KY-MSX1604 (DYMEC Ten Gigabit (10GbE) Traffic SERIES)

LAYER 2, Layer 2+, and Layer 2++ HARDENED, IP30, MANAGED, 20 PORT, Ten Gigabit (10 GbE), DIN\_RAIL / Shelf Mount, Military Grade, INDUSTRIAL, Traffic SWITCH with ERPS, Fiber & Copper Diagnostics, DDMI, MAC Table, Device, Cable Diagnostics, Remote Temperature Sensing, Cyber Secure Video (CSV) with silicon enhancements & Clean Code Technology. Supported by KY-USB – Easy Maintenance DBU for Data & Configuration Automated Backup. Meets NSA Guidelines for End Point Security: All ports including the console port can be shut down and secured. The switch will also support Built-in Port Monitoring and Statistical gathering – Silicon embedded. Fully Secured High Security Chassis meeting NSA Guidelines.

The switch “MUST” support SECURE USB PORT. The switch will also support Built-in Port Monitoring and Statistical gathering – Silicon embedded.

MUST support security feature: “Service Control” for HTTP / HTTPS / Telnet / SSH / Reset Button & Console Port – used for control of protocols and hardware services. Altitude Certified GB4943.1-2011 (0~5000 Meters). TAA Compliant

MTBF > 150,000 Hours

Made in USA

**PART 1 – GENERAL**

The intent of this document is to specify the minimum criteria for the engineering, design, supply, installation, and commissioning of the DYMEC 20 port, 10 GbE, Layer 2, Layer2+ and Layer 2++, Rack / Shelf Mount, Managed, Military Grade Industrial, Ethernet Traffic Switch, with CYBER-SECURE Video (CSV), Cable Diagnostics, and Clean Code Technology. IP30 Hardened Casing. DC Powered. All ports and power inputs are surge protected and the switch is Fanless (Convection Cooled). Meets NSA Guidelines for End Point Security: All ports including the console port and Reset Button can be shut down and secured according to NSA Guidelines.

