AQ 8000 Series
DOCSIS® & EURODOCSIS™ 3.0
Ethernet Business Services & Mobile Backhaul

ELECTROLINE

AQ8000 Highlights

The AQ 8000 series Rugged Cable Modem is DOCSIS® 3.0 and EuroDOCSIS™ 3.0 compliant and is weatherproof and specially designed for installations where temperatures can be extreme, uncontrolled, and typical of the outside plant in an HFC cable network. This cable modem is designed to withstand electrical over-voltages and surges commonly experienced in HFC network outside plant. It is also designed to withstand high powered small cells at close proximity. It eliminates LTE frequencies getting into the HFC network. It has an optional built in MEF Compliant Carrier Ethernet Demarcation Device.
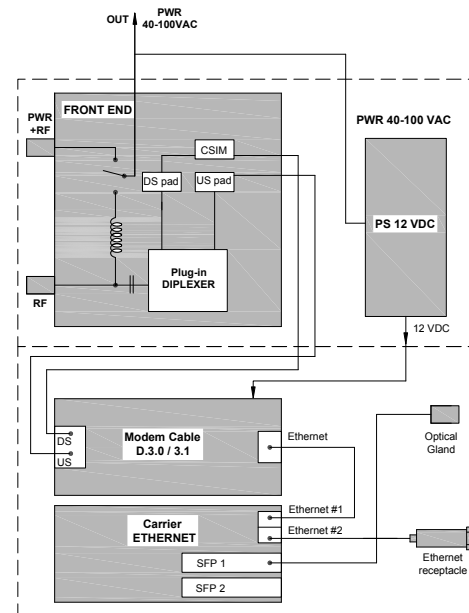
Cable Modem Features

- Designed for DOCSIS® & EURODOCSIS™ specifications
- Network Monitoring - Embedded Spectrum Analyzer
- For D3.0, 8x4 bonded channels with data rates in excess of 340 and 120 Mbps for DS and US respectively
- Support for BSOD and L2VPN
- Dual PAD (US & DS) system
- Adjustable DS slope with Cable Simulator module
- Specialized Ethernet Receptacle that reduces RF interference
- Watchdog module that monitors Cable Modem health and resets unit when problem is detected. This reduces truck rolls.
- Modular design with field upgradable Diplexer module, Power Supply, Carrier Ethernet module and Cable Modem
- Strand, pedestal, mast, pole and wall mounting
- HFC cable powered, 40 to 100 VAC
- 10/100/1000 BASE-T auto sensing / auto-MDIX Ethernet port
- Power over Ethernet (PoE and PoE+) Gigabit interface for attached Ethernet devices with remote power recycle option
- Temperature Hardened and weather proof IP68 rated housing.
- Optional wall outlet power supply
- Optional Optical Interface with SFP

       950-0241 Rev. D 2018-10

Electroline Specific and Unique Features

1. Superior Radio Frequency Interference (RFI) Isolation: over 130dB

  1.1. Ethernet RFI Enhanced Port: A special patented design that filters noise coming from Small Cells and getting inside the AQ housing, and thus into the HFC network.

  1.2. Ethernet termination: a shielded Ethernet cable is terminated inside the Ethernet receptacle and the proper grounding of the Ethernet cable shield.

  1.3. Specific design to isolate the different sections of the outdoor housing from each other in order to reduce or eliminate the interference between each other. These sections are the Power Supply, HFC plant RF and the Ethernet.


2. Proprietary Intelligence (PI) for our Cable Modem: Reduce truck rolls.
Electroline has implemented many levels of protection to ensure that the Cable Modem remains functional in case of a failure. These PI system will reduce maintenance and truck rolls. There are 5-tiers PI:

  2.1. A Firmware Watchdog system designed to reboot the CM engine if an internal error is detected.

  2.2. A Hardware Watchdog system that will reset the complete CM. With the help of a special Chipset added to the CM, the Electroline PI code running in the CM will monitor the health of the CM and reset the CM if it finds any malfunctions.

  2.3. An SNMP watchdog. The PI in the CM is set to reset the CM if there are no SNMP activity detected during a certain period of configured time.

