstallation of the Software Product. This Agreement does not permit the installation or use of multiple copies of the Software Product, or the installation of the Software Product on more than one computer at any given time, on a system that allows shared use of applications, on a multi-user network, or on any configuration or system of computers that allows multiple users. Multiple copy use or installation is only allowed if you obtain an appropriate licensing agreement for each user and each copy of the Software Product.

Restrictions on Transfer

Without first obtaining the express written consent of HSQ, you may not assign your rights and obligations under this Agreement, or redistribute, encumber, sell, rent, lease, sublicense, or otherwise transfer your rights to the Software Product.

Restrictions on Use

You may not use, copy, or install the Software Product on any system with more than one computer, or permit the use, copying, or installation of the Software Product by more than one user or on more than one computer. If you hold multiple, validly licensed copies, you may not use, copy, or install the Software Product on any system with more than the number of computers permitted by the license, or permit the use, copying, or installation by more users, or on more computers than the number permitted by license.

You may not decompile, "reverse-engineer". Disassemble, or otherwise attempt to derive the source code for the Software Product.

You may not use the database portion of the Software Product in connection with any software other than the Software Product.

Restrictions on Alteration

You may not modify the Software Product or create any derivative work of the Software Product or its accompanying documentation. Derivative works include but are not limited to translations. You may not alter any files or libraries in any portion of the Software Product. You may not reproduce the database portion or create any tables or reports relating to the database portion.

Restrictions on Copying

You may not copy any part of the Software Product except to the extent that licensed use inherently demands the creation of a temporary copy stored in computer memory and not permanently affixed on storage medium. You may make one archival copy which must be stored on a medium other than a computer hard drive.

Disclaimer of Warranties and Limitation of Liability

UNLESS OTHERWISE EXPLICITLY AGREED TO IN WRITING BY HSQ, HSQ MAKES NO OTHER WARRANTIES, EXPRESSED OR IMPLIED. IN FACT OR IN LAW, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OTHER THAN AS SET FORTH IN THIS AGREEMENT OR IN THE LIMITED WARRANTY DOCUMENTS PROVIDED WITH THE SOFTWARE PRODUCT.

HSQ makes no warranty that the Software Product will meet your requirements or operate under your specific conditions of use. HSQ makes no warranty that operation of the Software Product will be secure, error free, or free from interruption. YOU MUST DETERMINE WHETHER THE SOFTWARE PRODUCT SUFFICIENTLY MEETS YOUR REQUIREMENTS FOR SECURITY AND UNINTERRUPTABILITY. YOU BEAR SOLE RESPONSIBILITY AND ALL LIABILITY FOR ANY LOSS INCURRED DUE TO FAILURE OF THE SOFTWARE PRODUCT TO MEET YOUR REQUIREMENTS. HSQ WILL NOT, UNDER ANY CIRCUMSTANCES, BE RESPONSIBLE OR LIABLE FOR THE LOSS OF DATA ON ANY COMPUTER OR INFORMATION STORAGE DEVICE.

UNDER NO CIRCUMSTANCES SHALL HSQ, ITS DIRECTORS, OFFICERS, EMPLOYEES, OR AGENTS BE LIABLE TO YOU OR ANY OTHER PARTY FOR INDIRECT, CONSEQUENTIAL, SPECIAL, INCIDENTAL, PUNITIVE, OR EXEMPLARY DAMAGES OF ANY KIND (INCLUDING LOST REVENUES OR PROFITS OR LOSS OF BUSINESS) RESULTING FROM THIS AGREEMENT, OR FROM THE FURNISHING, PERFORMANCE, INSTALLATION, OR USE OF THE SOFTWARE PRODUCT, WHETHER DUE TO A BREACH OF CONTRACT, BREACH OF WARRANTY, OR THE NEGLIGENCE OF HSQ OR ANY OTHER PARTY, EVEN IF HSQ IS ADVISED BEFOREHAND OF THE POSSIBILITY OF SUCH DAMAGES. TO THE EXTENT THAT THE APPLICABLE JURISDICTION LIMITS THE ABILITY OF HSQ TO DISCLAIM ANY IMPLIED WARRANTIES, THIS DISCLAIMER SHALL BE EFFECTIVE TO THE MAXIMUM EXTENT PERMITTED.

Limitation of Remedies and Damages

Your remedy for a breach of this Agreement or of any warranty included in this Agreement is the correction or replacement of the Software Product. Selection of whether to correct or replace shall be solely at the discretion of HSQ. HSQ reserves the right to substitute a functionally equivalent copy of the Software Product as a replacement. If HSQ is unable to provide a replacement or substitute Software Product or corrections to the Software Product, your sole alternate remedy shall be a refund of the purchase price for the Software Product exclusive of any costs for shipping and handling.

Any claim must be made within the applicable warranty period. All warranties cover only defects arising under normal use and do not include malfunctions or failure resulting from misuse, abuse, neglect, alteration, problems with electrical power, acts of nature, unusual temperatures or humidity, improper installation, or damage determined by HSQ to have been caused by you. All limited warranties on the Software Product are granted only to you and are non-transferable. You agree to indemnify and hold HSQ harmless from all claims, judgments, liabilities, expenses, or costs arising from your breach of this Agreement and/or acts or omissions.

Governing Law, Jurisdiction, and Costs

This Agreement is governed by the laws of California, without regard to California's conflict or choice of law provisions.

Severability

If any provision of this Agreement shall be held to be invalid or unenforceable, the remainder of this Agreement shall remain in full force and effect. To the extent any express or implied restrictions are not permitted by applicable laws, these express or implied restrictions shall remain in force and effect to the maximum extent permitted by such applicable laws.

APPENDIX A-4
CONTRACTOR'S PROPOSAL QUOTATION NO. 1912-0006-MP
DATED DECEMBER 10, 2019

[See following pages.]

HSQ TECHNOLOGY

26227 Research Road
Hayward, California 94545-3725
Telephone: (510) 259-1334 ◆ *Facsimile: (510) 259-1392*
http://www.hsq.com

APPENDIX A-4
CONTRACTOR'S PROPOSAL QUOTATION NO. 1912-0006-MP DATED DECEMBER 10, 2019

By email: FMortensen@SantaClaraCA.gov
GKoepplin@SantaClaraCA.gov

December 10, 2019

City of Santa Clara
1705 Martin Avenue
Santa Clara, CA 95050

Attention: Franz Mortensen

Reference: **HSQ MISER SCADA System Upgrade – Phase 1**
City of Santa Clara
HSQ Quotation No. 1912-0006-MP

Gentlemen:

HSQ Technology is pleased to offer you the following quotation for upgrading your HSQ MISER SCADA System. The quote is only for the Phase 1 upgrade, which includes new servers and workstations, MISER software upgrades, MISER graphics conversions, new networking hardware, dedicated server and workstation racks, and necessary communication infrastructure installation. Also included are new master radio systems and converting all existing SCADA graphics screens.

Per our most recent meeting with you on August 12, 2019, and in review of the previous emails and budgetary quote, HSQ Technology has detailed a plan for upgrading your HSQ MISER SCADA System, including labor and material summaries.

HSQ MISER System Hardware Upgrade Sequence Description

1. Coordinate and upgrade HSQ MISER software on the two (2) existing HSQ MISER Servers, in the Electric Control Room and library, and two (2) existing Workstations, in Electric Control Room and EOC, in conjunction deployment of the new HSQ MISER Servers.

2. Concurrently, HSQ Technology will, optionally, install the new server/workstation racks, one (1) in the SCADA Building, one (1) in the Library, and one (1) in the EOC, and install new Ethernet cable for racks as needed.

3. Eight (8) current model rack mounted HP Switches will be provided to facilitate redundant communication between the Library, Electric Control Room, new SCADA Building, EOC, the City Hall Data Center, and City Hall office. The City Hall Office will be connected to the redundant switches in the City Hall Data Center. HSQ will

install and configure network components to bring HSQ SCADA network to the Library, Electric Control Room, new SCADA building, the EOC, City Hall Data Center, and City Hall office. Existing fiber communication installed and commissioned by City of Santa Clara, will be utilized for the communication.

4. Procure, configure, install and deploy new redundant HSQ MISER Servers, two (2), to replace existing servers STCVSA and STCVSB. New servers will be located in the SCADA Building (STCVSA), and City Hall Data Center (STCVSB).

5. Procure, configure, install and deploy HSQ MISER Workstations, three (3), to replace existing workstations STCVS1 and STCVS4 and new workstation STCVS2. Workstations will be located in the Library (STCVS1), SCADA Building (STCVS2), and EOC (STCVS4). One (1) workstation, STCVS1, will be configured as the primary MISER Windows PC Client Server, with an additional workstation configured as a backup MISER Windows PC Client Server.

6. Procure, configure, install and deploy HSQ MISER XView Windows PC clients, four (4), to be STCVS3, STCVS5, STCVS6, and STCVS7. Three (3) XView Windows PC clients will be located in the Library and will be small PC clients with a single monitor. Using KVM hardware, HSQ will locate one (1) monitor, keyboard, and mouse set within the Library, and two (2) monitor, keyboard, and mouse sets within the Electric Control Room. All KVM hardware will include audio and a set of speakers. Existing Ethernet network within the building will be used for the KVM extender hardware. One (1) XView Windows PC client will be located at City Hall Office and will not require KVM hardware.

7. Each of the three (3) new SCADA network and hardware racks will be provided with a rack mount UPS to power all rack mounted hardware for fifteen (15) minutes upon power outage. A rack mount UPS will be provided for installation in the existing City Hall Data Center Rack.

8. After successful installation and deployment of new HSQ MISER Servers, including verification of full HSQ MISER System functionality with the existing HSQ RTUs and associated existing communications infrastructure, migrate active monitoring and control of City of Santa Clara facilities with existing HSQ RTUs to the new HSQ MISER Servers by changing the data source of the existing workstations from existing HSQ MISER Server to the new HSQ MISER Servers.

9. After successful migration of the existing Servers and Workstations data source, the existing HSQ MISER Servers and workstations will be removed from the system. The

existing servers and workstations will not be reconfigured as workstations due to the age of the computers.

10. During this process, the Server and Workstation computer hardware will be upgraded to new, rack mountable models and relocated to a designated computer rack location in the Library (Workstation Only), SCADA Building, City Hall Data Center (Server Only) and EOC building (Workstation Only).

11. After the MISER SCADA hardware and software upgrades are complete and operational, HSQ will, optionally, complete upgrade to thirteen (13) existing MISER SCADA Graphics screens.

12. Concurrently, HSQ will supply and install new master radios, and associated antenna and cable accessories, at the SCADA building and Electrical Shop (Master Radio Only), with optional installation of the antenna and cabling on existing mast at the SCADA Building. HSQ and City of Santa Clara will work together for all FCC related license and permitting. Radios will be setup for an Online/Standby configuration

HSQ MISER SCADA System Upgrade Scope of Work

HSQ will provide two (2) new rack mounted HPE rx2800 i6 servers running the latest version of VSI OpenVMS operating system and HSQ MISER software at time of delivery. These systems will each have 16GB RAM, a 146 GB system drive, and a 300GB history drive. These servers will also be provided with redundant power supplies.

HSQ will provide three (3) new rack mounted HPE rx2800 i6 workstations running the latest version of VSI OpenVMS operating system and HSQ MISER software at time of delivery. These systems will each have 16GB RAM, a 146 GB system drive. One workstation will be setup as the Windows PC XView Server to facilitate adding Xview Windows PC clients. These workstations will also be provided with redundant power supplies.

HSQ will provide four (4) new XView Windows PC Clients, running Windows 10 Pro x64 and the latest version of XView for Windows, Exceed Edition. Windows PC basic specs will be a Dell Optiplex 5070, 24" Monitor, Intel Core i5 processor, 8 GB Ram, and a 1 TB Hard Drive. Exact specifications will be confirmed at the time of order.