**Works in NEMA and Non-NEMA Traffic Cabinets. Power input is 12 Volts DC ~ 48 Volts DC**

* 1. SUMMARY

1. The Layer 2, 2+, 2++ Managed, Industrial, Ethernet switches are a series of managed industrial edge, and or core switches that are used as access devices to provide entry points into core networks or can be used to form a core network. The switch enables connectivity for up to sixteen (16) 10/100/1000BaseT(X) twisted pair copper ports and four (4) 1/10 GbE Base(X) Small Form-Factor Pluggable (SFP) Ten Gigabit sockets. The 4 SFP socket ports can be configured as 10/100/1000BASE-T(X) RJ45 copper ports or 1/10 GbE BASE-SX/LX/LH/ZX, LC fiber ports, in any permutation, to provide maximum network flexibility. USB Port for Data backup, configuration, bootup and Syslog.
2. The Ethernet switches can operate across a wide range of operating temperatures, in non-environmentally conditioned, industrial applications. The Ethernet switches support a communications protocol specifically designed for industrial applications to provide automatic recovery of cable and port failure in less than 6ms.The switches are designed to be managed through several different interfaces, (GUI, Command Line, Telnet, SSH) and provide a large range of hardware and software features to ensure ease of installation and enhancement of network performance.
3. All ports and power inputs are surge protected and the switch is Fanless (Convection Cooled).
4. Every switch is programmed using precision programming techniques and algorithms (Clean Code Technology) and incorporates CYBER-SECURE Video (CSV) for enhanced switch protection against hackers, viruses and BOTS.
5. Coated PCB final assembly circuit boards.
6. The switch will also support Built-in Port Monitoring and Statistical gathering – Silicon embedded.
7. Meets NSA Guidelines for End Point Security: All ports including the console port can be shut down and secured.
8. Supports security feature: “**Service Control”** for HTTP / HTTPS / Telnet / SSH / Reset Button & Console Port – used for control of protocols and hardware services.
9. TAA Compliant
10. Altitude Certified GB4943.1-2011 (0~5000 Meters).
11. Made in USA
    1. SECTION INCLUDES
12. **KY-MSX-1604** Layer 2, 2+, 2++, Industrial Hardened, 20 Port, Managed Ten Gigabit Industrial switch – 8 X 10/100/1000BaseT(X) RJ45 ports, 4 X 1/10 GbE Base(X) SFP Ten Gigabit Sockets, USB Port, IP30, – DIN\_RAIL / Shelf Mount, Wide Range Power Supply 12 - 48 Volts DC.
13. NSA Guidelines for End Point Security: All ports including the console port can be shut down and secured.
14. Dimensions: 91 x 145 x 118 mm – (W x H x D)
15. Weight: 1.38 kg
16. IP 30
    1. REFERENCES
17. Conformity for Europe (CE)
18. American National Standards Institute (ANSI)
19. Federal Communications Commission (FCC)
20. Australian Communications Authority (C-Tick)
21. International Electro-technical Commission (IEC)
22. Electronic Industry Association (EIA)
23. Institute of Electrical and Electronics Engineers (IEEE)
24. European Standards (EN)
25. Restriction of Hazardous Substances (RoHS)
26. Consultative Committee for International Radio (CCIR)
27. Underwriters Laboratories Inc. (UL)
28. Underwriters Laboratories of Canada (ULC)
29. Waste Electrical & Electronic Equipment (WEEE)
30. Open Network Video Forum (ONVIF)
31. Physical Security Interoperability Alliance (PSIA)
32. Software Engineering Institute (SEI)
33. National Security Agency (NSA)
34. Central Security Service (CSS)
35. National Electrical Manufacturers Association (NEMA)
36. Voluntary Control Council: Interference by Information Technology Equipment (VCCI)
37. American Certified Ethernet (ACE)
38. Network Security Architecture (NSA Guidelines)
39. Manufacturing Certification ISO9001:2008 / UKAS MANAGEMENT SYSTEMS
40. NEMA TS-2 for Outdoor Traffic Equipment
    1. DEFINITIONS
41. No Substitutes: The exact make and model number identified in this specification shall be provided without exception.
42. Or Equal: Any item may be substituted for the specified item provided that in every technical sense, the substituted item provides the same or better capability and functionality
43. Or Approved Equal: A substitute for the specified item may be offered for approval by the Owner. The proposed substitution must, in every technical sense, provide the same or better capability and functionality as the specified item. Such requests for approval shall be submitted in accordance with the provisions of PART 1.06 – SUBMITTALS and must be obtained within the time frames outlined.
    1. SYSTEM DESCRIPTION
44. Performance Requirements:
    1. Provides managed edge connectivity into core networks.
    2. Provides managed core network capability, if required.
    3. Meets NSA Guidelines for End Point Security:
    4. All ports including the console port can be shut down and secured.
    5. Full Chassis Security
    6. Provides dual redundant uplink capability.
    7. Provides 16 x 10/100/1000BaseT(X) RJ45 ports and 4 x SFP Ten Gigabit (1/10 GbE Base(X)) sockets.
    8. Possess a power consumption of less than 0.70A @ 24 Volts DC Typical
    9. Operate in temperature ranges of -40°C to +85°C
    10. Provide a casing with IP30 protection class.
    11. Dimensions: 91 x 145 x 118 mm – (W x H x D)
    12. DIN-RAIL / Shelf Mount
    13. Recover from port and cable failures in less than 6ms.
    14. Provide Access Control Lists
    15. Provide ERPS Redundant Ring (ITUT G.8032 ERPSv2)
    16. Possess the ability to be configured using HyperTerminal, Telnet, SSH and a Web Browser.
    17. Possess DC 12 - 48 Volts / power inputs – surge protected
    18. UL 6095-1 / 62368
    19. Possess Port Status indicators.
    20. Provide Fiber Cable diagnostics & Remote Temperature Sensing
    21. Provide full SFP Diagnostics & DDMI Support
    22. Provide Copper Cabling Diagnostics
    23. Provide MAC Table Display & Diagnostics
    24. Provides Service Control for SSH / TELNET / HTTP / HTTPS / Reset Button / Console Port
    25. Possess CYBER-SECURE Video with Silicon Enhancements
    26. Provide STORM Protection & BROADCAST CONTROL
    27. Possess Clean Code Technology (Precision Coding Algorithms)
    28. IP Camera Ready
    29. Possess Automatic Denial of Service (DOS) / Distributed Denial of Service (DDOS) attack prevention and quenching mechanisms on every port.
    30. Possess IP Policing and Port Binding Mechanism for MAC Address and IP Addressing Security.
    31. Quick Configuration Wizard for Cameras / HD Video
    32. Switch Latency of 6us or less
    33. USB Backup Capable for Automated Data & Configuration Backup