  2.4. An RF watchdog: The AI code in the CM will reset the CM if it becomes offline after a certain configured time.

  2.5. An RF scanning watchdog: The PI code in the CM will reset the CM if after 5 DS scanning cycles no DOCSIS carrier is found

3. Ruggedized Architecture: Our ruggedized product is among the leaders in the industry

  3.1. Industrial Components used: Most critical parts used on the CM are rated for Industrial specifications

  3.2. Specialized RF Front End: Modularized Diplexer for future band-split changes; Separate PADs to adjust power levels (attenuation) on downstream and upstream direction; Adjustable downstream slope (Cable Simulator); Downstream Test Point (TP 20 dB).

  3.3. Troubleshooting Tool: A special Electroline developed integrated spectrum analyzer with a precision of 1 dB at typical temperatures; temperature sensor integrated in CM to compensate the values reported by different temperature readings .

  3.4. Individually calibrated with specific calibration points for improved accuracy .

  3.5. Temperature hardened: Tested SCTE40 at -40 to 60 degrees Celsius.

  3.6. Water/Dust Ingress Protection Rating: IP-68 rated.

  3.7. MSO OPEX optimized: Through the PI implemented in the CM and its ability not only to self reset, but also remotely control the power on any attached CPE device on its PoE ports.

    p. 2/6   950-0241 Rev. D 2018-10
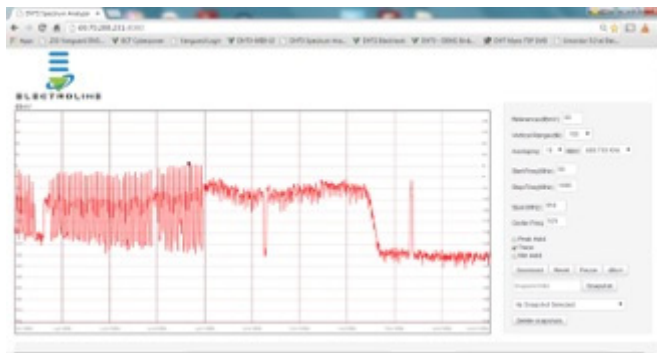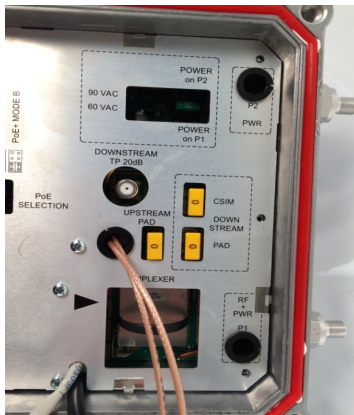
4. Customer Service Level Agreement (SLA) requirements and Business Services support:

4.1. Integrated Carrier Ethernet Demarcation Device (EDD) that is MEF CE2.0 compliant. This device is able to provide IEEE and ITU standards based loop-back testing and performance monitoring that are requested by MNOs. (RFC 2544, ITU-T Y.174 and Y.1731)

4.2. Business Services over DOCSIS® (BSoD) support. Capability to map different SLAs on specified Layer 2 DOCSIS® Tunnels (L2VPN) based on packet differentiating factors. These factors are:

    4.2.1.   VLAN Tags (IEEE802.1q)
    4.2.2.   IP addresses
    4.2.3.   IP Differentiated Services Code Points (DSCP)
    4.2.4.   UDP/TCP port numbers
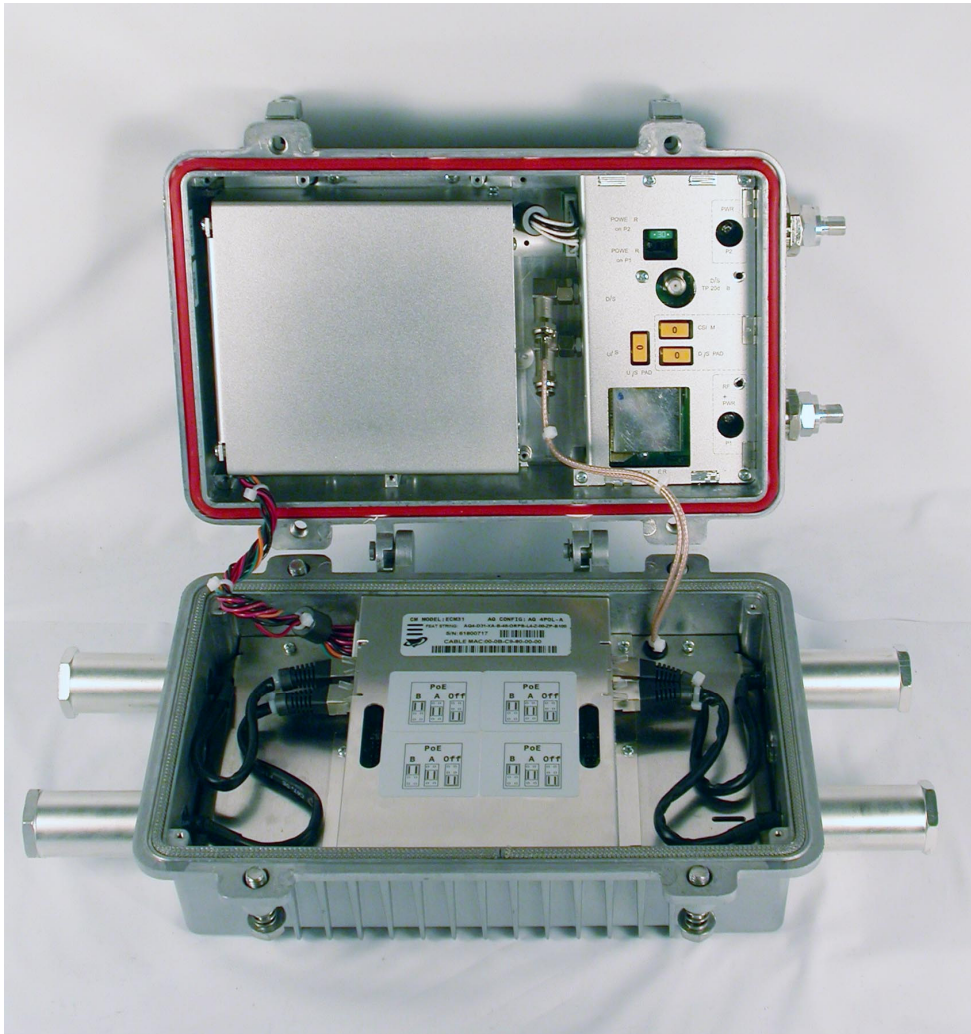
5. Modular and Scalable architecture: A customer focused product

5.1. Scalable design with options for 1-port, 2-ports and 4-ports PoE+ interfaces.

5.2. Factory configuration option for an integrated Carrier Wi-Fi radio module within the housing: Exists today with centrally managed Wireless controllers.

5.3. Additional features include:

    5.3.1.   Strand, wall, pedestal, pole mounting options.
    5.3.2.   100% Electroline designed and Cablelabs® certified Cable Modem.
    5.3.3.   Power Output on Ethernet capable of doing 12VDC (non-standard), 24VDC (non-standard) and 48VDC (actual 50-57 VDC at PSE as PoE+ standard).