HSQ will provide eight (8) HP Aruba 2540 Switches with Fiber ports, to provide network redundancy for your upgraded network that has the additional flexibility of accommodating any Layer 3 transports for future isolation and control of the SCADA network, including the ability to add encrypted tunnels and support DECnet across your network. Switches will have 1 Gbps Copper Ethernet Ports and 1 Gbps Fiber Ethernet Ports.

HSQ will provide two (2) new GE MDS Master Radios, with required cabling, antennas, and accessories. The new master radios will be installed within the rack at the new SCADA building and the Electrical Shop.

HSQ will, optionally, upgrade thirteen (13) existing SCADA graphics screens to the currently available MISER graphic offerings. HSQ will provide a submittal package with upgrades to screens for approval. Upon approval, HSQ will install and test the upgraded graphic screens. Once the new SCADA graphic screens are functional, the existing SCADA graphics screens will be removed from the system. HSQ has allotted three (3) days per screen for the above work.

At our Hayward office, we will upgrade a recent backup of your system to the current MISER revision, including modifying the database to accommodate an extended acronym length of thirty-five (35) characters, and install a SNMP driver (SNMPNCC) to allow SCADA to directly monitor your network devices. The new servers and network router/switches will be configured and tested at our Hayward Office.

Once tested, the new HSQ MISER configuration will be prepared for the upgrade of the existing HSQ MISER Servers and Workstations. A plan to minimize downtime will be developed, and our installation engineers will be scheduled for two (2) days of startup to complete the upgrade of the existing HSQ MISER Servers and Workstations and to field test the upgraded system.

Once all MISER SCADA Hardware and Software is upgraded, including network switches, and fully operational, HSQ will, optionally, work with the City of Santa Clara to upgrade thirteen (13) existing SCADA Graphics screens. HSQ has accounted for thirteen (13) screens and has allocated three (3) days of work per screen for coordination, submittal of upgraded screens for approval, installation and testing of new screens, and eventual removal of existing screens.

Bill of Material and Cost Summary

MISER SCADA Software, Hardware and Networking Upgrades

- Hardware - $151,070.00
    - Two (2) HPE rx2800 i6 servers, rack mounted, running the latest version of VSI OpenVMS operating system and HSQ MISER software, 16 GB RAM, 146 GB system drive, 300 GB history drive, redundant power supplies
    - Three (3) HPE rx2800 i6 workstations, rack mounted, running the same version of VSI OpenVMS operating system and HSQ MISER software, 16GB RAM, 146 GB system drive, redundant power supplies
    - Four (4) HSQ MISER XView Windows PC clients, Windows 10 Pro x64, Dell Optiplex 5070, 24" monitor, Intel Core i5 processor, 8 GB Ram, and a 1 TB Hard Drive
    - Three (3) 19", full height, floor mount rack

  - Five (5) 24" HP Monitors
  - Four (4) 24" Dell Monitors
  - Eight (8) HP Aruba 2540 Switches with one (1) Gbps Copper Ethernet and one (1) Gbps Fiber ports
  - Four (4) N-Tron Fiber/Ethernet Media Converters
  - Eight (8) KVM Extender pairs for Server and Workstation connection to desks (Monitor, Keyboard, Mouse) with sound and speakers
  - SCADA Network cabling
  - Four (4) rack mounted UPS, 120V, 2000VA, 10 outlets

- Software - $16,100.00
  - One (1) MISER Upgrade License for new Servers (Redundant) (Replacing existing)
  - Two (2) MISER Upgrade Licenses for new Workstations (Replacing existing)
  - One (1) MISER Full License for new Workstation
  - Four (4) MISER XView for Windows, Exceed Edition, Full Version for Windows PC
- Labor - $36,800.00
  - Field investigation of existing conditions related to network and server rack location
  - Network device configuration
  - MISER software and database upgrade and graphics conversion
  - Existing server and workstation field upgrades for MISER
  - New networking hardware installation and cutover, including KVM hardware
  - New server and workstation field deployment and installation, including existing system functionality with new equipment
  - Cutover from existing servers and workstations to new servers and workstations

Master Radio Upgrades at SCADA Building and Electrical Shop

- Hardware - $35,000.00
  - Two (2) GE MDS Master Radios
  - One (1) set Antenna, Cable, and Accessories
- Labor - $23,000.00
  - Master Radio installation and configuration support
  - FCC License coordination and procurement

Project Management and Expenses (For all mandatory and optional scopes)

- Project Management and Expenses (For all above scopes) - $56,150.00
  - Project Management
  - Project Administration
  - Submittal prep and consumables

- SCADA Network Upgrade Planning and Drawings
- Drawing Drafting
- Freight in and out

Optional Work Scopes

- Optional MISER SCADA Graphic Screen Upgrades (thirteen [13] screens @ three [3] days per screen)
  - Labor - $62,410.00
    - SCADA Graphics Screen upgrades (drafting)
    - SCADA Graphics Screen upgrades submittal and approval
    - SCADA Graphics installation, testing and removal of exiting screens
- Optional MISER SCADA System and Graphics Screen Development Training
  - Labor and Expenses - $11,400.00
    - Three (3) days of training for two (2) City of Santa Clara Employees
      - One (1) day of system training and two (2) days of graphics training
      - Includes training course development, preparation time, and lunch
- Optional Network Cabling and Server Rack Installation
  - Labor - $14,450.00
- Optional Master Radio Antenna and Cable Installations at SCADA Building
  - Labor - $23,470.00

Sales Tax

- City of Santa Clara Sales Tax – 9% on $250,039.00 = $22,503.00

Excluded

- Fiber optic cable installation and testing
- Prevailing Wage
- Certified Payroll
- Bonds
- Permits
- Submittals – other than 'Plans' included above

The total lump sum for the above HSQ MISER Central System Upgrade Scope of Work is as Follows;

MISER SCADA Software, Hardware, Networking and Radio Upgrades	$318,120.00
Estimated Sales Tax on Hardware, Software and Subcontractor	$22,503.00
Optional MISER SCADA Graphics Upgrades	$62,410.00
Optional MISER SCADA Graphics Screen Development Training	$11,400.00

Optional network cabling and server rack installation is an additional	$14,450.00
Optional Master Radio antenna and cabling installation is an additional	$23,470.00
TOTAL LUMP SUM INCLUDING OPTIONS AND SALES TAX	**$452,353.00**

Total lump sum above is a not to exceed amount, unless modified by an approved change order.

This quote is valid for a period of ninety (90) days. The HSQ MISER Central System Upgrade Scope of Work, as described above, will be completed according to a schedule mutually agreed upon between HSQ Technology and the City of Santa Clara.

HSQ appreciates the opportunity to provide you with this quotation and looks forward to working with you to finalize the scope of work, pricing, and any required adjustments to the phasing plan scheduling for upgrading your HSQ MISER System.

VISA and MasterCard are accepted for order payments and will be subject to a surcharge.

The HSQ warranty period shall commence on the date of beneficial use and will be twelve (12) months from that date (unless modified by equitable adjustment).

The tax will be adjusted to the current rate at the time of order.

The above lump sum is based upon receiving 'contract documents' and review of 'Terms & Conditions'.

Please contact the undersigned if you have any questions and/or ready to proceed with the HSQ MISER Central System Upgrade Scope of Work.

Sincerely yours,

HSQ TECHNOLOGY

Matt Puskas
Senior Estimator

MP/ks

Enclosures:
1. HPE Integrity rx2800 i6 Server Data Sheet
2. HP Aruba 2540 Switch Data Sheet
3. GE MDS Master Radio Data Sheet
4. APC UPS Data Sheet

HP Integrity rx2800 i6

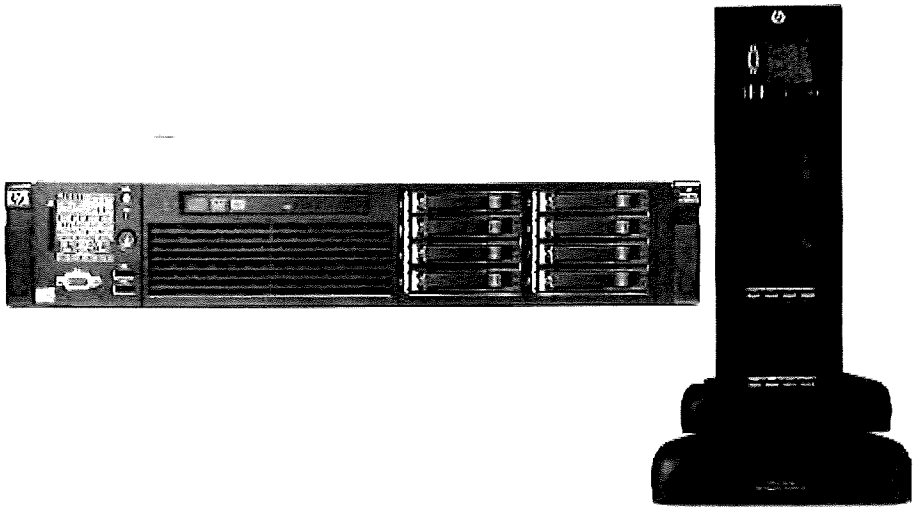
MISER Workstation / Server

HSQ TECHNOLOGY

Technical Summary

Key Features

- ◇ 4-Core 1.73 GHz Processor
- ◇ 4-Port 1GbE LAN
- ◇ 8-Port Serial Attached SCSI Controller
- ◇ 4 USB Ports (2 front, 2 rear)
- ◇ 2 VGA Ports (1 front, 1 rear)
- ◇ 1 RS-232 Port
- ◇ SATA DVD Optical Drive
- ◇ Rackmount and Free-Standing options
- ◇ Redundant Power Supply option
- ◇ RAID 0, 1, 5, 6, and 10 capabilities
- ◇ ENERGY STAR® Compliant



The HP rx2800 i6 is the latest MISER workstation/server from HSQ. It offers a 64-bit, quad-core, 9700 series Intel Itanium processor. The rx2800 i6 is energy-efficient and offers high availability due to its hot-swappable power supplies, hard disk drives, and cooling system. Due to it running the MISER operating system, the rx2800 i6 does not need constant rebooting to implement patches like a Windows machine and also has no need for anti-virus software. Since 1989, no viruses have been reported as existing on any MISER system, making it a highly available and secure OS that is easy to use. The rx2800 i6 lowers your Total Cost of Ownership (TCO) with performance, compact scalability, energy efficiency, and the 99.99% uptime inherent with the MISER operating system.

Other Features

- **HSQ MISER Operating System**
  - **Optimized for a wide variety of environments, including combinations of I/O intensive, client/server, real-time, and other applications**
  - **Routinely passes security audits such as Department of Defense Information Assurance Certification and Accreditation Process (DIACAP), Department of Energy (DOE), and Department of Homeland Security (DHS)**
- **Integrity Integrated Lights Out 3 (iLO3) Management Processor**
- **Volume shadowing with an increase of up to six member disks**
- **Improved application performance**
- **Compression support with BACKUP Utility**

General Specifications

• **Dimensions:**	
• **Rackmount (2U)** W x H x D	482 x 89 x 692 mm (19 x 3.5 x 27.25 in.)
• **Pedestal Mount** W x H x D	127 x 508 x 692 mm (5 x 20 x 27.25 in.)
• **Power Input:** (per power supply)	100-120 VAC, 9.3 A max @ 100 VAC 200-240 VAC, 6.6 A max @ 200 VAC
• **Power Supply Output:**	800 W max @100-240 VAC 1200 W max @ 200-240 VAC
• **Weight:**	30 kg (66 lbs.)