34. All ports and power inputs are surge protected and the switch is Fanless (Convection Cooled).

35. American Certified Ethernet for protection against counterfeit Ethernet chips / chip sets.

36. Supports IPv4 & IPv6 Protocols

37. Supports ACL (Access Control Lists)

38. Supports G.8032 ERPSv2 Ethernet Ring Protection System

39. Supports STP / RSTP / MSTI & MSTP

40. Supports Port Trunking / LACP

41. Supports 802.1x / RADIUS / TACACS+ / SSL / SSH

42. Supports Built-in Port & Flow Analysis (Port Monitoring & Statistical Analysis

43. Supports uPnP

44. Supports VLAN QinQ

45. Supports IGMP Port Snooping

46. Supports USB Configuration

47. Supports LLDP (Neighbor Discovery Protocol)

48. Jumbo Frame Support 16,000 Bytes

49. MAC Table Size 16K Entries

50. IGMP Groups 1024

51. Supports 802.1Q VLAN & PVID

52. Supports DHCP Relay / Server

53. Supports SFTP / TFTP / FTP

54. Supports Event Warning

55. Supports non-coded Generic SFP’s with diagnostics

56. Fully Secured High Security Chassis meeting NSA Guidelines for Endpoint Security

57. Supports “SECURE USB PORT”

58. The switch will also support Built-in Port Monitoring and Statistical gathering – Silicon embedded.

58. Supports security feature: “**Service Control”** for HTTP / HTTPS / Telnet / SSH / Reset Button & Console Port – used for control of protocols and hardware services.

59. Altitude Certified GB4943.1-2011 (0~5000 Meters).

60. TAA Compliant

59. Made in USA

* 1. SUBMITTALS

1. General: Submittals shall be made in accordance with the Conditions of the Contract and Submittal Procedures Section.
2. Shop Drawings and Schematics: Shall depict the Layer 2 Industrial Ethernet switch in final proposed “as built” configuration. The following must be provided:
3. Connection diagrams for interfacing equipment.
4. List of connected equipment.
5. Locations for all major equipment components to be installed under this specification.
6. Product Data: The following shall be provided:
7. Technical data sheets.
8. A complete set of product instruction manuals.
9. Quality Assurance Submittals: The following shall be submitted:
   * + 1. Test Report: The final test report shall indicate that every device was tested successfully in a system test.
   1. DELIVERY, STORAGE AND HANDLING
10. General: Delivery, storage, and handling of the Layer 2, 2+, 2++ Industrial, “Power Over Ethernet OPTIONAL”, switch shall be in accordance with the manufacturer’s recommendations.
11. Ordering: The manufacturer’s ordering instructions and lead-time requirements must be followed in order to avoid installation delays.
12. Delivery: The Layer 2, 2+, 2++ Industrial, Power Over Ethernet OPTIONAL”, switch shall be delivered in the manufacturer’s original, unopened, undamaged container with identification labels intact.
13. Storage and Protection: The Layer 2, 2+, 2++, “Power Over Ethernet OPTIONAL”, Industrial switch shall be stored and protected from exposure to harmful weather conditions and at the environmental conditions recommended by the manufacturer.
    1. PROJECT/SITE CONDITIONS
14. Temperature Requirements: Layer 2, 2+, 2++, POE+, Industrial, ”Power Over Ethernet OPTIONAL”, switch products shall operate in an environmental temperature range of –40˚C to +85˚C // –40˚F to +185˚F
15. Humidity Requirements: Products shall operate in an environment with relative humidity of 0% to 95% (non-condensing).
    1. WARRANTY
16. Manufacturer shall warrant the Layer 2, 2+, 2++ Industrial, “Power Over Ethernet OPTIONAL” switch products to be free from defects in material or workmanship for a period of **5 Year / Limited Lifetime Warranty.** Maintenance releases for embedded software shall be supported for the full warranty period.

**PART 2 - PRODUCTS**

**2.01** ACCEPTABLE MANUFACTURER

* + 1. **DYMEC**, 1107 SE Willow Place, Blue Springs, MO 64014-5248, United States of America.  
       Telephone: +1-(816)-988-7861, Fax: +1-(480)-287-8605  
       Email: **sales@DYMEC.com**, Internet: **www.DYMEC.com**