        950-0241 Rev. D 2018-10

Embedded DOCSIS® & EURODOCSIS™ 3.0 Cable-Modem Specifications

	DOCSIS® 3.0	EURODOCSIS™ 3.0
RF DOWNSTREAM		
Operating Frequency Range (center)	111 to 999 MHz	112 to 1002MHz
Frequency Range (edge-to-edge)	54 to 1002, 85 to 1002, 108 to 1002 MHz	85 to 1006, 108 to 1006MHz
Tuner	Full band capture frontend with 8 or 16 fully independent digital tuners	
Demodulation	8 (BCM3383) or 16 (BCB33843) demodulators, 64 QAM or 256 QAM	
Maximum Raw Data Rate	8 or 16 downstream channels, each 6 MHz channel: 42.88 Mbps for 256 QAM and 30.34 Mbps for 64 QAM	8 or 16 downstream channels, each 8 MHz channel: 55.62 Mbps for 256 QAM and 41.71 Mbps for 64 QAM
Bandwidth per Channel	6MHz	8MHz
Operating Level Range (at modem's input)	-15 to +15dBmV	+43 to +73 dBµV for 64 QAM +47 to +77 dBµV for 256 QAM
Input Impedance	75 ohms	
RF UPSTREAM		
Operating Frequency Range (edge-edge)	5 to 42 MHz, 5 to 65 MHz, or 5 to 85 MHz	5 to 65 MHz, or 5 to 85 MHz
Upstream Transmission	4 upstream channels	
Modulation	QPSK, 8 QAM, 16 QAM, 32 QAM, 64 QAM at ATDMA Mode QPSK, 8 QAM, 16 QAM, 32 QAM, 64 QAM, 128 QAM at SCDMA mode	QPSK, 8 QAM, 16 QAM, 32 QAM, 64 QAM at ATDMA Mode QPSK, 8 QAM, 16 QAM, 32 QAM, 64 QAM, 128 QAM at SCDMA mode
Maximum Data Rate per channel	**Channel Width (MHz) Raw Data Rate (Mb/s)**	**Channel Width (MHz) Raw Data Rate (Mb/s)**

Modulation	Channel Width (MHz)	Raw Data Rate (Mb/s)	Channel Width (MHz)	Raw Data Rate (Mb/s)
QPSK	1.6	2.56	1.6	2.56
16 QAM	1.6	5.12	1.6	5.12
QPSK	3.2	5.12	3.2	5.12
16 QAM	3.2	10.24	3.2	10.24
32 QAM	3.2	12.8	3.2	12.8
8 QAM	6.4	15.4	6.4	15.4
16 QAM	6.4	20.5	6.4	20.5
32 QAM	6.4	25.6	6.4	25.6
64 QAM	6.4	30.72	6.4	30.72

ELECTRICAL		
Input Voltage	Cable powered 40 to 120 AC 50 / 60 hz sin or Quasi square wave;	
Power Consumption (modem module)	<10 Watts D3.0 Cable Modem, <25 W D3.0 with Carrier Ethernet	
Surge Protection (F connector) Ring Wave Combination wave	IEEE C62.41-1991, cat A3 6KV 200A IEEE C62.41-1991, cat B3 6KV 3KA	IEC 61000-4-12, Level 4 (4KV/133A) IEC 61000-4-5, Level 4 (4KV/2KA)
Surge Protection for Ethernet Port	Combo Wave 6Kv 12 Ohms (500A)	
Data Ports	Ethernet 10/100/1000BASE-T (Auto-sensing with Auto-MDIX) RJ-45 Ethernet	
Optical (optional)	SFP cage	
RF	Female "F" type	
Power Over Ethernet (PoE+); choose from 1-port, 2-ports, and 4-ports options	For IEEE 802.3at configuration: 48Vdc at 600mA; Optional factory configurations: 24Vdc; or 12Vdc	
MECHANICAL		
Dimension (W x D x H)	Not including "F" connector: 9"x8.7"x5.9" (23cmx22cmx15cm)	
Weight	8 lbs (3.6 Kgs)	
Operating Temperature	-40° to 140°F (-40° to 60°C)	
Operating Humidity	0 to 90% RH non-condensing	
Designed to Comply with the Following Standards	DOCSIS® / EuroDOCSIS™ 3.0, 2.0, 1.1, 1.0	
Regulatory and Safety Approvals	As required per country	

