µFalcon-MX/G

Transport Enabled Edge Grandmaster Clock

Product Overview

The **µFalcon-MX/G** is a compact, high performance, Edge Grandmaster/GW Clock, with service aggregation and demarcation capabilities, delivering high end Timing coupled with Carrier Ethernet services.

This product extensively supports the evolving needs for Timing and Synchronization in a constantly growing number of applications. Geared with integrated GNSS receiver, highly accurate timestamping engines and dedicated packet generators and responders, it delivers consistent and robust high performance.

The **µFalcon-MX/G** supports the Precision Time Protocol (PTP, IEEE1588v2), Synchronous Ethernet (SyncE) and NTP packet-based timing services. These are coupled with a market leading variety of interfaces, including 10/100/1000BaseT and 100/1000/2500M/10G optical interfaces (supporting all common types of SFPs). These provide unparalleled flexibility in deployment and connectivity.

All Ethernet interfaces of the system can be used for Carrier Ethernet services delivery, for aggregation or demarcation. This is performed in parallel to all timing functions, with no performance degradation.

The **µFalcon-MX/G** can support numerous applications requiring timing. The most common one being mobile backhaul and fronthaul, for LTE/5G, both macro sites and small cells.

The **µFalcon-MX/G**'s extensible hybrid (ASIC-FPGA) Hardware architecture allows for ultimate flexibility and performance.

The **µFalcon-MX/G's** capacity for Ethernet services delivery, including MEF standards is based on a highly advanced timing aware, switching core.

- Market leading integrated Edge/Gateway Clock and Transport system
- Ideal for timing and backhaul in private and public LTE and 5G mobile networks
- Excellent fit for mobile fronthaul
- High performance, high accuracy PTP Grandmaster, BC, TC and OC
- Multiple timing inputs / outputs (GNSS, PTP, SyncE, ToD, 1PPS, 10MHz)
- Unparalleled port configuration flexibility (100/1000/2500M and 10G)
- Wire-speed forwarding on all ports
- Redundancy mechanisms on both timing and transport planes
- Advanced QoS and service level traffic management
- Compact, low power, fan-less design
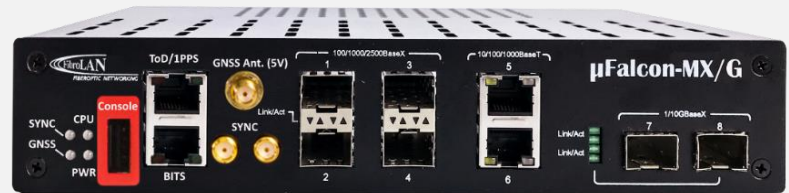
Quality of Service (QoS) features including classification and mapping based on layer 1 through layer 4 attributes, rate limiting per service, with highly flexible scheduling, queuing and shaping options (including HQoS).

All MEF defined services (EPL, EVPL, ELAN, etc) can be configured on the **µFalcon-MX/G** series and can also be protected through use of high-performance mechanisms, based on G.8031, G.8032, etc., for link, path, and ring resilience.

The system implements current OAM standards (802.3ah, 802.1ag, Y.1731with HW assist as well as proactive measurements and alarming facilities.

To complete its toolbox, the **µFalcon-MX/G** has a variety of OAM functions (such as Y.1731), a built-in packet generator and analyzer to implement (RFC2544/Y.1564) for quick service turn-up and verification.

The **µFalcon-MX/G** is housed in a highly compact, half-19", 1U chassis (150mm deep only), implements a fan-less design, and has an integrated internal, wide range AC or DC power supply.