1. Substitutions: Not Permitted
2. All Ethernet switches and SFP modules shall be supplied from a single manufacturer.
3. SFP Modules MUST be temperature hardened
   1. SYSTEM PERFORMANCE
      1. The Layer 2 Industrial Ethernet switch products shall include, as a minimum, the following features/functions/specifications:
4. The system shall provide managed edge network connectivity into core networks.
5. The system shall provide managed core network connectivity, if required.
6. The system shall provide 16 x 10/100/1000BaseT(X), RJ45 ports, 4 x 1/10 Base(X) SFP Ten Gigabit socket ports, 1 x Secure USB port and one shielded RJ45 Console interface.
7. The system shall provide a casing with an IP30 protection class rating.
8. The system shall support ERPS protocols (recovery time <10ms) and RSTP/STP (IEEE 802.1w/d) and ring redundant protocols.
9. Configuration of the system shall be achieved by HyperTerminal, Telnet, or a Web Browser.
10. The system shall provide port status indicators, and PoE indicators – where applicable.
11. The system shall provide the ability when configured in a Ring network to have an additional uplink port.
12. The system shall provide ERPS, MAC Table, Cable Diagnostics, SFP Diagnostics (DDMI), Temperature Monitoring, Broadcast Storm Control, Port Mirroring, Static FDB, Multicast, Quality of Service (QoS), Virtual Local Area Networks (VLANs), Port Trunking, RMON Configuration, Secure Shell (SSH), Authentication, DHCP Server, DHCP Client, LACP,VLAN’s, Automatic DOS & DDOS Quenching, MSTP, Cyber Secure Video (CSV),TOS, COS, DiffServ, Protocol 41, Jumbo Frames(up to 16K),IGMP Snooping, IGMPv3,IP based Bandwidth Management, SNMPv3, GVRP, MAC based Port Security, IP Based Port Security, MAC & IP based Port Security, TACACS, NEMA TS-2, Configuration Wizards, Multicast, Authorization, Authentication and Accounting (AAA).
13. The system shall use Store & Forward as its switching method.
14. The system’s transfer rate shall be 148,810pps Fast Ethernet Port, 1,488,100pps Ten Gigabit Ethernet Port, its backplane switch capacity shall be 30 Gbps, it shall provide up to 4094 VLANs, 128 IGMP Multicast Groups for Each VLAN, an 16K MAC address table, 8 Security Queues and 8 Priority Queues.
15. The system shall support the following protocols: Simple Network Management Protocol (SNMP) v3.0, Internet Group Management Protocol (IGMPv1, v2, v3) Snooping, Address Resolution Protocol (ARP), Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), ERPS (world engineering standard redundant ring protocol), Simple Network Time Protocol (SNTP)
16. The system shall have an operating temperature of -40°C to +85°C; have an operating humidity of 0 to 95% non-condensing and a MTBF of > 150,000 hours.
17. The module shall have a power consumption figure of 0.70A @24 Volts DC Typical
18. The system shall provide built in over-current protection.
19. The system radiated emission shall be compliant with FCC Part 15/EN55022, Class A.
20. The system shall provide Remote Temperature Sensing
21. The system shall be available in PoE / PoE+ and Non PoE configurations.
22. All ports and power inputs are surge protected and the switch is Fanless (Convection Cooled).
23. The system will be American Certified Ethernet – guaranteed protection against counterfeit chips / chip sets.
24. The switch will also support Built-in Port Monitoring and Statistical gathering – Silicon embedded.
25. Switch must have “SERVICE CONTROL” support for Security.
26. Altitude Certified GB4943.1-2011 (0~5000 Meters).
27. TAA Compliant
28. The system will be manufactured in the USA.
    1. Switch Specifications:
       * 1. Physical DATA Ports:
         2. 10/100/1000 BaseT(X) Ports – RJ45 (Auto MDI /MDIX)

**16 x PORTS Bidirectional. Surge Protected**

**Auto-Negotiable**

**Built-in Cable Diagnostics**

* + - 1. 1/10 GbE Base-(X) SFP Sockets

**4 x SFP Sockets, Bidirectional,**

**Surge Protected,**

**Auto-Negotiable**

**Supports Copper RJ-45 SFP’s**

**DDMI Diagnostics**

**Remote Temperature Sensing**

* + - 1. Ethernet Standards:

1. IEEE802.3 for 10BaseT
2. IEEE802.3u for 100BaseTX
3. IEEE802.3z for 1000Base-X
4. IEEE802.3ab for 1000 Base-T
5. IEEE802.3x for Flow Control
6. IEEE802.3ad for LACP (Link Aggregation Control Protocol)
7. IEEE802.3ae for 10 GbE Support
8. IEEE802.1D for STP (Spanning Tree Protocol)
9. IEEE802.1p for Cos (Class of Service)
10. IEEE802.1Q for VLAN Tagging
11. IEEE802.1w for RSTP (Rapid Spanning Tree Protocol)
12. IEEE802.1x for Network Authentication
13. IEEE802.1ad for Stacked VLANS (QinQ)
14. IEEE802.1s – for MSTP (Multiple STP)
15. IEEE802.1AB – for LLDP (Neighbor Discovery
16. ITUT G.8032 / Y.1344 for ERPS – Ethernet Ring Protection Service
17. SFF-8472 for DDMI (Digital Diagnostic Monitoring Interface)
18. NEMA TS-2 for Outdoor Traffic Equipment
    * + 1. Ethernet Interface Specifications

1. Ethernet Compliance: IEEE 802.3 10BASE-T, IEEE 802.3u 100BASE-TX & 100BASE-FX, IEEE 802.3x Full Duplex, IEEE 802.1AB, IEEE802.1Q (QinQ), IEEE 802.1d Spanning Tree, IEEE 802.1w Rapid Spanning Tree, IEEE 802.1p Class of Service and IEEE 802.1q VLAN Tagging. LLDP, Jumbo-Frames, IEEE 802.3ae

2. Interface: RJ45 Auto-MDI/MDI-X & 1000 Base SFP.

3. Data Rate: 10/100/1000 Mbps (Manual or auto-negotiate) and SFP ports that can be configured as 1000Base-TX or 1000Base-SX/LX/LH/ZX.