Communications

• **Serial Ports:**	One RS-232, DB9 connector
• **LAN:**	Four 10/100/1000 Base-T, RJ-45 ports

Environment

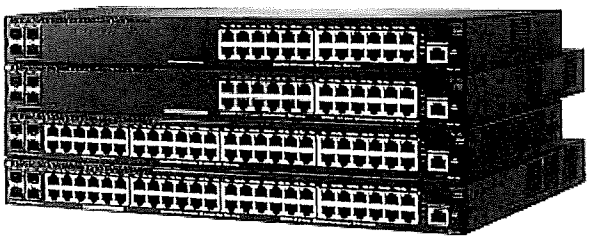
• **Operating Temperature:**	5 – 35° C (41 – 95° F)
• **Storage Temperature:**	-40 – 80° C (-40 – 175° F)
• **Operating Humidity:**	20 – 80% (non-condensing)
• **Storage Humidity:**	8 – 90% (non-condensing)

26227 Research Road, Hayward, California 94545
Phone: (510) 259-1334 Fax: (510) 259-1392
sales@hsq.com www.hsq.com

Rev. 01/2019

DATA SHEET

ARUBA 2540 SWITCH SERIES



PRODUCT OVERVIEW

Designed for the digital workplace, the Aruba 2540 Switch Series is optimized for today's mobile and IoT needs. The switches are easy to deploy, use and manage using Aruba AirWave or Aruba Central. Aruba ClearPass offers centralized security and external captive portal support.

The Aruba 2540 Switch Series provides a convenient and cost-effective wired access solution that can be quickly set up with Zero Touch Provisioning. PoE+ models deliver power across all access ports for wireless APs, security cameras, and other IoT devices.

The 2540 has wire-speed backhaul bandwidth capacity with built-in 10 GbE uplinks, robust QoS, static and RIP routing, IPv6 and includes a limited lifetime warranty with no software licensing required.

KEY FEATURES

- Aruba Layer 2 switch series with static and RIP routing, ACLs, and robust QoS
- Security and network management via Aruba ClearPass Policy Manager, Aruba AirWave and Aruba Central
- Simple deployment with Zero Touch Provisioning
- Convenient 10 GbE uplinks and up to 370 W PoE+
- Software defined ready with REST APIs

ENHANCED FEATURES

Software-defined networks

- Supports REST APIs to enable automation of network operations, monitoring, and troubleshooting

Unified Wired and Wireless

- Supports unified wired and wireless policies using Aruba ClearPass Policy Manager
- Switch auto-configuration automatically configures switches for different settings such as VLAN, CoS, PoE max power, and PoE priority when an Aruba access point is detected
- User Role defines a set of switch-based policies in areas such as security, authentication, and QoS. A user role can be assigned to a group of users or devices, using switch-based local user role or download from ClearPass
- Static IP Visibility allows ClearPass to do accounting for clients with static IP address

Quality of Service (QoS)

- Traffic prioritization (IEEE 802.1p) allows real-time traffic classification into eight priority levels mapped to eight queues
- Layer 4 prioritization based on TCP/UDP port numbers
- Class of service (CoS) sets the IEEE 802.1p priority tag based on IP address, IP Type of Service (ToS), Layer 3 protocol, TCP/UDP port number, source port, and DiffServ
- Rate limiting sets per-port ingress enforced maximums and per-port, per-queue minimums
- Large buffers provide graceful congestion management

Connectivity

- Flexible 10 Gbps Ethernet with four built-in 10 Gigabit ports (SFP+)
- Auto-MDIX provides automatic adjustments for straight-through or crossover cables on all 10/100 and 10/100/1000 ports
- IEEE 802.3at Power over Ethernet (PoE+) provides up to 30 W per port that allows support of the latest PoE+-capable devices such as IP phones, wireless access points, and security cameras, as well as any IEEE 802.3af-compliant end device; eliminates the cost of additional electrical cabling and circuits that would otherwise be necessary in IP phone and WLAN deployments

- Pre-standard PoE support detects and provides power to pre-standard PoE devices
- IPv6
  - IPv6 host Enables switches to be managed in an IPv6 network
  - Dual stack (IPv4 and IPv6) Transitions from IPv4 to IPv6, supporting connectivity for both protocols
  - MLD snooping Forwards IPv6 multicast traffic to the appropriate interface
  - IPv6 ACL/QoS Supports ACL and QoS for IPv6 network traffic
  - IPv6 routing Supports static and RIPng protocols
  - Security Provides RA guard, DHCPv6 protection, dynamic IPv6 lockdown, and ND snooping

Performance and Efficiency

- Energy-efficient design delivers power savings
  - 80 PLUS Silver Certified power supply increases efficiency and savings
  - Energy-efficient Ethernet (EEE) support reduces power consumption in accordance with IEEE 802.3az
- Designed with the latest ProVision ASIC, providing very low latency, increased packet buffering, and adaptive power consumption
- Selectable queue configurations allow for increased performance by selecting the number of queues and associated memory buffering that best meet the requirements of the network applications

Convergence

- IP multicast snooping and IGMP automatically prevent flooding of IP multicast traffic
- IEEE 802.1AB Link Layer Discovery Protocol (LLDP) facilitates easy mapping using network management applications with LLDP automated device discovery protocol
- LLDP-MED (Media Endpoint Discovery) defines a standard extension of LLDP that stores values for parameters such as QoS and VLAN to configure automatically network devices such as IP phones
- PoE and PoE+ allocations support multiple methods (automatic, IEEE 802.3at dynamic, LLDP-MED fine grain, IEEE 802.3af device class, or user-specified) to allocate and manage PoE and PoE+ power for more efficient energy savings
- Local MAC Authentication assigns attributes such as VLAN and QoS using locally configured profile that can be a list of MAC prefixes

Resiliency and high availability

- IEEE 802.1s Multiple Spanning Tree provides high link availability by allowing multiple spanning trees; provides legacy support for IEEE 802.1d and IEEE 802.1w
- IEEE 802.3ad link-aggregation-control protocol (LACP) and port trunking support up to 26 static, dynamic, or distributed trunks with each trunk having up to eight links (ports) per static trunk
- SmartLink provides easy-to-configure link redundancy of active and standby links

Simplified Configuration and Management

- SNMPv1, v2, and v3 provide complete support of SNMP; support of industry-standard Management Information Base (MIB) plus private extensions; SNMPv3 supports increased security using encryption
- Zero-Touch Provisioning (ZTP) simplifies installation of the switch using Aruba Activate or a DHCP-based process with AirWave Network Management
- Flexible management with same hardware – Supports both cloud-based Central and on-premise AirWave without ripping and replacing switching infrastructure
- Aruba Central cloud-based management platform offers a simple, secure, and cost-effective way to manage switches

Manageability

- Dual flash images provide independent primary and secondary operating system files for backup while upgrading
- Friendly port names allow assignment of descriptive names to ports
- Find-Fix-Inform finds and fixes common network problems automatically, then informs administrator
- Multiple configuration files allow multiple configuration files to be stored to a flash image
- Software updates free downloads from the Web
- RMON, XRMON, and sFlow® provide advanced monitoring and reporting capabilities for statistics, history, alarms, and events
- Troubleshooting ingress and egress port monitoring enable more efficient problem solving
- Unidirectional link detection (UDLD) monitors the link between two switches and blocks the ports on both ends of the link if the link goes down at any point between the two devices

Layer 2 switching

- VLAN support and tagging supports IEEE 802.1Q (4,094 VLAN IDs) and 512 VLANs simultaneously
- Jumbo packet support improves the performance of large data transfers; supports frame size of up to 9,220 bytes
- IEEE 802.1v protocol VLANs isolate select non-IPv4 protocols automatically into their own VLANs
- Rapid per-VLAN spanning tree (RPVST+) allows each VLAN to build a separate spanning tree to improve link bandwidth usage; is compatible with PVST+
- GVRP and MVRP allow automatic learning and dynamic assignment of VLANs

Layer 3 services

- DHCP server centralizes and reduces the cost of IPv4 address management

Layer 3 routing

- Static IP routing provides manually configured routing; includes ECMP capability
- 256 static and 2,000 RIP routes facilitate segregation of user data, without adding external hardware
- Routing Information Protocol (RIP) provides RIPv1, RIPv2, and RIPng routing

Security

- Multiple user authentication methods
  - Uses an IEEE 802.1X supplicant on the client in conjunction with a RADIUS server to authenticate in accordance with industry standards
  - Supports web-based authentication
  - Supports MAC-based authentication
- Authentication flexibility
  - Multiple IEEE 802.1X users per port provides authentication of multiple devices on a single port; prevents a user from piggybacking on another user's IEEE 802.1X authentication
  - Concurrent IEEE 802.1X, Web, and MAC authentication schemes per port switch port will accept up to 32 sessions of IEEE 802.1X, Web, and MAC authentications
- Access control lists (ACLs) provide IP Layer 3 filtering based on source and destination IP address or subnet and source and destination TCP/UDP port number
- Source-port filtering allows only specified ports to communicate with each other
- RADIUS/TACACS+ eases switch management security administration by using a password authentication server
- Secure shell encrypts all transmitted data for secure remote CLI access over IP networks
- Secure Sockets Layer (SSL) encrypts all HTTP traffic, allowing secure access to the browser-based management GUI in the switch
- Port security allows access only to specified MAC addresses, which can be learned or specified by the administrator
- MAC address lockout prevents particular configured MAC addresses from connecting to the network
- Secure FTP allows secure file transfer to and from the switch; protects against unwanted file downloads or unauthorized copying of a switch configuration file
- Switch management logon security helps secure switch CLI logon by optionally requiring either RADIUS or TACACS+ authentication
- Custom banner displays security policy when users log in to the switch
- STP BPDU port protection blocks Bridge Protocol Data Units (BPDUs) on ports that do not require BPDUs, preventing forged BPDU attacks
- DHCP protection blocks DHCP packets from unauthorized DHCP servers, preventing denial-of-service attacks
- Dynamic ARP protection blocks ARP broadcasts from unauthorized hosts, preventing eavesdropping or theft of network data
- Dynamic IP lockdown works with DHCP protection to block traffic from unauthorized hosts, preventing IP source address spoofing
- STP root guard protects the root bridge from malicious attacks or configuration mistakes
- Identity-driven ACL enables implementation of a highly granular and flexible access security policy and VLAN assignment specific to each authenticated network user
- Per-port broadcast throttling configures broadcast control selectively on heavy traffic port uplinks
- Monitor and diagnostics digital optical monitoring of SFP+ and 1000BASE-T transceivers allow detailed monitoring of the transceiver settings and parameters

Warranty and support

- Limited Lifetime Warranty
  See **www.hpe.com/networking/warrantysummary** for warranty and support information included with your product purchase
- Software releases to find software for your product, refer to **www.hpe.com/networking/support**; for details on the software releases available with your product purchase, refer to **www.hpe.com/networking/warrantysummary**