Carrier Ethernet Highlights

Network Security	Upgraded security with port-isolation, basic ACL, broadcast/multicast/DLF storm control, unique port loopback detection, and DHCP Client/Option82 functionality
Resiliency & Protection	ITU-T G.8031 linear and ITU-T G.8032 ring protection with switching time less than 50ms IEEE 802.1ax Link Aggregation G.8131 linear protection for MPLS-TP in LSP layer and PW layer
MEF CE2.0	MEF ELINE, ELAN, ETREE service available
Ethernet OAM	IEEE 802.3ah Link OAM, IEEE 802.1ag end-to-end connectivity OAM and ITU-T Y.1731 end-to-end service and performance, SLA reporting
Management	Auto-Provisioning, plug&play, single IP for all the connected remote devices, end to end configuration Device management and VPN service management
SAT	Service activation test using Y.1564 up to 8 stream, act as a generator or a reflector
QoS	Advanced QoS technology allows stream-marking based on CoS, DSCP, IP precedence and priority; scheduling modes including SP, WRR, SP+WRR; WRED, flow-based mirroring/rate-limit/redirection/VLAN swapping and rewriting
Power Reliability	Dual hot-swappable power supply, with voltage/temperature alarms
TWAMP-Light	Standard IP SLA measurement, include generator and reflector
SLA Portal	B/S architecture, SLA TWAMP KPIs monitor(include FD, FDV, FLR, availability, bandwidth, bandwidth utilization)
E2E Provisioning	Standard MEF40 architecture, include bandwidth/performance profile GUI, standard service modules(ELINE, ELAN, ETREE), and End-to-End configuration based on service

Carrier Ethernet Key Features

Switching Mode	Store and forward mode; Supports jumbo frame
Ethernet	MTU:12,288 byte Up to 8k MAC Support 4,094VLANs (C-tag), stacked VLANs (QinQ, S-tag) Layer 2 loopback on single and multiple flows Layer 2 control protocol (L2CP) handling
IP Services	DHCP client, option61 IPv4, Static management routing
Traffic Management	Service classification per port/VLAN/CoS(DSCP) Support SP, WRR and SP+WRR scheduling modes, and up to 8 queues per port MEF-compliant 3-color policing with color-aware and color-blind mode Bandwidth throttling per port/VLAN/CoS(DSCP), CIR/EIR per flow
Security	ACL based on VLAN, CoS, MAC, EtherType, IPv4, IPv6, or user-define RADIUS, TACACS+ Storm control (broadcast, multicast, DLF)
Reliability	Link aggregation group (LAG) Interface backup ITU-T G.8031 Ethernet link protection switching (ELPS) and G.8032 Ethernet ring protection switching (ERPS) with the automatic protection switchover time less than 50ms Port/VLAN-based Ethernet local loop detection Fault propagation AC&DC dual-feed power supplies

Ethernet OAM	IEEE 802.3ah EFM-OAM link management IEEE 802.1ag connectivity fault management (CFM) with 3.3ms CCM resolution ITU-T Y.1731 performance monitoring (PM) Hardware-based frame delay (FD) measurement Y.1564 TWMAP-Light Hardware-based SLA KPIs per port or EVC, which include throughput, delay, jitter, packet loss and availability Dying gasp message in case of power failure
Auto-Provisioning	Auto-establishment of management tunnels across L2/L3 networks
System Management	Remote management via SNMP v1/v2/v3, Telnet and SSH v1/v2 Local management via console interface MEF 36 compliant MIB KeepAlive, RMON, LLDP, Syslog Port/VLAN/CoS-based statistics SFP digital diagnostic management (DDM) Temperature and CPU monitoring Voltage and temperature monitoring Dual system
Fault Propagation	From line to client interface fault propagation (user configurable) Client interface fault propagation
Compliances, standards and protocols	IEEE802.3,802.3u IEEE802.3ad Link Aggregation IEEE802.1p,802.1Q VLAN IEEE802.1ad QinQ IEEE802.3ah OAM IEEE802.1ag CFM ITU-T Y.1731 Services OAM ITU-T G.8031 ELPS ITU-T G.8032 ERPS IGMP v1/v2/v3 SNMPv1/v2c/v3 CE certified ,UL RoHS compliance EMI Class A MEF6,8,9,10,11,13,14,16,17,20,31,36

Specifications are subject to change without prior notification.

For more information on our products, please visit: www.electroline.com or call: 800-461-3344