4. Operating Mode: Half or full-duplex

5. Surge Protected

6. Network Protocols: Unicast/Multicast/Broadcast, SNMP v3.0, IGMP, ARP, STP, MSTP, RSTP, ERPSv2 & SNTP.

* + - 1. Switch Specifications

1. Switching Method: Store & Forward.
2. Minimum 16 x 10/100/100 RJ-45 & 4 x 1/10 GbE SFP Slots
3. SFP Slots can be converted to Copper RJ-45 Ports

4. Transfer Rates: 148,810pps @Fast Ethernet Port, 1,488,100pps @Ten Gigabit Ethernet Port

5. Backplane Switch Capacity: 150 Gbps or Greater

6. Packet Buffer: 12 Mbits

7. Fully Non-Blocking Switch Fabric

8. Mac Address Table: 16K Addresses

9. Number of VLANs: 4094

10. Number of Priority Queues: 8

11. Number of Security Queues: 8

12. Switching Latency: <6ųs

13. Switching Bandwidth: 150 Gbps

14. Maximum Available VLANS: 4094

15. IGMP Groups: 1024

16. IGMP Multicast Groups: 128 for Each VLAN

17. Port Rate Limiting: User Defined

18. Jumbo Frame Support: 16K Bytes

19. VLAN Table Size 4094

20. Lockable Console Port & Reset Switch

21. Rack / Shelf Mounting for ITS Cabinets

22. Dimensions: 91 x 145 x 118 mm (W x H x D)

23. G.8032 ERPSv2 Ethernet Ring Protection System

24. DDMI (Full fiber diagnostics and remote temperature sensing)

25. Copper Cable Diagnostics

26. MTBF >150,000 hours

27. Network Redundancy: RSTP, MSTP, G.8032 ERPSv2, Port Trunking with LACP

28. All ports and power inputs are surge protected.

29. Power: 0.70A @24 Volts DC or less

30. Switch is Fanless (Convection Cooled)

31. Minimum 5 Year / Limited Lifetime Warranty

32. Built-in Port Monitoring Statistical Gathering

33. Power Support: 12 ~ 48 Volts DC

34. Secure and Lockable Console Port

35. Secure and Lockable Reset Button

36. Remote Temperature Sensing

37. Fully Secured High Security Chassis Meeting NSA Guidelines

38. FULL NSA CERTIFIED SERVICE CONTROL

39. Secure USB Interface

40. Digital Control Interface

41. Relay Interface

42. The switch will also support Built-in Port Monitoring and Statistical gathering – Silicon embedded.

43. ISO9001:2008 / UKAS Management Quality Specifications

44. Altitude Certified GB4943.1-2011 (0~5000 Meters).

45. TAA Compliant

46. Made in USA

* + - 1. Status Indicators

1. **Power Indicator: (PWR)** Green Power Indicator
2. **System Ready Indicator: (STA)** Green : Indicates System Ready / Blinking: System is upgrading firmware
3. **Ring Master Indicator: (RM)** Green Indicates the system is operating in Ring Master Mode
4. **Ring Indicator: (Ring)** Green Indicates the system is operating in Ring Mode. // Blinking indicates the ring is broken,
5. **System Running Indicator: (RUN)** System operated continuously
6. **Reset to Default Running Indicator: (DEF)** Green Indicates system reset to default configuration
7. **PoE Indicator:** Blue – POE LED x 8 (Only Applies to PoE Models)

2. **10/100/1000BaseT(X) RJ45 Indicator:** Green for port Link/Activity Amber for Duplex /Collision

3. **1000Base(X) SFP Port Indicator:** Green for port LINK/ACTIVITY

4. **System Status**

* 1. POWER SPECIFICATIONS
     1. Power Input: 12 ~ 48 Volts DC – Dual Power Inputs
     2. Frequency: 50-60 Hz
     3. Power Consumption: 0.70A @ 24 Volts DC Typical
     4. Overload Current Protection: Yes
     5. Surge Protected: Yes (All Ports / All Power - Dual Inputs)
     6. Supports both NEMA and non-NEMA ITS Traffic Cabinets
  2. MECHANICAL SPECIFICATIONS
     + 1. Dimensions: 91 x 145 x 118 mm (W x H x D)
       2. Weight: 1.38 kg
       3. Casing: IP30 Protection
  3. Regulatory Approvals
     + 1. **EMI:** FCC Part 15, Subpart B Class A / CISPR (EN55022) Class A, IEC-60255-5
       2. **EMS:** EN61000-4-2 (ESD), EN61000-4-3 (RS), EN61000-4-4 (EFT), EN61000-4-5 (Surge)