SPECIFICATIONS

	Aruba 2540 24G 4SFP+ Switch (JL354A)	Aruba 2540 48G 4SFP+ Switch (JL355A)
I/O ports and slots		
	24 RJ-45 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 4 SFP+ 1/10GbE ports; PHY-less	48 RJ-45 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only 4 SFP+ 1/10GbE ports; PHY-less
Additional ports and slots		
	1 dual-personality (RJ-45 or USB micro-B) serial console port	1 dual-personality (RJ-45 or USB micro-B) serial console port
Physical characteristics		
Dimensions	17.42(w) x 7.88(d) x 1.73(h) in. (44.25 x 20.02 x 4.39 cm) (1U height)	17.42(w) x 9.7(d) x 1.73(h) in. (44.25 x 24.63 x 4.39 cm) (1U height)
Weight	5.31 lb (2.41 kg)	6.83 lb (3.10 kg)
Memory and processor	Dual Core ARM® Coretex A9 @ 1016 MHz, 1 GB DDR3 SDRAM; Packet buffer size: 12.38 MB 4.5 MB Ingress/7.875 MB Egress, 4 GB eMMC	Dual Core ARM Coretex A9 @ 1016 MHz, 1 GB DDR3 SDRAM; Packet buffer size: 12.38 MB 4.5 MB Ingress/7.875 MB Egress, 4 GB eMMC
Performance		
1,000 MB Latency	< 3.8 µs (64-byte packets)	< 3.8 µs (64-byte packets)
10 Gbps Latency	< 1.6 µs (64-byte packets)	< 1.6 µs (64-byte packets)
Throughput	up to 95.2 Mpps	up to 112.0 Mpps
Switching capacity	128 Gbps	176 Gbps
Routing table size	2,000 entries (IPv4), 1,000 entries (IPv6)	2,000 entries (IPv4), 1,000 entries (IPv6)
MAC address table size	16,384 entries	16,384 entries
Environment		
Operating temperature	32°F to 113°F (0°C to 45°C); up to 5,000 Feet, -0°C to 40°C (32°F to 104°F) up to 10,000 Feet	32°F to 113°F (0°C to 45°C); up to 5,000 Feet, -0°C to 40°C (32°F to 104°F) up to 10,000 Feet
Operating relative humidity	15% to 95% @ 104°F (40°C), noncondensing	15% to 95% @ 104°F (40°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C); up to 15,000 Feet	-40°F to 158°F (-40°C to 70°C); up to 15,000 Feet
Nonoperating/Storage relative humidity	15% to 95% @ 149°F (65°C), noncondensing	15% to 95% @ 149°F (65°C), noncondensing
Acoustic	Power: 49.7 dB, Pressure: 37.1 dB	Power: 54.1 dB, Pressure: 40.2 dB
Airflow direction	Side-to-side	Side-to-side
Electrical characteristics		
Frequency	50/60 Hz	50/60 Hz
Maximum heat dissipation	100 BTU/hr (105.5 kJ/hr)	159 BTU/hr (167.74 kJ/hr)
Voltage	100–127/200–240 VAC, rated	100–127/200–240 VAC, rated
Current	0.6/0.4 A	0.9/0.6 A
Maximum power rating	29.3 W	46.6 W
Idle power	19.5 W	32.7 W
Notes	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated.	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated.

SPECIFICATIONS

	Aruba 2540 24G 4SFP+ Switch (JL354A)	Aruba 2540 48G 4SFP+ Switch (JL355A)
Safety		
	UL 60950-1, 2nd Edition; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011 +A2:2013; IEC 60950-1:2005 +A1:2009 +A2:2013; CSA 22.2 No. 60950-1-07 2nd; EN 60825-1:2007/IEC 60825-1:2007 Class 1	UL 60950-1, 2nd Edition; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013; IEC 60950-1:2005 +A1:2009 +A2:2013; CSA 22.2 No. 60950-1-07 2nd; EN 60825-1:2007/IEC 60825-1:2007 Class 1
Emissions		
	VCCI Class A; CNS 13438; ICES-003 Class A; FCC CFR 47 Part 15, Class A; EN 55022: 2010/CISPR-22, Class A	VCCI Class A; CNS 13438; ICES-003 Class A; FCC CFR 47 Part 15, Class A; EN 55022: 2010/CISPR-22, Class A
Immunity		
Generic	EN 55024:2010/CISPR 24	EN 55024:2010/CISPR 24
ESD	IEC 61000-4-2	IEC 61000-4-2
Radiated	IEC 61000-4-3	IEC 61000-4-3
EFT/Burst	IEC 61000-4-4	IEC 61000-4-4
Surge	IEC 61000-4-5	IEC 61000-4-5
Conducted	IEC 61000-4-6	IEC 61000-4-6
Power frequency magnetic field	IEC 61000-4-8	IEC 61000-4-8
Voltage dips and interruptions	IEC 61000-4-11	IEC 61000-4-11
Harmonics	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Management		
	Aruba Central; Aruba AirWave Network Management; IMC – Intelligent Management Center; Command-line interface; Web browser; Configuration menu; SNMP manager; Telnet; RMON1; FTP; Out-of-band management (serial RS-232C or micro USB)	Aruba Central; Aruba AirWave Network Management; IMC – Intelligent Management Center; Command-line interface; Web browser; Configuration menu; SNMP manager; Telnet; RMON1; FTP; Out-of-band management (serial RS-232C or micro USB)
Services		
	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.

SPECIFICATIONS

	Aruba 2540 24G PoE+ 4SFP+ Switch (JL356A)	Aruba 2540 48G PoE+ 4SFP+ Switch (JL357A)
I/O ports and slots		
	24 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only 4 SFP+ 1/10GbE ports; PHY-less	48 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only 4 SFP+ 1/10GbE ports; PHY-less
Additional ports and slots		
	1 dual-personality (RJ-45 or USB micro-B) serial console port	1 dual-personality (RJ-45 or USB micro-B) serial console port
Physical characteristics		
Dimensions	17.42(w) x 11.98(d) x 1.73(h) in. (44.25 x 30.42 x 4.39 cm) (1U height)	17.42(w) x 11.98(d) x 1.73(h) in. (44.25 x 30.42 x 4.39 cm) (1U height)
Weight	8.6 lb (3.9 kg)	9.83 lb (4.46 kg)
Memory and processor	Dual Core ARM Coretex A9 @ 1016 MHz, 1 GB DDR3 SDRAM; Packet buffer size: 12.38 MB 4.5 MB Ingress/7.785 MB Egress, 4 GB eMMC	Dual Core ARM Coretex A9 @ 1016 MHz, 1 GB DDR3 SDRAM; Packet buffer size: 12.38 MB 4.5 MB Ingress/7.875 MB Egress, 4 GB eMMC
Performance		
1,000 MB Latency	< 3.8 µs (64-byte packets)	< 3.8 µs (64-byte packets)
10 Gbps Latency	< 1.6 µs (64-byte packets)	< 1.6 µs (64-byte packets)
Throughput	up to 95.2 Mpps	up to 112.0 Mpps
Switching capacity	128 Gbps	176 Gbps
Routing table size	2,000 entries (IPv4), 1,000 entries (IPv6)	2,000 entries (IPv4), 1,000 entries (IPv6)
MAC address table size	16,384 entries	16,384 entries
Environment		
Operating temperature	32°F to 113°F (0°C to 45°C); up to 5,000 Feet, -0°C to 40°C (32°F to 104°F) up to 10,000 Feet	32°F to 113°F (0°C to 45°C); up to 5,000 Feet, -0°C to 40°C (32°F to 104°F) up to 10,000 Feet
Operating relative humidity	15% to 95% @ 104°F (40°C), noncondensing	15% to 95% @ 104°F (40°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C); up to 15,000 Feet	-40°F to 158°F (-40°C to 70°C); up to 15,000 Feet
Nonoperating/Storage relative humidity	15% to 95% @ 149°F (65°C)	15% to 95% @ 149°F (65°C)
Acoustic	Power: 54.1 dB, Pressure: 40.6 dB	Power: 55.7 dB, Pressure: 41.7 dB
Airflow direction	Side-to-side	Side-to-side
Electrical characteristics		
Frequency	50/60 Hz	50/60 Hz
80plus.org Certification	Silver	Silver
Maximum heat dissipation	258.0 BTU/hr (272.2 kJ/hr)	293.0 BTU/hr (309.1 kJ/hr)
Voltage	100–127/200–240 VAC, rated	100–127/200–240 VAC, rated
Current	4.9/2.4 A	5.1/2.5 A
Maximum power rating	445 W	459 W
Idle power	36.8 W	48.6 W

SPECIFICATIONS

	Aruba 2540 24G PoE+ 4SFP+ Switch (JL356A)	Aruba 2540 48G PoE+ 4SFP+ Switch (JL357A)
Electrical characteristics continued		
PoE power	370 W PoE+	370 W PoE+
Notes	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated.	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated.
Safety		
	UL 60950-1 2nd Edition; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013; IEC 60950-1:2005 +A1:2009 +A2:2013; CSA 22.2 No. 60950-1-07 2nd; EN 60825-1:2007/IEC 60825-1:2007 Class 1	UL 60950-1 2nd Edition; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013; IEC 60950-1:2005 +A1:2009 +A2:2013; CSA 22.2 No. 60950-1-07 2nd; EN 60825-1:2007/IEC 60825-1:2007 Class 1
Emissions		
	VCCI Class A; CNS 13438; ICES-003 Class A; FCC CFR 47 Part 15, Class A; EN 55022: 2010/CISPR-22, Class A	VCCI Class A; CNS 13438; ICES-003 Class A; FCC CFR 47 Part 15, Class A; EN 55022: 2010/CISPR-22, Class A
Immunity		
Generic	EN 55024:2010/CISPR 24	EN 55024:2010/CISPR 24
ESD	IEC 61000-4-2	IEC 61000-4-2
Radiated	IEC 61000-4-3	IEC 61000-4-3
EFT/Burst	IEC 61000-4-4	IEC 61000-4-4
Surge	IEC 61000-4-5	IEC 61000-4-5
Conducted	IEC 61000-4-6	IEC 61000-4-6
Power frequency magnetic field	IEC 61000-4-8	IEC 61000-4-8
Voltage dips and interruptions	IEC 61000-4-11	IEC 61000-4-11
Harmonics	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Management		
	Aruba Central; Aruba AirWave Network Management; IMC – Intelligent Management Center; Command-line interface; Web browser; Configuration menu; SNMP manager; Telnet; RMON1; FTP; Out-of-band management (serial RS-232C or micro USB)	Aruba Central; Aruba AirWave Network Management; IMC – Intelligent Management Center; Command-line interface; Web browser; Configuration menu; SNMP manager; Telnet; RMON1; FTP; Out-of-band management (serial RS-232C or micro USB)
Services		
	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.

STANDARDS AND PROTOCOLS (APPLIES TO ALL PRODUCTS IN SERIES)

Denial of service protection

- CPU DoS Protection

Device management

- RFC 1155 Structure and Mgmt Information (SMIv1)
- RFC 1157 SNMPv1/v2c
- RFC 1591 DNS (client)
- RFC 1901 (Community based SNMPv2)
- RFC 1901-1907 SNMPv2c, SMIv2 and Revised MIB-II
- RFC 1908 (SNMP v1/2 Coexistence)
- RFC 2576 (Coexistence between SNMP V1, V2, V3)
- RFC 2578-2580 SMIv2
- RFC 2579 (SMIv2 Text Conventions)
- RFC 2580 (SMIv2 Conformance)
- RFC 2819 (RMON groups Alarm, Event, History and Statistics only)
- RFC 3416 (SNMP Protocol Operations v2)
- RFC 3417 (SNMP Transport Mappings)
- HTML and telnet management
- HTTP, SSHv1, and Telnet
- Multiple Configuration Files
- Multiple Software Images
- SNMP v3 and RMON RFC support
- SSHv1/SSHv2 Secure Shell
- TACACS/TACACS+
- Web UI