Technical Specifications

Interfaces & Indicators

- Ethernet:
  - 4 x 100/1000/2500BaseX (SFP)
  - 2 x 10/100/1000BaseT (RJ45)
  - 2 x 1/2.5/10G (SFP+)
- Supported SFP/SFP+: MM,SM,SFS, xWDM, Copper
- Sync:
  - All Ethernet ports support PTP, SyncE and NTP
  - GNSS antenna in (SMA, active, 5VDC)

- 2 x 1PPS/10MHz (SMA)
- ToD/1PPS (RJ45)
- BITS (RJ48)
- 1 xUSB Console
- LEDs:
  - Link/Activity (per port)
  - Power/Fans (per PSU)
  - CPU

IEEE1588/PTP

- Functions:
  - Grandmaster (PRTC-A)
  - Boundary Clock (Class C/D)
  - Ordinary Clock (M/S)
  - Transparent Clock (Class C/D)
- Profiles supported:
  - Telecom Frequency (G.8265.1)
  - Telecom Phase (G.8275.1, G.8275.2)
  - Default (1588)
  - AVB (802.1AS)
  - Power Profile * (C37.238)
  - Custom

- Modes supported:
  - 1 and 2 step
  - L2 Multicast
  - L3/UDP Unicast/Multicast
  - IPv4, IPv6
  - Mixed transport modes
  - E2E and P2P delay
  - VLAN tagging
- Slave capacity:
  - Up to 128 Unicast @ full packet-rate (optional)
- Support for max packet rates for Sync, DelReq, Announce

Other Timing Services/Features

- Synchronous Ethernet (SyncE):
  - G.8261, G.8262
  - ESMC (G.8264)
- Physical interfaces:
  - 2 x SMA connectors
  - User configurable for 1PPS/10MHz input/output
  - ToD/1PPS (NMEA) input and output
- Built-in Stratum 3/3E clock (model dependent)
- SyncCenter

- GNSS:
  - 32 channels
  - Multi-constellation: GPS,GLONASS,Galileo,Beidou,QZSS
- NTP:
  - Server (Future upgradable to HW based)
  - Client
- BITS:
  - Input and output
  - E1 (2.048Mbps) and T1 (1.544Mbps)
  - 2.048MHz

Architecture & Forwarding

- Hybrid (ASIC-FPGA) HW architecture
- 256MB RAM, 256MB flash memory
- L2 forwarding (802.1D MAC bridging)
- Flow-based forwarding
- Performance: wire-speed, on all ports, all frame sizes
- Switching fabric: 34Gbps, non-blocking
- MTU: 10K bytes
- MAC table: 16K addresses
- VLANs: 4K concurrent
- Provider bridging: 802.1ad (Q-in-Q)

- Private VLANS
- L1-L4 ACLs
- Multicast:
  - IGMPv3 snooping
  - MLD snooping
  - Up to 8K MC groups
- Layer 3:
  - Static routes
  - IPv4/IPv6
  - DHCP (client, server, relay)

(*) roadmap

Quality of Service

- Classification based on L1-L4 information
- Ingress policing per flow (MEF BW profiles)
- Two rate, 3-color marking
- Hierarchical queuing/scheduling
- Hierarchical shaping
- Priority based flow control (802.1Qbb)

- Scheduling: Strict and DWRR (WFQ equivalent)
- 4 drop precedence levels w/WRED and tail drop for CA
- P-bit and DSCP remarking
- Storm control: UC, MC, BC
- QoS Control Lists
- Compliant with 3GPP QoS requirements for LTE backhaul

Protection

- Link:
    - Link aggregation: static or LACP
    - Link Protection

- Linear protection: G.8031
- Ring protection: G.8032v2
- Spanning tree: STP, RSTP, MSTP
- Loop protection

OAM & Diagnostics

- IEEE802.3ah link OAM
- IEEE802.1ag CFM (HW assisted)
- ITU-T Y.1731 PM (HW assisted)
- RFC2544 traffic generator & analyzer (wire speed)

- L2 loopbacks w/ MAC swap
- Throughput metering
- SFP diagnostics (SFF-8472)
- Traffic mirroring and remote mirroring
- sFlow