EN61000-4-11, EN61000-4-8 (Surge), EN61000-4-6 (CS) EN61000-4-12, 61000-4-16, EN61000-4-17

* + - 1. **SHOCK:** IEC60068-2-27
      2. **FREE FALL:** IEC60068-2-32
      3. **VIBRATION:** IEC60068-2-6
      4. **NEMA:** Exceeds NEMA TS-2 for Traffic Control Equipment
      5. **IEEE1613:** IEEE C37.90. IEEE C37.90.1, IEEE C37.90.2, IEEE C37.90.3
      6. **IEC61850-**9-3 edition 2
      7. **Altitude Certified GB4943.1-2011** (0~5000 Meters).
      8. **IEC / UL 60950-**1 Safety / 62368
      9. **RoHS Compliant**
      10. **Certifications: UL60950-1 / 62368**

**IEC61000-6-2**

**IEC61000-6-4**

**FCC Part 15 – Subpart B Class A**

**NEMA-TS2**

**IEEE**

**ITUT**

**RoHS**

* 1. ENVIRONMENTAL SPECIFICATIONS
     + 1. Operating Temperature: -40°C to +85°C
       2. Storage Temperature: -40°C to +85°C
       3. Humidity: 0% to 95% (non-condensing)
       4. Emissions: FCC CFR47 Part 15/EN55022, Class A
       5. IEC 600068-2-1, IEC 600068-2-2, IEC 600068-2-30. IEC 60255-21-1, IEC 60255-21-2
       6. Mean Time between Failure: >150,000 hours
  2. SFP MODULES

The SFP modules used shall be supplied by DYMEC. The SFP modules shall have a hot-pluggable SFP footprint, low power dissipation, a metal enclosure for lower EMI, a single 3.3V power supply and an operating temperature range of -40°C to +85°C. SFP’s must support DDMI. The switch shall support but not be limited to supporting the following SFP Ten Gigabit modules: (Note: D is for Diagnostics / nm is nanometer / S is Single-mode / M is Multi-mode / BiDi is Single Fiber Bidirectional)