General protocols

- IEEE 802.1AX-2008 Link Aggregation
- IEEE 802.1D MAC Bridges
- IEEE 802.1p Priority
- IEEE 802.1Q VLANs
- IEEE 802.1s Multiple Spanning Trees
- VLAN classification by Protocol and Port
- IEEE 802.3ad Link Aggregation Control Protocol (LACP)
- IEEE 802.3af Power over Ethernet
- IEEE 802.3at PoE+
- IEEE 802.3az Energy Efficient Ethernet
- IEEE 802.3x Flow Control
- RFC 768 UDP
- RFC 783 TFTP Protocol (revision 2)
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 854 TELNET
- RFC 868 Time Protocol
- RFC 951 BOOTP
- RFC 1058 RIPv1
- RFC 1256 ICMP Router Discovery Protocol (IRDP)
- RFC 1350 TFTP Protocol (revision 2) IEEE 802.1v
- RFC 1519 CIDR IEEE 802.1w Rapid Reconfiguration
- RFC 1542 BOOTP Extensions IEEE 802.3ab
- RFC 1918 Address Allocation for Private Internet
- RFC 2030 Simple Network Time Protocol (SNTP) v4
- RFC 2131 DHCP
- RFC 2236 IGMPv2
- RFC 2453 RIPv2
- RFC 2865 Remote Authentication Dial In User Service (RADIUS)
- RFC 2866 RADIUS Accounting
- RFC 3046 DHCP Relay Agent Information Option
- RFC 3411 An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks
- RFC 3412 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
- RFC 3413 Simple Network Management Protocol (SNMP) Applications
- RFC 3414 User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)
- RFC 3415 View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)
- RFC 3416 Protocol Operations for SNMP
- RFC 3417 Transport Mappings for the Simple Network Management Protocol (SNMP)
- RFC 3418 Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)
- RFC 3575 IANA Considerations for RADIUS
- RFC 3576 Ext to RADIUS (CoA only)
- RFC 4541 Considerations for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping Switches
- RFC 4675 RADIUS VLAN & Priority
- RFC 4861 Neighbor Discovery for IP version 6 (IPv6)
- RFC 4862 IPv6 Stateless Address Auto configuration
- RFC 5905 Network Time Protocol Version 4: Protocol and Algorithms Specification
- UDLD (Uni-directional Link Detection)

IP multicast

- RFC 1112 IGMP
- RFC 2236 IGMPv2
- RFC 2710 Multicast Listener Discovery (MLD) for IPv6
- RFC 4541 Considerations for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping Switches

IPv6

- RFC 1981 IPv6 Path MTU Discovery
- RFC 2080 RIPng for IPv6
- RFC 2081 RIPng Protocol Applicability
- RFC 2082 RIP-2 MD5 Assignments
- RFC 2460 IPv6 Specification
- RFC 2464 Transmission of IPv6 over Ethernet Networks
- RFC 2710 Multicast Listener Discovery (MLD) for IPv6
- RFC 2925 Definitions of Managed Objects for Remote Ping, Traceroute, and Lookup Operations (Ping only)
- RFC 3019 MLDv1 MIB
- RFC 3315 DHCPv6 (client and relay)
- RFC 3484 Default Address Selection for IPv6
- RFC 3513 IPv6 Addressing Architecture
- RFC 3596 DNS Extension for IPv6
- RFC 3810 MLDv2 for IPv6
- RFC 4022 MIB for TCP
- RFC 4113 MIB for UDP
- RFC 4251 SSHv6 Architecture
- RFC 4252 SSHv6 Authentication
- RFC 4253 SSHv6 Transport Layer
- RFC 4254 SSHv6 Connection
- RFC 4291 IP Version 6 Addressing Architecture
- RFC 4293 MIB for IP
- RFC 4419 Key Exchange for SSH
- RFC 4443 ICMPv6
- RFC 4541 IGMP & MLD Snooping Switch
- RFC 4861 IPv6 Neighbor Discovery
- RFC 4862 IPv6 Stateless Address Auto-configuration
- RFC 5095 Deprecation of Type 0 Routing Headers in IPv6
- RFC 6620 FCFS SAVI
- draft-ietf-savi-mix

MIBs

- IEEE 802.1ap (MSTP and STP MIB's only)
- IEEE 8021-Bridge-MIB (2008)
- IEEE 8021-Q-Bridge-MIB (2008)
- RFC 1155 Structure & ID of Mgmt Info for TCP/IP Internets
- RFC 1156 (TCP/IP MIB)
- RFC 1157 A Simple Network Management Protocol (SNMP)
- RFC 1213 MIB II
- RFC 1493 Bridge MIB
- RFC 1724 RIPv2 MIB
- RFC 2021 RMONv2 MIB
- RFC 2578 Structure of Management Information Version 2 (SMIv2)
- RFC 2579 Textual Conventions for SMIv2
- RFC 2580 Conformance Statements for SMIv2
- RFC 2613 SMON MIB
- RFC 2618 RADIUS Client MIB
- RFC 2620 RADIUS Accounting MIB
- RFC 2665 Ethernet-Like-MIB
- RFC 2668 802.3 MAU MIB
- RFC 2674 802.1p and IEEE 802.1Q Bridge MIB
- RFC 2737 Entity MIB (Version 2)
- RFC 2819 RMON MIB
- RFC 2863 The Interfaces Group MIB
- RFC 2925 Ping MIB
- RFC 2932 IP (Multicast Routing MIB)
- RFC 2933 IGMP MIB
- RFC 3414 SNMP-User based-SM MIB
- RFC 3415 SNMP-View based-ACM MIB
- RFC 3417 Simple Network Management Protocol (SNMP) over IEEE 802 Networks
- RFC 3418 MIB for SNMPv3
- RFC 4836 Managed Objects for 802.3 Medium Attachment Units (MAU)

Network management

- IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
- RFC 1155 Structure of Management Information
- RFC 1157 SNMPv1
- RFC 2021 Remote Network Monitoring Management Information Base Version 2 using SMIv2
- RFC 2576 Coexistence between SNMP versions
- RFC 2578 Structure of Management Information Version 2 (SMIv2)

- RFC 2579 Textual Conventions for SMIv2
- RFC 2580 Conformance Statements for SMIv2
- RFC 2819 Four groups of RMON: 1 (statistics), 2 (history), 3 (alarm) and 9 (events)
- RFC 2819 Remote Network Monitoring Management Information Base
- RFC 2856 Textual Conventions for Additional High Capacity Data Types
- RFC 2925 Definitions of Managed Objects for Remote Ping, Traceroute, and Lookup Operations
- RFC 3164 BSD syslog Protocol
- RFC 3176 sFlow
- RFC 3411 SNMP Management Frameworks
- RFC 3412 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
- RFC 3413 Simple Network Management Protocol (SNMP) Applications
- RFC 3414 User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)
- RFC 3415 View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)
- RFC 3418 Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)
- RFC 5424 Syslog Protocol
- ANSI/TIA-1057 LLDP Media Endpoint
- Discovery (LLDP-MED)
- SNMPv1/v2c/v3 XRMON

QoS/CoS

- IEEE 802.1p (CoS)
- RFC 2474 DiffServ Precedence, including 8 queues/port
- RFC 2475 DiffServ Architecture
- RFC 2597 DiffServ Assured Forwarding (AF)
- RFC 2598 DiffServ Expedited Forwarding (EF)
- Ingress Rate Limiting

Security

- IEEE 802.1X Port Based Network Access Control
- RFC 1321 The MD5 Message-Digest Algorithm
- RFC 1334 PPP Authentication Protocols (PAP)
- RFC 1492 An Access Control Protocol, Sometimes Called TACACS
- RFC 1492 TACACS+
- RFC 1994 PPP Challenge Handshake Authentication Protocol (CHAP)
- RFC 2082 RIP-2 MD5 Authentication
- RFC 2104 Keyed-Hashing for Message Authentication
- RFC 2138 RADIUS Authentication
- RFC 2139 RADIUS Accounting
- RFC 2246 Transport Layer Security (TLS)
- RFC 2548 Microsoft® Vendor-specific RADIUS Attributes
- RFC 2618 RADIUS Authentication Client MIB
- RFC 2620 RADIUS Accounting Client MIB
- RFC 2716 PPP EAP TLS Authentication Protocol
- RFC 2818 HTTP Over TLS
- RFC 2865 RADIUS (client only)
- RFC 2865 RADIUS Authentication
- RFC 2866 RADIUS Accounting
- RFC 2867 RADIUS Accounting Modifications for Tunnel Protocol Support
- RFC 2868 RADIUS Attributes for Tunnel Protocol Support
- RFC 2869 RADIUS Extensions
- RFC 2882 NAS Requirements: Extended RADIUS Practices
- RFC 3162 RADIUS and IPv6
- RFC 3576 Dynamic Authorization Extensions to RADIUS
- RFC 3579 RADIUS Support For Extensible Authentication Protocol (EAP)
- RFC 3580 IEEE 802.1X RADIUS
- RFC 3580 IEEE 802.1X Remote Authentication Dial In User Service (RADIUS) Usage Guidelines
- RFC 4576 RADIUS Attributes
- Access Control Lists (ACLs)
- draft-grant-tacacs-02 (TACACS)
- Guest VLAN for 802.1X
- MAC Authentication
- MAC Lockdown
- MAC Lockout
- Port Security
- Secure Sockets Layer (SSL)
- SSHv2 Secure Shell
- Web Authentication

ARUBA 2540 SWITCH SERIES ACCESSORIES

Transceivers

- Aruba 100M SFP LC FX 2km MMF XCVR (J9054D)
- Aruba 1G SFP RJ45 T 100m Cat5e XCVR (J8177D)
- Aruba 1G SFP LC SX 500m MMF XCVR (J4858D)
- Aruba 1G SFP LC LX 10km SMF XCVR (J4859D)
- Aruba 1G SFP LC LH 70km SMF XCVR (J4860D)
- Aruba 10G SFP+ LC SR 300m MMF XCVR (J9150D)
- Aruba 10G SFP+ LC LR 10km SMF XCVR (J9151D)
- Aruba 10G SFP+ LC ER 40km SMF XCVR (J9153D)
- Aruba 10G SFP+ to SFP+ 1m DAC Cable (J9281D)
- Aruba 10G SFP+ to SFP+ 3m DAC Cable (J9283D)

Note: No support for 10G LRM (J9152D) and no support for 10G 7m DAC (J9285D)

Cables

- Aruba X2C2 RJ45 to DB9 Console Cable (JL448A)

Mounting Kit

- HPE X410 1U Universal 4-post Rack Mounting Kit (J9583A)

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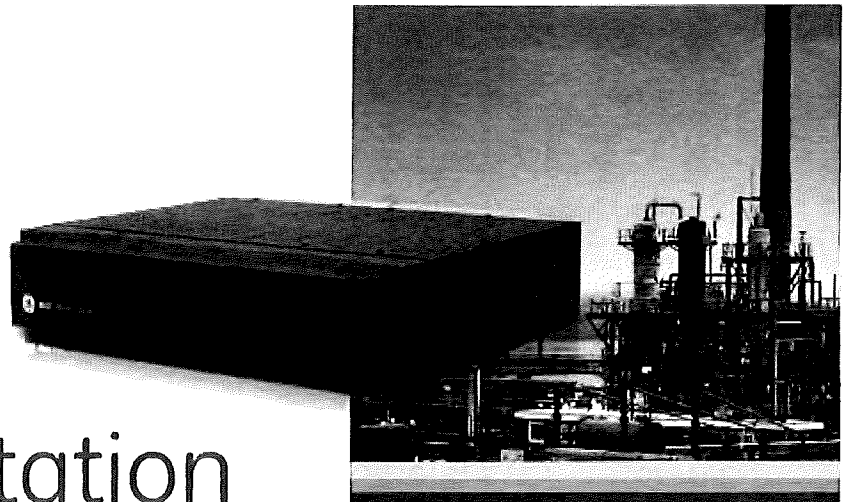
GE
Grid Solutions



MDS Master Station

Exceptional Reliability for Protected Licensed or Unlicensed Communications

Narrowband communication networks are deployed to monitor, control and maintain critical industrial processes and distributed assets. Such applications require high reliability and availability especially at the access point, thus driving demand for high duty cycle solutions with built-in redundancy that are capable of continuous operation. The MDS Master Station is built to meet these demanding requirements.

The MDS Master Station offers two transceivers in a 1+1 redundancy, and dual power supplies to maximize network availability. In the event of a failure the controlling logic switches to the standby transceiver unit. Switchover can occur based upon transceiver error codes, loss of communication over a configurable time period or loss of power.

The MDS Master Station supports two types of transceiver modules.

- Orbit licensed or unlicensed transceiver modules enable the latest generation performance, networking, and security offered in the MDS Orbit platform.
- SD licensed transceiver modules enable the deployment of MDS SD Series networks. Additionally, they allow for backward compatibility with x710/x790 legacy networks.