Management

- Interfaces:
    - CLI: Console (RS232), Telnet, SSH1/2
    - SNMP: v1/v2c/v3, extensive MIBs, trap profiles
    - Web: HTTP/HTTPS
    - Management VLAN
    - IPv6 management
- Authentication:
    - RADIUS, TACACS+
    - Multiple local users
    - User access levels (15)
    - Management ACLs
    - 802.1x (port/MAC based)

- Link discovery: LLDP, CDP snooping
- Operations:
    - Remote System Update (TFTP or Web)
    - Configuration upload/download (TFTP or Web)
    - Text based config files
- Alarms:
    - SNMP traps
    - Syslog (internal and remote server)
    - CLI events
    - Dying gasp (802.3ah or SNMP trap)
- Remote temperature reading & alarm
- Per port, EVC and CoS detailed statistics, RMON; NTPv4

Power & Environmental

- Power Supply:
    - Internal power supply: 20-60VDC, dual feed
    - AC adapter option (FPA40)
- Power consumption:
    - Maximum: <20W; typical: <15W

- Passive cooling (no fans)
- Operating temperature:
    - Standard: -10°C ÷ +50°C (14°F ÷ 122°F)
    - Extended: -40°C ÷ +65°C (-40°F ÷ 149°F) (optional)
- Storage temperature: -40°C ÷ +80°C (-40°F ÷ 176°F)
- Humidity: 10-90%, non-condensing

Physical

- Dimensions (HxWxD):
    - 44x221x150mm (1.73x8.70x5.90 inch)
- Mounting:
    - Desktop
    - Rack
    - Wall

- Weight: ~0.8Kg (1.76 lb)
- Accessories:
    - Power cable
    - RS232 cable (console)
    - Rack mounting kit (optional)

Regulatory & Compliance

- Safety:
    - IEC EN60950-1
- CE
- RoHS

- EMC:
    - FCC CFR 47 part 15, subpart B, Class A
    - EN 300 386 V1.3.3: 05
- MEF: CE2.0

Typical Application: Private LTE/5G/CBRS
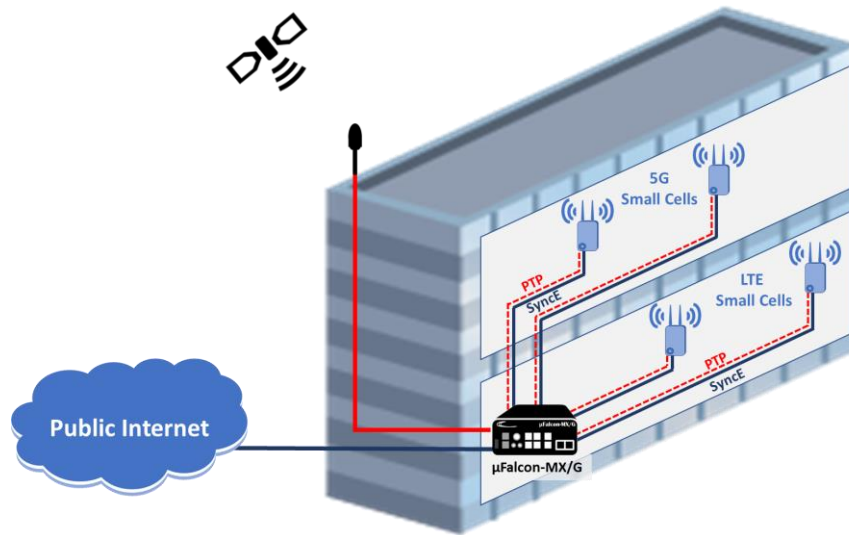
Ordering Information

Model	P/N	Description
µFalcon-MX/G/D	7143	Edge Grandmaster Clock, Transport enabled, 4x100/1000/2500BaseX (SFP), 2x10/100/1000BaseT, 2x 1/10GE (SFP+), internal DC (20-60VDC) dual feed power supply
FPA40	7108	AC (100-240V) to DC (48V) power adapter, 40W

Specifications are subject to change w/o prior notice

We've got Timing for you!