1. Copper, 10/100/1000 Mbps, 100m, RJ45. **KY-CGSFP-TXRJ**
2. Copper, 100 Mbps, 1 / 2 Pair, Twisted, Up to 2400 m, VDSL2, RJ-45, D. **KY-VDSL2SFP**
3. Fiber, 1000 Mbps, 2 fibers, multi-mode, 550m, 850nm, LC, D. **KY-MGSFP-550MD**
4. Fiber, 1000 Mbps, 2 fibers, multi-mode, 2KM, 1310nm, LC, D **KY-MGSFP-LR2KMD**
5. Fiber, 1000 Mbps, 1 fiber, single-mode, 3KM, 1310/1550nm, LC, D. **KY-BIDISGSFP-LR3KMD**
6. Fiber, 1000 Mbps, 2 fibers, single-mode, 10KM, 1310nm, LC, D. **KY-SGSFP-LX10KMD**
7. Fiber, 1000 Mbps, 2 fibers, single-mode, 20KM, 1310nm, LC, D **KY-SGSFP-LX20KMD**
8. Fiber, 1000 Mbps, 2 fibers, single-mode, 40KM, 1550nm, LC, D **KY-SGSFP-LX40KMD**
9. Fiber, 1000 Mbps, 2 fibers, single-mode, 80KM, 1550nm, LC, D **KY-SGSFP-ZX80KMD**
10. Fiber, 1000 Mbps, 2 fibers, single-mode, 120KM,1550nm, LC, D **KY-SGSFP-ZX120KMD**
11. Fiber, 1000 Mbps, 1 fiber, single-mode 10KM, 1550nm/1310nm, D. **KY-BIDISGSFP-LX10KMD**
12. Fiber, 1000 Mbps, 1 fiber, single-mode 20KM, 1550nm/1310nm, LC, D. **KY-BIDISGSFP-LX20KMD**
13. Fiber, 1000 Mbps, 1 fiber, single-mode 40KM, 1550nm/1490nm, LC, D. **KY-BIDISGSFP-LX40KMD**
14. Fiber, 1000 Mbps, 1 fiber, single-mode 80KM, 1550nm/1490nm, LC, D. **KY-BIDISGSFP-ZX80KMD**
15. Fiber, 1000 Mbps, 2 fibers, multi-mode, 3KM, 1310nm, LC, D **KY-MGSFP-LR3KMD**
16. Fiber, 10 GbE, 2 fibers, multi-mode, 300M 850nm, LC, D **KY-10G-SFP+/SOSP-8599-05**
17. Fiber, 10 GbE, 2 fibers, multi-mode, 2KM, LRM 1310nm, LC, D **KY-10G-SFP+/SOSP-3199-2**
18. Fiber, 10 GbE, 2 fibers, single-mode, 10KM, 1310nm, LC, D **KY-10G-SFP+/SOSP-3199-10**
19. Fiber, 10 GbE, 2 fibers, single-mode, 20KM, 1310nm, LC, D **KY-10G-SFP+/SOSP-3199-20**
20. Fiber, 10 GbE, 2 fibers, single-mode, 40KM, 1550nm, LC, D **KY-10G-SFP+/SOSP-5599-40**
21. Fiber, 10 GbE, 2 fibers, single-mode, 80KM, 1550nm, LC, D **KY-10G-SFP+/SOSP-5599-80**
22. Fiber, 10 GbE, 2 fibers, single-mode, 20KM, 1310nm, LC, D **KY-10G-SFP+/SOSP-3199-20**
23. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 10KM, Tx1270/Rx1310nm, **KY-10GBiDiSFP+/SOSPB-2399-10**
24. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 10KM, Tx1310/Rx1270nm, **KY-10G-BiDiSFP+/SOSPB-2399-10**
25. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 20KM, Tx1270/Rx1310nm, **KY-10G-BiDiSFP+/SOSPB-2399-20**
26. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 20KM, Tx1270/Rx1310nm, **KY-10G-BiDiSFP+/SOSPB-2399-20**
27. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 40KM, Tx1310/Rx1270nm, **KY-10G-BiDiSFP+/SOSPB-2399-40**
28. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 40KM, Tx1270/Rx1310nm, **KY-10G-BiDiSFP+/SOSPB-2399-40**
29. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 60KM, Tx1310/Rx1270nm, **KY-10G-BiDiSFP+/SOSPB-2399-60**
30. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 40KM, Tx1270/Rx13100nm, **KY-10G-BiDiSFP+/SOSPB-2399-60**
31. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 60KM, Tx1310/Rx1270nm, **KY-10G-BiDiSFP+/SOSPB-2399-60**
32. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 60KM, Tx1270/Rx1310nm, **KY-10G-BiDiSFP+/SOSPB-2399-60**
33. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 80KM, Tx1490/Rx1550nm, **KY-10G-BiDiSFP+/SOSPB-2399-80**
34. Fiber, 10 GbE, 1 fiber, single-mode, LC, D 80KM, Tx1550/Rx1490nm, **KY-10G-BiDiSFP+/SOSPB-2399-80**
35. **PART 3 - EXECUTION**

**3.01** EXAMINATION

1. Inspect modules before installation to verify physical condition as well as inclusion of all peripheral materials
2. Modules shall be free of any cosmetic defects or damage.
3. Shipping box shall include the module, power supply (surface mount units) and operations manual.

**3.02** PREPARATION

1. Wall Mount
2. Shall be mounted on a properly prepared surface adequate for the size and weight of module. The placement of the unit shall allow provision for cable installation and maintenance as indicated on the approved detail drawings and in accordance with the installation manual.
3. Rack & DIN-RAIL Mount
4. Shall be mounted on a properly installed equipment cabinet or rack adequate for the size and weight of the unit. The placement of the unit shall allow provision for cable installation and maintenance as indicated on the approved detail drawings and in compliance with the installation manual.

**3.03** INSTALLATION

1. General: The Layer 2, 2+, 2++, POE Ethernet switch products must be installed, configured, and tested in accordance with the manufacturer’s instructions.

**3.04** TESTING AND CERTIFICATION

1. The Contractor shall demonstrate the functionality of the Layer 2, 2+, 2++ POE Ethernet switch on completion of installation, documenting the result of all tests and providing these results to the Owner. The Layer 2, Ethernet switch shall be tested in accordance with the following:
2. The Contractor shall conduct a complete inspection and test of all installed Layer 2,2+, 2++,POE Ethernet switch equipment. This includes testing and verifying operation with connected equipment and network infrastructure.
3. The Contractor shall provide staff to test all devices and all operational features of the system for witness by the Owner’s representative and the Authority having jurisdiction. All testing must be witnessed by the Owner’s representative, prior to acceptance.