Key Benefits

- Maximize network availability with 1+1 transceiver protection and hot-swappable components
- Range of backward compatibility and migration options to extend or evolve legacy networks and provide project budget flexibility
- Simple migration options with field upgradability from SD to Orbit radio modules
- The most comprehensive set of cybersecurity and networking capabilities offered by the Orbit platform provides protection from threats and ease of integration into modern networks
- Integration with the MDS PulseNET network management system

Applications

Oil & Gas

- SCADA communication for flow/metering devices, controllers and RTUs
- Data acquisition for well head production data and pipeline status

Energy

- SCADA communication for IEDs, controllers and RTUs at distribution substations
- Data acquisition for pole-top transformers and capacitor banks

Water & Wastewater

- SCADA communication for lift station controllers and monitoring devices
- Data acquisition for tank and reservoir levels, flow rates and pipeline valve status

imagination at work

Reliability and Modularity

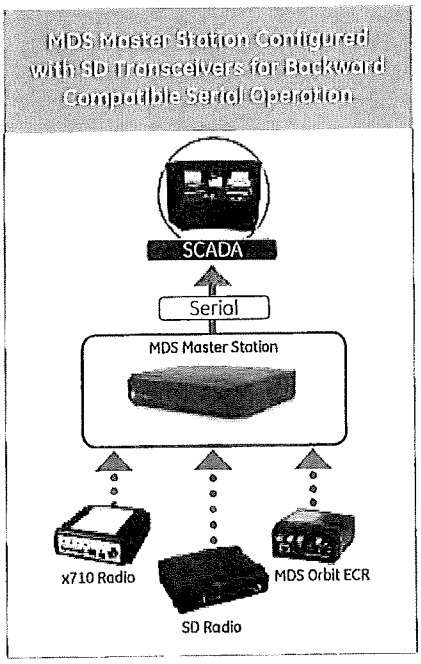
- Support for Orbit Unlicensed 900MHz and Licensed 500MHz
- 1+1 transceiver redundancy with warm standby and fast radio switchover
- Various AC/DC power supply options with redundant operation
- Modular, in-service, hot-swappable components
- Operation from -30 to +60 °C
- Rated for continuous operation
- No moving parts or fans
- Battery backup option

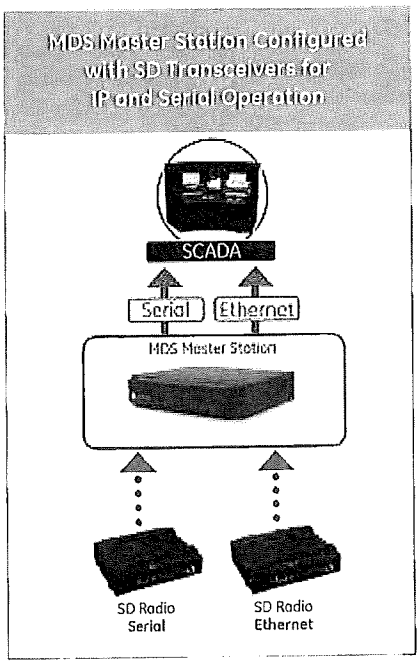
Flexibility

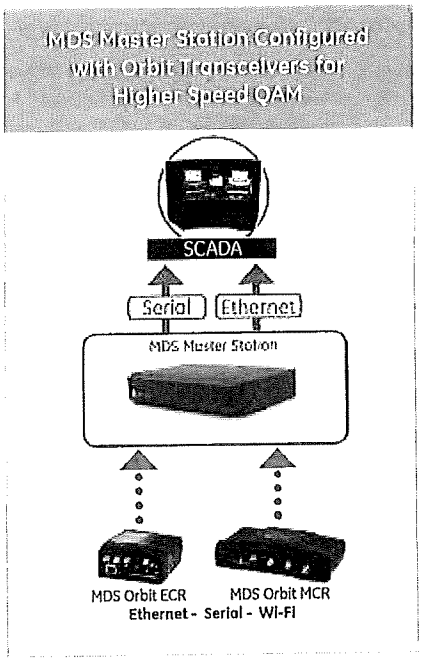
- Support for GE MDS SD Series radio technology covering the 300-512 MHz and 880-960 MHz bands with backward compatibility to legacy X710/X790 systems
- Support for GE MDS Orbit unlicensed 900MHz[1] or licensed technology with QAM covering the 100, 200, 400, 500, 700, and 900 MHz bands
- MDS Orbit supports up to 50kHz bandwidth in 200, 700 and 900 MHz bands
- Optional internal duplexer, GPS, and WiFi
- Connectivity for additional notched filter

Advanced Networking & Security

- Orbit Network Operating System with advanced routing, switching, Quality of Service and network management capabilities
- Cutting edge cyber security suite including firewalling, RF Encryption, end-to-end IPSec VPNs, X.509 certificates with key rotation, secure boot and firmware







MDS Master Station Overview

The MDS Master Station is built on a cutting edge hardware framework to offer exceptional reliability for critical communications. It can be configured as a 1+1 system with redundant power supplies and transceivers that are hot-swappable to ensure always-on operation and maximize network availability. Other components such as duplexers and alarm cards are also modular and can be field replaceable for ease of maintenance.

The Master Station utilizes a variant of the GE MDS Orbit network Operating System (Orbit OS) offering future-ready security, networking and quality of service capabilities.

Enterprise-Class Security

The MDS Orbit OS offers a comprehensive cyber security framework to facilitate the deployment of highly secure networks. Orbit's firewall ensures protection at Layer 2 to 4 to permit only valid traffic through the network. Its RF encryption secures communication between remote and AP while its IPSec VPN and DMVPN capabilities enable end-to-end encryption between remotes and control center. RADIUS enforces a centralized authentication process where users are granted access based on pre-authorized roles and access level.

Flexible Networking and Quality of Service

MDS Orbit OS enables the Master Station to offer dynamic and static routing services as well as full managed switch capability for maximum flexibility in network design. In addition to 1+1 transceiver protection, Orbit OS offers other High Availability mechanisms when used with MDS Orbit remotes such as interface bonding, Spanning Tree, Layer 3 failover, VRRP as well as latency and packet-loss based failover. Quality of Service enables the granular classification and prioritization of traffic as well as the dedication of uplink throughput on a per-application basis to minimize latency and maximize bandwidth for critical applications.

MDS Master Station with SD Radio Modules

The MDS Master Station may be configured with SD transceiver modules in a non-redundant or redundant mode of operation. SD transceiver modules utilize a similar radio technology as the industry-leading MDS SD Series radios to enable communication with MDS SD remotes, as well as MDS x710 and 2310/4310 remotes. The MDS Master Station has been designed to replace MDS 2100 and x790B masters and to provide a seamless evolution path to an all SD network. This backward compatibility allows the seamless co-existence of legacy and SD based networks.

Furthermore, when operating in the CPFSK A modem, the Master Station with SD radio modules can communicate with MDS Orbit remotes operating in a legacy backward compatible mode to facilitate the migration of legacy networks to Orbit-based technology. Once all of the legacy remotes have been replaced with Orbit, a field conversion is possible utilizing the same firmware already on the master station along with swapping out the SD radio modules for Orbit radio modules.

This can allow for more flexibility and control over cost and schedule compared to alternative forklift or higher cost full master station migration options.

MDS Master Station with Orbit Licensed Modules

The MDS Master Station may be configured with the latest generation MDS Orbit licensed radio modules covering the 100, 200, 400, 700, or 900 MHz bands. Orbit radio modules enable communication with the MDS Orbit MCR/ECR remotes using its high-performance radio technology with up to 64-QAM of modulation and up to 50kHz of bandwidth. Its bi-directional adaptive modulation as well as IP header and payload compression maximize upstream and downstream throughput. Dynamic Forward Error Correction (FEC) boosts link sensitivity to maximize distance and operation in tough terrains.

Network Management and User Interface

The MDS Master Station with its Orbit OS supports standards-based SNMP and Netconf network and device management protocols for easy integration into MDS PulseNet and 3rd party NMS software. It can be configured and managed using Command-Line Interface (CLI) or an intuitive Graphical User Interface (GUI).

Migrating Legacy Networks with Master Station Evolution Technology

The MDS Master Station provides a solution for customers requiring the latest generation Orbit communication technology in parts of their network while maintaining an existing legacy network, either GE MDS or another vendor's radios.

A GE MDS Master Station equipped with Orbit licensed radio modules and an embedded Evolution Module allows coexistence of both new and legacy networks by routing the traffic over the appropriate network. This solution supports legacy networks operating in non-continuously keyed switched carrier mode and utilizing a standard serial polling protocol such as DNP3,

Versatile Serial Server

Serial traffic from SCADA and telemetry data can be encapsulated in TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) for point-to-point or point-to-multipoint transport across wired and wireless networks. Serial protocols, such as Modbus and DNPv3 are fully supported to connect legacy PLCs, RTUs etc...

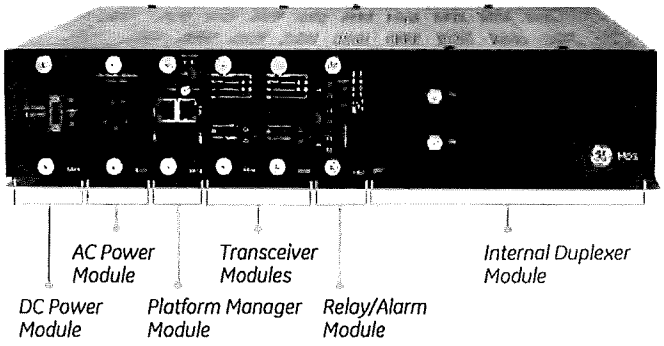
Modular Communication Platform

Ease of maintenance and serviceability are benefits of the modular communications platform of the MDS Master Station. All components are easily accessed from the front panel for simplified maintenance. Redundant transceivers and power supply modules are hot swappable to ensure continuous operation during service periods after a failover. The Relay and Alarm module provides connectivity for two sets of alarm contacts to externally signal radio switchover and alarm events.

The Master Station's Platform Manager is the main processor/brain of the system. It can be factory-configured with optional WiFi to simplify local management. It also supports 2 Ethernet and 2 Serial interfaces, and allows for single or multiple SCADA host systems.

Migrate legacy networks to next generation MDS Orbit performance and capabilities with the optional Evolution Module, embedded directly into the Master Station and available with or without internal duplexer.

Exterior View – Front Panel



Graphical User Interface (GUI)

The MDS Master Station utilizes an intuitive Device Manager GUI based on the Orbit Network Operating System. The Device Manager allows for easy configuration and maintenance of radios, networking, security and management functions with specialized wizards that speed up complex configuration tasks. The Master Station can also be managed using a CLI.

MDS Master Station Configuration Options

The MDS Master Station can be factory-configured as a system with the following radio technology types: SD, Orbit Licensed, or Orbit Unlicensed. The system can be configured with single or dual redundant radio modules of the same type. Components such as chassis, power supplies, platform manager (processor), alarm modules and duplexers are common between the types of systems to enable flexibility in field upgrades, maintenance and inventory stocking. Most of the hardware components listed above can be ordered as spares, please check the online store or with a GE Sales representative for more information.