## END OF SECTION

**Brief Specification**

The Layer 2, 2+, 2++, IP30, Managed Industrial Ethernet Edge switch products shall be DYMEC model **KY-MSX-1604**, 20 Port, Managed, 10 Ten Gigabit, NSA Secure. Din-Rail or Shelf Mount. Refer to contract drawings for mounting type. The system shall provide edge connectivity into both edge and core networks. The system shall provide 16 x 10/100/1000BaseT(X) RJ45 ports, 4 x 1/10 GbE Base(X) SFP Gigabit Ethernet/Ten Gigabit sockets, 2 x Redundant DC Inputs - Connectivity for power / ground Inputs, 1 x Digital Input, 1 x Relay Input, a shielded RJ45 Console interface **WHICH “MUST” BE ABLE TO BE TURNED OFF / Meeting NSA Endpoint Guidelines.** The SFP ports shall be configured as either 10/100/1000BASE-T(X) RJ45 copper ports or 1000BASE-SX/LX/LH/ZX, LC fiber ports, in any permutation, to provide maximum network flexibility. The system shall provide a casing with an IP30 protection class rating. The system shall have high speed redundant ring technology (ERPS) and be able to recover from port and cable failures in less than 10ms. Configuration of the system shall be achieved by either HyperTerminal, Telnet or a Web Browser. The system shall provide port status indicator. The system shall provide the ability to be configured in an ERPS Ring network and shall have an additional uplink port. ERPS Rings MUST be supported. The system shall provide Broadcast Storm Control, MAC Table, DDMI, Automated Configuration Backup USB, Copper & Fiber Cable Diagnostics, Port Mirroring, Static FDB, Multicast, Quality of Service (QoS), Virtual Local Area Networks (VLANs), Port Trunking, RMON Configuration, Secure Shell (SSH), Authentication, DHCP Server, DHCP Client, LACP,VLAN’s, Automatic DOS & DDOS Quenching, MSTP, Cyber Secure Video (CSV),TOS, COS, DiffServ, Protocol 41, Jumbo Frames(up to 16K),IGMP Snooping, IGMPv3,IP based Bandwidth Management, SNMPv3, GVRP, MAC based Port Security, IP Based Port Security, MAC & IP based Port Security, NEMA TS-2, Configuration Wizards, Authorization, Authentication and Accounting (AAA).The system shall use Store & Forward as its switching method. The switch latency will be 6us or less. The system’s transfer rate shall be 148,810pps Fast Ethernet Port, 1,488,100pps Ten Gigabit Ethernet Port, its backplane switch capacity shall be 95 Gbps, it shall provide up to 4094 VLANs, an 16K MAC address table, 8 Security Queues and 8 Priority Queues. The system shall support the following protocols: Simple Network Management Protocol (SNMP) v3.0, Internet Group Management Protocol (IGMP) Snooping, LLDP, Address Resolution Protocol (ARP), Spanning Tree Protocol (STP), Multicast, Rapid Spanning Tree Protocol (RSTP), File Transfer Protocol (FTP), G.8032 ERPSv2 Redundant Ring (international standard redundant ring protocols), Network Time Protocol (NTP). The system shall have an operating temperature of -40°C to +85°C, have an operating humidity of 0 to 95% non-condensing, and have a power consumption of less than 0.70 A @ 24 Volts DC Typical (minus POE) and an MTBF of > 150,000 hours. The system shall provide built in over-current protection. All ports and power inputs are surge protected and the switch is Fanless (Convection Cooled). The system radiated emission shall be compliant with FCC Part 15/EN55022, Class A. Supports IPv4 & IPv6 Protocols. The switch will have Advanced Port Statistics capabilities – built in and silicon based.

**Dimensions must be 91 x 145 x 118 mm and the device will be designed as a DIN\_RAIL / Shelf mount. The switch will have a Fully Secured Chassis meeting NSA Guidelines**

It MUST support security feature: “**Service Control”** for HTTP / HTTPS / Telnet / SSH / Reset Button & Console Port – used for control of protocols and hardware services. It MUST support security feature: “**Service Control”** for HTTP / HTTPS / Telnet / SSH / Reset Button & Console Port – used for control of protocols and hardware services. Altitude Certified GB4943.1-2011 (0~5000 Meters). TAA Compliant. The switch will also support Built-in Port Monitoring and Statistical gathering – Silicon embedded. The switch MUST have a SECURE USB PORT

The switch will be UL 60950-1 / 62368 including IEC61000-6-2 & IEC61000-6-4 Certified

The switch will have a 5 Year / Limited Lifetime Warranty and be manufactured in the USA.

The switch must be American Certified Ethernet (ACE).

Manufacturing Certification ISO9001:2008 / UKAS MANAGEMENT SYSTEMS