MDS Master Station loaded with	Compatible with	Modulations	Max Raw Data Rate in 25KHz	Duplex Modes
SD RADIO MODULES	• MDS SD Series remotes • MDS x710/x790 remotes • MDS Orbit Licensed Narrowband remotes operating in 3FSK modulation	• CPFSK, Digital	38.4 Kbps in 25 kHz	Half Duplex Full Duplex
ORBIT LICENSED NARROWBAND RADIO MODULES	• MDS Orbit Licensed Narrowband Remotes	• QPSK, 16QAM, 64QAM • Bi-directional Adaptive Modulation	120 Kbps in 25 kHz	Half Duplex
ORBIT UNLICENSED 900MHZ RADIO MODULES[1]	• MDS Orbit Unlicensed 900MHz Remotes	• 2, 4-level GFSK	1.25 Mbps	Half Duplex

MDS Master Station

ORBIT LICENSED NARROWBAND RADIO MODULES

Modulation	QPSK, 16QAM, 64QAM
Adaptive Modulation	Per-packet, per-remote, bi-directional
Dynamic FEC:	Convolutional, Reed Solomon
Compression	IP Header and Payload with up to 30% efficiency improvement
Media Access Control	High performance MAC

ORBIT MODULE BANDS

L1B: 150-174 MHz	L4C: 450-520 MHz
L2X: 216-235 MHz	L4 E: 406.1-470 MHz
L4A: 330-406 MHz	L7A: 757-758 and 787-788 MHz
	L9C: 896-960 MHz

RAW DATA RATES

Channel	QPSK	16QAM	64QAM
6.25 KHz	9.6 Kbps	19.2 Kbps	28.8 Kbps
12.5 KHz	20 Kbps	40 Kbps	60 Kbps
25 KHz	40 Kbps	80 Kbps	120 Kbps
50 KHz[2]	80 Kbps	160 Kbps	240 Kbps

TRANSMITTER CHARACTERISTICS

Frequency Stability	+/- 0.5ppm	
Peak Power*	330-470MHz	896-960MHz
- Radio Module	39.28	38.8
- Non-Redundant, no duplexer	38.93	38.05
- Non-Redundant, with duplexer[3]	37.73	35.95
Power Range	+20dBm to +40dBm	
Output Impedance	50 Ohms	

RECEIVER CHARACTERISTICS

Type	Direct Conversion
Adjacent Channel Rejection	60 dB nominal

Receiver Sensitivity[1]

	Frequency Bands				
	L1B	L2X	L4E	L7A	L7A
Redundant, no duplexer	-114.7	-113.6	-112.4	-110.7	-110.7
Redundant, with duplexer	N/A	N/A	-111.2	-109.2	-109.2

ORBIT UNLICENSED 900MHZ RADIO MODULES

Frequency	902-928 MHz
Modulation	2, 4-level GFSK, Dwell Time 10-300 msec
Spreading method	FHSS, DTS
Occupied Bandwidth	152 to 1320 kHz, up to 80 channels
Data Rates/Sensitivity	
• 125 Kbps/-104 dBm	• 1.0 Mbps/-94 dBm
• 250 Kbps/-102 dBm	• 1.25 Mbps/-94 dBm
• 500 Kbps/-98 dBm	
Peak Power	29dBm +/-0.5dB
Latency	tunable to <5 msec one-way
Output Impedance	50 Ohms

SD RADIO MODULES

Module	Digital, CPFSK
Radio Mode	Packet-with-MAC, Transparent
Compatibility	MDS X710 Series MDS SD Series MDS Orbit in CPFSK A Modem

SD MODULE BANDS

SDM4 D	300-360 MHz
SDM4 B	400-450 MHz
SDM4 C	450-512 MHz
SDM9 C	928-960 MHz
SDM9 K	TX 926-960 MHz RX 880-915 MHz

RAW DATA RATES

Channel	300-512 MHz	880-960 MHz
6.25 KHz	4.8 Kbps	-
12.5 KHz	19.2 Kbps	19.2 Kbps
25 KHz	38.4 Kbps	38.4 Kbps
50 KHz	-	-

TRANSMITTER CHARACTERISTICS

Frequency Stability	+/- 0.5ppm	
Peak Power	300-512MHz (dBm +/- 0.5dB)	928-960MHz (dBm +/- 0.85dB)
- Radio Module	40.5	40.25
- Redundant, no duplexer	39.4	38.7
- Redundant, with duplexer[3]	38.2	36.6
Power Range	+30dBm to +40dBm	
Duty Cycle	Continuous	
Output Impedance	50 Ohms	

RECEIVER CHARACTERISTICS

Type	Double Conversion Superheterodyne	
Adjacent Channel	60 dB Nominal Rejection	
Receiver Sensitivity @1x10-6BER, Modem 9600	400-512MHz	928-960MHz
Redundant, no duplexer	-110.9	-112.5
Redundant, with duplexer	-109.7	-110.4

ELECTRICAL

Power Required	< 80 Watts (based on redundancy)
DC Power	+/- 12-36V, +/- 36-75V, +/- 75-140V
AC Power	100-240V, 50/60 Hz

MECHANICAL

Dimensions	3.5 H x 17.2 W x 16 D in 8.9 H x 43.8 W x 40.6 D cm
Weight	24 lbs., 10.9 kg

ENVIRONMENTAL

Temperature	-30° to +60°C (-22° to 140°F)
Humidity	95% at 40°C (104°F) non-condensing
Cooling	Heat sinks, no fans, no moving parts

WI-FI OPTION

- Frequency 2.4GHz with IEEE 802.11 b/g/n
- Operating Modes: Access Point, Station
- Scalability Up to 2 SSIDs, up to 7 clients/stations
- SSID hiding Yes | VLAN mapping Yes
- Carrier Power 20dBm adjustable

POWER SUPPLY OPTIONS

- 110/220 VAC
- 12-36 VDC
- 90-260 VAC
- +/- 36-72 VDC
- 75-140 VDC

INTERNAL DUPLEXER OPTIONS

- 9 MHz (932.0-932.5) / (941.0-941.5) MHz
- 24 MHz (928.0-929.0) / (952.0-953.0) MHz
- 31 MHz (928.0-929.0) / (959.0-960.0 MHz
- 39 MHz (896.0 - 898.0) / (935.0 -937.0) MHz
- 350-512MHz / 5-10MHz SP (INT)
- TX high or low duplexer options available for each band
- No Internal Duplexer

NETWORKING

- IPv4 Routing OSPF, EBGP, RIPv2 with performance-based route failover, IPv6 Routing[1]
- Full managed switch capability, IEEE 802.3, 802.1Q/VLANs, 64 VLANs, STP
- Concurrent Bridging & Routing
- GRE Tunneling with Layer 2 (Ethernet) and Layer 3 support
- Route/path failover between any two wireless/Ethernet interfaces based on link loss, latency degradation or packet loss thresholds
- Quality of Service 16 egress queues, Priority Queuing, Fair Queuing, Traffic Shaping, Classification based on DSCP, 802.1p and Layer 2-4 classifiers
- IP Protocols TCP, UDP, ARP, DHCP, ICMP, NTP, FTP, SFTP, TFTP, DNS, configurable HTTP and HTTPS, SSH
- Serial TCP server, Modbus/TCP, Modbus RTU, TCP client, UDP Unicast and Multicast, BSAP, and DNP3

SECURITY

- IPSec VPN Server (responder) and Client (initiator) with DMVPN
- Authentication Public Key, EAPTLS, Pre-Shared, Ike 1-2
- Encryption : 3DES, AES 128/192/256, CBC, CTR, CCM, GCM, SHA 256/384/512 HMAC, WiFi WPA/WPA2 PSK
- Firewalling: Stateful Layer 3-4 Firewall with MAC Filtering, NAT, Source NAT (Masquerading), Static NAT, Port Forwarding
- Device Security : Secure Boot, Secure Firmware, Digitally Signed Hardware and Software, Magnetometer Tamper Detection
- Certificate Management: X.509, SCEP, PEM, DER, RSA
- User Authentication: Local RBAC, AAA/RADIUS, 802.1x
- FIPS 140-2 (Level 2) certification in progress

MANAGEMENT

- GE MDS PulseNET NMS support with device management and auto-configuration
- GUI configuration wizards to simplify operation
- Secure device management via a web-based GUI and/or CLI
- Event logging, Syslog-over-TSL, SSH, Console
- Iperf throughput diagnostic, NETCONF
- SNMPv1/v2c/v3, MIB-II, Enterprise MIB

INTERFACES

Serial COM1	RS232, RJ45
Serial COM2	RS232/485, RJ45
USB	2
Ethernet 1	10/100 BaseT, RJ45
Ethernet 2	10/100 BaseT, RJ45
Wi-Fi	RP-SMA connector
GPS	SMA Female
Antenna	N Female

AGENCY APPROVALS

Master Station with SD Radio Modules
- Industry Canada and ENTELA
- FCC Part 101: 820 to 960 MHz
- FCC Part 90: 928 to 960 MHz
- FCC Part 24: 820 to 960 MHz
- FCC Part 90: 300 to 512 MHz
- CE, ETSI: 300 to 512 MHz
- UL 60950-1 Safety approval

Master Station with Orbit Licensed Narrowband Radio Modules
- Industry Canada, Anatel
- FCC Part 90: 896-960 MHz
- FCC Part 90: 406-470 MHz
- FCC Part 27: 757-758 & 787-788 MHz
- CE, ETSI: 330-406 MHz, 406-470 MHz
- CSA General Safety approval

Master Station with Orbit Unlicensed Radio Modules
- FCC Part 15, ICRSS-210
- CSA General Safety approval

WARRANTY

Standard 2-year manufacturer warranty applies to all MDS Master Station models

1. Check with local sales representative for availability.
2. 200, 700, and 900 MHz Orbit band options support 12.5, 25, and 50 kHz. 200 MHz 5 kHz option also available. Other band options support 6.25, 12.5, and 25 kHz.
3. With GE MDS standard 400MHz notch or 900MHz bandpass duplexers. Internal duplexers are not available for 100 and 200MHz versions.
4. dBm +/-0.5dB, QPSK Average Power is 5dB less than Peak, QAM Average Power is 7dB less than Peak. Power may vary for other frequency bands. Please consult GE for specs on your exact configuration.
5. Shown @ 1x10-6 BER, QPSK, 12.5kHz, No FEC. FEC enabled improves sensitivity between 3-6dB. Sensitivity reduced by -6dB in 16QAM and -13dB in 64QAM.

GE Grid Solutions

175 Science Parkway
Rochester, NY 14620
+1 877-605-6777 (toll free in North America)
+1 678-844-6777 (direct number)

GEGridSolutions.com

GEA-12790B(E)
English
190131

imagination at work

Product data sheet
Characteristics

SMX2000LVNCUS
APC Smart-UPS X 2000VA Short Depth Tower/ Rack Convertible LCD 100-127V with Network Card TAA

Overview

Model Name	APC Smart-UPS X 2000VA Short Depth Tower/Rack Convertible LCD 100-127V with Network Card TAA
Includes	CD with software , Documentation CD , Installation guide , Network Management Card , Rack Mounting brackets , Rack Mounting support rails , Rack mounting hardware , Smart UPS signalling RS-232 cable , USB cable
Standard Lead Time	Usually in Stock
Product Distribution	Canada , United States

Output

Output Power Capacity	1800 Watts / 1920 VA
Max Configurable Power (Watts)	1800 Watts / 1920 VA
Nominal Output Voltage	120V
Output Voltage Distortion	Less than 5%
Output Frequency (sync to mains)	50/60Hz +/- 3 Hz
Other Output Voltages	100, 110, 127V
Other Output Voltages	Line Interactive
Waveform Type	Sine wave
Output Connections	(1) NEMA L5-20R (Battery Backup) , (3) NEMA 5-20R (Battery Backup) , (6) NEMA 5-15R (Battery Backup)

Input

Nominal Input Voltage	120V
Input Frequency	50/60 Hz +/- 3 Hz (auto sensing)
Input Connections	NEMA 5-20P
Cord Length	8 feet (2.44 meters)
Input voltage range for main operations	70 - 153 V
Input voltage adjustable range for mains operation	75 - 154V
Other Input Voltages	100 , 110 , 127

Batteries & Runtime

Battery Type	Maintenance-free sealed Lead-Acid battery with suspended electrolyte : leakproof
Included Battery Modules	1
Typical recharge time	3 hour(s)
Replacement Battery	APCRBC143 , CURK143-01-04

Communications & Management

Interface Port(s)	RJ-45 Serial , Smart-Slot , USB
Pre-Installed SmartSlot™ Cards	AP9631
Control panel	LED status display with On Line : On Battery : Replace Battery and Overload indicators , Multi-function LCD status and control console
Audible Alarm	Alarm when on battery : distinctive low battery alarm : configurable delays

Surge Protection and Filtering

Surge energy rating	540 Joules
Filtering	Full time multi-pole noise filtering : 0.3% IEEE surge let-through : zero clamping response time : meets UL 1449

Physical

Maximum Height	17.0 inches (432.0 mm)
Maximum Width	7.0 inches (178.0 mm)
Maximum Depth	19.0 inches (483.0 mm)
Rack Height	4 U
Net Weight	85.0 lbs (38.64 kg)
Shipping Weight	105.0 lbs (47.73 kg)
Shipping Height	13.0 inches (330.0 mm)
Shipping Width	23.06 inches (586.0 mm)
Shipping Depth	24.94 inches (633.0 mm)
Color	Black
Units per Pallet	6.0
# of Layers per Pallet	4
# of Units per Layer per Pallet	2
Pallet Weight	855.12 lbs (388.69 kg)

Environmental

Operating Environment	32 - 104 °F (0 - 40 °C)
Operating Relative Humidity	0 - 95 %
Operating Elevation	0-10000 feet (0-3000 meters)
Storage Temperature	5 - 113 °F (-15 - 45 °C)
Storage Relative Humidity	0 - 95 %
Storage Elevation	0-50000 feet (0-15000 meters)
Audible noise at 1 meter from surface of unit	55.000 dB
Online Thermal Dissipation	203.000 BTU/hr

Conformance

Approvals	BSMI , CSA , EN 50091-2 , EN 55022 Class A , FCC Part 15 Class A , NOM , TAA compliance , TUV , UL 1778 , VCCI Class A
Standard warranty	3 years repair or replace (excluding battery) and 2 year for battery
Equipment protection policy	Lifetime : $150000

Sustainable Offer Status

RoHS	Compliant
REACH	REACH: Contains No SVHCs

EXHIBIT B
COMPENSATION

1. MAXIMUM COMPENSATION

The maximum amount payable for all materials and services provided under this Agreement shall not exceed Four Hundred Fifty-Two Thousand Three Hundred Fifty-Three Dollars ($452,353) during the term of the Agreement. Any additional services or materials requested by the City that would exceed the preceding maximum amount will be addressed in an Amendment to the Agreement. No additional services will be performed unless both Parties execute an Amendment outlining the services requested and the compensation agreed for such services.

2. PROGRESS PAYMENT SCHEDULE

2.1. Contractor shall provide all equipment, materials, and labor as specified in Exhibit A on a firm fixed cost basis.

2.2. Progress payments shall be made to Contractor by City following acceptance of designated milestones as shown in Table B-1.

Table B-1: Payment Schedule

Milestone/Deliverable	% of Total	Amount
Project Plan	15%	$67,852
Project Procurement	30%	$135,706
Estimated Sales Tax (to be paid in accordance with applicable milestone for which sales tax is due)	5%	$22,482
Documentation	1%	$5,021
Factory Acceptance Test	14%	$63,000
Shipment to Site	14%	$63,000
System Commissioning	5%	$23,276
Training	1%	$6,333
Final System Acceptance*	15%	$65,683
TOTAL	**100%**	**$452,353**

*The signed Final Acceptance Certificate (Appendix A-2) triggers final payment and start of warranty period.

2.3. All payments are based upon City's acceptance of Contractor's performance as evidenced by successful completion of all of the deliverables as set forth for each milestone. City shall have no obligation to pay unless Contractor has successfully completed, and City has approved, the milestone for which payment is due.

2.4. Payment for any part or parts of the System provided hereunder, or inspection or testing thereof by City, shall not constitute acceptance or relieve Contractor of its obligations under this Agreement. City may inspect

the components of the System when delivered and reject upon notification to Contractor any and all components of the System, which do not conform to the specifications or other requirements of this Agreement. Components of the System that are rejected shall be promptly corrected, repaired, or replaced by Contractor. If City receives components of the System with defects or nonconformities not reasonably apparent on inspection, then City reserves the right to require prompt correction, repair, or replacement by Contractor in accordance with Contractor's warranty obligations.

3. ADDITIONAL WORK

3.1. In the event that any work is identified during the course of the Project that the Parties agree is necessary to complete the Scope of Services but nevertheless is outside the scope of this agreement, City and Contractor shall negotiate a price for such work. Additional work may be negotiated on a lump sum basis in accordance with the rates set forth in Table B-2 below. City and Contractor will execute an Amendment to the Agreement outlining the additional work and/or services.

Table B-2: Additional Work

Description	Rate
Project Management	$300 per hour
Senior Engineer	$250 per hour
Engineer	$200 per hour

4. INVOICING

4.1. City will pay Contractor within thirty (30) days of City's receipt of an approved invoice.

EXHIBIT C
INSURANCE REQUIREMENTS

Without limiting the Contractor's indemnification of the City, and prior to commencing any of the Services required under this Agreement, the Contractor shall provide and maintain in full force and effect, at its sole cost and expense, the following insurance policies with at least the indicated coverages, provisions and endorsements:

A. COMMERCIAL GENERAL LIABILITY INSURANCE

1. Commercial General Liability Insurance policy which provides coverage at least as broad as Insurance Services Office form CG 00 01. Policy limits are subject to review, but shall in no event be less than, the following:

   $2,000,000 Each occurrence
   $2,000,000 General aggregate
   $2,000,000 Products/Completed Operations aggregate
   $2,000,000 Personal Injury

2. Exact structure and layering of the coverage shall be left to the discretion of Contractor; however, any excess or umbrella policies used to meet the required limits shall be at least as broad as the underlying coverage and shall otherwise follow form.

3. The following provisions shall apply to the Commercial Liability policy as well as any umbrella policy maintained by the Contractor to comply with the insurance requirements of this Agreement:

   a. Coverage shall be on a "pay on behalf" basis with defense costs payable in addition to policy limits;

   b. There shall be no cross liability exclusion which precludes coverage for claims or suits by one insured against another; and

   c. Coverage shall apply separately to each insured against whom a claim is made or a suit is brought, except with respect to the limits of liability.

B. BUSINESS AUTOMOBILE LIABILITY INSURANCE

Business automobile liability insurance policy which provides coverage at least as broad as ISO form CA 00 01 with policy limits a minimum limit of not less than one million dollars ($1,000,000) each accident using, or providing coverage at least as broad as, Insurance Services Office form CA 00 01. Liability coverage shall apply to all owned, non-owned and hired autos.

In the event that the Work being performed under this Agreement involves transporting of hazardous or regulated substances, hazardous or regulated wastes and/or hazardous or regulated materials, Contractor and/or its subcontractors involved in such activities shall provide coverage with a limit of two million dollars ($2,000,000) per accident covering transportation of such materials by the addition to the Business Auto Coverage Policy of Environmental Impairment Endorsement MCS90 or Insurance Services Office endorsement form CA 99 48, which amends the pollution exclusion in the standard Business Automobile Policy to cover pollutants that are in or upon, being transported or towed by, being loaded onto, or being unloaded from a covered auto.

C. WORKERS' COMPENSATION

1. Workers' Compensation Insurance Policy as required by statute and employer's liability with limits of at least one million dollars ($1,000,000) policy limit Bodily Injury by disease, one million dollars ($1,000,000) each accident/Bodily Injury and one million dollars ($1,000,000) each employee Bodily Injury by disease.

2. The indemnification and hold harmless obligations of Contractor included in this Agreement shall not be limited in any way by any limitation on the amount or type of damage, compensation or benefit payable by or for Contractor or any subcontractor under any Workers' Compensation Act(s), Disability Benefits Act(s) or other employee benefits act(s).

3. This policy must include a Waiver of Subrogation in favor of the City of Santa Clara, its City Council, commissions, officers, employees, volunteers and agents.

D. COMPLIANCE WITH REQUIREMENTS

All of the following clauses and/or endorsements, or similar provisions, must be part of each commercial general liability policy, and each umbrella or excess policy.

1. Additional Insureds. City of Santa Clara, its City Council, commissions, officers, employees, volunteers and agents are hereby added as additional insureds in respect to liability arising out of Contractor's work for City, using Insurance Services Office (ISO) Endorsement CG 20 10 04 13 and CG 20 37 04 13, or its equivalent.

2. Primary and non-contributing. Each insurance policy provided by Contractor shall contain language or be endorsed to contain wording making it primary insurance as respects to, and not requiring contribution from, any other insurance which the Indemnities may possess, including any self-insurance or self-insured retention they may have. Any other insurance Indemnities may possess shall be considered excess insurance only and shall not be called upon to contribute with Contractor's insurance.

3. General Aggregate. The general aggregate limits shall apply separately to Contractor's work under this Agreement providing coverage at least as broad as Insurance Services Office (ISO) Endorsement CG 2503, 05 09 Edition, or insurer's equivalent (CGL).

4. Cancellation.

   a. Each insurance policy shall contain language or be endorsed to reflect that notice of cancellation shall be given to City at least thirty (30) days prior to the effective date of such modification or cancellation.

5. Other Endorsements. Other endorsements may be required for policies other than the commercial general liability policy if specified in the description of required insurance set forth in Sections A through D of this Exhibit C, above.

E. ADDITIONAL INSURANCE RELATED PROVISIONS

Contractor and City agree as follows:

1. Contractor agrees to ensure that subcontractors, and any other party involved with the Services who is brought onto or involved in the performance of the Services by Contractor, provide the same minimum insurance coverage required of Contractor, except as with respect to limits. Contractor agrees to monitor and review all such coverage and assumes all responsibility for ensuring that such coverage is provided in conformity with the requirements of this Agreement. Contractor agrees that upon request by City, all agreements with, and insurance compliance documents provided by, such subcontractors and others engaged in the project will be submitted to City for review.

2. Contractor agrees to be responsible for ensuring that no contract used by any party involved in any way with the project reserves the right to charge City or Contractor for the cost of additional insurance coverage required by this Agreement. Any such provisions are to be deleted with reference to City. It is not the intent of City to reimburse any third party for the cost of complying with these requirements. There shall be no recourse against City for payment of premiums or other amounts with respect thereto.

3. The City reserves the right to withhold payments from the Contractor in the event of material noncompliance with the insurance requirements set forth in this Agreement.

F. EVIDENCE OF COVERAGE

Prior to commencement of any Services under this Agreement, Contractor, and each and every subcontractor (of every tier) shall, at its sole cost and expense,

provide and maintain not less than the minimum insurance coverage with the endorsements and deductibles indicated in this Agreement. Such insurance coverage shall be maintained with insurers, and under forms of policies, satisfactory to City and as described in this Agreement. Contractor shall file with the City all certificates and endorsements upon request for the required insurance policies for City's approval as to adequacy of the insurance protection.

G. EVIDENCE OF COMPLIANCE

Contractor or its insurance broker shall provide the required proof of insurance compliance, consisting of Insurance Services Office (ISO) endorsement forms or their equivalent and the ACORD form 25-S certificate of insurance (or its equivalent), evidencing all required coverage shall be delivered to City. Unless otherwise required by the terms of this Agreement, all certificates, endorsements, coverage verifications and other items required to be delivered to City pursuant to this Agreement shall be provided by e-mail to ctsantaclara@ebix.com.

Or by mail to:

EBIX Inc.
City of Santa Clara – Water & Sewer Utilities Department
P.O. Box 100085 – S2
Duluth, GA 30096
Telephone number: 951-766-2280
Fax number: 770-325-0409

H. QUALIFYING INSURERS

All of the insurance companies providing insurance for Contractor shall have, and provide written proof of, an A. M. Best rating of at least A minus 6 (A- VI) or shall be an insurance company of equal financial stability that is approved by the City or its insurance compliance representatives.